Otaki River Floodplain Management Plan

Otaki River Mouth Lagoon

Design Report

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1 Introduction

The purpose of this report is to outline the design and work required to enhance the lagoon area located on the northern bank of the Otaki River mouth. The project area is within the soil conservation reserve land administered by the Wellington Regional Council for flood protection purposes. The Otaki River Environmental Strategy has been used as the foundation for the work presented here.

The design plan contained in this report is the first step in enhancing the wetland area on the northbank of the Otaki River. It identifies an overall vision and plan for achieving that vision. This report should be used as a reference point for anybody interested in the river environment in this area. It will also ensure that management options, as they occur, are consistent with the long-term vision.

Four components are essential to successfully implementing any design in this area:

- a design vision
- a design and planting plan
- weed and pest management
- advocacy.

Ongoing maintenance will be required to ensure the opportunities presented in this report are realised in the long-term.

Design Area

The project area is illustrated in figure 1. The area is bordered by the soil conservation reserve boundaries, although the actual area covered by the plan is smaller.

Design Implementation

The design contains ways to enhance the wetland area. Some of these actions will be implemented incrementally, as funds and opportunities become available. Matching achievable targets with available funds must be a priority in implementing this design. ~~Identifying areas that can be enhanced in phases with the revegetation work, attendant~~ maintenance programmes and pest strategies is the most practical way to achieve the vision set out below.

Vision

To enhance the Otaki River mouth lagoon to provide for the ecological, cultural and community values that make this environment unique.

The Current State of the Otaki River Environment[1]

The Otaki River environment has changed enormously since European settlement. The principal causes have been:

- the extensive clearance of lowland forest for farming, including the removal of riparian vegetation.
- the introduction of weeds, pests, and cattle.
- flood protection works that have restricted river to a single channel.

These changes have had huge impacts on the natural character of the river, particularly in the lower reaches of the river. The river corridor is defined in the Otaki Floodplain Management Plan, and is a strip of land adjacent to the river from State Highway 1 to the mouth.

Visually the river is dominated by stopbanks and bands of willows, cutting the river off from the surrounding landscape. Landscape quality is generally low to average in the middle reaches of the river but of higher quality in the gorge and estuary/river mouth reaches.

The ecological landscape is dominated by exotic species that are adapted to survival amidst predation and disturbance. The original ecological processes have been severely disrupted, and the quantity and variation of species has been reduced. Few natural sites remain within the river corridor.

Public access to the river is limited, firstly, by the comparatively few roads which lead to the river and, secondly, by the significant proportion of privately owned land within and adjacent to the river corridor. This restricts recreational opportunities such as walking, fishing, hunting, canoeing, swimming and picnicking. Because of the limited access points, people who explore the river are obliged to return by the same route if they are not to trespass (or wet their feet by crossing the river!)

On the other hand, the river mouth area gets a lot of recreational use and is valued for its undeveloped character and easy access. It is also one of the most ecologically important parts of the river. It is a rich breeding ground for marine, aquatic and terrestrial wildlife species, with diverse habitats and harsh environmental conditions.

This has resulted in a significant conflict between natural processes and human recreational interests. The river mouth beaches, especially on the north bank, have become riddled with tracks and roads.

This, and subsequent roaming of dogs and bikes:

- reduces the undisturbed bird roosting and nesting opportunities.
- introduces weeds.
- opens up vegetation that relies upon aerodynamic stability for its vigour.
- the use of vehicles and motorbikes may also impact on other recreational use.

[1] Otaki River Environmental Strategy, 1999

Estuary/River Mouth[2]

The river widens here, opening out around Katihiku Island to a low-lying estuarine landscape with swamps and marshlands to north and south. There is an expansive coastal lagoon, with large areas of silt flats that attract bird life. The Rangiuru and Ngatoko Streams join the river through swamps to the north and the Pahiko Drain flows Whakapawaewae swamp to the south (an ecologically and visually important remnant of formerly more extensive swamps). Distinct swamp and coastal vegetation is characteristic. This area is of higher landscape quality than the rest of the floodplain reaches: - memorable for its wide-open landscape, with Kapiti Island a distant feature, and its greater natural character. The area is popular for fishing, whitebaiting, hunting, and beachfront recreation including walking and firewood gathering.

Tangata Whenua

Ngati Raukawa and, in particular, Nga Hapu O Otaki, are the tangata whenua of the area identified in this design plan. The project area also encompasses part of the Pakakutu Pa site. Accordingly, any plans or developments in this area must include at the very least consultation and liaison with the tangata whenua to ensure their aspirations are met in the area. Consultation with tangata whenua has occurred since the beginning of the process developing this design and will be ongoing.

The following section sets out the vision of the Ngati Raukawa Otaki River and Catchment Iwi Management Plan.

Ko te tino tumanako/primary vision statement:
The mauri of the Otaki River and its people restored and revitalised

Te Taiao me nga Taonga (Environment)
The mauri of the Otaki River and catchment is protected, sustained, nurtured and enhanced so that Ngati Raukawa in turn may be protected, sustained, nurtured and enhanced by it.

Te Mana Whakahaere
Equitable, effective and responsible management of the Otaki River.

Te Oranga te Tangata Whenua
The tangata whenua re-associated with their taonga, fully empowered to fulfil their kaitiakitanga responsibilities and to pass on this knowledge to future generations.

The design plan is consistent with the ecological restoration objective, policy and methods identified in section 4.1.2 of the iwi management plan. In addition, this design plan will incorporate the primary indicator of inanga identified in section 4.1.6 to help monitor progress. We believe that this design is also concordant with policy 4.1.7 'development to benefit Otaki communities'.

[2] The Otaki River Environmental Strategy, Appendix A: Landscape Reaches within the Study Area

1.1 Project Design & Process Followed

This design follows recommendations of the Otaki River Environmental Strategy. The strategy provides the overall vision, values and issues to be taken into account for enhancement work in the Otaki River environment.

Two studies of the river were undertaken to develop the strategy, a landscape/recreation study and an ecological survey. The results from these studies were pulled together into a consistent set of recommendation addressing the river's environmental values. To reflect the community's values, local people were involved in developing the strategy's vision. The principal recommendations from this - revegetation and improved public access –were adopted as the core objectives of the Strategy.

The design was further refined and chosen after consultation had occurred with Iwi, the Department of Conservation, Fish and Game Wellington Region, the Friends of the Otaki River and the Kapiti Coast District Council. A copy of the consultation outcomes and issues can be found in the appendix.

1.2 Relevant Plans and Strategies

- Otaki River Iwi Management Plan
- Regional Coastal Plan
- Regional Pest Management Strategy
- Conservation Management Strategy (DOC)
- Kapiti Coast District Plan
- Otaki River Floodplain Management Plan
- Otaki River environmental Strategy
- Kapiti Coast District Council 10-year Action Plan for the Otaki River
- Kapiti Coast District Council Heritage Strategy
- Wellington Regional Council Wetland Action Plan.

1.3 General Responsibilities for Project

Numerous agencies, community groups and landowners have an interest or a role in managing the Otaki River and its environment. Each of these parties has their own objectives for managing, protecting and enhancing the river environment. Overall co-ordination of their different roles is necessary to ensure that they are consistent, and to ensure that all opportunities and priorities for environmental enhancement are realised.

Flood protection staff are responsible for the project's funding from Flood Protection unto the 02/03 financial year. However, a more sustainable outcome will occur if agencies such as the Department of Conservation and Fish and Game continue to be involved throughout the project. Both of these agencies have expressed support for a combined advocacy approach for protecting the area's values.

The Kapiti Coast District Council has included budget for undertaking works in accordance with the Environmental Strategy in the 'Otaki River 10 Year Action Plan'.

2 Design Components

2.1 Environmental Strategy Vision

The Environmental Strategy does not seek to re-establish the natural environment that existed before human habitation. This would be unrealistic and would exclude the community.

This vision for the river deals with the natural character of the river environment, as well as our relationship with that natural character.[3] That includes landscape, ecosystems (both indigenous and exotic), public access and recreation. This section describes the qualities of the river environment that we want to protect and improve and is derived from the Environmental Strategy's recommendations.

Despite modifications, the river has important values and retains some natural integrity. This derives largely from:

- the remnant native vegetation on the plain
- the coastal swamps
- the scattered totara on the river terraces
- the bush remnants on the steep terrace edges
- the native forest visible on the slopes of the mountain backdrop.

These provide the basis for larger and biotically richer areas, and in landscape terms, give the floodplain a recognisable local identity based on its natural character: - a 'sense of place'.

The key components include taking into account the following values:

- The Otaki River as a greenbelt
- Landscape
- Ecosystems
- Access and Recreation
- Flood Protection works.

2.2 Who is Involved – Responsibilities

The success of this project is dependent on the co-operation and good will of the following people and organisations, all of which currently have management roles in the Otaki River Mouth Lagoon.

[3] 'Natural character' can be thought of as the extent to which naturally occurring ecology and/or physical processes of the river environment remain intact.

- **Ngati Raukawa** through Nga Hapu O Otaki – Treaty Partner.
- **Wellington Regional Council** staff likely to be involved include Flood Protection, Resource Policy, Resource Investigations and Biosecurity staff – land manager, biodiversity and Flood Protection responsibilities.
- **Kapiti Coast District Council**, including the District Plan Group, Parks and Reserves and possibly Operations Group – District considerations including biodiversity, recreational aspects and environmental education aspects.
- **Department of Conservation** staff – coastal, biosecurity and biodiversity.
- **Fish and Game** staff – game birds and habitat.
- **Friends of the Otaki River** – community relations, river guardians and revegetation work.

2.3 Environmental Strategy Recommendations

This section contains the recommendations from the Otaki River Environmental Strategy, including:

- Enhance backwaters and sluggish water shaded by banks or vegetation (WRC)
- Create new islands or shingle banks (WRC)
- Plant riverbed sides with natives (WRC)
- Replace pampas with toetoe (KCDC)
- North bank river mouth area (KCDC) including:
  >Access tracks
  >Planting
  >On-site interpretation

Please refer to the appendix for further details about 'Reach One', which includes this project area.

2.4 Nature Reserve Design and Planting Plan

The landscape concept plan can be found in the appendix. The following subsections provide the necessary detail to implement the plan and enhance the project area.

Species Selection

Ecological 'domains' identified by Isobel Gabites have been used as a basis for plant species selection. The biogeoclimate zones ("domains") that the Otaki River passes through are mapped in the Environmental Strategy. The domains give us an indication of what environmental factors limit, or allow, plant growth. This lets us predict what native plants are best suited to planting programmes in these different zones.

Similarly we might learn what energy and habitat dynamics influencing wildlife distribution and to predict the effects people have in the river system. Recognising domain characteristics lets us plan enhancement and mitigation works economically and effectively.

Domains and sub-zones are based on a correlation between climatic factors, topography and substrate characteristics, which results in distinctive, recognisable biological boundaries. Domains identified in the broad mapping techniques applied to the Wellington Region by Gabites 1998, form the basis of this more detailed zonation[4]. Please refer to the following for species recommended in the environmental strategy by domain.

Domain I(i): Duneland, Sandplain and Wetlands

Suitable Species on dry Foreshore	Suitable Species around Brackish Estuarine Areas
Spinifex hirsutus (spinifex) *Desmochoenus spiralis* (pingao) *Muehlenbeckia complexa* (pohuehue) *Acaena* sp. (sand piripiri) *Coprosma acerosa* (sand coprosma) *Pimelea arenaria* (shore pimelea) *Coprosma repens* (taupata).	*Leptospermum scoparium* (manuka) *Plagianthus divaricatus* (marsh ribbonwood) *Phormiun tenax* (harakeke) *Juncus maritimus* (sea rush) *Apodasma similis* (oioi) *Hebe sp.* (koromiko) *Cortaderia toetoe* (toetoe)

Domain I(ii): Duneland, Sandplain and Wetlands

Suitable Species on Dunes and Dry Sand Plain	Suitable Species in Permanently Damp Sites on Sand Plains
Coprosma repens (taupata) *C. propinqua* *Kunzia ericoides* (kanuka) *Dodonea viscosa* (akeake) *Myoporum laetum* (ngaio) *Cassinia leptophylla* (tauhinu)	*Phormium tenax* (harakeke) *Cordyline australis* (cabbage tree) *Cortaderia toetoe* (toetoe) *Eugenia maire* (swamp maire) *Dacrydium dacrycarpus* (kahikatea) *Leptospermum scoparium* (manuka) edge of open water, rushes such as: *Typha orientalis* (raupo) *Cyperus ustulatus* *Carex secta*

Domain II(i) Shifting bars and islands near the coast

[4] The Otaki River Environmental Strategy

Domain II(ii) Alluvial Waterway

Suitable adventive plants for riverbanks, stopbanks and rock groynes (open ground) *(* suitable as nursery crop)*	**Suitable plants for riverbanks (sheltered by willows)** *(* suitable as shelterbelts)*
Cortaderia toetoe (toetoe) *Coprosma propinqua* *Coprosma repens (*taupata*) near the coast* *Coriaria arborea* (tutu) *Hebe stricta** *Carmichaelia* sp. (NZ broom) *Cassinia leptophylla* (tauhinu) *Melicytus ramiflorus* (mahoe) *Myrsine australis* (mapou)	*Macropiper excelsum* (kawakawa)* *Dicksonia squarrosa* (wheki) *Melicytus ramiflorus* (mahoe) *Coprosma robusta* (karamu)* *C. rhamnoides* *C. areolata* *Phymatorus postulatus* (Hounds tongue fern)

Domain II(iii) Alluvial Terraces

Suitable Plants Open Ground *(* suitable as nursery crop)*	**Suitable plants where shaded by willows** *(* suitable as shelterbelts)*	**Suitable Plants on Wet Sites**
*Kunzia ericoides (kanuka)** *Podocarpus totara* (totara) *Prumnopitys taxifolia* (matai) *Melicytus ramiflorus* (mahoe)* *Alectryon excelsum* (titoki) *Myrsine australis* (mapou) *Pennantia corymbosa* (kaikomako)	*Geniostoma ligustrifolia* (hangehange) *Dicksonia squarrosa* (wheki) *Melicytus ramiflorus* (mahoe)* *Coprosma robusta* (karamu)* *Phymatorus postulatus* (Hounds tongue fern) *Macropiper excelsum* (kawakawa) *Metrosideros perforata* (climbing rata) *Melicope simplex*	*Phormium tenax* (harakeke) *Cordyline australis* (cabbage tree) *Cortaderia toetoe* (toetoe) *Eugenia maire* (swamp maire) *Dacrydium dacrycarpus* (kahikatea) *Laurelia novae-zelandiae* (pukatea)

In addition, Department of Conservation staff were approached to incorporate their expertise and knowledge in the plantings suggested in the design. Further work could be undertaken with the Department of Conservation, if it was decided that more specialised plantings were desired.

2.5 Weed and Pest Management[5]

This section briefly outlines the weed and pest species commonly found in the lagoon area. Any efforts to enhance the area must take into account the corresponding need to effectively manage weeds and pests before and after any planting occurs. This is likely to be an ongoing requirement as the area is subject to weed species moving naturally down the river corridor. This occurs particularly in times of high flows or flooding that inundates the area. Dumping of garden waste is another threat to the area, which should be addressed as part of any advocacy undertaken as part of this project.

Weeds within this report are defined as simply being the wrong plants in the wrong place for the purposes of enhancing this area. They may or may not be identified within the Regional Pest Management Strategy and generally they are exotic species (with the exception of karo). This does not rule out using exotic species, if appropriate, as a nursery for revegetation work. Weeds are not plantings used for Flood Protection purposes, and accordingly any plantings fulfilling this function will not be removed.

The main pests and weeds are identified below:

Pests

- Rabbits

Threats:

- Pukeko
- Dumping of garden waste

Weeds

- Silver Poplar
- Gorse
- Lupins
- Montbrettia
- Blackberry
- Pampas
- Boxthorn
- Marram
- Arum lillies
- Transcantia/Wandering willy
- Broom
- Boneseed
- Karo

[5] This section was compiled with the assistance and expertise of M Urlich, Biosecurity Department, WRC

Weed control, in general, should be attempted on a site led basis at the Otaki River Mouth. This means that small areas 1000-2000 square metre size portions of land should be controlled for a variety of weeds rather than single species controlled over the whole site. These small 'bite size' weed controlled areas should be followed up with restoration efforts. Co-ordination and timing of weed control is imperative, that is, bare areas need to be replanted in the following season. The rationale around this site-led approach is that certain weed controlled areas that are not replanted are susceptible to weed replacement. This replacement, in effect, negates the original weed control effort.

The area designated for planting needs to be within the capacity of any working restoration group. Given the standard 1metre plant spacing rule a cleared area of $1000m^2$ would require 1000 plants. It is envisaged that digging in the wetland should not be difficult. A person of average fitness could plant 10-15 trees per hour, so for the above area a total of 100 person hours should be allowed.

Plants that are highly invasive, or are very few in number but which pose a long-term threat, should be cleared on a species led basis. Currently, boneseed is being controlled by the WRC in the Otaki area and WRC will remove all boneseed at the river mouth. There is a low number of boxthorn that should be removed in the near future. Low numbers of karo should also be removed.

The Department of Conservation have also expressed interest in assisting in the care of the river mouth area. It is envisaged that there will be a high degree of collaboration between DOC, KCDC and the WRC to harness the combined expertise in weed control and efforts may be forthcoming in the actual control of weeds. Specific weed control information and advice is available from the WRC.

Poplar, silver poplar and willow will most probably be killed standing via a drill and fill method, in order to maintain perching sites and some protection for surrounding native vegetation. Dead trees will be interplanted with native species as part of the revegetation plan.

WRC have a minimum impact policy and thus will attempt to minimise the amount of chemical required in weed control and utilise the least toxic chemical available. All agencies involved in pest control will follow the best practice in the application of chemicals in this area.

2.6 Project Stages

The above planting and pest management aspects have been included in the following prioritised stages. The stages have been prioritised on smaller areas identified on the landscape plan attached to this report.

Stage 1

- Removal of silver poplar north of the lagoon inlet and replanting with flax, toetoe, taupata association. Domain I(ii).
- Placement of barriers seaward of the lagoon, leaving pedestrian access, as shown on the landscape plan.
- Placement of information signs at beach entry point and picnic area, and planting of picnic area. Domain I(ii).

- Fencing as shown to direct traffic north of the lagoon and around car park at the end of the stopbank.
- Ripping of surplus tracks and placement of beach logs.
- Eradication of noxious weeds for stage 2 planting.

Stage 2

- Create car park in picnic area.
- Planting of flax, rush association seaward of lagoon. Domain I(ii).
- Complete planting of flax, toetoe, and taupata association north of lagoon inlet up to beach entry point. Domain I(ii).
- Planting of representative domain species adjacent to beach area. Domains I(i), I (ii), and II(i).
- Removal of undesirable species e.g. karo and weeds in the above areas.
- Release earlier planting and eradication of noxious weeds for stage 3 planting.

Stage 3

- Removal of silver poplar and invasive weeds e.g. transcantia by the road east of the lagoon and replant in appropriate natives. Domains I (ii) and II(ii).
- Removal of silver poplar on higher ground between raupo association and coastal grass. Removal of montbrettia and replanting in appropriate natives as above.
- Develop track network and lookout.
- Release earlier planting as required and eradication of weeds for stage 4 planting.

Stage 4

- Planting area west of lagoon mouth in flax, toetoe, etc. Domain I(ii).
- Planting of restoration native area of dunes north of picnic area and on section between floodgates and pastureland. Domain I(ii) and nursery crop species from Domain II.
- Release earlier plantings as required.
- Reassess access requirements.

Stage 5

- Planting of additional species selected from Domains II(ii) and (iii) once earlier colonising planting is well established in stages 3 and 4.
- Development of small educational and information centre at beach entry point.
- Removal of pampas, gorse, etc adjacent to river and replant with toetoe, flax association. Domains I(i) and II(i) close to the mouth, I(ii) and II(ii) further up river.

2.7 Maintenance and Management

Currently this area is actively managed by Flood Protection for flood protection purposes, in line with the Otaki Floodplain Management Plan. Otaki Depot staff are responsible for undertaking weed eradication as the land manager and for flood protection purposes, currently this includes species such as gorse. General maintenance undertaken by Flood Protection staff will primarily reflect the role of Flood Protection, although where possible and as budget allows work will be undertaken in accordance with this strategy.

WRC Biosecurity staff are responsible for the removal of target species in accordance with the Regional Pest Strategy. Boneseed and boxthorn are currently target species. In addition, the Department of Conservation have indicated that they would be able to help with eradication programmes.

The Kapiti District Coast Council was part of developing the Otaki River Floodplain Plan and the Environmental Strategy. They have also outlined Environmental Strategy projects that will be implemented in their 10-year action plan for the river.

Maintenance of planted areas will remain the responsibility of the group responsible for planting a given area.

2.8 Project Management Responsibilities

Flood Protection will be responsible for co-ordinating Regional Council's involvement in this project, while the current funding arrangements continue. Assistance from within the Regional Council will come directly from the Resource Policy and Biosecurity Departments.

The Kapiti Coast District Council officers and representatives from Iwi, DOC, Fish and Game and the Friends will determine their respective roles in the project. These roles are generally envisaged to be ongoing throughout the implementation and successful establishment of the project.

3 Advocacy

This section briefly outlines the final component of implementing the plans to enhance the lagoon area.

3.1 Community Connections

It is vital that the community and people using the area know what we are trying to achieve in the area for the best possible outcome. All the agencies involved in this project are supportive of a joint approach that helps achieve the aim of this design. Advocacy will be an important part of ensuring the community is aware of why and what is happening in the area.

Important elements to be included and addressed:

- Identifying all the values that contribute to the area's distinctive identity.
- Roles and responsibilities of agencies involved in the area and this design.
- What we're trying to achieve in the area.
- Who to contact and how to be involved.
- Do's and Don'ts – what's appropriate and what's not.

Ways to communicate to the community:

- Signage on site
- Newspaper articles
- Rates notices
- Local council newsletters
- Friends of the Otaki River
- Meetings.

3.2 Reporting Pathways

The outcomes of each task identified in section 2 of this report will be communicated directly to Graeme Campbell, Design Engineer responsible for the Kapiti area. The Regional Council's Landcare Committee will be informed of the project's progress through the Landcare Manager's report presented at each committee meeting.

KCDC, DOC and F&G officers will be responsible for reporting on the project's progress directly to their relevant committees as appropriate.

3.3 Reporting Requirements until June 2003

To date the project has been reported in the Landcare Divisional Manager's report to the Landcare committee in December 2001. Reporting will also occur through the quarterly reports and the next committee meetings for 2002/2003 financial year.

3.4 Further Communication

Information will be provided to the community in the Friends of the Otaki River forum, local newspapers, such as the Kapiti Observer, and signage onsite.

4 Resourcing and Funding

4.1 Regional Council

Overall Budget

The Regional Council funding for project implementation until June 2003 is provided below.

Timeframe	Budget	Short-term Performance Indicators
June 2002	$10,000	• Final landscape and planting plan prepared
June 2003	$29,000	• Complete construction activities • Planting

The Regional Council will also provide resourcing in the following way:

- Flood Protection Group leading project management and operational tasks from ongoing and operational budgets.
- Resource Policy Department providing feedback on final design.
- Biosecurity providing feedback on weed management issues.

4.2 Resourcing from Other Parties

The Department of Conservation has indicated that although they do not have the ability to provide financial support, they are willing to provide support in kind. Fish and Game has indicated that there may be opportunities to fund signage. Both of these agencies are very supportive of a joint advocacy approach being taken within the project area.

The Kapiti Coast District Council has prepared a 10-year action plan for implementing projects in the Otaki River Environmental Strategy. The recommendation contained within section 3 of this document supports the aims of the nature reserve project. The budget needs to be discussed with KCDC planners.

5 Other Matters

A combined and more detailed work programme will be prepared at the conclusion of the scoping exercise in July 2003. More tasks can be added to the programme and existing tasks modified as necessary.

The future roles and responsibilities of each interested party need to be further refined and agreed on to ensure that the project is a sustainable and viable development. Sufficient resources, including staff time and money from the appropriate Flood Protection budgets is required in the years after 2003. This remains a serious constraint in the success or otherwise of this project.

Appendix A

Environmental Strategy Objectives[6]

1. The Otaki River as a Greenbelt

The role of the Otaki River as a greenbelt is the central concept in this vision for the river environment. All the recommendations in this Strategy feed into, or are consistent with, this concept. The objective is to protect and improve the natural character of the land adjacent to the river. This will provide a corridor of particular landscape, ecological and recreational value that connects the coast and inland hills.

This concept does not exclude development but requires it to be discrete and of low density.

2. Landscape

The Otaki River is an important visual link between the Tararua Ranges and the coast. It is also significant as a distinct feature that provides variation in the landscape of the coastal plain.

The landscape qualities that are sought for this area are:

- a large proportion of natural vegetation, habitats and landforms.
- sufficient vegetation to enhance the river as an unbroken natural feature.
- variation, with a mix of enclosed bush, open spaces, and visual links with the surrounding rural landscape.
- minimal structural development.

3. Ecosystems

The greenbelt will be an ecological corridor providing for the distribution, feeding, breeding and roosting needs of birds, fish, invertebrates and plants within a continuous habitat. Corridors also provide migration and nutrient flow paths. The aim then is to restore the native and natural biodiversity of the area where possible. Not only is the aim to increase the volume and diversity of indigenous species, but also the natural ecological processes and systems.

4. Access and Recreation

Providing better public access, especially more points of access to the river, is the key to improving recreational opportunities. This will enhance the river as a corridor for recreation, used for walking, fishing, hunting, canoeing, swimming and picnicking.

There is also potential to extend the recreational value of the river by developing linkages to adjacent areas. These could include round trips for walking, cycling or horse riding.

[6] Please refer to p12, Otaki River Environmental Strategy, 1999

However, the disturbance and destruction of natural ecosystems that can occur as a result of public access to the river must also be recognised. The aim therefore, should be:

- to establish a track network which provides for good recreational opportunities.
- to close down tracks which are not part of the track network.

Access is important for people using this area, including fishers, game bird hunters, bird watchers and walkers. In the lagoon area, it is important that public access does not damage this unique area, as this would result in the values people appreciate in this area being diminished.

5. Flood Protection Works

While many of the flood protection measures are not ideal from an environmental point of view[7], they are essential to protect the community from flooding. Therefore, looking for opportunities to mitigate effects, improve the existing environment and make positive use of flood protection measures, (such as using stopbanks for public access) is important. Where possible, low cost improvements are suggested that can be combined with major or routine improvements.

General Environmental Strategy Recommendations[8] 'Reach One – Estuary to Pylons'

1. Enhance backwaters and sluggish water shaded by banks or vegetation (WRC)

These sites are prime fisheries habitats. Therefore:

- avoid earthworks in these areas
- undertake enhancement plantings
- create new backwaters where possible in the course of flood mitigation works

2. Create new islands or shingle banks (WRC)

New islands or shingle areas should be created whenever old ones are removed, to provide roosting sites for coastal birds. These should be located away from riverbanks. The Department of Conservation notes that nesting birds are likely to be in the area from August to January and this period should be avoided.

3. Plant riverbed sides with natives (WRC)

The objective is to use the stopbanks to provide the habitat naturally provided by stabilised dunes.

4. Replace pampas with toetoe (KCDC)

This could occur when riverbanks are rock lined. It is important that when weed species are removed from an area, open spaces are not left for other weed species to colonise.

[7] Otaki River Floodplain Management Plan
[8] Please refer to p 37, Otaki River Environmental Strategy, 1999

Specific Recommendations for the Otaki River North Bank

North bank river mouth area (KCDC)

The river mouth area has high recreational use and yet is also one of the most ecological sensitive areas of the river. The impacts of recreational users on the area are described in the issues and objectives section of the Environmental Strategy.

The following recommendations will help to control and reduce these effects.

1. Provide a well-maintained public walkway to enable people to reach the beach.

2. Close down unnecessary tracks. Aim to limit access along the inland banks of the estuary. (There is a need for a consultative process with regular users and residents, carried out in a way that they 'buy in' to any changes. Also monitoring is needed to ensure that track closure is not resulting in new tracks being created elsewhere).

3. Replant closed access tracks and other areas with natives. In particular, replace pampas with toetoe.

4. Develop a picnic area and toilet block. These should be located towards the housing area to reduce the need for vehicles to drive onto the beach.

5. The toilets should be designed and located to be unobtrusive. It is important that, while they are well maintained, the facilities and tracks provided are in keeping with the area's informal, undeveloped character.

6. On-site interpretation of the estuary habitat should be considered as a means of fostering appreciation and understanding of the special features to be seen in the estuary.

7. The question of unrestricted vehicle access onto the beach may need to be addressed at some stage. The low key, undeveloped nature of the beachfront with easy access to the river mouth for fishing and whitebaiting is clearly one of its attractions. However, motor bikes are already a problem[9] and, if numbers build too much, vehicles could detract from the atmosphere.

[9] P. 90, *1992 Environmental Investigations*

Environmental Enhancement Techniques

Summary

Planting Techniques

- inter-plant with local native species to diversify the visual character of plantings
- landmark plantings
- 'light gap' planting
- nursery crops
- give priority to planting wet ground
- give priority to species which are known to germinate readily and regenerate freely in open or modified sites
- planting around tree lucerne
- experiment with coppicing mahoe
- 'seal off' willow plantings
- allow for the natural regeneration of native plants

Controlling the Effects of Weeds, Pests and Cattle

- fence off stock from the riparian areas
- weed control
- pest control

Enhancing Landscape and Public Access

- reduce the width of willow planting in the berm area
- set back the plantings of willows from the river edge
- maintain clear access at regular intervals through the willows

Planting Techniques

1. Inter-plant with local native species to diversify the visual character of plantings

This is feasible towards the back of the plantings since the willow protection is most essential at the river edge.

2. Landmark plantings

This involves planting key landmark locations identified specifically as enhancement projects (like the Chrystall's Bend pond area) with well-planned planting and maintenance programmes. In the long term, as the planting develops, these locations will become landmarks along the river, adding to its visual interest.

The aim of landmark planting of natives is to maximise their impact and success. If native planting is implemented in random locations and small areas, it will be harder to locate and its maintenance more likely to be overlooked.

3. 'Light gap' planting

One of the problems of mixing native and willow species is that few New Zealand plants thrive under deciduous trees, especially in windy sites. Many of our species that are shade tolerant as seedlings also require stable, humid air of a complete canopy to grow well. Winter exposure is not beneficial. Seedlings that are light demanding, on the other hand, do not appreciate annual shading by leafy willows.

One solution is to deliberately create 'light gaps' in willow plantings. Within these light gaps establish groups of light-demanding pioneers such as coprosmas or mahoe in combination with shade tolerant species. This is an economical way of introducing fruit and flower-bearing plants into the riparian strip.

Birds should soon take over the distribution of seeds for further establishment of natives.

4. Nursery crops

'Nursery' crops are recommended for the shelter of young broadleaf species planted on the sides of stopbanks. This is because these sites are exposed to wind which is particularly damaging to plants on excessively drained stopbank slopes.

The inland sides of stopbanks are often permanently damp. There is less stress on suitably adapted plants, and vegetation programmes are likely to be more successful and require less sheltering.

5. Give priority to planting wet ground

The easiest areas to revegetate will be those with permanently wet soils that can be planted with wetland species. There are several sites on the south bank in Domain I and on private land in Domain II, which are suitable for planting programmes. Blackberry is likely to be the main weed threatening successful plantings.

6. Give priority to species that are known to germinate readily and regenerate freely in open or modified sites

The best way to optimise value for money is to concentrate on species that are known to germinate readily and regenerate freely in open or modified sites. Generally speaking, riverbank plantings should concentrate on using adventives such as kowhai, manuka, hebe, broom, tutu, toetoe, tauhinu and karamu for rapid spread and resilience to flooding.

On stable ground, early succession plants which attract birds (karamu, poroporo, Coprosma rhamnoides, mahoe and kawakawa) will achieve rapid results (check the appropriate species recommended in Domain descriptions).

7. Planting around tree lucerne

It is logical to concentrate new plantings where there is tree lucerne, which will already be attracting bird life, and providing year-round shade.

8. Experiment with coppicing mahoe

Several native tree species can be induced to coppice in the same way that willows naturally coppice and provide a dense thicket of stems to impede floodwaters. One of these species is mahoe, which is a common component in the floodplain vegetation.

It is suggested that an experimental area for trialling mahoe coppicing be created within Domain II (which has optimal conditions for mahoe growth).

9. 'Seal off' willow plantings

'Sealing off' a stand of willows as completely as possible from wind is another way of encouraging shelter-demanding forest species within the stand. This can achieved by planting dense shelterbelts of fast growing, light-demanding forest edge species such as:

- poroporo
- large-leafed coprosmas
- kawakawa
- mahoe

Suitable 'interior' species are listed in Section 4.

These planting patterns are suited to large clusters of willows that will be allowed to mature.

10. Allow for the natural regeneration of native plants

Where possible, willows should not be cut or replanted, to allow for the natural regeneration of native plants. Conversely, do not plant natives where willows will be cut on an ongoing basis.

Selecting Plant Species[10]

Domain I: Dry Duneland and Sandplain with Wetlands

The coastal climate here is very dry (1011mm mean annual rainfall) with little seasonal variation in rainfall (winter is the wettest season). The predominant winds are from the north to northwest (i.e. parallel or oblique to the coast), or in calm conditions a southwesterly sea breeze often prevails from late morning.

These winds are dry and salt-laden and this combination determines the biotic communities on dry dunes where soils are generally thin to non-existent and not very fertile.

[10] p21-28, Otaki River Environmental Strategy, 1999

Streams in the sand country are deep, narrow, meandering channels providing excellent eel, freshwater mussel and fish habitat unless polluted by excessive farm run-off or trampled by stock. Swamps and estuaries formed behind the foredunes, on the other hand, are often shallow, ephemeral and water is warm. Wildlife habitat is improved by the shading of the water in these sites by riparian or swamp vegetation. These low-lying areas absorb much of the energy and volume of freshwater in a flood.

The flat sand plains provide important roosting habitat for coastal birds, and the swamps and waterways, both ephemeral and permanent, provide waterfowl habitat. The dominance of grass and sedge species in this zone (especially pingao, spinifex, toetoe, sea-rush, raupo and now the exotic pampas and marram) attracts finches and larks.

Clearly, in this zone micro-conditions are important biotically and create diversity in an otherwise limited biotic community. *This is arguably the most important zone in the floodplain strategy, requiring the most care and foresight* – it is a rich breeding ground for marine, aquatic and terrestrial wildlife species, with diverse habitats and stressful environmental conditions. It is also the zone with the greatest interaction and potential conflict between natural processes and human recreational interests.

Sub-zone (i)

- coastal foredune and sandy beach.
- relatively homogenous character.
- frost-free.
- ground conditions are hot and dry, usually experiencing summer drought.
- estuarine areas of brackish or salt water occur behind the foredunes.

Planting Suggestions

Suitable Species on Dry Foreshore	Suitable Species around Brackish Estuarine Areas	Exotic Plant Threats	Replacement Policy
Spinifex hirsutus (spinifex) *Desmochoenus spiralis* (pingao) *Muehlenbeckia complexa* (pohuehue)	*Leptospermum scoparium* (manuka) *Plagianthus divaricatus* (marsh	****** (boxthorn)	******** (marram) with *Spinifex hirsutus* (spinifex)

Sub-zone (ii)

- older dunes and sand plain.
- diverse micro-climates and niches.
- ground conditions on the dunes are hot and dry, usually experiencing summer drought.
- on the sand plains behind the foredunes the water table can be close to, or at, ground level and soils conditions are wet and cold.
- frost becomes a major environmental factor on flat, open land sheltered from onshore breezes or the mild influence of the sea, from autumn to spring.

Planting Suggestions

Suitable Species on Dunes and Dry Sand Plain	Exotic Weed Threats	Suitable Species in Permanently Damp Sites on Sand Plains	Exotic Weed Threats	Replacement Policy
Coprosma repens (taupata) *C. propinqua* *Kunzia ericoides* (kanuka) *Dodonea viscosa* (akeake) *Myoporum laetum* (ngaio) *Cassinia leptophylla* (tauhinu)	** (boxthorn) ** (pampas) *Ulex* *** (gorse) *** lupin	*Phormium tenax* (harakeke) *Cordyline australis* (cabbage tree) *Cortaderia toetoe* (toetoe) *Eugenia maire* (swamp maire) *Dacrydium dacrycarpus* (kahikatea) *Leptospermum scoparium* (manuka) in open water, rushes such as: *Typha orientalis* (raupo) *Cyperus ustulatus* *Carex secta*	**** (blackberry)	*Pampas* **** (pampas) with *Cortaderia toetoe* (toetoe)

Domain II: Dry Alluvial Plains

This zone also experiences a dry (approximately 1011mm mean annual rainfall), hot climate with little seasonal variation in rainfall, and often heavy frosts away from the mild influence of the river or the foreshore, but the alluvial and fertile river-silt substrates have a marked influence on biotic communities. The dynamics of the river and its past and present floodplains dominate this Domain.

Plant life is limited to species which, although having a preference for fertile substrates, must also tolerate seasonal drought, low air humidity, excessive drainage, stony ground and in some areas frost as well. The result (in the past) has been a dense forest canopy of totara and matai with some titoki, with kawakawa and mahoe dominant sub-canopy species and an understorey of small-leafed shrubs such as *Coprosma rhamnoides* or *C. areolata*.

The riverbanks are areas of erosion and deposition characterised by adventive species (these days mostly weeds species but previously would have been dominated by toetoe, tutu, hebe, karamu, broom etc.). Where riverbank sites have been stabilised longer, a diverse, frost-free plant association of would grow alongside the river including tree ferns (probably *Dicksonia* species) and possibly kowhai and wineberry (although there is no direct evidence of these trees now).

An important aspect of this domain is the salt-water wedge (the furthest extent of salt-water up-stream during spring high tides). *This defines the winter whitebait spawning zone and special care should be taken to preserve, create and improve the habitat required*.

The hinterland has a significant influence on the river in this Domain, as ground water flows horizontally through terrace alluvials and into the riverbed. Although it is not within the scope of this strategy to encourage filtration planting on neighbouring properties, there are some sites where riparian planting has the additional benefit of filtering run-off and ground water from farmland.

Sub-zone (i)

- Shifting banks, bars and islands near the coast – frost free.

Planting Suggestions

Suitable plants for coastal shingle/silt banks	Main weed threats
Cortaderia toetoe (toetoe) *Coprosma repens* (taupata) *C propinqua* *Disphyma* sp. (iceplant) *Coriaria arborea* (tutu) *Hebe stricta* *Carmichaelia* sp. (NZ broom) *Cassinia leptophylla* (tauhinu) (rushes, etc.)	Lupin arboreus *Crocosmia* (Montbrettia)

Sub-zone (ii)

- alluvial waterway and riverbanks
- frost free
- wind is not a limiting factor.

Planting Suggestions

Sub-zone (iii)

- alluvial terraces
- frosty.

Planting Suggestions

Suitable Plants Open Ground *(* suitable as nursery crop)*	**Suitable plants where shaded by willows** *(* suitable as shelterbelts)*	**Suitable Plants on Wet Sites**	**Main Weed Threats**
*Kunzia ericoides (kanuka)** *Podocarpus totara* (totara) *Prumnopitys taxifolia* (matai) *Melicytus ramiflorus* (mahoe)* *Alectryon excelsum* (titoki) *Myrsine australis* (mapou) *Pennantia corymbosa* (kaikomako)	*Geniostoma ligustrifolia* (hangehange) *Dicksonia squarrosa* (wheki) *Melicytus ramiflorus* (mahoe)* *Coprosma robusta* (karamu)* *Phymatorus postulatus* (Hounds tongue fern) *Macropiper excelsum* (kawakawa) *Metrosideros perforata* (climbing rata) *Melicope simplex* (poataniwha) *Rubus schmedelioides* (bush lawyer)	*Phormium tenax* (harakeke) *Cordyline australis* (cabbage tree) *Cortaderia toetoe* (toetoe) *Eugenia maire* (swamp maire) *Dacrydium dacrycarpus* (kahikatea) *Laurelia novae-zelandiae* (pukatea)	Arum lily (damp sites)

Controlling the Effects of Weeds, Pests and Cattle

1. Fence off stock from the riparian areas

Stock should fenced off from riparian areas:

- to allow the establishment of palatable species.
- to prevent stock gaining access to the watercourses where they can do damage, pollute, and introduce weeds.

2. Weed Control

The vegetative character of an alluvial riverbed is one of change and of extremes of heat, wind, drought and inundation. The plants that establish in these stressful sites are adventives that germinate promptly, and establish strong roots. A great number of exotic weeds are perfectly adapted to these conditions and will compete successfully with native species.

Greater priority must be given to weed control along a riverbed than on stable country – especially as the seeds will be distributed by water in addition to wind and birds. All modifications to the riparian environment must anticipate the weed control requirements. There are different weeds to target in each ecological domain.

3. Pest control

It is anticipated that different pests become a priority in different reaches of the river. In Domain I (sand country) wild cats, stoats and rabbits probably present the greatest ecological threats. In Domain II (seasonally dry alluvial plains) possums and magpies, and in Domain III (humid alluvial plains and foothills) possums, rats, stoats and on the loess hillslopes rabbits and hares.

Enhancing Landscape and Public Access

1. Reduce the width of willow planting in the berm area

The need for extensive willow planting in the berm areas should be accessed on a site by site basis prior to planting. Willows should not be planted where they are not necessary.

2. Set back the plantings of willows from the river edge

Where possible willows should be set back from the river edge. For example, where there is alternative bank protection such as riprap.

3. Maintain clear access at regular intervals through the willows

This serves a dual purpose, allowing for routine river inspections as well as public access.

	Stakeholder: Key Issues / Comments	WRC Response
Iwi	• RW thought that enhancing the environment was fine, but wondered how long this would be viable with the river mouth area being so dynamic. • Pingao on the beach had been planted by Raukawa people. • Rabbits were a problem along the dunes. • Land ownership/tenureship was a sore point with Raukawa and RW supported the use of pou for marking boundaries. • RW had an interest in what plants would be used. • The Iwi management plan should be taken into account, particularly enhancing inanga habitat, as inanga are an indicator identified in the plan. • The research project, which looked at titles and where historically kainga and pa were located would be of use to the project and would be available in October.	• Garry Baker observed that waves could be expected to break over the dune system 4–5 times a year and inundate the lagoon area with seawater. • Design to take dynamic nature of area into account.
DOC	• From an ecological point of view saw value in letting the river mouth go south, as the best ecological values were found on that side of the river. Also noted that, given the dynamic nature of the area, it was difficult to make any recommendations. • Again, from an ecological point of view, it would be desirable to control vehicle access to the area, in particular, native vegetation and the nesting areas of wading birds, such as oystercatchers. However recognises the range of values the area offers to people • Re-establishing pingao, John Sawyer DOC. • Controlling dogs in the area. • Removing weed species, weed control is definitely a big issue here and DOC can help advise, if needed. • All values need to be recognised, this way there is a better chance of getting the wider community involved in the project. This would have to be done through the media and possibly information boards. • All interested parties will need to be involved from the outset. In terms of advocacy, would help with information on the richness of natural environment within estuaries (flora and fauna) and the threat of invasive weeds inappropriate land use etc. Fish & Game could express the importance of wildfowl habitat and water quality to convey the recreational hunting and fishing values. Whitebaiters and anglers (through the fishing club) could promote the need for a healthy coastal environment and suitable stream	• WRC pointed out that land to the south was owned by the Katihiku X Trust. The Floodplain Management Plan currently dictates the types and timing of activities undertaken by Flood Protection. Trigger points for changing the mouth opening are stated in the Coastal Plan as well as consents held by WRC. The budget currently available was for works in the wetland area on the north bank. • Plans to include advocacy strategy and continue consultation and liaison with main stakeholders. • Involve Biosecurity Department. • Include weed/pest management in plans.

	Stakeholder: Key Issues / Comments	WRC Response
	bank vegetation for whitebait spawning etc. Walking groups could focus on the issues of free access, pleasant scenery and walking opportunities. If the community at large recognises all of these values within the estuary then a plan (and the will) to look after or enhance the area will follow. Priority would be to get this message across first.	
F&G	• Also saw value in letting the river mouth go south, as the best ecological values were found on that side of the river. Given the dynamic nature of the area, it was difficult to make any recommendations. • The preservation of the lagoon area, mainly for ducks. • Retention of the 5 maimais, although they 'could do with some tidying up'. • Parking was necessary although a short walk was not unreasonable. • Restricting access may affect access for fishers to the spit. • A key management objective should be the re-establishment of a representative sequence of indigenous vegetation both for it's intrinsic value and it's value as habitat for birds and other wildlife. Plant communities of salt marshes and their margins are arrayed in zones, with plant cover increasing as you move away from the waters edge. The tidal zone of the salt marsh looked fairly unmodified. • Expect the jointed rush Leptocarpus simillis or the sedge Baumea juncea to colonise the edge of the lagoon around the high tide mark, leaving re-planting efforts to the area of higher area behind them. Flax (Phormium tenax) may be a suitable candidate for replanting this zone together with tree species like manuka (Leptospermum scoparium), karamu (Coprosma robusta), ngaio (Myoporum laetum) and cabbage tree (Cordyline australis). Suggests seeking advice from DoC before deciding what to plant and where. • Encroachment of invasive exotic plants is a problem and controlling these weeds will be a prerequisite to restoring the indigenous vegetation. The weed encroachment is most severe on the higher ground away from the waters edge. • Rather than sinking a lot of effort into weed control and replanting of indigenous plants on this higher ground, my preference would be to extend the lagoon by excavating much of this area. If the excavation could be carried out so that the resulting water body had a gently sloping margin like that of the existing lagoon, then sedges and rushes would probably re-establish themselves on the areas inundated at high tide. The new area of open water and it's margins would be attractive to migratory wading	• Would require further community wide consultation, as project stands similar to projects outlined in environmental strategy and KCDC 10 year action plans. • Also likely to be subject to RMA processes,

	Stakeholder: Key Issues / Comments	WRC Response
	birds and to waterfowl, and would reduce the area over which effort needs to be expended on the control of weeds. • To liaise with Garry Baker over getting the hunting stands on the lagoon tidied up. • Regarding advocacy work would be keen to see some signage erected at the main access point on the foreshore to provide information on the various botanical, wildlife and amenity values that the area holds. Public Awareness Manager, Graham Ford, may be interested in helping to fund this signage and it's an aspect of the project that I'll be happy to raise with him as things develop.	which could be expensive reducing available project funds.

Friends	• Planting native species important.
	• Viewing platform & seats out of flood extent e.g. Pauatahanui and Nga Manu.
	• Information boards e.g. Mt Bruce.
	• Picnic areas.
	• The removal of weeds.
	• Rubbish.
	• Leo had observed 28 different bird species using the lagoon, including seabirds and spoonbills. David McDowell noted that 16 species of birds had been observed in the area, including Kotuku, as well as 3-4 pairs of nesting Banded Dotteril.
	• Recreational uses include:
	  • Duck shooting: The area was the only duckshooting area between Wellington and the Manawatu for Kapiti Coast residents to use.
	  • Fishing/Whitebaiting: In the season >100 nets in the water. However, as there were no facilities the area became 'filthy', as people wouldn't leave the area to find toilets. In the past the fishing club had installed toilet facilities but the vandalism was so bad they removed it after a year. Access is important to the spit for fishers, especially those fish less mobile.
	  • Camping – this is a problem as the area is a flood risk. Although WRC depot staff advise campers (whitebaiters) of the dangers they still stay and rescues of campers caught by flooding have been carried out in the past.
	  • Birdwatching: Potential resource for schools and people to watching the birds.	

	Stakeholder: Key Issues / Comments	WRC Response
KCDC	• Andrew Guerin and Anna Carter key liaison people, Mike Cardiff may also have an interest. • Budget is identified under 10 year action plan. • Supportive of project, keen to be part of advocacy strategy. • Would like to be kept up to date on progress/ process and attend next site meeting. • New environmental planner due to start next financial year to be involved in projects such as this. • Area is an 'outstanding landscape' and an ecological site 'E27' identified in plan. • No resource consents are required from KCDC. • North-end of reserve has been used for dumping in the past.	
Site Meetings	• DOC, Fish & Game and Friends. • The following points came out of the discussion had on site: • Weed control is a major concern that needs to be addressed, including the spread of trees in the damp margins of the lagoon. • Saltmarsh vegetation is valuable habitat for waders and waterfowl. • Not a lot could be done about natural water level fluctuations, which meant any plants planted would have to be saline tolerant and be able to withstand inundation. • Enhancement should occur through natural processes. • 'People control' was an important aspect that needed to be addressed. This includes potential conflict arising because of the range of values and uses of the area. For instance, increasing walkways in the area may lead to clashes between walkers and hunters. • Advocacy is an extremely important part of any enhancement project's success in the area. This includes signage, controlling access points and ways, and education of both the community and the different communities of interest using the area. There is an opportunity for a joint agency approach, which would have many benefits; both DOC and F&G are looking into this. • Opportunities for traditional harvesting were present.	

Stakeholder: Key Issues / Comments	WRC Response
• Passive recreation was important to the local area, as there was a lack of walking areas such as this in the Otaki area. • Currently the area attracts rubbish, including dumping of garden waste. ***Friends*** • The frequency of the site being inundated was discussed, and although flood flows in the area were generally not fast moving it meant that inundation would have to be addressed in any designs. In particular, the need for regular maintenance of any boardwalks, including the removal of any debris caught in the boardwalks would be required. As it was likely that the boards would be slippery, the need for construction to use mesh was also raised. The group noted that the current surface had survived inundation in the past, making it a suitable surface and agreed that it would be sufficient. • The use of bollards was suggested as a way of restricting vehicle passage. Log fences were also suggested as an alternative way to restrict vehicles and campers to the area held by WRC as a Soil Conservation Reserve. • The need for signs advising people of the flooding hazard was brought up. Garry noted that signs had been put in the past but had been removed by vandals. • Eric noted that DOC, in 1992, had undertaken research, which included assessing the plants, birds and fish of the lagoon.	