

Hikurangi Swamp Floodway Riparian and Ox-Bow/Cut Off Channel Management Plan

May 2011

Hikurangi Swamp Floodway Riparian and Ox-Bow/Cut Off Channel Management
Plan

Whangarei District Council

Table of contents

1	Executive summary	1
1.1	INTRODUCTION	1
1.2	PROCESS	1
1.3	GOAL	1
1.4	METHODOLOGY	1
	1.4.1 <i>Planting, fencing and stock exclusion</i>	1
	1.4.2 <i>Water level control in Oxbow/cut-off channels</i>	2
	1.4.3 <i>Maintenance</i>	2
	1.4.4 <i>Timeline</i>	2
1.5	PROPOSED RESTORATION SITES	2
2	Introduction	3
2.1	BACKGROUND AND PURPOSE	3
2.2	DOCUMENT CONTROL AND REVIEW	3
	2.2.1 <i>Document Control</i>	3
	2.2.2 <i>Document Register</i>	3
2.3	CONSENTS	4
2.4	RELATED DOCUMENTS	4
2.5	RESOURCE CONSENT REFERENCE DOCUMENTS	4
3	Process	6
3.1	BACKGROUND	6
3.2	STAKEHOLDERS	6
3.3	RESERVES AND MARGINAL STRIPS VESTED IN THE CROWN	7
3.4	SIGNIFICANT INDIGENOUS WETLANDS.	7
3.5	THE APPROACH TO DEVELOPING THE ROBMP	8
	3.5.1 <i>Issues Identified</i>	9
4	Goal of Riparian and Ox-Bow/Cut-off Channel Enhancement	11
4.1	GOAL	11
5	Methodology	12
5.1	PLANTS	12
	5.1.1 <i>Plant Selection</i>	12
	5.1.2 <i>Planting Method</i>	13
5.2	RIPARIAN MARGIN WIDTH	13
	5.2.1 <i>Riparian Width – Main River</i>	13
	5.2.2 <i>Riparian Width - Oxbow/cut-off channels</i>	13
5.3	STOCK EXCLUSION	13
	5.3.1 <i>Grazing Licenses – Current Situation</i>	13
	5.3.2 <i>Fencing</i>	14
	5.3.3 <i>Water Supply</i>	14
5.4	WATER LEVEL CONTROL IN OX-BOW/CUT-OFF CHANNELS	14
5.5	MAINTENANCE	14
	5.5.1 <i>Mechanical Cleaning and Clearing</i>	14
	5.5.2 <i>Control of plant pests and unsuitable plants</i>	15
	5.5.3 <i>Control of Animal Pests</i>	15
	5.5.4 <i>Fence Line Maintenance</i>	15
5.6	TIMELINE	15
6	Proposed Restoration Sites	16
6.1	TYPICAL CROSS SECTIONS	16
6.2	PHOTOGRAPHS OF INDIVIDUAL SITES	16

List of Figures:

Figure 6.1: Typical Cross-section along main river bank.....	16
Figure 6.2: Typical cross-section – Oxbow-Cut-off channel	16
Figure 6.3: Index Plan Showing sites 1 to 12.....	17
Figure 6.4: Index Plan showing sites 12 to 18	18

Management Plan status

1 Overall responsibility for the co-ordination of all matters in this plan		
Date	Name	Designation
May 2011	Conal Summers	Stormwater Asset Engineer

2 Prepared/reviewed/updated by		
Date	Name	Designation
May 2011 – Version 1 -Draft	Prepared by V Kloosterman, Warren King	VK Consulting Environmental Engineers Ltd

3 Council consideration		
Date	Minute no	Reason/decision

4 Public consultation	
Date	Form of

Document management

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1 Executive summary

1.1 Introduction

This document has been prepared in accordance with resource consent 20031137501 issued by Northland Regional Council for the activities associated with the Hikurangi Swamp Scheme. These consents require WDC as consent holder to prepare a Floodway Riparian Management Plan by 27 May 2011 and an Oxbow/Cut-Off Channel Management Plan by 27 May 2012. The management of the riparian margins and the enhancement of the oxbow/cut-off channels are closely interlinked and so WDC has combined these two management plans into this one document called the Floodway Riparian and Ox-Bow/Cut-off Channel Management Plan (ROBMP).

This document forms part of, and should be read in conjunction with, the Hikurangi Swamp - initial Scheme Management Plan (i.e. iSMP) which also contains the full resource consent and register of scheme plans.

1.2 Process

During the development of this ROBMP, WDC has followed a process of involving representatives of the Northland Fish and Game Council and Department of Conservation, identifying current good practice carried out by DOC and NFGC in the Scheme area, consulting with and taking advice from Northland Regional Council staff and having regard to relevant Northland Regional Council documents. The advice and input from these groups and individuals is gratefully acknowledged.

WDC also proposes to make this draft ROBMP available on Council's website so that it is accessible to all farmers in the Scheme. WDC will also be consulting directly with grazing licence holders to discuss and agree the changes which need to be put in place to allow for implementation of riparian margin and oxbow enhancement within the grazed floodway areas.

This process identified the following key issues

- Plant suitability.
- Planting methodology
- Stock exclusion.
- Compatibility with grazing licences.
- Stakeholder coordination.
- Ongoing maintenance.
- Affordability.

1.3 Goal

The goal of this ROBMP is to:

Revegetate the areas (referred to in the resource consent) in a manner which creates environmental benefits and ensures the design basis and flood carrying capacity of the Scheme is not compromised; and at a rate that has regard to practicality, benefit and affordability.

1.4 Methodology

1.4.1 Planting, fencing and stock exclusion

A range of plants have been identified which are able to withstand ponding and flooding, survive intermittent wetting and drying, require minimal maintenance, do not have significant die-back periods nor contribute large volumes of dead plant material, and do not adversely affect the flood carrying capacity of the scheme. Suitable plant species identified include: *Phormium tenax* (New Zealand Flax) *Carex secta* (Pukio) *Bolboschenus fluviatilis* (River bulrush), native *Hebe* already endemic in the area, *Juncus* species (leafless rushes). This is not an exclusive list and other plants could also be used.

It is intended to fence the riparian zones, exclude stock and allow for natural regeneration to occur. Riparian margin width will be variable depending on the cross-sectional shape of the channel and the slope of the side banks. In general it is proposed to locate the fencing 1 to 2 m back from the top of the main river channel on flat land. For oxbow/cut-off channels a riparian margin of up to a maximum of 5 metres is proposed.

Responsibility for fencing and provision of alternative water supply still needs to be discussed and agreed between WDC and grazing licence holders.

1.4.2 Water level control in Oxbow/cut-off channels

NFGC has indicated that some water level control is desirable in the oxbow/cut-off channels and simple earthen embankments of up to 2 m in height are proposed between the cut-off channel and the main river channel to retain greater water depths.

1.4.3 Maintenance

Ongoing maintenance is likely to be a joint responsibility with contribution from a range of stakeholders. Final details still need to be discussed and agreed. Maintenance will include mechanical cleaning and clearing of sediments, vegetation and detritus from oxbow and cut-off channels. Control of plant pests and inappropriate plant species also needs to be carried out. It is proposed this will be in general accordance with Table 3 of the NRC document "*Clean Streams-A Guide to Riparian Management in Northland*".

Control of animal pests in the floodway areas is likely to remain the responsibility of grazing licence holders.

1.4.4 Timeline

The timeline for this riparian revegetation will depend on a number of factors including:

- the renegotiation of the grazing licences
- the allocation of tasks and management responsibilities between the various stakeholders
- the revegetation method adopted.
- the need for consents from NRC to carry out works within the riparian zone or in the oxbow/cut-off channels
- the cost and availability of funding, which is also influenced by the factors identified above.

1.5 Proposed Restoration Sites

Annotated photographs are included in section 6 which show the proposed work along the main river banks and oxbow/cut-off channels between the southern end of the floodway at Matarau Road and the Tanekaha pump station (Borrow-Cut Area). There are a total of 18 sites which have been photographed and it is proposed to restore these areas first and then based on the experience gained to move on to the northern part of the floodway.

Annotated oblique photographs are supplied for each oxbow/cut-off channel site indicating where fencing, weed removal, alterations to the banks and the formation of a low embankment may be required.

Annotated oblique photographs of the riparian zones along the main river show the proposed location of fencing and existing vegetation.

2 Introduction

2.1 Background and Purpose

This Floodway Riparian and Ox-Bow/Cut-off Channel Management Plan (ROBMP) is prepared in accordance with the resource consents issued by Northland Regional Council (NRC) for the Hikurangi Swamp Drainage Scheme.

The consents require Whangarei District Council (WDC) to prepare a Floodway Riparian Management Plan to address the riparian margins within the Scheme floodway up to 10 metres either side of the low flow river channel banks. This Management Plan must be forwarded to NRC's Monitoring Manager by 27 May 2011.

The consents also require WDC to prepare an Ox-Bow/Cut-Off Channel Management Plan which identifies the ox-bow/cut-off channels within the floodway which can be enhanced having regard to practicality and benefit and which outlines the methods to achieve this enhancement. This Management Plan must be forwarded to NRC's Monitoring Manager by 27 May 2012.

As the management of the riparian margins and the enhancement of the ox-bow/cut-off channels is interlinked, these two Management Plans have been combined into this one document resulting in the Ox-bow/Cut-off Channel Management Plan being submitted one year ahead of schedule.

The ROBMP also needs to be read in conjunction with the Hikurangi Swamp initial Scheme Management Plan (iSMP) which was submitted to NRC in November 2010 in accordance with resource consent requirements. The iSMP sets out operating and management procedures for the Hikurangi Swamp Scheme and a timetable for achieving all consent requirements by 27 May 2012, by which time a full Scheme Management Plan (SMP) needs to be submitted to NRC.

The overall purpose of the full Scheme Management Plan will be to incorporate best practice, the requirements of the consents and any other associated documents in a comprehensive guide for the management of the Scheme. The full Scheme Management Plan includes the ROBMP and a Fisheries Management Plan. The latter needs to be submitted by 27 May 2012.

These Management Plans must be read in light of the terms and conditions of the resource consents granted by NRC. In the event of any conflict in meaning, or ambiguity, between the terms and conditions of the resource consents and the provisions in the Management Plans, the resource consents take precedence.

2.2 Document Control and Review

2.2.1 Document Control

The ROBMP and any subsequent updates to any part of the document are issued to those listed on the Document Register. A record of changes will be listed on the Status page with the version and release date.

Each of the individual sections and attachments may be independently issued.

In addition, WDC as part of its standard best practice makes Management Plans for the Hikurangi Scheme accessible on its website: www.wdc.govt.nz.

2.2.2 Document Register

Copy No.	Holder	Organisation and (Function)	No. of Copies
1	Stormwater Asset Engineer (SAE)	Whangarei District Council (Owner/Manager/Consent Holder/General overview)	1
2	Waste and Drainage Operations Supervisor	Whangarei District Council (Supervision of Scheme Operators)	1
3, 4	Scheme Operator	Transpacific Ltd (Scheme Operators)	1

Copy No.	Holder	Organisation and (Function)	No. of Copies
5	Monitoring Manager	Northland Regional Council (Consent Authority)	1

2.3 Consents

The Consent Holder and contracted Scheme Operators are responsible for taking such measures as are required to ensure that the scheme is operated in accordance with all resource consents. CON20031137501 has been issued by the Northland Regional Council for the following activities associated with the Hikurangi Swamp Scheme:

- (01) Water Permit: To divert and dam floodwaters within the Hikurangi Swamp Scheme ("Scheme") control-banks (=stopbanks), canals, drains and floodgates.
- (02) Discharge Permit: To discharge floodwaters over Scheme control-banks on to land and to water courses and rivers via flood control mechanisms within the Scheme.
- (03) Land Use Consent: To use restore, manage and maintain existing dams, culverts, control banks and floodgates, and placement and use additional structures on the bed of the watercourses within the Scheme.
- (04) Land Use Consent: To carry out excavation or disturbance of the bed of the water courses for the purpose of the free flow of water.
- (05) Water Permit: To divert water from repaired control-banks.
- (06) Discharge Permit: To discharge water from repaired control-banks.
- (07) Land Use Consent: To undertake earthworks on the control-banks and berms adjacent to watercourses within the Scheme, including modifications to spillways.

The full resource consent is included in Appendix A of the iSMP.

2.4 Related Documents

The following are related documents required by the resource consent issued by NRC.

- *Hikurangi Swamp-Initial Scheme Management Plan Version 001-3* dated March 2011. This document should be referred to for information on: scheme description, scheme purpose and design basis, roles and responsibilities, programme of works, monitoring programme, scheme maintenance and contingency and emergency planning. This document also contains the full resource consent and register of scheme plans.
- *Hikurangi Swamp Full Scheme Management Plan* (to be prepared by 27 May 2012) - will supersede initial scheme Management plan above
- *Fisheries Management Plan* (to be prepared by 27 May 2012)

2.5 Resource Consent Reference Documents

- *Hikurangi Swamp Major Scheme Volumes 1 and 2*. Northland Catchment Commission, 1968. (TRIM Record Numbers 07/40129 and 07/40130 respectively)
- *Hikurangi Swamp Scheme - Application for Resource Consents and Assessment of Effects on the Environment* MWH, May 2004. (TRIM Reference 09/114427)
- *Pump Station Operation and Maintenance Manuals*.
 - *Otonga, May 2008*: (Trim Record Number 08/48584)
 - *Ngararatunua, May 2008*: (Trim Record Number 08/46639)
 - *Okarika, May 2008*: (Trim Record Number 08/46612)

- *Mountain, May 2008*: (Trim Record Number 08/46598)
- *Junction, May 2008*: (Trim Record Number 08/46600)
- *Te Mata, May 2008*: (Trim Record Number 08/46583)
- *Tanekaha, May 2008*: (Trim Record Number 08/46574)
- *As-Built Plans*. (refer Appendix B of the iSMP)
- *Assessment of Effects on the Environment of the Hikurangi Swamp Scheme*. Hawthorn and Geddes, August 2009. (TRIM Record Number 09/72187)
- *Stormwater Business Continuity Plan*. Whangarei District Council, June 2008. (TRIM Record Number 08/48584)
- *Whangarei District Council's Health and Safety Procedures* (TRIM Record Number 10/102860)

3 Process

3.1 Background

Whangarei District Council's application for the consents for the Hikurangi Swamp Drainage Scheme went through a consent process which included a number of stakeholders (refer section 3.2) and resulted in the consent being issued by Northland Regional Council on 27 May 2010. The relevant consent conditions, 3 and 4, from this consent are given below.

3. *"The Consent Holder shall prepare a Floodway Riparian Management Plan . . . to address the riparian margin of the rivers within the Scheme up to 10 metres either side of the low-flow river channel bank. The provisions of this Management Plan relating to riparian margins within a floodway shall include, as a minimum, the following:*

(a) *the requirements for the types and the maintenance of riparian vegetation that are to be established along the banks of the main channels of the Whakapara, Waiotu and Wairua rivers.*

Advice note: It is recommended to take into account the following when preparing 3(a): the Northland Regional Council document "Clean Streams: a Guide to Riparian Management in Northland", advice from the Northland Regional Council staff and current good practice in the Scheme area or in similar areas.

(b) *A description of appropriate methods to be implemented for exclusion of stock from the riparian margins within the floodway. . . ."*

4 *The Consent Holder shall prepare a description of oxbows and cut off channels within the floodway channels of the Waiotu, Whakapara and Wairua Rivers that can be enhanced with respect to riparian function, such to be included in the Scheme Management Plan as the Oxbow/Cut-Off Channel Management Plan.*

The description shall include the procedures, methodology and funding mechanisms to achieve the enhancement and shall be prepared in conjunction with the Northland Regional Council and representatives of the Northland Fish and Game Council and the Department of Conservation and in consultation with persons farming the land in question. The plan shall identify which oxbows/cut off channels can be enhanced having regard to practicality and benefit. . . ."

WDC has followed the process of taking into account the specified Northland Regional Council documents, taking advice from Northland Regional Council staff, identifying current good practice carried out by DoC and NFGC in the scheme area, and involving representatives of the NFGC and DoC in the development of this ROBMP as set out in conditions 3 and 4.

It is also proposed that this draft ROBMP will be made available to all farmers in the Scheme for their input and comments by making it available on WDC's website. WDC will also be consulting directly with those "persons farming the land in question"(ie: grazing licence holders) to determine and agree the modifications needed to the grazing licences and the new mechanisms which need to be put in place to allow for implementation of riparian margin and oxbow enhancement within the grazed floodway areas.

3.2 Stakeholders

There is a combination of stakeholders with an interest and role in maintaining and enhancing riparian function and managing the outcomes. These include:

Stakeholder	Role and Interest
Northland Regional Council (NRC)	NRC is the consent authority responsible for issuing the consent and monitoring compliance. NRC also made a submission in general support of WDC's application noting that the integrity of the Scheme and its stated objectives should be maintained. Condition 3 recommends that NRC's document " <i>Clean Streams: A Guide to Riparian Management in Northland</i> " and advice from NRC Council staff be taken into account when preparing Floodway Riparian Management Plan.
Northland Fish and Game Council (NFGC)	NFGC made a submission on WDC's application about the lack of planting in the riparian zone of the main river and old oxbows.

Stakeholder	Role and Interest
	<p>Work is currently underway, lead by NFGC, to restore the "Borrow-Cut" Oxbow within the floodway near the Tanekaha Pump Station. This involves enhancement for both aquatic and terrestrial habitat. NFGC initiatives include installing water level control and fencing to exclude and/or limit and control stock access. This restoration has provided guidance for future work proposed in this ROBMP.</p> <p>NFGC is also partnering with DOC via a formal Management Agreement for joint management of the Wairua River Wildlife Management Reserve immediately adjacent to the floodway.</p>
Department of Conservation (DoC)	<p>DoC made a submission on WDC's application expressing concern about potential adverse effects on indigenous freshwater fish and seeking mitigation to address any adverse effects on natural and habitat values and processes.</p> <p>DoC administers the marginal strips adjacent to the river banks which have been vested in the Crown as Reserve. (Refer section 3.3) and is also responsible for jointly managing the Wairua River Wildlife Management Reserve with NFGC.</p>
Local land owners and those farming the land in question	<p>The floodway land is vested in WDC as a reserve for soil conservation and river control purposes as part of the Scheme. It is grazed under lease to the local landowners. The lease includes a number of conditions including to farm and manage the land in good and husband-like manner, at all times maintain the land in good grass, no greater than 150 mm in height on average, and clear the land of all noxious weeds as well as controlling animal pests.</p>
Iwi (Ngati Hau Trust Board)	<p>The Trust Board made a submission on WDC's application expressing concern about habitat degradation and its adverse effects on freshwater fish and their habitat. They sought input and participation into the effective management of the waterways including the freshwater fishery. (These aspects are being dealt with by a separate body of work currently underway to form the basis of the Fisheries Management Plan which is due for completion in May 2012).</p>

3.3 Reserves and Marginal Strips vested in the Crown

Marginal strips within the Scheme area were created along the Whakapara and Wairua Rivers where crown land was sold adjacent to the river. This occurred long before the Scheme was constructed and typically a 20 metre strip adjacent to each bank of the rivers was vested in the crown as Reserve. These reserves are known as marginal strips and are administered by the Department of Conservation (DoC) for the purposes of:

- a reserve for public access;
- protection of the conservation values present;
- their inherent species values; and
- the improvement of the water quality.

The location of these marginal strips is shown in Figure 5.1 of the iSMP (provided by DoC). Where these marginal strips are located within the Scheme floodway they come under the umbrella of conditions 3 and 4 of the Scheme consent, which requires WDC to prepare a Management Plan to address riparian and oxbow/cut-off channel enhancement. Accordingly, the provisions for the enhancement of these areas with respect to riparian function are addressed in this ROBMP.

3.4 Significant indigenous wetlands.

The final Scheme Management Plan is required to include "*provisions for the protection of significant indigenous wetlands within the main floodway (washway) channels ie. between the control banks.*" (Condition 2 (f)).

The NRC staff report for the consent application¹ identified four separate remaining significant areas of remnant swamp or forest as follows:

¹ Northland Regional Council, April 2007. "Northland Regional Council staff report on application: CON20031137501"

- Forsythe meander
- Otakairanga Peat Bog
- Wairua wildlife Management reserve
- Jordan Valley Shrubland.

All of these areas are outside the floodway channel, but three of them, the Forsythe Meander, the Wairua River Wildlife Management Reserve and the Jordan Valley Shrubland have remnant cut-off channels within the floodway, although these are no longer hydraulically linked to the wetland areas due to the construction of the stop banks. The enhancement of these cut-off channels within the floodway is addressed in this ROBMP.

3.5 The approach to developing the ROBMP

This section outlines the approach taken by WDC in developing this ROBMP including meetings, discussions, liaison and site visits with various stakeholders and review of relevant documents.

Description - Date	Present	Outcomes/Discussion
Meeting 8 December 2010	Bob Cathcart (NRC) Conal Summers (WDC) Viv Kloosterman (VKCEE for WDC)	<p>Plants need to be able to withstand ponding, cope with intermittent wetting and drying, require minimal management and not adversely affect the hydraulic capacity of the Scheme. Suggested rushes, sedges, flaxes and hebes. If flaxes are planted first then the rest of the species tend to follow naturally.</p> <p>From the junction of the Waitutu and Whakapara rivers and upstream, it is important not to trap sediment and riparian planting is probably not required in this area. Willows were planted in this area because the banks were slumping but they do need to be managed. Bob Cathcart (NRC) to go out with Andy Keith (WDC) to decide which willows should be trimmed, removed.</p> <p>Need to select which oxbows should be managed and revisit grazing licences for these oxbows so that restoration can be implemented over a period of time to fit in with these licenses.</p> <p>Potentially creating significant wetlands over time so need a good photographic record of the "before" photos and be clear that these wetlands which will develop over time need to be managed within the constraints of the Scheme and in a way that does not compromise the Drainage Scheme objectives.</p>
Meeting 10 February 2011	Ian Hogarth (DoC) Rudy Hoetjes (NFGC) Conal Summers (WDC) Viv Kloosterman (VKCEE for WDC)	<p>DoC and NFGC agreed to help identify oxbows/cut-off channels for enhancement and offered to send aerial photograph identifying oxbows/cut-off channels.</p> <p>NFGC and DoC were working on Management Plan for the Wairua Wetland Reserve and agreed to provide a copy of this for background information.</p> <p>Photographic record of the oxbows/cut-off channels was important to provide a baseline record. Protocols need to be agreed now so that restoration and ongoing management can be carried out without the need for further consents.</p> <p>Necessary to increase the water levels in oxbows/cut-off channels for longer periods to get increased area of habitat, so earthworks are first step. Depths of 1 to 1.5 m maximum are desirable.</p> <p>Access is required for machinery to control sedimentation, remove dead plant materials and detritus and provide access for spraying.</p> <p>Stock exclusion is crucial to achieving successful riparian revegetation. Suggested options of solar powered electric fencing.</p> <p>Discussion on who was responsible for management of behalf of WDC. In regard to funding mechanism NFGC suggested work in</p>

Description - Date	Present	Outcomes/Discussion
		kind and that they were available to act in an advisory capacity. Suggested a meeting once per year between iwi, DoC, NFGC, WDC and landowners.
Aerial photographs showing location of oxbow/cut-off channels March 2011		Provided by NFGC to assist with identifying oxbows/cut-off channels for restoration
Wairua Wetland Reserve Management Plan Management Plan for the Borrow-Cut area adjacent to Tanekaha pumping station 6 April 2011		Provided by NFGC and used by WDC as guidance and for consistency with this ROBMP
Telephone discussion 19 April 2011	Viv Kloosterman (VKCEE for WDC) Rudy Hoetjes (NFGC)	Sought NFGC views on how to prioritise the rehabilitation of the ox bows. NFGC suggested starting from the south end and working north. Also suggested working on ox bows in the area where WDC may already have machinery working to keep costs down. The ability to carry out restoration and riparian planting would also be dependent on reaching agreements with the farmers who currently graze the floodway and modifying grazing licences. These discussions could also impact on timing and prioritisation. Revegetation in the Borrow-Cut area has been achieved by excluding/controlling stock access, and with minimal actual replanting. The area has mainly been colonised by species native to the area. This approach to revegetation could be an affordable option for the Scheme.
Site visit to Scheme 27 April 2011	Ian Hogarth (DoC) Rudy Hoetjes (NFGC) Warren King (VKCEE for WDC)	Visit to Borrow-Cut restoration area adjacent to Tanekaha pump station. Site visit to inspect oxbows/cut-off channels and riparian margins (refer section 6))

3.5.1 Issues Identified

This process identified the following key issues:

- Plant suitability: Plants are required to withstand the conditions within the riparian margins while at the same time maintaining the integrity of scheme capacity and design.
- Planting methodology: What is the most efficient and effective method of revegetation?
- Stock exclusion. How is stock exclusion from the riparian margins best achieved?
- Compatibility with grazing licences. These licenses will need to be renegotiated to deal with aspects relating to water supply, fencing and plant and animal pest control
- Stakeholder coordination. How is stakeholder coordination carried out so that each party can make a meaningful contribution towards restoration in a way that maximises the different capabilities and inputs from each of the stakeholders?

- Ongoing maintenance: What is the most efficient way of carrying out long-term maintenance for riparian areas and newly created oxbow channel restorations (e.g. sediment, weed, plant and detritus removal)?
- Affordability: How can restoration of riparian margins and oxbows/cut-off channels be carried out so that it is cost-effective and works are undertaken at a rate that is both financially and environmentally sustainable.

4 Goal of Riparian and Ox-Bow/Cut-off Channel Enhancement

4.1 Goal

The goal of the riparian and oxbow cut-off channel improvement within the floodway is to:

Revegetate these areas in a manner which creates environmental benefits and ensures the design basis and flood carrying capacity of the Scheme is not compromised; and at a rate that has regard to practicality, benefit and affordability.

Environmental benefits of this revegetation include:

- Improved water quality
- Enhanced aquatic and fisheries habitat leading to greater diversity and abundance of freshwater life
- Enhanced terrestrial habitat for flora (native plants) and fauna (eg: wildfowl) leading to greater diversity and abundance of these species.
- Improved bank stability and reduced erosion
- Contributing towards restoration of the historical use of the swamp by Maori.

5 Methodology

5.1 Plants

The choice of appropriate plant species is central to the success of riparian revegetation and restoration. The plants selected need the following attributes:

- able to withstand ponding and flooding;
- able to survive intermittent wetting and drying;
- require minimal maintenance
- do not have significant dormant/die off periods nor contribute large volumes of detritus during die-off periods
- do not adversely affect the flood carrying capacity of the Scheme.

5.1.1 Plant Selection

The features of suitable plants which meet the above criteria are given in the table below. These plants are suitable for marginal shallow-water, embankments and areas surrounding open water. They are reasonably easy to grow and able to tolerate wet soils and periodic flooding. They are able to bend with the flow and are low growing (generally no higher than 1-2 m) so as not to inhibit flood flows and trap debris.

Smaller native sedges, grasses and rushes are the most effective filter for removing sediment, bacteria and nutrients from surface run-off on relatively level ground.² The list below is not exclusive and other plants may also be suitable.

Plant species	Common names	General growth characteristics	Depth range (m)	Recommended plant spacings	Comments
Phormium tenax	Harakeke, New Zealand flax	1-3 m tall. Robust clumps of tough fibrous leaves. Tall dark brown to black flowerheads.	0**-0.05	1-1.2 m	Suitable for embankments. Does not generally grow well in continuously flooded conditions. A very important plant for Maori, traditionally providing fibre for weaving and rope making, as well as nectar and buoyant flower stalks. Also an important nectar source and cover plant for wildlife
Carex secta ⁽¹⁾	Pukio	1-1.5 m tall. Drooping harsh tussocks forming trunk like base when mature. Green year round.	0*-0.05	0.4-0.6 m	Classic plant of New Zealand wetland and stream margins. Suitable for margins and embankments.
Bolboschenus fluviatilis, etc	Ririwaka, River bulrush, Marsh club rush	1-1.8 m tall. Leafy sedges with stems, (triangular in cross section).	Shallow water to 0.3 m.		Fast-growing in spring and early summer, there is some die back overwinter, but can provide seasonal diversity.
Hebe (native hebe endemic to area)					(obtain info from NFGC)
Juncus spp.; especially J pallidus J effusus	Leafless rushes	Generally range in height from around 0.4 to 1.5 m, but J. Pallidus will grow to 2 m or more. Form clumps of green cylindrical stems with seedheads emerging from just below the tip	0*-0.25		Rush species commonly found in wet pastures and swampy areas. Suitable for stabilising margins and embankments. Tend to grow in periodically wet conditions, and once established, will tolerate periods of dryness.

(1) also Carex flagellifera which NFGC have reported growing in Zone 2 of the Wairua Wildlife management Reserve.

"0**" refers to tolerance of periodically wet soils and conditions where the water table generally remains within 200 mm of the soil surface.

"0***" refers to tolerance of relatively dry conditions, approaching those of normal temperate terrestrial plants. Some embankment species are likely to require supplementary water supply during establishments under dry conditions.

² Northland Regional Council, 2005. "Clean Streams-A Guide to Riparian Management in Northland".

5.1.2 Planting Method

The revegetation of riparian margins will involve re-establishing native grasses, sedges and rushes for long-term protection. This may involve protecting riparian areas to allow natural regeneration, replanting, or a combination of the two. Natural regeneration has the advantage of the areas being colonised by species that are endemic to the area and naturally able to withstand the conditions.

Successful revegetation will require the exclusion of stock from the riparian areas (refer section 5.3) and the removal of weeds and inappropriate plant species (refer section 5.5.2).

5.2 Riparian Margin Width

5.2.1 Riparian Width – Main River

Recent New Zealand research recommends that for gently rolling land, widths of one to three metres per 100 m of slope feeding into waterways are ideal.⁽²⁾ Run on slopes between the stop banks and the riverbanks are generally in the order of 100 m along the floodway indicating that a riparian width of one to three metres would be appropriate.

Given the cross sectional shape of the river channel, if this was strictly applied the fencing would be located on the side slopes of the riverbank. A practical alternative is to locate the fencing 1 to 2 m back from the top of the river channel on flat land. This is shown in the typical cross section and annotated photographs in section 6.

5.2.2 Riparian Width - Oxbow/cut-off channels

The cut-off channels have varying cross sections. Some banks are gently sloping, with one in four gradients or flatter while other banks are steep with a marked change to a flat gradient at the top of the bank.

NFGC indicated a preference to have a platform for machinery access to allow for long-term maintenance and also to have side slopes of one in three or flatter as this gradient allows waterbirds to walk up the bank. The soil which is removed during this bank regrading could be used to construct the earthen embankments referred to in section 5.4.

Overall this results in a fence location and riparian width of up to 2 m from the top of the channel bank on flat land, or a maximum of 5 m from normal water level. These details are shown in the typical cross section and annotated photographs in section 6.

5.3 Stock Exclusion

Condition 3 of the resource consent requires WDC to describe the methods that will be implemented to exclude stock from the riparian margins within the floodway. In order for this to occur changes will need to be negotiated to the grazing licences between WDC and the farmers who graze the floodway land. This raises the issues of fencing and alternative water supply which will need to be negotiated in consultation with the farmers grazing the land. Some proposals are outlined below.

5.3.1 Grazing Licenses – Current Situation

It is necessary, as part of Scheme operation, to maintain low vegetation on the current river banks in order to maximise the flood carrying capacity of the rivers. This is facilitated in a cost-effective manner by grazing the full extent of the floodway. Stock access to the river edge is generally provided to allow stock to drink, as there is no reticulated water supply in the floodway. Currently the banks of the river are generally maintained in short grass, rather than allowing dense riparian vegetation to grow.

The grazing and management of this floodway area is covered by a grazing licence between WDC and the farmers grazing the floodway land.

The grazing licences require the farmers to:

- maintain, clean, keep open and in proper working order and free from obstruction, all water courses
- comply with any direction of WDC regarding the conservation of water-fowl, fish life and other wildlife;
- clear the land of noxious weeds and plants
- keep the land free and clear from all rabbits and noxious vermin
- top dress the pasture

- farm and manage the area in a good and husband like manner in accordance with the Scheme operational requirements
- keep all fences, bridges, gates, culverts etc in a good state of repair and condition
- not erect fences on the land without the prior written consent of the WDC.

WDC is not liable to provide or maintain a supply of water on this land either to stock or for any other purpose.

5.3.2 Fencing

A single wire electric fence along the riparian margins of the river and the oxbow/cut-off channels is proposed. Fence posts could be either permanent or temporary. These details, including who will be responsible for erecting and maintaining the electric fences, still need to be agreed and confirmed between WDC and the licence holders.

5.3.3 Water Supply

When stock are excluded from the riparian margins, an alternative reticulated water supply will need to be provided. Responsibility for constructing and maintaining this alternative water supply will need to be agreed and confirmed between WDC and the licence holders.

5.4 Water Level Control in Ox-Bow/Cut-off Channels

NFGC and DoC have indicated the importance of water level control and active management to preserve open water areas and improve habitat.

They report that in the Wairua Reserve some species have already disappeared due to a reduction in the shallow margins on the ponds and wetlands. The creation of open water areas is a requirement for species which live in and under the water. The loss of open water areas limits invertebrate species such as dragonfly, damselfly, midges, water boatmen and back swimmers which are an essential part of providing a high protein food source for both fish and birds in wetlands. These open water areas also provide habitat for native fish species, such as eels. It can also be beneficial to manipulate water levels to simulate natural ecosystems and allow for drying out of areas to provide a healthy environment.^{3, 4}

One option to increase water levels in the oxbow and cut off channels is by constructing simple earthen embankments of up to 2 m in height between the cut-off channel and the main river channel. A number of these cut-off channels already have earthen embankments in this location. Refer section 6 for further details.

It is considered that these activities would be covered by the consents already granted for the Scheme, but this still needs to be confirmed with NRC.

5.5 Maintenance

It is envisaged that ongoing maintenance will be a joint responsibility with contribution from a range of stakeholders. Discussions still need to take place to confirm and agree long-term arrangements. The following section describes the maintenance work which will be required to be allocated between the parties.

5.5.1 Mechanical Cleaning and Clearing

Oxbow and cut-off channel restoration and deepening of water levels creates additional requirements for ongoing maintenance. Access needs to be provided for machinery to clear and remove sediments, vegetation, including water weeds, dead plant materials and detritus. Weeds such as privet also need to be removed around some of the cut-off channels and this may need to be carried out mechanically.

Any mechanical clearing which takes place in the oxbow/cut-off channels will ensure that:

- weed fragments are not distributed downstream
- any work will not take place during peak fish spawning and migration and bird nesting periods.

The proposed machinery access platform is shown on the typical cross-section in section 6.

³ Northland Fish and Game Council and Department of Conservation, 2011. "Wairua Wildlife Management Reserve Strategy"

⁴ Northland Fish and Game Council, 1999. "Management Plan for the Borrow-Cut Area Adjacent to Tanekaha Pumping Station."

5.5.2 Control of plant pests and unsuitable plants

Chemical control of weeds in oxbow's/cut-off channels will be carried out using only chemicals that are licensed for application over water. In general, contact herbicides, which act directly on plant tissue, will be used.

Weeds in revegetating riparian zones will be controlled in general accordance with Table 3: Methods and Herbicides for Controlling Weeds in "*Clean Streams-A Guide to Riparian Management in Northland*" NRC 2005.

It will also be necessary to remove plants which have colonised the riparian areas but are unsuitable, due to their size, for example. Removal of larger shrubs and trees will probably be by hand or by spraying.

5.5.3 Control of Animal Pests

Under the current grazing licences, control of animal pests is the responsibility of the licence holders and this is likely to continue unchanged.

5.5.4 Fence Line Maintenance

Fence lines along the riparian boundaries will need to be inspected after flood events and maintained, repaired or reinstated as required prior to any grazing on floodway areas.

5.6 Timeline

Section 6 includes annotated photographs showing the proposed work along the main river banks and oxbow/cut-off channels between the southern end of the floodway at Matarau Road and the Tanekaha pump station (Borrow-Cut Area). It is proposed to restore these areas first and then based on the experience gained to move on to the northern part of the floodway.

The timeline for this riparian revegetation will depend on a number of factors including:

- the renegotiation of the grazing licences
- the allocation of tasks and management responsibilities between the various stakeholders
- the revegetation method adopted. It is proposed to commence with fencing and allow revegetation to occur naturally, but experience may show that some replanting is required.
- the need for consents from NRC to carry out any revegetation or earthworks within the riparian zone or in the oxbow/cut-off channels
- the cost and availability of funding, which is also influenced by the factors identified above.

6 Proposed Restoration Sites

Typical cross-sections and photographs of proposed sites for restoration and riparian enhancement are included in this section.

6.1 Typical Cross Sections

Figures 6.1 and 6.2 show a typical cross-section along the main river bank, and a typical cross-section along an oxbow/cut-off channel respectively.

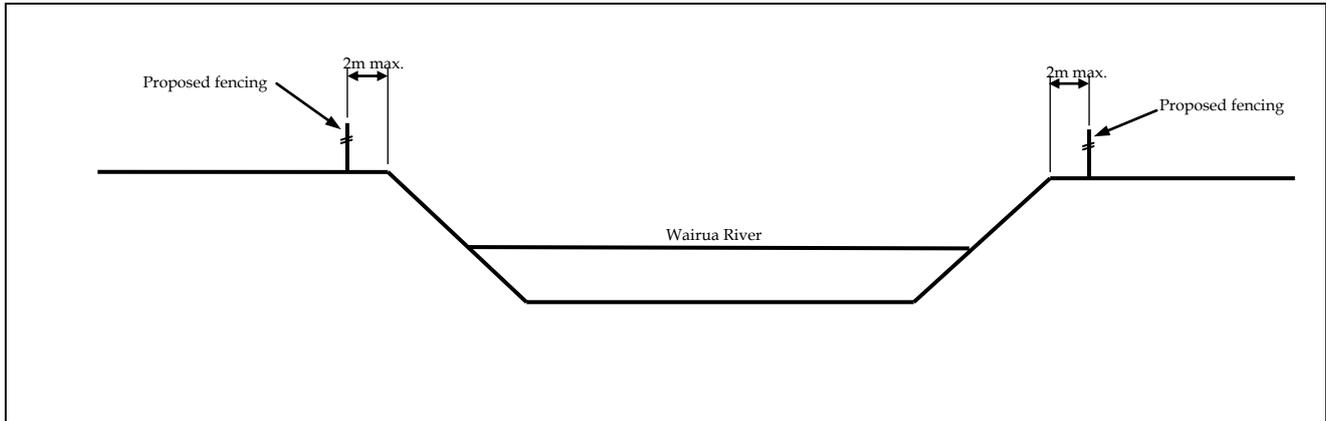


Figure 6.1: Typical Cross-section along main river bank

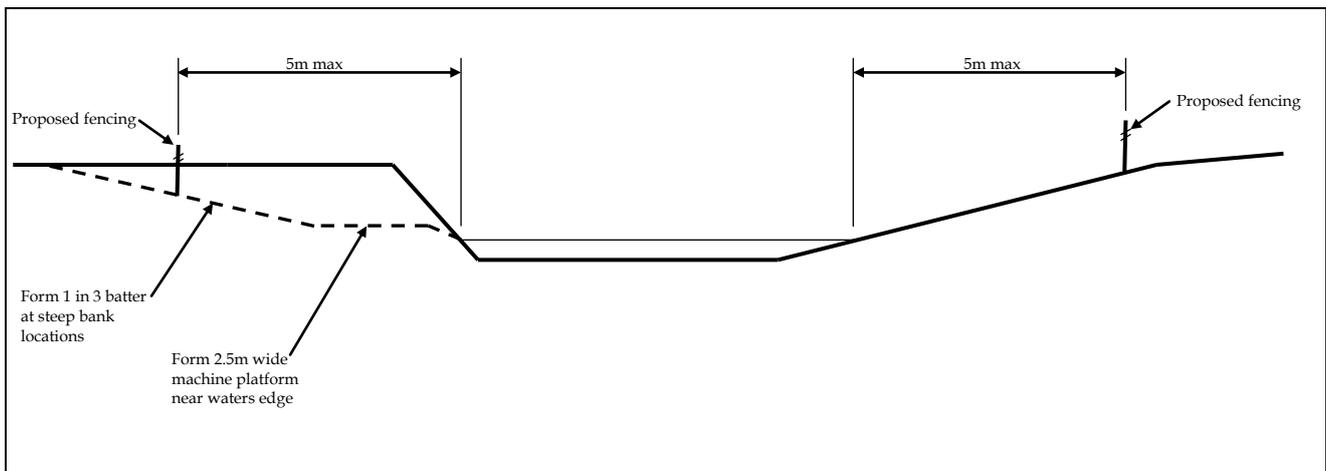


Figure 6.2: Typical cross-section – Oxbow-Cut-off channel

6.2 Photographs of individual sites

The main index plan shows the location of the restoration sites labelled 1 to 18 starting at Matarau Road at the southern end of the floodway. The following information is supplied for each oxbow/cut-off channel site:

- an aerial photograph of the site showing the location and direction from which oblique photographs were taken. These aerial photographs are all aligned with a north point up the page.
- annotated oblique photographs of each oxbow/cut-off channel indicating where fencing, weed removal, alterations to the banks and the formation of a low embankment would be required
- annotated oblique photographs of the riparian zones along the main river showing the proposed location of fencing and existing vegetation.

The location of fences is indicative only and would be subject to agreement between stakeholders.



Figure 6.3: Index Plan Showing sites 1 to 12



Figure 6.4: Index Plan showing sites 12 to 18

Glossary of terms

Abbreviation	Description
iSMP	Hikurangi Scheme- initial Scheme Management Plan
ROBMP	Floodway <u>R</u> iparian and <u>O</u> x- <u>B</u> ow/ <u>C</u> ut-Off Channels <u>M</u> anagement <u>P</u> lan
NRC	Northland Regional Council
NFGC	Northland Fish and Game Council
DoC	Department of Conservation
WDC	Whangarei District Council