

Extent of freshwater wetlands

Prepared by:
Karen Denyer, (Papawera Consulting)
Craig Briggs (Waikato Regional Council)

For:
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

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Peer reviewed by:
Kaitlin Morrison

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Approved for release by:
Mike Scarsbrook

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Abstract

This technical report documents the extent of freshwater wetlands in the Waikato Region based on 2018 land cover.

In pre-human times the Waikato region had an estimated 356,516 hectares of freshwater wetland with emergent vegetation (Ausseil *et al.* 2008), covering approximately 15 per cent of the region's land area (excluding large open water bodies). Swamps and marshes comprised over 70 per cent of the pre-human freshwater wetland extent, with the extensive raised bogs and associated fens in the Hauraki Plains and Hamilton Basin contributing most of the balance. Today, less than 10 per cent of those pre-human wetlands remain (Ausseil *et al.* 2008), with swamps and marshes the most significantly affected, and now comprising just over half of the total area of freshwater wetland. While bogs fared somewhat better, having been reduced by 81 per cent compared with the 95 per cent loss of swamps and marshes and over 99% of fens (Ausseil *et al.* 2008), the former Komakorau, Rukuhia and Moanatuatua bogs have been reduced to small fragments.

The current (as of 2018) extent of freshwater wetland in the Waikato region is 33,268 hectares, covering approximately 1 per cent of the region's total land area. The largest remaining areas, Kopuatai Peat Dome and Whangamarino Wetland, are internationally significant.

Eighty-three per cent of the remaining areas of freshwater wetland in the Waikato Region occur within the most threatened environments (Category 1 and 2).

Freshwater wetlands occur mostly in lower elevations, with 85 per cent of the current extent found in the lowland bioclimatic zone. Flaxland tends to occur at higher elevations, with 75 per cent of the remaining Flaxland in the Submontane Zone (300 to 800 m elevation)

The Waikato, Hauraki and Matamata-Piako districts collectively hold 78 per cent of the region's extent of freshwater wetland. Extensive areas remain in the lower Waikato Valley and Hauraki Plains, where the internationally significant Ramsar wetlands (Kopuatai Peat Dome and Whangamarino Wetland) are found.

Between 1996 and 2018 the total area of freshwater wetland vegetation was reduced by 503 hectares. However, some of the losses are transition to another wetland habitat type, such as Lake & Pond.

In terms actual loss of wetland habitat, the LCDB records the conversion of 459 hectares of freshwater wetland vegetation to dryland land cover. This comprises the conversion of 416 hectares of Herbaceous Freshwater Vegetation (HFV), 25 hectares of wet Mānuka &/or Kānuka (MK), and 18 hectares of wet Deciduous Hardwood (DH). Most of these areas were converted to pasture. The average annual rate of loss of freshwater wetlands to developed land since 1996 is 20 hectares. This has slowed in the past five years to 6 hectares per year on average, with a recorded loss of 36 hectares of freshwater wetland types to dry land.

In contrast to the loss of freshwater wetland since 1996, the gains have amounted to an average 2 hectare per year from pasture or cropping land, with no gains from developed land since 2012, although some restoration projects during that time may be of insufficient scale or stage of maturity to show up on the Land Cover database.

1 Introduction

Waikato Regional Council monitors changes in the amount and proportions of freshwater wetland in the region.

Wetlands are an important storehouse of indigenous biodiversity. Native plants and animals, and the wetland ecosystems they form, are valued for their unique genetic diversity, cultural and spiritual importance, scientific interest, recreational opportunities and intrinsic values. In addition wetlands provide many environmental services, improving water quality, storing carbon, and reducing the effects of floods.

Yet wetlands are a severely depleted and often degraded ecosystem type. Nationally an estimated 90 per cent of the pre-human extent of wetlands has been cleared and drained (Ausseil *et al.* 2008).

The Waikato region remains a North Island strong-hold with almost eight per cent of its original (pre-human) freshwater wetland extent remaining (compared with five per cent for the North Island as a whole) (Ausseil *et al.* 2008). An estimated 44 per cent of all of the North Island's remaining freshwater wetlands occur in the Waikato region, which also has three of New Zealand's seven Ramsar Wetlands (sites of international significance).

Change in the extent of remaining wetlands may affect the diversity and security of native species. This indicator describes and quantifies the spatial extent and distribution of freshwater wetland vegetation and how that has changed over time. Waikato Regional Council uses the Land Cover Database (LCDB) to monitor current freshwater wetland vegetation. Landcare Research have estimated pre-human extent of freshwater wetlands in the Waikato region (Ausseil *et al.* 2008).

Monitoring trends in the type, location, and extent of freshwater wetland vegetation gives us valuable information on how well we are maintaining our region's unique freshwater biodiversity.

Monitoring wetlands helps us to:

- find out where wetland areas have been lost (for example through drainage), or gained (for example through wetland creation on retired pasture)
- gain information on where land use pressures are occurring, to help us identify policy responses to avoid or reverse adverse effects on wetland biodiversity
- find out what geographic areas have lost the greatest amount of freshwater wetland
- measure the spread of invasive canopy species such as grey or crack willow.

The monitoring outcomes can therefore guide adaptive management and policy decisions for biodiversity management planning.

2 Definitions

2.1 Freshwater wetlands

For this indicator, freshwater wetland refers to areas of land dominated by plant species that grow in freshwater saturated soils or grow tall enough to emerge above areas of shallow freshwater. These include areas of bog, swamp and fen, but do not include open water, flowing

water, or salty (saline or brackish) water. We use classes from the Land Cover Database¹ to identify areas that are predominantly freshwater wetlands: all Herbaceous Freshwater Vegetation, all Flaxland, Mānuka and/or Kānuka where Wetland Context = Yes and Deciduous Hardwoods where Wetland Context = Yes).

Herbaceous Freshwater Vegetation includes areas dominated by herbaceous aquatic vegetation as a component of freshwater wetlands. Common plants include sedges, rushes, or grasses, herbs or moss species.

We include Deciduous Hardwoods that have a wetland context, because an estimated one third of the freshwater wetlands remaining in the Waikato Region have been invaded by willow or alder species². Willow and alder stands often mask diverse understories with abundant native wetland species and are important habitat for many wetland fauna. When reporting on the extent and condition of freshwater wetlands at the regional scale it is important therefore to consider and report on the extent of all wetland types, including areas dominated in the canopy by non-native deciduous hardwoods. Such sites are important repositories of indigenous biodiversity and can be priority areas for wetland restoration.

We also include wet Mānuka &/or Kānuka which is present in a significant amount in the region, particularly in the Whangamarino wetland.

Terrestrial and saltwater (saline) habitat protection is covered by other indicators in the State of the Environment Indicator series. Some vegetation types in the Land Cover Database can establish in wetland or terrestrial habitats, such as Flaxland, Fernland, and Mānuka and/or Kānuka scrub. For the purpose of this indicator the following land cover classes have been allocated to the terrestrial State of the Environment Indicators: all Fernland; and Mānuka and/or Kānuka where “Wetland Context = No”.

The extent of pre-human freshwater wetland vegetation is derived from published data (Ausseil *et al.* 2008).

2.2 Threatened environments

In 2007, the Government released a statement of national priorities for protecting rare and threatened biodiversity on private land (Ministry for the Environment & Department of Conservation, 2007). The priorities are also relevant to public land.

Protecting biodiversity in Category 1 and 2 threatened land environments (see Table 1) is a National priority (Ministry for the Environment & Department of Conservation, 2007). Here, 20 per cent of remaining habitat is a critical threshold for measuring ecosystem vulnerability - the rate of biodiversity loss increases dramatically when the amount of available habitat drops below 20 per cent of its original extent. Therefore, National Priority 1 Environments are the habitats most in need of protection.

In 2012 Manaaki Whenua Landcare Research announced they were no longer using the terms Acutely and Chronically Threatened (Walker *et al.* 2012), and introduced additional categories⁶, however the criteria for the former AT and CT Environments remain unchanged. To be consistent with the National Biodiversity Priorities, we report on the amount of wetland within each of the first two categories, which mirror the AT and CT categories.

¹ The Land Cover Database (LCDB) uses satellite imagery to map land cover in New Zealand. This indicator draws upon version 5, which was released in 2018 and includes corrections to all LCDB version time steps 1996/97, 2001/02, 2008/09 2012/13 and 2017/18. <https://iris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/>

Table 1: Threatened Environment Classification description for National Priority 1 Environments

Category	Category criteria
1	<10% indigenous cover left
2	10-20% indigenous cover left

3 Methods

3.1 Monitoring area

This indicator covers the entire Waikato region, 2022 boundary using:

POL_2022_REGIONAL_AUTH_WRCGIS_ALL.POL_2012_REGIONAL_AUTH_EW_L1 regional boundary (2022)

Data are reported within four spatial frameworks:

a. Region (2022) -

POL_2022_REGIONAL_AUTH_WRCGIS_ALL.POL_2012_REGIONAL_AUTH_EW_L1

b. District/city councils (2022) –

GIS_ALL.POL_2012_TERR_AUTHORITY_EW_L1POL_2022_TERRITORIAL_AUTH_FULL_WRC

c. Bioclimatic zones (1994) – GIS_ALL.BIOCLIMATIC_ZONES

d. Threatened environments (2015) –

LENZ_THREATENED_ENVIRONMENT_CLASSIFICATION_TECGIS_ALL.SNA_LENZ_TEC

3.2 Monitoring frequency

Updates will happen as new (region-wide) vegetation/cover spatial layers become available. It is estimated that this will be updated every five years.

3.3 Monitoring history

This replaces an indicator on Extent of Wetlands published on the Waikato Regional Council's website in 2017 because earlier versions of the LCDB have been corrected in LCDB v5.

3.4 Measurement technique

We use the Land Cover Database (LCDB v5) to calculate the regional extent of freshwater wetlands. The LCDB (Land Cover Database) minimum mapping unit is 1 hectare and the data are suitable for applications down to 1:25,000 scale.

The statistics are compiled using ArcGIS Pro software and Microsoft Excel. Relevant wetland land cover classes were selected from the Land Cover Database v5.0.

Statistics are compiled for four spatial frameworks:

a. Waikato region (2018)

b. District councils (2018)

c. Bioclimatic zones (1994)

d. Threatened environments (2012)

3.5 Guidelines and standards

3.5.1 Regional boundary

The total land area of the regional boundary has been estimated using data from both the Land Cover database as well as the POL_2022_REGIONAL_AUTH_WRC layer.

For this indicator, the 2020 regional boundary was used as a baseline for all time periods reported on. In future updates of this indicator, any change in the size or shape of the regional boundary will affect the total area of indigenous coverage, due to areas of indigenous cover being included or excluded from the new boundary. To account for this issue either all previous results need to be recalculated or the update should retain the 2022 boundary as a baseline rather than any new regional boundary layer.

The same holds true for the indicator results pertaining to territorial authorities in which the 2022 territorial boundaries POL_2022_TERRITORIAL_AUTH_FULL_WRC have been clipped to the 2022 regional land boundary. Retaining these boundary layers will enable consistent change analysis to be conducted. This indicator is a regional analysis and as such does not cover the Waitomo, Taupō and Rotorua territorial authorities in their entirety.

3.5.2 LCDB 5 classes

For the current extent of freshwater wetlands in the Waikato region, we use the LCDB 5 classes and wetland context attributes listed in Table 2.

Table 2: Target land cover groups and names from LCDB 5

Land cover group	Freshwater wetland land cover name
Grassland, Sedgeland and Marshland	Herbaceous Freshwater Vegetation (where Wetland Context = Yes or No or Blank)
Scrub and shrubland	Mānuka &/or Kānuka (where Wetland Context = Yes) Flaxland (where Wetland Context = Yes or No or Blank)
Forest	Deciduous Hardwoods (where Wetland Context = Yes)

3.6 Quality control procedures

This indicator was created using ESRI ArcGIS Pro software. The queries for the analysis were completed using model builder scripts. This method enables the queries to be easily recalculated if required. The model outputs calculated values to an excel spreadsheet.

For information on data quality (lineage, positional accuracy, attribute accuracy, logical consistency and completeness) see the updated metadata for the LCDB v5.0, available on the Manaaki-Whenua Landcare Research LRIS portal website.

3.7 Limitations

1. Freshwater wetland extent is based on LCDB Version 5 data. The LCDB gives a 'snapshot' of vegetation at the time when the data were collected and should not be considered as a definitive measure of present-day vegetation cover.
2. Some vegetation types are incorrectly identified in LCDB 5 which may result in errors in extent of freshwater wetland types.
3. The Lake and Pond land cover group is excluded from this analysis, however lake margins with emergent vegetation are included in the assessment where they are mapped by LCDB as one of the target classes.
4. Flax is a hardy species capable of thriving in wet or dry conditions. The LCDB class Flaxland is described in the Illustrated Guide to Target Classes for LCDB7 as predominantly a wetland class dominated by the swamp flax *Phormium tenax*.

Therefore, Flaxland is treated as a wetland class for the purpose of Waikato Regional Council SOE reports.

5. Fernland and Grey Scrub vegetation classes can occur in wetland systems but are more frequently encountered in terrestrial systems. Wetland context attributes in LCDB are considered too unreliable for these classes to allow for a separation of terrestrial and wetland polygons. These LCDB classes were included as scrub classes in the terrestrial State of the Environment (SOE) indicators, and therefore are not included in the wetland SOE indicators.
6. Mānuka can also occur in a wet or dry hydrosystems. The LCDB Wetland Context attribute was used to select wetland areas of Mānuka and/or Kānuka for this indicator.
7. Deciduous hardwoods are described in the Illustrated Guide to LCDB Classes (Thompson et al. 2003 as being “typically willow and poplar species growing adjacent to inland water and rivers, this class also includes stands of planted exotic deciduous hardwoods, such as oak (*Quercus* spp.), ash (*Fraxinus excelsior*) and elm (*Ulmus* spp.)”. An estimated 1/3rd of Waikato wetlands have a canopy of invasive deciduous hardwoods - primarily grey willow, crack willow and, to a lesser extent, alder (Leathwick et al. 1995). Excluding this land cover will greatly underestimate the total area of freshwater wetland and proportion in legal protection. The Wetland Context attribute offers a method to separate out DH polygons that represent wetlands. A visual check using Google Earth of 120 Deciduous Hardwood polygons from the LCDB found a high degree of accuracy where wetland context = Yes (over 90 per cent agreement) but a lower degree of accuracy where wetland context = No (62 per cent agreement). This indicates that the extent of deciduous hardwoods with a wetland context is under-estimated in the LCDB. This may be partly offset by loose polygon boundaries that often include areas of terrestrial vegetation, particularly in narrow gullies.
8. The 2022 district council boundaries clipped to the regional land boundary were used for this indicator. Some district councils extend beyond the regional boundary, and statistics compiled at the district scale for the Waikato Region may not reflect the pattern for those districts as a whole.
9. The Threatened Environments (TE) data layer has not been updated since 2015. Until a new layer has been updated (incorporating changes to land cover since 2022), this indicator will report on the extent of wetland within our most depleted environments using the 2015 TE layer.

4 Results - data and trends

4.1 Types of wetlands

Today 1 per cent of the region's land area remains in freshwater wetlands, totalling 33,268 hectares (approximately 8 per cent of the historic extent). This comprises 20,054 hectares of Herbaceous Freshwater Vegetation, 11,224 hectares of wet Deciduous Hardwoods, 358 hectares of Flaxland and 1634 hectares of wet Mānuka and/or Kānuka. Deciduous hardwoods have invaded areas of Herbaceous Freshwater Vegetation since willow (*Salix*) and alder (*Alnus*) species were introduced to the region to stabilise riverbanks. Most of the wetland lost in the Waikato region since 1996 was developed into pasture, and over half of the total loss was in a single block of land cleared between 1996 and 2001.

Figure 1 shows the location of freshwater wetlands in the Waikato region and changes since 1996. Figure 2 shows the amount of each wetland type as of 2018.

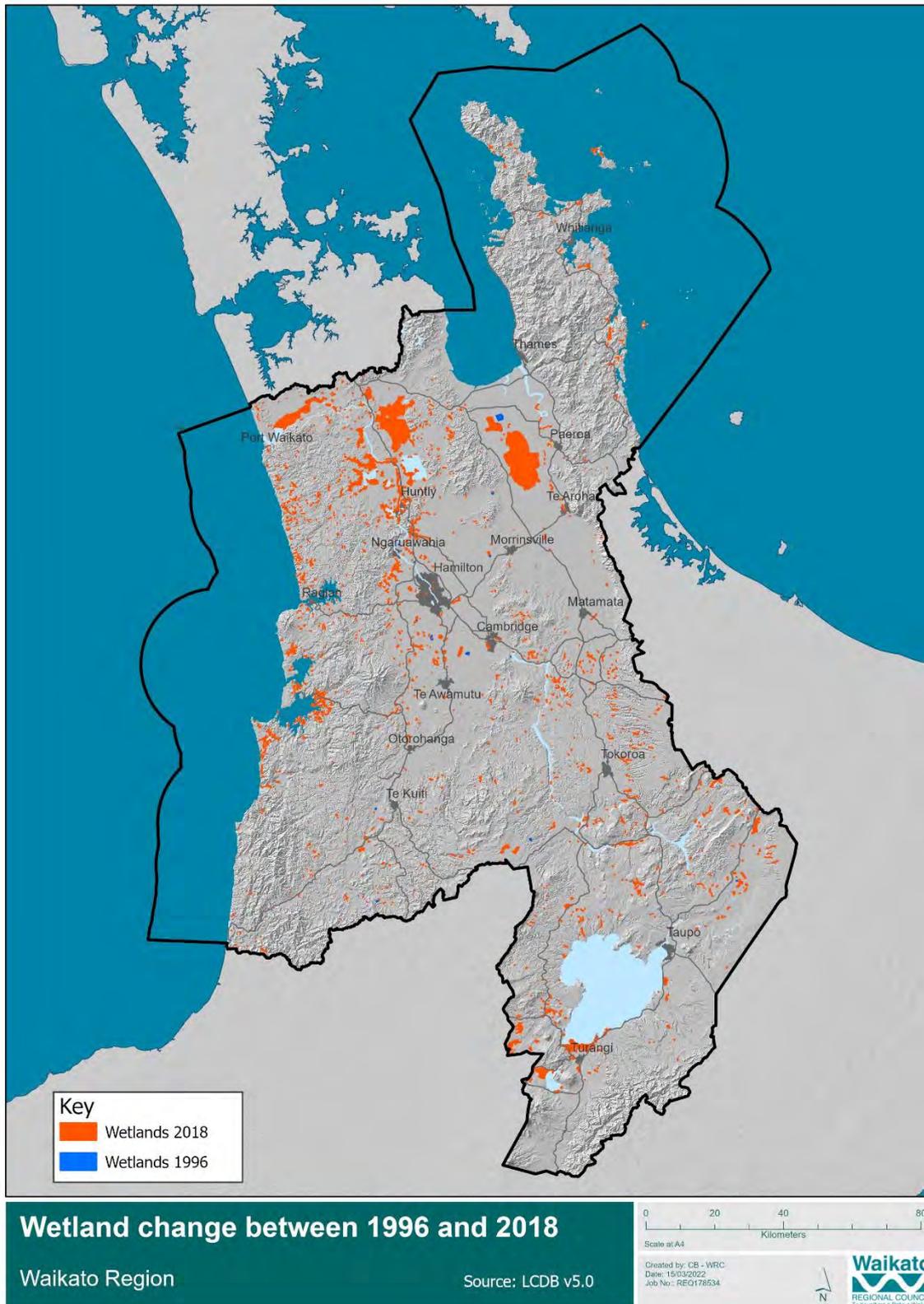


Figure 1: Freshwater wetlands in the Waikato region 1996 to 2018



Figure 2: Amount of the region's freshwater wetlands by vegetation type (2018)

4.2 Wetlands by National Priority 1 Environments

Eighty-three per cent of all of the remaining areas of freshwater wetland in the Waikato Region occur within the most threatened environments (those with < 20 per cent of any indigenous cover remaining).

Wetlands are over-represented in these threatened environments because they tend to occur in lowland areas where much of the original native cover has been cleared. Wetlands are among the few natural features that remain in areas of intensively farmed lowlands. Figure 3 shows that while most of the Herbaceous Freshwater Vegetation and Deciduous Hardwoods in the Region occur in threatened environments, Flaxland tends to occur in less depleted or better protected land environments and wet Mānuka and/or Kānuka is evenly distributed across land environments.

Figure 5 shows that high proportions of the remaining wetlands in priority environments are already protected in Hauraki and Matamata-Piako districts. These districts are where one of New Zealand's Ramsar sites, the 10,000-hectare Kopuatai Peat Dome wetland, is located. However, across the region almost 10,550 hectares of freshwater wetland remains unprotected in our most threatened environments. Most of that is in the Waikato District.

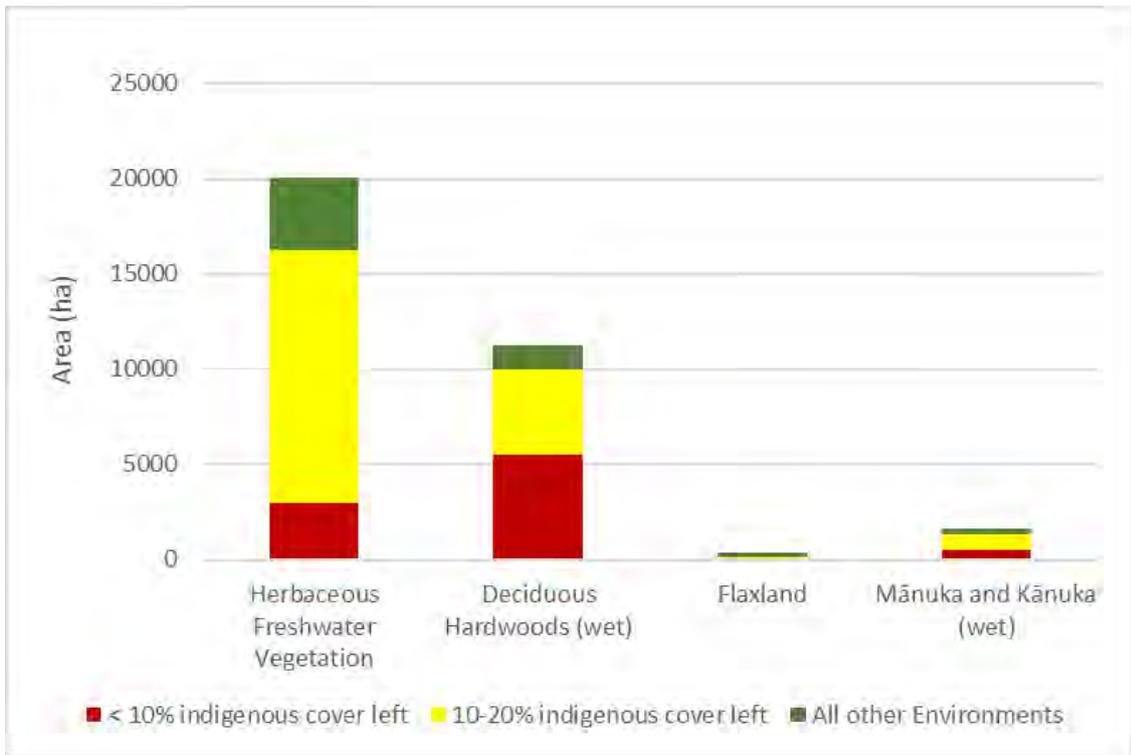


Figure 3: Amount of freshwater wetland in Threatened Environments (2018)

4.3 Wetlands per Bioclimatic Zones

Figure 4 shows which bioclimatic zone each freshwater wetland type occurs in.

In the Waikato region, freshwater wetlands are mainly confined to the lowland bioclimatic zone (below 300 m elevation), where 85 per cent of the current extent of freshwater wetlands occur. Flaxland tends to occur at higher elevations, with 75 per cent of the regional extent found in the submontane zone (300 to 800 m elevation). Less than 1 per cent of any freshwater wetland vegetation type occurs within the montane zone (800 to 1300 m elevation) and no freshwater wetlands are mapped above 1300 m elevation (subalpine and alpine zones).

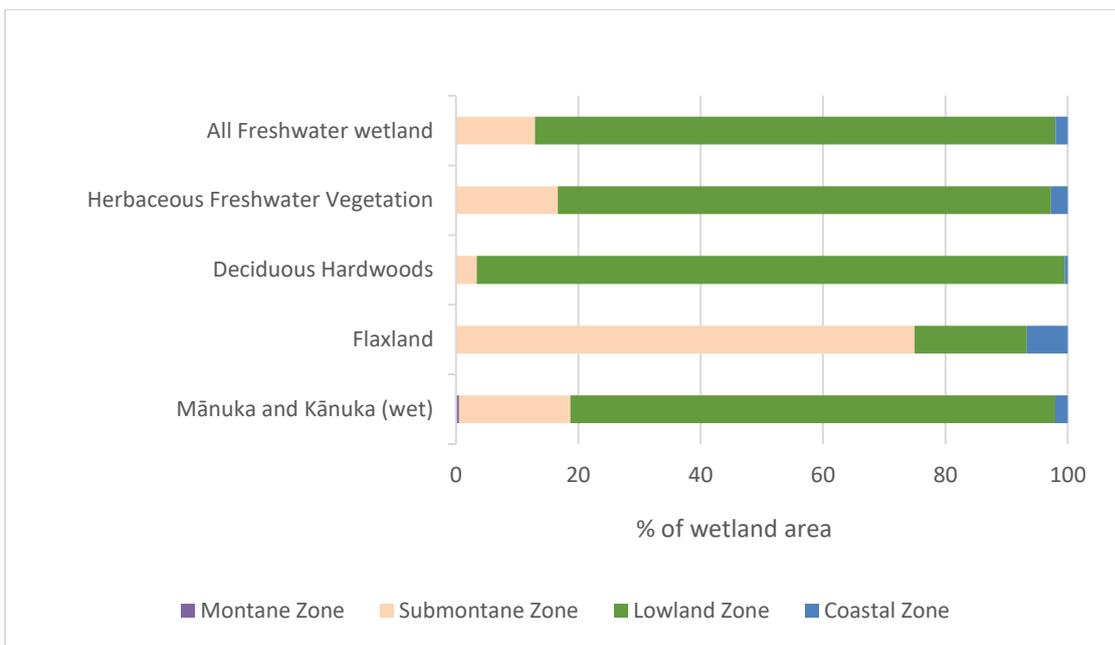


Figure 4: Proportion of remaining freshwater wetland in each bioclimatic zone (2018)

4.4 Wetlands by local authority

Most of the region’s freshwater wetlands occur within Waikato, Matamata-Piako, and Hauraki districts (Figure 5). These districts are where the 10,000 ha Kopuatai Peat Dome (split between Hauraki and Matamata-Piako districts) and the 7,000 ha Whangamarino Wetland Ramsar Wetlands are found. Taupō District also has extensive wetlands associated with the margins of Lake Taupō and Lake Rotoaira.

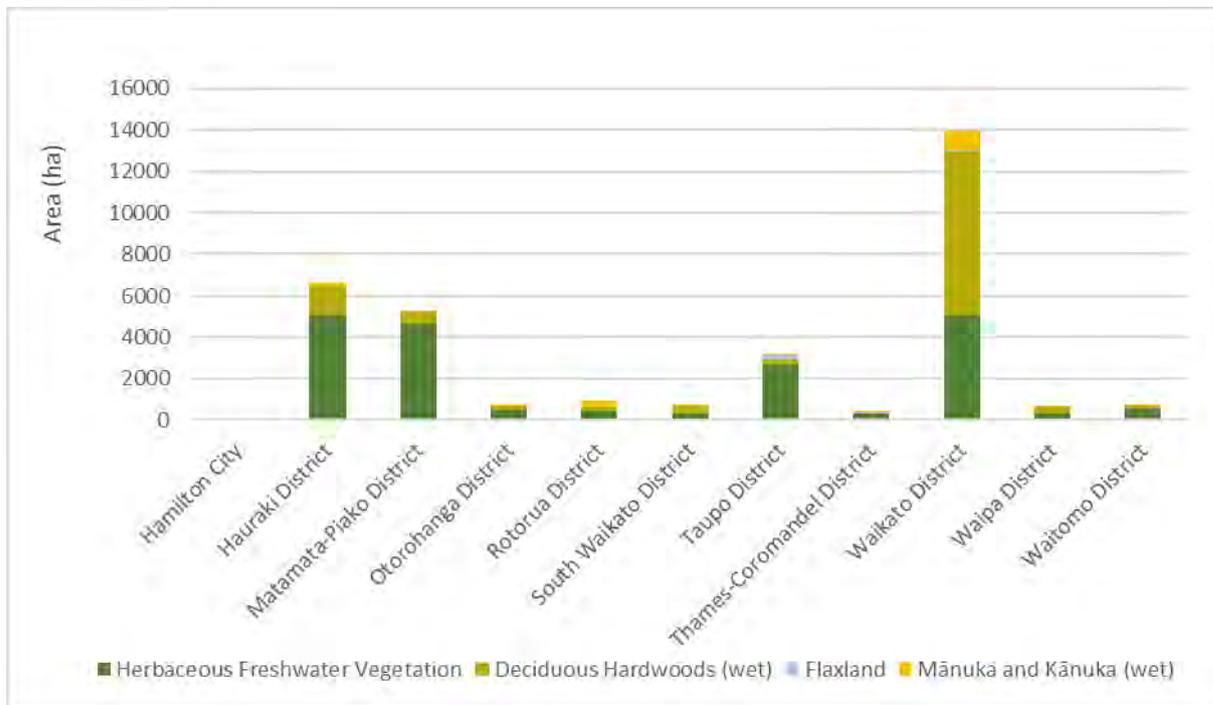


Figure 5: Area of remaining freshwater wetland in each local authority (2018)

4.5 Trends in wetland extent

Figure 6 shows the changes in wetland extent between 1996 and 2018. During this time there was a net reduction in area of HFV by 506 hectares, wet DH by 17 hectares, and wet M&K by 29 hectares, and a net gain in Flaxland of 50 hectares.

However, some of the losses are transition to different habitat type, such as Lake & Pond, which may be a transient change related to fluctuating water levels. Changes within wetland types include 50 hectares of HFV to Flaxland, 34 hectares of wet DH to HFV (likely the result of clearance of willow species), and 43 hectares of HFV to wet DH (invasion by willow species). The flaxland gain from HFV and is considered to be a classification error, as this represents a single polygon in the Whangamarino wetland mapped by Reeves (2011) as mānuka scrub.

In terms of actual loss of wet habitat, the LCDB records a total conversion of 459 hectares of freshwater wetland to dryland land cover. This comprises the total loss of 416 hectares of Herbaceous Freshwater Vegetation (HFV), 25 hectares of wet Mānuka &/or Kānuka (MK), and 18 hectares of wet Deciduous Hardwood (DH). High producing pasture claimed over 390 hectares and low producing pasture claimed 60 hectares. These losses were offset by a mapped wetland gain from pasture of 39 hectares of HFV and 1 hectare of wet DH. Almost half of the wetland lost to the region since 1996 was attributed to a single 220-hectare block in the vicinity of Ngātea, which was drained and converted to farmland between 1996 and 2001.

The average annual rate of loss of freshwater wetlands to developed land since 1996 is 20 hectares. This rate of loss to developed land has slowed in the past five years to 6 hectares per year on average. Between 2012 and 2018 there was a recorded loss of 36 hectares of freshwater wetland types to dry land, comprising 20 hectares of HFV, 12 hectares of wet M&K, and 4 hectares of wet DH. There were no recorded gains of freshwater wetland from dryland during this period.

In contrast to the loss of freshwater wetland since 1996, the gains have amounted to an average 2 hectare per year from pasture or cropping land, with no gains from developed land since 2012. While there are many wetland revegetation and restoration projects occurring in the region, these are not yet at a scale, or sufficiently mature to be recorded in the Land Cover Database.

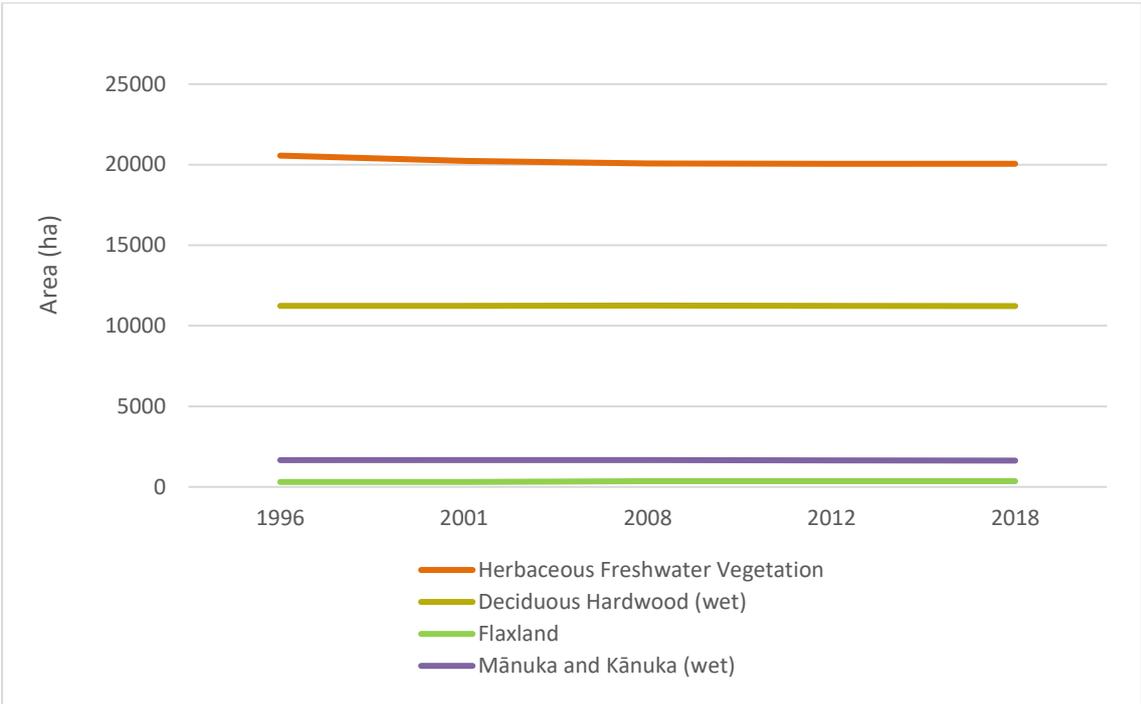


Figure 6: Change in amount of freshwater wetland since 1996

5 Further indicator developments

5.1 Updates

Updates will happen as new (region-wide) vegetation/cover spatial layers become available. It is estimated that this will be updated every five years. The last update was July 2017. The data presented in this report replaces the earlier indicator because of changes in extent of vegetation cover and some boundaries since 2017.

5.2 Future developments

Waikato Regional Council created a region-wide indigenous vegetation spatial layer (Bioveg 2012) using aerial imagery captures in 2012, and is developing a biodiversity inventory with more detailed vegetation classes, following Singers and Rogers (2014). When the biodiversity inventory is completed, it is expected to be a high-quality layer which could be used as an alternative or to supplement the Land Cover database. However, when completed the biodiversity inventory will only be a snapshot in time predominantly using aerial imagery taken in 2017 and oblique aerials from 2016-2018, and may not be able to present trend data over time.

Changes to the Land Cover database classification scheme are likely to influence the indicator results. In addition, it is expected that the accuracy of the Land Cover database will increase with new technology and remote sensing information and this will influence the extent to which any change in indigenous cover can be accurately interpreted.

When/ if an updated version of the Threatened Environments Classification is released this indicator will be updated to assess the amount of wetland within the new TE framework. This will only affect the results in Figure 3.

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