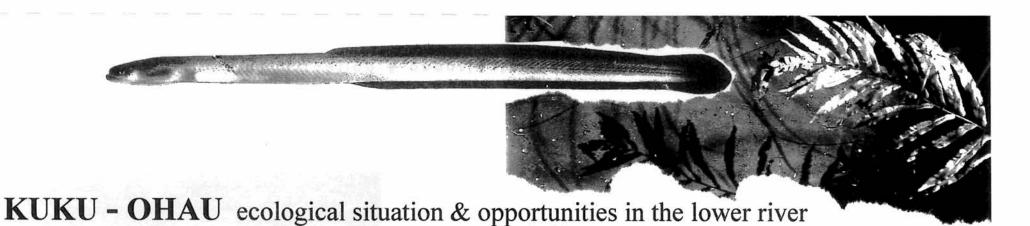


Preliminary ecological report for Te Raukawakawa O Te Ora of Ngaati Tukorehe, regarding life in the lower Ohau river, with particular focus on the roto, "long lake" or "loop" in the Tahamata area.



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AIMS

- To recognise the whole of the Ohau as a taonga.
- To express rangitiratanga and kaitiakitanga, to ensure people who whakapapa to this place can pass on an environment which has been enhanced by their presence and efforts.
- To address the issues and opportunities resulting from river management, in particular the effects of the 'cut' and associated works.
- To ensure that developments and management are not at the expense of the river, nor of the land.
- To seek rehabilitation and restoration of areas of cultural significance, and respect of waahi tapu.
- Recognising the constraints imposed by land development and river management, seek to restore or enhance the whitebait, eel and other fisheries.
- To restore the depleted and degraded indigenous flora & fauna of the lower Ohau, with regeneration, revegetation, reforestation and wetland restoration.
- To enhance nga rongoa o nga rakau.
- To make information available to hapu, iwi, runanga, Govt departments and any organisation or individual able to utilise this information for the betterment of Māori health and well-being.

BACKGROUND

SOURCE & CONNECTIONS

The Ohau flows from the greywacke ranges of Tararua, across the marine terraces at their base, and through the adjoining sand plain country to the coast. The mountain path of the Ohau has formed a trail for people for centuries - trampers use this trail today.

John Bevan Ford depicts the source of the Ohau and six other rivers at Hanga-o-hia-tangata (Arete) in *Ko Tararua 5*, the hydrological hub of Tararua. The cloak also suggests the connections beyond. Wider connections are also shown by the kereru in their loop route between Tararua, Kapiti and the coastal plain of the Ohau.



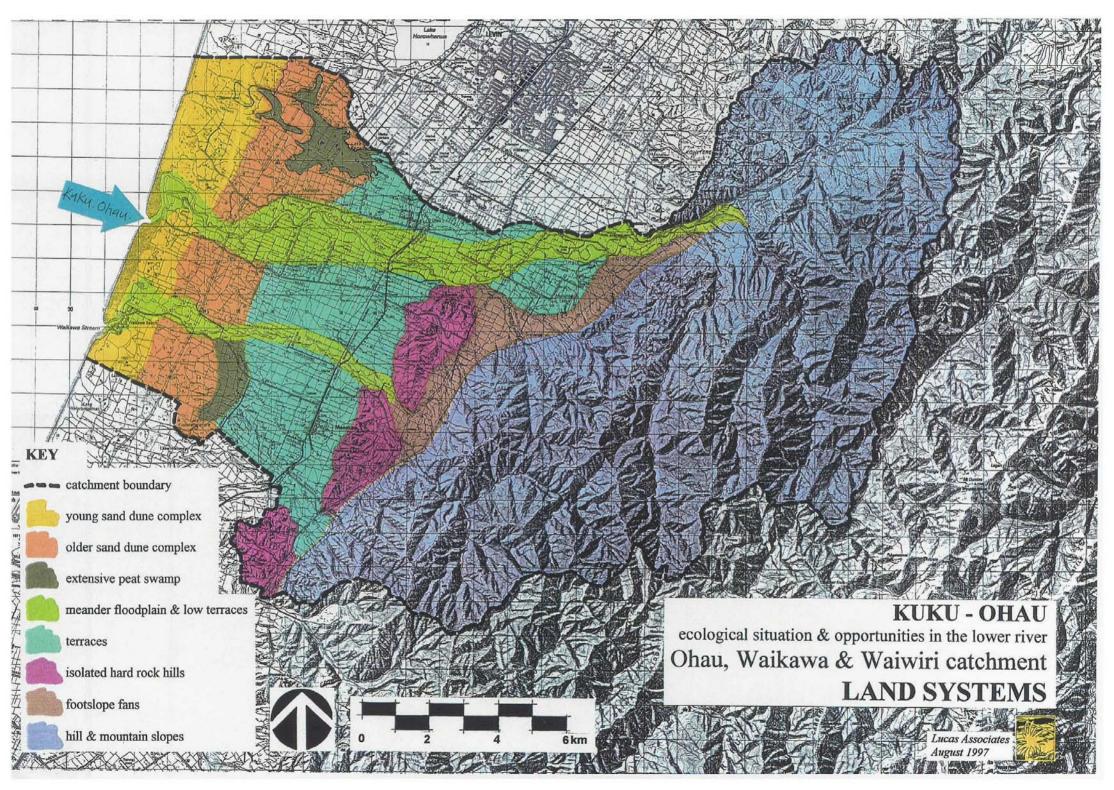
This coastal plain had once reached right across to the South Island, as revealed by Leslie Adkin when he sought to unravel the geological history. Aeons ago, oceans warmed and ice melted and the plain was submerged. It then emerged again from the shallow sea. From Adkin's mapping of the Horowhenua plains, he became aware of this historic dynamism.

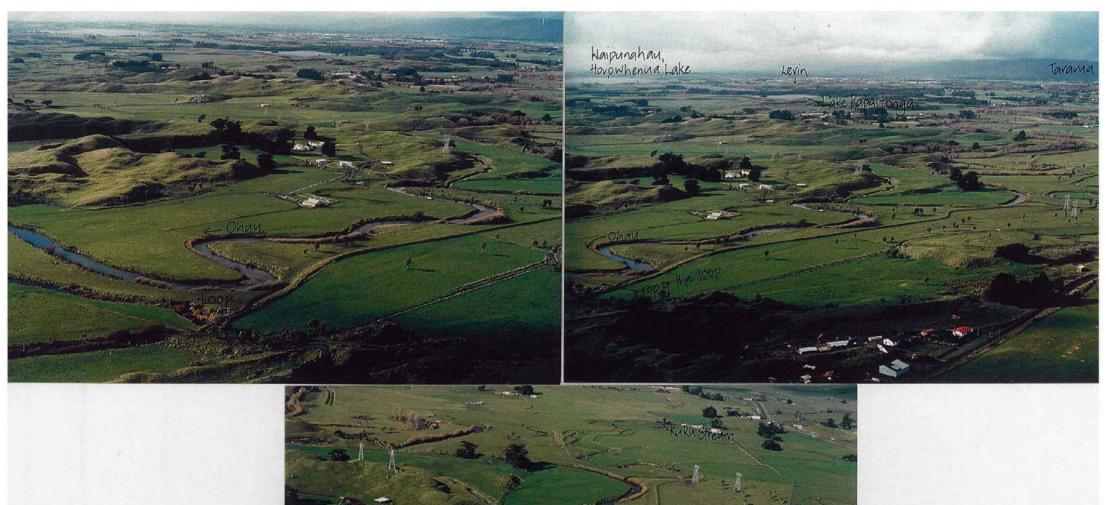
MOVEABLE FEAST

The Ohau is a key feature of the Horowhenua Plains. It demonstrates the dynamics, the ever-changing character and pattern of the coastal plains. Water courses came and went. The Ohau has had two previous courses.

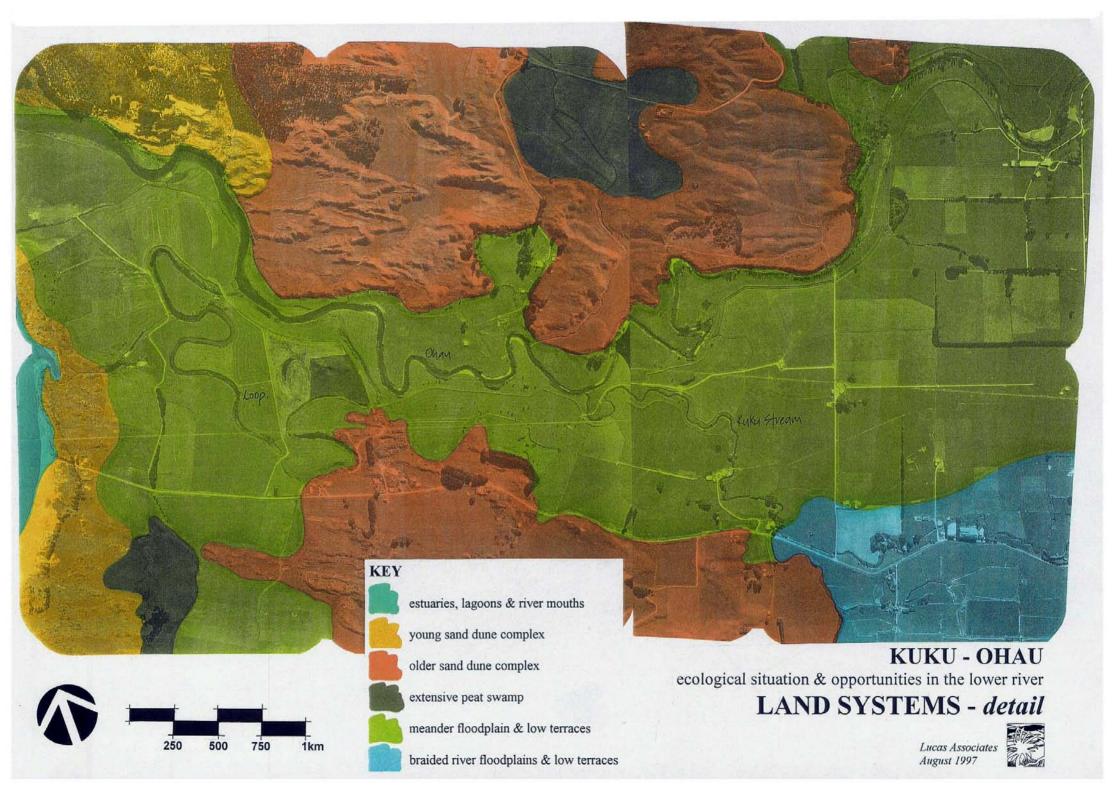
The Ohau used to emerge from the Tararua mountains and meander north, with streams of the Manawatu, to flow into the low-lying basin where Waipunahau (Horowhenua lake) now lies. The lake Papaitonga was once a lagoon at the mouth of the Ohau. Advancing dunes trapped the lakes against the marine terrace.

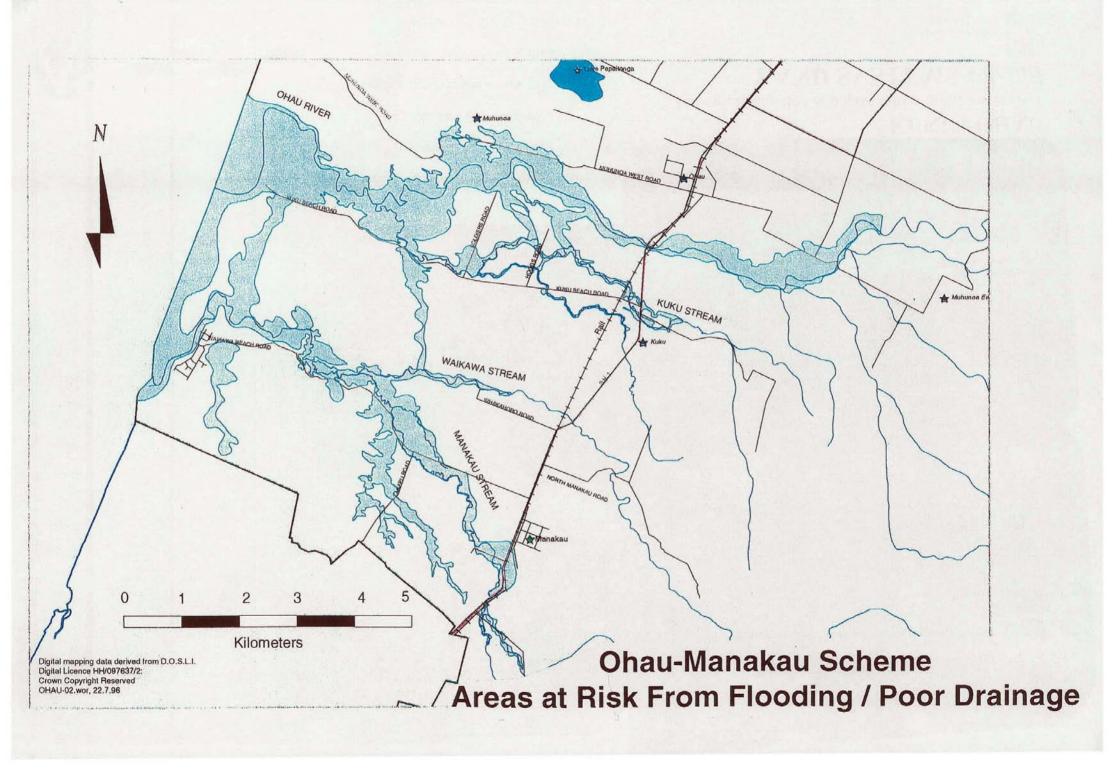
Suddenly the Ohau changed course to spill south from the Tararua mountains, to flow in the corridor to the sea still followed today. On this southern course, engineering intervention has shortened the lower river resulting in a long sinuous remnant lake through Tahamata. The induced lagoon, the roto, the "loop, at Tahamata is the focus of this report.











NATURE OF THE PLACE

The lowlands are a sand plain country with a heritage of abundant forests lakes, lagoons and swamps. Maori described to Adkin a mosaic of lagoons, lakes, swamps and forests. The stumping and ploughing of farm development early this century showed the forest history in these lands. (Park, 1995, pp.207-210).

This was a forest landscape. Almost continuous forest over plain, terrace and mountain slopes up to tree line. Few remnants of plains forest remain. Papaitonga provides a precious reminder, and a model and nucleus for new forest.

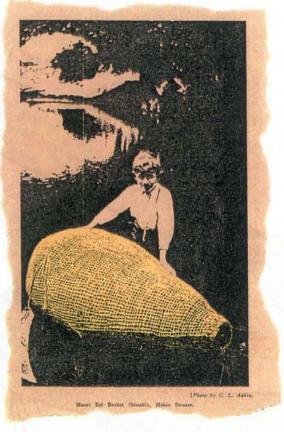
The coastal plain complex was famed for its natural food resources, particularly the tuna (eel) supply abundant in the lakes, lagoons, some streams - plus the artificial storage ponds and the channels (papa-tutaki) constructed for eel harvest. There were at least two eel species, and many local varieties. Inanga also, in season, were in plentiful supply. When tuna and inanga were running seaward to breed, stream weirs "were the scene of industrious and joyful activity." (Adkin, p.23).

Kaumātua have varied memories of the seasonal food collection practices, the drying and storing, the gifting, feeding of visitors or manaakitanga (feeding, care and mana upraising). They share the realisation of "the loss and disappearance of the bountiful fish, animal and shellfish supplies, especially since 'the cut' at the mouth of the Ohau... 'The cut' was considered the plan to minimise the effects of flooding on a flood plain!" (Perenara)

Drainage of contiguous swamp lands to increase pasture for livestock, has been detrimental to all the waterbodies of the coastal plain. They have reduced in size, their margins modified and made less favourable as eel feeding places, and the water bodies have also been silted up. The land development has resulted in "the accelerated obliteration of the beautiful, natural, moisture-conserving water-features of our landscape" (Adkin, 1948).

McDonald (1929) described being told of "several small lakes with no outlet whatever other than evaporation or soakage". These were regularly stocked with eel and grown on for some six years prior to harvest using hinaki.

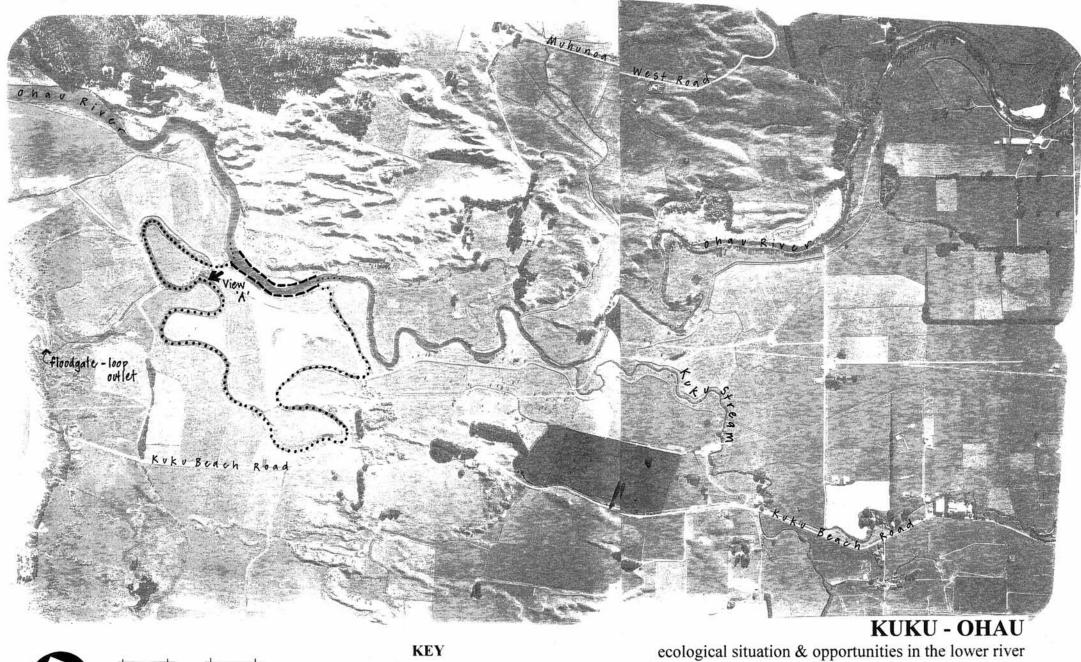




Adkin (1948) described two types of freshwater bodies in the (Papaitonga).

mullet (kanae) Horowhenua - lagoons and lakes. Lagoons lie in hollows among the dunes and their water levels fluctuate. Lakes lie along the inner margin of the dune belt, for example, Waipunahau (Horowhenua lake) and Waiwiri Kaumātua have told of past riches. Settlers reportedly lived on giant patiki (black flound kokopu. Kaumātua speak of the loss of the breeding grounds of: •tuna (eel) •kokopu (adult inanga, whitebait) •lamprey (spawn in small bush-covered streams) •patiki (black flounder) •mullet (kanae) •herring (aua) •kakahi •koura (freshwater crayfish) operarau (soft shell mussel, or Maori oyster - formerly harvested from Blind Creek, a backwash of semi-stagnant water) kokopu (adult inanga, wnitebait) tuna (eel) tuna (eel) - short finned lamprey

KUKU - OHAU ecological situation & opportunities in the lower river - preliminary notes







Chau River diversion

.... Ohau River meander since cut off

THE SITE

Lucas Associates August 1997



SITUATION

RIVER MANAGEMENT

The river character varies along its length. Above the rail bridge it is a broad, steep, gravel-lined river. Below the Kuku confluence, the river is a well-defined, slow-moving, tidally influenced waterway.

From a proposal in 1968, a river diversion was in 1972 constructed to reduce the Ohau river length between Haines Bend and the sea. The river was confined and shortened through engineering works forming the "cut" and stop-banking. This work successfully reduced the size and frequency of flooding along the Ohau. It is managed by the Manawatu-Wanganui Regional Council.

Natural processes have thus been disrupted. The relationships between river system and adjoining lands has been changed. The old channel had a balance between erodability of banks and force of channel flow. Through shortening the length, and thus steepening of the river channel, has increased river bank erosion. Unchecked, bank erosion will continue until the channel regains its old length. It is necessary to securely vegetate bank sections if regaining the old length is to be avoided.

The Regional Council's Ohau Manakau Scheme Review was criticised by tangata whenua for, among other things, purporting to want minimum impact solutions but providing "limited content or thought to instigating the processes that can re-enhance or re-enrich this once plentiful river system, flood plain or wetlands. Now is the time to impart and support a balance of truly sustainable practices" (Henry Perenara) - and meet such criticisms.

Flood protection recommendations for the Ohau River from the Ohau Manakau Scheme Review included to:

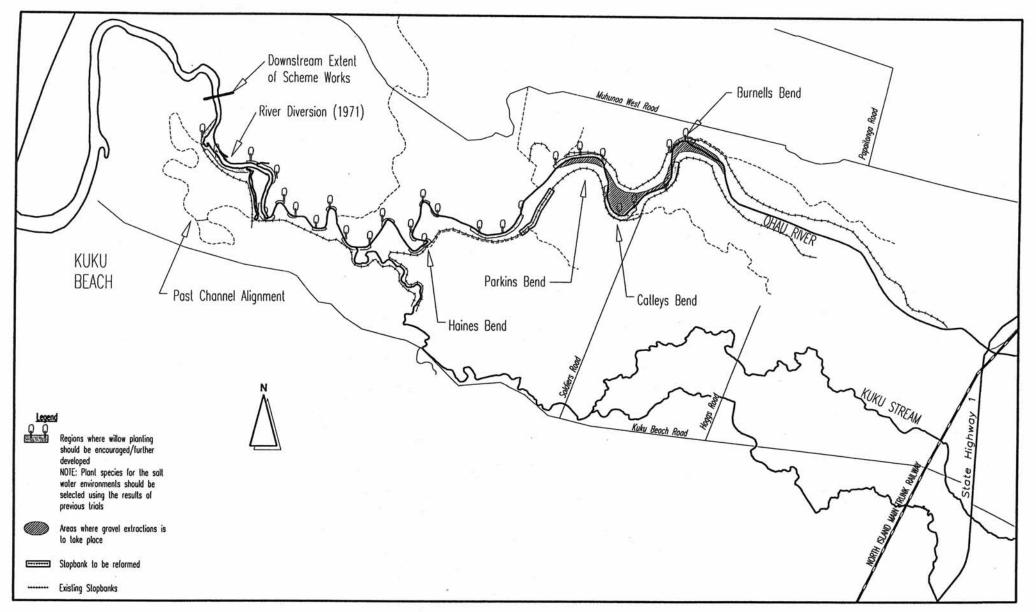
- continue to encourage long-term extraction [gravel] extraction between Catleys Bend and Hoggs Road. Policy in the Plan for Beds of Rivers, Lakes and Wetlands should be to set gravel extraction at between 5,000 and 10,000 cubic metres per year.
- · control vegetation along the lower reaches. Management of over-abundant vegetation - particularly willow - is considered necessary in the diversion channel to stop silt build up. The Review sought that willow planting be accompanied with limited native tree planting in close consultation with local iwi.

The shortened river now operates as a largely separate system from the Loop. From some testing undertaken recently (refer Andrew Tipene, monitoring project - results appended), the quality of the Ohau river waters appears to not be particularly degraded. However, the river habitat quality is seriously degraded, with the artificial river confinement and lack of vegetation. Much of the river bank is grazed by cows, thus destroying the fishery potential. Overhanging vegetation, undercut banks, and dense cover are essential for the breeding and life of many fishes.

FLOOD MANAGEMENT

Previously substantial floods over farmland are now confined by stopbanks. The "cut" reduces flood levels by shortening the river. In this regard it is successful.

Above the Kuku confluence, stopbanks to the river have low-points as weirs - they are overtopped even by 1-year events. Below the Kuku confluence, the stopbanks are designed for 100-year return period flood events. In this area, the tide is the main influence on flood levels.



ohau manakau scheme

Ohau River - Proposed Works Downstream of Burnells Bend

GRAVEL/WORKS

The main gravel extraction occurs upstream of the "cut" - between Hoggs Road and Catleys bend to retain channel capacity by ensuring river bed levels do not increase. Excavations are required to be done above water level only, to minimise environmental effects.

RIPARIAN VEGETATION

River management involves willow plantings to retain and strengthen certain lengths of river bank. Where vegetation overhangs the river, it benefits the in-stream habitat through providing shade and food - prolific insects from the willows feed the fish below. The Review proposed incorporating indigenous plantings where practical.

Flood management through river confinement and gravel extraction has encouraged adjacent landowners to farm right to channel banks. Through land development and grazing, there is little riparian vegetation and few riparian wetlands remaining along the lower river. Formerly rich forest and wetlands that contributed to a healthy river system, the lower Ohau is now a seriously depleted environment.

RESULTANT "LOOP"

The diversion "cut" has left several kilometres of river channel divorced from the river flow. The Loop, the river remnant is a totally different system - long lagoon, not river.

Lakes cut off from rivers are a natural part of this sand plain country. Left to natural processes, dunes and rivers move. Sections of river are cut off or left, as with Waipunahau when the Ohau moved south. Lakes and lagoons are left behind.

Late autumn was not the best time to sample for environmental parameters that may be potentially limiting. The best time to look at environmental conditions would be mid-late summer. However, based on our observation (21/5/97), it appears likely that environmental conditions are limiting for a considerable part of the year.

Preliminary impressions of the aquatic community show the Loop is a highly eutrophic old river channel. It is understood that the water depth may be in excess of 3 metres in sections of the Loop. In the deeper sections there is a reasonable chance that pockets of saline water are ponded in the bottom by the usual processes of stratification. These pockets will be stable and anaerobic.

Kaumatua lament that with the "cut" the fish and birds have all diminished severely. The river system has undoubtedly changed, being confined and shortened. Now stilled, the waters in the lagoon Loop show a concentration of the pollutants from the land.

The lands adjoining the river and the Loop are denuded. Pasture and stock right to waters edge does not provide conditions conducive to healthy waterways. The decline in wildlife may therefore be substantially due to change in riparian management as well as to river flow management.

Richard de Hamel.

Hopes Rand and Carleys bond to relate channel capacity by ensuring river

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system - long lagoon, not river.

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LOWER SECTION OF LOOP

The lower sections of the Loop are obviously affected by saltwater intrusions - possibly through the sand flats enclosed by the sanddunes, and/or ponding of seawater from high tides. Plant zonation reflected the effects of increased salinity and perhaps turbidity. The algae *Enteromorpha intestinalis* remained as the only significant aquatic plant in the lower reaches of the Loop.

As they seek the freshwater interface, saline intrusion into the Loop placed areas suitable for whitebait spawning at some distance upstream.

The substrates were less anaerobic in the lower Loop, suggesting organic loadings were a little less than further up the Loop, or, there was better water exchange.

Riparian margins of the lower Loop are heavily affected by cattle grazing - the flatter terrain allows easy access by stock to water's edge.

An artificial outlet has been constructed from the Loop to the coast, ending with a floodgate to prevent high tide entry. However, this gate inhibits fish passage, and is easily blocked by log debris brought up by the tides.

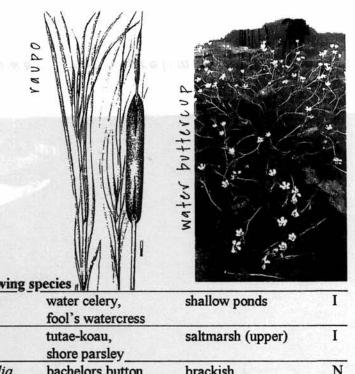


LOOP VEGETATION

The forest has all gone. The wetlands have almost gone, with now merely a tiny fragment - and the last of the harakeke.

Around the loop riparian vegetation is currently mostly pasture (700+ha dairy farm) - with a few cabbage trees, toetoe and rushes. The coastal dune country was planted in pines 1996.

Existing plants in the loop include:		(C.Mitchell 21/5/97)	
botanical name	common name	$ \begin{array}{ll} \textbf{preferred} & \textbf{native} = \mathbf{N} \\ \textbf{habitat} & \textbf{introduced} = \mathbf{I} \\ \end{array} $	
Aquatics			
Potamogeton ochreatus	blunt pondweed, manihi?	brackish or fresh, open or slow moving waters	N
Elodea canadensis	Canadian pondweed	freshwater, rooting or I drifting, fast coloniser	
Floating plants			
Lemna minor	duckweed	freshwater	N
Azolla filiculoides	rotoroto, karerarera	freshwater; still, fertile ponds and drains.	N
Rorippa nasturtium- aquaticum	watercress	in seepages & along streams	I
Emergents			
Typha orientalis	raupo, bullrush	freshwater	N
Baumea articulata	jointed twig-rush	ponds, swamps.	
Juncus effusus	soft rush	damp ground	I
			_



Marginal low growing	species #		
Apium nodiflorum	water celery, fool's watercress	shallow ponds	Ι
Apium prostratum	tutae-koau, shore parsley	saltmarsh (upper)	Ι
Cotula coronopifolia	bachelors button	brackish	N
Paspalum distichum	Mercer grass	wet, non-saline soils	I
Polygnum persicaria	willow weed damp ground, swamp edges.		I
Wetland species			
Baumea articulata	jointed twig-rush	swampy margins	N
Cyperus eragrostis	umbrella sedge	damp, along streams	I
Festuca arundinacea	tall fescue grass	saltmarsh (upper), freshwater	I
Isolepis prolifer	green clubrush	swampy ground, brackish pool edges	N
Juncus maritimus var australiensis	searush	saltmarsh (upper to lower)	N
Phalaris arundinacea	reed canary grass	shallow pond & stream margins	I
Salix cinerea	grey willow, sallow	in swamps, by rivers	I
Ranunculus spp.	buttercups	freshwater, pasture	I

LOOP FISHERY

Fish Sampling The Loop

(C.Mitchell, 21/5/97)

In the Loop, above the floodgate:

Gobiomorphus cotidianus common bully ++ Palaemon affinis common shrimp Retropinna retropinna common smelt

Seawards of the Loop, below the flood gate,:

Palaemon affinis

common shrimp +++ grev mullet ++

Mugil cephalus Retropinna retropinna

common smelt

Galaxias maculatus

common whitebait, inanga

Gobiomorphus cotidianus

common bully

Rhomboselea reteria

black flounder

On the riverside at the top end of the "cut", inanga are breeding in the long grass. They hatch with the full tide and pass out on the tide. The site is perhaps the extent of salinity (the Cotula (bachelors button) growing nearby is another indicator).

However, the current state of the waters and environs within the Loop is largely inappropriate for most wildlife.

Inanga are annual fish, they have to get in and out each year. They need waterway connections free of barriers - they can't cope with piping and the floodgate is a barrier.

Tuna, or eel, in contrast, do not go to sea to spawn for some years, and then never return. Of the two species of eel, the short-finned eel is the main species of the lowland swamps, lagoons and stable creeks. But as the locals well know, there are many many varieties - for example, puhi



and hau reputed to migrate at dusk in autumn, and, papaka and rehi rehi, migrating in early spring.

Eels can of course move overland on damp grass to reach ponds without running water. Some small lakes of this Horowhenua sand plain country used to be stocked with juvenile eels (McDowall, 1990).

Eels are able to survive in poor water conditions that are fatal to many other fish. They can survive low oxygen levels, varying temperatures and salinity - they move freely between fresh and salt waters. The shortfinned eel feeds almost exclusively on insects and bottom fauna - snails, shrimps, etc. - and, after floods, they eat lots of earthworms.



HABITAT NEEDS OF SHORTFINNED EELS (D. Jellyman, NIWA)

Whereas the endemic longfinned eels is principally a fish of flowing water and hence frequents stony rivers and penetrates well inland to high-country lakes, the shortfinned eel (shortfin) is mainly a species of still or slow-flowing water and hence dominates eel populations in coastal lakes and swamps.

Although shortfins do penetrate well inland, they are predominantly a coastal species and dominate populations in the Foxton-Himatangi sanddune lakes (Cunningham et al. 1953).

Freshwater eels are diadromous, i.e. they spend most of their lives in fresh water, before migrating to sea to spawn. Therefore, access to and from the sea is essential for maintaining populations. The initial entry from the sea, by glass-eels (5.5-6.5 cm) is during spring, but each summer there is a further upstream/inland movement of juvenile eels (elvers) unless suitable habitat is encountered (Jellyman 1977).

A major issue for tangata whenua will be the restoration of eel stocks. Presently the Loop is virtually inaccessible to glass-eels as the lack of flow will mean that the gate is shut except for those times when flows increase following rainfall. (Options for improving fish passage are given at end of report.)

Assuming that the entry of glass-eels can be improved, then there are several factors associated with suitable habitat - adequate water quality and quantity, adequate food and cover. Eels are among the most tolerate of our freshwater fish with regard to water temperature and levels of dissolved oxygen - likewise tolerate a wide range of water levels, with increased levels during floods allowing eels to forage along flooded margins.

Food requirements change with the size of the eel - eels of all sizes are opportunist scavengers and take a wide range of prey. Small eels in lakes

eat mainly chironomid (midge) larvae, aquatic snails, amphipods, and other small invertebrates (Jellyman 1989). With increasing size and mouth gape, eels are able to consume larger prey, and by the time eels reach 60-70 cm they include small fish in their diet. Both the quality and quantity of food affect growth rates.

Eels are light-avoiding, meaning that daytime cover is a critical component of eel habitat - the quantity of large eels an area can contain has been found to be directly proportional to the amount of suitable cover available (Burnet 1952). In shallow lakes, turbid water can act as partial cover, although turbidity can also reduce plant growth and alter the food chain. The more important components of cover are suitable substrate, aquatic weed, debris, and depth. Juvenile eels are mainly found in shallow (<2 m) littoral zones, and prefer soft mud and/or small cobbles - firm sand is unsuitable (Jellyman and Chisnall in prep.). Larger eels have a wider distribution, but generally avoid shallow margins, preferring deeper water where wave action is reduced. Again soft substrates provide excellent cover for the eels to bury in, but large cobbles and boulders are preferred to small cobbles. Emergent marginal vegetation like sedges, rushes and raupo, can provide suitable cover if there is a base of organic debris for eels to hide in - larger eels forage extensively in such shallows at night. Likewise aquatic weeds provide both cover and a source of food.

Burnet, A.M.R. 1952. Studies on the ecology of the NZ longfinned eel, Anguilla dieffenbachii Gray, Australian Jnl of Marine and Freshwater Res. 3:32-63.

Cunningham, B.T.; Moar, N.T.; Torrie, A.W.; Parr, P.J. 1953. A survey of the western coastal dune lakes of the North Island, New Zealand. Australian Journal of Marine and Freshwater Research 4: 343-386.

Jellyman, D.J. 1977. Summer upstream migration of juvenile freshwater eels in New Zealand. N Z Journal of Marine and Freshwater Research 311: 61-71.

Jellyman, D.J. 1989. Diet of two species of freshwater eel (Anguilla spp.) in Lake Pounui, New Zealand. New Zealand Journal of Marine and Freshwater Research 23: 1-10.

Jellyman, D.J.; Chisnall, B.L. (in prep.). Habitat utilisation by shortfinned eels Anguilla australis, in two New Zealand lowland lakes.

ISSUES HABITAT

With the loss of all the former forest and wetland vegetation from these flats, and replacement with pasture, the lands and waters are very exposed to sun, wind and saltburn. Shelter is necessary for a richer habitat. Overhanging vegetation for lagoon and stream not only provides shelter, but also provides insects, crucial food for fishery and birds. The Loop lacks overhanging vegetation, and in this state has very limited habitat potential.

The lack of wetlands associated with the lower river and the Loop also limits wildlife opportunity. For example, raupo swamps to provide rearing areas for inanga.

Riparian responsibilities and management protocols are unclear.

NUTRIENTS

Excess nutrients: "Just a teaspoon of super will turn a swimming pool green" (Charles Mitchell). There is little evidence of nutrient enrichment of the waters by farm runoff where into the flow and volume of the Ohau main channel. However, it becomes very obvious when it is in to a lagoon type system such as the Loop has become. The waters are not flushing the nutrients out to sea, but storing them in the lagoon. The nutrient runoff problem, which can be ignored when conveniently flushed away by the river, cannot be ignored where clearly evident when held in the lagoon. The effects of farm management, gathered together because of the "cut" stopping them being flushed out to sea, has resulted in severely degraded waters.

A concentration of nutrients results from previous dairy shed effluent disposal directly into the channel. This rather toxic situation will remain for decades. Action is essential to remove the nutrients.



WEED POTENTIAL

Grazing by stock has limited weed growth, excepting for less palatable species as blackberry and boxthorn, and wetland weeds that stock have difficulty reaching.

With destocking of riparian areas for revegetation and spawning habitat, there is huge weed growth potential. Mass planting must therefore accompany any destocking to ensure that the resultant vegetation is useful and not a problem. In this fertile environment, active weed control of shade-tolerant weeds (e.g. of wandering willie) will be essential if an area is to be destocked for revegetation.

BARRIERS

Structures in waterways often block fish passage, for example, culverts. The course of the Loop has also been interrupted by roading, disrupting the length of the Loop waters. The floodgate on the outlet channel from the Loop (see page 14) stops fish passage.

FLOW

The Loop was cut off from the Ohau river some 25 years ago. The Loop has little input of fresh water, which allows the pollutants to concentrate. Re-connection to the river flow would require a warning system and control gate to prevent the river flooding through Tahamata. Being now largely protected from floods, just one failure of a warning and gate system could be devastating to the farm.

The river has cut down so that the loop is now higher than the river and it is not feasible to re-connect river flow through the Loop.

At the seaward outlet from the Loop, in the artificial channel to the coast, the floodgate can become jammed with log debris allowing saltwater flooding of the farmland. This is an effect which should be addressed.

INVESTIGATIONS SOUGHT:

WATER QUALITY IN THE LOOP

The water quality parameters proposed to be sampled in the Loop are:

SURFACE	BOTTOM
WATER	WATER
~	~
~	~
~	~
~	-
~	:-:
~	-
	WATER

These parameters would perform the following functions:

- 1. Serve as the baseline to show environmental conditions in the loop at present, before any restoration strategy is undertaken.
- 2. Indicate the potential for success of any project to restore the loop as fish habitat, and in particular eel and inanga habitat.

To better understand the water quality issues and opportunities in the Loop, we consider that three sites along the loop should be sampled:

- At the outlet to the estuary Sampling would preferably have to be at low tide when water/effluent is flowing from the loop.
- In the centre of the loop. Here the old channel is more open and exposed to the prevailing wind. This allows some aeration and the shallow surface layers at least appear to be oxygenated to some extent.
- The upper reaches of the loop, at the cowshed site. This area has
 received significant volumes of dairyshed effluent for a timespan
 measured in decades. It is presumed that this material represents a
 significant store of nutrients that will continue to affect water quality
 in the loop for a considerable period.

The best time to look at environmental conditions would be mid-late summer.

It is hoped that easily replicable sampling sites can be established. Continued, this sampling programme will be a significant component of the effort required to show later that the restoration programme has attained the intended goals.

NUTRIENT & SALINITY INTRUSION

Monitor the potential for cow-shed effluent spray to penetrate into the water bodies of the Loop. Also, identify the extent saltwater invades or percolates into the Loop.

FISH MONITORING

Undertake fish monitoring and barrier observation during spring to identify fishery limitations and opportunities.

STATUS

Appropriate custodianship and ownership of the lands and waters in and around the lower Ohau needs to be explored. It is understood the southern half of the river was under the custodianship of Tukorehe. The northern under Kikopiri.

HERITAGE SITES

Cognisance needs to be taken of special places and waahi tapu sites, including the urupa. (Perhaps have Susan Forbes assemble a report)

PLANTINGS

Plan, prepare for and undertake indigenous riparian planting trials for the riverbank and Loop.

Seek to monitor the ecological effects of the recent dune pine plantations on the coastal ecosystem as they grow.

OPPORTUNITIES

INTEGRATED MANAGEMENT

Management of lands and waters need to be managed for their interrelationships, including the flows and cycling of waters, animals, seeds and nutrients.

The Regional Council Review of the Ohau recommended the development of a management plan for other waters. Development of an integrated management plan is desirable for the Kuku Ohau.

LOOP WATERS

The potential to again allow river flow into the Loop was reviewed. Whilst this would allow the pollutants to be flushed through the Loop, and fish passage, it is not now considered a practical option.

The preferred option for Loop waters is, however, to divert some clean stream water into the Loop. Along with a nutrient removal and riparian revegetation programme, this should allow a healthy lagoon ecosystem to be developed.

Recommendation:

Manage the Loop as a long, sinuous lagoon, an elaborate ox-bow. A
river remnant that is a totally different system than a river. Not a
stream/river, but a lagoon.

Saline intrusion into the Loop could be pushed well downstream by:

- increasing the freshwater flow into the Loop, for example, through diverting flow from Kuku Stream into the upper Loop.
- re-opening the old channel outlet that was further upstream.

Recommendations to improve Loop waters & fisheries:

- Diversion of high quality spring water flowing along the toe of the sand-dunes upstream into the top of the Loop.
- · Permanent fencing and retirement of the slopes of the Loop.
- Cleaning out of the cow-shed effluent area by drag-line. This
 represents the removal of a significant amount of stored nutrients and
 carbon that will otherwise pollute the water body for decades.
- In addition the removal of extensive suds of emergent vegetation will assist considerably with re-oxygenation of the water column.



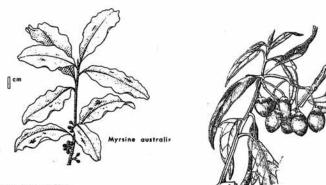
• riparian fencing to exclude stock from trampling banks.

• establish dense riparian vegetation to trap nutrients from farm runoff.

REVEGETATION

- Explore with owners the opportunities to revegetate in the Kuku Ohau. Priority is for planting up the riparian margins of the Loop and river to restore habitat values.
- Seek a minimum band 10 to 20 metre wide alongside waterways, and permanently and securely fence to exclude all stock.
- Explore opportunities for wetland re-instatement. Develop substantial harakeke wetlands.
- Undertake a weed risk assessment to ascertain the feasibility of establishing a sustainable indigenous vegetation resource.
- Seek to develop a matrix of lush native vegetation, with riparian plantings and wetlands etc. providing shelter to farmland too.
- Re-establish the kahikatea forest and wetland associations, beginning with dense plantings of hardy shrubs, such as karamu, harakeke, and raupo wetlands.
- For forest, interplant several years later with stage two plants such as kahikatea, pukatea, kohekohe and totara (see plant lists appended).
- With adequate permanent fencing, revegetation of riparian areas in the Loop have greater potential for success, and for creating a rich wildlife resource in this long lake.
- Encourage Regional Council in their intended Ohau reserve plantings of indigenous plants.
- Develop friendly information on the nature of the area, to assist in revegetation and restoration projects.
- Provide for sustainable resources of particularly depleted and/or important species.

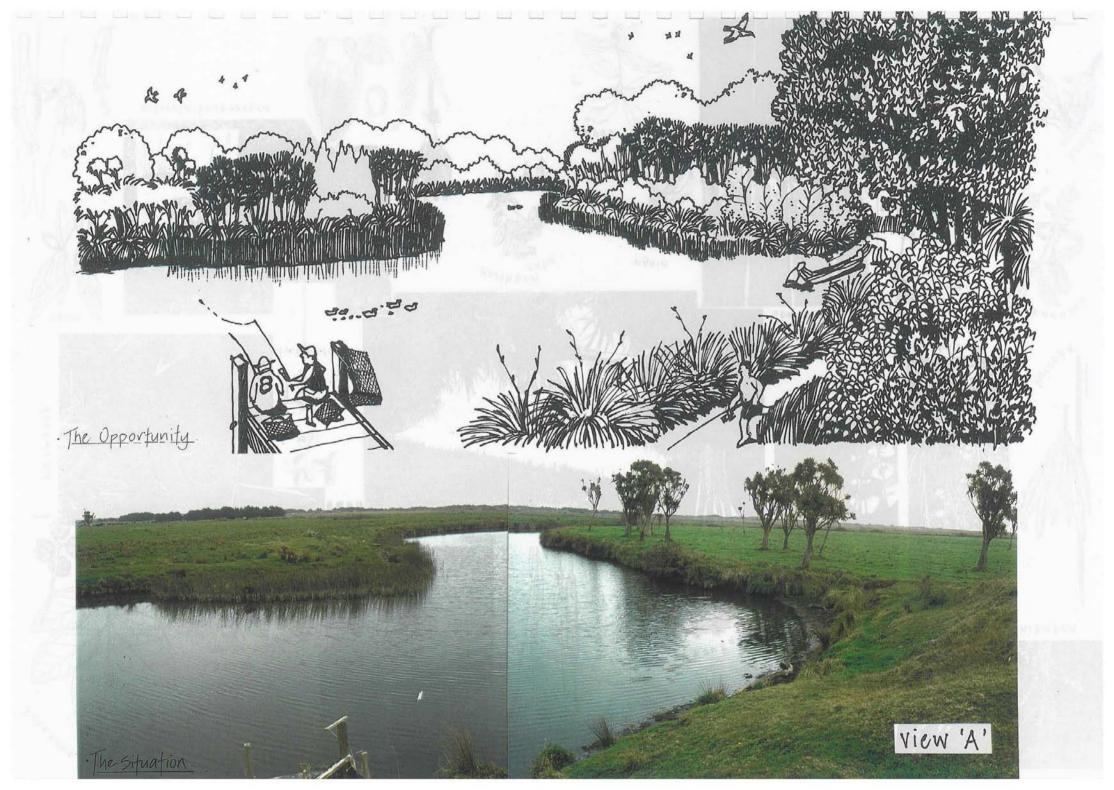
 To ensure plant availability, investigate potential nursery establishment or co-operation with other operations propagating native plants of and for this sand plain country.

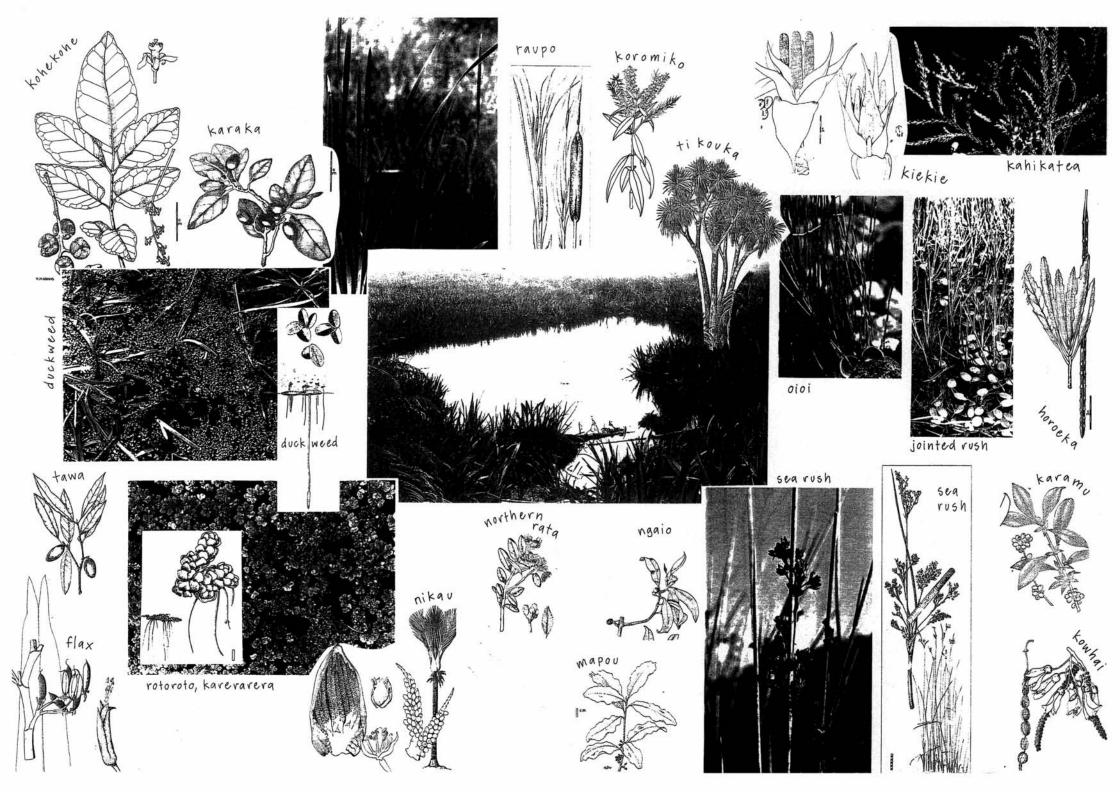


RONGOA RESOURCE

- Seek to establish sustainable supplies and information of rongoa for Traditional Healers and traditional healing for the betterment of Maori health and well-being.
- Explore inclusion of locally indigenous plants of cultural value in accessible river reserves and riparian plantings.

Locally Indig	enous Rongoa plants include:	situation preferred:
Pukatea	Laurelia novaezelandiae	sun, boggy ok. Not dry, poor
Kawakawa	Macropiper excelsum	clay. (Impossible to get locally) shade, moist ok.
	State of the transfer of the first of the state of the st	Not dry, boggy, poor clay.
Mapou	Myrsine australis	sun, dry, moist, wind ok.
		Not boggy.
Karaka	Corynocarpus laevigatus	sun, shade, moist ok.
		Not boggy, poor clay.
Karamu	Coprosma robusta	sun, dry, moist, poor clay ok.
		Not shade, boggy.





LOOP OUTLETS

Modification of the floodgate at the outlet to the Loop would improve fish passage.

· Mount the floodgate on short rollers

(As used by Environment Waikato) the floodgate is then pushed wide open by the falling tide and water velocities through the gap are less than when the gate is mounted as at present.

Other options for modifying the flood gate are:

· Mounting the floodgate on a level controlled trigger

The floodgate will then be open over both the incoming tide (the major period for upstream migration by whitebait), as well as the outgoing tide. The level controlled trigger would trip the flood gate to close if there was a risk of flooding. (This method will be relatively low cost compared with other following option but would have to be manually reset after each flood event.)

Mount the floodgate with a radio controlled trip

The floodgate will then be tripped automatically if there is a risk of flooding but will remain open the rest of the time to allow free passage of these small weak swimming native fishes.

Re-open Loop route to Ohau

- Re-opening the old route for the Loop back into the Ohau River, and with fencing to remove stock, a whitebait spawning ground would develop at this old outlet.
- Maintenance of the present outlet from the lower Loop against sand encroachment and the accumulation of tide borne timber debris.
 Debris jamming the floodgate causes the land to be flooded with saltwater, and the effects of this need to be included in the costing comparisons with options. Restoration of the old Loop outlet to the

Ohau River is likely to dramatically lower the maintenance costs compared with the current scenario.

FISHERIES MANAGEMENT

To improve the native fishery:

- · Enhance whitebait with breeding and rearing areas, and sea access.
- Identify whitebait spawning areas along the Ohau River and protect them from stock grazing over autumn.
- Provide areas of swamp (e.g. of raupo, pukio) adjoining the channel for inanga rearing, where stock are fenced out.
- Riparian re-vegetation to provide shade to moderate water temperatures, reduce weed growth and to improve in-stream conditions.
- Modify barriers to fish passage culverts and tide gate to enable fish to get in and out to spawn.
- Allow whitebait fishing no closer than 20 metres from the floodgate (DoC regulations) for Fridays, Saturdays and Sundays. Place a rahui on fishing the other 4 days to allow the resource to replenish.
- Ban commercial eel fishing in the loop assuming access can be controlled.
- Stock the loop with large eels saved from other areas to speed the process of ecosystem recovery.

STATUTORY PROCESS

To ensure environmental effects are addressed, river management structures and activities are not accepted as permitted activities.

PRELIMINARY LOOP ENHANCEMENT PROPOSALS REVIEWED Gary Williams, engineer, Otaki 22 October 1997

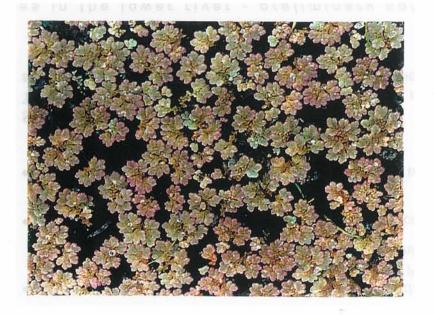
"The proposed re-vitalisation of the old river channel as a lagoon, and riparian re-vegetation around the margins is a very commendable project. It would certainly add to the biodiversity of the area, and enhance food supplies along with a general enhancement of the local environment. The dairy farm would benefit from the shelter and shade to stock provided by the margin vegetation, and with some stock access locations, an improved stock water supply.

I do not see any practical difficulties in implementing it. Water could be diverted from the Kuku Stream, through a piped structure, and taken down a drainage way to the loop. By throttling the off take structure, the additional water diverted during flood flows in the Kuku Stream (as water levels rise) could be kept relatively low, and within the capacity of the drainage way. A manually operated gate could be installed to close down the off take, as a manual safety back up.

The diversion of the spring feed stream into the loop would appear to be straight forward.

There are a number of ways of improving culvert flapgate operation, from a simple double hanging of the flapgate to more sophisticated mechanisms. I would presume the outlet from the Loop could be reinstated to the river, at the downstream end of the cut, by installing a flapgate culvert there. To ensure good fish passage this culvert should be positioned with its invert (bottom) below normal low flow water levels (throughout its length), and there should be a significant outflow through the culvert during low flows - from the supplementary water supply.

It would be an excellent example of environmental enhancement, as opposed to just preventing further deterioration. I would, therefore, be very pleased to be further involved, if I can be of assistance."



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Appendix

PAST AND POTENTIAL INDIGENOUS VEGETATION

To establish, shelter is needed to protect many species from saltburn. Hardy species are proposed for first stage plantings. Long-term canopy species © to be carefully and sparsely located, particularly the podocarps.

For native forest restoration, plant densely (@ 1 per sq.m.) with: first stage:

TREES

karaka kohuhu Corynocarpus laevigatus Pittosporum tenuifolium Sophora microphylla

kowhai manuka

Leptospermum scoparium

ngaio

Myoporum laetum

SHRUBS & FLAXES

harakeke hukihuki

Phormium tenax

karamu

Coprosma tenuicaulis

shining karamu

Coprosma robusta Coprosma lucida

three-penny bit shrub

Coprosma areolata

second stage:

TREES

hinau ©

ewekuri hangehange

Geniostoma rupestre

horoeka, lancewood

Dacrycarpus dacrydioides

kohekohe © mahoe

kahikatea ©

Melicytus ramiflorus

Streblus banksii

Elaeocarpus dentatus

Pseudopanax crassifolius

Dysoxylum spectabile

mapou matai © nikau

northern rata ©

oro-oro porokaiwhiri ©

pukatea © putaputaweta

rimu ©

tawa © titoki©

totara ©

Myrsine asutralis Prumnopitys taxifolia Rhopalostylus sapida Metrosideros robusta Nestegis montana Hedycarya arborea Laurelia navaezelandiae Carpodetus serratus Dacrydium cupressinum Beilschmiedia tawa Alectryon excelsus

SHRUBS

koromiko

poroporo shrub pseudopanax Hebe stricta

Solanum aviculare Pseudopanax anomalus

Podocarpus totara

CLIMBERS & FLAXES

giant astelia kiekie

Astelia grandis Freycinetia banksii

third stage:

FERNS

mamaku maratata

ponga

Cyathea medularis Phymatosorus pustulatus Cyathea dealbata

CLIMBERS

kareao kawakawa white rata vine Ripogonum scandens Macropiper excelsum Metrosideros diffusa







ECOLOGICAL SITE INVENTORY DETAILS

Produced by the Department of Conservation Wellington Conservancy 13-Jan-98

Warning: Interpretation of this information must be with reference to the accompanying documentation.

SITE NAME: OHAU RIVER MOUTH

Num: 89

Map Number/s:

S25

Eastings:

2692500

Northing:

605800

Significant Values:

Council/s:

Horowhenua

Species: Bird: Haemotopus ostrelagus finschi South Island Pied

Oystercatcher Breeding

Vegetative association: Rushland on tidal flat Vegetative association: Herbland on tidal flat Vegetative association: Shrubland on tidal flat

Species: Bird: Hydroprogne caspia Caspian Tern

Species: Bird: Haematopus unicolor Variable Oystercatcher Species: Bird: Charadrius poicinctus bicinctus Banded Dotterel

Species: Bird: Botaurus poiciloptilus Australasian Bittern

Species: Plant: Spiranthes novae-zelandiae Lady's tresses Orchid

Bibliography: NZWSNHR

FRD FFR No.90 SSWI 26/19 3

FOXTONPNA 69 RAP2/5

The sand dune and beach vegetation inventory of

NZ - North Island 1992 W78

MANER 69

OSNZ Dune Lakes Survey

OSNZ Bird Cards

Comment:

- Wide diversity of plant species. Probably resting area for North/South migrants.
- Trailbikes and 4 wheel drive vehicles. Supports whitebait and flounder fisheries.
- Inanga spawning habitat (WERI)
- Excellent example of bar built estuary almost unmodified. Wide diversity of bird species (SSWI)
- Very similar to part of the Manawatu Estuary, except it is smaller and less diverse (PNA)

Ecological District/s: Foxton

Date: 07/06/90

Area: 220.0ha.

WERI Ranking: 3

SSWI Ranking: Moderate-high

Tenure: Private land, Public land Protection status: None

Vegetative types:

saltmarsh ribbonwood

sea rush - jointed wire rush

sea rush

jointed wire rush

halfstar

glasswort-halfstar-Triglochin striatum

marram

RAP(2) 5 OHAU ESTUARY

Ecological Units

- 1. saltmarsh ribbonwood/searush shrubland on tidal flat.
- 2. sea rush jointed wire-rush rushland on tidal flat.
- 3. sea rush/halfstar rushland on tidal flat.
- 4. jointed wire-rush/halfstar rushland on tidal flat.
- 5. halfstar herbfield on tidal flat.
- 6. glasswort halfstar (Triglochin striatum) herbfield on tidal flat.

Alternative to: RAP22

Landform

Geology: Soils: unconsolidated windblown sand; windblown sand; peat no soil development; recent yellow-brown sands; yellow-

brown sands; thin sands; organic soils.

The mouth of the Ohau River has reached the sea in a number of places over 3km of coastline in the last 120 years, at one time sharing a common mouth with the Waikawa Stream (Duguid, 1990). The river mouth still moves 100m or more each year. There is now 100ha of scattered, unstable, low dunes bounded by disused river channels as well as the present, more northerly channel. The only stable areas in this system are on the inland edges and on a 50ha tidal flat in the north-east (which is the part of the area which is recommended for protection). The tidal flat is dissected by a branching channel on its south side. Ten hectares on the east of this flat have been ploughed and partly cultivated and drains dug but the exercise appears futile as the area would be submerged during very high tides. There are numerous trailbike tracks in mud south of the tidal flat despite the whole area being fenced.

Vegetation

Two-thirds of the RAP is covered by a community of sea rush over halfstar. A band, covering 10ha and running north-south across the centre of the area, is dominated by saltmarsh ribbonwood. In the west, partly covered by sand, jointed wire-rush is common. A muddy area of several hundred square metres, covered in halfstar has been badly damaged by trailbikes.

Other locally common species are three-square, bachelor's button, shore primrose, <u>Triglochin striatum</u>, glasswort and <u>Schoenus nitens</u>. The cultivated area is being recolonised by <u>Isolepis cernua</u>, bachelor's button and shore primrose. The only common weeds are gorse on the inland edges and tall fescue on drier ground on the south bank of the river. <u>Spartina</u> grass and <u>Juncus acutus</u> grows nearby and threaten the area. No stock damage was observed.

On the north bank of the river some flax, jointed wire-rush and halfstar persist against the influence of vehicles, pasture weeds and river erosion.

Special Features

The Ohau Estuary is a known South Island pied oystercatcher breeding area and is used by migratory waders (Hugh Robertson, pers. comm).

Selection Criteria

Representativeness:

Good examples of estuarine communities.

Diversity:

Moderate diversity for a large area.

Special Features:

M Some wildlife value.

Naturalness:

High except on edges and where

cultivated.

Н

Viability:

H Would be even better with light weed

control and if trail bikes were restricted.

Size and Shape:

H Relatively large and square.

Buffering:

H Fenced. Protected by salinity and tidal

influence from weeds.

Comment

This RAP is very similar to part of the Manawatu estuary, except it is smaller and less diverse.

References

F C Duguid (1990).

ACKNOWLEDGEMENTS

Te Raukawakawa O Te Ora as an organisation of Māori Traditional Healers is to be commended for their long term vision concerning the preservation of our Taonga - Indigenous Flora of Aotearoa. Their partnership with Otarere Directors shows how Māori can work together to achieve long term benefits for Te Iwi Maori and consequently the peoples of New Zealand.

Thanks to all those who assisted Di Lucas and Charles Mitchell on site, and the Lucas Associates team in preliminary report preparation, in particular:

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Peter Shore, Horowhenua District Council

Ian Lynn, Manaaki Whenua Landcare Research, Lincoln for land systems Artist John Bevan Ford and owner Chris MacLean for the use of Ko Tararua 5

Potential contact people:

Chris Thompson, Manawatu-Wanganui Regional Council (beds plan) Geoff Park, Wellington (landscape historian, ecologist) Susan Forbes, Kotuku Consultancy, Paekakariki (archaeologist) Lucas Associates was invited to prepare a report on the potential to restore life to the lower Ohau. Following discussions with tangata whenua and investigations with Charles Mitchell (Raglan), report prepared by Lucas Associates, landscape planners, Di Lucas & Jeremy Head; with comment added by Don Jellyman, NIWA re. eel fishery, and Gary Williams, engineer, Otaki.



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