INTERNAL

# TUKITUKI ESTUARY ECOLOGICAL MONITORING 2006

June 2007
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HBRC Plan No. 3947

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**Environmental Management Group**
**Technical Report**

**Internal**

**Environmental Monitoring Section**

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# Tukituki Estuary Ecological Monitoring 2006

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# TUKITUKI ESTUARY ECOLOGICAL MONITORING 2006

**Report prepared for Hawke's Bay Regional Council**

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**April 2006**

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Cover photo: Small pond near photopoint 1. Adjacent to this site is a healthy population of the threatened plant *Mimulus repens* which was previously unrecorded in the 2004 survey. This highlights the ephemeral nature of these populations and their sensitivity to change.

# INTRODUCTION

Regular monitoring of ecological condition and trend is built into the planned management of Tukituki Estuary, Hawke's Bay, by the Hawke's Bay Regional Council.

In late November 2002, a regime for monitoring the ecological condition and trend of the estuary 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 Pekapeka Swamp in 1998, in Whakaki Lagoon, Lake Poukawa and Lake Hatuma in 1999, in Waitangi Estuary in 2000 and in Lake Runanga in 2001. It also had the benefit of the local knowledge of Department of Conservation staff. Baseline surveys of vegetation and fauna were carried out at the same time. The findings of the baseline survey and ecological monitoring set-up were reported on in Walls 2002b (Tukituki Estuary Ecological Monitoring 2002).

A companion report provides more background information and forms a plan for ongoing ecological monitoring (Walls 2002a: Tukituki Estuary Ecological Monitoring Plan, December 2002). Hawke's Bay Regional Council produced a management plan for Tukituki Estuary in May 2002 (Cheyne & Addenbrooke, 2002). Ecological monitoring is factored into that plan. The wetland was last routinely monitored in 2004.

In November 2006 the wetland was revisited and the monitoring was repeated. This document reports on the current findings and includes previous monitoring results.

# 1. VEGETATION

## 1.1 Terrestrial vegetation

There were two aspects to monitoring of the terrestrial vegetation of the estuary in the monitoring plan: mapping of the current vegetation cover; monitoring of photopoints.

### 1.1.1 Vegetation map

*Method:*

The patterns of terrestrial vegetation were mapped in late November 2002 using recent monochrome aerial photos. A copy of this map is shown in Appendix 1.

*Observations:*

Seven major vegetation types were identified and mapped (see below). There were no significant changes detected in 2004.

**G** Gravel beaches, mostly bare except for a scattering of low vegetation; **Gs** is the stable rear of the beach, with shore bindweed and various exotic invaders; **Gr** is the river gravels.

**W** Water: **Wo** open riverine/tidal water; **Wp** ponded (fresh or brackish) water. Various aquatic macrophytic plants are present in places.

**S** Saline flats vegetation, usually containing wet turf communities amongst taller vegetation. Variations are: **Sb** *Bolboschoenus fluviatilis* dominant; **Sj** *Juncus maritimus* dominant; **Sp** *Plagianthus divaricatus* dominant; **Sm** mosaic. The turfs are made up of varying combinations of arrow-grass (*Triglochin striata*), *Samolus repens*, *Selliera radicans*, glasswort (*Sarcocornia quinqueflora*), buck's horn plantain (*Plantago coronopus*), batchelor's buttons (*Cotula coronopifolia*), sea spurrey (*Spergularia media*) and *Mimulus repens*.

**R** Riparian vegetation: **Rw** wet fringe (mainly *Bolboschoenus fluviatilis)*; **Rd** dry fringe, mostly backing the wet fringe (exotic grasses, especially tall fescue, with shrub and vine weeds such as fennel, gorse, tree lupin, boxthorn, blackberry, hemlock, tamarisk and exotic convolvulus in places).

**T** Treelands of planted exotic trees (willows, poplars, gums, tamarisk, macrocarpa, etc.).

**P** Pasture (mainly rank grassland of tall fescue and other exotic pasture plants).

**Mw** Mixed weedy vegetation : combinations of shrubs, trees, grasses, herbs, etc. (mainly exotic). Occupying ground in places that have been kept free of grazing. There are recent plantings of native trees, shrubs and flaxes in places on the true right bank of the river.

The saline flats and wet riparian fringe communities are the most natural vegetation types; the others are the product of considerable past modification through burning, mechanical clearance and the impact of farm stock. In the distant past (before people

arrived), there would have been swamps associated with the estuary. There is likely to have been a zone of rushes, sedges, manuka, harakeke (lowland flax) and cabbage trees backing the saline flats and wet fringe. Behind this would probably have been coastal forest, perhaps featuring pukatea, tawa, kahikatea, totara, ngaio, kanuka, kohuhu and nikau. On the strip between the estuary and the sea may have been low shrubland of taupata, akiraho and various small-leaved shrubs. *Muehlenbeckia ephedroides* was probably present. Pingao, sand tussock and spinifex may have grown in sandy beach sites.

The low wet turfs are expected to persist, unless permanently flooded. The saline flats and riparian communities of sedges and rushes are likely to contain increasing amounts of saltmarsh ribbonwood as stock have largely been fenced out. Cabbage tree and harakeke are likely to increase too. Around the newly created ponds and scrapes typical wetland vegetation of sedges, rushes, grasses and herbs are beginning to naturally establish. However, boxthorn, pampas grass, iceplant, gorse, tamarisk, silver poplar, willows and a suite of other weeds (especially vines) look as though they may proliferate in various places if not kept in check: at present they are largely under control.

In 2006 the situation for the weeds adjacent to the scrapes is similar with better coverage from the native vegetation both naturally and from plantings. A previously unmentioned weed species the Phoenix palm has become established in the wetland and will need removal. This plant will prove difficult to control as large seeding trees are located in the nearby HDC reserve and thus a constant seed supply into the wetland is assured.

*Next monitoring:*

In three or four years' time (2007- 2008).

### 1.1.2 Photopoints

*Method:*

10 photopoints were set up in late November 2002. Each was marked with an aluminium label attached to a post, mostly an existing fence post, where possible. 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 50mm lens was used. Film was Kodak colour print, 200asa. The photopoints were revisited, photographed and described in November 2004 and again in 2006.

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, and observations on changes noted.

*Observations:*

**Photopoint 1:**

Sited at the rear of the gravel beach to the north of the river mouth. This photopoint was chosen to follow the weed situation on the stable gravel (where in 2002 exotic iceplant was overcoming native shore bindweed, and pampas and boxthorn were present but under control); also to see whether or not saltmarsh ribbonwood would increase in the damp hollow behind. If vehicles were excluded from the beach there could also be other positive changes. In 2004, there had been an increase in the vegetation cover on the stable gravel, especially shore bindweed. Pampas had been controlled, but there was some boxthorn and tamarisk requiring control. Iceplant was continuing to look threatening, and other exotic plants were apparently increasing. The area was being used by banded dotterels and looked to be ideal nesting habitat for them; however if it becomes too vegetated it might not be. In the pond, marsh clubrush had bulked up noticeably.

In 2006 the situation is similar with no serious weed issues other than the continued existence of the introduced ice plant on the gravel beach. Vehicle use has been greatly diminished and the area was being well used by walkers. This foot traffic is probably having a limiting effect on the distribution of birds in the area as dogs accompanied all walkers during the time of survey. The *Bolboschoenus fluviatilis* appears to have encroached very little into the small pond to the south. A substantial population of *Mimulus repens* has established in the lagoon edge to the north.

**Photopoint 2:**

Sited on the stop-bank to the north of the river, where there are saline flats with a mosaic of rushes, turfs, raupo and exotic grasses. There are also various ponds. Since stock were excluded it was expected that the wetland plants would grow in stature and density. In 2004, marsh clubrush and tall fescue had thickened up where possible and had largely displaced the turf around the artificial ponds, along with creeping bent. The whole area seemed drier than in 2002, perhaps due to changes in the river mouth. Woody weeds had been well controlled. Black-fronted dotterels were using the dried-up ponds.

In 2006 no bird life was noted using the ponds, as very little open ground was available for them. The Raupo, *Bolboschoenus fluviatilis* and tall fescue continue to be the dominant species in this unit and the turf species have been completely replaced. Scattered taupata saplings are becoming evident and these will no doubt add increased structural diversity to the area.

**Photopoint 3:**

Sited on the stop-bank SW of Photopoint 2, with views of similar vegetation. In 2002, there were some newly created ponds and scrapes that were expected to progressively clothe in wetland vegetation. Artificial flooding was expected to drown the saline turfs. In 2004, there was considerable change where grazing had ceased, with the new ponds becoming clothed in marsh clubrush (wet margins) and tall fescue (drier ground). Turf vegetation had been displaced accordingly. Silver poplars had spread markedly via suckers from the parent trees, despite cattle presence. They will continue

to invade the area if not controlled. In the inner area where cattle were still present, the area was pretty trashed by them.

In 2006 *Bolboschoenus fluviatilis* continues to thicken so that it has covered the entire available land surface. Where open water is evident this has become crowded with green filamentous algae suggesting that there may be some issues with increased nutrient loads from the cattle grazing. Cattle grazing appears to be selecting tall fescue as the dominant plant cover in area that the animals can access as it is least preferred of the available species. Silver poplars have not increased markedly as was the concern from the previous survey; however there has been some minor expansion and this will need control eventually. Young Crack willows are also becoming established and these too will need attention preferably before they become too much of an issue.

**Photopoint 4:**

Sited on the riverbank (true left) near the mouth. Chosen to follow the progress of the riparian vegetation in the vicinity now that stock are excluded. In 2002, willows and silver poplars were predicted to burgeon unless controlled. In 2004, there was little change to the north, except that the eroding banks may have healed a bit (become more vegetated). Upriver, it was similar though apparently drier than before and therefore with more fringing vegetation (tall fescue, ephemeral herbs, creeping bent); willows and silver poplars had indeed spread and thickened.

In 2006, *Bolboschoenus fluviatilis* continues to thicken substantially but the *Schoenoplectus pungens* has been reduced by grazing somewhat. More tall fescue and *Bolboschoenus fluviatilis* has become established on the true right bank. The remaining willows have spread a little and will need control in the future.

**Photopoint 5:**

Sited at an estuarine channel that was partially fenced several years ago to protect whitebait spawning habitat. Since this is the proposed site for a sill, there may be considerable changes to come. In 2004, in the absence of grazing, marsh clubrush, tall fescue and creeping bent had proliferated and displaced most of the turf. The whole site seemed drier than before: changes at the river mouth meaning less freshwater input? Cattle had been allowed into the southern side of the whitebait spawning area for a time, to control the marsh clubrush there (this management was being carried out by Hans Rook of DOC).

In 2006, the effects of cattle grazing on the *Bolboschoenus fluviatilis* is still evident on the southern side of the spawning area. *Isolepsis cernua* has substantially reduced. There are large aggregations of algae and no *Mimulus repens* or Bachelors button with *Juncus kraussii* only a minor component. This loss of turf species has been bought about by the shading from adjacent rush and grass species.

**Photopoint 6:**

Sited on the stop-bank on the true right of the river. Chosen to follow changes in a backwater filled with *Bolboschoenus fluviatilis* and with willows that may invade. This backwater had been fenced off to exclude stock in 2002. As a result, in 2004 there had been thickening of the marsh clubrush and regeneration of a fringe of rank pasture. The willows appeared to have grown a little but not yet spread.

In 2006, the situation is similar to the previous survey period. *Bolboschoenus fluviatilis* has spread to cover nearly the entire area previously open. The adjacent willows have grown taller but don't appear to be spreading. Many Tui are using the tall eucalyptus trees near the ponds and the flax has had a strong flowering.

**Photopoint 7:**

Sited on the true right bank of the river, and chosen to follow the processes and patterns there. They include possible willow invasion of a gravel island in the river, and revegetation on mechanically cleared riverbanks and around newly created ponds and scrapes. In 2004, the gravel island on the river had been swept fairly clean of vegetation (by floods), except for a persistent young willow. The island was being used as a roost by black shags and gulls. Around the scrapes, tall fescue and other exotic pasture plants had grown up. Of the plantings, harakeke looked the most successful. Some turf development had occurred on the edges of the scrapes. Some of the remnant cabbage trees had died (sudden decline; altered drainage?).

In 2006 the situation is similar to the predicted progression from 2004. Willows on the gravel bank have been removed with Shags, Gulls and White faced herons roosting on emergent driftwood. Cabbage trees that were previously noted as dead have all recovered in the form of epicormic shoots. The other restoration plantings are becoming more evident amongst the fennel. Tall poplars have been removed from behind the stop bank. Harakeke is well established with a prolific flowering evident, whilst *Pittosporum ralphii* appears to be the most successful of the shrub species and has signs of having fruited last year. Koromiko have had a mixed success rate with some plants large and well established while others seem to have disappeared from the site. This could be a function of the tall fennel obscuring them at present.

**Photopoint 8:**

Sited on the stop-bank above the newly created ponds on the true right of the river. Chosen to follow the progress of the plantings there and the expected natural establishment of typical wetland vegetation. In 2004, as described for Photopoint 7, tall fescue and other exotic herbs and grasses had grown up around the scrapes. Some of the cabbage trees had died. Some young crack willows and poplars had grown up and will need to be eradicated. Raupo in NE corner looked to be expanding. Water birds were using the ponds. The plantings had sustained heavy losses but there were notable successes. Harakeke, koromiko and *Pittosporum ralphii* had established best. Suggestions to improve the success of future plantings are: use appropriate plants; use hardened plants (not straight out of a sheltered nursery); prepare the sites with spot spraying, or plant using mulch or weed mats; stake the plants (so they can be found

amongst the rank grass, etc); perhaps plant using compost or fertiliser; release weed around the plants (most important).

In 2006 the situation is generally the same with Harakeke approaching canopy closure in some spots and flowering profusely. Tall fescue is the dominant ground cover on the islands and may be suppressing potential native species such as C*arex secta.* Some of the planted toetoe has begun to flower and suppress the ephemeral weeds. Raupo has begun to spread a little but the big advances in cover have been from the *Bolboschoenus fluviatilis.* Some willow saplings and young gorse bushes have grown in the restoration area and will need removal before they become more of an issue.

**Photopoint 9:**

Sited on the stop-bank where it meets lower Grange Creek. Chosen to examine the patterns and processes amongst the extensive beds of marsh clubrush (*Bolboschoenus fluviatilis*) and the weedy mosaic of vegetation on the drier ground. In 2004, gorse had been fairly well controlled, though some was still alive. Populations of saltmarsh ribbonwood, marsh clubrush and raupo were looking healthy. The planted trees (mostly exotics or "exotic natives") were still present and were providing structural vegetation diversity and habitat for birds. It is an excellent area for restoration planting using ngaio, akiraho, taupata, *Pittosporum ralphii*, etc.

In 2006 the *Plagianthus divaricatus* is in good health with some expansion of individuals, but this appears to be in direct competition with the more competitive gorse. *Bolboschoenus fluviatilis* continues to thicken into attractive swathes into Grange creek. Taupata is well established also. Silver poplar and Tamarisk are abundant along the banks of Grange creek and will no doubt spread seaward into the restoration zone. Stinking Iris is common in the paddocks adjacent to the wetland and appear to be slowly spreading into the *Bolboschoenus fluviatilis* fringe particularly near the Whitebait Spawning sign. A well established Phoenix palm is to the north of the photopoint and will need to be removed as soon as possible, preferably before it begins to seed also.

**Photopoint 10:**

Sited at the beach at the south-eastern end of the estuary, atop a gravel pile. Chosen to follow the patterns and processes in the estuarine vegetation, in which saltmarsh ribbonwood is expected to increase over time; also to check whether weed control there (many weeds are present) is successful or not. In 2004, raupo in the channel looked to have spread significantly. Marsh clubrush and saltmarsh ribbonwood populations were healthy. Weed control looked pretty successful, though stinking iris and convolvulus were still abundant. The remaining tamarisk should perhaps be eliminated.

This photopoint has been relocated due to changes in the river mouth and surrounding area. Taupata on the stopbank edge are looking unhealthy possibly due to nearby earthworks or indiscriminate spraying. *Bolboschoenus fluviatilis* is spreading slowly but may have been reduced somewhat due to flooding and erosion at the mouth. Tamarisk, Stinking Iris, Smilax, and Blackberry are all still present in significant numbers and need further control. A previously unmentioned weed in this wetland is

the Phoenix Palm, *Phoenix canariensis.* This plant poses a dilema as large, seeding adults are growng in the adjacent Hastings District Council Reserve. These large palms will provide a constant source of seedlings to reinvade the wetland. Complete removal of these large trees will be needed if the wetland is to become a self perpetuating native ecosystem. Until such time vigilance and control is recommended in relation to this species.

*Next monitoring:*

November-December 2008; thence every second year. Photos to be repeated; recording sheets to be used.

## 1.2 Aquatic vegetation

*Method:*

The composition of the aquatic vegetation was assessed at two sites, chosen to represent the main parts of the estuary. Macroinvertebrate sampling was done at these sites too. The site locations are marked on the map (Appendix 1) and described on the combined aquatic vegetation and macroinvertebrate recording sheets (one for each site, Appendix 3).

Sampling at each site was done by observing the aquatic vegetation from the banks and winnowing available vegetation in water into a collecting tray. The samples were examined in the field. The aquatic macrophytes present were identified, and their relative abundances were recorded. Macroinvertebrates were searched for in each sample (see 2.4), and their standard sensitivity scores recorded to give a measure of water quality.

*Observations:*

Aquatic site 1:

Sited at the head of area fenced a few years ago for whitebait spawning habitat protection. Dense tall marsh clubrush where fenced off. To landward, grazed until recently and vegetation cover therefore much lower: includes turf of *Isolepis cernuus* and arrow grass, with some sea rush, creeping bent, batchelor's buttons and *Mimulus repens*. A sill is proposed for here that may also flood the site in future. In 2002, it was expected that vegetation change would be rapid now that grazing had ceased, and turf might disappear. In the water, the only macrophytes recorded were green algae, *Ruppia polycarpa*, arrow-grass and creeping bent. In 2004, creeping bent and batchelor's buttons had increased much and marsh clubrush was invading former wet pasture. Otherwise the macrophytes were similar, except that green algae had diminished somewhat. Cattle had been deliberately allowed into the southern side of the spawning area, to keep the marsh clubrush under control.

In 2006 the site has lost a considerable amount of the turf species due to the shading out of the ground surface from *Bolboschoenus fluviatilis* and tall fescue, with only small and unhealthy patches of Bachelors Button evident. No Mud crabs were noted other than evidence of their burrows.

Aquatic site 2:
Sited at the mouth of Grange Creek, where a small side channel enters. It is a highly tidal site, flushed and flooded twice daily. It has a muddy substrate. In 2002 there was much riparian marsh clubrush and green algae, *Ruppia polycarpa*, and creeping bent in the water. In 2004, green algae had diminished, creeping bent had appeared and the raupo seemed to be increasing seaward of the culvert.

In 2006 the situation is very similar to that in 2004. There has been minimal expansion of the raupo fringe but *Bolboschoenus fluviatilis* has expanded somewhat. The vegetation component is the same as previously recorded.

*Next monitoring:*

November-December 2006; thence every second year. Sampling to be repeated; recording sheets to be used.

## 1.3 Weeds

*Method:*

Weeds were searched for during the survey and monitoring of both the terrestrial and aquatic vegetation (1.1, 1.2). Their presence and impact were noted.

*Observations:*

In 2002, the following terrestrial weeds were regarded as requiring surveillance.

**Crack willow (*Salix fragilis*)**, established in various places along the river banks and capable of spreading around the estuary shores; apparently invading a gravel island in the river; also considered an aquatic weed; should be kept under control;
**Silver poplar (*Populus alba*)**, well established on both banks of the river; controlled recently in places, should be kept under control;
**Gorse (*Ulex europaeus*)**, a minor threat to the rear beach and some estuary margins; recently controlled;
**Pampas grass (*Cortaderia selloana*)**, established in places; recently controlled but requires vigilance;
**Chinese tamarisk (*Tamarix chinensis*),** spreading in saline flats; outlier plants recently controlled but still requires control in places;
**Boxthorn (*Lycium ferocissimum*)**, invading the rear gravel beaches and some banks; readily controllable at present;
**Indian doab (*Cynodon dactylon*)**, a creeping grass invading the rear gravel beach system; a definite potential threat to shore bindweed and *Muehlenbeckia ephedroides*; difficult to control;
**Convolvulus** (***Calystegia silvatica*** and ***Convolvulus arvensis***), locally abundant on the estuary margins;
**Blackberry** (***Rubus fruticosus*** agg.), common in mosaic communities; not considered an ecological problem;
**Smilax** (*Asparagus asparagoides*), a garden escape creeper established on the south margin of the estuary; difficult to control;
**Ivy** (*Hedera helix*), a garden escape creeper established on the south margin of the estuary; difficult to control;

**Japanese honeysuckle** (*Lonicera japonica*), a creeper established on the south margin of the estuary; difficult to control;
**Periwinkle** (*Vinca major*), a garden escape creeper established on the north margin of the estuary, misidentified as wandering Jew in the HBRC management plan; being controlled;
**Stinking iris** (*Iris foetidissima*), a garden escape established on the south margin of the estuary; difficult to control.

In 2006, the situation was essentially the same, weeds had been well controlled at the worst infestations but new arrivals need attention.

**Phoenix palm (***Phoenix canariensis)* In 2006 the same suite of weeds are still an issue with the inclusion of the Phoenix palm. This palm poses a dilema as it is widely used as a landscape plant in Hawkes Bay. Unfortunately it is a prolific seeder, and is spread via introduced passerine birds, therefore trees that are near a sensitive environment such as wetland or a forest patch should be removed to reduce the risk to these environments. There would need to be an education progamme of landowners to ensure that these plants do not becoem a significant ecological issue.

**Karo** (*Pittosporum crassifolium*) and **Tasmanian ngaio** (*Myoporum insulare*) could be regarded as weeds too. Both are planted on the southern side of the estuary, and contribute welcome structural diversity. Karo is native to northern NZ but not to Hawke's Bay. Tasmanian ngaio is not native to NZ but resembles the native species and hybridises with it. If in ecological restoration the policy is to be genetic purity then it will be necessary to remove these plants. Otherwise they could be regarded as usefully substituting for lost native trees.

In 2002, the following aquatic weeds were regarded as requiring surveillance and still are:

**Hornwort** (*Ceratophyllum demersum*), **curly pondweed** (*Potamogeton crispus*), **Canadian pondweed** (*Elodea canadensis*), **water buttercup** (*Ranunculus trichophyllus*) and **egeria** (*Egeria densa*), all common throughout the estuarine backwaters of nearby Waitangi Estuary;
**Cord grass** (*Spartina anglica*, *S.* x *townsendii*), recently reported from nearby Ahuriri Estuary, and possibly already present in nearby Waitangi Estuary; a serious threat to the saline flats vegetation, especially the wet turfs; should be searched for and eradicated immediately if discovered;
**Water net** (*Hydrodictyon reticulatum*), reported in 1999 from the Clive River and present in Lake Poukawa, that eventually drains into the nearby Waitangi Estuary via Karamu Stream and the Clive River; a smothering alga that could severely affect the aquatic ecology.

*Next monitoring:*

November-December 2008, along with other vegetation monitoring; thence every second year.

## 1.4 Notable flora

*Method:*

Plants of note were searched for, as during baseline survey and monitoring set-up.

*Observations:*

To date, only one native plant listed within the Department of Conservation's Threat Classification System (Hitchmough 2002) is known from Tukituki Estuary: *Mimulus repens*, an estuarine turf herb with a pretty pink flower. It is quite common in places. The area of dense saltmarsh ribbonwood (*Plagianthus divaricatus*) in the southern part of the estuary is also significant: it is one of the better areas of that species in Hawke's Bay. Not far to the south on the raised gravel beach at Te Awanga is the nationally threatened prostrate creeper *Muehlenbeckia ephedroides*, in very precarious circumstances. The stable gravel beaches at the estuary are good potential habitat for that species, which was probably formerly present and could be reintroduced. Should any other notable plants be detected or introduced in future, extra monitoring will be needed.

*Mimulus repens* appears to be in good health around the estuary with several previously unreported patches being found in the 2006 survey. The Saltmarsh ribbonwood is also in good health although some competition with species such as gorse will limit is range and reduce its chances for expansion.

*Next monitoring:*

November-December 2008; thence every second year.

# 2. FAUNA

## 2.1 Waterbirds

*Method:*

Two methods were used:

1. **Directed searches**, whereby a number of sites around the estuary were visited to listen and look for crakes, rails and bitterns.
2. **General fauna survey**, whereby waterbirds were searched for during other survey and monitoring activities.

However, since OSNZ and Department of Conservation regularly survey the estuary for birds, this aspect of the monitoring is not given a high degree of attention. In this report a departure from using the standard Department of Conservation fauna survey cards has been made, simply for ease of compilation. The lists in Appendices 4 and 5 are based on the standard cards.

*Observations:*

A great range of species of waterbirds has been recorded from the Tukituki Estuary (OSNZ and Department of Conservation records). They include migrant waders (including kotuku, godwit, knot and wrybill), various seabirds (including gulls, terns and gannet) and resident species. Not all may still be present. The list also includes Australasian bittern and dabchick, two native species listed as threatened by the Department of Conservation (Hitchmough 2002), and spotless crake, now rare in Hawke's Bay.

The other wetland birds include swans, ducks, geese, shelducks, shags, pied stilt, variable oystercatcher, banded dotterel, black-fronted dotterel, royal spoonbill, cattle egret, pukeko, Australasian harrier, NZ kingfisher and welcome swallow. The swans, ducks, shelducks and pukeko are possibly seasonally hunted in the wetland. Although it is the nature of waterbirds to be somewhat shy, they are extremely wary, suggesting that hunting and human disturbance are making it difficult for them to feed, roost and breed in safety. Predation by stoats, ferrets, cats, dogs and rats must also occur. No doubt control of human disturbance and predators would benefit the water birds immensely.

In late November 2002 a sub-set of the above water birds was detected (Appendix 4). No additional species were detected. No signs of Australasian bittern, dabchick or spotless crake were found, although these birds are hard to detect and could well have been present, particularly in the dense areas of marsh clubrush.

In November 2004, the suite of water birds was essentially the same, although godwit, black-billed gull and gannet were not seen (possibly because of the slightly earlier survey time, missing these migratory birds). The numbers of NZ shoveler, grey teal, banded dotterel and Caspian tern appeared a little higher than in 2002. Black-fronted dotterel was seen (it was not detected in 2002).

In 2006 the composition of the water birds was essentially the same with none of the more cryptic species being recorded but this is expected unless a detailed search is undertaken for these birds. White Heron were noted feeding in the Grange Creek near Aquatic site 2.

*Next monitoring:*

November-December 2008; thence every second year.

## 2.2 Other birds

*Method:*

General fauna survey, whereby birds other than waterbirds were searched for during other survey and monitoring activities.

*Observations:*

Many other species of birds have been recorded at the estuary. A few are common natives, such as pipit and silvereye, whilst the remainder are common introduced species typical of the Hawke's Bay rural scene. The full list of birds noted during the survey and their estimated numbers is in Appendix 4.

In 2006 several Tui were seen in the area adjacent to the wetland using flowering gums and in season presumably the extensive flax plantings.

*Next monitoring:*

November-December 2008; thence every second year.

## 2.3 Fish

*Method:*

Fish were surveyed only as part of other monitoring work. This is because the HBRC and Department of Conservation have duties and interests regarding the fish of the estuary, particularly in relation to the whitebait fishery.

*Observations:*

Tukituki Estuary is regionally significant for native freshwater and estuarine fish. It is a traditional and important harvesting site for eels and whitebait (mostly juvenile inanga, the adults of which spawn in places in the estuary). It is a breeding, feeding and nursery area for mullet, flounders and kahawai. Native fish recorded from the estuary include lamprey, longfin eel, shortfin eel, common smelt, banded kokopu, koaro, inanga, common bully, giant bully, black flounder, yellowbelly flounder, grey mullet, yelloweye mullet, kahawai and parore (names according to McDowall, 2000).

In late November 2002, adult inanga were seen at a number of sites, and whitebait fishermen were actively ensconced on the river banks, indicating that protection of the spawning habitat in the estuary is already paying handsome dividends. Mullet were seen in lower Grange Creek. Mosquito fish, an introduced pest, is resident and was seen at Aquatic Sample Site 1 in the estuary on the northern side of the river.

Introduced goldfish were present in puddles on the southern side of the river in the mid 1990s and are probably still present in the estuary. Brown trout and rainbow trout are also reported from the estuary, but were not seen during the survey.

In 2004, few fish were seen during the survey. However, there was a seething population of mosquito fish in the pond near Photopoint 3, just south of Aquatic Sample Site 1 where they were previously found but were absent this time.

Large populations of Mosquito fish were seen at nearly all sights and appear to have completely colonised the available habitat in the wetland.

*Next monitoring:*

November-December 2008; thence every second year.

## 2.4 Aquatic invertebrates

*Method:*

Macroinvertebrates (invertebrates big enough to see with the naked eye) were sampled along with aquatic vegetation at two representative sites (see 1.2; locations marked on the map, Appendix 1, and described in the aquatic vegetation and macroinvertebrate recording sheets, Appendix 3). Aquatic vegetation and substrate were winnowed in the water into a plastic tray. The samples were examined with the use of a hand lens. Invertebrates were identified using the Taranaki Regional Council guidebook (1997) and Parkinson and Cox (1990). Sensitivity scores, indicative of water quality, were assigned from the Taranaki Regional Council guidebook (1997). Species found and their scores are listed in the aquatic vegetation and macroinvertebrate recording sheets (Appendix 3).

*Observations:*

In both sites the invertebrates found had a maximum sensitivity score of 5 (moderate water quality; 10 is very high water quality). The ranges and averages of the scores are tabulated below. They show that at none of the sites was the water of very good quality. The number of species found ranged from 4 to 6, which indicates quite low diversity. No rare or unusual species were found. No obvious changes were detected between 2004 and 2006.

| | Number of species found | | Range of sensitivity scores | |
|---|---|---|---|---|
| Date | 2004 | 2006 | 2004 | 2006 |
| Site 1 | 4 | 4 | 3-5 | 3-5 |
| Site 2 | 6 | 6 | 3-5 | 3-5 |

*Next monitoring:*

November-December 2008; thence every second year. Sampling to be repeated; recording sheets to be used.

## 2.5 Mammalian pests

*Method:*

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

*Observations:*

Four mammals that can be regarded as pests in the wetland were detected during the baseline survey and monitoring set-up, and confirmed in 2004 (Appendix 5):

- Possum: present around the estuary margins, though not in high numbers.
- Hedgehog: present around the estuary margins.
- Feral and domestic cat: present around the estuary margins.
- Domestic dog: regularly present; a threat to breeding, feeding and roosting birds.

Other mammalian pests probably present but not detected include:

- Rabbit and hare: probably present around the margins, although not in great numbers; would require control if known to be threatening valuable vegetation.
- Mouse: known predator of invertebrates.
- Ship rat and Norway rat: known predators of birds, lizards and invertebrates.
- Stoat, ferret and weasel: known predators of birds, lizards and invertebrates; good swimmers.

*Next monitoring:*

November-December 2008; thence every second year.

## 2.6 Terrestrial invertebrates

Not deliberately surveyed or included in the monitoring plan, but worthy of separate study. The suite of invertebrates living in driftwood is noteworthy. Rapid examination showed that few native species were present: they appeared to have been largely displaced by exotic invertebrates.

These were not searched for in 2006.

## 2.7 Reptiles and amphibians

Also not deliberately surveyed or included in the monitoring plan, but worthy of separate study. Despite some searching, no signs of skinks or geckos were found. However, unlike in 2002 (when they were absent), southern bell frogs were found in quantity in the wetland on the north side of the Tukituki River. Although introduced, they are not regarded as an ecological threat and given their drastic decline in recent years because of disease their presence is perhaps to be celebrated.

In 2006 no frogs were heard at the site but this is possibly a reflection of the climatic conditions at the time of sampling

# CONCLUSIONS

The key natural features of Tukituki Estuary and its surrounds are:

- Estuary: outstanding habitat for wetland birds, including several rare and iconic species; inanga, smelt, mullet and other native fish; fringes of primarily native vegetation, including shore ribbonwood, marsh clubrush and the threatened turf plant *Mimulus repens*;

- Gravel beach ridge and bar system: roosting and possibly nesting habitat for birds (dotterels, stilts, gulls and terns);

- River and backwaters/channels and ponds: outstanding spawning habitat for whitebait species; nesting and feeding habitat for wetland birds;

- Overall restoration potential: wetland and coastal shrubland and forest, flax, rushlands and sedgelands, estuarine turfs, wetland and coastal bird populations.

In addition, there is a strong tradition of use by whitebaiters and the local community. Therefore there are bright prospects for restoration and enhancement of the natural features of the wetland system. The local Community Interest Group is keen to be involved. Although the members are not very ecologically experienced they are highly observant of the river and the sea.

The monitoring regime has allowed a series of conclusions to be drawn about various aspects of the ecological condition and trend of the wetland system, and the efficacy of management. Out of these conclusions flow a consequent series of recommendations. They build on those from the 2002 baseline survey but are essentially similar.

**Fencing and native vegetation restoration**

The fencing that has been carried out has been successful in excluding domestic cattle from the wetland. The result so far has been improvement in the condition and noticeable regeneration of the native wetland vegetation around the wetland margins there, especially shore ribbonwood, rushes, sedges and saline turfs. This improvement should continue.

Because the native vegetation has become so depleted around the wetland system and in the surrounding landscape, deliberate planting is necessary to re-introduce species and to create a dominant and self-perpetuating cover of native vegetation for the future. An excellent start has been made; the potential for more such restoration planting is great.

Due to the failure of some plants to establish in the restoration areas replanting of gaps could be undertaken to ensure canopy closure can be achieved as soon as possible. Without canopy closure serious weed infestations will continue to be an ongoing issue.

**Water levels**

On the north side of the river, where the new scrapes and fenced-off whitebait spawning area are, the water level or supply seems to have dropped since 2002. This is to the detriment of the wetland qualities of this part of the estuarine system. This is still the case in 2006 with very little surface water present in these areas.

**Weeds**

There are some terrestrial weeds present, but few aquatic ones as yet. Of greatest concern are silver poplar, crack willow, gorse, pampas grass, boxthorn, tamarisk, smilax, ivy, periwinkle and Japanese honeysuckle, all of which are being controlled. Exotic iceplant is a threat to the native shore vegetation on the stable gravel beach and should be watched. Karo, although a native of NZ, is not native to Hawke's Bay and Tasmanian ngaio is also a foreigner. Both could be regarded as weeds but alternatively could be regarded as providing welcome analogue vegetation structure. Potentially troublesome terrestrial arrivals could be vines such as old mans beard, which should be controlled as soon as it is detected. Water net poses a serious potential aquatic threat to the ponded freshwater parts of the wetland system, and could easily arrive. Cord grass (spartina) is another serious potential threat to the estuary.

**Notable flora**

There is a strong population of *Mimulus repens*, a saline turf herb listed as nationally threatened. The area of saltmarsh ribbonwood in the south-eastern part of the estuary is of regional significance. Both of these plants appear to be in good health with in the wetland system and will need only minor management inputs to maintain their integrity. *Muehlenbeckia ephedroides* is a nationally threatened plant only known in Hawke's Bay from a precarious site at nearby Te Awanga. Tukituki Estuary's gravel beach system could provide it with another site.

**Water birds**

The variety and numbers of water birds appear to be holding their own well at present. One nationally rare species - Australasian bittern - may now be resident at the wetland, and there may also be a resident population of the regionally rare spotless crake. The condition of the habitat for these birds is improving with the changes in management in recent years. However, there is much human disturbance of breeding, roosting and feeding water birds, and predation whilst nesting is probably considerable.

**Land birds**

Land birds use the wetland in considerable numbers. Most are exotic (introduced) species, but a few are natives. These birds include species such as Tui and Bellbird using the tall flowering gums adjacent to the wetland at the Grange creek confluence. Kereru have also been noted in the area but it is uncertain if they are using the terrestrial portion of the wetland area.

**Fish**

The wetland is clearly somewhat depleted in terms of its native fish fauna but is valuable regionally and recovering. There are introduced fish that may be hampering the recovery. Anecdotal evident suggests that the Mosquito fish population is providing a significant food source for Bittern.

**Aquatic invertebrates and water quality**

Aquatic macroinvertebrates provide a useful measure of water quality and habitat condition. They indicate that the wetland can support a considerable diversity of small animal life, but that the water quality is compromised by artificial nutrient input. There are limitations to the technique though, because it was primarily developed for stream systems, and other measures of water quality are necessary for comprehensive monitoring of condition and trend. The Ecological Monitoring Plan for Tukituki Estuary (Walls 2002) proposes regular (monthly or quarterly) sampling of standard parameters. These included pH, conductivity, turbidity, colour absorbances, biochemical oxygen demand, dissolved reactive phosphorus, ammoniacal-nitrogen, nitrate-nitrogen, total phosphorus and total nitrogen.

**Driftwood**

Driftwood provides valuable natural habitat for native birds, lizards and invertebrates. At present it is being harvested or burnt too fast to allow it to accumulate, thereby depriving the ecosystem of that kind of habitat.

**Vehicle access and public perception**

There appears to be a growing sense of local pride in the estuary as a natural area, but there is still a way to go. At the time of the baseline survey in 2002, I found the locked gate on the access road from Black Bridge smashed open and vehicles were using the beaches on each side of the river mouth. I was told by locals that since the Regional Council had begun regulating public access, dumping of rubbish had markedly diminished. In 2004, vehicle access had been blocked off (except to ATVs) and there appeared to be little disturbance or littering of the beach. The barriers and education programme are clearly working. The recent establishment of a Community Interest Group to participate in the estuary restoration can only help the situation.

In 2006 access to the beach has been restricted to ATV’s but these still cause considerable disturbance to the roosting bird congregations. Further restrictions on vehicle access will have a beneficial impact on both the ecology and aesthetics of the site.

**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 2002 can be arrived at:

| Indicator | Status/Condition (**H**igh, **M**edium, **L**ow | Trend (**I**mproving, **S**table, **D**eteriorating) |
|---|---|---|
| Native vegetation | L-M | I |
| Native flora | L | S-I |
| Native birds | M | I |
| Native fish | L-M | I |
| Native macroinvertebrates | L | S |
| Water levels/supply/habitats | M | I, D |
| Water flows | M | S |
| Water quality parameters | ? | ? |
| Weed control | M-H | S |
| Animal pest control | L | S |
| Human disturbance control | M | S |
| **Overall ecology** | **L-M** | **S-I** |

The conclusion is that the wetland is in a low-moderate natural state and is stable or improving in condition in most key aspects. It is expected that restoration management will produce further marked improvement in status/condition in future.

**Monitoring techniques and frequency**

In the light of five years' experience in Pekapeka Swamp and other wetlands in Hawke's Bay, the suite of techniques being used to monitor the ecological condition and trend of Tukituki Estuary appears to be appropriate and valuable. The only issues are the difficulty of detecting rare water birds and the lack of monitoring of water quality parameters (see above). In view of the relative stability of the wetland but some pressing management issues, monitoring at two-yearly intervals seems sensible.

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# APPENDICES:

## APPENDIX 1: Map of Tukituki Estuary, showing vegetation types and monitoring site locations

## Vegetation types

**G** Gravel beach; **Gs** stable rear of beach; **Gr** River gravels
**W** Water: **Wo** open riverine/tidal water; **Wp** ponded (fresh or brackish) water
**S** Saline flats vegetation, containing turf communities: **Sb** *Bolboschoenus fluviatilis* dominant; **Sj** *Juncus maritimus* dominant; **Sp** *Plagianthus divaricatus* dominant; **Sm** mosaic
**R** Riparian vegetation: **Rw** wet fringe (mainly *Bolboschoenus fluviatilis)*; **Rd** dry fringe (exotic grasses with shrub weeds in places;
**T** Treelands of exotic trees (willows, poplars, gums, tamarisk, macrocarpa, etc.)
**P** Pasture (mainly rank grassland of tall fescue and other exotic pasture plants)
**Mw** Mixed weedy vegetation : combinations of shrubs, trees, grasses, herbs, etc. (mainly exotic)

## Monitoring sites

- Photopoints
- Aquatic sampling sites

## APPENDIX 2: Photopoint recording sheets, November 2006

- 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 RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 1**

**Grid reference: V21/E2848312 N6171834**

**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
End of Bell St: fence post with tag atop stop-bank; photopoint on causeway 17m to seaward of post.

**Direction from marker/post (magnetic bearing):** 1 photo to N; 2 photos to S
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
On stable rear of gravel beach, low vegetation of shore bindweed, exotic iceplant and grasses, with occasional pampas, small boxthorn and garden escapes. Weed invasion is the issue, especially effect of iceplant, also vehicle use (planned to close). Excellent potential site for re-establishment of *Muehlenbeckia ephedroides* from Te Awanga.
In damp and ponded depression, *Bolboschoenus fluviatilis* dominant, with some sea rush and occasional saltmarsh ribbonwood (that may increase in future).
To N is a more tidal and open wetland for contrast.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | To the north, not much change is evident, apart from a little more ephemeral vegetation on the gravel beach. To the south, marsh clubrush has thickened around the pond and advanced into it; on the gravel rear beach there has been a considerable increase in vegetation cover, especially shore bindweed. Good to see that pampas has been destroyed; there is some boxthorn and tamarisk to be killed still. Iceplant is a worry and should be monitored at least. The rear beach is ideal breeding habitat for banded dotterel at present but would not be if it became too vegetated. |
| 27/11/06 | Andrew Lamason | In 2006 the situation is similar with no serious weed issues other than the continued existence of the introduced ice plant on the gravel beach. Vehicle use has been greatly diminished and the area was being well used by walkers. This foot traffic is probably having a limiting effect on the distribution of birds in the area as dogs accompanied all walkers during the time of survey. The *Bolboschoenus fluviatilis* appears to have encroached very little into the small pond to the south. A substantial population of *Mimulus repens* has established in the lagoon edge to the north |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 2**
**Grid reference: V21/E2848329 N6171571**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
On stop-bank at end of School Rd. A lone post is there with no tag.

**Direction from marker/post (magnetic bearing):** 5-photo panorama N-E-S
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Mosaic of vegetation on flats with damp and drier areas. Much *Bolboschoenus fluviatilis* where wetter and some raupo; dominated by tall fescue where drier. A series of natural and artificial ponds and channels. Some patches of blackberry and gorse; being controlled. Turfs around ponds and on spoil, featuring bachelors button, bucks horn plantain, sea spurrey, exotic buttercups, grasses, etc. Recently fenced from stock.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | Not much visual change. Marsh clubrush, raupo and tall fescue have thickened where possible, especially around the artificial ponds, where the turf has been largely displaced by the taller plants (including creeping bent). Black-fronted dotterels feeding in the dried-up ponds. Woody weeds have been well controlled and the absence of stock is now evident. The whole area seems drier than before (changes at river mouth?). |
| 27/11/06 | Andrew Lamason | In 2006 no bird life was noted using the ponds, as very little open ground was available for them. The Raupo, *Bolboschoenus fluviatilis* and tall fescue continue to be the dominant species in this unit and the turf species have been completely replaced. Scattered taupata saplings are becoming evident and these will no doubt add increased structural diversity to the area. |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 3**
**Grid reference: V21/E2848215 N6171289**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
On stop-bank at very end of Waipureku Rd. Tag on nearby gate post on top of bank. Photopoint 15m to N.

**Direction from marker/post (magnetic bearing):** 4-photo panorama N-E-S
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
As for Photopoint 2 but more tall fescue and less *Bolboschoenus fluviatilis*. Newly-created ponds a feature. Silver poplars may be a weed problem in future.

**REPHOTOGRAPHY DETAILS:**

| **Date** | **Observer/ Photographer** | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | Considerable visual change where not now grazed: the new ponds have become clothed in dense marsh clubrush around the wet margins and by tall fescue where it is drier. Silver poplars are spreading substantially from the parent trees despite cattle use and will need to be controlled or they will progressively invade the area. The inner area is still being used by cattle and is pretty trashed as a result. |
| 27/11/06 | Andrew Lamason | In 2006 *Bolboschoenus fluviatilis* continues to thicken so that it has covered the entire available land surface. Where open water is evident this has become crowded with green filamentous algae suggesting that there may be some issues with increased nutrient loads from the cattle grazing. Cattle grazing appears to be selecting tall fescue as the dominant plant cover in area that the animals can access as it is least preferred of the available species. Silver poplars have not increased markedly as was the concern from the previous survey; however there has been some minor expansion and this will need control eventually. Young Crack willows are also becoming established and these too will need attention preferably before they become too much of an issue. |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 4**

**Grid reference: V21/E2848380 N6171297**

**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
Riverbank at seaward end of silver poplars. Tag on big strainer post; photopoint 15m to N.

**Direction from marker/post (magnetic bearing):** 1 photo to N; 3-photos panorama E-S
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Rank exotic pasture grasses on bank to NE, with marginal fringe of *Bolboschoenus fluviatilis*. Upriver, fringe of *Bolboschoenus fluviatilis, Schoenoplectus validus, Schoenoplectus pungens*, backed by rank grasses, willows, blackberry and fennel. Willows will undoubtedly spread and thicken up: may need to be controlled.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | To the north, little change except that the eroding banks may be healing a bit (becoming more vegetated). Upriver, similar though apparently drier than before and therefore more fringing vegetation (tall fescue, ephemeral herbs, creeping bent); willows have spread and thickened. |
| 27/11/06 | Andrew Lamason | In 2006, *Bolboschoenus fluviatilis* continues to thicken substantially but the *Schoenoplectus pungens* has been reduced by grazing somewhat. More tall fescue and *Bolboschoenus fluviatilis* has become established on the true right bank. The remaining willows have spread a little and will need control in the future. |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 5**
**Grid reference: V21/E2848317 N6171319**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
Head of area fenced a few years ago for whitebait spawning habitat protection. Also Aquatic sampling site 1. Tags on landward post.

**Direction from marker/post (magnetic bearing):** 2 photos: seaward and landward
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Dense tall *Bolboschoenus fluviatilis* where fenced off. To landward, grazed until recently and vegetation cover therefore much lower: includes turf of *Isolepis cernua* and arrow grass, with some sea rush, creeping bent, bachelors button and *Mimulus repens*. Expect vegetation change to be rapid here now grazing has ceased, and turf may disappear. A sill is proposed for here that may also flood the site in future.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | In the absence of grazing, marsh clubrush, tall fescue and creeping bent have proliferated and displaced most of the turf. The whole site seems drier than before: changes at the river mouth meaning less freshwater input? Cattle have been allowed into the southern side of the whitebait spawning area, to control the marsh clubrush there. |
| 27/11/06 | Andrew Lamason | In 2006, the effects of cattle grazing on the *Bolboschoenus fluviatilis* is still evident on the southern side of the spawning area. *Isolepsis cernua* has substantially reduced. There are large aggregations of algae and no *Mimulus repens* or Bachelors button with *Juncus kraussii* only a minor component. This loss of turf species has been bought about by the shading from adjacent rush and grass species |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 6**

**Grid reference: V21/E2848362 N6170720**

**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
Top of stop-bank where public road bens away towards river. Tag on stayed fencepost by nearest tree (gum). Photopoint 15m to NW.

**Direction from marker/post (magnetic bearing):** 1 photo, looking SE
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Dense *Bolboschoenus fluviatilis* dominant in head of back channel of Grange Creek. Could be interesting to observe whether or not willows invade. Private land?

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | This backwater has been fenced off to exclude stock since 2002. As a result, there has been thickening of the marsh clubrush and regeneration of a fringe of rank pasture. The willows appear to have grown a little but not yet spread. |
| 27/11/06 | Andrew Lamason | In 2006, the situation is similar to the previous survey period. Bolboschoenus fluviatilis has spread to cover nearly the entire area previously open. The adjacent willows have grown taller but don't appear to be spreading. Many Tui are using the tall eucalyptus trees near the ponds and the flax has had a strong flowering. |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 7**
**Grid reference: V21/E2848393 N6170844**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
Where public access road meets river bank. No post or tag.

**Direction from marker/post (magnetic bearing):** 10-photo panorama W-N-E-S
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Silver poplars on river bank. Low gravel island in river, with young willows and tidal herbfield/grassland (good high-tide bird roost). Cleared river banks currently quite bare. Series of recently-created ponds and scrapes with plantings of cabbage trees and harakeke, being colonised by exotic herbs and grasses. Predict typical wetland vegetation of sedges and rushes etc will establish by itself. Good interesting development.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | On the river, the gravel island has been swept fairly clean of vegetation (by floods), except for a persistent willow. The island is used as a roost by black shags and gulls. Around the scrapes, tall fescue and other exotic pasture plants have grown up. Of the plantings, harakeke looks the most successful. Some turf development on the edges of the scrapes. Some of the remnant cabbage trees have died (sudden decline; altered drainage?). |
| 27/11/06 | Andrew Lamason | Willows on the gravel bank have been removed with Shags, Gulls and White faced herons roosting on emergent drift wood. Cabbage trees that were previously noted as dead have all recovered in the form of epicormic shoots. The other restoration plantings are becoming more evident amongst the fennel. Tall poplars have been removed from behind the stop bank . Harakeke is well established with a prolific flowering evident, whilst *Pittosporum ralphii* appears to be the most successful of the shrub species and has signs of having fruited last year. Koromiko have had a mixed success rate with some plants large and well established while others seem to have disappeared from the site. This could be a function of the tall fennel obscuring them at present. |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 8**
**Grid reference: V21/E2848486 N6170759**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
Top of stop-bank behind new pond area. Tag on post at fence on other side of bank, at end of row of planted pussy willows.

**Direction from marker/post (magnetic bearing):** 5-photo panorama W-N-E
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Chosen to follow changes in newly created pond system. Planted harakeke and cabbage trees; some standing youthful cabbage trees. Expect *Bolboschoenus fluviatilis* to expand into most of area and other sedges and rushes to establish. Plantings will grow up.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | As for Photopoint 7. Tall fescue and other exotic herbs and grasses have grown up around the scrapes. Some of the cabbage trees have died. Some young crack willows and poplars that will need to be eradicated. Raupo in NE corner looks to be expanding. Water birds using the ponds.<br>The plantings have sustained heavy losses but there are notable successes. Harakeke, koromiko and *Pittosporum ralphii* have established best. Suggestions to improve the success of future plantings are: use appropriate plants; use hardened plants (not straight out of a sheltered nursery); prepare the sites with spot spraying, or plant using mulch or weed mats; release weed around the plants; stake the plants (so they can be found amongst the rank grass, etc); perhaps plant using compost or fertiliser. |
| 27/11/06 | Andrew Lamason | In 2006 the situation is generally the same with Harakeke approaching canopy closure in some spots and flowering profusely. Tall fescue is the dominant ground cover on the islands and may be suppressing potential native species such as C*arex secta* Some of the planted toetoe has begun to flower and suppress the ephemeral weeds. Raupo has begun to spread a little but the big advances in cover have been from the *Bolboschoenus fluviatilis.* Some willow saplings and young gorse bushes have grown in the restoration area and will need removal before they become more of an issue |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 9**
**Grid reference: V21/E2848595 N6170753**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
At corner of stop-bank by Grange Creek. Tag on nearest fence post to seaward.

**Direction from marker/post (magnetic bearing):** 6-photo panorama N-E-S
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Area to seaward of Grange Creek is a mosaic of waterways with expanses of *Bolboschoenus fluviatilis* and saltmarsh ribbonwood (that may increase in future), with some raupo. Various planted trees and shrubs on dry higher areas, amongst gorse (being controlled), fennel and rank grasses. Up Grange Creek are big expanses of *Bolboschoenus fluviatilis*, fenced off to protect whitebait spawning habitat. A splendid vantage point to follow patterns and processes.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | Gorse has been fairly well controlled, though some is still alive. Populations of saltmarsh ribbonwood, marsh clubrush and raupo are looking healthy. The planted trees (mostly exotics or "exotic natives") are still present and currently providing structural vegetation diversity and habitat for birds. It is an excellent area for restoration planting using ngaio, akiraho, taupata, etc. |
| 27/11/06 | Andrew Lamason | In 2006 the *Plagianthus divaricatus* is in good health with some expansion of individuals, but this appears to be in direct competition with the more competitive gorse. *Bolboschoenus fluviatilis continues* to thicken into attractive swathes into Grange creek. Taupata is well established also. Silver poplar and Tamarisk are abundant along the banks of Grange creek and will no doubt spread seaward into the restoration zone. Stinking Iris is common in the paddocks adjacent to the wetland and appear to slowly spreading into the *Bolboschoenus fluviatilis* fringe particularly near the Whitebait Spawning sign. A well-established Phoenix palm is to the north of the photopoint and will need to be removed as soon as possible, preferably before it begins to seed also. |

# PHOTOPOINT RECORDING SHEET

**Location/Area: Tukituki Estuary** **Photopoint no: 10**
**Grid reference: V21/E2848805 N6170890**
**Establishment date: 27/11/02** **Observer/Photographer: G. Walls**

**Photopoint relocation notes:**
Top of gravel pile on seaward side of rail-and-cable fence. No post or tag. Pile could shift anytime!

**Direction from marker/post (magnetic bearing):** 4-photo panorama SW-NW
**Camera info (lens, film, etc): 50mm, 200 asa**

**Vegetation (composition, structure, patterns, processes):**
Mosaic of *Bolboschoenus fluviatilis* expanses, with saltmarsh ribbonwood (that may increase in future), some raupo, rank exotic grass-herbfield and 'tree-shrubland' of planted karo, taupata, Tasmanian ngaio and tamarisk, with some of the weeds (tamarisk and silver poplar) recently removed. Will be interesting to follow this much modified but partially natural site. Dreadful suite of weeds present: Japanese honeysuckle, smilax, ivy, stinking iris, convolvulus, blackberry, silver poplar, etc.

**REPHOTOGRAPHY DETAILS:**

| Date | Observer/ Photographer | Comments (changes, processes, etc) |
|---|---|---|
| 9/11/04 | Geoff Walls | 3 photos taken. Raupo in the channel looks to have spread significantly. Marsh clubrush and saltmarsh ribbonwood populations are healthy. Weed control looks pretty successful, though stinking iris and convolvulus are still abundant and tamarisk should perhaps be eliminated. |
| 27/11/06 | Andrew Lamason | This photopoint has been relocated due to changes in the river mouth and surrounding area. Taupata on the stop bank edge are looking unhealthy possibly due to nearby earthworks or indiscriminate spraying. *Bolboschoenus fluviatilis* is spreading slowly but may have been reduced somewhat due to flooding and erosion at the mouth. Tamarisk, Stinking Iris, Smilax, and Blackberry are all still present in significant numbers and need further control. A previously unmentioned wed in this wetland is the Phoenix Palm, *Phoenix canariensis*. |

APPENDIX 3: Aquatic vegetation and macroinvertebrate recording sheets, November 2004

- Site no. 1
- Site no. 2

AQUATIC VEGETATION AND MACROINVERTEBRATE RECORDING SHEET

**Location/Area: Tukituki Estuary** **Site no: 1**

**Grid reference: V21/ E2848317 N6171319**

**Establishment date: 27/11/02** **Observer: G. Walls**

**Site notes (location details, vegetation, etc):**

Head of area fenced a few years ago for whitebait spawning habitat protection. Also Photopoint 5. Tags on landward post.

Dense tall *Bolboschoenus fluviatilis* where fenced off. To landward, grazed until recently and vegetation cover therefore much lower: includes turf of *Isolepis cernua* and arrow grass, with some sea rush, creeping bent, bachelors button and *Mimulus repens*. Expect vegetation change to be rapid here now grazing has ceased, and turf may disappear. A sill is proposed for here that may also flood the site in future.

**SAMPLING DETAILS**

**Date: 27/11/06** **Observer: A Lamason & B Stansfield**

**Sampling methods/notes:**

Samples taken in small channel

| **AQUATIC VEGETATION PRESENT** | | | **COMMENTS** |
|---|---|---|---|
| **Species** | **Relative abundance*** | | |
| | 2004 | 2006 | |
| Green algae | S | M | Dominant in water species |
| Ruppia polycarpa | M | S | |
| Arrow grass | M | A | Diminished in 2004, absent in 2006 |
| Creeping bent | M | M | Has expanding considerably |
| Batchelor's buttons | M | S | Very diminished in 2006 |
| Mimulus repens | S | A | No longer present in 2006 |
| Marsh Club Rush | M | M | Has expanding considerably |
| | | | |
| | | | |

*** estimated % or: a = absent u = uncommon/rare s = some m = much**

| **MACROINVERTEBRATES PRESENT** | | | | **COMMENTS** |
|---|---|---|---|---|
| **Species** | **SENSITIVITY SCORE (1-10)** | **2004** | **2006** | Continues to be a non-diverse site |
| Isopod | 5 | P | P | |
| Amphipod | 5 | P | P | |
| Potamopyrgus snail | 4 | P | P | |
| Mud crab | 3 | P | P | |

AQUATIC VEGETATION AND MACROINVERTEBRATE RECORDING SHEET

| | |
|---|---|
| **Location/Area: Tukituki Estuary** | **Site no: 2** |
| | **Grid reference: V21/ E2848658 N6170779** |
| **Establishment date: 27/11/02** | **Observer: G. Walls** |

**Site notes (location details, vegetation, etc):**
Mouth of Grange Creek, on track where a small side channel enters. Much marsh clubrush (*Bolboschoenus fluviatilis*). Highly tidal, flushed and flooded twice daily. Muddy substrate. Tag on lone fence post 5m N of culvert.

**SAMPLING DETAILS**
**Date: 27/11/06** **Observer: A Lamason & B Stansfield**
**Sampling methods/notes:**
Samples taken either side of culvert.

| **AQUATIC VEGETATION PRESENT** | | | **COMMENTS** |
|---|---|---|---|
| **Species** | **Relative abundance*** | | |
| | 2004 | 2006 | |
| Green algae | S | M | Dominant in water species |
| Ruppia polycarpa | M | S | |
| Marsh Club Rush | M | M | Has expanding considerably |
| Creeping bent | M | M | Has expanding considerably |
| | | | |

*** estimated % or: a = absent u = uncommon/rare s = some m = much**

| **MACROINVERTEBRATES PRESENT** | | **COMMENTS** | | |
|---|---|---|---|---|
| **Species** | **SENSITIVITY SCORE (1-10)** | **2004** | **2006** | Continues to be a non-diverse site |
| Isopod | 5 | P | P | |
| Amphipod | 5 | P | P | |
| Potamopyrgus snail | 4 | P | P | |
| Mud crab | 3 | P | P | |
| Shrimp | 3 | P | P | |
| Amphibola mud whelk | 3 | P | P | |

# APPENDIX 4: Bird lists, Tukituki Estuary, November 2006

| Water birds | | | Other birds | | |
|---|---|---|---|---|---|
| **Species** | **Est. Nos.** | **Breeding (yes/no)** | **Species** | **Est. Nos.** | **Breeding (yes/no)** |
| **Native species** | | | **Native species** | | |
| Black shag | 10 | n | Pipit | 5 | ? |
| Little shag | 15 | n | Silvereye | 20 | ? |
| NZ shoveler | 20 | ? | Rironiro | 2 | ? |
| Paradise shelduck | 4 | ? | Tui | 5 | ? |
| Grey teal | 10 | ? | | | |
| Pied stilt | 15 | y | **Introduced species** | 5 | ? |
| Var. oystercatcher | 4 | ? | Skylark | 30 | y |
| Banded dotterel | 15 | ? | Starling | 10 | y |
| Black-fronted dotterel | 6 | ? | Blackbird | 10 | y |
| E. bar-tailed godwit | - | - | Thrush | 20+ | ? |
| White-faced heron | 20 | ? | Redpoll | 20+ | ? |
| Spur-winged plover | 20 | y | Greenfinch | 20+ | ? |
| Caspian tern | 3 | n | Goldfinch | 10+ | ? |
| White-fronted tern | 10 | ? | Chaffinch | 10+ | ? |
| Red-billed gull | 20 | ? | Yellowhammer | 30 | y |
| Black-billed gull | - | - | House sparrow | 15 | y |
| Black-backed gull | 20 | ? | Dunnock | 5 | ? |
| Pukeko | 20 | y | Magpie | 30 | ? |
| Welcome swallow | 30 | y | Myna | 20 | n |
| NZ kingfisher | 10 | ? | Feral pigeon | | |
| Australasian harrier | 5 | ? | | | |
| Gannet | - | - | | | |
| White Heron | 1 | | | | |
| | | | | | |
| **Introduced species** | | | | | |
| Mallard | 25 | y | | | |
| Black swan | 5 | ? | | | |

# APPENDIX 5: Other animal lists, Tukituki Estuary, November 2006

| Species | Est. Nos. | Breeding (yes/no) | Species | Est. Nos. | Breeding (yes/no) |
|---|---|---|---|---|---|
| **Introduced mammals (detected)** | | | **Native reptiles** | | |
| Cat | | y | | | |
| Dog | | y | **Introduced reptiles** | | |
| Hedgehog | 10 | y | | | |
| | | | **Introduced frogs** | | |
| **Introduced mammals (probably present)** | | | Southern bell frog | 10 | y |
| Rabbit | | y | | | |
| Hare | | y | | | |
| Stoat | | y | | | |
| Ferret | | y | | | |
| Weasel | | y | | | |
| Ship rat | | y | | | |
| Norway rat | | y | | | |
| Mouse | | y | | | |
| Possum | | y | | | |