

WETLANDS ON PRIVATE LAND IN THE WAITUNA CATCHMENT, SOUTHLAND

WETLAND RESTORATION PRIORITISATION

Prepared for Department of Conservation
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Summary

A multi-criteria constraints analysis was conducted to identify and prioritise wetland restoration activities on private land within the Awarua-Waituna catchment. This method involves overlaying and interrogating datasets of information available in GIS using a set of pre-determined criteria or 'constraints'. This is an objective method that can be used to determine priorities, and in this case, determine key sites for wetland protection, restoration and enhancement.

The project team collated available GIS-based information from a wide variety of sources, including national, regional and catchment-scale information. A set of pre-defined criteria or 'constraints' were developed to prioritise the wetlands throughout the catchment and identify the most important wetland sites from an ecological and water quality basis. The constraints included information related to wetlands, hydrogeology, terrestrial ecology, aquatic ecology and water quality. The constraints and data analysis was developed through a collaborative process with DOC, Fonterra and other stakeholders to ensure a transparent process in line with Living Water project objectives.

Wetlands were prioritised and ranked based on private property boundaries. This method allows for properties to be identified and individual landowners to be targeted and engaged. It also overcomes inherent difficulties that occur when wetlands cross several properties or where delineating the edges of wetlands can be difficult.

This process has resulted in a prioritised list of the wetlands on private land throughout the catchment to ensure that works are focused on those areas where maximum benefit will be realised. This includes a list of the top 30 properties in the catchment as priorities for wetland restoration, and the top 10 Fonterra farms which can be a focus for Living Water activities.

Department of Conservation

Wetlands on Private Land in the Waituna Catchment, Southland: Wetland Restoration Prioritisation

CONTENTS

Summary.....	i
1 Introduction	1
1.1 Background.....	1
1.2 Report Purpose and Scope	1
1.3 Structure	2
2 Methodology.....	3
2.1 Approach	3
2.2 Multi-Criteria Analysis.....	3
2.2.1 Sources of Information.....	3
2.2.2 Selection of Draft Constraints	3
2.2.3 Stakeholder Review and Refinement of Constraints.....	4
2.2.4 Constraints Analysis and Site Prioritisation	7
3 Results	8
3.1 Individual Constraints Analysis.....	8
3.2 Full Constraints Analysis and Site Prioritisation	9
4 Discussion and Recommendations	16
5 References.....	17

LIST OF TABLES

Table 2-1: GIS Layers and constraints used for the multi-criteria analysis.....	5
Table 3-1: Top 10 Ranked Sites for Wetland Restoration – All Landowners	10
Table 3-2: Top 10 Ranked Sites for Wetland Restoration – Fonterra Farms	11

LIST OF FIGURES

Figure 3-1: Wetland Site Prioritisation - MCA Results for the Waituna Catchment.....	12
Figure 3-2: Wetland Site Prioritisation - MCA Scores for the Lower Catchment.....	13
Figure 3-3: Scores for the Top 30 ranked properties within the Waituna catchment (*indicates Fonterra farms)	14
Figure 3-4: Breakdown of total score for Top 30 properties (*indicates Fonterra farms)	15

APPENDICES

Appendix A	Summary of GIS Layers and Constraints
Appendix B	Maps of Individual Constraints
Appendix C	Wetland Restoration Priority Scores
Appendix D	Details of Priority Fonterra Farms

1 Introduction

1.1 Background

The Living Water programme is a joint initiative between the Department of Conservation (DOC) and Fonterra working with local communities, dairy farmers and other stakeholders to improve water quality in sensitive water catchments. The Awarua-Waituna catchment is one of five Living Water programme sites across New Zealand. The other sites are the Kaipara Harbour, Firth of Thames / Tīkapa Moana, Waikato Peat Lakes and Te Waihora / Lakes Ellesmere.

Living Water is a 10 year commitment to work in the Awarua-Waituna catchment, commencing in 2013. The focus of the programme is land in private ownership as the DOC Arawai Kākāriki programme addresses land in Crown ownership. The vision for the Waituna catchment is *“to work with the local community to continue to enhance the health of the Waituna catchment and the lagoon, to create healthy, functioning farms and wetlands living side by side now and in the future”* (Fonterra & DOC, 2014).

The Waituna catchment site goals for 2014 to 2015 (Fonterra & DOC, 2014) are as follows:

- Protect and enhance remaining wetland fragments on private land within the catchment
- Work with Ngāi Tahu on protection of key mahinga kai species such as tuna (eels)
- Enhance local pride in enhancement projects through ongoing community engagement
- Work closely with the Waituna Partners Group to complement and enhance other work going on in the catchment through the Community Investment in Water (CIW) programme
- Work alongside the DOC Arawai Kākāriki wetland restoration programme on public conservation land within the catchment, and
- Be widely known in the community for the work that CIW is carrying out.

The Living Water programme has identified the need for baseline reports to enable the partnership to make informed decisions on priorities for operational work and to measure the effectiveness of projects. This report contributes to the above goals and objective by providing a methodology to identify and prioritise wetlands on private land where restoration work can be focussed.

1.2 Report Purpose and Scope

The purpose of this report is to develop a methodology to identify and prioritise wetlands on private land as a focus for restoration efforts to maximise water quality and biodiversity improvements within the Awarua-Waituna catchment. This study provides a way for the Living Water programme to prioritise engagement with stakeholders and restoration efforts going forward.

More specifically, the purpose of this report is to:

- Identify opportunities for restoration and/or enhancement with priority sites suggested
- Provide a GIS map showing data collected and layered to provide a visual picture of data collected, and
- Provide recommendations for monitoring in order to fill gaps in knowledge and measure short- and long-term improvements in biodiversity and habitat quality.

This report responds to a Request for Proposal issued by the Department of Conservation in November 2014 (DOCDM-1499821). This report is focuses on wetland sites on private land and is based on existing information and GIS data analysis. It can be read in conjunction with the literature review prepared by MWH in September 2015 and finalised in June 2017 (MWH, 2017).



The report also contains a summary of the available information from the information sources used on the top ten priority land parcels in Appendix D.

1.3 Structure

The report includes the following sections:

- Section 1 introduces the Living Water programme and the objectives of this report
- Section 2 describes the methodology used to prioritise private wetlands in the catchment
- Section 3 details the results of the GIS constraints analysis that has been undertaken to prioritise the private wetlands, and
- Section 4 details the recommendations with respect to monitoring and management.

2 Methodology

2.1 Approach

The following approach has been adopted for the wetland prioritisation:

- Develop a set of criteria or “constraints” for the analysis in consultation with DOC and Fonterra
- Minimise overlap with other work being undertaken in the catchment to avoid duplication of effort
- Identification of priority sites within which works should be initially focussed to achieve the best return in terms of water quality and biodiversity improvements
- Focus on private properties within the Awarua-Waituna catchment, particularly those farms that are suppliers to Fonterra
- Identify monitoring that is required to determine the impact of wetland restoration works, which is detailed in the separate report prepared by MWH for this project, and
- Summary of information in the sources used in the constraints analysis for the priority land parcels owned by Fonterra suppliers.

2.2 Multi-Criteria Analysis

A multi-criteria GIS constraints analysis (MCA) was conducted to identify and prioritise the wetland fragments on private land. The method involves overlaying and interrogating datasets of information available in GIS using a set of pre-determined criteria or ‘constraints’. This is an objective method that can be used to determine priorities, and in this case, determine key sites for wetland protection, restoration and enhancement.

2.2.1 Sources of Information

Existing data on rivers, streams, wetlands, groundwater, terrestrial and aquatic biodiversity was collated for the purposes of the project. In total, 46 GIS layers were sourced for the Waituna catchment and an additional nine layers were prepared by MWH by manipulation of existing data.

GIS data was sourced from the following organisations:

- DOC
- Environment Southland
- Fonterra
- GNS Science
- Landcare Research
- Land Information New Zealand (LINZ)
- NIWA.

The data included both national and regional datasets, in addition to site specific information for the Waituna catchment.

2.2.2 Selection of Draft Constraints

The analysis has been undertaken for contiguous land parcels in the same ownership. Hence the base layer on which the analysis was performed was developed by MWH from the land parcels in the catchment.

The existing GIS data available within the Waituna catchment was compiled and prioritised. The constraints to be used for the GIS analysis was prepared based on criteria specified by DOC in the request for proposal:

- **Significance** of habitat (wetland or creek), including potential significance if restored
- **Size** of wetland/creek fragment (no minimum size, but prioritise the bigger sites)
- Benefit to catchment **water quality**, and
- Opportunity for public **engagement**/ showcase work.

Criteria for significance included the known presence of native flora and fauna, including threatened species, existing legal protection, and vicinity to protected areas such as public land and QEII covenants.

The presence and size of wetlands was a key constraint, with larger sites given a higher priority. It was also considered that protecting larger sites would be beneficial as these are more likely to contain a higher diversity of species and habitats, including different wetland types. It is acknowledged that selecting sites on basis of size may mean that sites in the upper catchment, where wetlands tend to be smaller, could be ranked lower. However this is only one of many criteria to be applied.

Priorities for improvements to water quality were taken into account by prioritising sites higher in the catchment. Properties which contain watercourses or wetlands that are on first and second order streams were ranked higher than third and fourth order streams, as these sites provide maximum gain to water quality when restored. Benefits are harder to achieve for sites lower in the catchment if water quality is already degraded. The presence of existing monitoring sites for water quality and water quantity was also taken into consideration, allowing existing data to be used and compared.

Opportunities for public engagement can be more difficult to track in GIS, however this criteria was met through ranking sites by property size. Larger land parcels may be more likely to contain larger areas of wetland, however these properties also allow greater ability to implement and showcase land management change than if implemented over smaller properties and/or multiple landowners. There is also the potential that land owners of larger properties may be more influential in the community i.e. for advocacy and behaviour change.

The chosen constraints included criteria for wetland type and extent, surface water, groundwater, terrestrial ecology, aquatic ecology and monitoring information. Each constraint was divided into three classes with associated scores: low (1), medium (2) and high (3), relating to the effectiveness of the constraint in meeting the objectives of the project.

Multipliers were also applied to the scores to each constraint which reflected the relative weight of each constraint in comparison to the other constraints. Each constraint was weighted between 1 (low priority) and 5 (highest priority) which indicates the relative importance of that constraint to the overall multi-criteria analysis. The highest multipliers were given to key criteria such as wetland size and the presence of threatened species. Lower multipliers were given to criteria that were considered less important, such as the presence of monitoring sites. This allowed each site to be scored on the basis of the constraint class and weighting.

2.2.3 Stakeholder Review and Refinement of Constraints

A draft list of constraints was developed by MWH and circulated to the project team in June 2015.

A workshop was held on 22 June 2015 to review and refine the draft constraints criteria and weightings. The workshop included representatives from DOC, Fonterra and the MWH project team. The initial workshop discussed all of the available GIS layers and the layers recommended to be used as the constraints. As a result, all but one of the recommended constraints were included (mahinga kai species were removed) with the addition of a new layer developed by MWH to account for wetlands that had been identified by DOC as lost or drained in recent surveys (this new layer was named "2012 Private Wetlands"). Several of the weightings were adjusted based on local knowledge of the wetlands and farms in the catchment.

A draft GIS constraints analysis was performed on the basis of the criteria and weightings assigned at the June meeting. A subsequent workshop with representatives from DOC, Fonterra, TAMI and the MWH project team was held to review the output and revise the constraints and weighting accordingly. The revised constraints analysis resulting from this second workshop is that which is used as the basis for the prioritisation of the wetlands in this report.

A total of 20 layers were selected for use in the final GIS constraints analysis. This resulted in a total of 22 constraints within the Waituna catchment boundary. The criteria and the justification for inclusion is

summarised in Table 2-1. Additional detail including the classification and weighting for each criteria is provided in Appendix A.

Table 2-1: GIS Layers and constraints used for the multi-criteria analysis

GIS Layer	Source	Constraint and Justification
BASE INFORMATION		
Cadastral boundaries	LINZ	Wetlands to be monitored were constrained to cadastral boundaries to ensure that single landowners would be able to be dealt with. Larger land parcels (>200ha and 100-200ha) were favoured over smaller farms (<100ha) due to the likelihood that larger land parcels would contain larger areas of wetland, and have a greater ability to alter surrounding land use. There is also the potential that land owners of larger properties may be more influential in the community i.e. for advocacy and behaviour change.
Waituna Catchment Boundary Oct 13	DOC	Waituna catchment boundary. Only data within the Waituna catchment was analysed.
HYDROLOGY & WETLANDS		
Awarua Rivers	DOC	Presence of REC stream order 1, 2, 3 or 4. Smaller streams (REC 1 and 2) were prioritised over larger streams (REC 3 and 4). It is a priority for water quality to restore streams and wetlands in the upper catchment where maximum benefit can be achieved, therefore 1st and 2nd order streams were given highest priority.
QEII Wetland Waituna	DOC	Presence of QEII wetlands within property boundary. Properties which already have a QEII covenant present are likely to have increased biodiversity. Property owners with QEII covenants may be more likely to protect remaining wetlands on their land.
	DOC	Presence of QEII wetlands within 1km of property boundary. Ability to form connections to existing protected areas
2012 Private Waituna	Generated by MWH from DOC data	Location and extent of wetlands and watercourses on private land. Presence and size of wetlands and riparian habitat. Larger wetlands (<1 ha; 1-5 ha; >5 ha) are presumed to hold higher biodiversity values and are likely to support a variety of habitat types.
	Generated by MWH from DOC data	Wetland types on private land. Presence of shallow water; fen; swamp or marsh wetland type. Wetlands with flowing water provide a water quality management function within the catchment
Wetland Public Waituna	DOC	Location and extent of wetlands and watercourses on DOC land. Presence of wetland on public land within 1km of property boundary. Ability to form connections to existing protected areas
Waituna Wetland Loss	DOC	Presence of historic wetlands. Properties where wetlands have been lost provide opportunities for restoration, however protection of existing wetlands should be the higher priority.

GIS Layer	Source	Constraint and Justification
HYDROGEOLOGY		
All Bores	Generated by MWH from ES data	Summary of all ES bores within the Waituna catchment. Presence of groundwater monitoring bore(s) within 1km. Existing bores can be used for future monitoring.
Groundwater Dipping Data	Environment Southland	Groundwater levels in wells monitored by ES within the Waituna catchment (15/01/97-18/12/2014). Existing groundwater monitoring data present within 1km. Prioritise sites where information on groundwater levels are known
Physiographic Survey ¹	Environment Southland	Broad zones of different physical and chemical properties of groundwater, relating to soil types. Sites prioritised based on soil type. Sites in "leaky soils" are higher priority than organic soils. Based on soil leaching of nitrogen.
Surface Water Flow Continuous Monitoring Sites	Environment Southland	Continuous stream flow monitoring data. Existing surface water monitoring data present within 1km. Prioritise sites where information on flow is known
AQUATIC ECOLOGY		
ES SOE Ecosystem Sites	Environment Southland	Existing monitoring site present within 1km. ES State of the Environment "ecosystem sites" monitored. Sites where monitoring has already been undertaken provides existing baseline data. Provides the ability to source and use existing data.
FENZ_v1_rivers	Landcare Research	FENZ condition scores from the national river and stream data layers based on REC flow lines and catchments. Streams with higher condition (≥ 0.7) were ranked higher than streams with lower conditions scores (0-0.3 and 0.31-0.69). River and stream pressures. Aims to identify and protect sites of higher condition as a priority.
New Zealand Freshwater Fish Database	NIWA	Presence of NZFFD records. Sites where at risk or threatened species are known to occur are given higher priority
TERRESTRIAL ECOLOGY		
HVA Surveys Completed 2007 to 29 April 2015	Environment Southland	Existing High Value Area (HVA) monitoring site within property boundary. Properties which have HVAs present are likely to have increased biodiversity. Larger HVA sites given priority over smaller sites.
	Environment Southland	Existing HVA monitoring site present within 1km. Ability to form connections to existing HVAs
Land Cover Database Version 4.0 (LCDB v4.0)	Landcare Research	Presence of native vegetation within the property. Larger areas of native vegetation given priority over smaller areas (<5 ha; 5-20 ha; >20 ha).

¹ Analysis was performed using the initial version of the physiographic zones, which identified three broad areas across the catchment. This has been subsequently updated by ES into a more detailed map but this revised map has not been incorporated into the analysis.

GIS Layer	Source	Constraint and Justification
Bioweb Herpetofauna Database	DOC	Presence of native lizard species. Sites where at risk or threatened species are known to occur are given higher priority
Bioweb Threatened Plant Database	DOC	Presence of native plant species. Sites where at risk or threatened species are known to occur are given higher priority
WATER QUALITY		
ES Groundwater Quality Monitoring Sites Waituna	Environment Southland	Location of ES groundwater monitoring sites cropped to the Waituna catchment. Presence of groundwater monitoring bore(s) within 1km. Prioritise sites where information on groundwater quality is known
ES Surface Water Quality Monitoring Sites	Environment Southland	Location of ES State of the Environment surface water monitoring sites cropped to the Waituna catchment. Presence of surface water monitoring within 1km. Prioritise sites where information on surface water quality and flow data is known.

2.2.4 Constraints Analysis and Site Prioritisation

The final constraints analysis was run in GIS using the approved criteria and weightings agreed by the project team.

Sites were prioritised and ranked based on property boundaries (“Cadastral Boundaries”). This method allows for certain properties to be prioritised over others and also allows individual landowners to be targeted and engaged. It also overcomes inherent difficulties that occur when wetlands cross several properties or where delineating the edges of wetlands can be difficult, particularly for river catchments where wetlands may be joined by streams, drains and other watercourses.

Initially, each of the 22 constraints were run individually. This allows an assessment of those constraints that are more or less influential in differentiating sites within the catchment. Colour-coded maps were produced for each constraint, except for the “Waituna Wetland Loss” layer which is confidential information. The colour-coded maps represent the relative scoring for each land parcel, ranging from bright green for lower scoring parcels through to bright red for the highest scores. This allows parcels to be easily distinguished and are also simple to understand for stakeholders.

The overall analysis was then run combining all of the constraints. This resulted in overall scores for every private property within the catchment. Colour-coded maps were produced as per the method above, with properties shaded from green (low scores) to red (high scores). Data for the top 30 properties were graphed and the top 10 Fonterra farms were mapped and summarised in more detail.

3 Results

3.1 Individual Constraints Analysis

A series of maps showing the results of individual constraints is provided in Appendix B.

The map of “Cadastral Boundaries”, representing property size was a differentiator throughout the catchment. Larger properties (>20 hectares) were found to be more prevalent in the lower catchment, including sites closer to the Waituna Lagoon. Smaller properties were evenly distributed through the middle and upper catchment. This result may relate to property prices, with smaller properties orientated near major roads (possibly the result of sub-division of accessible land parcels) and larger properties near the Waituna Lagoon which may be of lower value due to a propensity to flood.

The Awarua Rivers layer was not found to be a differentiator. Almost every property throughout the catchment included REC streams of order 1 and 2. This means that there is good potential to reduce sediment and nutrient inflows to first and second order streams throughout the catchment.

The GIS analysis identified five properties with QEII covenants. These sites are all located in the lower catchment. This resulted in the “QEII Connection” constraint identifying adjacent properties also in the lower catchment. There are no QEII covenants in the mid to upper catchment. This may be due to a lack of suitable habitat and/or less engaged landowners in this area.

The private wetlands layer (“2012 Private Waituna”) had two constraints. Properties with larger wetlands were concentrated in the lower catchment, with some properties in the mid catchment. No large wetlands (>5ha) were located in the upper catchment. This is likely to be due to differences in topography and soil type. Wetland types were more variable through the catchment, with swamp and marsh wetlands in the mid and lower catchment and shallow water wetlands (generally associated with riparian wetlands along stream margins) distributed throughout the catchment. Fen wetlands were also concentrated in the lower catchment.

The “Wetland Public Waituna” layer identified properties near to wetlands formally protected in DOC estate. These properties are all located in the lower catchment adjacent to Waituna Lagoon and the major tributaries that feed into the Lagoon. No private properties adjoin DOC wetlands in the mid or upper catchment.

The “Waituna Wetland Loss” layer is confidential, therefore no constraints map was produced for this layer.

Groundwater bores (“All Bores”) were found to be located throughout the catchment, with almost all properties located within 500 metres of a bore, and many within 100m of a bore. This provides good potential to create a comprehensive groundwater monitoring programme throughout the catchment, using existing bores. However, few locations had groundwater levels taken in the past (“Groundwater Dipping Data”). These sites were in the lower and upper catchment, meaning that some information on groundwater levels is known. Surface water monitoring is only undertaken in the lower catchment, on or near DOC land, as illustrated by the “Surface Water Flow Sites” map. This indicates that surface water monitoring could be expanded in the catchment.

Nitrogen leaching is represented by the “Physiographic Survey” map². The mid-catchment is located on the Mokotua Infiltration Zone which readily leaches nitrogen (Rissmann & Wilson, 2012). Soil leaching of nitrogen is moderate in the upper catchment and considered lower risk in the southern part of the catchment as it contains peaty soil and organic material creating reducing conditions which can remove nitrate-nitrogen from groundwater.. This reflects research conducted by Environment Southland (Rissmann & Wilson, 2012).

² Analysis was performed using the initial version of the physiographic zones, which identified three broad areas across the catchment. This has been subsequently updated by ES into a more detailed map but this revised map has not been incorporated into the analysis.

Aquatic ecology monitoring is undertaken by Environment Southland in the mid and lower catchment (“ES SOE Monitoring Sites”). This provides a limited overview of catchment aquatic ecology. NZFFD records are more widely spread in the catchment, and include several records for “at risk” fish species and one record for “threatened” species in the catchment (“NZFFD”).

The “FENZ Rivers” database indicates that the majority of the streams in the catchment have low condition scores (≤ 0.3) with moderate scores (0.31-0.69) confined to the lower catchment. Only one private property in the lower catchment had a high FENZ condition score (≥ 0.7). It is noted that this property is not protected by a QEII covenant.

Several private properties in the catchment have had High Value Area (HVA) monitoring undertaken between 2007 and 2015 (“HVA Sites”). These are mainly located in the mid to lower catchment. This indicates that there are several sites of high biodiversity value in through the catchment and that there is existing biodiversity data available for these properties. This could form the base of a terrestrial ecology monitoring programme. Almost all HVA sites are within 500m of a wetland on private land, indicating good potential for restoration (“HVA Connections”).

Land Cover Database information (“LCDB v4.0”) indicates that the lower catchment retains large areas of native vegetation with many properties including native vegetation in excess of 20 hectares. The mid catchment has some areas of native vegetation, but there are few properties in the upper catchment identified as having native vegetation remaining.

DOC threatened species records indicate that four private properties have had native herpetofauna recorded (“Herpetofauna”), and four properties have had threatened plants recorded (“Threatened Plants”). These sites are mutually exclusive, except for one property in the west of the catchment which has had both an “At risk” reptile and “threatened” plant species identified. This property is adjacent to but not within a QEII covenant. It is likely that additional surveys may reveal additional records for native plants and lizards, particularly in the lower catchment which retains larger areas of native vegetation.

Environment Southland groundwater monitoring sites indicate that there are several monitoring sites throughout the catchment including near private wetlands (“ES GW Monitoring Sites”). However as previously reported above, the collection of groundwater data appears to be incomplete (“GW Dipping Data”). Surface water quality monitoring appears to be very comprehensive, with monitoring undertaken within 100m of private wetlands in the upper, mid and lower portions of the catchment (“ES SW Monitoring Sites”).

3.2 Full Constraints Analysis and Site Prioritisation

The results of the overall constraints analysis is presented in Figure 3-1 and Figure 3-2 with full results for each land parcel presented in tabular form in Appendix C.

Out of a total of 691 land parcels within the Waituna catchment, a total of 417 private properties were found to have areas of wetland present. These sites were grouped by landowner into 145 land parcels. Wetland sites on private land ranged from small shallow water wetlands running adjacent to streams in the upper catchment through to large areas of bog and marshland in the lower catchment.

A map of the catchment and the locations of wetlands on private land is given in Figure 3-1. The results indicate that highest priority for wetland restoration should be given to sites lower in the catchment. This is not surprising as this is where the largest areas of wetland occur. It is also the portion of the catchment which retain the most native vegetation, records of native flora and fauna (including threatened species), and can form connections or wildlife corridors to areas of protected public conservation land. The lower catchment is also the location of the largest properties and with the most comprehensive available baseline data on groundwater, surface water, terrestrial and aquatic ecology.

The MCA results ranged from a low of 15 up to a score of 101 for a property owned by D. and M. Ballantine in the mid-west of the catchment. This represents a percentage range of 11.4% to 76.5% out of a theoretical maximum score of 132. Note that these scores represent the relative importance of the property to achieving the project objectives, including for water quality and biodiversity improvements, and can be used as a starting point to prioritise stakeholder engagement and restoration. They do not necessarily reflect the ecological health of the property, although sites with large wetlands and which retain native biodiversity are likely to score more highly than others.

Graphs illustrating the total scores for the top 30 properties in the catchment are presented in Figure 3-3. Figure 3-4 presents a breakdown of the total score into wetland and hydrology specific constraints, constraints relating to availability of data and data relating to ecological significance. The largest differentiator between sites related to wetland-specific constraints, which made up 30 to 60 points or approximately 40.0% to 72.2% of the score total. The wetland type, location relative to QEII covenants and presence or absence of groundwater bores was the biggest differentiator. Monitoring data was less of an influence on the overall score, apart from “Physiographic Survey” which varied between sites, relating to soil type and nitrogen leaching potential. Ecological criteria varied by a factor of three between different sites, with the presence of High Value Areas (“HVA Sites”) and flora and fauna database records (“Threatened Plants” and “NZFFD”) the biggest differentiators.

The top 10 private properties in terms of potential for wetland restoration is summarised in Table 3-1. The top 10 Fonterra farms are summarised in Table 3-2. The top 10 farms in the catchment scored 86 to 101 (65.2% to 76.5%) with the top 10 Fonterra farms scoring 70 to 91 (53.0% to 68.9%). Two of the top Fonterra farms are also in the top 10 overall. It is also noted that six of the top 10 Fonterra farms are owned by three landowners. This means that seven landowners control the top 10 Fonterra farms.

Maps of each of the top ten Fonterra farms including the relevant information from the GIS data and a summary of the available for each of these farms is included in Appendix D.

Table 3-1: Top 10 Ranked Sites for Wetland Restoration – All Landowners

Rank	Owner	Restoration Priority Score
1	Derek Neil Ballantine, Marguerita Anne Ballantine	101
2	Stanley Farms Limited	94
3	Kathryn Gay Munro, Ronald Ewart Munro	93
4=	Inverlac Farms Limited	91
4=	Webster Waikite Limited	91
6	Stevenson Farm Company Limited	88
7=	Flat Hill Farms Limited	87
7=	Foveaux Investments (2008) Limited	87
7=	Kathryn Gay Munro, Ronald Ewart Munro	87
10	Kapuka Dairies Limited	86

Table 3-2: Top 10 Ranked Sites for Wetland Restoration – Fonterra Farms

Rank	Owner	Restoration Priority Score
1	Inverlac Farms Limited - Site 1	91
2	Foveaux Investments (2008) Limited	87
3	Darrin Noel Crack, Joanne Florence Crack	84
4	Jan Marten Kingma	82
5=	Inverlac Farms Limited - Site 2	79
5=	Waituna Investments Limited - Site 1	79
7	Rhonda Karen Raymond-Williams	77
8	Kevin John Singh Belling, Rhonda Karen Belling - Site 1	71
9=	Kevin John Singh Belling, Rhonda Karen Belling - Site 2	70
9=	Waituna Investments Limited - Site 2	70

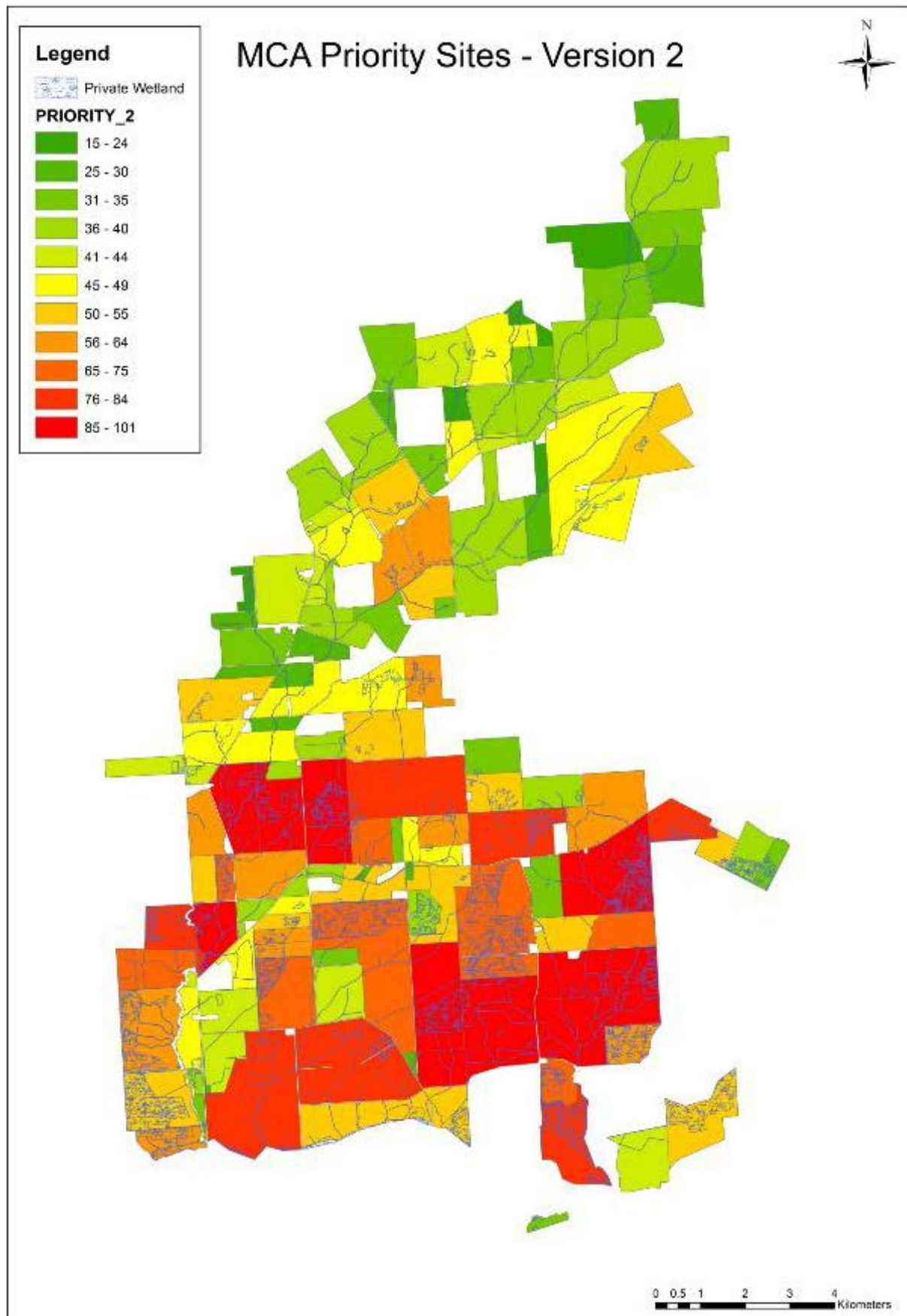


Figure 3-1: Wetland Site Prioritisation - MCA Results for the Waituna Catchment

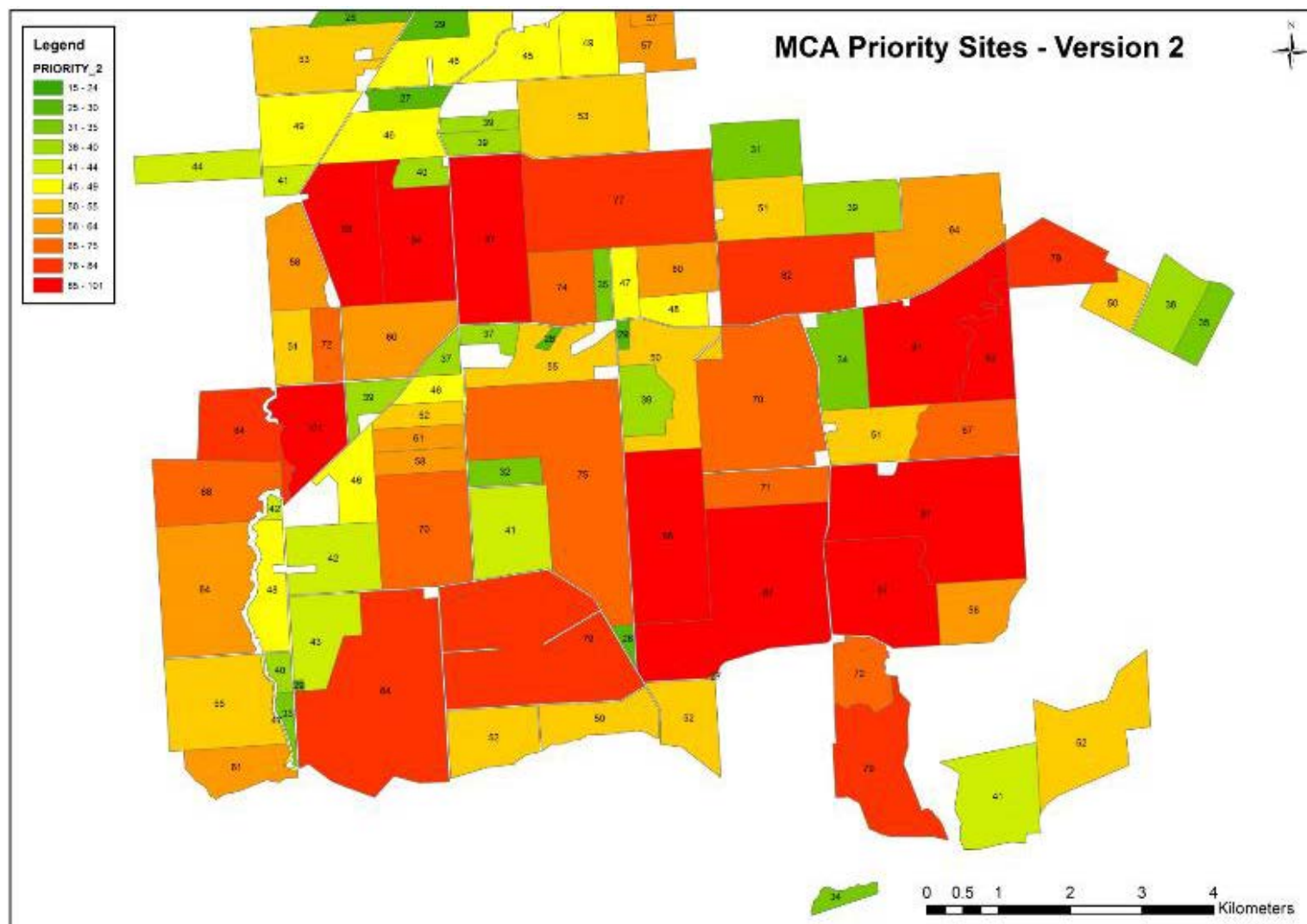


Figure 3-2: Wetland Site Prioritisation - MCA Scores for the Lower Catchment

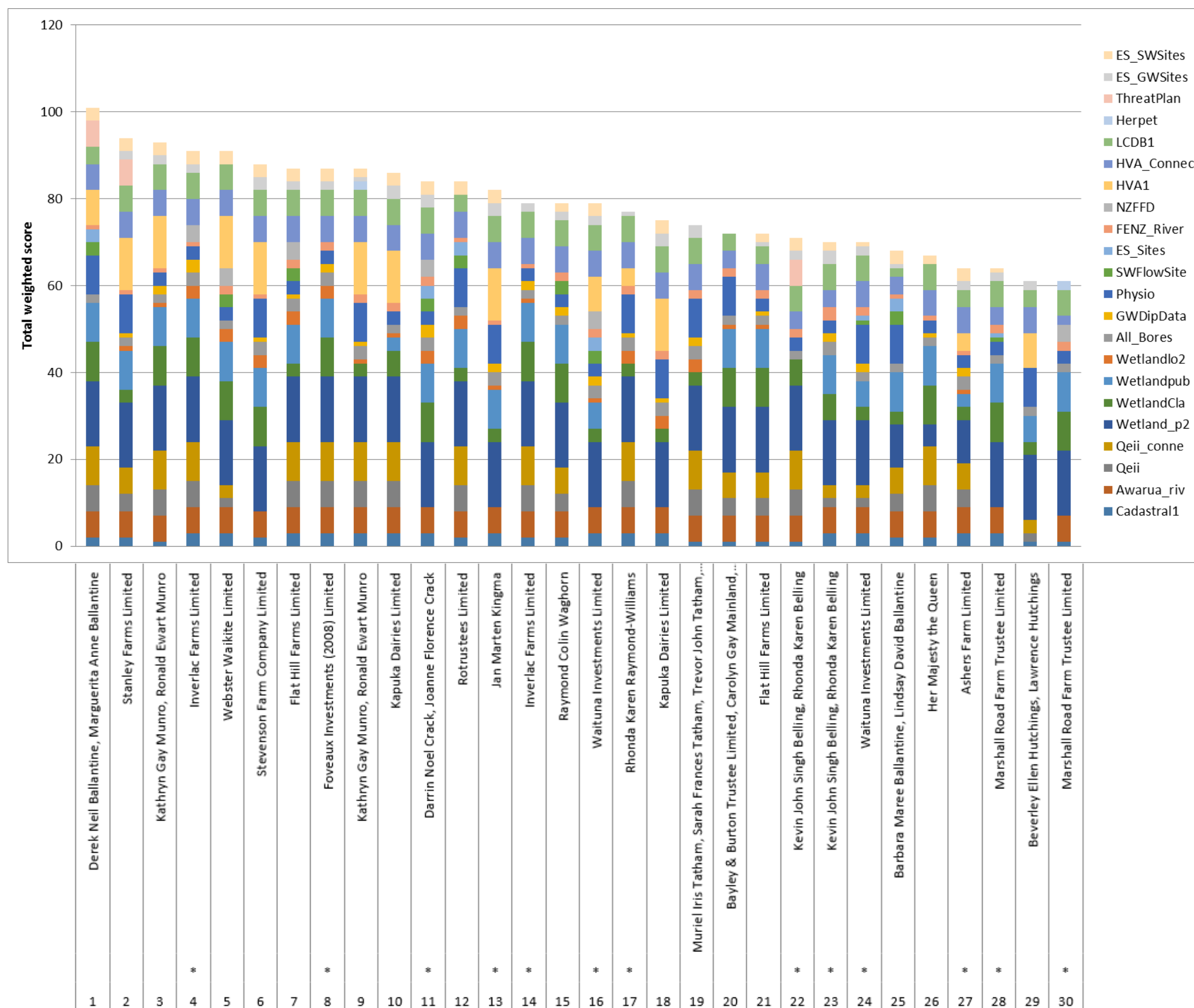


Figure 3-3: Scores for the Top 30 ranked properties within the Waituna catchment (*indicates Fonterra farms)

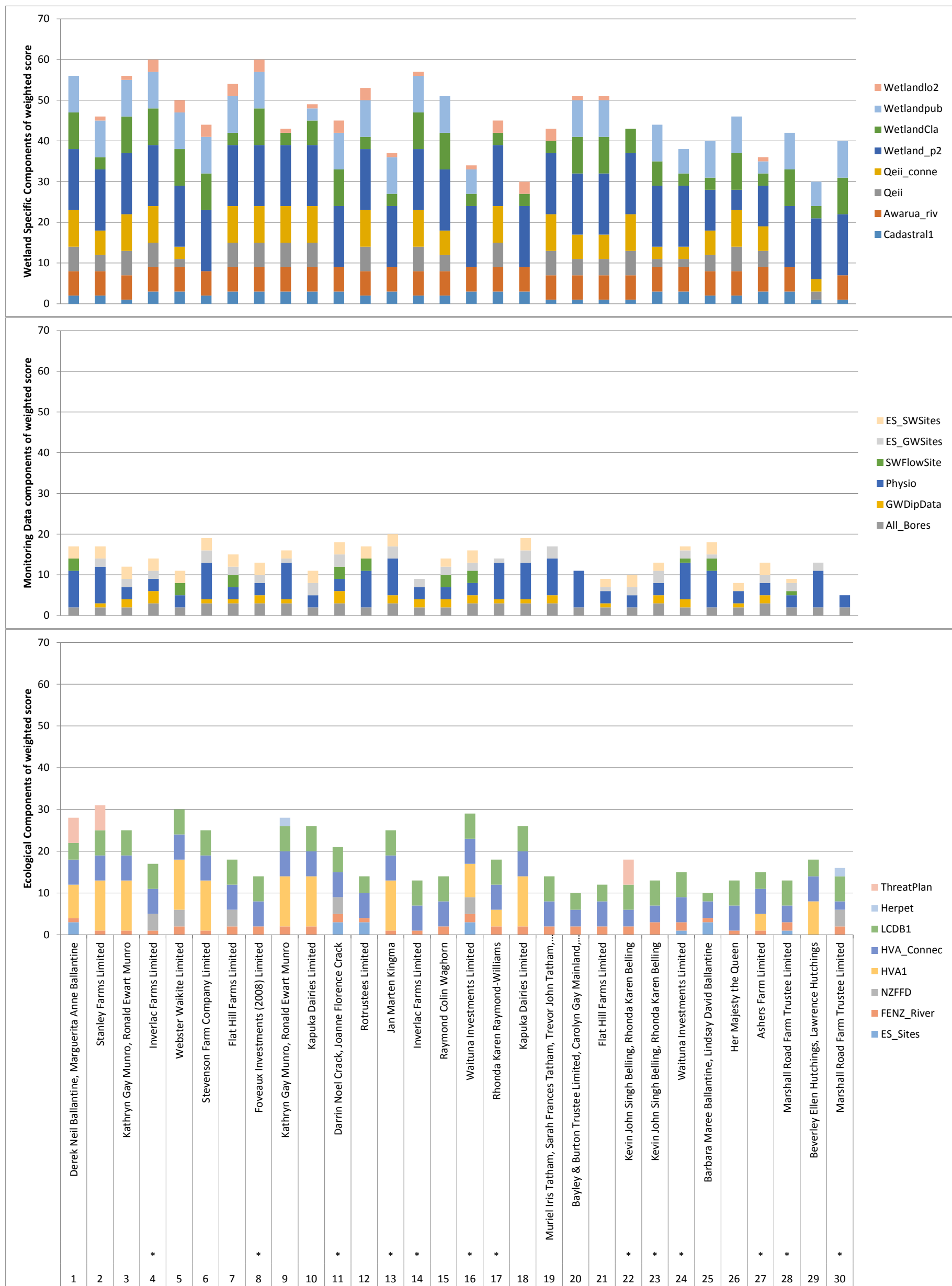


Figure 3-4: Breakdown of total score for Top 30 properties (*indicates Fonterra farms)

4 Discussion and Recommendations

The GIS constraints analysis was based on land parcels within the Waituna catchment which contain wetlands. All of these properties were ranked in terms of their ability to achieve objectives relating to wetland restoration; specifically significance of habitat, wetland size, benefits to water quality and opportunities for public engagement. This method objectively identified the highest priority sites on which restoration action can be focused. It is noted that this does not preclude the involvement of other landowners in the programme, however other properties are likely to not have as much benefit as those identified by the MCA analysis.

The information from the constraints assessment can be used to engage with landowners and farm managers of prioritised properties. As a first step, it is recommended that the highest-ranking Fonterra farms should be the focus for engagement activities, if not already engaged in the Living Water programme.

As part of this process, DOC and Fonterra could complete a site verification process to verify the information in the constraints assessment. If the farmer is amicable, this could include checking for the presence and extent of wetland fragments, streams, riparian margins, and remnant native habitat on these properties. In subsequent stages of the engagement, the willingness of the landowner to change management practices and/or protect areas of habitat could also be investigated. A detailed description of management activities that could be performed for these sites is contained in the separate report for this project (MWH, 2017). Management activities to protect or enhance wetland fragments on private land could include but are not limited to:

- Fencing of wetlands and stream margins
- Formal or informal protection of native habitat (e.g. rates relief, QEII Covenants)
- Protection or creation of wetlands for gamebird shooting
- Weed control; and
- Native planting.

It is also recommended that DOC, Fonterra and Environment Southland consider establishing a more comprehensive monitoring programme within the catchment. The scope and details of the recommended programme is contained in our separate report for this project (MWH, 2017). At present, monitoring and conservation activities are concentrated on public land in the lower catchment with much less focus on the mid or upper catchment. There is significant potential for monitoring on private land information relating to groundwater, surface water and ecological information. This includes the possible engagement of landowners, farmers and children as citizen scientists. There is also significant potential to formally protect remnant native vegetation and habitat on private properties in the catchment.

A summary of the available information for each of the top ten Fonterra farms is included in Appendix D. This information can be used to define the specific works on each farms, once land owners have agreed to work with the programme.

For further information on catchment management and monitoring recommendations to improve wetland and water quality on private land, please refer to the complementary report for this project prepared by MWH (MWH, 2017).

5 References

- Fonterra & DOC. (2014). *Waituna Catchment Annual Operational Plan July 201 - June 2015 Summary*. Invercargill: Fonterra and Department of Conservation.
- MWH. (2017). *Wetlands on Private Land in the Waituna Catchment, Southland: Ecology, Hydrology and Water Quality*. Invercargill: MWH now part of Stantec.
- Rissmann, C., & Wilson, K. (2012). *Waituna Catchment Groundwater Resource Technical Report*. Invercargill: Environment Southland.

Appendices



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Appendix A Summary of GIS Layers and Constraints

GIS Layers, Constraints and Weightings used for Multi-Criteria Analysis

GIS Layer	Constraint and Rationale	Type	Constraint Class (1 to 3)			Multiplier (1 to 5)
			Low (1)	Medium (2)	High (3)	
BASE INFORMATION						
Aerial photos 0.4m 2013-2014	Not used as a constraint	-	-	-	-	-
Aerial photos 0.75m 2005-2011	Not used as a constraint	-	-	-	-	-
Cadastral boundaries	Wetlands to be monitored were constrained to cadastral boundaries to ensure that single landowners would be able to be dealt with. Larger land parcels were favoured over small due to the likelihood that larger land parcels would contain larger areas of wetland, and have a greater ability to alter surrounding land use. There is also the potential that land owners of larger properties may be more influential in the community i.e. for advocacy and behaviour change.	Engagement	<100 ha	100 - 200 ha	>200 ha	1
NZ Coastlines Topo 1500k	Not used as a constraint	-	-	-	-	-
NZ Mainland Contours Topo 150k	Not used as a constraint	-	-	-	-	-
NZ Mainland Topo 50 Maps	Not used as a constraint	-	-	-	-	-
NZ Mainland Topo 250 Maps	Not used as a constraint	-	-	-	-	-
NZ Roads Centerlines Topo 1500k	Not used as a constraint	-	-	-	-	-

GIS Layer	Constraint and Rationale	Type	Constraint Class (1 to 3)			Multiplier (1 to 5)
			Low (1)	Medium (2)	High (3)	
Shademodel	Not used as a constraint	-	-	-	-	-
Waituna Catchment Boundary Oct 13	Only data within the Waituna catchment was analysed.	Base Constraint	Base Constraint	Base Constraint	Base Constraint	Base Constraint
HYDROLOGY & WETLANDS						
Awarua Rivers	It is a priority for water quality to restore wetlands in the upper catchment therefore first and second order streams are given highest priority	Water Quality	Presence of REC stream order 4	Presence of REC stream order 3	Presence of REC stream order 1 and 2	2
NZ Mainland Lake Polygons Topo 150k	Not used as a constraint	-	-	-	-	-
NZ Mainland River Centerlines Topo 150k	National scale, not fine enough detail to use as a constraint in Waituna catchment	-	-	-	-	-
NZ Mainland River Polygons Topo 150k	National scale, not fine enough detail to use as a constraint in Waituna catchment	-	-	-	-	-
NZ Mainland Swamp Polygons Topo 150K	National scale, not fine enough detail to use as a constraint in Waituna catchment	-	-	-	-	-
QEII Wetland Waituna	Properties which already have a QEII covenant present are likely to have increased biodiversity. Property owners with QEII covenants may be more likely to protect remaining wetlands on their land.	Significance	QEII covenant <1ha	QEII covenant 1-5ha	QEII covenant >5ha	2
	Ability to form connections to existing protected areas	Significance	QEII covenant within 1km of 2012 private wetland	QEII covenant within 500m of 2012 private wetland	QEII covenant within 100m of 2012 private wetland	3
Wetlands Current Waituna	"Wetland Private Waituna" and "Wetland Public Waituna" provides more detailed data than this layer	-	-	-	-	-

GIS Layer	Constraint and Rationale	Type	Constraint Class (1 to 3)			Multiplier (1 to 5)
			Low (1)	Medium (2)	High (3)	
Wetlands Historic Waituna	"Waituna Wetland Loss" shows more detail than this layer	-	-	-	-	-
Wetland Private Waituna	Not used as a constraint	-	-	-	-	-
2012 Private Waituna	Larger wetlands are presumed to hold higher biodiversity values and are likely to support a variety of habitat types.	Size	Wetland and riparian habitat <1ha	Wetland and riparian habitat 1-5ha	Wetland and riparian habitat >5ha	5
	Wetlands with flowing water provide a water quality management function within the catchment	Water Quality	Presence of Shallow Water wetland	Presence of Fen wetland	Presence of Swamp or marsh wetland	3
Wetland Public Waituna	Ability to form connections to existing protected areas	Significance	Public wetland within 1km of 2012 private wetland	Public wetland within 500m of 2012 private wetland	Public wetland within 100m of 2012 private wetland	3
Waituna Wetland Loss	Properties where wetlands have been lost provide opportunities for restoration, however protection of existing wetlands should be the higher priority.	Significance	Historic wetland in "gone" category <10 ha	Historic wetland in "gone" category 10 -20 ha	Historic wetland in "gone" category >20 ha	1
HYDROGEOLOGY						
All Bores	Existing bores can be used for future monitoring.	Existing Data	Bore within 1km of 2012 private wetland	Bore within 500m of 2012 private wetland	Bore within 100m of 2012 private wetland	1
Aquifer Drawdown	Not used as a constraint.	-	-	-	-	-
Climate Stations	There are two climate stations present in the Waituna catchment. Not used as a constraint.	-	-	-	-	-
Consented GW Takes All Clip	Not used as a constraint. Covered under aquifer drawdown	-	-	-	-	-

GIS Layer	Constraint and Rationale	Type	Constraint Class (1 to 3)			Multiplier (1 to 5)
			Low (1)	Medium (2)	High (3)	
Groundwater Dipping Data	Prioritise sites where information on groundwater levels are known	Existing Data	Bore within 1km of 2012 private wetland	Bore within 500m of 2012 private wetland	Bore within 100m of 2012 private wetland	1
GW Levels Bores Greater 30m	Not used as a constraint.	-	-	-	-	-
GW Levels Bores Less than 30m	Not used as a constraint.	-	-	-	-	-
Highest GW Levels	Not used as a constraint.	-	-	-	-	-
Lowest GW Levels	Not used as a constraint.	-	-	-	-	-
Physiographic survey	Sites in “leaky soils” are higher priority than organic soils. Based on soil leaching of nitrogen	Water Quality	Southern Zone	Northern Zone	Mokotua Infiltration Zone	3
QMAP Murihiku	Not used as a constraint.	-	-	-	-	-
Waituna Catchment Bore Log Data	Not used as a constraint.	-	-	-	-	-
Surface Water Flow Continuous Monitoring Sites	Prioritise sites where information on flow is known	Existing Data	Site within 1km of 2012 private wetland	Site within 500m of 2012 private wetland	Site within 100m of 2012 private wetland	1
AQUATIC ECOLOGY						
ES SOE Ecosystem Sites	Sites where monitoring has already been undertaken provides existing baseline data. Provides the ability to source and use existing data.	Existing Data	Monitoring site within 1km of 2012 private wetland	Monitoring site within 500m of 2012 private wetland	Monitoring site within 100m of 2012 private wetland	1
FENZ_v1	Not used as a constraint	-	-	-	-	-
FENZ_v1_lakes	Not used as a constraint	-	-	-	-	-

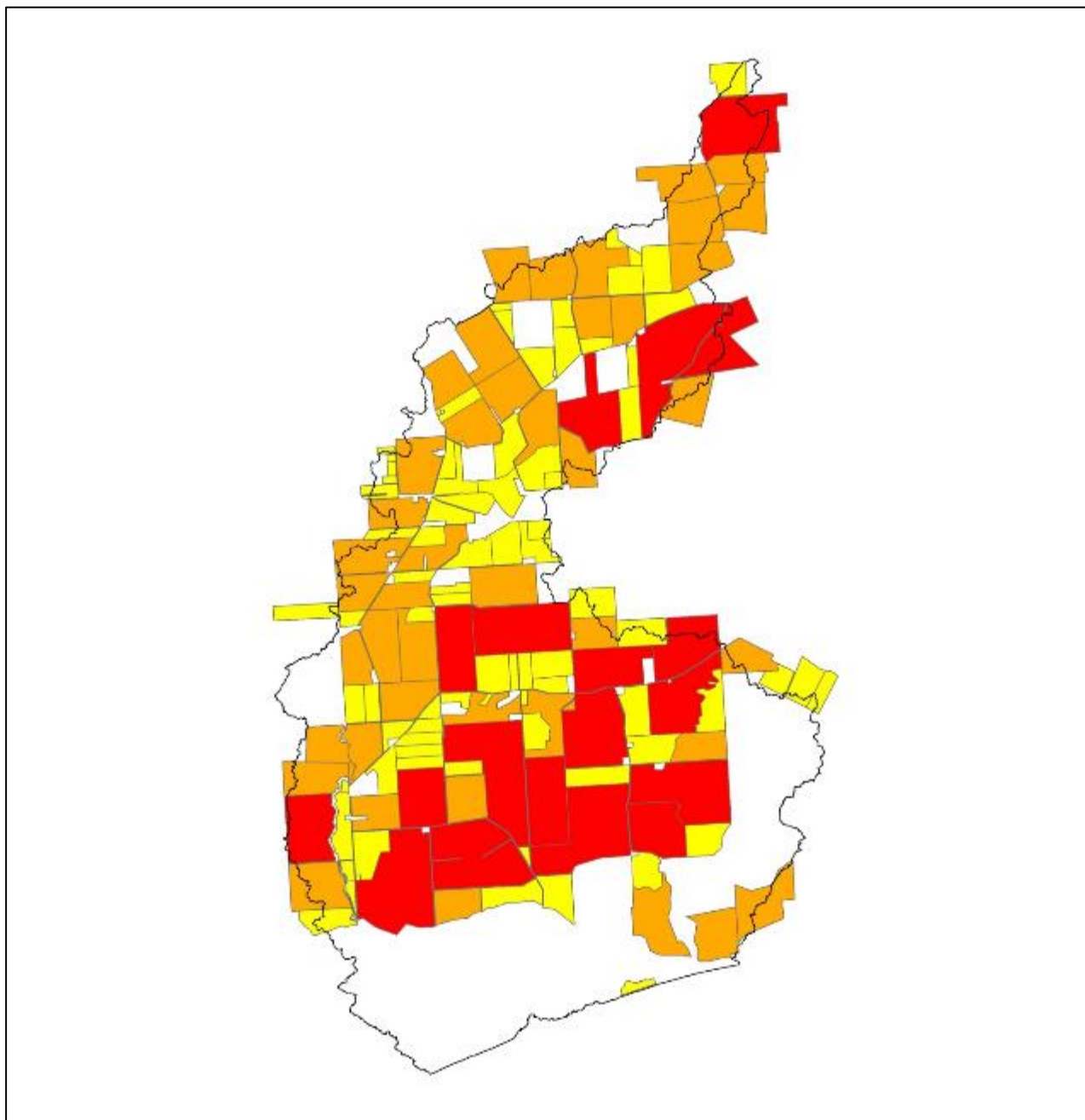
GIS Layer	Constraint and Rationale	Type	Constraint Class (1 to 3)			Multiplier (1 to 5)
			Low (1)	Medium (2)	High (3)	
FENZ_v1_rivers	River and stream pressures. Aims to identify and protect sites of higher condition as a priority	Significance	Condition score 0-0.3	Condition score 0.31-0.69	Condition score 0.7+	1
FENZ_v1_wetlands	"Wetland Private Waituna" and "Wetland Public Waituna" provides more detailed data than this layer	-	-	-	-	-
New Zealand Freshwater Fish Database	Sites where at risk or threatened species are known to occur are given higher priority	Significance	Non-threatened native species present	At risk species recorded	Threatened species recorded	2
WONI Biogeographic Provinces	Not used as a constraint	-	-	-	-	-
WONI Biogeographic Units	Not used as a constraint	-	-	-	-	-
TERRESTRIAL ECOLOGY						
Extent Fire	Only one small fire recorded in the Waituna catchment. Not a constraint	-	-	-	-	-
HVA Surveys Completed 2007 to 29 April 2015	Properties which have HVAs present are likely to have increased biodiversity.	Significance	Area of HVA within property boundary <5 ha	Area of HVA within property boundary 5-20 ha	Area of HVA within property boundary >20 ha	4
	Ability to form connections to existing HVAs	Significance	HVA site within 1km of 2012 private wetland	HVA site within 500m of 2012 private wetland	HVA site within 100m of 2012 private wetland	2
Threatened Environments Classification 2012	All land likely to be in same threat class. Not a distinguishing factor	-	-	-	-	-
Land Environments New Zealand LENZ Level 4 Polygons	Not used as a constraint	-	-	-	-	-

GIS Layer	Constraint and Rationale	Type	Constraint Class (1 to 3)			Multiplier (1 to 5)
			Low (1)	Medium (2)	High (3)	
LCDB v40 Land Cover Database Version 4.0	Presence of native vegetation	Significance	Native vegetation < 5 ha	Native vegetation 5 – 20 ha	Native vegetation > 20 ha	2
Bioweb Herpetofauna Database	Sites where at risk or threatened species are known to occur are given higher priority	Significance	Non-threatened native species present	At risk species recorded	Threatened species recorded	2
Bioweb Threatened Plant Database	Sites where at risk or threatened species are known to occur are given higher priority	Significance	Non-threatened native species present	At risk species recorded	Threatened species recorded	2
WATER QUALITY						
ES Groundwater Quality Monitoring Sites Waituna	Prioritise sites where information on groundwater quality is known	Existing Data	Bore within 1km of 2012 private wetland	Bore within 500m of 2012 private wetland	Bore within 100m of 2012 private wetland	1
ES Surface Water Quality Monitoring Sites	Prioritise sites where information on surface water quality and flow data is known	Existing Data	Site within 1km of 2012 private wetland	Site within 500m of 2012 private wetland	Site within 100m of 2012 private wetland	1

Appendix B Maps of Individual Constraints

1.0 BASE INFORMATION

1.1 Cadastral Boundaries (Property Size)

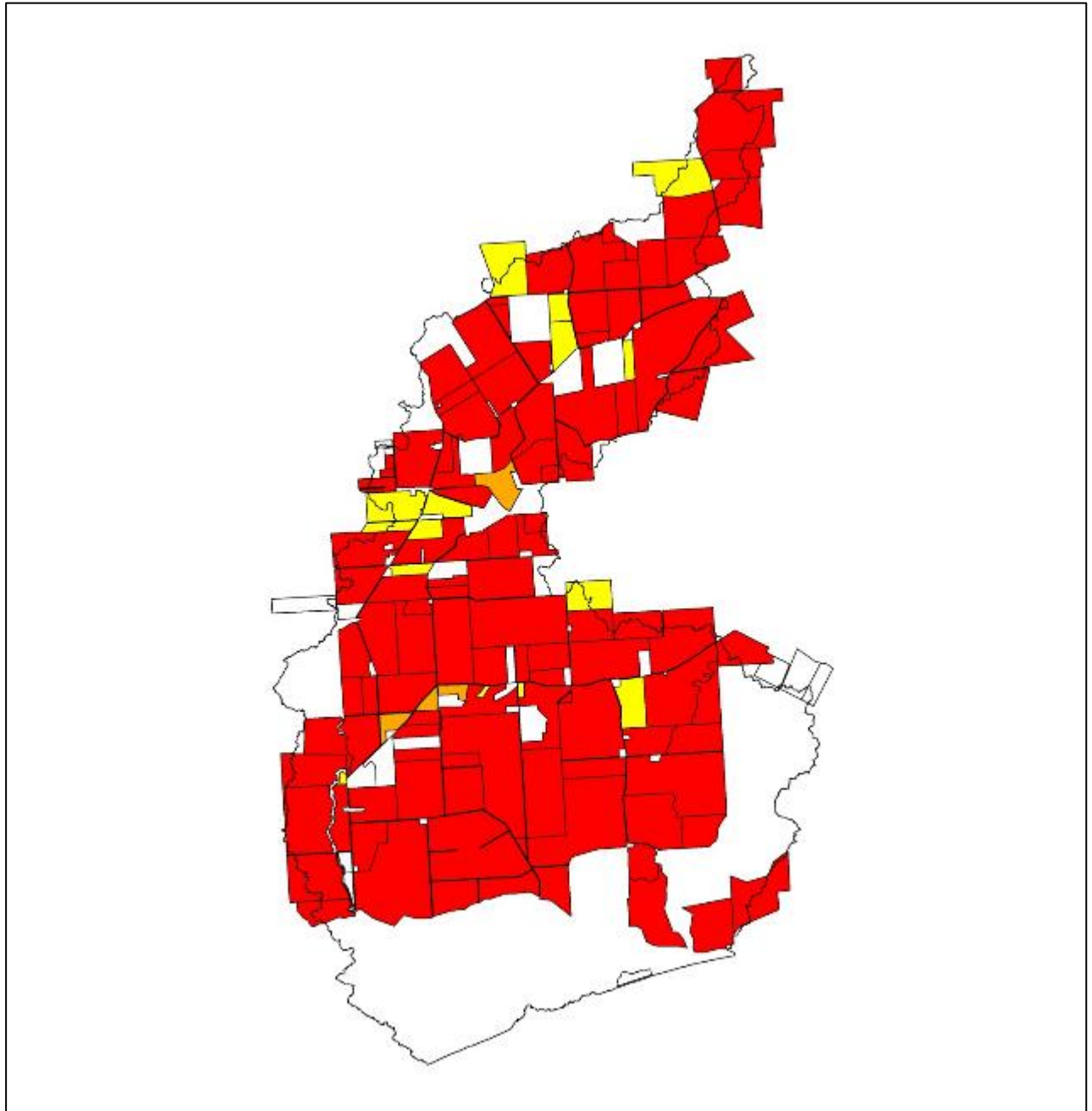




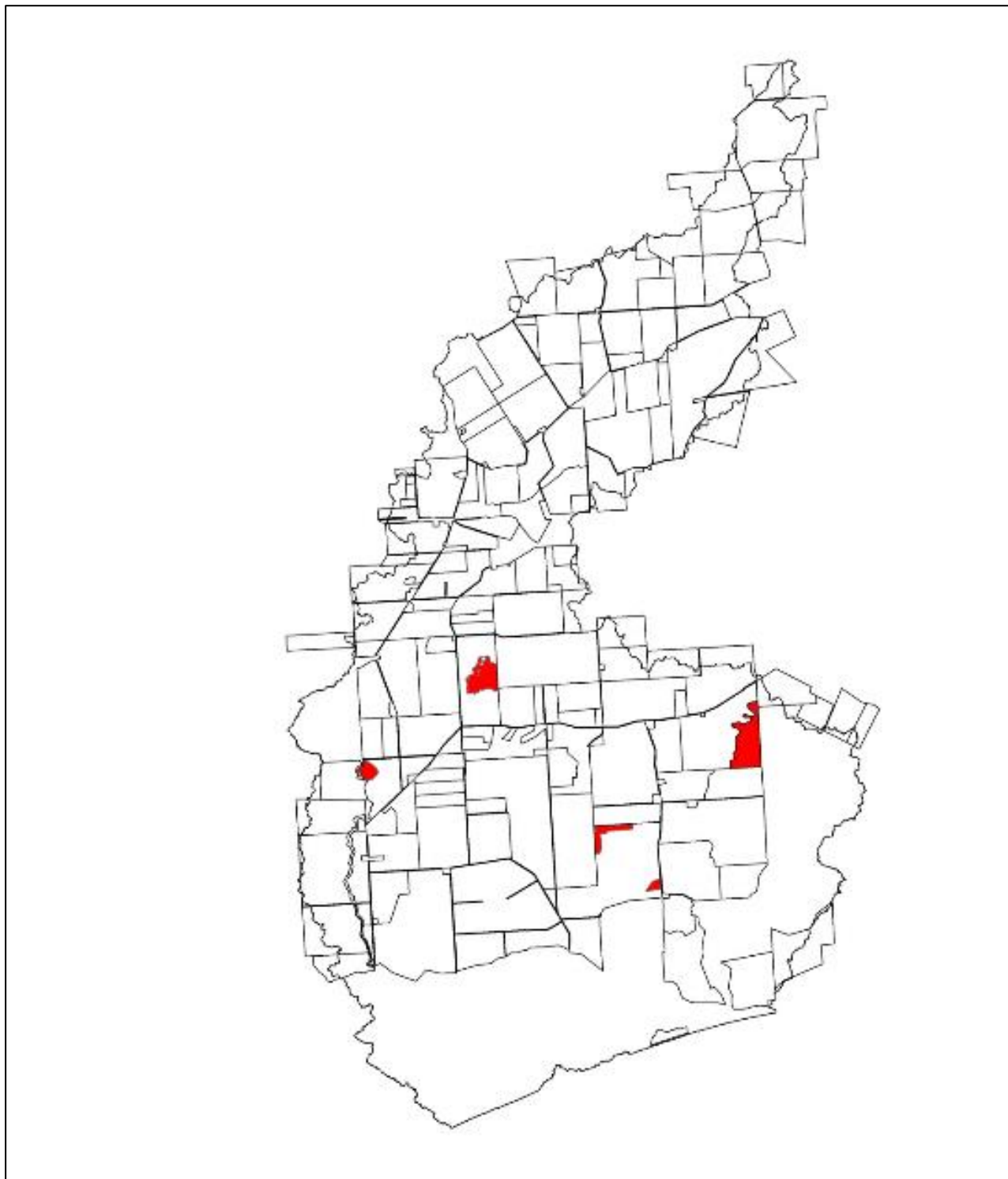
2.0 Hydrology and Wetlands

Note that the map of output from the wetland loss constraint is not included as this information is confidential.

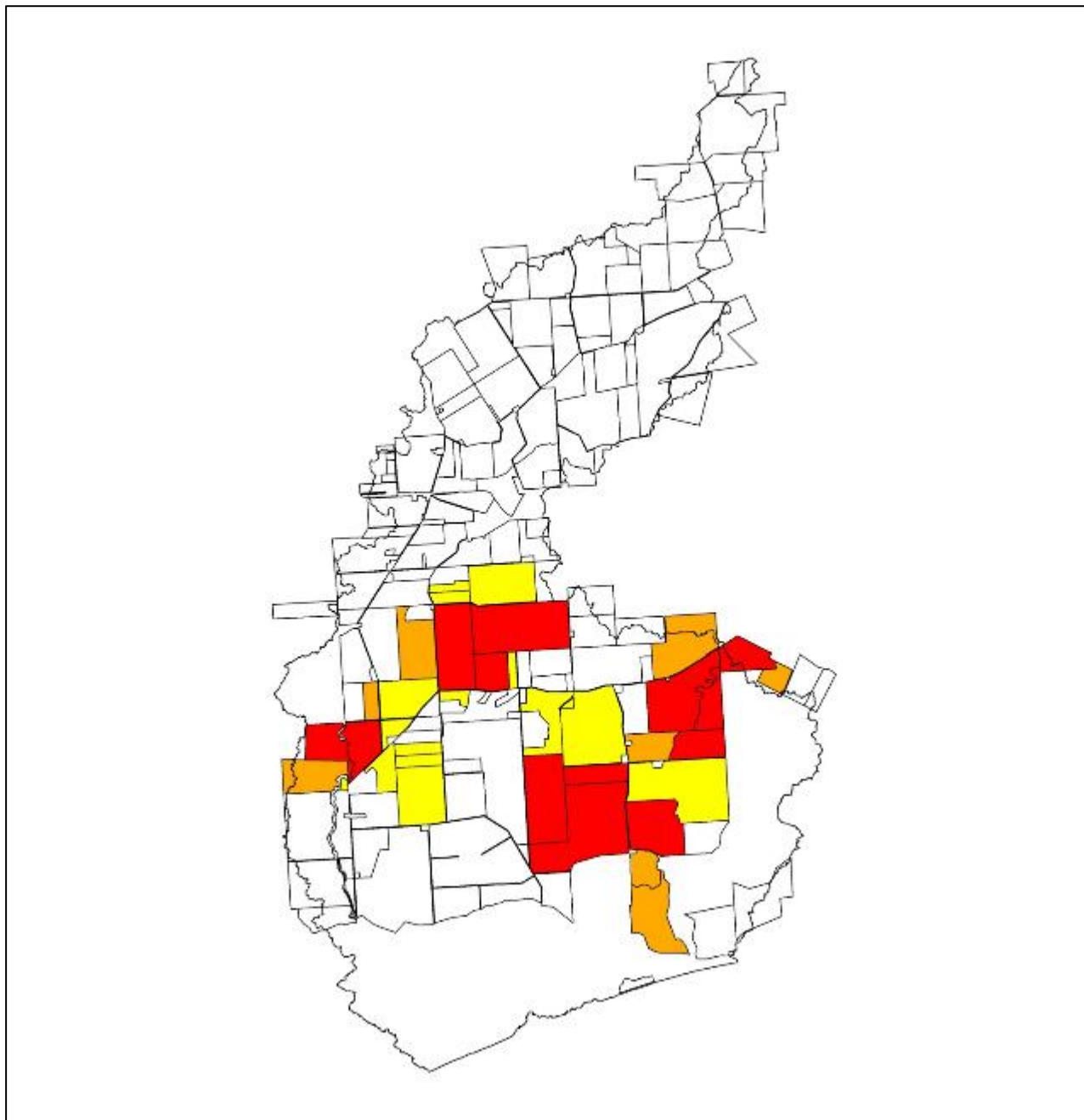
2.1 Awarua Rivers



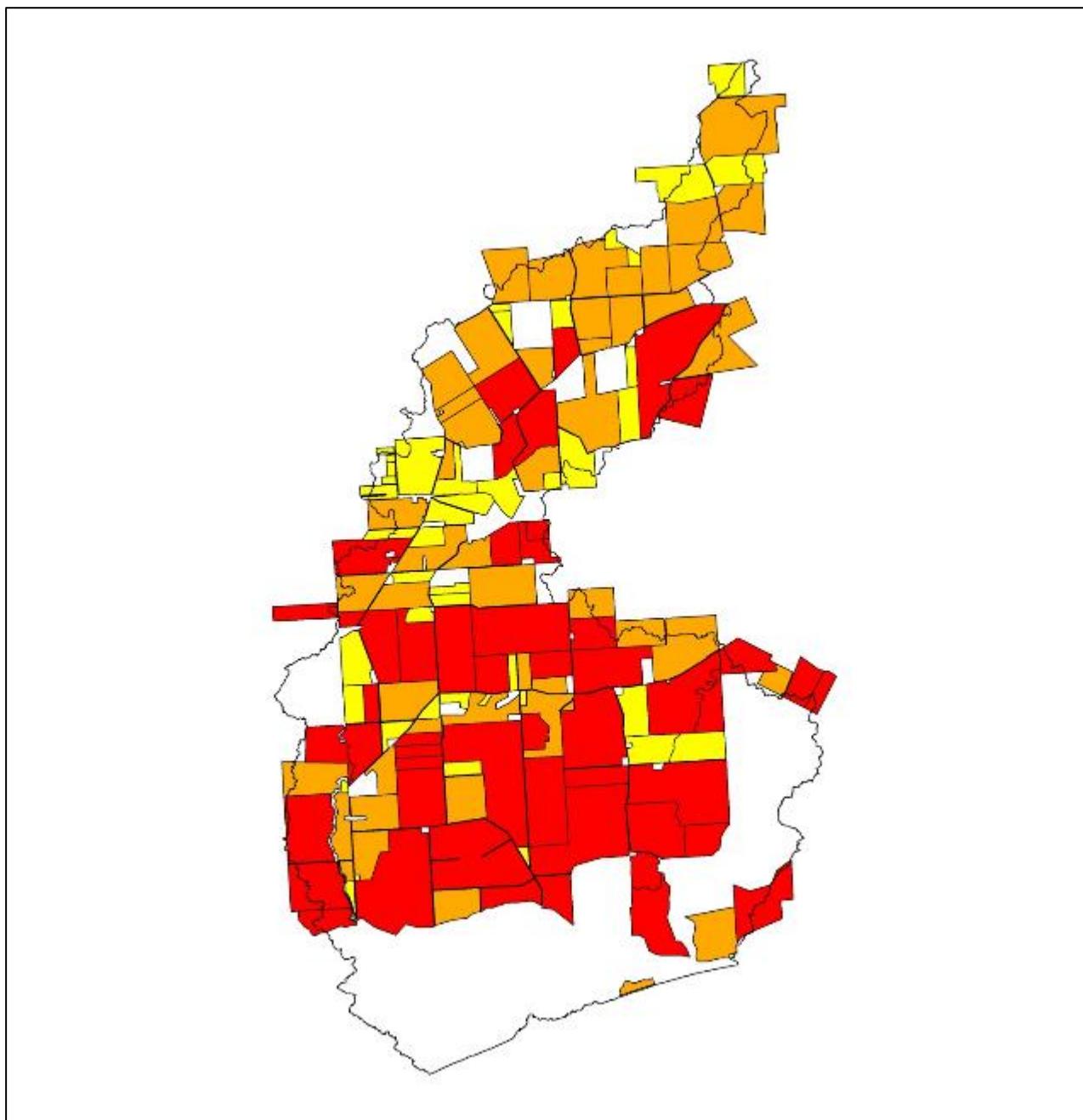
2.2 QEII Wetland



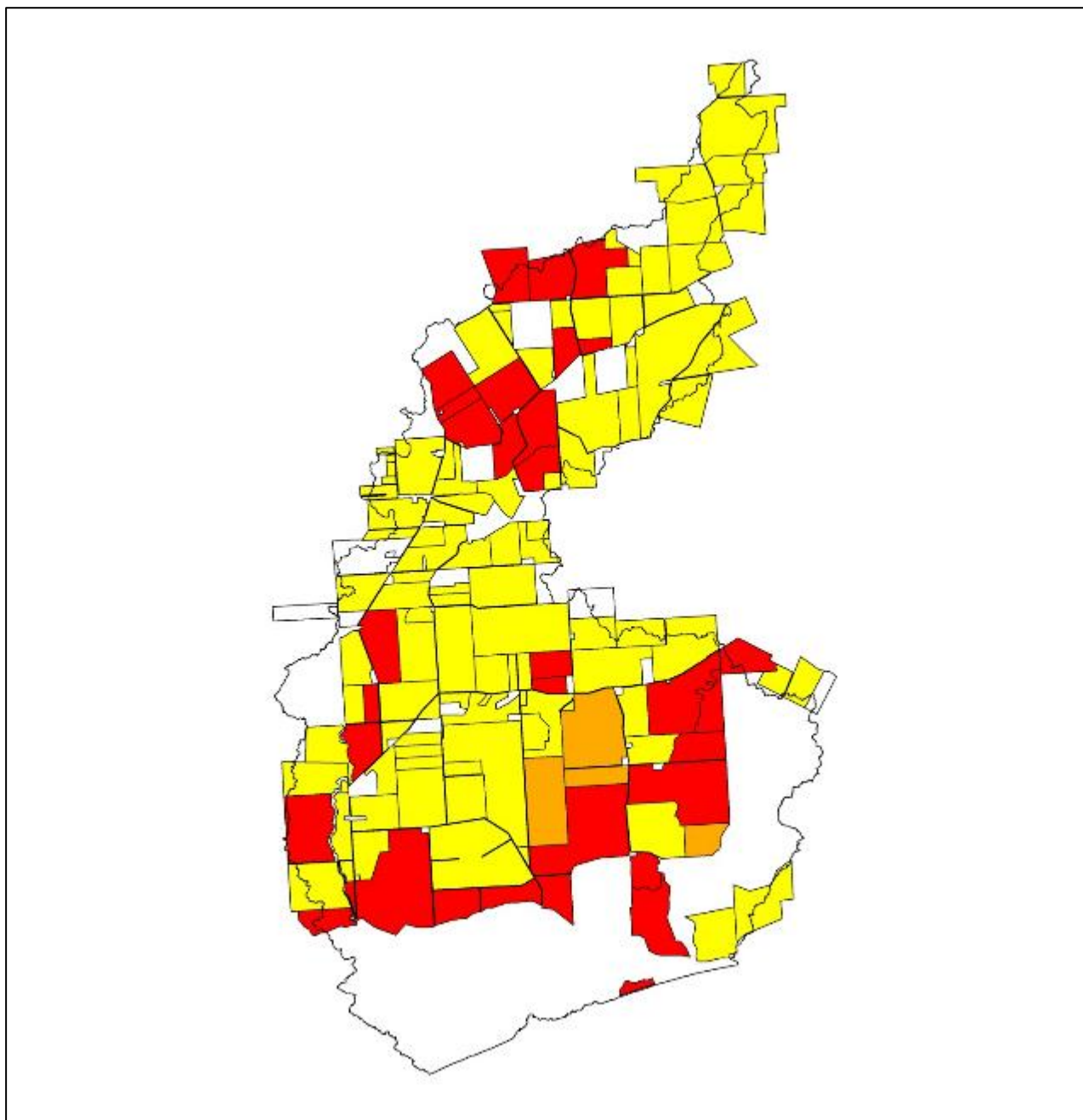
2.3 QEII Wetland Connections



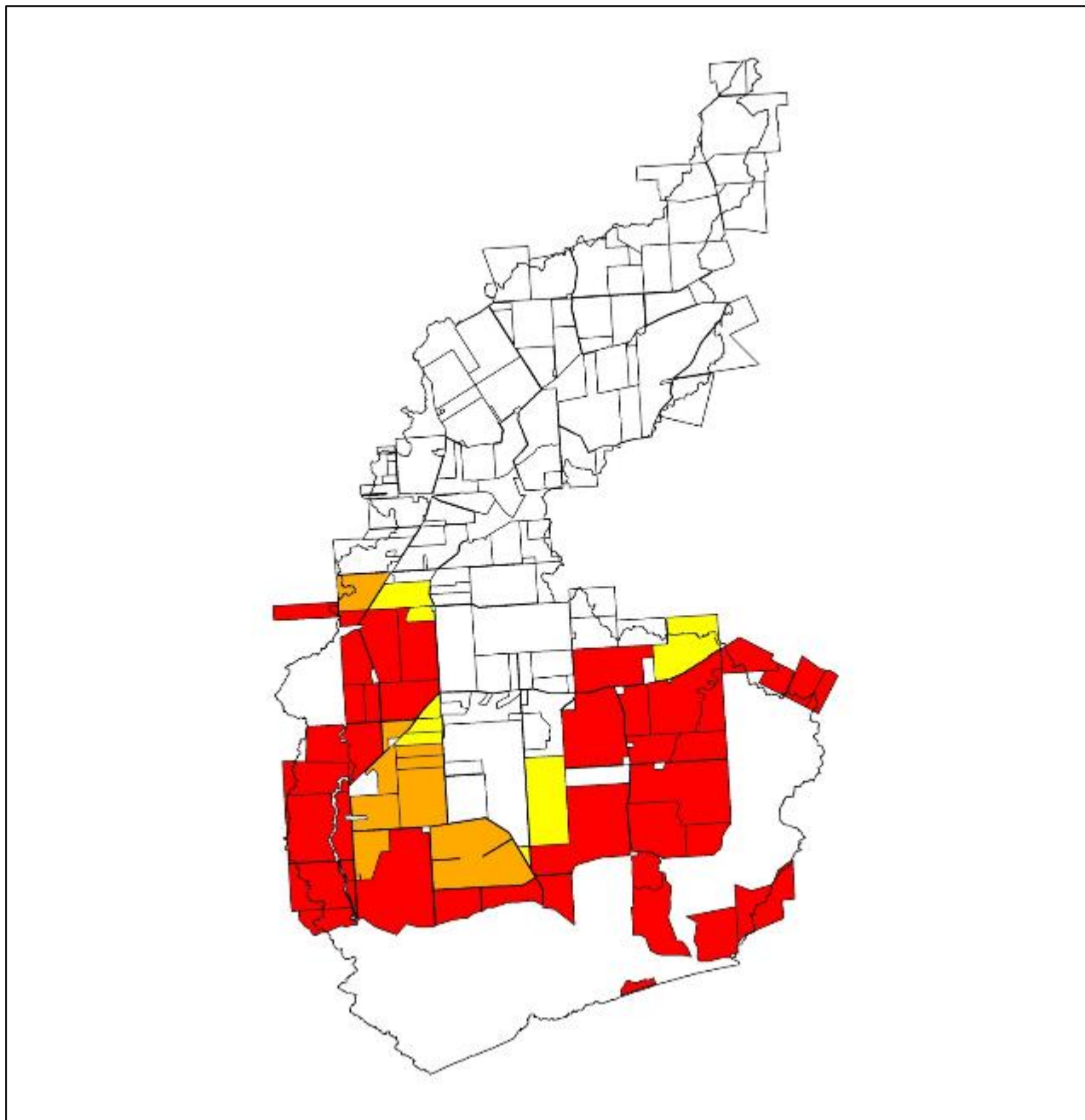
2.4 Wetland Private (Wetland Size)



2.5 Wetland Private (Wetland Type)

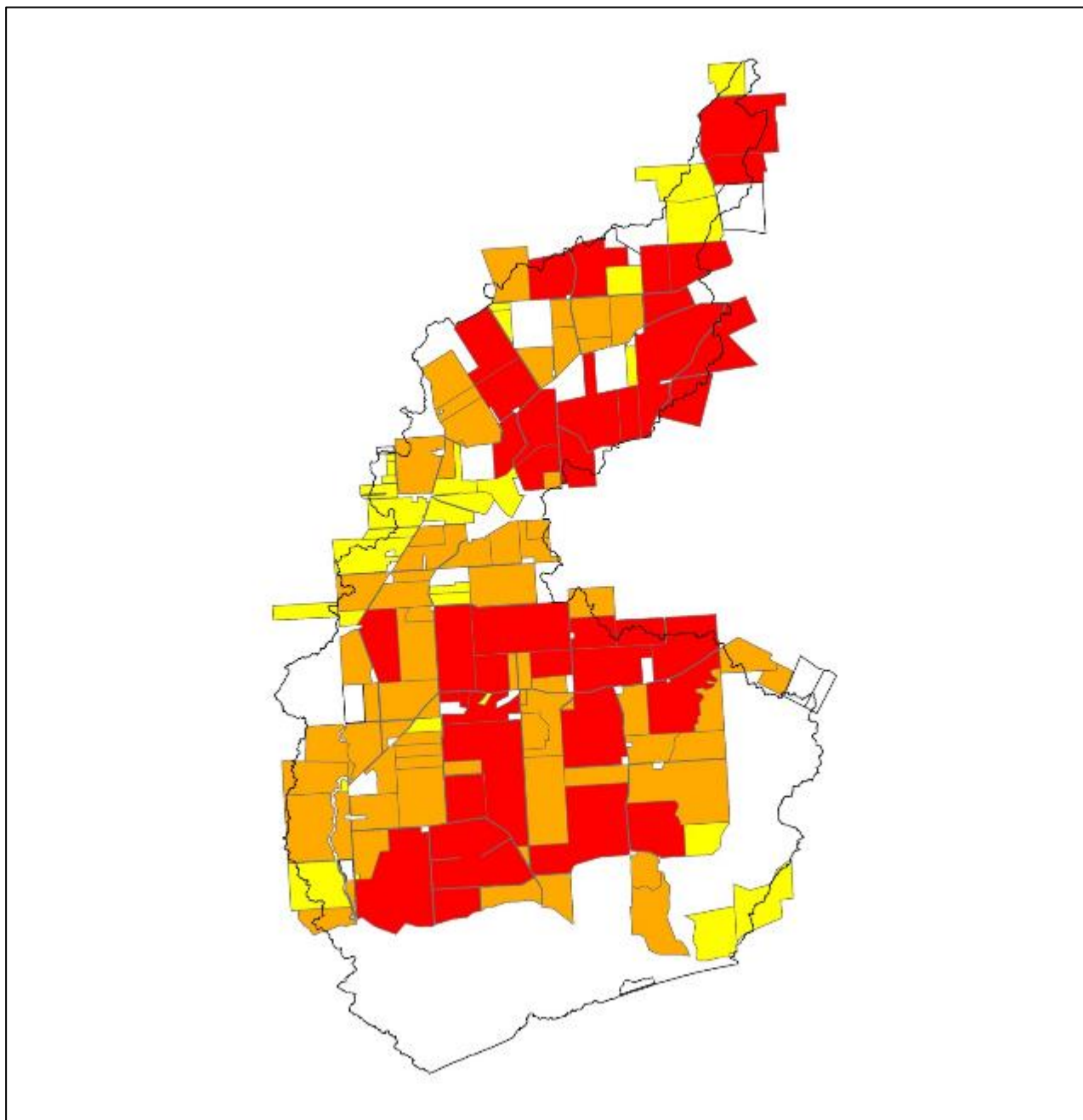


2.6 Wetland Public Connections

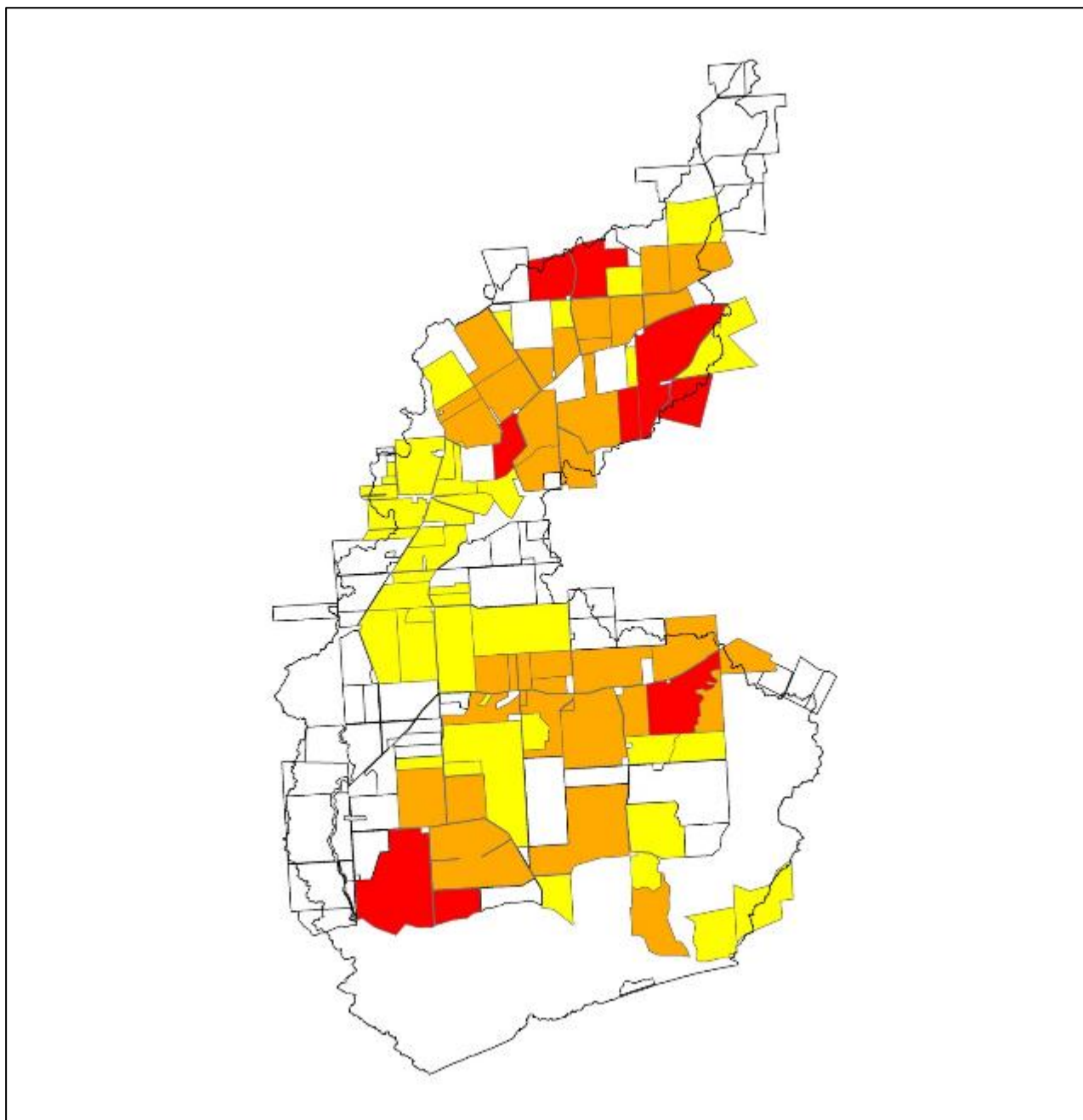


3.0 HYDROGEOLOGY

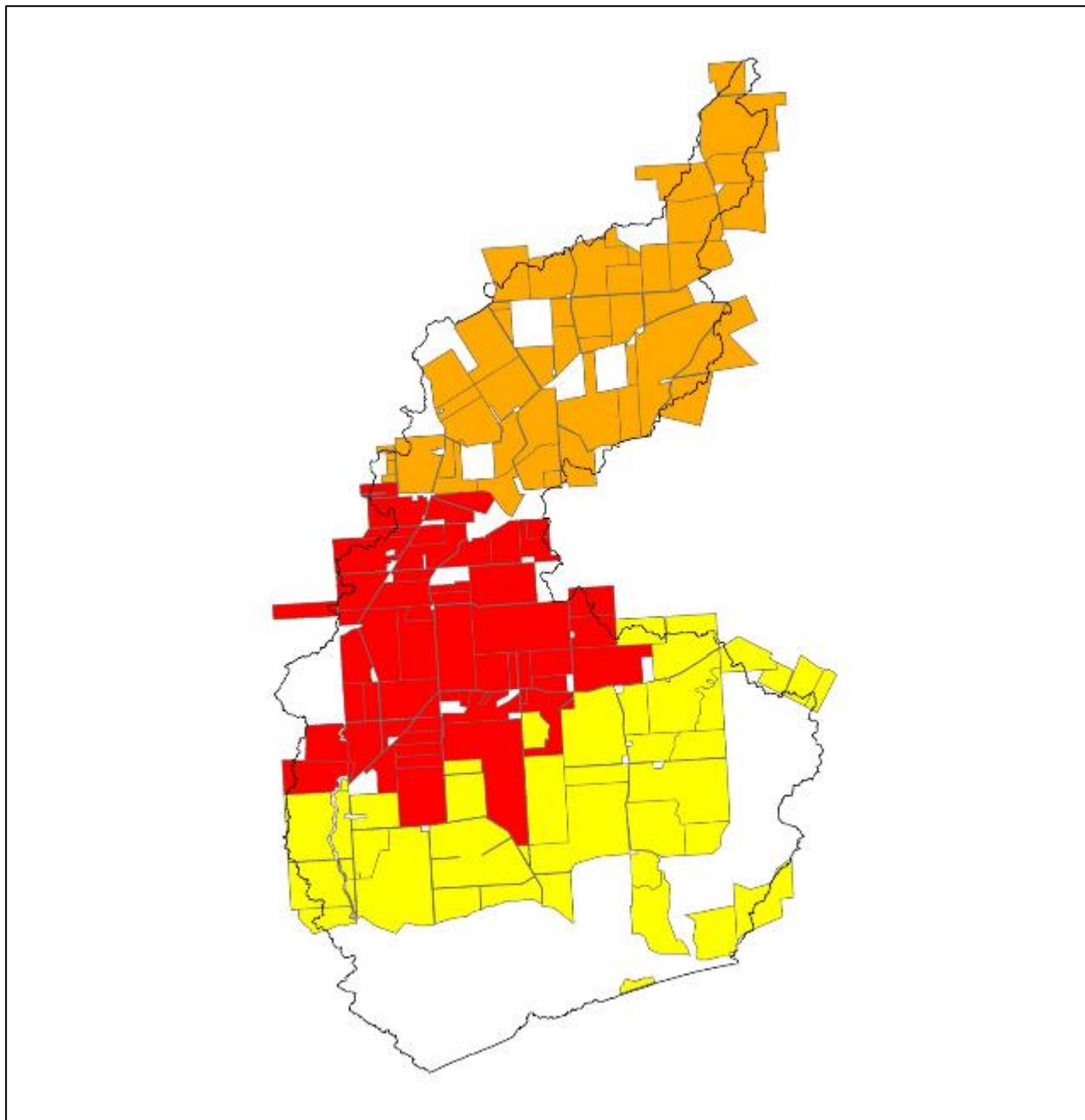
3.1 All Bores



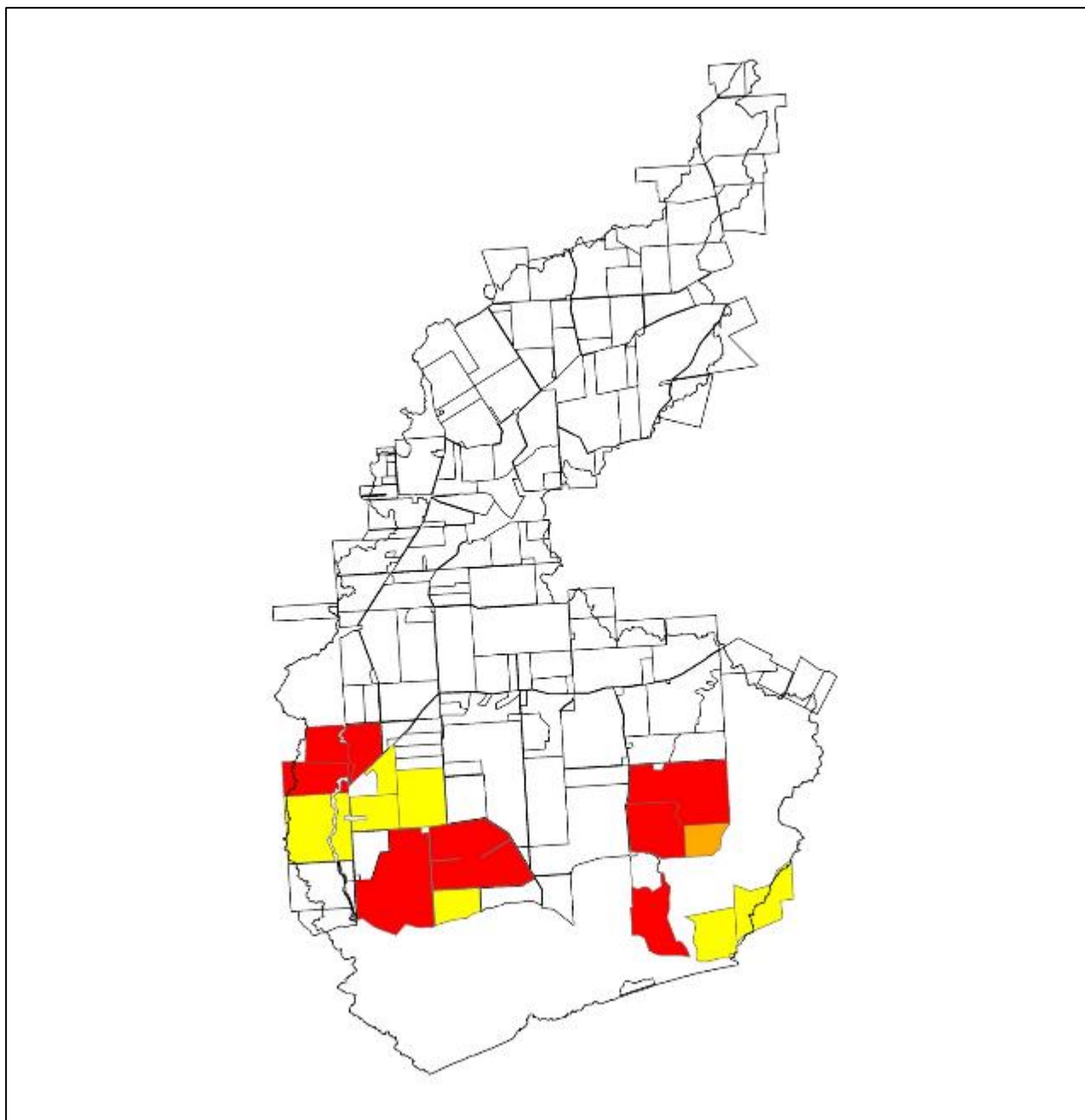
3.2 GW Dipping Data



3.3 Physiographic Survey

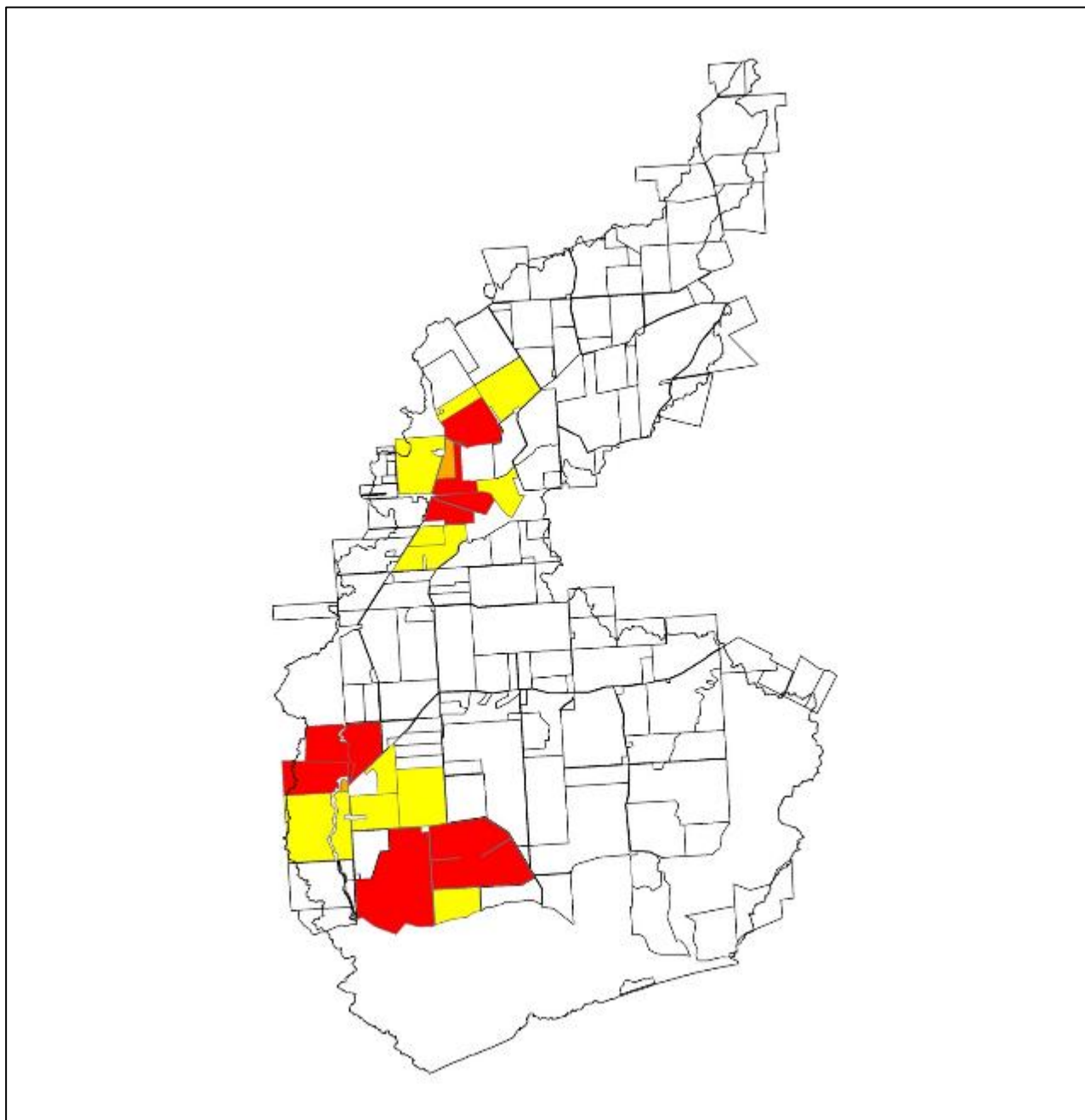


3.4 SW Flow Sites

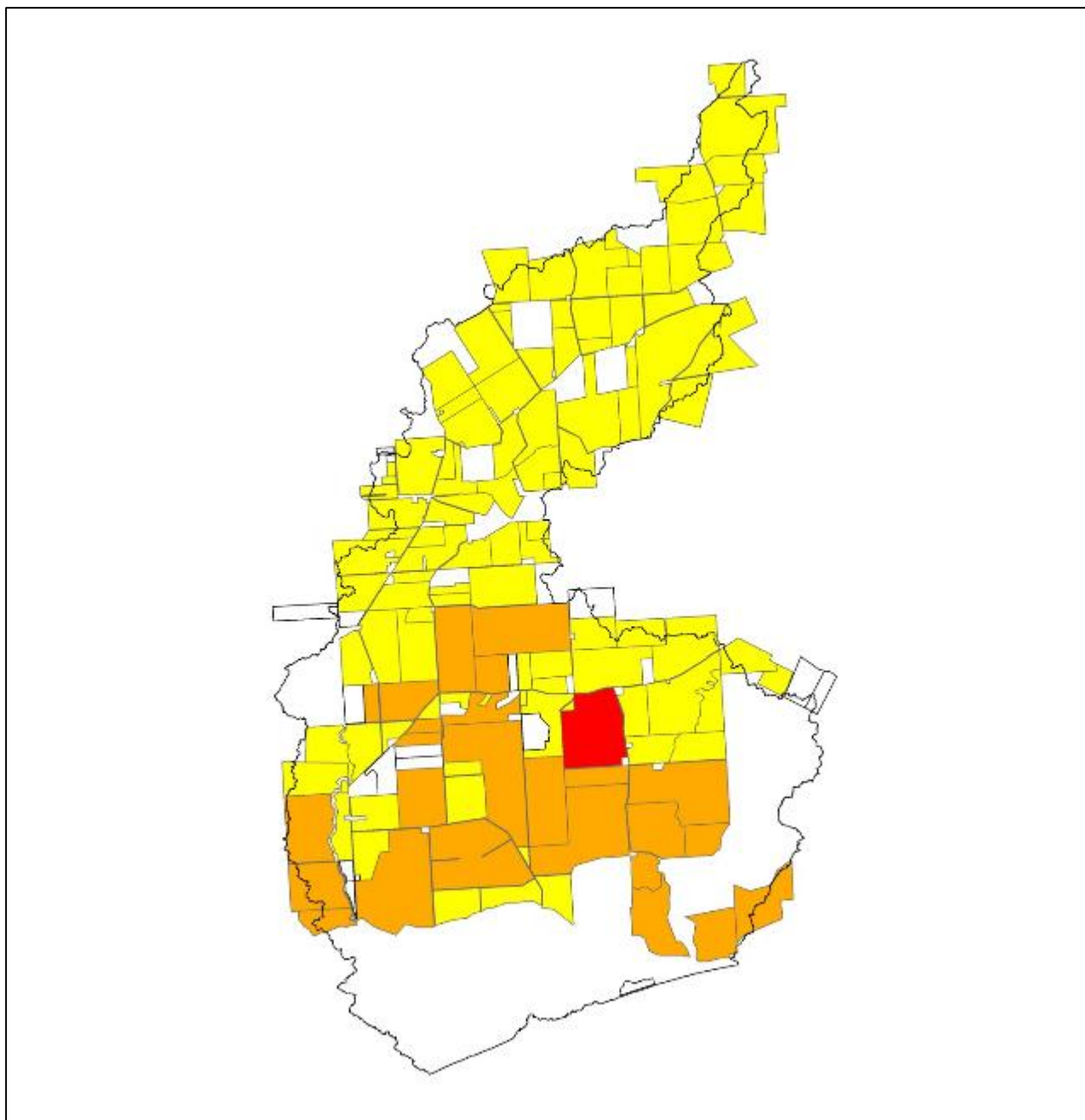


4.0 AQUATIC ECOLOGY

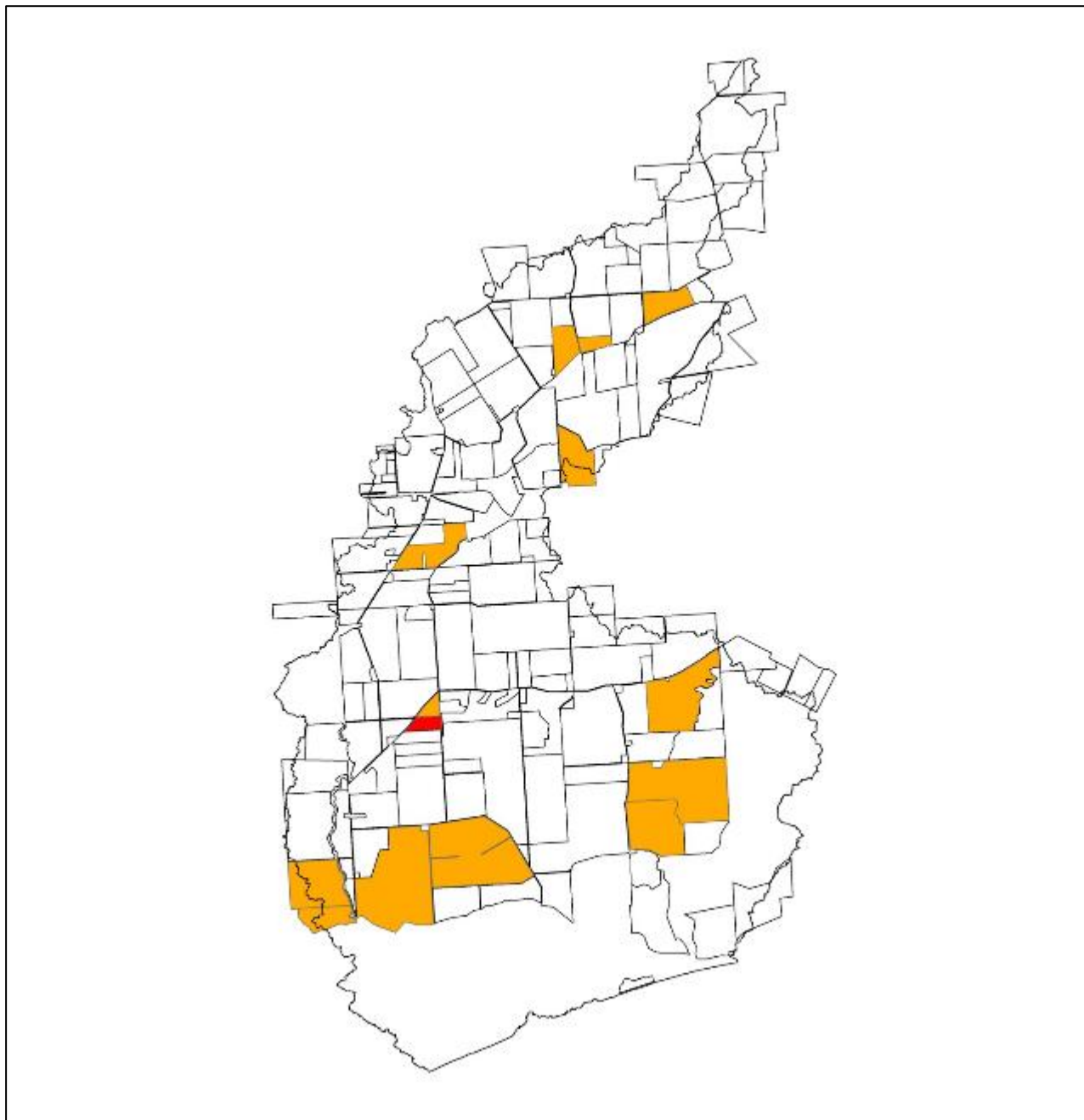
4.1 ES Monitoring Sites



4.2 FENZ Rivers

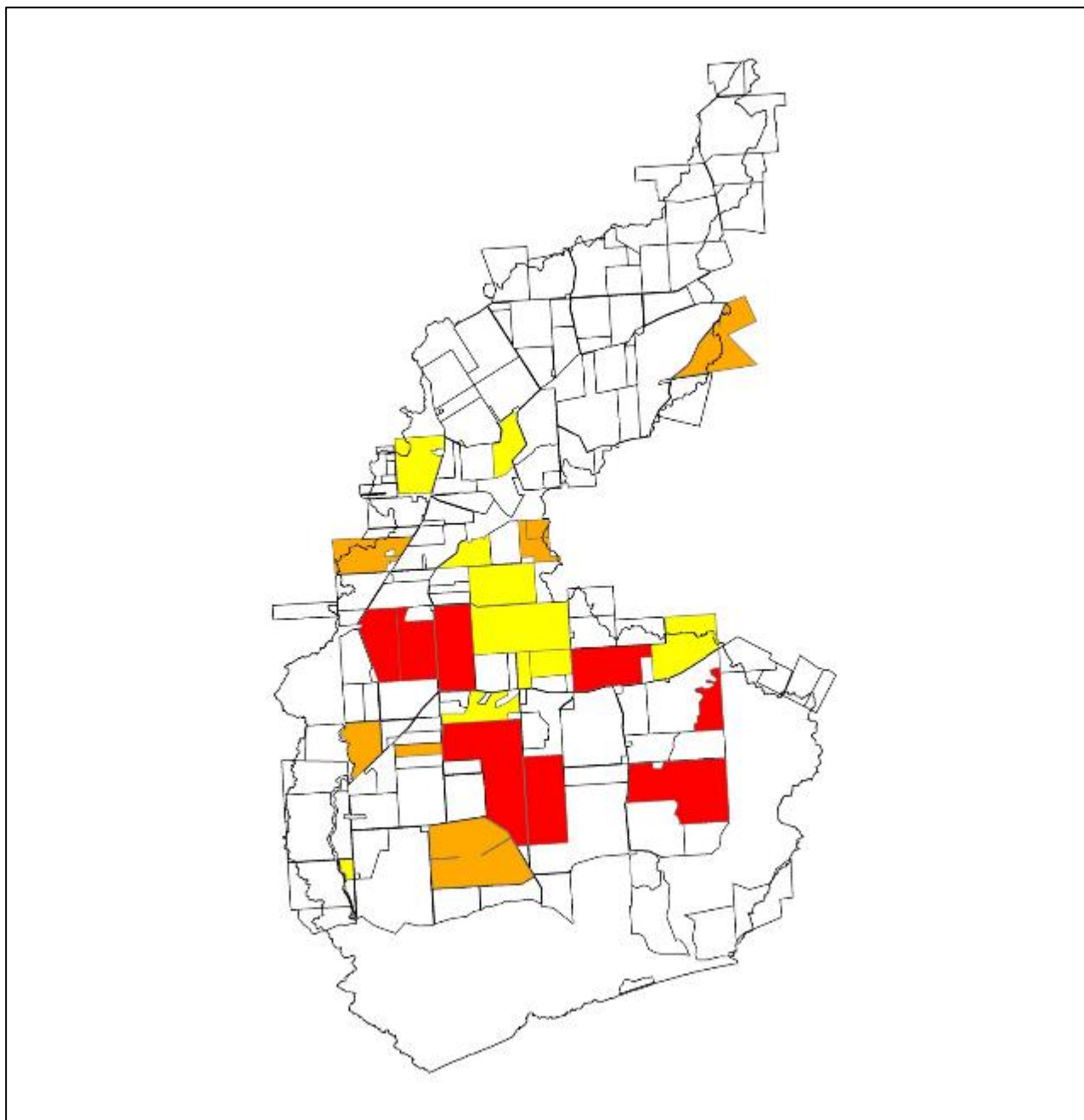


4.3 NZFFD

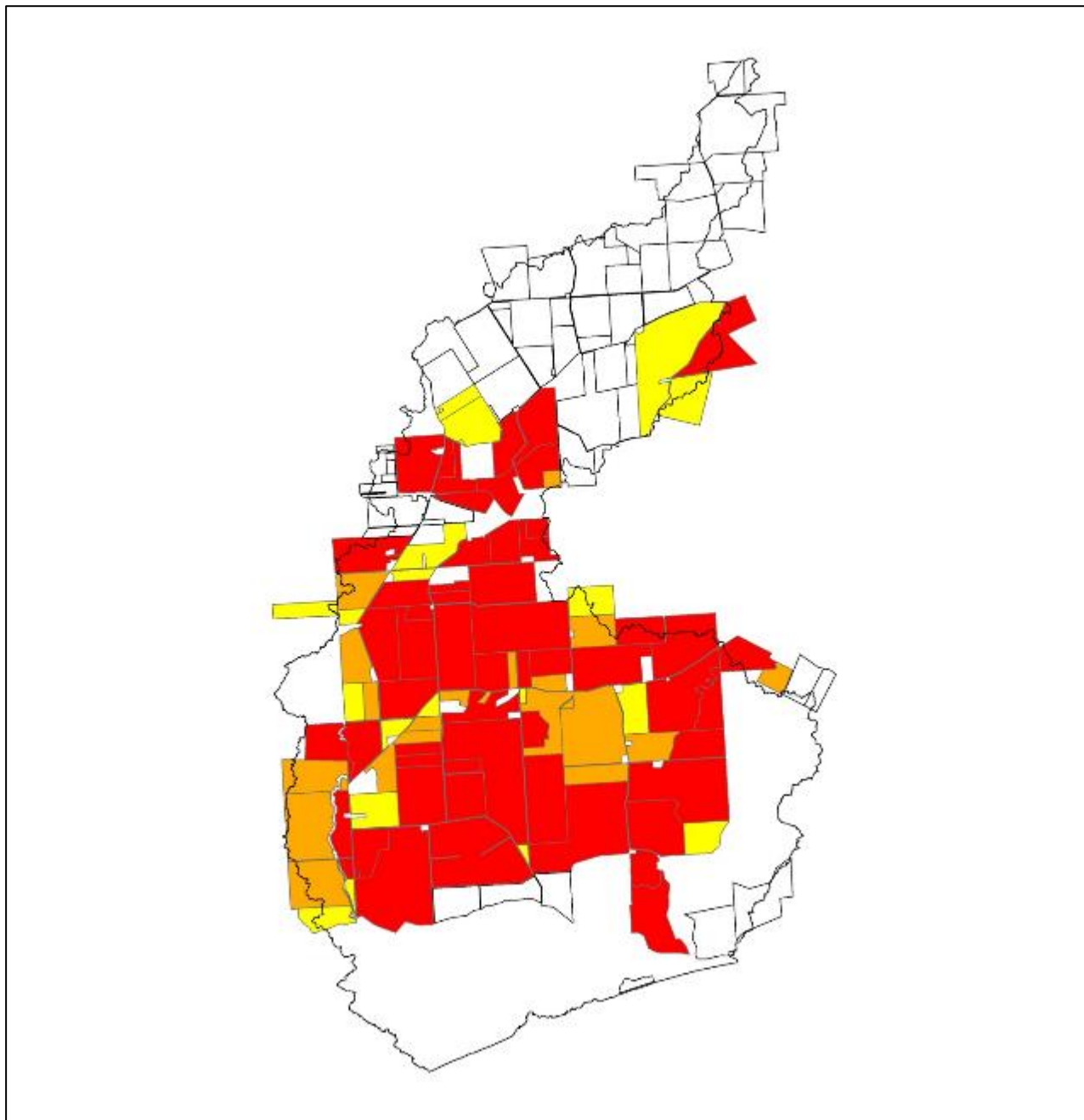


5.0 TERRESTRIAL ECOLOGY

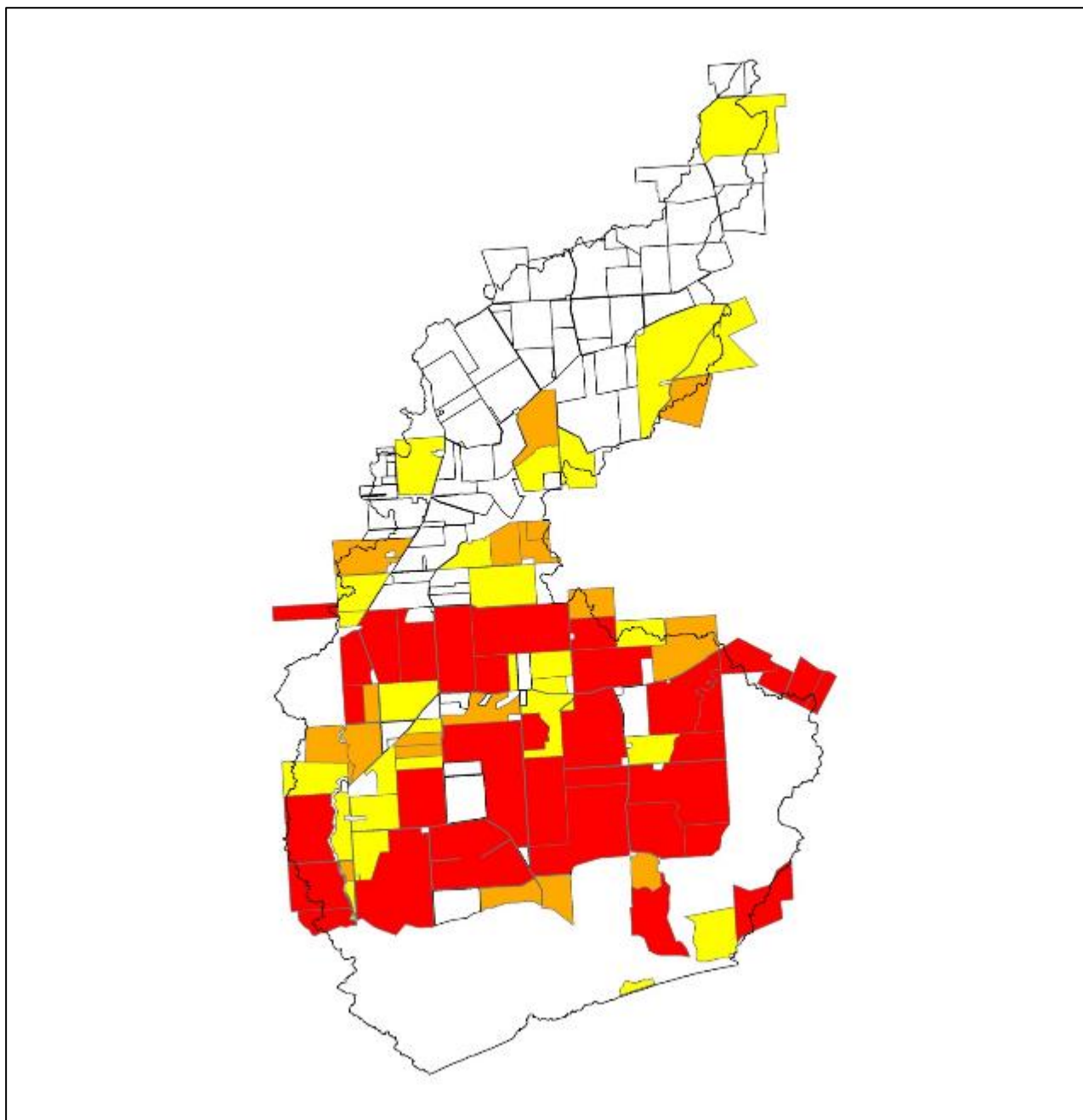
5.1 HVA Sites



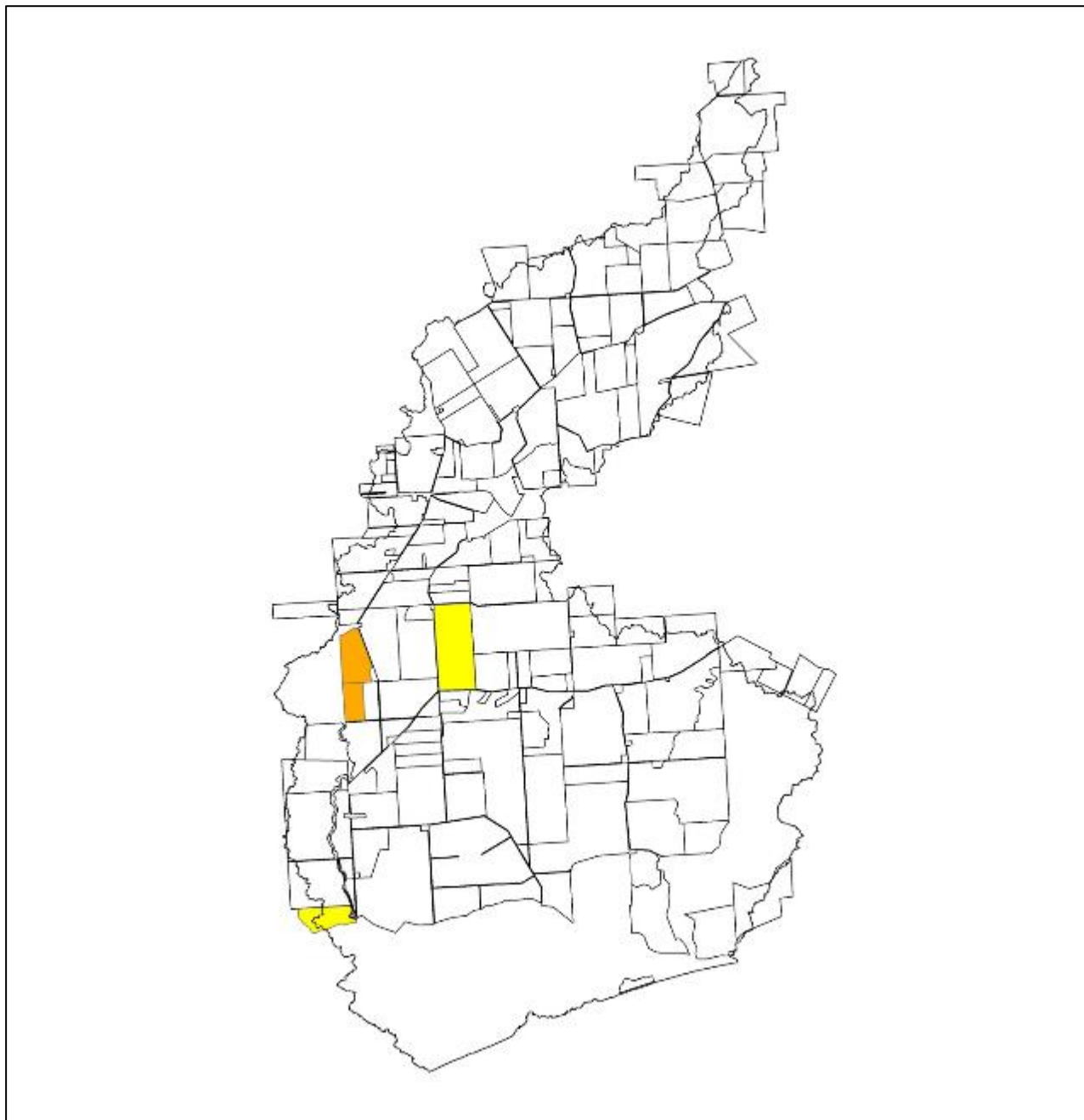
5.2 HVA Connections



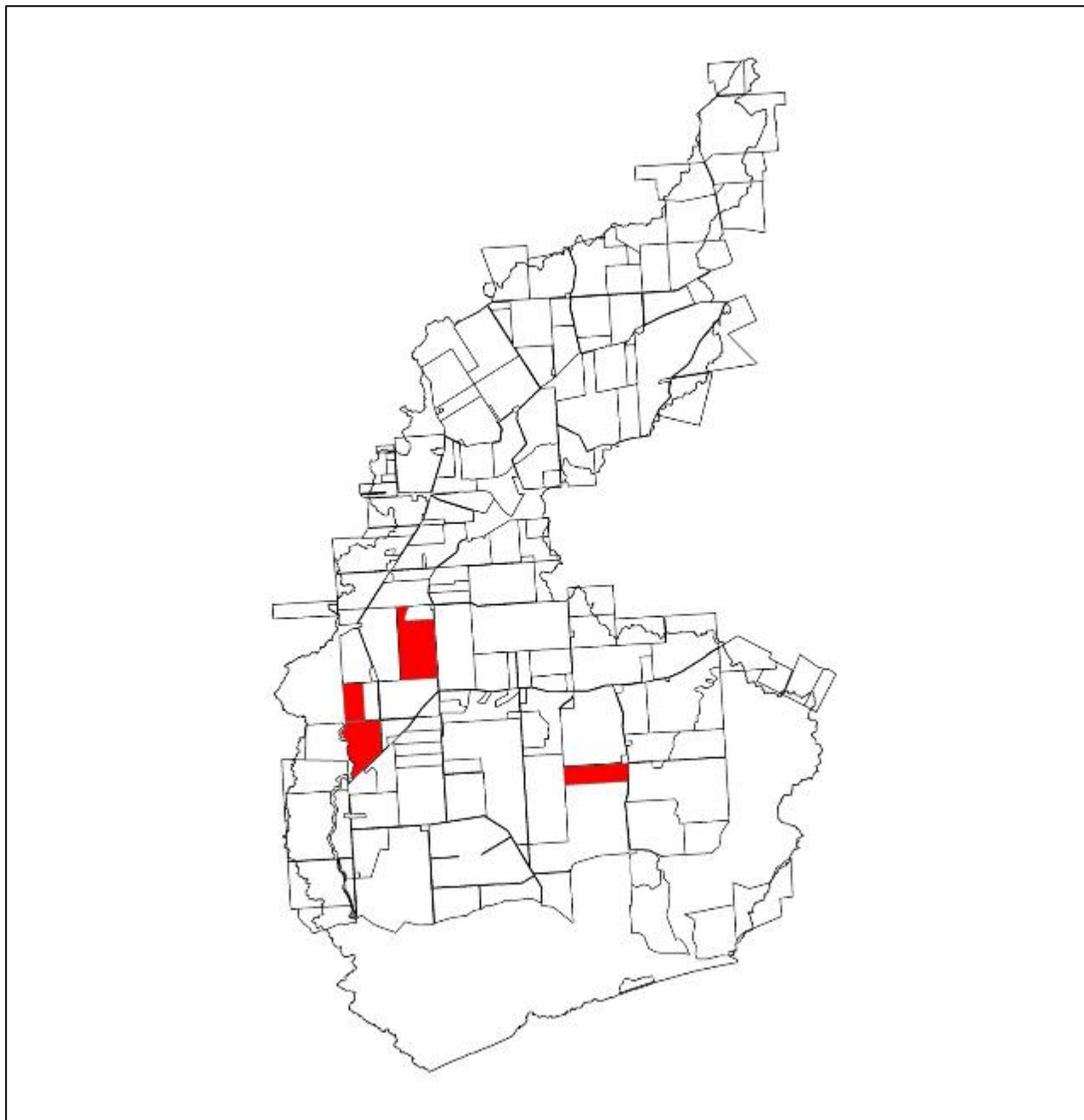
5.3 LCDB v4.0



5.4 Herpetofauna

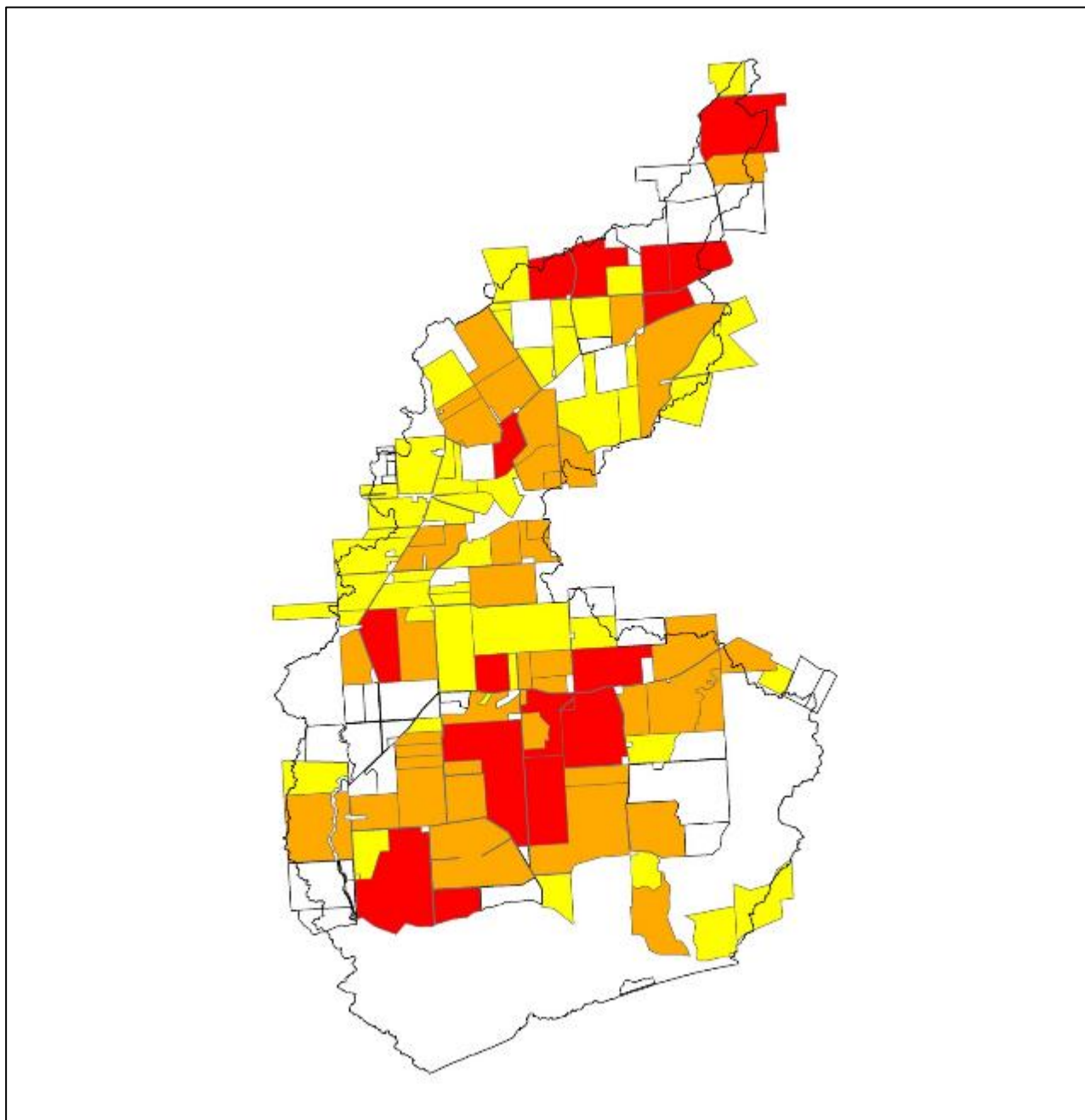


5.5 Threatened Plants

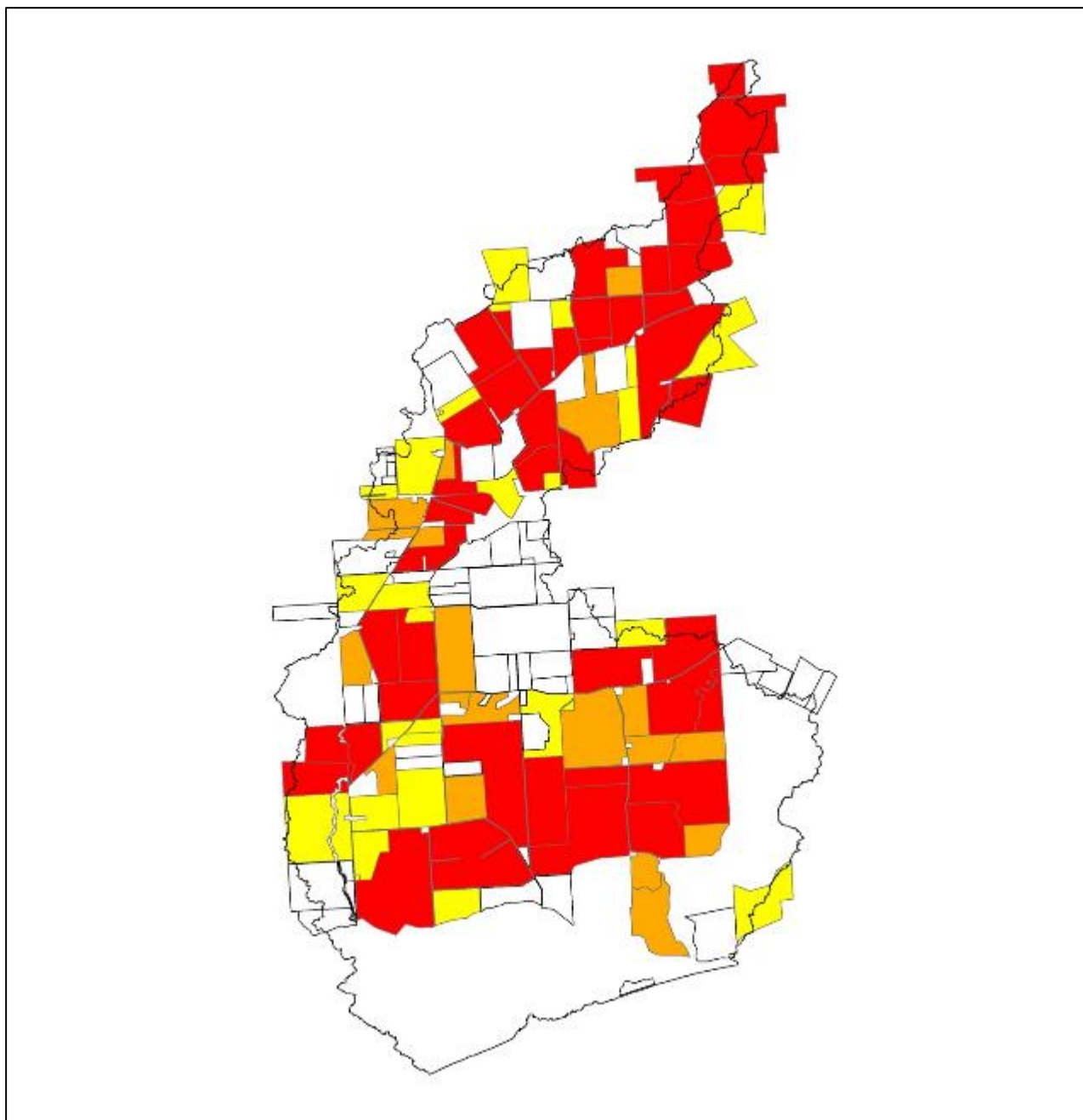


6.0 WATER QUALITY

6.1 ES GW Monitoring Sites



6.2 ES SW Monitoring Sites



Appendix C Wetland Restoration Priority Scores

Land Parcels Containing Wetlands Ranked from Highest to Lowest Score

Property Owner	Constraint Multiplier	Property Size	Awarua River	QEII Present	QEII Connect	Wetland Size	Wetland Type	Wetland DOC	Wetland Loss	All GW Bores	GW Dip Data	Physiography	SW Flow Site	ES SOE Sites	FENZ Rivers	NZFFD	HVA Present	HVA Connect	LCDB v4.0	Threat Herps	Threat Plants	ES GW Sites	ES SW Sites	TOTAL
Constraint Type	Eng	WQ	Sig	Sig	Size	Sig	Sig	Sig	Sig	Data	Data	WQ	Data	Data	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Data	Data	
Derek Neil Ballantine, Marguerita Anne Ballantine	2	3	3	3	3	3	3	3	0	2	0	3	3	3	1	0	2	3	2	0	3	0	3	101
Stanley Farms Limited	2	3	2	2	3	1	3	1	2	1	1	3	0	0	1	0	3	3	3	0	3	2	3	94
Kathryn Gay Munro, Ronald Ewart Munro	1	3	3	3	3	3	3	3	1	2	2	1	0	0	1	0	3	3	3	0	0	2	3	93
Inverlac Farms Limited	3	3	3	3	3	3	3	3	3	3	3	1	0	0	1	2	0	3	3	0	0	2	3	91
Webster Waikite Limited	3	3	1	1	3	3	3	3	3	2	0	1	3	0	2	2	3	3	3	0	0	0	3	91
Stevenson Farm Company Limited	2	3	0	0	3	3	3	3	3	3	1	3	0	0	1	0	3	3	3	0	0	3	3	88
Flat Hill Farms Limited	3	3	3	3	3	1	3	3	3	3	1	1	3	0	2	2	0	3	3	0	0	2	3	87
Foveaux Investments (2008) Limited	3	3	3	3	3	3	3	3	3	3	2	1	0	0	2	0	0	3	3	0	0	2	3	87
Kathryn Gay Munro, Ronald Ewart Munro	3	3	3	3	3	1	0	1	3	1	3	0	0	0	2	0	3	3	3	1	0	1	2	87
Kapuka Dairies Limited	3	3	3	3	3	2	1	1	2	0	1	0	0	0	2	0	3	3	3	0	0	3	3	86
Darrin Noel Crack, Joanne Florence Crack	3	3	0	0	3	3	3	3	3	3	3	1	3	3	2	2	0	3	3	0	0	3	3	84
Rotrustees Limited	2	3	3	3	3	1	3	3	3	2	0	3	3	3	1	0	0	3	2	0	0	0	3	84
Jan Marten Kingma	3	3	0	0	3	1	3	1	3	2	3	0	0	0	1	0	3	3	3	0	0	3	3	82
Inverlac Farms Limited	2	3	3	3	3	3	3	3	1	2	2	1	0	0	1	0	0	3	3	0	0	2	0	79
Raymond Colin Waghorn	2	3	2	2	3	3	3	3	0	2	2	1	3	0	2	0	0	3	3	0	0	2	2	79
Waituna Investments Limited	3	3	0	0	3	1	2	1	3	2	2	1	3	3	2	2	2	3	3	0	0	2	3	79
Rhonda Karen Raymond-Williams	3	3	3	3	3	1	0	3	3	1	3	0	0	0	2	0	1	3	3	0	0	1	0	77
Kapuka Dairies Limited	3	3	0	0	3	1	0	3	3	1	3	0	0	0	2	0	3	3	3	0	0	3	3	75
Muriel Iris Tatham, Sarah Frances Tatham, Trevor John Tatham, Trevor Robert Tatham	1	3	3	3	3	1	0	3	3	3	2	3	0	0	2	0	0	3	3	0	0	3	0	74
Bayley & Burton Trustee Limited, Carolyn Gay Mainland, Matthew James Mainland	1	3	2	2	3	3	3	3	1	2	0	3	0	0	2	0	0	2	2	0	0	0	0	72
Flat Hill Farms Limited	1	3	2	2	3	3	3	3	1	2	1	1	0	0	2	0	0	3	2	0	0	1	2	72
Kevin John Singh Belling, Rhonda Karen Belling	1	3	3	3	3	2	0	0	2	0	1	0	0	0	2	0	0	2	3	0	3	2	3	71
Kevin John Singh Belling, Rhonda Karen Belling	3	3	1	1	3	2	3	0	3	2	1	0	0	0	3	0	0	2	3	0	0	3	2	70
Waituna Investments Limited	3	3	1	1	3	1	2	0	2	2	2	3	1	1	2	0	0	3	3	0	0	2	1	70
Barbara Maree Ballantine, Lindsay David Ballantine	2	3	2	2	2	1	3	0	2	0	3	3	3	3	1	0	0	2	1	0	0	1	3	68
Her Majesty the Queen	2	3	3	3	1	3	3	0	2	1	1	0	0	0	1	0	0	3	3	0	0	0	2	67
Ashers Farm Limited	3	3	2	2	2	1	1	1	3	2	1	0	0	0	1	0	1	3	2	0	0	2	3	64
Marshall Road Farm Trustee Limited	3	3	0	0	3	3	3	0	2	0	1	1	1	1	2	0	0	2	3	0	0	2	1	64
Beverley Ellen Hutchings, Lawrence Hutchings	1	0	1	1	3	1	2	0	2	0	3	0	0	0	0	0	2	3	2	0	0	2	0	61
Marshall Road Farm Trustee Limited	1	3	0	0	3	3	3	0	2	0	1	0	0	0	2	2	0	1	3	1	0	0	0	61
Bayley & Burton Trustee Limited, Carolyn Gay Mainland, Matthew James Mainland	2	3	1	1	2	1	3	1	2	0	3	0	0	0	2	0	0	3	1	0	0	0	3	60
Milk Power Limited	1	3	0	0	3	3	0	0	3	2	3	0	0	0	1	0	1	3	1	0	0	2	0	60
Van Rossum Limited	2	3	0	0	3	3	0	1	3	2	2	0	0	0	1	0	0	3	2	0	0	2	3	60
Anne Elizabeth Robson	1	3	1	1	3	1	2	0	2	1	3	0	0	0	0	0	0	3	1	0	0	2	0	58
Marshall Road Farm Trustee Limited	2	3	0	0	1	1	3	3	2	0	3	0	0	0	1	0	0	2	3	2	0	2	2	58
Allan Wayne Henderson, Marlene Ruth Henderson	1	3	0	0	3	1	0	0	2	0	3	0	0	0	1	0	2	3	2	0	0	2	0	57
Dorstrom Limited	1	3	0	0	3	3	0	0	3	3	2	0	0	0	1	0	1	3	0	0	0	3	0	57
Jan Marten Kingma	1	3	0	0	3	1	0	0	2	0	3	0	0	0	1	0	2	3	2	0	0	2	0	57
Max Group Limited	1	3	0	0	3	2	3	1	1	0	1	2	0	0	2	0	0	1	3	0	0	0	2	56
Douglas Robert McIntyre, Lynda Margaret Williamson	2	3	0	0	2	1	0	0	3	2	3	0	0	0	2	0	1	3	2	0	0	2	2	55
White Pine Forest Limited	2	3	0	0	3	1	3	0	1	0	1	0	0	0	2	2	0	2	3	0	0	0	0	55

Property Owner	Constraint	Property Size	Awarua River	QEII Present	QEII Connect	Wetland Size	Wetland Type	Wetland DOC	Wetland Loss	All GW Bores	GW Dip Data	Physiography	SW Flow Site	ES SOE Sites	FENZ Rivers	NZFFD	HVA Present	HVA Connect	LCDB v4.0	Threat Herps	Threat Plants	ES GW Sites	ES SW Sites	TOTAL
Amelia Mary Spain, Gerald David Spain, Keryn Leanne Spain, Mark Graeme Spain, Ronald William Sasse		2	3	0	0	3	0	0	0	1	0	3	0	0	1	0	2	3	2	0	0	1	0	53
CP Trustees Limited, Murray James Little, Wayne John Barker		2	3	1	1	2	1	0	1	2	0	3	0	0	1	0	1	3	1	0	0	2	0	53
Alida Harris, Allan James Harris		2	3	0	0	3	1	3	1	1	1	1	1	0	2	0	0	0	3	0	0	1	1	52
Anray Holdings Limited		1	3	0	0	2	3	0	1	3	2	2	0	0	1	0	0	3	1	0	0	2	3	52
Peter Murray Diack, Wendy Yvonne Diack		1	3	0	0	3	3	3	0	2	1	1	0	0	1	0	0	0	2	0	0	1	0	52
The Marist Brothers' Old Boys' Association Invercargill Incorporated		1	3	0	0	3	1	1	0	2	0	3	0	0	2	0	0	2	2	0	0	2	1	52
Waituna Investments Limited		2	3	0	0	2	3	3	0	3	3	1	1	1	1	0	0	0	0	0	0	3	1	52
Drakes Hill Farming Limited		2	3	0	0	3	3	0	1	3	2	2	0	1	1	0	0	0	0	0	0	2	3	51
Gordon John McKenzie, Oraka Trustees Limited		3	3	0	0	2	1	0	0	3	1	2	0	0	1	0	2	3	1	0	0	1	1	51
Her Majesty the Queen		1	3	0	0	1	1	3	0	0	0	3	0	0	0	0	0	1	3	2	3	0	0	51
Kenzie George Andrews		2	3	0	0	3	1	0	1	3	0	3	0	0	1	0	0	2	3	0	0	1	0	51
Southland Plantation Forest Company of New Zealand Limited		1	3	2	2	1	1	3	1	2	1	1	0	0	1	0	0	2	1	0	0	1	2	51
Bayley & Burton Trustee Limited, Kevin John Singh Belling, Rhonda Karen Raymond-Williams		2	3	1	1	2	1	0	0	2	2	3	0	0	1	0	0	2	1	0	0	3	1	50
Garry John Lake, Ronald Desmond Lake		1	0	2	2	2	1	3	0	2	0	1	0	0	1	0	0	2	3	0	0	1	0	50
Waituna Investments Limited		1	3	0	0	3	3	3	0	2	0	1	0	0	1	0	0	0	2	0	0	0	0	50
Anna-Jane Kathryn Wallis, Jason Leslie Wallis		2	3	0	0	3	1	0	0	3	3	2	0	0	1	0	0	1	2	0	0	1	3	49
Anray Holdings Limited		1	3	0	0	3	1	0	0	2	0	3	0	0	1	0	0	3	2	0	0	2	0	49
Gordon John McKenzie, Oraka Trustees Limited		3	3	0	0	3	1	0	0	3	3	2	0	0	1	0	0	1	1	0	0	2	3	49
Inglenook Farms Limited		2	3	0	0	2	1	2	2	2	0	3	0	0	1	0	0	2	1	0	0	1	1	49
Legrayle Farm Limited		2	3	0	0	2	3	0	1	2	2	2	0	3	1	0	0	1	0	0	0	2	3	49
Elizabeth Mataepo O'Connor, Grant Andrew O'Connor		1	3	0	0	2	3	0	0	2	2	3	0	0	1	0	0	2	1	0	0	2	0	48
Marshall Road Farm Trustee Limited		1	3	0	0	2	1	3	0	2	0	1	1	1	1	0	0	3	1	0	0	2	1	48
Muriel Iris Tatham, Trevor John Tatham		1	3	0	0	2	1	0	1	2	2	3	0	0	1	0	1	3	0	0	0	2	0	47
Southland District Council		1	3	0	0	1	3	3	0	2	0	1	0	0	2	2	0	2	1	0	0	0	0	47
Bernadette Nola Rooney		1	3	0	0	2	0	1	0	1	0	3	0	0	2	3	0	2	1	0	0	1	1	46
Charles Raymond McCrostie, Janette Lorna McCrostie, Philip Charles Munro		2	3	0	0	2	1	1	1	2	1	3	0	0	1	0	0	3	0	0	0	1	1	46
David Keith Morton, Joanne Helen Morton		1	1	0	0	3	3	0	0	2	2	2	0	0	1	2	0	0	0	0	0	1	3	46
Derek Neil Ballantine, Marguerita Anne Ballantine		1	0	1	1	2	1	2	0	2	0	3	1	1	0	0	0	2	1	0	0	0	2	46
Glendoroch Farms Limited		2	3	0	0	2	3	0	0	3	3	2	0	0	1	0	0	0	0	0	0	3	3	46
Janice Isobelle Craig, Murray Donald Craig		2	3	0	0	2	1	0	0	2	1	3	0	1	1	2	0	1	0	0	0	2	3	46
Angela Maria Barker, CP Trustees Limited		1	3	0	0	2	1	0	0	2	0	3	0	0	1	0	1	3	1	0	0	1	0	45
46 Below Limited		1	0	0	0	3	0	3	0	1	0	3	0	0	0	0	0	1	3	0	0	1	0	44
Van Rossum Limited		1	3	0	0	2	3	0	0	2	2	2	0	0	1	2	0	0	0	0	0	0	3	44
David Keith Morton		2	3	0	0	2	3	0	0	3	3	2	0	0	1	0	0	0	0	0	0	3	0	43
Inglenook Farms Limited		1	3	0	0	2	3	0	0	2	2	2	0	1	1	0	0	1	0	0	0	2	1	43
Marshall Road Farm Trustee Limited		1	3	0	0	2	1	2	1	2	0	1	0	0	1	0	0	3	1	0	0	1	1	43
Barbara Maree Ballantine, Lindsay David Ballantine		1	1	1	1	1	1	3	0	1	0	1	3	2	1	0	0	2	0	0	0	0	3	42
Gordon John McKenzie, Oraka Trustees Limited		1	3	0	0	2	1	0	0	3	2	2	0	0	1	2	0	0	0	0	0	3	3	42
Inglenook Farms Limited		2	3	0	0	1	1	0	1	2	1	2	0	1	1	0	1	3	1	0	0	1	1	42
Marshall Road Farm Trustee Limited		2	3	0	0	2	1	2	0	2	0	1	1	1	1	0	0	1	1	0	0	2	1	42
Brian Henry Matthews, Rosemary Heather Matthews		1	3	0	0	2	1	0	0	2	1	2	0	2	1	0	0	3	0	0	0	1	2	41

Property Owner	Constraint	Property Size	Awarua River	QEII Present	QEII Connect	Wetland Size	Wetland Type	Wetland DOC	Wetland Loss	All GW Bores	GW Dip Data	Physiography	SW Flow Site	ES SOE Sites	FENZ Rivers	NZFFD	HVA Present	HVA Connect	LCDB v4.0	Threat Herps	Threat Plants	ES GW Sites	ES SW Sites	TOTAL
Charles Raymond McCrostie, Janette Lorna McCrostie, Philip Charles Munro		1	0	0	0	3	0	3	1	1	0	3	0	0	0	0	0	1	1	0	0	1	0	41
Raymond Colin Waghorn		2	3	0	0	2	1	3	0	1	1	1	1	0	2	0	0	0	1	0	0	1	0	41
Waituna Investments Limited		2	3	0	0	2	1	0	1	3	2	1	0	0	1	0	0	3	0	0	0	2	2	41
Anthony Elton Reiger		1	0	0	0	2	1	3	0	0	0	1	0	0	0	0	1	3	2	0	0	0	0	40
Carl Robertson McCrostie, Katie Jane McCrostie		1	3	0	0	1	1	1	1	2	1	3	0	0	1	0	0	3	0	0	0	1	1	40
David Grant Iggulden, Jillian Margaret Harrison, Neville William Harrison		1	3	0	0	1	1	0	0	1	1	3	0	3	1	0	0	3	0	0	0	1	3	40
Highland Downs Limited		3	3	0	0	2	1	0	0	3	0	2	0	0	1	0	0	0	1	0	0	3	3	40
Aotearoa Kaitiaki Limited		2	3	0	0	2	1	0	0	3	2	2	0	0	1	0	0	0	0	0	0	3	3	39
Brian Beaton Spain		2	3	0	0	1	1	0	0	3	2	2	0	0	1	2	0	0	1	0	0	2	3	39
Charles Raymond McCrostie, Janette Lorna McCrostie, Philip Charles Munro		1	3	1	1	1	1	0	0	1	1	3	0	0	1	0	0	3	0	0	0	1	0	39
Derek Neil Ballantine, Marguerita Anne Ballantine		1	2	1	1	1	1	2	0	2	0	3	0	0	1	0	0	1	0	0	0	0	1	39
Kapuka Holdings Limited		1	3	0	0	2	1	0	3	3	0	1	0	0	1	0	0	3	1	0	0	0	1	39
Kathryn Gay Munro, Ronald Ewart Munro		1	3	1	1	1	1	0	0	1	1	3	0	0	1	0	0	3	0	0	0	1	0	39
Kevin John Singh Belling, Rhonda Karen Raymond-Williams		1	0	0	0	3	1	0	0	2	1	1	0	0	0	0	0	3	3	0	0	2	0	39
Annette Helen Trent, Carolyn Ruth Northover, Ronald Desmond Lake		1	0	0	0	3	1	3	1	0	0	1	0	0	0	0	0	0	3	0	0	0	0	38
Fernlea Farm Limited		2	3	0	0	2	3	0	0	2	1	2	0	0	1	0	0	0	0	0	0	1	0	38
Gerrit Jan Hendrick Amtink, Gerritje Johanna Amtink		1	3	0	0	2	1	0	0	3	2	2	0	0	1	0	0	0	0	0	0	3	3	38
P K Dairies Limited		2	3	0	0	2	1	0	0	3	2	2	0	0	1	0	0	0	0	0	0	2	3	38
Barry John Smail, Heather May Botting, Rex Nigel Botting		2	3	0	0	2	1	0	0	2	2	2	0	0	1	0	0	0	0	0	0	2	3	37
Bayley & Burton Trustee Limited, Carolyn Gay Mainland, Matthew James Mainland		1	2	0	0	1	1	1	0	2	0	3	0	0	1	2	0	1	0	0	0	0	3	37
Inglenook Farms Limited		1	3	0	0	1	1	0	0	1	1	2	0	3	1	0	0	3	0	0	0	1	3	37
Kathryn Gay Munro, Ronald Ewart Munro		1	2	1	1	1	1	0	0	3	0	3	0	0	1	0	0	2	0	0	0	0	2	37
Van Rossum Limited		3	3	0	0	2	1	0	0	3	2	2	0	0	1	0	0	0	0	0	0	1	2	37
Schrader Mains Limited		2	3	0	0	2	1	0	0	2	2	2	0	0	1	0	0	0	0	0	0	1	3	36
Barry James Hillis		1	3	0	0	1	1	0	0	2	1	2	0	3	1	0	0	1	0	0	0	2	3	35
Drakes Hill Farming Limited		1	3	0	0	2	1	0	0	2	2	2	0	0	1	0	0	0	0	0	0	1	3	35
Muriel Iris Tatham, Trevor John Tatham		1	0	1	1	1	1	0	1	2	2	3	0	0	0	0	0	2	1	0	0	1	0	35
Premier Dairies Limited		2	1	0	0	2	3	0	1	2	0	2	0	0	1	0	0	0	0	0	0	1	1	35
Southroads Limited		1	0	0	0	3	0	3	1	0	0	1	0	0	0	0	0	0	3	0	0	0	0	35
Charles Gerard Keenan		1	1	0	0	1	1	3	0	2	2	1	0	0	1	0	0	1	0	0	0	2	2	34
Murray James Waghorn		1	0	0	0	2	3	3	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	34
Marshall Road Farm Trustee Limited		1	0	0	0	1	3	3	0	2	0	1	0	0	0	0	0	1	1	0	0	0	0	33
Warren John Blackmore		2	3	0	0	2	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	0	3	33
Gerrit Jan Hendrik Amtink, Gerritje Johanna Amtink		1	3	0	0	2	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	1	2	32
Prima Farms Limited		2	1	0	0	2	1	0	0	1	1	3	0	0	1	0	0	0	0	0	0	1	2	32
Waituna Investments Limited		1	3	0	0	1	1	0	2	2	1	1	0	0	1	0	0	3	0	0	0	2	0	32
Anray Holdings Limited		1	2	0	0	1	1	0	0	1	1	2	0	1	1	0	0	3	0	0	0	1	1	31
Brent Thomas McKenzie, David Edward Mitchell, Priscilla Moana McKenzie		2	3	0	0	1	1	0	0	3	0	2	0	0	1	0	0	0	0	0	0	2	3	31
Clifford Alan Nicol, Valmai Muriel Nicol		1	3	0	0	1	1	0	0	2	0	2	0	0	1	0	0	2	0	0	0	2	1	31
DuoReges Limited		1	1	0	0	2	0	0	1	2	0	3	0	0	0	0	0	1	2	0	0	0	0	31
Brian William McFaul, Dianne Mary McFaul		1	3	0	0	1	1	0	0	3	3	2	0	0	1	0	0	0	0	0	0	1	1	30

Property Owner	Constraint	Property Size	Awarua River	QEII Present	QEII Connect	Wetland Size	Wetland Type	Wetland DOC	Wetland Loss	All GW Bores	GW Dip Data	Physiography	SW Flow Site	ES SOE Sites	FENZ Rivers	NZFFD	HVA Present	HVA Connect	LCDB v4.0	Threat Herps	Threat Plants	ES GW Sites	ES SW Sites	TOTAL
David Grant Iggulden, Jillian Margaret Harrison, Neville William Harrison		1	1	0	0	1	1	0	0	1	1	3	0	3	1	0	0	0	0	0	0	1	3	30
Alan Ronald Wells, Janine Rae Wells, Norma Lesley Wells, Ronald Albert Wells		1	3	0	0	1	1	0	0	1	1	3	0	0	1	0	0	0	0	0	0	1	1	29
David Grant Iggulden, Jillian Margaret Harrison, Neville William Harrison		1	1	0	0	1	1	0	0	2	1	3	0	1	1	0	0	0	0	0	0	2	2	29
Jane Helen Blackmore, Neill Alexander Blackmore		2	3	0	0	2	1	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	1	29
Lynette Mary Blackler, Murray John Blackler		1	1	0	0	1	1	0	0	2	2	3	0	0	1	0	0	1	0	0	0	2	0	29
Warren David Owen		1	0	0	0	1	1	2	0	1	0	1	0	0	0	0	0	3	1	0	0	1	1	29
Graeme Hugh Chisholm		1	1	0	0	1	1	0	0	1	1	3	0	0	1	0	0	2	0	0	0	1	0	28
Kerry Isobel Clark, Murray Laurence Clark, Peter Michael O'Brien		1	3	0	0	1	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	1	3	28
Anthony Michael Wallace, Anthony Wallace		1	3	0	0	1	1	0	0	1	0	2	0	0	1	0	0	0	0	0	0	1	3	27
Janice Isobelle Craig, Murray Donald Craig		1	1	0	0	1	1	0	0	2	1	3	0	0	1	0	0	1	0	0	0	1	0	27
Raymond Colin Waghorn		1	1	0	0	1	1	3	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	27
David Grant Iggulden, Jillian Margaret Harrison, Neville William Harrison		1	1	0	0	1	1	0	0	1	1	3	0	0	1	0	0	0	0	0	0	1	2	26
Foveaux Investments (2008) Limited		1	3	0	0	1	1	1	0	2	0	1	0	0	1	0	0	1	0	0	0	0	0	26
Drakes Hill Farming Limited		1	3	0	0	1	1	0	0	1	0	2	0	0	1	0	0	0	0	0	0	1	1	25
Brian Louis Peterson		1	3	0	0	1	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	0	0	24
Carole Elizabeth Knight, Leslie John Knight		1	3	0	0	1	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	0	0	24
Barbara Frances Williams, Peter Henry Phiskie, Yvonne Maria Phiskie		1	1	0	0	1	1	0	0	2	1	2	0	0	1	0	0	0	0	0	0	1	1	23
Morton Downs Limited		2	1	0	0	1	1	0	0	1	0	2	0	0	1	0	0	0	0	0	0	0	3	23
Barbara Frances Williams, Peter Henry Phiskie, Yvonne Maria Phiskie		1	3	0	0	1	1	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	22
Barry John Smail, Heather Mae Botting, Rex Nigel Botting		1	1	0	0	1	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	1	1	22
Alan Ronald Wells, Janine Rae Wells		1	0	0	0	1	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	16
Alan Ronald Wells, Janine Rae Wells		1	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	15

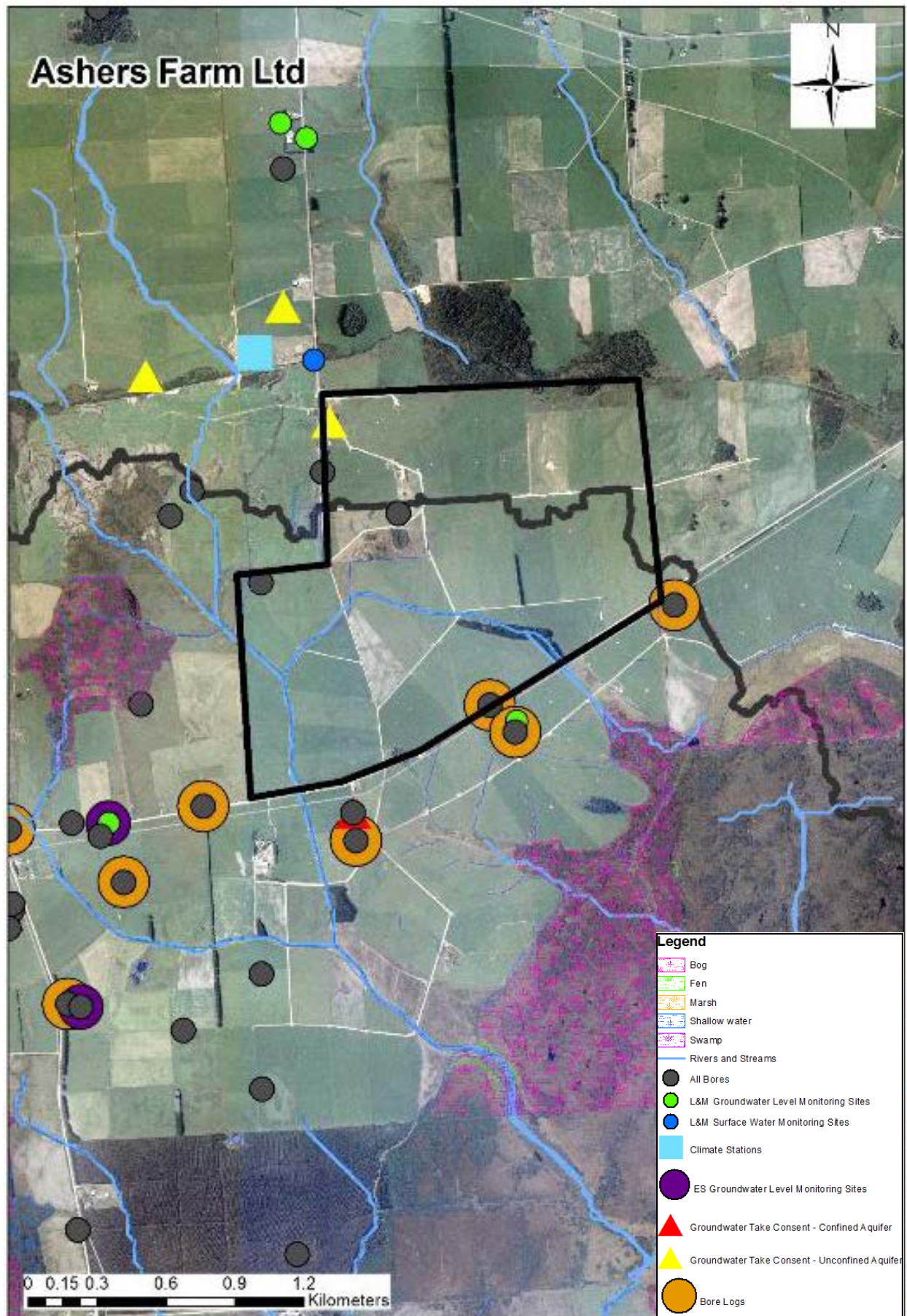
Appendix D Details of Priority Fonterra Farms

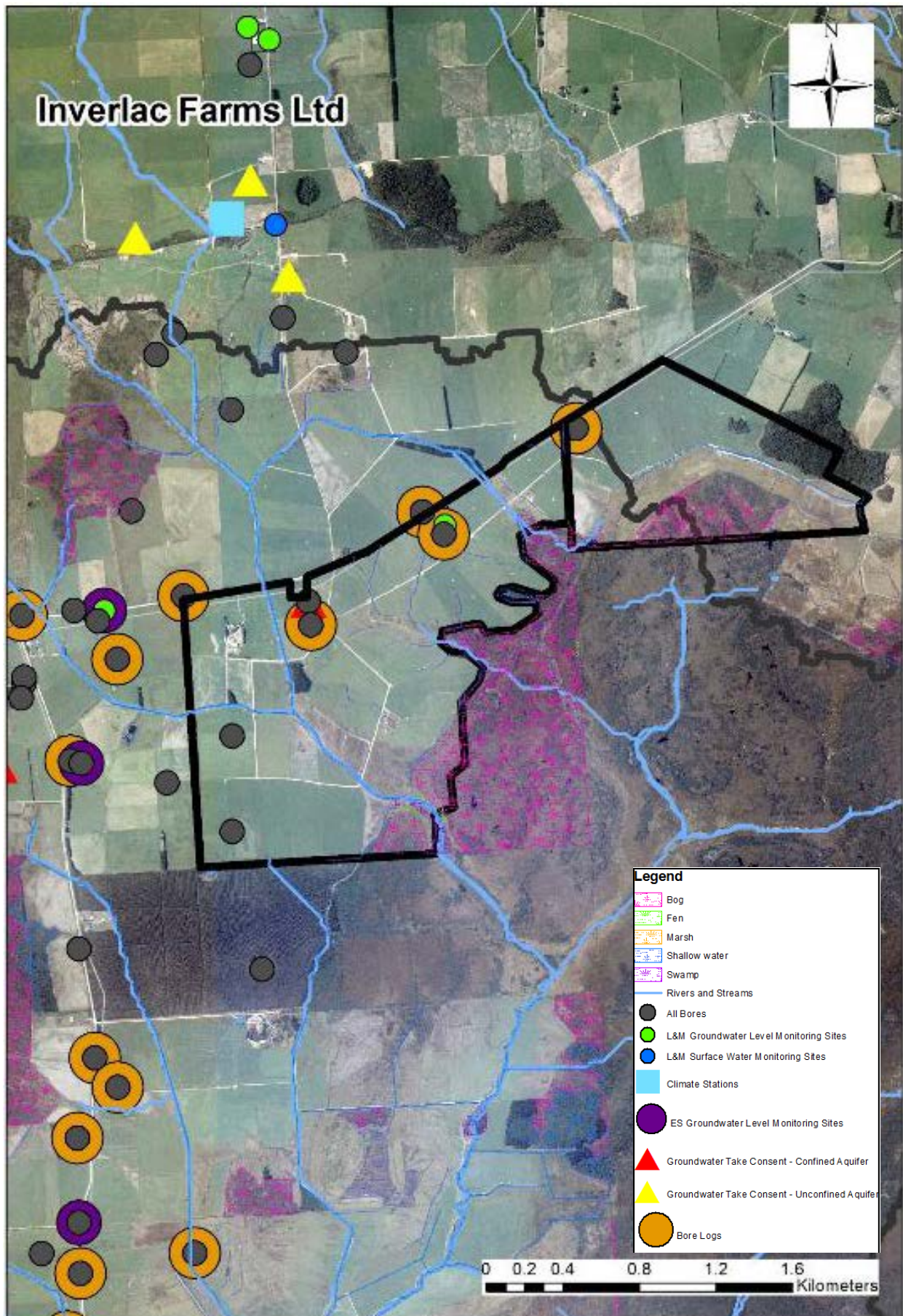
Summary of the Available Information for the top ten Fonterra Farms

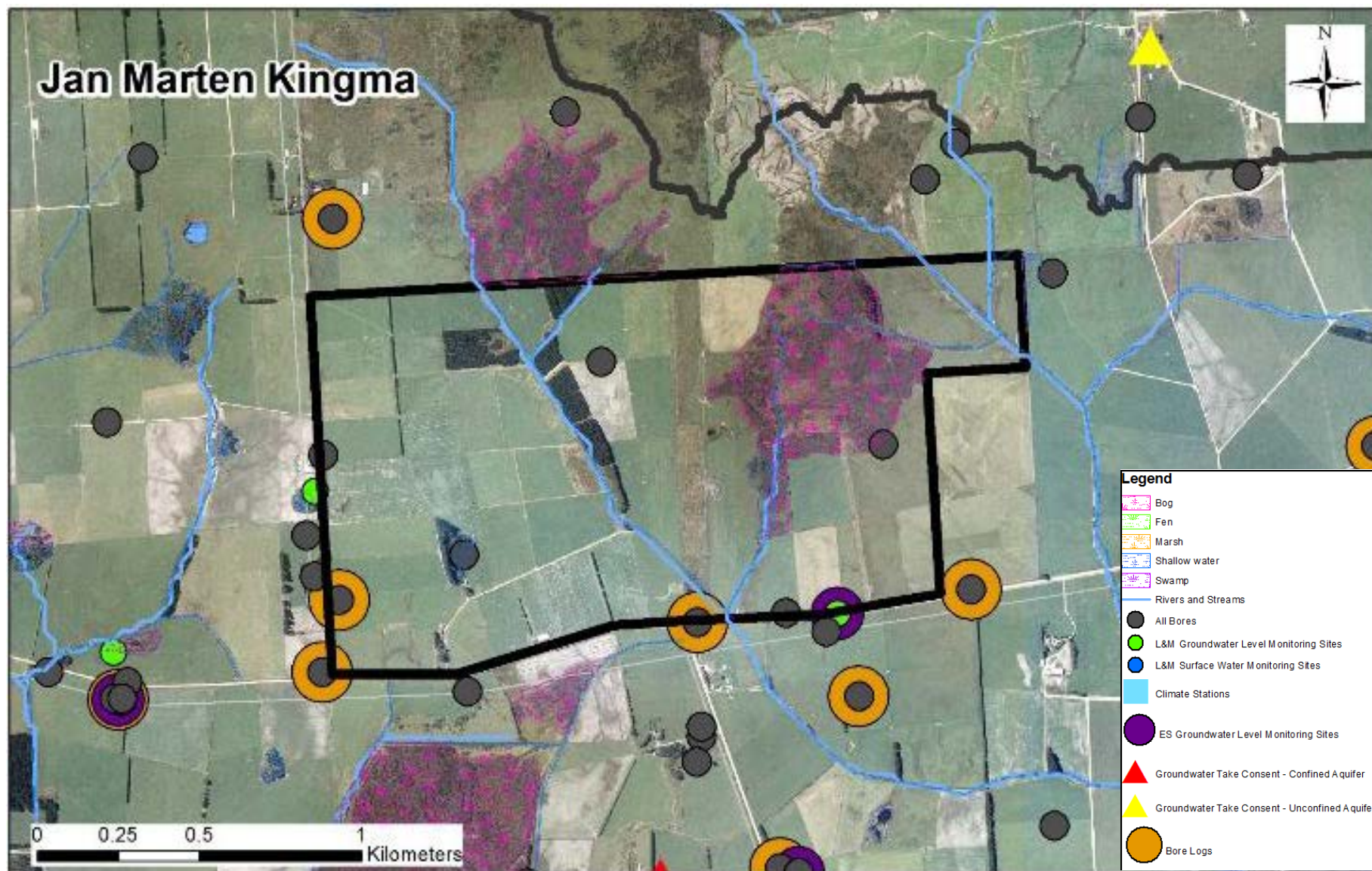
Wetland Characteristics	Description	Ashers Farm Ltd	Inverlac Farms Ltd	Jan Merten Kingma	Rhonda Karen Raymond-Williams	Kevin John Singh Belling, Rhonda Karen Belling	Foveaux Investments	Waituna Investments
General	Cadastral area of property (ha) Sourced from shapefile labelled owner10 created by MWH from column labelled Cadastral	230	361 (both sites)	217	343	588 (both sites)	418	617 (both sites)
	Current wetlands area (ha) Sourced from shapefile labelled owner10 created by MWH from column labelled Wetland_pr	2.6	57	31	12.5	249	39	84
	Physiographic location defined by Environment Southland Sourced from Rissmann et al, 2012 report titled <i>Waituna Catchment Groundwater Resource</i>)	Southern Waituna Zone	Southern Waituna Zone	Southern Waituna Zone and Mokotua Infiltration Zone	Mokotua Infiltration Zone	Southern Waituna Zone	Southern Waituna Zone	Southern Waituna Zone
Hydrology and Hydrogeology	Soils classifications represented within property From Land Resource Information System spatial data layers, produced by Landcare Research, 2008, <i>LRIS Data Dictionary v3</i>)	Typic Perch-gley Podzols (ZPT)	Typic Perch-gley Podzols (ZPT) in northern areas. Acid Mesic Organic Soils (OMA) in southern areas	Typic Perch-gley Podzols (ZPT)	Typic Perch-gley Podzols (ZPT) Acid Mesic Organic Soils (OMA) Mottled Firm Brown Soils (BFM)	Typic Perch-gley Podzols (ZPT) Acid Mesic Organic Soils (OMA)	Typic Perch-gley Podzols (ZPT) Acid Mesic Organic Soils (OMA)	Typic Perch-gley Podzols (ZPT) Acid Mesic Organic Soils (OMA)
	Soil drainage Sourced from Landcare S-Map	Imperfect drainage away from the streams Poorly drained adjacent to the streams	Imperfect drainage away from the streams Poorly drained adjacent to the streams	Imperfect, poor and very poor drainage areas away from the streams Poorly drained adjacent to the streams	Very poor (SW corner) Poorly drained (middle of property) Imperfectly drained in the middle and eastern edges of property Poorly drained in what appears to be an unmapped paleo stream channel near SW corner of property	Very poorly drained over 80 % of the property. Imperfectly drained across the NE area of the property	Very poorly drained over northern part of the property Imperfectly drained across the middle area of the property Poorly to imperfectly drained in south	Ranges from well drained to very poorly drained
	Wetland classes represented Sourced from shapefile labelled 2012_1_Private Wetland created by MWH. The actual data within this shapefile was produced by DOC)	Unknown Shallow Water	Bog (majority) Fen and swamp (next to the Carran Creek Tributary)	Bog (majority) Terrestrial Shallow Water Unknown	Bog Shallow Water Terrestrial	Bog (majority) Fen Shallow Water Terrestrial	Bog Fen Swamp Terrestrial Shallow Water	Bog (majority) Shallow Water Terrestrial Unknown
	Wetland - Hydrosystem Sourced from shapefile labelled 2012_1_Private Wetland created by MWH. The actual data within this shapefile was produced by DOC)	Unknown is Palustrine Shallow Water is Riverine	Palustrine	Palustrine (majority) Terrestrial Shallow Water is Riverine	Palustrine (majority) Terrestrial Shallow Water is Riverine	Palustrine (majority) Terrestrial (minor)	Palustrine Riverine Terrestrial	Palustrine Riverine Terrestrial
	Wetland - Water origin Sourced from shapefile labelled 2012_1_Private Wetland created by MWH. The actual data within this shapefile was produced by DOC)	Unknown the water origin is not known Shallow Water is the tributary of Carrans Creek	Swamp	Not identified	Swamp (majority) Lake Unknown	Swamp (majority) Lake	Swamp Drain Unknown Lake	Swamp (majority) Lake Drain
	Wetland - Water table relative to land surface Estimated from groundwater level variations measured in monitoring bores previously monitored by Environment Southland	0.5 – 4 mBGL	0.5 – 4 mBGL	0.5 – 4 mBGL	0.5 – 4 mBGL	0.5 – 3 mBGL	0.5 – 3.5 mBGL	0.5 – 3 mBGL
	Wetland - Water table fluctuations Estimated from groundwater level variations measured in monitoring bores previously monitored by Environment Southland	Approx. 2.5 m	Approx. 2.5 m	Approx. 2.5 m	Approx. 2.5 m	Approx. 2.5 m	Approx. 2.0 m	Approx. 1.0 – 1.5 m

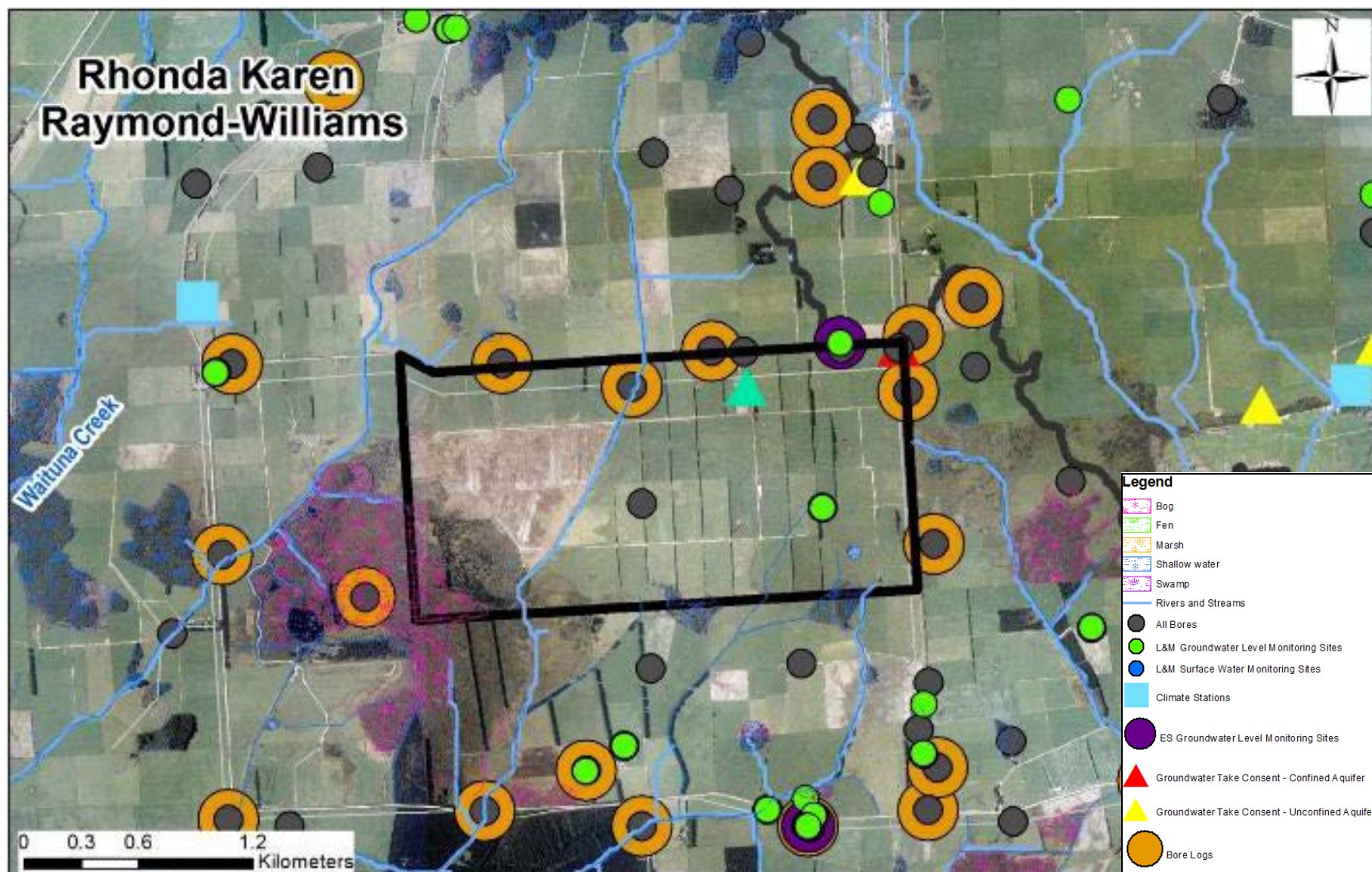
Wetland Characteristics	Description	Ashers Farm Ltd	Inverlac Farms Ltd	Jan Merten Kingma	Rhonda Karen Raymond-Williams	Kevin John Singh Belling, Rhonda Karen Belling	Foveaux Investments	Waituna Investments
	Surface water catchment Based on Awarua_rivers layer sourced from DOC	Carran or Ashers Creek, difficult to tell which	Carran or Ashers Creek, difficult to tell which	Carran or Ashers Creek, difficult to tell which	Waituna Creek	Moffat Creek and Carran Creek	Carran Creek and two smaller streams within the SW parts of the property	Main catchment is Moffat Creek followed by a number of smaller catchment streams draining in Waituna Lagoon. Possibly a small area drains into Waituna Creek catchment
	Streams passing through property Based on Awarua_rivers layer sourced from DOC	Two. In addition there is a stream flowing near the northern property boundary	Four. Aerial photos suggest more streams	One which is fed by two tributaries	One (tributary of Waituna Creek)	3	6	7
	Ponds present within property boundary Based on Lakes shapefile from LINZ GIS database	None identified	None identified but there is a small pond on the SW boundary of the property	None identified	1	5	2	3
	Subsurface drains present (mole, tile, novaflow) No GIS data. Needs to be determined in the field	None identified	None identified	None identified	None identified	None identified	None identified	None identified
	Surface drains present No GIS data. Needs to be determined in the field	None identified	None identified	None identified	None identified	None identified	None identified	None identified
	Presence of artificial structures No GIS data. Brief notes based on aerial photos.	Possibly culverts present where streams pass beneath farm roads	Possibly culverts present where streams pass beneath farm roads	None identified	None identified	None identified	None identified	None identified
	Springs present within property boundary No GIS data. Brief notes based on aerial photos.	None known	None are known but springs are likely. From aerial photo it is likely that one occurs near some trees along Waituna George Road	None known	None are known but aerial photos suggest a spring at the head of the stream near the SE boundary of the property	None are known but aerial photos suggest that a number of springs could be present feeding along the margins of the streams	None are known but aerial photos suggest that a number of springs could be present feeding along the margins of the streams	None are known but aerial photos suggest that a number of springs could be present feeding along the margins of the streams
	Bores present within property boundary and listed on Environment Southland database Data sourced from Environment Southland and MWH record of information held by L&M Mining	4	8	7	7	7	10	12
	Shallow unconfined or unknown aquifer with a consented groundwater abstraction within 250 m of wetland (L/s) Data sourced from Environment Southland)	2	None	None	Potentially one	None	None	2
	Deeper confined consented groundwater abstraction within 250 m of wetland (L/s) Data sourced from Environment Southland)	1	1	None	One (maybe two)	1	1	1
	Surface water abstraction(s) Environment Southland said that there are no consented takes but some takes are likely for various uses. Need to be determined in the field.	Could be some for abstracted from the streams for stock water	Could be some for abstracted from the streams for stock water	Could be some for abstracted from the streams for stock water	Could be some for abstracted from the streams for stock water	Could be some for abstracted from the streams for stock water	Could be some for abstracted from the streams for stock water	Could be some for abstracted from the streams for stock water
	Distance to nearest climate station Data sourced from Environment Southland and MWH record of information held by L&M Mining	Ashers-Waituna owned by L&M is approximately 300 m away	Ashers-Waituna owned by L&M is approximately 1.9km away	Ashers-Waituna owned by L&M is approximately 900 m away	ES site at Waghorns	Ashers-Waituna owned by L&M is approximately 2.2 km away	ES rainfall site at Lawsons Rd approximately 3.3 km away	ES rainfall site at Lawsons Rd approximately 4.8 km away
	Groundwater level monitoring sites within 500 m Data sourced from Environment Southland and MWH record of information held by L&M Mining	None. Closest are about 1.2 km away	One. Used in past by ES.	Two. One used in past by ES and the other by L&M	Two. Plus another four site between 500 and 1000 m away	3	2	1 plus another site monitored by ES located about 950 m south

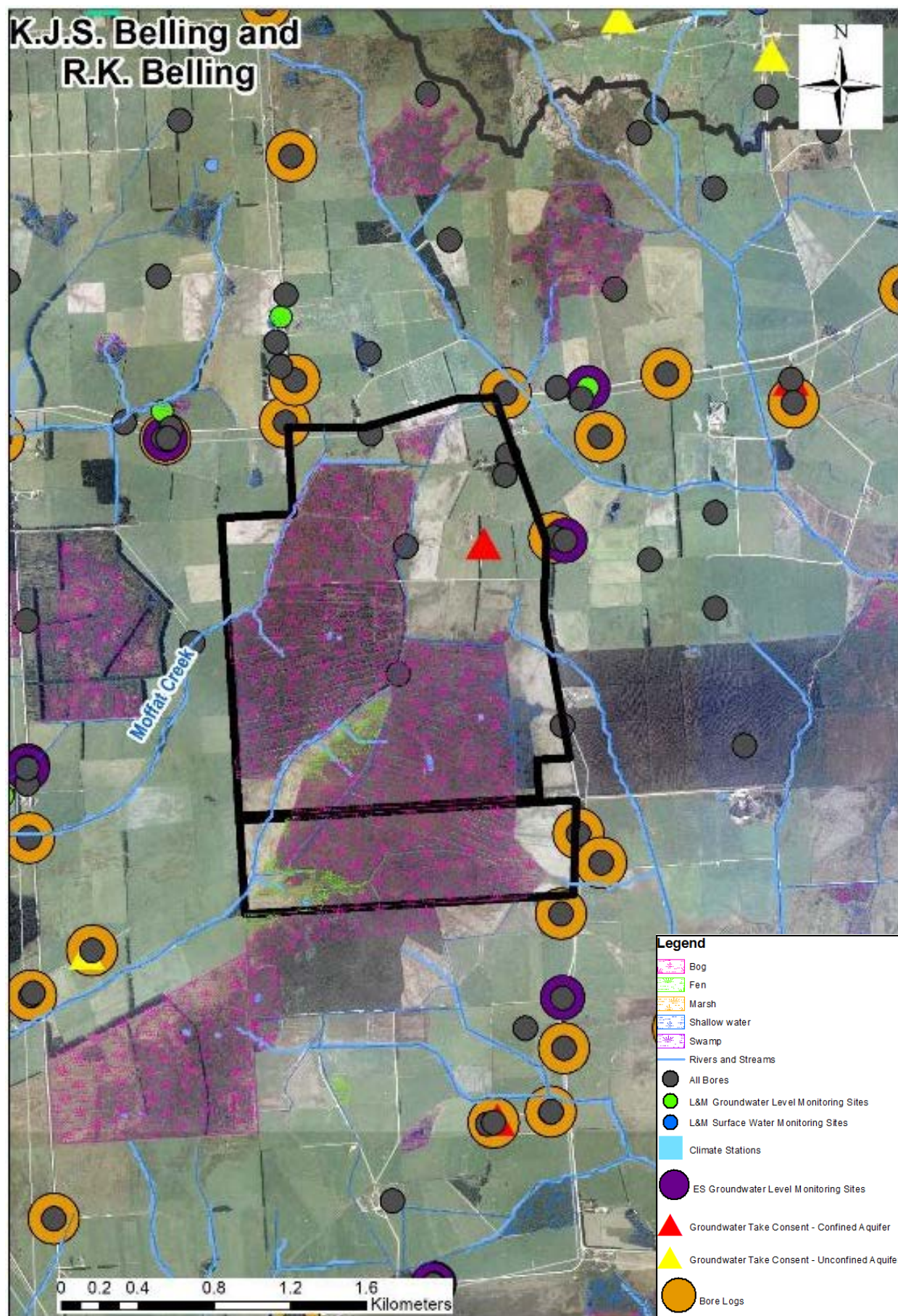
Wetland Characteristics	Description	Ashers Farm Ltd	Inverlac Farms Ltd	Jan Merten Kingma	Rhonda Karen Raymond-Williams	Kevin John Singh Belling, Rhonda Karen Belling	Foveaux Investments	Waituna Investments
	Surface water flow monitoring sites within 500 m Data sourced from Environment Southland and MWH record of information held by L&M Mining	L&M site on Ashers Creek at Ashers Rd Bridge	None	None	None	None but the ES site on Carran Creek is about 1.8 km from the SE boundary	None but the ES site on Carran Creek is about 1.3 km from the SE boundary	1 (ES site on Moffat Creek)
	Vegetation types present Data sourced from potential-vegetation-of-New-Zealand shape file	Rimu-miro-totara/kamahi forest, wetlands	Rimu-miro-totara/kamahi forest, wetlands	Rimu-miro-totara/kamahi forest	Rimu-miro-totara/kamahi forest, wetlands	Rimu-miro-totara/kamahi forest, wetlands	Rimu-miro-totara/kamahi forest, wetlands	Rimu-miro-totara/kamahi forest, wetlands
	Threatened plant species identified Data sourced from Bioweb_Threatened Plants	None noted	Boundary of the property – <i>Coprosma pedicellata</i>	None noted	None noted	Boundary of the property – <i>Gentianella grisebachii</i>	None noted	None noted
	Herpetofauna (Lizards and Frogs) present Data sourced from Bioweb_Geckos and Bioweb_Skinks	None noted	None noted	None noted	Common skink identified approximately 600-700 metres from property boundary	None identified	None identified	None identified
	Fish species identified Data sourced from NZFFD_crop shape file	<i>Galaxias argenteus</i> (giant kokopu), <i>Anguilla dieffenbachii</i> (longfin eel) and <i>Hyridella menziesi</i> (freshwater mussel)	<i>Galaxias argenteus</i> (giant kokopu), <i>Anguilla dieffenbachii</i> (longfin eel) and <i>Hyridella menziesi</i> (freshwater mussel)	No records	No records	No records	<i>Galaxias argenteus</i> (giant kokopu), <i>Anguilla dieffenbachii</i> (longfin eel) and <i>Galaxias maculatus</i> (Inanga)	<i>Gobiomorphus cotidianus</i> (common bully), <i>Gobiomorphus huttoni</i> (redfin bully), <i>Galaxias fasciatus</i> (banded kokopu), <i>Galaxias argenteus</i> (giant kokopu), <i>Gobiomorphus spp.</i> (unidentified bully), <i>Salmo trutta</i> (brown trout), <i>Anguilla dieffenbachia</i> (longfin eel), <i>Galaxias spp.</i> (unidentified galaxid), <i>Galaxias maculatus</i> (inanga), <i>Paranephrops spp.</i> (koura), <i>Paratya curviorstris</i> (freshwater shrimp) and <i>Hyridella menziesi</i> (freshwater mussel).
Water Quality	Presence of constructed wetlands Constructed wetland and filters kmz	None	None	None	None	None	Fisken Wetland (P filter) located on property boundary	None
	Groundwater monitoring sites within 500 m of wetland Data sourced from ES Groundwater Monitoring	2 within 500m property boundary (F47/0132, F47/0221)	2 within property boundary (F47/0132, F47/0221), 1 within 500m boundary (F47/0145)	2 within property boundary (F47/0149, F47/0101)	No bores within 500m of property boundary.	3 near property boundary (F47/0145, F47/0149, F47/0101)	2 within property boundary (F45/0167_d, F47/0253)	5 near property boundary (F47/0201, F47/0041, F47/0262, F47/0257, E47/0129)
	Surface water monitoring sites within 500 m of wetland Data source from ES Surface Water Monitoring	1 site on property boundary (Carran Creek east branch u/s Waituna Gorge Road)	2 within or on property boundary (Carran Creek 1km d/s Waituna Gorge Road, Carran Creek east branch u/s Waituna Gorge Road)	1 on property boundary (Carran Creek west branch d/s Waituna Gorge Road), 1 within 500m (Carran Creek east branch u/s Waituna Gorge Road)	No surface water sites within 500m of property boundary.	1 on property boundary (Moffat Creek Sth branch 1.2km u/s Miller Road), 1 within 500m (Carran Creek west branch d/s Waituna Gorge Road)	1 within 500m (Moffat Creek Sth branch 1.2km u/s Miller Road)	2 on property boundary (Moffat Creek 20m u/s Hanson Road, Moffat Creek at Moffat Road)
	Groundwater quality status Groundwater graphs prepared by MWH	Not enough data	Not enough data	Not enough data	No monitoring sites	Not enough data	Generally meets applicable guideline values (F47/0253)	Exceeds nutrient effects guidelines
	Surface water quality status Surface water graphs prepared by MWH	Elevated nutrients	Elevated nutrients	Elevated nutrients	No monitoring sites	Elevated nutrients	Not enough data	Not enough data
	Bank reconstruction ES bank reconstruction shape files 2013-2015	None near property	None near property	None near property	None near property	None near property	None near property	None near property

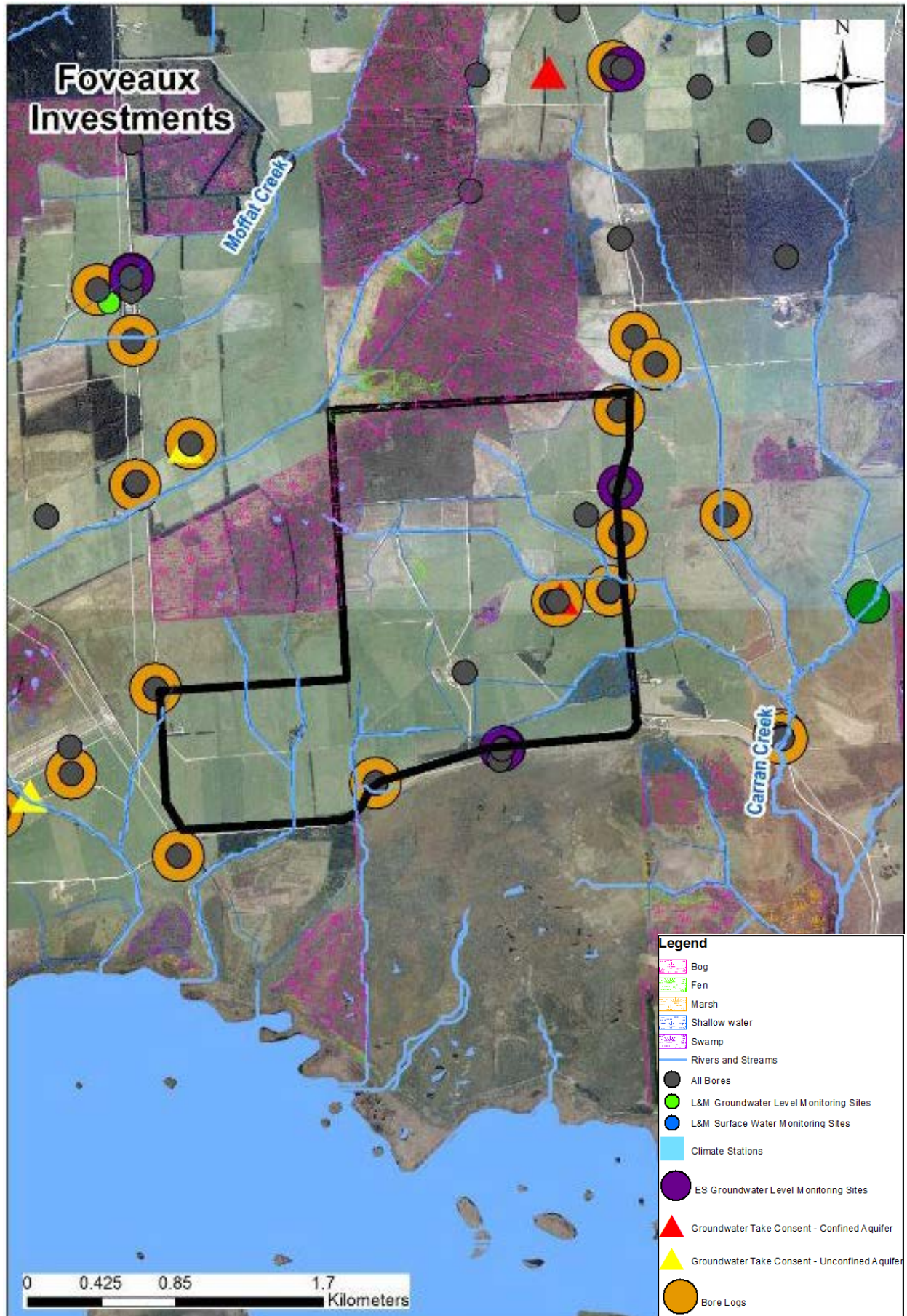


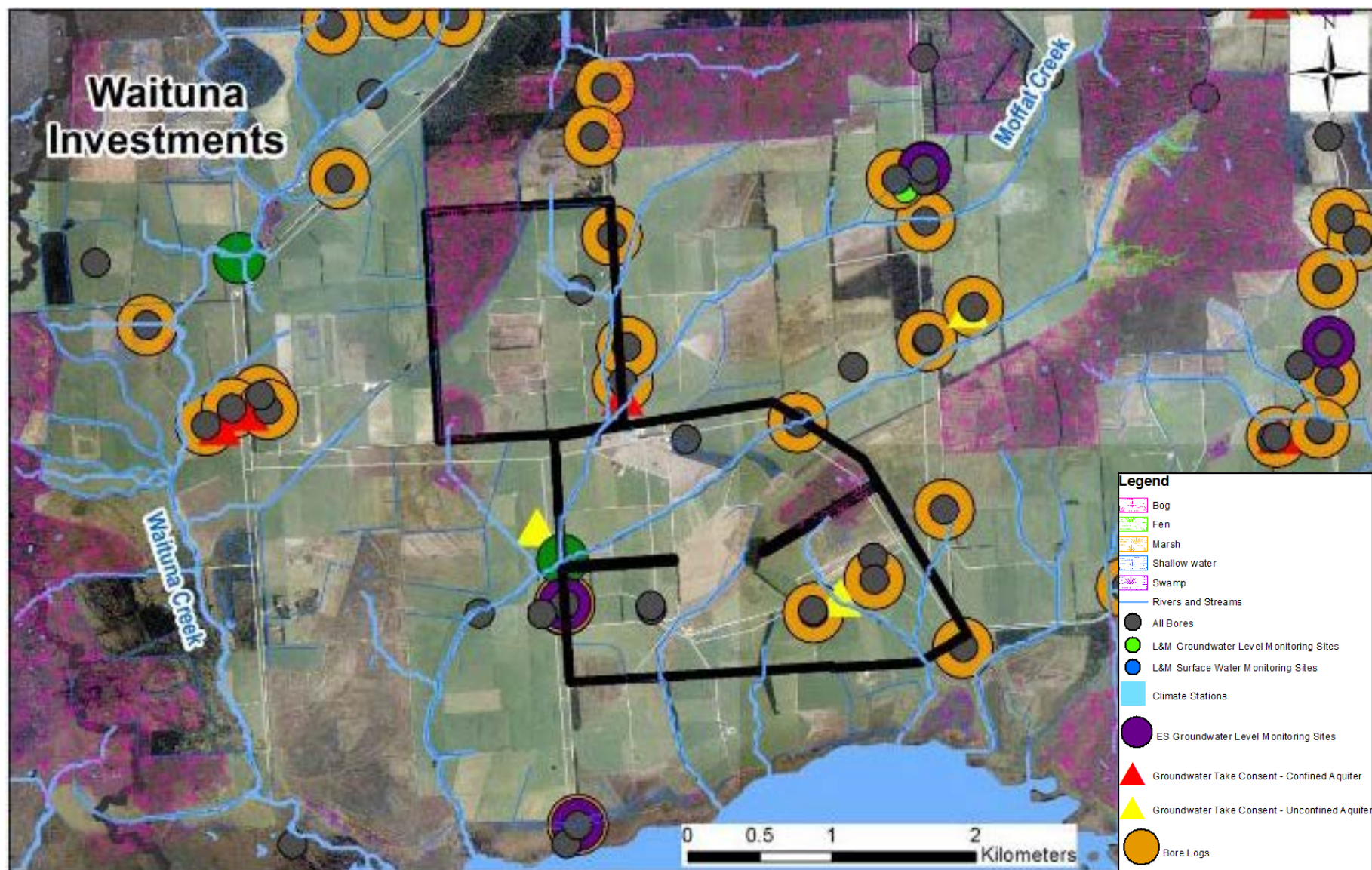














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