Osbornes Drain Downstream wetland

Habitat Restoration and Enhancement Plan

(24 Feb 2019 - for consideration and endorsement by the Working Party)

2019

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Selwyn DISTRICT COUNCIL

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1.0 BACKGROUND

1.1 Acknowledgement

The Habitat Restoration and Enhancement Plan is being developed in recognition of the long-term and historical degradation of the wetlands downstream of the Pump House in the discharge zone as a result of the constructed Pump House discharge channel.

1.2 Purpose of Document

The purpose of this document is to plan for and facilitate the habitat restoration and enhancement of the section of Osbornes Drain downstream of the Pump House.

1.3 Consent Requirements

The requirements of this plan are set out in Consent CRC172231 conditions 19 and 20. These are provided below:

> ***Condition 19*** *The Consent Holder shall prepare the Habitat Restoration and Enhancement Plan based on the recommendations of the Osbornes Catchment Management Working Party within 24 months of the commencement of this Consent for consideration and endorsement by the Working Party.*
>
> ***Condition 20*** *The Consent Holder shall complete the implementation of the Habitat Restoration and Enhancement Plan within five years of the Plan being endorsed by the Working Party in accordance with Condition (19), and shall obtain certification from a suitable qualified and experienced person that confirms that the Habitat Restoration and Enhancement Plan has been implemented in accordance with Condition (18)(b).*

1.4 Drainage System Description

The Osbornes scheme has a rating area of approximately 1758 ha, servicing the area between Halswell Cannel and Hudson Roads with the main drainage outlets for this scheme via the Osbornes Pump Station. The ultimate receiving environment for this area is Te Waihora (Lake Ellesmere).

The total length of classified drains within the scheme is 9 km.

Below is a summary of the drainage schemes history taken from the publication 'Osbornes Drain and Pumping Scheme – An Evaluation' July 1989

1868	Regular lake openings began
1889	Halswell Canal constructed
****	Drain re-routed through stone-faced bank direct to the lake
1955	Double, manually operated flood gate installed within stop bank
1962/63	Osbornes Pump Scheme initiated by North Canterbury Catchment Board
1967/68	Scheme constructed under supervision of the Ellesmere County Council
1968	First pump reading was taken late May 1968

Prior to European settlement most of the area was a shallow bay covered by the high levels of Te Waihora (Lake Ellesmere). The land drain running through the catchment (Osbornes drain) originally flowed into the Halswell Canal via a wooden floodgate in the stone face bank. Improvements in the Halswell drainage system keep the canal levels high so the drain was rerouted through the stone face bank directly to the Lake. In 1955 a double, manually operated, floodgate was installed.

The upgrade of this land drainage scheme was initiated by the then North Canterbury Catchment Board in 1962/63 and was constructed under the supervision of the then Ellesmere County Council. The scheme provided for two pumps with a combined capacity of approximately 1.7 cubic meters per second; designed to cope with all floodwaters, except under extreme rainfall. The main canal is designed to act as a ponding area. From an economic return perspective, the capital works had a return on investment of 3 years. However this did not consider the impact of drainage water on lake health and cultural impact.

The key feature of this drainage district is the Osbornes Pump Station. It is the responsibility of the Osbornes Drainage Committee with contractors utilised for maintenance. The pumping hours range dramatically over the year. Approximately 50% of the pumping hours occur during the months of July and August, and 75% of the pumping hours occur between the months of June and September.

The majority of the infrastructure assets in this scheme are open channels. As mentioned above, there is also a pump station.

The Osbornes catchment is low lying flat land. Prior to European settlement a map shows most of the area as a shallow bay covered by High lake levels. Pasture for grazing is the predominate land use with the catchment followed by dairying and lifestyle blocks.

A scheme map is provided in Figure 1 and a scheme schematic in Figure 2 below.

1.5 Cultural Significance/effect

It is recognised that Te Waihora is an area of considerable cultural significance. Under the Ngāi Tahu Claims Settlement 1998, ownership of the lake bed of Te Waihora was returned to Te Rūnanga O Ngāi Tahu.

Te Rūnanga o Ngāi Tahu and the Department of Conservation share management responsibilities for Te Waihora and have prepared a joint management plan. The joint management plan was prepared by Te Rūnanga o Ngāi Tahu with advice from the Te Waihora Management Board (local Papatipu Rūnanga representatives) and the Canterbury Conservancy of the Department of Conservation in accordance with the provisions set out in sections 167 to 182 and schedule 12 of the Ngāi Tahu Claims Settlement Act 1998.

Te Waihora is also subject to a Water Conservation Order which recognises the outstanding amenity and intrinsic values that the lake provides, including Ngāi Tahu historical, spiritual and cultural characteristics and significance in accordance with tikanga Ngāi Tahu, including in respect of kaitiakitanga and mahinga kai.

Any activity that may affect water or the environment of Te Waihora are of significant interest to Te Rūnanga O Ngāi Tahu. This is recognised and acknowledged by Selwyn District Council. The Cultural Impact Assessment prepared by Te Taumutu Rūnanga for the consent application is a key reference document.

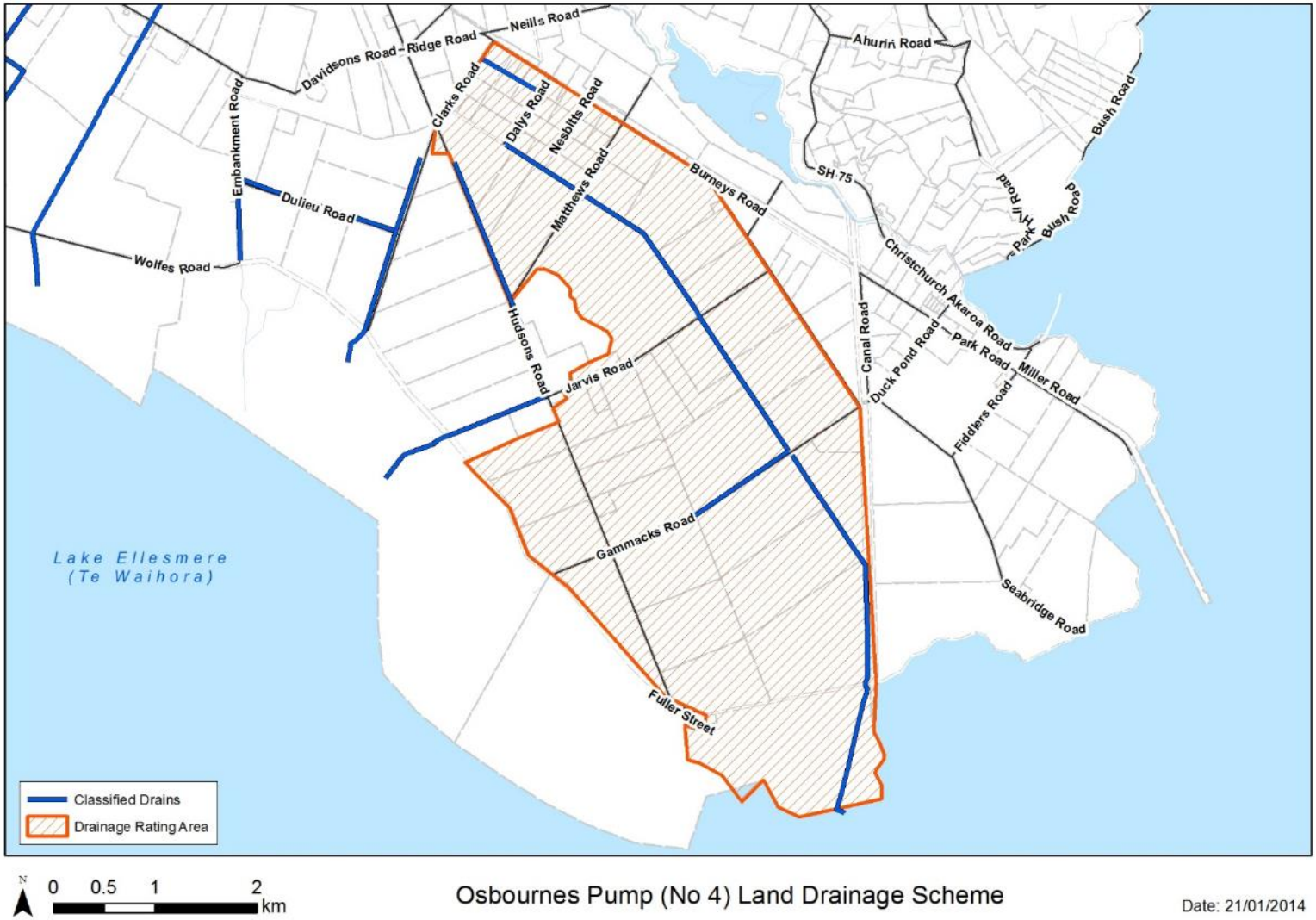


Figure 1 Scheme Map

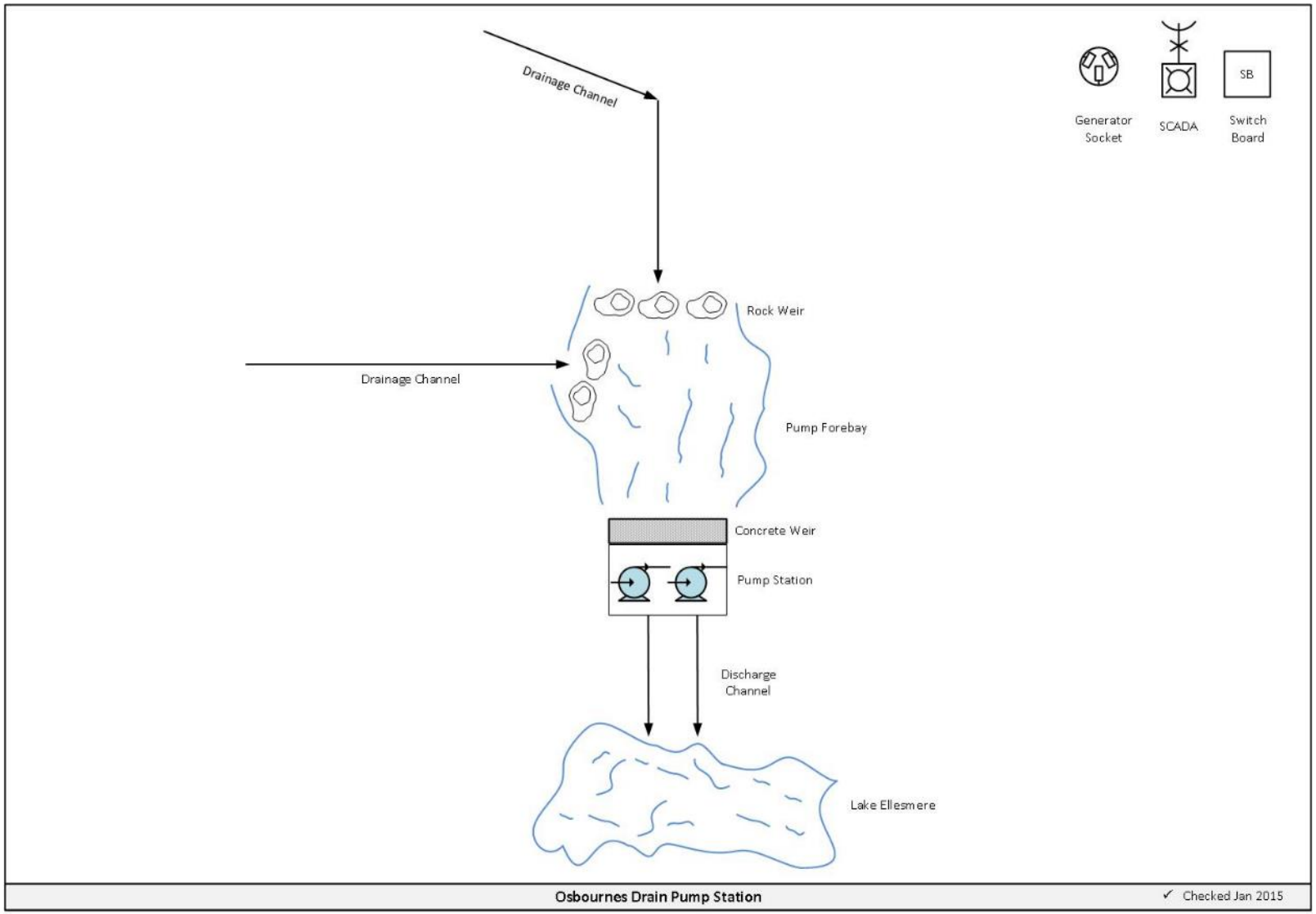


Figure 2 Scheme Schematic

2.0 WORKING PARTY ADVICE

The Working Party met on the 2nd February 2017 to discuss the aspirations for the Habitat Restoration and Enhancement Plan. The working party worked through a skeleton version of this report providing feedback on its contents and providing direction for further work. The below figures are copied from white board sketches on the day along with brief 'notes' of the discussion under each.

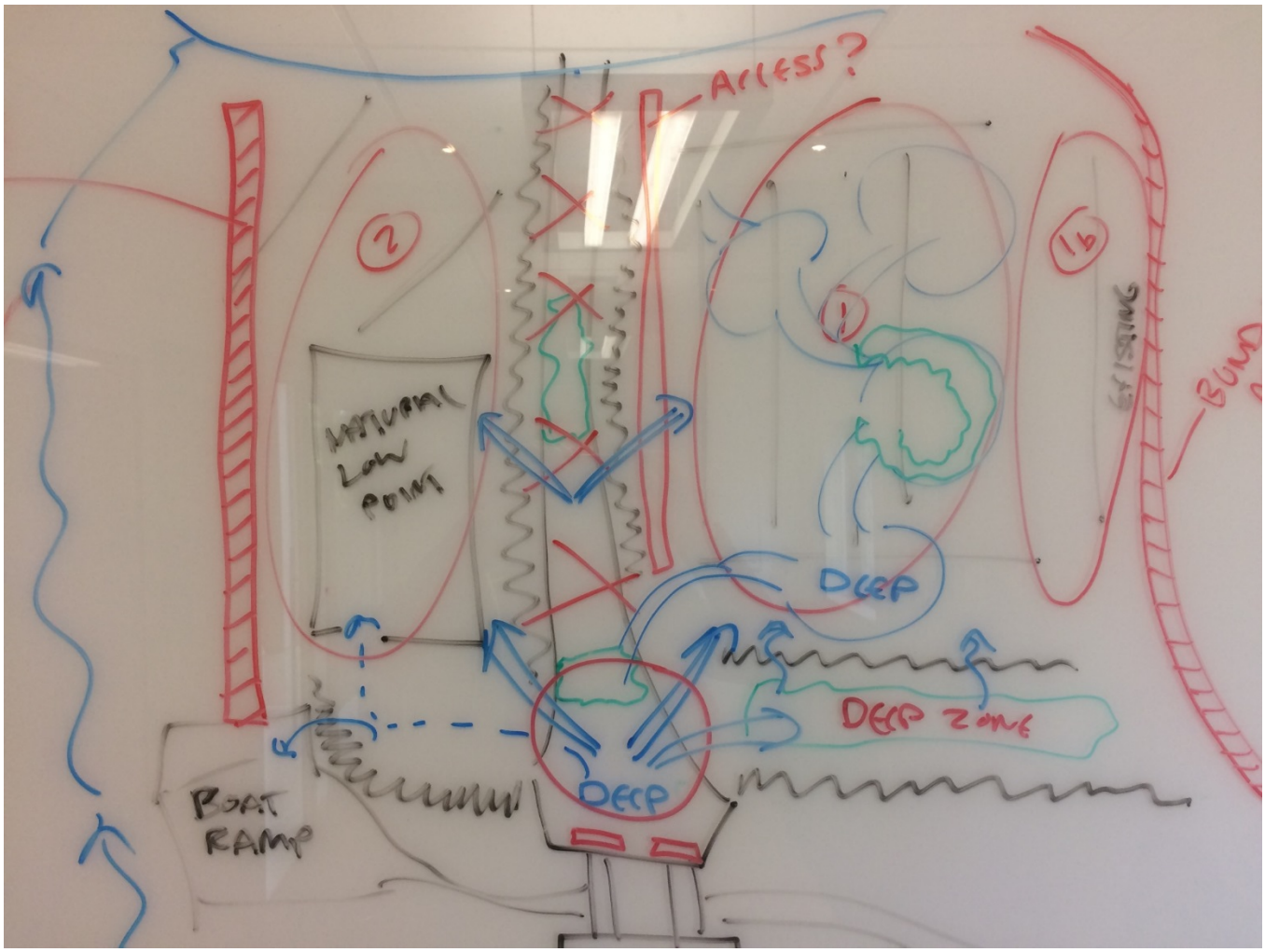


Figure 1 *– Initial ideas on potential site layout considerations*

The formation of natural habitat to discourage the need / desire of eel (short and long fin) to migrate further upstream is of critical importance as is the development of Mahinga kai habitat.

The working party identified two initial wetland locations (1) and (2) above for consideration. The form of the wetland was agreed to mimic nature with varying zones of shallow and deeper water in a meandering pattern. The wetland should be developed sympathetically with the natural contour of the land.

A site visit, in the early stages of developing the plan, with all working party members will be critical to ensuring a successful project. This occurred in march 2018.

Provide for enhanced bittern habitat and ensure that this is in place before any bittern habitat is removed. This was discussed as part of the discussion on the potential to remove Raupo in a number of places. It was noted that wild life is a measure of success.

Promote the establishment of salt-marsh plants once stock are removed.

Access to the lake shall remain and in the future educational information / boards etc could be put in place to explain the work that was put in place and the reasons why.

There was a desire for much of this work to be designed in house

An assessment of consent requirements will be required early on in the process.

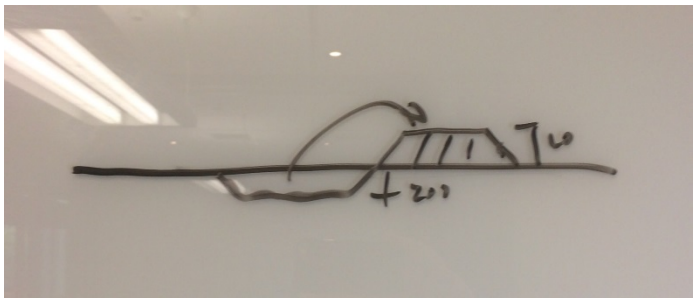


Figure 2 *– Idea of 'low impact' wetland formation*

The above figure illustrates a shallow excavation with the 'cut' material forming a low bund. It is expected that the wetland will be constructed in a sympathy with the natural contours of the land and the existing natural features of the site.

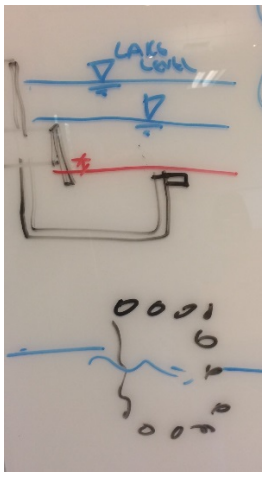


Figure 3 *– Ideas to limit eel migration*

The *upper sketch* in figure 3 above shows a level/elevation drop between the pump station pipe outlet and the proposed normal water level. This 'step' would provide a barrier to fish passage (be it limited) between the outlet channel and the pump discharge pipe.

Consideration of the wetland and its operation under different lake level scenario's will be an important consideration throughout this project.

The *lower sketch* shows a x-section through a formed gravel bund where water is passed through providing a filtering process while at the same time limiting fish passage.

3.0 ENHANCEMENT OPTIONS

Mahinga kai habitat

One of the key objectives of this plan is to provide Mahinga kai habitat.

Mahinga kai, as defined in the Te Waihora Joint Managemant Plan, is the customary gathering of food and natural materials and the places where those resources are gathered." (Section 167, NTCSA).

The principal mahinga kai species of Te Waihora are outlined in appendix 1 which is taken from the Joint Management Plan. Many of these species are recorded in an 1880 document (Taiaroa, 1880) that identifies the food and natural materials gathered at that time and those that were used as tohu.

It is proposed that the works will promote the establishment of mahinga kai species.

Discourage further upstream eel migration into Osbornes Drain

Another of the key objectives of the plan is to discourage migration of eels upstream into Osbornes drain. The below measures are proposed to be further investigated and developed and implemented in line with resource consent CRC172231.

- Ensure efficient seal on Osborne drain pump house flap gate
- Provide enhanced habitat downstream of the pump house discharge to provide a preferred habitat
- Formation of natural barriers to upstream migration where possible (in addition to the first measure if practicable)

Habitat and Water Quality Enhancement

It is proposed that a Wetland / wetland swale(s) be constructed to facilitate habitat and water quality enhancement. This will include where appropriate:

- Work in collaboration with working party members to realise the collective vision of the group (refer also section 2.0 of this report).
- Eco sourcing of plants wherever possible and allowing for natural regeneration,
- Minimise earthworks (Work with the natural contours of the land),
- The inlet and outlet locations be considered and sympathetic to the existing ecology and hydrology
- Protect and develop further bittern habitat

Restriction of 4x4 and other vehical access

Where approprate, use the development of the wetland to restrict vehical access e.g. deep pools, planting, embankments etc.

4.0 WETLAND DESIGN STATEMENT

4.1 Introduction

The purpose of this document is to outline the design requirements to meet Councils obligations under Environment Canterbury land drainage consent CRC172231 in terms of developing mahinga kai habitat downstream of the pump house and in particular to discourage further upstream eel migration into Osbornes Drain.

Wetlands are complex natural shallow water environments that can provide a high level of ecological habitat and provide attractive amenity spaces.

4.2 Wetland objectives

The intention of the proposed wetland is to provide the following:

- Mahinga kai habitat
- Discourage further upstream eel migration
- Recreational amenity for the community;
- Enhanced wildlife habitat over the existing land use;
- Enhancement of social and cultural values.
- Restriction of vehical access

4.3 Design against re-suspension

The wetland shall be designed such that flows through wetland will be maintained below 0.25m/s during full pump flows in order to avoid the re-suspension /erosion of sediments contained within the wetland and to avoid the damage of plants contained within the wetland.

The wetland will be designed, as far as practicable, to avoid short circuiting of flows to minimize the potential for stagnate areas of water.

The normal (lake unaffected) operating water depth within the wetland (other than deep zones) shall be no greater than 300mm to minimise potential damage to the plants contained within the wetland.

4.4 Geometry

The wetland geometry will be as defined below:

4.5 Wetland Zone Depths

The wetland shall be designed in general accordance (while blending with the natural topography) with the below standard

- Approximately 80% of the wetland area to consist of shallow water 0 to 0.3m deep
- Approximately 20% of the wetland area to consist of deep pools 0.3 to 1m deep

A conceptual configuration of an Urban Stormwater Wetland is provided below.

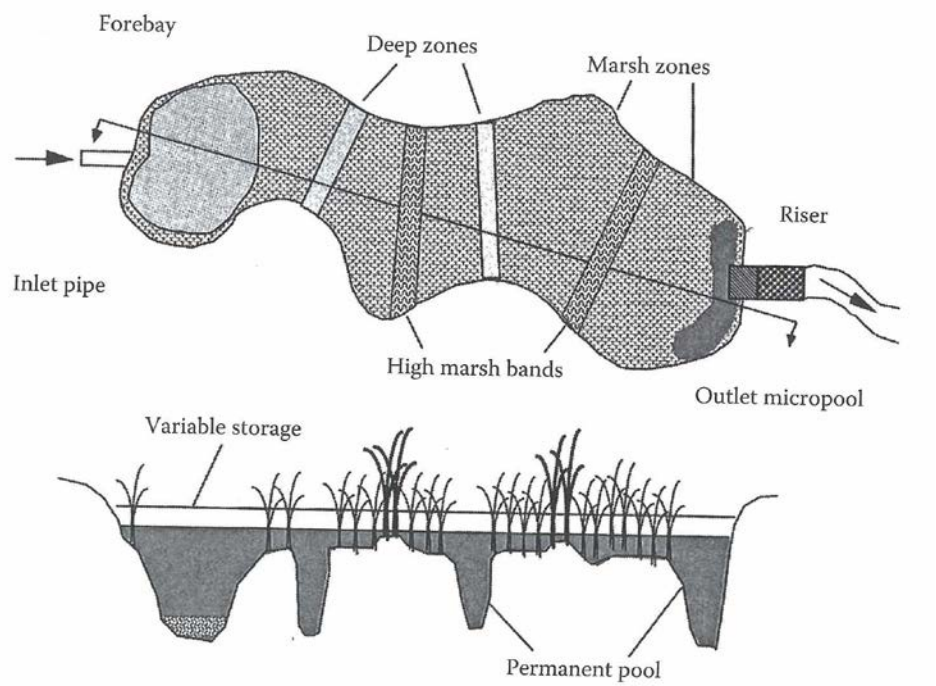
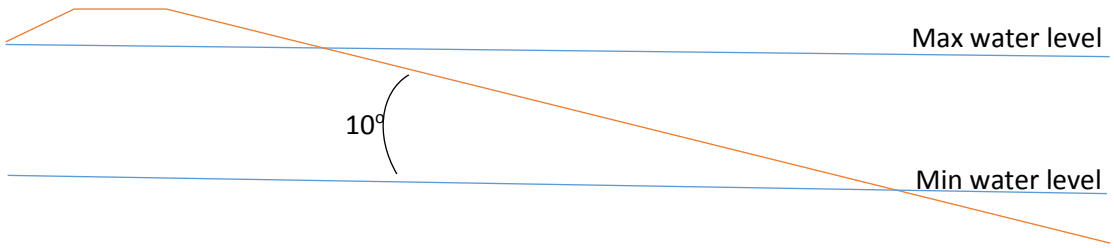


Figure 5.1 – Conceptual Configuration of an Urban Stormwater Treatment Wetland (from Kadlec and Wallace (2009)

4.6 Raupo/reed margins

To ensure that the 200mm water depths and raupo/reed margins essential for Bittern feeding, are abundant and retained over all water levels:

- The bank gradient of the constructed wetland should be very gradual (no more than a 10-degree slope) and should occur across all water levels including deep pools and bunds.



- To increase raupo/ reed margins, create numerous 'fingers' of channel branching off the main channel that are surrounded by vege cover
- These sub channels should be gradually sloped length wise back towards the main channel and be of varying depths.
- Minimise water loss during drought through various methods i.e. increasing vegetation cover, consider securing Osbornes drain water flow rate over summer period.
- Consider a long-term successional approach to avoid disrupting and permanently displacing existing wildlife.

4.7 Forebay Design

Deep pools (forebay) are to be used at points where flows enter wetland areas. The purpose of the forebay area is to provide a zone to evenly distribute flows across the remaining wetland area.

4.8 Access

The wetland design shall allow for maintenance access to the inlet (forebay) and outlet structures. Recreation vehical access should be restricted where possible.

This is a great opportunity to mitigate damage and disturbances being caused by recreational 4x4 vehicals in the immediate area. Making this wetland inaccessible by 4wds would greatly improve the future benefit to bittern and other wildlife. Consider blocking entry points with deep pools mounds of excess soil and dense vegetation.

4.9 Safety

A maximum 300mm deep bench extending 1m into wetland shall be provided around the wetlands perimeter to allow easy egress in an emergency.

Embankment slopes surrounding the wetland will be designed, where possible, to generally not exceed a maximum grade of 1V:3H to minimise the risk of people slipping down banks and to ensure saturated bank stability.

4.10 Aesthetics

The wetland will be developed to form an attractive and natural looking environment for the community, utilising native plants (where appropriate and not exclusively) selected in conjunction with the local Iwi (see Section 7, Planting). It is noted here that the Engineer will make the final decision on planting and design.

The wetland will also include island(s) to provide a nesting habitat for wildlife.

4.11 Wetland Lining

Due to elevated groundwater and artesian spring flow in the area, no liner is proposed.

4.12 Planting

The following plants are proposed for the landscaping of the wetland. These have been generally agreed between SDC and local Iwi (previously through Lincoln wetland project):

Planting Zone	Botanical Name	Common Name
Shrub / Tree Mix	*Astelia fragrans*	kakaha, bush lily
	Carpodetus serratus	putaputawētā / marbleleaf
	Coprosma pedicellata	mikimiki (shrub)
	Coprosma propinqua	mikimiki (shrub)
	Coprosma robusta	karamū
	Coprosma rotundifolia	round-leaved coprosma
	Coprosma virescens	mikimiki
	Cordyline australis	tī kōuka / cabbage tree
	Cortaderia richardii	toetoe
	Griselinia littoralis	kāpuka / broadleaf
	Hebe salicifolia	koromiko (shrub)
	Hoheria angustifolia	houhere / narrow-leafed lacebark
	Leptospermum scoparium	mānuka tea tree
	Lophomyrtus obcordata	rōhutu / NZ myrtle
	Myrsine divaricata	weeping māpou (shrub)
	Pennantis corymbosa	kaikōmako
	Phormium tenax	harakeke / NZ flax
	Pittosporum tenuifolium	kōhūhū / black matipo
	Plagianthus regius	mānatu / lowland ribbonwood
	Podocarpus totara	tōtara
	Prumnopitys taxifolia	mataī / black pine
	Pseudopanax arboreus	whauwhaupaku / five finger
	Pseudopanax crassifolius	whauwhaupaku / lancewood
	Pseudowintere colorata	horopito/ peppertree

	Sophora microphylla	South Island kōwhai
Periodically inundated	*Carex maorica / geminata*	makura
	Carex virgata	tussock sedge
	Carex secta	tussock sedge
	Coprosma propinqua	Mingimingi
	Cordyline australis	tī kōuka / cabbage tree
	Cyperus ustulatus	upoko-tangata / umbrella sedge
	Dacrycarpus dacryioides	kahikatea / white pine
	Juncus edgarae (J. gregiflorus)	wīwī / tussock rush
	Juncus pallidus	wiiwii / giant rush
	Juncus sarophorus	wīwī / tussock rush
	Leptocarpus similis / Apodasmia similis	oioi / jointed wire rush
	Phormium tenax	harakeke / NZ flax
Permanent Water (0 - 0.3m)	*Baumea rubiginosa*	twig rush
	Bolboschoenus caldwellii	purua, sedge
	Carex secta	tussock sedge
	Carex virgata	tussock sedge
	Cyperus ustulatus	upoko-tangata / umbrella sedge
	Eleocharis acuta	spike sedge
	Juncus pallidus	wiiwii / giant rush
	Leptocarpus similis / Apodasmia similis	oioi / jointed wire rush
	*Schoenoplectus validus/tabemaemontani**	kopupu / lake club rush

* Can tolerate deeper water

Key plants identified by DOC are highlighted above

Note that above list is not exhaustive. Additional native species will be incorporated into the wetland landscaping if deemed suitable for the conditions and is acceptable to local Iwi.

The following plants will not be used due to their potential toxicity to humans and / or livestock:

Botanical Name	Common Name
Coriaria arborea	Tutu
Myoporum species	Ngaio
Pteridium esculentum	Bracken Fern
Sophora microphylla and S. tetraptera	Kōwhai
Brachyglottis repanda	Rangiora

4.13 Staging

The preliminary concept provided in the appendix of this document outlines 4 zones of wetland. It is expected that zones will built on a priority basis with one of the four zones forming parted of this consented plan. That said, subject to committee approval, ecological merit and budget, additional zones may be constructed as part of this consent plan.

5.0 SCHEDULE OF COSTS

A summary of estimated 'high level' costs are provided in the table below:

Consultants	$10,000 (if in house design / partnerships)
Earthworks	$80,000 (minimal earthworks)
Structures	$50,000 (control structures, culverts etc)
Planting	$10,000 (if in kind labour and natural rejuvenation)
Total	$150,000

Current budgets provided in for the 2018-28 Long Term Plan are provided in the table below.

Project Description	Proposed Budget
Restoration plan	$20,000
Consent Renewal	$40,000
Renewals	$350,000
WQ Improvements	$125,000

Consideration of alternative funding sources should also be considered if supported by the Working Party. This may include grants from external funders or funding from partner organisations (including in kind support)

6.0 IMPLEMENTATION PROGRAM

The timeline for the implementation of the Habitat Restoration and Enhancement Plan is provided below. Timeframes are indicative and subject to review and amendment.

24 Feb 2018	'Habitat Restoration and Enhancement Plan Investigation Report' operational
25 Feb 2018	Development of the 'Habitat Restoration and Enhancement Plan'
	Commence plan development with field inspection and onsite workshop with working party members and advisors
	Develop the plan with ongoing review and input from the working party
24 Feb 2019	'Habitat Restoration and Enhancement Plan' submitted for consideration
	Implementation Step 1 (March 2019) – Survey
	Implementation Step 2 (Sept 2019) – Concept design
	Implementation Step 3 (Feb 2020) – Design and consenting (earthworks etc)
	Implementation Step 4 (March – April 2020) –Construction
	Implementation Step 5 (from May 2020) – Monitoring and alterations
	Implementation Step 6 (TBC) – Post plan works (post consent) *It is likely that the works will be completed in stages to allow monitoring, lessons to be learned, and enhancements made for following stages.*
24 Feb 2024	Complete implementation of the 'Habitat Restoration and Enhancement Plan' zone of choice.
	Its is only proposed that one zone is completed as part of the consent plan. That said, subject to committee approval, ecological merit and budget, additional zones may be constructed as part of this consent plan.

7.0 PLAN REVIEW

The plan will need to be reviewed throughout the implementation of the Habitat Restoration and Enhancement works. The function and operation of the wetland will need to be monitored and ajustments and maintenance undertaken as required.

8.0 REFERENCE DOCUMENTS

The below reference documents shall be taken into account when designing, consenting and constructing the habitat restoration and enhancement measures.

8.1 Cultural Impact Assessment

8.2 Mahaanui Iwi Management Plan

8.3 Te Waihora Joint Management Plan

8.4 National Water Conservation (Te Waihora/Lake Ellesmere) Order 1990

8.5 Consultants Reports

8.5.1 Osbornes Drain Ecology

8.5.2 Osbornes Drain Hydrology and Water Quality

8.5.3 Osbornes Drain Water Quality Improvements

8.5.4 Osbornes Drain Mitigation Measures

Reports can be found on the Selwyn District Council website www.selwyn.govt.nz/osbornes

8.6 Design standards

8.6.1 Auckland Regional Council, Stormwater Management Devices: Design Guidelines Manual, May 2003, Technical Publication No.10;

8.6.2 Christchurch City Council, Waterways, Wetlands and Drainage Guide, Part B: Design, February 2003;

8.6.3 The On-Site Stormwater Management Guideline, October 2004, New Zealand Water Environment Research Foundation.

8.6.4 Georgia Stormwater Management Manual, Volume 2, Technical Handbook, First Edition August 2001. http://www.georgiastormwater.com/GSMMVol2.pdf (large file 40MB)

8.6.5 Knox County Tennessee Stormwater Management Manual, Volume 2 (Technical Guidance). http://www.knoxcounty.org/stormwater/pdfs/vol2/2-3%20Channel%20Protection.pdf

8.7 LIDAR Data

8.8 Consent CRC172231

9.0 APPENDIX 1 – MAHINGA KAI RESOURCES OF TE WAIHORA

Table 1: Mahinga kai resources of Te Waihora

Kai whenua (from the land)	
Māori name	**English name**
aruhe/tauhinu	fern root*
harakeke	flax*
kākaho	reeds
kiore	rat[9]
kōwhitiwhiti	watercress (introduced)
kūmara	kumara
mānia	sedge*
paru	mud
pīngao	sand sedge*
pūhā	sour thistle
raupō	bullrush/raupo*
rongoā	medicinal plants
tī kouka	cabbage tree*
tororaro	wiggy wig
wīwī/whiwhi/ wewe	rushes*
Ika (fish)	
aua	yellow-eyed mullet
īnanga, mata/ua	whitebait
kanakana/ piharau	lamprey
kōkopu	kōkopu
mohoao	black/common flounder
pāraki	smelt
pātiki	3-corner flounder/ whitebelly
pātiki totara	yellow-belly flounder
tuna	eel
ūpokororo	grayling
kākahi	freshwater mussels
waikōura	freshwater crayfish
tuaki	cockles×
A number of other marine fish species also intermittently inhabit Te Waihora and are sourced as mahinga kai.	

Manu (birds)	
Māori name	**English name**
hua kakī ānau	black swan eggs°
hua manu	other bird eggs
kakī ānau	black swan°
karoro	black-backed gull*
kererū	wood pigeon*+
kōau	black+*, pied*, little shag*
kōtuku	white heron+*
kuruwhengi/ pāteke	New Zealand shoveller*
matuku	Australasian bittern+
pākura/pūkeko	pukeko*°
pāpango/ raipo	New Zealand scaup/ black teal+
pateke/ tarawhatu	brown teal+*
pārera /māunu	grey duck*°
pūtakitaki	paradise shelduck+*
rīrīwaka	bar-tailed godwit+
ruru koukou	morepork+*
tarāpuka	Red-billed gull+
tete	grey teal*
whiowhio	blue duck+

+ Protected under the Wildlife Act 1953.

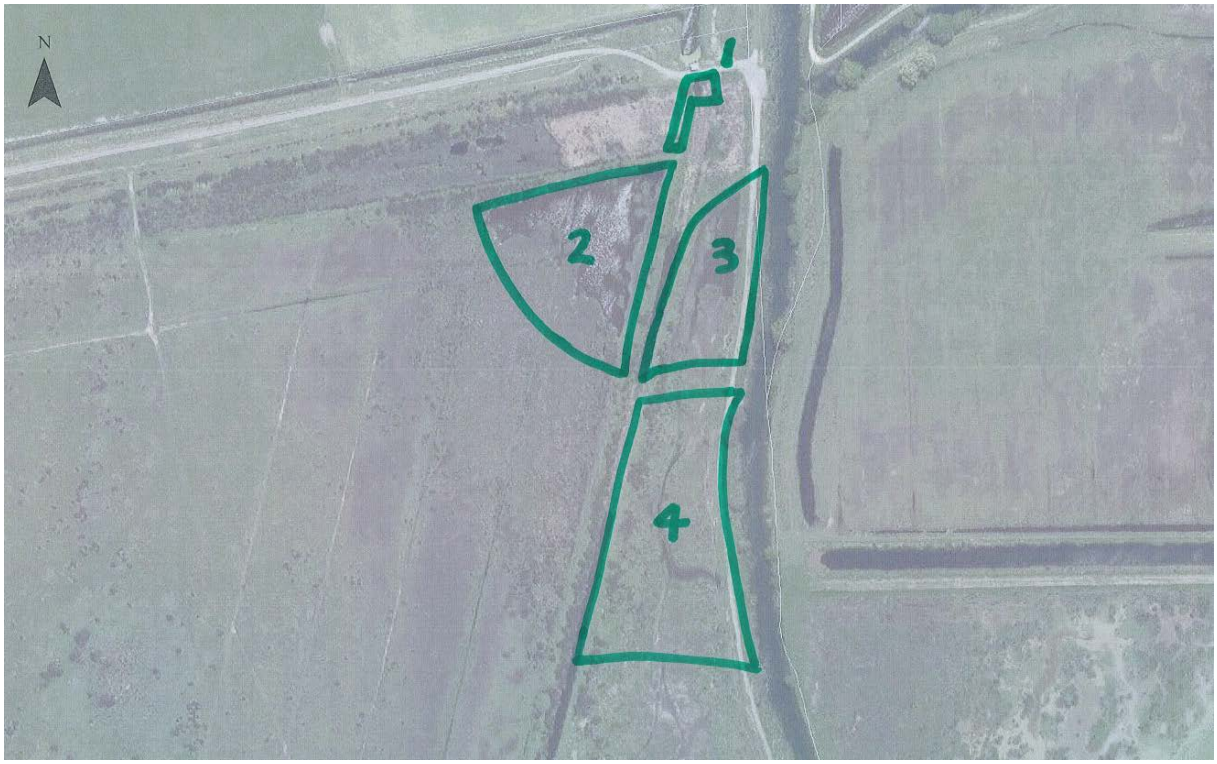
× Customary fisheries "Shellfish species" under the Ngāi Tahu Claims Settlement Act 1998.

* Taonga Species under the Ngāi Tahu Claims Settlement Act 1998.

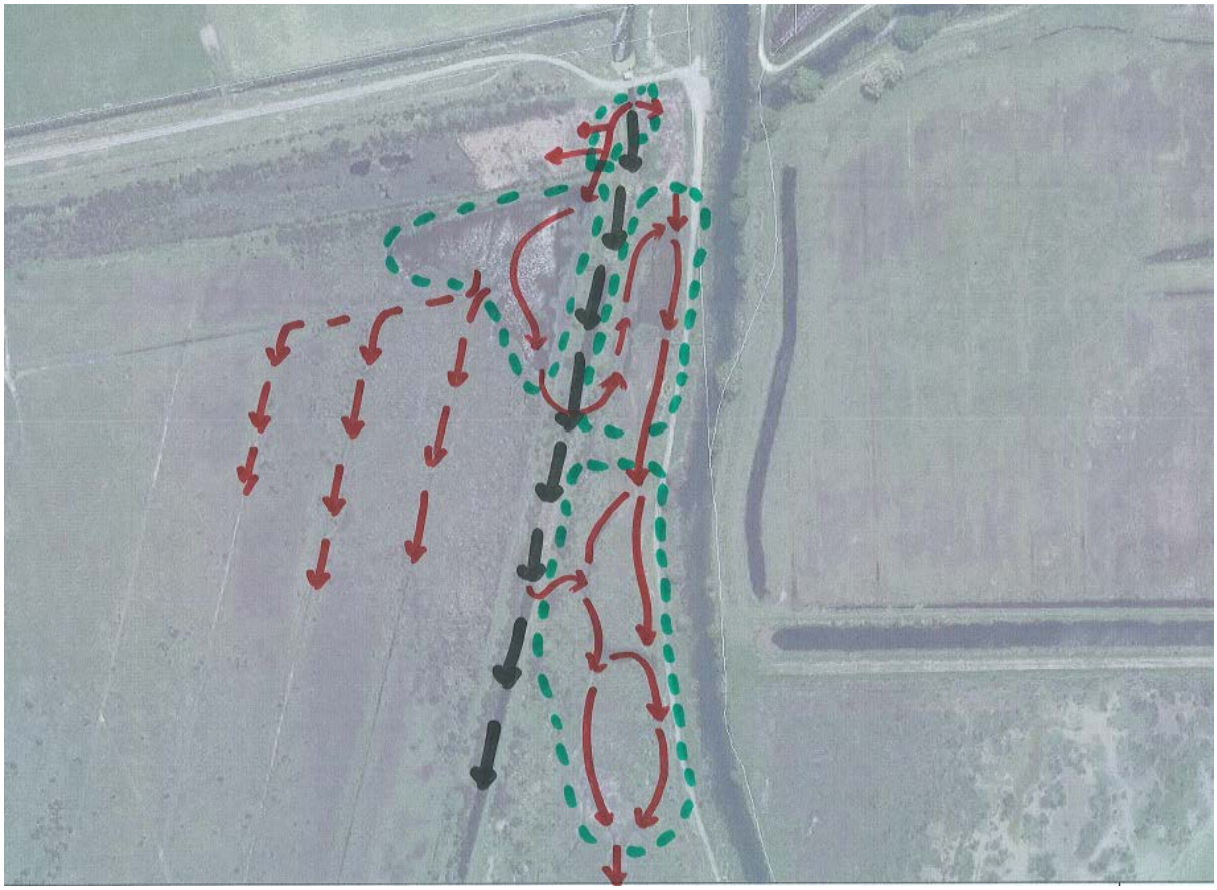
° Game birds under the Wildlife Act 1953

[9] While recognising that kiore are a valued mahinga kai species, it is now recognised that they were a significant predator on indigenous wildlife species and their food sources.

10.0 APPENDIX 2 – PROPOSED WETLAND PLAN

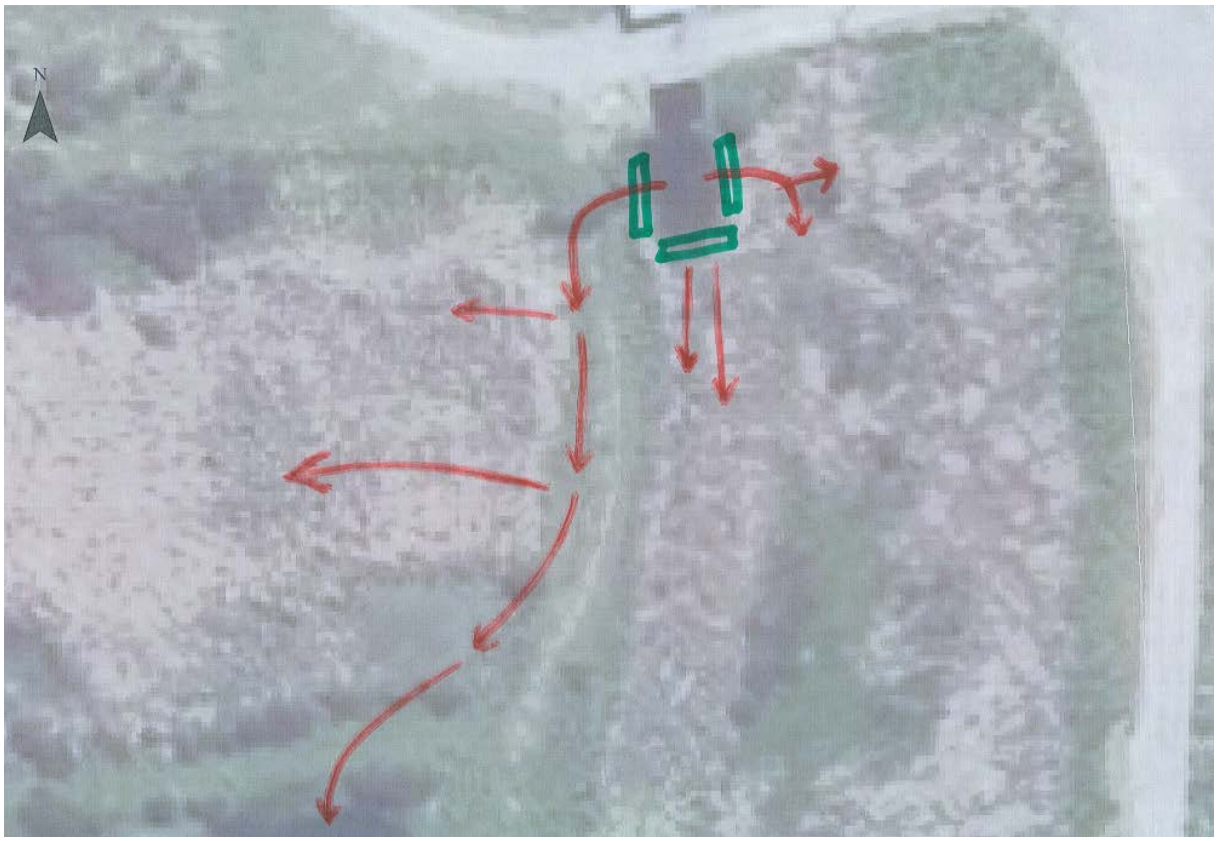


Plan 1 – Overview of 4 potentual work zones.



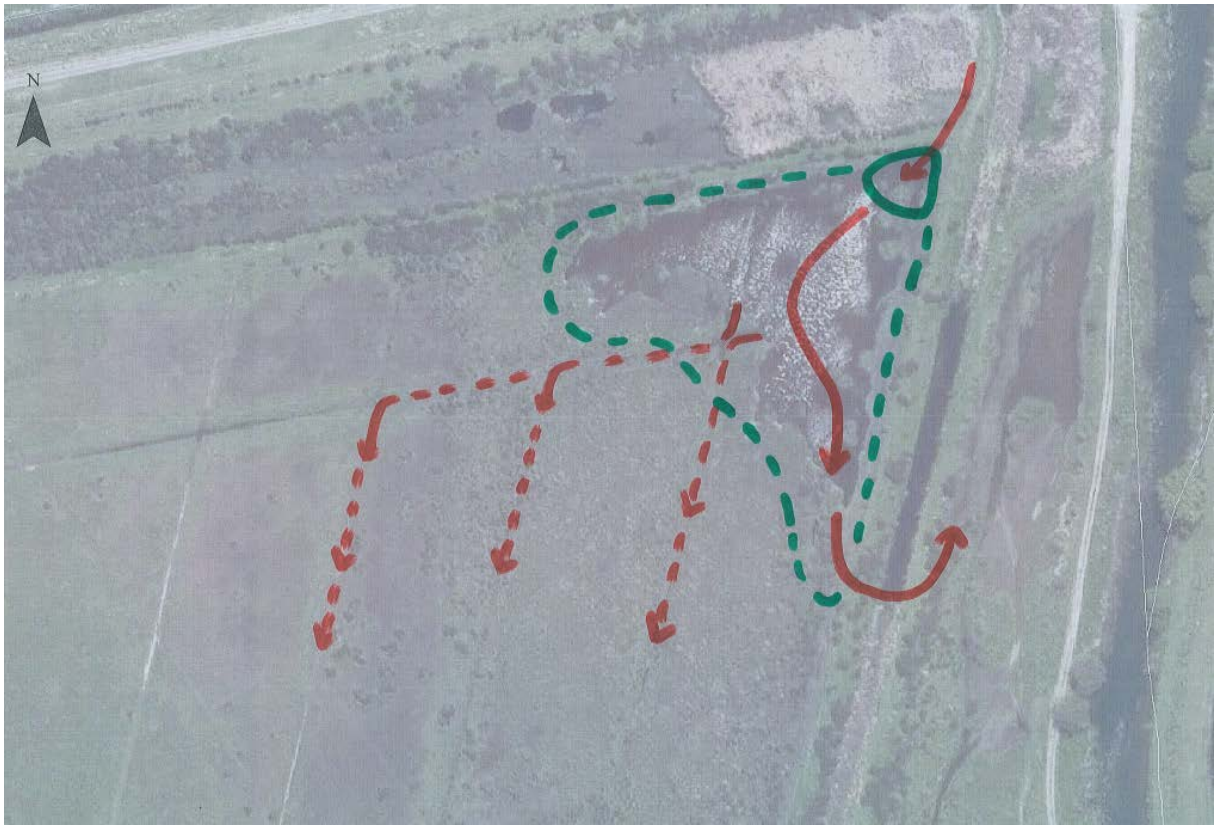
Plan 2 – Overview of hydrolic flow paths

Low and medium flow paths (red solid line) shallow fingers (dashed red line) and high flow (black lines)



Plan 3 – Zone 1.

Three flow control structures (solid green) and indicative flow paths (red)



Plan 4 – Zone 2.

Proposed wetland (dashed green line), deep pool (solid green line), indicative flow paths (red line), shallow fingers (dashed red line).

Plan 5 – Zone 3.

Proposed wetland (dashed green line), deep pool (solid green line), indicative flow paths (red line), potential natural forming ‘island’ (hatched green line).

Plan 6 – Zone 4.

Proposed wetland (dashed green line), deep pool (solid green line), indicative flow paths (red line).

11.0 APPENDIX 3 - SITE PHOTOS

Image 1 – Overview of downstream catchment

Zone 1 (Refer plans appendix 2)

Image 2 – Overview of pumpstation outlet

Image 3 – Pumpstation outlet headwall and downstream channel

Image 4 – Overview of potential new outlet channel

Image 5 – Route of potential new outlet channel (looking north towards pumpstation)

Image 6 – Route of potential new outlet channel (looking south towards proposed wetland)

Image 7 – Route of potential new outlet channel and proposed wetland forebay

Zone 2 (Refer plans appendix 2)

Image 8 – looking over proposed wetland

Image 9 – looking over proposed wetland

Image 10 – edge extent of proposed wetland

Zone 3 (Refer plans appendix 2)

Image 11 – Location where new wetland either re-enters the drain or crosses to proposed eastern wetland (zone 3).

Image 11 –looking South of potential future wetland.

Image 12 –looking South from the boat ramp – potential to restrict 4x4 access at this point.

Zone 4 (Refer plans appendix 2)

Image 14 – 4x4 tracks to be converted into natual flow paths and ponding areas.

Image 15 – 4x4 tracks to be converted into natual flow paths.