Manaaki Whenua
Landcare Research

Otago wetland monitoring – interim report 2024

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Otago wetland monitoring – interim report 2024

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1 Introduction

Otago Regional Council (ORC) contracted Manaaki Whenua – Landcare Research to design and implement vegetation monitoring for four regionally significant wetlands.

2 Background

The upcoming Otago Land and Water Regional Plan (LWRP) details how national policy statements and regulations for wetland resource management are implemented in Otago. The following are the national regulations/guidelines that must be actioned:

- National Policy Statement for Freshwater Management (NPS-FM 2020)
- Resource Management (Stock Exclusion) Regulations 2020
- Resource Management (National Environmental Standards for Freshwater) Regulations 2020).

These guidelines and regulations set the standards for natural wetlands management and monitoring. The NPS-FM 2020 makes ecosystem health a compulsory value to monitor, and specifically lists ecological processes as one of five components of ecosystem health.

In 2022 ORC began working with Manaaki Whenua – Landcare Research to better understand the ecology of the Upper Taieri River scroll plain to inform a meaningful management and monitoring plan under the requirements of the NPS-FM 2020.

In 2023 ORC extended the wetland monitoring network by adding four regionally significant wetlands:

- Tahakopa River Bogs (Catlins Freshwater Management Unit [FMU])
- Lake Tuakitoto Wetland (Clutha River / Mata-Au FMU, Lower Clutha Rohe)
- Upper Black Swamp Marshes (Clutha River / Mata-Au FMU, Roxburgh Rohe)
- Fortification Creek Wetland Management Area (Clutha River / Mata-Au FMU, Roxburgh Rohe).

3 Objectives

Implement wetland vegetation monitoring for four regionally significant wetlands in Otago.

4 Methods

We followed Clarkson et al.'s (2004) wetland sampling method (which is widely used by other regional councils and supported by the Ministry for the Environment) to establish at least three permanent plots per major vegetation type per wetland, with a minimum of five plots per wetland.

Prior to fieldwork we randomly assigned 50 points per wetland using a spatially balanced design in ArcGIS (wetland polygons were supplied by ORC). More points were placed than required to provide alternative sampling locations in case the point was unsafe to sample or was located in an already sampled vegetation type. Figures 1 to 4 show the established plot locations for each wetland:

- Tahakopa River Bogs, 186 ha, eight plots.
- Lake Tuakitoto Wetland, 544 ha (half of the area is open water), eight plots
- Upper Black Swamp Marshes, 3.5 ha (between two separate areas), seven plots
- Fortification Creek Wetland Management Area, 526 ha, 21 plots.

For each plot we navigated to within 1 m of the GPS waypoint using a handheld GPS unit (Garmin GPSMAP 64s, average accuracy 3 m in open areas). The 5 × 5 m plot was laid out as detailed in Clarkson et al. 2004. All plots were established with the same aspect, starting at the south-west corner, and running a 20 m tape north and east around the edge of the plot. All four corners were permanently marked with an aluminium peg engraved with the plot name.

Vegetation sampling

The percentage cover across all height tiers (using the alive or attached dead photosynthetically active shoot biomass for each species) and cover classes in each height tier (<0.3 m, 0.3–1 m, 1–2 m, 2–5 m, 5–12 m, 12–25 m) was recorded for each vascular plant species. Because species overlap (due to multiple layers of plants), total plant cover can sum to more than 100%. The maximum and average height for each species in the plot was recorded. The proportion of cover of all vegetation <1.35 m, bryophytes, litter, bare ground, and water was recorded for each plot using a vertical projection of cover below 1.35 m (i.e. birds-eye view). A list of species recorded in the four wetlands is provided in Appendix 1.

Soil sampling

At each plot two soil cores (10 cm diameter × 7 cm deep) were collected from the south-west corner of the plot or from the lowest point in the plot. Depth to the water table was measured, and a hole dug to a depth of 60 cm, where required. If water wasn't present within the top 60 cm, the depth to water table was recorded as greater than 60 cm. Where a water table was present or there was standing water on the plot, pH, temperature, and conductivity were measured using a TPS WP-81 conductivity and pH meter. Peat condition was assessed, where applicable, using the von Post humification scale. Each soil sample was analysed for bulk density, water content, conductivity, pH, organic carbon, and total

nitrogen, phosphorus, and potassium (Gradwell & Birrell 1979; Metson et al. 1979; Blakemore et al. 1987).

Additional notes

For each plot a set of photos was taken from the south-west corner looking east and north. A 5 min bird count was performed on arrival at the plot (a list of bird species recorded in the four wetlands is given in Appendix 2), and notes on the presence of birds or other fauna, and grazing or other land uses, were made.

Data storage

Vegetation data were entered into the NVS (National Vegetation Survey databank, https://nvs.landcareresearch.co.nz). The soils data and 5 min bird count data were entered into a spreadsheet, along with plot metadata. The soils data, photos, and plot metadata are stored in DataStore (https://datastore.landcareresearch.co.nz).

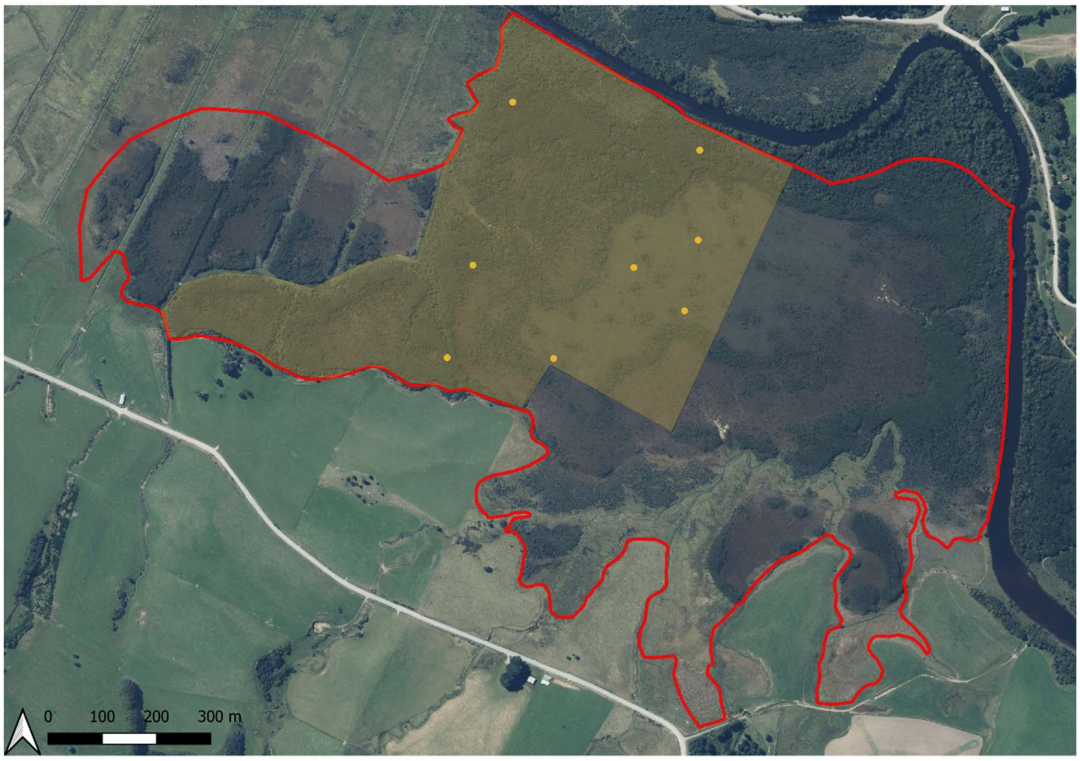

Figure 1. Tahakopa River Bogs plot locations (yellow dots).
Notes: The red line shows the extent of mapped wetland (supplied by ORC); the yellow-shaded polygon shows the extent of public conservation land.
Source: LINZ aerial imagery (https://data.linz.govt.nz/layer/106403-otago-03m-rural-aerial-photos-2019-2021/)

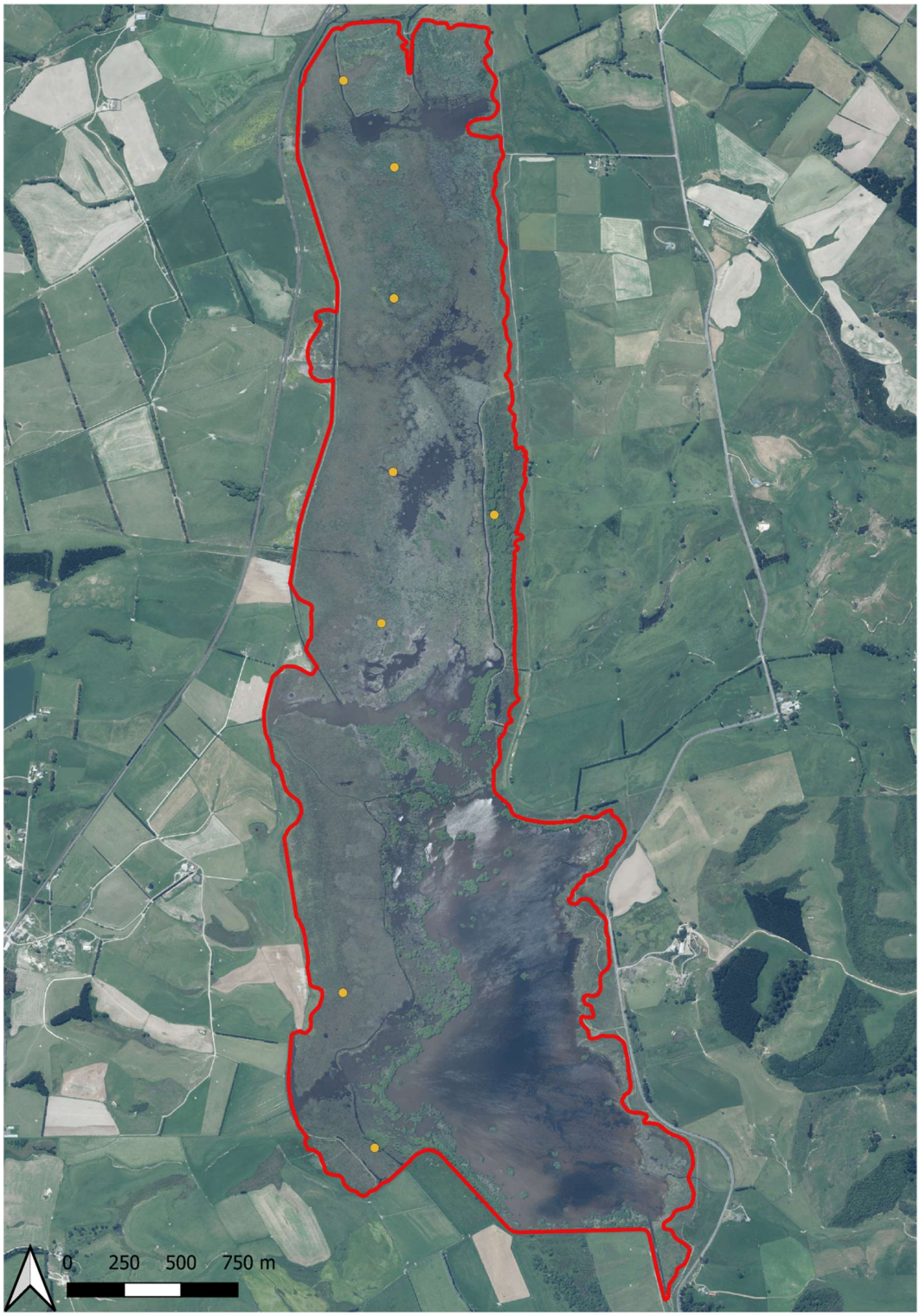

Figure 2. Lake Tuakitoto Wetland plot locations (yellow dots).
Notes: the red line shows the extent of mapped wetland (supplied by ORC).
Source: LINZ aerial imagery (https://data.linz.govt.nz/layer/106403-otago-03m-rural-aerial-photos-2019-2021/)

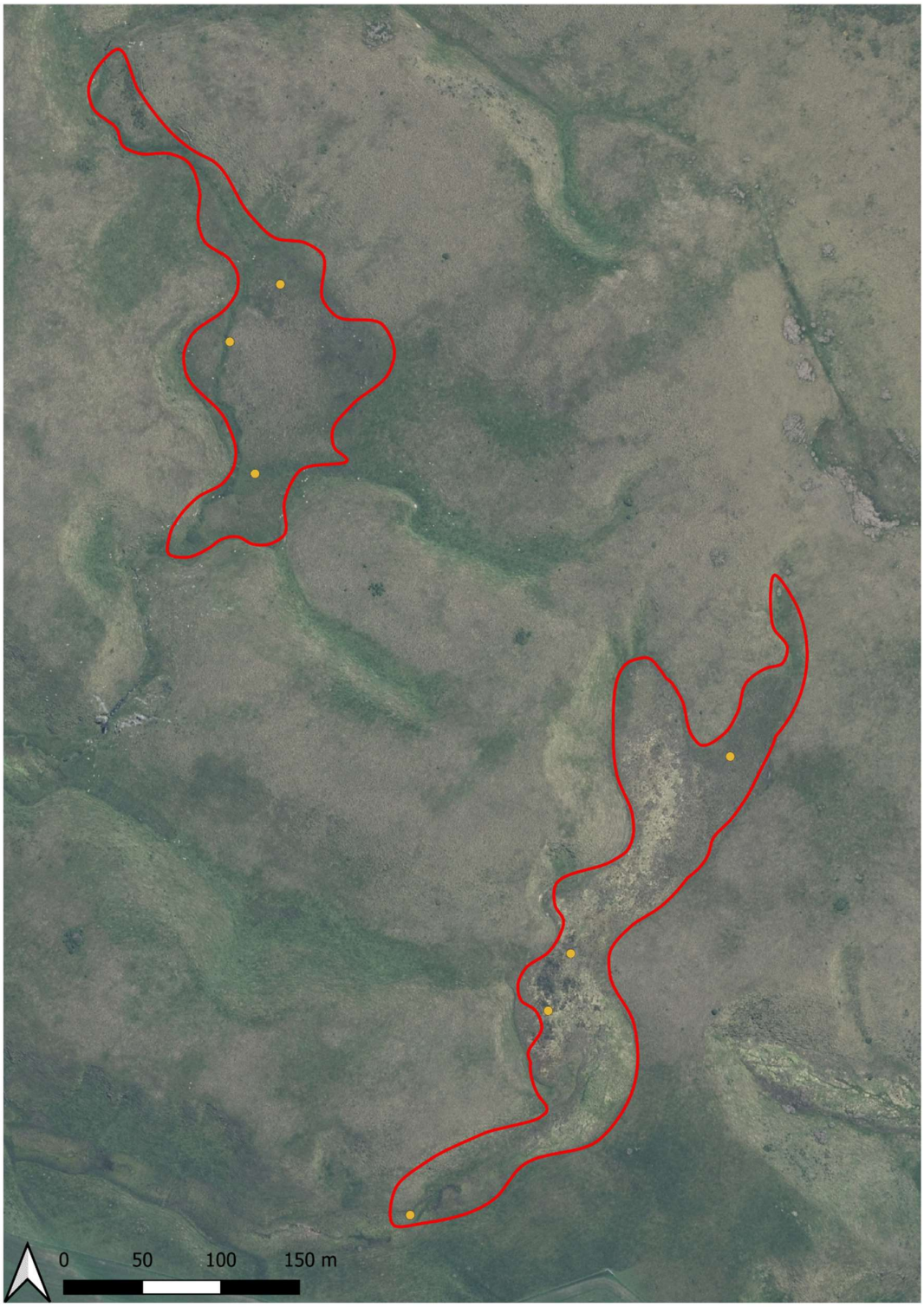

Figure 3. Upper Black Stream Marshes Wetland plot locations (yellow dots).
Notes: the red line shows the extent of mapped wetland (supplied by ORC).
Source: LINZ aerial imagery (https://data.linz.govt.nz/layer/106403-otago-03m-rural-aerial-photos-2019-2021/)

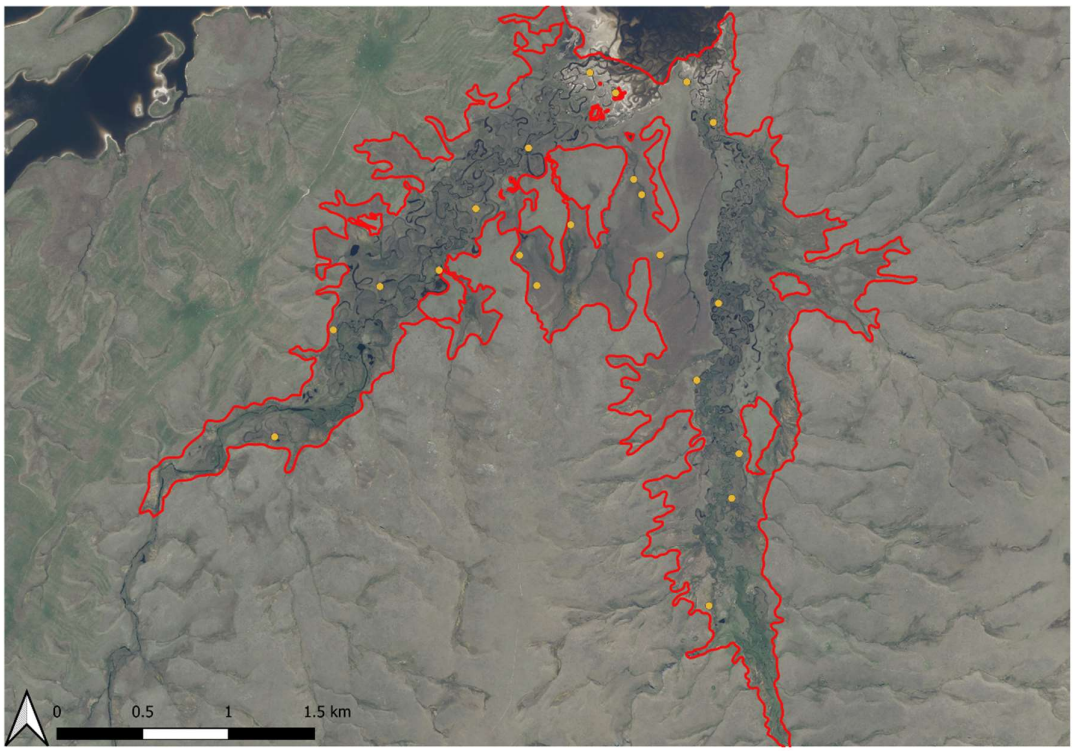

Figure 4. Fortification Creek Wetland Management Area plot locations (yellow dots).
Notes: the red line shows the extent of mapped wetland (supplied by ORC).
Source: LINZ aerial imagery (https://data.linz.govt.nz/layer/106403-otago-03m-rural-aerial-photos-2019-2021/)

5 Conclusions

- Forty-four plots were established across four wetlands, with an average of one plot per 20 ha.
- A total of 158 plant species and 20 bird species were recorded across the four wetlands.
- For all but the Tahakopa River Bogs we were able to sample across the full extent of the wetland. We were only able to sample the public land in the Tahakopa River Bogs. (Once permissions are granted, we recommend completing the sampling in the other half of the wetland.)

6 Recommendations

I recommend that Otago Regional Council:

- continue to use the established wetland vegetation plot sampling methods
- complete the sampling in the second half of the Tahakopa River Bogs
- continue establishing monitoring in regionally significant wetlands.

7 Acknowledgements

We thank Sami Khan for initiating this project, and the landholders for granting permission to sample on their farms.

8 References

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Appendix 1 – Plant species list

This appendix lists the plant species for each of the four wetlands. Threat status is assigned following de Lange et al. (2018).

Table A1. Species list for Tahakopa River Bogs

Species	Growth form	Threat status	Number of occurrences
Androstoma empetrifolium	Shrub		5
*Anthoxanthum odoratum**	Graminoid		1
Astelia fragrans	Graminoid		1
*Berberis darwinii**	Shrub		2
Blechnum penna-marina	Fern		1
Blechnum procerum	Fern		2
Carex dissita	Graminoid		1
Carex uncinata	Graminoid		1
*Cerastium fontanum**	Forb		1
Chiloglottis species	Forb		2
Chionochloa rubra	Graminoid		1
Coprosma ciliata	Shrub		1
Coprosma elatirioides	Shrub		1
Coprosma foetidissima	Tree		2
Coprosma lucida	Tree		1
Coprosma propinqua	Tree		3
Coprosma rhamnoides	Shrub		1
Coprosma rotundifolia	Shrub		1
*Crepis species**	Forb		1
Dacrycarpus dacrydioides	Tree		2
Dracophyllum oliveri	Shrub		5
Drosera binata	Forb		4
Elaeocarpus hookerianus	Tree		1
Empodisma minus	Graminoid		5
Gaultheria macrostigma	Shrub		1
Gleichenia alpina	Fern		5
Griselinia littoralis	Tree		1
Histiopteris incisa	Fern		1
*Holcus lanatus**	Graminoid		1
Isolepis reticularis	Graminoid		1
Leptospermum scoparium	Tree		8

Species	Growth form	Threat status	Number of occurrences
*Lotus pedunculatus**	Forb		1
Melicope simplex	Tree		2
Neomyrtus pedunculata	Tree	Nationally Critical – Threatened	1
Nertera scapanioides	Subshrub		2
Parsonsia heterophylla	Vine		1
Pentachondra pumila	Shrub		1
Pittosporum tenuifolium	Tree		2
Podocarpus totara	Tree		2
Prumnopitys taxifolia	Tree		1
Pseudopanax crassifolius	Tree		2
Pseudowintera colorata	Tree		2
*Ranunculus repens**	Forb		1
Raukaua anomalus	Shrub		2
Rubus australis	Vine		1
Schoenus pauciflorus	Graminoid		1
*Stellaria media**	Forb		1
Thelymitra cyanea	Forb		5

Note: Asterisk (*) indicates exotic species.

Table A2. Species list for Lake Tuakitoto

Species	Growth form	Threat status	Number of occurrences
*Agrostis stolonifera**	Graminoid		7
Azolla rubra	Fern		4
Azorella species	Forb		1
*Callitriche stagnalis**	Forb		4
Carex maorica	Graminoid		5
Carex secta	Graminoid		5
Carex virgata	Graminoid		4
Coprosma propinqua	Tree		2
Eleocharis acuta	Graminoid		3
*Galium palustre**	Forb		1
Galium propinquum	Forb		5
*Glyceria fluitans**	Graminoid		4
Hypolepis ambigua	Fern		1
*Juncus articulatus**	Graminoid		2
Juncus edgariae	Graminoid		7

Species	Growth form	Threat status	Number of occurrences
*Juncus effusus**	Graminoid		2
Lemna minor	Forb		2
*Lotus pedunculatus**	Forb		2
*Lythrum portula**	Forb		1
Muehlenbeckia complexa	Vine		1
*Myosotis laxa**	Forb		5
Myriophyllum pedunculatum	Subshrub		3
*Phleum pratense**	Graminoid		1
*Poa pratensis**	Graminoid		2
*Ranunculus flammula**	Forb		5
*Ranunculus repens**	Forb		1
*Rumex crispus**	Forb		2
*Salix cinerea**	Tree		1
*Salix xfragilis**	Tree		4
*Solanum nigrum**	Subshrub		1
*Stellaria graminea**	Forb		1

Note: Asterisk (*) indicates exotic species.

Table A3. Species list for Upper Black Stream Marshes

Species	Growth form	Threat status	Number of occurrences
*Agrostis capillaris**	Graminoid		2
*Agrostis stolonifera**	Graminoid		4
Anaphalioides bellidioides	Subshrub		2
Androstoma empetrifolium	Shrub		1
Anisotome aromatica	Forb		1
*Anthoxanthum odoratum**	Graminoid		5
Blechnum penna-marina	Fern		5
Brachyscome longiscapa	Forb	Naturally Uncommon – At Risk	3
Carex coriacea	Graminoid		7
Carex echinata	Graminoid		2
Carex gaudichaudiana	Graminoid		4
Carex secta	Graminoid		1
Celmisia gracilenta	Forb		4
Chionochloa rubra	Graminoid		6
*Crepis capillaris**	Forb		1
Dracophyllum longifolium	Tree		2

Species	Growth form	Threat status	Number of occurrences
Drosera arcturi	Forb		4
Gaultheria macrostigma	Shrub		6
Gentianella bellidifolia	Forb		1
Geranium aff. microphyllum	Unknown		3
Gonocarpus micranthus	Subshrub		3
Gunnera dentata	Forb		2
Hierochloe equiseta	Graminoid		2
*Holcus lanatus**	Graminoid		5
*Hypochaeris radicata**	Forb		5
*Juncus articulatus**	Graminoid		3
*Juncus effusus**	Graminoid		7
Leptospermum scoparium	Tree		2
Lobelia angulata	Forb		1
Montia fontana	Forb		1
Nertera balfouriana	Subshrub		6
Orchidaceae	Forb		1
Oreobolus strictus	Graminoid		1
*Pilosella officinarum**	Forb		1
*Pilosella piloselloides subsp. praealta**	Forb		4
Rytidosperma gracile	Graminoid		2
*Trifolium repens**	Forb		4
Wahlenbergia albomarginata	Forb		1

Note: Asterisk (*) indicates exotic species.

Table A4. Species list for Fortification Creek Wetland Management Area

Name	Growth form	Threat status	Number of occurrences
Acaena inermis	Forb		1
*Agrostis capillaris**	Graminoid		2
Agrostis muscosa	Graminoid		2
*Agrostis stolonifera**	Graminoid		19
*Alopecurus geniculatus**	Graminoid		1
Anaphalioides bellidioides	Subshrub		4
*Anthoxanthum odoratum**	Graminoid		16
Blechnum penna-marina	Fern		5
Callitriche petriei	Forb		3
Carex coriacea	Graminoid		1
Carex echinata	Graminoid		2

Name	Growth form	Threat status	Number of occurrences
Carex gaudichaudiana	Graminoid		12
*Carex leporina**	Graminoid		16
Carex punicea	Graminoid		2
Carex species	Graminoid		1
Carex tenuiculmis	Graminoid	Declining – At Risk	3
Celmisia gracilenta	Forb		12
*Cerastium fontanum**	Forb		4
Chaerophyllum ramosum	Forb		5
Chionochloa macra	Graminoid		1
Chionochloa rubra	Graminoid		15
Craspedia species	Forb		1
*Crepis capillaris**	Forb		1
Deschampsia cespitosa	Graminoid	Declining – At Risk	3
Elatine gratioloides	Forb		1
Eleocharis acuta	Graminoid		7
Epilobium alsinoides	Forb		4
Epilobium angustum	Forb	Naturally Uncommon – At Risk	2
Epilobium chionanthum	Forb		3
Epilobium komarovianum	Forb		2
Euchiton involucratus	Forb		4
Euchiton traversii	Forb		2
Festuca novae-zelandiae	Graminoid		3
*Festuca rubra**	Graminoid		3
Galium perpusillum	Forb		5
Galium propinquum	Forb		4
Gaultheria depressa	Shrub		1
Gaultheria macrostigma	Shrub		1
Gentianella grisebachii	Forb		4
Geranium aff. microphyllum	Unknown		5
Gonocarpus micranthus	Subshrub		8
*Holcus lanatus**	Graminoid		16
Hydrocotyle heteromeria	Forb		1
Hydrocotyle hydrophila	Forb		2
Hydrocotyle microphylla	Forb		2
Hydrocotyle novae-zeelandiae	Forb		1
Hydrocotyle sulcata	Forb		5
Hypericum rubicundulum	Forb	Nationally Endangered – Threatened	2

Name	Growth form	Threat status	Number of occurrences
*Hypochaeris radicata**	Forb		5
Isolepis basilaris	Graminoid	Declining – At Risk	2
*Juncus articulatus**	Graminoid		9
*Juncus bufonius**	Graminoid		2
*Juncus effusus**	Graminoid		9
Juncus pusillus	Graminoid	Naturally Uncommon – At Risk	3
Kelleria croizatii	Subshrub		2
Lachnagrostis striata	Graminoid		1
Lagenophora cuneata	Forb		1
Lagenophora species	Forb		1
*Leontodon saxatilis**	Forb		1
Leptinella maniototo	Forb	Relict – At Risk	3
Lobelia angulata	Forb		4
Lobelia ionantha	Forb	Declining – At Risk	4
Lobelia perpusilla	Forb		2
Luzula rufa var. rufa	Graminoid		1
Luzula species	Graminoid		1
Microtis unifolia	Forb		6
Myriophyllum triphyllum	Subshrub		3
Nertera scapanioides	Subshrub		1
*Pilosella officinarum**	Forb		8
*Pilosella piloselloides subsp. praealta**	Forb		6
Plantago triandra	Forb		3
Ranunculus cheesemanii	Forb		6
*Ranunculus flammula**	Forb		2
Ranunculus foliosus	Forb		1
Ranunculus gracilipes	Forb		5
Raoulia subsericea	Subshrub		1
Rytidosperma gracile	Graminoid		3
*Sagina procumbens**	Forb		2
Senecio wairauensis	Forb		1
Styphelia nesophila	Shrub		1
*Taraxacum officinale**	Forb		1
*Trifolium repens**	Forb		3
Viola cunninghamii	Forb		7
Wahlenbergia albomarginata	Forb		3

Note: Asterisk (*) indicates exotic species.

Appendix 2 – Bird species list

Following is a list of bird species recorded in the 5 min bird counts. Threat status is assigned following Robertson et al. (2021).

Table A5. List of bird species recorded across the four wetlands

Common name	Scientific name	Threat status
Paradise shelduck	*Tadorna variegata*	
South Island fernbird	*Poodytes punctatus punctatus*	At Risk – Declining
Welcome swallow	*Hirundo neoxena neoxena*	
Common redpoll	*Acanthis flammea*	
Australian magpie	*Gymnorhina tibicen*	
Chaffinch	*Fringilla coelebs*	
Spur-winged plover	*Vanellus miles novaehollandiae*	
Bellbird	*Anthornis melanura melanura*	
European goldfinch	*Carduelis carduelis britannica*	
Eurasian skylark	*Alauda arvensis*	
European greenfinch	*Chloris chloris*	
Little shag	*Microcarbo melanoleucos brevirostris*	At Risk – Relict
Mallard duck	*Anas platyrhynchos*	
South Island fantail	*Rhipidura fuliginosa fuliginosa*	
Australasian harrier	*Circus approximans*	
Silvereye	*Zosterops lateralis lateralis*	
Grey warbler	*Gerygone igata*	
Southern black-backed gull	*Larus dominicanus*	
Pied stilt	*Himantopus himantopus leucocephalus*	
Yellowhammer	*Emberiza citrinella*	