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Waimea Land and Water Care Group – 15 July 2013

Overview

- PSWP Groundwater Project
- Environmental monitoring
- Next Steps
- Water and Land 2020 & Beyond

Primary Sector Water Partnership

Maintain and/or enhance water quality from primary production land…

Demonstrate improvements in water use efficiency by the primary sector…

Balfour Project

- Started 2009.
- Catchment understanding – soils, history of land use, geographical history.
- Water quality monitoring – regular + more detailed surveys.
- Land use review – point source and diffuse N, fertiliser usage.
- Reports produced.
- Advice and information provided.

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Main Conclusions

- **The combination of slow groundwater flow and recharge from the land surface makes the aquifer susceptible to contamination.**
- **This is impacting on drinking water quality and on surface water quality above acceptable levels.**
- **This is also impacting on surface water quality and in-stream habitats.**

The data highlights the vulnerability of this particular hydrogeological setting to land use impacts on water quality

Intro Groundwater Quality

- **Context**
  - Waimea Plains
  - What is a nitrate ‘hotspot’ and why do they occur where they do?
  - Update on Balfour

- **On-going work**
  - Chemistry and Isotopes
  - Lag times
  - Groundwater-surface water interaction
  - Denitrification Potential of Southland’s Aquifers

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"Hotspots?"

What is a "Hotspot"

- Hotspots: Areas where at least two wells consistently show nitrate as nitrogen (NO_3-N) concentrations that exceed 75% of the Maximum Allowable Value (MAV) defined by the NZDWS

- True 'hotspots' are typically associated with diffuse leaching of nitrate to groundwater over a relatively large area (not localised contamination often associated with point-source discharges (e.g. septic tanks, silage stacks, leaking ponds)).

Why and where do Hotspots Arise?

- Nitrate 'hotspots' occur where conditions are favorable for nitrate concentrations to accumulate to high levels within an aquifer. The controls over accumulation include:

    1. Land use intensity (land use type) and history
    2. Setting (hydrogeology and soils

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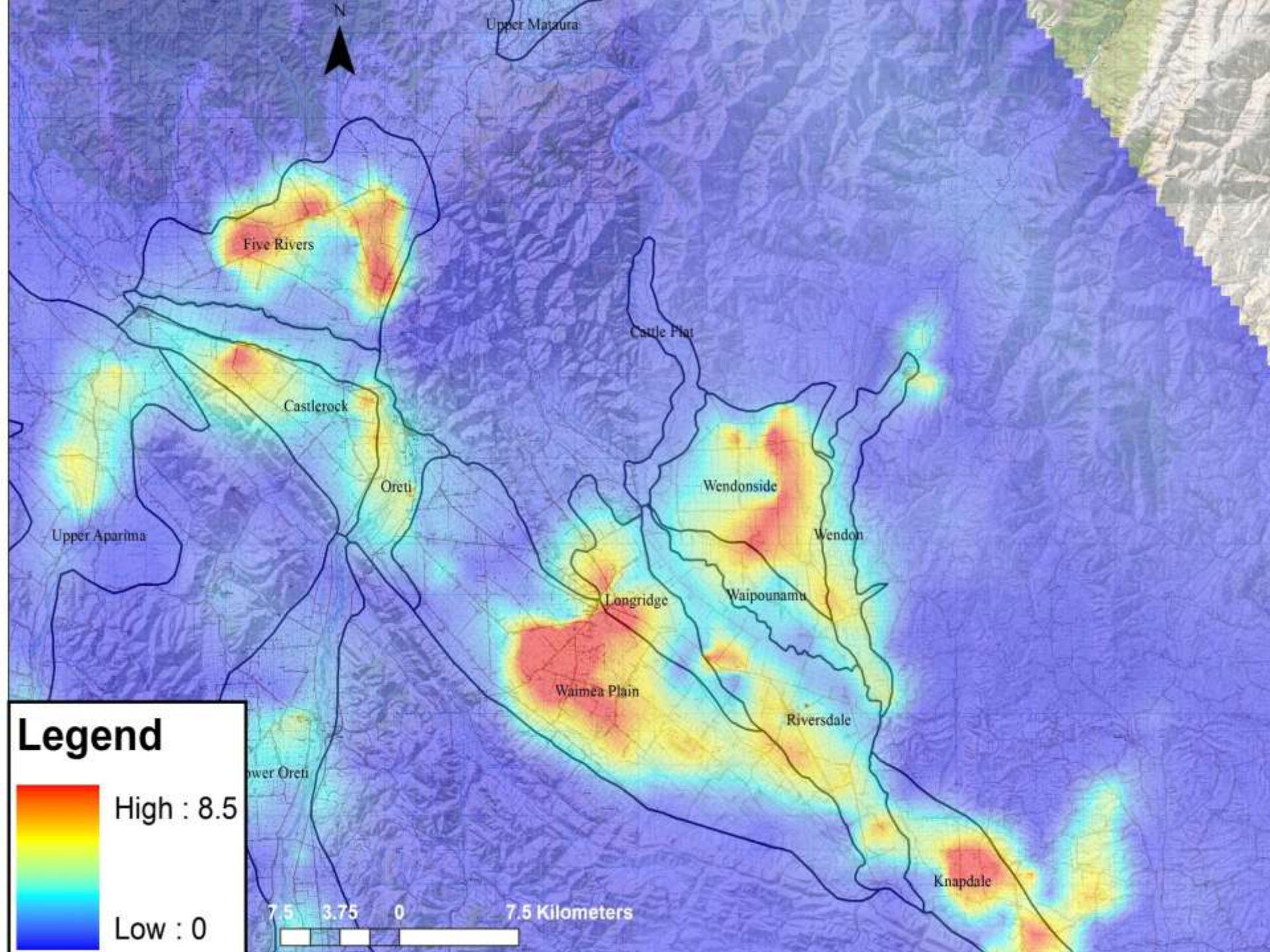
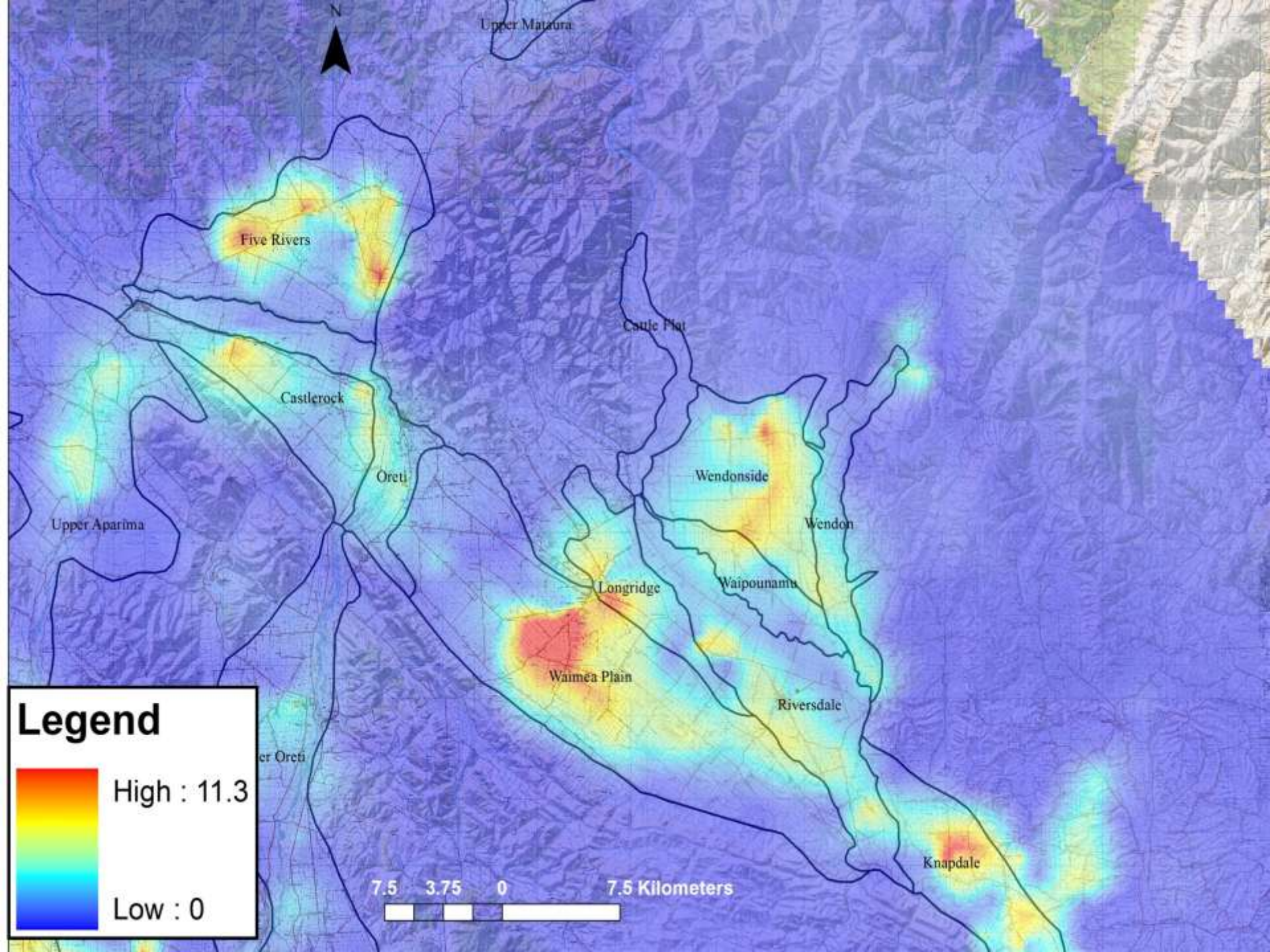

N
Upper Mataura
Five Rivers
Cattle Flat
Castlerock
Oreti
Upper Aparima
Wendonside
Wendon
Longridge
Waipounamu
Waimea Plain
Riversdale
Knapdale
Legend
High : 8.5
Low : 0
7.5
3.75
0
7.5 Kilometers


N
Upper Mataura
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Wendon
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Waipounamu
Waimea Plain
Riversdale
Knapdale
Legend
High : 11.3
Low : 0
7.5 3.75 0 7.5 Kilometers

Why and Where?

Given a similar land use intensity across the Southland Plains the main reason nitrate hotspots occur relates to the geology and hydrology (hydrogeology):

- *Not typically because of different (poorer) farming practices or even because of higher nitrate leaching losses.*

The specific conditions that favour the development of a hotspot at any given location within an unconfined aquifer include:

- Relatively permeable soils that contain little organic carbon (so nitrate is not assimilated within the soil zone);
- Slow moving groundwater within an oxidised aquifer (so nitrate concentrations can accumulate over time);
- Limited connection to a river or source of high altitude recharge (so there is little dilution of soil zone recharge by water from sources containing low nitrate
- Predominantly soil zone recharge (so underlying groundwater quality reflects the
- cumulative effects of land use and associated nitrate losses over the contributing recharge area)

Where ‘Hotspots’ do Not Occur

- Given a similar land use and land use intensity most farms will loose the same amount of nitrate

- But not all regions have ‘hotspots’ so why not? ‘Hotspots” are unlikely to develop where:

  Aquifers are flushed (diluted) by river water or high altitude recharge containing low nitrate (nitrate inputs are effectively diluted);

  Groundwater flow is relatively rapid due to the above flushing (the aquifer system is more well mixed and nitrate doesn’t have time to accumulate in localised areas);

  The underlying aquifer is reducing due to the presence of lignite measures or peat (under these conditions nitrate is converted to other forms of nitrogen)

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So What?

Conventional farming practices, even those that are very well run would fail to prevent groundwater nitrate build up when hydrogeological factors exist that favour nitrate accumulation.

Regions without ‘hotspots’ are still loosing the same amount of nitrate but b/c of different hydrogeological setting you are less likely to see nitrate build up.

A question of load

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What Can Be Done?
- Seasonality -

- The influx of the bulk of nitrate to shallow aquifers during the wettest times of year coincides with peak recharge to our aquifers via the infiltration of water through the soil.

- During these times of soil water infiltration, water acts as the mechanism for the transport of soluble contaminants from the land surface into underlying aquifers.

- Ergo: bulk of the nitrate associated with nitrate 'hotpots' is inferred to enter our aquifer systems during the late autumn, winter and spring.

- Seasonality therefore plays a critical role in nitrate transfer to regional aquifer systems under intensive land.

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Balfour Update

- Samples collected in Summer 12/13
- Extended area and suite (chemical and isotopic)
- Stream samples and stream gauging undertaken simultaneously

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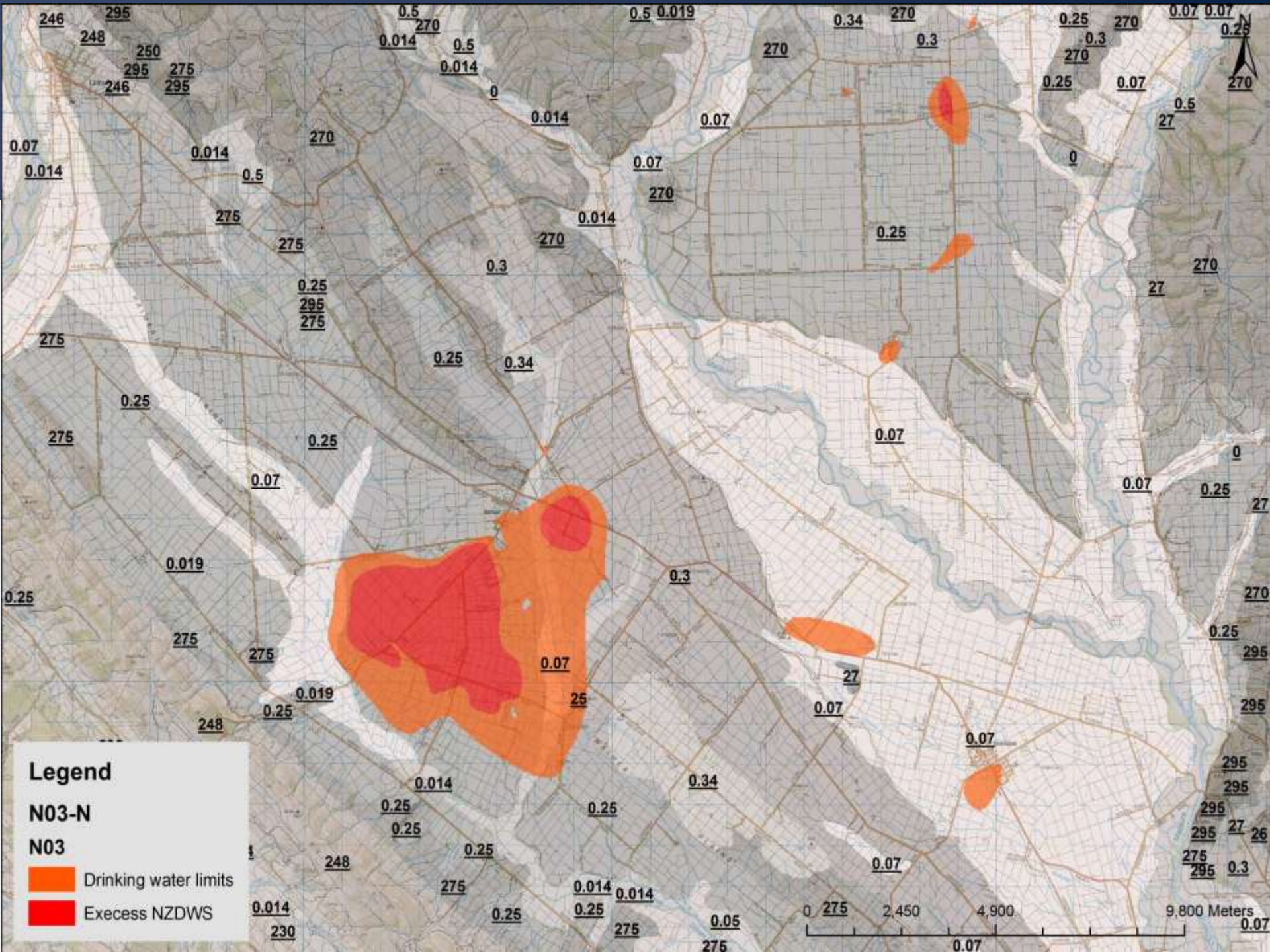
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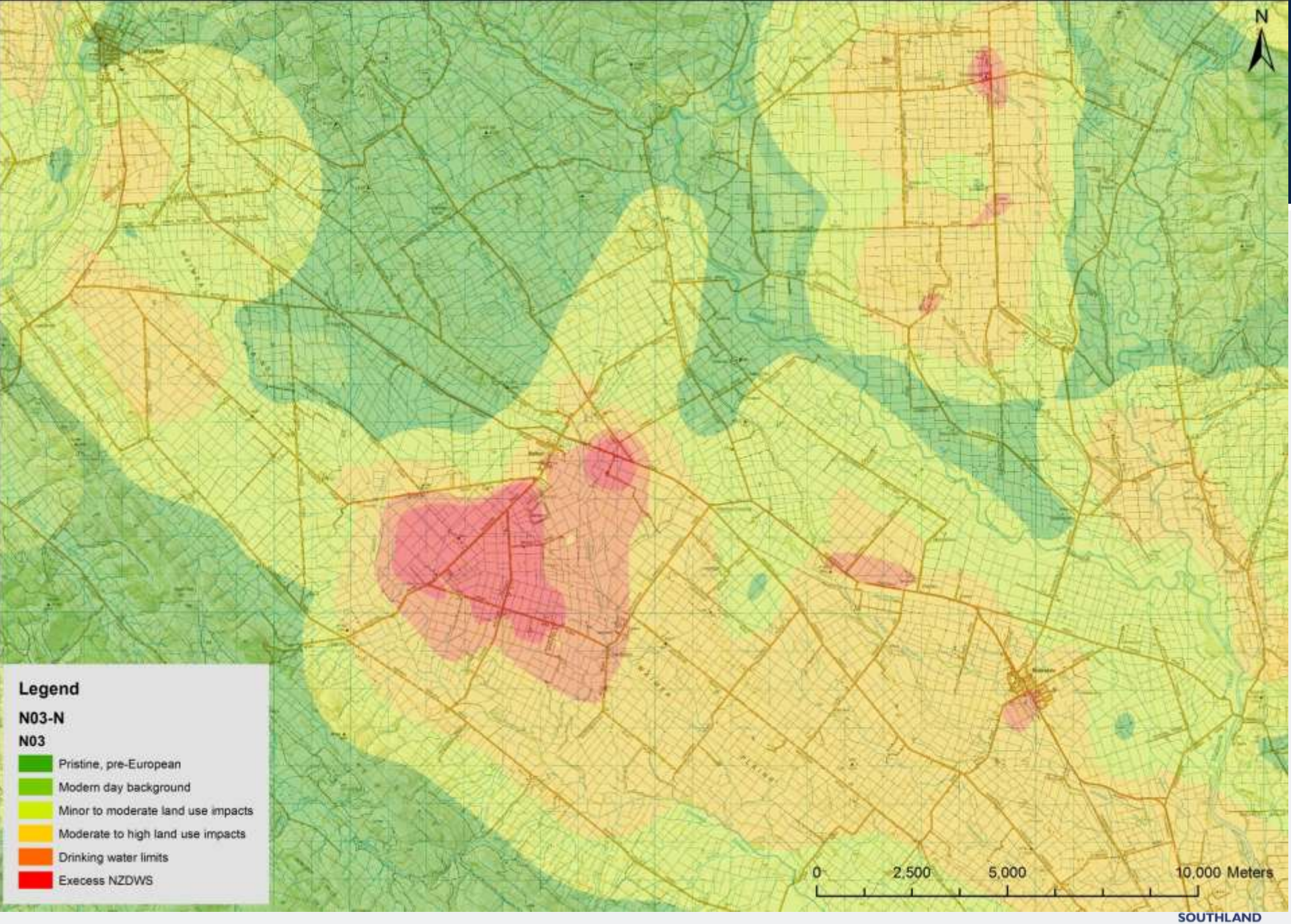
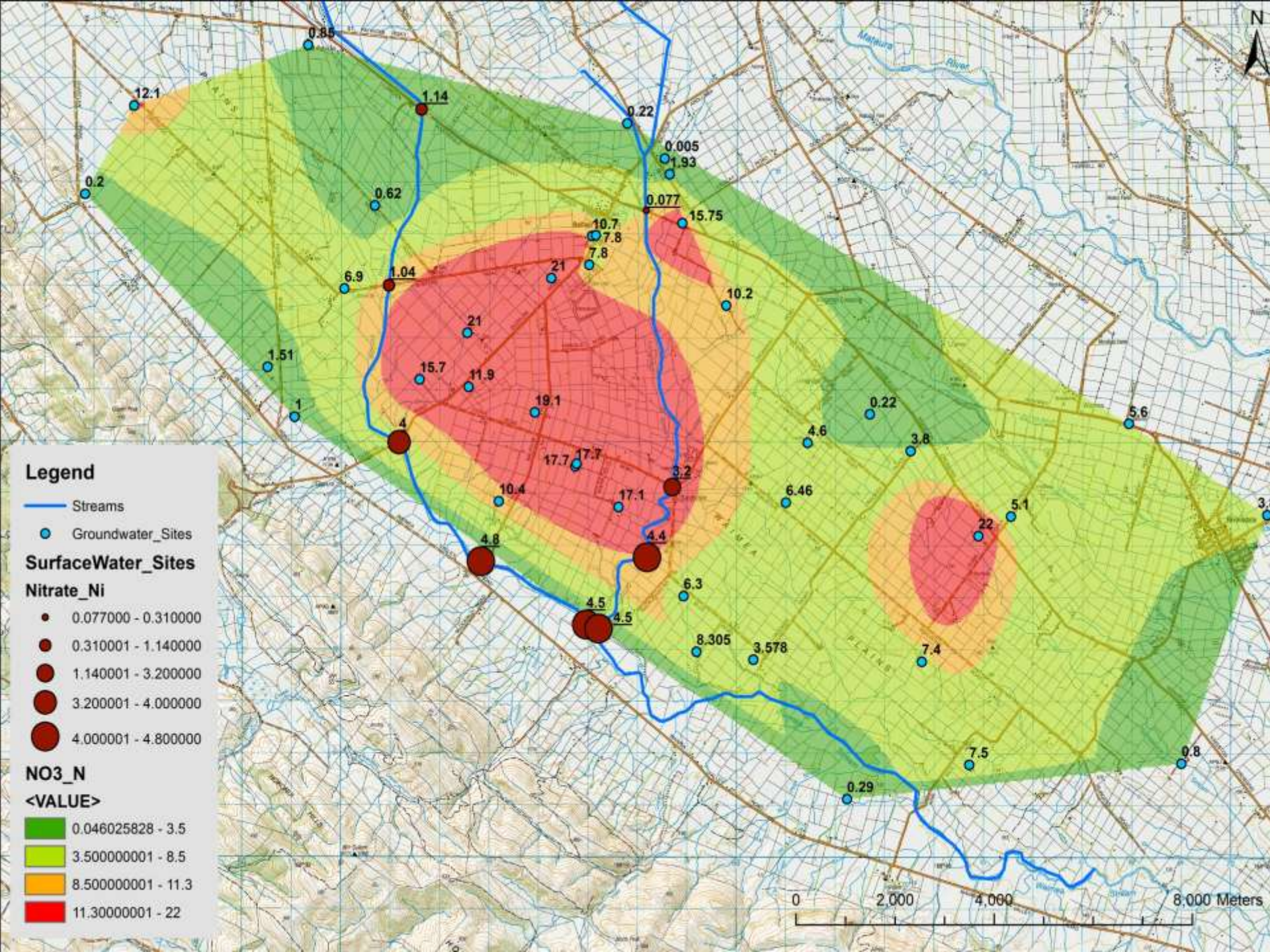
N03-N
N03
Drinking water limits
Execess NZDWS
0 275 2,450 4,900 9,800 Meters
N


N
Legend
N03-N
N03
Pristine, pre-European
Modern day background
Minor to moderate land use impacts
Moderate to high land use impacts
Drinking water limits
Excess NZDWS
0
2,500
5,000
10,000 Meters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Streams
Groundwater_Sites
SurfaceWater_Sites
Nitrate_Ni
0.077000 - 0.310000
0.310001 - 1.140000
1.140001 - 3.200000
3.200001 - 4.000000
4.000001 - 4.800000
NO3_N
<VALUE>
0.046025828 - 3.5
3.500000001 - 8.5
8.500000001 - 11.3
11.30000001 - 22
0.85
12.1
1.14
0.22
0.005
1.93
0.2
0.62
0.077
15.75
10.7
7.8
7.8
6.9
1.04
21
10.2
21
1.51
15.7
11.9
19.1
1
4
0.22
5.6
4.6
3.8
17.7
17.7
3.2
10.4
17.1
6.46
5.1
22
4.8
4.4
6.3
4.5
4.5
8.305
3.578
7.4
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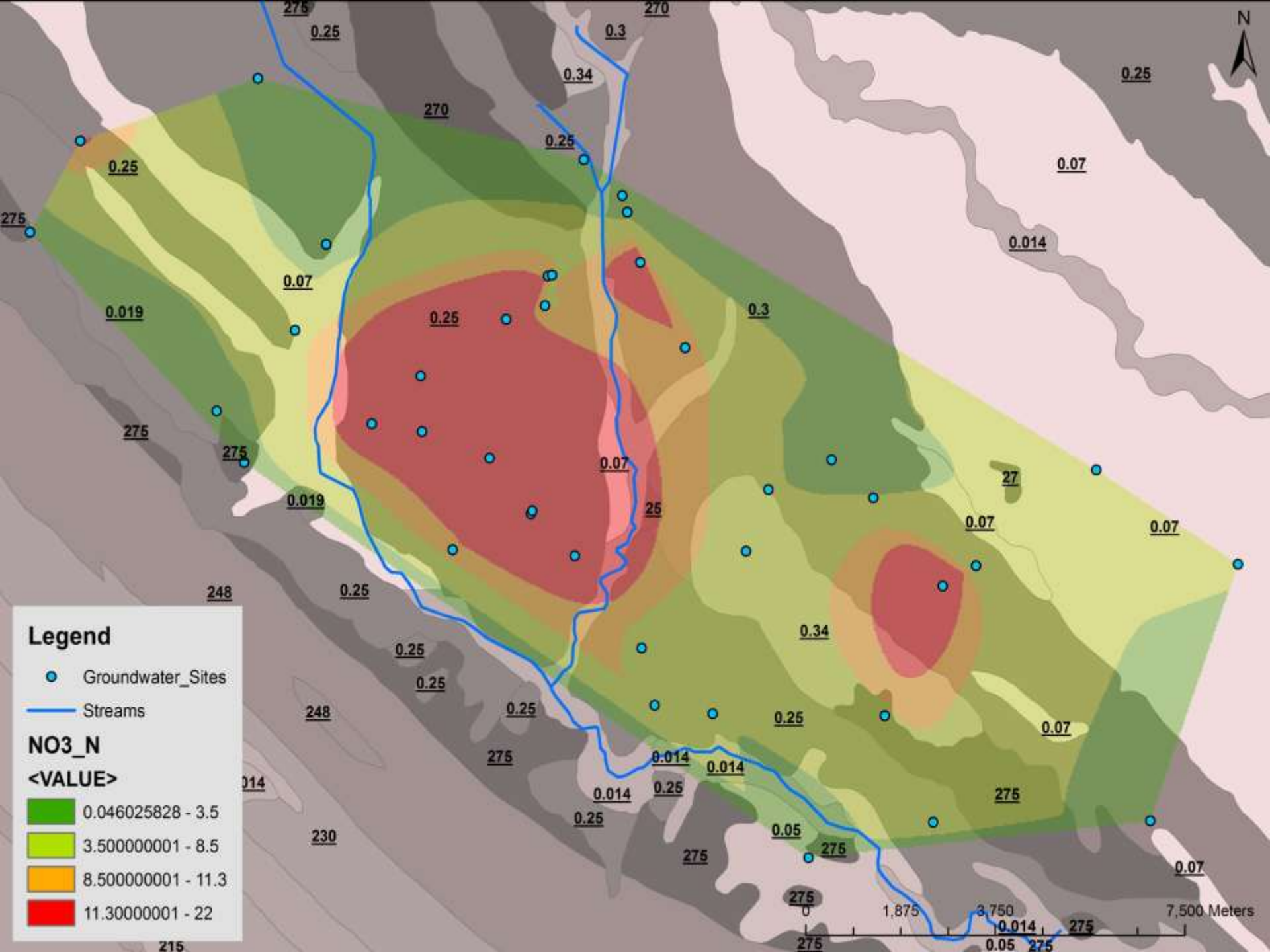
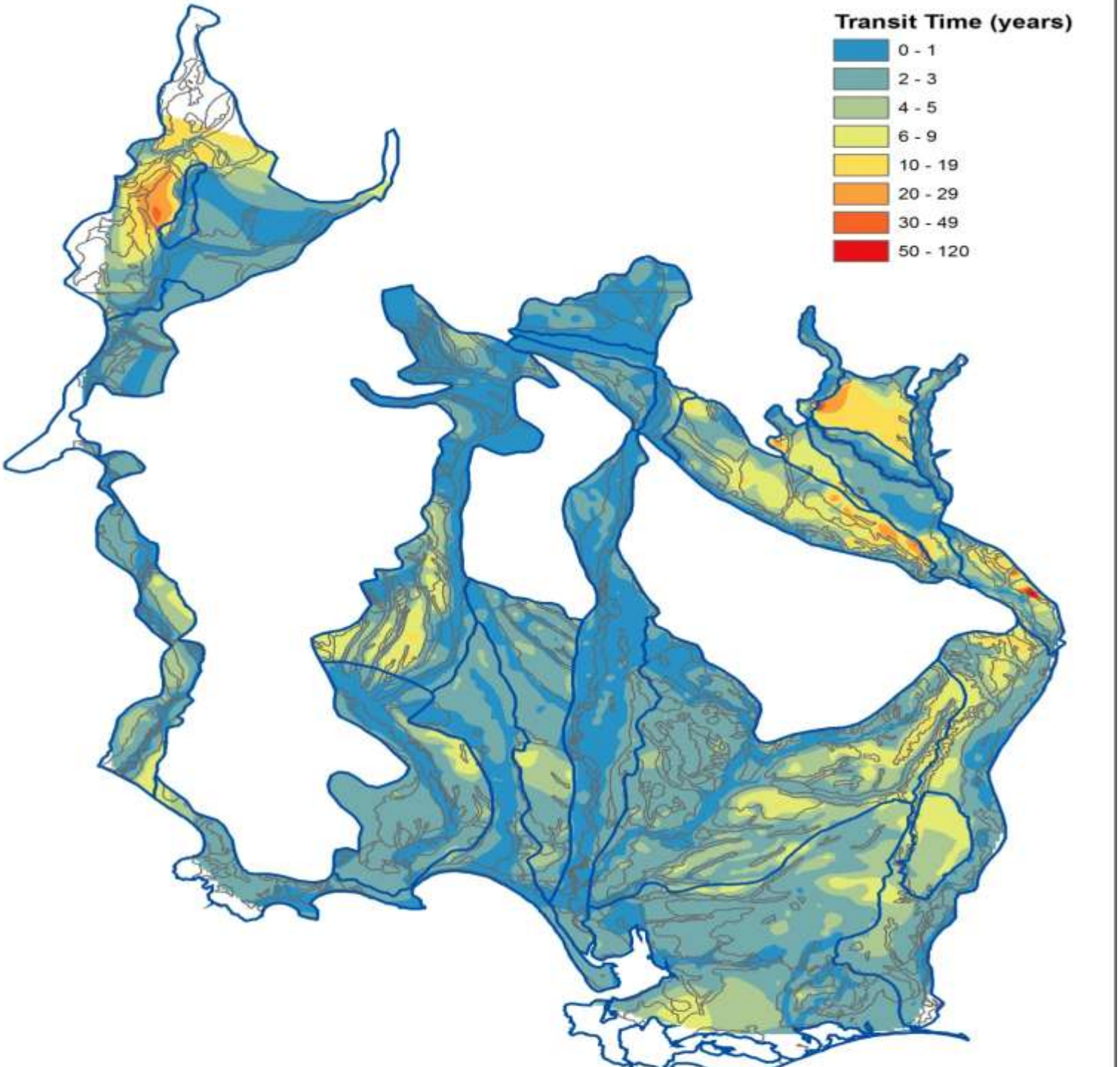
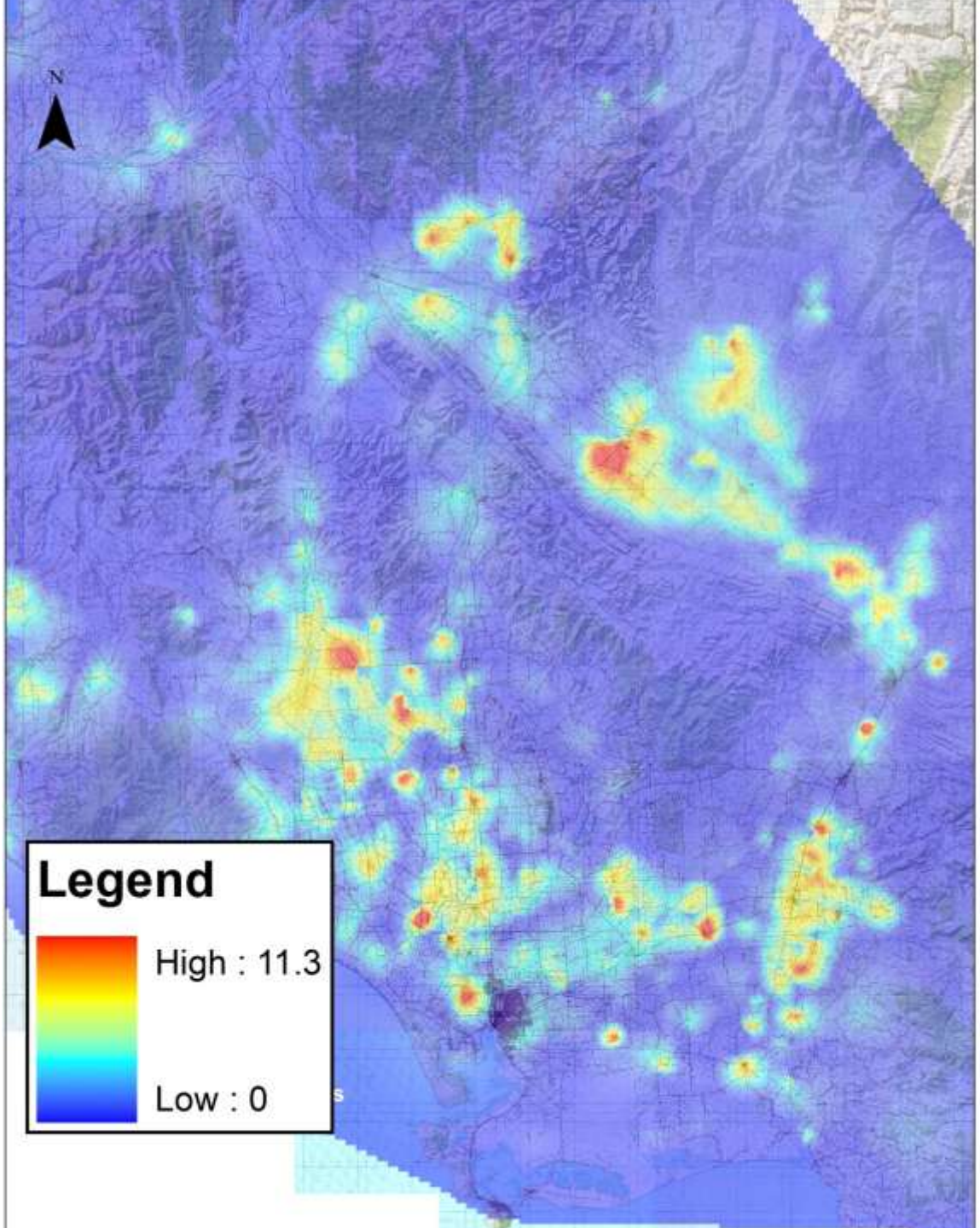
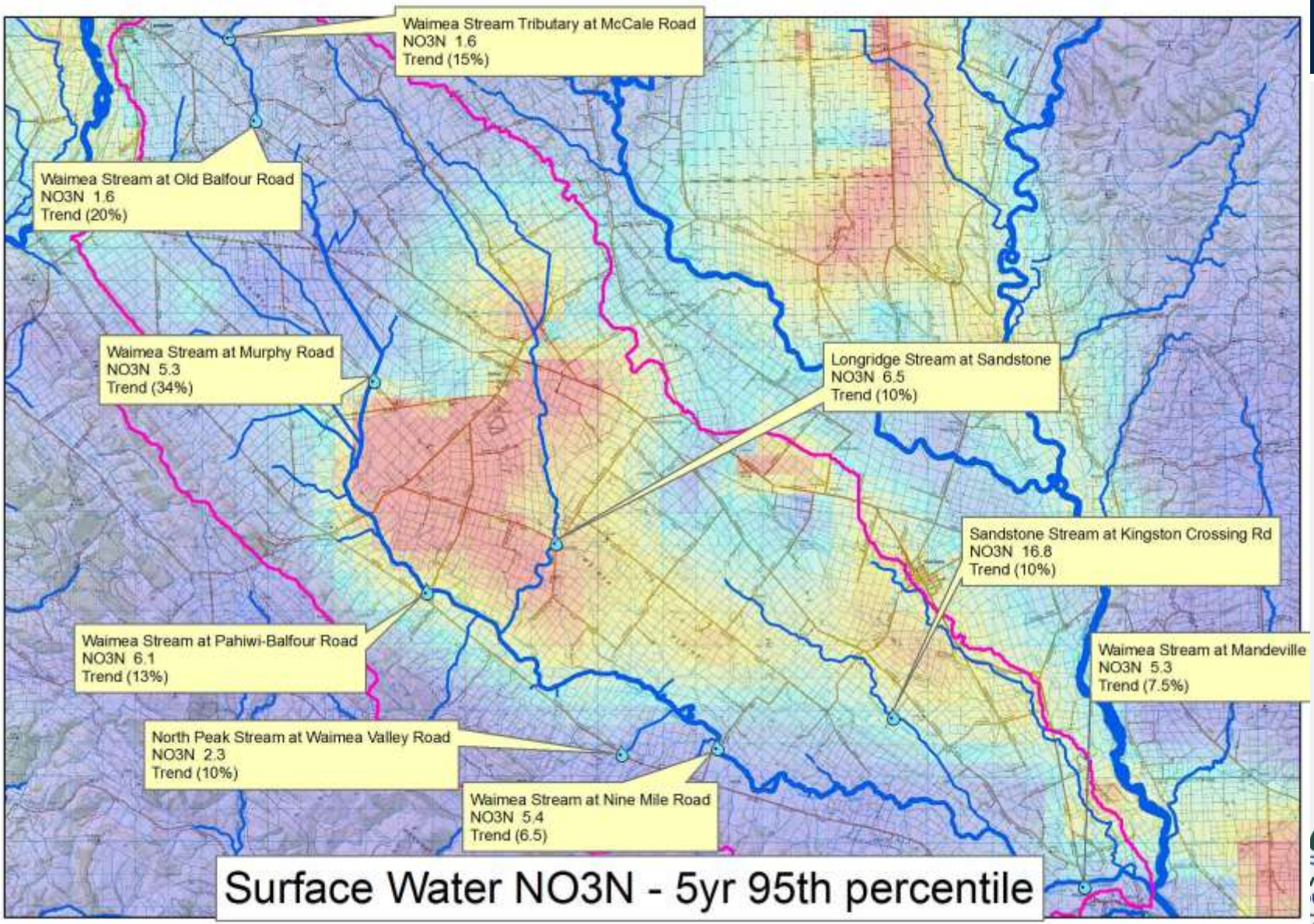
N
Maitland
River
PLAINS
0
2,000
4,000
8,000 Meters


N
Legend
Groundwater_Sites
Streams
NO3_N
<VALUE>
0.046025828 - 3.5
3.500000001 - 8.5
8.500000001 - 11.3
11.30000001 - 22
0
1,875
3,750
7,500 Meters


Transit Time (years)
0 - 1
2 - 3
4 - 5
6 - 9
10 - 19
20 - 29
30 - 49
50 - 120


N
Legend
High : 11.3
Low : 0

Surface Water - NO3N



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In Stream Biological monitoring

- Waimea at Mandeville, Sandstone and Longridge Stream
- Fish food (Macroinvertebrates) indicate moderate to severe pollution pressure
- Algae (Periphyton) frequently high
- Water plants (Macrophytes) often very abundant

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Balfour

- Continues to grow in extent but closely matches extent of Q6-Q8 geological surface

- Nitrate concentrations continue to increase (up to 21 ppm, NO3-N)

- Lag time model consistent with chemistry and suggests 6 – 9 years for nitrate deposited on land to reach groundwater:
    - What will nitrate do in future?
    - Good news in that the lag is pretty short when contrast with other areas of the Waimea Plains
        - Can see changes rapidly

- Looking forward:
    - Better spatial resolution over NO3 distributions (and other WQ parameters)
    - Isotopes, a better understanding of where our water comes from
    - Contaminants definitive source tracking

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Next Steps

- Continuing science and monitoring.
- Continuing advice and information.
- Involvement in Water and Land 2020 & Beyond project.

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Water and Land 2020 & Beyond

- *Enabling sustainable land use*
- *Maintaining and improving water quality*
- *Addressing water quantity*

National Policy Statement for Freshwater Management

Must safeguard life-supporting capacity, maintain/improve overall water quality & quantity, protect outstanding water bodies and address over allocation.

Regional plans must set objectives, limits and methods (including rules) as soon as reasonably practicable (by 2030 at latest).

Must ensure that tangata whenua values and interests are identified and reflected in management and decision making

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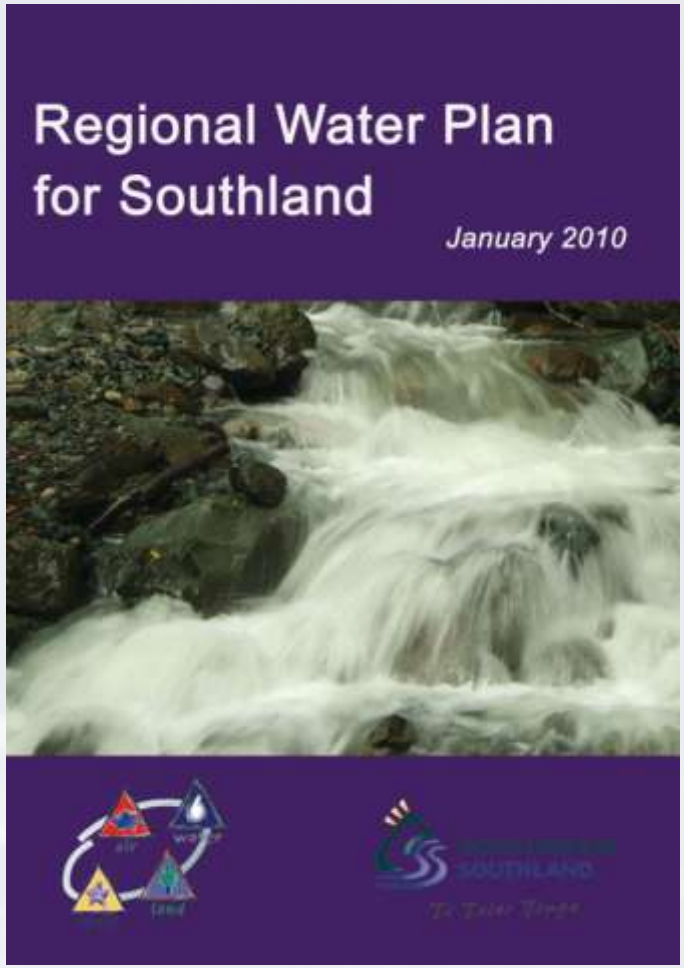
Regional Water Plan for Southland (2010)

- The Water Plan sets out the **community's values** and **goals** in relation to water quality & quantity:

  Sufficient water available for individual, community and ecosystem wellbeing.

  Water quality that supports community uses and values e.g. drinking water (human and stock), recreation, food gathering, fisheries and ecosystems.



Water Quality Objectives

Protect the high water quality of natural state waters.

Maintain water quality where community values are already met.

Stop further deterioration where community values are not met and gradually improve water quality over time.

In relation to the above, the Plan specifies a 10% improvement in levels of nutrients, faecals and sediment from 2010 to 2020.

Groundwater suitable for human and stock consumption without treatment.

How will this be delivered?

Focus Activities 2013-2015

- Moving to good management practice.

Interim Measures 2013-2015

- Holding the line and working towards meeting community values.

Catchment Limits 2013-2030

- Limits to ensure community values are met.

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Focus Activities (2013-2014) Priorities

Nutrient Management

Sept 13

Overland Flow and Riparian Management

Sept 13

5 existing notified Plan Changes

Wintering

Sept 13

Community Sewage Schemes

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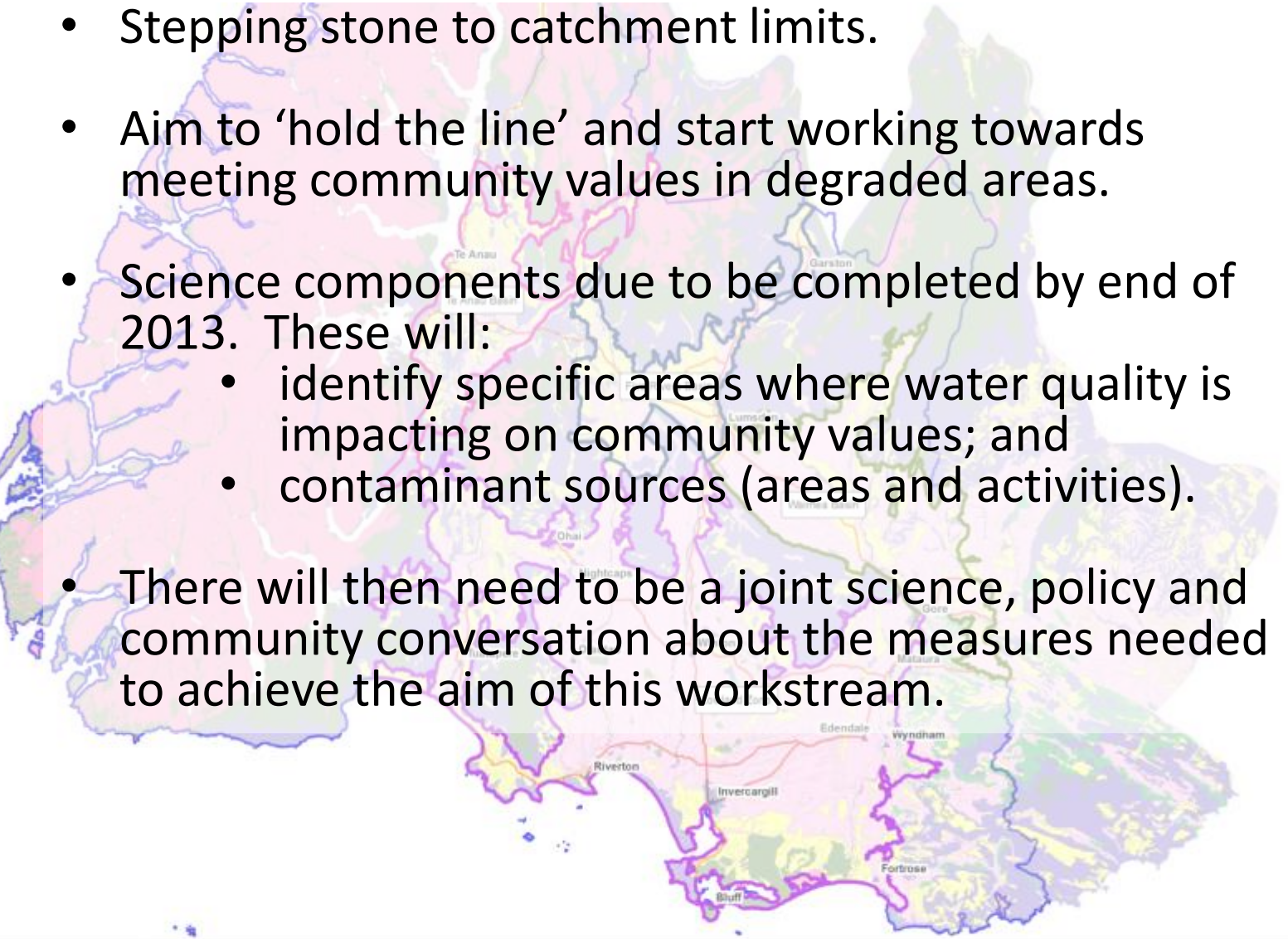
Interim Measures (2013-2015)

- Stepping stone to catchment limits.
- Aim to 'hold the line' and start working towards meeting community values in degraded areas.
- Science components due to be completed by end of 2013. These will:
  - identify specific areas where water quality is impacting on community values; and
  - contaminant sources (areas and activities).
- There will then need to be a joint science, policy and community conversation about the measures needed to achieve the aim of this workstream.



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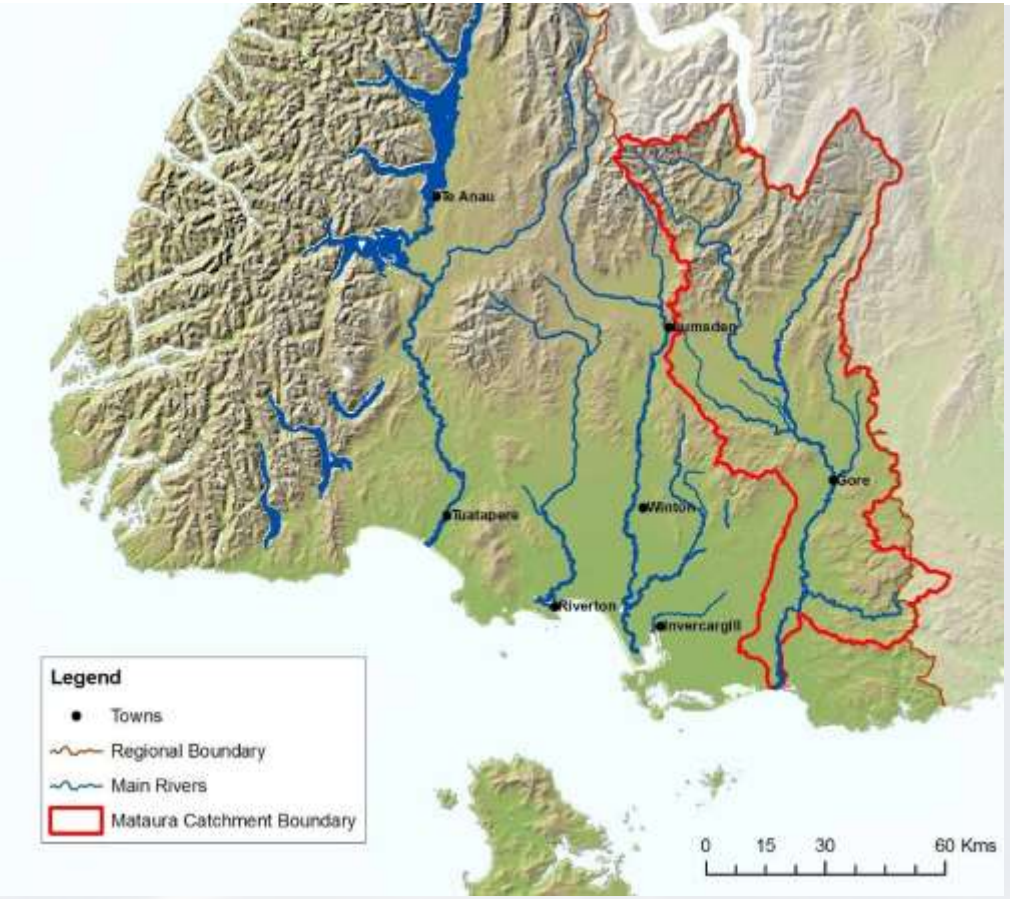
Catchment Limits (2013-2030)

- Limits apply to water bodies (e.g. X tonnes of nitrogen or sediment per year).
- Variety of ways of achieving limits.
- All contaminant sources need to be considered.
- Will look at water quantity as well as quality.
- Significant need to engage with communities around consequences of limits.



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Catchment Limits (2013-2030)

1

- **Getting ready** – now to mid 2016 (bulk done by mid 2015)
- *Where are contaminants coming from, how much is coming from each source?*
- *What limits setting process will work best in Southland?*
- *What catchments when?*

2

- **Doing** – mid 2015 onwards
- *Collaborative processes?*
- *Implementation will extend to 2030 and beyond.*

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Concluding comments

- Partnership is key to this project – PSWP making important contribution.
- Whole of community – what are the values?
- Understanding regional groundwater characteristics important.
- Effects on Waimea Stream potentially significant.

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Questions?

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