WHANGAREI
DISTRICT COUNCIL

Hikurangi Swamp Scheme

Fishery Management Plan

Whangarei District Council

Creating the ultimate living environment

HIKURANGI SWAMP SCHEME

FISHERY MANAGEMENT PLAN

Contents

QUALITY MANAGEMENT

Version	Reason	Date	By	Designation
001	Draft for comment	May 2012	Conal Summers	Stormwater Asset Engineer
002	Final to NRC	May 2012	Conal Summers	Stormwater Asset Engineer

1. INTRODUCTION

1.1. SCHEME LOCATION & HISTORY

SCHEME DESCRIPTION

The Hikurangi Swamp is located approximately 20 km north of Whangarei CBD, near Hikurangi. The northern extent of the Scheme is located where State Highway 1 (SH1) crosses the Whakapara and Waiotu Rivers. The southern extent is at Matarau Road (Lewis Bridge on the Wairua River). The Hikurangi Swamp Scheme area is approximately 5,670 ha.

The Whakapara and Waiotu Rivers join to form the Wairua River, which is the main river flowing through the Scheme area. The catchment above this confluence is approximately 320 square kilometres. The length of the Wairua River from this confluence through the Scheme area, to the Lewis Bridge, is approximately 12 kilometres.

Below the Lewis Bridge, the river runs for another 22 km before it cascades down the Wairua Falls, near Titoki Road towards the junction with the Mangakahia River, to form the Northern Wairoa River at Tangiteroria.

Figure 1 shows the location plan of the Hikurangi Swamp Scheme.

Whangarei District Council currently manages the Scheme and day-to-day operations and maintenance are contracted to an external contractor, Transpacific Ltd.

1.1.1.1 The Drainage District and Catchment Area

The original drainage district and catchment area is defined in the Hikurangi Swamp Major Scheme Report Volume 1, 1968[1] which describes the Swamp and its surrounding catchment as:

"The three main tributaries the Waiotu River, Waiariki Stream and Whakapara River, draining an area of 124 sq. miles [321 square kilometres] join at the northern end of the swamp to form the Wairua River. Other tributaries totalling 57 sq. miles [148 square kilometres] join the Wairua River in the main swamp which has an area of 14,000 acres [5670 ha] so that at the outlet of the swamp in the south west the total catchment is 204 sq. miles [528 square kilometres] with a straight line length of the swamp of 5½ miles [8.8 kilometres] and river length of 14½ miles [23.3 kilometres]. There are also some 18,000 acres [7290 ha] of flats in tributary streams which will benefit from the works.

Below the swamp, the Wairua River flows for 3½ miles [5.6 kilometres] through a narrow valley with limestone rock outcrops and further downstream over a basaltic lava flow before cascading down the Mangere Rapids."

SCHEME COMPONENTS

The Scheme components are described in the original report1 as:

1. Limited improvements to the Wairua River downstream of the junction of the Whakapara and Waiotu Rivers.
2. Channel reconstruction of the Whakapara and Waiotu Rivers between the junction and State Highway 1.
3. Channel improvement of the Whakapara River above State Highway 1.
4. Construction of a floodway parallel to and north of the North Auckland Railway Line between Waiotu Bridge and Hukerenui.

[1] Northland Catchment Commission, 1968. *Hikurangi Swamp Major Scheme – Scheme Report, Vols I and II*

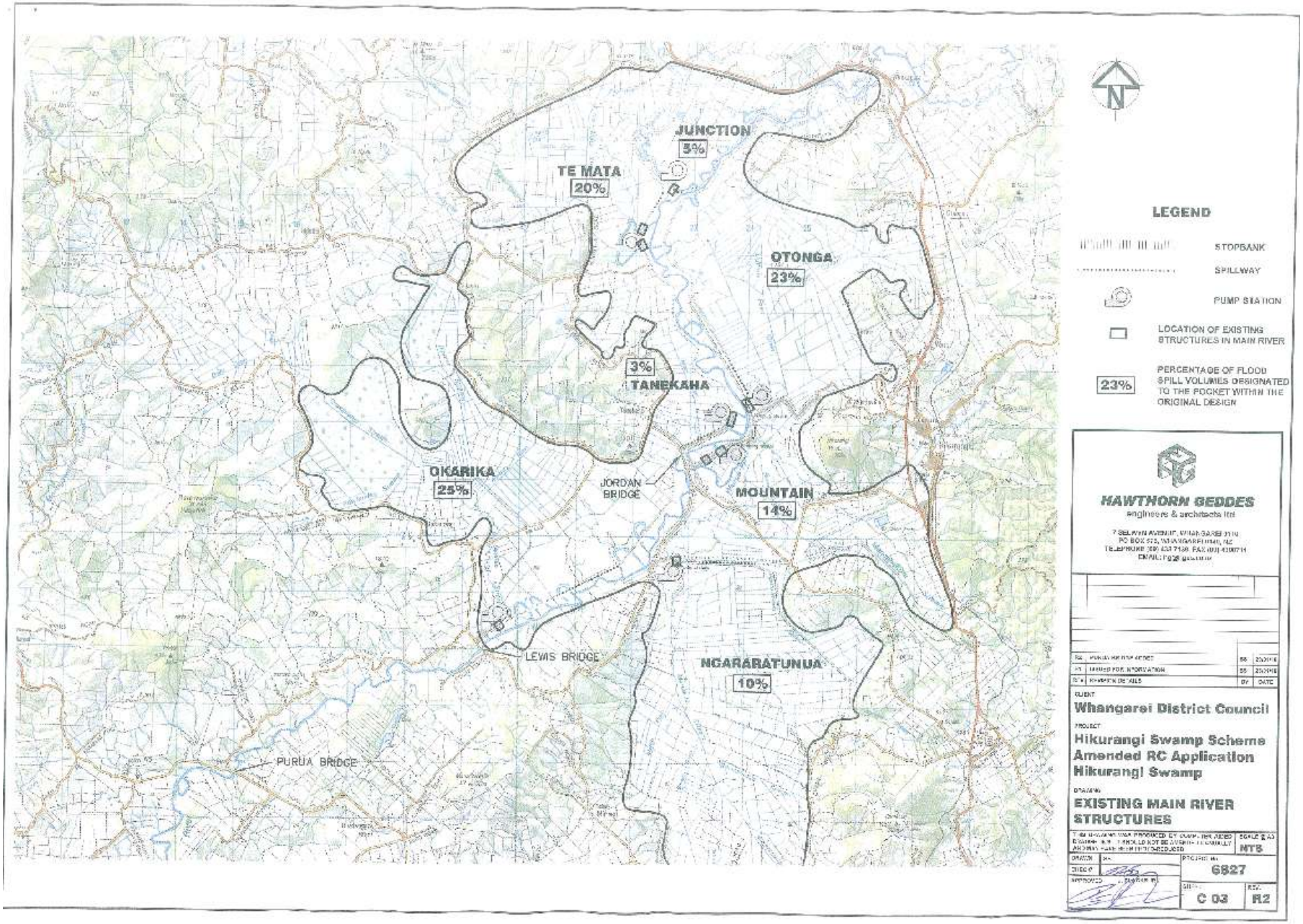

Figure 1: Hikurangi Swamp Scheme Location (Percentages refer to % of floodwaters allocated to each pocket)

5. Construction of control banks along the Wairua River between Lewis Bridge and the junction of the Whakapara and Waiotu Rivers and along those rivers as far as State Highway 1.
6. Construction of stopbanks linking the control banks with the hills and dividing the swamp into seven pockets.
7. Construction of seven pumping stations, one in each pocket.
8. Part reconstruction of the main drainage channels and diversion of some secondary channels where these will be blocked by the control banks.
9. Ancillary works.

All these components were put in place and continue to operate currently.

The seven pockets of the Scheme are:

- Junction
- Te Mata
- Tanekaha
- Otonga
- Mountain
- Ngararatunua
- Okarika

The locations of the pockets are shown in Figure 1.

Each pocket consists of a series of open drains serving low lying farmland leading to a pump station which discharges to one of the rivers. The hills surrounding the pockets comprise farmland and some areas of native bush and runoff from these areas drains to the pockets. The catchment areas contributing to the pockets are shown in Table 1.

Table 1: Pocket Catchment Areas

Pocket	Lowland Land Area (ha)	Upland Catchment Area (ha)	Total Catchment Area (ha)
Junction	**275**	**170**	**445**
Te Mata	**919**	**1571**	**2490**
Tanekaha	**190**	**235**	**425**
Otonga	**943**	**1547**	**2490**
Mountain	**506**	**142**	**648**
Ngararatunua	**1619**	**2834**	**4453**
Okarika	**1182**	**3757**	**4939**

1.2 SCHEME PURPOSE AND DESIGN BASIS

SCHEME PURPOSE

The Scheme was constructed in the early 1970s by the Northland Catchment Commission for the purpose of controlling floodwaters that regularly inundated farmland within the Hikurangi Valley.

Before the Scheme was built, flooding occurred when the inflow exceeded the capacity of the outfall channel and floods persisted on farmland for two to three weeks, particularly following heavy rain of three to four days duration.

The purpose of the scheme was to increase production from the Hikurangi Swamp. It was proposed to do this by reducing and controlling flooding in the swamp and the lower river flats of the Waiotu and Whakapara Rivers above State Highway 1 and also to improve drainage conditions in these areas to a standard acceptable for *"good present day grassland farm management"*.1

In addition the scheme enabled drainage of higher stream flats without endangering the lower areas.

DESIGN BASIS

Control Banks

The function of the control banks are to:

- protect the low swamp areas from flooding except during major floods
- to provide storage for flood waters
- to increase the water level and thus create more fall
- and to form a definite watercourse.

Control-banks are of earthen construction and are grassed. The height of the main control-banks varies from approximately 2 metres to 4 metres, and they have crest widths varying from 2.4 to 3 metres and batters varying from 3 to 1 to 2 to 1.

Stopbanks linking the control banks with the hills

The original scheme report1 defines the purpose of the stop banks as being to *"prevent floodwaters flowing from the higher areas to the lower and causing flooding of different areas by the same water as occurs under present conditions, the swamp area will be divided into seven sections by means of stopbanks linking the control banks with the hills."*

These seven sections or pockets – Ngararatunua, Mountain, Otonga, Junction, Te Mata, Tanekaha and Otaika (refer Table 1) have separate drainage systems and pumping stations but the intent of the original design was that they would be affected to the same degree by the river water levels between the banks. The water quantities flowing into these sections via overflows (spillways) during major floods are controlled by the length of overflows in the banks protecting the different sections.

Pumping Stations

The following is extracted from the original Scheme report.1

"The swamp areas will not be flooded by river water as long as the control banks are not overtopped. However, runoff from the swamp itself and the surrounding hill country cannot be discharged into the river during high water levels and would cause flooding to almost the same extent as under present conditions.

For this reason pumping stations will be constructed in each of the pockets of the swamp area. These stations will be capable of discharging the runoff from the surrounding flats and hill country during rains storms of up to 5 years frequency. During major storms the banks will be overtopped and pumping would not avoid flooding although as soon as the river water level drops, pumping will reduce the durations of flooding considerably.

The capacity of the pumping stations is based on the fact that when the flood duration exceeds approximately 3 days under warm and humid summer conditions the grass will be killed and regrassing required.

To keep the flood duration during rain storms of up to 5 years frequency below 3 days, the pumps should have a capacity sufficient to discharge a runoff of 0.85"/day [21.6 mm/day] from the swamp areas and hill country.

The maximum rate of pumping for the original Scheme design, for the currently installed pumps and for the proposed upgraded pumps is shown in Table 2.

Table 2: Pump Capacities

Pocket	Maximum Pump Flow Rate (m^3/sec)		
	Original Design	**Currently Installed**	Proposed for Future
Junction	**1.11**	**1.07**	**1.10**
Te Mata	**6.22**	**6.20**	**6.20**
Tanekaha	**1.06**	**1.77**	**1.75**
Otonga	**6.22**	**6.23**	**6.30**
Mountain	**1.62**	**2.14**	**2.14**
Ngararatunua	**11.13**	**11.26**	**11.10**
Okarika	**12.34**	**11.27**	**12.30**
Total	39.70	39.94	40.89

1.3 RESOURCE CONSENT

WDC was granted Resource Consent for the scheme by Northland Regional Council in May 2010. The following excerpts from the Resource Consent detail conditions relevant to fishery management:

Condition 2:

(g) Details of monitoring programmes, including the following:

(i) Management of the flood gates of the Scheme, including assessment of the provision of fish passage both upstream and downstream including during summer low flow conditions;

(ii) Monitoring any fish mortality within the Scheme, distribution and likely cause;

Condition 17:

17 The Consent Holder shall undertake studies in relation to mechanisms, structures and other techniques to, as far as practicable, minimise fish entry into the pumps and enhance the passage of fish through the Scheme. These studies shall include obtaining further advice on eel population management from a suitable qualified person, and include a general assessment of habitat opportunities and eel populations above the pumps and the area of habitat for each pocket in terms of drain and/or ox-bow reserve areas and upstream tributaries. Within 24 months of the commencement of these consents the Consent Holder shall prepare and forward to the Regional Council's Monitoring Manager a Fisheries Management Plan which sets out proposals and timetables for enhancement of fish passage, pump fish entrainment deterrent and ongoing monitoring and management of such measures as are implemented.

2 CULTURAL SIGNIFICANCE

As part of the WDC resource consent process for the Hikurangi Swamp Scheme, a Cultural Effects Assessment Report was prepared in conjunction with Ngati Hau. This report clearly demonstrated the importance of the traditional tuna fishery to Ngati Hau. An excerpt from the report is reproduced below:

"Effects on fish and fishing were of enormous importance to Nga Hapu o Te Reponui and this concern is multi-facetted. Of prime importance is the ability of the hau kainga and ahi kaa to be able to fish for the needs of their whanau and manuhiri. It is widely acknowledged that fish stocks, both in terms of numbers and diversity of species, have been heavily depleted over time and any additional impacts that may affect stock recovery will have significant effect on the wellbeing of tangata whenua."

As a result of this report WDC has developed an ongoing relationship with Ngati Hau to examine the fishery issues within the scheme. WDC, NIWA and Ngati Hau have undertaken a number of field trips and meetings/workshops to examine the issues and evaluate mitigative measures in place both nationally and internationally. The continued engagement and support of local iwi is valued by WDC and is critical to progressing fishery management both within the scheme and across the greater catchment.

3 FISHERY DESCRIPTION

3.1 FRESHWATER FISH IN THE WAIROA RIVER CATCHMENT

The following section has been extracted with kind permission from: *NIWA Client Report No:HAM2012-014: Freshwater fish in the Wairoa River catchmentTraining workshop 24–26 February 2012, Akerama Marae. Authors: Williams, E.K. & Boubée, J.A.T.Prepared for Ngāti Hau*

New Zealand has a diverse range of freshwater fish species, many of which are quite small, nocturnal and very secretive. Currently New Zealand has 35 recognised indigenous species of freshwater fish, and seven species that are essentially marine but often enter fresh water. Several galaxiid varieties have been recognised but are still to be described.

Many of our freshwater fish species have to be able to travel (or migrate) between the ocean and freshwater to complete their lifecycle successfully. Some of the dominant migration periods for a selection of New Zealand's indigenous freshwater fish species are provided in Table 3. Environmental conditions, such as water levels and temperatures, will also vary on a seasonal basis and these influence the timing of migration events.

A short introduction to the biology and ecology of selected indigenous and introduced freshwater fish species (focusing on species that are known to occur in the Wairoa River catchment as listed in Table 2) follows. The information presented (by species) is primarily derived from two key sources:

The NIWA Atlas of New Zealand Freshwater Fish (compiled by Jody Richardson and the late Dr Bob McDowall) can be accessed via: http://www.niwa.co.nz/our-science/freshwater/tools/fishatlas.

McDowall, R. M. (2000). The Reed Field Guide to New Zealand Freshwater Fishes. Reed Publishing (NZ) Ltd, Auckland. 224 p.

The New Zealand Freshwater Fish Database (NZFFD)[2] was accessed to see what freshwater fish species have been recorded in the Wairoa River catchment during previous fisheries surveys and where these species occurred. The aim/purpose of most fisheries information contained in the NZFFD is generally not known (e.g., habitat and methods used are often selected to target certain research questions and/or species rather than collect general fish distribution information) and this must be taken into account when interpreting information extracted from the NZFFD.

[2] The New Zealand Freshwater Fish Database (NZFFD) records the occurrence of fish in fresh waters of New Zealand, including major offshore islands. These data are contributed voluntarily by organisations such as NIWA, fish and game councils, the Department of Conservation, regional councils, environment consultants, universities, and interested individuals. The methods used, quality and extent of data contained in this database is dependent on the organisations and individuals contributing information and the purpose of their investigation (which is not recorded in the database). In this document this data has been used to provide an indication of what species have been found in the catchment and where. This database can be accessed via: http://www.niwa.co.nz/our-services/databases/freshwater-fish-database.

As of the 20 February 2012, 185 records (out of a total of 31,598) have been entered into the NZFFD for sites sampled for freshwater fish in the Wairoa River catchment (Table 4, Figure 2). The most commonly found species to date include longfin eels, koura/kēwai [freshwater crayfish] and Crans bullies (Table 4).

Table 3: Key migration periods for selected New Zealand indigenous freshwater fish species (⇑ = upstream, ⇓ = downstream).

Freshwater fish			Summer			Autumn			Winter			Spring		
Common name	**Species**	**Life stage**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**
Tuna	*Anguilla australis & A. dieffenbachii*	Juvenile	⇑	⇑	⇑	⇑								⇑
Shortfin	*A. australis*	Adult		⇓	⇓	⇓	⇓							
Longfin	*A. dieffenbachii*	Adult		⇓	⇓	⇓	⇓	⇓				⇓	⇓	
Lamprey	*Geotria australis*	Juvenile					⇓	⇓	⇓	⇓	⇓			
		Adult						⇑	⇑	⇑	⇑	⇑		
Smelt (riverine)	*Retropinna retropinna*	Juvenile	⇑	⇑	⇑	⇓	⇓	⇓	⇓				⇓⇑	⇓⇑
		Adult	⇑	⇑	⇑	⇓	⇓	⇓						⇑
Īnanga	*Galaxias maculatus*	Juvenile	⇑	⇑	⇓	⇓	⇓				⇑	⇑	⇑	⇑
		Adult	⇑	⇑	⇓	⇓	⇓	⇓⇑	⇑	⇑	⇑	⇑	⇑	⇑
Kōaro	*G. brevipinnis*	Juvenile					⇓	⇓	⇓		⇑	⇑	⇑	⇑
		Adult [a]					⇑⇓	⇓⇑	⇓⇑	⇓⇑				
Banded kōkopu	*G. fasciatus*	Juvenile						⇓	⇓	⇓	⇑	⇑	⇑	⇑
		Adult					⇑⇓	⇓⇑	⇓⇑	⇓⇑				
Shortjaw kōkopu	*G. postvectis*	Juvenile						⇓	⇓			⇑	⇑	⇑
		Adult						⇑	⇑					
Common bully	*Gobiomorphus cotianus*	Juvenile	⇑	⇑	⇑	⇓	⇓	⇓	⇓		⇓	⇓	⇓⇑	⇓⇑
Redfin bully	*G. huttoni*	Juvenile [a]	⇑⇓	⇑	⇑						⇓	⇓	⇓⇑	⇓⇑
Torrentfish	*Cheimarrichthys fosteri*	Larvae	⇑	⇑	⇑⇓	⇓	⇓	⇓						⇑
		Adult [a]	⇑⇓				⇓⇓	⇓⇑	⇓⇑	⇑	⇑	⇑		⇓

[a], More research is needed to confirm the migration period.

Table 4: Freshwater fish species recorded in the NZFFD for the Wairoa River catchment between 1965 and 2011.

Species	Scientific name	Frequency (number of records)	Min–max length (mm)	Migrate between the sea and freshwater?
Longfin eel	*Anguilla dieffenbachii*	38% (N = 71)	50–1,200	Yes
Kōura/kēwai	*Paranephrops*	37% (N = 68)	10–150	No
Cran's bully	*Gobiomorphus basalis*	30% (N = 55)	10–100	No
Shortfin eel	*Anguilla australis*	28% (N = 52)	60–1,070	Yes
Gambusia	*Gambusia affinis*	22% (N = 41)	10–54	No
Common bully	*Gobiomorphus cotidianus*	20% (N = 37)	10–150	Yes (but can also be landlocked)
Īnanga	*Galaxias maculatus*	16% (N = 30)	30–134	Yes
Unidentified eel	*Anguilla sp.*	15% (N = 27)	60–1,000	Yes
Torrentfish	*Cheimarrichthys fosteri*	11% (N = 21)	20–119	Yes
Black mudfish	*Neochanna diversus*	10% (N = 19)	15–169	No
Rainbow trout	*Oncorhynchus mykiss*	9% (N = 17)	30–500	–
Redfin bully	*Gobiomorphus huttoni*	9% (N = 16)	30–100	Yes
Goldfish	*Carassius auratus*	8% (N = 15)	18–305	–
Banded kōkopu	*Galaxias fasciatus*	8% (N = 14)	50–235	Yes
Common smelt	*Retropinna retropinna*	6% (N = 11)	50–110	Yes (but can also be landlocked)
Brown trout	*Salmo trutta*	5% (N = 9)	200–300	–
Grey mullet	*Mugil cephalus*	4% (N = 8)	200–500	Marine wanderer
Brown bullhead catfish	*Ameiurus nebulosus*	3% (N = 6)	50–300	–
Unidentified bully	*Gobiomorphus sp.*	2% (N = 4)	30–75	–
Lamprey	*Geotria australis*	2% (N = 3)	68–390	Yes
Shortjaw kōkopu	*Galaxias postvectis*	2% (N = 3)	51–230	Yes
No species recorded	–	2% (N = 3)	–	–
Rudd	*Scardinius erythrophthalmus*	1% (N = 2)	355–358	–
Unidentified galaxiid	*Galaxias sp.*	1% (N = 2)	50–200	–
Kōaro	*Galaxias brevipinnis*	0.5% (N = 1)	–	Yes (but can also be landlocked)
Perch	*Perca fluviatilis*	0.5% (N = 1)	–	–
Yelloweyed mullet	*Aldrichetta forsteri*	0.5% (N = 1)	–	Marine wanderer

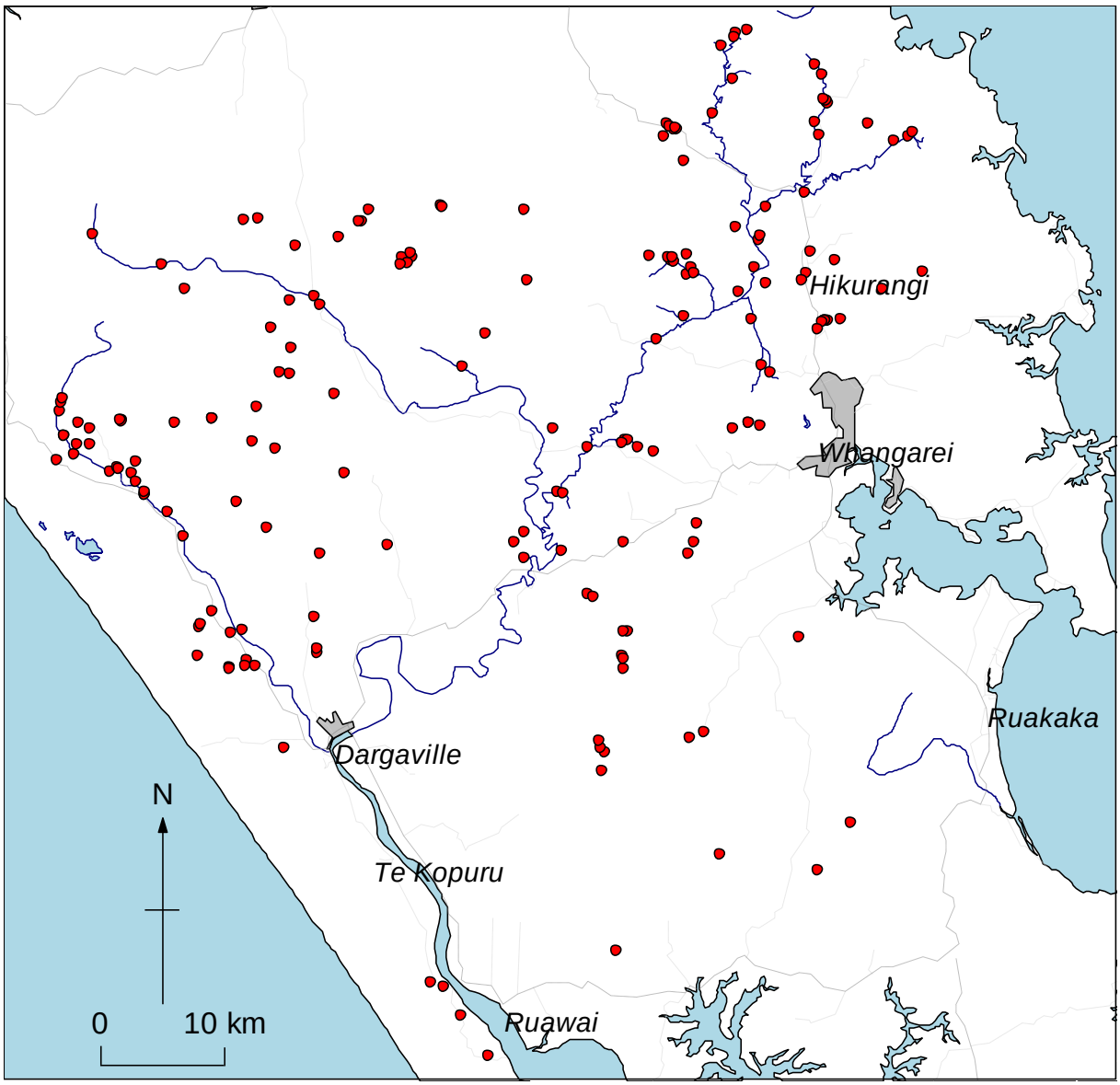

Figure 2: Locations of 185 sites sampled (between 1965 and 2011) for freshwater fish in the Wairoa River catchment and entered in the NZFFD.

The primary fishery of concern within the Hikurangi Swamp Major Scheme is the eel (tuna) fishery, due to the nature of the eel lifecycle, the migration barriers present within the scheme, and the strong cultural links with local iwi. Measures taken to improve the tuna population will generally improve fish passage for other migratory species. This is explained in more detail in the following sections.

3.2 TUNA (EEL) LIFECYCLE

The following section has been extracted with kind permission from: *NIWA Client Report No:HAM2012-014: Freshwater fish in the Wairoa River catchment. Training workshop 24–26 February 2012, Akerama Marae. Authors: Williams, E.K. & Boubée, J.A.T.Prepared for Ngāti Hau.*

In order to complete their lifecycle, freshwater eels must move between freshwater and the sea (known as a diadromy), spending extended periods in marine, estuarine, and freshwater habitats. The eel has a unique and complex life stage. Breeding occurs in the marine environment, following an extended adult growth stage in freshwater, and a long migration from their freshwater habitat (Figure 3).

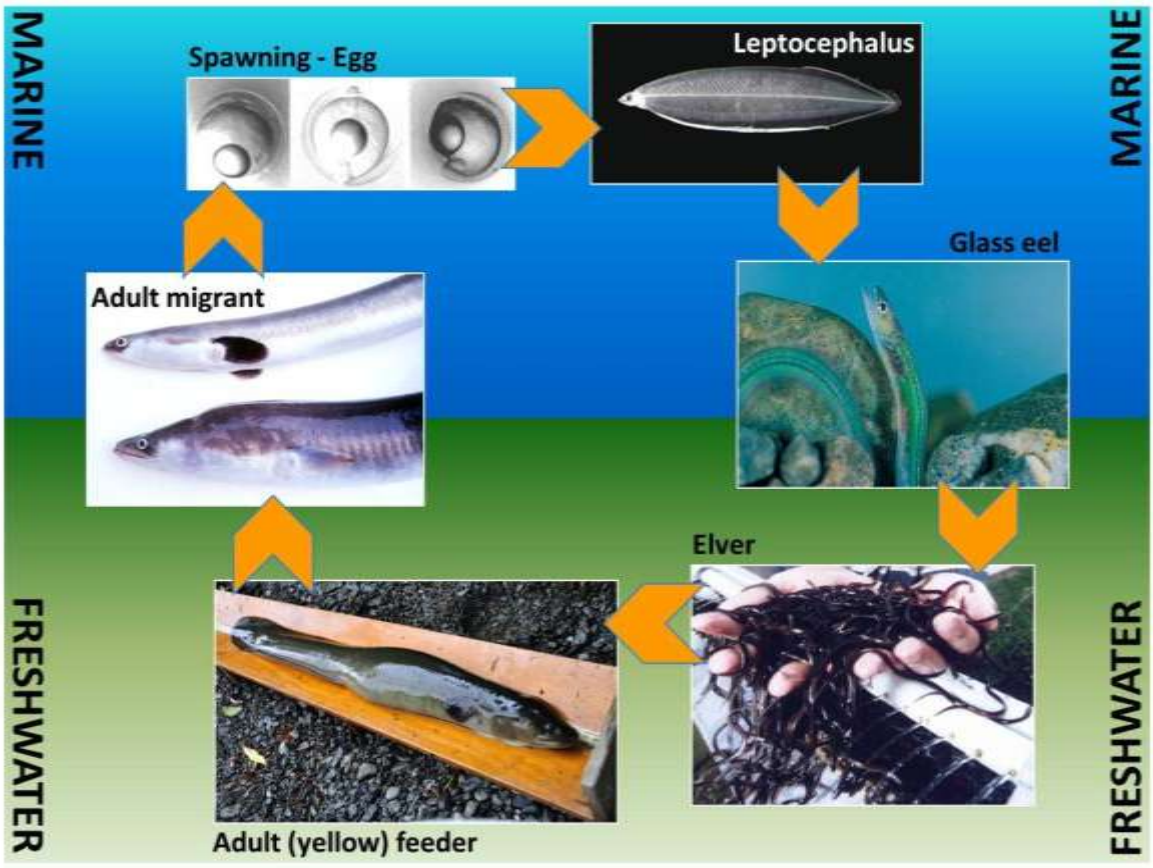

Figure 3: General life cycle of freshwater eels, showing the marine (blue) and freshwater (green) components.

3.3 IMPACTS ON THE NATURAL FISHERY

There are 4 primary areas where the natural fishery has been impacted within and adjoining the scheme boundaries:

- Commercial fishing,
- Natural barriers to upstream fish passage
- Man made barriers to upstream and downstream fish passage
- Loss of habitat

COMMERCIAL FISHERY

The extent and impact of past and present commercial fishing within the scheme and wider catchment has not been documented. The Ministry of Fisheries manages the eel fishery under a Quota Management System. The Hikurangi Swamp is part of the northland quota management area but this is geographically large and specific catch locations and numbers are not recorded. Anecdotally, commercial presence and catches have decreased markedly over the last decade or so.

NATURAL BARRIERS TO FISH PASSAGE

The most significant natural barrier to upstream migration within the catchment (but outside the HSS area) is the Wairua/Omiru falls. Since the construction of the Wairua power Station in 1917 significant flows have been diverted through the headrace to the channels, at times reducing the base flows by up to 90%. Given the historical abundance of eels within the scheme area, it appears that in its natural state the falls did not severely impede elver recruitment.

MANMADE BARRIERS TO FISH PASSAGE

Within the wider catchment the Wairua Power Station presents a significant barrier. NorthPower, who currently operates the station, commenced an elver trap and transfer programme in the 2011/12 summer with over 4 million elvers estimated to have been transferred past the station and Wairua Falls this season.

Within the Hikurangi Swamp Scheme, the pump stations and stopbanks present barriers to both upstream and downstream migration to tributaries within the swamp scheme "pockets" but do not impact on migration within the main channel or to tributaries above State Highway 1. The pumps also causes loss of downstream migrants while the stopbanks impound water in major flood events resulting in oxygen depletion and temperature rise that can result in fish kills.

LOSS OF HABITAT

Swamp and wetland drainage, waterways re-alignment, decrease in extent and frequency of flooding (during which eels gorge themselves on land invertebrates), loss of natural bankside cover and increased nutrient load have all contributed to a significant loss of fish habitat within the entire catchment.

4 PROPOSED MITIGATION MEASURES WITHIN HIKURANGI SWAMP

4.1 UPSTREAM MIGRATION

Upstream migration relates to movement of juvenile eels (elvers) from the sea to the inland waterways where they will remain until returning to sea to spawn as Tuna Heke (downstream migrants). Based on records obtained at the Wairua Power Station in summer 2011/12 the upstream migration appears to begin around September-October runs until approximately March. Movement of elvers at the schemes control structure may, however, only begin around November.

As discussed previously, significant downstream barriers exist, both natural and man made, and Council has been and will continue to be engaged with the stakeholders downstream in a supporting role to facilitate elver movement past these barriers.

Within the scheme, the primary barriers to movement from the main Wairua River channel to tributaries are at the pump stations. Each station has a gravity flapgate which is designed to prevent flows from the main channel entering the pockets during elevated river levels. Elvers must pass through these gates to access the upstream tributaries.

The issues and proposed mitigative measures to mitigate upstream passage within the Scheme are detailed in Table 5.

Table 5: Issues and Mitigative Measures Proposed for Upstream Migration

ISSUE	MITIGATIVE MEASURE	TIMELINE
Invert of flapgate is above the invert of the outlet channel, and at low flows it is difficult for elvers to climb over the gate frame	Build up weir (with rock spalls or similar) to level of gate invert at approach to gate to maintain permanent water level above flapgate invert.	December 2012
Flapgates can only slightly open at low flows, increasing water velocities and making elver passage difficult.	Flapgates all have cable lifts, ensure these are used to open gates sufficiently at times of low flow in the periods November-March. **Note**- this will require maintenance contractors and/or farmers to monitor and raise and lower gates accordingly.	December 2012

4.2 DOWNSTREAM MIGRATION

Downstream migration is a significantly more complex issue to manage. There are 2 main issues:

- Eel mortality through entrainment in scheme pumps
- Impediments to migrant movement into the main river channel during periods of oxygen depletion in the pocket areas following significant storm events (where the river has spilled into the pockets).

The extent and exact factors that lead to mortality is unknown,. In the case of extreme storm events where waters are impounded for several days and extensive oxygen depletion occurs, eels may be dead within large areas of the catchment but this may not be evident until water is drawn down to the pump stations and eel carcases are destroyed through the pumping process. There is video evidence showing significant numbers of chopped mature eels downstream of a pump station, however such events are likely to be time and location specific and it would be erroneous to assume that this occurs at every station during every pumping event.

Factors such as seasonality, size of storm, and time of migration by eels to the stations from within the pocket catchments all impact on mortality throughout the scheme. Mortality due to oxygen depletion would most likely also have occurred in the natural (pre-developed) state of the swamp area following extreme storm events and it is difficult to quantify the effect of the scheme on the extent of mortality through this mechanism.

WDC has previously investigated use of Archimedes Screw pumps which are more fish friendly, but for a number of reasons (including cost, inability to access during storm events, operational aspects) at present such pumps are judged not viable within the Scheme.

PROPOSED APPROACH

WDC has been working closely with NIWA and it is proposed that a number of measures be trialled at a single pump station to validate their effectiveness before implementation across the scheme. This will also provide valuable research information to assist in management of eel fisheries nationally and internationally. Mountain pump station is proposed for the trials due to having two identical pump bays and ease of access.

The approach involves catching migrant eels with the permission and assistance of local iwi, and attaching a RFID (Radio Frequency Identification) transmitter to the migrants. The migrants are then released upstream of the pump station. Each pump bay and the central gravity gate are fitted with an aerial which activates the RFID transmitter when they pass through and generates a signal which can be electronically logged. One pump bay will be used as a control with no alterations and the other will be used for the various measures. This will also provide information as to the number of eels able to migrate through the gravity doors before the river level rises sufficiently to close the doors. NIWA will provide or have provided the equipment for the monitoring and electrification of one screen for this initial stage.

The issues and proposed mitigative measures are detailed in table 6:

Table 6: Issues and Mitigative Measures Proposed for Downstream Migration

ISSUE	MITIGATIVE MEASURE(S)	TIMELINE
Migrant eels only exit to the main channel during a flood event (after floodgates have closed) is via the pumps.	Deter eels from entering pump intakes until flood recedes through:	
	Electrification of screens (12V pulsed while pumps operate)	Trial installed at Mountain pump station by December 2012
	Reduce aperture size on pump intake screen to 20mm	
Oxygen depletion during larger events	Examine options for increased gravity drainage reducing ponding extent and duration	July 2013

Dependent on the outcome of the trials a plan for rolling out any effective measures across the remainder of the scheme will be provided through amendment of this plan. It is expected that reducing the screen aperture will have an impact on the operation during an event where much of the time is spent removing weed and other debris build-up form the screens.

4.3 HABITAT IMPROVEMENT

Whangarei District Council has a Riparian and Oxbow Management Plan (ROBMP) for the HSS as required by the resource consent. The plan provides a staged approach to undertaking riparian restoration of both the main waterway and the oxbows (which were the initial river meanders prior to the scheme being constructed). A timeline for implementation has yet to be finalised in conjunction with the stakeholders, as there is a need to select revegetation species that can withstand intermittent wetting & drying, require minimum maintenance, do not generate significant amounts of dead plant material, and do not impact significantly on the channel roughness (slowing flows down).

It is intended that as part of the oxbow restoration some of the oxbows will have an earth bund constructed to increase the permanent water level within the oxbows. This, combined with riparian planting will increase available habitat significantly.

4.4 OPERATIONAL ASPECTS

The primary operational activity potentially impacting on the tuna fishery is mechanical drain cleaning. Spoil form the cleanings is currently placed alongside the drains in discrete piles and eel have been observed on numerous occasions exiting the spoil once it is deposited. Given the proximity of the spoil to the waterways this is not seen as having a significant impact on the population provided a line of spoil is not deposited in such a way as to prevent eels and elvers re-entering the channel. To ensure proper procedures are followed in future, best practice guidelines will be developed and provided to all operators.

4.5 MONITORING OF FISH MORTALITY

It is proposed that monitoring of mortality be undertaken subsequent to pump operation through a visual inspection of the main channel (once waters have receded) to determine if any eel carcases in the vicinity. Photographic records shall be undertaken and the date, location, and number of carcases shall be noted and notified to WDC. This will be undertaken by the scheme maintenance contractor.