Appendix 3 Baseline Data Of Sensitive Taxa For Comparisons

Stream	Wharemauku Drain 7 Lower		Wharemauku Drain 7 Upper		Wharemauku Stream		Mazengarb Stream		Mazengarb at Waste Water		Muaupoko Stream		Waikanae		Waimeha Stream		Ngarara Drain (Te Harakeke)		Smithfield Drain		Hadfield Drain	
Date Collected	2-Dec-10		13-Apr-11		2-Dec-10		3-Dec-10		3-Dec-10		3-Dec-10		3-Dec-10		9-Dec-10		9-Dec-10		13-Apr-10		11-Feb-11	
Easting	1745927.99		1745928.18		1745933.86		1755351.13		405341.43		1750139		1750139		1752040		1750249.57		1750602.85		1750515	
Northing	405506.91		405506.82		405452.97		405351.13		175010.86		405241		405239.7		405204		405141.03		405340.34		405017	
Taxa with MCI >5	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM	Average abundance	SEM
Acanthophlebia					2.0	2.0																
Austroclima					18.0	3.5																
Coloburiscus													5.7	2.6								
Deleatidium					8.0	5.3					17.0	17.0	733.7	304.7							11.0	2.6
Ichthybotus					0.3	0.3																
Nesameletus													0.7	0.3								
Confluens													63.3	40.6								
Helicopsyche													19.0	12.5								
Hydrobiosis sp.											0.3	0.3	4.7	2.2								
Neurochorema											5.0	1.5	0.7	0.7							0.3	0.3
Oeconesidae																					1.7	0.9
Olinga													124.7	47.5								
Plectrocnemia													4.3	2.2								
Polyplectropus															1.0	0.6	0.3	0.3				
Psilochorema					1.0	0.0					0.3	0.3	7.7	3.9								
Pycnocentria													11.0	11.0								
Pycnocentrodes											35.3	35.4	482.7	153.0								
Triplectides	1.3	1.3	2.0	1.2	4.7	3.7	0.7	0.3			5.7	2.7	0.3	0.3							6.0	2.1
Triplectidina																			0.3	0.3		
Zelandobius													2.0	1.2								
Zelandoperla													1.0	1.0								
Elmidae					416.0	10.6					20.0	18.5	433.3	179.0							0.7	0.3
Hydrophilidae					0.3	0.3													0.7	0.3		
Anisoptera											0.3	0.3										
Aphrophila	0.7	0.3			82.0	29.1							8.7	1.9								
Eriopterini											1.7	1.7	8.0	2.3								
Hexatomini					0.3	0.3															0.7	0.3
Limonia									0.3	0.3												
Molophilus							1.3	0.3														
Orthocladiinae	8.0	2.0	0.3	0.3	110.0	10.6	12.7	9.2	145.3	104.9	4.3	4.3	6.3	4.5	1.3	0.7	0.3	0.3	4.0	2.6	1.0	0.6
Parochlus															0.7	0.7						
Paralimnophila											0.7	0.7									5.7	2.0
Podonominae																						
Polypedilum															3.3	0.3					2.3	0.9

Tanypodinae	186.0	106.8	12.0	7.6	32.0	26.3	1.7	1.2			2.0	1.5	10.0	6.1	1.7	0.7	13.7	9.7	23.0	11.0	5.0	1.7
Tanytarsus																					0.3	0.3
Archichauliodes					6.0	3.2					0.7	0.7	6.0	1.0							0.7	0.7
Amphipoda											1.3	0.9										
Paracalliope					292.0	146.4	388.3	121.3			139.0	112.3			2379.3	835.4	680.7	377.2	1.7	0.7	900.0	271.5
Paratya					16.0	7.2					25.3	3.8	6.3	4.5	2.3	1.5						
Tanaidacea																					16.3	4.4

Average abundance and the standard error of the means are presented in the above table for taxa with either a soft bottom or hard bottom MCI score > 5 (stream substrate dependent).

Appendix 4 Mud Fish Survey Results Report

MacKay's to PekaPeka Expressway Mudfish Survey Report

January 10th 2013
BoffaMiskell LTD

Introduction

Sampling for the proposed M2PP road had not identified mud fish in any waterway, but through the hearing it was agreed that specific methodologies had not been employed in all possible locations in which mud fish could reside. One of the conditions likely arising from the BOI, should the consents and conditions be granted was that an additional mudfish survey would be required prior to construction. Given the potential time frames of NZTA, should the BOI decisions grant consent, Mudfish surveys were needed to be undertaken immediately so as not to loose the seasonal requirement of undertaking such surveys. To that end BML sort agreement with GWRC on the methodologies acceptable and the locations to be sampled. An agreement on the methodology to be used was reached via email and conversation with (principally) Alton Perrie (GWRC aquatic ecologist expert), but also and Richard Percy at GWRC. It is our understanding that from those communications that the methodology proposed by BML was sufficient and would be acceptable if the proposed consent condition relating to mudfish surveys was to be agreed by the Board of Inquiry.

It was agreed that the deployment of mudfish traps (Fyke nets and Gee Minnow traps) was dependent on the local knowledge and site conditions at the time of survey (including the number of traps deployed) and therefore some variation from the proposed methods in terms of fyke net use etc was allowable.

Six further areas of waterway were surveyed, they were: Smithfield drain, Paetawa stream, upper drain 7 (Wharemauku stream), Otaihanga Wetlands, Muaupoko stream, and Hadfield-Kowhai drain. The results of each, including particular methods are presented below; also presented (Table 1) is a range of water quality parameters that persisted at the time of survey.

Executive summary:

No mudfish were trapped or recorded

Results

Smithfield Drain

Survey Date: 14 – 16 December 2012

Site Conditions: Dry, followed a period of little rainfall and entering dry conditions. Dry grass surrounding the stream and recent stock access in upper portion of Smithfield Drain. Very little water present in the upper site and waterbody consisted of deep muds with a small continuous watercourse of between 10 and 30cm wide and approximately 3-8 cm deep water on average above the muds. The lower Smithfield Drain site was characterised by more and deeper water, less modification and a number of deeper pools and areas of blackberry. A lack of stock access due to steep banks has resulted in more riparian habitat under blackberry and rushes.

Logger Numbers: 795, 796 and 797 (refer attached spreadsheet).

Readings (upper Smithfield): Temp = 21.2; NTU = 91.1; pH = 8.8; Dissolved O2 = 0.02

Readings (lower Smithfield): Temp = 23.6; NTU = 27.2; pH = 7.94; Dissolved O2 = 0.01

GPS reference: Upper Smithfield: 1773627 547514. Lower Smithfield: 1773492 5475048

Gee Minnows: 8 Gee Minnow traps were deployed in a number of habitats, predominantly open sections representative of the waterbody. Areas of blackberry and overhangning vegetation or in-stream debris were also prioritised for deployment. All traps had to be dug into the stream substrate (largely anoxic muds). 7 Gee minnow traps were deployed in the lower Smithfield Drain just north of the junction of the Kakariki Stream. These lower sites did not require any stream modifications and they were installed in a mix of habitat conditions, including within water weeds, under blackberry, in deeper pools and Total of 15 gee minnow traps deployed.

Fyke Nets: There was insufficient water for the deployment of Fyke nets in the Upper Smithfield Drain (near Smithfield Road) without substantial stream modifications. However, the deeper water and wider drains in the lower Smithfield Drain meant that 4 Fyke nets were installed in varying areas of habitat. These nets were set over an area of approximately 150m, focusing on the deeper areas of the watercourse. The full six Fyke nets were not deployed given habitat restrictions and shallow water.

A single Fyke net was also deployed during this survey in the Kakariki Stream for 2 nights, just downstream of the farm access bridge beside the Smithfield Drain.

Smithfield Drain Results:

Trap Number	Location	Results for Night 1 (15th December 2012)	Results for Night 2 (16th December 2012)
Gee Minnow 1	Open stream	Nil	Inanga @ 50 mm (dead in trap)
Gee Minnow 2	Open stream	Nil	Nil
Gee Minnow 3	Open stream under blackberry	Nil	Nil
Gee Minnow 4	Open stream	Nil	Nil
Gee Minnow 5	Open stream	Nil	Nil
Gee Minnow 6	Open stream	Nil	Nil
Gee Minnow 7	Open stream	Nil	Nil
Gee Minnow 8	Open stream under blackberry	Nil	Nil
Gee Minnow 9	Open stream	Nil	Nil
Gee Minnow 10	Open stream	Nil	LF eel @ 200mm; inanga @ 45mm (dead in trap)
Gee Minnow 11	Open stream under blackberry	LF eel @ 40cm	Inanga @ 65 mm
Gee Minnow 12	Open stream under blackberry	Nil	Inanga @ 65 mm; elver @ 80 mm
Gee Minnow 13	In water weeds	Nil	Common bully @ 40mm
Gee Minnow 14	In water weeds	Nil	Inanga @ 50 mm (dead in trap)
Gee Minnow 15	Open stream in pool	Nil	LF eel @ 220 mm
Fyke 1	Open stream and pool	LF eel @30cm; LF eel at 40cm	LF eel @ 650 mm
Fyke 2	Open stream and pool	LF eel @ 60cm	LF eel @ 300 mm; LF eel @ 450 mm; LF eel @ 400 mm.
Fyke 3	Open stream by blackberry	LF eel @ 40cm	Nil
Fyke 4	Open stream by blackberry	LF eel @ 35 cm	Nil
Fyke 5	Open stream and pool	Nil	Nil
Fyke 6	Kakariki Stream downstream of bridge	LF eel @ 120 cm; LF eel @ 40cm; LF eel @ 60 cm	LF eel @ 600mm; LF eel @ 600 mm; LF eel @ 1,100 mm.

Photo 1 Smithfield Drain

Paetawa Stream

Survey Date: 16 – 18th December 2012

Site Conditions: Dry conditions, followed a period of little rainfall. Stream banks fenced from cattle and long grass overhanging stream along entire length surveyed. Lots of stream vegetation dominated by monkey musk, water cress and rushes/reeds. Water depths ranged between 8 cm to deep pools of 40cm in parts. Stream substrates predominantly fine sands and silts, with some mud. The Paetawa Stream looked to be fenced from cattle on both sides for some months – particularly the southern side. There was an absence of deep muds that characterised the stream during the initial SEV survey.

35mm of rainfall fell on the night of 17th December and site conditions were saturated on the morning of the 18th December. Water levels had risen approximately 5 cm on average in the Paetawa Stream between deployment and retrieval.

Logger Numbers: 809, 810, 811 (refer attached spreadsheet).

Readings: Temp = 17.9; NTU = 15.1; pH = 7.62; Dissolved O2 = 0.12

GPS reference: 1775132 5476211

Gee Minnows: 15 Gee Minnow traps were deployed in a number of habitats along the survey reach, including overhanging vegetation, undercut banks and open sections representative of the relatively uniform waterbody. Areas in-stream debris and macrophytes were also prioritised. There was sufficient water depth that no traps required stream modification.

Fyke Nets: 6 Fyke nets were deployed in the deeper sections of the Paetawa Stream. Given the relatively thin and uniform nature of the Paetawa Drain, Fyke net sampling locations were restricted to the deeper areas. However, all areas had some macrophyte growth, were adjacent to overhanging vegetation and embankments and some in-stream debris. Fyke nets were set over a length of approximately 200m.

Paetawa Drain Results:

Trap Number	Location	Results for Night 1 (17th December 2012)	Results for Night 2 (18th December 2012)
Gee Minnow 1	Open stream with macrophytes	Nil	Banded kokopu @ 65mm; koura @ 65mm; banded kokopu @ 35mm
Gee Minnow 2	Open stream with macrophytes	Nil	Nil
Gee Minnow 3	Open stream	Nil	Banded kokopu @ 35mm
Gee Minnow 4	Open stream with macrophytes and overhanging grasses	Nil	Nil
Gee Minnow 5	Open stream with macrophytes and overhanging grasses	Freshwater koura @ 65mm	3 x banded kokopu @ 35 – 40mm

Gee Minnow 6	Under an overhanging embankment in pool	Nil	6 x banded kokopu @ 35 – 40mm; koura @ 60mm
Gee Minnow 7	Open stream	Nil	1 x banded kokopu @ 35mm; koura @ 45mm
Gee Minnow 8	Open stream with macrophytes	Banded kokopu @ 35mm	Banded kokopu @ 35mm
Gee Minnow 9	Open stream in deeper pool.	Nil	Nil
Gee Minnow 10	Under an overhanging embankment	Elver @ 110mm; banded kokopu @ 35 mm; banded kokopu @ 35mm; koura @ 40mm	Nil
Gee Minnow 11	Open stream with macrophytes	Banded kokopu @35mm	Nil
Gee Minnow 12	Open stream	Banded kokopu @ 35mm; banded kokopu @ 35mm; banded kokopu @ 35mm;	Nil
Gee Minnow 13	Open stream	Nil	2 x banded kokopu @ 35mm
Gee Minnow 14	Open stream with macrophytes and overhanging grasses	Nil	Nil
Gee Minnow 15	Open stream with macrophytes	Nil	Nil
Fyke 1	Open stream with grasses overhanging and macrophytes	LF eel @ 450mm; LF eel @ 500mm; LF eel @650mm; LF eel @ 650mm.	Nil
Fyke 2	Open stream with macrophytes	LF eel @ 800mm	LF eel @ 900mm; LF eel @ 1,200mm; LF eel @ 400mm; LF eel @ 650mm
Fyke 3	Open stream with deeper pool	LF eel @ 1,200mm	LF eel @ 1,100mm; LF eel @ 400mm
Fyke 4	Open stream with overhanging grasses and macrophytes	LF eel @ 600mm	Nil
Fyke 5	Open stream with macrophytes	Nil	Nil
Fyke 6	Open stream with macrophytes	Nil	LF eel @ 650mm

Photo 2 Paetawa Drain

Drain 7, Wharemauku Stream

Survey Date: 6 – 18 January 2012

Site Conditions: Water table still relatively high and no recent stream modification (this section is subject to regular drain clearance by KCDC). Some overhanging vegetation (predominantly pine and manuka regeneration with some gorse) present and lots of in-stream vegetation (predominantly Isolepis prolifa and duckweed) and instream debris (predominantly old logs and branches from peats).

Drain 7 waterbody on average 900mm deep, not a lot of sufficiently shallow areas to set Gee minnows as water predominantly deeper so only 15 deployed. Gee minnow traps were deployed in emergent vegetation and open water on stream banks. Where overhanging pines present, Gee minnows were hung from solid vegetation (branches and flax) to ensure sufficient oxygen in traps. Similarly, water depth and site conditions restricted deployment of Fyke nets to stream edges and channels to ensure sufficient oxygen for any trapped fish.

Logger Numbers: 846, 847, 848 (refer attached spreadsheet).

GPS reference: GPS; 1767797 5467066

Readings: Temp = 15.3; NTU = 5.07; pH = 5.57; Dissolved O2 = 0.27.

Gee Minnows: 15 Gee minnow traps were deployed in a range of habitat areas, predominantly on edges within stream vegetation and overhanging vegetation where present. A number of traps were also located in the junction of a smaller drain entering Drain 7 as well as upstream and downstream of a large existing culvert in Drain 7.

Fyke Nets: 6 Fyke nets were deployed in a range of habitats, but subject to stream conditions and depth to ensure sufficient oxygen. Fyke nets were set over a length of 200m upstream and downstream of the proposed culvert.

Drain 7 Results:

Trap Number	Location	Results for Night 1 (17 January 2013)	Results for Night 2 (18 January 2013)
Gee Minnow 1	Bank edge with Isolepis prolifa.	SF eel @ 220mm.	Nil
Gee Minnow 2	In Isolepis prolifa at culvert inlet	Nil	Nil
Gee Minnow 3	In Isolepis prolifa at culvert inlet	Nil	Nil
Gee Minnow 4	In Isolepis prolifa with willow weed overhanging bank	SF eel @ 150; LF eel @ 300mm	Nil
Gee Minnow 5	In Isolepis prolifa with gorse overhanging	Nil	Nil
Gee Minnow 6	Duckweed with gorse and willow weed overhanging	Nil	Nil
Gee Minnow 7	Side drain in Isolepis	Nil	LF eel @ 300mm

	prolifa		
Gee Minnow 8	Side drain in Isolepis prolifa	Nil	SF eel @ 220mm
Gee Minnow 9	Open water with Isolepis	Nil	Nil
Gee Minnow 10	In Isolepis prolifa and Carex overhanging	Nil	SF eel @ 270mm
Gee Minnow 11	Isolepis and open water	2 x SF eel @ 180 and 200mm	Nil
Gee Minnow 12	Under overhanging flax	Nil	Nil
Gee Minnow 13	Under overhanging Pinus radiata	Nil	Inanga @ 60mm
Gee Minnow 14	Under logs and Isolepis prolifa and bracken	SF eel @ 180;	Nil
Gee Minnow 15	Under bracken, Isolepis prolifa and duckweed	SF eel @ 250mm; SF eel @ 280mm	Nil
Fyke 1	Below Isolepis prolifa at culvert inlet	Nil	Nil
Fyke 2	By side drain in deep section of stream	Nil	Nil
Fyke 3	Under Pinus radiate and Carex	LF eel @ 300; SF eel @ 250	Banded kokopu @ 130; LF eel @ 450mm
Fyke 4	Under Pinus radiate and flax	LF eel @ 300; SF eel @ 300	Banded kokopu @ 140mm; SF eel @ 440mm; SF eel @ 350mm
Fyke 5	Under kanuka, gorse overhanging	Banded kokopu @ 115 and 120 mm (both dead); Banded kokopu @ 155 mm; SF eel @450mm	1 x juvenile little shag (alive);
Fyke 6	Under flax and kanuka	SF eel @ 420mm; LF eel @ 600mm	LF eel @ 750mm

Photo 3 Drain 7

Otaihanga Wetlands

A single Fyke net was deployed in the Northern Otaihanga Wetland for 4 nights from the 14 – 19 December to check for freshwater fish presence. The Fyke net was checked for presence of fish species each morning, then moved to another location within the wetland each morning.

Otaihanga Wetland Results:

Trap Number	Location	Results for Night 1 (15th December 2012)	Results for Night 2 (16th December 2012)	Results for Night 3 (17th December 2012)	Results for Night 4 (18th December 2012)
Fyke 1	Open wetland under manuka with Sphagnum and bryophytes	Nil	Nil	Nil	Nil

Photo 4 Otaihanga Wetland

Muaupoko Stream:

Site Conditions: This water body has two different conditions upstream and downstream of the walking trail. Downstream of the trail the planted riparian vegetation provides full shade and organic input into the stream. The stream banks are 100% sand, high (750mm to 1500mm) which erode easily. The downstream depth ranges from 800mm to 1300mm. The substrate is 100% sand. The water clarity is poor due to the dark tannin tones and depth.

The upstream reach was completely inundated with blackberry. The water (where it could be reached) was 300mm to 700mm deep. The stream was shaded by the blackberry and willow. The substrate was 70% sand, 30% gravels.

Gee minnows: 15 were set – attached to streamside or overhanging vegetation, from both the left and right banks. The remaining 5 minnows were placed upstream, 3 to a bridge, and 2 to blackberry.

Fyke nets (downstream) were placed near the culvert along the stream bank under flax, and 3 others were set further downstream near an undercut portion and across the middle of the stream channel. The upstream fyke nets could only be set under a large willow amongst submerged branches.

Logger Numbers: 849, 850, 851 (refer attached spreadsheet).

GPS reference: GPS; 1770860 5472812

Readings: Temp =16.7 degrees; NTU = 8.47; pH = 7.60; Dissolved O2 = 0.23

Trap Number	Location	Results for Night 1 (23 January 2013)	Results for Night 2 (24 January 2013)
Gee Minnow 1	Bank under flax	31 Inanga @ 30-60mm, 9 banded Kokopu 40-55, 13 smelt 45-55mm	Banded Kokopu @150mm, 5 Inanga @ 30, 40, 40, 50, 55mm
Gee Minnow 2	Bank under fern	1 inanga @ 25mm, 2 shrimp 15mm and 18mm	2 shrimp
Gee Minnow 3	Under overhanging fern	Banded Kokopu @ 60mm, Common Bully @ 30mm	1 inanga @ 30mm 5 shrimp
Gee Minnow 4	Under flax, bank of Tradescantia fluminensis	SFE @ 250mm	3 Inanga @ 40, 60, 35mm and 2 shrimp
Gee Minnow 5	Bank – Long Grass	3 Smelt @ 50, 55, 60. 2 inanga @ 30mm	1 inanga 30mm and 13 shrimp
Gee Minnow 6	Bank – long Grass	2 common bully @ 20, 25, 1 inanga 40	5 inanga @ 30, 40, 45, 30, 50mm. 2x common bully @ 20, 35mm and 3 shrimp
Gee Minnow 7	Bank – Long Grass	5 inanga @ 50, 55, 60, 30, 30mm	2 Banded kokopu @ 55 and 60mm
Gee Minnow 8	Bank – Flax and Wandering Dew	1 SFE 250	nil
Gee Minnow	Open water	3 Inanga @ 50, 55, 60, 2 smelt	2 inanga @ 45, 50mm

9		30mm	
Gee Minnow 10	Undercut bank	2 common bully @ 20, 25mm 1 inanga 40mm	1 common bully @ 25mm
Gee Minnow 11	Under Whiteywood	1 inanga @ 40mm	nil
Gee Minnow 12	Under flax	1 inanga @ 40mm, 2 shrimp	3 shrimp
Gee Minnow 13	Under flax	nil	1 inanga @ 40mm
Gee Minnow 14	Bank near culvert entrance	2 inanga @ 25mm	1 shrimp
Gee Minnow 15	Bank, tied to Blackberry	3 Inanga @ 45, 50, 70mm	1 Banded kokopu @ 120, 4 inanga @ 30, 60, 60, 75mm 2 shrimp
Gee Minnow 16	Bank, tied to Blackberry	3 shrimp	1 common bully @ 30mm, 2 inanga @ 45, 50 and 2 shrimp
Gee Minnow 17	Bank, tied to Blackberry	Nil	1 Common bully @ 70mm – (covered in blue dots), 2 inanga @ 30, 35mm. 5 shrimp
Gee Minnow 18	Bridge/willow	2 common bully @ 30mm, 35mm	2 shrimp
Gee Minnow 19	Bridge	2 shrimp	3 banded kokopu @ 60, 75, 55, 4x Inanga @ 35, 35, 40, 45mm
Gee Minnow 20	Bridge	3 shrimp	2 shrimp
Fyke 1	Undercut bank - flax	nil	nil
Fyke 2	Across stream near log debris	2 SFE @ 400, 600mm	1 LF eel @ 400mm
Fyke 3	Across stream	2 SFE @ 500, 700mm	1 SF eel @ 500mm
Fyke 4	Bank near culvert	Nil	1 SF eel @ 300mm
Fyke 5	Under Willow	1 SFE @ 400mm	Nil
Fyke 6	Under Willow	3 SFE @ 500mm, 600mm, 1200mm 1 Common Bully @ 60mm	1 SF eel @ 450mm

Photo 5 Muaupoko Stream (upstream)

Hadfield Kowhai Stream

Site Conditions: The Hadfield Kowhai Stream runs below mature pine trees. The stream banks are steep and sandy, at 800 -1000mm high. The canopy consists of pine (overhead), with fern (Asplenium), Calla lily (Zantedeschia)and blackberry in small areas on the stream bank offering extra cover, assisting in erosion control. The stream bed is made of fine gravels and sands, with a depth of 20mm over the majority of the reach, with 2 to 3 pools at 300mm. At the upstream portion of the reach, at the culvert entrance fine mud has accumulated over the gravels enabling monkey musk (Mimulus sp) to take hold.

Gee minnows: 20 were set – equal distance along this stream portion, attached to streamside or overhanging vegetation, and dug into the stream bed slightly where the water level was below the minnow entrance.

Fyke nets (downstream) were placed near the culvert along the stream bank under flax, and 3 others were set further downstream near an undercut portion and across the middle of the stream channel. The upstream fyke nets could only be set under a large willow amongst submerged branches.

Logger Numbers: 852, 853, 854 (refer attached spreadsheet).

GPS reference: GPS; 1776054 5477069

Readings: Temp =19.3 degrees; NTU = 38.23; pH = 7.44; Dissolved O2 = 0.08

Trap Number	Location	Results for Night 1 (28 January 2013)	Results for Night 2 (29 January 2013)
Gee Minnow 1	Culvert entrance	4 Banded Kokopu @ 120 100, 90, 70 mm	3 Banded kokopu @ 110, 95, 80mm
Gee Minnow 2	In mud with monkey musk	5 Banded kokopu @ 30, 40, 80, 120, and 120mm	1 Banded kokopu @ 42mm
Gee Minnow 3	Shallow water – undercut sand bank	5 Banded kokopu @ 80, 80, 40, 40, 65mm	Nil
Gee Minnow 4	Sand bank	nil	1 Banded kokopu @ 65mm
Gee Minnow 5	Bank under long grass	12 Banded kokopu @ 130, 120, 110, 110, 110, 100, 90, 85, 70,70, 60, 50,	4 Banded kokopu @ 120, 110, 100 and 70mm
Gee Minnow 6	Shallow water, sand bank	10 Banded Kokopu @ 130, 120, 120, 120, 115, 110, 80, 80, 70, 70,	2 Banded kokopu @ 60mm and 55
Gee Minnow 7	Shallow water under fern	nil	1 Banded kokopu @ 110mm
Gee Minnow 8	Shallow water under shade of fern	1 Banded kokopu @ 80mm	1 Banded kokopu @ 40mm
Gee Minnow 9	Shallow water under shade of fern	3 Banded kokopu @ 120, 30 and 45mm	Nil
Gee Minnow 10	Shallow water under fern	7 Banded kokopu @ 30, 30, 40, 50, 50, 80, 120mm	8 Banded kokopu @ 160, 80, 40, 40, 40, 40, 30 30mm
Gee Minnow 11	Shallow water under large Lilly	14 Banded kokopu @ 1 x 120mm, 6 x 90-100mm,3 x	4 Banded kokopu @ 110, 40, 30, 30mm

		70mm 4 x 30-50	
Gee Minnow 12	In pool under fern	11 banded kokopu @ 122, 120, 120, 120, 118, 90, 80, 50, 40, 35, 30mm	10 Banded kokopu @ 90, 90, 80, 75, 70, 65, 60, 50, 40, 40mm. 2 Inanga @ 75mm and 70mm
Gee Minnow 13	In pool under fern	6 Banded kokopu @ 120, 60, 30, 30, 35, 40	1 Long fin eel @ 210mm. 2 Banded kokopu @ 40 and 30mm
Gee Minnow 14	In pool, sand bank	10 Banded kokopu @ 120, 110mm, 8 @ 30-50mm.	3 Banded kokopu @ 40, 35 and 30mm
Gee Minnow 15	In pool, sand bank, long grass	16 Banded kokopu @120, 115, 90, 80 and 12 x at 30 -50mm	5 Banded kokopu @ 110, 90, 50, 40, 35mm
Gee Minnow 16	In pool, sand bank, long grass	7 Banded kokopu @ 80, 75, 70, 70, 60, 65, 50mm	6 Banded kokopu @ 70, 40, 40, 40, 35, 30, 30mm. And 4 Inanga @ 100, 80, 60, 50mm
Gee Minnow 17	In pool, sand bank, long grass	13 Banded kokopu @ 110, 110, 100, 100, 95, 90, 80, 75, 70, 70, 65, 45, 40,	nil
Gee Minnow 18	Under fern	11 Banded kokopu @ 120, 110, 90, 90, 90, 85, 80, 70, 70, 70, 40	4 Banded kokopu @ 120, 110, 90, 90mm
Gee Minnow 19	Under Blackberry	9 Banded Kokopu @120, 115, 110, 90, 80, 70, 50, 45, 40,	2 Banded kokopu @ 80 and 55mm
Gee Minnow 20	Bank of long grass	Banded kokopu @ 110, 105, 70, 70, 60, 60, and 8 inanga 30-60mm	2 Banded kokopu @ 120 and 80mm.
Fyke 1	Under fern	Nil	2 Banded kokopu @ 140mm and 160mm
Fyke 2	Under fern	Nil	Nil
Fyke 3	In pool grass bank	2 long fin eel 400mm and 500mm	1 Long fin eel @ 600mm

Photo 6 Hadfield Kowhai Stream

Table 4 Water Quality Results

Location	GPS North	GPS Easting	Date	Temp	Average	NTU	Average	pH	Average	Dissolved O_2	Average
Smithfield Drain	1773627	547514	14/12/2012	21.2		52.3		8.92		0	
				21.4		69		8.95		0.03	
				21.1	21.23	152	91.10	8.73	8.87	0.03	0.02
Smithfield (Nga Manu)	1773492	5475048	14/12/2012	23.6		26.4		7.94		0	
				23.6		29		7.94		0.01	
				23.8	23.67	26.4	27.27	7.94	7.94	0.03	0.01
Paetawa	1775132	5476211	18/12/2012	17.9		18.5		7.66		0.15	
				17.9		12.5		7.63		0.1	
				17.9	17.90	14.2	15.07	7.59	7.63	0.12	0.12
Drain 7	1767797	5467066	16/01/2013	15.3		5.1		5.59		0.26	
				15.3		5.1		5.57		0.28	
				15.3	15.30	5	5.07	5.54	5.57	0.26	0.27
Mauopoko	1770860	5472812	23/01/2013	16.8		7.3		7.72		0.26	
				16.8		9.9		7.59		0.23	
				16.7	16.77	8.2	8.47	7.48	7.60	0.19	0.23
Hadfield Kowhai	1776054	5477069	28/01/2013	19.3		37.7		7.63		0.03	
				19.3		38.3		7.4		0.2	
				19.3	19.30	38.7	38.23	7.3	7.44	0.03	0.09

Conclusions

No mudfish were surveyed from any of the sampling sites.

No new fish taxa were caught, i.e. taxa that were not already recognised in the M2PP AEE or FFDB

In several waterways fish not previously caught (but reported in the data base) were recorded, in particular inanga and banded kokopu.

Appendix 5 Waikanae River detailed baseline results

Waikanae Specific Baseline survey results

Macroinvertebrate parameters at each of 5 transects. Each table supplies the summary data for biometrics and a list of the taxa found along each transect from 4 benthic samples (2 kick and 2 subra). Each table shows the pre-works mean biometric score against which to test the resultant in-stream Waikanae River habitat post construction.

Species	Waikanae T1, riffle 1	Waikanae T1 riffle 2	Waikanae T1 riffle 3	Waikanae T1 riffle 4	MEANs	Total Abundance
Total abundance	219	113	193	33	139.5	
Number of taxa	7	8	14	8	9.25	
Number of EPT taxa	3	5	8	6	5.5	
MCI score	105.7	120	114.3	125	116.25	
QMCI	6.3	7	6	6.6	6.475	
OLIGOCHAETA	1					1
Elmidae	151	22	14	3		190
Hydraenidae						0
Paracalliope		1				1
Aphrophila			2			2
Orthocladiinae			23	2		25
Tanytarsini			6			6
Deleatidium	43	70	89	17		219
Zephlebia			1	1		2
Archicauliodes			1			1
Potamopyrgus	13	9	3			25
PLATYHELMINTHES	3					3
Zelandoperla				1		1
Aoteapsyche		2	9	5		16
Beraeoptera		1	2	1		4
Helicopsyche	5		1			6
Olinga			1			1
Oxyethira			2			2
Psilochorema		2				2
Pycnocentrodes	3	6	39	3		51
Species	Waikanae T2 Run	Waikanae T2 Run	Waikanae T2 Run	Waikanae T2 run	MEANS	Total Abundance
1 Total abundance	196	238	226	120	195	
2 Number of taxa	13	10	11	6	10	
3 Number of EPT taxa	7	7	7	4	6.25	
4 MCI score	121.5	128	125.5	116.7	122.925	
5 QMCI	6.2	6.9	6.6	6.7	6.6	
OLIGOCHAETA	2				2	2

Elmidae	97	51	32	63	60.75	243
Paracalliope			1		1	1
Aphrophila	8	4			6	12
Eriopterini	1				1	1
Deleatidium	39	123	103	49	78.5	314
Archicauliodes	1		1		1	2
Potamopyrgus	12	13	7	1	8.25	33
Aoteapsyche	3	7	10	4	6	24
Beraeoptera			1		1	1
Costachorema	1				1	1
Helicopsyche	7	3			5	10
Hydrobiosis	2	2	1		1.666667	5
Olinga		5	4		4.5	9
Plectrocnemia		2			2	2
Psilochorema	1		4	1	2	6
Pycnocentrodes	22	28	62	2	28.5	114

Species	Waikanae Run2Kick1	Waikanae Run2Kick2	Waikanae Run2Surber1	Waikanae Run2Surber2	MEANS	Total Abundance
Total abundance	41	55	123	102	80.25	321
Number of taxa	6	7	9	10	8	
Number of EPT taxa	4	3	5	6	4.5	
MCI score	143.3	111.4	117.8	120	123.125	
QMCI	7.1	5.2	6	5.9	6.05	
OLIGOCHAETA		2			2	2
Elmidae	4	26	53	44	31.75	127
Aphrophila			6	9	7.5	15
Eriopterini		2			2	2
Deleatidium	23		23	14	20	60
Archicauliodes	1		2	1	1.333333	4
Potamopyrgus		20	8	2	10	30
Aoteapsyche		1	2	2	1.666667	5
Beraeoptera				1	1	1
Helicopsyche		1			1	1
Hudsonema			1		1	1
Hydrobiosis				1	1	1
Olinga	2				2	2
Plectrocnemia	1				1	1
Psilochorema			1	1	1	2
Pycnocentrodes	10	3	27	27	16.75	67

Species	Waikanae Run3Kick1	Waikanae Run3Kick2	Waikanae Run3Surber1	Waikanae Run3Surber2	MEANS	Total Abundance
1 Total abundance	133	460	118	58	192.25	769
2 Number of taxa	10	13	11	5	9.75	
3 Number of EPT taxa	5	8	6	2	5.25	
4 MCI score	108	118.5	112.7	112	112.8	

5 QMCI	6.8	5.8	6.7	6.5	6.45	
OLIGOCHAETA	2		3		2.5	5
Elmidae	6	264	10	8	72	288
Paracalliope	17	1	1		6.333333	19
Aphrophila		6	1	1	2.666667	8
Stratiomyidae	1				1	1
Tanytarsini		1			1	1
Deleatidium	83	48	65	27	55.75	223
Ichthybotus		1			1	1
Potamopyrgus	7	72	2	2	20.75	83
Aoteapsyche	1	5	1		2.333333	7
Beraeoptera		1	1		1	2
Hydrobiosis		1			1	1
Plectrocnemia	1	1	1		1	3
Psilochorema	1	3	1		1.666667	5
Pycnocentrodes	14	56	32	20	30.5	122

Species	Waikanae Site4,Kick1	Waikanae Site4,Kick2	Waikanae Site4,Surber1	Waikanae Site4,Surber2	Means	Total Abundance
1 Total abundance	158	189	95	127	142.25	569
2 Number of taxa	12	12	13	10	11.75	
3 Number of EPT taxa	5	7	6	4	5.5	
4 MCI score	110	125	98.5	98	107.875	
5 QMCI	5.3	5.5	5.5	5	5.325	
OLIGOCHAETA	13	16	7	7	10.75	43
Elmidae	30	34	30	7	25.25	101
Hydraenidae	1				1	1
Paracalliope	2	41	6	61	27.5	110
Aphrophila	2		1		1.5	3
Chironomus				1	1	1
Orthocladiinae			1	1	1	2
Podonominae		1			1	1
Tanytarsini	1		3		2	4
Deleatidium	25	38	17	14	23.5	94
Potamopyrgus	6	7	4	19	9	36
Aoteapsyche	1	1	1		1	3
Beraeoptera		1			1	1
Helicopsyche		1			1	1
Hydrobiosis			1		1	1
Olinga	1			2	1.5	3
Plectrocnemia	1	1	1		1	3
Psilochorema		3	3	1	2.3	7
Pycnocentrodes	75	45	20	14	38.5	154

Fish Results

The following is the fish data from sampling of two full-width transects at each of 5 sites representing the area of the Waikanae River affected by the proposed works. Each transect consisted of a 4 m wide band through which the EFM wand was passed 10 time (depletion fishing) and each station progressed in 2m wide increments across the river. In this way the river on average received 7-10 EFM sweep stations per transect. The total area fished by each Transect is calculated by the width of the transect and the 4m fished width. Densities as fish per m2 can then be calculated.

	Width fished (m)	Area fished (m2)
Site 1 is located adjacent to the reserve entrance.		
Transect 1 (8/2/13) wide run	12	48
Transect 2 (19/2/13) wide run	12	48
Site 2		
Transect 1 (19/2/13) glide (4m), shallow riffle (4m), fast run (2m)	10	40
Transect 2 (19/2/13) deep fast run	6	24
Site 3		
Transect 1 (19/2/13) fast run / run / riffle	11	44
Transect 2 (19/2/13) wide run with deep long pool	11	44
Site 4 is below the Muaupoko Stream confluence		
Transect 1 (19/2/13) -11 m wide run	11	44
Transect 2 (19/2/13) wide run	11	44
Site 5 is the most upstream site sampled on the Waikanae river		
Transect 1 (19/2/13) - A series of fast riffles	15	60
Transect 2 (19/2/13) wide run	8	32

The following are the data for each transect fished.

Site 1 is located adjacent to the reserve entrance.

TRANSECT 1	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	25	20		50	90		180
Max (mm)	45	55		65	170		180
Mean (mm)	33.1	30.0		55.8	116.7		180.0
Count	8	5	0	12	3	0	1
TRANSECT 2	Torrent fish	Common	Redfin bully	Elver	Longfin eel	Shortfin eel	Black

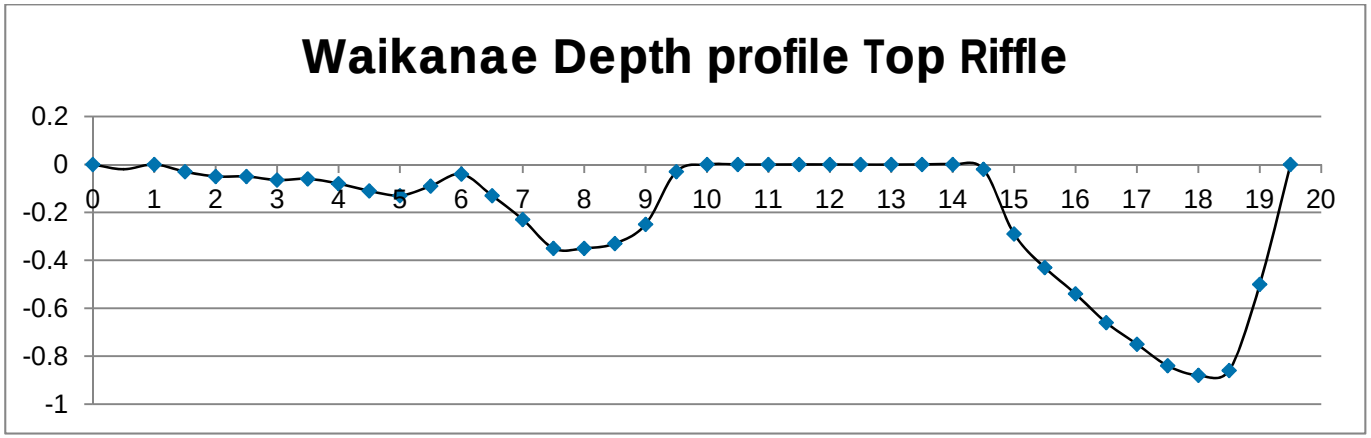
		bully					founder
Min (mm)	22	12		60			
Max (mm)	45	55		100			
Mean (mm)	37.3	27.3		80			
Count	3	3	0	2	0	0	0
OVERALL SITE 1	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	22	12		50	90		180
Max (mm)	45	55		100	170		180
Mean (mm)	34.3	29.0		59.3	116.7		180.0
Count	11	8	0	14	3	0	1
Site 2							
TRANSECT 1	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	45	20	40	70			
Max (mm)	45	20	50	90			
Mean (mm)	45	20	45	75.7			
Count	1	1	2	7	0	0	0
TRANSECT 2	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)							
Max (mm)							
Mean (mm)							
Count	0	0	0	0	0	0	0
OVERALL SITE 2	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	1	1	2	7			
Max (mm)	45	20	50	90			
Mean (mm)	30.33333	13.66667	32.33333	57.6			
Count	3	3	3	3	1	1	1
Site 3							
TRANSECT 1	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	35			100	140		
Max (mm)	50			100	200		
Mean (mm)	41.25			100	185		
Count	4	0	0	1	4	0	0
TRANSECT 2	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)		15					
Max (mm)		15					
Mean (mm)		15					
Count	0	1	0	0	0	0	0
OVERALL SITE 3	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	35	15		100	140		
Max (mm)	50	15		100	200		
Mean (mm)	41.25	15		100	185		
Count	4	1	0	1	4	0	0
Site 4							

TRANSECT 1	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	26	12		70	180		
Max (mm)	50	50		100	180		
Mean (mm)	39.6	29.8		77.5	180.0		
Count	11	4	0	12	1	0	0
TRANSECT 2	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	30	25		60	180		
Max (mm)	45	25		120	180		
Mean (mm)	38.8	25.0		72.0	180.0		
Count	4	5	0	5	1	0	0
OVERALL SITE 4	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	26	12		60	180		
Max (mm)	50	50		120	180		
Mean (mm)	39.4	27.1		75.9	180		
Count	15	9	0	17	2	0	0
Site 5							
TRANSECT 1	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	25			50	230	300	
Max (mm)	86			120	230	300	
Mean (mm)	39.4			74.8	230	300	
Count	65	0	0	65	1	1	0
TRANSECT 2	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	30	10		70	120		
Max (mm)	45	50		100	160		
Mean (mm)	38.3	32.8		74.3	140.0		
Count	3	6	0	7	3	0	0
OVERALL SITE 5	Torrent fish	Common bully	Redfin bully	Elver	Longfin eel	Shortfin eel	Black founder
Min (mm)	25	10		50	120	300	
Max (mm)	86	50		120	230	300	
Mean (mm)	39.3	32.8		74.7	162.5	300.0	
Count	68	6	0	72	4	1	0

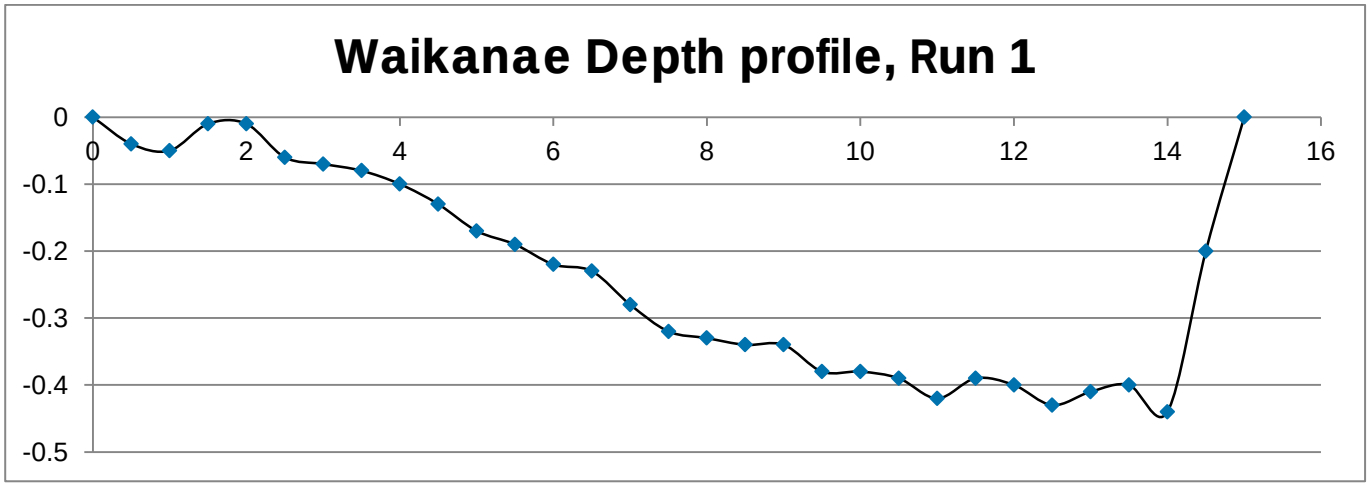
Physical Habitat Results

The physical habitat was measured as described in the main body of the EMP the following data were obtained. A depth profile as graphed is presented below along with the average velocities at measure. Actual depth by width tables are attainable upon request.

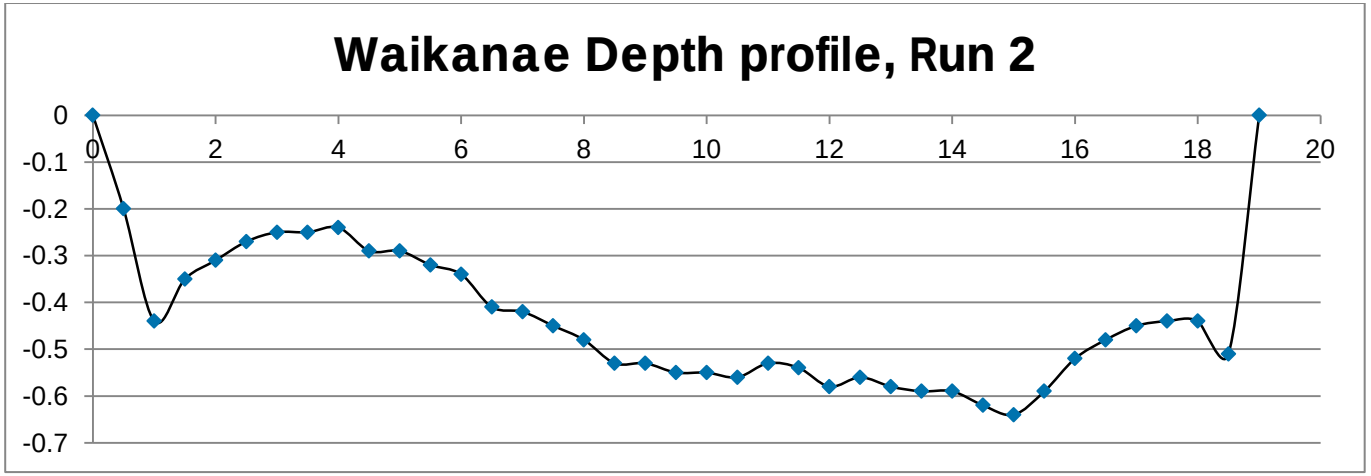
Site 5, Top riffle



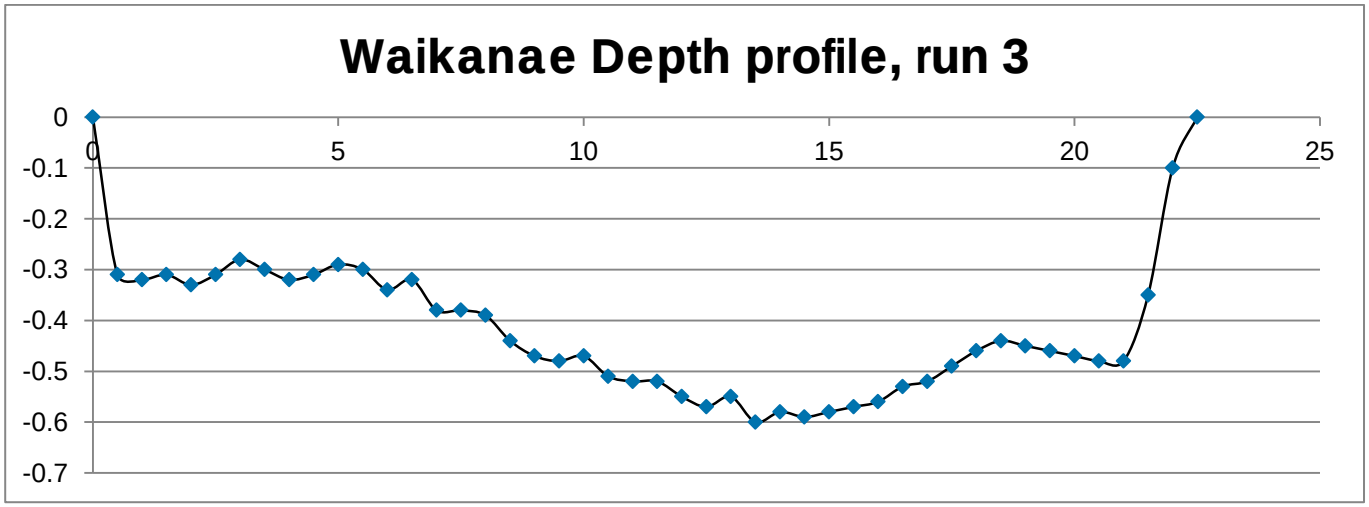
Site 4 (Run) Velocity at measure (0.69m/s)



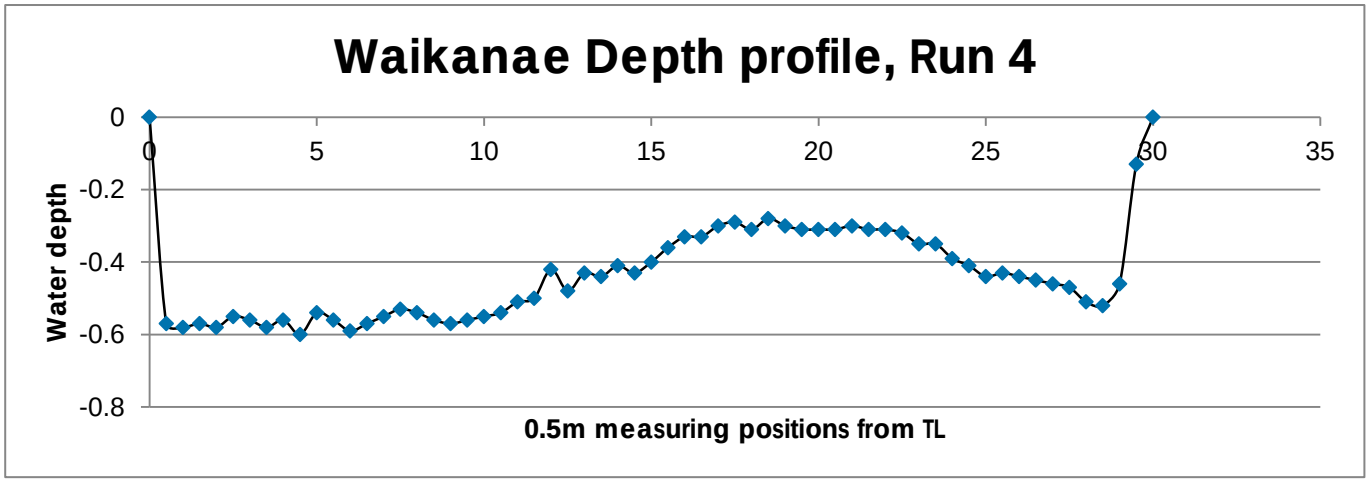
Site 3 (run) Velocities - mid-stream (0.33m/s), edge (0.45m/s)



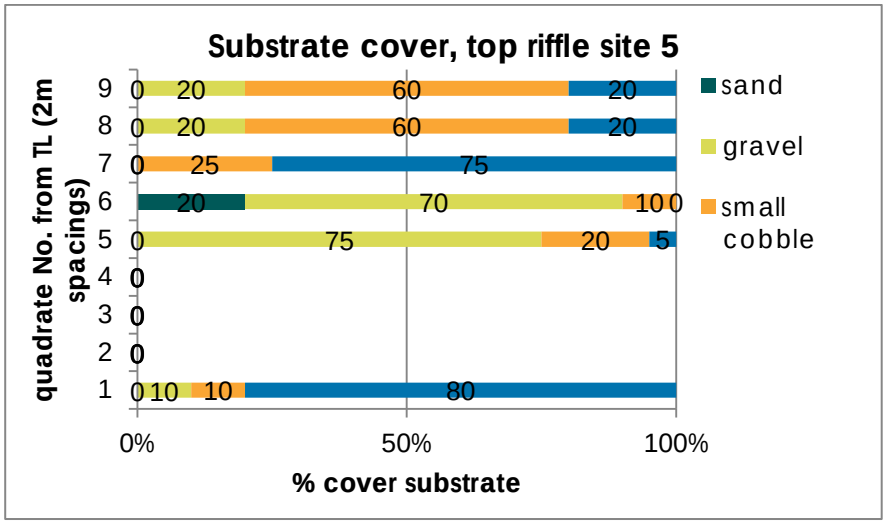
Site 2, Run 3 Velocities – TR (0.81m/s), TL (0.63m/s)

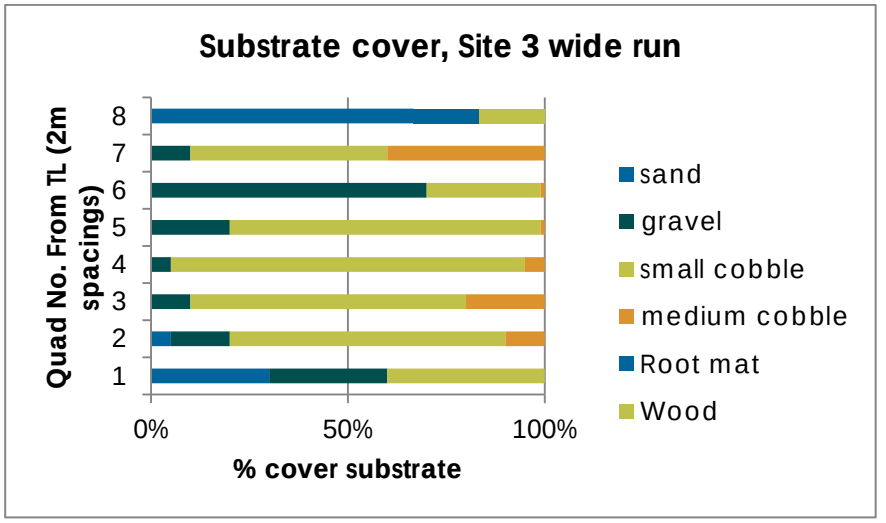


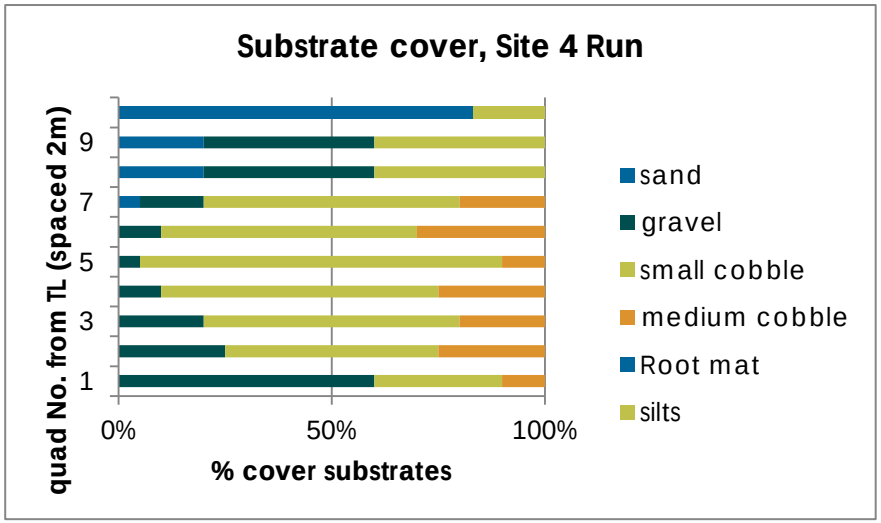
Site 1, lower River (20m below foot bridge)

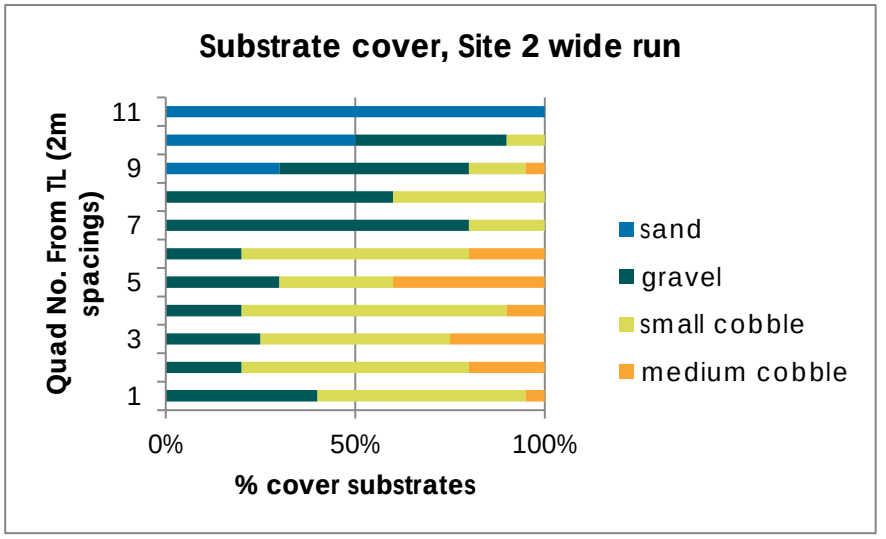


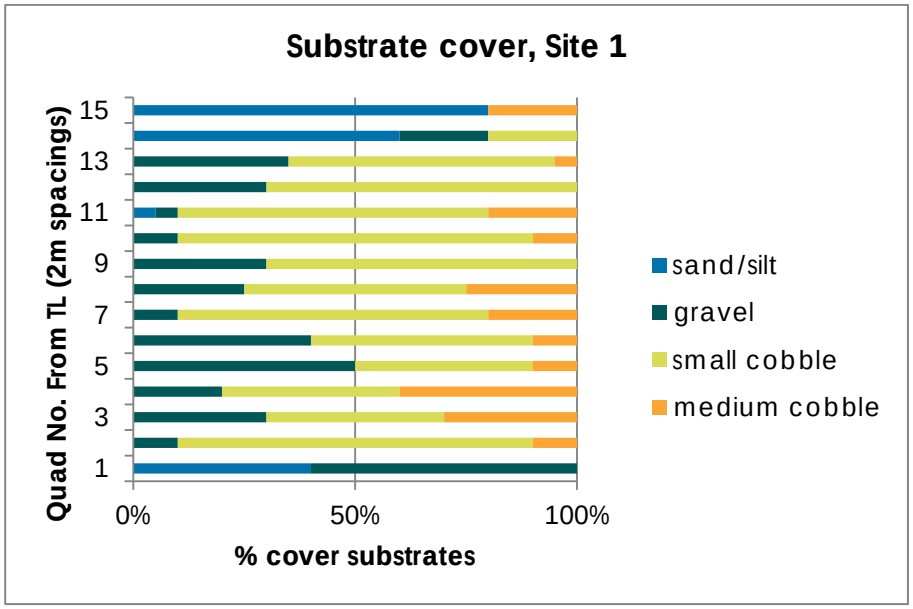
Substrate types and composition from multiple 1 m² quadrats at each site





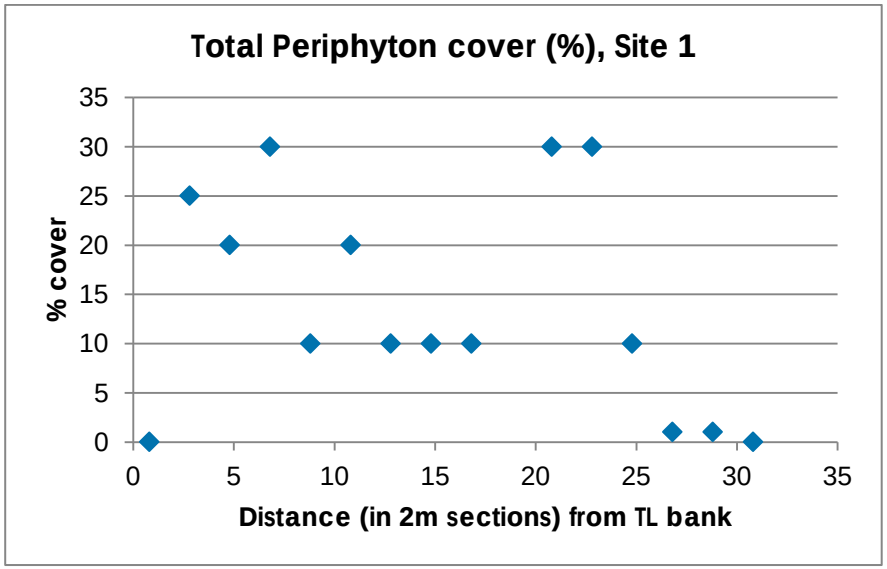


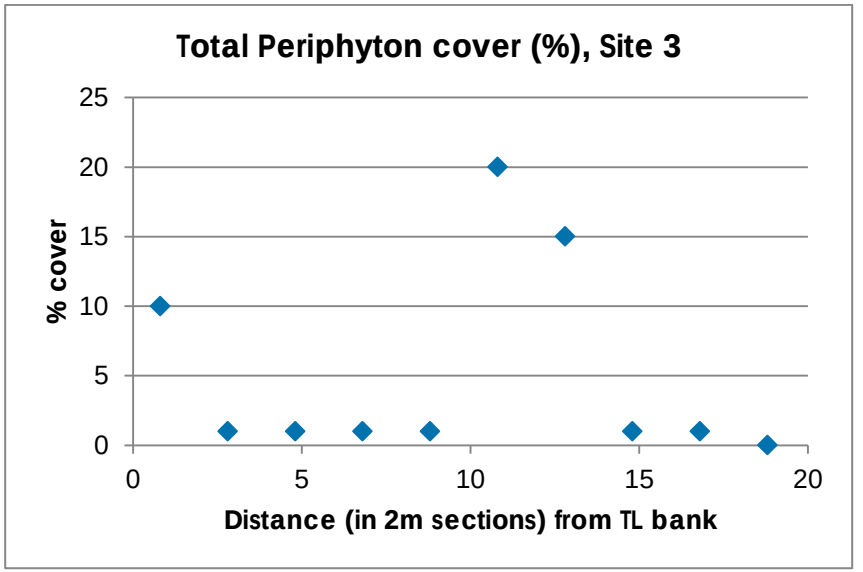


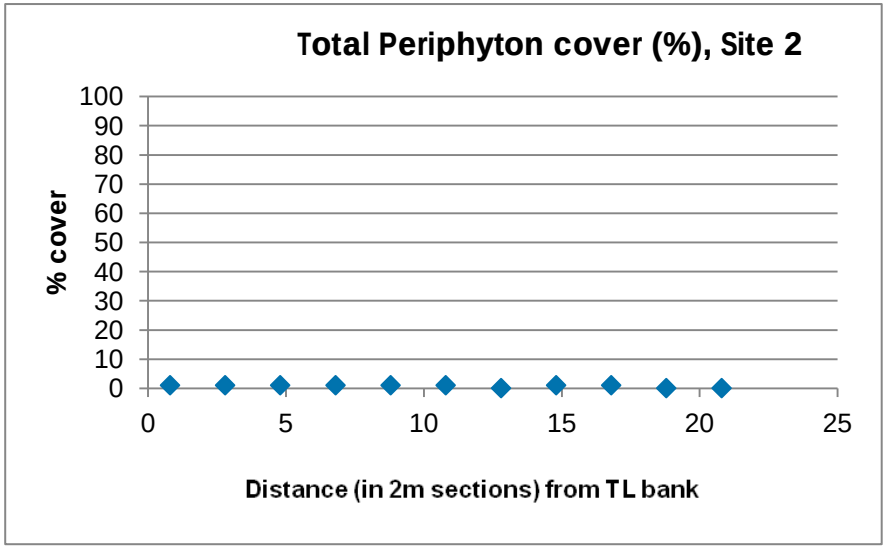


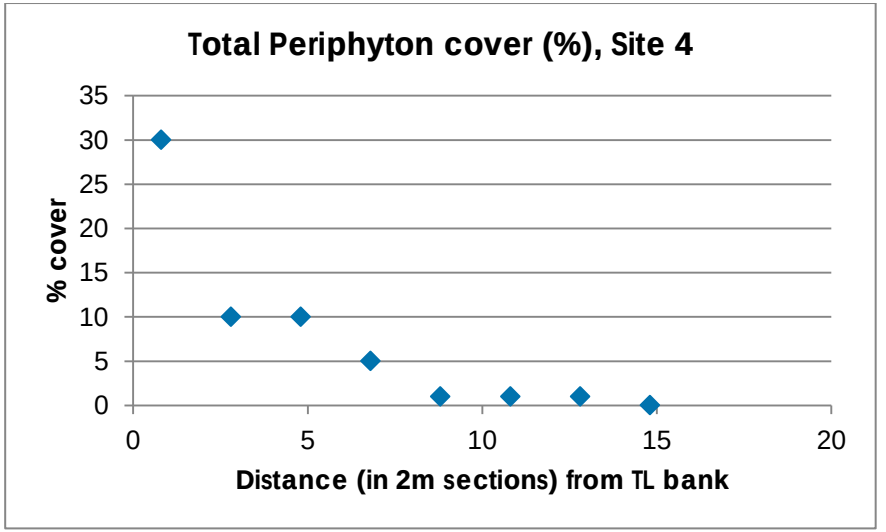
Periphyton Substrate Cover.

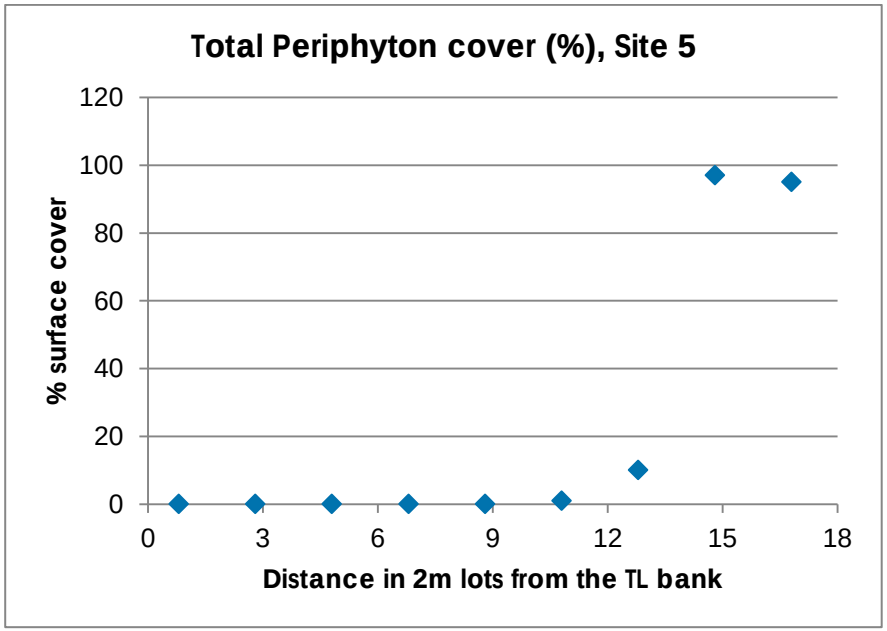
As described in the methods visual percentage cover of 1m2 quadrats was made of periphyton cover and included notes on the basic algae types present.


Total Periphyton cover (%), Site 1
% cover
0
5
10
15
20
25
30
35
0
5
10
15
20
25
30
35
Distance (in 2m sections) from TL bank


Total Periphyton cover (%), Site 3
% cover
0
5
10
15
20
25
0
5
10
15
20
Distance (in 2m sections) from TL bank


Total Periphyton cover (%), Site 2
% cover
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
Distance (in 2m sections) from TL bank


Total Periphyton cover (%), Site 4
% cover
0
5
10
15
20
25
30
35
0
5
10
15
20
Distance (in 2m sections) from TL bank


Total Periphyton cover (%), Site 5
120
100
80
60
40
20
0
% surface cover
0
3
6
9
12
15
18
Distance in 2m lots from the TL bank

Appendix 6 Kakariki-Paetawa bed load sediment baseline results.

Trap volume 190mm by 190mm by 290mm = 10469000mm3 or 0.0105m2 or approximately 10 Liters																	
Period Day in/ Day Out	Rainfall Waikanae River (mm)	Rainfall Mangaone Valley (mm)	Paetawa 1	Paetawa 2	Paetawa 3	Paetawa 4	Paetawa 5	Kak Lower 1	Kak Lower 2	Kak Lower 3	Kak Lower 4	Kak Lower 5	Kak Upper 1	Kak Upper 2	Kak Upper 3	Kak Upper 4	Kak Upper 5
7/09/2012 - 14/09/2012	20.5	52.5	100%	100%	100%	100%	100%										
14/09/2012 - 18/09/2012	5.5	11.5	13%	13%	5.30%	3.70%	7.90%	81.6%	100%	100%	100%	100%	100%	100%	100%	100%	75%
18/09/2012 - 26/09/2012	0	0	10.50%	13%	7.90%	13%	13%	81.5%	94.70%	100%	100%	100%	13%	2.70%	10.50%	10.50%	10.50%
26/09/2012 - 3/10/2012	8.5	14.5							100%	100%	100%	100%	100%				
03/10/2012 - 5/10/2012	7.5	5.5							100%	100%	100%	100%	100%				
26/09/2012 - 19/10/2012	73	92.5	13%	2.70%	13%	2.70%	1%	100%	100%	100%	100%	100%	100%	63%		47.30%	100%
19/10/2012 - 22/11/2012	69	135.5	96%	50%	50%	50%	50%	100%	100%	100%	100%	100%	100%	100%	90%	80%	70%
Composition by eye in the traps			fine mud, leaf material, nittella	fine mud, leaf material, nittella	fine mud, leaf material, nittella	fine mud, leaf material, nittella	fine mud, leaf material, nittella	50% organic, 50% sand	30% organic, 70% sand	20% organic, 80% sand	30% organic, 70% sand	70 % sand, 30% organic	30% organic, 70% sand	20% organic, 80% sand/muds	40% organic, 60% sands/muds	30% organic 70 % sand/muds	30 % organic, 70% sand
								100% sand	100% sand	100% sand	100% sand	100% sand	30% sand, 35 mud, 35 organic	20 sand, 20 mud, 60 orginic	sand 30, mud 30, organic 60	sand 50, mud organic mix 50	sand 50, mud 20, organic 30
								sand organic mix	sand organic mix	sand organic mix	sand organic mix	sand organic mix	90 sand/10 carbon	90 sand/10 carbon	Stick had moved,	Sand 90/10 carbon	
									70% sand / 30% organic	70% sand / 30% organic	70% sand / 30% organic	70% sand / 30% organic	80% organic and 20% sands	80% organic and 20% sands	80% organic and 20% sands	80% organic and 20% sands	80% organic and 20% sands
								60% sand/40 debris	80% sand 20% organic	80/20 sand organic	75 sand/25 organic	80 sand/20 organic					
								100% sand	100% sand	100% sand	100% sand	100% sand					

Accumulation periods

The accumulation of sediments in the traps was highly variable (Table below). The Paetawa could have a bed movement that filled 100% (10L) of the trap within 7 days or even after 34 days the traps might only be 60% full. The Paetawa bed movement appears to be related most to rain events and particular sizes as well as the possibility for specific land use influences. The loer Kakariki however, caould fill the traps within 2 days and did not appear reflective of rain event or flow. The upper Kakariki was more mobile than the Paetawa but less so than the lower Kakariki.

Accumulation period (days)	Paetawa	lower Kakariki	upper kakariki
7	100%		
4	9%	96.32%	95%
8	11.48%	95.24%	9%
7		100%	

2		100%	
23	6%	100%	70%
34	59%	100%	88%

The correlation between rain fall events and trap catch is not apparent and higher rainfalls did not lead to higher sediment capture in the traps (Table below).

Rainfall Mangaone Valley (mm)	Paetawa	lower Kakariki	upper kakariki
0	11.48%	95.24%	9.44%
5.5		100.00%	
11.5	8.58%	96.32%	95.00%
14.5		100.00%	
52.5	100.00%		
92.5	6.48%	100.00%	70.10%
135.5	59.20%	100.00%	88.00%

Analysis of the sediments for quantities relating to volumes caught in the pit traps show in the Paetawa 10L of sediment (or 0.01m2) can shift under 20-50 mm of rain in 1 week and that that volume equates to around 28 grams of dry sediment which is comprised of 3 grams of fine material (<63 µm) and around 30% of both large and small material is organic.

Paetawa sediment caught	Sediment component >63um	Sediment component <63um
Average dry weight (gm)	25.26554	2.95622
organic material (%)	27.106	30.308
Trap 100 full (10L)		

Appendix 7 Paetawa and Kakariki Senstive Taxa (MCI ≥5) baseline Data

Sensitive Taxa (>5 MCI score (for soft bottom streams (Stark & Maxted 2007)) for the Paetawa and Kakariki Streams.

Stream	Kakariki		Paetawa	
Sampling protocol/effort:	3 kicks per site.		3 kicks per site.	
Date Collected	9-Dec-10		12-Dec-10	
Easting	1750249.57		405351	
Northing	405141.03		1750050	
Dom Rip Hab	Blackberry		Scrub	
Dom Land Use	Riparian		Grazing	
Sub Samples	Average	SEM	Average	SEM
Trichoptera				
Hydrobiosis sp.	8	2.45		
Olinga			4.67	2.03
Plectrocnemia			1	
Polyplectropus	1			
Psilochorema	1			
Triplectides	9.3	1.9	2	0.82
Diptera				
Molophilus	1			
Paralimnophila			1	
Tabanidae			4	
Crustacea				
Amphipoda	6.67	2.8	698	183
Paracalliope	1887	199		

Average values are presented with an error of the mean estimate of variance

Appendix 8 Indicative Stream Diversion guideline

Introduction

An indicative stream diversion design and cross-section has been developed by the Project team with ecological input. The information for these diversion design guidelines has been developed from the freshwater sampling carried out by Boffa Miskell as part of the ecological investigations undertaken for the MacKays to Peka Peka Expressway and the reference material provided by published works such as Richardson Jowett (1996) on fish species requirements.

Objectives

The design objective for all stream diversions and new stream sections is to form new channels which have the ecological components necessary to achieve the mitigation levels required by the SEV models ecological compensation ratios. This means creating channels that have values at or near those of a reference or pristine stream.

This will require the design to consider the stream and floodplain form, the stream bed and bank substrate, flow dynamics and riparian cover.

Current Situation

With the exception of the Muaupoko Stream diversion, all existing streams consist of long uniform run situations with similar depth, substrate and velocity profiles over large linear distances. Furthermore, most stream diversions are proposed in areas of open grassed channel characterised by dense beds of aquatic weeds and riparian weeds such as blackberry. In all these waterbodies there are good opportunities for diversion and new lengths to enhance the local stream function and habitat value.

These Guidelines

The purpose of these stream diversion design guidelines is to guide the establishment of the final design of the diversion channels, focusing in particular on setting the meander, habitat hypes, depths and maintaining current velocity. These guidelines have been developed to improve the stream corridor so that small meanders and flood plains can be installed that will reduce the total stream length lost and create a greater diversity of stream habitat.

Because of the relatively uniform and homogenous characteristics of the streams proposed to be diverted, we consider that a set of guiding principles and indicative stream plans and cross-sections is more practical than developing specific stream diversion design guidelines. The objective of ecological involvement during construction of the stream diversions will ensure these principles are met.

The following design standards for diversions and new sections of stream are based on the results of the SEV sampling and analysis. Matching these parameters as closely as possible will ensure that all new diversions improve the diversity of morphology, hydrology, substrate, and habitats of the current channels:

Channel length:

While most waterbodies diverted consist of flat, uniform sections, in order to minimise the loss of channel length through diversions, the development of meandering sections within the floodplain is essential.

Creating meanders in all stream diversions is vital for improving current values and providing habitat diversity, channel complexity, and velocity reduction. In some locations such as the Muaupoko Stream realignment the meanders will require rock rip rap and armouring, but if properly installed this form of armouring can provide good habitat for small native fish and macro-invertebrates.

The meander should be planned on detailed drawings.

Width of wetted bed and water depth

To match existing stream widths and depths, but designed to provide irregular widths to improve habitat values and provide habitat diversity.

The width and depth of the wetted bed should be planned and pegged out on site in conjunction with the Project Ecologist.

Velocity

To match existing low velocities and long runs consistent with these low-lying streams in sand country.

Bed material

To match as closely as possible current substrates which are dominated by fine sands, muds and silts with small gravels in some sections.

The placement of these different sized bed materials needs to be monitored and size will be determined by velocity and desired habitat. Consent conditions need to require ecological instruction and guidance during this process.**

Hyporheic Zone

Where the new diversion channel is to be formed in peat or sands, the bed is to be cut down 0.5m below final bed depth and filled with coarse material to form a deep gravel / cobble bed and functioning Hyporheic zone. If the excavation falls in river gravels this will not be necessary.

Channel complexity

- To match as closely as possible current low gradient runs and pools.
- 90% runs / slow glides
- 10% pool

Channel Habitat Diversity

This is expected to increase over time from 3 to 6 types including

- Cobble riffle
- Run
- Pool
- Root mat (from riparian vegetation)
- Undercut (bank)
- Wood and log material

Shading

Currently low shading based on predominantly grazed pasture to stream edges with some overhanging banks, blackberry weedlands, and weedy aquatic macrophyte.

To attain a minimum (with revegetation) of 80% shading based on riparian canopy of small trees, and sedgelands.

Spawning Habitat

Currently limited to small areas not subject to regular stock grazing or mowing.

Intention is to increase spawning habitat with landscaping to a minimum of 40% of stream margin (subject to substrate strength) and extending into riparian planting.

Planting

Species and planting to be carried out as described in the SLMP

A focus on native species tolerant of wet conditions and that exhibit rapid growth and robust root structure as well as potential for shading.

Planting to achieve the following

- Erosion control immediately following earthworks – hydro-seed with inter-planting
- Riparian cover and stream shading
- Weed control – elimination

Appendix 9 SEV baseline comparison numbers for Diversion channels post construction and establishment

SEV total scores and compartmentalised scores for each functional aspect of the waterways related to Diversions

Function category	Variable (code)	Paetawa Drain	Kakariki	Drain 7	Muaupoku Stream	Mazengarb (WWTP)	Hadfields Drain/Kowhai	Upper Drain 7	Smithfield Drain	KC Ref 1
	Vbed	0.54	0.5	0.5	0.7	0.5	1	0.5	0.5	1
	Verosn	1	0.7	0.2	0.7	0.2	0.7	0.2	0.2	1
	Vimper	1	1	1	1	0.5	0.5	0.9	0.3	1
Hydraulic	=	0.77	0.6	0.35	0.7	0.175	0.425	0.315	0.105	1
	Vfpwidth	0.7	0.4	0	0	0	0	1	1	1
	Vfreq	0.4	0.4	0.1	0.4	0.4	0.4	0.1	0.8	0.1
Hydraulic	=	0.55	0.4	0.05	0.2	0.2	0.2	0.55	0.9	0.55
	Vbarr	0.3	1	0.3	0.3	0	0	0.3	0.3	1
	Vcatch	1	1	1	1	1	1	1	1	1
Hydraulic	=	0.3	1	0.3	0.3	0	0	0.3	0.3	1
	Vbed	0.54	0.5	0.5	0.7	0.5	1	0.5	0.5	1
Hydraulic	=	0.54	0.5	0.5	0.7	0.5	1	0.5	0.5	1
Hydraulic function mean score		0.54	0.625	0.3	0.475	0.2188	0.40625	0.416	0.4513	0.888
	Vshade	0.95	0.7	0.55	0.4	1	0.51	0.09	0.01	0.94
	Vdepth	0.7	0.8	0.7	1	0.8	0.8	1	0.8	1
	Vveloc	1	1	0.8	1	0.8	0.9	1	1	0.9
	Vlength	0.4	0.4	0.4	0.4	0.4	0.8	0.8	0.8	0.4
biogeochemical	=	0.825	0.717	0.592	0.6	0.833	0.67167	0.512	0.438	0.853
	Vdod	0	0.147	0.275	1	0.703	0.51134	0	0.0369	1
biogeochemical	=	0	0.147	0.275	1	0.7033	0.51134 1	0	0.0369	1
	Vcanop	0.061	0.1	0.38	0.32	0.99	0.54	0.04	0	0.85
	Vdecid	0.05	0.05	0.4	0.05	0.4	0.45	0.27	0.23	0.94
biogeochemical	=	0.059	0.098	0.304	0.312	0.792	0.4185	0.035	0	0.451
	Vtrans	1	1	0.7	0.1	0.4	1	1	1	0.1
	Vretain	0.039	0.025	0.025	0.02	1	1	1	1	0.017
biogeochemical	=	0.039	0.025	0.017	0.002	0.4	1	1	1	0.002
	Vsurf	0.083	0.104	0.162	0.1349	0.1607	0.09539	0.061	0.061	1
biogeochemical	=	0.083	0.104	0.162	0.1349	0.1607	0.0954	0.061	0.0607	1
	Vfpwidth	0.7	0.4	0	0	0	0	1	1	1
	Vrough	0.79	0.73	0.55	0.7	0.4	0	0.16	0.7	1
	Vfreq	0.4	0.4	0.1	0.4	0.4	0.4	0.1	0.8	0.1
biogeochemical	=	0.63	0.51	0.217	0.3667	0.2667	0.1333	0.42	0.8333	0.7
Biogeochemical function mean score		0.273	0.267	0.261	0.403	0.526	0.4717	0.338	0.395	0.668
	Vgalspwn	1	0	0	1	0	0	0	1	1
	Vgalqual	0.25	0.75	0.25	0.75	0.25	0.25	0.25	0.75	1
	Vgobspwn	0.8	0.8	1	1	1	0.1	0.1	0.1	1

habitat provision	=	0.525	0.4	0.5	0.875	0.5	0.05	0.05	0.425	1
	Vphyshab	0.186047	0.302326	0.313953	0.442	0.569767	0.476744	0.069767	0.372093	1
	Vwatqual	0	0.066171	0.144377	0.3	0.421989	0.258227	0	0.003871	0.72
	Vimper	1	1	1	1	0.5	0.5	0.9	0.3	1
habitat provision	=	0.343	0.418	0.443	0.5459	0.5154	0.42793	0.26	0.2624	0.93
Habitat provision function mean score		0.434	0.409	0.472	0.711	0.508	0.23896	0.155	0.3435	0.965
	Vfish	0.5	0.6	0.367	0.533	0.3667	0.3	0.3	0.3	0.6
Biodiversity	=	0.5	0.6	0.367	0.533	0.3667	0.3	0.3	0.3	0.6
	Vmci	0.1	0.1	0.1	1	0.1	1	0.3	0.1	0.7
	Vept	0.364	0.182	0.09	0.5455	0	0.4	0.1	0.1	1
Biodiversity	=	0.232	0.141	0.096	0.773	0.05	0.7	0.2	0.1	0.85
	Vvert	0.5	0.6	0.367	0.533	0.3667	0.3	0.3	0.3	0.6
	Vinvert	0.518	0.471	0.143	0.740	0.016	0.598639	0.438	0.6488	1
Biodiversity	=	0.51	0.535	0.255	0.637	0.191	0.44932	0.369	0.474	0.8
	Vripcond	0.3	0.3	0.1	0.1	0.1	0.1	0.6	0.3	0.6
	Vripconn	1	1	1	0.8	0.8	0.2	0.2	0.8	1
	Vripar	0.5	0.1	0.1	0.2	1	0.5	0.1	0	0.8
Biodiversity	=	0.6	0.467	0.4	0.3667	0.633	0.2667	0.3	0.3667	0.8
Biodiversity function mean score		0.46	0.436	0.279	0.577	0.310	0.429	0.292	0.31	0.76
Overall mean SEV score		0.407	0.416	0.302	0.503	0.393	0.416	0.323	0.381	0.783

EMP Attachment 5: Wetland Monitoring and Mitigation Plan

17 June 2013

NZ TRANSPORT AGENCY
WAKA KOTAHI

MacKays to Peka Peka Expressway

Revision History

Revision Nº	Prepared By	Description	Date
A	Matiu Park	Draft for Alliance Review.	10 April 2013
B	Matiu Park	Draft incorporating KCDC & GWRC review comments for internal review	14 April 2013
C	Matiu Park	Final Draft Report	3 May 2013

Document Acceptance

Action	Name	Signed	Date
Prepared by	Matiu Park	Final Report	6 May 2013
Reviewed by	Stephen Fuller		17 June 2013
Approved by	Stephen Fuller		
on behalf of	MacKays Peka Peka Alliance		

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TABLES

1 INTRODUCTION

This wetland monitoring and mitigation plan provides the technical details to support the general information and summaries contained in the EMP. Information from the Ecological Impact Assessment (Technical Report 26) and Ecological Technical Report 1: Terrestrial Vegetation and Habitats (including wetlands) (Technical Report 27) and the baseline ecological investigations of wetlands have informed the methodology.

A number of consent conditions relate to the protection of valued wetland vegetation and habitats. In summary these conditions require:

Table 1 Summary of consent conditions relating to wetlands

Conditions	Sub	Summary Text
DC.54	d)	An LMP shall be prepared
	iv)	seek to retain areas of wetlands as far as practicable including minimising effects
	vi)	Integrate landscape work with restoration of wetlands
G.27	-	Erosion and Sediment control management plan will be prepared and shall
	ii)	ensure activieis avoid remedy mitigate effects of soil erosion sediment runn off and deposition on valued areas/habitats
G.28A	-	In managing the project
	a)	shall be no changes to groundwater that will result in significant changes to wetland hydrologic conditions
G.29	a)	A GMP will be prepared
	-	GMP will be developed in parallel with the EMP
G.34	d)	develope triggers for wetland and actions for exceedences
	e)	Develop details of all remedial and mitiagation measures proposed.
	f)	including monitoirng during
	g)	including monitoirng post
	h)	Response measures if remedy and mitgation not succesfful
	i)	outlaine adaptive management approach foro wetlands
	k)	including consideration of wetland loss outside project footpring duei to hydrology changes
	m)	inlcuding salvage of wetland plants
G.38	-	Shall undertake monitoring ans shall
	a)	Collect baseline for 1 year to support development of EMP
	b)	Monitor wetlands for the entire duration of construction in accordance with management triggers
	c)	Monitor wetland hydrology for five years following construction to confirm mitigaiton successfully acheived
G.38B	a)	Undertake Wetland Condition Monitoring in the five wetlands identified as potentially at risk of hydrological changes to water tables:
	1	Raumati Manuka Wetland;

	2	Otaihanga Northern Wetland;
	3	Otaihanga Southern Wetland;
	4	El Rancho Wetland (Weggery); and
	5	Ngarara Wetland;
	b)	Wetland condition surveys shall be carried out as follows
	c)	Wetland condition monitoring shall be carried out for 5 years post construction
	d)	See also GD.7, G.34, G.38
G.40	a)	Develop an adaptive management process for wetlands
	b)	Adaptive management shall
	i)	Establish baseline information on wetland hyrdolrology and develop management trigger levels (where practicable)
	ii)	Undertake monitoirng during and following construction to observe if triggers exceeded
	iii)	If management trigger exceeded implement the followoing
	4	Provide a reportt to the manager
	c)	Details of proposed adaptive management to be included in EMP
	d)	If inconsistency conditions take precedence
G.41	a)	Prepare detailed maps of all wetlands.
	b)	maps used to
	i)	raise awareness during plan preparation
	ii)	raise awareness during construction and operation
	c)	areas of indigenous vegetatoin and habiatat are
	ii)	valued wetlands
	1	Raumati Manuka Wetland;
	2	Northern Otaihanga Wetland;
	3	Southern Otaihanga Wetlands;
	4	New wetland adjacent to Wastewater Treatment Plant Drain
	5	El Rancho Wetland (Weggery);
	6	Tuku Rakau Wetland; and
	7	Ngarara Wetland.
	d)	The adverse effects on these areas will be minimised by
	i)	Detailed design will avoid or minimise effects as far as practicable
	ii)	Mechanisms will be developed to protect areas of valued habitat that are not required to be cleared
	iii)	Mechanisms will be developed to minimise effects where part of valued habitat is to be cleared.
G.42	a)	shall undertake planting and restoration
	b)	in accordance with plan set which shall comprise
	ii)	5.4 ha of landscaped and planted indigenous wetland habitat
	iv)	within flood storage Areas 2A and 3 10 ha of wetland and riparian planting
G.42 A	-	mitigaiton for loss of modificaiont of wetland habitat shall as far a practical mirro the wetland classess lost

These conditions of consent are listed in full in Appendix 1.

As part of the Board of Inquiry process, it was agreed that there were only eight potentially affected wetlands that needed specific consideration as part of the EMP and project monitoring. They are specified in Consent Condition G.38A and the related Consent Condition G.D 7. These valued wetlands are located as follows:

Table 2 Valued Wetland Vegetation and Habitats

Site Name	Chainage
1. Raumati Manuka Wetland	Between 3700 & 3900
2. New wetland created adjacent to Wastewater Treatment Plant	Between 8525 & 8650
3. Southern Otaihanga Wetlands	Between 8700 & 8800
4. Northern Otaihanga Wetland	Between 9250 &9150
5. El Rancho Wetland (Weggery)	Between 10900 &11050
6. Tuku Rakau Wetland	Between 11300 &11400
7. Ngarara Wetland	Between 13600 &13750

1.1 Integration between Ecology and Hydro-Geology

Conditions relating to the monitoring and protection of extant wetlands span two disciplines and require close integration between the EMP and Groundwater Management Plan and coordination between the project ecologist and project hydro-geologist.

The GMP is responsible for piezometer installation and monitoring methodology and the development of management alert levels and action triggers. The project hydro-geologist is responsible for monitoring, statistical analysis of the piezometer data and liaising with the project ecologist on a regular basis and in the event of an exceedence (See conditions GD.1 to GD.7).

The EMP is responsible for establishing a baseline of wetland health based on Wetland Condition Monitoring surveys. The project ecologist is responsible for construction and post construction monitoring of these wetlands, the analysis of any changes to wetland vegetation and functioning and liaising with the project hydro-geologist on a regular basis and in the event of piezometer exceedences and/or significant changes to wetland condition (G.38 c) and G.38B).

1.2 OBJECTIVES

In summary there are nine primary requirements for this plan. They are:

1. To map and describe all valued wetland vegetation and habitats within the designation;
2. To understand wetland hydrology
3. To ensure detailed design will avoid or minimise effects as far as practicable;
4. To raise awareness of each of the areas during construction and operation;

5. To provide mechanisms that will protect areas of valued habitat that lie within the Project Footprint and designation, but which do not need to be cleared;
6. To provide mechanisms that minimise the impact on areas of valued habitat where complete loss is not required.
7. To establish an adaptive management process for construction and post construction monitoring.
8. To monitor wetlands and their hydrology for 5 years following construction to determine if remedy and mitigation have been successful.

2 METHODOLOGY

The vegetation survey and mapping carried out for the Assessment of Effects has been carried out to a level of detail that it provides a sufficient baseline to inform detailed design and construction management sufficient to achieve the outcomes described by resource consent conditions G.34 and G.41 for valued terrestrial vegetation and habitats. The following sampling methods were used (Refer to Technical Reports 26 & 27).

2.1 Vegetation Mapping and Survey

2.1.1 Fieldwork Timing and Effort

The botanical fieldwork for the plant species lists was undertaken during October 2010, November 2010 and January 2011. Following on from the spring/summer field work, and more detailed refinement of the Expressway Alignment, more detailed field mapping was undertaken during March and April 2011. For the vegetation study the entire Expressway Alignment was either walked or driven to ensure all mapped vegetation was observed. Incidental botanical observations were also added during other ecological investigations.

Further site visits were undertaken during April, May and July 2011 to refine the vegetation mapping and species descriptions and to visit areas where further information was required. Specific Wetland Condition Assessments were undertaken in July 2011 following the final Expressway Alignment and Designation extent being confirmed.

2.1.2 Vegetation Mapping

Vegetation patterns were mapped in the field onto high resolution colour aerial photographs overlaid with proposed Designation boundaries. This work was undertaken through March and April 2011, prior to the final Expressway Alignment being confirmed. To ensure all potentially affected vegetation communities were included within this assessment a corridor extending 100 m to either side of the centreline of the alignment was mapped. Following confirmation of the preferred Designation route, this vegetation was trimmed back to

include the Construction Designation. Vegetation shown on maps outside this corridor is based on the LDCBII national dataset.

During the ecological survey particular attention was paid to vegetation communities known to be reduced from their former extent in the Wellington Ecological District (e.g. wetlands, dunes and coastal forest) or vegetation with potentially rare or uncommon species present. Where these sites fell within the Designation or where these sites were considered to be potentially affected through indirect effects (e.g. hydrological changes), they were individually visited to check for presence of rare or threatened plant species (refer discussion below).

2.1.3 Botanical Surveys

Desktop studies and discussions with local botanical experts determined the location of key habitats where rare or uncommon plants, known to occur locally, were most likely to occur within close proximity to the Project. Botanical surveys and lists of vascular plants were compiled for 10 indigenous habitats within these locations. Habitats where these surveys were conducted included manuka-dominated wetlands, sedgeland and rushland wetlands, wet dune depressions in pasture, mature shrublands and areas of advanced regeneration.

To maximise botanical effort during seasonal flowering, botanical surveys were undertaken in key habitats identified as potentially at risk during the initial project scoping phase (when a number of alternative route options were still being considered). While this approach has meant that some areas surveyed are now not affected by the Project, the botanical information gathered has provided some useful comparative information on species and composition of wetlands in close proximity. For example, the survey included detail on a number of wetland and forest communities now located some distance from the Expressway Alignment (e.g. Poplar Ave Peatlands, 131 Raumati South Peatlands). Following the final route confirmation (7 July 2011), more detailed Wetland Condition Assessments were undertaken in those immediately affected habitats.

Botanical survey work was undertaken during October 2010, November 2010, January 2011 and July 2011 by Pat Enright and Matiu Park.

2.2 Piezometers

A series of piezometers were installed in / close proximity to the wetlands outlined in Condition G.38B to provide baseline information on wetland hydrology in order to develop action alert trigger levels for each wetland.

The locations and methodologies for this installation, monitoring, and analysis are contained in the Groundwater Management Plan.

2.3 Wetland Condition Monitoring

The Handbook for Monitoring Wetland Condition (Clarkson et al. 2004) was used to develop the baseline dataset, and will be used to monitor wetland condition in the five wetlands identified as being potentially affected by project-related effects. These locations were agreed in conjunction with hydro-geologists and agreed in ecological conferencing and consent condition G.38B and the Wetland Monitoring Locations are outlined in the valued wetland map sets in the EMP.

The Handbook for Monitoring Wetland Condition methodology was followed, with soil and plant leaf samples sent to Hills Laboratory for processing. Wetland Condition Monitoring sampling and data analysis were carried out by BML Staff and Pat Enright, a local botanist.

Sampling locations were determined by experienced staff to take into account relative distance to Expressway and ensure representative sampling plots. Data was gathered and analysed in accordance with the methods described in the Handbook for Monitoring Wetland Condition (Clarkson et al, 2003)1.

In addition to canopy composition, information was gathered on understory, canopy height, ecological context, hydrology, catchment characteristics and physical wetland parameters.

Wetland condition assessments were undertaken by Matiu Park, with botanical assistance from Pat Enright and Tim Park.

Wetland condition monitoring surveys have been undertaken at the five identified wetlands in summer 2012/13, with further survey to take place in winter 2013 to coincide with high water levels.

Maps 1 - 7outline the locations of the Wetland Condition Monitoring Plots.

2.4 The Prevalence Index (PI) method

In the event of a recorded change in hydrology (Piezometers) which may result in changes to wetland condition an attempt will be made to apply this tool to the plot vegetation data from the Wetland Condition Monitoring plots. If water tables are significantly lowered as a result of the Project, the plant species composition in the plot will become less hydrophytic and the PI will increase (US Army Corps of Engineers 2010).

The PI provides a quantitative measure of how hydrophytic ('wet') the vegetation is, based on species abundance and wetland ratings. To use this tool requires rating categories of obligate (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU) and

[1] CLARKSON, et.al. 2003. Handbook For Monitoring Wetland Condition. Coordinated Monitoring of New Zealand Wetlands. A Ministry for the Environment Sustainable Management Fund Project (5105). Revised October 2004

upland (UPL). We understand this is being developed for NZ wetland plant species by Landcare.

Note that this tool has not been used in New Zealand before for the monitoring of construction activity and the results of this analysis must be considered in relation to the findings of other monitoring methods.

3 BASELINE SURVEY RESULTS

3.1 Vegetation Mapping

Consent condition G.41 a) requires

> *The Consent Holder shall engage a suitably qualified ecologist to prepare detailed maps identifying all those areas that contain indigenous vegetation or indigenous habitats, including those listed in (c) below, with information on their relative values and protection requirements.*

The following wetland communities were identified by this survey.

Table 3: Descriptions of wetland vegetation communities within the MacKays to Peka Peka Corridor.

		Project Footprint	Designation	Project Footprint	Designation
Wetlands and wet depressions:		Area (ha)	% of Total Project Footprint	Area (ha)	% of Total Project Footprint
2.01	Riparian margins in pasture / rushlands: Dominated by introduced pasture grasses and *Juncus* rushlands. Usually associated with farm drains. Common species include Yorkshire fog, browntop, water pepper (*Persicaria hydropiper*), *Isolepis prolifa*, monkey musk (*Mimulus guttatus*) and rushland species are both native and exotic.	1.99	1.2%	3.99	1.2%
2.02	Wet pasture with *Juncus*: Predominantly exotic pasture grasses with grazing-induced *Juncus*. Native *Juncus* predominantly *Juncus sarophorus* and *J. edgariae*, with exotic *Juncus* dominated by *J. articulatus* and *J. effusus*. Typically regularly grazed by stock.	13.90	8.2%	21.14	6.4%
2.03	Sedge-rushland dominated wetlands: Purei sedgeland wetlands with *Carex secta* and *Carex virgata* predominantly. Includes areas of occasional *Baumea* and *Juncus* (introduced and exotic). This vegetation community often includes areas of open water. *Sphagnum* may be present in some areas.	0.78	0.5%	2.04	0.6%
2.04	*Cyperus ustulatus* dune depressions: Wet dune depressions in pasture dominated by grazing-induced *Cyperus ustulatus*. Occasional *Carex* species present and *Juncus* often widespread.	0.25	0.2%	0.47	0.1%
2.05	Manuka wetlands: Typically dominated by a canopy of *manuka* over a range of wetland shrub, sedge, rush and fern species. *Carex secta* and *C. virgata* often present in sub-canopy or areas of open water. *Isolepis prolifer* often dominant in wetter areas and *Sphagnum* occasional.	0.76	0.4%	1.30	0.4%
2.06	Manuka wetlands with *Sphagnum*: As above, but with *Sphagnum* the dominant understory species and *Isolepis prolifer* often common.	0.03	0.0%	1.00	0.3%
2.07	Mature and maturing swamp forest with kahikatea: *Kahikatea* and *pukatea* dominant, with a wide range	0	0.0%	0.06	0.0%

	of understory species, including kiekie, *mahoe*, kawakawa, water bracken, cabbage tree, *Carex geminata*, *Carex virgata*, kanuka, *Baumea* and fern species.				
2.08	Open water / permanent ponds. Typically farm ponds or areas of open water in areas of pasture where water table is exposed, but can include larger open water components of larger wetlands when separately mapped.	0.60	0.4%	2.01	0.6%

Maps 1 – 7outline the wetland vegetation communities in each of the identified wetlands.

3.2 Relative Values

The following eight sites are the only areas of continuous wetland vegetation found within the designation that were agreed to have ecological value.

Table 4 Relative Values of indigenous vegetation

Wetland	Size (ha)	Description	Existing site management/fencing	Relative Value
Raumati Manuka Wetland	2	The main and northern extent consists of a manuka scrub and Sphagnum wetland with large areas of open water and Isolepis. To the south, predominantly open water with Carex and areas of Baumea rushland around the wetland margins. Seasonally wet dune depression with 0.5m of water during winter months, drying out over summer months. Wetland interior relatively weed free, but surrounded by a large buffer of gorse and blackberry. Refer plant species list attached to Technical Report 27.	Almost entirely surrounded by blackberry and gorse. Western edge of wetland is subject to ongoing illegal dumping (mostly vegetation and soil). Wetland is unfenced.	Medium
New wetland created adjacent to Wastewater Treatment Plant	TBC	New proposed wetland	Blackberry weedlands	NA
Otaihanga Southern Wetland	1.4	A large purei sedgeland (Carex secta and Carex virgata) with large areas of open water, Baumea rushland and scattered manuka (mostly dead or dying) Northern extent of this wetland adjoins a small remnant of dry vegetation with a large matai. Standing water through winter and spring dries out over summer months.	Low level of management by KCDC and mountain bike track maintenance; recent pine forest removal in some areas, particularly around northern extent of northern wetland. No grazing pressures. Wetland is unfenced.	Medium
Otaihanga Northern Wetland	1.0	A moderately sized manuka and Carex wetland situated between two high sand dunes. Due to surrounding pine plantation and associated low light conditions, this wetland remains relatively weed free. Seasonally wet, with standing water of approximately	Low level of management by KCDC and mountain bike track maintenance; recent pine forest removal in some areas, particularly around northern	Medium

		0.5m deep disappearing during summer months. A road has separated the two wetland components and impeded drainage, modifying the vegetation from historical extent.	extent of northern wetland. No grazing pressures. Wetland is unfenced.	
El Rancho Wetland (Weggery)	3.9	A large area of manuka dominated wetland with some open water. A number of remnant kahikatea present and showing a high biodiversity of wetland species present. While buffered by considerable infestation of gorse and blackberry, the wetland interior remains relatively intact and weed free. Drainage in recent years has modified historical Sphagnum wetland values to some extent. Part of KCDC Ecosite K170 (El Rancho Wetland Complex).	Surrounded by rank pasture, blackberry with low levels of grazing. Part of area is maintained by Vector under the gas pipeline. Limited grazing pressures. Southern part of wetland is unfenced, with an old fence located within wetland interior.	Mediu m
Tuku Rakau	0.3	A small wetland with scattered manuka, cabbage trees, baumea and Juncus spp.	Fenced	Low
Ngarara Wetland	2.7	A large area of manuka dominated wetland with areas of Carex sedgeland and regenerating kahikatea forest east of Ngarara Road. One of the few wetlands on the Kāpiti Coast that still contains the naturally uncommon mistletoe Korthalsella salicornioides. Wetland margins surrounding the wetland core are dominated by blackberry.	Northern and eastern sides are in pasture. Remainder is almost entirely blackberry with some regenerating forest. Wetland is fenced, although some animal pressures.	Mediu m

3.3 Protection Requirements

The consented project footprint will affect the seven sites of valued wetland vegetation and habitat to the extent shown in the following Table. The protection requirements are given.

Table 5 Protection requirements for indigenous wetlands

Site Name	Protection Requirements
Raumati Manuka Wetland	Loss of 0.03 ha of this 2.0 ha wetland. Remainder to be avoided and/or effects remedied.
New wetland created adjacent to Wastewater Treatment Plant	Requires shaping and development to form wetland and the transfer of plants and materials from other wetland reclamation
Southern Otaihanga Wetlands	Loss of 0.55 ha of this 1.4 ha wetland. Remainder to be avoided and/or effects remedied.
Northern Otaihanga Wetland	Loss of 0.53 ha of this 1.0 ha. Remainder to be avoided and/or effects remedied.
El Rancho Wetland (Weggery)	Loss of 0.38 ha of this 3.9 ha wetland. Remainder to be avoided and/or effects remedied.
Tuku Rakau Wetland	This 0.3 ha wetland is to be avoided and/or effects remedied.
Ngarara Wetland	Loss of 0.01 ha of the dry buffering edges adjacent to this 2.7 ha wetland. Wetland and surrounding buffering vegetation to be avoided and/or effects remedied.

Table 6 outlines the consented totals of each wetland vegetation community within the Project Footprint.

Table 6: Consented area of indigenous wetland vegetation communities lost or modified under the Project Footprint:

Vegetation Community	Amount Lost (ha)
Sedge-rushland dominated wetlands (type 2.03)	0.78
Cyperus ustulatus dune depressions (type 2.04)	0.25
Manuka wetlands (type 2.05)	0.76
Manuka wetlands with Sphagnum (type 2.06)	0.03
TOTAL	1.80

3.4 Wetland Hydrology

- The Groundwater (Level) Management Plan outlines the results of the piezometer information from the wetlands being monitored in accordance with Condition G.38A.

4 MONITORING

Condition G.34 f), requires the ongoing construction and post-construction monitoring of the seven wetlands identified above to determine whether those wetlands to be avoided have been, to identify any changes in condition arising from the Project that have not been consented and ensure the outcomes sought have been achieved (including remedial and mitigation measures). Monitoring shall be carried out as follows:

4.1 Introduction

There are three scenarios of potential adverse effects on extant valued wetlands, each requiring a different monitoring and management approach. They are

- Areas of valued indigenous wetland within the designation that can be avoided (outside project footprint). Various mechanisms and monitoring and management will be used to confirm there have been no adverse effects.
- Areas of valued wetland that will be cleared in part. These areas will need to be subject to detailed monitoring during and post construction.
- Wetlands that may be adversely affected by hydrological changes associated with the project within, and outside the designation.

In addition monitoring is required for ecological mitigation sites post construction to determine success. The following sections outline the monitoring and management requirements under these scenarios.

4.2 Construction Monitoring

Observation of Vegetation Clearance

a. Immediately following clearance

Immediately following vegetation removal/completion of earthworks in vicinity of any of the seven areas of valued wetland vegetation a survey will be carried out to

- Confirm the extent of clearance has been carried out in accordance with the demarked area.
- Determine if any remedial work is required which may include but is not limited to:
- buffer planting to protect from edge effects
- clearance of earth-worked material entering and/or smothering areas of wetland vegetation during construction;
- Identify any existing weeds for monitoring and potential control.
- The results of the survey and any remedial work will be included in the required quarterly reports.

b. Bi-Annual Surveys following clearance

Surveys of all sites of indigenous wetland clearance or modification will be carried out twice per year in mid spring (October) and mid Autumn (April) in of each of the five wetlands requiring this survey (condition G.38) to:

- Determine if there has been consequent die-back beyond the demarked area as a result of edge effects such as
  - Removal of plantation pine forest leading to drying out or loss of vegetation outside of the demarked area/Project Footprint;
- Determine if there has been an increase in invasive weeds within the area of retained indigenous vegetation
- Determine if additional remedial work is required to further protect the vegetation (e.g. buffer planting).

The results of the survey and any remedial work will be included in the required quarterly reports.

NOTE: these surveys are of extant indigenous vegetation only and not of revegetation areas which will undergo surveys for weeds and browsing pests as part of the contract for planting (managed under the SSLMP or relevant SSEMP).

Wetland Condition Monitoring

Wetland Condition Monitoring will be undertaken in accordance with condition G.38B to determine if there has been a change in wetland vegetation community condition as a result

of hydrological change associated with the project. Each of the five wetlands monitored will be compared with the baseline wetland condition monitoring surveys as follows:

- Bi-annual surveys will be carried out in summer (during low groundwater conditions) and winter (during elevated groundwater conditions) throughout construction in the wetlands identified in Condition G.38B.
- It shall include Wetland Condition Monitoring of all potentially affected wetlands (Condition G.38B) outside of the Project Footprint including photopoints.
- The baseline pre-construction ecological information in Appendix 3 (Wetland Record Sheet for the *Handbook for Monitoring Wetland Condition* (Clarkson *et al.* 2004)) will be used to provide an overall assessment of condition and assist with identification of any changes to the overall condition over time.
- A report will be prepared outlining whether there have been any adverse effects or changes to these wetlands when compared with the pre-construction state of these areas.

Hydrological (Piezometer) Monitoring

Hydrological monitoring of extant wetlands using piezometers is also required for the five wetlands identified in Condition G.38B for five years following completion of construction of each stage.

- The methodology for this monitoring is described in the Groundwater Management Plan (GMP). This monitoring will be carried out under the GMP and the results provided and discussed with the Project Ecologist quarterly.
- The results of this piezometer monitoring will be included in the reports prepared for extant wetland condition monitoring.
- Piezometer monitoring management triggers and alert levels will be used as the basis for determining ecological involvement.

4.3 Post Construction Monitoring

Wetland Clearance Monitoring

Monitoring of wetlands where there has been loss of modification will continue for five following completion of earthworks in conjunction with wetland condition monitoring as described above.

Wetland Condition Monitoring

Wetland condition monitoring as described above will continue for five years following completion of earthworks in proximity to the wetland as described above.

Piezometer Monitoring

Piezometer monitoring will continue as outlined in the groundwater management plan for five years following project completion as described above.

Mitigation Success Monitoring

Monitoring of the success of wetland formation and mitigation planting will be undertaken in coordination with the project Landscape Architect, stormwater engineers and project hydrologist to ensure ecological remedial and mitigation works meet the project outcomes and objectives specified in conditions G.34 and G.38 c).

The timing and methodology of this monitoring will be detailed in the maintenance schedules to be developed for each of the SSEMP / SSLMP areas, as will any requirements for remedial work necessary to ensure mitigation success is achieved.

The ecological component of sign-off will involve the relevant specialist ecologists involved in determining the specific mitigation requirements for each site (e.g. avi-fauna, herpetofauna, freshwater, wetland).

Mitigation requirements will be specified within each SSEMP. Measures of success that will be monitored are:

- Total area of planted or restored wetland that as far as practicable reflects the indigenous habitat types, wetland classes lost and ecological functioning and is based on development of similar representative vegetation communities (G.42A).
- Survival of a minimum of 80% of the planted indigenous wetland plant species.
- Canopy closure of a minimum of 80% within the planted areas of the wetlands (excluding areas of open water).
- Invasive terrestrial weed species successfully controlled.
- Natural colonisation by other non-planted indigenous wetland species.
- Success of wetland plants salvaged from other wetlands being lost or modified (depending on specific wetland areas with salvaged plants).

Taking into account the above, at completion of all ecological mitigation planting, a survey will be undertaken by the Project Ecologist of each ecological wetland mitigation area to sign off on mitigation success, in terms of the above parameters (in conjunction with the Project Landscape Architect).

4.4 Other Considerations

The analysis and interpretation of monitoring results and any associated adaptive management response (as outlined in section 6) will need to take account of changes to land use associated with the Project, as well as natural seasonal and successional changes in wetland vegetation in these relatively young wetland systems. For example:

- Fencing and stock exclusion from the El Rancho Wetland (Weggery) will need to consider natural vegetation changes from reduced stock browsing and cattle pugging within the wetland and natural regeneration after wetland vegetation removal as part of the Western Link Road.
- Wetland Condition Monitoring will need to consider the rapid colonisation of the Ngarara Wetland by blackberry associated with the ongoing drying out of this wetland observed over the past 8 years.
- Wetland Condition Monitoring and photo points will need to consider the increased weed domination within the Otaihanga Northern and Southern Wetlands associated with the removal of plantation pines surrounding the perimeter of both wetlands. Pine removal may also result in water table changes in these wetlands associated with reduced water update.

These natural changes need to be considered in the monitoring reporting and in determining the need for an adaptive management response in terms of determining Project-induced change/s and/or determining mitigation requirements.

5 ADAPTIVE MANAGEMENT

The intention of the adaptive management approach (G.34 l) and G.40) is to:

- Respond in the event that clearance of wetlands result in adverse effects greater than allowed for in consent conditions.
- Respond in the event that the project results in hydrological changes that result in measureable changes to wetland community condition
- Respond in the event that mitigation planting does not achieve the mitigation objectives / outcomes.

Because of the complexity of wetland ecology and hydrology, no one tool can be relied upon to identify changes to wetland condition and health. In all cases described below the monitoring results and management triggers need to be considered together.

5.1 Management Triggers

Management Triggers for wetland loss and modification

The management triggers relate to specific conditions relating to consented loss of wetland habitat (1.8 ha) and to the requirement to manage weeds and pests.

Management Triggers for Hydrological Change:

Hydrology, using piezometers, is the only variable being monitored that allows for development of a quantifiable management trigger. This trigger however, needs to be considered in the context of any changes to wetland condition monitoring or wetland indigenous vegetation community extent. Small changes to hydrology may not lead to a change in wetland health. Similarly changes to wetland health may be triggered by environmental changes unrelated to hydrology (as outlined in section 5.3 above).

The Groundwater (Level) Management Plan (GMP) outlines the results of the piezometer information from the 5 wetlands being monitored in accordance with condition G.83B. Statistical analysis of the piezometer monitoring information has established a range of triggers that will be applied as management triggers and these are listed in the GMP.

The focus is on early identification of changes so that potential effects on wetlands can be avoided by mitigating groundwater level changes before the wetland is deleteriously affected.

Management Triggers for Wetland Condition Monitoring

The following management triggers have been developed from baseline wetland condition monitoring required by condition G.38B, general observations of wetland health on the Kapiti Coast, together with discussions with other wetland ecologists involved in long term wetland monitoring. The management triggers are as follows:

- A ~~20%~~ 3 point change in two or more of the following Wetland Condition Monitoring parameters based on the corresponding summer (with low groundwater levels) or winter (with elevated groundwater levels) baseline condition surveys (outlined in Appendix 2):
  - Total Wetland condition Index /25; or
  - Total wetland pressure index /30; or
  - Indicator Score for each Wetland Condition Monitoring Plot /20; or
  - A change in vegetation structure within the monitored wetland.

Note: A decrease in pressure index would be considered to be positive (i.e. an increase in wetland condition), while a decrease in pressure index could be a factor in triggering adaptive management.

Management Trigger Levels Mitigation Success

The focus for created ecological mitigation wetlands within the SSEMP areas is for them to mirror as closely as possible the wetlands which have been removed and for which these wetlands are being formed as mitigation (in conjunction with flood storage, hydrological and landscape and visual mitigation requirements).

The success of mitigation planting will be based on consent conditions which specify a minimum area of wetland mitigation planting and habitat formation, and upon standard requirements for revegetation success. The target outcomes for revegetation will be

- 9.5 ha of planted and/or restored wetland in the following proportions

Sedge-rushland dominated wetland (type 2.03)	4.1	43%
Cyperus ustulatus dune depressions (type 2.04)	1.3	14%
Manuka wetlands (type 2.05)	4.0	42%
Manuka wetlands with Sphagnum (type 2.06)	0.2	2%
	9.5	100%

- Survival of a minimum of 80% of the planted indigenous wetland plant species at completion of the 4 year plant maintenance requirements.
- Indigenous canopy closure of a minimum of 80% within the planted areas of the wetlands (excluding areas of open water) at completion of the 4 year plant maintenance requirements.
- Invasive terrestrial weed species successfully controlled, in accordance with plants listed in the GWRC Regional Pest Management Plan 2010.
- Natural colonisation by other non-planted indigenous wetland species.
- Success of wetland plants (Carex and Baumea spp.) salvaged from other wetlands being lost or modified (depending on specific wetland areas with salvaged plants).

Monitoring of these management triggers is the joint responsibility of the project ecologist and landscape architect.

5.2 Summary of Management Triggers

In summary, these result in the following management triggers.

Table 7: Management Triggers for changes in wetland extent and condition

Attri bute	Measure	Management Trigger
Extant valued vegetation (G.41)		
Total vegetation community area	The project clears more extant indigenous vegetation than consents allow (G.42)	> 1.8 ha of valued wetland vegetation lost or modified
Specific weed threats	Weeds currently not present in each area are introduced to the site or clearance encourages increase in invasive weed presence	Increase in either weed extent or diversity in response to vegetation clearance
Domestic stock access	Presence of stock and effect of grazing on extant vegetation.	Increase in browse damage.
Wetland Hydrology		
Baseline seasonal hydrology	Piezometer monitoring	See GMP
Wetland Condition Monitoring	A 20% change in two or more of the following Wetland Condition Monitoring parameters based on the corresponding summer (with low groundwater levels) or winter (with elevated groundwater levels) baseline condition surveys.	1. Total Wetland condition Index /25; or 2. Total wetland pressure index /30; or 3. Indicator Score for each Wetland Condition Monitoring Plot /20; or 4. A change in vegetation structure within the monitored wetland;
Mitigation planting (G.43)		
Total area of planted or restored wetland vegetation.	Area of revegetation does not meet consent requirements (G.42)	< 9.5 ha of terrestrial mitigation planting achieved
Wetland	Failure to achieve required proportions of mitigation for communities lost	< 4.1 ha sedge rushland < 1.3 ha Cyp Ust dune depressions < 4.0 ha manuka wetlands <0.2 ha manuka sphagnum wetlands
Plant survival	Survival of a minimum of 80% of plant species.	>20% loss of plants at 4 years
Canopy closure	Canopy closure of a minimum of 80% within the planted areas.	< 80% canopy closure at 4 years
Invasive weeds	Weeds currently not present in each area are introduced to the site or clearance encourages increase in invasive weed presence	Increase in either weed extent or diversity in response to vegetation clearance
Natural processes	Natural colonisation by other non-planted indigenous species.	Absence of colonisation of native species.

Wetland Salvage	Salvage and transfer of wetlands components from wetlands beneath project footprint to restored wetlands	Subjective assessment of plant survival.

5.3 Process if adverse effects

In the event that one or more of the above management triggers is exceeded an adaptive management processes will be implemented in consultation with the Manager as follows:

Vegetation clearance

- The Project Ecologist will be contacted within 24 hours to visit the site and review any construction-related effects against the baseline ecological condition of the site.
- A report will be prepared for the Manager, including outlining any response management and monitoring requirements, as outlined in section 6 (adaptive management) in accordance with Condition G.40.
- Prior to undertaking any adaptive management interventions the written consent of Greater Wellington Regional Council and Kāpiti Coast District Council will be required in accordance with Condition G.40 b) iii).

Change to Hydrology

In the event that the project hydro-geologist identifies through monitoring an exceedence of a trigger level (either an increase or decrease in groundwater level) the following process will be instigated.

- Where management triggers levels are approached or exceeded the Project Hydrologist shall inform the Project Ecologist and an adaptive management process will commence as described in Section 7 of this report and in the GMP.
- The Project Ecologist and Project Hydro-Geologist will visit the wetland to review wetland health against the established triggers and baseline ecological condition (wetland condition monitoring and mapping of wetland vegetation communities).
- Depending on the nature of the trigger exceedence, notes will be taken on any noticeable changes in the science-based indicators as appropriate, based on the Wetland Condition Monitoring surveys and the wetland vegetation communities. This could include changes in hydrology, water pollution, nutrient enrichment, seasonal biodiversity indicators (e.g. presence of summer flowering species), invasion by weeds, animal pests or impaired wetland functioning (e.g. indigenous wetland species die-back).
- Depending on the outcomes of the site visit, a recommendation will be made on whether there is a plausible cause-effect association with the Project. If the exceedence can be attributed to the Project, the on-site practice that is generating the effect will be identified, followed by a recommendation for any implementation mechanisms

necessary to prevent future exceedences and alterations to operational measures in consultation with GWRC.

- Should any remedial or mitigation action be required, a detailed programme will be developed for approval by GWRC before implementation. Certification of any necessary amendments to management plans or other documents will be undertaken, along with any necessary resource consents being obtained. Prior to undertaking any triggered adaptive management interventions the written consent of Greater Wellington Regional Council and Kāpiti Coast District Council will be required in accordance with Condition G.40 b) iii).
- A written report will be provided to GWRC within 10 Working Days of each exceedence which includes details of the exceedence, reasons for the exceedence and measures implemented in responses to the exceedence.

Wetland condition monitoring

In the event that adverse effects are identified to any extant wetland an adaptive management process will commence. This could include consideration of the following:

- Review of extent of mapped wetland vegetation communities to assess change in the dominance of native species and dryland plant invasion
- Botanical survey (species lists and identification of rare or threatened plants).
- Depending on the development of the Prevalence Index (PI) for wetland species in New Zealand (Landcare in development), this Wetland Condition Monitoring-based management trigger could take into account plant species composition in the monitoring plots (i.e. if they become less hydrophytic if water tables are significantly lowered as a result of the Project the PI will increase (and vice versa)).
- A report will be prepared for the Manager, including outlining any response management and monitoring requirements, as outlined in section 6 (adaptive management) in accordance with Condition G.40.
- Prior to undertaking any adaptive management interventions the written consent of Greater Wellington Regional Council and Kāpiti Coast District Council will be required in accordance with Condition G.40 b) iii).

Mitigation Planting Success

- In the event that mitigation planting does not achieve the objectives the project ecologist and landscape architect will prepare a report for the Manager, including recommendations for remedial work or additional mitigation, and ongoing monitoring and reporting through the adaptive management process.

5.4 Options for Adaptive Management

In the event that adaptive management is required for vegetation clearance, changes to wetland hydrology, or failure of remedy or mitigation a range of adaptive management

scenarios are available which could be applied. The method chosen will be specific to the wetland and the cause and extent of adverse effects that have been identified as follows:

- Additional monitoring if there is uncertainty regarding the severity or cuase of the adverse effect.
- For deposition of earthworks within extant wetlands (e.g. through pre-loading), careful hand-removal of debris could be undertaken as soon as practicable with ecological supervision.
- For changes to hydrological levels through Expressway embankment construction or changed water flows, construction of a new outlet with an adjustable weir system to alter groundwater or hydrological through-flows – or reductions in volume or outlet of adjacent flood storage area/s.
- For temporary raised or lowered water levels in the wetland during construction, manually raising or lowering the water level in the wetland through development of temporary or re-deployment of existing groundwater bores or construction of temporary drainage channels.
- For control of invasive weed species that have established in wetlands as a result of edge effects or as a result of hydrological changes, targeted control of any invasive weed species as listed in the GWRC Regional Pest Management Plan 2010 (attached as Attachment 5) or other weed species determined by the Project Ecologist.
- For additional loss or unanticipated die-back of wetland vegetation, replanting of any areas of lost or modified wetland vegetation with appropriate indigenous wetland species consistent with affected vegetation or the development of an expanded area of buffer planting surrounding the vegetation lost.
- Undertake additional mitigation opportunities at other areas of wetland or within landscape and amenity plantings within the designation (in conjunction with the Project Landscape Architect), such as the incorporation of plant species lost or an increased allowance for interplanting of primary swamp forest species.

5.5 Additional Mitigation

Should the Project outcomes for wetlands not be met or the adaptive management options described above be unsuccessful, additional mitigation may be required such as:

- Development of an expanded area of buffer planting surrounding the affected area (for example, in the large areas of gorse surrounding the Raumati Manuka Wetland);
- Undertake a comprehensive weed control and planting programme in other areas of flood offset storage within the Designation (for example, north of the Paetawa Stream
- Undertaking additional mitigation opportunities at other areas of indigenous vegetation within the Designation;

- Creation of additional habitat linkages with other areas of indigenous wetland or habitat to facilitate bird movement (e.g. additional planting between Ngarara Wetland and the Kakariki / Smithfield SSEMP area);; or
- Additional mitigation opportunities at other areas of wetland within the wider Foxton Ecological District.

In accordance with Condition G.34 k), in the event that additional wetland vegetation related to the Project occurs outside of the Project Footprint, additional mitigation must be undertaken applying the Environmental Compensation Ratio for wetlands outlined in condition G.34 k). See Table 6 below.

Table 8 Mitigation Ratios for Wetlands

Vegetation Community	Area consented for removal (Condition G.42 b) ii))	Landscaped and planted indigenous wetland habitat (Condition G.42 b) ii))	Wetland planting within the 10 ha area of flood storage areas 2A and 3 (Condition G.42 b) iv))	Mitigation Ratio
Wetlands	1.8 ha	5.4 ha	4.1 ha	X 5.2

As required by condition G.34 k), the Environmental Compensation Ratio for wetlands outlined in Table 8 has been derived from the area of consented indigenous wetland removal (1.8 ha) and the total area of landscaped and planted indigenous wetland habitat (5.4 ha) and the relative proportions of wetland (4.1 ha) and riparian (5.9 ha) of planting within the 10 ha of flood storage areas 2A and 3, as outlined in Condition G.42.

As per condition G.42A, ecological mitigation for loss or modification of any indigenous vegetation will comprise, as far as practicable, mitigation that reflects the Indigenous habitat types and ecological functioning and is based on development of similar representative vegetation communities.

As per Condition G.40, any adaptive management and/or mitigation requirements as a consequence of post-Construction effects on indigenous vegetation will roll over the 5-year monitoring requirements for indigenous vegetation monitoring and success monitoring.

If additional mitigation is required the project ecologist and landscape architect will provide a report and recommendation to the Manager.

ENDS

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7 APPENDICES:

Appendix 1: Consent Conditions

Conditions	Body Text
DC.54	d) The LMP shall provide information as to how the outcomes in Condition DC.53C will be achieved, including specific information on the following aspects:
	iv) The retention of areas of indigenous vegetation as far as can be achieved, including minimising effects of the Cycleway/Walkway/Bridleway (CWB) through the Raumati Manuka Wetland, Otaihanga Southern Wetland, Otaihanga Northern Wetland and the Otaihanga Kanuka Forest (for example, through the use of boardwalks);
	vi) The integration of landscape work with ecological restoration, including those required for stream diversion and permanent stormwater control ponds, and wetland planting and restoration to maximise the ecological benefits of mitigation planting and restoration.
G.27	The Consent Holder shall submit a draft Erosion and Sediment Control Management Plan (ESCP) to the Manager at least 30 working days prior to Work commencing. The final ESCP will be submitted to the Manager for certification at least 15 working days prior to commencement of Work. The ESCP shall be submitted with the CEMP as an appendix. The purpose of the ESCP is to describe the methods and practices to be implemented to ensure the effects of sediment generation and yield on the aquatic receiving environments associated with the Project will be appropriately managed. In addition, the ESCP shall:
	ii) Identify areas susceptible to erosion and sediment deposition and implement erosion and sediment control measures appropriate to each situation with particular Emphasis on high-risk areas, including El Rancho Wetland (Weggery), Raumati Manuka Wetland (between Poplar Avenue and Raumati Road), Southern Otaihanga Wetland, the Northern Otaihanga Wetland (adjacent to Otaihanga Landfill) Waikanae River, Wharemauku Stream and the Kakariki Stream;
G.28A	In managing the construction of the Project, and the potential for changes to the groundwater levels to occur, the Consent Holder shall achieve the following outcomes:
	a) That there shall be no changes to the groundwater levels that shall result in a significant change to wetland hydrological conditions; and
G.29	a) At least 15 working days before submitting the Groundwater (Level) Management Plan (GMP) to the Manager for certification, the Consent Holder shall submit a copy of the draft GMP required by condition G.29 to KCDC for comment. Any comments received shall be supplied to the Manager when the GMP is submitted, along with a clear explanation of where any comments have not been incorporated and the reasons why.
	Work shall not commence until the Consent Holder has received the Manager's written certification for the GMP. The GMP shall be developed in parallel with the EMP (as required by condition G.34) to ensure that the monitoring and mitigation measures are appropriate for wetland management.
G.34	d) The monitoring to be undertaken prior to the commencement of Work (in accordance with the monitoring conditions G.38 – G.40) to establish baseline data and to develop management trigger levels to measure effects against, and detail what actions will be taken in response to any exceedence of the trigger levels during Works;
	e) Full details of all remedial and mitigation measures proposed (including those detailed in condition G.42) the objectives of these measures and identification for each how the Consent Holder will determine whether mitigation has been successfully achieved;
	f) Full details of monitoring proposed to determine whether remedial and mitigation measures have been successfully achieved and have met objectives to ensure success;
	g) Full details of all monitoring to be undertaken post-construction Work in accordance with

Conditions	Body Text
	conditions G.38-G.40;
	h) Response measures should remedial and mitigation measures not have been successfully achieved;
	i) Detail on how adverse effects on the North Island Fernbird population will be avoided during construction and operation of the Project in conjunction with designation condition G.37B;
	k) Ensure that in the event that additional vegetation or habitat loss related to the Project occurs outside of the Project Footprint, including Project-related hydrological changes to wetlands, terrestrial and wetland mitigation calculations are consistent with the Environmental Compensation Ratios as detailed in Condition G.42.
	m) The salvage of elements of any valued habitat of indigenous flora and fauna identified in condition G.41 that is being lost as a result of the Project where practicable, including provision for transfer of elements of the affected habitat to ecological mitigation sites. This should include as a minimum: felled logs, Carex, Baumea and associated soils;
G.38	The Consent Holder shall undertake monitoring in accordance with the EMP as required by condition G.34 and shall:
	a) Collect baseline information for 1 year prior to commencement of Work on vegetation, wetlands, freshwater and marine ecology and fernbird to enable management triggers to be developed, to provide information to support the development of the EMP, and to allow Project-related ecological effects to be identified;
	b) Monitor vegetation, wetlands, freshwater and marine ecology and fernbird for the entire duration of construction Work in accordance with the pre-construction baseline management triggers to identify changes in condition arising from the Project; and
	c) Monitor ecological information on vegetation, freshwater and marine ecology in accordance with the pre-construction baseline management triggers for a minimum of 2 years and wetland hydrology for 5 years (in accordance with GD.7) following completion of construction of the Project to confirm mitigation requirements outlined in G.34 are successfully achieved;
G.38B	a In addition to the groundwater monitoring for wetlands (as outlined in condition GD.7), Wetland Condition Monitoring (undertaken in accordance with Clarkson et al, 2003. Handbook for Monitoring Wetland Condition. A Ministry for the Environment Sustainable Management Fund Project 5105), shall be undertaken in the following wetlands identified as potentially at risk of hydrological changes to water tables:
	i) Raumati Manuka Wetland;
	ii) Otaihanga Northern Wetland;
	iii) Otaihanga Southern Wetland;
	iv) El Rancho Wetland (Weggery); and
	v) Ngarara Wetland;
	b) A wetland condition survey shall be undertaken within representative habitat in each of the wetlands listed above, including photo-points. One survey shall be undertaken in representative wet and dry seasons (as defined by the EMP) at those locations listed above and the results of each survey shall be submitted to the Manager for information;
	c) Wetland condition monitoring shall be undertaken for 5 years post-construction in accordance with a) above; and
	d) This condition is to be read in conjunction with monitoring outlined in conditions GD.7, G.34 and G.38.
G.40	a) The Consent Holder shall implement an Adaptive Management approach to respond to ecological

Conditions	Body Text
	effects as outlined in the EMP for those ecosystems identified in the EMP under condition G.34 (l) based on the following principles:
	b) Adaptive Management monitoring shall:
	i) Establish baseline information on the pre-construction ecological values of vegetation, wetlands hydrology, freshwater and marine habitats, and distribution of fernbird, in order to develop 'management trigger levels (where practicable) for each of these environments, which shall be included in the EMP;
	ii) Undertake monitoring during and following construction to observe whether adaptive management trigger levels are exceeded and to determine the effectiveness of the environmental management methods implemented to respond to any exceedences; and
	iii) In the event that any management trigger level is exceeded during or post-construction, implement in consultation with the Manager the following:
	4. Provide a written report to the Manager within 10 Working Days of each exceedence which includes details of the exceedence, reasons for the exceedence and measures implemented in responses to the exceedence.
	c) Full details of the proposed adaptive management approach as required by this condition, including construction monitoring details, shall be included in the EMP required under condition G.34.
	d) If there is an inconsistency between the adaptive management process and timeframes specified in this condition and that specified in other conditions of this consent, the process and timeframes specified in the other relevant condition(s) shall take precedence.
G.41	a) The Consent Holder shall engage a suitably qualified ecologist to prepare detailed maps identifying all those areas that contain indigenous vegetation or indigenous habitats, including those listed in (c) below, with information on their relative values and protection requirements.
	b) The maps shall be used as follows:
	i) During development of the EMP and other relevant management plans, to raise awareness of the ecological implications (including mitigation and consenting requirements) of any design changes; and
	ii) During construction and operational work to inform staff and contractors of the purpose and mechanisms for ensuring the protection of sites of ecological value.
	c) For the purposes of this condition, areas of indigenous vegetation and habitats of indigenous flora and fauna are:
	ii) Valued wetland vegetation and habitats:
	1. Raumati Manuka Wetland;
	2. Northern Otaihanga Wetland;
	3. Southern Otaihanga Wetlands;
	4. New wetland adjacent to Wastewater Treatment Plant Drain created to mitigate permanent loss of wetlands;
	5. El Rancho Wetland (Weggery);
	6. Tuku Rakau Wetland; and
	7. Ngarara Wetland.
	d) The extent of adverse effects shall be minimised by, as a minimum:

Conditions	Body Text
	i) Developing detailed designs which avoid or minimise the extent of effect on areas identified under (c) above as far as practicable;
	ii) Developing mechanisms to ensure that the areas, or parts of areas beyond the Project Footprint, but within the designation, as identified under (c) above, to be avoided, are clearly marked on the ground (e.g. through fences) and that contractors are required to avoid them; and
	iii) For those areas which cannot be avoided, but where complete loss of the ecosystem, vegetation or habitat is not required, developing mechanisms to reduce the impact on the area as far as practicable.
G.42	a) The Consent Holder shall undertake a combined total of at least 40.7 ha of vegetation, wetlands, and streams planting and restoration for the purposes of landscape and ecological mitigation.
	b) In order to achieve the total mitigation outlined in a) above the Consent Holder shall undertake ecological mitigation in accordance with the Plan Set "Proposed Ecological Mitigation Sites" (dated 29 November 2012) unless otherwise approved by the Manager which shall comprise the following;
	ii) A minimum of 5.4 ha of landscaped and planted indigenous wetland habitat; as mitigation for the loss of 1.8 ha of indigenous wetland; plus
	iv) Within flood storage areas 2A and 3, the formation of at least 1.4km of new permanently flowing streams and 10ha of wetland and riparian planting...
G.42A	The ecological mitigation required in condition G.42 for loss or modification of any wetland or terrestrial habitat outlined in condition G.41, shall comprise, as far as practicable, mitigation that reflects the indigenous habitat types, wetland classes lost and ecological functioning and is based on development of similar representative vegetation communities.

Appendix 2: Sampling Carried Out For the AEE

Development of an assessment of ecological effects for the Project involved ecological investigations of all the wetlands that will be traversed by the project and a number in close proximity determined by ecological and hydro-geological advice as being potentially at-risk (generally defined as within 200m of the Project). All sampling was carried out as per the methods provided in the earlier sections. The sample site locations and details are as follows:

Table 9 Detail of each sampled wetland (listed south to north)

	Northing (NZTM)	Easting (NZTM)	Altitude a s l (m)	Size of wetland (ha)	
Raumati Manuka Wetland				2	
Otaihanga Southern Wetland				1.4	
Otaihanga Northern Wetland				1.0	
El Rancho Wetland (Weggery)				3.9	
Ngarara Wetland				2.7	

Sampling type used in each wetland is presented in Table 10.

Table 10: Sampling methods used in each wetland.

Name	Botanical Survey	Wetland Condition Monitoring	Permanent photo points	Mudfish surveys	EFM surveys	Basic Water Quality Sampling	Soil analysis	leaf litter samples	Detailed water quality monitoring	Piezometer sampling
Raumati Manuka Wetland	✓	✓	✓	✓	✓	✓	✓	✓		
Otaihanga Southern Wetland	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Otaihanga Northern Wetland	✓	✓	✓	✓	✓	✓	✓	✓	✓	
El Rancho Wetland (Weggery)	✓	✓	✓			✓	✓	✓		
Ngarara Wetland	✓	✓	✓			✓	✓	✓		

Table 11 summarises the current terrestrial vegetation, the site conditions surrounding each wetland and the nature of the surrounding land use. Relative ecological values are also outlined consistent with Technical Report 26. More information on these values, including botanical assessments, is included in Technical Report 27.

Table 11 Description of values and site management of the five wetlands.

Wetland	Size (ha)	Description	Existing site management/fencing	Relative Value
Raumati Manuka Wetland	2	The main and northern extent consists of a manuka scrub and Sphagnum wetland with large areas of open water and Isolepis. To the south, predominantly open water with Carex and areas of Baumea rushland around the wetland margins. Seasonally wet dune depression with 0.5m of water during winter months, drying out over summer months. Wetland interior relatively weed free, but surrounded by a large buffer of gorse and blackberry. Refer plant species list attached to Technical Report 27.	Almost entirely surrounded by blackberry and gorse. Western edge of wetland is subject to ongoing illegal dumping (mostly vegetation and soil). Wetland is unfenced.	Medium
Otaihanga Southern Wetland	1.4	A large purei sedgeland (Carex secta and Carex virgata) with large areas of open water, Baumea rushland and scattered manuka (mostly dead or dying) Northern extent of this wetland adjoins a small remnant of dry vegetation with a large matai. Standing water through winter and spring dries out over summer months.	Low level of management by KCDC and mountain bike track maintenance; recent pine forest removal in some areas, particularly around northern extent of northern wetland. No grazing pressures. Wetland is unfenced.	Medium
Otaihanga Northern Wetland	1.0	A moderately sized manuka and Carex wetland situated between two high sand dunes. Due to surrounding pine plantation and associated low light conditions, this wetland remains relatively weed free. Seasonally wet, with standing water of approximately 0.5m deep disappearing during summer months. A road has separated the two wetland components and impeded drainage, modifying the vegetation from historical extent.	Low level of management by KCDC and mountain bike track maintenance; recent pine forest removal in some areas, particularly around northern extent of northern wetland. No grazing pressures. Wetland is unfenced.	Medium
El Rancho Wetland (Weggery)	3.9	A large area of manuka dominated wetland with some open water. A number of remnant kahikatea present and showing a high biodiversity of wetland species present. While buffered by considerable infestation of gorse and blackberry, the wetland interior remains relatively intact and weed free. Drainage in recent years has modified historical Sphagnum wetland values to some extent. Part of KCDC Ecosite K170 (El Rancho Wetland Complex).	Surrounded by rank pasture, blackberry with low levels of grazing. Part of area is maintained by Vector under the gas pipeline. Limited grazing pressures. Southern part of wetland is unfenced, with an old fence located within wetland interior.	Medium
Ngarara Wetland	2.7	A large area of manuka dominated wetland with areas of Carex sedgeland and regenerating kahikatea forest east of Ngarara Road. One of the few wetlands on the Kāpiti Coast that still contains the naturally uncommon mistletoe Korthalsella salicornioides. Wetland margins surrounding the wetland core are	Northern and eastern sides are in pasture. Remainder is almost entirely blackberry with some regenerating forest. Wetland is fenced, although some animal pressures.	Medium

		dominated by blackberry.		

Table 12 below summarises the scores derived for each wetlands over the 11 key metrics from the Wetland Condition Monitoring sampling results, then presents the other physical parameters from field measurement data and laboratory analysis within each of the wetland condition monitoring plots.

Wetland	Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form	Total wetland condition index /25	Total wetland pressure index /30	Indicator Score Plot 1 /20	Indicator Score Plot 2 /20	Structure	Composition Plot 1	Composition Plot 2
Raumati Manuka Wetland	Palustrine	Permanent	Fen	Basin	18.9	16	17	19	Shrubland	Manuka / Baumea	Manuka / Carex
Otaihanga Southern Wetland	Palustrine	Permanent	Fen	Basin	20	23	17	17	Sedgeland	Carex	Purei
Otaihanga Northern Wetland	Palustrine	Permanent	Fen	Basin	19.3	19	19	17	Shrubland	Manuka / Carex	Manuka / Carex
El Rancho Wetland (Weggery)	Palustrine	Permanent	Fen	Basin	18	15	17	17	Shrubland	Manuka	Manuka
Ngarara Wetland	Palustrine	Permanent	Fen	Basin	15.6	17	9	n/a	Sedgeland	Carex	n/a

Table 12 Sampling results (from field assessments)

Wetland	Water Table cm		Water pH		Water conductivity		Von Post Index		Water Content (% dry weight)		Bulk Density T/m3		Soil pH		Total C %		Total N %		Total P mg/kg		Foliage % N		Foliage % P	
	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 1 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13	Plot 1 Summer 2012/13	Plot 2 Summer 2012/13
Raumati Manuka Wetland	20	15	4.04	4.14	21	29	5	5	81.9	775	775	0.14	4.3	4.3	31.8	34.2	1.9	1.79	775	423	1.8	1.8	0.10	0.10
Otaihanga Southern Wetland	30	45	4.52	4.85	20	25	7	7	83.8	587	587	0.12	4.5	4.9	42.2	36.0	1.82	2.23	587	980	1.6	1.7	0.23	0.13

Otaihanga Northern Wetland	30	15	4.52	4.7	-1	10	4	4	75.7	928	928	0.14	5.3	4.9	32.9	35.3	1.11	0.99	928	426	1.6	1.5	0.13	0.09
El Rancho Wetland (Weggery)	<5	<5	4.20	4.28	20	22	9	9	64.6	637	637	0.42	4.8	4.8	24.4	15.0	1.37	0.88	637	466	1.7	1.4	0.11	0.09
Ngarara Wetland	<10	n/a	4.56	n/a	23.1	n/a	9	n/a	79.8	n/a	0.15	n/a	4.8	n/a	36.2	n/a	2.59	n/a	1,445	n/a	1.7	n/a	0.13	n/a

Note: needs a placeholder for winter 2013 results

FRESHWATER FISH

Fkye nets and Gee minnow net sampling

Freshwater fish were surveyed on two occasions with wetland sampling locations determined after a review of potential habitat sites on the Kāpiti Coast and discussions with the Department of Conservation (DOC) and Greater Wellington Regional Council (GWRC). The primary focus of fish sampling was on brown mudfish, but the methods used were targeted to include other freshwater fish species:

The first survey by Natasha Petrove (a Massey University graduate experienced in mudfish surveys on the Kāpiti Coast) at the Raumati Manuka Wetland and Otaihanga Northern and Southern wetlands. 4 mm mesh Gee minnow traps were used as described in mudfish monitoring methodology (Ling, O'Brien, Miller, & Lake, 2009)). This monitoring technique gives qualitative information on mudfish within a wetland. In the Raumati Manuka Wetland the traps were set for three nights, the 6th to 9th of December, while at the Otaihanga wetlands they were set for five nights, the 9th, 13th, 20th, 21st, 22nd of December

The second survey was undertaken by Boffa Miskell ecologists experienced in mudfish surveys as part of more detailed stream surveys of mudfish. A single Fyke net as described in mudfish monitoring methodology (Ling, O'Brien, Miller, & Lake, 2009) was deployed in the Northern Otaihanga Wetland for 4 nights from the 14 – 19 December 2012 to check for freshwater fish presence. The Fyke net was checked for presence of fish species each morning, then moved to another location within the wetland each morning.

EFM surveys:

Electric Fishing Machine (EFM) sampling was carried out in a number of wetlands with more permanent water levels by NIWA certified operators using a Kainga 300 backpack electro-fishing machine using the following methodology:

- A suitable sample area was selected, with electric fish sampling targeting areas of deeper water, logs, loose debris, overhanging and trailing vegetation, beds of aquatic plants;
- Fishing within the wetlands was random, with a number of passes in areas of potential habitat identified above.

Wetlands EFM fish sampled

Wetland Name	Area fished (+/- 10m2)
Raumati Manuka Wetland	450 m2
Otaihanga Southern Wetland	500 m2
Otaihanga Northern Wetland	500 m2

WATER QUALITY

During the collection of the Wetland Condition Monitoring information, basic water quality measurements, pH, dissolved oxygen, conductivity and temperature were recorded in the field by BML. During ecological investigations, BML used a TPS 90FLT Field Lab Multimeter and an Insite IG3150 to carry out basic water quality parameters.

Environmental Laboratory Services (ELS) also undertook an extensive water and sediment quality study in the Otaihanga wetlands in conjunction with the ecological and contaminated sites team which is analysed and described in the Baseline Water and Sediment Quality Investigation (BECA, 2011).

Appendix 3: Wetland Condition Monitoring Forms (Summer 2012/13)

Raumati Manuka Wetland - Wetland Condition Sheet

Wetland name: Raumati Manuka Wetland
Region: Wellington
Altitude:
Date: 16 January 2013
GPS/Grid Ref.:
No. of plots sampled: 2

Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form
Palustrine	Permanent	Fen	Basin

Field team: Matiu Park, Pat Enright

Indicator	Indicator components	Specify and Comment	Score 0– 51	Mean score
Change in hydrological integrity	Impact of manmade structures	Induced, historical drainage as part of Drain 7 adjacent	3	3.6
	Water table depth	200mm, followed high rainfall	4	
	Dryland plant invasion	Minimal, gorse on edges	4	
Change in physico-chemical parameters	Fire damage	Nil	5	4.3
	Degree of sedimentation/erosion	Nil	5	
	Nutrient levels	Low	5	
	Von Post index	5 in Von Post index	2	
Change in ecosystem intactness	Loss in area of original wetland	Some noted infilling and changed hydrology and earthworks	3	2.5
	Connectivity barriers	Farnland, residential and large areas of gorse and blackberry	2	
Change in browsing, predation & harvesting regimes	Damage by domestic or feral animals	Rubbish tipping, Canada geese browsing	4	4
	Introduced predator impacts on wildlife	Low, domestic and feral cats?	3	
	Harvesting levels	Nil	5	
Change in dominance of native plants	Introduced plant canopy cover	Gorse and blackberry	4	4.5
	Introduced plant understorey cover	Absent	5	
Total wetland condition index /25				18.9

[1] Assign degree of modification as follows: 5=v. low/ none, 4=low, 3=medium, 2=high, 1=v. high, 0=extreme

Main vegetation types: Manuka canopy with Baumea and Isolepis prolifa.

Native fauna: Pukeko, mallard

Other comments: More species diversity on the raised mounds where manuka root mounds are forming.

Pressure	Score[2]	Specify and Comment
Modifications to catchment hydrology	3	Ongoing drain maintenance in Drain 7, Wharemauku, adjacent affecting water levels (same bed of peat).
Water quality within the catchment	3	Unlikely to be influenced.
Animal access	2	Limited due to no grazing animals. Domestic cats likely to be main issue.
Key undesirable species	3	Gorse, blackberry and weeds from fly tipping.
% catchment in introduced vegetation	4	Much of the catchment in gorse, blackberry and adjacent residential housing.
Other landuse threats	1	Dumping, invasive plants, drainage, 4WD access to wetland.

Total wetland pressure index /30	16	

[2] Assign pressure scores as follows: 5=very high, 4=high, 3=medium, 2=low, 1=very low, 0=none

WETLAND PLOT SHEET

Wetland name: Raumati Manuka **Date**: 16 January 2013 Plot no: 1
Plot size (2m x 2m default): 2x2 **Altitude**: xxx GPS/GR:
Field leader: Matiu Park **Structure**: Shrubland **Composition**: Manuka / Baumea

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1 (or Substrate)	%	H	Species	%	H	Species	%	H
Manuka	20	2.0	Baumea teritoflia	30	1.0	Gonocarpus micrantus	5	5cm
Open water	20		Isolepis prolifa	30		Nertera scapanoides	3	5cm
						Sphagnum moss	75	5cm
						Hydrocotlye pterocarpa	5	5
						Gorse seedlings	1	5cm

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Yorkshire fog

Comments: Relatively uniform vegetation in this area, with increased diversity in raised manuka root mounds.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	
Understorey: % cover introduced spp3	1	4	
Total species: % number introduced spp	10	4	
Total species: overall stress/dieback	NA	4	Gorse dieback
Total /20	NA	17	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
[3] Add sub canopy and groundcover % cover for introduced species

Field measurements:

Water table cm	20 cm	Water conductivity uS (if present)	21mv
Water pH (if present)	4.04	Von Post peat decomposition index	5

Soil core laboratory analysis (2 soil core subsamples): R J Hill Laboratories in Hamilton

Water content % dry weight	81.9	Total C %	31.8
Bulk Density T/m3	<0.10	Total N %	1.9
pH	4.3	Total P mg/kg	775
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Manuka	%N	1.8	%P	0.10

Raumati Manuka Wetland Plot 1 Photopoints:

Raumati Manuka Wetland - Wetland Plot Sheet

Wetland name: Raumati Manuka Date: 16 January 2013 Plot no: 2
Plot size (2m x 2m default): 2x2 Altitude: xxx GPS/GR: xxx
Field leader: Matiu Park Structure: Shrubland Composition: Manuka Carex

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1	%	H	Species	%	H	Species	%	H
Manuka	15	1.5	Baumea teritifolia	20	80	Isolepis prolifa	15	5
			Isolepis prolifa	15	1.5	Sphagnum moss	50	2-3
						Open water	30	0
						Nertera scapanoides	5	2-3
						Gonocarpus micranthus	2	2-3

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Bidens frondosa, Yorkshire fog, Juncus planifolius.

Comments: Similar to previous plot, raised manuka root mounds had increased species diversity compared with areas of open water and Isolepis prolifa/Sphagnum. Baumea scattered and often in association with edges of raised manuka mounds.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	Nil
Understorey: % cover introduced spp3	0	5	Occasional gorse and grasses
Total species: % number introduced spp	0	5	Very low, water table changes primary reason.
Total species: overall stress/dieback	5	4	Manuka in ephemeral margins showing some dieback.
Total /20	NA	19	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
[3]Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	15 cm	Water conductivity uS (if present)	29mv
Water pH (if present)	4.14	Von Post peat decomposition index	5

Soil core laboratory analysis (2 soil core subsamples):

Water content % dry weight	87.8	Total C %	34.2
Bulk Density T/m3	0.14	Total N %	1.79
pH	4.3	Total P mg/kg	423
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Manuka	%N	1.8	%P	0.10

Raumati Manuka Wetland Plot 2 Photopoints:

Otaihanga Northern Wetland - Wetland Condition Sheet

Wetland name: Otaihanga Northern Wetland Date: 16 January 2013
Region: Wellington GPS/Grid Ref.:
Altitude: No. of plots sampled: 2

Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form
Palustrine	Permanent	Fen	Basin

Field team: Matiu Park, Pat Enright

Indicator	Indicator components	Specify and Comment	Score 0– 51	Mean score
Change in hydrological integrity	Impact of manmade structures	Moderate, culvert over track	3	3.7
	Water table depth	20cm	4	
	Dryland plant invasion	Occasional gorse and blackberry	4	
Change in physico-chemical parameters	Fire damage	Nil	5	4.0
	Degree of sedimentation/erosion	None, leachate presumed	4	
	Nutrient levels	Elevated from landfill leachate	3	
	Von Post index	Low	4	
Change in ecosystem intactness	Loss in area of original wetland	Old landfill reduced extent	4	3.0
	Connectivity barriers	Culverts and old landfill	2	
Change in browsing, predation & harvesting regimes	Damage by domestic or feral animals	None	5	4.7
	Introduced predator impacts on wildlife	Moderate – residential/landfill	4	
	Harvesting levels	Nil	5	
Change in dominance of native plants	Introduced plant canopy cover	Low, gorse and blackberry	4	4.0
	Introduced plant understorey cover	Low, gorse and blackberry	4	
Total wetland condition index /25				19.3

1 Assign degree of modification as follows: 5=v. low/ none, 4=low, 3=medium, 2=high, 1=v. high, 0=extreme

Main vegetation types: Manuka over purei (Carex secta and C. virgata). Manuka on raised moss.

Native fauna: Tui.

Other comments: High water table, wetland extent to the north edges into landfill. Surrounded on other three sides by pine plantation on elevated dunes. Notable in that pine to north of Otaihanga wetland recently (6 months) all removed and noticeably increased weed component in this section.

Pressure	Score2	Specify and Comment
Modifications to catchment hydrology	3	Water abstraction bores, landfill.
Water quality within the catchment	4	Leachate from adjacent landfill.
Animal access	2	No control observed, intensive land uses and residential.
Key undesirable species	2	Blackberry and other weeds dominate adjacent wetland, increased weeds from recent pine removal.
% catchment in introduced vegetation	4	Almost entire catchment in landfill and pine plantation.
Other landuse threats	4	Landfill adjacent and continuing leachates.
Total wetland pressure index /30	19	

2Assign pressure scores as follows: 5=very high, 4=high, 3=medium, 2=low, 1=very low, 0=none

WETLAND PLOT SHEET

Wetland name: Otaihanga North **Date**: 16 January 2013 **Plot no**: 1
Plot size (2m x 2m default): 2x2 **Altitude**: xxx GPS/GR: xxx
Field leader: Matiu Park **Structure**: Shrubland Composition: Manuka purei

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1 (or Substrate)	%	H	Species	%	H	Species	%	H
Manuka	15	3.5	Carex secta	40	1.2	Isolepis prolifa	30	20
			Histiopteris incisa	5	60	Open water	80	
						Sphagnum moss	30	2-3
						Juncus (TBC)	5	

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Coprosma robusta, Muehlenbeckia complexa, Hydrocotyle novae-zelandiae (NZ). Asplenium flaccidum, blackberry, Rohomara adientiformus, Hypolis TBC, Microsorum pustulatum.

Comments: Some manuka die-back, remainder manuka relatively uniform age class.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	
Understorey: % cover introduced spp3	0	5	Low, occasional gorse, blackberry
Total species: % number introduced spp	0	5	
Total species: overall stress/dieback	5	4	Some manuka die-back.
Total /20	NA	19	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	20 – 40cm (deep holes)	Water conductivity uS (if present)	-1mv
Water pH (if present)	4.52	Von Post peat decomposition index	4

Soil core laboratory analysis (2 soil core subsamples): All analyses on the sediment samples were carried out by R J Hill Laboratories in Hamilton

Water content % dry weight	76.7	Total C %	32.9
Bulk Density T/m3	0.18	Total N %	1.11
pH	5.3	Total P mg/kg	928
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Manuka	%N	1.6	%P	0.13

Otaihanga Northern Wetland Plot 1 Photopoints:

Otaihanga Northern Wetland - Wetland Plot Sheet

Wetland name: Otaihanga Northern Wetland Date: 16 January 2013 Plot no: 2
Plot size (2m x 2m default): 2x2 Altitude: xxx GPS/GR: xxx
Field leader: Matiu Park Structure: Shrubland Composition: Manuka Carex

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1	%	H	Species	%	H	Species	%	H
Kanuka	90	6.0	Carex secta	50	1.2	Coprosma robusta	5	40
			Carex virgata	20	1.2	Lemna disperma	30	
			Muehlenbeckia australis	5	50	Open water	5	
			Blackberry	5	50	Azolla sp.	5	
						Blackberry	5	20

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Manuka, Nertera scapanoides; Coprosma robusta, Muehlenbeckia australis, Hydrocotyle novae-zelandiae (NZ), Asplenium flaccidum, Asplenium oblongifolium, Asplenium polyodon, Dicksonia squarrosa, blackberry, Ranunculus repens, Senecio bipinatasectis, bracken, foxglove, Conisa sumatransis.

Comments: Some kanuka die-back, remainder relatively uniform age class. Recent pine removal has increased edge weeds with blackberry, karamu, gorse in wetland and exterior. Likely to continue to change.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	
Understorey: % cover introduced spp3	10	4	
Total species: % number introduced spp	10	4	
Total species: overall stress/dieback	NA	4	Some manuka die-back.
Total /20	NA	17	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3 Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	15	Water conductivity uS (if present)	10mv
Water pH (if present)	4.7	Von Post peat decomposition index	4

Soil core laboratory analysis (2 soil core subsamples):

Water content % dry weight	82.3	Total C %	35.3
Bulk Density T/m3	0.14	Total N %	0.99
pH	4.9	Total P mg/kg	426
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Kanuka	%N	1.5	%P	0.09

Otaihanga Northern Wetland Plot 2 Photopoints:

Otaihanga Southern Wetland - Wetland Condition Sheet

Wetland name: Otaihanga Southern Wetland Date: 16 January 2013
Region: Wellington GPS/Grid Ref.:
Altitude: No. of plots sampled: 2

Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form
Palustrine	Permanent	Fen	Basin

Field team: Matiu Park, Pat Enright

Indicator	Indicator components	Specify and Comment	Score 0– 5[1]	Mean score
Change in hydrological integrity	Impact of manmade structures	Drainage, blockage and landfill	3	3.7
	Water table depth	Some modification	4	
	Dryland plant invasion	Some gorse , BB and pampas	4	
Change in physico-chemical parameters	Fire damage	No evidence	5	4.0
	Degree of sedimentation/erosion	Some from landfill	4	
	Nutrient levels	Elevated from leachate, sewage treatment plant upstream	3	
	Von Post index	Strongly decomposed (7)	4	
Change in ecosystem intactness	Loss in area of original wetland	Some loss to east	4	4.0
	Connectivity barriers	Mostly intact	4	
Change in browsing, predation & harvesting regimes	Damage by domestic or feral animals	Low, Canadian geese present	4	4.3
	Introduced predator impacts on wildlife	Low, adjacent to landfill / sewer	4	
	Harvesting levels	None	5	
Change in dominance of native plants	Introduced plant canopy cover	Low, BB, gorse and pampas	4	4.0
	Introduced plant understorey cover	Low	4	
Total wetland condition index /25				20

[1] Assign degree of modification as follows: 5=v. low/ none, 4=low, 3=medium, 2=high, 1=v. high, 0=extreme

Main vegetation types: Carex geminata and Carex virgata sedgeland with scattered dying manuka. Some areas of Baumea rushland. Scattered Juncus.
Native fauna:
Other comments: Kanuka dieback, large areas of open water. Water table seems relatively high, compared with other visits and dry conditions elsewhere in Kāpiti district. Recently fallen pines.

Pressure	Score[2]	Specify and Comment
Modifications to catchment hydrology	4	Water abstraction bores, landfill, sewage treatment.
Water quality within the catchment	4	Leachate from adjacent landfill, sewage leachate, farming.
Animal access	4	No control observed, intensive land uses and sewage plant.
Key undesirable species	3	Blackberry and other weeds dominate adjacent wetland.
% catchment in introduced vegetation	4	Almost entire catchment in landfill and pine plantation.
Other landuse threats	4	Landfill and sewage treatment adjacent: leachates.
Total wetland pressure index /30	23	

[2]Assign pressure scores as follows: 5=very high, 4=high, 3=medium, 2=low, 1=very low, 0=none

WETLAND PLOT SHEET

Wetland name: Otaihanga South **Date**: 16 January 2013 **Plot no**: 1
Plot size (2m x 2m default): 2x2 **Altitude**: GPS/GR:
Field leader: Matiu Park **Structure**: Sedgeland **Composition**: Purei

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1 (or Substrate)	%	H	Species	%	H	Species	%	H
Carex secta	30	1.8	Hypolepis ambigua	10	0.5	Open water	80	
Hypolepis ambigua	10	1.3	Bidens frondosa	5	0.5	Sphagnum	30	2-3
Carex virgata	10	1.0						

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Austroderia fulvida, Leptospermum scoparium, Carex virgata, Carex secta, blackberry*, gorse*, Pinus radiata*, Isolepis prolifer, Sphagnum, Bidens frondosa, Hypolips distans.

Comments: Unusually high water table. Kanuka die-back observed. Some blackberry beginning to establish in raised areas in interior of wetland, but not in plot.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	Nil
Understorey: % cover introduced spp3	5	4	Bidens frondosa only species within plot.
Total species: % number introduced spp	15	4	
Total species: overall stress/dieback	NA	4	Kanuka die-back in some areas (not plot)
Total /20	NA	17	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	30cm	Water conductivity uS (if present)	20mv
Water pH (if present)	4.52	Von Post peat decomposition index	7

Soil core laboratory analysis (2 soil core subsamples): All analyses on the sediment samples were carried out by R J Hill Laboratories in Hamilton

Water content % dry weight	83.8	Total C %	42.2
Bulk Density T/m3	0.13	Total N %	1.82
pH	4.5	Total P mg/kg	587
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Carex secta	%N	1.6	%P	0.23

Otaihanga Southern Wetland Plot 1 Photopoints:

Otaihanga Southern Wetland - Wetland Plot Sheet

Wetland: Otaihanga South (Cabbage Tree) Date: 16 January 2013 Plot no: 2
Plot size (2m x 2m default): 2x2 Altitude: GPS/GR:
Field leader: Matiu Park Structure: Sedgeland Composition: Carex

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1	%	H	Species	%	H	Species	%	H
Carex virgata	70	1.5	Hypolepis ambigua	10	0.5	Isolepis prolifa	20	5
Carex secta	10	1.5	Bidens frondosa	10	0.1	Azolla sp	10	
			Hydrocotly nz	10	5	Open water	20	
			Blechnum minus	5				

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Bidens frondosa, Austrodaria fulvida, Leptospermum scoparium, Baumea teretifolia, bracken, blackberry*, gorse*, Pinus radiata*, pampas*, Sphagnum, Yorkshire fog, Cabbage tree, Psuedopanax arboreus, Coprosma robusta, houndstongue fern.

Comments: Unusually high water table. Manuka die-back observed. Some dead pines nearby (fallen). Presumed to historically have been manuka over purei prior to water table modification. Blackberry and gorse on edges.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	
Understorey: % cover introduced spp3	10	4	
Total species: % number introduced spp	10	4	Bidens
Total species: overall stress/dieback	NA	4	Kanuka die-back (not in plot), raised watertable (artificially?).
Total /20	NA	17	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	45	Water conductivity uS (if present)	25mv
Water pH (if present)	4.85	Von Post peat decomposition index	7

Soil core laboratory analysis (2 soil core subsamples):

Water content % dry weight	85.1	Total C %	36.0
Bulk Density T/m3	0.12	Total N %	2.23
pH	4.9	Total P mg/kg	980
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Carex virgata	%N	1.7	%P	0.13

Otaihanga Southern Wetland Plot 2 Photopoints:

El Rancho Wetland - Wetland Condition Sheet

Wetland name: El Rancho Wetland (Weggery) Date: 16 January 2013
Region: Wellington GPS/Grid Ref.:
Altitude: No. of plots sampled: 2

Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form
Palustrine	Permanent	Fen	Basin

Field team: Matiu Park, Pat Enright

Indicator	Indicator components	Specify and Comment	Score 0– 51	Mean score
Change in hydrological integrity	Impact of manmade structures	Drains cut through interior of wetland.	3	3.0
	Water table depth	Altered through drainage, and evidence of lowering of water levels.	2	
	Dryland plant invasion	Gorse and blackberry and other weeds common.	4	
Change in physico-chemical parameters	Fire damage	None	5	4
	Degree of sedimentation/erosion	None	5	
	Nutrient levels	None	5	
	Von Post index	Almost completely decomposed	1	
Change in ecosystem intactness	Loss in area of original wetland	Some loss of historical wetlands extent in this location	4	3.0
	Connectivity barriers	Some connectivity barriers	2	
Change in browsing, predation & harvesting regimes	Damage by domestic or feral animals	Some browsing and pugging on edge of wetland by stock (and interior).	3	4
	Introduced predator impacts on wildlife	Low, but adjacent to residential areas	4	
	Harvesting levels	Nil.	5	
Change in dominance of native plants	Introduced plant canopy cover	Low	4	4.0
	Introduced plant understorey cover	Low, some blackberry and gorse.	4	
Total wetland condition index /25				18

1 Assign degree of modification as follows: 5=v. low/ none, 4=low, 3=medium, 2=high, 1=v. high, 0=extreme

Main vegetation types: Both plots in main wetland were within a regenerating manuka wetland.
Native fauna: Nil
Other comments: Ongoing grazing in wetland edge and interior by cattle and sheep. Low water table with artificial drain in vicinity of wetland. Some water visible in areas of cattle pugging.

Pressure	Score2	Specify and Comment
Modifications to catchment hydrology	2	Evidence of reducing water tables over years across El Rancho wetlands. Main wetland and surrounds historically drained (and more recently?).
Water quality within the catchment	1	Some pressures from El Rancho stock and residential areas.
Animal access	2	Currently limited grazing in this location.
Key undesirable species	3	Catchment has a high number of undesirable species present, including close proximity to weedy Waikanae River corridor.
% catchment in introduced vegetation	4	Most of the catchment modified and in pasture or blackberry

		and gorse.
Other landuse threats	3	Gas pipeline, access from El Rancho etc.
Total wetland pressure index /30	15	

2Assign pressure scores as follows: 5=very high, 4=high, 3=medium, 2=low, 1=very low, 0=none

WETLAND PLOT SHEET

Wetland name: El Rancho Weggery **Date**: 16 January 2013 **Plot no**: 1
Plot size (2m x 2m default): 2x2 **Altitude**: GPS/GR:
Field leader: Matiu Park **Structure**: Shrubland **Composition**: Manuka with groundcover

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1	%	H	Species	%	H	Species	%	H
Manuka	100	4				Viola TBC	50	8
						Schoenus masculinus	20	5
						Dandelion	1	10
						Gahlium propinqum	2	3
						Lotus pedunculatus	1	3
						Ranunculus glabufolius	1	3
						Hydrocotlye nz (agg)	1	1

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Manuka, gorse, Carex secta, blackberry

Comments: Occasional gorse, relatively uniform canopy and interior relatively weed free. Cattle pugging has resulted in wet depressions in interior. In areas of light, more grasses and broadleaf seedlings such as Coprosma robusta.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	Manuka
Understorey: % cover introduced spp3	5	4	Occasional dandelion, gorse seedlings and blackberry in close proximity.
Total species: % number introduced spp	1	4	
Total species: overall stress/dieback	NA	4	Grazing and pugging
Total /20	NA	17	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	<5cm	Water conductivity uS (if present)	20mv
Water pH (if present)	4.20	Von Post peat decomposition index	9

Soil core laboratory analysis (2 soil core subsamples):

Water content % dry weight	64.6	Total C %	24.4
Bulk Density T/m3	0.36	Total N %	1.37
pH	4.8	Total P mg/kg	637
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Manuka	%N	1.7	%P	0.11

El Rancho Wetland (Weggery) Wetland Plot 1 Photopoints:

El Rancho Wetland - Wetland Plot Sheet

Wetland name: El Rancho Date: 16 January 2013 Plot no: 2 (existing)
Plot size (2m x 2m default): 2x2 Altitude: GPS/GR:
Field leader: Matiu Park Structure: Shrubland Composition: Manuka

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1	%	H	Species	%	H	Species	%	H
Manuka	90	4.5m	Manuka	40	.60	Leaf litter	60	
			Coprosma tenuifolia	5	.2	Geniostoma ligustrifolium var. ligustrifolium	5	.3
						Mahoe	5	0.2
						Dichondra repens	5	.02
						Blackberry	5	.2
						Centella uniflora	30	0.01
						Schoenus masculinus	5	.2
						Blechnum minus	5	.2
						Lotus pedunculata	5	.2

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Schoenus masculinus, Nertera scapanoides, mahoe, Geniostoma rupestre, kahikatea (seedlings), Dichondra brevifolia, Eleocharis gracilis, Coprosma tenuifolia, Pseudopanax hybrid, Dicksonia squarrosa, Carex dipsacea, Phoenix palm, Juncus planifolius, Juncus effusus.

Comments: Some grazing observed, tracks cut and some drainage observed. Historic evidence of sphagnum dominant under manuka. However, none observed during field work in this area. Overall, this plot was much dryer than earlier Wetland Condition Survey for Expressway.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	0	5	None observed
Understorey: % cover introduced spp3	10	4	Blackberry and climbing asparagus.
Total species: % number introduced spp	10	4	Mainly Lotus and blackberry seedlings in low light.
Total species: overall stress/dieback	NA	4	Even aged manuka and remnant kahikatea suggest historic changes with drainage? Cattle browsing
Total /20	NA	17	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	<5cm	Water conductivity uS (if present)	22mv
Water pH (if present)	4.28	Von Post peat decomposition index	9

Soil core laboratory analysis (2 soil core subsamples):

Water content % dry weight	56.9	Total C %	15.0
Bulk Density T/m3	0.42	Total N %	0.88
pH	4.8	Total P mg/kg	466
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Manuka	%N	1.4	%P	0.09

El Rancho Wetland (Weggery) Wetland Plot 2 Photopoints:

Ngarara Wetland - Wetland Condition Sheet

Wetland name: Ngarara Wetland Date: 17 January 2013
Region: Wellington GPS/Grid Ref.:
Altitude: No. of plots sampled: 1 (refer below)

Classification: I System	IA Subsystem	II Wetland Class	IIA Wetland Form
Palustrine	Permanent	Fen	Basin

Field team: Matiu Park, Pat Enright.

Indicator	Indicator components	Specify and Comment	Score 0– 51	Mean score
Change in hydrological integrity	Impact of manmade structures	Low, other than local borefields and general shrinking of watertable	4	3
	Water table depth	Below groundsurface (bores and farming, drains)	3	
	Dryland plant invasion	High, blackberry dominates wetland interior with increasing gorse.	2	
Change in physico-chemical parameters	Fire damage	Nil	5	3.8
	Degree of sedimentation/erosion	Nil	5	
	Nutrient levels	Stock and peat changes with lack of water	4	
	Von Post index	Almost completely decomposed	1	
Change in ecosystem intactness	Loss in area of original wetland	Drainage, farming and bores have reduced historical extent and altered vegetation composition.	2	2.5
	Connectivity barriers	Farmland surrounds, large areas of blackberry. Close to Nga Manu.	3	
Change in browsing, predation & harvesting regimes	Damage by domestic or feral animals	Occaisional sheep and cattle, but wetland exterior well fenced.	4	4.3
	Introduced predator impacts on wildlife	Presumed low to moderate, with fernbird observed in area historically. Close to Waikanae.	4	
	Harvesting levels	Absent	5	
Change in dominance of native plants	Introduced plant canopy cover	Blackberry and occaisional gorse	3	2
	Introduced plant understorey cover	Creeping bent, blackberry, Biden frondosa, grasses	1	
Total wetland condition index /25				15.6

1 Assign degree of modification as follows: 5=v. low/ none, 4=low, 3=medium, 2=high, 1=v. high, 0=extreme

Main vegetation types: Sedgeland (Carex secta, Carex virgata and Cyperus ustulatus) with blackberry and ferns. Some manuka in wetter areas, kanuka on raised mounds and wetland edges.

Native fauna: Bellbird, tui

Other comments: Monitoring focused on native sedgeland in wetland interior. Based on a review of historic photos, sedgeland and manuka were dominant habitat types. However, blackberry and gorse invasion in wetland edges and interior has resulted in rapid loss of these communities and blackberry the dominant vegetation community. Restricted sampling to 1 plot. Changed hydrology observed in dryland species invasion (rapid).

Pressure	Score2	Specify and Comment

Modifications to catchment hydrology	3	Farming, bores, drainage.
Water quality within the catchment	2	Farming, some rural lifestyle inputs to adjacent wetland.
Animal access	1	Fenced, but some limited grazing animal access. Close to residential areas so some predator pests presumed.
Key undesirable species	4	Blackberry now dominant species and rapid loss of sedgeland species from interior observed.
% catchment in introduced vegetation	4	Almost entirely in pasture / farming, with exception of remnant areas and Nga Manu in close proximity.
Other landuse threats	3	Bores, subdivision, farming, weeds.
Total wetland pressure index /30	17	

2Assign pressure scores as follows: 5=very high, 4=high, 3=medium, 2=low, 1=very low, 0=none

WETLAND PLOT SHEET

Wetland name: Ngarara Wetland Date: 17 January 2013 Plot no: 1
Plot size (2m x 2m default): 2x2 Altitude: GPS/GR:
Field leader: Matiu Park Structure: Sedgeland Composition: Purei

Canopy (bird's eye view)			Subcanopy			Groundcover		
Species1 (or Substrate)	%	H	Species	%	H	Species	%	H
Carex secta	10	1.6	Blackberry	60	50	Isolepis prolifa	10	20
Carex virgata	40	1.4	Gahlium palustre	10	40	Creeping bent	80	20
Cperus ustulatus	30	1.4	Juncus effuses	5	40			
Bidens frondosa	10	0.5	Muehlenbeckia asutralis	5	30			
Blackberry	10	1.5	Digitalis (foxglove)	5	30			

1 % = % cover: total Canopy % cover = 100%; H = maximum height in m; indicate introduced species by *

Additional species in vicinity in same vegetation type: Mahoe, Carex geminate, Hypolepis distans, Cyathea medullaris, kanuka, manuka, Pseudopanax crassifolius, Coprosam sp, Pyrosia on kanuka, cabbage tree.

Comments: As above, blackberry rapidly changing structure. Grasses and creeping bent suggest water table continuing to decline in wetland interior.

Indicator (use plot data only)	%	Score 0–52	Specify & Comment
Canopy: % cover introduced species	20	4	Increasing blackberry
Understorey: % cover introduced spp3	70	2	Increasing groundcover species.
Total species: % number introduced spp	55	2	
Total species: overall stress/dieback		1	Rapid changes in wetland, with fencing, lack of stock grazing and water table.
Total /20		9	

25=0%: none, 4=1– 24%: very low, 3=25–49%; low, 2=50–75%: medium, 1=76–99%: high, 0=100%; v. high
3Add subcanopy and groundcover % cover for introduced species

Field measurements:

Water table cm	<10cm	Water conductivity uS (if present)	23.1mv
Water pH (if present)	4.56	Von Post peat decomposition index	9

Soil core laboratory analysis (2 soil core subsamples): All analyses on the sediment samples were carried out by R J Hill Laboratories in Hamilton

Water content % dry weight	79.8	Total C %	36.2
Bulk Density T/m3	0.15	Total N %	2.59
pH	4.8	Total P mg/kg	1,445
Conductivity uS			

Foliage laboratory analysis (leaf/culm sample of dominant canopy species):

Species	Carex secta	%N	1.7	%P	0.13

Ngarara Wetland Wetland Plot Photopoints:

Appendix4: Wetland Condition Monitoring Forms (Winter 2013)

TO DO

Appendix5: Summary Descriptions of Valued Wetlands

1. Raumati Manuka Wetland

Characteristics

- This moderate wetland comprises a manuka dominated wetland with *Sphagnum* with large areas of open water and *Isolepis prolifa*.
- Some areas of *Carex* sedgeland, open water and areas of *Baumea* rushland around the wetland margins.
- This wetland has large ephemeral edges dominated by *Baumea*, gorse and fern and wetland species.
- Assumed this wetland is modified from its former extent as a result of historical vegetation clearance and drainage associated with Drain 7, a tributary of the Wharemauku Stream.
- A seasonally wet dune depression with no direct hydrological linkages. Wetland levels presumed to be driven by water levels in Drain 7 – as this is located within the same bed of peat.
- Approximately 2 ha in size.

Values

- Not listed as a KCDC Ecosite in District Plan.
- Wetland interior relatively weed free, but surrounded by a large buffer of gorse and blackberry.
- *Nertera scapanoides* an uncommon herb in the Wellington Conservancy is a dominant ground cover in large wet areas.
- *Baumea teretifolia* which is at its southern limit in the conservancy.
- *Gleichenia dicarpa / G. microphylla* hybrid also somewhat uncommon in the conservancy.

General Description

The ecological value of the wetland is assessed as Medium.

Scale of works

- Limited wetland vegetation clearance on northern margins as part of Expressway embankment construction (0.03 ha loss).

Works Monitoring

- Wetland Condition Monitoring (pre and post-construction).
- 3 Piezometers (pre, during and post-construction) – up to twice-weekly through active construction phase (when works are located within 200m of the section).

Mitigation Monitoring

- No mitigation works proposed.

2. Wastewater Treatment Plant

New wetland to be created as described in SSEMP

3. Southern Otaihanga Wetland

Characteristics

- A large purei sedgeland (Carex secta and Carex virgata) with large areas of open water, Baumea rushland and scattered manuka (mostly dead or dying).
- The northern extent of this wetland adjoins a small remnant of dry vegetation with a large matai.
- Standing water through winter and spring dries out over summer months.
- A seasonally wet dune depression with no direct hydrological linkages.
- Manuka die-back, current wetland species composition and scale of land use change in adjacent Otaihanga Landfill suggest altered water tables from historic levels.
- Potential water quality issues with close proximity to Otaihanga Landfill.
- Approximately 1.4 ha in size.

Values

- KCDC-owned land, no formal protection.
- Not identified as a KCDC Ecosite, but identified in KCDC areas assessed for ecological values.
- Predominantly *Carex secta*, but a large area of *Baumea teretifolia*.
- Wetland interior relatively weed free, but surrounded by a large buffer of plantation pine and blackberry on margins. Scattered gorse in some dryer areas of wetland interior.

General Description

The ecological value of the wetland is assessed as Medium.

Scale of works

- Approximately 0.55 ha of vegetation clearance through southern half of this wetland as part of Expressway embankment and cycleway construction.

Works Monitoring

- Wetland Condition Monitoring (pre and post-construction).
- 3 piezometers (pre, during and post-construction) to ensure hydrology in residual area of wetland is maintained.

Mitigation Monitoring

- No mitigation works proposed.

4. Northern Otaihanga Wetland

Characteristics

- A moderately sized manuka and Carex wetland situated between two high sand dunes.
- A seasonally wet dune depression with no direct hydrological linkages. Standing water of approximately 0.5m deep disappearing during summer months.
- A road has separated the two wetland components and impeded drainage, modifying the vegetation from historical extent.
- Manuka die-back, current wetland species composition and scale of land use change in adjacent Otaihanga Landfill suggest altered water tables from historic levels.
- Potential water quality issues with close proximity to Otaihanga Landfill.
- Plantation pine surrounding wetland has been recently cleared.
- Approximately 1.0 ha in size.

Values

- KCDC-owned land, no formal protection.
- Not identified as a KCDC Ecosite, but identified in KCDC areas assessed for ecological values.
- Predominantly *Carex secta* and *Carex virgata* with manuka on raised hummocks within wetland.
- Wetland interior relatively weed free, but surrounded by a large buffer of plantation pine and blackberry on margins. Scattered gorse and blackberry in some dryer areas of wetland interior.

General Description

The ecological value of the wetland is assessed as Medium.

Scale of works

- Approximately 0.53 ha of vegetation clearance through southern half of this wetland as part of road embankment and cycleway construction.

Works Monitoring

- Wetland Condition Monitoring (pre and post-construction).
- 2 piezometers (pre, during and post-construction) to ensure hydrology in residual area of wetland is maintained.

Mitigation Monitoring

- No mitigation works proposed.

5. El Rancho Wetland (Weggery)

Characteristics

- A large area of manuka dominated wetland with some open water.
- A small number of remnant kahikatea present and showing a high biodiversity of wetland species present.
- Wetland interior remains relatively intact and weed free, although buffer has large components of gorse and blackberry.
- A seasonally wet dune depression with no direct hydrological linkages.
- Drainage in recent years has modified historical Sphagnum wetland values.
- Some restoration planting taking place on outer edge by El Rancho.
- Approximately 3.9 ha in size.

Values

- Privately owned land.
- KCDC Ecosite (K170), identified in KCDC areas assessed for ecological values.
- Nationally vulnerable *Ophiglossum petiolatum* (stalked adders tongue fern) has been recorded in this wetland in 1981, although it has not been recorded since.
- El Rancho Wetland (Weggery) forms part of the wider El Rancho/Takamore wetlands and when considered together have an SSBI (Site of Significant Biological Interest) ranking of "moderate-high".
- Wetland interior relatively weed free, but surrounded by a large buffer of pasture and gorse and blackberry.

General Description

The ecological value of the wetland is assessed as Medium.

Scale of works

- Approximately 0.38 ha of vegetation clearance through southern half of this wetland as part of road embankment construction.

Works Monitoring

- Wetland Condition Monitoring (pre and post-construction).
- 4 piezometers (pre, during and post-construction) to ensure hydrology in residual area of wetland and other El Rancho wetlands is maintained.

Mitigation Monitoring

- No mitigation works proposed.

6. Tuku Rakau

To be completed

7. Ngarara Wetland

Characteristics

- A large area of manuka dominated wetland with areas of *Carex* sedgeland and regenerating kahikatea forest east of Ngarara Road.
- Wetland margins surrounding the wetland core are dominated by blackberry.
- Approximately 2.7 ha in size.
- A peat-dominated dune depression, with no hydrological connections to other waterbodies.

Values

- Protected by KCDC Ecosite (K066) (Combined).
- One of the few wetlands on the Kāpiti Coast that still contains the naturally uncommon mistletoe *Korthalsella salicornioides*.
- North Island fernbird observed in the immediate vicinity and Ngarara Wetland and the adjacent Nga Manu Nature Reserve are considered to provide seasonal habitat for this species and potentially other cryptic wetland species.
- Moderate biodiversity values.
- Large weedlands of blackberry and gorse.

General Description

The ecological value of the wetland is assessed as Medium.

Scale of works

- Indirect effects only – limited vegetation clearance adjacent to northern margins of this wetland as part of road embankment construction.

Works Monitoring

- Fernbird population monitoring (pre and post-construction).

Mitigation Monitoring

- No mitigation works proposed

EMP Attachment 6: Marine Monitoring and Management Plan

17 June 2013

NZ TRANSPORT AGENCY
WAKA KOTAHI

1 MacKays to Peka Peka Expressway

Revision History

Revision N°	Prepared By	Description	Date
A	Dr Vaughan Keesing	Draft for Alliance Review	6 April 2013
B	Dr Vaughan Keesing	Draft incorporating KCDC & GWRC review comment for internal review	1 May 2013
C	Dr Vaughan Keesing	Final Draft	3 May 2013
D	Dr Sharon De Luca	Final Draft following peer review	30 May 2013

Document Acceptance

Action	Name	Signed	Date
Prepared by	Vaughan Keesing		6 May 2013
Reviewed by	Dr S De Luca		30May 2013
Approved by	Matiu Park		
on behalf of	MacKays to Peka Peka Alliance		

CONTENTS

1 Introduction

The resource consent conditions for the Mackays to Peka Peka Expressway contain a number of conditions pertaining to the marine environment and minimising adverse effects to that environment. A summary of these consent conditions in the context of the EMP are outlined in the table below. This document sets out the process and methodologies that will be used to manage and monitor for construction and operation the effects of the Project on the marine environment.

Condition	Summary
G.34	Requires the Ecological Management Plan (EMP) to include details regarding: b) Information on how the following outcomes will be achieved: ii) Minimise construction effects on freshwater bodies and the marine environments.
G.38	Requires the Consent Holder to undertake monitoring in accordance with the EMP and include : a) Collect baseline information for 1 year prior to commencement of work on marine ecology to enable management triggers to be developed, to provide information to support the development of the EMP, and to allow Project-related ecological effects to be identified. b) Monitor marine ecology for the entire duration of construction work in accordance with the pre-construction baseline management triggers to identify changes in condition arising from the Project; and c) Monitor ecological information on marine ecology in accordance with the pre-construction baseline management triggers for a minimum of 2 years following completion of construction of the Project to confirm mitigation requirements outlined in G.34 are successfully achieved. *Note: While G.38.(c) includes "marine" in the group of ecological areas to be monitored, there can be, under G38(c), no requirement to measure mitigation success for marine systems as there is no proposed marine mitigation actions or requirements.*
G.40	b) Requires implementation of an Adaptive Management approach which shall: i) Establish baseline information on pre-construction ecological values of marine habitats in order to develop management trigger levels (where practicable) for each of these environments, which shall be included in the EMP.
E.9	In the event of either: a) a failure of an erosion or sediment control measure; or b) a storm event exceedance of the design volume of the device ; or c) an exceedance of a discharge water quality trigger level required by the ESCP, CESCP or EMP; and where the discharge reaches a permanently or intermittently flowing water body, wetland or estuarine/marine environment, the Consent Holder shall engage a suitably qualified ecologist(s) to inspect the relevant receiving environment within 2 working days of the event occurring, unless a longer timeframe is otherwise agreed by the Manager. The ecologist shall determine and prepare a written report on whether significant adverse effects have or are likely to have occurred.

1.1 Objectives

There are four key requirements for management of Waikanae Estuary:

1. Sediment and erosion control will be developed and carried out in coordination with water and habitat quality monitoring by the project ecologist.

2. Carry our 1 year of Baseline sampling prior to earthworks and establish trigger thresholds.

3. Monitor through construction and for two years following construction.

4. Respond to any exceedance of triggers.

1.2 Integration between Ecology and Erosion Sediment control

Conditions relating to the monitoring of health of the Waikanae Estuary span two disciplines and require close integration between the EMP and ESCMP and coordination between the project ecologist and the erosion and sediment control team.

The ESCMP (which is part of the CEMP) details the methods for managing site works to minimise discharge of contaminants, including sediment, to the streams and rivers crossed by the Project (G.27 and E.9).

The project ecologist is responsible for carrying out baseline studies of estuarine health, establishing management triggers, ongoing construction and post construction monitoring, and liaising with the project construction team on a regular basis and in the event of exceedances and/or significant changes to estuarine conditions (G.38 and G.40).

1.3 Baseline Results

There are three potential marine receiving environments: Waimeha Stream mouth (Ngarara estuary), Waikanae River mouth estuary, and the Wharemauku Stream mouth estuary.

The Waimeha Stream is a small, spring-fed stream originating from the outskirts of the Waikanae township that becomes the Ngarara Estuary at the stream mouth. The stream mouth is modified, with channelisation and construction of an esplanade strip. In 1920 the stream was re-directed to discharge across the beach and provide another white-baiting stream (Todd et al., n.d). A string of small lakes occupies where the river once ran and is now an artificial estuary.

The Waikanae River estuary is a tidal river mouth estuary and covers approximately 80 ha (Todd et al., n.d.) and contains a variety of habitats including tidal mudflats, vegetated

sandflats, sand-dunes, two tidal lagoons and saltmarsh (McConkey & Bell, 2005; Robertson & Stevens, 2007).

Pressure is being exerted on the estuary habitats and fauna due to increasing urban development, human recreational activities, introduction of mammalian predators and the spread of exotic plant species, (particularly around the estuary margins as a result of urban development).

The Wharemauku Stream originates behind Raumati and continues through the Kaitawa Reserve, (the outskirts of Paraparaumu) with the stream discharging onto the sandflats along the open coast of Raumati Beach. The lower reaches of the stream are modified through channelisation, wooden walls, and adjacent roading and residential land use.

Wharemauku Estuary is a shallow, small tidal stream mouth estuary that is approximately 3-5m wide. The margins of the estuary are highly modified with sea walls and houses located on the foredunes (Robertson & Stevens 2007). Estuarine habitat diversity is low given the historic and ongoing modifications and the lack of salt marsh vegetation and tidal flats.

The conclusions of the research into the ecological values, was that all three marine habitats studied have high ecological values.

1. Waimeha and Wharemauku Streams discharge to high energy, open sandy beaches, affording significant and rapid dilution and removal of any stormwater discharges.
2. The Waikanae Estuary is lower energy and has more potential to accumulate sediment and associated contaminants.

Direct effects on marine ecological values due to construction or operation of the Project are not anticipated because the alignment occurs at some distance from marine environments. However, potential indirect effects may occur due to the discharge of runoff, during both construction and operation phases, to streams and rivers that discharge to the marine environment.

2 Avoiding Disturbance

Consent condition G.34 b) ii requires minimising the construction effects on freshwater bodies and the marine environments. As none of the works are near the estuaries and all works are within the designation there is no risk of direct construction effects to any of the marine habitats.

Indirect effects are specifically related to earthwork related discharges of sediments and associated contaminants into the waterways (rivers and streams) that eventually discharge to the marine environment. Avoidance of such discharge is a priority of construction works (earthworks), and there are a range of sediment discharge and contaminant

discharge defences and systems, including freshwater monitoring of discharges by NTU logger that form early alerts for the marine systems.

3 Monitoring Effects

G38 a-b requires that for 1 year prior to works, data be collected on the marine benthic invertebrates and other relevant aspects of the estuarine ecology that could be affected by sediment deposition, so as to develop trigger levels for assessing effects and to form comparative understandings of the fauna present from which to measure change. The conditions of consent do not stipulate the amount of sampling, but to be representative of the estuaries a winter and summer set of samples have been collected and add to the initial samples undertaken for the production of the AEE.

The conditions also require that monitoring be undertaken of the marine ecology for the entire duration of construction Work, in accordance with the pre-construction baseline management triggers, to identify changes in conditions arising from the Project. It is unclear again what frequency of monitoring is to be employed, but a sensible approach is to continue to undertake winter and summer sampling unless sampling is also caused by a breach of the trigger thresholds.

The monitoring has been and will be undertaken using the following methodology.

4 Baseline monitoring

4.1 Methodology

4.1.1 Site Selection

Intertidal estuarine sampling was based on the Estuarine Environmental Assessment and Monitoring National Protocol[1]. Two sites (WAE-01 (north site) and WAE-02 (south site)) within the Waikanae Estuary were surveyed. Surveys were carried out in June 2012 and February 2013 within two hours either side of low tide.

While it is recognised that these sampling locations relate to the prevailing tidal and river outlet paths, and so hydrology, and that the Council may, in the future, cut through the lagoon bar at or near the direct path of the Waikanae River and thereby fundamentally change the environs at the two sampling locations; that possibility cannot be controlled for. The locations have been chosen to allow use of the earlier collected assessment data as additional baseline data, and because those sites best reflect potential sediment settlement areas which may affect benthic life in the estuary.

1 Cawthron Institute, 2002. Estuarine Environmental Assessment and Monitoring: A National Protocol. Report to the Ministry for the Environmental, Sustainable Management Fund Project.

If Council bulldoze a new river exit, (something not done for 10 years), then not only would the monitoring sites be null and void for monitoring suspended and deposited sediments, but the entire lagoon habitat between the monitoring sites would be fundamentally changed. That effect (of opening a new river mouth), would be magnitudes greater on the current lagoon habitat than the potential water quality discharge related to the road construction.

We consider that if the Council was to cut a new and more direct mouth, then any sediment from the road construction that might be in the Waikanae River would remain in suspension in the higher energy river area and be flushed out to sea. The sediment would no longer endanger the slower lagoon habitats in which the monitoring is occurring, and thus the monitoring would not be required.

No surveys are to be undertaken in either the Wharemauku or Ngarara estuary because of their high energy, sediment dissipating systems.

4.1.2 Sampling Methodology

At each site a 50 m x 30 m grid (subdivided into ten 15 m x 10 m smaller grids, identified as A to J), was established using GIS prior to entering the field. The 10 smaller grids (A to J) were then subdivided into six 5 m x 5 m grids (identified as 1 to 6). Sampling was undertaken at one of the randomly selected 5 m x 5 m grids (1 to 6) within each 15 m x 10 m grid (A to J) (see Figure 1).

The following analyses were undertaken for each of these sites:

5. To assess faunal abundance and diversity a sediment core (haphazardly placed), was collected from each site using a 13 cm diameter x 10 cm deep (area = 1,327 cm^3) PVC tube. The tube had a tapered leading edge and a metal handle on the top to facilitate penetration. Individual tubes were manually driven into the sediment, removed with core intact, and the contents bagged. Samples were processed at each site by washing the contents of each sample through a 0.5 mm sieve using seawater from the estuaries. All material retained on the sieve was carefully removed and placed into a labelled plastic container, preserved in 60-70% ethanol, with 2% glyoxal. Cawthron Institute invertebrate experts processed the samples, extracting and identifying the macrofauna present.

6. A 0.50 m x 0.50 m (0.25 m^2) quadrat was used to sample epifauna (surface dwelling) and macroalgae. The quadrat was haphazardly placed at each site approximately 0.5 m from where cores were taken. All organisms occurring within the quadrat were identified to the lowest taxonomic level and counted. Macroalgal cover was estimated on the basis that a 5 x 5 cm area equates to 1 % cover. Crab/worm holes at the sediment surface were noted as either present or absent. A photographic record of each quadrat was collected.

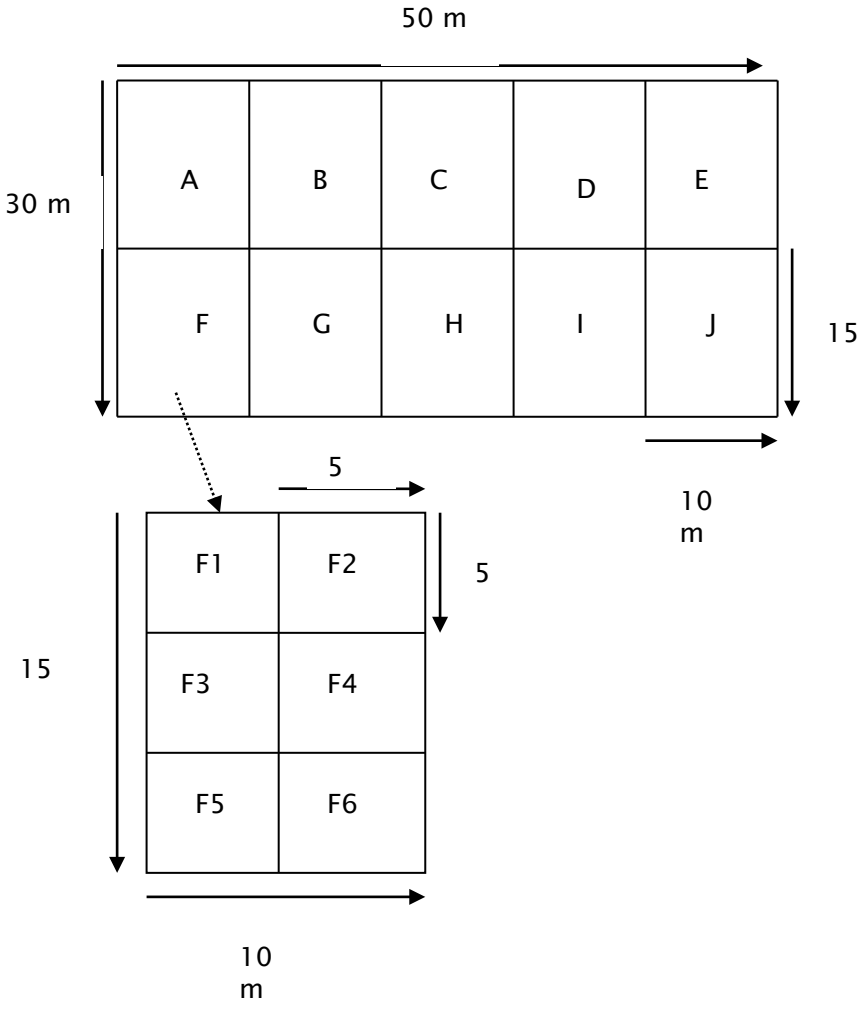
7. A redox discontinuity layer (RDL) sample was collected to assess the sediment anoxic layer at each site. A 60 mm diameter PVC cylinder was driven into the

sediment to a depth of 8-10 cm and capped before extracting the cylinder. After collection, the core was cut in half lengthways and the depth of the start of the anoxic sediment layer measured using a 30 cm ruler where present, (generally visible as a dark black (anoxic) zone, relative to lighter oxygenated sediment).

8. A surface sediment (top 2 cm) sample was collected for contaminant analyses and sediment grain size analyses. Using a garden trowel, the sediment samples from grids A to E were combined to form a composite sample, as were samples from F to J. The two composite samples were sent on ice to Hill Laboratories for analysis of copper, lead, zinc, high molecular weight polycyclic aromatic hydrocarbons (HMW PAHs), and total organic carbon (TOC) in both the total sediment and <63 µm fraction. PAHs were normalised to 1% TOC. The proportion of grain size fractions was also analysed by Hill Laboratories using a stacked wet sieve technique. We note the entire sample (the 2cm) was analysed for contaminants and not just the <2mm fraction, which is the method employed by Regional Council.

9. The concentration of common stormwater contaminants (copper, lead, zinc and HMW PAH's) were compared against the former Auckland Regional Council (ARC) Environmental Response Criteria (ERC) and the Australian and New Zealand Environment and Conservation Council (ANZECC) Interim Sediment Quality Guidelines (ISQG).

Figure 1: Benthic sampling procedure.



5 Construction monitoring

Construction monitoring follows the same methodology as the baseline, in the same locations, allowing for some spatial variation so as not to oversample a single location.

It also is to be undertaken once in winter and once in summer while construction remains in the catchment of the Waikanae River.

Construction triggered monitoring also follows the method, but may be located in areas where deposition of sediments is recorded following a breach of sediment discharge triggers.

6 Baseline Infaunal Invertebrate Community Composition

There is high spatial and temporal variability in substrate type and benthic invertebrate community in the Waikanae Estuary. [2]

In 2012-2013 the invertebrate community composition at both sites, and at both survey times, was dominated by amphipods (Figure 2). However, there were differences in community composition between the two sites and within each site between survey times. The abundance of gastropods, isopods and polychate worms between sites and seasons (Figure 2) varies. Care in establishing trigger changes for these groups will be required.

The raw data of the 2012-2013 baseline sampling is presented in Attachment 1.

At site WAE-01 amphipods comprised approximately 95% of the community in winter 2012, and approximately 90% in summer 2013. A higher proportion of gastropods were evident at WAE-01 during summer, whereas isopods were more common in winter 2012. Amphipods at site WAE-02 accounted for approximately 70% of the invertebrate community in winter 2012, and approximately 60% in summer 2013. The proportion of gastropods in winter 2012 at WAE-02 was approximately 15%, where in summer they comprised around 30% of the community (Figure 2).

[2] Boffa Miskell Ltd, 2011. Technical Report Marine Studies: Description & Values. Prepared for M2PP Alliance and NZTA.

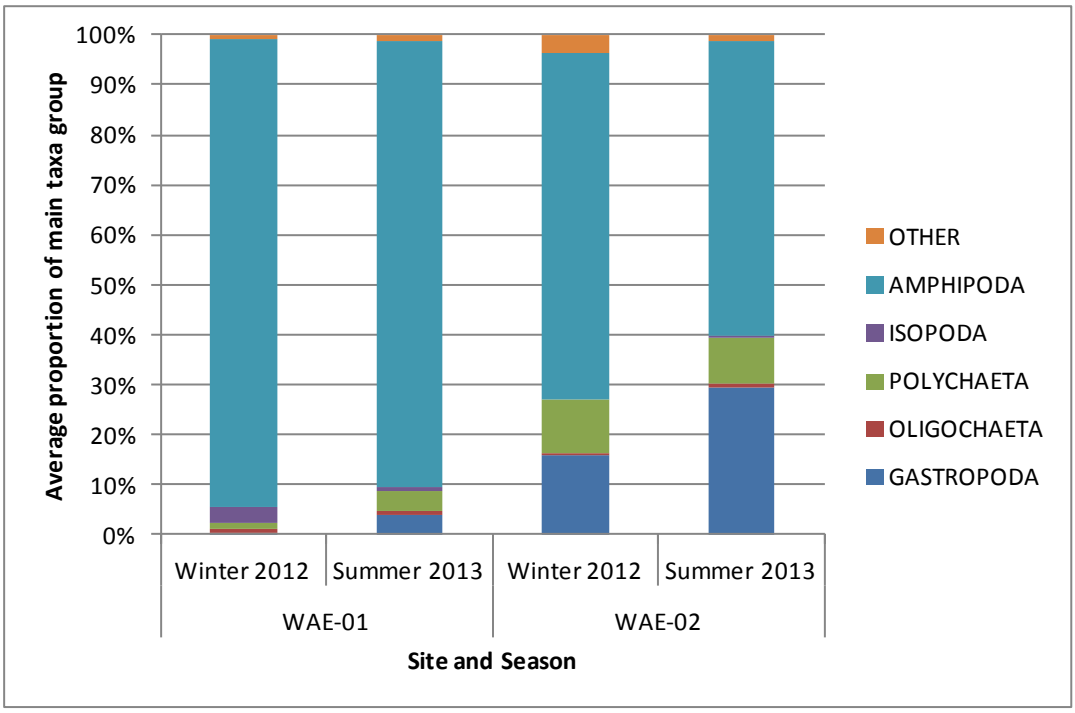


Figure 2: Average proportion of main taxa within core samples.

The average number of individual invertebrates declined between winter 2012 and summer 2013 at both sites by approximately 50% (Figure 3). Site WAE-02 had approximately 60% of the average number of individuals detected at WAE-01 in both seasons (Figure 4).

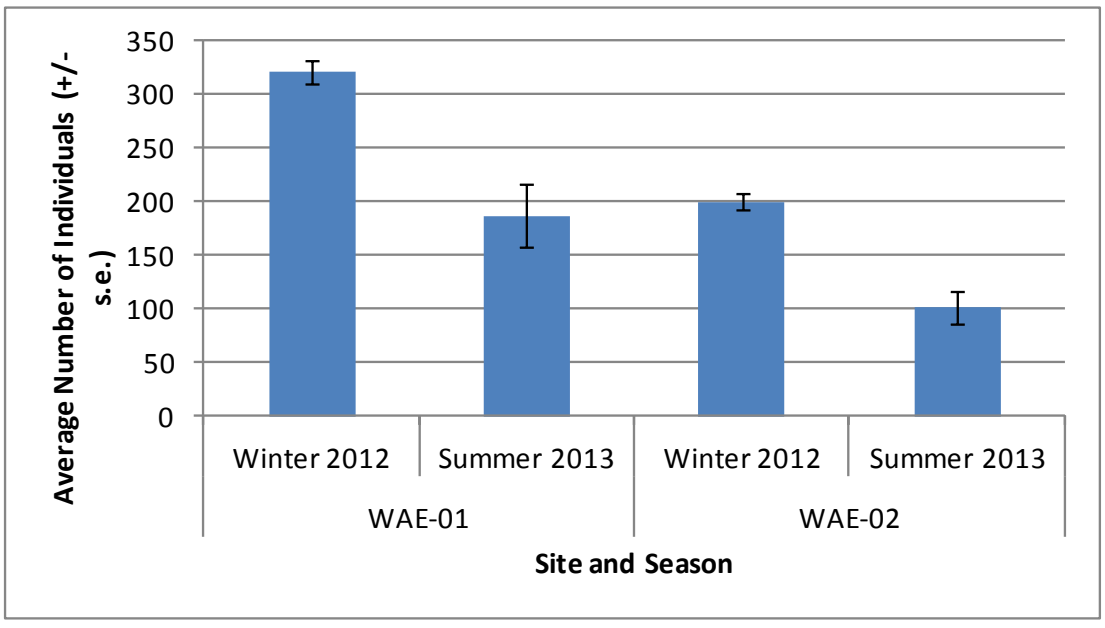


Figure 3: Average abundance of infaunal invertebrates per core sample.

The average number of taxa was low and did not vary greatly between sites or seasons, ranging between 5 and 7 per core sample (Figure 5).

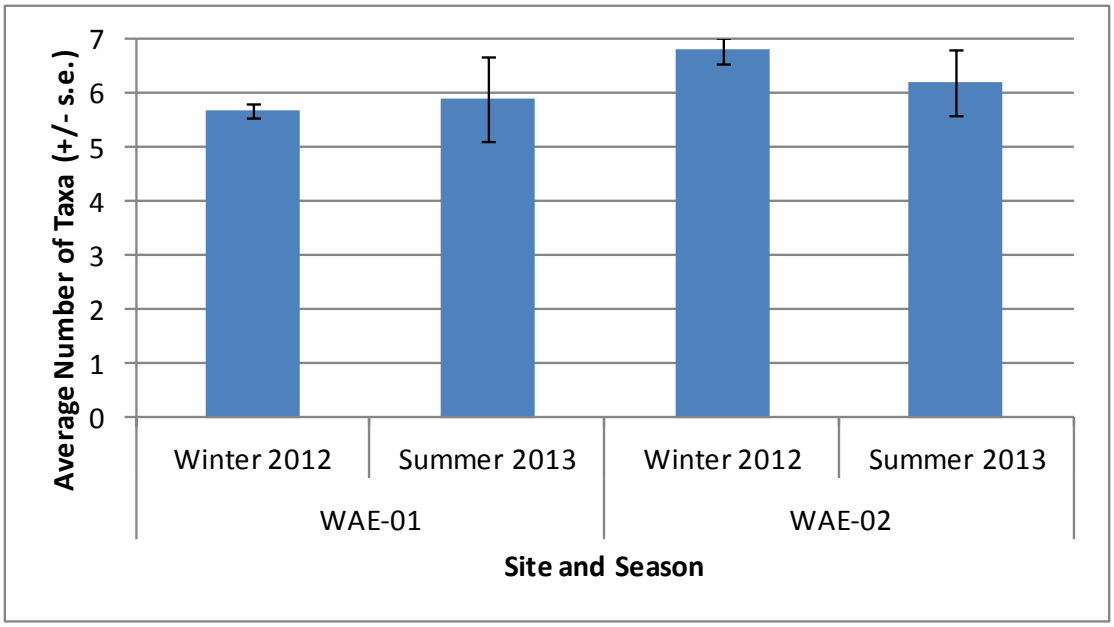


Figure 4: Average number of taxa per core sample.

Average Shannon-Wiener Diversity Index was low at WAE-01 in both winter and summer, where a moderate diversity was detected at sites WAE-02 at both survey times (Figure 5). A low diversity yet high abundance of individuals was detected at WAE-01, whereas the abundance of organisms at site WAE-02 are more evenly distributed across the taxa. This may be due to differences in physical characteristics between the sites, i.e. sediment grain size, period of exposure at high tide, etc.

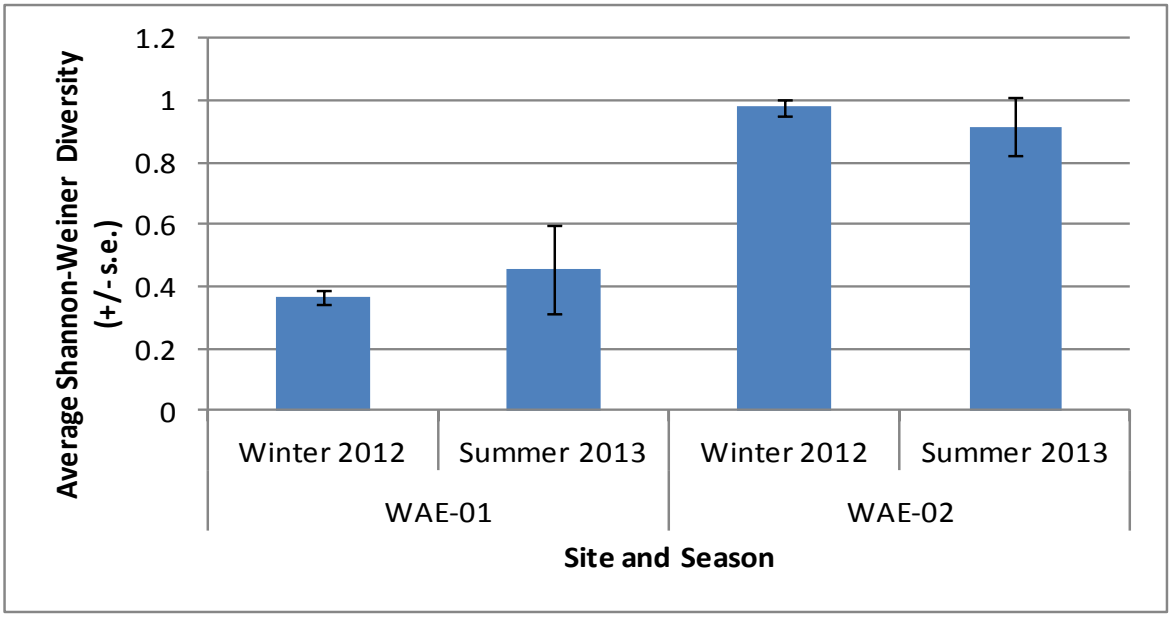


Figure 5: Average Shannon-Wiener Diversity per core.

7 Epifauna and Macroalgae

Epifauna and macroalgae were not detected at either site at both survey times. However, crab burrow holes and worm holes were present within most quadrats.

8 Sediment Quality

8.1 Sediment Grain Size

The grain size distribution at site WAE-01 was dominated by fine sand (approximately 75-80%), very fine sand (approximately 5-10%), and silt and clay (<10%) during both the winter 2012 survey and the summer 2013 survey (Figure 6).

The grain size distribution at site WAE-02 was different to that of WAE-01 and different between the two survey times. In winter, the surface sediment comprised approximately 45% silt and clay, 20% very fine sand and 30% fine sand. However, the summer survey indicated a reduction in silt and clay to approximately 20% and very fine sand to 15%, whereas fine sand was detected at approximately 60% (Figure 6).

Sediment grain sizes between medium sand and gravel comprised less than 5% at both sites during both sampling periods (Figure 6).

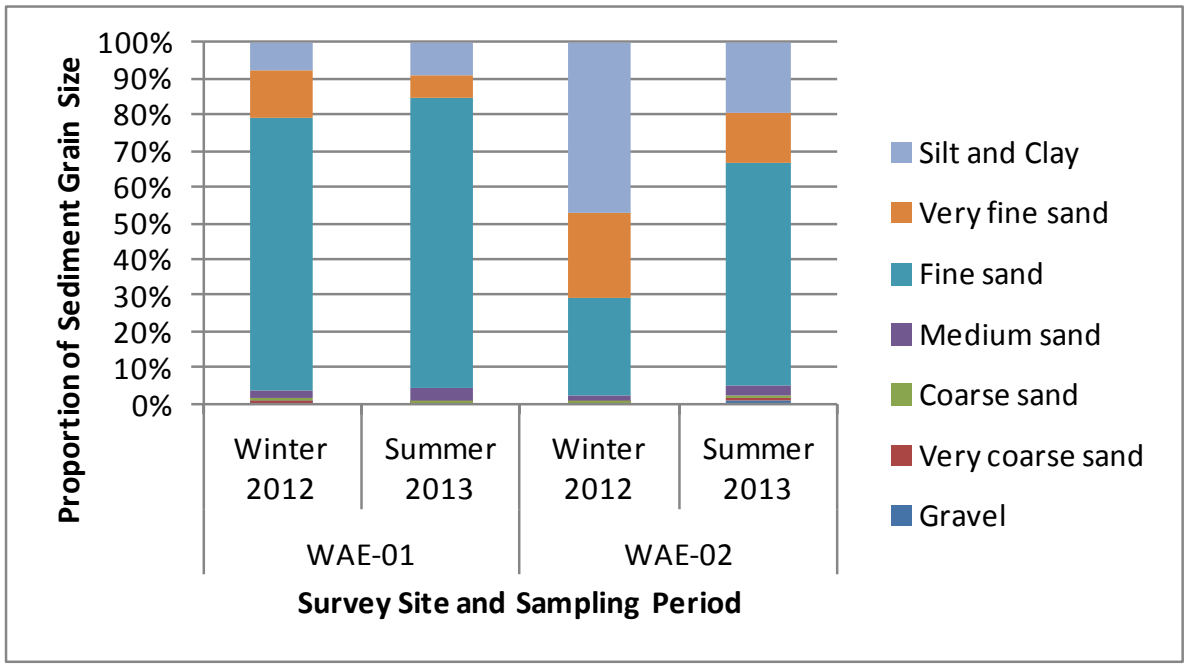


Figure 6: Proportion of sediment grain size by site and season.

8.2 Sediment Contaminants

The concentration of all contaminants in the total and <63µm fraction were within the ERC green range and below ISQG-Low at both sites (Table 1). Site WAE-01 had slightly higher

concentrations of copper and lead in the total sediment and <63µm fraction compared to WAE-02. The concentration of zinc was higher in total sediment from WAE-01 compared to WAE-02, but the concentration in the <63µm fraction was similar between sites. The concentration of HMW PAHs was low to very low in both sediment fractions at both sites in summer and winter (Table 1).

	WAE-01 Total Sediment		WAE-02 Total Sediment		WAE-01 <63um		WAE-02 <63um		ARC ERC Green	ARC ERC Amber	ARC ERC Red	ISQG Low
	Winter 2011	Summer 2012	Winter 2011	Summer 2012	Winter 2011	Summer 2012	Winter 2011	Summer 2012				
Copper (mg/kg dry wt)	3.5	3.9	5.65	7.3	8.15	7.55	9.4	7.9	<19	19-34	>34	65
Lead (mg/kg dry wt)	4.1	4.5	7.5	9.7	13.55	17.35	13.15	11.85	<30	30-50	>50	50
Zinc (mg/kg dry wt)	27	29	39	48.5	53	49.5	54.5	47.5	<124	124-150	>150	200
HMW PAH's (mg/kg dry wt)	0.013	0.025	0.014	0.008	*	0.01	0.004	0.004	<0.66	0.66-1.7	>1.7	1.7

Table 1: ***Sediment contaminant data (analysis in total sediment and 63µm fraction).***

- Insufficient volume of sample was collected to enable analysis of the <63µm fraction.

9 Threshold Trigger Levels for effects monitoring

Epifauna and macroalgae were absent at both sites at both surveys. This rules out their use as indicators of sediment issues.

Contaminants were low to very low at both sites and at both seasons, which may reflect the highly flushed nature of the estuary and the mobile nature of sediment within it. Thresholds related to the ANZECC 2000 guidelines should persist as the threshold trigger for operational contaminants.

In regard to the macroinvertebrate benthic community fauna, a change setting a community change threshold is problematic, and there is no apparent stable main taxa group with which to establish a reasonable response indicator. The bivalve community, a typical potential candidate for an adaptive management trigger, is not universally present and the Gastropod community is seasonally and year to year variable "naturally". Given these issues, we have set a 50% variation in either Permanova-type analysis or Shannon-Weiner diversity indices from the baseline data as an adaptive management trigger. This figure could be revised through ongoing seasonal monitoring and more information on these other indices or indicators.

Attachment 1. Benthic macroinvertebrate data

Infaunal Invertebrate Raw Data - June 2012																						
General Group	**Taxa**	**Common Name**	**W1-A**	**W1-B**	**W1-C**	**W1-D**	**W1-E**	**W1-F**	**W1-G**	**W1-H**	**W1-I**	**W1-J**	**W2-A**	**W2-B**	**W2-C**	**W2-D**	**W2-E**	**W2-F**	**W2-G**	**W2-H**	**W2-I**	**W2-J**
Gastropoda	Potamopyrgus estuarinus	Estuarine snail	4			4	3	2			1		6	25	19	6	20	49	66	49	55	23
Oligochaeta	Oligochaeta	Oligochaete worms		2						14			3				1	1				
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm			1		1										1					
Polychaeta: Spionidae	Scolecolepides benhami	Polychaete worm											1			1	4	5				
Polychaeta: Spionidae	Scolelepis sp.	Polychaete worm				10		2														
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	5	1				10	2	1		1	28	18	12	11	17	33	30	21	15	10
Polychaeta: Nereidae	Nicon aestuariensis	Rag worms	4	5		1								1		2	1	4		1		
Isopoda	Exosphaeroma waitemata	Isopod	12	25		18	16	24	5	1	3	3										
Isopoda	Flabellifera	Sea louse					1															
Amphipoda	Paracorophium sp.	Freshwater amphipod	137	206	402	212	329	451	434	317	220	261	156	181	151	42	78	198	153	170	198	61
Amphipoda	Amphipoda indet.	Amphipod	2	1	2	14	12	3														
Decapoda	Halicarcinus whitei	Pill-box Crab															1	1		1		
Decapoda	Helice crassa	Tunnelling Mud Crab							1				8	4	4	11	10	5	2	5	2	4
Platyhelminthes	Platyhelminthes	Flat Worm			2		5	2	1	1	1	7	1	1						1		
Nemertea	Nemertea	Proboscis worms											1									
Collembola	Collembola	springtails																1				
Mysidacea	Mysidacea	Mysid shrimp																1				
Bivalvia	Paphies australis	Pipi						1								1		1				
Insecta	Dolichopodidae larvae	Small fly larvae								1												2
Insecta	Muscidae	Fly larvae										1					1					1
Insecta	Orthocladiinae	Midges												1								

Infaunal Invertebrate Raw Data - February 2013																						
General Group	**Taxa**	**Common Name**	**W1-A**	**W1-B**	**W1-C**	**W1-D**	**W1-E**	**W1-F**	**W1-G**	**W1-H**	**W1-I**	**W1-J**	**W2-A**	**W2-B**	**W2-C**	**W2-D**	**W2-E**	**W2-F**	**W2-G**	**W2-H**	**W2-I**	**W2-J**
Gastropoda	Amphibola crenata	Mud Snail																2	1		1	
Gastropoda	Potamopyrgus estuarinus	Estuarine snail	15		2		33		3	3	14			3	17	21	13	48	59	36	80	20
Oligochaeta	Oligochaeta	Oligochaete worms		11		2	1				1		1	1						1		5
Polychaeta: Spionidae	Aonides trifida	Polychaetae worms					31	5	2													
Polychaeta: Spionidae	Prionospio aucklandica	Polychaetae worms	1				1															
Polychaeta: Spionidae	Scolecolepides benhami	Polychaetae worms		1					1			1			2		1		2	1	1	4
Polychaeta: Spionidae	Scolelepis sp.	Polychaetae worms	4			3			1			2										
Polychaeta: Capitellidae	Capitella capitata	Polychaetae worms								1												
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaetae worms					1															
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	1	5	1						1	1	1		4	2	3	9	9	8	6	2
Polychaeta: Nereidae	Nicon aestuariensis	Rag worms	3	2	2	2			1					4	6	1	3	4	8	5	5	
Polychaeta: Nereidae	Perinereis vallata	Rag worm												1								
Isopoda	Exosphaeroma waitemata	Isopod			1	8	1		4	1	1				3			1				
Amphipoda	Paracorophium excavatum	Amphipod	274	359	132	91	45	129	181	192	71	193	28	42	83	65	48	119	60	34	26	88
Amphipoda	Amphipoda indet.	Amphipod	1	2			5												1			
Bivalvia	Austrovenus stutchburyi (0-5mm)	Cockle (0-5mm)					1															
Decapoda	Halicarcinus whitei	Pill-box Crab																6	1	1		
Decapoda	Helice crassa	Tunnelling Mud Crab																		1	1	1
Decapoda	Decapoda (larvae unid.)	Unidentified Crab Larvae	1	1					1													
Insecta	Ephydridae	Shore Fly Larvae	1				17															
Insecta	Muscidae	Fly Larvae																				1
Arachnida	Acarina	Mites																				1
Chaetognatha	Chaetognatha	Arrow Worm																				1

Appendix A

Independent Review Comments

INDEPENDENT REVIEW OF Ecological Management Plans (EMP)
Independently Reviewed by: Gerry Kessels & Bruce MacKay, Kessels & Associates Ltd.

Boyden Evans comments (for Landscape Management Plan consistency)

Date of Independent Review: 16 May 2013
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Maps for SSEMP's are included in this document, however, it would help the reader if these maps would also be referenced to in specific EMP's.	Section 3.6 The SSEMP's, page 21	This will be done where appropriate. However, attachments are technical documents and this connection with the SSEMP maps is inferred in the EMP.
	Including a description of the specific SSEMP would be helpful to the reader to better assess site specific requirements, and to better understand the provided maps.	Section 3.6 The SSEMP's, page 21	Agree, changes made via inclusion of a new Table and associated descriptioins of each SSEMP area in section 7.9, Mitigation Sites and the SSEMPs.
	What plant species are likely to be included in vegetation salvage, and what is their likely chance of survival?	Section 7.1 Valued Vegetation and Habitat, page 38	This will be detailed further in the LMP and that detail will form part of each SSEMP (as the species will often be unique to the SSEMP site and vegetation treatment).
	Consider adding "Indigenous" to "Canopy closure " to make it read "Indigenous canopy closure" and to emphasise to reader that indigenous vegetation is the priority here.	Section 7.1 Valued Vegetation and Habitat, page 39	Agree, change made.
	What plant species are likely to be included in vegetation salvage, and what is their likely chance of survival?	Section 7.7 Valued Wetlands and Habitat, page 83	See comment above.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
G.33Biii	The EMP proposes a 20% change in two or more of the following parameters as trigger for adaptive management: Total Wetland Condition Index, Total Wetland Pressure Index, Indicator Score for Wetland Condition Monitoring Plot, or a change in vegetation structure within the monitored wetland. In our opinion, using a percentage in this case is counterproductive. For example, for the Wetland Condition Index the trigger threshold becomes less with decreasing index value and thereby allowing more pristine wetlands to degrade more before threshold level is reached than would be the case for wetlands with a lower index score (e.g. for a score of 19.3 Otaihange Northern) a 4 point change in total would be required, while for a total score of 15.6 (Ngarara) only a 3 point change would be needed to trigger intervention). Using an absolute value rather than a relative value would be more appropriate when assessing index scores. Based on the lowest Wetland condition Index of 15.6 (Ngarara Wetland) I would suggest using a 3 point threshold. While it could be argued that the 20% change in vegetation structure is critical, and the threshold should be set to a lower level of 5% for this criterion, I acknowledge that determining effects associated with the road construction from other externalities will be problematic . To help some readers unfamiliar with wetland condition indices I would recommend to also briefly describe in what direction these thresholds work, e.g. a decrease in pressure index would be seen as something positive, while an decrease in condition index could trigger adaptive management.	Section 7.7 Valued Wetlands and Habitat, page 84	Agree, changes made in Wetland Technical Attachment and this section is also updated.
	Consider adding "Indigenous" to "Canopy closure " to make it read "Indigenous canopy closure" and to emphasise to reader that indigenous vegetation is the priority here.	Section 7.7 Valued Wetlands and Habitat, page 84	Agree, change made.
G.33B	The Raumati Manuka wetland area 2.08 seems to have been overlaid with Offset Storage Area OB on the SSEMP SITES - GENERAL LOCATION PLAN for Raumati Manuka Wetland. This area is described as open water/pond, and while not necessary significant vegetation open water areas may provide feeding opportunities for certain bird species, or along its fringe may allow for growing conditions of more wet-adapted plant species, thus adding to the overall diversity of a wetland ecosystem. Based on the wetland EMP I wasn't able to assess the ecological value of this area, or whether it forms part of the 2 ha value for the Raumati Manuka wetland. More information on the Raumati Manuka wetland SSEMP and the affects on area 2.08 would be helpful to the reader.	Section 7.9 Mitigation Sites and the SSEMP's, page 105	Agree. No change made as this information will be detailed in the SSEMP for this area (Raumati Manuka SSEMP).

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Cross-referenacing - Rather than say ..”abundance in specific sensitive taxa as outlined in ***Attachment 4”*** I would prefer to see exact section number and page number of the relevant EMP or LMP.	Throughout, e.g. section 3.8 - Management Plan Linkages	No change made. The intention of the EMP is to provide an overview for most audiences, while the technical attachments to the EMP provides detail relevant to the specialist ecologists undertaking this work - or responding to breaches etc. However, we have gone through the EMPs to confirm that where the EMMP states something is covered, it actually is covered.
	last sentace in s3.8: "They also require communication and liaison with the earthworks teams responsible for 4) Stream diversions and culvert installation 5) Groundwater take 6) Vegetation clearance and wetland reclamation" How will this be given effect in QA protocols?	s3.8	No change made. This is an introductory chapter. The detail is provided in the subsequent sections on ecological management.
	Very good idea and key to sucess of this project: " *To ensure consistency between the objectives of the LMP and EMP and through the development of the SSEMPs and SSLMPs through detailed design, these plans will be combined (in addition to other site specific plan requirements in each area – e.g. Site Specific Urban Design Plans and other inputs such as stormwater, hydrology) into a single Site Specific Management Plan for each area. For example, the Kakariki / Smithfield SSEMP will be prepared in conjunction with up to half a dozen SSLMPs from Ngarara Road to north of Smithfield Road as well as two SSUDPs. This approach will improve integration between all disciplines and substantially reduce reporting and monitoring requirements* . "	s5	This has always been the intent. The apprarent separation of roles that was required by the Designation and Consent conditions was purely an artiface of the planning process and never intended to constrain normal interaction between Landscape and Ecology.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	CROSS REFERENCES WITH LMP AND CEMP		**BOYDEN EVANS COMMENTS**
	no such spp as *Chionocloa testacea*	LMP: Landscape and Visual Assessment Appendix A	Noted and changed to Carex
	Road median spp: lomandra is exotic - no problems but the intro says 'indigenous'	LMP: Landscape and Visual Assessment Appendix A	Noted.
	Specimen trees underplanted with groundcover': not sure this will work well with deciduous trees over native groundcover - perhaps use some exotic groundcover too?	LMP: Landscape and Visual Assessment Appendix A	Species will be selected accordingly and developed in SSMPs which will drive detailed design.
	Presumably drying the peat and mixing for planting is only for non-wetland planting areas. Drying the peat and mixing it with sand and topsoil would be counterproductive if applied to peatland or wetland planting areas	CEMP Appendix T Landscape Management Plan *Planting substrate* : sections 8.35-8.40	Intention to have different topsoil/sand/peat/compost mixes appropriate to each location. This will be developed in SSMPs which will drive detailed design
	What checks have been made or will be made that 'ecosourced' species are in fact from wild populations?	CEMP Appendix T Landscape Management Plan: 8.48	There is a seed collection contract with clear specifications that all seed collected has to be GPS referenced and a monthly report provided. The first seed collection contract was awarded in January and concludes end of September 2013. Subsequent eco-sourced seed collection contracts will be awarded after this.
	While the LMP has standards for planting performance (cf: 10.2) there seems to be nothing comparable in the EMP to ensure success of the ecological restoration say in terms of condition or trend or weed species elimination.	Appendix M of the CEMP Ecological Management Plan	The planting standards as set out in consent conditions apply to all planting. Given that the EMP and LMP must be consistent, further repetition of these standards in the EMP is considered unnecessary.
	To say (Northern and Southern Otaihanga Wetlands)' every effort should be taken to minimise vegetation removal within the project footprint'; (El Rancho)'Ecological input should be sought before vegetation clearance' and (Tuku Rakau Village wetland) 'Every effort needs to be made to limit encroachment....' and again (p17) ' careful attention needs to be given to reducing potential contaminants and construction related SW runoff in these areas...' are not very adequate statements for management purposes, unless the detail is elsewhere in the report or an associated technical report which we have missed. Assessing likely impacts in detail for specific areas and the likelihood of their occurrence to establish a risk level could provide a basis for providing specific actions to reduce these risks.	Appendix M of the CEMP Ecological Management Plan: section 2 Env. values and potential effects; Wetlands pp15 and following	Amended.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Why just botanist and not project/ terrestrial ecologist ?	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; 3.1 roles, p 21	Agree, change made to Terrestrial ecologist.
	Under 'site establishment': "Any medium-high value indigenous vegetation": As a general principle and precautionary measure (even though the overall footprint for works has already been reduced to a minimum) it would be good to limit the construction work areas to a minimum rather than limiting by fences the vulnerable areas - i.e. the reverse way of looking at this.	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; p 23/table 5	That is the intention with the construction but a fence provides an absolute limit. We also note several sections require briefings and the presence of an ecologist, landscape architect. Further the loctaion of the fence must be signed off by the project ecologist, landscape architect. The LMP under Attachment 2 outlines the processes for this to occur
	Under 'site establishment': "marking perimeter trees" suggests that the centre of the tree becomes the boundary line for vegetation removal rather than using the limits if the driplines as a guide. Also there is no mention of buffer area protection beyond the actual limits of any sensitive vegetation, wetlands or water habitats.	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; p 23/table 5	This is incorrect and has been clarified in Attachment 2 of the LMP that has gone for certification.
	Need a baseline weed survey - I note that the LMP allows for this however - should there be reference in both docs?	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; p 26	Weed management is outlined in LMP and will be undertaken as part of the SSMP process.
	Have the hydrological changes been addressed adequately?monitoring alone after the event is not likely to be an adequate response to this issue. What measures have been or will be taken to ensure hydrological continuity and hydrological regime integrity/viability from east to west across and beneath the expressway?	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; Table 7; all sectors	No change. Hydro-geological input has assisted with hydrological changes and a detailed adaptive management regime using piezometers is set out in the GWMP. Ongoing monitoring in the wetlands potentially at-risk of east-west flow changes are a key part of the monitoring and adaptive managment programme.
	"Particular attention to discharge" seems a little light for management detail. (Cf requirements on discharges using silt traps etc.) Is there reference elsewhere to such controls? - if so they should be referred to here. (Also the Te Kouka wetland 'Specific Management' comment seems to be misplaced with the Te Harakeke / Kawakahia wetland rather than opposite the Te Kouka left hand column..)	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; Table 7 Sector 4: Ti Kouka Wetland and Te Harakeke QEII covenants; pp 29-30	Agree - this section has been amended.
	Wetland planting in the areas of aggressive pest plants: where there are new wetlands there should be long-term management (including by NZTA in continuity after this work is completed) to ensure the new and existing wetland areas are cleared of weeds as this is essential to their viability. I note again this is referred to in the LMP but there should be cross-referencing of this issue here.	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; 3.3.3 a.2: p31	No change. This is addressed in the consent conditions which require the ongoing maintenance of mitigation areas, including weed species.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Where there is reference to weed control for restoration - what period of time is envisaged? Or is this detailed elsewhere?	Appendix M of the CEMP Ecological Management Plan: section 3 Implementation and operation; Table 8	No change. There are four years weed control for wetland planting, and three years for terrestrial planting. In addition there is a requirement for Planting Management Plans (PMP) to take effect at the end of the maintenance period which would carry on for up to 10 years. NZTAs standard maintenance including weed control will apply on an ongoing basis as set out in the NZTA Guidelines for Highway Landscaping.

INDEPENDENT REVIEW OF EMP Attachement 5: Wetland Monitoring and Mitigation Plan
Independently Reviewed by: Marc Hasenbank & Gerry Kessels, Kessels & Associates Ltd.
Date of Independent Review: 16 May 2013
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
G.34d)	The EMP proposes a 20% change in two or more of the following parameters as trigger for adaptive management: Total Wetland Condition Index, Total Wetland Pressure Index, Indicator Score for Wetland Condition Monitoring Plot, or a change in vegetation structure within the monitored wetland. In my opinion, using a percentage in this case is counterproductive. For example, for the Wetland Condition Index the trigger threshold becomes less with decreasing index value and thereby allowing more prestine wetlands to degrade more before threshold level is reached than would be the case for wetlands with a lower index score (e.g. for a score of 19.3 Otaihange Northern) a 4 point change in total would be required, while for a total score of 15.6 (Ngarara) only a 3 point change would be needed to trigger intervention). Using an absolute value rather than a relative value would be more appropriate when assessing index scores. Based on the lowest Wetland condition Index of 15.6 (Ngarara Wetland) we would suggest using a 3 point threshold. To help some readers unfamilliar with wetland condition indices I would recommend to also briefly describe in what direction these thresholds work, e.g. a decrease in pressure index would be seen as something positive, while an decrease in condition index could trigger adaptive management.	Section 5.1 Management Triggers, Management Triggers for Wetland Condition Monitoring, pages 18-19	Agree. 20% threshold changed to refer to a 3 point change in Wetland Condition Monitoring parameters. Comment added to outline the way that the pressure and condition indices work - i.e. That some changes could be positive.
G.34d)	Consider adding "Indigenous" to "Canopy closure of a minimum.." to make it read "Indigenous canopy closure of a minimum.." and to emphasise to reader that indigenous vegetation is the priority here.	Section 5.1 Management Triggers, Management Trigger Levels Mitigation Success, page 19	Agree. Change made.
G.34d)	Table 7 on age 20 page describes timeframe as "at 4 years" for measuring mitigation success of created wetlands. Consider describing this timeframe also in Management Trigger Levels Mitigation Success paragraph.	Section 5.1 Management Triggers, Management Trigger Levels Mitigation Success, page 19	Agree. Changes made.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
G.34d)	"Invasive terrestrial weed species successfully controlled", I would suggest expanding on that in order to put a quantifiable measure behind what is considered as being "successfully controlled". Success in controlling weed species should be measured against the presence and invasive character of present weed species listed in the GWRC Regional Pest Management Plan 2010, and the extent of exotic vegetation cover at different height tiers, for example.	Section 4.3 Post Construction Monitoring, Mitigation Success Monitoring page 16; and Section 5.1 Management Triggers, Management Trigger Levels Mitigation Success, page 19	Changes made to refer to the GWRC regional pest managmnet plan 2010. No changes in relation to exotic vegetation height tiers as the intention is that they do not get to this stage - i.e. They are successfully managed by plant contractors (as will be oulined in the SSMPs).
	Table 3 contains two values for Project Footprint and Designation, and it is not quite clear to me what these different values show.	Section 3.1 Vegetation Mapping, page 10-11	No changes. Referenced in Board of Inquiry documentation.
uiry	In Table 4 the wetland to be created is listed as well, although its ecological value can't yet be assessed. If kept as part of table I would find it useful if a description of the ecological/vegetation values of that planned wetland were added.	Section 3.2 Relative Values, page 11	No change. Table description is consistent with the consent conditions that reference this wetland to be created. Specifics will form part of SSEMP for this area.
	Consider briefly describing the rationale behind analsysing leaf and soil samples in regards to Wetland Condition Monitoring; this will help readers unfamiliar with the methodology to get a better understanding of why that is necessary.	Section 2.3 Wetland Condition Monitoring, page 8	No change. The rationale for soil and plant samples is set out in the Handbook for Monitoring Wetland Condition, a nationally recognised methodology referenced in the EMP and this Technical Attachment. However, we note that this information provides little value for monitoring short-term changes in wetland health.
	Refer to or show map of vegetation plots, as well as sampling locations for soil and leaf samples taken from wetlands. This may help the reader to get a better idea what areas the baseline data used for monitoring refers to.	Section 2.1 Vegetation Mapping and Survey, page 6; and Section 2.3 Wetland Condition Monitoring, page 8	Agree. New map included outlining wetland monitoring plot locations.
	Good to test a new tool, though I wonder how the Prevalence Index will integrate into the Adaptive Management as it is not listed as one of the trigger criteria.	Section 2.4 The Prevalence Index (PI) method, page 8	Agree. No changes made, as intent is to see how this PI work evolves through testing and refinement. Accordingly, there is no basis for use of PI in setting adaptive managemnet triggers.
	In different parts of this EMP SSEMPs/SSLMPs are mentioned, but it would be useful if a description of these plans would be added to document so reader can get a better picture of the site specific requirements.		No changes made, this is a technical attachment - and detailed discussion on SSEMP and SSLMPs in EMP front end.
	What plant species are likely to be included in vegetation salvage, and what is their likely chance of survival?	Section 5.1 Management Triggers, Management Trigger Levels Mitigation Success, page 19	Changes made. As required by Condition G.34 m), the salvage requires Carex and Baumea species. The detail will be specified in SSEMP. Personal opinion is that plant survival, particualrly for Carex spp should be relatively high. Baumea uncertain, and depeneds on excavation, and transplant conditions - but condition is ultimatley a 'best endeavours' approach.

INDEPENDENT REVIEW OF Indigenous Vegetation EMP
Independently Reviewed by: Gerry Kessels & Marc Hasenbank, Kessels & Associates Ltd.
Date of Independent Review: 13 May 2013
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Consider adding "Indigenous" to "Canopy closure of a minimum.." to make it read "Indigenous canopy closure of a minimum.." and to emphasise to reader that indigenous vegetation is the priority here.	Section 4.3 Post Construction Monitoring, Mitigation Success, page 15	Agreed, changes made.
	In different parts of this EMP SSEMPs/SSLMPs are mentioned, but it would be useful if a description of these plans would be added to document so reader can get a better picture of the site specific requirements.		No changes made, technical attachment - and detailed discussion on SSEMP and SSLMPs in EMP front end.
	"Invasive terrestrial weed species successfully controlled", I would suggest expanding on that in order to put a quantifiable measure behind what is considered as being "successfully controlled". Success in controlling weed species should be measured against the presence and invasive character of present weed species listed in the GWRC Regional Pest Management Plan 2010, and the extent of exotic vegetation cover at different height tiers, for example.	Section 4.3 Post Construction Monitoring, Mitigation Success, page 15	Changes made to refer to the GWRC regional pest managmnet plan 2010. No changes in relation to exotic vegetation height tiers as the intention is that they do not get to this stage - i.e. They are successfully managed by plant contractors (as will be oulined in the SSMPs).
G.42	Consider including detail on revegetation sites, or refer to relevant documents.	Section 4.3 Post Construction Monitoring, Mitigation Success, page 15	No changes made. These sites are specified in the EMP - and they will be specifically detailed during development of SSEMPs.
	What plant species are likely to be included in vegetation salvage, and what is their likely chance of survival?	Section 4.3 Post Construction Monitoring, Mitigation Success, page 15	No changes made. No conditions, nor EMP reference to salvaging of indigenous vegetation other than wetland species, which is specifically outlined in the wetland chapter.

INDEPENDENT REVIEW OF EMP Attachment 4: Aquatic Monitoring and Management Plan
Independently Reviewed by: Dr. Jennifer Blair, Kessels & Associates Ltd
Date of Independent Review: 8/5/13
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	When were the SEV surveys carried out? A date range would suffice.	2.2.2 SEV – Habitat Descriptions, page 7	A date was provided in section 2.2.2 methods, but for calrity SEV data was collected principally in November (& December) 2011. **Action** - none
	How many minnow traps were set in each wetland? Were traps baited or unbaited?	2.2.3 Freshwater Fish-Mudfish, page 8	Wetland mudfish trapping was an extra and not part of the required mudfish baseline, pre-construction requirement. In addition to the stream trapping which involved 20 individual 4mm mesh gee-minnow traps (in accordance with the Ling et al. (2009) a single Fyke net was deployed in the Northern Otaihanga Wetland for 4 nights from the 14 – 19 December 2012 to check for freshwater fish presence (noted in the January 2013 GWRC mudfish report). This trapping follows two earlier intensitive mudfish surveys (reported in the AEE and by separate report) in the Otaihanaga wetland (as well as in other wetlands) wherein 15-20 traps were run over 3 separate day and nights (no mud fish were returned). Action - text calrified in EMP.
	When were the EFM surveys carried out?	2.2.3 Freshwater Fish-Freshwater Fish, page 8	Several periods between January-April 2011 and November (2011) - February (2012). **Action** - text clarified in EMP.
	More details are needed here to justify the statement "these differences were not considered to affect the ecological findings or assessment." It would be helpful to add: How far away were water quality measurements taken from the ecological assessment sites? Were water quality measurements taken at a similar time to ecological assessments? e.g. within a few days/weeks?	2.2.5 Water quality, page 10	The measures taken by BML (those basic parameters using hand meters) were taken at the sampling locations for macroinvertebrates, PHA and fish surveys at the same time/s (usually at the downstream end of the sampling run area just prior to those samplings). The sampling (of sediments predominantly) under taken by Becca (for heavy metals etc) were undertaken at different times from the ecological sampling (sometimes within the same month) and at various locations not always near biological samplings. The "differences" in locations and time etc of collection was considered "not important" as the contaminant monitoring was undertaken for purposes related to modelling and storm water and would not be directly relatable to the ecological findings other than as general stream wide indication of levels of contamination. **Action** -text clarified, small section added to qualify "not affect the assessment".

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Great to display the comparison with regional mean or reference site values. I see that you specify which one is used in Table 5, but please specify within Table 4 which one you have used. It's a little but misleading to use both, as they likely present very different benchmarks. Is it possible to just use one or the other? Perhaps it would help if you presented them on different lines in the table. Also, please add mean or reference values for MCI and QMCI.	3 SUMMARY OF RESULTS FOR BASE LINE, Table 4, Page 11	In table 4 the values are the actual mean scores derived from the various samplings of the affected stream ways and not related comparisons. Then in table 5 the scores present are set as a % of the various regional mean values attained from either IBI data base/spread sheet or GWRC data. The data used from those sources were the regional means for MCI and QMCIs (as well as EPT, species richness etc) etc (IBI etc). Those used are reported in Table 22 of Technical Report 30, pages 69-70 from the 2007-2008 GWRC reporting. Further data 2009-2010 is now accessible through GWRC publication (as are the appendices that provided the assessment data). That data presented in the EMP is only a quick summary. **Action** -minor text clarification.
	Why are all the numbers in brackets? Also, your footnote to the table mentions numbers in red, but there aren't any in the table.	3 SUMMARY OF RESULTS FOR BASE LINE, Table 5, Page 11	No reason ? Formatting, as is the "red" issue - This can be fixed - but for reference those numbers in red were: Hadfield Drain; Smithfield Drain, Muaupoko; and Drain 7 upper. **Action** - removed brackets, inserted red highlighting.
	Paracalliope is an amphipod- so I think you can use the soft bottom MCI score for amphipods, which is 5.5. Diptera are "true fly larvae" not only "midge larvae".	3 SUMMARY OF RESULTS FOR BASE LINE, page 13	Accept the "midge" comment have used now "midge" alone as it was midges that the text wished to highlight (not true flys). Re the Paracalliope, this a text error and should have read, "which have no soft-bottom MCI score (Stark & Maxted 2007) and a Hard bottom score of 5 (Stark et al 2000)". **Action** -changed text to reflect comments.
	A bit more background information about what the different indices mean might be helpful for your readers. For example, you could explain the significance of having a high percentage of EPT taxa or a high abundance of molluscs.	3 SUMMARY OF RESULTS FOR BASE LINE, page 13	Appreciate that greater understanding is always desirable however, that information is in Technical Report 30 (section 3) and a detailed explanatory section on the metrics is not considered relevant to the EMP which is carried out only by a "suitably" qualified and expereienced aquatic ecologist. **Action** - none
	Figure captions usually go below the figure. Please state which taxa are included in "Other" in the figure caption. Axes need labels, i.e. "Site" and "Percentage composition"	3 SUMMARY OF RESULTS FOR BASE LINE, page 13 and 14, Figures 1 and 2	Agree re axis labels. Caption position is entirely up to the author and their preference. "Other" refers to all other taxa surveyed. In this case it means :Bryozoa, Hirudinea, Nematoda Nematomorpha, Nemertea, Oligochaeta, Platyhelminthes, Polychaeta, Rhabdocoela, Tardigrada, Coelenterata, Hydra, Hemiptera, Archnida, Acarina, Lepidoptera, Nuetroptera. **Action** -corrected graph labelling.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Species names need to be in italics (also for Tables 10-14). What do abundance numbers represent, are they fish per trap night or overall? How many traps were set at each site and for how many nights?	3.1 New Fish Data from Baseline Studies, Table 6, page 14	The sampling details are provided in the separate mudfish survey report and its certification of method to GWRC report. Agree taxa names should be in italics. Abundance represents number of fish caught over entire trap collection over entire trapping period (see report for both those details) of that particular pre-baseline survey. **Action** - names in italics, improved table heading text (explain abundance numbers).
	Mufish surveys are listed twice. Should just be "sediment pit traps"	4.1 Additional Baseline Monitoring, page 1 (goes back to page 1 here)	Agree extra line with additional "mud fish survey" and sedminent pit traps should be present instead. **Action** - removed additional reference to mud fish survey.
G38D	Good level of detail here. Perhaps your other mudfish sampling methodology sections could refer to this section? Or present the full methodology in the earlier section and refer back to it?	4.2 Mudfish Survey (Condition G38D).	The baseline mudfish report (and not the summary results presented in the EMP) does contain all of the Conditions stipulated monitoring methods and this does occur later in the EMP. **Action** -EMP cross reference to the Mudfish report.
G38	Needs editing, e.g. no footnote for Harding et al 2009, other reference footnote not superscript, please give website for river flow records, "quadrats" not "quadrates", "µm mesh" not "micron", figure missing, "spacings" not "spacing's", please either give method reference for flow estimation method or explain in more detail	4.3.1 Methodologies Employed	Agree referencing incomplete and further edit is required. **Action** - cleaned up references, removed foot notes, changed to reference section at end. Given web site for flows. Note Quadrat and quarate, micron, micrometer or µm is a trnd issue not strictly a correction issue (all are useable. Missing figure added and other aspects added (deatil on flow measure etc).
G38	I know the results are in the Appendix, but perhaps a very brief summary of results would be interesting here (just a sentence or so). Also for your descriptions of other surveys (e.g. mention that no mudfish were found in Section 4.2).	4.4 Sediment Bed Movement Monitoring in the Paetawa and Kakariki Waterways, page 5	Yes ok, but remembering that is not a repeat of the Technical Report 30 findings, nor Technical Report 30 findings, nor the evidence and has no focus on the values assessed or effects of the project. **Action** - brief summary of results at end of each section included.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Good explanation of the situation in the lower quality streams. What was the rationale behind the decision not to carry out construction monitoring in the Waikanae River? As it's one of the highest value waterways in the area I find this decision a bit confusing.	5 Construction Monitoring, page 6	The rationale re the Waikanae River as to the absence of recommended construction monitoring is that due to an agreement between GWRC flood protection and NZTA the greater portion of the river about the proposed bridge (initially a feature that would have avoided direct affects) is to be completely reworked (the bed and possiblly the banks) so as to reformate the channel for flood protection purposes. That work is more extensive than the actual bridge works and 160m-200m of River is to be completely changed. There seemed little point in monitoring the areas down stream of the bridge were flood protection activities would occur, other than to place a sediment logger further down stream. Instead a more detailed pre-activity measure was made (as denoted in the EMP) to describe the physical habitat and macroinvertebrate communities (and fish) so as to assess, post construction, the suitable reformation of a similar community. These data still allow a construction sediment triggered macroinvertebrate sampling protocol to establish (during construction) an effect of sediment discharge. **Action** -none
	Please clarify the monitoring plans for the Waikanae River, as Table 7, Section 5.2 and Appendix 3 are not consistent with each other. In Table 7, what does "a re-examination of the final river condition" mean? Will baseline surveys will be repeated? How does this relate to the actions proposed in Appendix 3?	5 Construction Monitoring, Table 7, page 7	There is no proposed monitoring of the invertebrate community or fish in the Waikanae River section through construction other than the constant sediment (NTU) logging. The re-examination means the measure of the community restoration/rehabilitation after all of the various bed works related to the river flood protection actions also being undertaken. That post activity survey is to be measured against the EMP directed pre-activity detailed survey. **Action** - changed Table 7 re Waikane, checked Appendix 6 9not 3), and section 5.2 for consistancy, recomended 6month post works survey as the time frame to re-measure Waikanae.
	Please specify in the table that SEV surveys include macroinvertebrate and fish surveys.	5 Construction Monitoring, Table 7, page 7	While there was debate in caucus between Dr Death, Dr Boothroyd, Mr Perrie and BML in the validity of use of macroinvertebrate and fish parameters in any SEV predictions, the SEV proposed in Table 7 includes full macroinvertebrate surveys and fish surveys of the new diversion habitats and any SEV survey must include those parameters. Still we shall add to Table 7 those parameters for clarity. **Action** - inserted gobal heading change in table to ensure SEV includes fish and macroinvertebrate surveys.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
G.38A, G.38Ac, d	Nice level of detail and information here.	5.3 NTU Logger Monitoring of Sediment (Condition G.38A), 6.1 Sediment triggered events (Condition G.38A c)), 6.3 At diversion, reconnections (Condition G.38A d)) Page 11-13	
G.34.b	Please add "will be humanely euthanised" to the point about pest fish.	7 Fish Rescue and Relocation (Condition G.34.b) and n)), Page 15	OK. **Action** -added text.
G34.j), G38e), WS3A and WS3B)	This may be implicit in the text, but would it be appropriate to have the designs checked by an appropriately trained ecologist before they are built as well as when construction is finished?	8 Fish Passage Monitoring (Conditions G34.j), G38e), WS3A and WS3B), page 15	Yes it is, and it would be appropriate and that is the proposed and recommended situation in the AEE and evidence. Shall include such a statement here too. **Action** - added text to specifically identify need for design to include ecological input.
WS3B,d)ii)	What was the reason for not including a downstream reach?	8.2 Muaupoko Stream diversion, page 16	The immediate down stream reach is in the affected area of the Waikanae River. **Action** - none
G42 (ii&iv)	When will the "series of SEV surveys" take place? How many? Years 4 and 10? Would it be possible to add an overview timeline of when all the sampling is taking place?	9.3 Response Measures to Failure of Mitigation Success, page 23	Section 9.2 and 9.3 recommends that these measurements be undertaken at year 3 (1 year prior to end of plant maintenance) and at year 5 (and onward until the quality conditions are meet), depending on results at year 3. **Action** -Clarifed text.
G42 (ii&iv)	With the macrophyte bed control, what does "too extensive" mean? If flow is restricted?	9.3 Response Measures to Failure of Mitigation Success, page 24	To extensive means where is forms a near complete (>70%) open water cover and or restricts flow, either in general in terms of velocity or narrowing the flow to less than 50% of the normal flow channel. **Action** - clarifed text to address.
G42 (ii&iv)	I'm not sure of the value of translocating a diadromous fish like inanga upstream if there are access issues, as the translocation would need to be repeated regularly to maintain the population. It would be far better to sort out fish passage issues. There might be some value in translocating non-diadromous species upstream, but again, improving fish passage would be a better long-term solution.	9.3 Response Measures to Failure of Mitigation Success, page 24	Agree re Inanga, the term "white bait" was used too loosely in that sentence and really the translocations of any species found within any of the diversions refers to diadromous species (e.g. banded kokopu, eel, common bully, red fin bully etc). Agree that the priority must be fixing the connection, translocations (after that) may assist recolonisation. **Action** - added text to discuss aspects other than passage issues -i.e. attempt to "seed" fish into the area (assumes passage (following monitoring of passage) is free, no barriers).
	Some typos and grammar issues. Is there a reason why some citations have footnotes and some don't?	Throughout	Difficulties in the formatting and template issue are the primary reasons for those. The updated version will have no foot noted references and a complete reference section. **Action** - Clean up in review.

INDEPENDENT REVIEW OF EMP Attachment 2: Lizard Management Plan
Independently Reviewed by: David Riddell, Kessels & Associates Ltd
Date of Independent Review: 11/5/2013
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Not sure that 10km is sufficiently wide to search - there are several lizard species that occur in the lowland parts of the Kapiti coast that could well occur in this area and range of habitat types, notably *Oligosoma zelandicum* and the southern North Island *Mokopirirakau. O. lineoocellatum* is also a possibility.	P. 3, 2.1 Herpetofauna Database Search	No change. Lizard Monitoring Plan agreed with Department of Conservation and issue resolved through Board of Inquiry.
	AR (Artificial Retreat) should be explained.	P. 3, 2.3 Lizard Surveys: Terrestrial Lizard Survey, para. 1	Agree, change made to refer to Artficial Retreat.
	Why were no diurnal surveys conducted for arboreal lizards (ie primarily Wellington green gecko)?	P. 3, 2.3 Lizard Surveys: Arboreal Lizard Survey	No change. Disagree with the reviewer's contention to search for green geckos by night - while diurnal, this species show up vividly in a spotlight whereas they are very well camouflaged if you look at one in the daytime. Also, whether or not they're diurnal/active is largely irrelevant to the search as they spend their time in pretty well the same spot day or night (and don't behave differently). Note: Lizard Monitoring Plan agreed with Department of Conservation and issue resolved through Board of Inquiry.
	Woodworthia maculatus should be *Woodworthia maculata , O. aeneaum* should be *O. aeneum* .	P. 5, 3 BASELINE SURVEY RESULTS, para 1.	Agree, changes made.
	Threatened and At Risk are separate categories. Wellington green gecko and ornate skink are listed as At Risk - Declining.	P. 5, 3 BASELINE SURVEY RESULTS, para 1.	Agree, changes made.
G.34	Reference to "on mild/warm, calm nights" should be altered to "during mild/warm weather" - see comment below.	P. 6, 4.2 Timing of the capture and relocation	Agree, changes made to para 4.2 in accordance with the DOC permit.
G.34	The reference to 'powerful spotlight(s)' indicates that these surveys are to take place at night (this probably should have been stated explicitly). While night searching is good for locating nocturnal species, it will probably miss diurnal species such as Wellington green gecko. Naultinus species are occasionally observed during night surveys, but they're generally active only by day. I understand from Section 4.6 that El Rancho (Weggery) has a significant manuka component. This species is favoured by Wellington green gecko, and the closely related Auckland green gecko occurs in wetlands (David Campbell, Waikato University, pers. comm.). It's therefore possible Wellington green gecko occurs here, so I'd recommend day searches be conducted as well.	P. 6, 4.3 Search Methods, para. 1.	No change made. This matter is acknowledged, however - Lizard Permits have been approved by DOC as per this methodolgy and consistent with the consent requirements for monitoring. However, the EMP requires an ecologist to be on site during all indigenous vegetation clearance (which will be undertaken during the day). As this is a focus area, I agree that best endeavours will be used to look for arboreal species in the manuka, in addition to clearance contractors beign trained in lizard species (recent update to EMP to include GWRC lizard identification kits). I note that the manuka in this area has regenerated in the last 20 years or so (from pasture), so changes of geckos are low.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	Should probably specify that searchers are to work in pairs, at least one of whom should be an experienced herpetologist. Nocturnal searching can be hazardous, and if lizards are to be captured from high branches that need to be cut or bent, two people are probably required.	P. 7, 4.4 Capture Methods	No changes made. DOC permit already approved.
	Not sure it's valid to say that habitats appear to be unoccupied - lizards are often extremely cryptic and can occur in very low densities, so may be present but overlooked.	P. 8, 5 MITIGATION, para. 1	No changes made. Substantial investigations undertaken and methodology and permits etc. agreed by DOC.
	Again, change "scanning foliage for lizards using powerful spotlights" to "scanning foliage for lizards, by night using powerful spotlights, and by day".	P. 9, 6 SUMMARY, para. 2	Agree, changes made.

INDEPENDENT REVIEW OF EMP Attachment 3: Avifauna Monitoring and Management Plan
Independently Reviewed by: David Riddell, Kessels & Associates Ltd
Date of Independent Review: 11/5/2013
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
G.41	"between the breeding period months of August and February" would be better put as "within the breeding period between August and February" - August and February are not the only breeding months.	P. 2, 1.1 Consent Conditions, Table 1, Condition G.41	No change. Wording taken directly from consent condition G.41 e.
	I'd like to see a map, to get some idea of where the survey effort was concentrated, and to show where playback and count sites were located. It's hard from a verbal description to assess whether all appropriate areas have been covered.	P. 5, 2.3 Site Selection and Species of Interest	No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE.
	Were all of these species actually recorded as present, or is it a mix of confirmed species and species that were searched for without being located? I see in the "CEMP Appendix M Ecological Management Plans (EMP)" document that bittern were recorded along the project alignment. Assuming that is correct, this is a Nationally Endangered species that is very rare in the southern North Island - why is there no further mention of this species?	P. 6, Table 3	No change. This table was first presented ast Table 2 in Technical Report 29 (Avifauna) which formed part of the AEE. The original intent of the table was to identify potential key species that may be located along the alignment and therefore assisted with the design of the baseline survey methdology.The avifauna surveys detected the presence of fernbird, bittern, kereru, shining cuckoo, NZ pipit, dabchick and black shag.
	The cryptic marshbird playbacks should probably have included banded rail. They're very scarce in the southern North Island, but one was found (cat killed) in the Wairarapa in 1992 after 60 years without sightings. They are present around Nelson, and were much more widespread in the past. Fernbird have only recently been rediscovered in the area, and there could be other species that have been overlooked.	P. 6, 2.4 5-Minute Point Counts, Table 3, Cryptic marshbird playbacks	No change. Disagree based on a knowledge of the species habtiat requirements and the habtiat that is present along and adjacent to the alignment. Furthermore, DOC reviewed the methodology and agreed with the focus spp.
	Does the project pose any threat (e.g. through sediment mobilisation) to the Waikanae Estuary, which lies downstream? This is recognised as one of the most important areas for birdlife along this stretch of coast. There are fernbirds there (see http://www.birdingnz.net/forum/viewtopic.php?f=9&t=1614&p=8822) as well as a wide range of water and shorebirds. There should be some recognition of the significance of this site, and some assessment of the threat posed to it by the project - even just to say that these threats are adequately managed by a sediment management plan (assuming that they are). Were any bird surveys carried out in the estuary?	P. 6, 2.5 Waterbird Counts	No change. Refer to Technical Reports 29 (avifauna) and 31 (Marine) which formed part of the AEE. The importance of Waikanae estuary to avifauna species were discussed and potential impact assessed.
	How was fernbird habitat identified? Were any fernbirds detected in the playback surveys?	P. 7, 2.6 Fernbird Baseline Studies, para. 1	No change. Through aerial photography, knowlege of the area and habtiat requirements, and in consultation with DOC (who approved fernbird monitoring methodology).

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	It would be good to have a list of all species recorded, even if only in an appendix, with notes on habitat use of threatened and at risk species (see below).	P. 10 Baseline Survey Results	No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE.
	Some mention of the significance of this fernbird population (i.e. the most southerly of the North Island subspecies, well south of the next nearest population) would be appropriate.	P. 10 3.2 Identification of Key Species, para. 2	No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE.
	Table 3 (p. 6) lists 13 "Key Species" of which only three are listed here - why is that? Possibly there is no breeding habitat affected, though this is not clear due to the lack of habitat maps, and seems unlikely given that habitat of grey duck and brown teal are similar. A summary of results from the surveys would help.	P. 10 3.2 Identification of Key Species	No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE.
	One of the fernbird sites confirmed was done so on the basis of only a single call. It would seem that levels of detection by this technique on this occasion were low, and therefore it is possible that fernbirds at other potential sites (Raumati South Peatlands and El Rancho Wetland) could have been missed. How extensive were the playback surveys, and how well did they cover areas of potential fernbird habitat? Though fernbirds are often described as cryptic they are usually quite easy to detect by their calls, especially if playbacks of calls are used.	P. 10, 3.3 Fernbird Distribution	No change. While only a single call, this was detected from the collection of 3 months (peak period of territorial calling) of data from that site. Exhaustive montoring of all potential sites was undertaken. Playback calls were undertaken when at bioacoustic monitoring sites when the devices were deployed and retrieved. No fernbird were detected on any such occasssions.
	Were any grey duck recorded in the bird surveys? If so how many?	P. 12, 4.1.2 Grey Duck	No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE. Report of grey duck along the alignment from a submitter during the BOI hearing.
	Again, some idea of the extent and results of playback surveys would be desirable.	P. 14, Figure 3	No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE.
	Fernbird habitat can also include stands of shrubland (e.g. manuka) with a continuous closed canopy, and open saltmarsh or sedgeland with no emergent shrubs or trees.	P.15, 4.3 Identifying potential fernbird habitat	Agreed and all such habitatats considered.
G.38	While fernbirds may over time become habituated to playbacks of calls, this is a very effective technique for determining presence/absence in a one-off survey. It's hard to tell from this report the extent to which these have been been done.	P. 16, 4.4 Bioacoustic monitoring, para. 2	No change. Refer Technical Report 29 (avifauna) which fromed part of the AEE. Agree that it can be an effective method and that is why it was used in the baseline avifauna and fernbird monitoring at appropriate stages.
G.41A c)	What criteria are to be used to determine that breeding is definitely not occurring?	P. 17, 4.5 Investigating breeding activity, para. 7	No change. A complete absence of any observations of breeding behaviours (as per Parker 2002) during the observational period. As stated in the plan, if there is any doubt then vegetation clearance will not go ahead.
G.41A b) & d)).	Specify that vegetation to line translocation boxes should be fresh (ie not dry material, which can harbour fungal spores that could give rise to lung infections).	P. 19, 4.7 Trap and transfer programme, para. 5	No change. Detail to be addressed in consultation with DOC if translocation required.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
DC.57	Perhaps this decision has already been made, but I'm surprised to see no recommendation of mammalian predator control (e.g. bait stations) to protect this small, isolated and highly precarious population. It may be a relict that has been overlooked for decades, or a recent recolonisation from further north, but either way it deserves every assistance at a critical stage in its history.	P. 20, 5 MITIGATION	No change. Refer to BOI decision which canvassed this extensively.
DC.53 to DC.58 and G.42C	While it may not be possible to assess population size and distribution accurately, some effort should be made to establish whether fernbird are in fact utilising the new habitat. A simple one-off playback survey should be sufficient.	P. 21, 5.2 Mitigation Success Monitoring	No change. Part of the sign-off process of SSEMPs (ecological mitigation areas).
	Not sure you can say the fernbird distribution has been confirmed as restricted to those areas, merely that they have not been located elsewhere.	P. 26, CONLCUSIONS [sic] para. 1	No change. As stated above, based onthe exhaustive bioacoustic monitoring conducted over a 3 month period (during peak territorial call period) and the inclusion of playbacks at these sites, we are confident regarding the distribution of the species.
	It would help if Kakariki Stream and other localities could be identified on Map 4.	P. 27, CONLCUSIONS para. 2	No change. Well canvassed in EMP.
	As a general comment this seems light on information regarding the current status and distribution of the birds in the vicinity of the designation. I suspect these results have been reported elsewhere, but it would help make sense of the proposals here if there was more background on this. For example why no mention of brown teal, dabchick or the shags outside of Table 3? Presumably there's little habitat for these aquatic species that would be directly affected by the project, though downstream effects (eg on the Waikanae Estuary) may need to be considered.		No change. Refer to the Technical Report 29 (Avifauna) which formed part of the AEE.

INDEPENDENT REVIEW OF EMP Attachment 6: Marine Monitoring and Management Plan
Independently Reviewed by: David Riddell, Kessels & Associates Ltd
Date of Independent Review: 13/5/2013
Signature of Independent Reviewer:

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
DC 53.C	Unsure how this relates to the marine environment? Is it the fernbirds in the saltmarsh at Waikanae Estuary (which weren't mentioned in the avifauna plan)?	P. 1, Table, Row 1	No change. This condition should not be included in the Marine Monitoring and Management Plan. It should be included in the Avifauna Plan.
	Waimeha River should be Waimeha Stream.	P. 2, 1.3 Baseline Results, para. 1	Agree, changes made.
	Should declining water quality due to human activities in the catchment be added to this list?	P. 3, 1.3 Baseline Results, para. 4	No change. Declining water quality due to human activities could be explicitly included in the list, but is implied in the "residential landuse" in paragraph 3.
	3-5 m wide is probably too small to be considered a river mouth estuary - stream mouth estuary might be better.	P. 3, 1.3 Baseline Results, para. 6	Agreed, change made.
	Not sure how this conclusion is reached if Wharemauku Estuary has low habitat diversity resulting from historic and ongoing modifications. Ngarara also sounds highly modified, though the mention of white-baiting and the string of small lakes suggest it may have some ecological values. Could you summarise what the ecological values are?	P. 3, 1.3 Baseline Results, para. 7	Please see Annexure A to Evidence in Chief of Dr Sharon De Luca for summary of ecological values at each estuarine waterway.
	"some distance" is only a kilometre or so. Effects from runoff could potentially be significant.	P. 3, 1.3 Baseline Results, para. 10	No change. "some distance" refers to direct effects of the project on the marine ecological values. Indirect effects from runoff are considered in the marine ecological assessment as having the potential to be significant, particularly in the Waikanae Estuary where sediment and associated contaminants may deposit.
E.9	What are the trigger thresholds, and how is a breach ascertained?	P. 4, 3 Monitoring Effects, para. 2	The trigger thresholds are a 50% change in a Permanova-type analysis of invertebrate community composition or a 50% in Shannon-Wiener diveristy index based on invertebrate community composition. Six-monthly monitoring of the benthic invertebrate community prior to construction provides the baseline for comparison of data from six-monthly surveys during and post construction. These comparisons provided the basis for ascertaining whether a trigger has been breached.
	Perhaps a little background on previous earthworks at the river mouth might help to clarify this issue. Comparing the Google Earth image with the image on p. 7 it's obviously a highly dynamic environment. How often has the council (or others) dug a fresh channel? Are there plans to do this in future?	P. 5, 4.1.1 Site Selection, para. 2	Background on previous earthworks at the Waikanae River mouth could be sought from GWRC, as the discussion around cutting a new river exit became incorporated into the monitoring report following review comments from Megan Oliver at GWRC. The monitoring report notes that such works have not occurred in the past ten years. GWRC could provide information on whether there are plans to do such works in the future.

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	If a new mouth was cut, would the sample sites even remain estuarine habitats, or would they be left dry? What is the likelihood that new areas of estuarine flats that could be affected by sediment deposition (and hence could be sampled using this methodology) could form, or would there more likely just be a narrow channel of swift-flowing water?	P. 5, 4.1.1 Site Selection, para. 4	The impact of cutting a new river mouth would depend on where the cut made in relation to the monitoring sites. It is likely that such works would make any further monitoring of established sites invalid. However, the result would likely be that sediment potentially arising from construction and/or operation of the Project would be rapidly discharged out to the open coast where it would be diluted and redistributed.
	Should GIS be GPS?	P. 5, 4.1.2 Sampling Methodology, para. 1	No. The survey grids were created using GIS. Within each grid the randomly selected sites for sample collection will have a GPS coordinate which can be uploaded to a hand held device in order to locate the sites in the field.
G.40	Who did this 2011 sampling? Could it be referenced?	P. 9, 6 Baseline Infaunal Invertebrate Community Composition, para. 1	Agreed, change made.
G.40	Should the first figure referred to be Figure 4, rather than Figure 5?	P. 10, 6 Baseline Infaunal Invertebrate Community Composition, para. 5	Agreed. Text has been corrected.
	Could naming of sites be standardised? In Figure 3 they're called WAE-1 and WAE-2, in Figure 4 they're Waikanae North and Waikanae South, which is confusing.	P. 10, 6 Baseline Infaunal Invertebrate Community Composition, graphs	Agreed. Discussion and figure numbering has been simplified.
G.40	Which organisms were primarily responsible for the changes? Eyeballing Attachment 1 it looks like mostly it's the amphipods?	P. 10, 6 Baseline Infaunal Invertebrate Community Composition, para. 6	Amphipods were the dominant taxa. Gastropods and isopods were variable in abundance between sites and seasons.
G.40	"The low diversity yet high abundance of individuals at WAE-01 indicates that the community is dominated by a few taxa that are present in high abundance" - this is tautologous. Better to attempt some explanation of why there might be high numbers of only a few species - fluctuating salinities? Also why the situation might be somewhat different at WAE-02.	P. 10, 6 Baseline Infaunal Invertebrate Community Composition, para. 8	Text has been simplified.
G.40	Would be good to see some analysis of what these figures mean. E.g. is WAE-01 a site where there is a regular flow of water that discourages deposition of the finest sediment grades? Could winter storms be mobilising sediment that then gets deposited at WAE-02? Do you have figures for 2011 as you did for the infauna?	P. 12-13 8.1 Sediment Grain Size	Sites surveyed in 2011 were different to those established for the baseline and ongoing monitoring. The 2011 data has now been excluded from this report as it doesn't add to the interpretation of the 2012-2013 data. The Waikanae Estuary is quite dynamic regarding sediment mobilisation and deposition, and water flow. It is likely that the proportion of sediment grain size fractions will be similarly dynamic and vary between survey periods.
	I generally agree with these conclusions. I also think sediment grain size is informative, and am not sure why this isn't mentioned here. That would seem to have the greatest potential for detecting a clear effect of any changes in the sediment regime resulting from the project, even if it's not possible to relate it unequivocally to any biological changes.	P. 15, 9 Threshold Trigger Levels for effects monitoring	N/A

Condition Reference	*Independent Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response*
	A final groom to fix typos, spelling and grammar would be desirable.	Throughout	Done.

Appendix B

GWRC Review Comments

M2PP ECOLOGICAL MANAGEMENT PLAN
Review Comments from Ian Boothroyd

General Theme	Plan	Comment	Revised EMP Comment	BML Response (6 June 2013)
Roles and responsibilities	All	Roles and responsibilities are listed but the linkages between them are not clear.	Roles and responsibilities are determined and Fig. 1 of EMP shows organisational structure. Shows a hierarchical structure ; and it is not immediately clear how communication and actions are co-ordinated at all levels, the position descriptions do describe this (for Environmental Specialist).	No change. Communication and actions are outlined in CEMP - with associated processes and management chart structure etc.
		Person responsible for contingency reponse to adverse effects is not clearly identified.	Despite reference in position descriptions to responsibilities for management systems, monitoring, complaints etc., there does not appear to be a role described for actioning contingencies in the event of incidents or failure of systems and follow up to make sure it has occurred satisfactorily. Unless Environmental Manager covers this under: Coordinates environmental emergency responses; and Responsible for resolving issues of environmental non compliances. Preferable to be more explicit.	No change. Currently the Environmental Manager has responsiblity for "notifying Alliance Project Manager and Regulatory Authorities of any significant non compliances" during construction.
		No reference to what will happen if responsibilities are not upheld.	No reference to what will happen if responsibilities are not upheld.	As above, this will be a breach of consent conditions and reporting and associated coordination will be required.
Relationship of EMP, SSEMPs and LMP		Linkages between these are often stated but the actual relationship is not clear. Good example is the pest and weed management which may have multiple purpose beyond landscape mitigation. Prefer to see the pest and management detailed in relavant plan if appropriate - e.g., lizard plan.	Attempt has been made to indicate a better integration of EMP, LMP, SSEMP etc. into a single Site Specific Management Plan for each area. Would have to see one to see how inclusive and integrated it would be but a good idea.	No change. Support the acknowledgement of this approach. Awaiting confirmation from KCDC and GWRC as to this approach.
Management Plan Linkages			Management Plan Linkages are pointed out in Section 3.8 of the EMP by way of reference to relevant consent conditions. There is still uncertainty of how the linkages between the plans will occur on the ground'. How will an event for one condition trigger of one plan an action in another plan? The single Site Specific Management Plan for each area might provide this if it covers monitoring/actions/contingencies etc.	No change. This is the intent of the rationalised SSMP approach as outlined in the EMP and LMP to be undertaken via SSMPs. Triggers will happen through close cooperation between Project LA and Project Ecologist, as per responsbilities sections in these documents.
Changes occurring at detailed design	Indigenous vegatation; Wetlands	No clear process detailed as to how any re-design that affects environment beyond that detailed here will be mitigated. Especially there needs to be a clear role of the Project Ecologist.	Detailed design involves Project Ecologist in any detailed design but only under certain conditions. These are mostly acceptable. I would expect the PE to be involved in detailed design change.?	No change. A register has been set up outlining any changes to detailed design that either affect, or have the potential to affect, areas of ecological value. Project Ecologist sitting in on design meetings for any sector with indigenous vegetation or habitat values. As per specific comments, the PE is involved in any detailed design changes affecting, or having potential, to affect areas of identified ecological value.
Environmental awareness training	All	What does the environmental awareness training consist of? General or site specific matters? Be useful to have a list of bullet points that show what is involved.	Main components of enviropnmental awareness training are covered in specific components of the EMP (e.g., 7.7.4C for wetlands). Would be helpful to see covered in the main body of the EMP.	No change. Agree this detail is currently included and will be more explicitly outlined in the CEMP which deals with environmental awareness training.
Management triggers	All	In some places there is a confusion between end outcome targets and adaptive monitoring triggers. Plans require clarity on these and what contingencies will occur for each type. For example, where an end outcome is not met then more mitigation may be required; where a monitoring trigger is breached a change in practice or action may be required.	This seems to be better determined in the EMP with reference to monitoring in most discipline areas. I remain uncertain of the management triggers in the infidgenous planting plans.	No change. Management triggers for indigenous vegetation will largely be deteremined in the LMP via plant selection and contractual arrangements for plant success and weed control. As outlined in the last comments, quantifying any other triggers for these highly grazed and modified systems for the Project is difficult for as soon as stock removed, there will be significant change in these systems.

		Where management triggers are narratives it would be beneficial to have a suite of triggers (as has been done for the indigenous vegattion) and some expectation of outcome for at least some of them. For example for indigenous vegetation a threshold for one trigger is 'increased overall dominance of native plants' with no measure of community, condition, how much is dominant.		N/A
		Not clear on how some of the triggers and thresholds have been derived. E.g., indigenous vegation focus on area and quantity of planting but not clear what is driving these triggers; and what the relationship is to the vegetation being disturbed. More explanation and clarity of purpose would be helpful.		N/A
Options for adaptive management	All	Options for adaptive management. Can't expect this to be exhaustive but it would be helpful and preferable to see some forethought and linkages between the potential effects (e.g., vegetation destruction, earth slips) with anticipated response.	Process for adaptive management and options for adaptive management are included in the respective attachments (e.g., . Section 5 of Attachment 1).	N/A
Mitigation Plans	All	More detail on mitigation associated with plans would be helpful. Where is the mitigation expected to occur and how will linkages/corridors be developed and maintained for different groups of plants and animals.	Linkages between plans are covered in the EMP but I don't see any such cross-reference in the LMP where guidance for much of the on-the-ground activity is provided. Principles and guidance within LMP and respective maps and figures cover some of these matters in general but I am concerned that there is integration of the various	No change in EMP - this specific comment was discussed with the LMP author and both authors consider it is best addressed within the SSMPs as a result of detailed design. *Note - review comment not complete.*
	All	A detailed programme for implementing the ecological mitigation package as a whole would be helpful and provide confidence that it is correctly scheduled. Particular attention to the cross-over linkages would also be helpful i.e., where avifauna and indigenous planting mitigation overlap - what is the plan to deal with this. Specify who will be responsible and what happens if schedule slips or something does not happen or is carried out incorrectly.	I have not seen an indicative programme for implementing the mitigation. This might include scheduling over time, anticipated start/finish, mitigation purpose, where and how it overlaps between purposes (e.g, avifauna, vegetation, wetlands, riparian).	No change. As outlined in earlier response, mitigation timing is dependent on construction staging and ultimately detailed design. For example, the development of the WWTP wetland will depend on construction of embankments in Otaihanga wetlands to be able to salvage wetland plants intended to inform this section. Detailed design, including extent of wetland and kanuka loss, currently occuring in this stage. This will occur through SSMPs.
		Linked to above is the planned mitigation planting. There needs to be a mitigation plan that brings together what could be conflicting outcomes for planting (between wetland, indigenous vegetation, lizards, birds and landscape) regarding planting requirements - in terms of purpose, species/community types and location. Of course some of these may overlap comfortably others may not - this is not clear from the current individual plans. This may be further complicated by further NZ Pipit habitat planting requirements.	Ditto above	As above - mitigation will be consistent with BOI agreed mitigation, which states that this be undertaken through the SSEMPs. Again, detailed design still occuring and too early to determine these requirements in resepect of overlaps etc. GWRC has acknowledged that there are no consent requirements relating to habitat creation requirements for NZ pipit.
Consistency	All	There is a high degree of difference in style and approach to each management plan. In part this is inevitable from the slightly different discipline areas and data available. However, it raises a concern regarding the anticipated audience for these plans and I am concerned that the message/actual implementation plans for each do not come across clearly and/or are lost in the mass of words and the detail of data. The freshwater MP is comprehensive but full of data that it runs the risk of confusing a non-specialist; whereas the lizard plan is quite sparse on detail. It would be helpful to see more consistency amongst the plans; perhaps upfront a 'road map' guide to each and all, a one page one-stop summary guide on what is actually expected from each plan and who/how/when it should be done.	EMP draws the respective discipline areas together in a more standard style and content.	N/A - support for revised approach appreciated.

M2PP ECOLOGICAL MANAGEMENT PLAN
Review Comments from Ian Boothroyd

Page **Section** **Comment**

Wetland Monitoring and Mitigation Plan				
General		**Original Review Comment**	**Revised GWRC EMP Comment**	**BML Response 10 June 2013**
		Wetlands outside of designation - no clear reference to these and would benefit from aseparate section. What monitoring of these will occur. Although not cleared, groundwater effects are not detailed and what mitigation will be provided in event of some effect?		N/A
1.1			Integration between Groundwater plan and wetland management plan is included in section 1.1. and details the responsibility of the PE and the project hydro-geologist to liaise on a regular basis and in the event of an exceedence.	N/A
14	4	Reference is made to Wetland Habitat Monitoring and Management Plan (Attachment 5). What is this plan and it is not clear where it is located.		N/A
14	4.1	Changes to detailed design - what is process for considering effects of change and how does any change in mechanisms for protection/mitigation be communicated through plans, people and Council?	Process detailed in EMP	N/A
	4.1	Extent and type of buffering not clear - presumably will be in the SSLMP?	locations of these seven areas of wetland will be shown on the SSLMPs with buffering zones.	N/A
17	5.1	Endorse the methodologies listed.		N/A
20	6.1	Heavy reliance on piezometer triggers. More desirable to have a suite of trigger mechanisms including botanical. Assume the grounwater alert trigger will have to be very conservative for other monitoring to occur.	Section 7.7.5 covers wetland monitoring:Observation of vegetation clearance and immediately following. – Bi-annual surveys following vegetation clearance. – Wetland Condition Monitoring to monitor wetland health and function. – Hydrological (piezometer) monitoring (refer the Groundwater Management Plan). – Mitigation success monitoring within mitigation wetlands.	N/A
		Science-based indicators appear to be only observational. Orefeernce for these to be fleshed out into qualitative and (semi) quantitative indicators. - use of indices acceptable Provides more confidence that actual changes are recorded.	Triggers are more semi-quantitativewith some real thresholds to respond to. Uncertain how the triggers have been derived but these are acceptable, measurable and sufficiently conservative.	N/A
20	6.1	Support the involvment of Project Ecologist at early stage in monitoring.		
21	6.1	Botanical,triggers; PI triggers. I would have thought triggers could be developed along lines of percentage change in weed intrusions, dominance, marginal encroachment. E.g., Trigger is > 10% increase in weed species cover.	As above although triggers would benefit from an invasive weed threshold.	This section has been amended to refer to control of all plants listed in GWRC Regional Pest Management Plan 2010 in accordance with NZTA review comments.
21	6.1	Condition monitoring triggers seem to be end of construction phase triggers and not during construction. What are triggers during construction (other than piezometer monitoring).	Monitoring schedule includes construction and post construction phase monitoring - acceoptable	N/A
22	6.2	Wetland function. How much are the created wetlands aimed to be same botanical community and habitats as those lost. Management target could be this replication. As for function then maybe a suite of indicators would be plant communities, bird breeding/nesting/utilisation, fish presence?	LMP covers some key elements of how reconstructed wetlands may be planted/created.	N/A. Again, intent is signalled in the 'like for like' consent condition as far as practicable.
24	7.1	Options for adaptive management. Can't expect this to be exhaustive but it would be helpful to see some forethought and linkages between the potential effects (e.g., vegetation destruction, earth slips) with anticipated response. Represent this in a table?		N/A - detail was added to last review version to address these comments.
	7.2	Ditto above		N/A
	7.4	Ditto above		N/A
27	7.4	Table 8 - Wetland ratio does not take into account additional 10 ha of wetland added during caucusing.		N/A
Aquatic Monitoring and Management Plan				
General				
		Table of relevant consent conditions (as other plans have provided) would be helpful to the reader.		N/A
		A comprehensive document with lots of data and detail. I hope this does not get to complicated for its readership.		N/A
7	Table 2	Describe acroynms in table.		N/A

22	5	Construction monitoring - expect to see habitat monitorng alongside the SEV monitoring, especially for the diversion sites, to ensure habitat diversity is privided for as in your guidelines.		
27	5.3	Wharemauku Stream NTU loggers. Grab samples were suggested for use to calibrate the logger to 20% or less if further downstream. Would like to see that spelt out here.	Included and detailed in attachment 4 (Section 5.3).	N/A
28	6.1	Options for adaptive management treated too lightly here. If something has gone wrong or is not working well then Council need some confidence that appropriate contingency is provided. Can't expect this to be exhaustive but it would be helpful to see some forethought and linkages between the potential effects with anticipated response. Represent this in a table?	Still feel that contingency options and how they would occur could be spelt out in more detail	No change. Agree, but intention is to develop these in consultation with Alliance and GWRC if and as required.
31	7	No. 8 - how will new habitat capacity be estimated?		
33	8.1	Detail culvert remedial action in more detail including steps/physical actions that will occur.	Included in Attachment 4 (Section 8.1)	N/A
33	8.2	Altered fish sampling proposed seems acceptable.		
	Attachment 8	Agree a set of guiding principles and indicative stream plans and cross-sections is more helpful than developing specific stream diversion design		
Avifauna Monitoring and Management Plan				
General				
		A comprehensive document with lots of detail and methods. I hope this does not get to complicated for its readership.		
2	2	Disturbance' should include all disturbance and not just direct habitat loss. Other examples are Construction noise and lighting and need to be considered here.	Disturbance relates only to the direct disturbance associated with the removal of habitat during the breeding season	Agreement was reached in meeting with GWRC on 6/5/13 that disturbance in the context of the Avifauna Monitoring Plan is in regard to habtiat loss during the breeding season, not construction noise and lighting.
2	2	Definition of 'breeding' season as used here. Does this include fledging and more; cf monitoring of nests only. If more than just nesting then revise methods accordingly.	I consider that the monitoring and adaptive process for other avifauna (NZ pipit and Grey Duck) has shortcomings and uncertainties. Without wanting to overwhelm the EMP process, the plan could be tightened up with some responses such as avoiding wetland vegetation clearance during Grey Duck breeding season.	We note in terms of avifauna, the only species for which the consent condition (G.40) require an adaptive management approach is fernbird. The avoidance of veg clearance outside of the breeding season is recommended several times in the plan for the different species.
2	2.1	NZ Pipit. Overall rather dismissed in the plan despite its conservation status and likely habitat in the designation and therefore requirement to be considered in the appropriate consent condition. Consent condition does refer to avoiding disturbance of threatened birds and this is not well considered for NZ Pipit in the plan. Requires much more justification, and reference to baseline data as well as contingency for adaptive management. More comments in body of the plan. Reference to what was said in evidence is rather irrelevant; what is relvant is the consent condition.	Agreed process with GWRC is reflected in the EMP.	Section 4.1.1 of revised plan outlines method for managing pipit.
2	2.1	Given the low results apparently recorded in the baseline survey yet the stated extent of habitat, and the rather dismissive approach to NZ Pipit, require a re-survey of pipit habitat, and document optimum habitat and population. Use information to formulate a habitat enhancement/mitigation plan.	Agreed process with GWRC is reflected in the EMP.	GWRC acknowledge at meeting on 6/5/13 that the suggestion of a re-survey of pipit habtiat and documentation of optimum habitat and population is not a requirement of the consent conditions and as such will not be undertaken.
2	2.1	Prior to habitat clearance undertake a sweep through potential pipit breeding habitat to 'flush' out birds.	Agreed process with GWRC is reflected in the EMP.	Section 4.1.1 of revised plan outlines method for managing pipit.
2	2.1	Provide for re-establishing a propoprtion of NZ pipit habitat within the designation. Clearly state the specified proportion and where this might occur.	Agreed process with GWRC is reflected in the EMP.	GWRC acknowledge at meeting on 6/5/13 that this is not a requirement of the consent conditions and as such will not be undertaken.
9	3.3	Extent of monitoring for fernbird nesting. Require 10 days to cover nest failures.		Section 4.5 of Plan now refers to 10 days.
	Appendix 1	Management trigger rather dismissed. Council requires a trigger which could rely on fernbird habitat retained as outcome of the project. Contingency could be creating equivalent areas of new available habitat or perhaps more possible by mitigating any habitat loss by impoving the quality of remaining available fernbird habitat (e.g. by improving connectivity or controlling exotic predators and/or weeds).		It was agreed that the reality of setting a trigger based on fernbird numbers was not acheivable, and as such fernbird habitat as a proxy. We have added a discussion on the benefits and requirements for this within the Smithfield/Kakariki SSEMP area. GWRC agreed with this approach at meeting 8/5/13. A paragraph has been added to the Conclusion seciton of Appendix 1.
Lizard Management Plan				
General		Management triggers - no triggers established. Not clear from consents if they are required. Best option might be a targeted outcome in habitat creation that can be measured - a % of the existing habitat that will be created/restored.		N/A

		Although not specifically required as a consent conmdition it is preferable if attempts to minimise effects/disturbance on terrestrial lizards is carried out at appropriate locations along the route.		N/A
		The lizard plan discusses arboeal lizards at length but also presents information on offsetting terrestrial lizard habitat - 'large areas of ecological, landscape and visual mitigation planting, most notably through specific modifications to planting areas to optimize habitat quality for terrestrial and arboreal lizards.'		N/A
6	3.1.2	Number of searches - is this recommended protocol?		N/A
8	3.2	Agree that SSEMP planting plans (and a number of the SSLMP planting plans) will be reviewed by a suitably-qualified herpetologist with the purpose of meeting the plan objective of offsetting lizard losses through the 'large areas of ecological, landscape and visual mitigation planting, most notably through specific modifications to planting areas to optimize habitat quality for terrestrial and arboreal lizards.'		N/A
Indigenous vegetation				
11	4.1	Changes to detailed design. Who will make this consideration? Will ecologist be involved? Not clear here or in 'roles' section below. Project ecologist should be involved in any change to detailed desogn that will impinge on the expected ecological outcomes/mitigation.	Detailed design involves Project Ecologist in any detailed design but only under certain conditions. These are mostly acceptable. I would expect the PE to be involved in detailed design change.?	No change - intention as stated is that the Project Ecologist will be involved in any detailed design that affects listed or identified areas of ecological value - or potential effects. This role is, and has been, ongoing thorugh the detailed design phases for each sector.
11	4.1	Changes to detailed design and additional mitigation. How will this be decided/signed off). Can you propose a mechanism. Involvement of Project ecologist should be a requirement.	ditto above	No change - as above.
14	5	Completion and monitoring mitigation success. It is not clear how completion and monitoring. How does this link with any habitat requirements of the mitigation for other species/communities eg lizards, birds. Focus here is on planting and not on other attributes that may be expected.	LMP could be improved to cover these matters.	No change. Discussed in more general comments earlier - expectation is that this will be undertaken during SSMPs, which require certification.
16	6.1	Management triggers. These appear to be a mix of triggers aimed for during construction potential effects, and endpoint or outcome focused effects. Be useful to separate these out and link the adaptive management with each type of potential effect. Indicative responses to specific potential issues would be very useful.	I still think that there is a mix of different monitoring and triggers together. The triggers read like final outcomes but presumably they will be tested during construction which could be difficult for NZTA and Council to deal with.	Point noted - outcomes are dependent on factors under responsibility of LMP e.g. Weed invasion. As above, intention is that these will be developed during SSEMP and SSLMP in relation to vegetation clearance (all of which has close ecological supervision).
16	6.2	Ditto above. Be useful to have an indication of what response/type of response would be linked to each potential effect. I don't think anyone expects a prescriptive response to very single potential impact but a range of indicative response would give confidence to Council that the correct things are line up.	Same issue	No change - as above.
18	7	Ensure ecologist and landscape are involved in design, implementation and evaluation.		N/A
Ecology Management Plan				
General				
21	5.1.3	I haven't seen these plans so not certain of what form the detail of pest and weed management will take. This occurs in the appendices as well so there are some gaps that are difficult to assess in this current process.		N/A
31	5.2.3	Is there a preferred time of year for collection ? Best endeavours to link with best timing?		N/A

M2PP ECOLOGICAL MANAGEMENT PLAN
General review comments via email on submitted final draft of EMP.

Wetland Monitoring and Mitigation Plan

Section	Comment	BML Response 6 June 2013
Mitigation	While I appreciate that detailed design has not been completed and that quarterly updates are proposed around implementation of mitigation required under G.42, details on when mitigation will be implemented really needs to be included in the EMP so we have some certainty that it will all happen in a timely manner to minimise the lag between adverse effect and mitigation.	Change made - new section inserted with Figure 2 re: staging of mitigation and remedial works. As noted in specific chapters, including this mitigation timing and areas will be subject to detailed design - e.g. Use of salvaged wetland plants from Otaihanga Wetlands will largely determine timing of created wetlands at WWTP wetland. Construction staging and detailed design still being worked through in this area.
Implementation of mitigation	During the hearing GWRC submitted that a programme for implementation and protection of mitigation needed to be provided prior to commencement of works. In response to our comments on the draft decision (where we sought conditions specifically requiring a programme to be included in the EMP), the BOI responded that this requirement is satisfactorily covered in other conditions. NZTA also confirmed in their response to GWRC's comments on the draft decision that the requirement to amend the conditions as suggested was unnecessary because those requirements are covered under G.34 (e), G.43 and G.43(f). As such, all parties were clear at that point that a programme for implementing mitigation would be provided prior to construction. This is a key certification matter for the council.	As above.
Cultural	It would be useful to have feedback from Te Ati Awa and Takamore regarding the amendments made in response to their initial comments.	Discussed revised content (Cultural section) with Cultural Advisor, Amos Kamo, who has confirmed that Te Atiawa Ki Whakarongotai are comfortable with this section.
Oxidation Ponds	I see that the Waikanae oxidation ponds have been retained as an option for wetland mitigation. However, my understanding is that KCDC are required to remediate those ponds as part of the decommissioning process, which means that these would not be available to mitigate the effects of the expressway.	No change. This area has been retained as a potential mitigation option as confirmed by BOI in terms of the specific SSEMP areas. The understanding during BOI process was that there were some aspects of these ponds available for restoration (outside of KCDC mitigation requirements which involved only part of the ponds) and that ultimately KCDC needed excess peat or fill to be able to undertake successful restoration on this scale. We note that any restoration would be consistent with the approved KCDC restoration plans for this area - and ultimately would be a good fit with any other restoration requirements in this large, approxiamtely 10ha area of ponds. For example, restoration could extend wetland buffers etc. in addition to strictly wetland planting.
Table 7, Attachment 4	Table 7, Attachment 4 – does not identify that grab sampling will need to be undertaken in all streams in response to triggers.	It is correct that Table 7 (now table 8) does not address grab sampling. In section 5.4 the text describes that grab sampling is to occur out side of the streams with a continuous logger and requires a sample/s to be taken as soon as practically possible after the "release (of sediment)" or alert (i.e. the trigger)and preferably within 2 hours. The conditions arising (i.e. the trigger) that requires the grab sampling (in those streams not permanently NTU logged) are by a threshold breach in the ESCP or circumstances in Condition E.9 (i.e. a failure of an erosion or sediment control measure, or a storm event in exceedance of the design volume of the sediment devices).
Section 5.3, para 2, Attachment 4	Section 5.3, para 2 Attachment 4 – It is stated that conditions require once a day checking of logs. This is not entirely correct. G.38A requires monitoring on a 'daily basis'. Once a day check may not pick up rapidly on discharges that have occurred.	Refer discussion below.
	Section 5.3, para 4 Attachment 4 – It is stated that initial consent conditions required loggers to be installed and collecting data 6 months prior to earthowkrs. The current conditions still require this (G.38A i)).	Loggers were installed in the Waikanae River on 23rd April 2013 due to a delay in manufacture and supply of telemetred units from Greenspan/NIWA. GWRC has been kept informed of these delays - but loggers are in place with intention to get as much comparative data as possible prior to construction. *Note - conversations with GWRC reviewer, Ian Boothroyd, agree that purpose of loggers is to get comparative data, rather than establish baseline information as there is an up stream logger as the control rather than the effect being reliant on a baseline comparison*

	Section 5.3, bullets para 6 Attachment 4 – While these monitoring locations have been discussed and agreed in order to get the 6 month pre-construction monitoring underway, the significant distances up and downstream of the discharge points are by no means ideal in terms of detecting sediment discharges from the site. Significant discharges may be detected, however these mixing zones are much greater than GWRC anticipated during the hearing and we would not normally accept that these are appropriate. As such, the effectiveness of the monitoring locations will need to be reviewed once works have commenced and this section should reflect this. In addition, and for the same reason, grab sampling (section 5.4) should apply to all streams, not just those that do not have the automated turbidity monitoring on them.	We agree that the distances of the logers down stream are not ideal, but this is primarily only an issue on the Wharemakau Stream. The Kakariki Stream, because of ownership and restriction of access, will be set appropriately while the Waikanae River is set just within the parameters discussed with Dr Boothroyd (in a position that best allowed hidden installation and good water depth and flow). We agree that the effect of these distances will need to be checked in the first rain events during construction period and that will require on site inspection with a hand NTU meter. With regard to grab samples, each logger position does require three rain event grab sample calibrators but otherwise we are uncertain what a grab sample (or hand held NTU readeing) will add over the continous NTU reading provided by the logger insitu? Additional text included to reflect the need to ensure down stream distance does not affect the ability to monitor discharge.
	Section 6.2, para 2 – Visual surveys are proposed further downstream to establish whether there is a noticeable increase in deposition of sediment. Is a baseline visual record going to be established prior to works	No change. The streams are generally too variable to establish a meaningful baseline, but new desposition is often observable visually as a different colour layer and on top of vegetation etc.
	Section 6.2, para 3 – Other onsite adaptive management responses may include reducing disturbed catchment through rapid stabilisation.	Agree, have added to the text.
	I am not clear as to who will be watching the NTU loggers and who they will be advising if triggers are exceeded. It would be good to have more detail on how this will work in practice. Will the person monitoring the loggers be automatically texted/emailed to advise on an exceedence? Can GWRC be automatically emailed/texted if an exceedence occurs?	Alliance freshwater ecologists are currently monitoring the loggers daily via website and reviewing data differences manually. Intention is that the Environmental Manager will be responsible for monitoring the loggers during construction and will advise the Project Ecologist and GWRC if triggers are exceeded. Currently we are working with NIWA to establish a text alert system for a 20% exceedence between loggers.
	Who will be undertaking the grab sampling and who will they be liaising with in terms of results? How will GWRC be advised of exceedence of triggers and when?	Intention is that Alliance ecologist will undertake the grab sampling and will liase with Environmental Manager and GWRC. Suggest updating this condition that GWRC will be informed within 24 hours of any grab sampling being undertaken.
	Section 9.1, para 4 – Some clarifications are required in this section. G.42 iii) requires 17.7ha of 'enrichment of riparian habitat' (so closer to 18ha) and G.42 iv) requires and additional 10ha of wetland and riparian planting in storage areas 2A and 3. There is also the requirement to provide at least 20m of planting each side of the stream unless otherwise approved. The EMP states that riparian planting will be 10-20m wide both sides and will result in 'roughly 17ha of riparian planting'. From the mitigation plans in section 7 of the EMP, 23.74ha of indigenous riparian planting is shown. Given the level of information provided in the EMP it would not be appropriate for GWRC to certify as part of the EMP a reduced width of planting, this would need to happen at the SSEMP stage once constraints are understood. The EMP needs to make clear that certification is not sought for a dispensation from the 40m width as part of the EMP certification	At 40 m wide the riprian planting will achieve 21.1 ha of riparian vegetation. Certification is not sought to deviate from a 40 m width of riaprian planting. However, intention was that overall across the Designation, a 20m width riparian strip (either side) would be achieved, subject to other constraints - e.g. Property boundaries etc. Ultimately, the consent conditions require a minimum of 17.7 ha of riparian planting and this will be acheived within the SSMPs**.** Have improve clarity of text re that matter.

Appendix C

KCDC Review Comments

KCDC REVIEW OF FINAL DRAFT Ecological Management Plan
Reviewed by: Shona Myers
Date of Review: 31 May 2013
Signature of Reviewer:

Condition Reference	*Condition Summary*	*KCDC Reviewer's comment*	*Page/paragraph/section reference within Management Plan*	*Management Plan Author's response 12 June 2013*
		Will also increase our understanding of the hydrology of wetlands affected by the project.	2.8.3	Agree, updated this para to reflect this comment.
GD7	Groundwater monitoring of wetlands	Section needs to discuss groundwater monitoring and link to wetland condition monitoring	3.2	Agree, updated this para to reflect this comment.
GD7 and G38B	"	needs to include linkage with GMP and between conditions GD7 and G38B regarding wetland monitoring	3.8	No change - this is address by the existing wording in this section "An overlap with conditions relating to Groundwater Diversion (GD.1 to GD.8A) where they relate to adverse ecological effects on wetlands and involvement of an ecologist." and comment a the end of this section in relation to liaison with teams responsible for Groundwater monitoring.
G39	Ecological monitoring	All ecological monitoring is required to be undertaken by an ecologist not by other members of the environmental construction team	4.1	No change - as this section already states "Suitably qualified ecological specialists will be nominated to carry out baseline studies, contribute where appropriate to elements of detailed design, monitor the effects of construction on the ecology and, following construction, to over-see mitigation activities and carry out mitigation success studies. "
G34 and G40	EMP	Need to discuss where responsibility lies if vegetation or habitats outside footprint are impacted, and what process is, if further areas will be impacted.	4.2	No change. Currently the Environmental Manager has responsiblity for "notifying Alliance Project Manager and Regulatory Authorities of any significant non compliances" during construction, which would include vegetation or habtiat outside of the project footprint (consented area). Intention is that a design schedule will address any additioanl vegetation or habtiat effects beyond consented/agreed - and this will be addressed via the SSMP process, which GWRC is resopnsible for certifying.
DC54	LMP	More detail is required in the EMP and the LMP as to how the mitigation restoration planting will be implemented including types of plants, ecosystem types to be restored and where, spacing, maintenance. Or refer to where this is in LMP.	Section 5	No change. The BoI determined the SSEMPs would be the mechanism for this detail of mitigation consistent with Condition G.42C - which as stated in this condition is to be developed by a Landscape Architect with inputs as requiired from others, includign specialist ecologists.
G 33B, G34, G26A		Adverse effects on areas of indigenous vegetation and habitats should be minimised so any change in extent of the footprint and effects on additional areas, including habitats for indigenous fauna, through detailed design should be minimal. This needs to be explained.	Section 6	No change. Best endeavours approach being undertaken to minimise ecological impacts through the design and construction phases, including close involvement with Project Ecologist. For example, a site visit on 10 June 2013 thorugh Otaihanga wetlands area was undertaken with construction and detailed design team to understand ecological issues in this area.
Terrestrial vegetation				
G34 and 41		There is more than one condition relating to indigenous vegetation. Both should be referred to here.	Section 7.1.2	No change. Condition G.34 is referenced thoughout the EMP and is not specific to the protection and management of valued indigenous vegetation. Intention is not to duplicate the more general conditions in the EMP.
G34 and 41		Conditions require minimising loss of areas of vegetation regardless of their current condition as described in this table. This needs to be made specific here. Table puts more emphasis on condition of vegetation rather than the requirement to minimise loss.	Section 7.1.4 and table	No change. The intent of this section and explanatory text in table is to outline the extent of vegetation (as per the AEE) within the Project Footprint (i.e. consented loss). Consent was for vegetation within Project Footprint - and condition/value is irrelevant.

DC 54		Needs to specify how effects on Otaihanga kanuka will be minimised by construction of boardwalks	Section 7.15	No change - this 'best endeavours' condition is a designation condition, rather than a resource consent requirement and therefore sits outside of the EMP.
Lizards/herpetofauna				
G33B		Adverse effects on indigenous vegetation and habitats, including for indigenous herpetofauna, should be minimised. This condition is also relevant and should be referred to here.	Sections 7.2.2; 7.2.5	No change - lizards not specifically mentioned within Condition G.333B. Intent is to minimise and this is clear through conditions. Lizard conditions are specific to the El Rancho Wetland area - and this is the focus.
G34	Lizard Management Pla	Lizard Management Plan should require monitoring of species capture and release	Sections 7.2.7; 7.2.4	No change. The Lizard Management Plan is consistent with the consent condition requirements and requires all lizard capture to be undertaken in accordance with the DOC permit. There are no ongoing capture and release monitoring requirements specified in the DOC permit.
G34, G40		Will require adaptive management process as part of lizard management plan and if unexpected lizard species are found during construction and if effects are greater than expected	7.2.8 and Attachment 2	No change. Project Ecologist will be involved in any unexpected finds. Mitigaiton for acknowledged loss of habitat across the Project has been allowed for in mitigation sites, including input of specialist ecologists into mitigation design/s as per consent conditions.
Avifauna				
G33B		Condition G33B also requires minimising adverse effects on indigenous vegetation and habitats, including for avifauna. Needs to be referenced.	7.4.1, 7.4.2, 7.4.4 and Attachment 3	No change. Avifauna are not specifically mentioned within condition G33B.
G34		Options to minimise adverse effects on pipits are supported. However, an adaptive management approach is needed if pipit are discovered during construction particularly during breeding season. Project ecologist should be present during construction and vegetation clearance and earthworks in areas of pipit habitat.	7.4.4	We note in terms of avifauna, the only species for which the consent condition (G.40) require an adaptive management approach is fernbird.

G40		Management of avifauna and avoidance of disturbance during breeding requires adaptive management approach	7.4.7	We note in terms of avifauna, the only species for which the consent condition (G.40) require an adaptive management approach is fernbird.
Aquatic				
DC54 and G42	LMP	There are overlaps with LMP regarding riparian mitigation; also overlaps with conditions regarding fernbird habitat and avoidance; and habitat restoration (Kakariki stream). Also overlaps with conditions regarding wetland mitigation planting and monitoring. These need to be added.	7.5.9; Attachment 4	No change. Agree there are overlaps (as was the nature of a number of conditions), and this is clarified in roles and responsibilites section of EMP and in the LMP. Detail in respect of these comments/overlaps will be addressed during development of SSMPs.
Wetlands				
GD7	Groundwater	Conditions regarding hydrological monitoring of wetlands need to be referenced.	7.7; and 7.7.7	Agree, changes made to reference conditions GD.5 and GD.7. Note that this section also refers to "An overlap with conditions relating to Groundwater Diversion (GD.1 to GD.8A) where they relate to adverse ecological effects on wetlands and involvement of an ecologist".
G28A, G33B, G34, G38B	Hydrological impacts on wetlands	Conditions regarding no significant changes in hydrology of wetlands; and minimising and monitoring the potential for hydrological effects on wetlands outside the Designation Footprint, need to be cross referenced. Project objectives and conditions section needs amending to include this.	7.7	No change. This section specifically deals with hydrolgoical monitoring - and already cross-references condition GD.5 and GD.7 and the Groundwater Management Plan in relation to those wetlands that consent conditions require hydrological and Wetland Condition Monitoring (G.38B).
G28A, G33B, G34, G38B		Who makes decision about any additional changes to extent which might have additional effects? What is the process?	7.7.3, 7.7.4	No change. Any changes to extent / or magnitude of design changes on areas of ecological value will be identified and discusssed with GWRC through corresponding SSMPs (which require certification). A design change register affecting ecolgoical values has been developed as part of this process.
No change.	Wetland mitigation	How is figure <9.5ha wetland planting calculated based on G42? Given the requirement in G42 for additional 10ha of wetland and riparian planting. Options for adaptive management need to include additional areas for wetland restoration.	7.7.6, Attachment 5 (section 5.1, Table8)	Agree, section on Options for Adaptive Management changed to incorporate restoration of other wetlands outside the designation. How the 9.5 ha figure for wetland planting is derived is outlined clearly in the Attachment 5 section that deals with this. In summary, this is derived from the total of the wetland mitigation of 5.4 ha for the loss of 1.8 ha as set out in Conditon G.42b)ii) and the wetland area after the riparian vegetation (20m wide on both sides of streams) within the Planted offset storage areas 2A and 3.
DC54 and G42	LMP	Ecologist needs to provide advise on design of wetland restoration and implementation of this - not just sign off.	7.7.7	No change - this is specifically required in Condition G.42C (SSEMPs).
G42A	Wetland design	Regarding design of wetland restoration areas - open water/ponds should be minimal part of design - should be vegetated wetlands primarily sedge, manuka etc with areas of shallow water, depending on the nature of what is being lost	7.7.7 maps of wetlands	No change - as outlined in the EMP and Attachment 5, there is a condition that requires 'like for like' mitigation for wetland loss as far as practicable and this will be determined through the detailed design of these areas through the specific SSMPs.
G42A	Wetland mitigation	Where is the extra 10ha of wetland and riparian specified in condition G42A identified on these plans?	SSEMP Sites General Location Plans	No change - this area is identified in SSEMP Map 6 entitled ' Drain 7'.
Attachments				
DC 54		DC 54 regarding Otaihanga kanuka is missing from the list of conditions. While this condition refers to LMP, needs cross referencing	Attachment 1, Section 1.1	Agree, change made through insertion of a new paragraph to this effect. Note - the EMP already cross-references DC.54 in the roles and responsibilities (see section 7.7).
DC 55		The LMP requires input from an ecologist. This should include significant input on the implementation and delivery of the mitigation planting, including plant selection, and habitat type restoration.	Attachment 1, page 7	No change. The LMP has been reviewed for consistency by the Project Ecologist. Mitigation planting and implementation etc. will be developed through the SSMPs, including plant selection and habitat type restoration consistent with the relevant consent conditions (inlcuding G.42C for example - SSEMPs).

G41		The methodology for relative values of areas of indigenous value in Table 2 is not explained. All areas of indigenous vegetation are significant in ecological district context. The low value assigned to the riparian vegetation does not reflect the importance of this area as a riparian buffer. The effects on the 1.85ha of additional indigenous vegetation identified on page 11 (section 3.2) should also be minimised. These areas were not described in this detail in the AEE for the designation hearing and are likely to have significance in the context of the ecological district.	Attachment 1, table 2, section 3.2, page 9, 10 and 11	No change - description in table corresponds with project footprint (consented) vegetation loss of these areas and values are as per the Board of Inquiry applciation information. Ultimately, the intention of this description is to alert Project personnel as to the area, protection and monitoring requirements. The effects on the 1.85 ha of additional vegetation (all mapped in the original ecological assessment) is consistent with the consent conditons, most of which comprise scattered trees.
DC 54		Needs to specify how effects on Otaihanga kanuka will be minimised by use of boardwalks	Attachment 1, table 3	Agree - as per changes made for similar comment above.
G34 and 41		Statement incorrect. No areas of valued vegetation have been identified for total clearance (e.g. as in described table 7 page 23). Monitoring and surveillance is needed to ensure total loss does not happen.	Attachment 1, Section 4.1	No change. The figures in Table 7 (0.4 ha mapped area, 0.35 ha affected) includes a number of scattered trees, for which it may be impractical to retain. Any change to consented footprint will require mitigation as per the consent condition.
DC54		Need cross reference to LMP to ensure buffer and edge planting is undertaken to protect areas of indigenous vegetation.	Attachment 1, Section 4.2	No change. This will be specified in the SSMP in relation to any area of indigenous vegetation affected.
DC54		need cross reference to DC54	Attachment 1, Section 4.3	No change - uncertain what is meant by comment, but note Condition DC.54 is extensively cross-referenced within EMP.
G42, G42A		Needs cross reference to G42 and requirements for hectares of mitigation planting. Monitoring required to ensure this is achieved. Measure of success will also be restoration which uses eco-sourced native plants and reflects ecosystem types it is replacing. Needs reference and linkage with habitat restoration for fernbird and lizards.	Attachment 1, page 15 and table 5	No change. Table 5 already includes two references to Condition G.42 in terms of mitigation planting areas. Note - this is a technical attachment. Details and cross-refrences for habitat restoration for fernbird, lizards and eco-sourcing are discussed in the EMP and LMP and will be a specific focus of the SSEMPs. Eco--sourcing is specifically outlined in LMP requirements.
G40, G33B	Adaptive management	Needs to ensure these principles are addressed. Is still not clear in EMP who makes decision if clearance outside footprint is required and why. Ecologist needs to have a clear role in this. Needs to be made clear upfront in the EMP that clearance of vegetation outside the footprint should be avoided. Project ecologist should have a clear role in ensuring loss is minimised and avoided.	Attachment 1, Section 5, plus other sections relating to same issue, including wetlands and fauna habitat (Attachments3, 5)	No change. As outlined in earlier comments, the Environmental Manager has responsiblity for "notifying Alliance Project Manager and Regulatory Authorities of any significant non compliances" during construction, which would include vegetation or habtiat outside of the project footprint (consented area). Intention is that a design schedule will address any additioanl vegetation or habtiat effects beyond consented - and this will be addressed via the SSMP process, which GWRC is resopnsible for certifying.
G33B		Should refer to condition G33B as well	Attachment 2, section 1.1	No change. This condition is not specific to lizards, which is the intention of this attachment. Condition G.33B is a general intention and is addressed in the EMP.
DC53C		Ecologist should have significant role in the implementation of habitat restoration for fernbird to ensure it is successful. This shouldn't be responsibility of landscape architect	Attachment 3, 1.3	No change. Agree - and this is the intention as per the consent requirement. The detail will be in the SSEMP for fernbird habitat - consistent with the consent conditions and roles and responsibilities sections in the EMP.
G38		G38 requires results of monitoring to be reported to and reviewed by DoC. This needs to be addressed in Attachment 4	Attachment 4, section 5.2	No change - this is consistent with the reporting requirements in the consent condiitions.
DC54		Ecologist needs to advise on design and implementation of riparian mitigation planting, Shouldn't be sole responsibility of landscape architect. Ecologist should advise on success of riparian mitigation.	Attachment 5, section 1.2.2	Agree. No change - this is a technical attachment and detail will be in the SSEMPs as relevant. Note - ecological input into ecological mitigaiton planting is specifically addressed in the EMP consistent with Condtioni G.42C (SSEMP requirements).

G34, G38B	Wetland monitoring	Triggers for changes in both hydrology and wetland condition need to be implemented and acted on. There needs to be strong linkages with reporting of the results of these parameters, so an understanding of the complete changes in wetlands affected by the project can be understood and responded to. If there is any doubt over what the source is of any adverse impacts on wetland hydrology or condition, it should have to be proven why it is not the expressway project . Changes in wetland condition and ecology may be long term and there may be lag periods before adverse effects are noticed. Wetland condition monitoring should measure: "A change in vegetation structure and composition (e.g. increased weediness or increase in % dryland plants) within the monitored wetland. The thresholds for wetland condition may be too coarse to pick up changes, so I support the inclusion of a trigger for change in species composition, an increase in weediness and increase in dryland species. This needs to be developed in consultation with experts. Will be a useful test and increase our understanding.	Attachment 5 - triggers	Agree. No change (other than minor changes to this section to take account of NZTA Techncial Review comments).
DC54		Mitigation monitoring needs to include success of using boardwalks to minimise damage to wetlands. Condition DC54: "The retention of areas of indigenous vegetation as far as can be achieved, including minimising effects of the Cycleway/Walkway/Bridleway (CWB) through the Raumati Manuka Wetland, Otaihanga Southern Wetland, Otaihanga Northern Wetland and the Otaihanga Kanuka Forest (for example, through the use of boardwalks)"	Attachment 5, Section 4	No change. Project has consent for the full extent of indgenous vegetation habitat in this area (Project Footprint) and Condition DC.54d)iv) is a 'best endeavours' condition to try and minimise loss as far as practicable in these ecologically sensitive areas during detailed design. Accordingly, it would be inconsistent with the consent conditions to include this as a part of mitigation success monitoring as further loss may not be able to be acheived.

Appendix D

Consultation Record

CONSULTATION FOR: Ecological Management Plan (EMP)
Name of Management Plan Author: Matiu Park
Signature of M2PP Management Plan Author:

Signature of M2PP Compliance Manager:

Condition Reference No:	*Details of Condtion*	*Timeframe for Consultation*	*Party/parties consulted*	*Consultation undertaken by*	*Date and location of consultation*	*Topic Discussed*	*Views of party/parties consulted*	*Responses made during consultation*	*Where and how views have been incorporated into the management plan?*	*If views have not been incorporated into the management plan, outline the reason/s why not*	*Has the condition been complied with?*
EMP Consultation Record											
G.34	*The Consent Holder shall submit a draft Ecological Management Plan (EMP) to the Manager at least 30 working days prior to Work commencing. The final EMP will be submitted for certification, and a copy provided to KCDC, at least 15 working days prior to Work commencing.*	*30WD prior to work commencing*	Ian Boothroyd, Megan Oliver	Matiu Park	Various meetings and conference calls undertaken durign review process.	Review Comments provided on the draft EMP	Draft EMP	Refer to Appendix ? of the EMP for comments and EMP author's response	Refer to Appendix ? of the EMP for comments and EMP author's response	Refer to Appendix ? of the EMP for comments and EMP author's response	Yes
G.37	*At least 15 working days before submitting the EMP to the Manager for certification, the Consent Holder shall submit a copy of the draft EMP required by condition G.34 to KCDC for comment. Any comments received shall be supplied to the Manager when the EMP is submitted, along with a clear explanation of where any comments have not been incorporated and the reasons why.*	*At least 15 working days before submitting the EMP to the GWRC Manager for certification*	Shona Myers	Matiu Park	Various meetings and conference calls undertaken with KCDC ecologist (Shona Myers) during review process.	Review Comments provided on the draft EMP	Draft EMP	Refer to Appendix ? of the EMP for comments and EMP author's response	Refer to Appendix ? of the EMP for comments and EMP author's response	Refer to Appendix ? of the EMP for comments and EMP author's response	Yes
G.34	The EMP shall be finalised in consultation with Te Āti Awa ki Whakarongotai and Takamore Trust.		Ben Ngaia and Hemi Sundgren	Kylie Eltham Amos Kamo Anna Lewis Andy Goldie	02/05/2013 Hui to dicuss LMP and EMP	Draft LMP and EMP	Amos Kamo identified the followign matters to Ben Ngaia for further development within the EMP as follows: • The plan requires a section on mahinga kai (this should include information on the locations of specific sites of importance to Te Ati Awa ki Whakarongotai along the expressway corridor; • Identification of species of particular importance to iwi i.e. avian, aquatic (terrestrial/marine) such as tuna, inanga, kereru etc and the habitats they existed traditionally within the tribal takiwa would be helpful to inform section 5.9 (mitigation); • I recommend either an overview chapter on tangata whenua environmental values or alternatively introductory sections on tangata whenua values within chapters 5.1 to 5.8; • Provisions for ecological monitoring need to include provision for iwi monitors where appropriate (see consent condition G.39 as an example), this is probably best informed by the Cultural Health Index (CHI) process that we discussed yesterday; • A section and proposed process for cultural awareness training specific to ecology is also important (focus on mahinga kai values, wahi tapu and regulatory controls i.e. rahui); • Clarification on rationale for SSEMP selection; • Plant selection process for mitigation, location clarification, habitat creation and connection to mahinga kai values required.	Incorporated a new section on cultural values that takes into account the matters raised.	9/5/2013 Incorporated a new section on cultural values that takes into account the matters raised and sent to Amos Kamo for approval.	More detail on these specific matters will be set out in SSEMP.	Yes.
Preliminary consultation record in relation to preparing the SSEMP's. This record is to be continued.											
G.42C - The SSEMPs shall be prepared in consultation with, as relevant:	*Te Āti Awa ki Whakarongotai and Takamore Trust;*		*Ben Ngaia and Hemi Sundgren*	*Kylie Eltham Amos Kamo Anna Lewis Andy Goldie*	*02/05/2013 Hui to dicuss LMP and EMP*	*Initial discussions relating to management plans generally*	*Provided an update, but no specific consultation undertaken on the actual SSEMPs as these have not been prepared.*	*As above*	*As above*	*As above*	*In part*
	Te Rūnanga O Toa Rangātira Inc		*As required when developing SSEMP's*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

Friends of Queen Elizabeth Park		*The chairman and 4 other members of the Friends of QE Park.*	*Boyden Evans and Matiu Park*	*25/03/2013*	*Initial discussions relating to management plan generally*	*The Friends propose to follow up with NZTA re the stretch of road from Mackays to Poplar in relation to several matters:* *- Future upgrade of this stretch of highway, if it's not part of M2PP or TG what's going to happen to it given it's condition;* *-Adding taller tree species to the strip of planting along this stretch of road;* *-What is the long term future of this planting;* *-NZTA's brutal maintenance of this strip of planting (ie chopping back with blade mounted on tractor);* *-Runoff from the escarpment through culverts and in to the Park.* *Two other key issues for the Friends are:* *-Dropping water table along the coastal plain and impact on wetlands and how the Expressway will affect this;* *-The cycleway, particularly the location and, alignment; which is outside the areas Mat and I deal with (we suggested that they talk to GWRC about this particular matter).*	*We outlined to the Friends what we are doing re preparation of the LMP & EMP and also the relationship to the SSLMPs and SSEMPs. We also said that there would be an opportunity for further dialogue and to look at the new drafts management plans when to hand. In the first instance Iain Smith needs to meet with them re stormwater and drainage matters and to answer some of the other broad queries regarding the water table that they have.* *In the meantime we will send through an enlarged aerial photograph with the Expressway superimposed on it so they have a clear idea of where it will actually sit in relation to the NE corner of the Park.*	*N/A - this is an SSEMP specific condition*	*N/A*	*N/A*
Friends of Wharemauku Stream		*Gordon Cameron, who was representing Friends of Wharemauku Stream.*	*Boyden Evans*	*Apr-13*	*According to Gordon the Friends group comprises about 50 on an email circulation list but there is only 6 active members who carry out various tasks (planting, etc). The main goal of the Friends is to improve water quality in the Wharemauku Stream and the main activity of the group is riparian planting to improve shading, stabilise the banks and to help prevent toxins entering the Stream. Secondary goals are ensuring there is good pedestrian and cycleway access along Wharemauku Stream and education about how water quality can be improved. Overall the Friends are interested in Wharemauku Stream from SH1 to the coast. Gordon also acknowledged the ongoing support they receive from Rob Cross at KCDC.*	*The key points raised by Gordon were:* *· The Friends are realistic about what can be achieved; they are pragmatic and acknowledge the focus of mitigation work will be in the vicinity of where the Expressway crosses Wharemauku Stream.* *· They are keen to work with the project team to ensure a good outcome for Wharemauku Stream and would like to ensure that the improvements that have been achieved along the Stream are not lost.* *· The baseline surveys and monitoring of the Stream that will be carried out by the Alliance team is seen as areal plus and the Friends are interested in the results, especially as regards water quality.* *· The Friends were interested in the stormwater wetlands and the role they can play in education about improving water quality.* *· The Friends want to ensure that any crossings of the Stream are via a bridge rather than culverts.* *· The Friends are interested in the details of the pedestrian access through the 'Wharemauku stormwater' wetlands. We advised that this would be resolved in the EMP and SSLMP and that we would be consulting with the Friends on this aspect.* *· One issue that the Friends were concerned about was the overall cost of the project and their view was that if the budget was squeezed then the "first things to go would be the ecological and landscape mitigation."*	*Actions:* *1. Reassurance to the Friends that ecological and landscape mitigation is an integral part of the project and the consent conditions stipulate that these aspects cannot be ignored or dispensed with (Gordon was referred to the relevant consent conditions).* *2. Direct the Friends to the GWRC water quality monitoring results (State of the Environment) or summarising these and also providing them with the outcome of the monitoring work being undertaken as part of the investigations as required by the consent conditions (eg turbidity monitoring which is to be carried out).* *3. Identify any ongoing role that the Friends could play in terms of assisting with monitoring.*	*N/A - this is an SSEMP specific condition*	*N/A/*	*N/A*
EMP shall be prepared in consultation with (as relevant): Friends of Waikanae River		*Friends of Waikanae River*	*Matiu Park and Boyden Evans*	*9/04/2013*	*Prior to the meeting the Friends they had sent through a series of questions from their reading of the Draft LMP and EMP that were prepared as part of the application and their involvement in presenting evidence at the BOI. We addressed and clarified all of the issues raised.*	*The key points covered at the meeting were:* *• The Friends were not fully conversant with all the details of the consent conditions and so we provided them with an overview and directed them to the relevant landscape and ecological conditions.* *• They were pleased at the level and period of maintenance proposed for the planting and also that the conditions required preparation of long term Planting Management Plans (PMPs) for particular areas, which they were not aware of.* *• More information and details on compliance monitoring and meeting consent conditions in terms of rehabilitation and mitigation were sought.* *• The Friends want details of how access along the pedestrian walkway will be handled during construction (diversion of tracks, timing, duration, etc). They stressed the need for there to be good forewarning of any closure or diversion. We directed them to the consent conditions on Community Communications (DC.11).* *• Weed control of planted areas is a real concern of the Friends having experienced what has occurred with planting in the past, although they were supportive of the maintenance time frames* *• Some concern at works still to be confirmed between Kauri Road and Waikanae River edge. The link between walkway/cycleway on the northern side of the river and to Kauri Road is of concern to the Friends; they said that they had been shown a plan that showed a straight line between the end of Kauri Road and the existing walkway/cycleway on the northern side of the river but they want to see details of the actual alignment.* *• They enquired about details of the Vector gas realignment, which*	*Actions:* *1. Details of the alignment of the walkway/cycleway link between the river and Kauri Road to be provided.* *2. To provide details on the Vector Gas pipeline and the timing, etc.* *3. To provide information and details of staging and timing of construction and the potential effects on the river walkway/cycleway and how public access will be maintained.* *4. To provide information on how community advice re forewarning on track closure and pedestrian access, etc. and confirmation of contact details and telephone numbers, etc.* *5. To provide details on final design of Waikanae Bridge; when available; Anna to advise Friends re when they can expect this.* *6. To check visual simulation of Waikanae Bridge and provide additional information to confirm accuracy in terms of heights.* *7. To contact Tony Jack (027 244 0023) to discuss potential site for dumping excess material.*	*N/A - this is an SSEMP specific condition*	*N/A*	*N/A*

	Nga Manu		*Bruce Benseman and Tony Ward*	*Matiu Park, Iain Smith and Boyden Evans*	*24/04/13 at Nga Manu*	*Nga Manu was provided with an outline of the management plan process, particularly in regard to the Site Specific Management Plans and addressed the matters raised previously, and also several other aspects.*	*The key points from the meeting were:* *• Nga Manu is supportive of the development of the large wetland proposed around Kakariki Stream; including a role in the long-term management/ownership of this area (following development).* *• They would like to have input into the detailed design of this area and believe their local knowledge and experience would be useful. We confirmed that we would value their input into the development of the Site Specific Ecological Management for this area. This would need to include development of access tracks etc. and consider access to pylons, stormwater treatment wetlands etc.* *• To enable Nga Manu to plan how they handle things during the construction period they would like a copy of the construction timetable in relation to this section of the Project that outlines what is going to happen and when.* *• Nga Manu is keen to utilise the re-contoured dune area that is proposed to be re-contoured, located on the northern side of the access road immediately opposite their existing carpark for future additional car parking.* *• Nga Manu is interested in relocating the existing Transpower bridge across Kakariki Stream to use as footbridge for the Reserve.* *• The worst flooding in Kakariki Stream has been in November; flooding has not been an issue during the winter months.* *• From Nga Manu's experience in the Reserve, the water table is only 300mm below the ground surface and there is a clay pan 1.8-2.0m.* *• No one has approached Nga Manu re land purchase and acquisition; they are keen that this advanced.*	*Actions:* *1. To send to Nga Manu construction programme and outline of scope of work and timing for this part of the project.* *2. To follow up with NZTA re contact with Nga Manu re land acquisition discussions.* *3. To advise Nga Manu re possibility of re-locating of Transpower bridge and use of area for future Nga Manu carpark* *4. To contact Kauri Park Nurseries re organising access to Nga Manu for seed collection.*	*N/A - this is an SSEMP specific condition*	*N/A*	*N/A*
	The Council (GWRC)		*Ian Boothroyd, Megan Oliver*	*Matiu Park*	*Various meetings and conference calls undertaken durign review process.*	*Review Comments provided on the draft EMP*	*Draft EMP*	*Refer to Appendix ? of the EMP for comments and EMP author's response*	*Refer to Appendix ? of the EMP for comments and EMP author's response*	*N/A*	*N/A*
	The Council (KCDC)		*Shona Myers*	*Matiu Park*	*Various meetings and conference calls undertaken with KCDC ecologist (Shona Myers) during review process.*	*Review Comments provided on the draft EMP*	*Draft EMP*	*Refer to Appendix ? of the EMP for comments and EMP author's response*	*Refer to Appendix ? of the EMP for comments and EMP author's response*	*N/A*	*N/A*