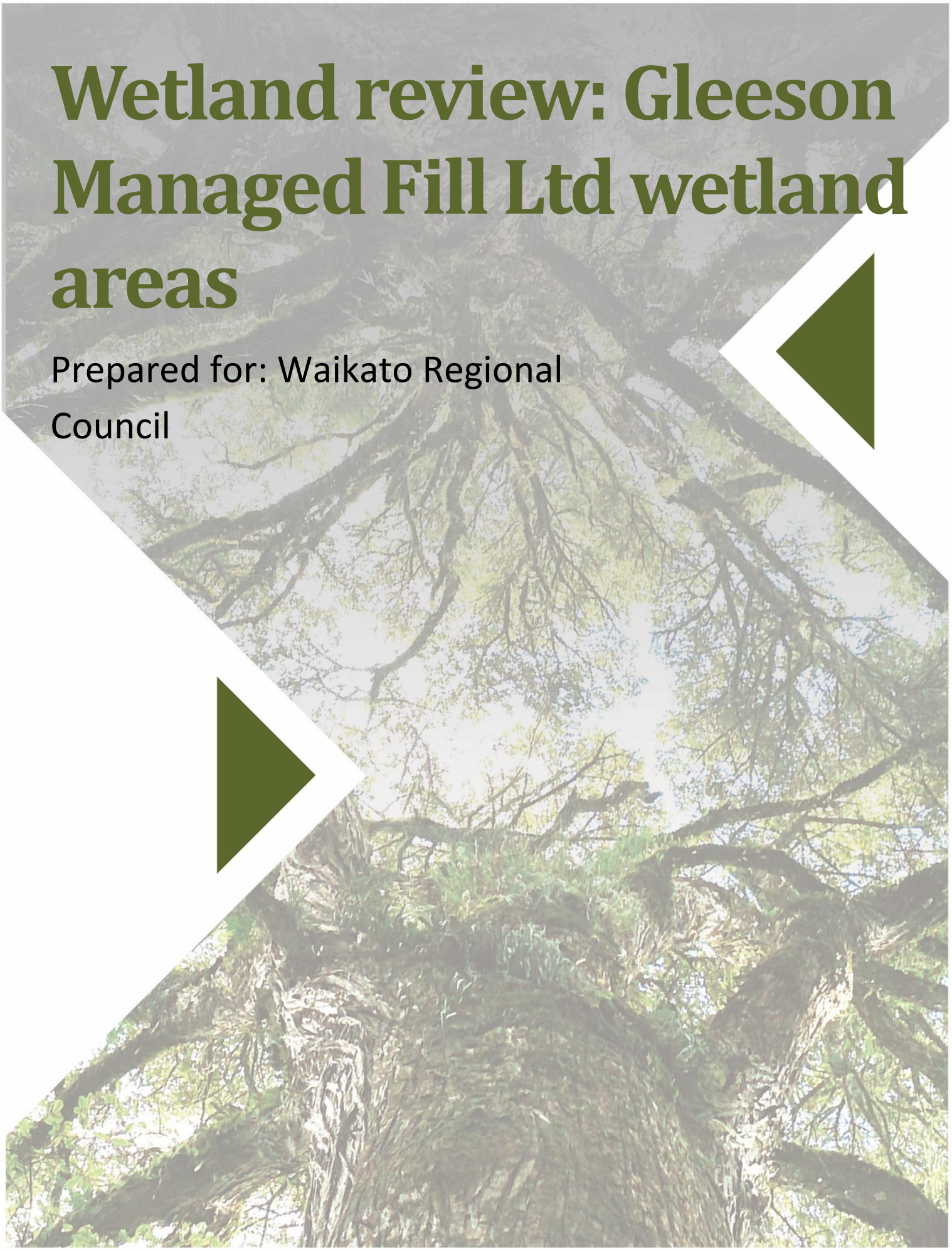
Wetland review: Gleeson Managed Fill Ltd wetland areas

Prepared for: Waikato Regional Council



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Ecological Solutions
Innovation in conservation

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1. Introduction

My name is Nicholas James Drysdale Singers. I have a Master of Science degree and my dissertation was on wetland ecology. I have been working as a professional ecologist for 23 years, focusing broadly on plant and ecosystem ecology. I have provided expert evidence to the environmental court with respect to wetland ecology, including defining wetlands within modified landscapes under the Resource Management Act 1991.

I have extensive knowledge of mapping ecosystems including wetlands within the Waikato Region, as well as the entirety of the North Island and the upper South Island.

I have been asked to provide a third-party review as to whether two small wetland habitats located on proposed fill sites within the Gleeson's Group quarry project (described in Madsen 2020), are wetlands with respect to the wetland definition within the National Policy Statement for Freshwater 2020.

I have reviewed evidence presented by Stantec (2021), Madsen (2020) and Dutton (2020). My opinion should therefore be read in conjunction to these reports.

The core of the issue is whether the two areas of wetland habitat are natural inland wetlands, induced wetlands, or artificial wetlands (as defined by MFE 2021).

This issue is addressed in the following questions.

1. Is there any evidence on early aerial photos and maps to show areas of wetland habitat prior to development?

2. Are the wetlands induced?

3. Is it geomorphologically likely that a wetland would naturally occur at these locations?

4. What wetland vegetation and species would likely be present, if natural wetlands were present?

2. Evidence from early aerial photos

The two wetland areas are in fill areas 2 and 4.

Paul Dutton (WRC) compiled a set of aerial images using Retrolens and Google Earth from 1973 to 2019. His position from reviewing those images was that there was insufficient information to determine either way, whether the areas were natural or artificial.

My assessment has used the aerial photos taken in 1941 and 1963 downloaded from Retrolens (SN174 and SN1397). 1941 aerial images were also compared with the first inch:mile topographic map (Figures 1, 2 and 3).

2.1 1941 aerial image

The 1941 aerial photo was downloaded in high resolution from Retrolens. This shows a landscape prior to significant European development into agricultural pasture. At that time, the land was fire induced with native forest remaining within gullies and a low scrub of possibly manuka and or gorse

occurring on ridges and hillslopes. In 1941 there is no evidence that it was used at that time for grazing.

Based on the 1941 aerial image location of where these wetlands now occur (within gully areas) Figures 1 & 2 do not show any open water or any vegetation which I consider to be wetland habitat. The area of wetland in fill site 4 was native forest, whilst the wetland in fill 2 was successional manuka and or gorse scrub (Figures 1 & 2). Both areas do not appear to include trees such as kahikatea which occur in swamp forest habitat.

Wetland habitat however was located further down the original gully, which drained fill site 3 approximately 600 m north of the wetland within fill site 2 and another gully further west (Figure 2).

This conclusion is also supported by the first topographical map of the area in 1941 NZMS1 N25 Ngaruawahia) (Figure 3). The NZMS 1 map series were made using these first aerial images and all maps were thoroughly field checked to add the detail. The Ngaruwahia map shows remnant forest habitat in these areas (Figure 3).

Figure 1: Approximate location of streams and wetland within fill site 4, downstream on the confluence of two small ephemeral headwater streams. Shown on SN174; 1941 image; LINZ creative commons via Retrolens)

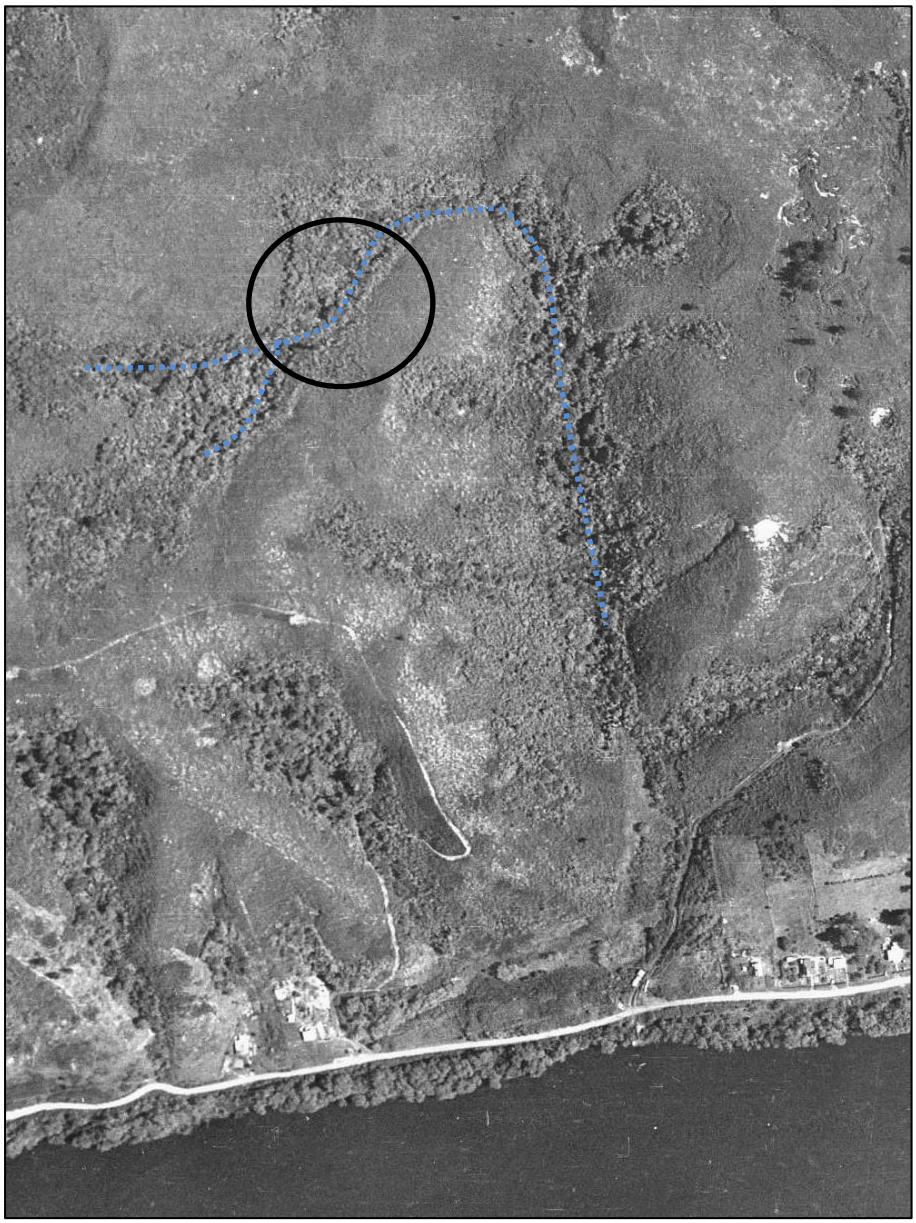


Figure 2: Approximate location of streams and wetland within fill site 2. Shown on SN174; 1941 image; LINZ creative commons via Retrolens). Note: wilding pine present within circle, which is present also in figures 6 & 7.

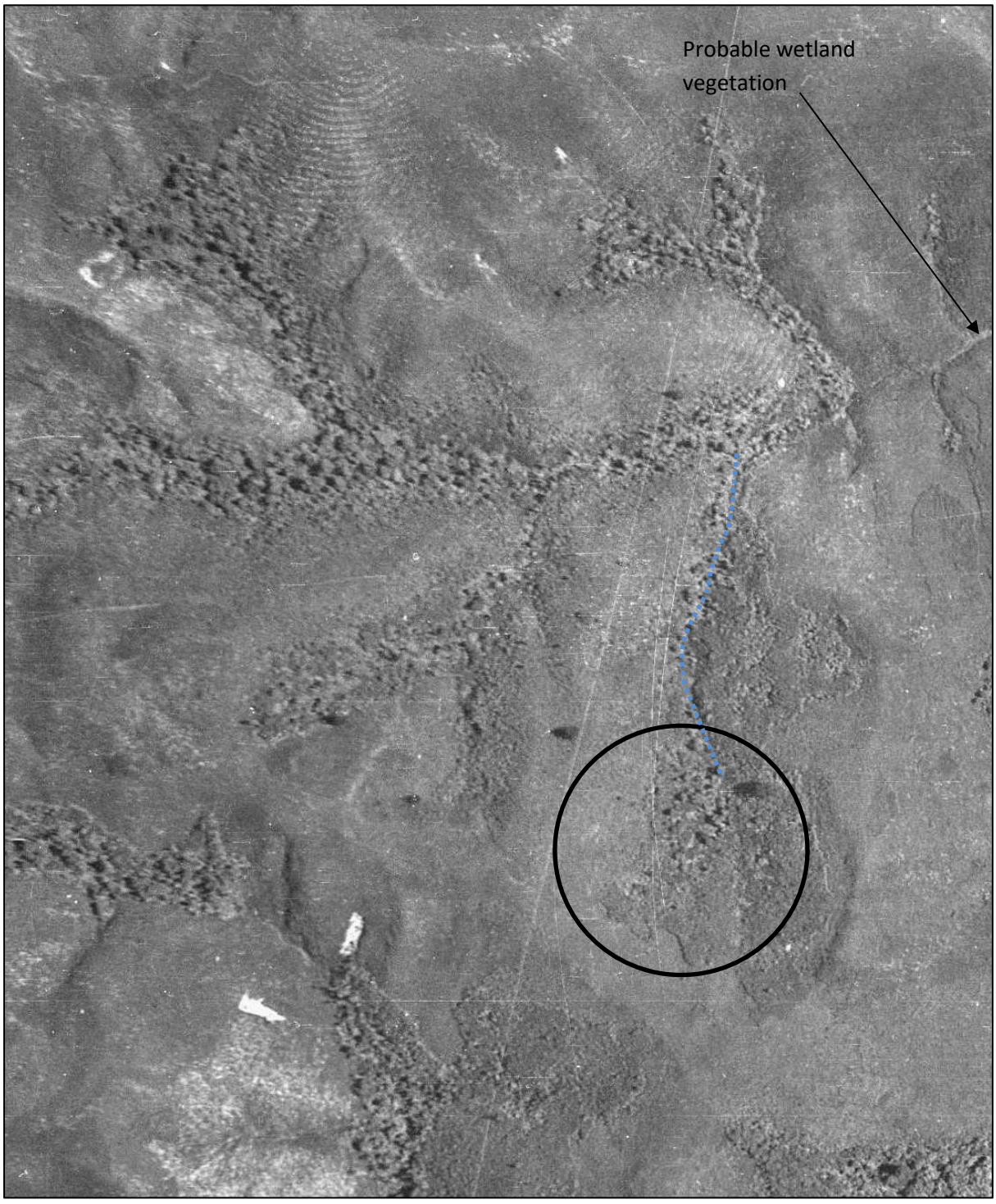
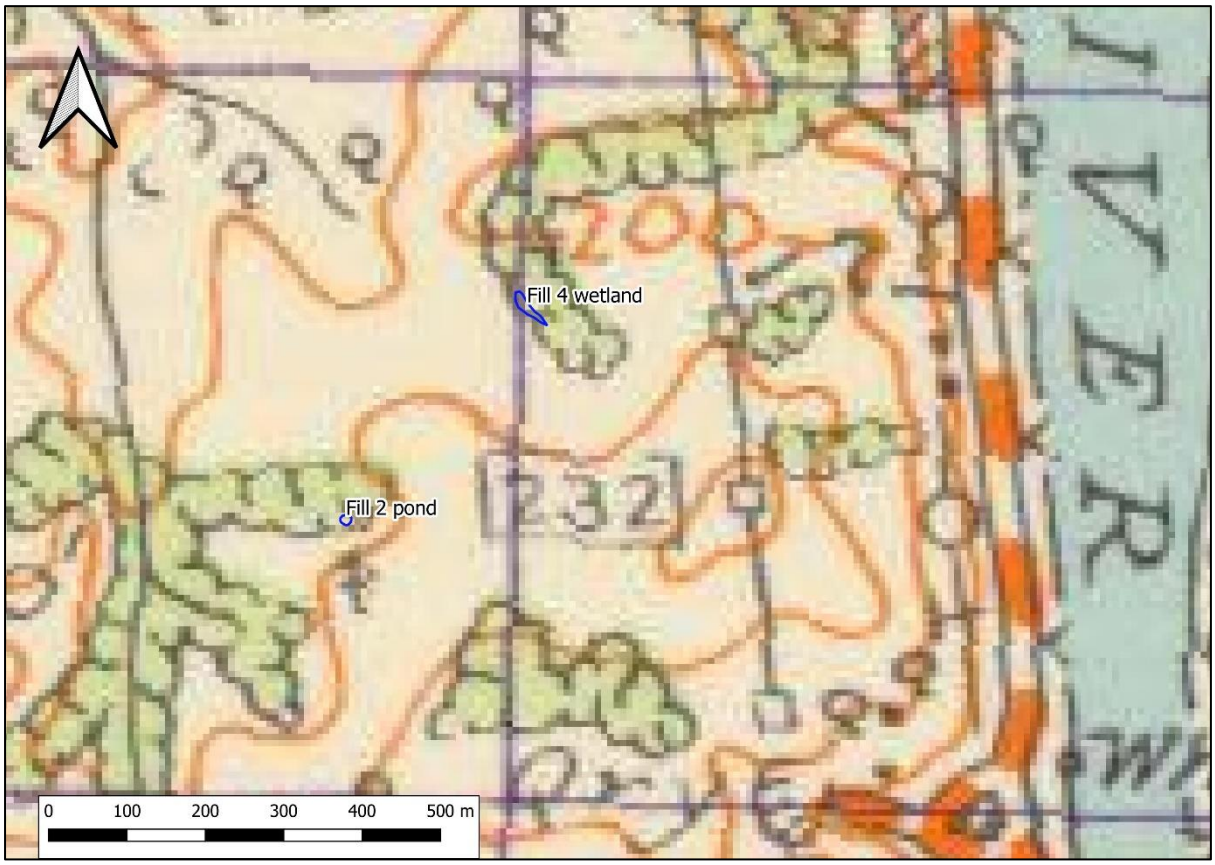


Figure 3: NZMS 1 N056 Ngaruawahia inch : mile 1941 map and approximate location of wetlands within remnant indigenous vegetation



2.2 1963 aerial image

An aerial image taken in 1963 (SN1397) was downloaded in high resolution from Retrolens and georeferenced using QGIS. Figures 4–7 compare 1963 with WRC (2016-19) images available on NZ aerial image. It is important to note that the 1963 image is of much higher resolution compared to the 1941 image and can be displayed at a higher resolution on a computer monitor which shows greater detail than shown in Figures 4–7,

In 1963, fill area 4 wetland appears to have been recently created. This image shows a newly formed stock dam, including an area of open water and recent exposed earth associated with the construction of the dam. At the head of the gully native forest is still present.

Figure 4: Fill site 4. An area of open water is present, up stream of a constructed dam. Shown on SN1397; 1963 image; LINZ creative commons via Retrolens). Scale 1:1000.

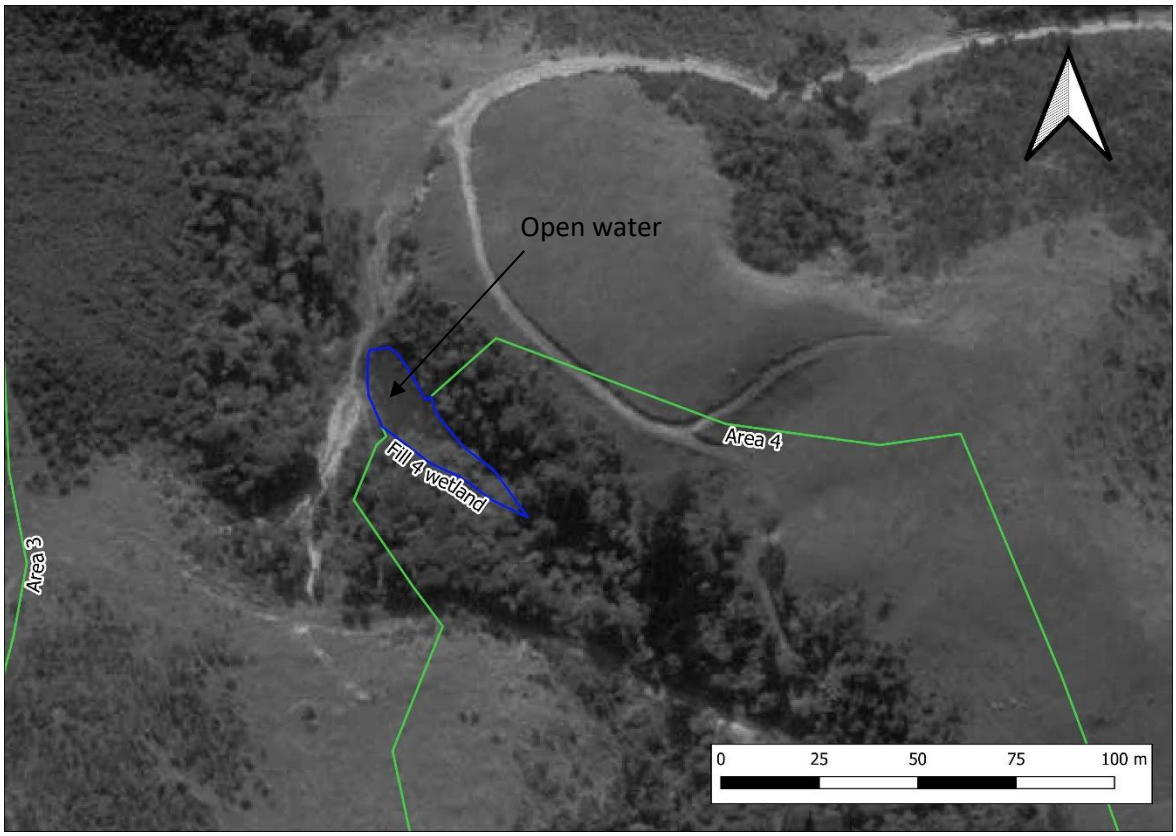


Figure 5: Fill site 4 (WRC 2016-19 images). Scale 1:1000.

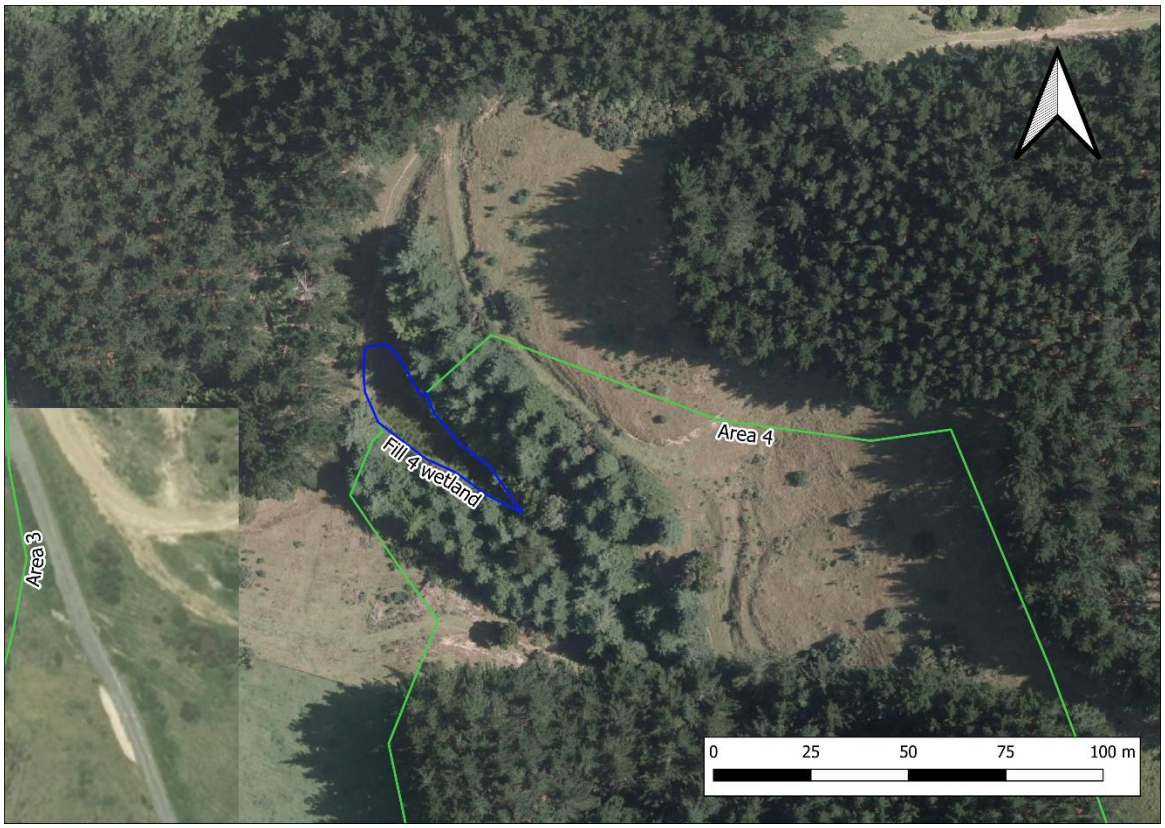


Figure 6: The location of fill 2 pond within area 2. Shown on SN1397; 1963 image; LINZ creative commons via Retrolens). Vegetation in this photo is dominated by successional scrub. Scale 1:1000.

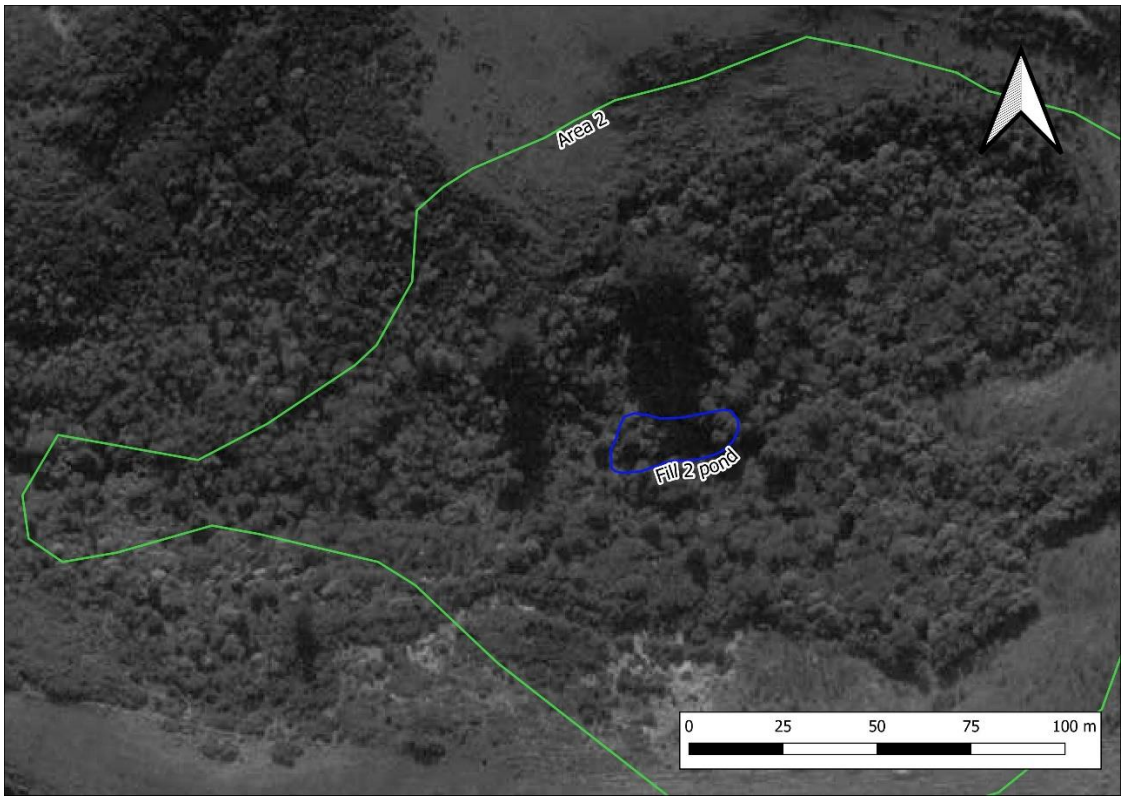
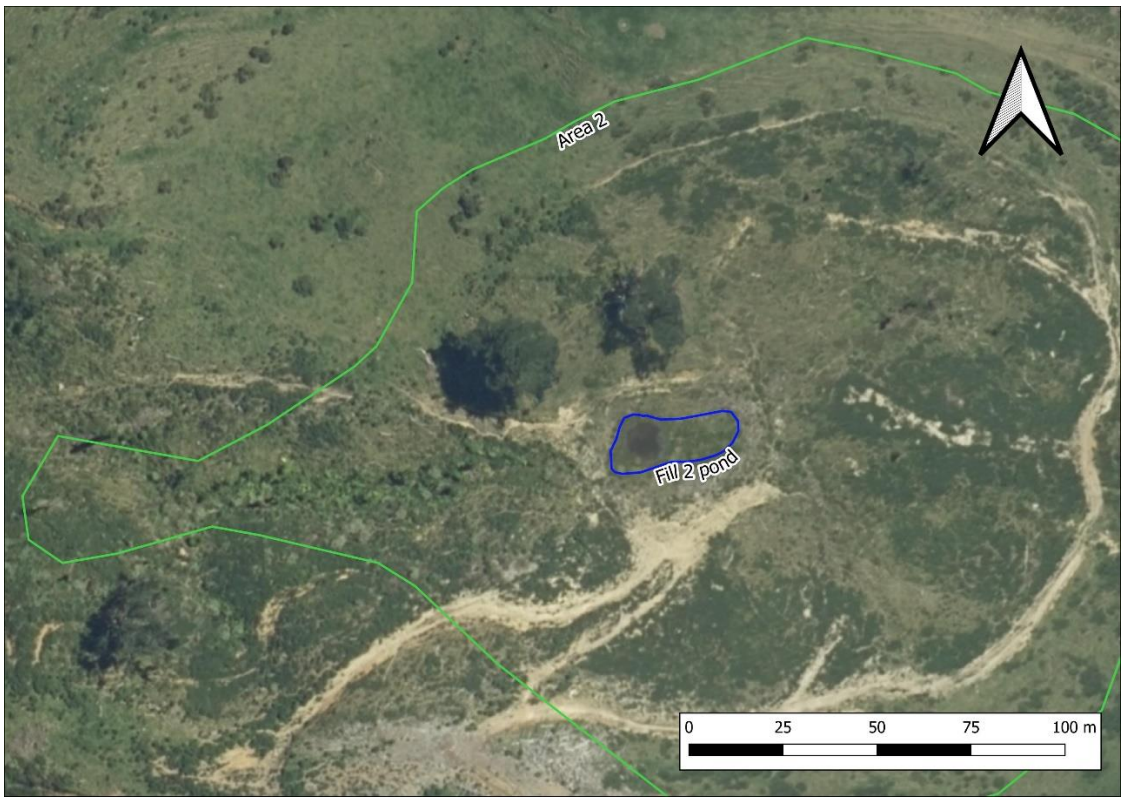


Figure 7: Fill site 2 pond and wetland (WRC 2016-19 images). Scale 1:1000.



3. Induced wetlands or artificial wetlands

The NPSFW 2020 defines an induced wetland as 'wetlands that have resulted from any human activity, except the deliberate construction of a wetland or waterbody by artificial means (see section 5). They are considered 'natural wetlands' (MFE 2021).

Examples of induced wetlands given include

- wetland induced through an overflowing culvert
- wetland induced as an unintentional result of forestry
- remnant wetland habitats, e.g., those associated with drainage channels and other works installed to drain a natural wetland
- wetland induced through stock pugging
- wetland induced through roading works.

The major distinguishing features between induced wetlands and artificial wetlands, are that artificial wetlands occur in locations where wetland habitat previously was not present and has established within deliberately constructed aquatic or wetland habitats AND induced wetlands are unintentionally created.

Evidence presented in question 1 strongly suggests that the area where wetlands occur within fill sites 2 and 4 were both formerly dryland, although sited within gullies and are between 45 to 60 years old.

Gleeson's have provided a letter from Mike O'Reilly that covers their origin and use. The evidence I have found on aerial images supports this.

Induced wetlands within hill country areas commonly develop with land use change (deforestation of native forest to agriculture pasture), combined with grazing and stock pugging which leads to changes in gully morphology and hydrology of formerly ephemeral and intermittent streams. This process is almost ubiquitous on hillslopes with clay rich soils — the sites in question have ultic soils which is clay dominant.

In my experience induced wetlands associated with these factors create intermittently wet wetland habitat which is commonly invaded by species tolerant of grazing, such as rushes and grasses. These sites do not develop open water wetland habitat, unless associated with landslips that dam streams. There is no visual evidence for landslips to have occurred at these locations.

4. Geomorphology of the area

Wetlands are uncommon habitat features in hill country areas because there are limited locations where water can pool for extended periods on time. Where present, they are usually associated with ground water seepages and the lower (wetter) part of narrow gullies, especially where hill country landforms merge into flat land. In tectonically active parts of New Zealand such as in the East Coast to Hawkes Bay Region and in the Rangitikei to Taranaki, where base rock is predominantly mudstone, siltstone and sandstones, wetlands also develop within depressions formed by large landslips. These types of events typically create a cluster of small lakes or wetlands within the land slip zone.

The Huntly site is situated with an area of eroded greywacke-based rock on shallow sloping hillslopes. Assessment of the wider land system using aerial images show induced wetlands within the lower valley areas (where expected) and in the upper more steeper reaches defined small streams. There are no obvious signs of small seepage wetlands and landslip formed wetland habitat creating ponded areas or wetland in upper reaches, anywhere along the western side of the Hakarimata Range.

5. Potential wetland vegetation

The wetlands within fill sites 2 and 4 occur on hillslopes which have ultic soils. Ultic soils are old and weathered soils and are naturally infertile (Molloy 1998). Locally these land-systems supported forest probably of podocarp, broadleaved trees and locally with stands of kauri and hard beech (Collins and Burns 2001). Species associated with low fertility sites such as rimu and tanekaha were likely common.

Wetlands located within these landforms are predominantly fen (moderately fertile wetlands) (Johnson and Gerbeaux 2004), even in gullies were nutrients settle. This is because the hill slopes are naturally infertile greatly limiting available nutrients. In similar areas within the northern New Zealand fen wetland habitat is dominated by manuka (*Leptospermum* unnamed taxon), tanglefern (*Gleichenia dicarpa*) and species of *Machaerina (*e.g., *M. tenax*, *M. teretifolia* and *M. rubignosa*). In more extensive areas, where organic matter accumulated, wire rush (*Empodisma robsta*) occurs.

Whilst deforestation, grazing, and the addition fertiliser increases soil fertility and leaching results in nutrients entering gullies and associated wetland areas, it would have been my expectation that some unpalatable fen wetland species would have remained in relict wetland habitat. *Gahnia xanthocarpa* is one species which may have occurred in these areas, at least on the wetland margin. This species was recorded by Wildlands Consultants (cited within Stantec 2021). *G. xanthocarpa* however commonly also grows within forests so is not indicative of fen wetland *per se*.

Stantec summarises species present within the wetlands within fill area 2 and 4. Whilst some native wetland species are present these are not indicative of fen habitat. Species present are found in fertile swamp wetlands and are also commonly found in artificial wetland habitat, including the native species water milfoil (*Myriophyllum propiqum*), *Carex secta* and *C. virgata*. This is unsurprising given that, open water wetland habitat is readily used by waterfowl, large areas of wetland and readily available wetland plant seed sources occur nearby, and lastly the ponded wetland areas were probably created between 45 and 60 ago allowing a considerable period for fertility to accumulate and natural colonisation to occur.

6. Conclusion

Given the above evidence I have very high confidence (>95%) that:

i. Wetland habitat was not present at these locations in 1941, and

ii. That fill site 4 wetland was created shortly before 1963.

The 1979 aerial image presented in Paul Dutton's series shows earthworks downstream of the fill 2 pond and wetland, providing evidence that this area was created sometime between 1973 and 1979.

My opinion is that they are artificial as defined by the NPS FW 2020 and were mostly likely constructed purposely for stock water.

Since creation they have been colonised by many wetland plant species including several native species. This vegetation succession probably increased greatly whilst they were surrounded by exotic plantation forest, so that the habitat present now appears to be somewhat natural.

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