

ENVIRONMENTAL MANAGEMENT GROUP

Technical report

INTERNAL



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Whakamahi & Whakamahia Lagoons Ecological Monitoring 2007



April 2008
EMI 0810
HBRC Plan Number 4023

Environmental Management Group Technical Report

Internal

Environmental Science Section

Whakamahi & Whakamahia Lagoons Ecological Monitoring, 2007

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INTRODUCTION

Regular monitoring of ecological condition and trend is built into the planned management of Whakamahi and Whakamahia Lagoons, northern Hawke's Bay, by the Hawke's Bay Regional Council (Whakamahi and Whakamahia Lagoons Management Plan, Hawke's Bay Regional Council Plan No. 3113, May 2002). The use of photopoint monitoring was recommended.

In December 2003, a basic photopoint regime for monitoring the ecological condition and trend of the macro features and vegetation of the lagoon system was set up on contract for the Hawke's Bay Regional Council by Geoff Walls. This was done using the experience gained in establishing a similar monitoring regime in other Hawke's Bay estuaries and coastal lagoons (Whakaki Lagoon, Walls 1999; Waitangi Estuary, Walls 2000; and Tukituki Estuary, Walls 2002).

Two reports were completed as a result of the December 2003 work. Walls (2004a) provided background information and formed an ecological monitoring plan. Walls (2004b) reported on the findings of the monitoring establishment.

In October 2005 the monitoring was repeated. This document reports on the findings and provides comparisons with the situation in 2003.

In 2007 the monitoring was repeated. This document gives the findings from the routine monitoring..

1. VEGETATION

1.1 Terrestrial vegetation

This is the main focus of the monitoring. It was done through the establishment of a series of photopoints.

Method:

11 photopoints were set up the length and breadth of the wetland system in December 2003. The location of each was fixed using a hand-held GPS unit. The photopoints were chosen to represent the spectrum of terrestrial vegetation types and situations around the wetland. They were also selected to be readily relocated. Photos were taken from the standing position at each photopoint: mostly panoramas of the vegetation; some more localised and specific. A SLR camera with a zoom lens was used, most photos taken at the 50mm setting but some at 28mm. Film was Kodak colour print, 200asa.

The location of each photopoint is marked on the map (Appendix 1). It is also described on the photopoint recording sheet (one for each photopoint, Appendix 2). Also on each sheet is a description of the vegetation and the ecological patterns and processes occurring there.

In October 2005 the photopoints were revisited. This time digital photography was used.

The photopoints were revisited again in 2007 and digital photography was again used. The photos, in order, are in the album that accompanies this document, and are also supplied as digital files on CD.

Observations:

Photopoint 1:

Sited at the seaward end of the Pilot Hill pa site, and chosen to view the river mouth and the wetland system. The bar entrance was in an unusual place in 2003, well west of where it had been in recent years. There are various weeds and planted native species in the hill reserve. In 2005, the bar entrance was in a more 'normal' place where the river runs more or less straight to the sea. This was way to the east of where it was in 2003. Pampas had grown much. In 2007 the bar entrance had recently been machine opened. It was considerably further West of it's more natural position in 2005.

Photopoint 2:

Sited at Pilot Hill and chosen to view the river mouth and Ngamotu Lagoon. The bar entrance was in an unusual place in 2003, well west of where it was in recent years. There are numerous weeds and various planted native species in the hill reserve. In 2005, the bar entrance was well to the east of the 2003 position, as outlined above. The plantings had grown. Smilax had proliferated in the vicinity. In ,2007 the area of the bar has changed a great deal in shape and is a lot narrower than in 2005. Terns, gulls and shags are using the islets and bar for a safe roosting location.

Photopoint 3:

Sited at the old concrete gun emplacement on the roadside, on the northern side of the wetland system. Chosen to follow the dynamics of the vegetation in the saline/freshwater mixing zone: an interplay between marsh clubrush (*Bolboschoenus fluviatilis*), sea rush (*Juncus kraussii*) and glasswort. Also for the fringing vegetation that includes saltmarsh ribbonwood and for the previously disturbed terrestrial margins, where some restoration planting has been done. In 2005, the vegetation patterns were much as in 2003. Saltmarsh ribbonwood had increased a little; marsh clubrush was perhaps somewhat less (though this could have been a seasonal timing effect). Smilax and montbretia were increasing near the old gun emplacement. In 2007 the tide was in at the time of the monitoring but the vegetation patterns looked similar to 2005. There were a lot of swans in the vicinity.

Photopoint 4:

Sited west of Photopoint 3, on the northern side of the wetland system and chosen to follow the same vegetation processes. An area of raupo, saltmarsh ribbonwood and restoration plantings are key features. In 2005, the salt turf had advanced into the marsh clubrush zone and the sea rush at the interface had grown noticeably. This indicated a slightly more saline influence in the lagoon, probably as a result of the changed position of the bar entrance (less ponding of river water in the lagoon perhaps). Saltmarsh ribbonwood had grown. Raupo was more or less unchanged. The native plantings were growing up, so this photopoint may not be as available in future and may have to be shifted. The plantings had been extended westwards between the road and the wetland. The raupo has grown back from the winter die off and appears to be expanding in 2007. *Bolboschoenus* has advanced into the sea rush and the saltmarsh ribbonwood has continued to grow. The plantings around the photopoint have grown a lot so this photopoint will need to be abandoned soon as it will become inaccessible.

Photopoint 5:

Sited west of Photopoint 4, on the northwestern side of the wetland system, and chosen to follow the vegetation processes higher up the system, where the saline influence runs out. Marsh clubrush is predominant. A proposed dam may be constructed to raise and pond water in this part of the wetland. In 2005, saltmarsh ribbonwood had increased, sea rush had increased noticeably, but marsh clubrush was still dominant. Japanese honeysuckle had increased on the roadsides. The overall health of the native vegetation is better in 2007 and the saltmarsh ribbonwood has grown well.

Photopoint 6:

Sited just west of Photopoint 5, on the northwestern side of the wetland system, and chosen to follow the same vegetation processes. Marsh clubrush is predominant. The area is likely to be flooded if the dam is created. In 2005, the situation was much as for Photopoint 5. Sea rush had increased significantly, but not at the expense of other vegetation as yet. Occasional taupata plants were seen in the marsh clubrush expanse. Japanese honeysuckle was increasing. Occasional wilding pampas had been controlled. Again, in 2007 the situation is much as photopoint 5. Increasing fescue is evident and may be due to the reduction in browsing by cattle.

Photopoint 7:

Sited at the extreme western end of the wetland, and chosen to follow the vegetation processes on this part of the spit/bar. Scattered taupata grows amongst low sparse cover of shore convolvulus, exotic grasses and herbs. In 2005, the shape of the stream outlet had changed somewhat. It is tentatively planned to redirect this stream

back into the head of the wetland, as it would have flowed in the past. The taupata had grown. There was no obvious change in 2007.

Photopoint 8:

Sited on the seaward side of the wetland, and primarily chosen to follow the situation of the spinifex behind the strand zone. Lupin looks to be much on the increase and could be threatening. In 2005, spinifex was still healthy and not apparently threatened by lupin (which had died off in places, allowing spinifex room). Shore convolvulus and exotic herbs had increased, probably because of recent 'wet' summers. In 2007 the spinifex is not looking very healthy even though lupin continues to die back. The shore convolvulus is looking well and co-existing with the spinifex.

Photopoint 9:

Sited on the seaward side of the wetland, and chosen to follow the same processes. In 2005, it was as for Photopoint 8. Lupin looked threatening to spinifex but may not be. Exotic herbs appeared as though they could be more of a worry, also vehicle use, which was high in this vicinity. Saltmarsh ribbonwood looked to be increasing. In 2007 the spinifex is looking healthy although the lupins are increasing in area. Saltmarsh ribbonwood continues to increase. Dogs were unleashed and allowed to roam freely at the time of visit which is causing a problem for ground-nesting birds.

Photopoint 10:

Sited on the seaward side of the wetland, at a point where many of the wetland components meet. The estuarine fringe has three-square, glasswort and sea rush. A slightly raised area has rank tall fescue. A 360-degree panorama was photographed at this strategic and dynamic site. In 2005, there had been some minor shape changes to the bar, and the entrance was no longer where it had been in 2003. The wetland vegetation hadn't changed appreciably, though sea rush had increased a little. There was perhaps more herbaceous growth on the stabler sand. Dogs were running free at the time of visit and domestic rubbish had been dumped near the photopoint spot. In 2007 the water level was raised markedly. There was not much change in the vegetation from previous years and remains of a dead duck were observed near the photopoint.

Photopoint 11:

Sited about 200m north of Photopoint 10, more within the wetland. Chosen to follow localised detailed vegetation changes. In 2005, there had been distinct wave erosion of the estuary shore in places. Sea rush hadn't expanded noticeably, probably because this site lies within the zone of routine saline influence rather than at its margin. Glasswort was still healthy and dense. Plantings had grown. In 2007, the water level was higher than previous years which meant that this photopoint could not be reached.

Next monitoring:

November-December 2009; thence every second year. Photos to be repeated; recording sheets to be used.

1.2 Weeds

Method:

Weeds were searched for during the survey and monitoring of the vegetation. Their presence and impact were noted.

Observations:

The following terrestrial weeds are regarded as requiring surveillance:

Silver poplar (*Populus alba*), well established on Pilot Hill and could spread;
Gorse (*Ulex europaeus*), a minor threat to the sand spit/bar;
Pampas grass (*Cortaderia selloana*), well established on Pilot Hill and roadsides and could spread;
Marram grass (*Ammophila arenaria*), not currently present but a major threat to the native sand communities; should be controlled if found as a matter of urgency;
Boxthorn (*Lycium ferocissimum*), present on the spit/bar and near Pilot Hill; controllable at present; should be kept in check;
Lupin (*Lupinus arboreus*), invading the spit/bar; could be a problem for spinifex;
Japanese honeysuckle (*Lonicera japonica*), present in the vicinity and capable of invading shrubby areas; apparently increasing
Tamarisk (*Tamarix chinensis*), present in small quantities and could spread;
Bindweeds (*Calystegia silvatica* and *Convolvulus arvensis*), abundant around the margins; not really an ecological problem;
Blackberry (*Rubus fruticosus* agg.), common in mosaic communities; not considered an ecological problem;
Montbretia (*Crocasmia x crocosmiiflora*), present in small quantities, should be controlled;
Smilax (*Asparagus asparagiodes*), proliferating on Pilot Hill and near the old gun emplacement in 2005, capable of smothering other vegetation and hard to control;
Tasmanian ngaio (*Myoporum insulare*), planted in places, not really an ecological threat except to the natural integrity of the vegetation;
"Exotic natives" (karo, pohutukawa), planted in places, not really an ecological threat except to the natural integrity of the vegetation.

No aquatic weeds were found.

Next monitoring:

November-December 2009, along with other vegetation monitoring; thence every second year.

1.3 Notable flora

Method:

Plants of note were searched for during baseline survey and monitoring set-up. They were searched for also during subsequent monitoring.

Observations:

To date, no rare native plants have been recorded from Whakamahi and Whakamahia Lagoons. However, the reported presence of native musk (*Mimulus repens*) and sea spurrey (*Spergularia media*) in the saltmarsh communities is regarded as noteworthy (Beadel 1989). So too is the presence of salt grass (*Puccinellia walkeri*). Whilst these plants are not endangered they are useful indicators of the ecological condition of the saltmarsh communities, and should be checked from time to time. This will require deliberate monitoring (not done in 2003) and cannot really be done using photopoints. In 2005, a search was made for these plants without success, and it may be that they have either gone from where they were previously or they occur elsewhere in the wider estuarine system. The situation was the same in 2007. Should any other notable plants be detected or introduced in future, extra monitoring will be needed.

No other notable flora was detected in 2003, 2005 or 2007

Next monitoring:

November-December 2009, along with other monitoring; thence every second year.

2 FAUNA

2.1 Water birds

Method:

Since good monitoring of the birds of the wetland is being done by the Department of Conservation and the Ornithological Society of New Zealand, this aspect was not concentrated on. Nevertheless casual observations were made.

Observations:

In 2003, banded dotterel, a nationally threatened species, was found breeding on the sand spit/bar at the very eastern end of where cars can drive. In 2005, birds were seen but they were being disturbed by visiting people and free-running dogs. The frequent presence of people, dogs and vehicles is probably severely inhibiting the breeding and roosting of this species and others such as terns, gulls and waders. People harvest driftwood from the spit/bar, preventing the build-up of valuable breeding and roosting habitat for birds such as dotterels, oystercatchers and little blue penguin. Education of the local community about this issue is needed to change things.

2.2 Other birds

Method:

Since good monitoring of the birds of the wetland is being done by the Department of Conservation and the Ornithological Society of New Zealand, this aspect was not concentrated on. Nevertheless casual observations were made.

Observations:

Nothing out of the ordinary was noted.

2.3 Fish

Method:

Since good monitoring of the fish of the wetland is apparently being done, this aspect was not concentrated on.

Observations:

Mosquito fish has been reported from the wetland and is a serious threat to the well-being of the native freshwater fish. In 2005, none were found despite searching in likely places. They could have been elsewhere in the wetland nevertheless. If there is a method of eradicating them without doing unacceptable damage to the native fish, it should be considered. The situation was the same in 2007.

2.4 Mammalian pests

Method:

General fauna survey, whereby signs of mammalian pests were casually searched for during other survey and monitoring activities.

Observations:

Various mammals that can be regarded as pests in the wetland were detected during baseline survey and monitoring set-up in 2003:

- Domestic dogs: brought routinely by people for exercise; undoubtedly highly disruptive to birds, particularly during roosting, loafing and breeding.
- Domestic horses: regular visitors; importers of weed seeds and browsers of native plants.
- Domestic sheep and cattle: excluded by fences, but potentially damaging if fences are breached.
- Rabbit and hare: present around the margins; damaging to native plants.
- Possum: present around the margins, though not in high numbers; damaging to native plants.
- Hedgehog: present around the wetland margins; damaging to ground-nesting birds, lizards and invertebrates.
- Feral cat: present in low numbers around the lagoon margins; damaging to birds and lizards especially.

Other mammalian pests probably present but not detected include:

- Ship rat and Norway rat: known predators of birds, lizards and invertebrates.
- Mouse: known predator of invertebrates.
- Stoat, ferret and weasel: known predators of birds, lizards and invertebrates; good swimmers.

In 2007, the situation regarding these animals did not appear to have changed significantly.

Next monitoring:

November-December 2009; thence every second year.

2.5 Invertebrates

Not deliberately surveyed or included in the monitoring plan, but worthy of separate study. The suite of invertebrates living in driftwood is particularly noteworthy, especially considering the relative intactness of the seashore. Rapid examination showed that some native species were present, including earwigs, beetles, ants and spiders. However, the native katipo spider was not found; it may have already been replaced by the invasion of related Australian and South African spiders afflicting the North Island coasts. In the estuarine flats, mud crabs and mud welks are abundant.

2.6 Reptiles and amphibians

Also not deliberately surveyed or included in the monitoring plan, but worthy of separate study. Common skinks (*Oligosoma nigriplantare polychroma*) probably live among the beach vegetation, and common geckos (*Hoplodactylus maculatus*) may be present. Southern bell frogs (*Litoria raniformis*) occur in Whakaki Lagoon to the east and may be present in the upper part of the wetland.

OBSERVATIONS AND RECOMMENDATIONS

This section of the report is taken directly from observations and recommendations given by Geoff Walls (2007)

Whakamahi and Whakamahia Lagoons constitute an ecologically valuable wetland system in the region. Although considerably modified, they still retain many natural patterns and processes. They are worthy of restoration management.

The wetland is functionally interesting. There is a complex interplay between saline water and freshwater, wet and dry zones, sea and shore, native and exotic vegetation and fauna, and nature and humans.

Ecological monitoring is important in understanding the way the wetland system works, in tracking changes over time and for gauging the effectiveness of management. The monitoring regime has allowed a series of conclusions to be drawn about various aspects of the ecological condition and trend of the lagoon system, and the efficacy of management. Out of these conclusions flow a consequent series of recommendations. They are split into three sections:

- Monitoring methods
- State of the Environment (SOE) monitoring and reporting
- Management issues

Monitoring methods

1. Photopoints are a useful ecological monitoring tool, particularly for broad vegetation, hydrological and landform processes. A series has been established around the wetland and revisited twice. In 2007, they demonstrated some significant ecological changes:
 - Considerably elevated water levels, probably as a result of a change in the bar entrance, increasing the ponding in the estuary of river water; therefore lower parts of the wetland were more inundated than usual and the saline/freshwater interface probably affected;
 - Continued regeneration in saltmarsh ribbonwood (*Plagianthus divaricatus*), a shrub natural to coastal wetlands and undoubtedly forming a dense fringe around the estuary (favoured habitat for fernbirds) in the past, but largely destroyed during the era of burning and stock use;
 - Marsh clubrush (*Bolboschoenus fluviatilis*) at a more advanced stage in its seasonal growth cycle than in 2005 (when monitoring was done in October), showing distinctly more new green growth and less brown dead foliage, thereby creating visual illusions of greater change than in reality; apparent invasion by exotic tall fescue may indicate lack of water in places;
 - The continued health of the spinifex on the foreshore, despite the presence of exotic plants that could be serious competitors including exotic lupin and various herbs;
 - Continued increase in several weed species in terrestrial places bordering the wetland, notably Japanese honeysuckle, montbretia and smilax;
 - Continued growth in plants established as part of a revegetation programme;

- High impact of vehicles on the beach side of the wetland, including some incursions into the wet zone;
- No roosting or nesting coastal birds (they were on the bar and islets to the east), probably due to constant disturbance by people, dogs and vehicles; waterfowl present but very wary, probably also due to disturbance.

It is recommended that the photopoints continue to be used as a prime ecological monitoring tool, revisited at two-yearly intervals.

2. It is recommended that some extra aspects are incorporated into the regular photopoint monitoring programme if appropriate opportunities present themselves: monitoring of noteworthy flora and weeds.
3. Other ecological monitoring is being done (birds, fish, water parameters). If not already so, it is recommended that these be regularised as parts of a formal ongoing monitoring programme.
4. The small native fauna is worthy of investigation. This includes lizards and invertebrates. At the very least it would be valuable to know which skink and gecko species were there and which large native shore invertebrates (including katipo) were still present.

State of the Environment (SOE) monitoring and reporting

Parameters used in this monitoring regime are directly applicable to State of the Environment (SOE) monitoring and reporting. Using a basic assessment of status (or condition) and trend for each parameter, they can be used as environmental indicators, and an overall condition and trend rating for the wetland as at December 2007 can be arrived at:

Indicator	Status/Condition (High, Medium, Low)	Trend (Improving, Stable, Deteriorating)
Native vegetation	M	I
Native flora	M	S
Native birds	L-M	S-D
Native fish	?	?
Native macroinvertebrates	?	?
Water levels	M	±S
Water flows	L-M	S
Water quality parameters	?	?
Overall ecology	L-M	±S

The conclusion is that the wetland is currently not in a very natural state and is more or less stable in condition in key aspects. The situation regarding native birds is of greatest current concern. This is very little different from the situation in 2005, and it is clear that there has been almost no restoration management in the last two years. It is expected that restoration management would produce marked improvement in status/condition.

It is recommended that a similar tabulation of ecological condition and trend is used as part of the regular monitoring reporting for the wetland.

Management issues

1. Native vegetation restoration

The restoration planting that has been done so far on the northern side of the lagoon system is appropriate and successful. There is scope for plenty more. On the margins of the wetland, pockets of cabbage trees, kahikatea, harakeke, manuka and coastal shrub daisy (*Olearia solandri*) could be planted to provide structural habitat, indigenous character and seed sources for natural regeneration. On the spit/bar, clumps of ngaio and taupata could be established to add to the structural diversity and natural character.

Recommendation: That the Regional Council encourage the continued planting of native plants around the lagoon system.

2. Water flows and levels and aquatic habitat

The freshwater level of the lagoon system has been lowered in the past by diverting the main inlet stream direct to the sea. This has probably allowed more salt water to penetrate further up the lagoon than previously. The proposed restoration of freshwater inflow and retention would allow greater development of freshwater vegetation and pond habitat for fauna. Although some current hydrological and vegetation patterns could be affected, there would probably be an overall ecological benefit.

Recommendation: That the proposed restoration of freshwater inflow and retention be investigated.

3. Weeds

There are various weeds present. Of greatest concern are silver poplar, pampas grass, boxthorn, Japanese honeysuckle and smilax. Marram grass is absent, but could arrive to pose a major threat to native spinifex. Lupins and exotic herbs are abundant on the rear of the beach, but at present do not appear to be adversely affecting the spinifex there.

Recommendation: That silver poplar, pampas grass, boxthorn, Japanese honeysuckle and smilax be actively controlled.

Recommendation: That marram grass is eradicated if detected.

Recommendation: That the condition of spinifex in relation to potential weeds continue to be monitored.

4. Mammal pests

Herbivorous mammal pests are not now much of a problem in the wetland. Domestic sheep and cattle have been excluded by fencing, and rabbits, hares and possums appear to be at low levels. Domestic dogs are highly disruptive to shore birds, and at present there seem to be no restrictions placed on their activity. Predators such as feral cats, stoats, rats and hedgehogs are probably significant threats to such birds also.

Recommendation: That domestic dogs are not encouraged in the vicinity of the wetland system.

Recommendation: That consideration is given to a predator control programme.

5. Vehicles

At present vehicles are permitted to drive almost anywhere on the spit/bar. Whilst that is good for easy public access it is damaging to the vegetation, disruptive to shore birds and encourages dumping of rubbish.

Recommendation: That vehicle access be limited, preferably confined to the western end of the spit/bar.

6. Native birds

The degree of disturbance by people, dogs and vehicles is adversely affecting native birds in the wetland. Waterfowl (ducks, swans and geese) are flighty. Pukeko seem to be absent or scarce. Coastal birds (terns, gulls, oystercatchers, dotterels, herons, penguins and shags) are more or less absent, although they are in the vicinity and would certainly use the wetland and its margins if given the chance.

Recommendation: That consideration is given to methods of reducing human impact, for the benefit of native birds and other natural aspects of the wetland system and its surrounds.

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Geoff Walls; Brett Stansfield, Graham Sevicke-Jones and Garth Eyles of Hawke's Bay Regional Council, Napeir; Malcolm Smith and Helen Jonas of the Department of Conservation, Wairoa.

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**APPENDIX 1: MAP OF WHAKAMAHI AND WHAKAMAHIA LAGOONS, SHOWING
PHOTOPOINT SITE LOCATIONS**

APPENDIX 2: PHOTOPPOINT RECORDING SHEETS, DECEMBER 2007

- Photopoint no. 1
- Photopoint no. 2
- Photopoint no. 3
- Photopoint no. 4
- Photopoint no. 5
- Photopoint no. 6
- Photopoint no. 7
- Photopoint no. 8
- Photopoint no. 9
- Photopoint no. 10
- Photopoint no. 11

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 1
Establishment date: 11/12/03		GPS reference: E2891802 N6228676
		Observer/Photographer: Geoff Walls
Photopoint relocation notes:		
Pilot Hill: walking track from upper carpark to edge of scarp.		
Direction from marker/post (magnetic bearing): 2 photos, E		
Camera info (lens, film, etc): 28mm, 200asa colour		
Vegetation (composition, structure, patterns, processes):		
Chosen to view Ngamotu Lagoon and river mouth. Numerous weeds in the foreground: pampas, pines, lupins, rank grasses. Site planted in ngaio, taupata, harakeke, tree lucerne. Karamu and tauhinu naturally present (or planted?). Bar entrance is in an unusual place: normally well to the east in recent years.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
11/10/05	G. Walls	Bar entrance in more 'normal' place, way to the east of where it was in 2003. Pampas has grown much.
07/12/07	G Walls F Cameron	Bar entrance has recently been machine opened, considerably West of 2005 position.

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 2
		GPS reference: E2891761 N6228502
Establishment date: 11/12/03		Observer/Photographer: Geoff Walls
Photopoint relocation notes: Seaward end of pa site at top of scarp, Pilot Hill Historic Reserve. Walking tracks from either carpark.		
Direction from marker/post (magnetic bearing): 6-photo panorama, E-S-W		
Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes): Entrance to lagoon: sand bars/spits with driftwood but little vegetation. To landward on pa site (significant site), rank grass (tall fescue etc); some silver poplar, grey willow, flax, taupata, ngaio, pohutukawa. Boxthorn by carpark.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
11/10/05	G. Walls	Bar entrance now well to the east of the 2003 position. Plantings have grown. Smilax has proliferated in the vicinity.
07/12/07	G Walls F Cameron	Area of the bar near the entrance has changed shape a lot – now much narrower. Terns, gulls and shags roosting on islets and bar.

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 3
		GPS reference: E2891119 N6228662
Establishment date: 11/12/03		Observer/Photographer: Geoff Walls
Photopoint relocation notes: Northern side of lagoon system: old concrete gun emplacement on roadside.		
Direction from marker/post (magnetic bearing): 5-photo panorama, E-S-W		
Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes): Chosen to follow the dynamics of the estuarine vegetation and the previously disturbed terrestrial margins. Interplay between marsh clubrush (<i>Bolboschoenus fluviatilis</i>) and glasswort in saline/freshwater mixing zone. Sea rush may be expanding. Saltmarsh ribbonwood on this edge amongst dense fescue. Plantings of trees and shrubs in places. On roadside, fescue etc with bracken, blackberry, convolvulus and montbretia. Taupata and karamu self-sown.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
11/10/05	G. Walls	Patterns of vegetation as in 2003. Saltmarsh ribbonwood has increased a little; marsh clubrush perhaps somewhat less (though this could be a seasonal timing effect). Smilax and montbretia increasing near the old gun emplacement.
07/12/07	G Walls F Cameron	Tide in/ Vegetation patterns look similar to 2005. Lot of swans

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 4
Establishment date: 11/12/03		GPS reference: E2890685 N6228552
		Observer/Photographer: Geoff Walls
Photopoint relocation notes:		
Northern side of lagoon system: in open newly-planted area (May 2003), just to the east of taller vegetation below the road.		
Direction from marker/post (magnetic bearing): 3-photo panorama, E-S-SW		
Camera info (lens, film, etc): 28mm, 200asa colour		
Vegetation (composition, structure, patterns, processes):		
Chosen to follow the dynamics of the estuarine vegetation and the previously disturbed terrestrial margins. Interplay between marsh clubrush (<i>Bolboschoenus fluviatilis</i>) and glasswort in saline/freshwater mixing zone. Sea rush may be expanding. Saltmarsh ribbonwood on each side of the estuary. Some raupo to the east.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
11/10/05	G. Walls	Glasswort appears to have moved into the marsh clubrush zone somewhat and the sea rush at the interface has grown markedly. Saltmarsh ribbonwood has grown. Raupo more or less unchanged. The native plantings are growing up, so this photopoint will not be as available in future and may have to be shifted. The plantings have been extended westwards between the road and the wetland.
07/12/07	G Walls F Cameron	Raupo has grown back from its winter die off and appears to be expanding. Bulboschoenus advanced seawards into the sea rush; saltmarsh ribbonwood has continued to grow. Plantings have grown up, so this photopoint will have to be abandoned soon

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 5
Establishment date: 11/12/03		GPS reference: E2890329 N6228384
Observer/Photographer: Geoff Walls		
Photopoint relocation notes: North-western side of lagoon system: on top of the eroding scarp above the road, above a post and to the west a little.		
Direction from marker/post (magnetic bearing): 6-photo panorama, E-S-W Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes): Higher up the estuarine system, where the saline effect runs out. Marsh clubrush (<i>Bolboschoenus fluviatilis</i>) is predominant, with lots of fescue on the east side. A dam is proposed to be constructed across the system in this vicinity.		
REPHTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
11/10/05	G. Walls	Saltmarsh ribbonwood has increased, sea rush has increased noticeably, marsh clubrush still dominant though. Japanese honeysuckle has increased on the roadsides.
07/12/07	G Walls F Cameron	Saltmarsh ribbonwood has grown. Overall health of the native vegetation is better.

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 6
Establishment date: 11/12/03		GPS reference: E2890231 N6228356
		Observer/Photographer: Geoff Walls
Photopoint relocation notes:		
North-western side of lagoon system: about 100m west of photopoint 5, atop the eroding scarp.		
Direction from marker/post (magnetic bearing): 6-photo panorama, E-S-W		
Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes):		
Excellent vantage point for the western end (head) of the wetland. Marsh clubrush (<i>Bolboschoenus fluviatilis</i>) is predominant, with scattered fescue. A dam is proposed to be constructed across the system in this vicinity, and much of the area will be thereby flooded and ponded.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
12/10/05	G. Walls	As for Photopoint 5. Sea rush has increased significantly, but not at the expense of other vegetation as yet. Occasional taupata in the marsh clubrush expanse. Japanese honeysuckle increasing. Occasional wilding pampas has been controlled.
07/12/07	G Walls F Cameron	As for photopoint 5. Increasing fescue may be due to less browsing from cattle.

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 7
Establishment date: 11/12/03		GPS reference: E2889450 N6227970
Observer/Photographer: Geoff Walls		
Photopoint relocation notes: Western end of the system at the road-end carpark. The photopoint is at the corner of the fence on a small rise.		
Direction from marker/post (magnetic bearing): 2 photos, E Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes): Spit/bar with scattered taupata (probably self-sown from planted individuals) and low vegetation: shore convolvulus, exotic grasses and herbs.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
12/10/05	G. Walls	The shape of the stream outlet has changed somewhat. Taupata has grown.
07/12/07	G Walls F Cameron	As 2005

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 8
GPS reference: E2890164 N6228105, E2890200 N6228120		
Establishment date: 11/12/03		Observer/Photographer: Geoff Walls
Photopoint relocation notes:		
Seaward side of the wetland (sand spit/bar): about 50m SW of a clump of planted Tasmanian ngaio.		
Direction from marker/post (magnetic bearing): 3 photos, E,S,W		
Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes):		
Spit/bar with spinifex and other low vegetation: shore convolvulus, exotic grasses and herbs. Lupin looks to be on the increase and could threaten the spinifex. Driftwood is an ecologically significant component/habitat.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
12/10/05	G. Walls	Spinifex is still healthy and not apparently threatened by lupins (which have died off in places, allowing spinifex room). Shore convolvulus and exotic herbs have increased, probably because of recent 'wet' summers.
07/12/07	G Walls F Cameron	Spinifex not looking healthy even though the lupin continues to die back. Shore convolvulus looking well and co-existing with the spinifex

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 9
Establishment date: 11/12/03		GPS reference: E2890586 N6228194
		Observer/Photographer: Geoff Walls
Photopoint relocation notes:		
Seaward side of the wetland (sand spit/bar): towards the eastern end, seaward of 3 taupata clumps (the eastern one has a post).		
Direction from marker/post (magnetic bearing): 5 photos, W, NE-E		
Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes):		
Spit/bar with spinifex and other low vegetation: shore convolvulus, exotic grasses and herbs. Lupin looks to be on the increase and could threaten the spinifex. There is saltmarsh ribbonwood on the estuary margin to the NE.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
12/10/05	G. Walls	As for Photopoint 8. Lupins look threatening to spinifex but may not be. Exotic herbs could be more of a worry, also vehicle use which is high in this vicinity. Saltmarsh ribbonwood looks to be increasing.
07/12/07	G Walls F Cameron	Spinifex looking healthy. Lupins are on the increase though. Saltmarsh ribbonwood continuing to increase. Dogs running free at the time of visit.

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 10
Establishment date: 11/12/03		GPS reference: E2890920 N6228324
Observer/Photographer: Geoff Walls		
Photopoint relocation notes: Seaward side of the wetland (sand spit/bar): eastern end, at end of access road.		
Direction from marker/post (magnetic bearing): 9-photo 360 degree panorama plus 3		
Camera info (lens, film, etc): 28mm, 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes): Estuarine fringe of three-square, sea rush and glasswort. Slightly raised area clad in rank tall fescue, more or less blocking off the upper portion of the wetland from the lower. Chosen to follow changes in this dynamic site. Banded dotterel breeding here in 2003.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
12/10/05	G. Walls	Some minor shape changes to the bar, and the entrance no longer where it was. Wetland vegetation hasn't changed appreciably, though sea rush has increased a little. Perhaps more herbaceous growth on the stabler sand. Dogs running free at the time of visit and domestic rubbish has been dumped here.
07/12/07	G Walls F Cameron	Markedly raised water level. Not much change in the wetland vegetation. Duck remain observed near site.

PHOTOPOINT RECORDING SHEET

Location/Area: Whakamahi & Whakamahia Lagoons		Photopoint no: 11
Establishment date: 11/12/03		GPS reference: E2890965 N6228421
		Observer/Photographer: Geoff Walls
Photopoint relocation notes: 200m north of photopoint 10, on the edge of the estuary by a wee islet.		
Direction from marker/post (magnetic bearing): 3 photos, N, W		
Camera info (lens, film, etc): 50mm, 200asa colour		
Vegetation (composition, structure, patterns, processes): Glasswort and a wee bit of sea rush where exposed to saline influence; backed by dense tall fescue with some planted flax and taupata.		
REPHOTOGRAPHY DETAILS:		
Date	Observer/ Photographer	Comments (changes, processes, etc)
12/10/05	G. Walls	There has been distinct wave erosion of the estuary shore in places. Sea rush hasn't expanded here. Glasswort still healthy and dense. Plantings have grown.
07/12/07	G Walls F Cameron	Unable to be photographed due to high water level.