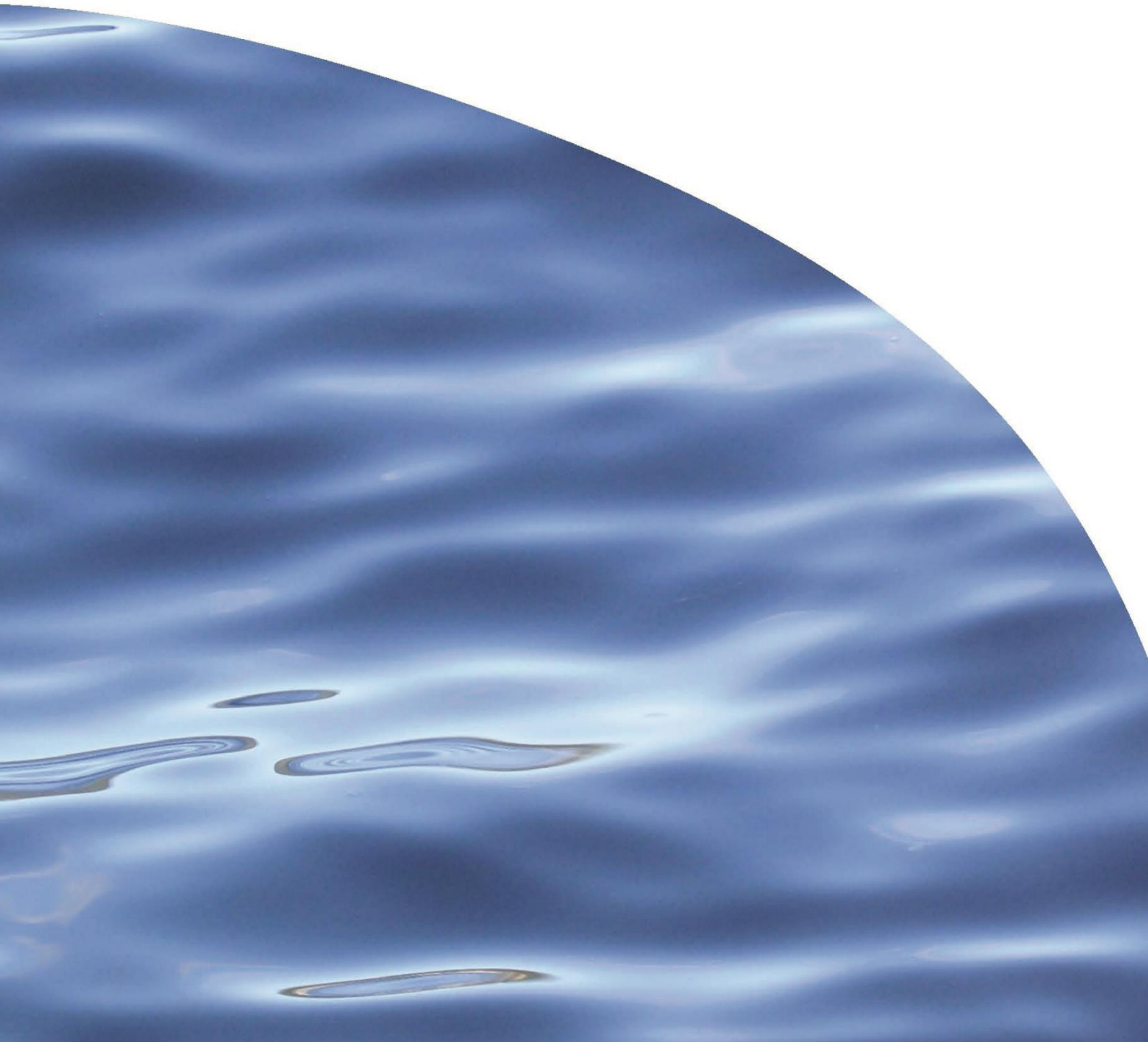
CAWTHRON
The power of science®

REPORT NO. 3023

METHODS FOR WAITUNA CREEK FISH AND HABITAT MONITORING IN ASSOCIATION WITH BANK RECONSTRUCTION AND POTENTIAL HABITAT REHABILITATION (2017)



METHODS FOR WAITUNA CREEK FISH AND HABITAT MONITORING IN ASSOCIATION WITH BANK RECONSTRUCTION AND POTENTIAL HABITAT REHABILITATION (2017)

ROBIN HOLMES

Department of Conservation, Southland

CAWTHRON INSTITUTE
98 Halifax Street East, Nelson 7010 | Private Bag 2, Nelson 7042 | New Zealand
Ph. +64 3 548 2319 | Fax. +64 3 546 9464
www.cawthron.org.nz

REVIEWED BY:
Karen Shearer

APPROVED FOR RELEASE BY:
Roger Young

ISSUE DATE: 29 May 2017

RECOMMENDED CITATION: Holmes R 2017. Methods for Waituna Creek fish and habitat monitoring in association with bank reconstruction and potential habitat rehabilitation (2017). Prepared for Department of Conservation Southland. Cawthron Report No. 3023. 8 p. plus appendices.

1. INTRODUCTION

1.1. Background

Fine sediment loading from eroding banks in the intensively-farmed Waituna Creek catchment is threatening biodiversity values in the downstream Waituna Lagoon (Robertson et al. 2011). In order to reduce the amount of stream-bank derived sediments (and associated contaminants) entering Waituna Lagoon, Environment Southland (ES) have undertaken extensive bank reconstruction works (bank reshaping) in Waituna Creek. The bank reshaping involved scraping the stream banks from the water's edge to a 1 in 2 slope along approximately 10 kilometres of stream throughout the mid-lower catchment (Figure 1). The work was initiated during January 2014 and was completed in summer 2016.

Figure 1. Bank re-shaping in a reach of the lower Waituna Creek (March 2014)

The Department of Conservation (DOC) has been investigating the feasibility of improving Waituna Creek habitat through riparian planting and increasing structural complexity along selected reaches of DOC marginal strip land (where bank reshaping has occurred). The Department of Conservation contacted the Cawthron Institute to initiate a monitoring programme in 2014 to assess the effects of potential rehabilitation interventions on stream habitat and biota.

The monitoring programme was set up using a Before-After-Control-Impact (BACI) study design. To date there have been four annual stream habitat monitoring occasions since the project began—all pre-rehabilitation.

The purpose of this report is to document the methods of the most recent Waituna Creek habitat and fish population surveys undertaken on 27–31 March 2017. This is to ensure that future monitoring surveys are repeated in a standardised manner. Results and data interpretation are outside the work scope for this report although some brief observations are presented where appropriate.

2. METHODS AND SELECTED RESULTS

2.1.1. Study sites

In 2014, three 40 m long 'impact' sites were selected within a one kilometre segment of creek upstream of White Pine Road (sites 1–3 in Figure 2). These reaches were selected as representative of habitat within the wider stream segment. They were also selected based on their likelihood to be located within areas where rehabilitation actions will be undertaken. Three 40 m long, upstream control sites were located on the Ballantine's property within a small section of QE2 covenanted bush (sites 4–8). The stream channel around the control sites had not been modified for at least ten years prior to 2014.

The impact and control sites have been sampled annually during March from 2014 to 2017. During the current monitoring round (2017), five additional monitoring sites were added to the study design (11 sites in total). Three impact sites (sites -1, 0 and 0.5) were added within a 1.5 kilometre stream-segment below the existing impact sites. In addition, two more control sites were added upstream of the existing control sites (sites 7 and 8) (Figure 2, Table 1).

All sampling was undertaken during base-flows. Flows[1] ranged from 0.14–0.12 m^3/s during sampling.

[1] recorded from the Environment Southland Waituna Creek gauging site at Marshals Road.

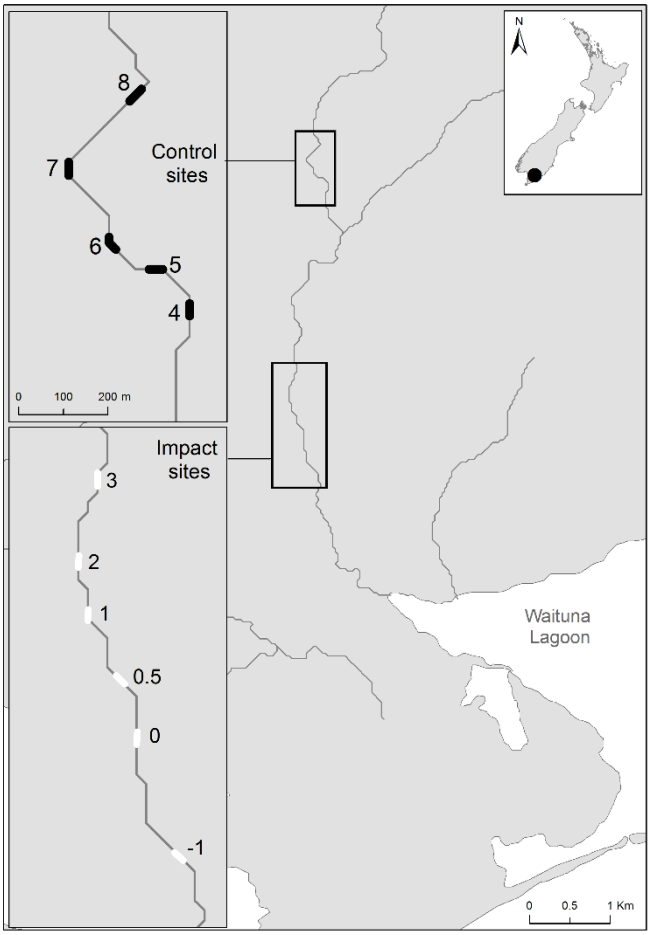


Figure 2. Waituna Creek showing the locations of the impact and control sites

Table 1. New Zealand Map Grid GPS coordinates for the impact and control sites. GPS positions mark the true-right downstream corner of each 40 m study reach. Sites marked with an asterisk have not undergone bank reshaping but are termed 'impact' because they may be locations for stream rehabilitation actions in the future.

Site	Site type	Easting	Northing
-1	Impact*	2167686	5397904
0	Impact*	2167566	5398271
0.5	Impact	2167534	5398477
1	Impact	2167415	5398659
2	Impact	2167363	5398816
3	Impact	2167412	5399096
4	Control	2167854	5401437
5	Control	2167780	5401531
6	Control	2167653	5401568
7	Control	2167597	5401750
8	Control	2167688	5401933

2.1.2. Sampling methods

Physicochemical data

A Hach turbidimeter and a YSI Professional Plus handheld water quality meter were used to collect spot measurements of turbidity (NTU), temperature, pH, conductivity, and dissolved oxygen (% and mg/L) from the impact and control segments. Water quality parameter results are shown in Table 2.

Table 2. Physicochemical measurements taken on 30 March 2017 at site -1 (lowermost impact segment) and site 8 (uppermost control segment).

Measurement	Impact segment	Control segment
Time	1410	1158
Temperature	16.7	15.6
Dissolved Oxygen (%)	128.1	85.4
Dissolved Oxygen (mg/l)	12.45	8.38
Conductivity	249	250
pH	7.55	7.39
Turbidity (NTU)	4.77	4.31

Physical /structural habitat data

Physical habitat data were collected at each 40 m long site according to the instream component of the broad-scale stream habitat mapping protocol detailed in Holmes and Hayes (2011); see example application in Holmes et al. (2015). To minimise disturbance to the reaches before biota were sampled, physical habitat data were collected after the invertebrate and electric fishing surveys (see methods descriptions for invertebrates and fish population below). However, visual estimates of the percentage cover of macrophytes were made prior to sampling biota, as fish and invertebrate sampling dislodges macrophytes.

During the current monitoring round photograph points were established for each site. Site photographs are shown in Appendix 1. Photograph point GPS locations are given in Appendix 2.

Invertebrates

At each site (on all monitoring occasions) three quantitative Surber samples of macroinvertebrates were taken randomly within the 40 m reach designated for electric fishing. Samples were collected according to Protocol P3 in Stark et al. (2001).

During the 2017 monitoring round, a semi-quantitative kick-net invertebrate sample was also taken at each site. We used the following kick-net sampling protocol:

- Before sampling the percentage cover of the different mesohabitat types and aquatic macrophytes were visually estimated for the entire 40 m reach (see physical /structural habitat data methodology above).
- Ten kick-net sampling sites were allocated representatively across the different mesohabitat and macrophyte habitat combinations determined from the visual estimates. For example, if a reach was 50% run and 50% riffle and the run habitat had 20% macrophyte cover (i.e. 10% cover for the entire reach), then five of the kick-net sample sites would be allocated to the riffle and five would be allocated to the run. One of the kick-net sites in the run habitat would be located within the macrophyte habitat area.
- At each kick-net site, an area of 0.5 m^2 was disturbed with a foot for exactly one minute. If macrophytes were present, the kick-net was swept through the macrophytes as well. Material and invertebrates from all 10 sampling locations were pooled to give a single composite sample for each 40 m reach.

Sampling was undertaken a day before the electric fishing surveys to allow fish to recover from the disturbance. All samples were preserved with 70% ethanol in the field immediately following collection. Invertebrate samples will be processed according to Protocol P3 in Stark et al. (2001) by a University of Otago Masters student. Macroinvertebrates will be identified to the lowest practical taxonomic level (i.e. species if possible). For the composite kick-net samples, it is likely subsampling will be required before processing.

Fish populations

Fish populations were sampled using the multiple depletion pass method (Johnson et al. 2007). At each 40 m site, stop nets were simultaneously placed at the upstream and downstream boundaries and secured to the substratum. Care was taken not to disturb the site prior to securing the stop nets to avoid disturbing the fish so they left the reach. Two Smith Root (LR24) backpack electric fishing machines (fished with one anode each in tandem) were used to systematically fish within the stop-netted reach in a downstream direction. Sites -1 and 0, located downstream of White Pine Road, were significantly wider the other sites, so three electric fishing machines were used simultaneously at these two sites. Weights, lengths and depletion pass number of all fish were recorded.

Because bullies and inanga were very abundant, the first 50–100 of these fish were weighed, measured and identified to determine a site-specific average weight and species ratio (for the bullies). Following this, bullies and inanga were weighed in batches. The average weight and species ratio were used to determine abundance from the total batch weights. The total wetted area of the stream between the stop nets was measured to allow conversion of fish abundance and total weights into densities and biomass per square metre.

During the 2017 monitoring occasion two teams of 7-8 people were needed to complete fishing the 11 sites within four days. At least seven field workers (per team) were required to effectively undertake the surveys—four people to electric fish and three people to weigh, measure and identify fish caught. At some of the sites large amounts of macrophytes were dislodged during electric fishing. This required an extra team member to intercept floating weed using a rake before it entered the downstream stop net.

Overall, 12 fish species have been recorded during the fishing surveys to date. In order of overall abundance fish species found included: common bullies, inanga, redfin bullies, giant bullies, longfin eels, lamprey, brown trout, black flounder, smelt, giant kokopu, shortfin eels and kōaro.

Trout gut content sampling

During the 2017 electric fishing survey, trout gut content samples were collected using a gastric lavage pump (Figure 3). The pump was constructed using a 2-litre garden spray hand pump and a metre of flexible hose. A 200 mm length of semi-ridged plastic tubing (5 mm diameter) was attached to the end of the hose. This was inserted down a trout's oesophagus whilst holding the trout ventral side up. Stomach contents were flushed into a white tray and the entire sample was then transferred to a pottle(s) and preserved with 70% ethanol. For small fish (< 200 mm), a 3 ml plastic Pasteur pipette was attached to the end of the plastic tubing.

At each site, the gut contents of all trout caught over 100 mm were collected. Large trout (> 350 mm) were anesthetised using AQUI-S^{TM} prior to stomach pumping. For each gut content sample the site and the length and weight of the trout was recorded. The samples will be analysed by a University of Otago Masters student.

Figure 3. Trout gastric lavage pump.

3. REFERENCES

Holmes R, Goodwin E, Allen C 2015. Riparian and instream habitat quality in the tributaries of Waituna Lagoon, Southland. Prepared for Department of Conservation / Fonterra Wetland Restoration Partnership. Cawthron Report No. 2587. 40p. plus appendices.

Holmes R, Hayes JW 2011. Broad-scale trout habitat mapping for streams (using aerial photography and GIS). Cawthron Report No. 1979. 40p.

Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR 2001. Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57 p.

Johnson DH, Shrier BM, O'Neal J S, Knutzen JA, Augerot X, O'Neil TA, Pearsons TN 2007. Salmonid field protocols handbook: techniques for assessing the status and trends in trout populations. Published by the American Fisheries Society. 478 p.

Robertson B, Stevens L, Schallenberg M, Robertson H, Hamill K, Hicks A, Hayward S, Kitson J, Larkin G, Meijer K, Jenkins C, Whaanga D. 2011. Interim recommendations to reduce the risk of the Waituna Lagoon flipping to an algal dominated state. Report prepared for Environment Southland by the Lagoon Technical Group (LTG). 19 p. plus appendices.

4. APPENDICES

Appendix 1. 2017 site photographs in sequence from site -1 though to site 8. Each page contains two photos one taken from the upstream end of the site facing downstream, and the other taken from downstream facing upstream.

Site -1 facing downstream

Site -1 facing upstream

Site 0 facing downstream

Site 0 facing upstream

Site 0.5 facing downstream

Site 0.5 facing upstream

Site 1 facing downstream

Site 1 facing upstream

Site 2 facing downstream

Site 2 facing upstream

Site 3 facing downstream

Site 3 facing upstream

Site 4 facing downstream

Site 4 facing upstream

Site 5 facing downstream

Site 5 facing upstream

Site 6 facing downstream

Site 6 facing upstream

Site 7 facing downstream

Site 7 facing upstream

Site 8 facing downstream

Site 8 facing upstream

Appendix 2. Downstream (DS) and upstream (US) photograph point GPS locations (NZ map grid) for sample sites.

Site	Easting	Northing
-1 (DS)	2167730	5397904
-1 (US)	2617686	5397932
0 (DS)	2167566	5398271
0 (US)	2167557	5398306
0.5 (DS)	2167534	5398477
0.5 (US)	2167495	5398499
1 (DS)	2167414	5398697
1 (US)	2167398	5398732
2 (DS)	2167362	5398825
2 (US)	2167355	5398861
3 (DS)	2167412	5499066
3 (US)	2167395	5399096
4 (DS)	2167855	5401439
4 (US)	5401475	2167873
5 (DS)	2167786	5401528
5 (US)	2167757	5401565
6 (DS)	2167659	5401575
6 (US)	2167627	5451585
7 (DS)	2167688	5401633
7 (US)	2167670	5401671
8 (DS)	2167597	5401750
8 (US)	2167609	5401774