

**BEFORE THE ENVIRONMENT COURT  
I MUA I TE KOOTI TAIAO O AOTEAROA**

**ENV-2018-CHC-26 to 50**

**IN THE MATTER** of the Resource  
Management Act 1991

**AND**

**IN THE MATTER** of appeals under clause  
14 of Schedule 1 to the  
Act relating to the  
proposed Southland  
Water and Land Plan

**BETWEEN** **WAIHOPAI RŪNAKA,  
HOKONUI RŪNAKA,  
TE RŪNANGA O  
AWARUA, TE  
RŪNANGA O ORAKA  
APARIMA, and TE  
RŪNANGA O NGĀI  
TAHU (collectively  
NGĀ RŪNANGA)**

**Appellants in ENV-  
2018-CHC-47**

**AND** **SOUTHLAND  
REGIONAL COUNCIL**

**Respondent**

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**MEMORANDUM OF COUNSEL FOR NGĀ RŪNANGA REGARDING CULTURAL  
INDICATORS OF HEALTH**

**29 NOVEMBER 2019**

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**MAY IT PLEASE THE COURT**

1. This memorandum of counsel is filed on behalf of Waihopai Rūnaka, Hokonui Rūnaka, Te Rūnanga o Awarua, Te Rūnanga o Oraka Aparima, and Te Rūnanga o Ngāi Tahu (collectively Ngā Rūnanga).
2. In accordance with the Minute of the Court (19 November 2019), the final report on cultural indicators of health is attached as **Appendix A** to this memorandum.
3. This report was compiled in response to the Minute of the Court dated 5 August 2019, which requested work to be completed on cultural indicators of health, which could then be used to describe what is “degraded” in relation to waterbodies in Southland.

**DATED** this 29<sup>th</sup> day of November 2019


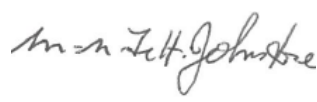


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J G A Winchester / S K Lennon  
Counsel for Ngā Rūnanga

## **Appendix A: Final report on cultural indicators of health**

## 1. Contributors for Ngā Rūnanga in the development of Cultural Indicators of health:

Name	Organisation	Contribution	Signature
Dr Jane Kitson	Kitson Consulting Ltd (on behalf of Ngā Runanga)	Development, context, compilation and writing.	
Ailsa Cain	Kauati (on behalf of Ngā Runanga)	Development, context, compilation and writing.	
Dr Erica Williams	National Institute of Water & Atmospheric Research Ltd Te Kūwaha: National Centre of Māori Environmental Research	Development, context and review.	
Sean Bragg	Te Runanga o Ngāi Tahu	GIS analysis and mapping	
Michael Skerrett	Ngāi Tahu kaumātua and upoko of Waihopai Rūnanga	Cultural Expert. Development, context and review.	
Muriel N Te Huikau Johnstone	Ngāi Tahu kaumātua and historian	Cultural Expert. Development, context and review.	

**Environment Court Practice Note**

2. All participants confirm that they have read the Environment Court Consolidated Practice Note 2014 and in particular Section 7 (Code of Conduct, Duty to the Court and Evidence of an expert witness) and Appendix 3 – protocol for expert Witness Conferences and agree to abide by it.

## Introduction

3. This report responds to the Minute of the Court dated 5 August 2019 (Minute), particularly on the subject of a programme of work for cultural indicators of health. Through the Minute, the Court has: Requested that work be completed on cultural indicators of health, which can then be used to describe what is “degraded” in relation to waterbodies in Southland.
4. These cultural indicators of health enable the assessment and monitoring of cultural thresholds and deterioration at a regional scale.
5. It should be noted that the cultural indicators of health implemented in the outcome of this work programme will not be a complete set of “Ngāi Tahu indicators of health”, as they will apply in the context of Policies 40 and 47 of the proposed Plan. This body of work does not replace kaitiaki<sup>1</sup> specific cultural indicators and frameworks to assess their specific cultural uses, values and associations.
6. To describe degradation, the cultural indicators are based on the attributes (with thresholds) of Te Ara Tawhito (traditional travel routes), Mahinga Kai, and Mauri. This is because these are pillars of Ngāi Tahu culture and identity.

## Process

7. Two wānanga of the experts (except Mr Bragg) were held on 12 and 16 September to discuss the information required to describe cultural degradation. The discussions included what would put a water body at risk.
8. Another two wānanga of the experts (except Dr Williams) were held on 15 and 28 November 2019 to reach agreement for each waterbody as to whether it is degraded or not, and how this will be visualised.
9. All the wānanga highlighted that to explain degradation requires contextual information to be provided. This approach is because effects on whānau can be/are compounding/cumulative and can be intergenerational in impact. Contextual measures are identified as such in the document and Table 1.

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<sup>1</sup> As applied in Te Tangi a Taurira (Ngāi Tahu ki Murihiku 2008) p42

## Primary information taken into account in this memorandum

10. The references used are cited in the text and at the end of this document.

## Appendices

11. The following appendices are attached to this document.

Appendix 1: Table 1: Potential indicators/measures for the Attributes: Te Ara Tawhito, Mahinga Kai and Mauri.

Appendix 2: Table 2: Grading of sites against cultural thresholds

Appendix 3: Contextual information

Map 1: Map of lands administered by the Department of Conservation in the Southland Region

Map 2: Examples of some farming land use within the Southland Region

Map 3: Hazardous Activities and Industries List (HAIL) sites across Southland [Kōreti/New River Estuary insert].

Map 5: Distribution of visible didymo in Southland.

Table 3: Threat categories of some customary fisheries

Map 7: Environment Southland Drain maintenance network

Appendix 4: Maps of degradation

Map 4: Discharges to water of wastewater, stormwater, sewage, oxidation pond effluent, meatworks effluent

Map 6: Changes in wetland extent illustrated by a) recent changes in wetland extend of surveyed wetlands in non-public conservation land from 2007-2014-15; and b) comparison of pre-human wetland extent and 2014-15 extent in non-public conservation land.

Map 8: Location of the Hydro-electric generation infrastructure in the Waiau Catchment

Map 9: Surveyed fish barriers in Southland

## Defining cultural degradation

12. Cultural Indicators of degradation are categorised by Te Mana o te Wai.<sup>2</sup> This position is informed by the requirement to put the needs of the waterbody first, and

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<sup>2</sup> pSWLP, pp. 5-6

the understanding that when a waterbody is no longer in a state of hauora, it is degraded.

13. In the 4 September 2019 Rivers and Lakes JWS, Ms Cain provided the following meanings for Te Mana o te Wai and Ki Uta Ki Tai in the Southland context.

The pSWLP seeks to manage water and land resources in a way that encompasses the Ngāi Tahu philosophy of Ki Uta Ki Tai. This approach recognises that water is important in a variety of ways and that Environment Southland is committed to managing the connections between land and all water, particularly the effects of water quality and quantity changes on the health and function of estuaries and coastal lagoons.<sup>3</sup>

Ki Uta Ki Tai is commonly referred to as 'mountains to the sea' and is about standing on the land and knowing the effects, both positive and negative, in every direction. This ethos reflects the mātauranga (knowledge) that all environmental elements are interconnected and must be managed as such. At a framework level, Ki Uta Ki Tai is similar to the RMA term 'integrated management'.

The pSWLP also recognises that Te Mana o te Wai is fundamental to the integrated framework for freshwater management in Southland.<sup>4</sup> Te Mana o te Wai was formally introduced to freshwater management in 2014 through the NPSFM, which states that it is nationally significant. Upholding Te Mana o te Wai acknowledges and protects the mauri of the water.<sup>5</sup> Another way of saying this is that the needs of the waterbody are put first. Te Mana o te Wai puts a korowai (cloak) over water to recognise its significance in its own right and provides an overarching principle of protection in freshwater management.

Te Mana o te Wai then moves to providing for Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people). Hauora is not just a reference to one's health but to a state of health. Hauora is defined in English

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<sup>3</sup> pSWLP Appeals Version, p. 5

<sup>4</sup> pSWLP Appeals Version, p. 6

<sup>5</sup> NPSFM, p. 7

as meaning ‘fit, well, healthy, vigorous, robust.’ A human analogy for hauora is that you can take a knock, such as have a cold, and have the resilience to bounce back to a healthy and vigorous state.

Therefore, at a principle level, Te Mana o te Wai puts the needs of the waterbody first and provides for healthy and robust waterbodies, people and environment – not one over the other but the hauora of all three elements. Te Mana o te Wai is encompassed in the pSWLP by Ki Uta Ki Tai that holistically integrates the application of Te Mana o te Wai from the estuaries to the headwaters and everything in-between.

14. Te Mana o te Wai puts the mauri and needs of the waterbody first. When a waterbody is no longer in the state of hauora, then is it degraded. If a waterbody continues to degrade over time it may come to a place where remedial actions to a state of te hauora o te wai is no longer possible or irreversible. Between the states of hauora and “terminal” is a continuum – degradation is both a state (i.e., it is either degraded or it’s not) and a process (i.e., a continuum of degradation). In regards to Te Ara Tawhito, Mahinga Kai and Mauri, cultural thresholds can be used to determine the state of degradation and/or the extent of degradation along a continuum.
15. Cultural indicators determine the state and/or extent of degradation in regards to Te Ara Tawhito, Mahinga Kai and Mauri. These attributes include indicators that assess; whether the characteristics reflected in the traditional name are still present, the qualities of the river and if they provide for the cultural uses known of the area, the sound and smell of the water, flow regime, shape of the river, species present and condition and safety to access and use the site, and seasonality. Cultural indicators need to be considered as a whole rather than siloed as separate components, regulatory or otherwise.
16. The definition of hauora and its application in cultural thresholds for degradation is visualised in Figure 1. The visualisation describes that when a waterbody is no longer in the state of hauora (green box), then is it degraded (yellow box). If a waterbody continues to degrade over time it may come to a place where the state of the waterbody is “terminal” (red box). The continuum of degradation from one state to another considers cumulative and compounding impacts, and spatial and temporal factors on Te Ara Tawhito, Mahinga Kai and Mauri.



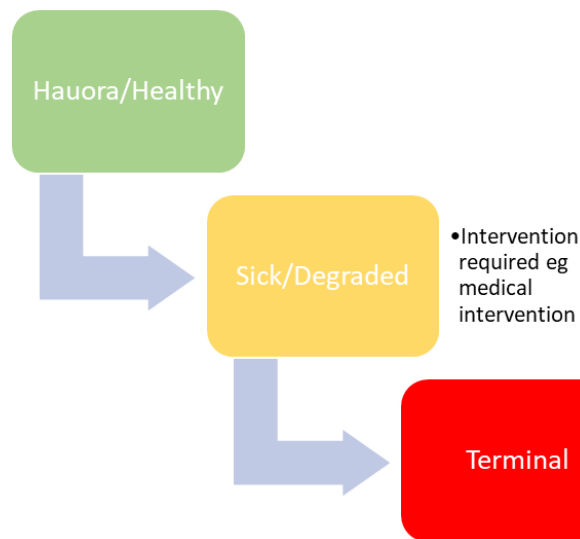


Figure 1: Cultural thresholds for degradation.

### Cultural Indicators and thresholds used

17. Cultural indicators and thresholds were developed using accessible information. No new research or data gathering was conducted. The overall list of potential indicators is recorded in Table 1. Table 1 indicates that there are information gaps that limited a full assessment of degradation. In addition to data deficiencies, there were also limitations in the ability to apply some of the accessible datasets to a regional scale. Due to these limitations, the overall analysis will underestimate of the scale of degradation in the region. At finer spatial and temporal scales, more detailed and specific assessments are required. Kaua e wareware -

**Toi tu te marae a Tane, Toi tu te marae a Tangaroa, ka ora ai te iwi.**

18. Contextual information layers are provided in this assessment to communicate the compounding and intergenerational impacts of degradation on Te Ara Tawhito, Mahinga Kai and Mauri. This assessment demonstrates:
- Impacts on Te Ara Tawhito, Mahinga Kai and Mauri that cannot be addressed directly through this plan change process (i.e., legislative barriers, different land use areas and land use seasonality);
  - doesn't indicate direct degradation of sites or catchment (i.e., Threat status of customary fisheries species);

- c. provides context on an issue but the measure itself requires more work before being applied as a direct indicator of cultural degradation (i.e., ES drainage maintenance schedule and contaminated (HAIL) sites).
  
19. Sites assessed include those from the following environments: rivers/streams, wetlands, lakes, coast and estuary. Sites that exceed thresholds of the indicators listed in Table 1 are reported for Rivers, Lakes and Estuaries in Table 2. Figure 2 shows areas of degradation, where they can be pinpointed to sites.
  
20. Whilst this assessment is limited to accessible datasets, the cultural indicators of health used to determine which waterbodies in Southland are degraded included:
  - a. Suitability for Recreation Grade (SFRG) at coastal and freshwater recreation monitoring sites
  - b. Shellfish water sites meeting the Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas
  - c. Presence of human faecal matter in water ways
  - d. Public health warnings for cyanobacteria present at rivers and lakes
  - e. Active consented discharges to water of wastewater, stormwater, sewage, oxidation pond effluent, and meat work effluent to Southland waterbodies
  - f. Decrease in wetland extent
  - g. Major hydroelectric dams and infrastructure
  - h. Man-made fish barriers.

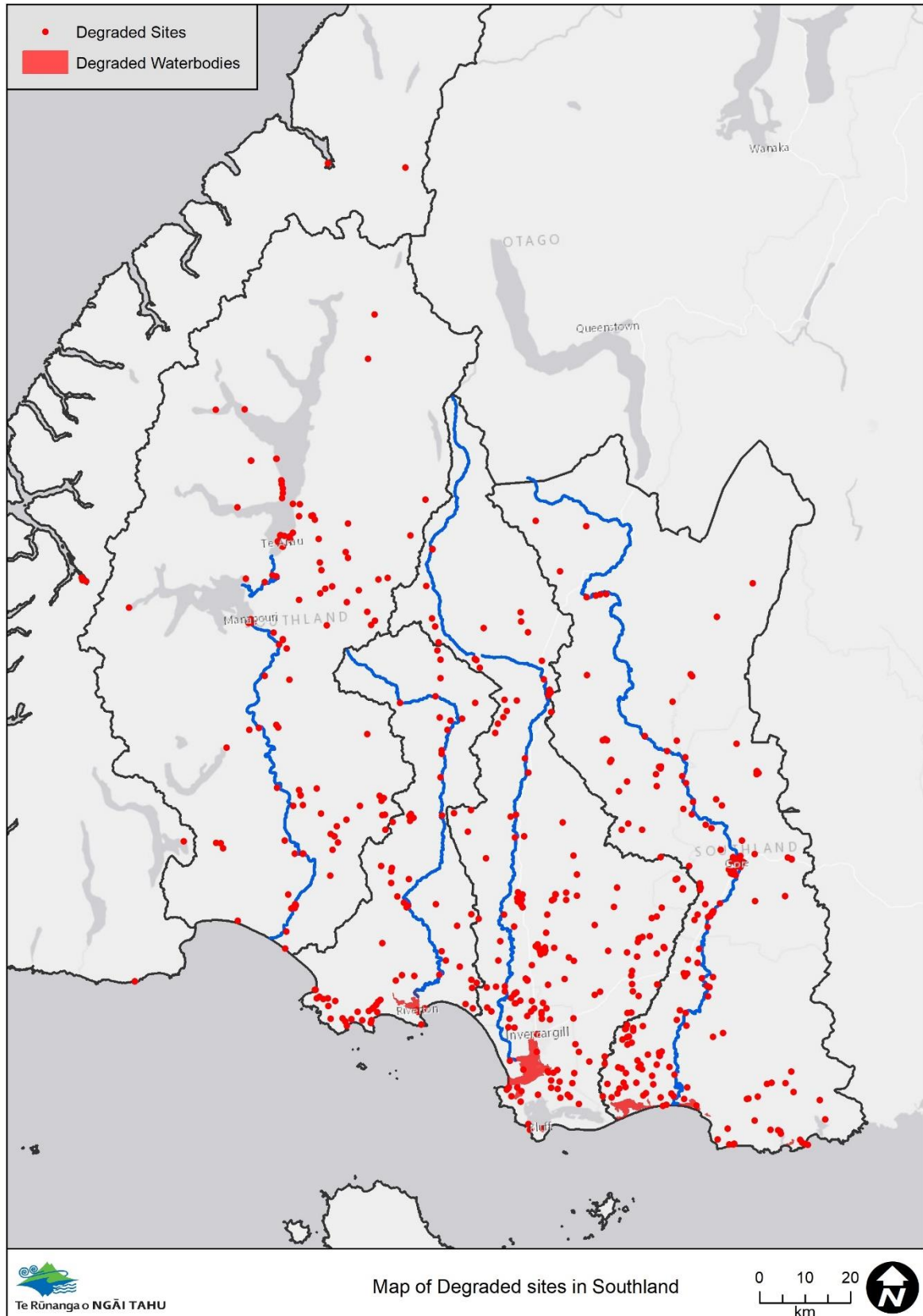


Figure 2: Map of all identified cultural degraded sites in Southland using thresholds and indicators from Table 1.

## Mahinga Kai

21. Mahinga kai is explained in Te Tangi a Tauira as being about:
- ...places, ways of doings things, and resources that sustain the people. It includes the work that is done (and the fuel that is used) in the gathering of all natural resources (plants, animals, water, sea life, pounamu) to sustain well-being. This includes the ability to clothe, feed and provide shelter.<sup>6</sup>*
22. Mahinga kai requires active, intergenerational participation to continue as a cultural practice and the transfer of mātauranga through 'doing' rather than academic theory. Therefore, if mahinga kai is not practiced, its value is diminished. Reasons for not practicing include, but are not limited to:
- a. the capacity of species and resources to replenish themselves, in terms of abundance and hauora
  - b. the degraded state of the waterbody and surrounding area
  - c. impacts of degraded water quality and quantity on the resources and those harvesting and consuming those resources
  - d. reduced access to the mahinga kai sites.

### ***Spatially and seasonality impacts – contextual information***

23. Almost 50% of the Southland region is lands administered by the Department of Conservation. Legislative reserve status can prevent mahinga kai access in such areas.<sup>7</sup> This status means that that Ngāi Tahu/Ngā Rūnanga are confined in their practice of mahinga kai to the areas in Southland where there are heavier impacts from land-use activities (Map 1).
24. Seasonal land use activities can also impact mahinga kai due to health and safety concerns and livestock management practises (e.g., lambing, calving, deer mating/roar). Figure 3 shows the common seasonal practices associated with mahinga kai and farming in Southland.<sup>8</sup> Map 2 illustrates the spatial extent at which

<sup>6</sup> Ngāi Tahu ki Murihiku 2008, p. 126

<sup>7</sup> National Parks Act 1980 s5; Reserves Act 1977 s21; Reserves Act 1977 s19

<sup>8</sup> Harvesting of migratory species such as kanakana will occur later inland than on the coast due to the fish reaching these areas later in the year. Timing of farming activities can vary between different areas for example lambing can be later inland due to risks of spring storms and delayed pasture growth due to soil temperatures taking longer to increase.

such farming activities could occur, noting that this sometimes can vary within farms and between farms from season to season.

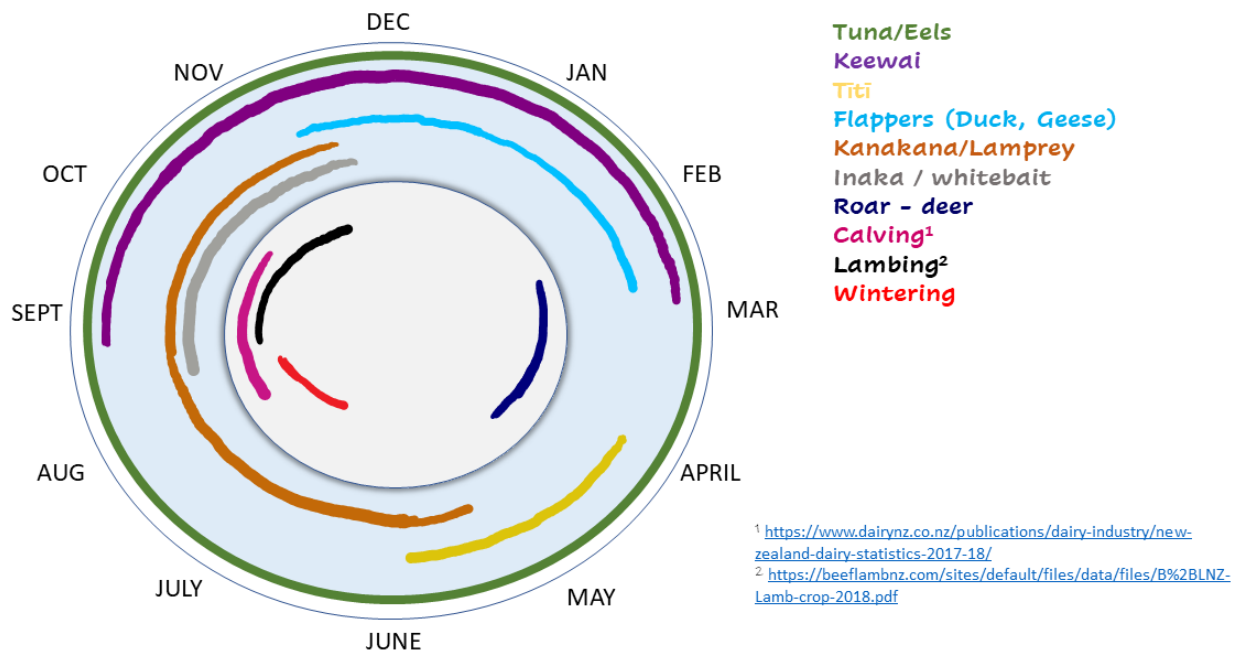


Figure 3: Example of overlaps of seasonality of some mahinga kai and farming activities.

### **Health risk from water contact or consumption**

#### **Microbial pathogens, faecal sources and health warnings (Microbial and cyanobacteria)**

25. The risk of getting sick from gathering or consuming resources is an important issue for Ngāi Tahu and therefore, incorporated into the cultural indicators. Health risks associated with microbial pathogens and faecal sources restrict the ability of whānau to harvest mahinga kai and also diminishes the mana and mauri of the site. If public health alerts are notified on a site of importance this then places a stigma on this site and can interrupt the associations and connections of Ngāi Tahu with that place.
26. Environment Southland monitors for microbial pathogens using three different faecal bacteria indicators:
  - a. *Escherichia coli* (*E.coli*) in Freshwater State of the Environment (SOE) sites and monitored bathing sites;

- b. Enterococci in coastal/estuarine bathing sites; and
  - c. Faecal Coliforms in shellfish sites.<sup>9</sup>
27. Environment Southland also monitors for benthic (rivers) and planktonic (lakes) cyanobacteria at established monitoring sites.
28. Public health surveillance monitoring data has relevance to cultural indicators of health. If a site is notified as a risk to human health through contact with the water or eating shellfish, and the site regularly is notified as a health risk, then the cultural health status of that site is degraded. There may also be consequential impacts on the intergenerational cultural values and associations with that site should human health risks persist.<sup>10</sup>
29. The regional council monitoring is used to notify the public of health risks, using human health alert thresholds<sup>11</sup>. If there is sufficient data to satisfy statistical analysis, then this monitoring can also be used to assess the long-term health risk ('grading'). Effectively there can be two different reasons for monitoring:
- a. Public health risk surveillance monitoring
  - b. Providing a long-term assessment of the sites in relation to human health.
30. The November JWS Water Quality and Ecology (Rivers, Estuaries and Lakes) assessed the long-term health risks posed from microbial pathogens at freshwater SOE sites and benthic cyanobacteria sites. There was not enough data to do this for lakes or estuaries, and the freshwater and coastal bathing sites were not included in that analysis. Sites that were assessed as degraded in that JWS analysis would be considered culturally degraded (Nov JWS Water Quality and Ecology Appendix 1: Grading of river sites against threshold).
31. Public health surveillance monitoring data has relevance to cultural indicators of health. If a site is notified as a risk to human health from contacting the water or eating shellfish, and this site regularly is notified as a health risk, then the status of that site is degraded and the ability to exercise kaitiakitanga negatively affected. A

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<sup>9</sup> The reasons why the different bacteria indicators for different monitoring are preferred is explained in Microbiological water quality guidelines for marine and freshwater recreational areas (MfE & MoH 2003).

<sup>10</sup> Panelli, R., Tipa, G. (2009)

<sup>11</sup> MfE & MoH 2003; MfE & MoH 2009

stigma is attached to the site, surrounding area and related resources which, by association, is also attached to the kaitiaki of that place.

32. To communicate health risk from contact recreation, freshwater and coastal bathing monitored sites are given a Suitability for Recreational Grade (SFRG). This grade is assessed using criteria from the MoH and MfE 2003 guidelines and incorporates five years of past microbial concentrations and sanitary surveys of the catchment. The grades are Very Poor, Poor, Fair, Good and Very Good. Sites that have been graded with a high health risk (Very Poor and Poor) then that site is degraded (Table 2).
33. Environment Southland monitors eight shellfish sites and these are assessed against the Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (MoH and MfE 2003). Of these eight sites, only one has satisfied the guidelines in the last five years.<sup>12</sup> The sites that have not satisfied the guidelines have a high health risk and the cultural health status of that site is degraded (Table 2).
34. The presence of human faecal matter in water ways and mahinga kai areas is highly offensive for several reasons including preventing cultural use. Environment Southland commissioned surveys to determine the source of faecal bacteria at selected sites.<sup>13</sup> Whilst the number of sites assessed was limited and therefore does not represent the extent of degradation that is likely due to human faecal matter contamination of Southland, human faecal matter was detected at 12 sites, and these sites are considered degraded (Table 2).
35. The risk from potentially toxic cyanobacteria present at rivers and lakes is assessed by measuring either the percentage cover of benthic cyanobacteria in rivers or the numbers of cells of Planktonic cyanobacteria in lakes. These are compared to national guidelines for New Zealand recreational areas to determine the risk.<sup>14</sup> Public health warnings are issued by the regional council if the risks are high. Between November 2017 and April 2019 seven sites have had public health warnings issued, with the period the warnings were in place ranging from 17 to 82 days. Two river

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<sup>12</sup> ES data and Pantos and Coxon 2019 (2016-2017)

<sup>13</sup> Pantos & Coxon 2019, Moriarty, Pantos & Coxon 2019a,b,c,d.

<sup>14</sup> MfE & MoH 2009

sites had two public health warnings in that time.<sup>15</sup> Sites with public health warnings are considered degraded (Table 2).

### **Contaminated sites – Hazardous Activities and Industries List (HAIL) sites – contextual information**

36. Some activities and industries have the potential to cause contamination to Southland waterbodies due to hazardous substance use, storage and/or disposal. The Hazardous Activities and Industries List (HAIL) has been compiled by the Ministry for the Environment to assist local authorities in identifying potentially contaminated sites.<sup>16</sup> These ‘potential’ sites require further investigation to determine whether the site is in fact contaminated or a risk to waterbodies.
37. In Southland there are to date 1,516 identified HAIL sites. Of the sites investigated or partially investigated (289 sites) nearly 29% were considered contaminated and 20% to have low/acceptable risk.<sup>17</sup> Map 3 illustrates the HAIL sites across Southland and the insert provides context to potential issues around Kōreti/New River Estuary.

### **Consented discharges to water**

38. The disposal of waste and the treatment and disposal of human effluent and waste water to water is of major concern to Ngāi Tahu.<sup>18</sup> Particular issues relate to the resultant physical and spiritual contamination of the water way, including the need to protect mahinga kai and wāhi tapu<sup>19</sup> and other cultural and physical contamination.
39. Map 4 shows the active consented discharges to water of wastewater, stormwater, sewage, oxidation pond effluent, and meat work effluent. Such areas are degraded because it impacts on cultural uses, diminishes the site status and mauri, and attaches a stigma to both the site and kaitiaki.

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<sup>15</sup> Waikaia River at Waikaia Feb 2019-for 21 days, Mar 2019 for 17 days; Aparima River at Thornbury: Nov 2017 for 62 days, Mar 2019 for 23 days.

<sup>16</sup> The current HAIL can be accessed from <https://www.mfe.govt.nz/land/hazardous-activities-and-industries-list-hail#hail-web>

<sup>17</sup> Classification categories: acceptable, managed, remediated, and no identified contamination

<sup>18</sup> Pauling & Ataria 2010

<sup>19</sup> Ngāi Tahu ki Murihiku 2008; Pauling & Ataria 2010



### ***Impacts of introduced species – contextual information***

#### **Didymo**

40. The introduction of plant and animal species have had an impact on mahinga kai species and practice. Introduced species can replace and out compete, alter habitat and/or prey on native species, as well as making it harder to access (e.g. dense gorse or blackberry in riparian) or less desirable to access sites.
41. The best data available to map the extent of an issue with a pest species is for Didymo (*Didymosphenia geminata*). However, this data does not provide an overall assessment of degradation of cultural health in Southland waterbodies in regards to pest species.
42. Didymo is a large distinctive diatom that can bloom in dense large mats that can cover large proportions of the river beds. High biomass is typically found in low-nutrient waters.<sup>20</sup> Didymo is a recent pest incursion that was first discovered in the Waiau River, Southland in 2004 and has spread across the region.
43. Research has shown that high Didymo biomass can alter the structure of benthic communities, change the composition of drifting invertebrate communities and reduced fish biomass.<sup>21</sup> Didymo has been found to impact fish communities both directly and indirectly through changes in their prey community.<sup>22</sup>
44. Didymo also can impact on mahinga kai. Large growth will cover and hide resources such as pounamu. It can make it undesirable to enter the water and hard to use nets and other fishing gear. The risk of spreading pest species is also a factor that impacts on entering infected waters, and biosecurity incursions impact on the status of the site and the associated kaitiaki. Waterways with visible Didymo growth are considered to be degraded.

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<sup>20</sup> Kirkwood et al. 2007

<sup>21</sup> Jellyman & Harding 2015, Kilroy et al. 2009

<sup>22</sup> Jellyman & Harding 2015

## ***Decline in mahinga kai species abundance***

### **Threat status of customary fisheries species - contextual information**

45. The freshwater fisheries threat rankings<sup>23</sup>, a process managed by the Department of Conservation, are used here to provide some context in relation to the threat of extinction faced by some mahinga kai and taonga species.
46. The three threat categories in Table 3 are:
- a. Threatened: Nationally Vulnerable: these species are considered to be facing the risk of extinction in the medium term. Examples of other species in the same threat category are: Rāpoka/New Zealand Sealion, Aihe/Hectors Dolphin and Tawaki/Fiordland Crested penguin
  - b. At risk: Declining: these species are not considered threatened but could become so quickly if the decline continues. Examples of other species in the same threat category are: Toutouwai/South Island Robin, Tara/white fronted tern; and kororā/southern blue penguin.
  - c. At risk: Naturally uncommon: these species that have naturally small populations and therefore susceptible to harmful impacts. Examples of other species in the same threat category are: Mātā/Codfish Island Fernbird and Koekoeā/long-tailed cuckoo.
47. Sixty percent of customary fisheries are placed in threat categories (Table 3).

## ***Te Ara Tawhito, Mahinga Kai and Mauri***

### **Changes in wetland extent**

48. As an important source of mahinga kai, wetlands are an important cultural resource to Ngāi Tahu ki Murihiku.<sup>24</sup> Comparing historic data (circa 1840) and 2010 data, 90% of wetlands have been lost within Southland (excluding the public conservation lands of Fiordland National Park and Stewart Island/Rakiura).<sup>25</sup>

<sup>23</sup> Dunn et al. 2018; Grainger et al. 2018; Nelson et al. 2019

<sup>24</sup> Ngāi Tahu ki Murihiku 2008

<sup>25</sup> Fitzgerald et al. 2010; Clarkson et al. 2011.

49. Environment Southland commissioned a mapping exercise of wetlands >0.5 ha in size (excluding public conservation lands), to monitor changes in wetland extent. The mapping results show a loss in wetland extent from 2007 to 2014-15 of 1362 ha which is approximately 7% (of those wetlands mapped).<sup>26</sup> Map 6A shows this change in wetland extent. This data is limited in that it only represents the wetlands surveyed however any decrease in wetland extent is considered degradation.
50. To provide context Map 6B compares the pre-human wetland extent with that of the Environment Southland 2014-15 wetland inventory.

### **Place names reflecting current conditions**

51. Ngāi Tahu place names can provide context to the past condition of a site or waterbody. If the waterbody characteristics become inconsistent with the place name then this can be an indication of degradation. More work is required to provide a robust and region wide analysis, however, below are some examples to highlight where place names can indicate deterioration in state:
- a. **Upokororo** is the original name for the Eglinton River, Fiordland. Upokororo is the name for the grayling, which is now extinct.
  - b. **Whaka-tutu-a-te-kete** is a name for part of the Aparima arm of Jacobs River Estuary. This name refers to how easily whitebait was able to be caught there. Under the right conditions it was possible to wade into the water and catch whitebait with a kete. This is no longer possible.
  - c. **Puke-ma-ta-wai** in Riverton/Aparima refers to an area with many springs. This area had 57 known springs; each one was named after the mahinga kai found in them. To date, only seven of these springs remain, with one having recently been removed due to the placement of a culvert.<sup>27</sup>
  - d. **Waiau River** was named for its turbulent, swirling waters and its great volume of water. In contemporary times, these characteristics have been greatly curtailed.

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<sup>26</sup> Ewan 2015; Ewan 2018

<sup>27</sup> Mrs M Johnstone pers comm.

### **Drain and small stream clearance- contextual information**

52. Clearance of drains and streams of macrophytes and sediments for drainage can have negative impact on instream communities and the habitat of fish, including threatened taonga species, such as tuna/longfin eel, giant kōkopu and waikākahi.<sup>28</sup>
53. Map 7 illustrates the extent of the drainage maintenance network managed by Environment Southland. This map does not show the whole extent of drainage maintenance occurring in the Region as maintenance does occur by private landowners.

### **Changes to the characteristics of the waterway**

#### *Hydro scheme modifications*

54. Hydroelectric dams and operations can have significant impacts on the characteristics of waterbodies. They can restrict movements of diadromous fish, which can generally result in their reduction or loss from habitats above obstructions.<sup>29</sup> Large downstream migrant eels can be killed passing through turbines on their way to the ocean to breed.<sup>30</sup>
55. Large dams change downstream flow regimes, which can alter habitats and the interconnection of habitats supporting mahinga kai species. Changes in flow regimes can impact the river, river mouth and coastal morphology.<sup>31</sup>
56. The Manapōuri and Monowai power schemes have altered the function and characteristics of the waterbodies in the Waiau Catchment, e.g., river flows have greatly reduced. The resulting diversions of water and fluctuations in lake levels have altered the hydrology of the waterbodies, freshwater/saltwater ratios and changed the characteristics of this catchment. Fish passage at these in river structures relies on human intervention. As such, the waters of the Waiau catchment are considered degraded due to the overall impacts of large-scale modifications. Map 8 illustrates the location of hydro scheme structures in the Waiau catchment.

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<sup>28</sup> Allibone & Dare 2015; Beentjes et al. 2005; Greer et al. 2012, Kitson pers. obs, Young et al. 2004.

<sup>29</sup> Jellyman and Harding 2012

<sup>30</sup> Beentjes et al. 2005, Williams et al. 2017.

<sup>31</sup> Young et al. 2004

### **Barriers to fish passage**

57. Freshwater fish require the ability to access different habitats at different life stages and to distribute themselves across the catchment. This spatial distribution of resources is an important requirement for Te Ara Tawhito, Mahinga Kai and Mauri of the waterbodies. Man-made fish barriers are thresholds for degradation.
58. Environment Southland undertook surveys of some potential man-made fish barriers in the region. These surveys are not representative of fish barriers regionally but do indicate sites of degradation. Map 10 shows the location of the surveyed sites for fish barriers.

### **Link to ecological and human health indicators**

59. In the 22 November 2019 Rivers, Estuaries and Lakes JWS Ms Cain and Dr Kitson highlighted that as the indicators of ecosystem and human health and cultural indicators of health have proceeded in parallel that it has not been possible to explore linkages between the two processes in any detail. Table 1 provides limited linkages between the two and indicates if thresholds from the ecosystem and human health workstream may have been incorporated into this document. When the ecosystem and human health thresholds have been used, then it must be noted that these thresholds may not be consistent with hauora (4 September 2019 Rivers and Lakes JWS), and as such could be an underestimation of degradation in cultural health.

### **Reported scale of Cultural degradation**

60. This report has focused on the degradation of sites and has not included analysis of applying Ki Uta Ki Tai to understand the interconnected effects of degradation across the region. For example, if an estuary is degraded, what is the extent of that state and where, if anywhere, along the contributing waterbodies does the state change from degraded to hauora. The continuum<sup>32</sup> of that degradation also needs to be factored into the spatial assessment.

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<sup>32</sup> This includes cumulative and intergenerational aspects.

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**APPENDIX 1:****Table 1: Potential indicators/measures for the Attributes: Te Ara Tawhito, Mahinga Kai and Mauri.**[The **bolded** attributes are those with sufficient data to include in this report. Note this is only a subset of possible cultural indicators]

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
Mahinga Kai	Access	Legislative barriers – some areas	<b>Reserve status (eg National Parks and scientific reserves) that prevents mahinga kai access.</b>	[This is a contextual layer to show restrictions on mahinga kai and cultural uses]	Yes. Online – DOC lands		A contextual layer is provided to illustrate spatial restrictions on mahinga kai and uses. Map 1.
		Land use activities, timing and restrictions for access	<b>Areas of different land use areas and timing of activities.</b>	[This is a contextual layer to show restrictions on mahinga kai and cultural uses]	Yes. ES data Some limitations.		A contextual layer is provided to illustrate seasonal restrictions on mahinga kai and uses. Map 2 and Figure 1.
		Physical access: banks	Bank stability for access	Unable to access sites.	Some. CHI measures. Coverage limitation.		

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			Banks too steep to enable access.				
		Physical access: riverbed too slippery	Periphyton	Unable to access. Periphyton growth makes access too slippery.	Needs further work to describe threshold and state	Partly - Periphyton as indicator but threshold different.	
	Able to harvest	Health risk from water contact or consumption	<b>Microbial pathogens [various indicators]</b> <sup>33</sup> [freshwater, marine/coastal, shellfish waters]	Health at risk – not meeting relevant health guidelines for shellfish sites. Very Poor and Poor Suitability for Recreational Grades on sites can diminish the site and associated kaitiaki.	Yes. ES	Partly. Not all indicators were able to be reported.	Bathing sites Suitability for Recreational grades.  Shellfish sites failing health guidelines.  Table 2 and Appendix 3.  Nov JWS degraded sites added to Table 2 and Appendix 3.

<sup>33</sup> The indicators vary depending on what is being monitored eg. Freshwater (SOE and bathing) sites (*E. Coli*), Marine bathing sites (Enterococci), Shellfish water sites (Faecal Coliforms)

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			<b>Faecal sources: Human</b>	Human sources should not be present in water for health, mahinga kai and other cultural reasons <sup>34</sup> High risk of pathogens in water waterways.	Some. Reports from ES. <sup>35</sup>		Sites found with human faecal sources reported.  Table 2 and Appendix 3.
			<b>Human health warnings (cyanobacteria)</b>	Public Health Alerts – MfE and MoH 2009 Guidelines. Sites with health warnings prevent cultural use and diminish the site and associated kaitiaki.	Yes. ES data	JWS May 2019 Lakes and Rivers. JWS Nov 2019 provided long term grading.	Public health alerts between Nov 2017 and April 2019. Table 2 and Appendix 3.
			Estuarine gross eutrophic zones causing illness (eg	Illness caused	Limited	Partly- Estuaries with Gross Eutrophic Zones reported.	Estuaries are considered degraded if GEZ are

<sup>34</sup> Ngāi Tahu ki Murihiku 2008; Pauling & Ataria 2010

<sup>35</sup> Pantos & Coxon 2019; Moriarty et al. 2019a b,c,d

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			nausea and headaches).				indicated in the Nov JWS. Added to Table 2 and Appendix 3.
			Contaminated sediments – including heavy metals, pesticides. Emerging contaminants.	Health at risk – not meeting relevant available health guidelines	Limited. ES	Partly – metals reported for estuaries. Needs more work.	
			Contaminated kai species	Health at risk – not meeting relevant available health guidelines	Limited. ES. Needs further work for regional assessment.		
			<b>Contaminated sites</b> – Hazardous Activities and Industries List (HAIL) sites		Yes. ES Hazardous substances are of concern to Ngāi Tahu, but this layer represents potential – not absolute risk.		Contextual layer of potential risk. <sup>36</sup> Map 3

<sup>36</sup> Hazardous substances are of concern to Ngāi Tahu; Ngāi Tahu ki Murihiku 2008

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			Perception – Perceived to be high risk to eat from and touch water	Avoidance of areas by whānau. Including avoidance due sewerage discharges to water and those close to waterways	No. Needs further work for regional assessment. <sup>37</sup>		
			<b>Consented discharges to water of wastewater, sewage, Oxidation Pond Effluent, Meatwork effluent to water</b>	Human waste and effluent should not be present in water for health, mahinga kai and other cultural reasons. These contaminants are culturally offensive.	Yes. ES consent data		Consents that discharge unacceptable contaminants are shown in Map 4 and Appendix 3.
		Able to set nets safely	Fine sediments/silt	Whānau get stuck.	No. Needs further work to describe threshold and state.	Partly- links to deposited sediment. Needs more work.	
		Methods for harvest	Algae fouling nets and impairing harvest methods	Impairs harvests.	No. Needs further work to describe threshold and state.	Partly- links to deposited sediment. Needs more work.	

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<sup>37</sup> Only some sites have data

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
		Impacts of introduced species	Presence and abundance of introduced species that impact on mahinga kai.	Impacts on mahinga kai species and activity.  <b>DIDYMO</b> presence as an example indicator of data available.	Limited data from ES on pest plants.  <b>Didymo</b> data from Meridian Energy Ltd.	Partly - Distribution of didymo at Environment Southland (ES) monitoring sites is reported in the Nov JWS in appendix 5.	Presence of visible Didymo shown in Map 5 and Appendix 3.
	Species	Species presence	Target species observed in sufficient numbers [incorporating seasonality and maramataka].	Expectations were not met from what is known about the site, observed over a period of time.	No. Needs further work to describe threshold and state.		
			Diversity and abundance of species (including bugs) [incorporating seasonality and maramataka].	Decline of expected species diversity and abundance from what is known about the site, over a period of time	No. Needs further work to describe threshold and state.	Partly – fish IBI Partly MCI Both limited to presence/absence. Fish IBI as a newer indicator needs further consideration in relation to cultural degradation.	Nov JWS MCI degraded sites added to Table 2 and Appendix 3.

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
		Decline in abundance	Trends	Reduction from expected for harvest species.	No. Needs further work to describe threshold and state.		
			<b>Threat status of customary fisheries species</b>	Contextual information as this doesn't indicate direct degradation of sites or catchment. Threshold: NZ Threat Category level of at risk – declining.	Yes. Department of Conservation.		Contextual information provided in Table 3- listing threat categories for some customary fisheries.
		Customary fishery fitness and condition	<b>Toxicity – nitrate, ammonia</b>	No effects. Band A	Yes. ES data in water quality and ecology JWS.	In JWS Nov 2019 – Band A threshold.	Nov JWS degraded sites added to Table 2 and Appendix 3.
			Disease, parasite load	Condition is unsuitable for cultural use in area that has been traditionally harvested.	No. Needs further work to describe threshold and state.		

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
		Condition of other resources including that of rimurapa/bull kelp, harakeke/flax.	Condition of resources meets requirements for use	Condition is unsuitable for cultural use in area that has been traditionally harvested	Limited (Ōmāui and rimurapa). Needs further work to describe threshold and state.		
Te Ara Tawhito, Mahinga Kai and Mauri	Habitat/water quality	Health/condition of waterbodies and whenua/land (Includes habitat measures)	Wetlands condition indicators	Condition does not meet hauora.	Limited. ES Need for cultural assessments.		
			Rivers / streams condition indicators	Condition does not meet hauora.	ES. Data in water quality and ecology JWS. Need for wider spatial coverage of cultural assessments.	Some. May- Rivers JWS and Nov JWS 2019. Thresholds are likely to be different.	
			Lakes condition indicators	Condition does not meet hauora.	ES data in water quality and ecology JWS. Need for cultural assessments	Some. May- Lakes JWS and Nov JWS 2019. Some thresholds maybe different.	Nov JWS degraded Lakes added to Table 2 and Appendix 3.
			Groundwater condition indicators	Condition does not meet hauora.	Limited/None? ES Need for cultural assessments.		



Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			Spring condition indicators	Condition does not meet hauora.	Limited/None? ES Need for cultural assessments.		
			Estuaries condition indicators	Condition does not meet hauora.	ES data in water quality and ecology JWS. Need for cultural assessments.	Some. May Lakes JWS and Nov JWS 2019. Some thresholds maybe different.	Nov JWS degraded estuaries added to Table 2 and Appendix 3.
			Land/Soil condition indicators including soil quality and land use capacity.	Condition does not meet hauora.	Limited. ES. Need for cultural assessments.		
	Changes to the function and characteristics of the waterway.	Places/quality/characteristics absent	Comparison of historic (circa 1840) with current flow, shape and characteristics of the waterway.	Channel modifications eg awa not able to flow/connect naturally (includes meanders and oxbows). Removal of bends removes mahinga kai areas. Includes channel straightening, stock banks, flood control	Limited. Some limitations with being able to use this in a comparative analysis This would need more time. .		

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
				works, gravel extraction, infrastructure (including <b>hydroelectric generation scheme modifications</b> )			
			Comparative analysis of place names and current conditions.	The waterbody characteristics are inconsistent with the place name.	Needs further work to describe state.		Some examples are provided in the text.
			Change in characteristics of the water including visual qualities (clarity, colour), smell, temperature and the way the river works (sediment/gravel movement).	Characteristics of the area have changed.	Limited. CHI measures. Coverage limitation.		
			Removal of smaller tributaries and ephemeral streams.	No removal of waterways	Limited. Needs work to determine state.		

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			Comparison of historic (circa 1840) with current maps.				
			<b>Changes in wetland extent. Comparison of historic (circa 1840) with recent removal and current extent.</b>	No removal of wetlands	Only pre-human baseline available (Landcare research). Data from ES: 2014-2015 layer and changes in wetland extent from 2007 to 2014. Data is limited to the areas surveyed and coverage is limited.		Pre-human baseline and 2014 layer to provide contextual information. Changes in wetland extent to provide information on degradation.
			Removal of springs	No removal of springs	No Lack of mapped data.		
			Drain and small stream clearance <b>ES drainage maintenance schedule</b> as an	Removal and damage of habitat for freshwater species.	Limited. ES data relates only to ES managed areas and doesn't include maintenance in		Contextual information of ES drainage network provided in Map 8.

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
			indicator with data available.		other areas by private landowners. Needs more work to determine state and thresholds.		
		Loss of connectivity	Comparative analysis of rivers connection with springs, wetlands, lakes and estuaries	Loss of connections that impact on species and knowledge of the area.	Needs more work to determine state and thresholds		
			Comparative analysis of historic and current extent of riparian and other habitat corridors.	Loss of connections that impact on species and knowledge of the area.	Needs more work to determine state and thresholds.		
		Flow reductions and flow regime changes [issue for taonga species and harvesting, mauri and navigation]	Comparative: historic conditions vs current	Impacts on harvesting and taonga species.	Some data available (ES/NIWA) but needs more work to determine state and thresholds.		
		Stock access and issues for habitat and stream shape	Stock access (CHI) and impacts on habitat	No stock access impacts on stream and riparian habitat.	Some CHI work for some awa in Southland.		

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
					Requires wider distribution for regional analysis. Needs more work to determine state and thresholds.		
	Fish passage	Barriers	<b>Hydro scheme modifications</b>	Hydro scheme impacts on the ability of taonga/mahinga kai species to be where they historically were distributed. Taonga species/mahinga kai mortalities from hydro infrastructure.	GIS points – ES consents and reports.		
			<b>Other human placed barriers for fish passage</b> (eg. Perched culverts)	Taonga/mahinga kai species cannot pass the barriers to where they historically were distributed.	Some. ES data. Limited to areas surveyed. The report that was supplied by ES was in draft form with limited information regarding how the		Surveyed known fish barriers in Southland are presented in Map 10.

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
					survey sites were selected and what the difference between fish barriers and potential fish barriers.		
	Wish to return		Cultural Health Index	Whanau do not wish to return to traditional sites	Some CHI work for some awa in Southland. Requires wider distribution for regional analysis.		
Te Ara Tawhito	Spatial diversity of resources	Diversity of resources spread across cultural landscapes that supports multiple cultural uses	Resource diversity	Required cultural resources are not found in sufficient quantity and quality, in-situ across the landscape	Some. CHI. Needs further work for kaitiaki to describe threshold and state.		
		Drinking water resources spread across cultural landscapes	Drinking water indicators	Drinking water is no longer safe where it once was safe. <sup>38</sup>	Limited. ES data (Nitrate and E. coli in groundwater, and surface water).	Some links to Mr Rodway's EIC.	

<sup>38</sup> Ngāi Tahu ki Murihiku 2008

Attribute	Component	Subcomponent	Potential Indicators/Measures	Threshold for degradation	Data available/limitations	Linkage to ecological indicators	How demonstrated in this JWS
					Needs further work for kaitiaki to describe threshold and state.		
Mauri	All above						

## APPENDIX 2:

Table 2: Grading of sites against cultural thresholds

[Table is in A3 page size. Note that the table doesn't include consented discharges or wetland indicators.]

Degraded sites	Type	FMU	SFRG	Shellfish waters	Human Faecal Matter Where Surveyed	Cyanobacteria	November 2019 JWS Ecosystem health and Human Health thresholds						
							Estuary	Lakes	ECOLI	MCI	DIN	NH4N_A	
Aparima River at Thornbury	River	Aparima	Very Poor			Yes			TRUE				
Hamilton Burn at Affleck Road	River	Aparima				Yes			TRUE	TRUE			
Opouriki Stream at Tweedie Road	River	Aparima			Yes				TRUE		TRUE		
Wairio Stream (22 Birchwood street)	River	Aparima			Yes								
Wairio Stream (u/s of Otautau confluence)	River	Aparima			Yes								
Ōtautau Stream at Ōtautau-Tuatapere Road	River	Aparima			Yes				TRUE				
Ōtautau Stream at Waikouro	River	Aparima			Yes				TRUE				
Pourakino River at Traill Road	River	Aparima							TRUE				
Waimatuku at Waimatuku Township Road	River	Aparima								TRUE			
Waimatuku Stream at Lorneville Riverton Hwy	River	Aparima			Yes				TRUE	TRUE	TRUE		
Waimatuku Stream at Rance Road	River	Aparima								TRUE			
Jacobs River Estuary d/s Railway Br East	River	Aparima	Poor										
Colac Bay/Ōraka at Colac Bay Road opp marae	Coastal_bathing	Aparima	Poor										
Colac Bay/Ōraka at Bungalow Hill Road	Coastal_shellfish	Aparima		Yes									
Jacobs River Estuary d/s Fish Co-op	Coastal_shellfish	Aparima		Yes									
Kawakaputa Bay at Wakapatu Road	Coastal_bathing	Aparima	Poor										
Monkey Island at Frenzt Road_s	Coastal_shellfish	Aparima		Yes									
Monkey Island at Frenzt Road	Coastal_bathing	Aparima	Very Poor										
Jacobs River Estuary	Estuary	Aparima					Yes						
Carran Creek at Waituna Lagoon Road	River	Mataura							TRUE	TRUE			
Longridge Stream at Sandstone	River	Mataura							TRUE	TRUE	TRUE	TRUE	
Mataura River at Riversdale Bridge 300m ds	River	Mataura	Very Poor										
Mataura River 200m d/s Mataura Bridge	River	Mataura							TRUE	TRUE	TRUE		
Mataura River at Gore	River	Mataura	Very Poor						TRUE	TRUE	TRUE		
Mataura River at Mataura Island Bridge	River	Mataura				Yes			TRUE	TRUE	TRUE		
Mataura River at Parawa	River	Mataura							TRUE				
Mimihau Stream at Wyndham	River	Mataura							TRUE				
Moffat Creek at Moffat Road	River	Mataura							TRUE	TRUE			
Mokoreta River at Wyndham River Road	River	Mataura							TRUE		TRUE		
North Peak Stream at Waimea Valley Road	River	Mataura							TRUE			TRUE	
Otamita Stream at Mandeville	River	Mataura							TRUE				
Oteramika Stream at Seaward Downs	River	Mataura			Yes				TRUE	TRUE	TRUE	TRUE	
Sandstone Stream at Kingston Crossing Rd	River	Mataura							TRUE	TRUE	TRUE	TRUE	
Tokanui River at Fortrose Otaru Road	River	Mataura							TRUE	TRUE			
Waikaia River at Waikaia	River	Mataura							TRUE				
Waikaia River at Waipounamu Bridge Road	River	Mataura							TRUE		TRUE		
Waikaka Stream at Gore	River	Mataura							TRUE				
Waikawa River at Progress Valley	River	Mataura							TRUE				
Waikopikopiko Stream at Haldane CurioBay	River	Mataura							TRUE				
Waimea Stream at Mandeville	River	Mataura							TRUE	TRUE	TRUE		
Waituna Creek at Marshall Road	River	Mataura							TRUE	TRUE	TRUE		
Lake Vincent	Lake	Mataura							Yes				



Degraded sites	Type	FMU	SFRG	Shellfish waters	Human Faecal Matter Where Surveyed	Cyanobacteria	November 2019 JWS Ecosystem health and Human Health thresholds						
							Estuary	Lakes	ECOLI	MCI	DIN	NH4N_A	
The Reservoir	Lake	Mataura				Yes							
Waituna Lagoon	Lake	Mataura				Yes		Yes					
Porpoise Bay at camping ground	Coastal_bathing	Mataura	Poor										
Toetoes Harbour at Fortrose	Coastal_shellfish	Mataura		Yes									
Toetoes/Fortrose Estuary	Estuary	Mataura					Yes						
Bog Burn d/s Hundred Line Road	River	Ōreti			Yes				TRUE				
Dipton Stream at South Hillend-Dipton Road	River	Ōreti							TRUE			TRUE	
Hedgehope Stream 20m u/s Makarewa Confl	River	Ōreti								TRUE			
Irthing Stream at Ellis Road	River	Ōreti							TRUE			TRUE	
Makarewa River at King Road	River	Ōreti									TRUE		
Makarewa River at Lora Gorge Road	River	Ōreti			Yes				TRUE				
Makarewa River at Wallacetown	River	Ōreti							TRUE	TRUE	TRUE		
Mokotua Stream at Awarua	River	Ōreti								TRUE			
Murray Creek at Double Road	River	Ōreti								TRUE			
Ōreti River at Lumsden Bridge	River	Ōreti										TRUE	
Ōreti River at Wallacetown	River	Ōreti							TRUE	TRUE	TRUE		
Otapiri Stream at Anderson Road	River	Ōreti								TRUE			
Otapiri Stream at Otapiri Gorge	River	Ōreti							TRUE			TRUE	
Otepunī Creek at Nith Street	River	Ōreti			Yes				TRUE	TRUE	TRUE		
Tussock Creek at Cooper Road	River	Ōreti							TRUE	TRUE	TRUE		
Waianiwa Creek 1 at Lornville Riverton Highway	River	Ōreti									TRUE		
Waihopai River at Kennington Road	River	Ōreti									TRUE		
Waihopai River at Waihopai Dam	River	Ōreti									TRUE		
Waihopai River u/s Queens Drive	River	Ōreti			Yes				TRUE	TRUE	TRUE		
Waikiwi Stream at North Road	River	Ōreti			Yes				TRUE	TRUE	TRUE		
Winton Stream at Benmore - Otapiri Road	River	Ōreti									TRUE		
Winton Stream at Lochiel	River	Ōreti							TRUE	TRUE	TRUE	TRUE	
New River Estuary at Ōmāui	Coastal	Ōreti	Very Poor										
New River Estuary at Water Ski Club	Coastal	Ōreti	Poor										
Bluff Harbour at Morrison Beach	Coastal	Ōreti	Poor										
Bluff Harbour at Ocean Beach	Coastal	Ōreti		Yes									
New River Estuary at Mokomoko Inlet	Coastal	Ōreti		Yes									
New River Estuary at Whalers Bay	Coastal	Ōreti		Yes									
New River Estuary	Estuary	Ōreti					Yes						
Mararoa River at Kiwiburn	River	Waiau										TRUE	
Mararoa River at The Key	River	Waiau							TRUE				
Mararoa River at Weir Road	River	Waiau				Yes							
Wairaki River at Blackmount Road	River	Waiau											
Orauea River at Orauia Pukemaori Road	River	Waiau							TRUE				
Upukerora River at Te Anau Milford Road	River	Waiau							TRUE				
Lill Burn at Lill Burn-Monowai Road	River	Waiau										TRUE	
Waiau River 100m u/s Clifden Bridge	River	Waiau										TRUE	
Waiau River at Duncraig Road	River	Waiau										TRUE	
Waiau River at Tuatapere	River	Waiau							TRUE	TRUE			
Waiau Lagoon	River	Waiau				Yes							

***APPENDIX 3: Contextual information***

Map 1: Map of lands administered by the Department of Conservation in the Southland Region.

Map 2: Examples of some farming land use within the Southland Region.

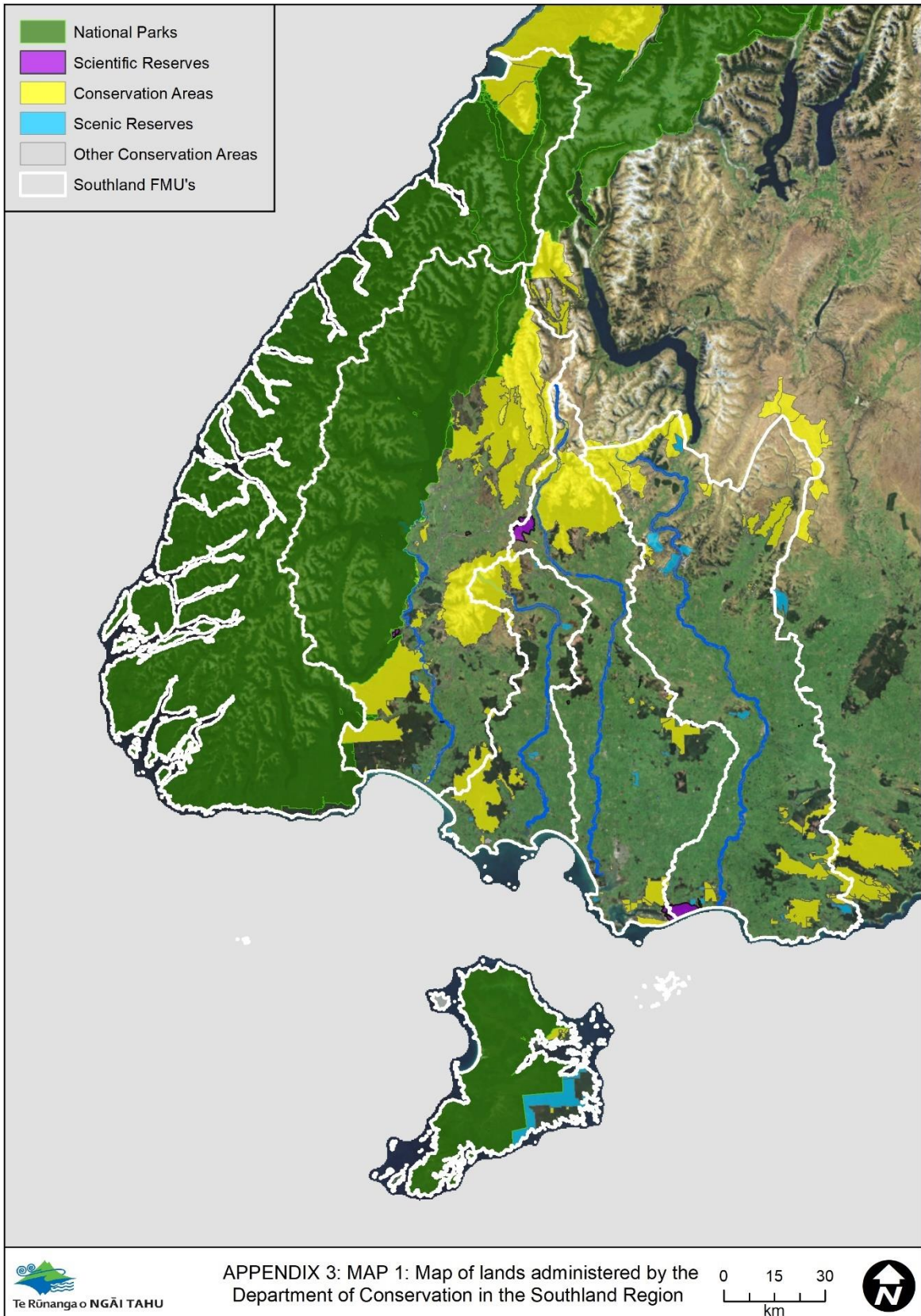
Map 3: Hazardous Activities and Industries List (HAIL) sites across Southland [with an insert of Koreti/New River Estuary].

Map 5: Distribution visible didymo in Southland.

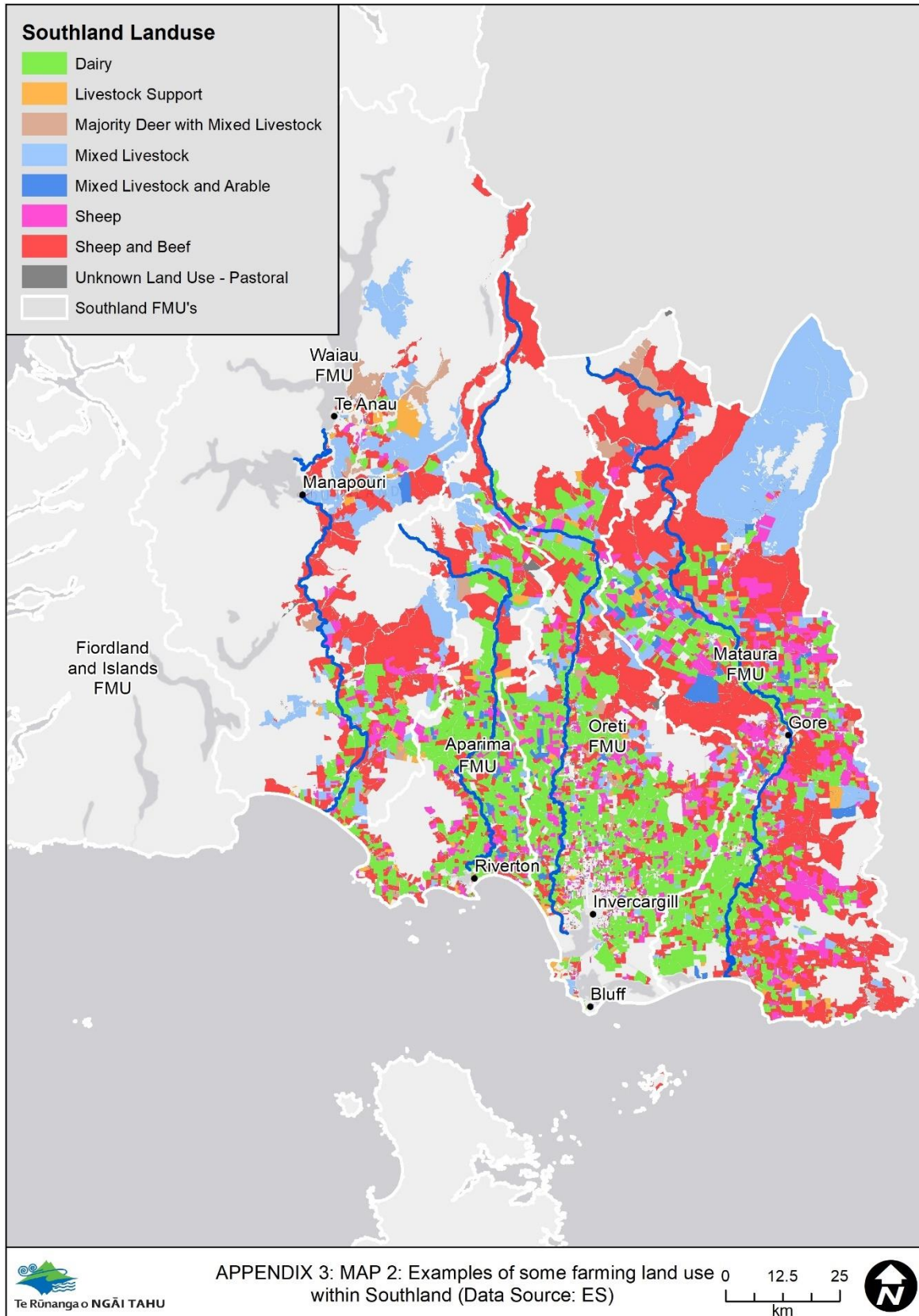
Table 3: Threat categories of some customary fisheries.

Map 7: Environment Southland Drain maintenance network.

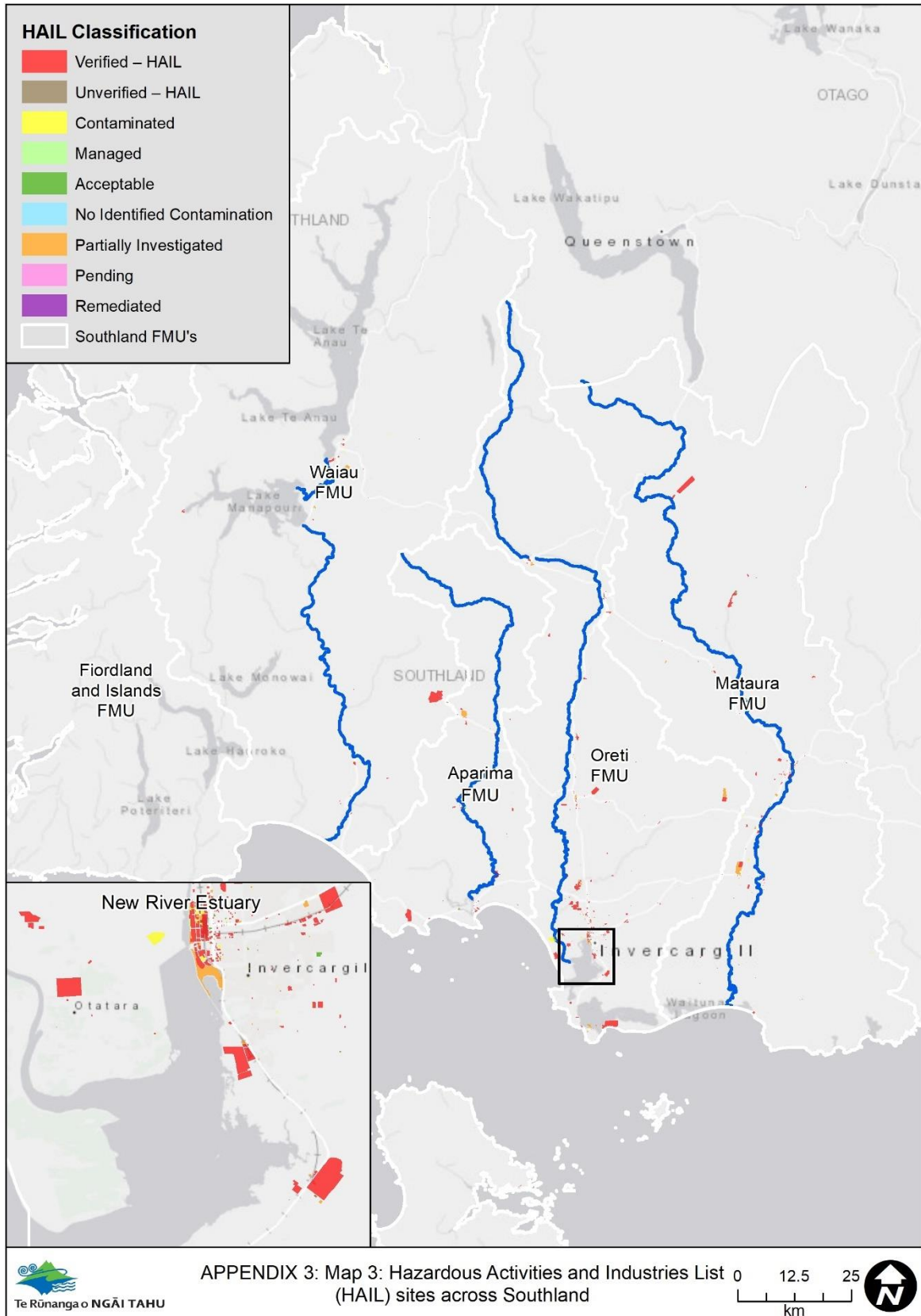
**Map 1: Map of lands administered by the Department of Conservation in the Southland Region (Data Source: Department of Conservation).**



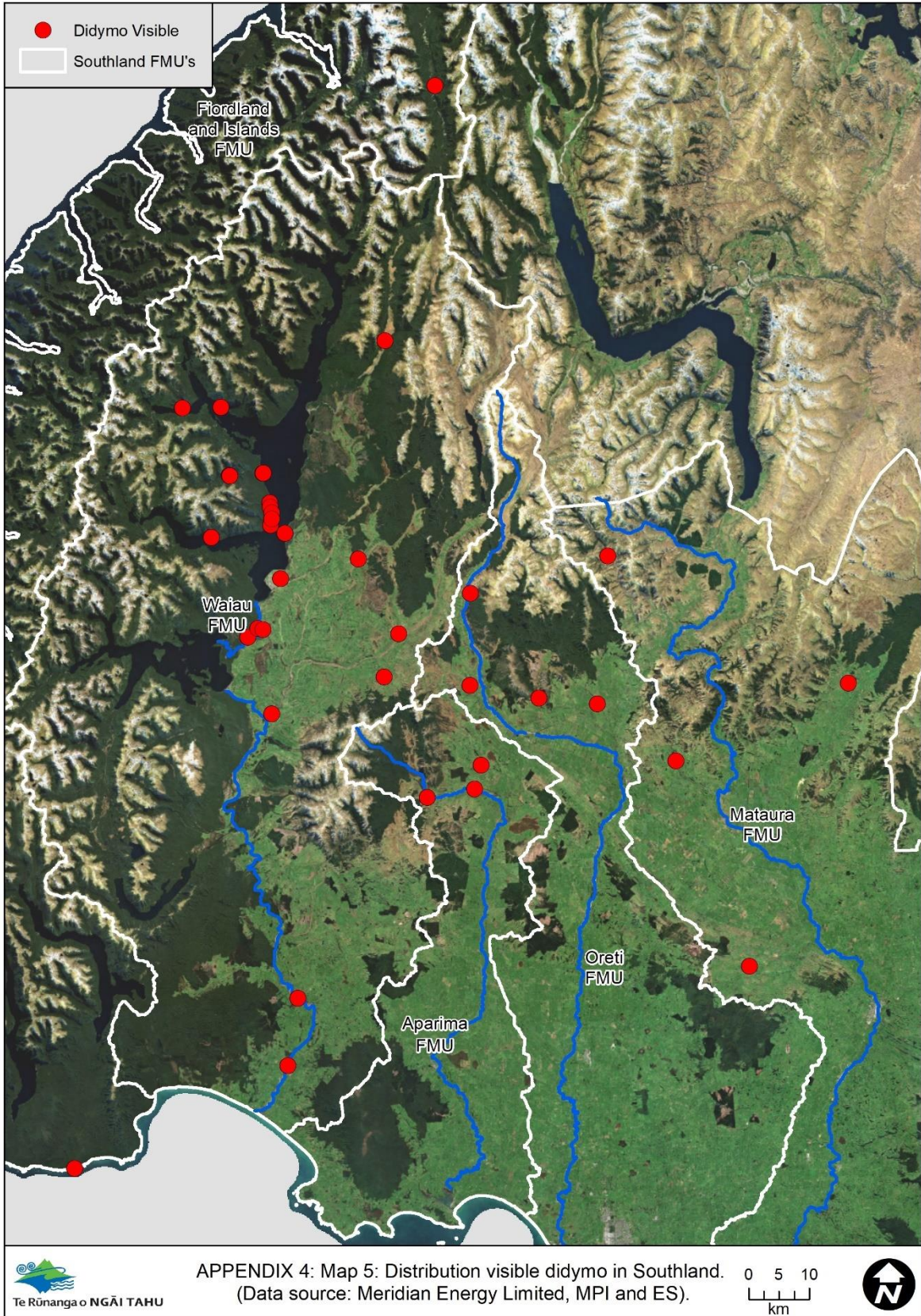
**Map 2: Examples of some farming land use within the Southland Region (Data Source: Environment Southland).**



**Map 3: Hazardous Activities and Industries List (HAIL) sites across Southland [Kōreti/New River Estuary insert]. Data Source: Environment Southland.**



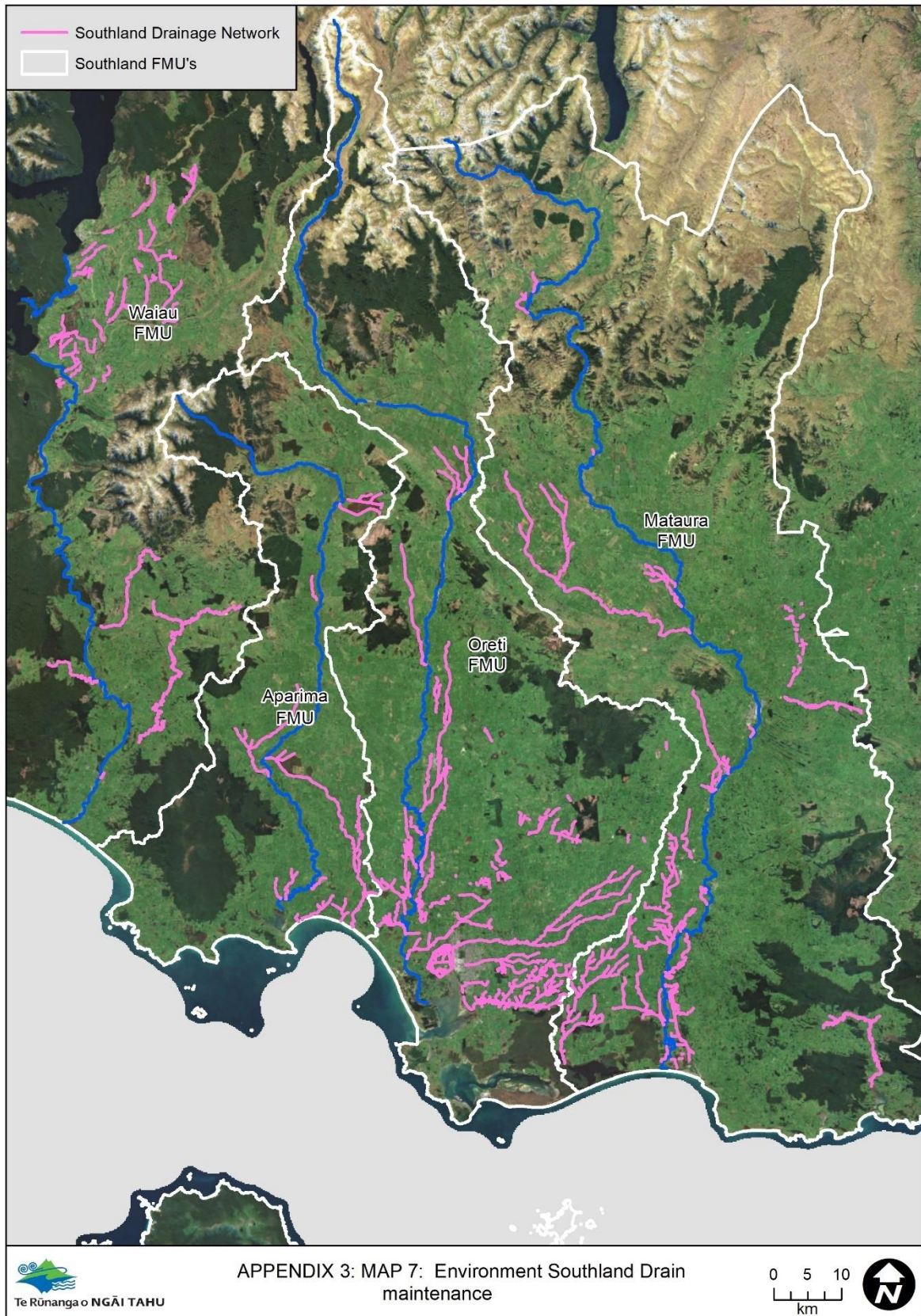
**Map 5: Distribution visible didymo in Southland. (Data sources: Meridian Energy Limited, MPI and Environment Southland).**



**Table 3: Threat categories of some customary fisheries**

<b>Common Name</b>	<b>Māori Name</b>	<b>Scientific name</b>	<b>Category</b>	<b>Status</b>
grayling	upokororo	<i>Prototroctes oxyrhynchus</i>	Extinct	Extinct
lamprey	kanakana	<i>Geotria australis</i>	Threatened	Nationally Vulnerable
shortjaw kōkopu	kōkopu	<i>Galaxias postvectis</i>	Threatened	Nationally Vulnerable
alpine galaxias (Southland)		Galaxias aff. <i>paucispondylus</i> "Southland"	Threatened	Nationally Vulnerable
gollum galaxias		<i>Galaxias gollumoides</i>	Threatened	Nationally Vulnerable
freshwater mussel	kākahi/ waikakahi	<i>Echyridella aucklandica</i>	Threatened	Nationally Vulnerable
longfin eel	tuna	<i>Anguilla dieffenbachii</i>	At Risk	Declining
freshwater mussel	kākahi/ waikakahi	<i>Echyridella menziesii</i>	At Risk	Declining
torrentfish	Piripiripōhatu	<i>Cheimarrichthys fosteri</i>	At Risk	Declining
giant kōkopu	Taiwharu	<i>Galaxias argenteus</i>	At Risk	Declining
inanga	inanga	<i>Galaxias maculatus</i>	At Risk	Declining
bluegill bully		<i>Gobiomorphus hubbsi</i>	At Risk	Declining
kōaro	kōaro	<i>Galaxias brevipinnis</i>	At Risk	Declining
freshwater crayfish	kōura/ Keewai	<i>Paranephrops zealandicus</i>	At Risk	Declining
Bull kelp	Rimurapa	<i>Durvillaea antarctica</i>	At Risk	Declining
giant bully	Kōkopu/ Hawai	<i>Gobiomorphus gobioides</i>	At Risk	Naturally Uncommon
yellow-eyed mullet	Aua	<i>Aldrichetta forsteri</i>	Not Threatened	Not Threatened
shortfin eel	tuna	<i>Anguilla australis</i>	Not Threatened	Not Threatened
banded kōkopu	kōkopu	<i>Galaxias fasciatus</i>	Not Threatened	Not Threatened
upland bully		<i>Gobiomorphus breviceps</i>	Not Threatened	Not Threatened
common bully		<i>Gobiomorphus cotidianus</i>	Not Threatened	Not Threatened
smelt	Paraki/Ngaio re	<i>Retropinna retropinna</i>	Not Threatened	Not Threatened
black flounder	mohoao	<i>Rhombosolea retiaria</i>	Not Threatened	Not Threatened
redfin bully		<i>Gobiomorphus huttoni</i>	Not Threatened	Not Threatened

**Map 7: Environment Southland Drain maintenance network (Data Source: Environment Southland).**





***APPENDIX 4: Maps of degradation***

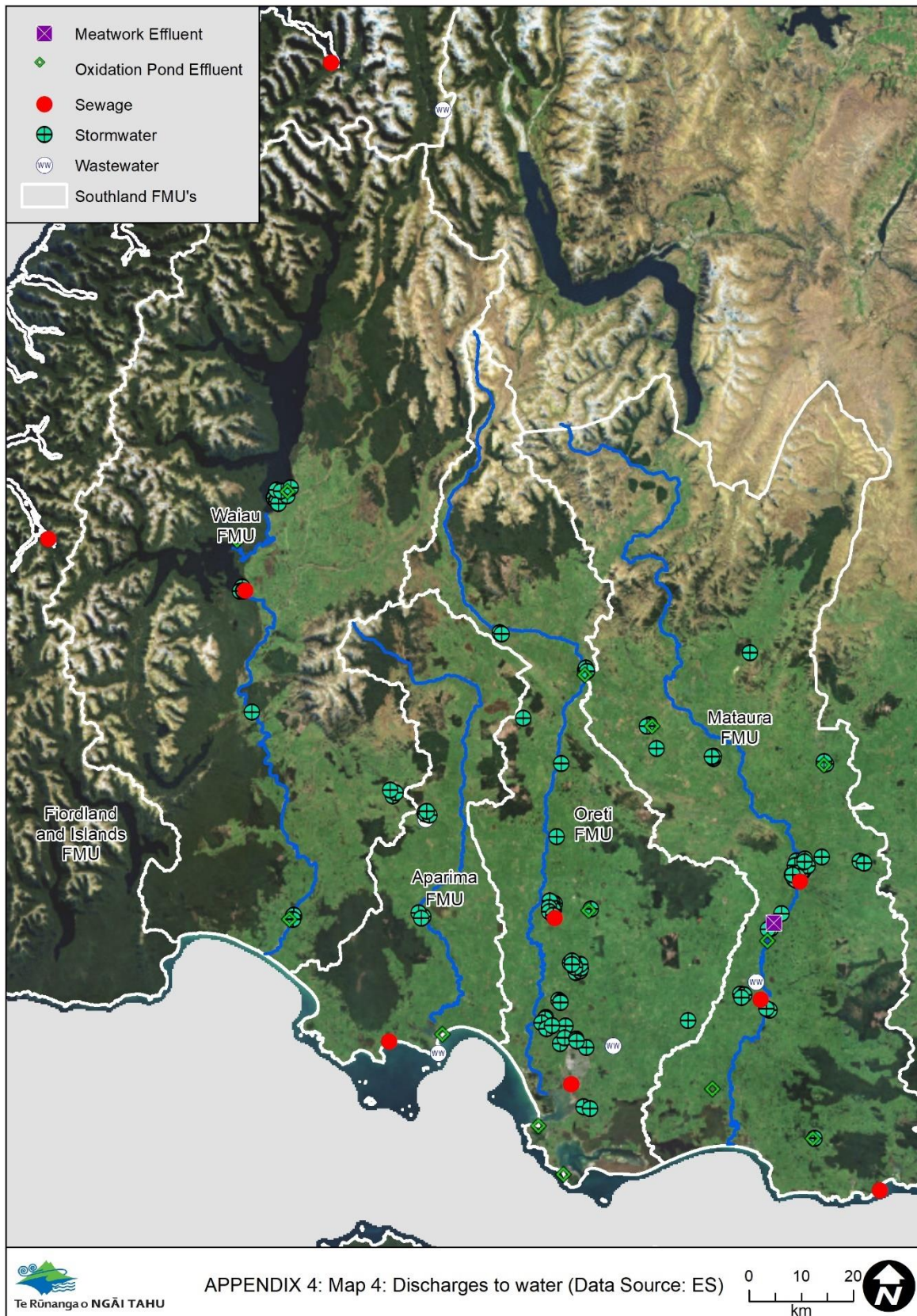
Map 4: Discharges to water of wastewater, stormwater, sewage, oxidation pond effluent, meatworks effluent.

Map 6: Changes in wetland extent illustrated by a) recent changes in wetland extent of surveyed wetlands in non-public conservation land from 2007-2014-15; and b) comparison of pre-human wetland extent and 2014-15 extent on non-public conservation land.

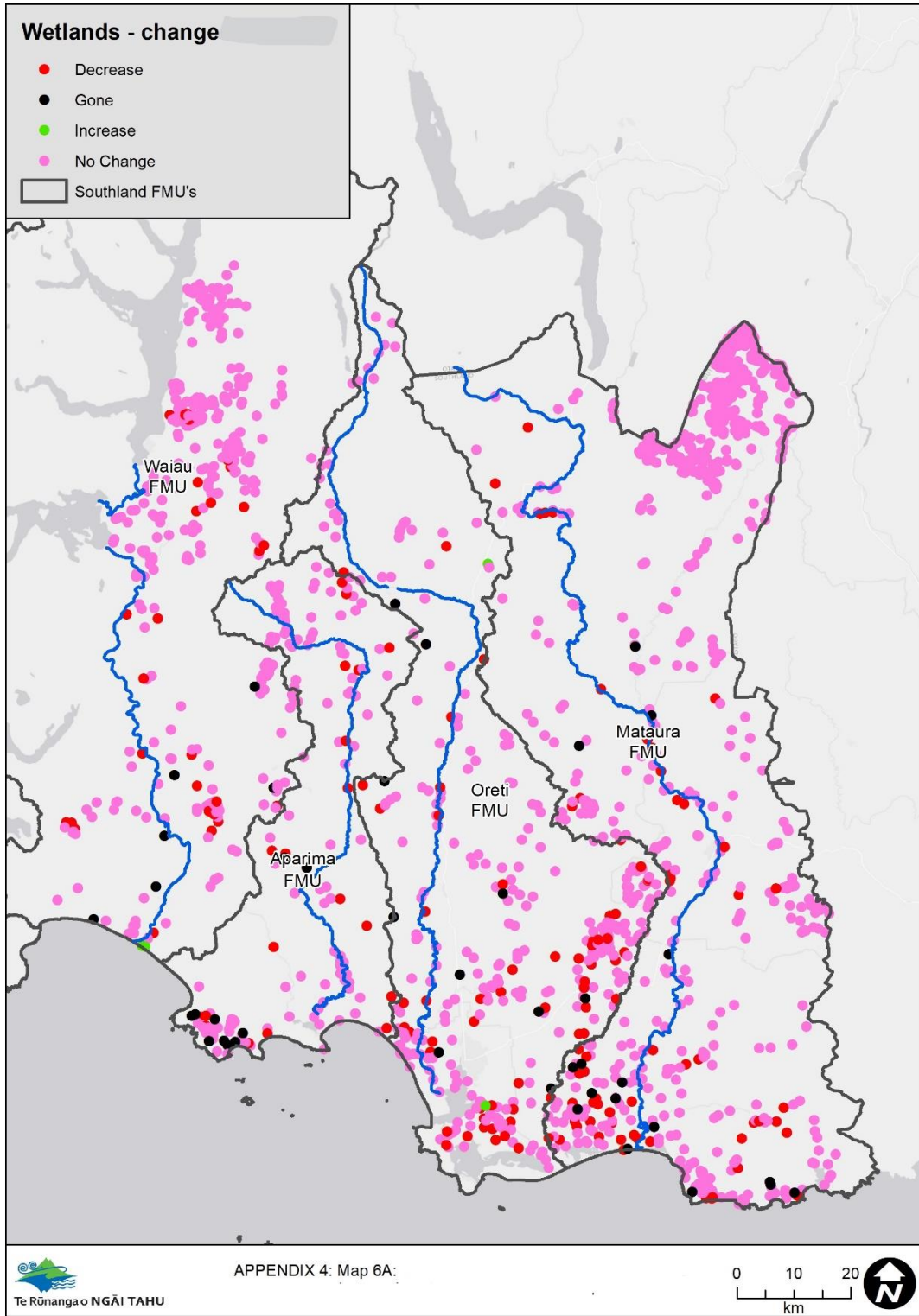
Map 8: Location of the Hydro-electric generation infrastructure in the Waiau Catchment.

Map 9: Surveyed fish barriers in Southland.

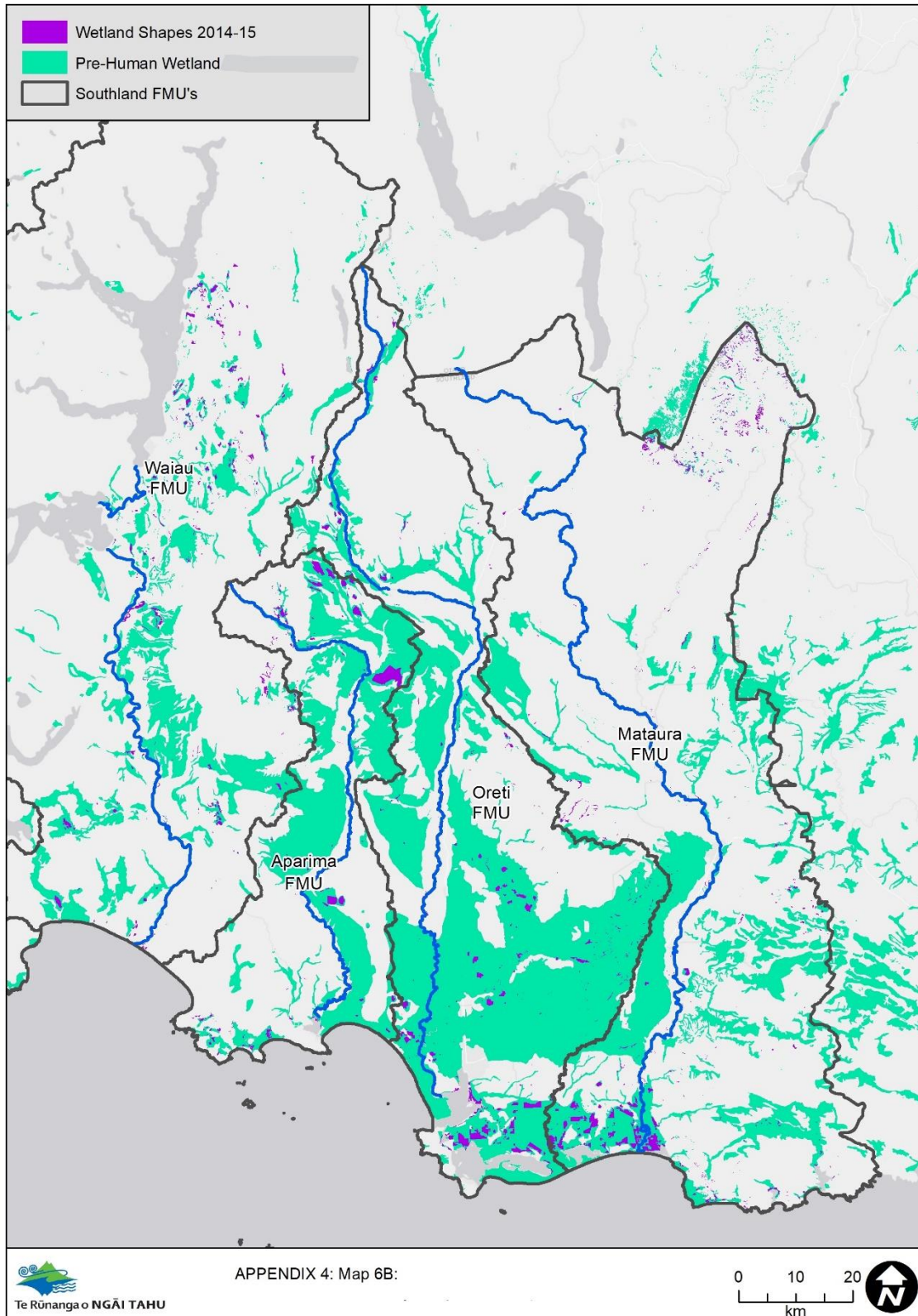
**Map 4: Discharges to water of wastewater, stormwater, sewage, oxidation pond effluent, meatwork effluent (Data source: Environment Southland).**



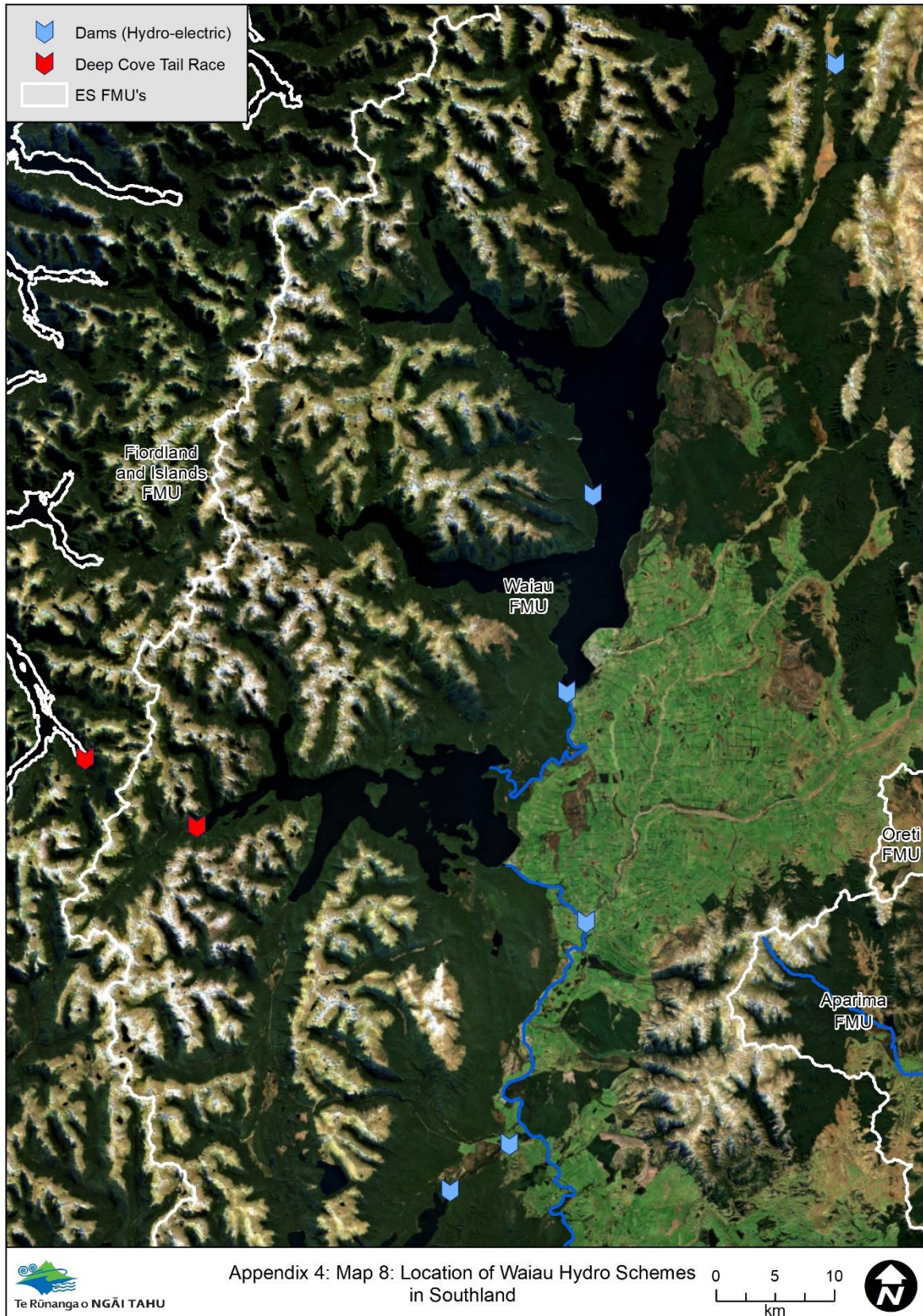
**Map 6: Changes in wetland extent illustrated by: A) Recent changes in wetland extend of surveyed wetlands in non-public conservation land from 2007-2014-15 (Data Source: Environment Southland).**



**Map 6B: Comparison of pre-human wetland extent and 2014-15 extent in non-public conservation land – contextual layer. (Data Sources: pre-human, Landcare Research; 2014-15, Environment Southland).**



**Map 8: Location of the hydroelectric generation infrastructure in the Waiau Catchment**



Appendix 4: Map 8: Location of Waiau Hydro Schemes in Southland

**Map 9: Surveyed fish barriers in Southland (red dots = degraded; Source: Environment Southland)**

