CENTRAL HAWKE'S BAY DISTRICT COUNCIL

APPENDIX J

Pōrangahau Wastewater Discharge to Land – Ecological Impact Assessment (Beca, 2021:P:D.66)

Pōrangahau Wastewater Discharge to Land - Ecological Impact Assessment

Prepared for Central Hawke's Bay District Council
Prepared by Beca Limited
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on behalf of	Beca Limited		

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Executive Summary

Central Hawke's Bay District Council (CHBDC) are proposing to discharge treated wastewater to land via irrigation at the Discharge Property in Pōrangahau. Beca Ltd (Beca) have been commissioned by CHBDC to prepare an Ecological Impact Assessment (EcIA) to support an application for resource consent for this discharge.

The Discharge Property includes a number of highly modified watercourses, as well as areas of degraded dune vegetation. Although the value of these ecological features is compromised by land use pressures, watercourses were found to provide intermittent habitat for At Risk – Declining īnanga, and dune vegetation represents a threatened ecosystem type.

Effects on these ecological features will be minimised via design of the proposed discharge to ensure application rates are matched to the soils and storage is provided for. A 20m setback from intermittent and permanent waterways has also been adopted.

Potential adverse effects that have been considered as a result of the discharge are:

- Degradation of water and habitat quality
- Alterations to hydrology
- Excessive growth of nuisance aquatic plants
- Altered vegetation composition

It is understood that once the existing Te Paerahi discharge to the dunes ceases, the existing site will be remediated, and existing treatment and discharge infrastructure will be removed. This is likely to lead to restoration of the natural dune environment which will compensate for effects on dune vegetation that may occur at the new land discharge site. This could also include restoration planting using indigenous species. It is understood that details of the remediation process will be worked through and agreed with mana whenua. Further, the landowners at the discharge site have indicated that there are some areas that could potentially be restricted from further grazing, allowing dune vegetation to be restored. Additional recommendations include ongoing monitoring to ensure eco-toxicity thresholds for freshwater fauna are not exceeded within the Discharge Property watercourses, fencing intermittent watercourses to exclude stock, and undertaking riparian planting along intermittent watercourses to mitigate any potential adverse effects on water and habitat quality.

The overall ecological effect of the proposal is considered to be **Very Low** assuming the above recommendations are implemented. This means that there is only anticipated to be a very slight change from existing baseline conditions. Over long-term time scales (15 - 25 years), there will a contribution towards a net gain in ecological value due to reductions in pollutants entering the Pōrangahau River and Estuary.

1 Introduction

Central Hawke's Bay District Council (CHBDC) are responsible for the management of wastewater from the communities of Pōrangahau and Te Paerahi. Wastewater for Pōrangahau is currently collected and conveyed to an oxidation pond treatment system located at the end of Jones Street, Pōrangahau. Treated wastewater is then discharged to a drain entering the Pōrangahau River. For Te Paerahi, wastewater is collected and conveyed to another oxidation pond treatment system where treated wastewater is discharged to culturally significant coastal sand dunes via soakage.

A proposed staged development approach has been adopted to cease the discharge from the Pōrangahau and Te Paerahi WWTPs, with eventual discharge to land at the Discharge Property at a rate which provides irrigation benefit, and some fertiliser inputs.

Beca Ltd was commissioned by Central Hawkes Bay District Council (CHBDC) to undertake an ecological assessment of effects to support a regional consent application for the irrigation of treated wastewater to land at the Discharge Property between Beach and Hunter Road, Pōrangahau (hereafter referred to as the Site). The purpose of this ecological impact assessment is to quantify the ecological values of the habitat and species within the Site, and to determine the effects of the discharge to land on those features.

1.1 Purpose and Scope

The purpose of this ecological impact assessment is to quantify the ecological values of the habitat and species within the Site, and to determine the effects of the discharge to land on those features.

The scope of this report includes:

- A desk-based review of:
  - Information held by Hawkes Bay Regional Council and Department of Conservation on the ecological values of the site; and
  - iNaturalist, New Zealand Freshwater Fish Database and eBird species data; and
  - Other publicly accessible reports or information.
- An assessment of the ecological values in the works area.
- An assessment of ecological effects and recommended mitigation prepared in general accordance with the EIANZ Ecological Impact Assessment Guidelines (Roper-Lindsay et al., 2018).

A separate assessment of ecological effects has been prepared for the coastal environment (Beca, 2021: P:D.65)

1.2 Proposed Activity

It is proposed that treated wastewater be discharged to land via an irrigation system at the Discharge Property. The development of the discharge system for Pōrangahau and Te Paerahi's wastewater is proposed to be staged and utilise land on the corner of Beach and Hunter Roads. The proposed system allows for a staged reduction in the amount of treated wastewater discharged via the existing systems to their respective receiving environments.

The proposed staging and irrigation areas is outlined below in Table 1 and Figure 1.

Table 1. Proposed staging of the discharge system for Pōrangahau and Te Paerahi's wastewater.

Stage	Scenario
0 (Baseline)	Pōrangahau WWTP discharge to Pōrangahau River Te Paerahi WWTP discharge to Te Paerahi dunes

Stage	Scenario
	Discharge Property existing nutrient management (fertiliser application onto farmland)
1	Pōrangahau WWTP discharge to Pōrangahau River with conditions Te Paerahi WWTP discharge to Discharge Property Discharge Property reduced nutrient management
2	Pōrangahau WWTP discharge to Discharge Property Te Paerahi WWTP discharge to Discharge Property Discharge Property reduced nutrient management
3	Pōrangahau WWTP discharge to Discharge Property Te Paerahi WWTP discharge to Discharge Property Discharge Property reduced nutrient management Improved treatment of wastewater at Discharge Property including UV

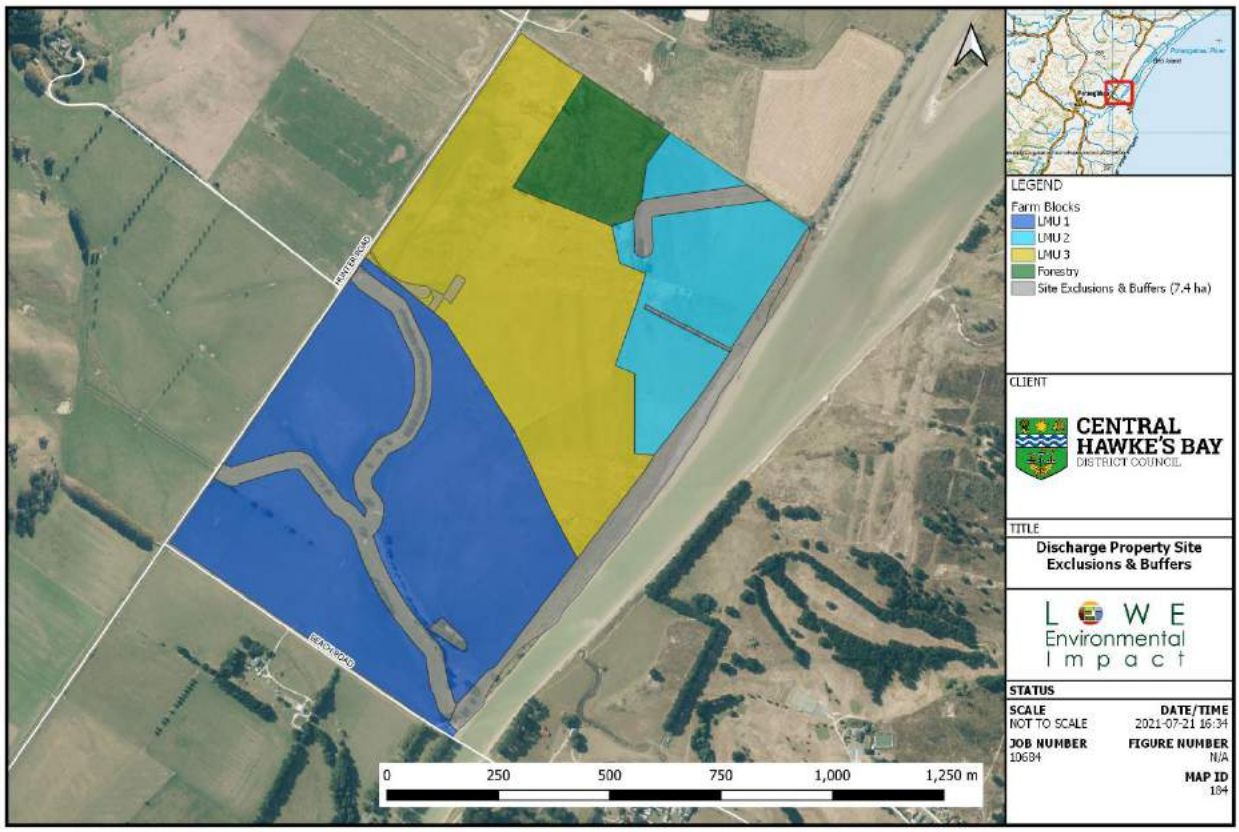

Figure 1. Proposed discharge area and exclusion areas (buffers) (LEI, 2021:P:C.15).

2 Site Location and Ecological Context

The Site is located within the Eastern Hawkes Bay Ecological District (McEwen, 1987) and the Pōrangahau River catchment. The ecological district includes longitudinal sand-dune systems that cover wave cut platforms (McEwen, 1987). Vegetation would have historically consisted of mixed hardwood-totara forest (tawa and kamahi largely absent) on rolling hills; and tall podocarp forest (matai, kahikatea, totara) on terraces (McEwen, 1987). The ecological district has been subject to extensive modification and wide-scale conversion to farmland. Introduced plant species have also resulted in a modification of coastal sand-dune communities (McEwen, 1987). The Pōrangahau River catchment is approximately 705 km² and is constrained by low hill country (~400 m above sea level) that stretches inland from the coast to Flemington, north to Blackhead Beach and south to the Hawke's Bay – Manawatu-Wanganui Regional boundary.

The Discharge Property is located between Beach Road to the west and Hunter Road to the north with the Pōrangahau River running along the property's eastern extent (Figure 2). The coastal edge of the property is bounded by grazed pasture forming a steep scarp along the banks of the Pōrangahau River. The bank transitions from pasture species to estuarine rushland (20m strip) towards the eastern boundary. Throughout the property, there are also a series of small streams and drains conveying water from the hills in the west to the Pōrangahau River in the east (LEI, 2020:P:B.15). There are two main flowing streams that enter the property from the west and flow in an east to south-east direction before converging and flowing to the Pōrangahau River (LEI, 2020:P:B.15). The southern stream has been realigned, with both streams irregularly lined with willow trees (LEI, 2020:P:B.15).

The site also contains a series of windblown historic dune ridges running through the northern extent of the property and a series of sudden depressions within the land surface, characteristic of former dune blowouts (LEI, 2020:P:B.15). The current site land use is described as a low intensity sheep and beef finishing block (LEI, 2020:P:B.15).

Figure 2. Site location within the surrounding landscape.

3 Methodology

3.1 Desktop review

A desk-based study was undertaken using ecological information from the following sources:

- New Zealand Freshwater Fish Database (NZFFD, administered by NIWA);
- Hawkes Bay Regional Council geospatial layers including catchment and hydrology layers;
- Google Earth and LINZ aerial imagery;
- iNaturalist and eBird fauna records;
- Other publicly accessible reports or information.

3.2 Field Investigations

A site visit was undertaken on the 23rd June 2021 to conduct a wetland delineation and habitat assessment to provide a high-level indication of baseline ecological condition and ecological value. The weather was fine and in the two weeks preceding the site visit there had been approximately 127mm of rainfall (NIWA, 2021; Rainfall averaged from three nearest weather stations - Waipawa Ews, Cape Turnagain Aws, Akitio Ews). Due to this heavy rainfall, macroinvertebrate samples were not able to be taken.

3.2.1 Water quality measurements

Field water quality measurements were recorded on the 23rd June 2021 for pH, dissolved oxygen (DO), conductivity and temperature using a hand-held meter (YSI Plus) at sample locations marked in Figure 4.

3.2.2 Wetland delineation

The Resource Management Act 1991 (RMA) defines wetlands as, “permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions”

The National Environmental Standards for Freshwater (2020; NES:FW) sets out controls relating to developments relating to ‘natural wetlands’. ‘Natural wetlands’ are defined in the NES:FW (via the National Policy Statement for Fresh Water Management (2020; NPS-FM) as:

‘… a wetland (as defined in the Act) that is not:

a) A wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or

b) A geothermal wetland; or

c) Any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain-derived water pooling.

A desktop and field assessment of ecology, hydrology, wetland and catchment characteristics was undertaken to classify the potential wetland (e.g. non-wetland, artificial wetland, or natural wetland) in accordance with the Landcare Research wetland delineation procedure (Figure 3; Clarkson, 2018)

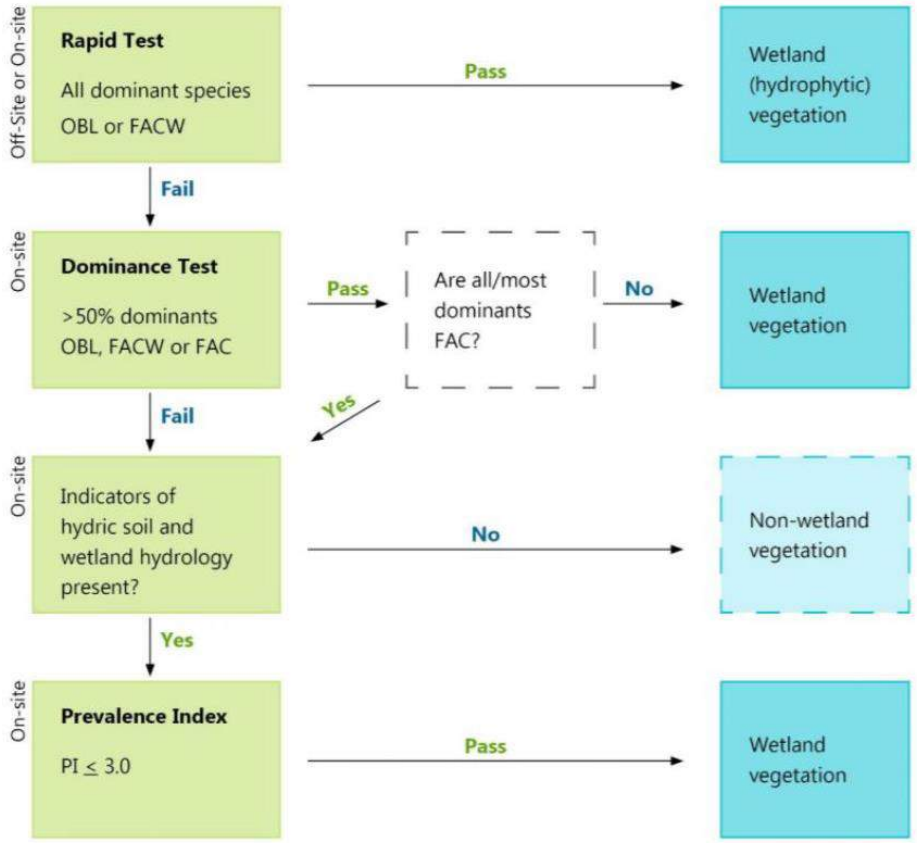

Figure 3. Landcare Research hydrophytic (wetland) vegetation delineation tool. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland.

3.2.3 Rapid habitat assessments

Watercourse assessments were completed on the 23rd of June 2021 following methods outlined in the Watercourse Assessment Methodology: Infrastructure and Ecology Document (Version 2.0) at each sampling location to assess the baseline condition of the existing watercourses (Lowe et al., 2016). Data collected included: channel condition and morphology, bank and channel modification, stream bank erosion, debris jams, streambed substrate composition, channel shade and riparian vegetation.

Terrestrial habitat assessments were also completed following Rapid Ecological Assessment methodology developed by Auckland Council (2012) to capture the species composition and ecological value of wetland and terrestrial vegetation at the site.

3.2.4 eDNA sampling

Three eDNA samples were taken from the unnamed tributary and one from the Pōrangahau River using high turbidity eDNA kits with 1.2 µm and 5 µm CA filters on the 23rd June 2021 (see Figure 4 for locations). Multi-species tests were undertaken on eDNA samples by Wilderlab Ltd using DNA metabarcoding to list out all of the species detected in each sample, within broad taxonomic groups.

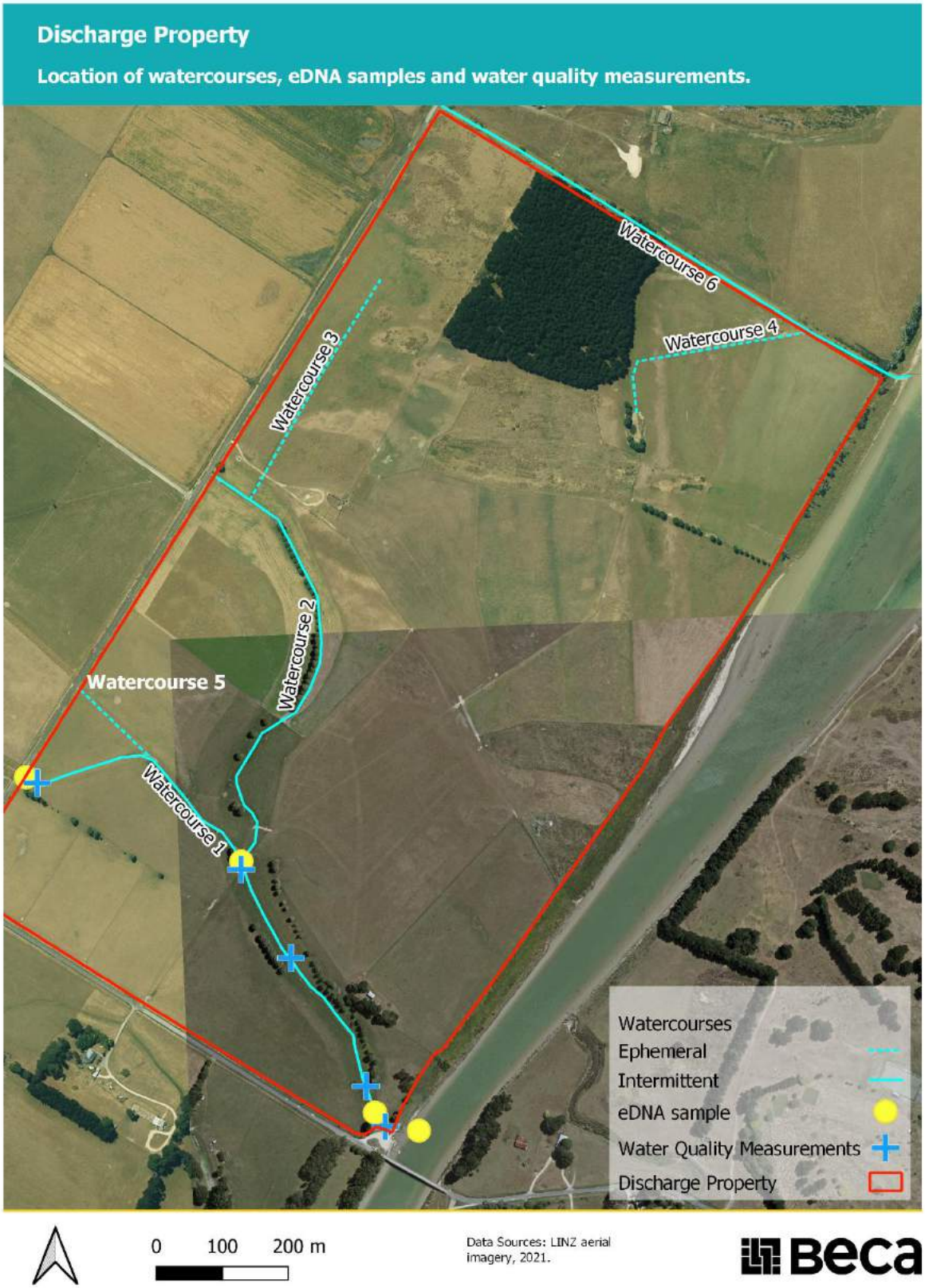

Figure 4. Location of watercourses and field measurements taken during the site visit on the 23nd June, 2021.

3.3 Assessment methodology

An assessment of ecological effects was undertaken in accordance with Ecological Impact Assessment (EcIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (Roper-Lindsay et al., 2018).

The EIANZ guidelines set out a methodology to assign ecological value to species and ecosystems based on four assessment criteria which are consistent with significance assessment criteria set out in the Proposed National Policy Statement for Indigenous Biodiversity (2019) Appendix 1: Criteria for identifying significant indigenous vegetation and significant habitat of indigenous fauna. These are reproduced in this report as Appendix 1: Tables 1.1-1.4. In summary:

- Attributes are considered when considering ecological value or importance. They relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context.
- Determining Factors for valuing terrestrial species; terrestrial species span a continuum of very high to negligible, depending on aspects such as whether species are native or exotic, have threat status, and their abundance and commonality at the site impacted
- Ecological Values are scored based on an expert judgement, qualitative and quantitative data collected.

Once ecological values have been identified and valued, the severity of potential impacts is assessed by determining the change from baseline ecological values likely to occur as a result of the proposal along the lines of a magnitude of effect as determined by the criteria set out in Appendix 1:Table 1.5.

Finally, once these two factors have been determined (the ecological value and the magnitude of effect), an overall level of effect on each of the identified ecological values is determined by applying the matrix shown in Appendix 1:Table 1.6.

4 Wetland Classification

Potential wetlands within the Site were identified based on desktop information including:

- Hawkes Bay Regional Council geospatial layers
- Google Earth and LINZ aerial photography
- Retrolens historical imagery
- Freshwater Environments of New Zealand (FENZ) estimated historic extent of wetlands in New Zealand geospatial layer.
- Retrolens historic imagery

These potential wetlands were then ground-truthed following the methodology outlined above in Section 3.2.2. The majority of potential wetland sites did not consist of wetland habitat and were either dry pasture (sites 6-7), riparian vegetation (site 5) or dune vegetation (Sites 3-4 and 8-11). The results of these investigations are discussed in more detail below (and see Figure 6 for the site locations). A full list of vegetation recorded in these areas is included in Appendix 2.

4.1.1 Sites 1 and 2

Sites 1 and 2 are located along the true left bank of the Pōrangahau River. These areas are part of the floodplain of the river.

The southern edge of this area is modelled as a historic swamp wetland associated with the Pōrangahau River, while the northern edge is modelled as a historic marsh wetland (Leathwick et al., 2010).

Stock is excluded from the southern end of the riverbank where Site 1 is located, while Site 2 has evidence of recent grazing which is reflected in the different vegetation composition.

Site 1 was dominated by *Carex geminata*. Other species included tall fescue (*Festuca arundinacea*), sea rush (*Juncus kraussii*), creeping thistle (*Cirsium arvense*), creeping buttercup (*Ranunculus repens*), willow (*Salix sp.*), and knobby club-rush (*Ficinia nodosa*). It passed the Rapid Test and was assessed as a natural wetland.

Carex geminata and orchard grass (*Dactylis glomerata)*, were dominant at Site 2. Other species included sea rush, clover (*Trifolium repens*), creeping buttercup, slender clubrush (*Isolepis cernua*), giant umbrella sedge (*Cyperus ustulatus*), and knobby club-rush. This site failed the rapid test and the dominance test, but the Prevalence Index (PI) was less than 3.0, indicating hydric vegetation is present (Table 2).

Soils in this area are described in the ‘Evaluation of Soils to Receive Porangahau and Te Paerahi’s Wastewater’ (LEI, 2020:P:B.15). Soil on the alluvial plain adjacent to the Porangahau River has a sand texture but is noted as having a greater profile available water and/or lower permeability status compared to those on the dunes (LEI, 2020:P:B.15). At 65 cm depth, this soil contains heavy clay and therefore represents a combination of the Kairaki Sandy Loam (topsoil) and the Kaiapo Silt Loam (>65 cm) (LEI, 2020:P:B.15).

Figure 5. Site 1 (top) and site 2 (bottom) along the true left bank of the Pōrangahau River.

4.1.2 Summary

Table 2. Results of the wetland classification in relation to the wetland delineation protocol and NPS-FM (Clarkson, 2018; NPS-FM, 2020)

Site	Rapid test	Dominance Test	Prevalence Test	Pasture Test	Soils	Hydrology	Constructed
1	Pass	Yes	Yes (2.5)	No	Yes – clay at 65cm depth.	Yes	No
2	Fail	No	Yes (2.9)	No	Yes – clay at 65cm depth.	Yes	No

Figure 6. Potential wetland areas identified via desktop, and confirmed wetlands identified during the site visit.

5 Ecological Values

5.1 Wetland 1

Wetland 1 is a marsh sedgeland/rushland associated with the Pōrangahau River. It is approximately 1.85ha and consists of a mixture of native and exotic species. Vegetation within the southern half of the wetland is dominated by the native wetland species, *Carex geminata*. Other species include tall fescue, sea rush, creeping thistle, creeping buttercup, willow, and knobby club-rush. Vegetation composition within the northern half of Wetland 1 has been altered due stock access and incudes large areas of orchard grass. Other species recorded here include sea rush, slender clubrush, and giant umbrella sedge.

Although the wetland (in particular the northern section) is in a degraded state, it is expected to provide ecosystem service values, reducing nutrient loads in surface water runoff, and to provide habitat values for native fauna.

The current overall ecological value of Wetland 1 is assessed as **Moderate** based on a high rating for rarity/distinctiveness (wetland ecosystem dominated by native species), a moderate rating for ecological context (buffering functions, habitat values), and low ratings for representativeness and diversity and pattern (low diversity, modified vegetation communities).

The NPS-FM 2020 requires that both the current ecological value and potential ecological value of wetland systems is considered. When considering the potential of the wetland, it is assumed that stock would be excluded from the wetland and exotic species replaced with indigenous species. This would improve the representativeness and diversity and pattern ratings for the wetland to moderate but would not alter the overall value of the wetland. Thus Wetland 1 is assessed as having **Moderate** potential value.

5.2 Watercourse 1

Watercourse 1 is an unnamed 2nd order stream with a soft-sedimentary geology that runs through a primarily agricultural catchment. Total rainfall preceding the site visit was slightly higher than typical mean rainfall for June in the Pōrangahau area (~143mm vs. 104mm mean total rainfall for the month of June over the previous five years; NIWA, 2021). The site was not able to be visited during summer months, but photographs from previous site visits provide evidence that the watercourse is periodically dry, excluding the lower section which is tidally influenced. Watercourse 1 is classified as an intermittent stream based on the presence of: a well-defined channel, the presence of surface water more than 48 hours after a rain event, evidence of substrate sorting, and the absence of rooted terrestrial vegetation across the majority of the channel. The tidally influenced section (Reach 1) is classified as a permanent stream.

Figure 7. Sections of Watercourse 1 assessed during the site visit on the 23rd June, 2021.

5.2.1 Reach 1

This section of the stream has a wetted channel width of ~2m and a depth of 30cm. Stream banks are approximately 1.5m high, banks are steeply incised, and erosion is present along much of the reach with some areas of mass wasting.

Substrate consists of silt/mud/sand and a small amount of emergent macrophytes are present within the channel. The stream consists predominantly of run habitat. This reach is fenced to exclude stock and riparian vegetation consists of ngaio (*Myoporum laetum*), kōwhai (*Sophora* sp.), harakeke (*Phormium tenax*), giant umbrella sedge, *Carex geminata, Juncus krausii*, and orchard grass. Vegetation provides limited shading.

Figure 8. Reach 1 of Watercourse 1 at the time of the site visit (23 June, 2021).

5.2.2 Reach 2

Reach 2 had recently been excavated at the time of the site visit. It has a wetted channel width of 1.4m and a depth of approximately 15cm. Banks are approximately 1-2m high. Cattle had access to the watercourse and there were signs of bank slumping and pugging where they had recently crossed it. The stream consists solely of run habitat and the substrate consists of silt/mud/sand with gravels present in some areas.

Riparian vegetation consisted predominantly of pasture grass and sedges which did not provide any shading.

At its confluence with Watercourse 2, a deeper (40-80cm) pool area is present and the stream is culverted under a vehicle crossing (Figure 9). The culverts do not present a barrier to fish passage.

Figure 9. Reach 2 of Watercourse 1 at the time of the site visit (23 June, 2021).

5.2.3 Reach 3

The upper section of Watercourse 1 running through the Discharge Property has a wetted channel width of 50cm and a depth ranging from 10 – 50cm. It had also been excavated, but not as recently as Reach 2. This section of the stream has been constructed and is not present in historic aerials (see Figure 12). The majority of the stream reach consists of run habitat with a small amount of riffle and pool habitat. Substrate consists predominantly of silt and mud with gravel present in some areas. Riparian vegetation consists solely of pasture grass that provides no shading. Stream banks are approximately 1m high and have a steep gradient with evidence of erosion. This section of the stream is not fenced to exclude stock. Īnanga were observed in a small pool within this reach (see Figure 7 above for location).

Figure 10. Reach 3 of Watercourse 1 at the time of the site visit (23 June, 2021).

5.2.4 Water quality

Dissolved oxygen concentrations control habitat quality for fish and thus influence fish population distribution and ability to migrate in watercourses (Franklin, 2014). Hawke's Bay Regional Council's Regional Resource Management Plan (RRMP) sets a minimum dissolved oxygen (DO) concentration of 80% saturation, applying at all river flows. DO measurements taken during the site visit were well above this minimum (see Table 3). DO levels recorded are also above the NPS-FM bottom line (7-day mean minimum; summer period: 1 November to 30th April), and within the 'A' attribute band. This is described as causing no stress on any aquatic organisms that are present (NPS-FM, 2020). pH recorded within the stream was within the tolerance range of native fish. A study by West et al., (1997) found that most native species exhibit avoidance behaviours between pH values <6.5 and >9.5.

Water quality measurements were also taken from Reach 1 near its confluence with the Pōrangahau River by LEI, (2021:P:B:20). These showed that ammonia levels were above the NPS-FM bottom line and within the B attribute band, described as providing 95% species protection level with occasional impacts on the 5% most sensitive species (NPS-FM, 2020). Dissolved reactive phosphorus (DRP) was also within the B attribute band, showing a minor DRP elevation above natural reference conditions. If other conditions also favour eutrophication, this could result in exacerbated algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates. Nevertheless, these measurements should be interpreted with caution as there was no flow through the upper section of Watercourse 1 at the time samples were taken and this was from a one-off sample.

Table 3. Water quality field measurements taken in the Watercourse 1.

Parameter	Measurement 1 (Reach 1)	Measurement 2 (Reach 1)	Measurement 3 (Reach 2)	Measurement 4 (Reach 3)	Measurement 5 (Reach 3)
Dissolved Oxygen (%)	97.9	96.6	101.4	104	100.5
Dissolved Oxygen (mg/L)	11.08	10.9	11.16	11.31	11.1

Parameter	Measurement 1 (Reach 1)	Measurement 2 (Reach 1)	Measurement 3 (Reach 2)	Measurement 4 (Reach 3)	Measurement 5 (Reach 3)
Temperature (°C)	9.7	9.8	10.7	10.4	10.8
Specific Conductivity (µS/cm)	792	706	646.7	645.6	647.7
Conductivity (µS/cm)	761	501	470.3	465.3	472.3
pH	7.88	8.1	7.94	8.14	8.11

5.2.5 Ecological value

Through channel modification, lack of appropriate riparian planting and shading, and unrestricted stock access along the majority of its length, Watercourse 1 is currently in degraded ecological condition.

Nevertheless, it retains good connectivity to the estuarine environment, adequate water quality, and provides intermittent habitat for At Risk – Declining īnanga. Further, given its proximity to the coast, it's possible that īnanga spawning habitat could be established along the watercourse if banks were recontoured to make them more accessible.

Overall, the stream is assessed as having **Moderate** current ecological value based on a High rating for rarity/distinctiveness, a low rating for ecological context, and very low ratings for representativeness and diversity and pattern (Table 4).

Table 4. Scoring and justification for assigned ecological value to Watercourse 1.

Matter	Rating	Justification
Representativeness	Very Low	Significant channel modification has reduced habitat heterogeneity and riparian vegetation is largely absent. Minor degradation of water quality – not expected to impact aquatic fauna.
Rarity/Distinctiveness	High	Provision of (intermittent) habitat for At Risk īnanga. Likely habitat for longfin eel.
Diversity and Pattern	Very Low	Natural diversity and pattern compromised by excavation, channel modification, and ongoing stock access. Homogenous flow conditions – little habitat complexity.
Ecological context	Low	Low-order stream. Good connectivity to marine environment. Modified in-stream habitat subject to stock access. Lack of riparian habitat. Catchment dominated by agricultural land-use.
		Overall value: Moderate

The NPS-FM 2020 requires that both the current ecological value and potential ecological value of freshwater systems is considered. When considering the potential, it is assumed that the riparian margins of Watercourse 1 would be revegetated, and the stream would be fenced to exclude stock along its length. This would reduce water temperature in the stream, increase woody debris inputs to the stream and habitat heterogeneity over time, improve erosion and scour protection, and result in minor improvements in water

quality. However, as the stream is situated within farmland, it is not expected that representativeness, diversity and pattern or ecological context ratings would approve beyond moderate. Thus, the stream is assessed as having **Moderate** potential value.

5.3 Watercourse 2

Watercourse 2 is an unnamed, 1st order stream with an alluvium geology that runs through a primarily agricultural catchment. Total rainfall preceding the site visit was slightly higher than typical mean rainfall for June in the Pōrangahau area (~143mm vs. 104mm mean total rainfall for the month of June over the previous five years; NIWA, 2021). Photographs from previous site visits provide evidence that the watercourse is periodically dry. Watercourse 2 is classified as an intermittent stream based its well-defined channel, the presence of surface water more than 48 hours after a rain event, and the presence of pools at its confluence and near the roadside.

The watercourse is fed via flow from a roadside drainage channel. It has a wetted channel width of 1m and has been historically excavated. Grass is established across the cross-sectional width of the channel. The stream is approximately 10-15cm deep. Banks have a moderate gradient and are 0.5-1m high. Some large deciduous trees are present along a section of the watercourse that are expected to provide partial shading in summer months. No riparian vegetation or shading is otherwise present. The watercourse is located in grazed pasture and is not fenced to exclude stock.

Overall, the stream is assessed as having **Moderate** current ecological value based on a High rating for rarity/distinctiveness, a low rating for ecological context, and very low ratings for representativeness and diversity and pattern (Table 5).

Table 5. Scoring and justification for assigned ecological value to Watercourse 2.

Matter	Rating	Justification
Representativeness	Very Low	Significant channel modification has reduced habitat heterogeneity and riparian vegetation is largely absent.
Rarity/Distinctiveness	High	Provision of (intermittent) habitat for At Risk īnanga.
Diversity and Pattern	Very Low	Natural diversity and pattern compromised excavation, channel modification, and ongoing stock access. Homogenous flow conditions – little habitat complexity.
Ecological context	Low	Low-order stream. Good connectivity to marine environment. Modified in stream habitat subject to stock access. Lack of riparian habitat. Catchment dominated by agricultural land-use.
		Overall value: Moderate

The NPS-FM 2020 requires that both the current ecological value and potential ecological value of freshwater systems is considered. Assuming the same restoration and improvements described for Watercourse 1 (see Section 5.2.5), it is expected that representativeness, diversity and pattern and ecological context would improve. However, as the stream is situated within farmland, land use pressures will be ongoing, and channel modification would remain. The stream is assessed as having **Moderate** potential value.

Figure 11. Watercourse 2 at the time of the site visit (23 June, 2021).

5.4 Ephemeral Watercourses (Watercourses 3, 4 and 5)

Watercourses 3, 4, and 5 had two defined banks but no low flow channel. Despite recent rainfall, they were dry at the time of the site visit. These watercourses were classified as ephemeral streams based on the stream bed being above the water table, and that water only flows during or shortly after rain events (confirmed with the absence of surface water during the site visit). It is evident from historical aerial photographs that these watercourses are constructed drainage channels and not naturally occurring (Figure 12).

Watercourse 3 has a channel width of 2m and grass is established across the cross-sectional width of the channel.

Watercourse 4 has a channel width of 3.7m and also has pasture grass established across the cross-sectional width of the channel, with sparse Juncus sp. giant umbrella sedge, and thistles interspersed throughout.

Watercourse 5 has a channel width of 1m and grass is established across the cross-sectional width of the channel.

These ephemeral watercourses are assessed as having **Very Low** freshwater ecological value based on very low ratings for representativeness, rarity/distinctiveness, diversity and pattern, and ecological context.

Figure 12. Aerial imagery of the site from 1944 (Source: Retrolens), and watercourses identified on the site during the site visit.

Figure 13. Clockwise from top left: Watercourse 3, Watercourse 4, and Watercourse 5.

5.5 Watercourse 6

Watercourse 6 is an unnamed, straightened 3rd order stream with a hard-sedimentary geology that runs along the north-eastern boundary of the Discharge Property. Photographs from previous site visits provide evidence that the watercourse is periodically dry. Watercourse 6 is classified as an intermittent stream based on the presence of a well-defined channel, and surface water more than 48 hours after a rain event. The lower section is classified as a permanent stream as it is tidally influenced.

The watercourse is highly channelised with little shading. Rooted vegetation is present across the majority of the channel (excluding the tidally influenced reach). The channel is approximately 90cm wide and water was 15cm deep at the time of the site visit. Banks have a steep gradient and are approximately 2m high. Riparian vegetation consists of rank grass and sparse exotic trees. The area is fenced but some evidence of stock access is present.

No fish records are available for the watercourse, however it is predicted as being highly likely that common bully, common smelt, īnanga (At Risk – Declining), longfin eel (At Risk – Declining), and shortfin eel are present (Leathwick et al., 2010). To take a precautionary approach, it is assumed that these species inhabit the stream. Given the proximity of the watercourse to the marine environment and the presence of overhanging herbaceous vegetation, potential īnanga spawning habitat may be present along the watercourse where banks have slumped and created small low-gradient terraces.

Overall, the stream is assessed as having **Moderate** current ecological value based on a High rating for rarity/distinctiveness, a low rating for ecological context, and very low ratings for representativeness and diversity and pattern (Table 6).

Table 6. Scoring and justification for assigned ecological value to Watercourse 6.

Matter	Rating	Justification
Representativeness	Very Low	Straightened and channelised - channel modification has reduced habitat heterogeneity. Lack of riparian vegetation.
Rarity/Distinctiveness	High	Potential habitat for At Risk – Declining īnanga and longfin eel. Potential īnanga spawning habitat.
Diversity and Pattern	Very Low	Limited habitat complexity due to channel modification and homogenous flow conditions.
Ecological context	Low	Good connectivity to marine environment. Modified in stream habitat. Lack of riparian habitat. Catchment dominated by agricultural land-use.
		Overall value: Moderate

The NPS-FM 2020 requires that both the current ecological value and potential ecological value of freshwater systems is considered. Assuming the same restoration and improvements described for Watercourse 1 (see Section 5.2.5), it is expected that representativeness, diversity and pattern and ecological context would improve. However, as the stream is situated within an agricultural catchment, land use pressures will be ongoing, and channel modification would remain. The stream is assessed as having **Moderate** potential value.

Figure 14. Watercourse 6 at the time of the site visit (23 June, 2021), looking upstream (left) and downstream (right).

5.6 Pond 1

A small (<600m²) constructed pond is present to the north-east of the property and overflows to Watercourse 4. The pond is not present in historical aerials and is likely constructed for duck shooting given the presence of decoys (see Figure 12). The pond is surrounded by pasture grass and a number of large established willows. It is not fenced to exclude stock.

Overall, the pond is assessed as having **Very Low** current ecological value based on a Low rating for ecological context, and very low ratings for representativeness, rarity/distinctiveness, and diversity and pattern (Table 6).

Table 7. Scoring and justification for assigned ecological value to Pond 1.

Matter	Rating	Justification
Representativeness	Very Low	Constructed, artificial habitat. Exotic species dominant.
Rarity/Distinctiveness	Very Low	Unlikely to support Threatened or At Risk species.
Diversity and Pattern	Very Low	Low diversity and pattern.
Ecological context	Low	Provision of low-quality aquatic habitat. Ongoing stock access and disturbance effects from duck shooting activities.
		Overall value: Very Low

Figure 15. Pond 1 at the time of the site visit (23rd June, 2021).

5.7 Freshwater Fauna

Fish records for the Lower Pōrangahau sub-catchment include a number of common and At Risk – Declining species (see Table 8). The pest species, goldfish, is also present.

Īnanga were observed in Watercourse 1 during the site visit. Given the proximity of Watercourse 1 and Watercourse 5 to the marine environment, and the presence of overhanging herbaceous vegetation along some sections of their length, potential īnanga spawning habitat may be present where bank gradient does not exclude access.

eDNA analysis for Watercourse 1 detected shortfin eel, longfin eel (At Risk – Declining), upland bully, and īnanga (At Risk – Declining). The stream is not expected to provide high quality habitat for these species, however, may provide a migration pathway and/or intermittent habitat when flowing water is present.

Based on the presence of At Risk – Declining species, Watercourse 1 is assessed as having **High** freshwater fish values.

Table 8. Fish records for the Lower Pōrangahau sub-catchment from the New Zealand Freshwater Fish Database (Crow, 2017)

Common name	Scientific Name	Conservation Status	Most Recent Record
Common bully	*Gobiomorphus cotidianus*	Not Threatened	2012
Shortfin eel	*Anguilla australis*	Not Threatened	2006
Inanga	*Galaxias maculatus*	At Risk - Declining	2006
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	2012
Koura	*Paranephrops spp.*	At Risk - Declining	2012
Common smelt	*Retropinna retropinna*	Not Threatened	2006
Giant bully	*Gobiomorphus gobioides*	At Risk - Declining	1993
Crans bully	*Gobiomorphus basalis*	Not Threatened	2012
Goldfish	*Carassius auratus*	Introduced and Naturalised	2003

5.8 Vegetation

The Discharge Property consists of mature exotic trees, grazed pasture and cropped areas, sedgeland/rushland, and dune vegetation (see Figure 16).

5.8.1 Grazed pasture and exotic trees

Grazed pasture and exotic trees are assessed as having **Negligible** ecological value based on very low ratings for representativeness, rarity/distinctiveness, diversity and pattern, and ecological context.

5.8.2 Sedgeland/rushland

Sedgeland is established along the downstream margins of Watercourse 1. *Carex geminata* is dominant in this area and has likely been planted. Other species present include pasture grasses, and giant umbrella sedge. Small areas of rushland dominated by *Ficinia nodosa* are also present here.

Areas of sedgeland/rushland are assessed as having **Low** ecological value based on a moderate rating for ecological context (provides a buffering function for Watercourse 1), and low ratings for representativeness, rarity/distinctiveness and diversity and pattern.

5.8.3 Dune vegetation

Areas of dune vegetation are highly modified and invaded by exotic weed species. Species present include: *Carex geminata*, marram grass, *Ficinia nodosa*, sea rush, hare tail (*Lagurus ovatus*), *Geranium molle*, pohuehue (*Muehlenbeckia complexa*), and pasture grasses. A section of the property also includes regenerating pine and exotic herbaceous vegetation with interspersed dune vegetation.

Dune vegetation has been greatly reduced in New Zealand, and coastal dunelands are identified as a national priority ecosystem under the New Zealand Coastal Policy Statement (Ministry for the Environment & Department of Conservation, 2007).

Dune vegetation present on site is assessed as having **Moderate** ecological value based on a high rating for rarity/distinctiveness (less 11.6 percent of the original extent of dunelands remain), a moderate rating for diversity and pattern (low diversity, but species composition varies based on underlying physical

patterns/topology), and low ratings for representativeness (invaded by marram grass and grazed by stock), and ecological context (ongoing grazing and pest plant pressures).

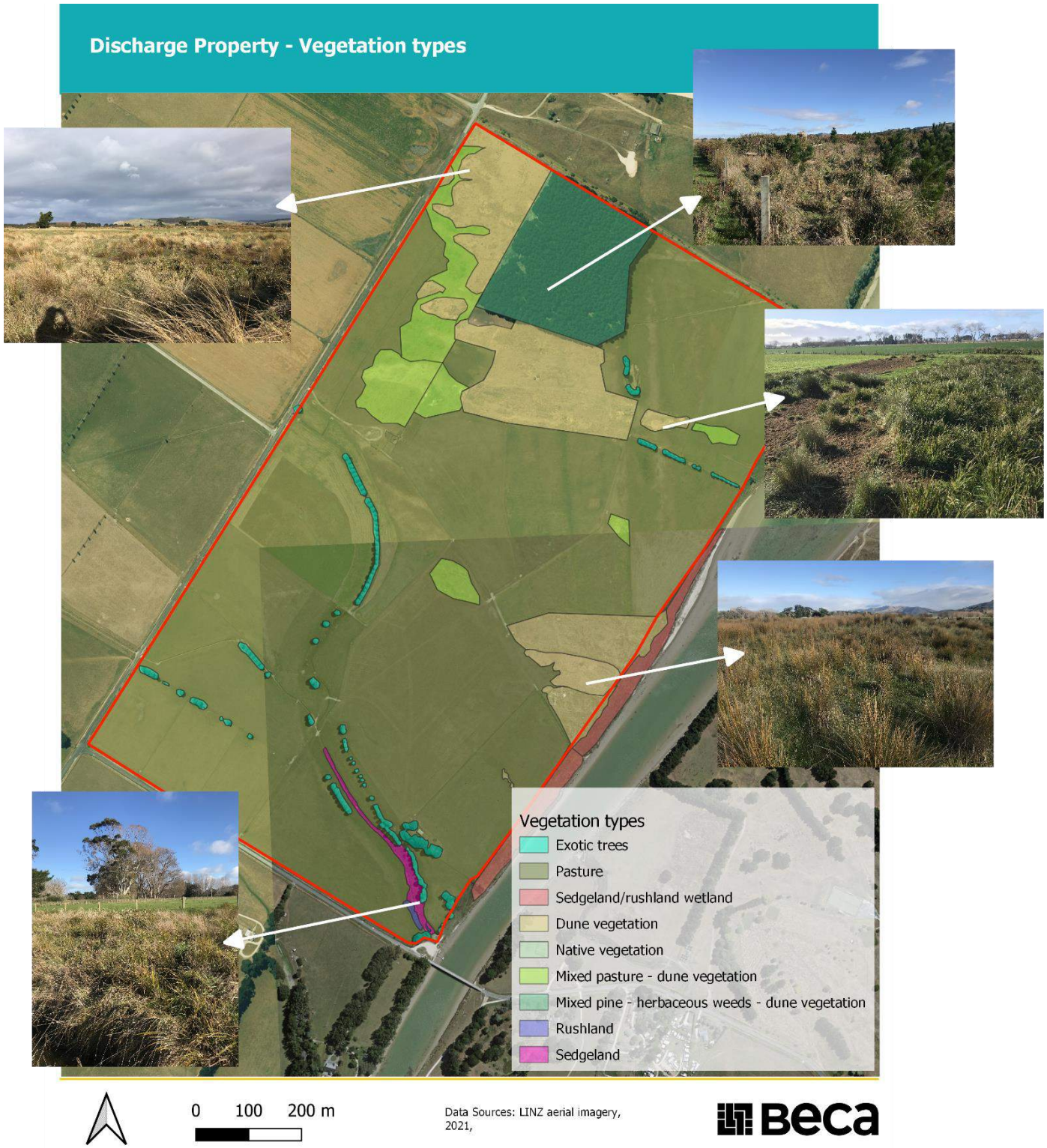

Figure 16. Approximate extents of vegetation types present on the Discharge Property.

6 Assessment of Ecological Effects

6.1 Key Ecological Effects

The following potential ecological effects have been considered for the proposed discharge:

- Degradation of water and habitat quality
- Alterations to hydrology
- Excessive growth of nuisance aquatic plants
- Altered vegetation composition

6.2 Magnitude of Effects

6.2.1 Degradation of water and aquatic habitat quality

Discharge of wastewater, and eventually UV treated wastewater, to land via irrigation will be partly offset by a reduction in fertiliser application onto the farmland. Nevertheless, nutrient loading at the farm is estimated to increase across the stages due to (a) conveyance of WWTP discharges, (b) population increases, and (c) irrigating land that has not historically been irrigated (Beca, 2021:P:B.24c). Despite a number of significant mitigating measures, the staged development is likely to result in a low increase in nutrient concentrations in the farm watercourses (Beca, 2021:P:B.24c).

Based on the Water Quality Report (Beca, 2021:P:B.24c), this is assessed as a **Low** magnitude of effect, resulting in a minor shift away from existing baseline conditions. However, baseline water quality and nutrient concentrations in the receiving watercourses following irrigation will need to be monitored to confirm this effects assessment.

6.2.2 Alterations to hydrology

Wastewater discharged to land will percolate through the soil and drain via the shallow groundwater into existing watercourses present on the Discharge Property. In winter months when the application of wastewater is at a rate that exceeds plant usage, this will potentially cause a minor change in the hydrological regime by increasing soil moisture, drainage to groundwater, and then the amount of water entering watercourses present on the farm.

This is expected to cause no more than a minimal shift away from existing baseline conditions and thus is assessed as having a **Low** magnitude of effect.

6.2.1 Altered vegetation composition

There is potential that wastewater irrigation will result in a shift in the composition of dune vegetation due to alterations to soil nutrients, soil moisture, and increases in organic matter over time that will lead to a transition to sandy loam soils rather than sand.

Dune vegetation presently consists of common native species and exotic pest plants that are not expected to be adversely impacted by increased nutrient levels. Previous studies have found that nutrient application (in the form of fertiliser) promotes the growth of both foredune and stable rear dune revegetation plantings (Bergin & Kimberley, 1999). However, although sand has high drainage rates and porosity, increased water availability due to irrigation frequency and the accumulation of organic matter is expected to result in a shift in vegetation composition over medium term time periods (5-15 years) leading to colonisation by species adapted to these altered soil conditions. As there is a degree of uncertainty involved in predicting this magnitude of effect, a conservative approach has been adopted in accordance with the EIANZ guidelines (see Roper-Lindsay et al., 2018) and this is assessed as a **Moderate** magnitude of effect, resulting in an

alteration to existing baseline conditions over time, such that the post-development character of dune areas (dune vegetation composition) will be partially changed. Nevertheless, it is important to note that the dune vegetation is currently vulnerable to the existing permitted farming activities on this site and could be removed due to farming practices.

6.2.2 Excessive growth of nuisance aquatic plants

An increase in nutrient concentrations has the potential to cause a proliferation of aquatic macrophytes and algal biomass. This is somewhat mitigated by the intermittent and ephemeral nature of watercourses present within the Discharge Property – during summer months when macrophytes are more likely to proliferate, streams will likely be dry. During winter months, dilution and cooler water temperatures may be sufficient for the effects of nutrient inputs to become negligible, however an assessment of baseline hydraulic flow would be required to confirm this. In the absence of this information, this is assessed as a **Low** potential magnitude of effect.

6.2.3 Improved downstream water quality

Currently, the Pōrangahau River and the Pōrangahau Estuary are the receiving environment for discharges of treated wastewater from the Pōrangahau WWTP. The discharge of wastewater to the Discharge Property will allow these point-source discharges to cease and will reduce nutrient and contaminant inputs.

This is expected to result in a slight decrease in nutrient and contaminant inputs, and contribute towards a potential improvement in the water quality and life-supporting capacity of the Pōrangahau River and the Pōrangahau Estuary stream in the long-term. Thus, this is assessed as a **Positive** magnitude of effect.

7 Effects Management

The ecological effects of the proposed discharge have been avoided in the first instance by designing the system to ensure application rates are matched to the soils and storage is provided for so excessive irrigation and runoff do not occur. In the second instance, potential effects of runoff have been minimised by the inclusion of a 20m setback from permanent and intermittent waterways. Further recommendations are outlined below.

To avoid adverse effects on native freshwater fauna, it is recommended that ongoing monitoring be undertaken to ensure eco-toxicity thresholds are not exceeded.

To minimise the risk of adverse ecological effects on watercourses, it is recommended that intermittent watercourses be fenced to exclude stock, and riparian planting be undertaken within the buffer zone. Long-term, these activities will enhance the habitat values of the site for indigenous fauna, reduce the risk of extensive macrophyte growth via shading, increase the riparian buffer length and width, reduce water temperature in the stream, increase woody debris inputs to the stream, and assist in mitigating any residual effects of nutrient inputs from wastewater discharge to adjacent land through increased filtration.

To compensate for the adverse ecological effects on dune vegetation, there is an opportunity to remediate the existing discharge site at Te Paerahi dunes. Following the cessation of the discharge in this location, existing treatment and discharge infrastructure will be removed which could lead to passive restoration of the natural dune environment. This could also be supplemented by restoration planting using indigenous species to enhance the ecological values of the site. As this land is not owned by CHBDC this would need to be worked through worked through and agreed with mana whenua. Additionally, the landowners at the Discharge Property have indicated that there are some areas that could potentially be restricted from further grazing within their property, allowing dune vegetation to be restored.

Overall effects are summarised in Table 9.

7.1 Overall Level of Effects

Table 9. Summary of potential ecological effects on ecological values including magnitude, level of effects and recommended mitigation measures. The overall level of effect has been calculated using the current ecological value as the proposed activity is not expected to result in any loss of potential ecological value.

Potential ecological effect	Ecological component	Ecological Value	Potential Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect	Effects management
Degradation of water and habitat quality	Wetland 1	Moderate	Moderate	Low	Low	Reduction in fertiliser application to the Discharge Property to offset nutrient application via wastewater irrigation No wastewater application to land to occur within 20m of intermittent or permanent watercourses. Monitoring to establish a baseline and ensure that no degradation of habitat occurs as a result of the discharge to land and eco-toxicity thresholds for īnanga are not exceeded. Fencing of watercourses to exclude stock. Riparian planting within the buffer zone using ecologically suitable native species.
	Watercourse 1	Moderate	Moderate	Low	Low	
	Watercourse 2	Moderate	Moderate	Low	Low	
	Ephemeral Watercourses (3 & 4)	Very Low	NA	Low	Very Low	
	Watercourse 6	Moderate	Moderate	Low	Low	
	Pond 1	Very Low	NA	Low	Very Low	
	Freshwater Fish	High	NA	Low	Low	
Alterations to hydrology	Watercourse 1	Moderate	Moderate	Low	Low	None.

Potential ecological effect	Ecological component	Ecological Value	Potential Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect	Effects management
	Watercourse 2	Moderate	Moderate	Low	Low	
	Ephemeral Watercourses (3 & 4)	Very Low	NA	Low	Very Low	
	Watercourse 6	Moderate	Moderate	Low	Low	
	Pond 1	Very Low	NA	Low	Very Low	
Excessive growth of nuisance aquatic plants	Watercourse 1	Moderate	Moderate	Low.	Low	Riparian planting within the buffer zone using ecologically suitable native species.
	Watercourse 2	Moderate	Moderate	Low	Low	
	Ephemeral Watercourses (3 & 4)	Very Low	NA	Low	Very Low	
	Watercourse 6	Moderate	Moderate	Low	Low	
	Pond 1	Very Low	NA	Low	Very Low	
Altered vegetation composition	Dune vegetation	Moderate	NA	Moderate	Moderate	Cessation of discharge to Te Paerahi dunes.

Potential ecological effect	Ecological component	Ecological Value	Potential Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect	Effects management
						Potential remediation of the site (incl. removal of existing infrastructure and possible restoration planting). Potential establishment of exclusion areas on the Discharge Property where dune vegetation is able to be restored.
Improved downstream water quality	Pōrangahau River	Moderate*	High*	Positive	Net Gain	None
	Pōrangahau Estuary	Very High*	NA	Positive	Net Gain	

*Ecological value assigned according to the Pōrangahau Coastal Assessment (Beca, 2021a)

8 Conclusions and Recommendations

The site includes a number of highly modified watercourses, as well as areas of degraded dune vegetation. Although the value of these ecological features is compromised by land use pressures, watercourses provide intermittent habitat for At Risk – Declining īnanga and longfin eel, and dune vegetation represents a threatened ecosystem type.

The proposed discharge has been designed to minimise effects on the receiving environment by ensuring application rates are matched to the soils and storage is provided for so excessive drainage from irrigation and runoff do not occur. A 20m setback from permanent and intermittent waterways has also been adopted.

Potential adverse effects that have been considered as a result of the discharge are:

- Degradation of water and habitat quality
- Alterations to hydrology
- Excessive growth of nuisance aquatic plants
- Altered vegetation composition

To compensate for the adverse ecological effects on dune vegetation, there is an opportunity to remediate the existing discharge site at Te Paerahi dunes. Following the cessation of the discharge in this location, existing treatment and discharge infrastructure will be removed which could lead to passive restoration of the natural dune environment. This could also be supplemented by restoration planting using indigenous species to enhance the ecological values of the site. As this land is not owned by CHBDC this would need to be worked through worked through and agreed with mana whenua. Additionally, the landowners at the Discharge Property have indicated that there are some areas that could potentially be restricted from further grazing within their property, allowing dune vegetation to be restored.

Additional recommendations include ongoing monitoring to ensure eco-toxicity thresholds for freshwater fauna are not exceeded within the Discharge Property watercourses, fencing intermittent watercourses to exclude stock, and undertaking riparian planting along intermittent watercourses with to mitigate any potential adverse effects on water and habitat quality.

The overall ecological effect of the proposal is considered to be **Very Low** assuming the above recommendations are implemented. This means that there is only anticipated to be a very slight change from existing baseline conditions. Over long-term time scales (15 - 25 years), a net gain in ecological value is likely due to reductions in pollutants entering the Pōrangahau River and Estuary.

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10 Limitations

This report has been prepared by Beca Ltd solely for Central Hawke's Bay District Council (the client). This report is prepared solely for the purpose of the assessment of potential ecological effects of the proposed works (Scope). The report has been prepared to support a resource consent application and may be used by the Client and others in subsequent processes to consider the application to which the assessment pertains. The contents of this report may not be used by the Client for any purpose other than in accordance with the stated Scope.

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This report should be read in full, having regard to all stated assumptions, limitations and disclaimers.

1

Appendix 1 – Ecological Impact Assessment (EIANZ methodology)

Appendix 1: Ecological Impact Assessment Guidelines

Assigning Ecological Value

Freshwater and terrestrial habitat

The ecological values of freshwater and terrestrial systems (riparian vegetation, habitats and species present) potentially impacted by the works were assessed against the following attributes:

- Representativeness;
- Rarity or distinctiveness;
- Diversity or pattern; and
- Ecological context.

These attributes are described in Table 1.1 and Table 1.2 below.

Table 1.1. Matters that may be considered when assigning ecological value to a freshwater site or area.

Matters	Attributes to be assessed
Representativeness	Extent to which site/catchment is typical or characteristic Stream order Permanent, intermittent or ephemeral waterway Catchment size Standing water characteristics
Rarity/distinctiveness	Supporting nationally or locally threatened, at risk or uncommon species National distribution limits Endemism Distinctive ecological features Type of lake/pond/wetland/spring
Diversity and pattern	Level of natural diversity Diversity metrics Complexity of community Biogeographical considerations - pattern, complexity, size, shape
Ecological context	Stream order Instream habitat Riparian habitat Local environmental conditions and influences, site history and development Intactness, health and resilience of populations and communities Contribution to ecological networks, linkages, pathways Role in ecosystem functioning – high level, proxies

Table 1.2. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/ habitat/community.

Matters	Attributes to be assessed
Representativeness	Criteria for representative vegetation and aquatic habitats: Typical structure and composition Indigenous species dominate Expected species and tiers are present Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: Species assemblages that are typical of the habitat Indigenous species that occur in most of the guilds expected of the habitat type
Rarity/distinctiveness	Criteria for rare/ distinctive vegetation and habitats: Naturally uncommon, or induced scarcity Amount of habitat or vegetation remaining Distinctive ecological features National priority for protection Criteria for rare/ distinctive species or species assemblages: Habitat supporting nationally Threatened or At Risk species, or locally uncommon species Regional or national distribution limits of species or communities Unusual species or assemblages Endemism
Diversity and pattern	Level of natural diversity, abundance, and distribution Biodiversity reflecting underlying diversity Biogeographical considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	Site history, and local environmental conditions which have influenced the development of habitats and communities The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (form "intrinsic value" as defined in RMA) Size, shape and buffering Condition and sensitivity to change Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material Species role in ecosystem functioning – high level, key species identification, habitat as proxy

The freshwater habitat features were assessed considering each of the attributes in Table 1.1, and terrestrial habitat features were assessed considering attributes in Table 1.2. Features of interest were subjectively given a rating on a scale of 'Very Low' to 'High' for each attribute and assigned a value in accordance with the description provided in Table 1.3.

Table 1.3. Rating system for assessing ecological value of terrestrial and freshwater systems (Roper-Lindsay et al. 2018)

Value	Description
Negligible	Feature rates Very Low for at least three assessment attributes and Low to Moderate for the remaining attribute(s).
Low	Feature rates Very Low to Low for most assessment attributes and moderate for one. Limited ecological value other than providing habitat for introduced or tolerant indigenous species.
Moderate	Feature rates High for one assessment attribute and Low to Moderate for the remainder, OR the project area rates Moderate for at least two attributes and Very Low to Low for the rest. Likely to be important at the level of the Ecological District.
High	Feature rates High for at least two assessment attributes and Low to Moderate for the remainder, OR the project area rates High for one attribute and Moderate for the rest. Likely to be regionally important.
Very High	Feature rates High for at least three assessment attributes. Likely to be nationally important.

Species

The EIANZ provides a method for assigning value (Table 1.4) to species for the purposes of assessing actual and potential effects of activities.

Table 1.4. Criteria for assigning ecological values to species

Ecological Value	Species
Very High	Threatened (Nationally Critical, Nationally Endangered, Nationally Vulnerable)
High	At Risk (Declining, Recovering, Relict, Naturally Uncommon)
Medium	Native – Not threatened
Low	Introduced

Assigning Magnitude of Impacts

The magnitude of impacts is determined by the scale (temporal and spatial) of potential impacts identified and the degree of ecological change that is expected to occur as a result of the proposed activity (Roper-Lindsay *et al*. 2018).

Based on the assessor's knowledge and experience, the magnitude of identified impacts on the ecological values within the project area and zone of influence were assessed and rated on a scale of 'Very High' to 'Negligible' based on the description provided in Table 1.5.

Table 1.5. Criteria for describing the magnitude of effects (Roper-Lindsay et al. 2018)

Magnitude	Description
Very high	Total loss or very major alteration to key features of existing conditions, such that the post-development attributes will be fundamentally changed and may be lost altogether; and/or loss of a very high proportion of the known population or range of the feature.
High	Major loss or alteration of key features of existing conditions, such that post-development attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the feature.
Moderate	Loss or alteration to one or more key features of the existing condition, such that post-development attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the feature.
Low	Minor shift away from existing conditions. Change arising from the loss/alteration will be discernible, but underlying attributes will be similar to pre-development circumstances; and/or having a minor effect on the known population or range of the feature.
Negligible	Very slight change from existing conditions. Change barely distinguishable, approximating “no change”; and/or having negligible effect on the known population or range of the feature.

Assessment also considered the temporal scale at which potential impacts were likely to occur:

- Permanent (>25 years).
- Long-term (15-25 years).
- Medium-term (5-15 years).
- Short-term (0-5 years).
- Temporary (during construction)

Assessing the Level of Effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the magnitude of impacts and the values of impacted ecological features (Roper-Lindsay *et al*. 2018).

Results from the assessment of ecological value and the magnitude of identified impacts were used to determine the level or extent of the overall impacts on identified ecological features within the project area and zone of influence using the matrix described in Table 1.6.

Table 1.6. Matrix combining magnitude and value for determining the level of ecological impacts (Roper-Lindsay et al. 2018).

Effect Level		Ecological and/or Conservation Value				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
	Very High	Very High	Very High	High	Moderate	Low
Magnitude	**High**	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Results from the matrix were used to determine the type of responses that may be required to mitigate potential direct and indirect impacts within the project area and within the zone of influence, considering the following guidelines (Roper-Lindsay *et al*. 2018):

- A ‘Low’ or ‘Very Low’ level of impact is not normally of concern, though design should take measures to minimise potential effects.
- A ‘Moderate’ to ‘High’ level of impact indicates a level of impact that qualifies careful assessment on a case-by-case basis. Such activities could be managed through avoidance (revised design) or appropriate mitigation. Where avoidance is not possible, no net loss of biodiversity values would be appropriate.

A ‘Very High’ level of impact is are unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values would be appropriate.

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Appendix 2 – Species recorded within wetland vegetation plots

Vegetation recorded within wetland vegetation plots on Site

Plot	Species	Scientific Name	Indicator status	Dominant
1	Cutty grass	*Carex geminata*	FACW	Y
1	Sea rush	*Juncus kraussii subsp. australiensis*	FACW	
1	Tall fescue	*Festuca arundinacea*	FACU	
1	Creeping buttercup	*Ranunculus repens*	FAC	
1	Knobby club-rush	*Ficinia nodosa*	FACU	
1	Creeping thistle	*Cirsium arvense*	FACU	
2	Cutty grass	*Carex geminata*	FACW	Y
2	Sea rush	*Juncus kraussii subsp. australiensis*	FACW	
2	Knobby club-rush	*Ficinia nodosa*	FACU	
2	Creeping buttercup	*Ranunculus repens*	FAC	
2	Clover	*Trifolium repens*	FACU	
2	Slender clubrush	*Isolepis cernua*	OBL	
2	Giant umbrella sedge	*Cyperus ustulatus*	FACW	
2	Orchard grass	*Dactylis glomerata*	FACU	Y

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Appendix 3 – eDNA results from Wilderlab Ltd

eDNA results: multi-species analysis by DNA metabarcoding.

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Bos taurus	species	Cattle	Mammals	1129	614	932
Homo sapiens	species	Human	Mammals	312	308	548
Ovis aries	species	Sheep	Mammals	484	164	462
Nasturtium officinale	species	Watercress	Plants	292	714	50
Lumbricus rubellus	species	Red earthworm	Worms	231	251	136
Mesocyclops leuckarti	species	Copepod	Crustaceans	107	0	407
Galaxias maculatus	species	Inanga	Fish	439	0	25
Tubifex tubifex	species	Sludge worm	Worms	169	143	0
Deroceras reticulatum	species	Grey field slug/Grey garden slug	Molluscs	114	119	11
Aporrectodea caliginosa	species		Worms	87	76	43
Chaetogaster diastrophus	species	Oligochaete worm	Worms	0	17	180
Hydra vulgaris	species	Hydra	Cnidarians	7	0	185
Eiseniella tetraedra	species	Squaretail worm	Worms	30	72	77
Lumbricus castaneus	species		Worms	59	81	0
Microscolex dubius	species		Worms	21	6	113

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Aporrectodea trapezoides	species	Southern worm	Worms	59	30	43
Allolobophora chlorotica	species	Green worm	Worms	40	71	0
Corynocarpus laevigatus	species	Karaka	Plants	35	73	0
Chaetogaster diaphanus	species	Oligochaete worm	Worms	0	0	96
Rhopalosiphum padi	species	Bird cherry-oat aphid	Insects	48	21	23
Gobiomorphus breviceps	species	Upland bully	Fish	0	0	79
Adineta vaga	species	Rotifer	Rotifers	0	69	0
Potamothrix bavaricus	species	Aquatic oligochaete worm	Worms	36	16	17
Ectopsocus briggsi	species	Psocopteran fly	Insects	0	19	41
Potamopyrgus antipodarum	species	Mud Snail	Molluscs	56	0	0
Corynoptera perpusilla	species	Fungus gnat	Insects	0	45	0
Saccamoeba sp. MSED6	species		Amoebae	31	10	3
Hypoponera opacior	species	Ponerine ant	Insects	0	0	41
Eukerria saltensis	species		Worms	27	13	0
Tuberolachnus salignus	species	Giant willow aphid	Insects	15	12	12
Aulodrilus pluriseta	species	Aquatic oligochaete worm	Worms	0	0	34

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Habrotrocha elusa elusa	subspecies	Rotefer	Rotifers	0	34	0
Plectonemertidae sp. NT72	species		Other	0	32	0
Trebouxia aggregata	species	Green algae	Green algae	31	0	0
Deroceras invadens	species	Slug	Molluscs	0	14	12
Anguilla dieffenbachii	species	Longfin eel	Fish	0	0	22
Trigonidium sjostedti	species		Insects	0	0	22
Spumella sp.	species	Golden-brown alga	Heterokont algae	0	21	0
Cyclotella cryptica	species	Brackish-water diatom	Diatoms	18	0	0
Psychoda nr. albipennis GMK-2012	species		Insects	0	0	18
Hypogastrura purpurescens	species		Springtails	0	17	0
Craspedacusta sowerbii	species	Freshwater jellyfish	Cnidarians	0	0	13
Nitzschia palea	species	Diatom	Diatoms	0	0	11
Capitophorus elaeagni	species	Artichoke aphid	Insects	0	0	11
Lumbriculus variegatus	species	Blackworm/California blackworm	Worms	0	0	10
Chrysophyceae sp.	species		Heterokont algae	10	0	0

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Coleochaete orbicularis	species	Charophyte green algae	Other	0	9	0
Hydra viridissima	species	Hydra	Cnidarians	9	0	0
Anas platyrhynchos	species	Mallard duck	Birds	0	0	9
Strombidium biarmatum	species	Ciliate	Ciliates	9	0	0
Henlea ventriculosa	species		Worms	9	0	0
Isotomurus palustris	species	Marsh springtail	Springtails	0	8	0
Austropeplea tomentosa	species		Molluscs	0	8	0
Ceratophysella aff. denticulata L3	species	Mushroom springtail	Springtails	0	0	8
Acanthamoeba sp.	species	Amoeba	Amoebae	0	0	7
Prostoma eilhardi	species	Freshwater ribbon worm	Other	0	0	7
Philodina flaviceps	species	Rotifer	Rotifers	0	7	0
Enchytraeus buchholzi complex sp. 2 MK-2019	species		Worms	0	0	7
Protaphorura fimata	species		Springtails	0	6	0
Porphyrio melanotus	species	Pukeko/Australasian swamphen	Birds	0	5	0

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Eucypris virens	species		Crustaceans	0	5	0
Chironomus cloacalis	species		Insects	0	0	5
Mythimna separata	species	Armyworm	Insects	0	5	0
Leptodictyum riparium	species	Kneiff's feathermoss	Mosses	0	4	0
Arcitalitrus dorrieni	species		Crustaceans	4	0	0
Anguilla australis	species	Shortfin eel	Fish	3	0	0
Bradysia pallipes	species		Insects	0	3	0
Skeletonema potamos	species	Diatom	Diatoms	0	0	3
Proteuxoa sanguinipuncta	species		Insects	0	3	0
Cryptomonas	genus		Cryptomonads	977	704	380
Ovis	genus		Mammals	586	65	661
Chaetonotus	genus	Gastrotrich	Other	43	55	465
Populus	genus	Poplars/aspens/cottonwoods	Plants	40	343	0
Gobiomorphus	genus	Bullies	Fish	0	0	383
Phytophthora	genus	Water mold	Heterokont algae	94	176	98
Nais	genus	Sludgeworm	Worms	0	5	243
Potamopyrgus	genus	Mud snails	Molluscs	19	38	184
Rumex	genus	Docks/sorrels	Plants	33	183	9
Sterkiella	genus		Ciliates	48	124	52

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Pedospumella	genus		Heterokont algae	67	76	81
Glyceria	genus	Mannagrasses/sweet-grasses	Plants	0	170	16
Paraphysomonas	genus	Golden-brown alga	Heterokont algae	87	42	52
Anteholosticha	genus		Ciliates	52	111	0
Dictyota	genus		Heterokont algae	42	93	24
Pinus	genus	Pines	Plants	65	68	17
Pythium	genus	Parasitic oomycete	Heterokont algae	55	53	18
Aporrectodea	genus		Worms	52	59	11
Trifolium	genus	Clover/trefoil	Plants	30	67	16
Chrysochaete	genus		Heterokont algae	35	35	41
Deroceras	genus		Molluscs	72	0	39
Cyclidium	genus		Ciliates	0	102	0
Halteria	genus		Ciliates	94	0	0
Euplotes	genus		Ciliates	22	27	38
Phialina	genus	Ciliate	Ciliates	0	0	86
Mallomonas	genus		Heterokont algae	39	19	27
Ranunculus	genus	Buttercups/spearworts/water crowfoots	Plants	31	43	8
Phascolodon	genus		Ciliates	82	0	0
Sorodiplophrys	genus		Heterokont algae	24	32	22
Chilodonella	genus		Ciliates	0	33	36

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Blepharisma	genus		Ciliates	18	15	31
Vorticella	genus		Ciliates	0	52	12
Eiseniella	genus		Worms	0	62	0
Milax	genus		Molluscs	0	34	20
Juncus	genus	Rushes	Plants	8	29	11
Tachysoma	genus		Ciliates	0	0	46
Galaxias	genus	Galaxiids	Fish	20	22	0
Ulnaria	genus		Diatoms	0	42	0
Rhogostoma	genus		Other	42	0	0
Navicula	genus		Diatoms	0	19	18
Henlea	genus		Worms	35	0	0
Pseudonotohymena	genus		Ciliates	0	32	0
Neobodo	genus		Other	17	14	0
Stylonychia	genus		Ciliates	0	29	0
Coprosma	genus	Coprosma	Plants	0	28	0
Euglena	genus		Other	18	0	8
Melicytus	genus	Mahoe	Plants	6	17	0
Tokophrya	genus		Ciliates	0	11	11
Procryptobia	genus		Other	0	22	0
Crataegus	genus	Hawthorn	Plants	0	21	0
Limnodrilus	genus		Worms	0	0	21
Sturnus	genus	Starlings	Birds	0	20	0
Opogona	genus	Fungus moth	Insects	11	9	0
Lumbricus	genus		Worms	16	0	0
Bodo	genus	Excavate	Other	0	15	0
Galium	genus	Bedstraw	Plants	14	0	0
Wiseana	genus		Insects	0	0	13
Acyrthosiphon	genus		Insects	0	0	12

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Diaxonella	genus		Ciliates	0	0	12
Coriaria	genus	Tutu	Plants	0	0	11
Rytidosperma	genus	Grasses	Plants	0	11	0
Linum	genus		Plants	0	9	0
Pseudomonas	genus		Bacteria	0	0	7
Geranium	genus	Geraniums/cranesbills	Plants	0	0	7
Aspergillus	genus		Fungi	0	0	7
Lamproderma	genus		Amoebae	7	0	0
Limnophyes	genus	Non-biting midge	Insects	0	7	0
Piper	genus	Pepper plants/pepper vines	Plants	0	6	0
Ectopsocus	genus	Psocopteran fly	Insects	0	6	0
Articulospora	genus		Fungi	0	6	0
Plantago	genus	Plaintains/fleaworts	Plants	5	0	0
Polymyxa	genus		Other	0	4	0
Lepocinclis	genus		Other	4	0	0
Cadophora	genus		Fungi	0	0	4
Brachycaudus	genus		Insects	0	4	0
Pegomya	genus		Insects	0	3	0
Asteraceae	family	Daisy family	Plants	252	176	73
Pooideae	subfamily		Plants	168	230	87
Poaceae	family	Grass family	Plants	4	222	0
Polygonoideae	subfamily		Plants	20	117	0
Strobilidiidae	family		Ciliates	11	44	76
Physidae	family		Molluscs	8	37	59

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Oedogoniaceae	family		Green algae	0	75	6
Chaetonotidae	family		Other	18	43	0
Euplotidae	family		Ciliates	24	33	0
Tateidae	family	Aquatic snails	Molluscs	0	26	20
Helicidae	family		Molluscs	0	0	36
Gonostomatidae	family		Fish	0	0	35
Lumbricidae	family		Worms	8	26	0
Bdellidae	family	Snout mites	Rotifers	0	33	0
Araliaceae	family	Ginseng family	Plants	0	15	14
Brassicaceae	family	Mustard family	Plants	12	14	0
Phaeosphaeriaceae	family		Fungi	0	0	24
Synchaetidae	family		Rotifers	0	22	0
Passifloraceae	family	Passionflower famly	Plants	0	19	0
Thalassiosiraceae	family		Diatoms	8	10	0
Philodinidae	family		Rotifers	10	8	0
Physciaceae	family		Fungi	17	0	0
Cupressaceae	family	Cypress family	Plants	16	0	0
Phacotaceae	family		Green algae	0	15	0
Bryaceae	family		Mosses	14	0	0
Polygonaceae	family	Buckwheat family	Plants	0	12	0
Oxytrichidae	family		Ciliates	0	11	0
Aphididae	family	Aphids	Insects	0	10	0
Tetrastemmatidae	family		Other	0	9	0
Plectosphaerellaceae	family		Fungi	0	7	0

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Pythiaceae	family	Water moulds	Heterokont algae	0	6	0
Lumbricinae	subfamily		Worms	0	4	0
cellular organisms	no rank		Other	6048	7794	5894
Spirotrichea	class		Ciliates	408	460	415
Poeae	tribe		Plants	372	593	31
Brassicales	order		Plants	217	457	23
Bilateria	no rank		Other	77	65	445
Saliceae	tribe		Plants	315	0	194
Sessilida	order		Ciliates	133	87	110
Haptorida	order		Ciliates	112	90	107
Bdelloidea	class		Rotifers	103	26	172
Ciliophora	phylum	Ciliates	Other	95	70	109
Chromulinales	order		Heterokont algae	119	77	23
unclassified Macrothrix	no rank		Crustaceans	49	40	124
Sporadotrichida	order		Ciliates	65	50	85
Malpighiales	order		Plants	57	90	0
Fungi	kingdom		Other	62	73	12
Litostomatea	class		Ciliates	0	0	124
Insecta	class	Insects	Other	65	42	9
Hymenostomatida	order		Ciliates	39	0	64
Cichorieae	tribe		Plants	0	82	20

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Chrysophyceae	class	Chrysomonads	Heterokont algae	33	10	52
Neogastropoda	order		Molluscs	5	20	68
Cryptophyceae	class	Cryptomonads	Other	22	50	18
Henicopini	tribe		Centipedes	0	62	28
Arthropoda	phylum	Arthropods	Other	0	23	63
Viridiplantae	kingdom	Green plants	Other	0	84	0
Xanthophyceae	class	Yellow-green algae	Heterokont algae	40	23	13
Gastropoda	class	Gastropods	Molluscs	8	0	56
Streptophyta	phylum		Other	37	23	0
Choreotrichida	order		Ciliates	17	26	15
Lamiales	order		Plants	0	0	55
Tetrahymenina	suborder	Ciliates	Ciliates	0	41	13
Urostylida	order		Ciliates	32	21	0
Chordata	phylum	Chordates	Other	16	11	22
core chlorophytes	clade		Green algae	30	15	0
Heterotrichida	order		Ciliates	8	0	34
Annelida	phylum	Annelid worms	Other	23	4	10
Amphifilida	order		Heterokont algae	25	0	12
Asparagales	order		Plants	34	0	0

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Cercozoa	phylum		Other	0	0	27
Polygoneae	tribe		Plants	0	26	0
Oomycetes	class		Heterokont algae	6	0	18
Diptera	order	Flies	Insects	0	0	24
Bacillariophyta	phylum	Diatoms	Heterokont algae	5	18	0
Rhizophydiales	order		Fungi	18	0	5
Gastrotricha	phylum	Gastrotrichs	Other	0	0	22
Chromadorea	class		Other	5	0	16
Sigmurethra	no rank		Molluscs	5	15	0
Pleosporineae	suborder		Fungi	0	20	0
Hypnales	order		Mosses	0	7	12
Colpodea	class		Ciliates	17	0	0
Arachnida	class	Arachnids	Other	0	0	17
Pleurostomatida	order		Ciliates	0	0	16
Agaricales	order	Gill mushrooms	Fungi	0	15	0
Ploima	order		Rotifers	0	15	0
Sophoreae	tribe		Plants	9	0	6
Cryptomycota	phylum		Fungi	8	0	7
Euglenales	order		Other	14	0	0
Oligohymenophorea	class		Ciliates	13	0	0
Eumycetozoa	class		Amoebae	7	6	0
Rosales	order		Plants	0	12	0

Scientific Name	Rank	Common Name	Group	Confluence Watercourse 1 and 2 - DNA sequence counts	Reach 3 - DNA sequence counts	Reach 1 - DNA sequence counts
Proteobacteria	phylum	Purple bacteria and relatives	Bacteria	0	11	0
Chlorophyta	phylum	Green algae	Other	0	11	0
Dinophyceae	class	Dinoflagellates	Other	4	0	5
Chlamydomonadales	order		Green algae	0	0	9
Zingiberales	order		Plants	0	0	9
Lepidoptera	order	Butterflies and moths	Insects	0	9	0
Magnoliopsida	class	Angiosperms	Plants	0	8	0
Macrosiphini	tribe		Insects	8	0	0
Gammaproteobacteria	class		Bacteria	7	0	0
Bryophyta	no rank	Mosses	Other	7	0	0
Thecofilosea	class		Other	0	7	0
Evosea	phylum		Amoebae	0	7	0
Rotifera	phylum	Rotifers	Other	0	6	0
Bacillariophyceae	class	Raphid pennate diatoms	Diatoms	0	5	0
Collembola	class	Snow fleas	Other	0	4	0
Clitellata	class		Worms	4	0	0
Verrucomicrobia	phylum		Bacteria	4	0	0
Enterobacterales	order		Bacteria	4	0	0
Planctomycetia	class		Bacteria	0	4	0