Sensitivity: General

Waipukurau South Precinct - Wetland Assessment

Development Area 1

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

14 February 2025



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Revision History

Revision Nº	Prepared By	Description	Date
0	Sarah Busbridge	Draft for technical review	18/8/22
1	Sarah Busbridge	Draft for approval	19/8/22
2	Sarah Busbridge	Draft for client review	22/8/22
3	Sandy Huang	Incorporation of updated NES-F and Structure Plan	14/02/25

Document Acceptance

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on behalf of	Beca Limited		

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Executive Summary

Beca Ltd has been commissioned by Central Hawkes Bay District Council to delineate ‘natural inland wetlands’ within Development Area 1 of the Waipukurau South Precinct. This is to support the Council in protecting and enhancing wetlands as part of their proposed Structure Plan for the area.

This report has been revised from its initial publication in 2022, in order to reclassify ‘natural inland wetlands’ against the latest definitions from National Policy Statement for Freshwater Management 2022 Amendment 1 (NPS-FM) and National Environmental Standard for Freshwater 2022 (NES-F). This was achieved using the field data collected from 2022.

Following assessments against the latest versions of the NPS-FM and NES-F, four out of six potential wetlands have been assessed as ‘natural inland wetlands’ within Development Area 1 (see Figure 1). At the time of the site visit in 2022, these four wetlands were all in extremely degraded condition due to ongoing stock access.

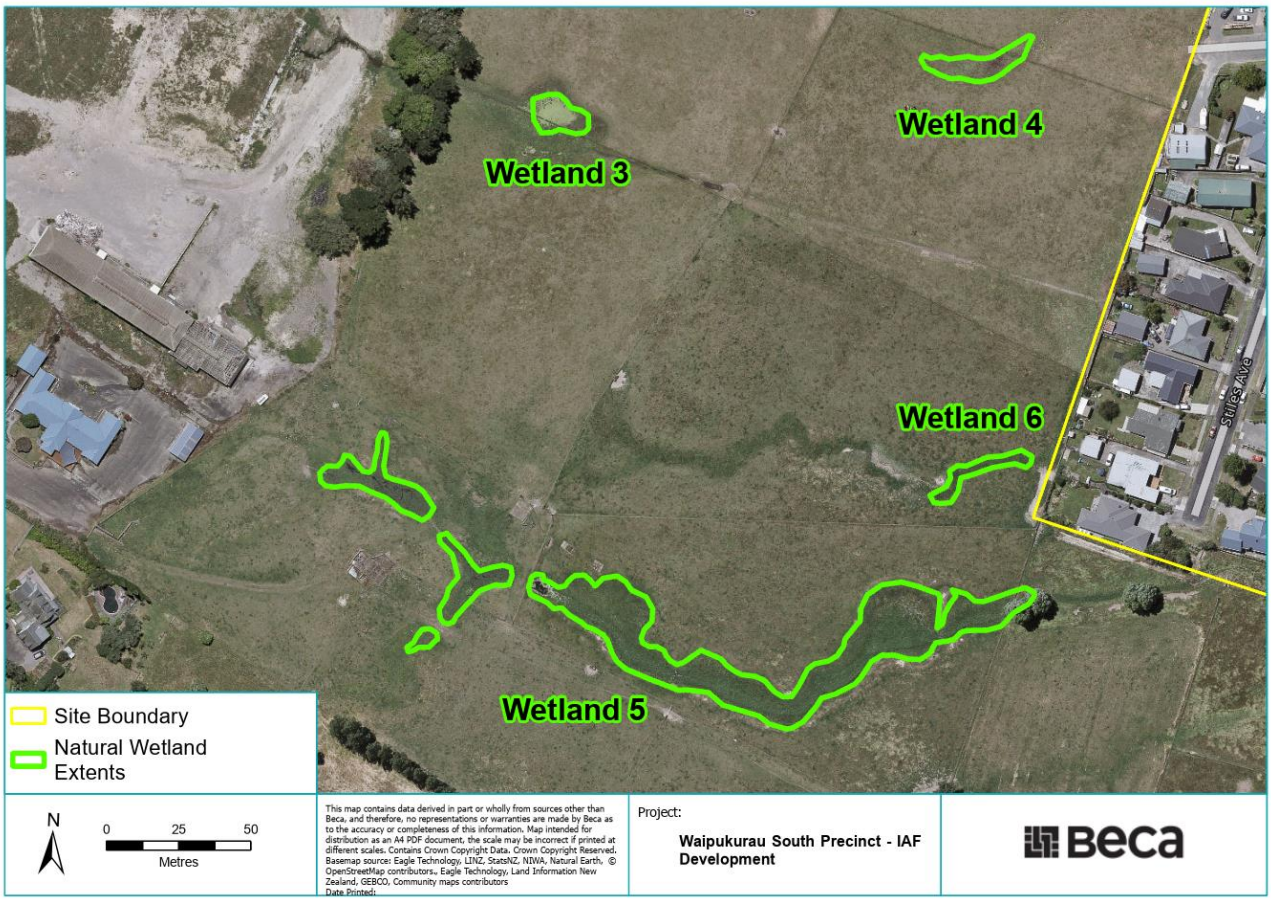


Figure 1. The extents of the four 'natural inland wetlands' (green outline) within Development Area 1 of the Waipukurau South Precinct.

1 Introduction

Beca Ltd has been commissioned by Central Hawkes Bay District Council (CHBDC) to delineate ‘natural inland wetlands’ at ‘Development Area 1 of the Waipukurau South Precinct’ (hereafter referred to as the ‘Site’) to support CHBDC in protecting and enhancing wetlands at the Site as part of their Structure Plan.

An initial wetland delineation report was prepared for CHBDC in 2022. Since then, the legislative definitions for 'natural inland wetlands' have been changed, including the introduction of the pasture exclusion criteria. As a result, this report has been revised to reclassify and redefine the spatial extent of 'natural inland wetlands' based on the latest definitions from the National Policy Statement for Freshwater Management 2022 Amendment 1 (NPS-FM) and the National Environmental Standard for Freshwater 2022 (NES-F)."

2 Site Location and Ecological Context

The Site is within the Heretaunga ecological district, in the Hawkes Bay ecological region (McEwen, 1987). The district includes a number of aggrading rivers, extensive broad plains, river terraces, and hill country composed of Pleistocene and Holocene gravels and alluvium (McEwen, 1987). Natural drainage ranges from excessive to poor with parts liable to flooding despite the district being one of the driest areas in the North Island with frequent summer droughts (McEwen, 1987). The district has undergone extensive modification with a large proportion of land converted to pasture and horticultural land (McEwen, 1987). Vegetation would have historically consisted of podocarp-hardwood forest in the south on the western foothills (rimu-matai-totara); with a few large areas of coastal forest (ngaio, titoki with totara and other podocarps in places); and scrub, fern and short tussockland in the central and northern parts, largely fire-induced during the Polynesian era (McEwen, 1987).

The Site is located between Porangahau Road and Tavistock Road in Waipukurau. Similar to the other areas of the district, it has been subject to extensive modification, with a former hospital occupied by some remaining derelict buildings located to the west of the Site, and much of the remainder converted for agriculture since at least 1949. It is bound on almost three sides by residential development.

The Site has several lower areas that can become inundated during higher rainfall events (Vision Urban Environmental Ltd, 2021). Its catchment discharges to the north east and through the drain under Mt Herbert Road, finally discharging into the Tukituki River (WSP, 2021).

The Site is modelled as a historic swamp wetland on sandy loam soils (Ausseil et al., 2008; Leathwick et al., 2010). According to SMap, the Site falls on Poporangi_2a.1 (Area: 50%; Confidence: Low), and Ruataniwha_7a.1 (Area: 50%; Confidence: Low) soils (Manaaki Whenua, 2021). Poporangi_2a.1 belongs to the Pallic soil order of the New Zealand soil classification. Pallic Soils have pale coloured subsoils, due to low contents of iron oxides, have weak soil structure and high density in subsurface horizons. Pallic Soils tend to be dry in summer and wet in winter. They are formed in alluvial sand silt or gravel deposited by running water. Poporangi_2a.1 subsoil generally has dominantly loam textures with some gravel content (Manaaki Whenua, 2021). A discontinuous impermeable hard pan underlies subsoil and soils are imperfectly drained with waterlogging occuring in winter and spring, and some soils remaining wet all year (Manaaki Whenua, 2021). Ruataniwha_7a.1 soil also belongs to the Pallic soil order of the New Zealand soil classification as described above. Topsoil and subsoils have dominantly silt textures with subsoil having a small amount of gravel content. A continuous impermeable hard pan underlies subsoil and results in Ruataniwha_7a.1 being poorly drained with a high vulnerability of water logging (Manaaki Whenua, 2021). This area is considered likely to have hydric soils.

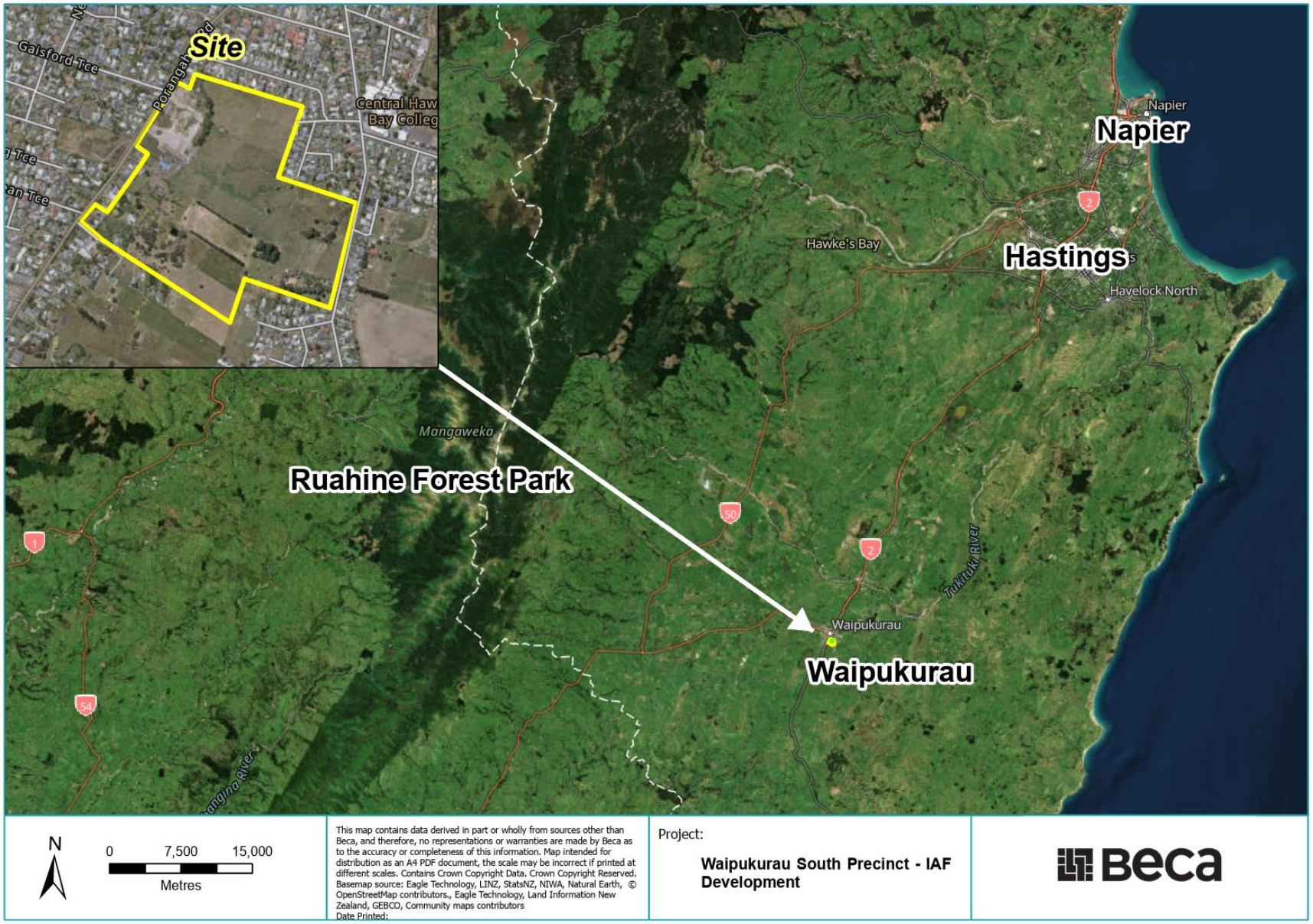


Figure 2. Site location within the surrounding landscape.

3 Wetland Assessment Methodology

3.1 Desktop review

Desktop screening for potential wetlands was undertaken for the Site using ArcGIS Pro 3.1.3 desktop geospatial software, and ecological information from the following sources:

- Central Hawkes Bay Regional Council geospatial layers including flood risk areas and contours.
- Google Earth and Land Information New Zealand (LINZ) aerial imagery;
- Retrolens historic aerial imagery;
- Freshwater Ecosystems of New Zealand (FENZ) geospatial layers of estimated historic and current extent of wetlands in New Zealand (Leathwick et al., 2010); and
- Other publicly accessible reports or information

To identify potential wetlands, aerial imagery was analysed using hydrophytic vegetation (e.g., rushes, reeds, sedges), signs of inundation or soil saturation, and typical wetland colours and patterns. Historic aerial photos were reviewed to check for any persistence of wetland characteristics over time. Hydrological and topographical data were also considered. Approximate boundaries were drawn based on changes in vegetation, topography, and soil saturation.

3.2 Field Investigations

Detailed wetland investigations were undertaken on the 3rd - 4th of August 2022 in general accordance with the New Zealand Wetland Delineation Protocols (Ministry for the Environment, 2022; Figure 3 for investigation locations, and Figure 4 for delineation protocols). Please note that this revised report uses this 2022 field data for analysis.

One small potential wetland area towards the south-west of the Site was not able to be visited as the landowner had not granted access but this area is considered unlikely to be confirmed to meet the definition of a ‘natural inland wetland’.

Weather was fine at the time of the site visit and 29.4mm of rain had accumulated in the two weeks prior to the site visit, with the last significant rainfall event occurring on the 27th of July (Waipawa Ews; NIWA, 2022). Total rainfall for July was 98.2mm which is typical for this time of year. The monthly normal rainfall for July (based on the past 30 years of data) is 101.4mm (Waipawa Ews; NIWA, 2022).

a. Vegetation assessment

Quick visual assessments were relied upon in areas that were very clearly dry pasture, or clearly wetland, although at least one vegetation plot was completed in each representative vegetation type to provide additional justification. Where vegetation was inconclusive and there were signs of wetland hydrology (i.e. ponding/pugging), full wetland delineation protocols were applied (Ministry for the Environment, 2022).

b. Soil samples and hydrological assessment

Soil test pits were dug to a depth of 20 – 50 cm at a number of the vegetation plots. Soil composition/type and presence of mottles or other features of note were recorded and interpretated in accordance with Fraser et al. (2018).

Presence of surface water and soil saturation, as well as other hydrological indicators, were recorded at each plot in line with the Wetland Delineation Hydrology Tool for Aotearoa New Zealand (Ministry for the Environment, 2021).

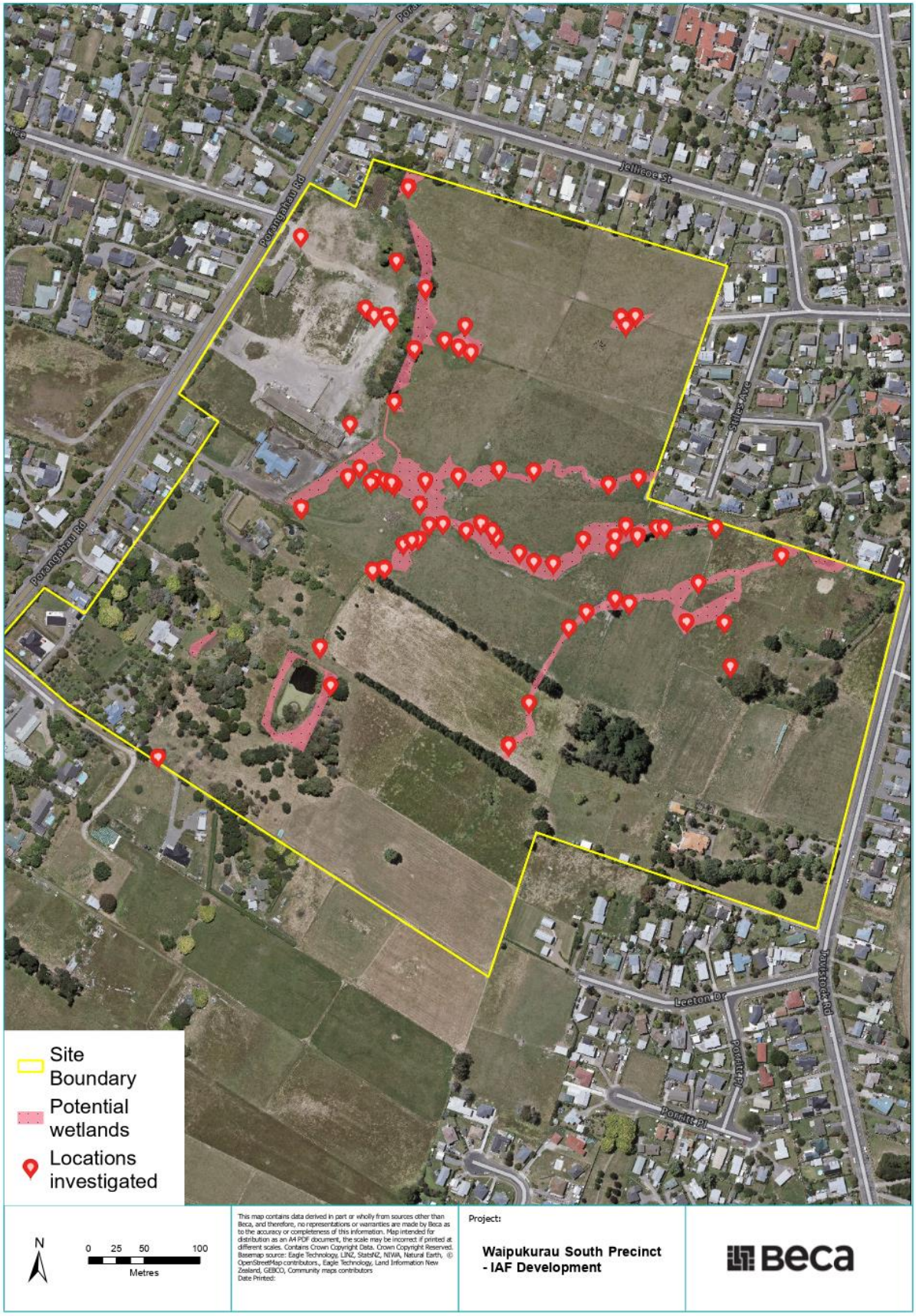


Figure 3. Potential wetland areas identified via desktop review and locations investigated during the site visit.

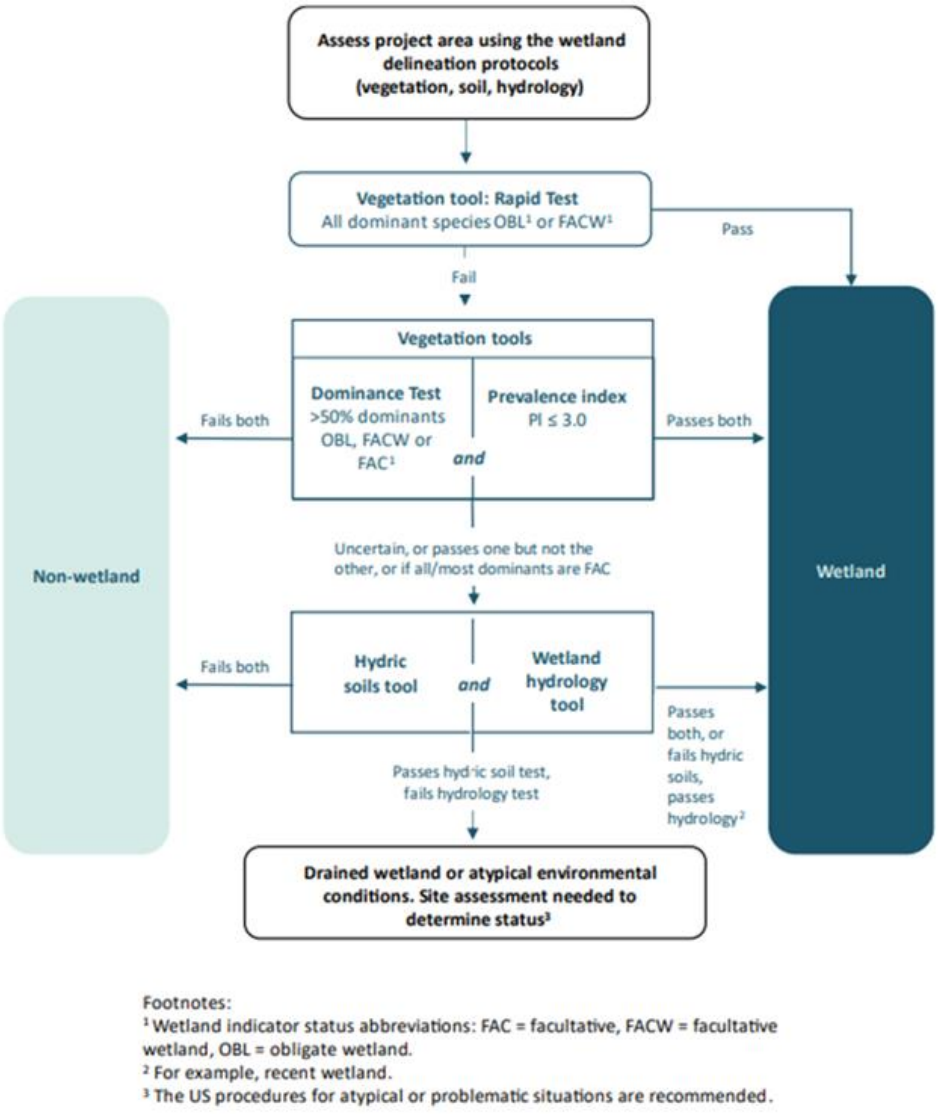


Figure 4. A summary diagram of the New Zealand Wetland Delineation Protocols (Ministry for the Environment, 2022).

3.3 Data Analysis and Interpretation

This revised report analyses the field data collected in 2022 against the latest legislation definitions (see Section 3.3 (b)).

Plots where specified exotic pasture species (as defined by Ministry for the Environment, 2022). comprised >50% of the total vegetation cover (all strata summed) were deemed to meet the pasture exclusion test and were not classified as ‘natural inland wetlands’.

When applying the vegetation tests, a dominance test score of 50% and a prevalence index value of 2.9 – 3.1 is considered to be marginal. Where vegetation test results were uncertain (i.e., the plot passed either the dominance test or the prevalence test, but not both), but vegetation was dominated by facultative (FAC) and facultative upland (FACU) species the area was assessed as non-wetland, otherwise the vegetation assessment was considered along with other indicators of wetland conditions such as soil and hydrology.

a. Wetland extent and boundary mapping

To delineate the wetland boundary, an assumed boundary was determined using visual clues such as changes in topography and vegetation. The perimeter of this boundary was walked to record a georeferenced polygon which was then refined using plot information, contours, and evidence of soil saturation visible in aerial imagery.

b. Wetland status under the RMA and NPS-FM

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 (2022; NES-F) sets out controls relating to development of ‘natural wetlands’. ‘Natural wetlands’ are defined in the NES-F (via the National Policy Statement for Fresh Water Management 2022 Amendment 1 (NPS-FM).

Under the NPS-FM, the definition of a ‘natural inland wetland’ is a subset of the RMA definition, with several exclusions. It defines a ‘natural inland wetland’ as:

‘Natural inland wetland means a wetland (as defined in the Act) that is not:

a) in the coastal marine area, or

b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland, or

c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body, or

d) a geothermal wetland, or

e) a wetland that:

i. is within an area of pasture used for grazing; and

ii. has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless

iii. iii) is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply.’

4 Wetland Delineation Results

Four out of six potential wetlands were confirmed as ‘natural inland wetlands’ subject to NES-F considerations, and are discussed further in the subsections below. The results of the investigations are mapped in Figure 5, and are detailed in Appendix A and B.

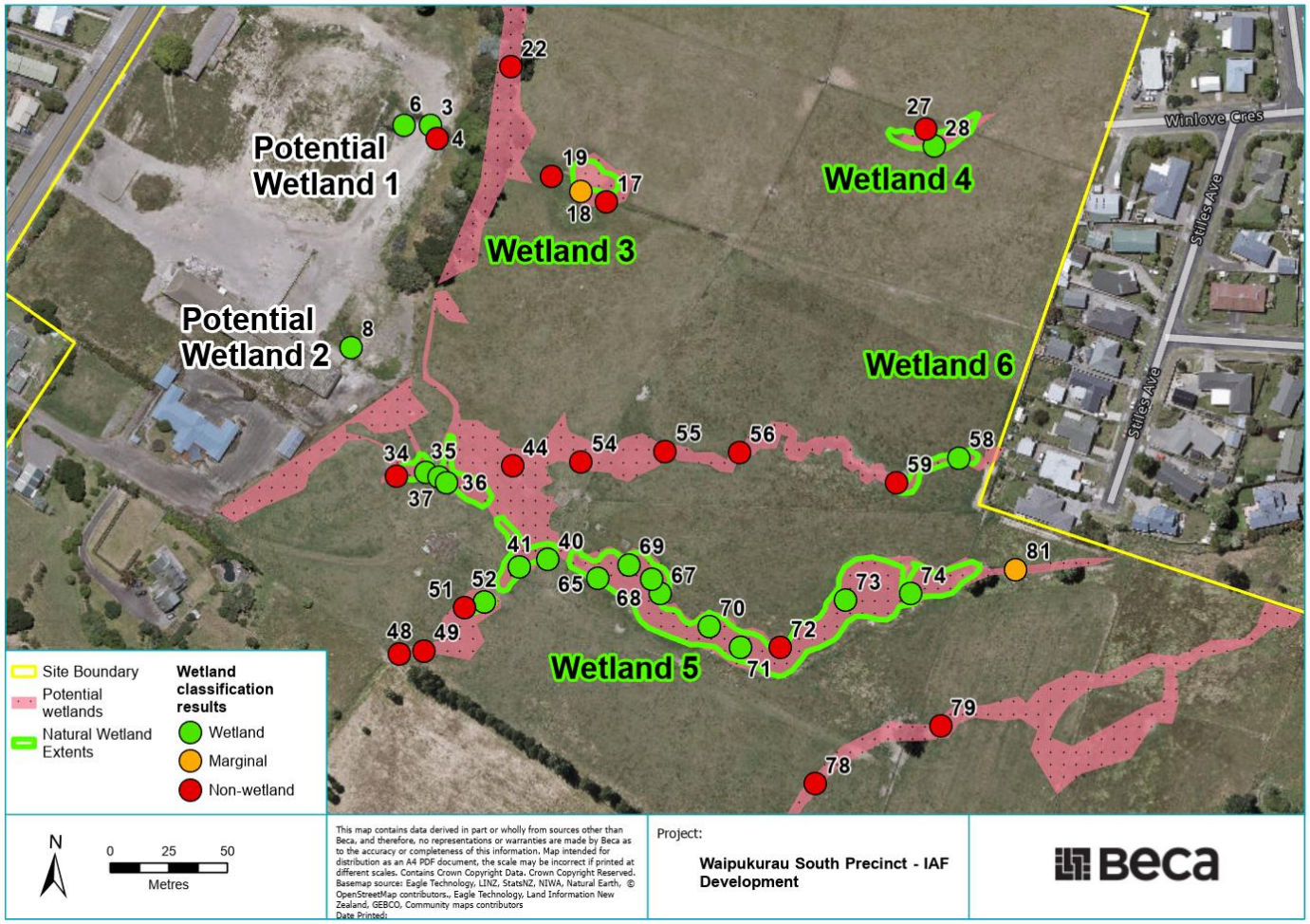


Figure 5. Plot locations and wetland extents at the time of the site visit. Potential Wetlands confirmed as ‘natural inland wetlands’ against the NPS-FM and NES-F are bolded in green, and their ‘natural inland wetland’ extents are indicated using green outlines.

4.1 Potential Wetlands 1 and 2

Potential Wetlands 1 (178m²) and 2 (139m²) are located within a small depression formed following the demolishing of derelict buildings at the old hospital site.

4.1.1 Hydrology and soils

Soils were not investigated due to their modified nature, but upper layers are expected to consist of debris and/or fill and are not considered to be hydric.

Potential Wetland 1 was in a very shallow low-lying area. A potential outfall was identified in the bank that may be feeding the wetland, however, as the outfall was not mapped, and was overgrown with weeds and not clearly visible, this was not able to be confirmed. It may just be debris/old pipes related to the old hospital buildings. A number of freshwater pond snails (*Physa* sp.; hydrology indicator 2J) were observed within the wetland.

Potential Wetland 2 consists of a closed, localised depression (hydrology indicator 4B) and passed the facultative neutral test (hydrology indicator 4D). The area was boggy at the time of the site visit.

Both Potential Wetlands are considered to have an induced wetland hydrology and consist predominantly of dryland vegetation during summer months.

4.1.2 Vegetation

Three plots were completed in the Potential Wetland 1 area and two of these were assessed as consisting of hydric vegetation. Vegetation in the plots with hydric vegetation was dominated by water speedwell (*Veronica anagallis-aquatica*) and creeping bent (*Agrostis stolonifera*)., and Yorkshire fog (*Holcus lanatus*). Other species included umbrella sedge (*Cyperus eragrostis*), Yorkshire fog (*Holcus lanatus*), plantain (*Plantago spp.*), *Lotus pedunculatus*, clover (*Trifolium sp.*), mercer grass *(Paspalum dilatatum*), celery leaved buttercup (Ranunculus sceleratus), *Carex sp., Epilobium sp., Juncus australis*, orchard grass (*Dactylis glomerata*), and rye grass (*Lolium perenne*). Free floating aquatic plants (*Lemna disperma* and *Azolla rubra*) were also present despite the lack of standing water, indicating the area was previously ponded. A few individuals identified as *Isoetes kirkii* (At Risk – Declining) were also recorded.

One plot was completed in Potential Wetland 2 and was assessed as consisting of hydric vegetation. Vegetation consisted predominantly of umbrella sedge with creeping bent and broad-leaved dock (*Rumex obtusifolius*) growing underneath. Surrounding vegetation consisted of *Juncus australis, Bromus* sp., jersey cudweed (*Helichrysum luteoalbum*), prostrate knotweed (*Polygonum aviculare*), blackberry (*Rubus fruticosus*), fennel (Foeniculum vulgare), and creeping mallow (*Modiola caroliniana*).

4.1.3 Summary

Although Potential Wetlands 1 and 2 have hydric vegetation, substrate consists of construction related debris and fill rather than typical hydric soils, and hydrology is induced as a result of land modification. This may have resulted in the adventitious establishment of wetland vegetation observed onsite.

As these two areas are located within a highly modified landform and no natural landscape features exist to suggest that these areas have restoration potential, professional judgement has been applied in determining the classification of these areas as **non-wetlands.**

4.2 Potential Wetland 3

Potential Wetland 3 is located in a shallow depression along a fence line within grazed pasture. The area is grazed by cattle and has extensive pugging which has likely exacerbated ponding. An artificial channel drains the Potential Wetland towards the east.

4.2.1 Hydrology and soils

As mentioned, the putative wetland is connected to an artificial drain, but is primarily fed by rain and surface water and thus has a palustrine hydro system. At the time of the site visit, a large area of surface water (hydrology indicator 1A) was present, despite the most recent rainfall occurring a week prior. Surface water was covered in free floating macrophytes (duckweed and mosquito fern) suggesting water had been there for a while.

Soil investigations were completed adjacent to Plot 18 and consisted of topsoil and silt loam over a layer of gley soils with mottling from 30cm. Low permeability gley soils are considered hydric and as water cannot infiltrate the low permeability soils, it is likely perched at very shallow depths in this location. During soil investigations, groundwater was noted trickling into the soil pit at 30cm (hydrology indicator 1B), supporting this.

The Potential Wetland is considered to have hydric soils and wetland hydrology.

4.2.2 Vegetation

The area covered by surface water with free floating macrophytes passes the rapid test, and thus no vegetation plot was undertaken.

Three plots were completed in the Potential Wetland 3 area and one of these (Plot 18) was assessed as consisting of hydric vegetation (Dominance test = 100%; Prevalence Index =2.2). Vegetation in the remaining two plots (Plots 17 and 19) was considered marginal and professional judgement was applied to classify these areas as non-wetland on the basis that all dominant species recorded were pasture species and facultative species.

All three plots had >50% pasture species cover, as they were dominated by Meadow foxtail (*Alopecurus pratensis*), duckweed, and hairy buttercup (*Ranunculus sardous*). A small amount of dock (*Rumex sp.*) is also present and areas of mosquito fern were present towards the northern edge of the Potential Wetland, outside of the plots.

4.2.3 Summary

The area of Potential Wetland 3 where surface water with free floating macrophytes is present (196m²) has been assessed as a **‘natural inland wetland’** as it has hydric vegetation, hydric soils and wetland hydrology. The wetland extent is reduced to discount the areas around Plots 17-19 which had more than 50% pasture species and is subject to the improved pasture exclusion criteria.



Wetland 3 – Plot 18



Wetland 3



Wetland 3 – soils from near plot 18



Wetland 3 – soils from near plot 18

4.3 Potential Wetland 4

Potential Wetland 4 is located in a shallow depression located at the top of an overland flow path/artificial drain within grazed pasture. The area is grazed by cattle and has extensive pugging which has likely exacerbated ponding.

4.3.1 Hydrology and soils

The putative wetland is expected to primarily be fed by rain and surface water and thus has a palustrine hydro system. At the time of the site visit, a small area of surface water (hydrology indicator 1A) was present near the fenceline and around Plot 28, despite the most recent rainfall occurring a week prior. Standing water had an oily film on the surface. Soil saturation is also visible on >1 recent aerial imagery (hydrology indicator 3F).

Soil investigations were completed adjacent to Plot 27 and were dominated by silt over a layer of gravel. This is consistent with soils types mapped on S-Map and described in Section 2 (Poporangi_2a.1 and Ruataniwha_7a.1; Manaaki Whenua, 2021). An impermeable pan is likely present beyond the depth investigated, resulting in poor drainage. During soil investigations, groundwater was noted trickling into the soil pit at 28cm (hydrology indicator 1B).

The Potential Wetland is considered to have hydric soils and wetland hydrology.

4.3.2 Vegetation

Two plots were completed in the Potential Wetland 4 area.

One of these (Plot 28) was assessed as consisting of hydric vegetation (Dominance test = 100%; Prevalence Index =1.9). Vegetation within the wetland plot was dominated by Meadow foxtail and slender spike sedge (*Eleocharis gracilis*). Other species present included sweetgrass (*Glyceria sp*. – *G. declinata* or *G. fluitans*), hairy buttercup and dock. The plot had a pasture cover of 40%, although this may increase in drier summer months.

Vegetation in the other plot (Plot 27) was assessed as non-wetland on the basis that 90% of vegetation cover was Meadow foxtail, a facultative pasture species.

4.3.3 Summary

Potential Wetland 4 is approximately 252m² and has been assessed as **'natural inland wetland'** as it has hydric vegetation, poorly drained soils and wetland hydrology. The wetland extent delineates an area that considers the 'improved pasture exclusion' criteria derived from plot vegetation data.



Wetland 4



Wetland 4 – Plot 27



Wetland 3 – soils from Plot 27



Wetland 3 - soils from Plot 27

4.4 Potential Wetland 5

Potential Wetland 5 is located in a wide, shallow concave channel that is fed via a stormwater outfall to the east as well as via rain and surface water. In aerial imagery from 1949, the depression in the western most area does not appear to exist. It is likely that this area has formed as a result of stormwater discharges combined with human modifications. The central and eastern section consists of the wetland are present in historic aerials, but more of a defined channel is visible in the central area compared to the present day, and a constructed pond is present within the eastern section. Currently the wetland is extremely pugged due to stock access and is culverted under farm tracks in a number of locations. Downstream, it is more characteristic of a stream with slightly more gradient and flow and a defined channel outside of the Site boundary where stock is excluded.

4.4.1 Hydrology and soils

The putative wetland is fed via a stormwater discharge outfall that drains to a wide shallow channel located that has little flow due to the low gradient of the area. This area develops into a stream towards the eastern most section of the Site. At the time of the site visit, multiple indicators of hydrology were present including surface water (hydrology indicator 1A) or soil saturation (hydrology indicator 1C), geomorphic position (hydrology indicator 4B), and ≥50% of plants species FACW and/or OBL (hydrology indicator 4C). Soil saturation is also visible on >1 recent aerial imagery (hydrology indicator 3F) and S-Map data indicates a semi-impermeable or impermeable pan may be present within 60cm of the soil surface (hydrology indicator 4C).

Soil investigations were completed adjacent to Plot 40 and Plot 68 and were predominantly silt with soils at Plot 40 being paler in colour than Plot 68. In Plot 40, an impermeable layer (potentially artificial) was encountered at 20cm depth. This was not present at Plot 68, but soils were saturated in this location with water shimmering on the soil surface (hydrology indicator 1C). Soils were generally consistent with soils types mapped on S-Map and described in Section 2 (Poporangi_2a.1 and Ruataniwha_7a.1; Manaaki Whenua, 2021).

The Potential Wetland is considered to have hydric soils and wetland hydrology.

4.4.2 Vegetation

A number of plots were completed in this area (Plots 34-52 and 65-74). Those mapped as wetland generally passed the rapid test and had prevalence index scores ranging from 1.0-2.1. No plots done in this area had more than 50% pasture cover

Vegetation within Potential Wetland 5 included areas dominated by starwort (*Callitriche stagnalis*), monkey musk (*Erythranthe guttata*), sweetgrass (*Glyceria* sp.), jointed rush (*Juncus articulatus*), soft rush (*Juncus effusus*), yorkshire fog and watercress (*Nasturtium officinale*). Other species present included water speedwell, dock species, creeping buttercup, rye grass, duckweed, hairy buttercup, celery leaved buttercup (*Ranunculus sceleratus*), meadow foxtail, clover, and creeping bent.

4.4.3 Summary

Potential Wetland 5 has been assessed as **‘natural inland wetland’** as it has hydric vegetation, hydric soils and wetland hydrology (albeit induced to some extent as a result of stormwater inflows and modification). This wetland is approximately 3,354m² and is the largest wetland on the Site.



Wetland 5 – outfall pipe



Wetland 5 – near plot 35



Wetland 5



Wetland 5



Wetland 5 – soils from plot 68.



Wetland 5 – soils from plot 40 with impermeable surface at base.

4.5 Potential Wetland 6

Potential Wetland 6 is located along an overland flow path within a shallow depression within grazed pasture. This depression is also visible in historic aerial imagery. Currently, an artificial channel drains the wetland and runs along the property boundary towards the east.

4.5.1 Hydrology and soils

The putative wetland is expected to primarily be fed by rain and surface water that travels along the upstream section of the overland flow path before collecting within the wider shallow depression that forms Potential Wetland 6. The part of the flow path colonised by wetland vegetation was likely larger prior to the construction of the drain at the eastern boundary of the Site. At the time of the site visit, multiple indicators of hydrology were present including surface water (hydrology indicator 1A) or soil saturation (hydrology indicator 1C), and geomorphic position (hydrology indicator 4B). Soil saturation is also visible on >1 recent aerial imagery (hydrology indicator 3F) and S-Map data indicates a semi-impermeable or impermeable pan may be present within 60cm of the soil surface (hydrology indicator 4C).

Soil investigations were not completed within the Potential Wetland area itself but were undertaken near Plot 55 within the upstream section of the flow path. Soils here consisted of silt loam and were saturated from 20cm, with water flowing in from 35cm. Soils were generally consistent with soils types mapped on S-Map and described in Section 2 (Poporangi_2a.1 and Ruataniwha_7a.1; Manaaki Whenua, 2021).

The Potential Wetland is considered to have hydric soils and wetland hydrology.

4.5.2 Vegetation

Two plots were completed in the Potential Wetland 6 area, as well as an additional three plots further upstream. Of the two plots confirmed to be wetland, one of these (Plot 58) was assessed as consisting of hydric vegetation (Dominance test = 100%; Prevalence Index =2.0). Vegetation in the other plot (Plot 59) was considered marginal (Dominance test = 50%; Prevalence Index =3.0) but has been classified as wetland on the basis that obligate species were recorded within the plot.

Vegetation within the Plot 58 was dominated by *Glyceria* sp., while vegetation within plot 59 was dominated by meadow foxtail and rye grass (both pasture species). Other species present included creeping bent, Epilobium sp., jointed rush, broad-leaved plantain, creeping buttercup, celery-leaved buttercup, clustered dock and broad-leaved dock. Only plot 59 had >50% pasture species cover.

4.5.3 Summary

Potential Wetland 6 has been assessed as **‘natural inland wetland’** as it has hydric vegetation (concentrated towards the eastern edge), hydric soils and wetland hydrology. The wetland extent delineates an area that considers the ‘improved pasture exclusion’ criteria derived from plot vegetation data.



Wetland 6 looking toward the drain along the eastern boundary.



Wetland 6 near plot 58.



Wetland 6 near plot 59



Nearby soils from adjacent to Plot 55

5 Conclusion

Initial investigations at the site were conducted in 2022, and an initial classification made in accordance with a definition of 'natural wetland' contained in the then-current NPS-FM and NES-F regulations governing wetland management. Since that time, changes have been made to the NPS-FM and NES-F. This updated report has used the data collected in 2022 to be re-classified in accordance with the current (as of the date of this report) regulations governing wetland management from the NES-F 2022.

Six potential wetlands were identified within the site, of which four are assessed as being 'natural inland wetlands'. These four wetlands were all in extremely degraded condition due to ongoing stock access, but nevertheless, retained enough characteristics to be classified as 'natural inland wetlands' and are subject to NES-F considerations.

The density and extent of wetland vegetation cover is expected to vary throughout these areas based on land use practices (all of the 'natural wetland' areas are currently grazed and unfenced), and weather patterns.

6 References

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7 Limitations

This report has been prepared by Beca Ltd solely for Central Hawkes Bay Regional Council (the client). This report is prepared for the purpose of the classification and delineation of wetlands at the Site (Scope). 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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Sensitivity: General

A

Appendix A: Wetland Plot – Vegetation Data

Appendix A: Wetland Plots – Vegetation Data

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
3	Kārearea	*Azolla rubra*	*1*	*no*	OBL	No	Native
3	Quillwort	*Isoetes kirkii*	*5*	*no*	OBL	No	Endemic
3	Water speedwell	*Veronica anagallis-aquatica*	*35*	*yes*	OBL	No	Exotic
3	Creeping bent	*Agrostis stolonifera*	*35*	*yes*	FACW	No	Exotic
3	White clover	*Trifolium repens*	*2*	*no*	FACU	Yes	Exotic
3	Narrow-leaved plantain	*Plantago lanceolata*	*1*	*no*	FACU	Yes	Exotic
3	Yorkshire fog	*Holcus lanatus*	*10*	*no*	FAC	Yes	Exotic
3	Umbrella sedge	*Cyperus eragrostis*	*15*	*no*	FACW	No	Exotic
3	Broad-leaved plantain	*Plantago major*	*3*	*no*	FACU	No	Exotic
3	Duckweed	*Lemna disperma*	*10*	*no*	OBL	No	Native
3	Celery-leaved buttercup	*Ranunculus sceleratus*	*1*	*no*	OBL	No	Exotic
4	Meadow foxtail	*Alopecurus pratensis*	*5*	*no*	FAC	Yes	Exotic
4	White clover	*Trifolium repens*	*5*	*no*	FACU	Yes	Exotic
4	Paspalum	*Paspalum dilatatum*	*7*	*no*	FACU	Yes	Exotic
4	Wild carrot	*Daucus carota*	*1*	*no*	UPL	No	Exotic
4	Broad-leaved plantain	*Plantago major*	*1*	*no*	FACU	No	Exotic
4	Water speedwell	*Veronica anagallis-aquatica*	*2*	*no*	OBL	No	Exotic
4	Yorkshire fog	*Holcus lanatus*	*80*	*yes*	FAC	Yes	Exotic
4	Quillwort	*Isoetes kirkii*	*1*	*no*	OBL	No	Endemic
4	Bristly oxtongue	*Helminthotheca echioides*	*1*	*no*	UPL	No	Exotic
4	Creeping bent	*Agrostis stolonifera*	*7*	*no*	FACW	No	Exotic
6	Water speedwell	*Veronica anagallis-aquatica*	*60*	*yes*	OBL	No	Exotic
6	White clover	*Trifolium repens*	*4*	*no*	FACU	Yes	Exotic
6	Narrow-leaved plantain	*Plantago lanceolata*	*20*	*no*	FACU	Yes	Exotic
6	Quillwort	*Isoetes kirkii*	*1*	*no*	OBL	No	Endemic
6	Perennial ryegrass	*Lolium perenne*	*5*	*no*	FACU	Yes	Exotic
6		*Juncus australis*	*5*	*no*	FACW	No	Native

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
6	Lotus	*Lotus pedunculatus*	*7*	*no*	FAC	Yes	Exotic
6		*Epilobium sp.*	*1*	*no*	FACW	No	Exotic
6		*Carex divisa*	*7*	*no*	FAC	No	Exotic
6	Cocksfoot	*Dactylis glomerata*	*1*	*no*	FACU	Yes	Exotic
8	Umbrella sedge	*Cyperus eragrostis*	*90*	*yes*	FACW	No	Exotic
8	Broad-leaved dock	*Rumex obtusifolius*	*5*	*no*	FAC	No	Exotic
8	Creeping bent	*Agrostis stolonifera*	*10*	*no*	FACW	No	Exotic
17	Hairy buttercup	*Ranunculus sardous*	*2*	*no*	FAC	No	Exotic
17	Meadow foxtail	*Alopecurus pratensis*	*90*	*yes*	FAC	Yes	Exotic
17	Duckweed	*Lemna disperma*	*1*	*no*	OBL	No	Native
18	Hairy buttercup	*Ranunculus sardous*	*7*	*no*	FAC	No	Exotic
18	Duckweed	*Lemna disperma*	*45*	*yes*	OBL	No	Native
18	Clustered dock	*Rumex conglomeratus*	*2*	*no*	FAC	No	Exotic
18	Meadow foxtail	*Alopecurus pratensis*	*65*	*yes*	FAC	Yes	Exotic
19	Hairy buttercup	*Ranunculus sardous*	*35*	*yes*	FAC	No	Exotic
19	Meadow foxtail	*Alopecurus pratensis*	*60*	*yes*	FAC	Yes	Exotic
22	Broad-leaved dock	*Rumex obtusifolius*	*3*	*no*	FAC	No	Exotic
22	Hairy buttercup	*Ranunculus sardous*	*40*	*yes*	FAC	No	Exotic
22	Broad-leaved plantain	*Plantago major*	*1*	*no*	FACU	No	Exotic
22	Scrambling speedwell	*Veronica persica*	*5*	*no*	UPL	No	Exotic
22	Perennial ryegrass	*Lolium perenne*	*30*	*yes*	FACU	Yes	Exotic
22	Mallow	*Malva sp.*	*5*	*no*	UPL	No	Exotic
27	Meadow foxtail	*Alopecurus pratensis*	*90*	*yes*	FAC	Yes	Exotic
27	Jointed rush	*Juncus articulatus*	*10*	*no*	FACW	No	Exotic
27	White clover	*Trifolium repens*	*2*	*no*	FACU	Yes	Exotic
28	Slender spike sedge	*Eleocharis gracilis*	*50*	*yes*	OBL	No	Native
28	Hairy buttercup	*Ranunculus sardous*	*2*	*no*	FAC	No	Exotic
28	Sweetgrass	*Glyceria sp.*	*5*	*no*	OBL	No	Exotic
28	Meadow foxtail	*Alopecurus pratensis*	*40*	*yes*	FAC	Yes	Exotic

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
28	Clustered dock	*Rumex conglomeratus*	*2*	*no*	FAC	No	Exotic
34	Meadow foxtail	*Alopecurus pratensis*	*85*	*yes*	FAC	Yes	Exotic
34	White clover	*Trifolium repens*	*5*	*no*	FACU	Yes	Exotic
34	Curled dock	*Rumex crispus*	*1*	*no*	FAC	No	Exotic
35	Watercress	*Nasturtium officinale*	*95*	*yes*	OBL	No	Exotic
35	Creeping buttercup	*Ranunculus repens*	*5*	*no*	FAC	No	Exotic
35	Creeping bent	*Agrostis stolonifera*	*10*	*no*	FACW	No	Exotic
36	Jointed rush	*Juncus articulatus*	*40*	*yes*	FACW	No	Exotic
36	Yorkshire fog	*Holcus lanatus*	*2*	*no*	FAC	Yes	Exotic
36	Creeping bent	*Agrostis stolonifera*	*5*	*no*	FACW	No	Exotic
37	Jointed rush	*Juncus articulatus*	*1*	*no*	FACW	No	Exotic
37	Monkey musk	*Erythranthe guttata*	*75*	*yes*	OBL	No	Exotic
37	Watercress	*Nasturtium officinale*	*20*	*no*	OBL	No	Exotic
37	Creeping bent	*Agrostis stolonifera*	*10*	*no*	FACW	No	Exotic
37	Creeping buttercup	*Ranunculus repens*	*5*	*no*	FAC	No	Exotic
37	Water speedwell	*Veronica anagallis-aquatica*	*1*	*no*	OBL	No	Exotic
40	Monkey musk	*Erythranthe guttata*	*30*	*yes*	OBL	No	Exotic
40	Watercress	*Nasturtium officinale*	*35*	*yes*	OBL	No	Exotic
40	Sweetgrass	*Glyceria sp.*	*10*	*no*	OBL	No	Exotic
40	Jointed rush	*Juncus articulatus*	*2*	*no*	FACW	No	Exotic
40	Yorkshire fog	*Holcus lanatus*	*15*	*no*	FAC	Yes	Exotic
41	Water speedwell	*Veronica anagallis-aquatica*	*25*	*no*	OBL	No	Exotic
41	Starwort	*Callitriche stagnalis*	*40*	*yes*	OBL	No	Exotic
41	Duckweed	*Lemna disperma*	*25*	*no*	OBL	No	Native
41	Sweetgrass	*Glyceria sp.*	*50*	*yes*	OBL	No	Exotic
41	Curled dock	*Rumex crispus*	*1*	*no*	FAC	No	Exotic
44	Meadow foxtail	*Alopecurus pratensis*	*95*	*yes*	FAC	Yes	Exotic
44	White clover	*Trifolium repens*	*2*	*no*	FACU	Yes	Exotic
44	Perennial ryegrass	*Lolium perenne*	*3*	*no*	FACU	Yes	Exotic

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
44	Cocksfoot	*Dactylis glomerata*	*5*	*no*	FACU	Yes	Exotic
49	Meadow foxtail	*Alopecurus pratensis*	*50*	*yes*	FAC	Yes	Exotic
49	Starwort	*Callitriche stagnalis*	*10*	*no*	OBL	No	Exotic
49	Perennial ryegrass	*Lolium perenne*	*10*	*no*	FACU	Yes	Exotic
49	Hairy buttercup	*Ranunculus sardous*	*5*	*no*	FAC	No	Exotic
49	Clustered dock	*Rumex conglomeratus*	*5*	*no*	FAC	No	Exotic
49	Yorkshire fog	*Holcus lanatus*	*5*	*no*	FAC	Yes	Exotic
51	Meadow foxtail	*Alopecurus pratensis*	*80*	*yes*	FAC	Yes	Exotic
51	Hairy buttercup	*Ranunculus sardous*	*10*	*no*	FAC	No	Exotic
51	White clover	*Trifolium repens*	*2*	*no*	FACU	Yes	Exotic
51	Yorkshire fog	*Holcus lanatus*	*10*	*no*	FAC	Yes	Exotic
51	Perennial ryegrass	*Lolium perenne*	*10*	*no*	FACU	Yes	Exotic
52		*Hydrocotyle heteromeria*	*1*	*no*	FACU	No	Endemic
52	Sweetgrass	*Glyceria sp.*	*70*	*yes*	OBL	No	Exotic
52	Perennial ryegrass	*Lolium perenne*	*10*	*no*	FACU	Yes	Exotic
52	Meadow foxtail	*Alopecurus pratensis*	*10*	*no*	FAC	Yes	Exotic
54	Hairy buttercup	*Ranunculus sardous*	*40*	*yes*	FAC	No	Exotic
54	Meadow foxtail	*Alopecurus pratensis*	*15*	*no*	FAC	Yes	Exotic
54	Narrow-leaved plantain	*Plantago lanceolata*	*2*	*no*	FACU	Yes	Exotic
54	Rough-stalked meadow grass	*Poa trivialis*	*50*	*yes*	FACU	Yes	Exotic
55	White clover	*Trifolium repens*	*10*	*no*	FACU	Yes	Exotic
55	Meadow foxtail	*Alopecurus pratensis*	*40*	*yes*	FAC	Yes	Exotic
55	Perennial ryegrass	*Lolium perenne*	*45*	*yes*	FACU	Yes	Exotic
56	Yorkshire fog	*Holcus lanatus*	*15*	*no*	FAC	Yes	Exotic
56	Meadow foxtail	*Alopecurus pratensis*	*85*	*yes*	FAC	Yes	Exotic
56	White clover	*Trifolium repens*	*2*	*no*	FACU	Yes	Exotic
56	Clustered dock	*Rumex conglomeratus*	*2*	*no*	FAC	No	Exotic
58	Clustered dock	*Rumex conglomeratus*	*5*	*no*	FAC	No	Exotic
58	Creeping buttercup	*Ranunculus repens*	*20*	*no*	FAC	No	Exotic

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
58	Broad-leaved plantain	*Plantago major*	*1*	*no*	FACU	No	Exotic
58	Creeping bent	*Agrostis stolonifera*	*5*	*no*	FACW	No	Exotic
58	Sweetgrass	*Glyceria sp.*	*60*	*yes*	OBL	No	Exotic
58	Perennial ryegrass	*Lolium perenne*	*10*	*no*	FACU	Yes	Exotic
58	Meadow foxtail	*Alopecurus pratensis*	*10*	*no*	FAC	Yes	Exotic
59	Jointed rush	*Juncus articulatus*	*1*	*no*	FACW	No	Exotic
59	Broad-leaved dock	*Rumex obtusifolius*	*3*	*no*	FAC	No	Exotic
59	Celery-leaved buttercup	*Ranunculus sceleratus*	*15*	*no*	OBL	No	Exotic
59	Creeping buttercup	*Ranunculus repens*	*2*	*no*	FAC	No	Exotic
59	Sweetgrass	*Glyceria sp.*	*10*	*no*	OBL	No	Exotic
59	Meadow foxtail	*Alopecurus pratensis*	*30*	*yes*	FAC	Yes	Exotic
59	Perennial ryegrass	*Lolium perenne*	*50*	*yes*	FACU	Yes	Exotic
59		*Epilobium sp.*	*2*	*no*	FACW	No	Exotic
65	Water speedwell	*Veronica anagallis-aquatica*	*15*	*no*	OBL	No	Exotic
65	Watercress	*Nasturtium officinale*	*2*	*no*	OBL	No	Exotic
65	Sweetgrass	*Glyceria sp.*	*55*	*yes*	OBL	No	Exotic
65	Celery-leaved buttercup	*Ranunculus sceleratus*	*1*	*no*	OBL	No	Exotic
65	Broad-leaved dock	*Rumex obtusifolius*	*3*	*no*	FAC	No	Exotic
67	Clustered dock	*Rumex conglomeratus*	*2*	*no*	FAC	No	Exotic
67	Jointed rush	*Juncus articulatus*	*25*	*yes*	FACW	No	Exotic
67	Sweetgrass	*Glyceria sp.*	*80*	*yes*	OBL	No	Exotic
67	Creeping bent	*Agrostis stolonifera*	*1*	*no*	FACW	No	Exotic
67	Meadow foxtail	*Alopecurus pratensis*	*5*	*no*	FAC	Yes	Exotic
68	Meadow foxtail	*Alopecurus pratensis*	*10*	*no*	FAC	Yes	Exotic
68	Sweetgrass	*Glyceria sp.*	*40*	*yes*	OBL	No	Exotic
68	Jointed rush	*Juncus articulatus*	*50*	*yes*	FACW	No	Exotic
68	White clover	*Trifolium repens*	*2*	*no*	FACU	Yes	Exotic
68	Creeping bent	*Agrostis stolonifera*	*5*	*no*	FACW	No	Exotic
68	Hairy buttercup	*Ranunculus sardous*	*5*	*no*	FAC	No	Exotic

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
69	Sweetgrass	*Glyceria sp.*	*70*	*yes*	OBL	No	Exotic
69	Meadow foxtail	*Alopecurus pratensis*	*40*	*yes*	FAC	Yes	Exotic
70	Perennial ryegrass	*Lolium perenne*	*10*	*no*	FACU	Yes	Exotic
69	Hairy buttercup	*Ranunculus sardous*	*1*	*no*	FAC	No	Exotic
70	Soft rush	*Juncus effusus*	*45*	*yes*	FACW	No	Exotic
70	Perennial ryegrass	*Lolium perenne*	*5*	*no*	FACU	Yes	Exotic
70	Sweetgrass	*Glyceria sp.*	*40*	*yes*	OBL	No	Exotic
70	Celery-leaved buttercup	*Ranunculus sceleratus*	*1*	*no*	OBL	No	Exotic
70	Curled dock	*Rumex crispus*	*3*	*no*	FAC	No	Exotic
70	Yorkshire fog	*Holcus lanatus*	*25*	*yes*	FAC	Yes	Exotic
71	Watercress	*Nasturtium officinale*	*70*	*yes*	OBL	No	Exotic
71	Soft rush	*Juncus effusus*	*5*	*no*	FACW	No	Exotic
71	Sweetgrass	*Glyceria sp.*	*25*	*yes*	OBL	No	Exotic
71	Jointed rush	*Juncus articulatus*	*2*	*no*	FACW	No	Exotic
71	Yorkshire fog	*Holcus lanatus*	*5*	*no*	FAC	Yes	Exotic
71	Water speedwell	*Veronica anagallis-aquatica*	*2*	*no*	OBL	No	Exotic
72	White clover	*Trifolium repens*	*5*	*no*	FACU	Yes	Exotic
72	Meadow foxtail	*Alopecurus pratensis*	*25*	*yes*	FAC	Yes	Exotic
72	Perennial ryegrass	*Lolium perenne*	*80*	*yes*	FACU	Yes	Exotic
72	Curled dock	*Rumex crispus*	*1*	*no*	FAC	No	Exotic
73	Sweetgrass	*Glyceria sp.*	*75*	*yes*	OBL	No	Exotic
73	Jointed rush	*Juncus articulatus*	*2*	*no*	FACW	No	Exotic
73	Soft rush	*Juncus effusus*	*2*	*no*	FACW	No	Exotic
74	Watercress	*Nasturtium officinale*	*60*	*yes*	OBL	No	Exotic
74	Curled dock	*Rumex crispus*	*2*	*no*	FAC	No	Exotic
74	Sweetgrass	*Glyceria sp.*	*40*	*yes*	OBL	No	Exotic
78	Celery-leaved buttercup	*Ranunculus sceleratus*	*5*	*no*	OBL	No	Exotic
78	Meadow foxtail	*Alopecurus pratensis*	*90*	*yes*	FAC	Yes	Exotic
78	Crane's bill geranium	*Geranium molle*	*1*	*no*	UPL	No	Exotic

Plot number	Common name	Species name	Percentage cover (%)	Dominant?	Status	Pasture species?	Biostatus
78	Curled dock	*Rumex crispus*	*2*	*no*	FAC	No	Exotic
79	Perennial ryegrass	*Lolium perenne*	*85*	*yes*	FACU	Yes	Exotic
79	Hairy buttercup	*Ranunculus sardous*	*5*	*no*	FAC	No	Exotic
79	Curled dock	*Rumex crispus*	*2*	*no*	FAC	No	Exotic
81	Sweetgrass	*Glyceria sp.*	*45*	*yes*	OBL	No	Exotic
81	Water speedwell	*Veronica anagallis-aquatica*	*15*	*no*	OBL	No	Exotic
81	Watercress	*Nasturtium officinale*	*50*	*yes*	OBL	No	Exotic
81	Starwort	*Callitriche stagnalis*	*1*	*no*	OBL	No	Exotic
81	Meadow foxtail	*Alopecurus pratensis*	*10*	*no*	FAC	Yes	Exotic

Sensitivity: General

B

Appendix B: Wetland Plots – Investigation Results

Appendix B: Wetland Plots – Investigation Results

Table 1. Results of wetland investigations.

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydric vegetation	Hydrology indicators	Soils	Classification	Label	Notes
3	Pass	Fail - 11%	Pass - 100 %	Pass - 1.8	Yes	2J (*Physa* sp.).	N/A - modified substrate	**Non-wetland**. (induced – professional judgement applied)	Wetland 1	Artificial, shallow depression within old hospital site. At risk plant species present (*Isoetes kirkii*). Potentially fed via outflow within bank.
4	Fail	Pass - 88%	Pass - 100 %	Marginal - 3.0	Uncertain		N/A - modified substrate	**Non-wetland**. All dominants are pasture sp. and FAC. More characteristic of a narrow flow path.	N/A	Plot within small flow path that drains small depression (plots 3 and 6).
6	Pass	Fail - 33%	Pass - 100 %	Pass - 2.1	Yes	1C	N/A - modified substrate	**Non-wetland**. (induced – professional judgement applied)	Wetland 1	Artificial shallow depression within old hospital site. Potentially fed via outflow within bank.
8	Pass	Fail - 0%	Pass - 100 %	Pass - 2.1	Yes	4B, 4D	N/A - modified substrate	**Non-wetland**. (induced – professional judgement applied)	Wetland 2	Artificial depression within old hospital site. Boggy in areas. Surrounded by exotic herbaceous weeds.
17	Fail	Pass - 97%	Pass - 100 %	Marginal - 3.0	Uncertain	1B	Not investigated	**Non-wetland**. All dominants are pasture sp. and FAC. Only 1% OBL cover and no FACW cover.	N/A	Towards edge of boggy area in paddock. Pugged.
18	Fail	Pass - 55%	Pass - 100 %	Pass - 2.2	Yes	1A	0-30cm: topsoil >30cm: dark grey clay with	**Non-wetland (Marginal)**. OBL species cover but	Wetland 3	Near centre of boggy area in paddock. Standing water covered in duckweed present adjacent. Artificial drain running towards east. Grazed by

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydric vegetation	Hydrology indicators	Soils	Classification	Label	Notes
							mottling. Water trickling in.	more than 50% pasture species.		cattle. Northern area has similar vegetation with areas of *Azolla rubra*. This has been mapped as wetland
19	Fail	Pass - 63%	Pass - 100 %	Marginal - 3.0	Inconclusive	1B	Not investigated	**Non-wetland**. All dominants are pasture sp. and FAC. No OBL or FACW cover.	N/A	Towards edge of boggy area in paddock. Pugged.
22	Fail	Fail - 36%	Fail - 50%	Fail - 3.6	No		Not investigated	**Non-wetland.**	N/A	Pugged area near trees where cows gather.
27	Fail	Pass - 90%	Pass - 100 %	Marginal - 2.9	Uncertain	1B	Hit rock/gravel under topsoil at 28cm. Water pooling.	**Non-wetland**. All dominants are pasture sp. and FAC but small amount of FACW cover. Likely wetland edge.	Wetland 4	Located on edge of low-lying depression.
28	Fail	Fail - 40%	Pass - 100 %	Pass - 1.9	Yes	1A, 4B	Not investigated - under water.	**Wetland**	Wetland 4	Located in centre of low-lying depression.
34	Fail	Pass - 99%	Pass - 100 %	Marginal - 3.1	Uncertain	1C	Not investigated	**Non-wetland**. All dominants are pasture sp. and FAC. No OBL or FACW cover.	N/A	Boggy, pugged area
35	Pass	Fail - 0%	Pass - 100 %	Pass - 1.2	Yes	1A, 4B	Layer of rock/gravel under topsoil. Water pooling.	**Wetland**	Potential Wetland 5	Standing water present - fed via stormwater outfall that drains to low lying depression not visible in historic aerials.
36	Pass	Fail - 4%	Pass - 100 %	Pass - 2.0	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	50% of plot covered in dead grass sp. (unidentified)
37	Pass	Fail - 0%	Pass - 100 %	Pass - 1.2	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	As 35.

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydric vegetation	Hydrology indicators	Soils	Classification	Label	Notes
40	Pass	Fail - 16%	Pass - 100 %	Pass - 1.4	Yes	1A, 4B	Layer of solid rock/impermeable surface under silty topsoil at 20cm.	**Wetland**	Potential Wetland 5	Pugged. Stock access. Culverted from north-west and again towards east.
41	Pass	Fail - 0%	Pass - 100 %	Pass - 1.0	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	As 35.
44	Fail	Pass - 100%	Pass - 100 %	Marginal - 3.1	Uncertain	Nil	Not investigated	**Non-wetland.** All dominants are pasture sp. and FAC. No OBL or FACW cover.	N/A	Dry pasture
49	Fail	Pass - 76%	Pass - 100 %	Pass - 2.9	Uncertain	1A	15-20cm of topsoil then low chroma silt and stones. Some mottles. Water flowing in from 27cm.	**Non-wetland**. All dominants are pasture sp. and FAC. Small amount of OBL cover due to macrophytes growing on water within ephemeral stream.	N/A	More characteristic of overland flow path/ephemeral stream.
51	Fail	Pass - 91%	Pass - 100 %	Marginal - 3.1	Uncertain	1C , 4B	Not investigated	**Non-wetland**. All dominants are pasture sp. and FAC. No OBL or FACW cover.	N/A	Boggy
52	Pass	Fail - 22%	Pass - 100 %	Pass - 1.6	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Fed via culvert from near Plot 40
54	Fail	Pass - 63%	Fail - 50%	Fail - 3.5	No	4B	Not investigated	**Non-wetland**	N/A	Very shallow overland flow path. Drier than 52 and dominated by pasture.
55	Fail	Pass - 100%	Fail - 50%	Fail - 3.6	No	1C, 4B	Silt loam. Saturated from 20cm. Water	**Non-wetland**	N/A	

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydric vegetation	Hydrology indicators	Soils	Classification	Label	Notes
							flowing in from 35cm.			
56	Fail	Pass - 98%	Pass - 100 %	Marginal - 3.0	Uncertain	1A, 4B	Not investigated	**Non-wetland.** All dominants are pasture sp. and FAC. No OBL or FACW cover.	N/A	Located in pugged overland flow path/concave channel
58	Pass	Fail - 18%	Pass - 100 %	Pass - 2.0	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 6	Located in pugged overland flow path/concave channel
59	Fail	Pass - 71%	Fail - 50%	Marginal- 3.0	Uncertain	1A, 4B	Not investigated	**Non-wetland.** Dominated by pasture and FAC/FACU species.	N/A	Located in pugged overland flow path/concave channel
65	Pass	Fail - 0%	Pass - 100 %	Pass - 1.1	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
67	Pass	Fail - 4%	Pass - 100 %	Pass - 1.4	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
68	Pass	Fail - 11%	Pass - 100 %	Pass - 1.8	Yes	1C, 4B	Dark, silty soil. Saturated.	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
69	Fail	Fail - 36%	Pass - 100 %	Pass - 1.7	Yes	1C, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
70	Fail	Fail - 31%	Pass - 100 %	Pass - 2.1	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
71	Pass	Fail - 5%	Pass - 100 %	Pass - 1.2	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide

Plot	Rapid Test	Pasture Test	Dominance Test	Prevalence Index	Hydric vegetation	Hydrology indicators	Soils	Classification	Label	Notes
72	Fail	Pass - 99%	Fail - 50%	Fail - 3.8	No	1C, 4B	Silty clay soils. High plasticity	**Non-wetland**	N/A	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
73	Pass	Fail - 0%	Pass - 100 %	Pass - 1.1	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
74	Pass	Fail - 0%	Pass - 100 %	Pass - 1.0	Yes	1A, 4B	Not investigated	**Wetland**	Potential Wetland 5	Located in pugged stream/historic channel visible in old aerial imagery. Defined channel is shallow and wide
78	Fail	Pass - 92%	Pass - 100 %	Marginal – 3.0	Uncertain	4B, 4C	0-20cm topsoil. 20-30cm silt. >30cm low chroma clay. Moist but not water table encountered.	**Non-wetland.** All dominants are pasture sp. and FAC. No OBL or FACW cover.	N/A	Located in overland flow path/intermittent stream. Pugged from stock access
79	Fail	Pass - 92%	Fail - 0%	Fail - 3.9	No	1A	Not investigated	**Non-wetland**	N/A	
81	Pass	Fail - 8%	Pass - 100 %	Pass - 1.2	Yes	1A	Not investigated	**Non-wetland (marginal)**. Pugged stream colonised by macrophytes. Defined channel still exists and reverts to a stream at boundary fence	N/A	Located on slight gradient compared to upstream wetland. More characteristic of pugged stream. True right still has a defined bank. Approx 2.5m wide but narrows to more defined channel outside of property.

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14 February 2025

Attention: Kim Anstey

Dear Kim

Waipukarau South Development Area – Wetland Assessment

1 Background

Central Hawkes Bay District Council (CHBDC) is currently formalizing the layout of 'Development Area 1 of the Waipukurau South Precinct' (hereafter referred to as the 'Site') through a Structure Plan and is developing provisions to be included in the District Plan by way of a plan change to give effect to the Precinct.

Beca Ltd has been commissioned by CHBDC to undertake a high-level review of the impact of the Structure Plan on identified 'natural inland wetlands' to support CHBDC in developing and restoring wetlands at the Site (see Figure 1). This assessment is based on the wetland delineation results from *Waipukurau South Precinct - Wetland Assessment (updated Feb 2025) (Beca Ltd, 2025)*[1], which identified four 'natural inland wetlands' and determined their spatial extents according to *the National Policy Statement for Freshwater Management 2022 Amendment 1 (NPS-FM)* and the *National Environmental Standard for Freshwater 2022 (NES-F)* (see Figure 1 for wetland locations). The delineation of these wetlands was completed using the field data collected in 2022.

This wetland assessment examines the potential impacts of the Proposed Structure Plan on the four 'natural inland wetlands' and provides recommendations for their protection and ecological enhancement.

[1] Beca Ltd. (2025). *Waipukurau South Precinct - Wetland Assessment (updated Feb 2025).* Prepared for Central Hawkes Bay District Council.

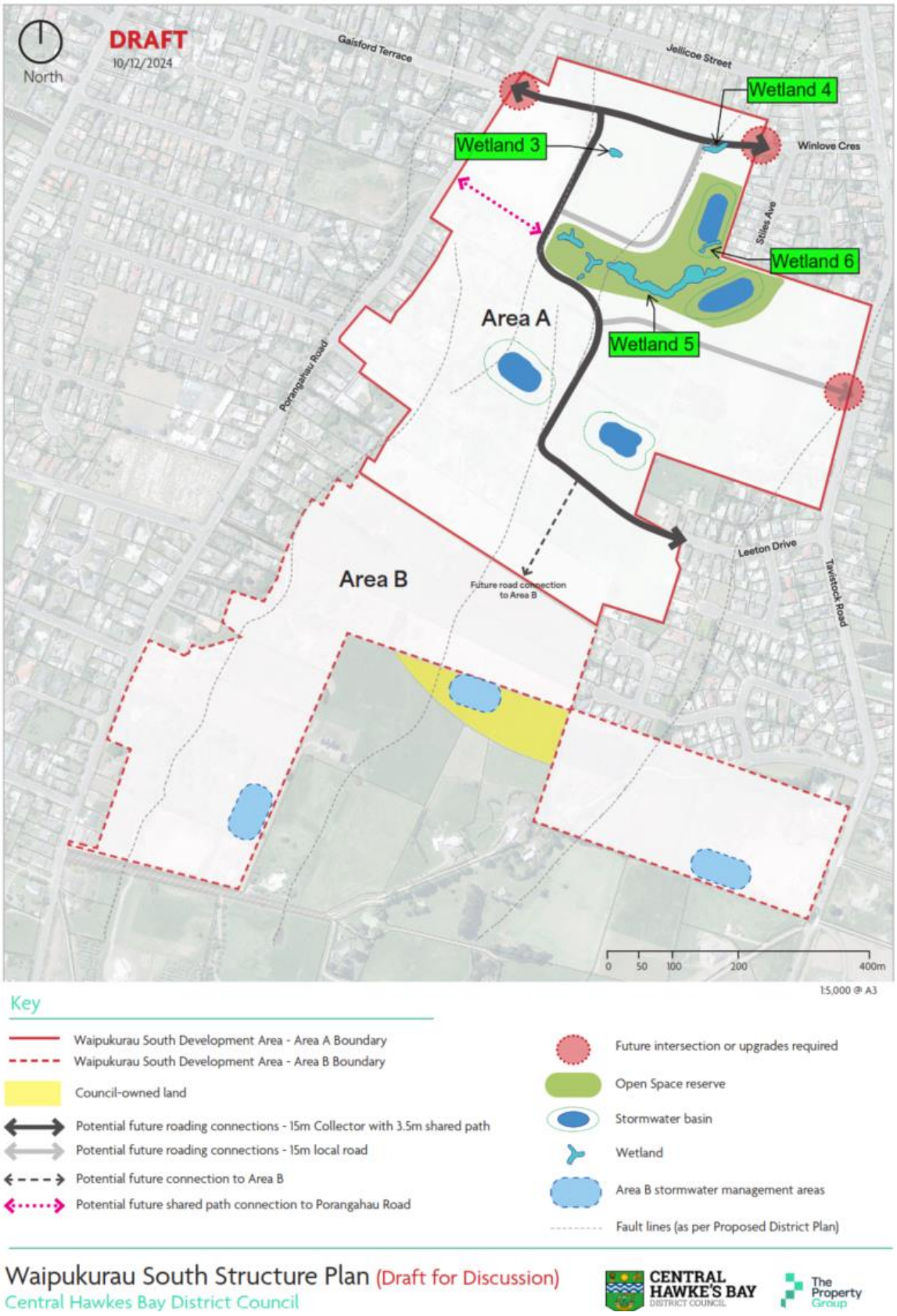


Figure 1. The Proposed Structure Plan, including the spatial extents of the 'natural inland wetlands ‘delineated by Beca Ltd (2025).

2 Potential ecological effects

The impact of the Proposed Structure Plan on the four 'natural inland wetlands' were considered at a high level, and overall, it is expected to have positive impacts in the long-term.

1. The Proposed Structure Plan **appears designed to avoid direct impacts on all 'natural inland wetlands'** by planning the road and development footprints outside the wetland extents. It is expected that all four wetlands will be protected from future development based on their explicit inclusion into the structure plan. While the current structure plan shows that Wetlands 3 and 4 are in close proximity to planned road connections, it has been assumed that these two features will be able to be avoided when the plan is developed at a more detailed scale.
2. Where there is **land modification (earthworks / topographic change), there is a possibility that hydrological parameters that contribute to maintaining 'natural inland wetlands' hydrology could also change**. Factors that contribute to these include the type of earthworks that may be undertaken, depth of cut / fill, extent of earthworks, and distance to existing wetlands. The direction of treated stormwater to the wetlands could also impact hydrological functioning. The wetlands identified are all considered to have a palustrine hydro-system, with the exception of Wetland 5 which is associated with stormwater/overland flow and a stream. If earthworks and typographical adjustments, and the introduction of treated stormwater, are minor, there may be limited impact on wetland function and habitat / extent – a positive result.
3. In addition to the above statements, during any implementation works for the Proposed Structure Plan, **construction works may also lead to the introduction of sediment** into the 'natural inland wetlands'. These effects are likely to be temporary, and with appropriate management and mitigation measures in place (such as erosion and sediment control; see Section 3), wetland habitat will likely recover following completion of works. It may be important to consider the length of disturbance and over the lifetime of development of the Precinct.
4. There are **opportunities to improve and derive ecological benefits for the 'natural inland wetlands' in the longer term**. It is noted that the Proposed Structure Plan currently includes Wetland 5 and Wetland 6 incorporated into a wider reserve. This will help to protect the existing values of the features, as well as providing opportunities for enhancement of their values – such as by planting (see Section 3). Additionally, degradation from stock access (e.g., pugging, grazing) will be reduced for all wetlands due to the land change from rural land use.

3 Recommendations

High level recommendations on protecting and enhancing the 'natural inland wetlands' have been outlined below.

Sediment and erosion control

If major excavation and sediment movement is required in proximity to the wetlands to implement the Proposed Structure Plan, it is recommended to undertake **sediment and erosion control measures** in accordance with good industry practice to reduce the amount of sediment entering the wetlands. This could include, but is not limited to, maintaining as large a distance between the wetlands and construction activities as practical, stabilized construction entranceways, silt fences, etc.

Buffer

It is recommended to maintain a buffer of at least 10 m between the wetlands and any planned road / development footprint to reduce edge effects. The effectiveness of the buffer, as well as its capacity to provide ecological benefits, can be enhanced through native planting (see below).

Native Wetland Planting

Active planting of wetland species within the wetland, and in a buffer around the wetland (e.g., 10 m buffer), can improve biodiversity values by increasing native species density and diversity, as well as protect the wetland against edge effects from the proposed roads. Within the wetland, it is recommended for the planting to focus on any gaps between the vegetation. In particular, the proposed reserve area could provide significant ecological benefits if planted, given that it will incorporate Wetland 5, the largest wetland area onsite.

Recommended native species for planting should be from the Heretaunga ecological district, in the Hawkes Bay ecological region, and should account for in-situ site conditions (e.g., hydric conditions of the wetland vs potentially drier conditions of the surrounding buffer area). A potential list of planting species based on current site conditions is shown in Table 1 below (Hawkes Bay Regional Council, n.d.-b, n.d.-a)[2]. If site conditions change, for example if the direction of treated stormwater increases water levels, then the list of planting species should be updated to align with the new conditions.

Table 1. Recommended list of species that could be used for native wetland and buffer planting.

Location	Common Name	Scientific Name
Wetland	Edgar's rush/wīwī	*Juncus edgariae*
	Cutty grass/rautahi	*Carex geminata*
	Pukio	*Carex secta/virgata*
	Sharp spike sedge	*Eleocharis acuta*
	Slender spike sedge (already present onsite)	*Eleocharis gracilis*
Buffer (damper conditions / lower slopes)	Flax	*Phormium tenax*
	Summer-flowering toetoe	*Austroderia fulvida*
Buffer (drier conditions / upper slopes)	Akeake	*Dodonaea viscosa*
	Black matipo / kōhūhū	*Pittosporum tenuifolium*
	Koromiko	*Veronica stricta*

4 Conclusion

The Proposed Structure Plan has the potential to provide overall positive ecological benefits to the 'natural inland wetlands' as despite some degradation from construction, there could be long-term protection of existing ecological values by the incorporation of Wetland 5 and 6 into a reserve, and the exclusion of stock. The Plan also appears to avoid direct impacts on the 'natural inland wetlands' by avoiding development within wetland extent.

Recommendations to protect and enhance wetland values include implementing sediment and control measures during construction, creating a buffer between the wetlands and the planned development, and planting native wetland species within the wetlands and surrounding buffer areas.

[2] Hawkes Bay Regional Council. (n.d.-a). *Planting native plants in Hawke's Bay*. https://www.hbrc.govt.nz/assets/Document-Library/Land-Management/Riparian-Planting-Guide.pdf

Hawkes Bay Regional Council. (n.d.-b). *Riparian Planting in Hawke's Bay*. https://www.hbrc.govt.nz/assets/Document-Library/Guides/18449-HBRC-RiparianBro-WEB.pdf

Yours sincerely

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Ecologist

on behalf of

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