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Waihou and Piako ecological monitoring 2014

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Executive summary

The Waikato Regional Council (WRC) is responsible for managing the status of water resources in the Waikato region. WRC have initiated investigations in the Waihou and Piako catchments to support and inform the scheduled water allocation review process in these catchments. One of the key objectives of the water allocation process is to safeguard the life-supporting capacity of freshwater ecosystems.

The scope of this study was to undertake monitoring of fish, macroinvertebrates, macrophytes and periphyton at ten sites across the Waihou and Piako catchments. Five sites were to be surveyed in each catchment. The aim was to build on and consolidate the previous ecological monitoring studies in the catchments by adding to the time series of data for these sites.

The results of this survey indicate that, at the Piako survey sites, the relative abundance of fish was higher in 2014 than in the previous surveys carried out in 2012 and 2013. However, inanga were again absent from all five sites (compared with being present at two of the sites in 2012). In the Waihou, the relative abundance of all fish species except longfin eels and torrentfish was also higher in 2014 compared to previous surveys. The numbers of longfin eels and torrentfish were generally lower. Macroinvertebrate communities in the Piako sites were generally improved relative to previous surveys, but in the Waihou catchment macroinvertebrate communities had declined. At some of the sites there is evidence of progressive increases in macrophyte and periphyton cover. In general this is associated with a reduction in the quality and diversity of the aquatic communities at these sites.

It is recommended that annual ecological monitoring continues at these ten sites. This will help to determine and understand the temporal dynamics of ecological communities, providing a more robust baseline against which to monitor the effects of human impacts on these river ecosystems over time. This will support WRC in setting appropriate, targeted and robust freshwater objectives and associated protection levels in the Waihou and Piako catchments.

1 Introduction

The Waikato Regional Council (WRC) is responsible for managing the status of water resources in the Waikato region. WRC's approach to the protection, management and use of water resources is set out in the Waikato Regional Plan (Waikato Regional Council 2012). As required by the National Policy Statement for Freshwater Management (MfE 2011), the Plan includes minimum flow and allocation limits for all catchments in the region (Table 3-5; Waikato Regional Council 2012). Scheduled reviews of the flow and allocation limits are also specified in the Plan (Table 3-4A; Waikato Regional Council 2012).

WRC have initiated investigations in the Waihou and Piako catchments to support and inform the scheduled allocation review process in these catchments. One of the key objectives of the water allocation process is to safeguard the life-supporting capacity of freshwater ecosystems (MfE 2011). WRC are seeking to improve their understanding of the ecological status of aquatic ecosystems in the Waihou and Piako river systems and have initiated ecological monitoring studies in the two catchments (Franklin & Bartels 2012, Franklin & Booker 2009, Franklin et al. 2011, Franklin et al. 2013).

The scope of this study was to undertake monitoring of fish, macroinvertebrates, macrophytes and periphyton at ten sites across the Waihou and Piako catchments. Five sites were to be surveyed in each catchment based on the recommendations in Franklin et al. (2013). The aim was to build on and consolidate the previous ecological monitoring studies in the catchments by adding to the time series of data for these sites. The results will contribute knowledge of the ecological values in the catchments to the water allocation decision-making process.

2 Methodology

2.1 Sites

Monitoring was carried out at ten sites in early March 2014 during a period of sustained summer low flows (Table 2-1 & Figure 2-1). The sites were those recommended by Franklin et al. (2013) and, with the exception of Site 10 on the Waitawheta River, all had been sampled at least once previously. Site 10 was established as a new site in the Ohinemuri sub-catchment, downstream of the Ohinemuri weir which is considered a barrier to upstream fish migrations.

Table 2-1: Location of the 2014 ecological monitoring sites in the Waihou and Piako catchments.

* Denotes new site in 2014. Easting and Northing given for downstream limit of survey reach (NZTM coordinates).

Site	Catchment	Stream	Easting	Northing	Distance inland (km)	Elevation (m)
1	Piako	Mangakahika Stream	1818698	5838814	59	62
2	Piako	Waitoa Stream	1831974	5803819	125	157
3	Piako	Mangapapa Stream	1836783	5809932	107	86
4	Piako	Waitakaruru Stream	1817745	5815748	92	63
5	Piako	Piakonui Stream	1831220	5809988	100	160
6	Waihou	Paiakarahi Stream D/S	1841027	5867879	34	60
7	Waihou	Karengorengo Stream	1848393	5823235	100	30
8	Waihou	Wairere Stream	1851660	5819808	108	40
9	Waihou	Waiteariki Stream	1852566	5818150	112	97
10	Waihou	Waitawheta River*	1845480	5849662	71	177

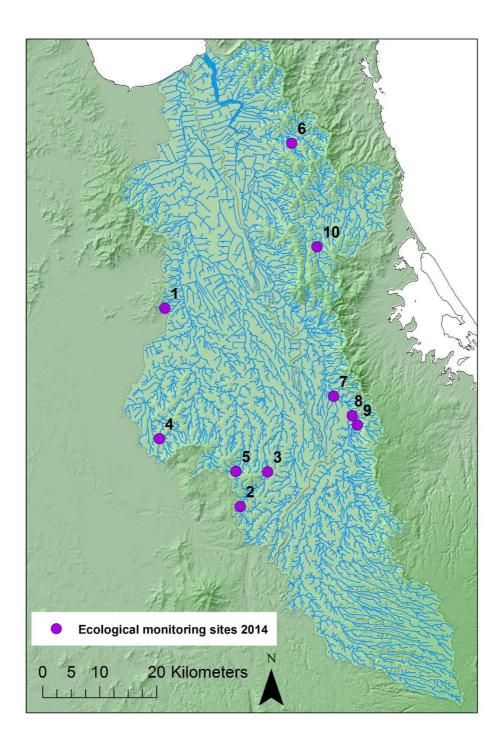


Figure 2-1: Map of ecological survey sites sampled in 2014. Site numbers refer to those in Table 2-1.

2.2 Fish

Fish surveys were carried out by electric fishing using the standardised methods outlined by WRC (David & Hamer 2010). At each site, a 150 m reach was surveyed by single pass electric fishing using an EFM300 with voltage adjusted dependent on local conditions. The number of each species captured, along with fish lengths, were recorded for every 15 m sub-reach.

This survey approach is designed to maximise the likelihood of capturing the full diversity of species present by encompassing the full range of habitats within a stream reach. Results are presented as relative abundance standardised by survey area (number of fish divided by total area sampled).

These abundance estimates are based on single pass electric fishing, which is a semi-quantitative method, and thus they are not equivalent to fish density and should not be used for comparison between sites. Interpretation of the relative abundance estimates are restricted to temporal comparisons at the same site, assuming that the same reach is sampled, with the same level of effort and sampling efficiency on each sampling occasion.

2.3 Macroinvertebrates

Macroinvertebrate sampling was carried out following the standardised procedures for wadeable streams as outlined by WRC (Collier & Kelly 2005). In soft-bottomed streams, woody debris, macrophytes and stream banks were sampled, as appropriate, using a hand net (0.5 mm mesh) following MfE Protocol C2 (Stark et al. 2001). For hard-bottomed streams, a kick-sampling approach targeting riffle areas and following MfE Protocol C1 was utilised (Stark et al. 2001). At each site the WRC REMS habitat assessment protocol was also carried out, with a Field Assessment Cover Form and a Habitat Assessment Field Data Sheet completed. All samples were preserved and returned to the laboratory for processing.

Samples were processed using the recommended MfE Protocol P2 (200 individual fixed count and scan for rare taxa) (Stark et al. 2001). This provides proportional abundance data suitable for the calculation of most invertebrate parameters (Collier & Kelly 2005). Complete taxonomic lists were compiled and a range of community metrics calculated at the taxa level indicated in Collier and Kelly (2005).

2.4 Macrophytes & periphyton

Macrophyte and periphyton surveys were carried out following the standardised procedures for wadeable streams as outlined by WRC (Collier et al. 2006). At each of five transects located in the reach, periphyton cover was assessed at five points (10%, 30%, 50%, 70% and 90%) across the wetted width of the stream and the area of macrophyte cover occupying the 1 m wide band upstream of the transect was estimated.

Details of the thickness and cover of periphyton were recorded allowing calculation of the Periphyton Enrichment Index (PEI), Periphyton Sliminess Index (PSI) and a range of periphyton biomass indices as defined in Collier et al. (2006). The percentage cover of different submerged and emergent species of macrophytes was also recorded, allowing calculation of the macrophyte cover indices (Collier et al. 2006).

3 Results

3.1 Piako catchment

3.1.1 Fish

A total of six different native fish species were recorded throughout the five survey sites in the Piako catchment during the 2014 survey (Table 3-1). No exotic species were captured even though they are known to be present and locally abundant in some areas of the Piako catchment. Both shortfin (*Anguilla australis*) and longfin eels (*Anguilla dieffenbachii*) were present at all five sites, as were koura (*Paranephrops planifrons*), the freshwater crayfish. Bullies were also present at all sites, with common bullies (*Gobiomorphus cotidianus*) found at the sites on the Mangakahika and Piakonui streams, and Cran's bullies (*Gobiomorphus basalis*) recorded at the sites on the Waitoa, Mangapapa and Waitakaruru streams. The other species recorded were banded kokopu (*Galaxias fasciatus*) in the Mangakahika and Piakonui, and torrentfish (*Cheimarrichthys fosteri*) in the Waitakaruru.

The relative abundance of fish was higher in 2014 than in previous surveys at all sites (Figure 3-1). However, species richness was lower in the Mangapapa and Waitoa sites where neither torrentfish nor inanga (Galaxias maculatus) have been recorded since 2012. At the Piakonui site, species richness has increased compared to 2013 with the addition of bullies, which were abundant at this site in 2014. A sub-sample of bullies was collected for identification in the laboratory. Based on the current key for bullies, they were identified as common bullies on the basis of pores being present on the head. However, there is increasing uncertainty around the effectiveness and consistency of some of the morphological differences that are typically used to distinguish between common and Cran's bullies. Given the location in the catchment, upstream of what is considered to be a natural migration barrier to swimming fish species just upstream of Morrinsville, the non-migratory Cran's bully would be considered more likely to occur at this site. Consequently, this should be treated with caution until more reliable differentiation between the species can be achieved. Also notable at this site was the extremely high abundance of koura. The continued presence of good numbers of banded kokopu across a range of sizes (64 - 150 mm) in the Mangakahika site maintains the significance of this site from a biodiversity perspective, especially given the generally low occurrence of this species at other sites surveyed in the Piako catchment.

Fish length data provide information on fish recruitment and survival rates. Length-frequency relationships for shortfin eels and the two bully species in the Piako survey sites are shown in Figure 3-2. The remaining species were not captured in sufficient numbers for development of length-frequency relationships. The abundance of shortfin eels was highest at the Waitakaruru and Waitoa survey sites, where populations were dominated by eels <200 mm in length. This indicates good recruitment of elvers (juvenile eels) has occurred at these sites in the last couple of years. In the 200-400 mm size range, the abundance of eels decreases with size at both sites. This is considered consistent with habitat constraints at these sites, with the relatively small stream size limiting the availability of larger pool habitats that larger eels can inhabit. Downstream migration of adult male shortfins also typically occurs at between 350-500 mm in length (Todd 1980), which will also contribute towards the observed declines in abundance of eels in this size range. However, shortfin eels >500 mm are generally females, which migrate at a larger size than males. The very low abundance of shortfin eels in these larger size classes (they are absent from all sites except Waitakaruru) indicates that few females are reaching maturity in these locations.

Recruitment of Cran's bullies appears to be good at all three sites (Mangapapa, Waitakaruru and Waitoa) where they are present, with good numbers of juveniles (<30 mm) recorded (Figure 3-2). However, larger adults (>50 mm) are only present in good numbers at the Waitoa site. This either indicates better growth rates at this site, or poorer survival of adults at the other two sites. At the two sites where common bullies were present, the diadromous recruitment of this species results in fewer fish in the smallest (<30 mm) size classes. The occurrence of larger size classes at the Piakonui site indicates that multiple year classes are present, even though this species was absent from this site in 2013. This suggests a significant redistribution of this species has occurred into this reach in the last year. The absence of this species in 2013 could have been a consequence of some parts of this reach being completely dry during the drought conditions.

Longfin eels were only present in low numbers at all sites and the majority of those captured were >500 mm in length. Compared to the shortfin eel populations in the Piako, the smaller size classes appear to be significantly under-represented in the longfin eel population, which may indicate relatively poor recruitment of this species. Given that small numbers of large individuals dominate the populations of longfin eels at these sites and that the species is long-lived (female age at maturity >20 years), there is a risk that there may have been poor recruitment of this species to these sites for a number of decades.

Site	Shortfin eel		Longfin eel		Cran's bully		Common bully		Torrentfish			ided opu	Koura	
Site	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.
1. Mangakahika Stream	30	13.3	8	3.5	-	-	21	9.3	-	-	27	11.9	7	3.1
2. Waitoa Stream	120	49.1	6	2.5	135	55.2	-	-	-	-	-	-	59	24.1
3. Mangapapa Stream	26	4.8	3	0.6	91	16.6	-	-	-	-	-	-	31	5.7
4. Waitakaruru Stream	89	29.7	10	3.3	88	29.3	-	-	1	0.3	-	-	38	12.7
5. Piakonui Stream	7	1.9	4	1.1	-	-	22	6.0	-	-	4	1.1	200	54.6

Table 3-1: Results of 2014 electric fishing survey at the five Piako catchment monitoring sites. Ab. = Number caught; Rel. Ab. = Relative abundance (Individuals per 100 m²).



Figure 3-1: Comparison between the relative abundance of fish captured in the 2012, 2013 and 2014 Piako surveys. The Mangakahika Stream and Piakonui US2 sites were not surveyed in 2012. The Mangapapa Stream at this location was not surveyed in 2013. Note the logarithmic x-axis.

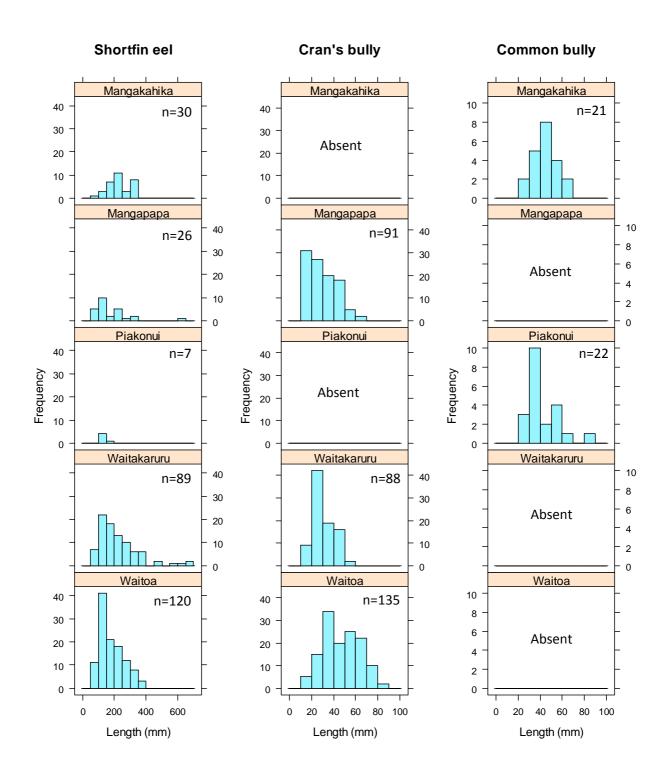


Figure 3-2: Length-frequency relationships for the most abundant fish species at each site in the Piako.

3.1.2 Macroinvertebrates

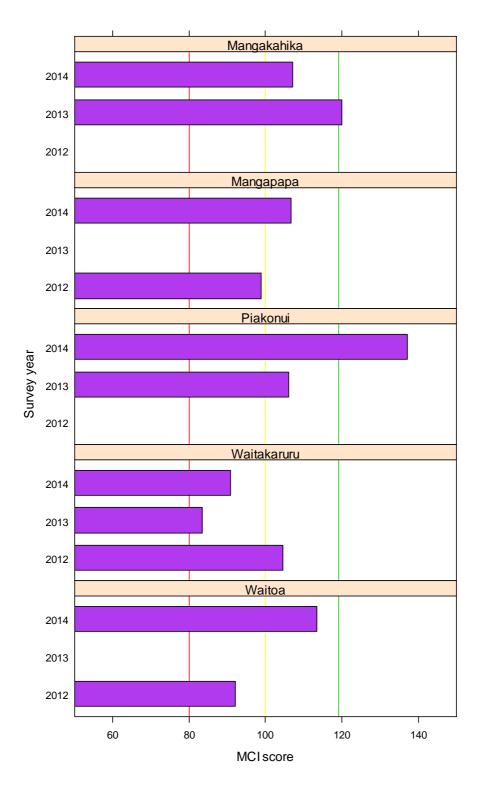
All sites were sampled according to MfE protocol C1 for hard-bottomed streams, with an area of approximately 1 m² sampled at each site. A full taxonomic list for each site is included in Appendix D and is summarised at the taxa level in Table 3-2 according to the methods and requirements of Collier and Kelly (2005). Total taxa richness describes the total number of different types of macroinvertebrates present at a site. Broadly speaking, the higher the total taxa richness, the greater the quality and diversity of habitats present. Benthic invertebrates such as Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) collectively known by the acronym EPT are widely utilised as bio-indicators in freshwater ecosystems due to their 'heightened sensitivity' to habitat degradation or pollution. Pristine or native forest habitats have greater biodiversity and a higher proportion of these types of sensitive species than intensively developed (i.e., pasture) catchments (Boothroyd & Stark 2000). EPT richness and %EPT (Table 3-2) are used to summarise the presence and significance of these taxa at a site. The Macroinvertebrate Community Index (MCI), in contrast, was developed as an indicator of the tolerance of macroinvertebrate communities to organic pollution (Stark & Maxted 2007) and therefore provides a complementary measure of stream health. Scores of less than 80 are classified as poor, those of 80-100 as fair, those of 100-120 as good, and those of greater than 120 as excellent (Stark & Maxted 2007).

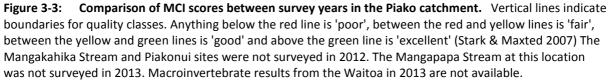
Total taxa richness and EPT richness were highest at the Piakonui survey site (Table 3-2). The %EPT and MCI scores were also highest at this site. This reflects the habitat at this site which was characterised by diverse instream physical habitat and intact native riparian bush cover. Compared with 2013 there has been a large improvement in the macroinvertebrate community at this site (Figure 3-3). In 2013, part of this reach dried out as a consequence of prolonged low flows. However, in 2014 water was flowing through the whole reach suggesting that the improvement in macroinvertebrates at this site is likely a result of higher flows. The lowest taxa richness in 2014 was recorded at the Mangapapa site (Table 3-2). This most likely reflects the high percentage of bedrock at this site. An extremely low score for %EPT was recorded at this site (Table 3-2) reflecting the abundance of snails (*Potamopyrgus*) at this site.

MCI scores declined between 2013 and 2014 in the Mangakahika, but improved in the Piakonui and Waitakaruru. However, the 2014 MCI score for the Waitakaruru was lower than the score recorded in the first survey in 2012 (Figure 3-3). In contrast, at the Waitoa and Mangapapa sites, MCI scores increased between 2012 and 2014. In 2014, three of the sites fell in the 'good' range, one in the 'excellent range, and one in the 'fair' quality class.

Site	Total taxa richness	EPT richness	%EPT	МСІ
1. Mangakahika Stream	20	11	58.7	107.0
2. Waitoa Stream	15	10	69.9	113.3
3. Mangapapa Stream	9	6	2.0	106.7
4. Waitakaruru Stream	13	5	38.6	90.8
5. Piakonui Stream	28	15	83.5	137.1

Table 3-2:	Summary of macroinvertebrate results for the Piako monitoring sites in 2014.
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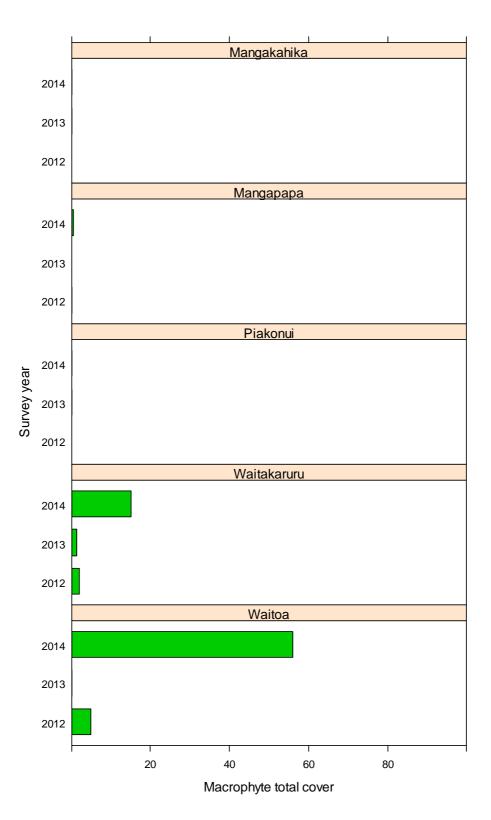


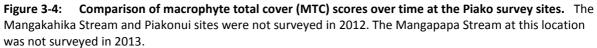


3.1.3 Macrophytes & periphyton

Three of the five sites have no or low macrophyte cover present (Figure 3-4). However, in both the Waitakaruru and Waitoa sites, there was a significant increase in the macrophyte cover in 2014 compared to previous years (Figure 3-4). This was particularly the case in the Waitoa site, where the MTC score increased from zero to 56% between 2013 and 2014. This was largely driven by a proliferation of watercress (*Nasturtium officinale*) within the reach. In the Waitakaruru, the increase in macrophyte cover to 15% was a result of the expansion of the exotics *Lagarosiphon major* and *Potamogeton crispus*.

The periphyton enrichment (PEI) and sliminess (PSI) indices have remained relatively stable over time at the Piakonui, Mangakahika and Mangapapa sites (Figure 3-5 & Figure 3-6). However, at the Waitakaruru site the PEI score has increased significantly over the past three years from 10 in 2012 to 85.6 in 2014 (Figure 3-5). Given the concurrent increase in macrophyte growth at this site, this may be indicative of increasing eutrophication (nutrient enrichment) at this site.





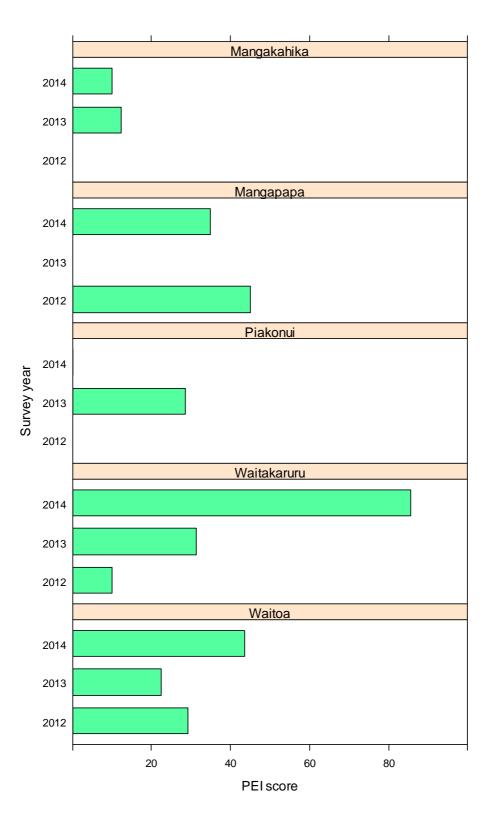
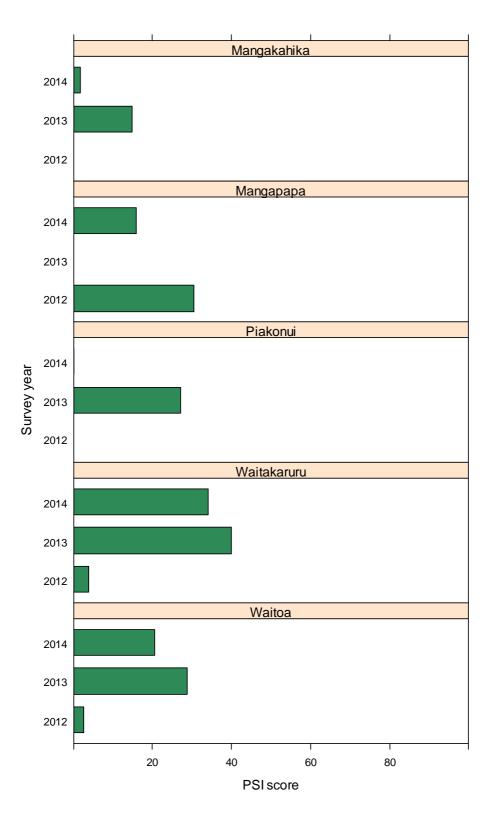
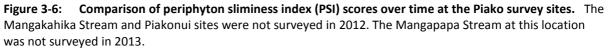


Figure 3-5: Comparison of periphyton enrichment index (PEI) scores over time at the Piako survey sites. The Mangakahika Stream and Piakonui sites were not surveyed in 2012. The Mangapapa Stream at this location was not surveyed in 2013.





3.1.4 Habitat quality scores

The habitat assessment scores provide a composite index of both reach scale and biotic characteristics of the stream, which can be used as an indicator of habitat quality. Full details of the habitat assessment results are included in Appendix A.

The habitat scores for the Mangakahika, Mangapapa and Piakonui sites have remained relatively stable between surveys to date (Figure 3-7). However, there has been a gradual decline in scores in the Waitakaruru and Waitoa sites. It is unclear what the main driver of changes in the Waitakarauru site is, however at the Waitoa site the reduction in habitat quality is likely to be a direct result of increased access to the stream by cattle. In 2009 cattle were fenced from the stream (using temporary single wire electric fences). However, these are no longer in use and no permanent fencing has been erected. As a consequence cattle now have direct access to the stream which has been observed to have increased erosion and fine sediment deposition, altered channel morphology and reduced riparian cover.

Correlations between habitat score and biotic indices were evaluated using the non-parametric Spearman's rank correlation (ρ). Samples from all survey years were pooled (n=11). The macroinvertebrate indices all correlated positively with the habitat score indicating a general improvement in macroinvertebrate communities with increasing habitat score. There was a relatively strong correlation between the habitat score and MCI score (ρ =0.58; Figure 3-8). The correlation between habitat score and fish species richness was positive, but relatively weak (ρ =0.18; Table 3-3). However, this may in part reflect the limited range in fish species richness (3-5 species) found in the Piako survey sites.

Biotic index	Spearman's rank correlation coefficient
MCI	0.58
Macroinvertebrate total richness	0.43
EPT richness	0.40
Fish richness	0.18

Table 3-3:Correlation coefficients between the habitat score and various biotic indices for the Piako
catchment.

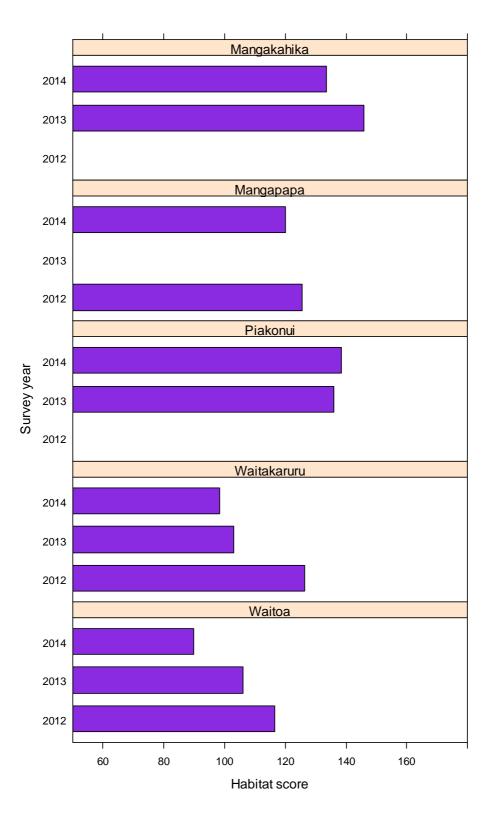


Figure 3-7: Comparison of habitat scores over time for the Piako survey sites. The Mangakahika Stream and Piakonui sites were not surveyed in 2012. The Mangapapa Stream at this location was not surveyed in 2013.

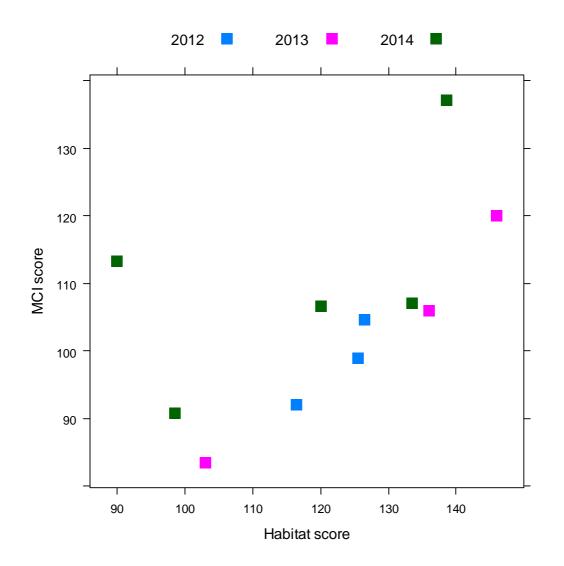


Figure 3-8: Scatterplot of habitat score against MCI score at the Piako survey sites in different survey years (ρ=0.58). No MCI score was available for the Waitoa site in 2013.

3.2 Waihou catchment

3.2.1 Fish

Ten different fish species were recorded among the five Waihou survey sites in 2014, eight of which were native and two of which were exotic species (Table 3-4). Shortfin eels were the only species present at all five sites, with longfin eels and brown trout (*Salmo trutta*) recorded at four sites each. The greatest species richness (7) was recorded in the Paiakarahi survey site, where shortfin eels, longfin eels, Cran's bully, torrentfish, inanga, banded kokopu and rainbow trout (*Oncorhynchus mykiss*) were captured (Table 3-4). The greatest abundance of fish was recorded from the Wairere Stream site, where large numbers of both shortfin eels and common bullies were captured.

The relative abundance of fish is compared between survey years for each site in Figure 3-9. A high abundance of macrophytes at the Karengorengo Stream site severely inhibited electric fishing in 2014 meaning that capture efficiency here was extremely poor and it is suspected that the abundance (and probably species richness) of fish was well underestimated for this site. This was particularly evident for shortfin eel and smelt, which were recorded in much lower numbers in 2014 compared to previous surveys. The absence of longfin eel and inanga in the 2014 survey results at this site are also likely a result of the poor sampling conditions.

At the Paiakarahi sampling site, the abundance of torrentfish, both eel species and Cran's bully was much greater in 2014 than in any of the three previous surveys (Figure 3-9). Inanga, banded kokopu and rainbow trout were also recorded at close to their highest numbers at this site. Koura were also recorded at a higher abundance than previously at this site.

At the Wairere Stream site, the abundance of both shortfin eels and common bullies was significantly higher than in the previous survey in 2011 (Figure 3-9). This was a consequence of high numbers of juvenile fish being captured (Figure 3-10). However, the numbers of torrentfish and longfin eel were lower, and no inanga were recorded in 2014. One new species was recorded at this site, which was brown trout.

At the Waiteariki survey site, the numbers of fish recorded in 2014 were generally similar to those in the 2011 survey (Figure 3-9). The main differences were a significant reduction in the number of torrentfish captured and the appearance of seven banded kokopu (as opposed to one unidentified galaxiid recorded in 2011).

Length-frequency relationships indicate a high level of recruitment of juvenile shortfin eels in the Wairere Stream this year (Figure 3-10). However, at all sites there was a generally low abundance of shortfin eels, particularly in the >200 mm size range. Shortfin eels >400 mm were extremely rare. Given the presence of large longfin eels at most of these sites, this suggests there may be poor survival or growth of shortfin eels in these sites as opposed to them being habitat limited. This is of potential concern for future recruitment of this species. The longfin eel populations at each site were primarily comprised of fish of >300 mm in length. In combination with the scarcity of longfin elvers this may be an indicator of poor recruitment of this species in recent years. The sites on the Paiakarahi and Waitawheta streams had the highest numbers of longfin eels. The Paiakarahi was the only site where small (<200 mm) longfin eels were recorded. Both species of bullies appear to be recruiting well at the sites where they are present, with a wide range of sizes represented. Several bullies of >70 mm were recorded in the Waiteariki, Wairere and Waitawheta sites indicating good survival and growth rates.

Site	Shortfin eel Longfin eel		Cran's bully		Common bully		Torrentfish		Inanga		Smelt		Banded kokopu		Rainbow trout		Brown trout		Koura			
Site	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.	Ab.	Rel. Ab.
6. Paiakarahi Stream D/S	8	1.6	8	1.6	64	13.0	-	-	5	1.0	1	0.2	-	-	1	0.2	3	0.6	-	-	32	6.5
7. Karengorengo Stream	33	9.1	-	-	-	-	3	0.8	-	-	-	-	2	0.6	-	-	-	-	1	0.3	9	2.5
8. Wairere Stream	254	31.1	2	0.3	-	-	965	118	2	0.3	-	-	-	-	-	-	-	-	1	0.1	58	7.1
9. Waiteariki Stream	20	2.1	10	1.1	47	5.0	-	-	1	0.1	-	-	-	-	7	0.7	-	-	6	0.6	88	9.4
10. Waitawheta River	23	4.5	16	3.1	-	-	64	12.6	-	-	-	-	-	-	1	0.2	-	-	3	0.6	10	2.0

 Table 3-4:
 Results of 2014 electric fishing survey at the five Waihou catchment monitoring sites.
 Ab. = Number caught; Rel. Ab. = Relative abundance (Individuals per 100 m²).

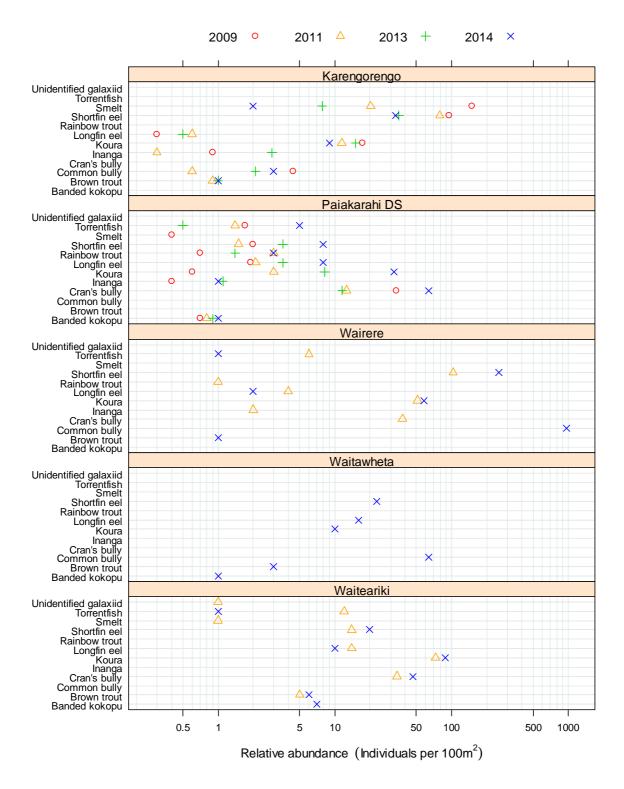


Figure 3-9: Comparison between the relative abundance of fish captured in the 2009, 2011, 2013 and 2014 Waihou surveys. Wairere Stream and Waiteariki Stream were only sampled in 2011 and 2014. The Waitawheta was only sampled in 2014. Note the logarithmic x-axis.

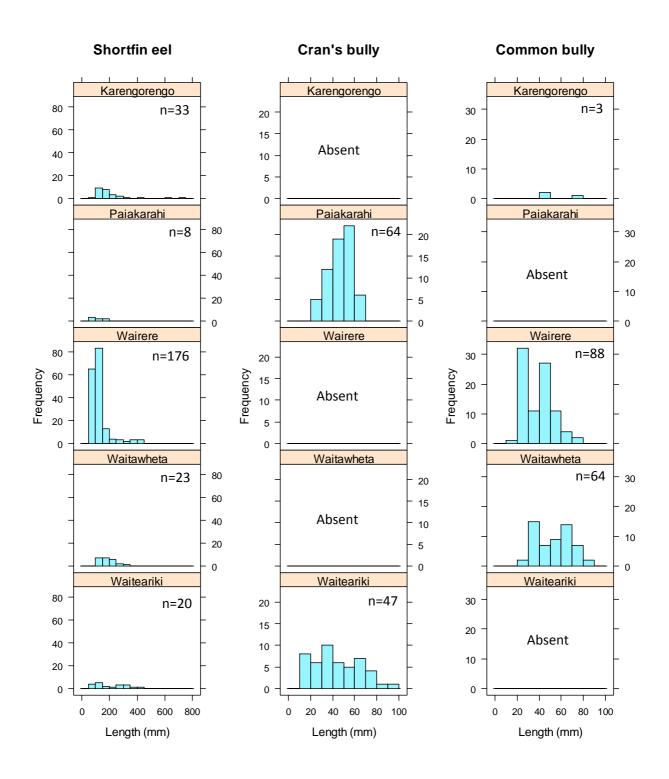


Figure 3-10: Length-frequency relationships for the most abundant fish species at each site in the Waihou.

3.2.2 Macroinvertebrates

Taxa richness was quite good at all sites, but total taxa richness and EPT richness were highest at both the Waiteariki and Waitawheta survey sites (Table 3-5). As a consequence of the high abundance of *Potamophyrus* at the Waitawheta site, the %EPT score was relatively low for this location, however it did have the highest MCI score and was the only site to fall in the 'Excellent' quality class in 2014 (Figure 3-11). The Waiteariki, Wairere and Paiakarahi sites were all classified in the 'Good' quality class based on their MCI score in 2014. However, the Karengorengo site was classified as only 'Fair' (Figure 3-11).

Compared to previous surveys, the MCI score at the Karengorengo site was similar to past results, reflecting the degraded, agriculturally impacted characteristics of this stream (Figure 3-11). The MCI scores for the Wairere, Waiteariki and Paiakarahi sites were lower in 2014 than in previous years. This was the first time in four surveys that the Paiakarahi site had dropped out of the 'Excellent' quality class based on MCI score (Figure 3-11). This has coincided with an increase in periphyton cover in the reach (see below). The Wairere and Waiteariki sites have also both dropped from the 'Excellent' to 'Good' quality classes between 2011 and 2014. Because these sites have only been sampled twice, it is not yet possible to determine the likely cause of these differences.

Site	Total taxa richness	EPT richness	%EPT	MCI
6. Paiakarahi Stream D/S	18	9	50.2	105.6
7. Karengorengo Stream	18	7	22.1	97.8
8. Wairere Stream	17	10	35.2	101.2
9. Waiteariki Stream	29	20	78.3	117.2
10. Waitawheta River	29	21	23.5	125.5

 Table 3-5:
 Summary of macroinvertebrate results for the Waihou monitoring sites in 2014.

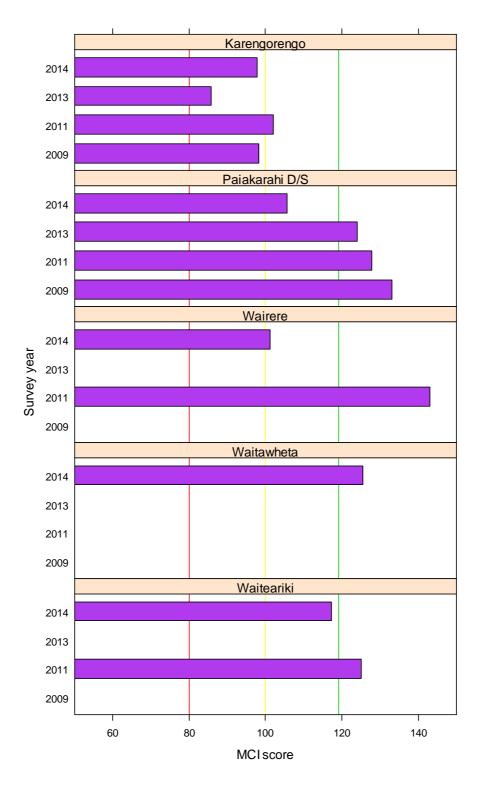


Figure 3-11: Comparison of MCI scores between survey years in the Waihou catchment. Vertical lines indicate boundaries for quality classes. Anything below the red line is 'poor', between the red and yellow lines is 'fair', between the yellow and green lines is 'good' and above the green line is 'excellent' (Stark & Maxted 2007) Wairere Stream and Waiteariki Stream were only sampled in 2011 and 2014. The Waitawheta was only sampled in 2014.

3.2.3 Macrophytes & periphyton

Macrophyte cover is low at all the Waihou survey sites except the Karengorengo Stream (Figure 3-12). At the Karengorengo Stream survey site, there has been a progressive increase in macrophyte cover since 2009, such that in 2014 the whole channel was clogged with macrophytes (MTC = 98%). The dominant macrophyte is the emergent species *Apium nodiflorum* which has progressively encroached from the margins to now fill most of the channel. As a consequence of this expansion, sampling for fish is now extremely difficult at this site and most of the reach is now unfishable.

PSI scores have remained relatively stable over time at those sites where periphyton is present (Figure 3-14), however there were notable increases in the periphyton enrichment scores (PEI) at the Waiteariki, Wairere and Paiakarahi sites in 2014 (Figure 3-13). It is unclear what the main driver of this is at these sites and it remains to be seen whether this is a temporary increase or part of a long term trend. There was a relatively long period of stable low flows prior to the 2014 survey which would have allowed a period of continuous accrual of periphyton. However, flows were also low in 2013 and the PEI was low at the Paiakarahi site in 2013.

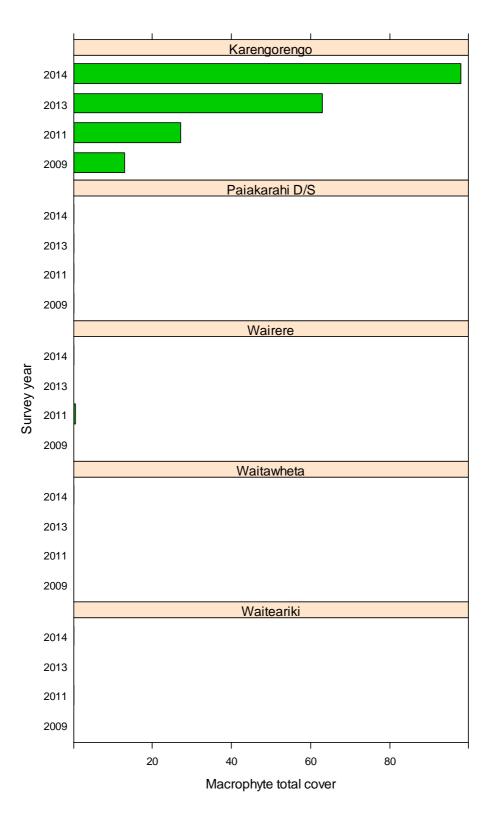


Figure 3-12: Comparison of macrophyte total cover (MTC) scores over time at the Waihou survey sites. Wairere Stream and Waiteariki Stream were only sampled in 2011 and 2014. The Waitawheta was only sampled in 2014.

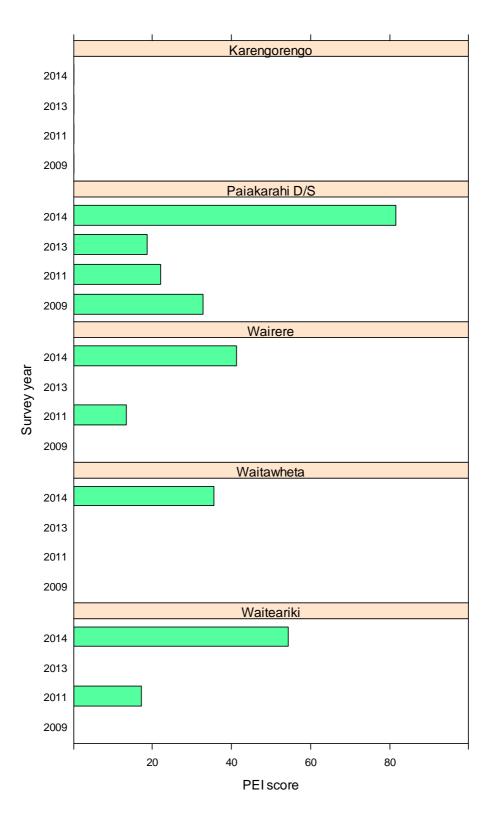


Figure 3-13: Comparison of periphyton enrichment index (PEI) scores over time at the Waihou survey sites. Wairere Stream and Waiteariki Stream were only sampled in 2011 and 2014. The Waitawheta was only sampled in 2014.

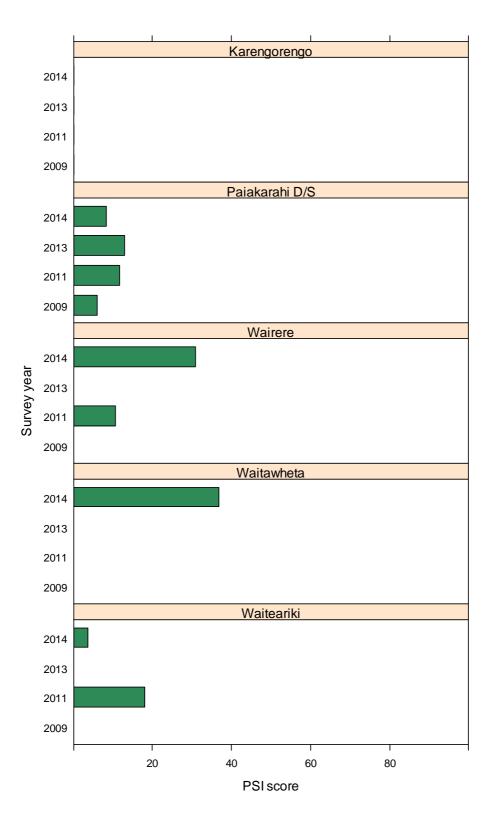


Figure 3-14: Comparison of periphyton sliminess index (PSI) scores over time at the Waihou survey sites. Wairere Stream and Waiteariki Stream were only sampled in 2011 and 2014. The Waitawheta was only sampled in 2014.

3.2.4 Habitat quality scores

The habitat quality scores have remained relatively stable over time at most of the Waihou survey sites (Figure 3-15). The only site where any significant change has been observed is the Karengorengo Stream where the habitat score has increased slightly over time. It is likely that this can be attributed to the exclusion of cattle from this gully by fencing which has reduced erosion in the stream. Broadly speaking, the habitat score is greater in the locations where streams are less heavily modified, with a more intact riparian zone.

Correlations between habitat scores and biotic indices again indicated a positive association between the macroinvertebrate indices and habitat quality (MCI ρ =0.49; %EPT ρ =0.59) (Table 3-6 & Figure 3-16). There was also a much stronger correlation between fish species richness and habitat score at the Waihou sites (ρ =0.72), when compared to the Piako sites (Figure 3-17). This, in part, probably reflects the larger range in fish species richness in the Waihou catchment compared to the Piako (maximum 8 species), and is indicative of a negative impact on fish species richness associated with increased channel modification.

Biotic index	Spearman's rank correlation coefficient
MCI	0.49
Macroinvertebrate total richness	0.47
EPT richness	0.50
Fish richness	0.72

Table 3-6:Correlation coefficients between the habitat score and various biotic indices for the Waihoucatchment.

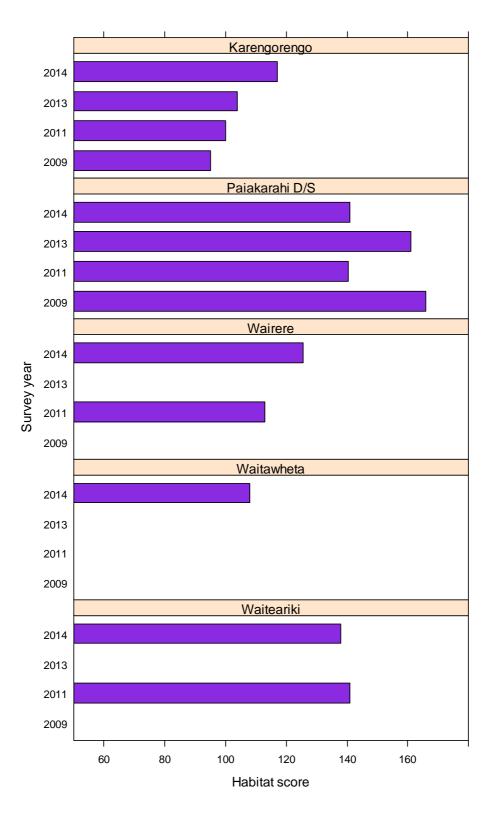


Figure 3-15: Comparison of habitat scores over time for the Waihou survey sites. Wairere Stream and Waiteariki Stream were only sampled in 2011 and 2014. The Waitawheta was only sampled in 2014.

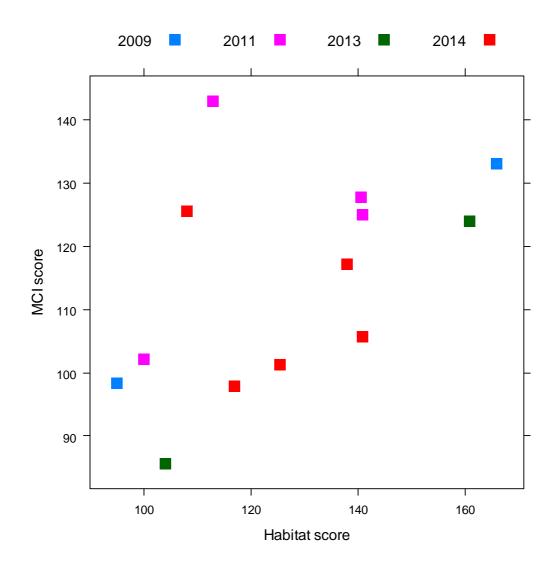


Figure 3-16: Scatterplot of habitat score against MCI score at the Waihou survey sites in different survey years (ρ =0.49).

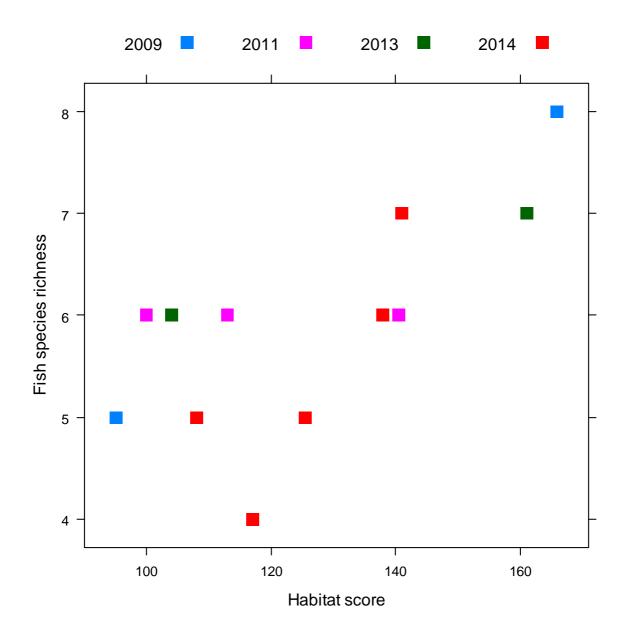


Figure 3-17: Scatterplot of habitat score against fish species richness at the Waihou survey sites in different survey years (ρ =0.72).

4 Discussion

One of the fundamental objectives of setting water resource use limits is the protection of ecosystem health. Setting robust limits requires an understanding of both the current status of ecological communities and changes in their status over time. The current status of ecological communities represents the combined effects of both natural environmental and biotic controls, e.g., distance inland, elevation, river type, species' life histories, and the consequences of human induced changes to the environment, e.g., land use change, reduced water quality and river channel engineering. Changes in status over time will also be driven by a combination of natural variability in environmental and biotic conditions (i.e., wet v. dry years; warm v. cold years; good v. bad recruitment; high v. low survival), and changes to the environment made by humans, e.g., water abstraction, pollutant discharges, land drainage and stream restoration.

Ecological monitoring is essential to understanding ecological status and trends. Franklin et al. (2013) proposed five sites in each of the Waihou and Piako catchments where annual ecological monitoring should take place with the aim of supporting the water allocation decision making process. This recommendation was based on attaining a compromise between spatial coverage of the catchments and characterising natural inter-annual variations in the biotic communities. The ten sites are representative of a range of river types typical of each catchment (i.e., lowland, upland, more modified, less modified, different tributaries), with the aim of providing a broad catchment scale overview of ecological status. This survey was the first to encompass all ten sites.

The results of this survey indicate that at the Piako survey sites, the relative abundance of fish was higher in 2014 than in the previous surveys carried out in 2012 and 2013. However, inanga were again absent from all five sites (compared with being present at two of the sites in 2012). Whilst the sites where they were found in 2012 (Waitoa and Mangapapa) are towards the upper extent of their likely range in the Piako, their absence is possibly indicative of the lower flows in 2013 and 2014 and hence reduced downstream connectivity. In the case of the Waitoa site, it may also be an indicator of the reduced habitat quality at this site. Macroinvertebrate communities in the Piako were also generally improved in 2014 compared to previous years. In particular, there was a significant improvement in the MCI score at the Piakonui site. This is likely a direct consequence of the channel at this site remaining wetted through the summer of 2013/14, as opposed to drying up as during the drought over the summer of 2012/13. With respect to macrophyte and periphyton communities, the most noticeable changes have been the steady increase in the PEI from 2012 to 2014 at the Waitakaruru site and the significant increase in macrophyte cover at the Waitoa site in 2014.

At the Waiteariki, Paiakarahi and Wairere sites in the Waihou catchment, the abundance of most fish species was generally higher in 2014 than in previous years. However, the relative abundance of both longfin eels and torrentfish in 2014 was lower at the Waiteariki and Wairere sites compared with 2011, when they were previously sampled. Of note was the higher number of banded kokopu captured at the Waiteariki site in 2014 as there are relatively few records of this species from the middle to upper part of the Waihou catchment. The relative abundance of fish in the Karengorengo site was reduced in 2014 compared to previous years. This was largely a result of a high cover of macrophytes which prevented effective sampling of this site in 2014. If macrophyte cover remains this high here, it is likely to compromise the effectiveness of future surveys also. However, this problem is common to many lowland, agricultural streams in the area and therefore is likely to be an issue in any stream representative of this stream type. In general, macroinvertebrate communities were slightly poorer in 2014 compared to previous years, with three of the four sites dropping down a quality class (Excellent to good). It will be important in the future to establish whether this was a

temporary change, or indicative of a long-term trend. Macrophyte cover has progressively increased since 2009 at the Karengorengo site to the point where the majority of the stream is now choked with plants. The PEI at the Paiakarahe site was considerably higher in 2014 compared to previous surveys and was likely one of the main drivers of the decrease in MCI score for the site in 2014.

In both catchments, there are indications that the recruitment of longfin eels is currently relatively poor, with few juveniles captured. In contrast, for shortfin eels there were very few larger female fish captured, perhaps indicating high fishing pressure or poor growth/survival rates for this species. The number of inanga and torrentfish captured during surveys in both catchments has also fallen. However, a good population of banded kokopu remains present in the Mangakahika Stream and was also found in the Waiareke Stream in 2014. Torrentfish have very specific habitat requirements, preferring fast flowing, turbulent habitats, and thus tend to be constrained to relatively small habitat patches within the survey reaches. Small changes in habitat structure between years can result in the loss of these habitats. These habitats are also probably more susceptible to the effects of low flows. This is likely to contribute to the observed variance in torrentfish populations. Inanga have also generally only been found in very low numbers at the sites included in this survey, primarily due to a lack of suitable habitat.

There remains a problem regarding reliable differentiation between populations of common and Cran's bullies within the Waihou and Piako catchments and wider Waikato Region. However, to resolve this issue will require a detailed study of these species' genetics, morphology and distribution. This is unlikely to be resolved in the near future and thus it will be necessary to rely on the existing taxonomic key to try and differentiate between species.

The results of this survey help to support the water allocation decision making process by informing WRC on the status and trends in ecological communities of the Waihou and Piako. It is recommended that the same ten sites are monitored annually from now on using the same survey methods. Over time this will help to build understanding of the natural variability in the ecological communities of these sites and to identify critical interactions and drivers of community stability and/or change. In addition to the annual monitoring sites, it may be valuable to also identify a further group of sites that would be monitored every 3-5 years. This would improve the spatial coverage of the monitoring. Some sites may already be included in the standard WRC REMS monitoring programme and it may be beneficial to include reference to these data as they are collected. It may also be useful to collect additional data on characteristics such as flow, water temperature, dissolved oxygen and water quality at the annual monitoring sites to better understand the relative importance of different environmental variables in determining the observed variations in ecology (particularly their associations with flow).

5 Conclusions

The process of developing water allocation rules and limits must be robust and transparent (Snelder et al. 2013). The resulting water allocation framework must be sustainable and support adaptive management of water resources. Reliable information on the status and dynamics of instream values is a key component in achieving this.

The NPSFM requires that regional councils set freshwater objectives and associated limits to water resource use that will ensure those objectives are met (MfE 2011). Ecosystem health has been identified as a core national value that must be sustained (MfE 2013). Reliable information on the status and dynamics of instream ecosystems is therefore critical to both setting appropriate protection levels and ensuring that freshwater objectives are met.

Knowledge of natural dynamics and variability in New Zealand's freshwater ecological communities is relatively limited, particularly for fish. However, to monitor human impacts on aquatic biota it is essential to understand and be able to distinguish natural drivers of change. Establishing a long-term routine ecological monitoring network allows the identification of instream values and characterisation of trends and differences in community population dynamics over time and between sites. This provides the knowledge that can be used to support development of robust and transparent management policies.

The establishment of this ecological monitoring programme in the Waihou and Piako catchments is a first step to understanding the ecological communities and dynamics that exist and therefore in setting appropriate protection levels. Evidence from these surveys already demonstrates the differences in structure and functioning of the ecological communities at different sites and particularly a difference is emerging between more and less heavily modified sites e.g., Piakonui versus Waitoa in the Piako catchment, and Paiakarahi versus Karengorengo in the Waihou catchment. This will support WRC in identifying appropriate freshwater objectives and setting related ecosystem protection levels in these catchments.

6 Recommendations

- It is recommended that annual ecological monitoring continues at these ten sites. This will help to determine and understand the temporal dynamics of ecological communities, providing a more robust baseline against which to monitor the effects of human impacts on these river ecosystems over time.
- It would be beneficial for additional physico-chemical variables be collected at each of the sites, e.g., flow, water temperature and water quality, in future. This would allow an evaluation of the relative importance of different environmental variables in determining the observed variations in ecology. Where possible, this should include regular sampling (preferably continuous), rather than one-off spot samples.
- To improve the spatial coverage of the monitoring, it may be valuable to introduce a further group of sites for monitoring once every 3-5 years.
- It would be beneficial to collate historical ecological monitoring data (e.g., REMS) collected by WRC in the catchments to supplement the analyses undertaken as part of this programme.

7 Acknowledgements

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Stream nume. Mange	kahika Stream				Assesso	r: Paul	Franklin			
Site number: 1		Samp	le number:		Date: 14	4/03/14	4 Т	ime:	16:00	
GPS coordinates		Down	stream:		E 18186	598	Ν	V 583	8814	
		Upstr	eam:		E 18186	518	Ν	883 ا	8767	
Channel & riparian	features				Instrea	ım hyo	draulic co	nditi	ons	
Canopy cover:					Estimate	d or me	asured reach	n aver	age:	
Open	Partly sh	aded	Very s	haded						
Fencing:	Dominant ri	pariar	vegetation:		Stream	width(active cha	nnel):	: 1.5 m	1
None/ineffective	Crops		Retired veg	getation	Stream	width(water): 1.5	5 m		
One side/partial	Pasture		Native shr	ub	Stream	depth:	0.1 m			
Complete	Exotic trees		Native tree	es	Surface	velocit	y: 0.15 m s	5-1		
Water quality					1					
Temperature:	16.0		°C		Conduc	tivity:	2	203.4		μS cm ^{-:}
Dissolved oxygen:	90.0		%		6.3	r —	n	ng l ⁻¹		
Turbidity:	Clear		Slightly turbid	Highly t	urbid	Stain	ed	С)ther	
Compaction (inorgan					compos	ition:	rganic subs	I		
Assorted sizes tightly	-				Substra		Dimensic	on	Perce	entage
Moderately packed w			-		Bedrock		- >256mm		00	
Mostly a loose assort					Boulder				80 20	
No packing/looso ass	ortmont opcily		d		Cobblo		>64-256mm			
	ortment easily	move	d		Cobble		>64-256mm >2-64mm		20	
Embeddedness:					Gravel		>64-256mm >2-64mm >0.06-2mm		20	
Embeddedness: (% gravel-boulder partic	les covered by fir	ne sedir	ment)	>75%	Gravel Sand		>2-64mm		20	
Embeddedness:	les covered by fir	ne sedir		>75%	Gravel		>2-64mm >0.06-2mm		20	
Embeddedness: (% gravel-boulder partic <5% 5-25	les covered by fir % 26-50	ne sedir	ment)	>75%	Gravel Sand Silt Clay	ttype	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm	۱m	20	
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Embeddedness: (% gravel-boulder partic <5%	les covered by fir % 26-5(% cover) liameter) % 26-5(l wood, sticks, % 26-5(deposits	ne sedir D% D% leaves D%	nent) 51-75% 51-75% etc., >1mm)	>75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges:	ort) hyte:	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s samplec 100% %	nm 1 Riff Rui	fles: ns:	
Embeddedness: (% gravel-boulder partic <5%	les covered by fir % 26-50 % cover) liameter) % 26-50 l wood, sticks, % 26-50 deposits % 26-50	ne sedir D% D% leaves D% D%	nent) 51-75% 51-75% etc., >1mm) 51-75% 51-75%	>75% >75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges:	ort) hyte:	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s samplec 100% % % % ertebrates	nm 1 Riff Rui	fles: ns: med:	
Embeddedness: (% gravel-boulder partic <5%	les covered by fir % 26-5(% cover) liameter) % 26-5(1 wood, sticks, % 26-5(deposits % 26-5(mer (% streamb	ne sedir D% D% leaves D% D%	nent) 51-75% 51-75% etc., >1mm) 51-75% 51-75%	>75% >75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges: Number	ort) hyte:	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s samplec 100% % % ertebrates S	nm 1 Riff Run retur	fles: ns: med: ps:	
Embeddedness: (% gravel-boulder partic <5%	les covered by fir % 26-50 % cover) liameter) % 26-50 l wood, sticks, % 26-50 deposits % 26-50 mats:	ne sedir)% D% leaves)% ed are	nent) 51-75% 51-75% etc., >1mm) 51-75% 51-75%	>75% >75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges: Numbel Koura:	ort) hyte:	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s samplec 100% % % ertebrates S	Riff Rui retur	fles: ns: med: ps:	100
(% gravel-boulder partic <5% 5-25 Organic material (% Large wood (>10cm d <5% 5-25 Coarse detritus (smal <5% 5-25 Fine (<1mm) organic <5% 5-25 Instream plant cov Filamentous algae &	les covered by fir % 26-50 % cover) liameter) % 26-50 I wood, sticks, % 26-50 deposits % 26-50 mats:	ne sedir)% D% leaves)% ed are	nent) 51-75% 51-75% etc., >1mm) 51-75% 51-75%	>75% >75% >75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges: Number Koura: Crabs:	hyte:	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s samplec 100% % % ertebrates S	Riff Rui retur	fles: ns: med: ps:	
Embeddedness: (% gravel-boulder partic <5%	les covered by fir % 26-5(% cover) liameter) % 26-5(1 wood, sticks, % 26-5(deposits % 26-5(er (% streamb mats: % 26-5(ne sediri)% D% leaves D% ed are	nent) 51-75% 51-75% etc., >1mm) 51-75% 51-75%	>75% >75% >75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges: Number Koura: Crabs: Other:	hyte: r of inv	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s sampled 100% % % % ertebrates S M	nm 1 Riff Rui retur ihrim Musse	fles: ns: med: ps:	
Embeddedness: (% gravel-boulder partic <5%	les covered by fir % 26-5(% cover) liameter) % 26-5(1 wood, sticks, % 26-5(deposits % 26-5(er (% streamb mats: % 26-5(ne sediri)% D% leaves D% ed are	nent) 51-75% 51-75% etc., >1mm) 51-75% 51-75% sa)	>75% >75% >75%	Gravel Sand Silt Clay Habita (% of effe Stones: Wood: Macrop Edges: Numbel Koura: Crabs: Other: Mussel	hyte: r of inv	>2-64mm >0.06-2mm 0.004-0.06m <0.004mm s sampled 100% % % % ertebrates S M	nm 1 Riff Rui retur ihrim Musse	fles: ns: rned: ps: els:	

Appendix A Habitat assessment forms

Stream name: Mangak	dTIIK	d						5	lite n	umb	er: 1									
Sample number:				А	ssess	or: P	aul F	rankl	in				Date	: 14/	03/14	4				
Habitat parameter		C	ptim	al			Sub	oopti	mal	Cate	gory		argin	ial				Pool		
1. Riparian vegetative zone width	•	>10n	tation n inuou	ı buffe s &	er	•	<10m	tation			•	Pathv and/o Most	or sto	ck		•	Hun	aks fre nan ac ious	•	
Left bank:15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 15																				
2. Vegetative protection	•	imme zone nativ Trees shrul wood prese Vege	ediate s cove e veg s, und os or i dy pla ent tative	nts	ian y n orey	•	cover nativ Disru Bank	s may red by	ainly etatio evide be	n	•	Bank cover of gra black & intr specie Veget disrup Bare cropp comn	red by asses/ berry, roduc es tation ption soil/cl ped ve	y mixt /shrub , willo ed obvio losely	us	•	cove & sh Disr stre vege high Gras graz Sign	ss hea	y gras i of nk i very vily : stock	¢
Left bank: 11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
3. Bank stability	•	Erosi failur abse	nt/mi of bai	ank nimal		•	Infree areas	of er ly hea of b	, sma osion Iled o	II	•	Mode unsta 30-60 reach erosid High poter flood	ible)% of i has a on erosic ntial d	bank areas	of	•	Mar 60-1	table ny eron LOO% c erosio	of ban	k
Left bank:12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 13.5																				-
4. Frequency of riffles	•	frequ Dista riffle strea	ient nce b s divio m wio	tively etwee led by dth=5 habita	en / -7	•	Dista riffles	s infre	quen etwee led by	en v	•	Occas run Botto provie habita Distar riffles streat 25	om con de son at nce be s divid	ntour me etwee led by	s en	•	wat riffle Poo Dist riffle	erally er, sha es r habit ance b es divi am wi	illow at etwe ded by	y
Score: 16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel alteration	•	chan abse Strea		redgir nimal th	ıg	•	Evide chan Rece chan	nel/dı ence o nel/dı	edgir f past edgir	ig : ig	•	Chang chang exten Emba ing st prese banks 40-80	ges/di isive inkme ructu ent on	ents/s res both	hor	•	gabi >80 read or d Inst	ks sho ion/ce % of st ch chai isrupt isrupt ream l red/at	ment ream nneliz ed nabita	ed

Habitat parameter		Cá	atego	ory		Ha	bitat	para	mete	r		Ca	itego	ry		Ha	bitat	para	mete	r
		С	ptim	nal								0	ptim	al						
6. Sediment deposition	•	point	bars of b ted b		nt	•	form from or fin 20-50 affec	ation, grave e sed 0% of ted t depo	ase in most I, san iment botto ositior	ly d : m	•	Some new (fine s old & 50-80 affec Sedin at ob const bend	gravel edime new 0% of ted nent o struct	l, sand ent of bars botto depos tions,	d or n m	•	fine Incre deve >809 chan frequ Pool abse sedin	matei ased lopm 6 of b	bar ent ottom ost e to	
Score: 15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•		nes p /deep /shall shallo	ów,		•	regin If fas	ity/de nes pr t/shal ng the	epth esent low is en sco		•	2 of 4 veloc regim If fas slow/ missi	ity/de nes pr t/shal (shallo	esent low o ow ar	r e	•	velo regir	city/d ne	d by 1 epth ep/slo	
Score: 11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	favou inver color varie debr mats Snag logs/ bank provi fish c	urable tebra hisatio ty of s, riff s, riff unde s/cot des a over	nte on & v wood iles, ro omerg rcut	y oot ed ant	•	favou inver color Snags logs/ bank Fish c Mode of ha Can c	urable tebra iisatio s/ sub under s/cob cover erate bitat t	te merg cut bles comm variet types. t of sc	ed non y	•	10-30 favou inver color Fish c 60-90 easily foot Wood or ma smot sedin	irable tebra isatio cover 0% sul y mov dy del ay be hered	for te on patch bstrat ed by bris ra	y e	•	favo inver color Fish abse Subs or la Stab lacki	urable tebra nisatio cover nt trate cking le hat	te on rare o unsta bitats limite	ble
Score:15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	• •	held Stabl	ent or stone e sub ices r	n hanc	!	•	visibl Stabl	e sub hytor	not stones strate obvie		•	Perip <20% availa		r of		•	& pr >20%	olific 6 cove	n obvi er of ubstra	
Score: 16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE: 133.5		•					•									•	•			

Stream name: Waitoa	Stream U/S				Assesso	or: Paul	Franklin		
Site number: 2		Samp	ole number:		Date: 1	4/03/2	014 1	Time	12:35
GPS coordinates		Dow	nstream:		E 1831	974	1	N 580)3819
		Upst	ream:		E 1831	878	1	N 580)3808
Channel & riparian	features				Instrea	am hye	draulic co	ndit	ions
Canopy cover:					Estimate	ed or me	asured reac	h ave	rage:
Open	Partly s	haded	Very sh	naded					
Fencing:	Dominant	riparia	n vegetation:		Stream	width	(active cha	nnel)	: 2.6 m
None/ineffective	Crops		Retired veg	etation	Stream	width	(water): 1.4	4 m	
One side/partial	Pasture		Native shru	b	Stream	depth:	0.15 m		
Complete	Exotic tree	S	Native trees	5	Surface	veloci	ty: 0.2 m s ⁻¹	1	
Water quality									
Temperature:	14.2		°C		Conduc	tivity:	1	128.8	μS cm ⁻¹
Dissolved oxygen:	89		%		9.2		r	ng l-1	
Turbidity:	Clear		Slightly turbid	Highly t	urbid	Stair	ned	0	Other
Stream-bottom sub	ostrata								
Compaction (inorgani	c substrata):				% surfi compo		rganic sub	strat	um size
Assorted sizes tightly	packed &/or	overla	oping		Substra	itum	Dimensio	on	Percentage
Moderately packed w	ith some ove	erlappi	ng		Bedroc	k	-		
Mostly a loose assortr	nent with litt	le over	lap		Boulde	r	>256mm		15
No packing/loose asso	ortment easily	y move	ed		Cobble		>64-256mm	n	70
Embeddedness:					Gravel		>2-64mm		
(% gravel-boulder particle	es covered by f	ine sedi	iment)		Sand		>0.06-2mm		
<5% 5-25	% 26-5	50%	51-75%	>75%	Silt		0.004-0.06r	nm	15
					Clay		<0.004mm		
Organic material (%	6 cover)				Habita	it type	s sample	d	
Large wood (>10cm d	ameter)				(% of eff	ort)			
<5% 5-25	% 26-5	50%	51-75%	>75%	Stones		100%		
Coarse detritus (small	wood, sticks	, leave	s etc., >1mm)		Wood:		%	Rif	fles: 100%
<5% 5-25	% 26-5	50%	51-75%	>75%	Macrop	ohyte:	%	Ru	ns: %
Fine (<1mm) organic o	leposits		1 1		Edges:		%		
<5% 5-25	% 26-5	50%	51-75%	>75%	Numbe	r of inv	ertebrates	retu	rned:
Instream plant cov	er (% stream	bed ar	ea)		Koura:		9	Shrim	ips:
Filamentous algae & r	nats:				Crabs:		r	Muss	els:
<5% 5-25	% 26-5	50%	51-75%	>75%	Other:				
I	ı		1 1		Mussel				
Macrophytes:	% 26-5	50%	51-75%	>75%	Hyridel	la	(Сиси	merunio
<5% 5-25									
	% 26-5		51-75%	>75%					

Wadeable Hard-Bo Qualitative Habitat As					Shee	et														
Stream name: Waitoa	Stre	am U	/S					9	Site n	umb	er: 2									
Sample number:			-	A	ssess	or: P	aul F	rankl	in				Date	: 14/	03/2	014				
										Cate	gory									
Habitat parameter		С	ptim	al			Sub	opti	mal			Μ	argir	nal				Poo	ſ	
1. Riparian vegetative zone width	•	>10r	tatior n inuou	n buffe is &	er	•	<10n	tation			•	Pathy and/ Most	or sto	ck		•		iks fre nan ac ous	•	
Left bank:6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 7			1	1				1	1											
2. Vegetative protection	•	imm zone nativ Tree shru woo prese Vege	ediate s cove re veg s, und bs or r dy pla ent tative	nts	ian Y n orey	•	cover nativ Disru Bank	surfa red m e veg ption s may red by try	ainly etatio evide be	n ent	•	cover of gra black & int speci Vege	tatior ption soil/c ped ve	y mixt /shrut , willo ed obvic losely	os, ow ous	•	cove & sh Disr stre vege high Gras graz Sign	s hea	y gras i of nk i very vily : stock	ſ
Left bank:3	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:3	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 3																				
3. Bank stability	•	Erosi failu abse	nt/mi of bai	ank nimal		•	Infre areas most	eratel quent s of er ly hea % of b ed	, sma osion iled o	II	•	Mode unsta 30-60 reach erosi High poter flood	able 0% of n has a on erosio ntial c	bank areas on	of	•	Mar 60-1	table iy eroo .00% c erosio	of ban	k
Left bank:5	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:3	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 4																				
4. Frequency of riffles	•	frequ Dista riffle strea	uent ince b s divio im wio	tively etwee ded by dth=5 habita	en / -7	•	riffle: Dista riffle:	rrenco s infre nce b s divic m wic	equen etwee led by	en /	•		om co de so at nce b s divio	ntour me etwee led by	en /	•	wat riffle Poo Dist riffle	erally er, sha es r habit ance b es divit am wi	illow at etwe ded by	/
Score: 13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel alteration	•	chan abse Strea		redgir nimal th	0	•	chan Evide chan Rece chan	e char nel/di ence o nel/di nt nel/di oresen	redgir of past redgir redgir	ng t ng	•	exter Emba ing st prese bank 40-80	ges/d nsive ankme ankme ructu ent or s 0% of nelize	ents/s res both reach	hor	•	gabi >80 read or d Inst	ks sho on/ce % of st h chan isrupt ream h red/at	ment ream nneliz ed nabita	ed
Score:16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
				1		<u> </u>	1			1		1			<u> </u>		1	1	1	

Habitat parameter		Ca	atego	ory		Ha	bitat	para	mete	r		Ca	itego	ry		На	bitat	para	mete	er
Habitat parameter		С	ptim	al								0	ptim	al						
6. Sediment deposition	•	point	bars of b ted b nent		nt	•	form from or fin 20-50 affec	t depo	most I, san iment botto	ly d : m	•	fine s old & 50-80 affec Sedin at ob	gravel edime new 0% of ted nent o struct	l, sand ent or bars botto depos tions,	d or n m	•	fine Incre deve >809 char freq Pool abse sedin	mater eased elopm	bar ent ottom ost e to	
Score: 11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•		nes pi /deep /shall shallo	ow,		•	regin If fas	ity/de nes pr t/shal ng the	esent low is		•	If fas slow/	ity/de nes pr	esent low o ow are	r Ə	•	velo regii	city/d ne	d by 1 epth ep/slo	
Score: 11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	favou inver color varie debr mats Snag logs/ bank provi fish c	urable tebra hisatic ty of s, riff s/ sub unde s/cob des a over	ite on & v wood iles, ro omerg rcut	y oot ed ant	•	favou inver color Snags logs/ bank Fish c Mode of ha Can c	0% sul urable tebra hisatic s/ sub under s/cob cover erate bitat consis mater	for te merg cut bles comm variet types.	ed non sy	•	favou inver color Fish o 60-90 easily foot Wood or ma)% sul / mov dy del ay be hered	for te patch bstrat ed by bris ra	y e	•	favo inve colo Fish abse Subs or la Stab lacki	urable rtebra nisatio cover nt trate cking le hat	ite on rare o unsta bitats limite	ble
Score: 15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	• •	held Stabl	ent or stone e sub	n hand	!	•	visibl Stabl	hytor e on s e sub hytor uch	tones strate		•	<20%	hytor cove able s	r of		•	& pr >20%	olific % cove	n obvi er of substra	
Score: 10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE: 90	•		•			•		•	•	•			•	•	•	•		•	•	•

Stream name: Manga	papa Stream				Assesso	r: Josh	ua Smith		
Site number: 3		Samp	le number:		Date: 1	1/03/2	014 T	ime:	13:30
GPS coordinates		Dowr	nstream:		E 18367	783	١	1 580	9932
		Upsti	ream:		E 18367	750	١	1 580	9802
Channel & riparian	features				Instrea	am hye	draulic co	nditi	ons
Canopy cover:					Estimate	d or me	asured react	n aver	age:
Open	Partly s	haded	Very	shaded					
Fencing:	Dominant	riparia	n vegetation:		Stream	width	(active cha	nnel)	: 4.0 m
None/ineffective	Crops		Retired ve	getation	Stream	width	(water): 3 r	n	
One side/partial	Pasture		Native shr	ub	Stream	depth:	0.25 m		
Complete	Exotic tree	S	Native tree	es	Surface	velocit	ty: 0.25 m s	5-1	
Water quality					1				
Temperature:	18.2		°C		Conduc	tivity:	1	20.1	μS cm ⁻
Dissolved oxygen:	79.7		%		7.53		r	ng l-1	
Turbidity:	Clear		Slightly turbid	Highly t	urbid	Stair	ned	C	Other
Stream-bottom sub					% surfic compos		rganic subs	strati	um size
Assorted sizes tightly	packed &/or	overlap	oping		Substra	tum	Dimensio	on	Percentage
Moderately packed w	vith some ove	erlappi	ng		Bedrocl	¢	-		90
Mostly a loose assortr					Boulder	•	>256mm		
No packing/loose asso	ortment easily	/ move	ed		Cobble		>64-256mm	I	
Embeddedness:					Gravel		>2-64mm		_
(% gravel-boulder particle	· · ·		т [.] т	750/	Sand		>0.06-2mm 0.004-0.06n		5
<5% 5-25	26-5	50%	51-75%	>75%	Silt		<0.004-0.06h	nm	5
Overseis westeriel (0	(Clay				
Organic material (%					(% of eff		s sampled	J	
Large wood (>10cm di <5% 5-25	ı <i>'</i>	.0%	51-75%	>75%			100%	1	
	I		I I	2/3%	Stones:			Dif	fles: 100
Coarse detritus (small <5% 5-25 ^o	i i		51-75%	>75%	Wood: Macrop	hvte:	%	Ru	
Fine (<1mm) organic o	I		51,5%	,,,,,,	Edges:	inyte.	%	na	
<5% 5-25	· .	50%	51-75%	>75%	-	r of inv	ertebrates	retu	rned:
Instream plant cov					Koura:		1	hrim	
Filamentous algae & r	•	beu un	24)		Crabs:			Auss	
<5% 5-25 ⁶	1	50%	51-75%	>75%	Other:				
Macrophytes:	1		1 1		Mussel	type:			
< 5% 5-25	% 26-5	50%	51-75%	>75%	Hyridel		0	Cucur	nerunio
Mosses/liverworts:	Ĩ		i İ						
	.	- 00/	51-75%	>75%					
< 5% 5-25	% 26-5	0%	51-7570	21370					

Right bank:8 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 Mean:10	Meter Category Optimal Suboptimal Marginal one • Bankside vegetation buffer >10m • Bankside vegetation buffer >10m • Pathways present and/or stock • Continuous & dense • Mostly continuous • Mostly healed over	•		Роо		
Habitat parameter Optimal Suboptimal Marginal Port Port 1. Riparian vegetative zone vegetation zurgetation vegetation vegetation vegetation vegetation vegetation vegetation buffer is clum Bankside vegetation Mostly headed over Bankside vegetation Bankside vegetation vegetation vegetation vegetation vegetation vegetation vegetation vegetation Bank surfaces Bank surf	Optimal Suboptimal Marginal one Bankside vegetation buffer >10m Bankside vegetation buffer >10m Pathways present and/or stock • Continuous & dense • Mostly continuous Mostly healed over			Роо		
vegetative zone width vegetation buffer Continuous & dense Continuous & dense Mostive continuous & dense dense dense dense	one vegetation buffer vegetation buffer is and/or stock >10m <10m Mostly continuous Mostly healed over • Mostly continuous • Mostly continuous Mostly healed over				r	
Right bank:8 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 Mean:10 Immediater iparian consec covered by mittive organization in the vegetation native vegetation woody plants woody plants 8 7 6 5 8 8 8 8 8 7 6 5 4 3 Left bank:16 20 19 18 17 16			obv	man ad	•	
		5	4	3	2	1
2. Vegetative protection Bank surfaces & immediate riparian zones covered by native vegetation Trees, under-storey shrubs or non- woody plants present Vegetative disruption minimal Bank surfaces covered by native vegetation Trees, under-storey shrubs or non- woody plants present Vegetative disruption minimal Trees, under-storey shrubs or non- woody plants present Vegetative disruption minimal Trees, under-storey shrubs or non- woody plants present Vegetative disruption binants To /ul>	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6	5	4	3	2	1
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$						
Right bank:9 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 Mean: 9	immediate riparian zones covered by native vegetationcovered mainly by native vegetationcovered by mixture of grasses/shrubs, blackberry, willow & introduced species• Trees, under-storey shrubs or non- woody plants present• Disruption evident • Banks may be covered by exotic forestry• Wegetation • Disruption evident • Banks may be covered by exotic forestry• Vegetation • Disruption evident • Banks may be covered by exotic forestry• Vegetative disruption minimal• Bare soil/closely cropped vegetation	•	cove & sh Disr stre vege high Graa graz Sign	ered b hrubs ruption eam ba etatio n ss hea zed hifican	oy gras n of ank n very avily t stoc	/ k
Mean: 9 Moderately stability Moderately s	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6	5	4	3	2	1
3. Bank stability • Banks stable • Moderately stable • Moderately stable • Moderately stable • Unstable 3. Bank stability • Erosion/bank failure absent/minimal • Solo of bank areas of erosion mostly healed over • Moderately stable • Moderately unstable • Unstable • < C5% of bank affected	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6	5	4	3	2	1
 Erosion/bank failure absent/minimal S-30% of bank affected Infrequent, small areas of erosion mostly healed over S-30% of bank affected S-30% of bank eroded S-30% of bank erosion mostly healed over High erosion potential during floods High erosion erosion erosion erosion High erosion erosion erosion erosion High erosion erosion erosion erosion High erosion erosion erosion erosion erosion erosion erosion erosion High erosion erosion erosion erosion erosion erosion erosion erosion erosion erosion High erosion erosion erosion erosion erosion erosion erosion erosion erosion						
Right bank:16 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 Mean: 16	 Erosion/bank failure absent/minimal Infrequent, small areas of erosion mostly healed over <5% of bank affected 5-30% of bank eroded High erosion potential during 	•	Mai 60-2	ny ero 100%	of bar	nk
Mean: 16 Image: Note of the second secon	20 19 18 17 16 15 14 13 12 11 10 9 8 7 6	5	4	3	2	1
4. Frequency of riffles • Riffles relatively frequent • Occurrence of riffles infrequent • Occasional riffle or run • Generally fla water, shallo riffles infrequent • Distance between riffles divided by stream width=5-7 • Uariety of habitat is key • Other infles divided by stream width=7-15 • Other infles divided by stream width=15-25 • Variety of habitat is key • Other infles divided by stream width=15-25 • Distance between riffles divided by stream width=15-25 • Distance between riffles divided by stream width=15-25 Score:17 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 5. Channel alteration • Changes to channel/dredging absent/minimal • Some changes to channel/dredging • Channel/dredging • Stream with normal pattern • Stream with normal pattern • Recent channel/dredging • Embankments/shori ing structures present on both hereing • Jantee between rifles divided ing extensive • Jantee between rifles divided by stream width	6 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6	5	4	3	2	1
riffles riffles divided by stream width=5-7 Variety of habitat is key Score:17 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 5. Channel alteration Changes to channel/dredging absent/minimal Stream with normal pattern in many pattern is stream with normal pattern. Stream with normal pattern is stream with normal pattern is stream with normal pattern is stream with normal pattern. riffles infrequent is provide some habitat is key stream width=7-15 is bottom contours provide some habitat is key stream width=7-15 is bottom contours provide some habitat is key stream width=7-15 is bottom contours provide some habitat is key stream width=15-25 is bottom contours provide some habitat is key stream width=15-25 is bottom contours provide some habitat is key stream width=15-25 is bottom contours provide some habitat is key stream width=15-25 is bottom contours provide some habitat is key stream width=15-25 is bottom contours provide some habitat is key stream width=15-25 is bottom contours provide some habitat is bottom c						
5. Channel alteration • Changes to channel/dredging absent/minimal • Some changes to channel/dredging • Channel changes/dredging extensive • Banks shored gabion/ceme extensive • Stream with normal pattern • Stream with normal pattern • Recent channel/dredging • Channel extensive • Banks shored gabion/ceme extensive • Instream hat	frequentriffles infrequentrun• Distance between riffles divided by stream width=5-7• Distance between riffles divided by stream width=7-15• Bottom contours provide some habitat• Variety of habitat is key• Variety of habitat is stream width=15-• Distance between riffles divided by stream width=7-15	•	wat riffle Poo Dist riffle	er, shi es or habi ance l es divi	allow itat betwe ided b	у
alteration channel/dredging absent/minimal channel/dredging extensive changes/dredging extensive gabion/ceme extensive • Stream with normal pattern • Stream with normal pattern channel/dredging extensive • Embankments/shor ing structures present on both • Instream hat		5			2	1
40-80% of reach channelized & disrupted	channel/dredging absent/minimalchannel/dredging extensive• Stream with normal pattern• Evidence of past channel/dredging • Recent channel/dredging not present• Embankments/shor ing structures present on both banks• Au-80% of reach channelized &	•	gab >80 read or d Inst	ion/ce % of s ch cha lisrupt ream	ement tream inneliz ted habita	zed

Habitat parameter			Catego Optin			Ha	abita	t para	amet	er			itego ptim			Ha	bitat	para	mete	er
6. Sediment deposition	•	Little poin <209 affee	e/no is t bars % of bo cted b osition	slands prese ottom y sedi	nt	•	bar mos grav fine 20-5 affe Slig	v incre forma stly fre vel, sa sedir 50% o cted ht dep ools	ation, om nd or nent f bott	om	•	Some new fine s old & 50-80 affec Sedir at ob	e depo gravel edime new 0% of ted nent o struct	osition I, sand ent or bars botto depos cions,	d or า m	•	fine lncro deve >809 char freq Pool abse sedi	mate eased elopm	bar ent ottom / ost e to	
Score: 16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•	regin Slow slow fast/	locity/ mes pr //deep //shallo /shallo /deep	resent o, ow,		•	regi If fa mis:	4 ocity/o mes p st/sha sing tl re low	oreser allow hen	nt	•	regin If fas slow,	ity/de nes pr	esent low o ow are	r e	•	velo regi	city/c ne	d by 1 lepth eep/slo	
Score: 15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	favo inve colo varie debr mats Snag logs, bank prov fish	% subs urable rtebra nisatic ety of ris, riff s (under (s) sub vides a cover t not b sient	e for te on & v wood les, rc omerg rcut bles bunda	y oot ed ant	•	favo inve colo Sna logs ban Fish com Mot of h Can som	50% si purable rtebr onisati gs/ su s/unde ks/co ks/co cove amon derate abitat consi consi consi cerial	le for ate ion bbmer ercut bbles r e varie t type ist of	ged	•	favou inver color Fish o 60-90 easily foot Woo or ma)% sul / mov dy del ay be hered	for te n patch bstrat ed by pris ra	y e	•	favo inve colo Fish abse Subs or la Stab lacki	urabl rtebra nisati cover ent strate cking le ha	ate on rare o unsta pitats limite	ble
Score: 12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	evid ston Stab	le sub aces ro	n hand strate	!	•	visil Stat Peri	phyto ple on ple su phyto ious t	ston bstrat	es :e	•	<20%	hytor cove able s	r of		•	& pr >209	olific % cov	n obvi er of substr	
Score: 9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE: 120	•	•		-	•	•				•	•				•	•	-			•

Stream name: Waitak	aruru Stream	1			Assesso	r: Josh	ua Smith			
Site number: 4		Samp	le number:		Date: 12	2/03/2	014	Time	: 09:30	
GPS coordinates		Down	stream:		E 18177	45		N 58	15748	
		Upstr	eam:		E 18179	03		N 58	15670	
Channel & riparian	features				Instrea	m hyo	Iraulic co	ondit	ions	
Canopy cover:					Estimate	d or me	asured rea	ch ave	rage:	
Open	Partly s	haded	Very sha	aded						
Fencing:	Dominant	ripariar	vegetation:		Stream	width (active ch	annel): 3.5 m	
None/ineffective	Crops		Retired vege	tation	Stream	width (water): 2	.5 m		
One side/partial	Pasture		Native shrub		Stream	depth:	0.25 m			
Complete	Exotic tree	S	Native trees		Surface	velocit	y: 0.3 m s	5-1		
Water quality										
Temperature:	15.9		°C		Conduct	tivity:		130.7	7 μS	cm ⁻¹
Dissolved oxygen:	66.4		%		6.55			mg l-	1	
Turbidity:	Clear		Slightly turbid	Highly to	urbid	Stain	ed		Other	
Stream-bottom su	ostrata									
Compaction (inorgan	ic substrata):				% surfic compos		rganic sul	ostrat	um size	
Assorted sizes tightly	packed &/or	overlap	ping		Substrat	tum	Dimens	ion	Percent	age
Moderately packed v	vith some ove	erlappiı	ng		Bedrock	Ξ.	-			
Mostly a loose assort	ment with litt	le over	ар		Boulder		>256mm			
No packing/loose ass	ortment easil	y move	d		Cobble		>64-256m	m	20	
Embeddedness:					Gravel		>2-64mm		55	
(% gravel-boulder partic	es covered by f	ine sedir	ment)		Sand		>0.06-2mr	n	15	
<5% 5-25	% 26-!	50%	51-75%	>75%	Silt		0.004-0.06		10	
					Clay		<0.004mm	١		
Organic material (9	6 cover)				Habita	t type	s sample	ed		
Large wood (>10cm d	iameter)				(% of effo	ort)		i		
<5% 5-25	I	50%	51-75%	>75%	Stones:		100%			
Coarse detritus (smal	1				Wood:		9		ffles:	100%
< 5% 5-25	I	50%	51-75%	>75%	Macrop	hyte:	9		ins:	%
Fine (<1mm) organic	· 1		I I		Edges:		9			
< 5% 5-25		50%	51-75%	>75%			ertebrate			
Instream plant cov	•	bed are	a)		Koura: r	are		Shrin		
Filamentous algae &	1		I I		Crabs:			Muss	sels:	
450/ 1 5 35	% 26-	50%	51-75%	>75%	Other:	h				
< 5% 5-25		-0%	F1 7F0/	> 7 5 0/	Mussel			C		
Macrophytes:	0/ 20.	50%	51-75%	>75%	Hyridell	u		cucu	merunio	
Macrophytes:	% 26-									
Macrophytes:	ļ	50%	51-75%	>75%						

Stream name: Waital	arur	u Stre	am					S	ite n	umb	er: 4									
Sample number:				А	ssess	or: J	oshua	a Smi	th				Date	: 12/	03/2	014				
										Cate	gory									
Habitat parameter		0	ptim	al			Sub	optir	mal			Μ	argin	al				Poor		
1. Riparian vegetative zone width	•	Banks buffe Conti	r >10r	n		•	<10n	ation			•	Pathy and/o Most	or sto	ck		•		ks frei an act ous	•	
Left bank:13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 11.5																				
2. Vegetative protection	•	Bank imme zones native Trees shrub wood prese Veget disrup	diate cove vege , unde s or n y plar nt :ative	ripari red by etation er-stor on- nts	rey	•	cover nativ Disru Bank	surface red ma e vege ption s may red by try	ainly etatio evide be	n ent	•	black & intr speci Vege	red by asses/ berry roduc es tation ption soil/c ped ve	y mixt /shrut , willo ed obvio losely	os, ow ous	•	cove & sh Disru strea vege high Gras graze Signi	iption im bai tation s heav	y gras of nk very vily	¢
Left bank:10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 9.5																				
3. Bank stability	•	Banks Erosic abser <5% c affect	on/ba nt/mir of ban	nk fail nimal	ure	•	Infre areas most	eratel quent of er ly hea % of b ed	, sma osion Iled o	II	•	Mode unsta 30-60 reach erosid High poter flood	ible)% of i has a on erosic ntial d	, bank areas on	of	•	60-1	able y eroc 00% o erosio	of ban	k
Left bank:14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 12.5																				
4. Frequency of riffles	•	Riffle: frequ Distan riffles strean Varie key	ent nce be divid m wid	etwee ed by th=5-	7	•	riffle: Dista riffle:	rrence s infre nce be s divid m wic	quen etwee led by	en /	•	habit Dista	om co de so at nce b s divic	ntour me etwee led by	s en /	•	wate riffle Poor Dista riffle	erally f r, sha s habit ince b s divio im wio	llow at etwe ded b	y
Score: 12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel alteration	•	Chann chann abser Strea patte	nel/dr nt/mir m wit	edgin nimal		•	chan Evide chan Rece chan	e chan nel/dr nce o nel/dr nt nel/dr resen	edgir f past edgir edgir	ng : ng	•	exter Emba	ges/de isive inkme ructu ent on s 0% of	ents/s res both reach	hor	•	gabio >80% react or di Instr	s shoi on/cei 6 of st h char srupte eam h ed/ab	ment ream nneliz ed nabita	ed

		Ca	itego	ory		На	bitat	para	mete	r		Ca	itego	ry		Ha	bitat	para	mete	r
Habitat parameter		0	ptim	al								0	ptim	al						
6. Sediment deposition	•	•	bars of bo ted by nent	prese ottom /	nt	•	form from or fin 20-50 affec	ation, grave le sed 0% of ted t depo	ase in most l, san iment botto ositior	ly d : m	•	Some new { fine s old & 50-80 affect Sedin at ob const bend	grave edim new 0% of ted nent o struct	l, sand ent or bars botto depos tions,	dor า m	•	fine r Incre devel	ased lopmo of bo ging ently almo nt due	bar ent ottom ost e to	
Score: 10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•	 Slow/deep, slow/shallow, fast/shallow, fast/deep 					regin If fas	ity/de nes pr t/shal ng the	esent		•	2 of 4 veloc regim If fast slow/ missi	ity/de nes pr t/shal (shalle	esent low o ow are	r e	•	veloc regin	ity/d ne	d by 1 epth ep/slo	
Score: 12	20	19 18 17 16 >50% substrate					14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	20 19 18 17 16 • >50% substrate favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats • Snags/ submerged logs/undercut banks/cobbles provides abundant fish cover				•	favou inver color Snags logs/ banks Fish o Mode of ha Can o	urable tebra nisatic s/ sub under s/cob cover erate bitat	te on rcut bles comn variet types. t of so	ed non sy	•	10-30 favou inver colon Fish c 60-90 easily foot Wood or ma smot sedin	urable tebra iisatic cover 0% sul 7 mov dy del ay be hered	te patch bstrat ed by bris ra	y e	•	abser Subst or lac Stabl	irable tebra iisatic cover nt trate cking e hab ng or	e for te on rare o unstal itats limite	ble
Score: 10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	held : (mac wood	nt on subst rophy I etc.,	hand rates		•	visibl subst	rates		ı	•	Perip <20% availa	cove			•	& pro	lific cove	n obvi er of ubstra	
Score: 9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE: 98.5	-			sediments 20 19 18 17 16									-				-			

Stream name: Piakon	ui Stream				Assesso	r: Josh	ua Smith		
Site number: 5		Samp	le number:		Date: 1	1/03/1	4 -	[ime:	: 15:30
GPS coordinates		Down	stream:		E 18312	211	I	V 58 1	15768
		Upstr	eam:		E 18312	210	I	N 580)9980
Channel & riparian	features				Instrea	am hye	draulic co	ndit	ions
Canopy cover:					Estimate	d or me	asured reac	h ave	rage:
Open	Partly s	haded	Very	shaded					
Fencing:	Dominant	ripariar	vegetation:		Stream	width	(active cha	nnel)	: 8 m
None/ineffective	Crops		Retired ve	getation	Stream	width	(water): 3.	5 m	
One side/partial	Pasture		Native shr	ub	Stream	depth:	0.30 m		
Complete	Exotic tree	S	Native tre	es	Surface	velocit	ty: 0.30 m :	5 ⁻¹	
Water quality									
Temperature:	13.1		°C		Conduc	tivity:	8	38.7	µS cm⁻¹
Dissolved oxygen:	57.4		%		6.01	1	1	ng l-1	
Turbidity:	Clear		Slightly turbid	Highly t	urbid	Stair	ned	(Other
Stream-bottom sub					% surfic compos		rganic sub	strat	um size
Assorted sizes tightly	packed &/or	overlap	ping		Substra	tum	Dimensio	on	Percentage
Moderately packed w	vith some ove	erlappiı	ng		Bedroc	¢	-		
Mostly a loose assortr			-		Boulder	•	>256mm		40
No packing/loose asso	ortment easily	y move	d		Cobble		>64-256mm	1	25
Embeddedness:	as sourced by f	ino codiu	mantl		Gravel		>2-64mm >0.06-2mm		10
(% gravel-boulder particle	1		· · ·	> 75.0/	Sand Silt		0.004-0.06r		5 20
<5% 5-25	% 26-5	50%	51-75%	>75%	Clay		<0.004-0.001		20
Organic material (%	(covor)					+ +\/no	s sample	4	
Large wood (>10cm di					(% of eff		s sample	J	
<5% 5-25		50%	51-75%	>75%	Stones:		100%	I	
Coarse detritus (small			I I	,,,,,,	Wood:		%	Rif	fles: 1009
<5% 5-25	1		51-75%	>75%	Macrop	hyte:	%		ins:
Fine (<1mm) organic o	I.				Edges:	,	%		
< 5% 5-25	· 1	50%	51-75%	>75%	-	r of inv	ertebrates	retu	rned:
Instream plant cov	er (% stream	bed are	a)		Koura:		1	Shrim	
Filamentous algae & r			,		Crabs:		1	Muss	els:
< 5% 5-25	1	50%	51-75%	>75%	Other:				
Nacrophytes:	I		I I		Mussel	type:			
< 5% 5-25	% 26-5	50%	51-75%	>75%	Hyridell	a		Сиси	merunio
Mosses/liverworts:	I		. I						
	26-1	50%	51-75%	>75%					
<5% 5-25	20.								

Stream name: Piakonu	ıi Str	eam						c	lite n	umb	er 5									
Sample number:	11 311	cann		Α	55655	or: lo	osh S		inte n	unib	ei. J		Date	: 11/	03/20	014				
										Cate	gory			,	,-					
Habitat parameter		С	ptim	al			Sub	opti	nal	Cate	gory		argin	ial				Poor		
1. Riparian vegetative zone width	•	>10n	tation n inuou	ı buffe s &	٢	•	Bank veget <10m Most	tation 1			•	Pathv and/c Most	or sto	ck		•		iks frei ian act ous	•	
Left bank:16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:19	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 17.5																				
2. Vegetative protection	•	imme zone nativ Trees shrul wood prese Vege	ediate s cove e veg s, und os or i dy pla ent tative	nts	ian y n vrey	•	nativ Disru Bank	red m e vege ption s may red by	ainly etatio evide be	n Int	•	Bank cover of gra black & intr specie Veget disrup Bare cropp comn	red by asses/ berry, roduc es tation ption soil/cl ped ve	y mixt /shrub , willo ed obvio losely	us	•	cove & sh Disre strea vege high Gras graz Sign	s heav	y gras: of nk very vily stock	ï
Left bank:19	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 18																				
3. Bank stability	Banks stable Erosion/bank failure absent/minimal <5% of bank affected							quent of er ly hea % of b	, sma osion led o	II		Mode unsta 30-60 reach erosid High poter flood	ible)% of i has a on erosic ntial d	bank areas	of	•	Mar 60-1	able y eroc 00% o erosio	f ban	k
Left bank:18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 18																				
4. Frequency of riffles	•	frequ Dista	es rela Jent Ince b s divio	•	Dista riffles	s infre	quen etwee led by	en v	•	Occas run Botto provie habita	om coi de soi	ntour		•	wate riffle Poor	erally f er, sha s habit ance b	llow at etwee			
	•	strea	m wid	dth=5-					-		•	Distai riffles streat 25	s divid	led by	,			am wie		
Score: 17	• 20	strea Varie				15	14	13	12	11	• 10	Dista riffles strea	s divid	led by	,	5		s divid		
Score: 17 5. Channel alteration		strea Varie key 19 Chan chan abse Strea	18 18 nel/di	17 17 redgin nimal th	nt is 16	15 • •	14 Some chant Evide chant Recei chant	e chan nel/dr nce o nel/dr	12 ges to edgir f past edgir	11 0 9g	10 •	Distai riffles streai 25	s divid m wic 8 nel ges/di sive nkme ructu nt on 5 0% of nelize	led by ith=1! 7 redgir ents/s res both reach	6 ng hor	•	4 Banl gabi >809 reac or di Instr	es divio am wio	2 red wi ment ream nnelize ed	25 1 ith ed

Lishitat parameter		Ca	itego	ory		Ha	bitat	para	mete	r		Ca	itego	ory		Ha	bitat	para	mete	r
Habitat parameter		0	ptim	al								0	ptim	al						
6. Sediment deposition	•	•	bars of bo ted by nent	prese ottom /	nt	•	form from or fin 20-50 affec	ation, grave le sed 0% of ted t depo	ase in most l, san iment botto ositior	ly d : m	•	Some new (fine s old & 50-80 affec Sedin at ob const bend	grave edim new 0% of ted nent o struct	l, sand ent or bars botto depos tions,	dor า m	•	fine r Incre deve	ased lopmo of bo ging ently almo nt due	bar ent ottom ost e to	
Score: 11	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•	 Slow/deep, slow/shallow, fast/shallow, fast/deep 					regin If fas	ity/de nes pr t/shal ng the	esent		•	2 of 4 veloc regim If fast slow/ missi	ity/de nes pr t/shal (shalle	esent low o ow are	r e	•	veloc regin	ity/d ne	d by 1 epth ep/slo	
Score: 11	20	19 18 17 16 >50% substrate					14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	20 19 18 17 16 • >50% substrate favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats • Snags/ submerged logs/undercut banks/cobbles provides abundant fish cover				•	favou inver color Snag logs/ bank Fish o Mode of ha Can o	urable tebra nisatic s/ sub under s/cob cover erate bitat	te on rcut bles comn variet types. t of so	ed non sy	•	10-30 favou inver color Fish o 60-90 easily foot Wood or ma smot sedin	urable tebra iisatic cover 0% sul 7 mov dy del ay be hered	te patch bstrat ed by bris ra	y e	•	abser Subst or lac Stabl	irable tebra iisatic cover nt trate cking e hab ng or	e for te on rare o unstal itats limite	ble
Score: 18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	held : (mac	nt on subst rophy I etc.,	hand rates		•	visibl subst	rates		ı	•	<20%	cove	n visib r of ubstra		•	& pro	lific cove	n obvi er of ubstra	
Score: 9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE: 138.5						-					-		-				•	-		

	Dow Upst	ple number: nstream: rream:		Date: 13	3/03/20)14 Т	ime:	11:50
Channel & riparian fe Canopy cover: Open Fencing:	Upst							
Canopy cover: Open Fencing:		ream:		E 18410	27	١	1 586	57879
Canopy cover: Open Fencing:	atures			E 18410	98	١	N 586	57799
Open Fencing:				Instrea	m hyc	lraulic co	nditi	ions
Fencing:				Estimate	d or me	asured reach	n aver	rage:
U U	Partly shaded	Very sl	haded					
None/ineffective	Dominant riparia	in vegetation:		Stream	width (active cha	nnel)	: 6 m
	Crops	Retired veg	etation	Stream	width (water): 3 r	n	
One side/partial	Pasture	Native shru	ıb	Stream	depth:	0.25 m		
Complete	Exotic trees	Native tree	S	Surface	velocit	y: 0.3 m s⁻¹	L	
Water quality				1				
Temperature:	15.9	°C		Conduc	tivity:	1	.13.7	µS cm⁻¹
Dissolved oxygen:	97	%		9.6	1	r	ng l-1	
Turbidity:	Clear	Slightly turbid	Highly t	urbid	Stain	ed	C	Other
Stream-bottom subs	substrata):			compos	ition:	ganic subs		1
Assorted sizes tightly pa				Substra	tum	Dimensic	n	Percentage
Moderately packed with				Bedrock		-		
Mostly a loose assortme		-		Boulder		>256mm		70
No packing/loose assort	ment easily move	ed		Cobble		>64-256mm	1	30
Embeddedness:				Gravel		>2-64mm		
(% gravel-boulder particles	1	1 1	. 750/	Sand		>0.06-2mm		
<5% 5-25%	26-50%	51-75%	>75%	Silt Clay		<0.004-0.001		
Organia matarial (%							J	
Organic material (% of Large wood (>10cm diar	•			(% of eff		s sampled		
<5% 5-25%	26-50%	51-75%	>75%	Stones:	510)	100%	1	
Coarse detritus (small w	I	1 1	27370	Wood:		100% %	Rif	fles: 100 s
<5% 5-25%	26-50%	51-75%	>75%	Macrop	hvte:	%		ns:
Fine (<1mm) organic de			.,,,,,	Edges:		%		
<5% 5-25%	26-50%	51-75%	>75%		r of inv	ertebrates	retu	rned:
Instream plant cover				Koura:	-		hrim	
Filamentous algae & ma	•	/		Crabs:			Auss	•
<5% 5-25%	26-50%	51-75%	>75%	Other:				
Macrophytes:	1	ı 1		Mussel	type:			
< 5% 5-25%	26-50%	51-75%	>75%	Hyridell		0	Cucur	nerunio
Mosses/liverworts:	I	· ·						
<5% 5-25%	26-50%	51-75%	>75%					

Stream name: Paiakara	ahi S	tream	י/ח ו						lite n	umb	er 6									
Sample number:		tream	10/5		ssess	or: P	aul F			unio			Date	: 13/	03/14	4				
										Cate	gory				-					
Habitat parameter		С	ptim	al			Sub	opti	nal				argin	al				Poor		
1. Riparian vegetative zone width	•	>10n	tation า inuou	buffe s &	er	•	Banks veget <10m Most	ation			•	Pathv and/c Mostl	or sto	ck		•		ks fre an ac ous	•	
Left bank:20	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:20	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 20																				
2. Vegetative protection	•	imme zone nativ Trees shrul wood prese Vege	ediate s cove e veg s, und os or r dy pla ent tative	nts	ian y n rey	• • •	Bank cover native Disru Banks cover fores	ed m e vege ption s may ed by	ainly etatio evide be	n ent	• • •	Bank cover of gra blackl & intr specie Veget disrup Bare cropp comm	ed by sses/ berry, oduces ation otion soil/cl eed ve	mixto shrub willo ed obvio osely	s, w us	• • • •	cove & sh Disru strea vege high Gras graz	s heav	y gras: of nk very vily stock	Ĩ
Left bank:17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 17.5																				
3. Bank stability	•	Erosi failur abse	nt/mi of bar	ink nimal		•	Mode Infred areas most 5-309 erode	quent of er ly hea 6 of b	, sma osion led o	II	•	Mode unsta 30-60 reach erosid High e poter floods	ble % of l has a on erosic ntial d	bank i ireas i		•	60-1	able y eroc 00% c erosio	f ban	k
Left bank:9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 12.5																				
4. Frequency of riffles	•	Riffle	s rela	tivelv		•	Occu	rrence	of		•	Occas	ional	riffle	or	•		erally er, sha		
	•	riffle strea	nce b s divic m wic	etwee led by lth=5- habita	en / -7	•	riffles Dista riffles strea	s infre nce b s divic	quen etwee led by	en /	•	run Botto provid habita Distar riffles strear 25	de sor at nce be divid	me etwee ed by	'n	•	riffle Poor Dista riffle	s habit ince b s divio im wio	etwee ded by	/
Score: 18		Dista riffle strea Varie	nce b s divic m wic	etwee led by lth=5-	en / -7	• 15	Dista riffles	s infre nce b s divic	quen etwee led by	en /	•	Botto provie habita Distar riffles strear	de sor at nce be divid	me etwee ed by	'n		riffle Poor Dista riffle	habit nce b s divio	etwee ded by	/
Score: 18 5. Channel alteration	•	Lista riffle strea Varie key 19 Chan chan abse Strea	nce b s divic m wic ty of 18 ges to nel/di	etwee led by dth=5- habita 17 redgin nimal	en 7 at is 16	•	Dista riffles strea	s infre nce b s divic m wic 13 e chan nel/dr nce o nel/dr nt nel/dr	quen etwee led by lth=7 12 ges to edgir f past edgir edgir	2n 7 -15 -15 -15 -15 -15 	• • 10 •	Botto provid habita Distar riffles strear 25	de son at nce be divid m wid 8 mel ges/dr sive nkme ructui nt on 5 % of i melize	me etwee ed by lth=1! 7 redgir res both reach	n 6 Ig hor	•	riffle Poor Dista riffle stread 4 Bank gabi yabi yabi yabi yabi yabi yabi yabi y	habit ance b s divio am wie	etwee ded by dth=> 2 red wi ment ream nnelize ed iabita	/ 25 1 ith

Habitat parameter		Ca	itego	ory		Ha	bitat	para	mete	r		Ca	itego	ry		Ha	bitat	para	mete	r
Habitat parameter		0	ptim	al								0	ptim	al						
6. Sediment deposition	•	Little, point <20% affect sedin depo	bars of bo ted by nent	prese ottom /	nt	•	form from or fin 20-50 affec	ted t depo	most I, san iment botto	ly d : m	•	Some new (fine s old & 50-80 affec Sedin at ob const bend	grave edim new 0% of ted nent o struct	l, sand ent or bars botto depos tions,	dor า m	•	fine r Incre deve	ased lopmo of bo ging ently almo nt due	bar ent ottom ost e to	
Score: 16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•	 Slow/deep, slow/shallow, fast/shallow, fast/deep 19 18 17 16 					regin If fas	ity/de nes pr t/shal ng the	esent low is		•	2 of 4 veloc regim If fast slow/ missi	ity/de nes pr t/shal (shalle	esent low o ow are	r e	•	veloc regin	ity/d ne	d by 1 epth ep/slo	
Score: 18	20	fast/deep 19 18 17 16 >50% substrate					14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	20 19 18 17 16 • >50% substrate favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats • • Snags/ submerged logs/undercut banks/cobbles provides abundant fish cover					favou inver color Snag logs/ bank Fish o Mode of ha Can o	0% sul urable tebra hisatic s/ sub under s/cob cover erate bitat consis mater	for te merg cut bles comn variet types.	ed non sy	•	10-30 favou inver color Fish o 60-90 easily foot Wood or ma smot sedin	tebra iisatic cover)% sul y mov dy del ay be herec	for te patch bstrat ed by bris ra	y e	•	abser Subst or lac Stabl	irable tebra iisatic cover nt trate cking e hab ng or	e for te on rare o unstal itats limite	ble
Score: 17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	Perip evide held s (mac wood sedin	nt on subst rophy l etc.,	hand rates rtes,		•	visibl subst	hytor e on trates ous to	but	ı	•	<20%	hytor cove able s	r of		•	& pro	lific cove	n obvi er of ubstra	
Score: 6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE:141			-						-		-		-				•	-		

Stream name. Kareng	orengo Strear	n			Assesso	or: Josh	ua Smith			
Site number: 7		Sampl	e number:		Date: 1	0/03/1	4 -	Time:	08:00	
GPS coordinates		Down	stream:		E 18483	393		N 582	3235	
		Upstre	eam:		E 18484	123	I	N 582	3099	
Channel & riparian	features				Instrea	am hye	draulic co	nditi	ions	
Canopy cover:					Estimate	d or me	asured reac	h aver	age:	
Open	Partly sh	naded	Very	shaded						
Fencing:	Dominant r	iparian	vegetation:		Stream	width	(active cha	nnel)	:4 m	
None/ineffective	Crops		Retired v	egetation	Stream	width	(water): 2.	5 m		
One side/partial	Pasture		Native shi	rub	Stream	depth:	0.5 m			
Complete	Exotic trees	6	Native tre	es	Surface	velocit	y: 0.35 m :	S ⁻¹		
Water quality										
Temperature:	13.9		°C		Conduc	tivity:	:	131.4	μS	cm ⁻¹
Dissolved oxygen:	73.4		%		7.58		1	ng l-1		
Turbidity:	Clear		Slightly turbid	l Highly t	urbid	Stair	ed	(Other	
Stream-bottom sub	strata									
Compaction (inorgan	c substrata):				% surfic		rganic sub	strat	um size	
Assorted sizes tightly	packed &/or c	verlap	ping		Substra	tum	Dimensio	on	Percen	tage
Moderately packed w	ith some over	lapping	Ş		Bedroc	ĸ	-			
Mostly a loose assortr	nent with littl	e overl	ар		Boulder	-	>256mm			
No packing/loose ass	ortment easil	y move	ed		Cobble		>64-256mm	n		
Embeddedness:					Gravel		>2-64mm		10	
(% gravel-boulder particle	es covered by fi	ne sedin	nent)		Sand		>0.06-2mm		85	
<5% 5-25	% 26-5	0%	51-75%	>75%	Silt		0.004-0.06r	nm	5	
I	I	I	I		Clay		<0.004mm			
Organic material (%	(cover)				Habita	t type	s sample	d		
Large wood (>10cm d	-				(% of eff					
< 5% 5-25		0%	51-75%	>75%	Stones:		%	1		
\3 % 3-23	l 	leaves	etc., >1mm)		Wood:		%	Rif	fles:	%
Coarse detritus (small	wood, sticks,		1			hvte:	100%	Ru	ns:	100%
	1	0%	51-75%	>75%	Macrop	,				
Coarse detritus (small	% 26-5	0%	51-75%	>75%	Edges:	, i y cer	%			
Coarse detritus (small	% 26-5	ı I	51-75% 51-75%	>75% >75%	Edges:	-	% ertebrates		rned:	
Coarse detritus (small <5%	% 26-5 leposits % 26-5	0%	51-75%		Edges:	r of inv	ertebrates	retu	rned: ips: Comi	non
Coarse detritus (small <5% 5-25 Fine (<1mm) organic o	% 26-5 deposits % 26-5 er (% streamb	0%	51-75%		Edges: Numbe	r of inv	ertebrates	retu	ips: Com	mon
Coarse detritus (small <5% 5-25 Fine (<1mm) organic (<5% 5-25 Instream plant covernment)	% 26-5 deposits % % 26-5 er (% streamb nats:	0% Ded are	51-75%		Edges: Numbe Koura:	r of inv	ertebrates	retu Shrim	ips: Com	mon
Coarse detritus (small <5% 5-25 Fine (<1mm) organic of <5% 5-25 Instream plant cover Filamentous algae & r	% 26-5 deposits % 26-5 er (% streamb	0% Ded are	51-75%	>75%	Edges: Numbe Koura: Crabs:	r of inv Abunda	ertebrates	retu Shrim	ips: Com	mon
Coarse detritus (small <5% 5-25 Fine (<1mm) organic (<5% 5-25 Instream plant cove Filamentous algae & r <5% 5-25	% 26-5 deposits % 26-5 er (% streamb nats: % 26-5	0%	51-75%	>75%	Edges: Numbe Koura: Crabs: Other:	r of inv Abunda type:	ertebrates ant 9	i retu Shrim Muss	ips: Com	mon
Coarse detritus (small <5% 5-25 Fine (<1mm) organic (<5% 5-25 Instream plant cove Filamentous algae & r <5% 5-25 Macrophytes:	% 26-5 deposits % 26-5 er (% streamb nats: % 26-5	0%	51-75% a) 51-75%	>75%	Edges: Numbe Koura: Crabs: Other: Mussel	r of inv Abunda type:	ertebrates ant 9	i retu Shrim Muss	ips: Comi els:	mon

Sample number: Habitat parameter 1. Riparian									ite n											
1. Riparian				A	ssess	or: J	oshua	a Smi	th				Date	: 10/	03/1	4				
1. Riparian										Cate	gory									
		C	Optim	al			Sub	optii	mal			Μ	argin	al				Poor		
vegetative zone width	•	>10r	tation n inuou		er	•	Bank veget <10m Most	tation 1	buffe Itinuo			Pathv and/c Most	or sto	ck		•		an ac	quent tivity	
Left bank:8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 8		<u>.</u>																1		
2. Vegetative protection	•	shrubs or non- woody plants present Vegetative disruption minimal					nativ Disru Bank	red m e vege ption s may red by	ainly l etatio evide	n	•	Bank cover of gra black & intr specie Veget disrup Bare cropp comm	red by asses/ berry, roduc es tation btion soil/cl ped ve	y mixt /shrut , willo ed obvio losely	os, ow ous	•	cove & shi Disru strea vege high Gras graze Signi	rubs ption m ba tatior s heav d	y grass of nk very	ī
Left bank:8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean:8																				
3. Bank stability	•	0 19 18 17 16 Banks stable Erosion/bank failure absent/minimal <5% of bank affected				•	Infree areas	quent of er ly hea % of b	osion Ied o	II	•	Mode unsta 30-60 reach erosid High poter flood	ble % of has a on erosic ntial d	bank areas	of	•	60-1	y eroo 00% c	ded ar of ban nal sc	k
Left bank:12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 12		<u> </u>					1	L		L				L						
4. Channel sinuosity	•	Bends increase stream length 3-4 times longer than if it was straight						m len i long	gth 2- er tha			Bends strear times it was	m len longe	gth 1- er tha		•	Chan	nel st	raight	:
Score: 12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel alteration	•	it was straight 0 19 18 17 16					chan Evide chan Recei chan	nel/dr nce o nel/dr nt	edgin edgin	ig ig	•	Chang chang exten Emba ing st prese banks 40-80 chang disrug	ges/di isive inkme ructu int on 5 1% of nelize	ents/s res both reach	hor	•	gabio >80% react or di Instr	on/ce 5 of st 5 char 5 rupte	abita	ed

		Ca	itego	ry		Ha	bitat	para	mete	r		Ca	itego	ry		Ha	bitat	par	amete	er
Habitat parameter		0	ptim	al								0	ptim	al						
6. Sediment deposition	•	Little, point <20% affect sedin depo	bars of bo ted by nent	prese ottom /	nt	•	forma from or fin 20-50 affec	ation, grave e sed 0% of ted t depo	ase in most el, san iment botto ositior	ly d : m	•	fine s old & 50-80 affec Sedin at ob	grave edim new 0% of ted nent o struct	l, sand ent or bars botto depos tions,	tor າ m	•	fine i Incre deve	mate asec lopn 6 of l ging lent s alm nt du nent	l bar hent botton y host ue to	
Score:14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Pool variability	•	Large/shallow, large/deep, small/shallow, small/deep					large	/deep few s	f pool) hallov		•		alence ow po			•	Majo smal		of poo Illow	ls
Score: 13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	 20 19 18 17 16 >50% substrate favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats Snags/ submerged logs/undercut banks/cobbles provides abundant fish cover 					favou inver color Snags logs/ banks Fish o Mode of ha Can o	irable tebra iisatio s/ sub under s/cob s/cob cover erate bitat t	te merg cut bles comm variet types. t of sc	ed non Sy		favou inver color Fish o 60-90	urable tebra iisatic cover 0% sul y mov dy del ay be hered	te patch bstrat ed by bris ra	y e	• • • •	favou inver color Fish o abse Subs or lao Stabl	urab tebr nisat cove nt trate cking e ha	ion r rare unsta bitats r limite	or ble
Score: 14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	Perip evide held s Stable Surfa touch	nt on stone e sub ces ro	hand s strate		•	visibl Stabl	e subs hytor	n not stones strate n obvie		•	<20%	cove	n visib r of ubstra		•	& pro	olific 6 cov	on obv er of substr	
Score: 18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	1	1			1		1			L	i									

	e Stream			Assesso	r: Kath	ryn Julian		
Site number: 8	S	ample number:		Date: 10	0/03/2	014	Time	2:
GPS coordinates	[Downstream:		E 18319	68		N 58	03870
	ι	Jpstream:		E 18318	578		N 58	03808
Channel & riparian	features			Instrea	m hyd	draulic co	ondi	tions
Canopy cover:				Estimate	d or me	asured read	ch ave	erage:
Open	Partly sha	ded Very s	haded					
Fencing:	Dominant rip	arian vegetation:		Stream	width	active cha	anne	l): 5.6 m
None/ineffective	Crops	Retired veg	getation	Stream	width	(water): 4	.5 m	
One side/partial	Pasture	Native shru	du	Stream	depth:	0.3 m		
Complete	Exotic trees	Native tree	es	Surface	velocit	y: 0.3 m s	-1	
Water quality								
Temperature:	18.2	°C		Conduc	tivity:		62.6	µS cm⁻¹
Dissolved oxygen:	NA	%		NA			mg l	-1
Turbidity:	Clear	Slightly turbid	Highly t	urbid	Stain	ed		Other
Stream-bottom sub	strata	I						
Compaction (inorgani	c substrata):			% surfic		rganic sub	stra	tum size
Assorted sizes tightly p	oacked &/or ov	erlapping		Substra		Dimensi	on	Percentage
Moderately packed w				Bedrock		-	-	
Mostly a loose assortn				Boulder		>256mm		70
No packing/loose asso		-		Cobble		>64-256m	n	15
Embeddedness:	,			Gravel		>2-64mm		5
(% gravel-boulder particle	es covered by fine	sediment)		Sand		>0.06-2mn	n	5
<5% 5-25%	1	1 1	>75%	Silt		0.004-0.06	mm	5
I	Ι	1 1		Clay		<0.004mm		
Organic material (%	cover)				t type	s sample	d	
Large wood (>10cm di				(% of eff			-	
<5% 5-25%	1	% 51-75%	>75%	Stones:		100%	6	
Coarse detritus (small	1			Wood:		%		iffles: 1009
< 5% 5-25%	1	1 1	>75%	Macrop	hvte:	%		uns: 9
Fine (<1mm) organic d	I	1 1		Edges:		%	5	
<5% 5-25%	· .	% 51-75%	>75%	_	r of inv	ertebrate	s reti	urned:
Instream plant cove				Koura: d		1		nps: common
Filamentous algae & m		,		Crabs:			Mus	
<5% 5-25%	1	% 51-75%	>75%	Other:				
I	1			Mussel	type:			
iviacrophytes:	6 26-509	% 51-75%	>75%	Hyridell			Сиси	imerunio
Macrophytes: <5% 5-25%		1 1						
· · ·								

Stream name: Wairere	e stre	eam						9	Site n	umb	er: 8									
Sample number:				A	ssess	or: K	athry	n Jul	ian				Date	: 10/	03/2	014				
										Cate	gory									
Habitat parameter	Ì	O	ptim	al			Sub	optii	mal			Μ	argin	al				Рооі		
1. Riparian vegetative zone width	•	>10n	tatior n inuou	n buffe is &	er	•	Bank veget <10m Most	tation			•	Pathy and/o Most	or sto	ck		•		iks fre nan ac ous		
Left bank:13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:12	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 12.5			•		<u> </u>															<u> </u>
2. Vegetative protection	•	imme zone: nativ Trees shrut wood prese Vege	ediate s cove e veg s, und os or i dy pla ent tative	nts	ian Y n orey	•	nativ Disru Bank	red m e vege ption s may red by	ainly etatio evide be	n ent	•	Bank cover of gra black & intri specie Vege disrup Bare cropp comm	red by asses/ berry roduc es tation ption soil/c ped ve	y mixt /shrub , willo ed obvio losely	us	•	cove & sh Disre strea vege high Gras graz Sign	s hea	y gras: of nk very vily	
Left bank:9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:7	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 8																				
3. Bank stability	•	Erosi failur absei	nt/mi of bai	ank nimal		•	Infree areas	of er ly hea 6 of b	, sma osion Iled o	II	•	Mode unsta 30-60 reach erosio High poter flood	ible)% of i has a on erosic ntial d	bank areas	of	•	Mar 60-1	able ay eroo 00% c erosio	f ban	ĸ
Left bank:17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 17																				
4. Frequency of riffles	•	frequ Dista riffle strea	ient nce b s divio m wie ety of	tively etwee ded by dth=5 habita	en / -7 at is	•	Dista riffles strea	s infre nce b s divic m wic	etwee led by lth=7	en / -15	•	Occas run Botto provi habit Dista riffles strea 25	om co de so at nce b divic m wic	ntour me etwee led by lth=1!	s en 7 5-	•	wate riffle Poor Dista riffle strea	r habit ance b as divie am wi	llow at etwee ded by dth=>	, 25
				17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Score: 14	20	 Changes to channel/dredging absent/minimal 					-					~ 1					-			
Score: 14 5. Channel alteration	20 •	Chan chan abser Strea	ges to nel/d nt/mi im wi	l redgir nimal th		•	Evide chan Rece chan	nel/dr nce o nel/dr	edgir f past edgir edgir	ng : ng	•	Chan chang exter Emba ing st prese banks 40-80 chang disru	ges/di inkme ructu ent on s 0% of nelize	ents/s res both reach	hor	•	gabi >809 reac or di Instr	ks sho on/ce % of st h chai srupte ream h red/at	ment ream nnelize ed nabita	ed

Habitat parameter	Category Optimal • Little/no islands or point bars present • <20% of bottom affected by sediment deposition				Habitat parameter					Category Optimal Some deposition of new gravel, sand or fine sediment on old & new bars 50-80% of bottom affected Sediment deposits at obstructions, constrictions & bends					Habitat parameter					
Habitat parameter																				
6. Sediment deposition					 New increase in bar formation, mostly from gravel, sand or fine sediment 20-50% of bottom affected Slight deposition in pools 										 Heavy deposits of fine material Increased bar development >80% of bottom changing frequently Pools almost absent due to sediment deposition 					
Score: 16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•	regimes present				 3 0f 4 velocity/depth regimes present If fast/shallow is missing then score lower 				 2 of 4 velocity/depth regimes present If fast/shallow or slow/shallow are missing, score low 					 Dominated by 1 velocity/depth regime Usually deep/slow 					
Score: 18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	 favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats Snags/ submerged logs/undercut banks/cobbles provides abundant fish cover 				 30-50% substrate favourable for invertebrate colonisation Snags/ submerged logs/undercut banks/cobbles Fish cover common Moderate variety of habitat types. Can consist of some new material 					 10-30% substrate favourable for invertebrate colonisation Fish cover patchy 60-90% substrate easily moved by foot Woody debris rare or may be smothered by sediment 					 <10% substrate favourable for invertebrate colonisation Fish cover rare or absent Substrate unstable or lacking Stable habitats lacking or limited to macrophytes 				
Score: 17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	evident on hand held stones • Stable substrate				 Periphyton not visible on stones Stable substrate Periphyton obvious to touch 				 Periphyton visible <20% cover of available substrates 					 Periphyton obvious & prolific >20% cover of available substrates 					
Score: 6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE 125.5	•	•	•		•	•			•	•	•	•		•						

Stream name: Waitea	Assessor: Joshua Smith														
Site number: 9	te number: 9 Sample number:						4 1	Time: 09:30							
GPS coordinates		E 18525	666	1	N 5818150										
	E 1852697 N 5818212														
Channel & riparian	Instream hydraulic conditions														
Canopy cover:	Estimated or measured reach average:														
Open	Partly s														
Fencing:	Stream width (active channel): 20 m														
None/ineffective	one/ineffective Crops Retired vegetation							Stream width (water): 5 m							
One side/partial	ne side/partial Pasture Native shrub						Stream depth: 0.35 m								
Complete	Surface velocity: 0.20 m s ⁻¹														
Water quality		<u>.</u>													
Temperature:	Conductivity: 44.8 µS cm ⁻¹														
Dissolved oxygen:	99.7		%		10.38	•	mg l ⁻¹								
Turbidity:	rbidity: Clear			Highly t	urbid Stain		ned Other								
Stream-bottom sub Compaction (inorgani					% surfic compos		rganic sub	strati	um size						
Assorted sizes tightly	Substratum Dimen		Dimensio	on	Percen	tage									
Moderately packed w	Bedrock	(-												
Mostly a loose assortr	Boulder >256mm		>256mm	85											
No packing/loose asso	Cobble >64-256			imm 10											
Embeddedness:	Gravel >2-64m			^m 5											
(% gravel-boulder particle	Sand >0.06-2			mm											
<5% 5-25	>75%	Silt 0.004-0.													
		Clay <0.004n													
Organic material (%	6 cover)				Habita	t type	s sampleo	ł							
Large wood (>10cm d	(% of effort)			1											
<5% 5-25% 26-50%			51-75%	>75%	Stones:		80%								
Coarse detritus (small	arse detritus (small wood, sticks, le		s etc., >1mm)		Wood:		%	Rif	fles:	50%					
<5% 5-25	I.	50%	51-75%	>75%	Macrop	hyte:	%			50%					
Fine (<1mm) organic o	>75%	Edges: 20%													
<5% 5-25	Number of invertebrates returned:														
Instream plant cov	Koura:			Shrimps:											
Filamentous algae & r	Crabs:			Mussels:											
<5% 5-25	% 26-5	50%	51-75%	>75%	Other: Mussel										
								Commence in the							
Macrophytes:	% 26-5	0%	51-75%	>75%	Hyridell	а		ucur	nerunio						
< 5% 5-25															
	% 26-5	.00/	51-75%	>75%											

Stream name: Waites	ariki St	rear	n					0,	Site n	umb	er: 9									
Sample number:				A	ssess	or: J	oshua	a Smi	th				Date	: 11/	03/2	014				
										Cate	gory									
Habitat parameter	İ	С	ptim	al			Sub	oopti	mal			Μ	argin	al				Рооі	ſ	
1. Riparian vegetative zone width		buffe	side ve r >10r nuous	n		•	<10m	tation			•	Pathy and/o Most	or sto	ck		•	Hun	aks fre nan ac ious	•	
Left bank:15	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 12.5																				
2. Vegetative protection	•	imme zone: nativ Trees shrut wood prese Vege	surface ediate s cove e vege s, unde os or n ly plar ent tative ption	ripari red by etation er-stor on- nts	/ n rey	•	cover nativ Disru Bank	surfa red m e veg ption s may red by try	ainly etatio evide be	n	•	Bank cover of gra black & intri specie Vege disrup Bare cropp comm	red by asses/ berry roduc es tation ption soil/c ped ve	y mixt /shrut , willo ed obvio losely	us	•	cove & sh Disr stre vege high Gras graz Sign	ss heav	y gras i of nk n very vily : stock	¢
Left bank:18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:5	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 11.5			<u> </u>		<u> </u>		<u> </u>					<u> </u>					<u> </u>	<u> </u>		
3. Bank stability	•	Erosi absei	s stabl on/ba nt/mir of ban ted	nk fail nimal	ure	•	Infree areas	, of er ly hea % of b	, sma osion iled o	II	•	Mode unsta 30-60 reach erosio High poter flood	ible)% of i has a on erosic ntial d	bank areas	of	•	Mar 60-1	table ny eroo LOO% c erosio	of ban	k
Left bank:18	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 16																				
4. Frequency of riffles	•	frequ Dista riffles strea	s relat ent nce be divid m wid ty of h	etwee ed by th=5-	7	•	riffles Dista riffles	rrenc s infre nce b s divic m wic	equen etwee led by	en v	• •	Occas run Botto provi habit Dista riffles strea 25	om co de so at nce b s divic	ntour me etwee led by	s en	• • •	wat riffle Poo Dist riffle	erally er, sha es r habit ance b es divid am wi	illow at etwe ded b	y
Score: 17	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel alteration		chan absei	ges to nel/dr nt/mir m wit rn	edgin nimal		•	chan Evide chan Recei chan	nel/dı	redgir of past redgir redgir	ig ig	•	Chan chan exter Emba ing st prese banks 40-80 Chan	ges/di isive inkme ructu ent on	ents/s res both reach	hor	•	gabi >80 read or d Inst	ks sho ion/ce % of st ch chai isrupto ream h red/ab	ment ream nneliz ed nabita	ed

7. Velocity/depth regimes • 4 velocity/depth regimes present • 3 0f 4 velocity/depth regimes present • 2 of 4 velocity/depth regimes present • Dominated by 1 velocity/depth regimes present 5.0w/deep, slow/shallow, fast/deep • 1 fast/shallow is missing then score lower • 1 fast/shallow or slow/shallow ar missing, score low • Usually deep/slow 5.0re: 19 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 8. Abundance & diversity of habitat • >50% substrate favourable for invertebrate colonisation • 30-50% substrate favourable for invertebrate colonisation • 10-30% substrate favourable for invertebrate colonisation • <10% substrate favourable for invertebrate colonisation • Sags/ submerged logs/undercut banks/cobbles • Snags/ submerged fablat types. Can consist of some new material • Woody debris rare or may be smothered by sediment • Stable habitats lacking or limited to macrophytes, wood etc.,) or fine sediments	Habitat parameter			tego			На	bitat	para	mete	r			itego			На	bitat	para	mete	r
7. Velocity/depth regimes • 4 velocity/depth regimes present • Slow/deep, slow/shallow, fast/deep • 3 0 f 4 velocity/depth regimes present • If fast/shallow is missing then score lower • 2 o f 4 velocity/depth regimes present • If fast/shallow is missing then score lower • 2 o f 4 velocity/depth regimes present • Usually deep/slow Score: 19 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 8. Abundance & diversity of habitat • >50% substrate favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats • 30-50% substrate favourable for invertebrate colonisation • 10-30% substrate favourable for invertebrate colonisation • <10% substrate favourable for invertebrate colonisation	6. Sediment		Little/ point <20% affect sedim	no is bars of bo ed by ent	lands prese ottom y	nt		form from or fin 20-50 affec Slight	ation, grave le sed 0% of ted t depo	most el, san iment botto	ly d : m	•	Some new p fine s old & 50-80 affec Sedin at ob const	e depo grave edim new 0% of ted nent o struct	osition I, sand ent or bars botto depos tions,	d or า m	•	fine r Incre devel >80% chang frequ Pools abser sedin	ased lopmo of bo ging lently almo nt duo nent	ial bar ent ottom ost e to	
8. Abundance & diversity of habitat >50% substrate favourable for invertebrate colonisation & wide variety of woody debris, riffles, root mats Snags/ submerged logs/undercut banks/cobbles Snags/ submerged logs/undercut banks/cobbles Snags/ submerged logs/undercut banks/cobbles Snags/ submerged logs/undercut banks/cobbles Fish cover patchy 60-90% substrate easily moved by foot Stable habitats lacking or limited to macrophytes, wood etc) or fine sediments Stable habitats barts Stable habitats substrates but obvious to touch Periphyton not evident on hand held substrates (macrophytes, wood etc) or fine sediments Periphyton value of sediments Stable habitats substrates but obvious to touch Periphyton value sediments Stable habitats substrates but obvious to touch Periphyton visible Sediments Stable substrates substrates but obvious to touch Periphyton visible Sediments Stable substrates Stable substrates<!--</td--><td>7. Velocity/depth</td><td>•</td><td>4 velo regim Slow/ slow/s fast/s</td><td>city/ es pr deep shallo hallo</td><td>l depth esent o, ow,</td><td></td><td>•</td><td>3 Of 4 veloc regin If fas missi</td><td>ity/de ity/de nes pr t/shal ng the</td><td>epth esent low is</td><td></td><td>•</td><td>2 of 4 veloc regim If fas slow/</td><td>ity/de ity/de nes pr t/shall (shallo</td><td>epth esent low o ow are</td><td>r</td><td></td><td>Domi veloc regin</td><td>inateo ity/do ne</td><td>d by 1 epth</td><td></td>	7. Velocity/depth	•	4 velo regim Slow/ slow/s fast/s	city/ es pr deep shallo hallo	l depth esent o, ow,		•	3 Of 4 veloc regin If fas missi	ity/de ity/de nes pr t/shal ng the	epth esent low is		•	2 of 4 veloc regim If fas slow/	ity/de ity/de nes pr t/shall (shallo	epth esent low o ow are	r		Domi veloc regin	inateo ity/do ne	d by 1 epth	
9. Periphyton • Periphyton not evident on hand held substrates (macrophytes, wood etc.,) or fine sediments • Periphyton not visible on substrates but obvious to touch • Periphyton visible evident on band held substrates but obvious to touch • Periphyton visible evident on band held substrates • Periphyton visible evident on band held substrates • Periphyton visible evident on band held substrates • Periphyton visible evident on band held substrates • Periphyton evident on band held substrates • Periphyton visible evident on band held substrates • Periphyton evident on band held substrates • Periphyton evident on band held substrates • Periphyton evident on band held substrates • Periphyton evident on band held substrates	8. Abundance &	•	>50% favou invert coloni variet debris mats Snags logs/u banks provid fish co Must	subs rable ebra isatic y of v s, riff / sub inder /cob des a over not k	trate for te on & w woody les, ro omerge rcut bles bunda	vide / ot ed	•	30-50 favou inver color Snag logs/ bank Fish o Mode of ha Can o	0% sub urable tebra hisatio s/ sub under s/cob cover erate bitat consis	bstrat for te merg cut bles comn variet types. t of so	ed non	•	10-30 favou inver color Fish c 60-90 easily foot Wood or ma smot	0% sul urable tebra iisatio cover 0% sul y mov dy del ay be hereo	bstrat for te patch bstrat ed by bris ra	y v	•	<10% favou inver color Fish c absei Subst or lac Stable lackir	subs urable tebra lisatic cover nt trate cking e hab	trate for te on rare o unstal itats limite	ble
Score: 9 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1			Periph eviden held s (macr wood	nytor nt on ubst ophy etc.,	n not hand rates rtes,) or fii			Perip visibl subst	hytor e on trates	n not but	<u> </u>	•	Perip <20%	hytor cove	n visib r of	le	•	Perip & pro >20%	hytor olific	n obvi er of	
	Score: 9	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Stream name: Waitaw	vheta River	<u>.</u>			Assesso	r: Paul	Franklin		<u>.</u>	
Site number: 10		Samp	le number:		Date: 13	3/03/2	014 T	ime	: 16:30	
GPS coordinates		Dowr	nstream:		E 18454	80	٩	V 584	19662	
		Upstr	eam:		E 18453	88	١	V 58 4	19622	
Channel & riparian	features				Instrea	m hye	draulic co	ndit	ions	
Canopy cover:					Estimate	d or me	asured react	n ave	rage:	
Open	Partly s	haded	Very sh	aded						
Fencing:	Dominant	ripariaı	n vegetation:		Stream	width	(active cha	nnel)	: 5.0m	
None/ineffective	Crops		Retired veg	etation	Stream	width	(water): 3.0)m		
One side/partial	Pasture		Native shrul	b	Stream	depth:	0.1m			
Complete	Exotic tree	S	Native trees		Surface	velocit	ty: 0.2m s ⁻¹			
Water quality										
Temperature:	17.1		°C		Conduc	tivity:	7	'3.4		µS cm⁻¹
Dissolved oxygen:	106.8		%		9.95		r	ng l-1		
Turbidity:	Clear		Slightly turbid	Highly t	urbid	Stair	ned	(Other	
Stream-bottom sub	ostrata									
Compaction (inorgani	c substrata):				% surfic compos		rganic subs	strat	um size	9
Assorted sizes tightly	packed &/or	overlap	oping		Substra	tum	Dimensio	n	Perce	entage
Moderately packed w	ith some ove	erlappi	ng		Bedrock	(-			
Mostly a loose assortr	nent with litt	le over	lap		Boulder		>256mm		80	
No packing/loose asso	ortment easily	y move	d		Cobble		>64-256mm	I	15	
Embeddedness:					Gravel		>2-64mm		5	
(% gravel-boulder particle	es covered by fi	ine sedi	ment)		Sand		>0.06-2mm			
<5% 5-25	% 26-5	50%	51-75%	>75%	Silt		0.004-0.06n	nm		
					Clay		<0.004mm			
Organic material (%	် cover)				Habita	t type	s sampled	ł		
Large wood (>10cm d	ameter)				(% of eff	ort)				
<5% 5-25	% 26-5	50%	51-75%	>75%	Stones:		100%			
	wood, sticks,	, leaves	s etc., >1mm)		Wood:		%	Rif	fles:	100 9
Coarse detritus (small	% 26-5	50%	51-75%	>75%	Macrop	hyte:	%	Ru	ns:	ç
Coarse detritus (small					Edges:		%			
1	I							retu	rned:	
<5% 5-25	deposits	50%	51-75%	>75%	Numbe	r of inv	ertebrates		nns.	
<5% 5-25 Fine (<1mm) organic o	deposits % 26-5			>75%	Number Koura:	r of inv	1	hrim	ip5.	
<5% 5-25 Fine (<1mm) organic o <5% 5-25	deposits % 26-5 er (% streaml			>75%	1	r of inv	S	ihrim Auss	•	
<5% 5-25 Fine (<1mm) organic of <5% 5-25 Instream plant covery	deposits % 26-5 er (% streamb nats:	bed are		>75% >75%	Koura:	r of inv	S		•	
<5% 5-25° Fine (<1mm) organic of <5% 5-25° Instream plant cover Filamentous algae & r	deposits % 26-5 er (% streamb nats:	bed are	ea)		Koura: Crabs:		S		•	
<5%	deposits % 26-5 er (% streamb nats: % 26-5	bed are	ea)		Koura: Crabs: Other:		S		•	
<5% 5-25 Fine (<1mm) organic (<5% 5-25 Instream plant cover Filamentous algae & r <5% 5-25 Macrophytes:	deposits % 26-5 er (% streamb nats: % 26-5	bed are	51-75%	>75%	Koura: Crabs: Other:		S		•	

Wadeable Hard-Bo Qualitative Habitat As					Shee	et														
Stream name: Waita	wheta	a Rive	er					9	Site n	umb	er: 10	0								
Sample number:				A	ssess	or: K	athry	/n Jul	ian				Date	: 13/	03/2	014				
										Cate	gory									
Habitat parameter		С	ptim	al			Sub	opti	mal			Μ	argir	nal				Poo	r	
1. Riparian vegetative zone width	•	>10n	tatior n inuou	n buffe is &	er	•	<10m	tation			•	and/o	or sto	prese ck aled o		•	Hun	aks fre nan ac ious	•	
Left bank:3	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:6	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 4.5		1	1	1				1					1							
2. Vegetative protection	• •	imme zone nativ Trees shrul wood prese Vege	ediate s cove re veg s, und bs or r bs or r dy pla ent etative	nts	ian Y n orey	•	cover nativ Disru Bank	surfa red m e veg ption s may red by try	ainly etatio evide be	n ent	•	cover of gra black & intr speci Vege disru Bare	asses/ berry roduc es tatior ption soil/c ped ve	/ mixt /shrut /, willo :ed	os, ow ous	•	cove & sh Disr stre vege high Graa graz Sign	ss hea	y gras n of nk n very vily : stock	5
Left bank: 4	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:7	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 5.5																				
3. Bank stability	•	Erosi failui abse	nt/mi of bai	ank nimal		•	Infre areas		, sma osion iled o	II	•	unsta 30-60 reach erosi High	0% of has a on erosio ntial c	bank areas	of	•	Mar 60-2	table ny eron LOO% c erosio	of ban	k
Left bank:13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Right bank:13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mean: 13					<u> </u>					<u> </u>		<u> </u>		<u> </u>	•		<u> </u>		<u> </u>	
4. Frequency of riffles	•	frequ Dista riffle strea	uent ince b s divio im wio	tively etwee ded by dth=5 habita	en / -7	•	riffle: Dista riffle:	rrenco s infre nce b s divic m wic	equen etwee led by	en /	•	run Botto provi habit Dista riffles	om co de so at nce b s divic	l riffle ntour me etwee ded by dth=1	en /	•	wat riffle Poo Dist riffle	erally er, sha es r habit ance b es divit am wi	allow tat betwee ded by	/
Score: 16	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
5. Channel alteration	•	chan abse Strea		redgir nimal th		•	chan Evide chan Rece chan	e char nel/di ence o nel/di nt nel/di oresen	redgir of past redgir redgir	ng t ng	•	exter Emba ing st prese banks 40-80	ges/d nsive ankme aructu ent on s 0% of nelize	i both reach	hor	•	gabi >80 read or d Inst	ks sho ion/ce % of st ch chai isrupt isrupt ream h red/at	ment tream nneliz ed nabita	ed
Score:19	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	_	1		1	I		1			I		I		I	i	I	1	1	1	I

Habitat parameter		Ca	atego	ory		На	bitat	para	mete	r		Ca	itego	ry		Ha	bitat	para	mete	er
Habitat parameter		0	ptim	al								0	ptim	al						
6. Sediment deposition	•	point	bars of bo ted b nent		nt	•	form from or fin 20-50 affec	ted t depo	most el, san iment botto	ly d : m	•	Some new (fine s old & 50-80 affec Sedin at ob const bend	gravel edime new 0% of ted nent o struct	l, sand ent of bars botto depos tions,	d or n m	• •	fine Incre deve >809 chan frequ Pool abse sedin	mater ased lopm 6 of b	bar ent ottom ost e to	
Score: 19	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
7. Velocity/depth regimes	•		nes pi /deep /shallo shallo	ow,		•	regin If fas	ity/de nes pr t/shal ng the	esent low is			2 of 4 veloc regim If fast slow/ missi	ity/de nes pr t/shal (shallo	esent low o ow ar	r e	•	velo regir	city/d ne	d by 1 epth ep/slo	
Score: 10	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
8. Abundance & diversity of habitat	•	varie debri mats Snag logs/ bank provi fish c	urable tebra iisatic ty of s, riff s/ sub unde s/cob des a over not b	e for te on & v wood les, rc omerg rcut	y oot ed ant	•	favou inver color Snags logs/ bank Fish c Mode of ha Can c	under s/cob	for te on rcut bles comn variet types. t of so	ed non sy	•	10-30 favou inver color Fish c 60-90 easily foot Wood or ma smot sedin	urable tebra iisatio cover 0% sul 7 mov dy del ay be hered	for te n patch bstrat ed by pris ra	y e	•	favo inver colo Fish abse Subs or la Stab lacki	urable rtebra nisatio cover nt trate cking le hat	ite on rare o unsta bitats limite	ble
Score:13	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
9. Periphyton	•	held Stabl	ent or stone e sub ces re	hand		•	visibl Stabl	hytor e on s e subs hytor uch	stones strate		•	Perip <20% availa	, cove	r of		•	& pr >20%	olific 6 cove	n obvi er of substra	
Score: 8	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TOTAL SCORE: 108	•			•													•			

Appendix B Fish surveys

Fish collection	on forn	n – Wa	adeable	strea	ms/	rivers														
Team members: Paul Franklin (NIW	/A)			GPS (d/s):	E	2728975	N6	400407	Site	e: Ma	ngakahika	a Stream					Date:	14/0	3/2014	Ļ
Mike Martin (NIWA Gareth van Assem				GPS (u/s):	E	2728895	N6	400360	Ν	lot fished		ed none lected		ed 10 sub- eaches		ed 5-9 eaches		d <5 sub [.] aches		FLAG for fished/not fished
Fish sample id:	Tota	l shock (min):	61	Fishir time:	ng	Start Finish	14:10 16:00	Sample distance	(m):	150	Wette (m):	ed width	AB	1.3 C 1.7 D			1.0 1.4	Н	2.2 1.4	l 2.4 J 1.5
Sampling gear:	Spotli	ght	EFM		Seir		ength (m) esh (mm)		Wa visi	iter bility:	Good	Avera	age	Poor	Water temp.		16.0	Cond (µS):	ductivit :	^y 203
EFM anode:	Big Small	EFM	volts (x100)): 3				se rate (Hz	or pps):	60	EFM p	oulse wid	th (ms)				ght (watt			
Species		А	В		-	D	E	ach tally F	G	Н			J	Total count	San cou		Length Min.	Max		FLAG
Banded Kokopu Shortfin Eel		1	2	4		3	3	1	3 3	6	6		2	26 30			64 70		55 50	
Longfin Eel		1	5	-)	1	2	5	1	2	2		3	8			163	82		
Common Bully		2	3	3	3	1	2	2		3	2		3	21			30	6	63	
Koura		3		-	1		1	2						8						
FLAG Commen	it								FL/	AG CO	mment									

Fish collection form	n – Wa	deable	streams	/rivers											
Team members: Paul Franklin (NIWA)			GPS (d/s):	∃ 1831974	N 5	803819	Site:	Waite	oa Stream U	/S			Date:	14/03/201	4
Mike Martin (NIWA) Gareth van Assema (NIWA))		GPS (u/s):	E 1831878	N 5	5803808	No	ot fished	Fished no collected		ned 10 sub- reaches	Fished 5-9 sub-reaches		l <5 sub- iches	FLAG for fished/not fished
	Il shock (min):	73	Fishing time:	Start Finish	10:15 12:15	Sample distance	(m): 1	50	Wetted wi (m):	idth <u>A</u> B	0.7 C 2.1 D	2.0 E 1.0 F		G 1.7 H 2.7	l 1.7 J 2.0
Sampling gear: Spotl	ight	EFM	Se		ength (m) esh (mm)		Wate visib		Good A	verage	Poor	Water temp. (°C):	14.2	Conductiv (µS):	^{/ity} 129
EFM anode: Big Small	EFM v	olts (x100)	: 3		EFM puls	se rate (Hz	or pps):	60	EFM pulse	e width (ms): 2	Spo	tlight (watte	s):	
Species	А	В	С	D	Sub-rea	ach tally F	G	н		J	Total count	Sample count	Length Min.	(mm) Max.	FLAG
Shortfin eel	9	16	15	15	8	15	3	11	9	13	114		91	395	
Cran's bully	10	25	28	13	7	6	2	6	9	27	133		20	85	
Longfin eel	2				1		2	1			6		275	880	
Koura	1	7	7	5		10	10	4	10	13	67				
FLAG Comment			<u> </u>				FLA	G Com	ment					1	
F1 Final 5 m of section	J not fished	because of	f deep pool												

Fish colle	ection	n forn	n – Wa	deable	strean	ns/rivers											
Team membe Joshua Smith					GPS (d/s):	E 1836783	s N	5809932	Site	: Man	gapapa Stre	eam			Date:	11/03/20)14
Rimutere Wha Kathryn Juliar			-Stow		GPS (u/s):	E 1836750	N	5809802	No	ot fished	Fished r collect		ished 10 sub- reaches	Fished 5-9 sub-reache		<5 sub- ches	FLAG for fished/not fished
Fish sample id:			l shock (min):	75	Fishing time:	Finish	13:10 15:20	Sample distance	(m):	50	Wetted v (m):	vidth <u>A</u> B		D 4.5 F		G 4.6 H 3.2	J 2.9
Sampling gea		Spotli	ght	EFM	:		_ength (m) Mesh (mm)		Wat visib	er vility:	Good	Average	Poor	Water temp. (°C):	18.2	Conduct (µS):	^{ivity} 120
EFM anode:		Big Small	EFM	volts (x100): 3			lse rate (Hz	or pps):	60	EFM puls	e width (r	,		otlight (watte		_
Species			А	В	С	D	E	each tally F	G	н		J	Total count	Sample count	Length Min.	Max.	FLAG
Cran's bully			5	13	21	13	12	9	8	10	3	_	94		15	65	
Shortfin eel				4	6	4	4	1	3	4	-	-	26		90	610	
Longfin eel				1	8			2	2	1	1	1	3		500	700	
Koura				5	8	8	-	2	2	1	2	3	31				
L																	
					_						_	_					
					_					+							
FLAG Con	nment								L FLA	G Com	nment			<u> </u>		1	
									I LA		mont						

Fish o	collecti	on forn	n – Wa	deable	stream	s/rivers											
Team m Kathryn					GPS (d/s):	E 1817745	N	5815748	Site:	Wait	akaruru Str	eam			Date:	12/03/20)14
Joshua S Rimu Wl					GPS (u/s):	E 1817903	N	5815670	No	ot fished	Fished r collect		Fished 10 sub- reaches	Fished 5-9 sub-reaches		d <5 sub- aches	FLAG for fished/not fished
Fish sample i	id:		l shock (min):	53	Fishing time:	Start Finish	08:30 11:25	Sample distance	(m):	50	Wetted v (m):	vidth /		C 1.7 E D 2.2 F		G 1.9 H 2.1	J 2.4
Samplin	g gear:	Spotli	ght	EFM	S		ength (m) lesh (mm)		Wate visib		Good	Average	Poor	Water temp. (°C):	15.9	Conduct (µS):	^{ivity} 131
EFM and	ode: -	Big Small	EFM \	volts (x100)): 3			lse rate (Hz	or pps):	60	EFM puls	e width (-	otlight (watt		
Species			А	В	C	D	Sub-re	each tally F	G	Н		J	Total count	Sample count	Length Min.	(mm) Max.	FLAG
Shortfin e	eel		7	7	6	8	8	10	10	15	7	10	88		90	700	
Longfin e	el		1			4	1	1	2		1		10		90	740	
Cran's bu	ılly		4		14	10	25	4	22	10	13	2	104		21	57	
Torrentfi	sh						1						1		95	95	
Elver									7	2	2	1	12				
Koura				1	5	2	1	3	11	8	1	6	38				
																	<u> </u>
	0																<u> </u>
FLAG F1	Commer Difficult t		a R duo to r	nacrophyte	covor				FLA	G Con	nment						
11			i b uue to	Παστομηγιά	CUVEI												

FISN COllec	tion for	n – Wa	deable	stream	s/rivers													
Team members Joshua Smith	:			GPS (d/s):	E 1831211	N	5815768	Site:	Piak	onui Strean	n U/S					Date:	11/03/20)14
Aslan Wright-Sto Rimu Wharakura		stley		GPS (u/s):	E 1831210	N	5809980	Nc	ot fished	Fished i collect			10 sub- ches	Fished sub-read		Fished - reac		FLAG for fished/not fished
Fish sample id:		l shock (min):	NA	Fishing time:	Start Finish	15:30 NA	Sample distance	(m):	50	Wetted (m):			3.5 C 1.8 D				G 2.4 H 2.2	J 2.3
Sampling gear:	Spotli	ght	EFM	S		ength (m) esh (mm)		Wate visib		Good	Average		Poor	Water temp. (°C	C): 1	3.1	Conduct (µS):	^{ivity} 89
EFM anode:	Big Small	EFM	olts (x100)	: 3		EFM pul	se rate (Hz	or pps):	60	EFM puls	se width	ms):	2	s	Spotligh	t (watts)):	
Species		А	В	С	D	Sub-re	ach tally F	G	н	1	J		Total count	Sample count		.ength (i /lin.	mm) Max.	FLAG
Longfin eel		1	1		2								4			400	650	
Common bully					1		1	4		3	13		22			30	87	
Shortfin eel		1					2	1		1	2		7			105	185	
Banded kokopu											4		4			100	205	
Koura		29	12	18	20	29	15	14	14	7	29		200					
FLAG Comm	ent							FLA	G Con	nment								

Fish c	ollectio	on forn	n – Wa	deable	stream	s/rivers											
Team me Paul Fra					GPS (d/s):	E 1841027	Ν	5867879	Site:	Paia	karahi Strea	m D/S			Date:	13/03/20	14
Kathryn Rimu Wł					GPS (u/s):	E 1841098	Ν	5867799	No	ot fished	Fished no collecte		hed 10 sub- reaches	Fished 5-9 sub-reaches		<5 sub- ches	FLAG for fished/not fished
Fish sample i	d:		l shock (min):	56	Fishing time:	Start Finish	09:55 11:50	Sample distance	(m):	50	Wetted w (m):	ridth <u>A</u> B	2.4 C 3.4 D	2.8 F		G 3.2 H 2.2	J 3.5
Sampling	g gear:	Spotli	ght	EFM	S		ength (m) lesh (mm)		Wate visib		Good A	Average	Poor	Water temp. (°C):	15.9	Conducti (µS):	vity 114
EFM and	ode:	Big Small	EFM	volts (x100)	: 4		-	lse rate (Hz	or pps):	60	EFM puls	e width (m			ight (watts		_
Species			A	В	С	D	E	each tally F	G	н	1	J	Total count	Sample count	Length (Min.	Max.	FLAG
Cran's bu			8	2	4	6	5	4	9	9	7	10	64		20	70	
Shortfin e					1		1		3		1	1	7		86	190	
Longfin e			1		4		1		2				8		98	1002	
Rainbow											2	1	3		150	156	
Banded k	okopu								1				1		158	158	
Inanga								1					1		90	90	
Torrentfis	sh		1				1		2			1	5		55	105	
Koura				2	6	5	2	1	5	2	1	8	32				
	0	4															
FLAG	Commen	It							FLA	GCorr	nment						

Fish c	collection	on forn	n – Wa	deable	strean	ns/rivers											
Team m Joshua S					GPS (d/s):	E 184839	3 N	5823235	Site	: Kare	engorengo S	tream			Date:	10/03/20	14
Kathryn Rimu W	Julian harakura				GPS (u/s):	E 184842	3 N	5823099	No	ot fished	Fished n collecte		ned 10 sub- reaches	Fished 5-9 sub-reaches		<5 sub- ches	FLAG for fished/not fished
Fish sample i	id:		l shock (min):	21	Fishing time:	Finish		Sample distance	(m):	50	Wetted w (m):	vidth <u>A</u> B	2.1 C 2.0 D	2.0 F		G 2.8 H 2.4	l 2.9 J 2.7
Samplin	g gear:	Spotli	ght	EFM	:		Length (m) Mesh (mm)		Wate visib		Good /	Average	Poor	Water temp. (°C):	13.9	Conducti (µS):	vity 131
EFM and	ode:	Big Small	EFM	volts (x100)	: 3			lse rate (Hz	or pps):	60	EFM puls	e width (ms	s): 2	Spot	ight (watts		
Species			А	В	C	D	Sub-re	each tally F	G	н	1	J	Total count	Sample count	Length (Min.	(mm) Max.	FLAG
Shortfin e	eel		13	14	4	2							33		100	750	
Common	ı bully		1	1	1								3		45	74	
Smelt			2										2		70	95	
Brown tr	out		1										1		130	130	
Koura			5	4									9				
																	-
FLAG	Commen							1	FLA	G Con	nment			1	1	1	
F1			over in rea	ch D-J maki	ng fishing	impossible											
F2	Shrimp at	oundant															

	Date: 10/03/				ream	airere	Site:	5803870	N 5	1831968	GPS (d/s):				nembers:	
	Fished <5 sub- reaches	Fished 5-9 sub-reaches	ed 10 sub- eaches		shed none collected		Not fi	5803808	N 5	E 1831878	000					Joshua Kathryn Rimu W
3.0 J 4.7	6.9 H 3	6.7 E 8.2 F	5.2 C 3.7 D	A B	etted width	V (I		Sample distance (m	11:20 15:22	Start Finish	Fishing ime:		shock (min):	Total time (id:	Fish sample
Conductivity 63 (µS):	18.2 Condu (µS):	Water temp. (°C):	Poor	age	Avera	Goo	Water visibilit		ength (m) esh (mm)	ne <u>Le</u> M	Se	EFM	ght	Spotlig	ng gear:	Samplir
	ght (watts):		: 2	lth (ms)	/I pulse widt	E	os): 6	se rate (Hz or p	EFM puls		4	lts (x100):	EFM vo	Big Small	node:	EFM ar
m) Max. FLAG	Length (mm) Min. Max.		Total count	J	1	I	G	ach tally F	Sub-rea	D	С	В	А		S	Species
580	75 580		240	18	21	j	23	18	13	16	48	25	45		eel	Shortfin
76	20 76		942	83	88)	130	85	93	130	133	59	62		n bully	Commo
125	125 125		1									1			rout	Brown t
930	880 930		2		1					1					eel	Longfin
90	75 90		2	2											fish	Torrentf
			58	4	4		1		10	2	12	13	6			Koura
						omme	FLAG								Commen	FLAG
													of reach	n upstream	Smelt see	F1
						omme	FLAG						of reach			

Fish colle	ection	forn	n – Wa	ideable	stream	s/rivers											
Team member Joshua Smith		Wharak	ura		GPS (d/s):	E 1852566	N	5818150	Site:	Wait	eariki Strear	n			Date:	11/03/20	14
Kerry Costley Aslan Wright-					GPS (u/s):	E 1852697	N	5818212	No	ot fished	Fished n collecte		shed 10 sub- reaches	Fished 5-9 sub-reaches		<5 sub- ches	FLAG for fished/not fished
Fish sample id:			shock (min):	82	Fishing time:	Start Finish	08:10 NA	Sample distance	(m):	50	Wetted w (m):	ridth <u>A</u> B	4.5 C 6.5 D	3.7 F		G 8.4 H 6.5	l 4.3 J 6.4
Sampling gea		Spotlig	ght	EFM	S		ength (m) esh (mm)		Wate visib		Good /	Average	Poor	Water temp. (°C):	13.6	Conducti (µS):	vity 45
EFM anode:		Big Small	EFM	volts (x100)	: 4		EFM pul	se rate (Hz	or pps):	60	EFM puls	e width (m	s): 2	Spot	light (watts	s):	
Species			А	В	С	D	Sub-re	ach tally F	G	н		J	Total count	Sample count	Length Min.	(mm) Max.	FLAG
Shortfin eel			1	2		5	4		4	3		1	20		90	410	
Banded kokopu	u		2	2			1			1	1		7		120	205	
Cran's bully			4	2	9	8	10	6	3	2	1	3	48		15	90	
Longfin eel				1			1	1		3	4		10		350	850	
Brown trout						1	2	1			1	1	6		117	250	
Torrentfish									1				1		100	100	
Koura			5	8	7	9	9	6	10	17	8	10	89				
																	<u> </u>
FLAG Con	nment								FLA	G Com	nment						

Fish collect	tion form	n – Wa	deable	stream	s/rivers											
Team members: Paul Franklin				GPS (d/s):	E 1845480	N	5849662	Site	Wait	awheta Rive	er			Date:	13/03/20	14
Kathryn Julian + student helper				GPS (u/s):	E 1845388	N	5849622	No	ot fished	Fished r collect		ished 10 sub- reaches	Fished 5-9 sub-reaches		<5 sub- ches	FLAG for fished/not fished
Fish sample id:		l shock (min):	44	Fishing time:	Start Finish	16:45 18:05	Sample distance	(m):	50	Wetted v (m):	vidth A B) 3.2 F		G 2.8 H 2.7	J 4.9
Sampling gear:	Spotli	ight	EFM	S		ength (m) lesh (mm)		Wate visib		Good	Average	Poor	Water temp. (°C):	17.1	Conduct (µS):	^{ivity} 73
EFM anode:	Big Small	EFM v	olts (x100)	: 4			lse rate (Hz o	or pps):	60	EFM puls	e width (r			ight (watts		
Species		А	В	С	D	E	each tally F	G	н		J	Total count	Sample count	Length Min.	Max.	FLAG
Longfin eel		5		3		2	1	3	1	1	1	17		250	750	
Common bully		7	8	11	14	9	4	3	4	1	3	64		30	85	
Shortfin eel		1	1	1	12	2	1	3	2	1		25		115	350	
Banded kokopu		1										1		220	220	
Brown trout			1						1	1		3		145	150	
Koura								1	7	2		10				
																+
FLAG Comm	ent	1			1			FLA	G Com	nment	1		- I	1		

Appendix C Macrophytes and periphyton

Periphyton Assessmer	nt						
Stream: Mangakahika Strea	m	Date: 14/	03/2014				
Sample Number: 1		Located r	number:				
Thickness category	Colour category	A	в	с	D	E	Mean cover
Thin (<0.5mm) Mat/Film	NA	5	10	10	5	15	9
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0
Shint theky	Light brown (% cover)						0
	Black/dark brown (% cover)						0
Thick (>3mm) mat/film	Green/light brown (% cover)						0
	Black/dark brown (% cover)						0
Filaments short (<2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Filaments long (>2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Submerged bryophytes	NA						0
Iron Bacteria growths	NA						0

Macrophyte	recording she	et								
Stream: Manga	kahika Stream		Located nu	imber:		Sample Number: 1			Date: 14/03/2	2014
						Vegetation co	ver (% w	etted area)		
	Wetted width	Channel width			Sub	merged plants				Emergent plants
Transect	(m)	(m)	Total	Surface-reaching Below surface Total submerged Sub- Sub-						
			cover	Total submerged	Total submerged Sub- Species Su		Sub- total	Species	Total emergent	Species
1	1.3	1.8	0						0	
2	1.0	1.2	0						0	
3	1.0	1.3	0						0	
4	2.2	2.2	0						0	
5	2.4	2.4	0						0	

Periphyton Assessmer	nt						
Stream: Waitoa Stream U/S		Date: 14	/03/2014				
Sample Number:		Located r	number: 2				
Thickness category	Colour category	A	В	с	D	E	Mean cover
Thin (<0.5mm) Mat/Film	NA	30	10	15	40	20	23
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0
Shin they	Light brown (% cover)						0
	Black/dark brown (% cover)						0
Thick (>3mm) mat/film	Green/light brown (% cover)						0
	Black/dark brown (% cover)						0
Filaments short (<2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Filaments long (>2cm)	Green (% cover)			5		80	17
	Brown/Reddish (% cover)						0
Submerged bryophytes	NA						0
Iron Bacteria growths	NA						0

Macrophyte	recording she	et								
Stream: Waitoa	a Stream U/S		Located nu	mber: 2		Sample Number:			Date: 14/03/2	2014
						Vegetation co	over (% w	etted area)		
	Wetted width	Channel width		cover Total submerged Sub- Species Sub- Species						Emergent plants
Transect	(m)	(m)	Total	Total submerged Sub				ow surface		
			cover	Total submerged		Species		Species	Total emergent	Species
1	0.7	1.45	65	0					65	Na
2	1.0	1.3	35	0					35	Na
3	2.7	3.2	90	0					90	Na
4	1.7	2.5	20	0					20	Na
5	2.0	2.1	70	0					70	Na

Periphyton Assessmer	nt						
Stream: Mangapapa Stream	1	Date: 11/	/03/2014				
Sample Number:		Located r	number: 3				
Thickness category	Colour category	A	В	с	D	E	Mean cover
Thin (<0.5mm) Mat/Film	NA						0
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0
Shin thek)	Light brown (% cover)	30		20	30	20	20
	Black/dark brown (% cover)						0
Thick (>3mm) mat/film	Green/light brown (% cover)		20				4
	Black/dark brown (% cover)						0
Filaments short (<2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Filaments long (>2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Submerged bryophytes	NA	10	5	10	20	5	10
Iron Bacteria growths	NA						0

Macrophyte	recording she	et								
Stream: Manga	papa Stream		Located nu	imber: 3		Sample Number:			Date: 11/03/	/2014
						Vegetation co	over (% w	etted area)		
	Wetted width	Channel width			Sub	omerged plants			ļ	Emergent plants
Transect	(m)	(m)	Total	Surface-reaching Below surface Total submerged Sub- Sub- Sub- Species Species				ow surface		
			cover	Total submerged Sub		Species	Total emergent	Species		
1	4.3	6.7	0	0					0	
2	4.5	7.6	0	0					0	
3	5.0	8.1	5	5			5	Lm, Nh	0	
4	3.6	4.7	2	2			2	Nh	0	
5	4.6	4.9	1	1			1	Lm	0	

Periphyton Assessme	nt						
Stream: Waitakaruru Strear	n	Date: 12/	/03/2014				
Sample Number:		Located r	number: 4				
Thickness category	Colour category	A	в	с	D	E	Mean cover
Thin (<0.5mm) Mat/Film	NA						0
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0
Sinn theky	Light brown (% cover)						0
	Black/dark brown (% cover)						0
Thick (>3mm) mat/film	Green/light brown (% cover)	10		15	5		6
	Black/dark brown (% cover)						0
Filaments short (<2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Filaments long (>2cm)	Green (% cover)	40	50	15	20	50	35
	Brown/Reddish (% cover)						0
Submerged bryophytes	NA						0
Iron Bacteria growths	NA						0

Macrophyte	recording she	et								
Stream: Waitak	aruru Stream		Located nu	mber: 4		Sample Number:			Date: 12/03/2	2014
						Vegetation co	over (% w	etted area)		
	Wetted width	Channel width							ļ	Emergent plants
Transect	(m)	(m)	Total	Total submerged Sub- Species Sub-						
			cover	Total submerged		Species	Sub- total	Species	Total emergent	Species
1	2.1	4.0	0	0					0	
2	1.5	2.9	60	60			60	Lm, Pk	0	
3	1.7	3.8	10	10			10	Lm, Pk	0	
4	2.2	4.0	5	5			5	Lm, Pk	0	
5	2.4	4.4	0	0					0	

Periphyton Assessmer	nt						
Stream: Piakonui Stream		Date: 11/	03/2014				
Sample Number:		Located r	number: 5				
Thickness category	Colour category	A	В	С	D	E	Mean cover
Thin (<0.5mm) Mat/Film	NA						0
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0
Shint theky	Light brown (% cover)						0
	Black/dark brown (% cover)						0
Thick (>3mm) mat/film	Green/light brown (% cover)						0
	Black/dark brown (% cover)						0
Filaments short (<2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Filaments long (>2cm)	Green (% cover)						0
	Brown/Reddish (% cover)						0
Submerged bryophytes	NA	20	30	10	35	15	22
Iron Bacteria growths	NA						0

Macrophyte	Macrophyte recording sheet											
Stream: Piakon	ui Stream		Located nu	imber: 5		Sample Number:			Date: 11/03/2014			
				Vegetation cover (% wetted area)								
	Wetted width	Channel width			Sub	merged plants				Emergent plants		
Transect	(m)	(m)	Total		Su	rface-reaching	Bel	ow surface				
			cover	Total submerged	Sub- total	Species	Sub- total	Species	Total emergent	Species		
1	3.5	6.0	0	0					0			
2	2.8	6.0	0	0					0			
3	3.0	7.4	0	0					0			
4	2.4	6.0	0	0					0			
5	3.0	7.0	0	0					0			

Periphyton Assessme	nt									
Stream: Paiakarahi Stream	D/S	Date: 13/03/2014								
Sample Number:		Located number: 6								
Thickness category	Colour category	A	В	с	D	E	Mean cover			
Thin (<0.5mm) Mat/Film	NA						0			
Medium mat/film (0.5-	Green (% cover)						0			
3mm thick)	Light brown (% cover)	90	80	45	20	70	61			
	Black/dark brown (% cover)						0			
Thick (>3mm) mat/film	Green/light brown (% cover)						0			
	Black/dark brown (% cover)						0			
Filaments short (<2cm)	Green (% cover)				5		1			
	Brown/Reddish (% cover)						0			
Filaments long (>2cm)	Green (% cover)						0			
	Brown/Reddish (% cover)						0			
Submerged bryophytes	NA						0			
Iron Bacteria growths	NA						0			

Macrophyte	recording she	et								
Stream: Paiaka	rahi Stream D/S		Located number: 6 Sample Number:				Date: 13/03/	2014		
	Wetted width	Channel width			Sub	omerged plants	-			Emergent plants
Transect	(m)	(m)	Total		Su	rface-reaching	Bel	ow surface		
			cover	Total submerged	Sub- total	Species	Sub- total	Species	Total emergent	Species
1	2.8	6.4	0	0					0	
2	3.1	5.8	0	0					0	
3	2.2	6.1	0	0					0	
4	3.6	5.3	0	0					0	
5	4.8	7.7	0	0					0	

Periphyton Assessmen	nt								
Stream: Karengorengo Stre	am	Date: 10/03/2014							
Sample Number:		Located number: 7							
Thickness category	Colour category	A	В	с	D	E	Mean cover		
Thin (<0.5mm) Mat/Film	NA						0		
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0		
	Light brown (% cover)						0		
	Black/dark brown (% cover)						0		
Thick (>3mm) mat/film	Green/light brown (% cover)						0		
	Black/dark brown (% cover)						0		
Filaments short (<2cm)	Green (% cover)						0		
	Brown/Reddish (% cover)						0		
Filaments long (>2cm)	Green (% cover)						0		
	Brown/Reddish (% cover)						0		
Submerged bryophytes	NA						0		
Iron Bacteria growths	NA						0		

Macrophyte	recording she	et										
Stream: Kareng	orengo Stream		Located number: 7			Sample Number:			Date: 10/03/2014			
				Vegetation cover (% wetted area)								
Wetted width	Channel width			Sub	merged plants				Emergent plants			
Transect	(m)	(m)	Total		Su	rface-reaching	Bel	ow surface				
			cover	Total submerged	Sub- total	Species	Sub- total	Species	Total emergent	Species		
1	2.2	3.5	60	0					60	An, Ph		
2	2.3	4.0	100	0					100	An, Ph		
3	2.4	4.0	90	0					90	An		
4	2.3	4.0	100	0					100	An		
5	2.9	4.5	100	0					100	An		

Periphyton Assessmer	nt									
Stream: Wairere Stream		Date: 10/03/2014								
Sample Number:		Located number: 8								
Thickness category	Colour category	A	в	с	D	E	Mean cover			
Thin (<0.5mm) Mat/Film	NA	60	70				26			
Medium mat/film (0.5-	Green (% cover)			50			10			
3mm thick)	Light brown (% cover)						0			
	Black/dark brown (% cover)					30	6			
Thick (>3mm) mat/film	Green/light brown (% cover)						0			
	Black/dark brown (% cover)						0			
Filaments short (<2cm)	Green (% cover)						0			
	Brown/Reddish (% cover)						0			
Filaments long (>2cm)	Green (% cover)				40	50	18			
	Brown/Reddish (% cover)				10		2			
Submerged bryophytes	NA						0			
Iron Bacteria growths	NA						0			

Macrophyte	recording she	et										
Stream: Wairer	e Stream		Located number: 8			Sample Number:			Date: 10/03/2	2014		
				Vegetation cover (% wetted area)								
	Wetted width	Channel width			Sub	omerged plants			ļ	Emergent plants		
Transect	(m)	(m)	Total		Su	rface-reaching	Bel	ow surface				
			cover	Total submerged	Sub- total	Species	Sub- total	Species	Total emergent	Species		
1	4.5	5.6	2	0					2	Lp		
2	7.2	8.8	0	0					0			
3	5.8	5.2	0	0					0			
4	4.7	7.15	0	0					0			
5	5.7	9.0	0	0					0			

Periphyton Assessmer	nt									
Stream: Waiteariki Stream		Date: 11/03/2014								
Sample Number:		Located number: 9								
Thickness category	Colour category	A	В	с	D	E	Mean cover			
Thin (<0.5mm) Mat/Film	NA						0			
Medium mat/film (0.5-	Green (% cover)		5	5	3		2.6			
3mm thick)	Light brown (% cover)						0			
	Black/dark brown (% cover)						0			
Thick (>3mm) mat/film	Green/light brown (% cover)					10	2			
	Black/dark brown (% cover)						0			
Filaments short (<2cm)	Green (% cover)						0			
	Brown/Reddish (% cover)						0			
Filaments long (>2cm)	Green (% cover)						0			
	Brown/Reddish (% cover)						0			
Submerged bryophytes	NA	10	2	2	2	10	5.2			
Iron Bacteria growths	NA						0			

Macrophyte	recording she	et										
Stream: Waitea	ariki Stream		Located number: 9 Sample Number:					Date: 11/03/2	2014			
				Vegetation cover (% wetted area)								
Wetted width	Wetted width	Channel width			Sub	omerged plants				Emergent plants		
Transect	(m)	(m)	Total		Su	rface-reaching	Bel	ow surface				
			cover	Total submerged	Sub- total	Species	Sub- total	Species	Total emergent	Species		
1	4.5	25.0	0	0					0			
2	6.5	15.0	0	0					0			
3	5.8	15.0	0	0					0			
4	3.7	18.0	0	0					0			
5	4.6	20.0	0	0					0			

Periphyton Assessmer	nt								
Stream: Waitawheta River		Date: 13/03/2014							
Sample Number:		Located number: 10							
Thickness category	Colour category	A	В	с	D	E	Mean cover		
Thin (<0.5mm) Mat/Film	NA		5		1		1.2		
Medium mat/film (0.5- 3mm thick)	Green (% cover)						0		
3mm thick)	Light brown (% cover)						0		
	Black/dark brown (% cover)						0		
Thick (>3mm) mat/film	Green/light brown (% cover)						0		
	Black/dark brown (% cover)						0		
Filaments short (<2cm)	Green (% cover)						0		
	Brown/Reddish (% cover)						0		
Filaments long (>2cm)	Green (% cover)	20		30		0.5	10.1		
	Brown/Reddish (% cover)						0		
Submerged bryophytes	NA						0		
Iron Bacteria growths	NA						0		

Macrophyte	recording she	et								
Stream: Waitaw	vheta River		Located nu	mber : 10		Sample Number:			Date: 13/03/2	2014
	Wetted width	Channel width			Sub	merged plants				Emergent plants
Transect	(m)	(m)	Total		Su	rface-reaching	Bel	ow surface		
			cover	Total submerged	Sub- total	Species	Sub- total	Species	Total emergent	Species
1	4.6	5.3	0	0					0	
2	4.2	4.3	0	0					0	
3	2.6	7.2	0	0					0	
4	3.3	3.3	0	0					0	
5	2.7	5.2	0	0					0	

Species		Sites									
	1	2	3	4	5	6	7	8	9	10	
Archichauliodes diversus	68	1		4	18	28			24	4	
Antipodochlora braueri								1		1	
Xanthocnemis zealandica			1				16	12			
Ameletopsis perscitus					2				4		
Austroclima sp.		12			44	4	48		24		
Austroclima sepia		1	1		18	8			24	4	
Deleatidium spp.	8	60								12	
Coloburiscus humeralis			1		38	8			128	12	
Mauiulus luma									8	12	
Neozephlebia scita	2				14		16				
Nesameletus sp.					1				52	20	
Rallidens Mcfarlanei										4	
Zephlebia spp.	2	4			80		96				
Zephlebia borealis	2	1								4	
Zephlebia dentata	2			20	26		24		4		
Zephlebia inconspicua				1							
Zephlebia spetabilis	1										
Zephlebia versicolor					10		16	36	1	4	
Acroperla sp.						4					
Austroperla cryene					2					1	
Megaloptoperla grandis					2						
Zelandoperla decorata									8	4	
Aoteapsyche catherinae			1						4		
Aoteapsyche colonica	6	4		28		20			16		
Aoteapsyche tepoka			1								
Aoteapsyche spp.		4	2	8		44			48	12	
Beraeoptera roria						60					
Confluens olingoides									8		
Costachorema spp.									1		
Helicopsyche spp.					2					1	
Hudsonema alienum	8							4			
Hudsonema amabilis		4		36				36	8	4	
Hydrobiosella mixa					1						
Hydrobiosis spp.	2	1		8	1	1		1	4	8	
Hydrobiosis (pupa)										4	
Hydrobiosis copis		1							1		

Species	Sites										
	1	2	3	4	5	6	7	8	9	10	
Hydrobiosis parumbripennis							8				
Neurochorema spp.	6						16				
Neurochorema confusum						16		4		1	
Neurochorema armstrongi									4		
Ocetis unicolor							1				
Olinga feredayi	10	8									
Orthopsyche spp.					24				4		
Orthopsyche fimbriata					4				4		
Oxyethira albiceps		1				72	8	100	24	28	
Oxythira pupa						4					
Paroxythira sp.			1					20	4	4	
Polyplectropus sp.	6						1	1	4	4	
Psilochorema mimicum										1	
Pycnocentria evecta	26	12	8		2			20		12	
Pycnocentrodes sp.	112	592		248		80		4	72	4	
Triplectides obsoletus	6		1		1		104	48	12	20	
Zelolessia cheira					2				24		
Aphrophila neozelandica						4			4		
Austrosimulium sp.		1	2	12	2	32	48	12	52	1	
Corynoneura sp.							8	4			
Cricotopus spp.						44		48	44	8	
Hexatomini sp.							1				
Kaniwhaniwhanus	6				2				4		
Lobodiamesinae										1	
Tanypodinae =Macropelopiini sp.							1	52	4	8	
Maoridiamesa sp.						4					
Muscidae			1								
Naonella forsythi				4		24		36		12	
Nothodixa sp.					2						
Orthocladinidae sp.	24				6			4			
Paradixa sp.	4						96	20			
Polypedilum spp.	6				4		1				
Tabanidae	10				1	1					
Tanytarsus spp.	8					56		44	25	44	
Tanyderidae							1				
Elmidae (larvae)	6	4		352	10	84	8	48	12	28	
Hydraenidae (A)					1	4					
Hydrophilidae (A)					1						

Species					Si	tes				
	1	2	3	4	5	6	7	8	9	10
Ptilodactylidae (larvae)					2					
Scirtidae					2					
Latia neritoides				1		1			8	60
<i>Lymnaea</i> sp.		1			2					
Physa sp.				1			8			
Potamopyrgus antipodarum	12	296	788	184	8	176	928	360	28	484
Oligochatea									4	
Naididae	2					4		12	4	
Plathylminthes	2			1					1	
Leach	2			1						
Ostracoda	26						24			
Paracalliope fluviatus				8			40	8		
Paranephropus planiforins					1					