



## 2 Input Data

Data	Source	Use	Date accessed
NZ Parcel Boundaries	LINZ data service	Base dataset used in the analysis	September 2019
NZ Title Boundaries	LINZ data service	Used to aggregate parcels to a 'property' level	September 2019
Wellington Region Water Network Data	Wellington Water GIS Services	Used to tag parcels in and out of the reticulated water network	September 2019
Property Valuation Tables	GWRC	Joined to the parcel data for building improvement and age descriptions	Provided by GWRC in September 2019
GWRC Wells	GWRC	Used to tag parcels with wells	Provided by GWRC in September 2019
Agribase	GWRC	Used to tag parcels with stock	Provided by GWRC in September 2019
Landuse 2013	GWRC	Used to tag parcels with stock in absence of Agribase data	Provided by GWRC in September
Land Cover Database 4.1	Landcare Research	Used to tag parcels with grassland area for stock calculations	September 2019
River Environment Classification	NIWA	Used to tag properties with streams	September 2019
2018 Census usually resident population and age groups by Statistical Area 2	Stats NZ	Quantify population density across the Whaitua	September 2019

## 3 Methodology

### 3.1 Base Data

It was agreed with GWRC that Collaborations would employ a similar methodology to previously commissioned studies for consistency and a standardised approach in delivery. National and regional policy documents set rules for water abstraction at a 'property' scale therefore defining the spatial extent of a property is important. For the purposes of this report, a property is the land that makes up an individual title which is often a combination of more than one adjoining parcel in rural areas. LINZ describe parcels and titles as:

- Primary parcels can be thought of as the 'base level' of the 'jigsaw puzzle' of all land making up New Zealand

- There can be multiple parcels associated with a title, and a title may only have a part share in a parcel. This means the shape representing the title will be an aggregation of all parcels that the title is associated with.

Although the reporting and final assessment was carried out at a title scale, the GIS analysis was conducted at the parcel scale as parcel data can be joined and related to other datasets more readily. The desired output was to establish a dataset with proportional stock and domestic water use assigned to each parcel based on a series of parameters. The LINZ Primary Parcel dataset was used as the base of model with several additional tags and attributes associated with each parcel. This approach allowed for the groundwater and surface water abstraction reporting to be carried out at the same time.

Only parcels within the TWT boundary, which are not serviced by the Wellington Water network, were considered in this study. All other parcels are either outside the area of interest or receive water from a town supply. The base parcel dataset was intersected with the buffered water network and the water zone polygons to determine what parcels should be removed from the analysis. An additional tag was added to those parcels with a parcel intent of 'road' or 'hydro' so that they could also be excluded from the analysis.

Separating surface water and groundwater abstraction in the TWT Wahitua involved tagging those properties containing a well (assuming those properties would take their permitted water allocation from groundwater) whilst the remainder would take their allocation from surface water (either from a stream or a rainwater tank). Only Wells with the USER\_CODE1, 2 or 3 recorded as "Domestic Supply", "Stock Supply", "Irrigation" or "Dairy Use" are used in the model. All other uses are assumed to require a consent and therefore don't contribute to the estimated permitted water take.

The parcel dataset was intersected with the 28 sub-catchments provided by GWRC for reporting purposes.

The following calculation has been used to determine allowances for a given parcel:

*Permitted allowance = Permitted Take (R136) + Stock Water (RMA s14) + Domestic Water (RMA s14)*

### 3.2 Permitted Take

The permitted take has been calculated using provisions from Rule 136 of the PNRP which allow the follow abstractions based on property (title) size:

>20 hectares: 20,000L per day

<20 hectares: 10,000L per day

### 3.3 Domestic Water

Domestic water use was assigned to properties where there is deemed to be a dwelling present. It is important to make a distinction between parcels and properties when assigning domestic water as in many instances a property might be made up of several parcels. In these cases, assigning a domestic water allocation at a parcel scale would be misleading. We have considered it better to assign domestic water at a title scale which better represents actual water use. In order to do this, the following workflow was employed:

- The valuation dataset was joined to the parcel data using the parcel ID field allowing for the improvement description to be added. Improvement descriptions with the following attributes were assumed to have a dwelling and therefore require domestic water: (APARTMENT, HOME, BACH, HOSPICE, BEDSIT, RESIDENCE, COTTAGE, TOWNHOU, DORMITORY, TOWNHOUS, DWG, TOWNHOUSE, FLAT, UNI, GRANNYFLAT, UNIT)

- The NZ Title dataset was intersected with the parcels above to identify all titles that contain a dwelling.
- The NZ Title dataset from above was intersected with the 2018 Census Area Unit dataset in order to assign a statistical area to each title. A population density number was assigned to each statistical area by dividing the 2018 usually resident population by the number of titles with a dwelling in that area.
- The population density was joined back to the base parcel dataset and multiplied by 230L<sup>2</sup> per person for all parcels with a residence tag. Additional analysis was carried out to tag parcels that had adjacent parcels on the same title to ensure water use was only accounted for once per title.

### 3.4 Stock Water

We have estimated permitted stock water take by assigning stock densities to each parcel and multiplying them by the area of usable land on each parcel and then by daily stock water consumption. This approach means water can be distributed across the land proportionately and can be carried out at a parcel scale.

In line with previous reports made available, land use with Beef, Sheep, Dairy and/or Deer was deemed to use stock water. The Agribase dataset covered most of the rural land in the TWT Whaitua and where Agribase data wasn't available the 2013 land use layer was used. Assigning stock water to each parcel was carried out by:

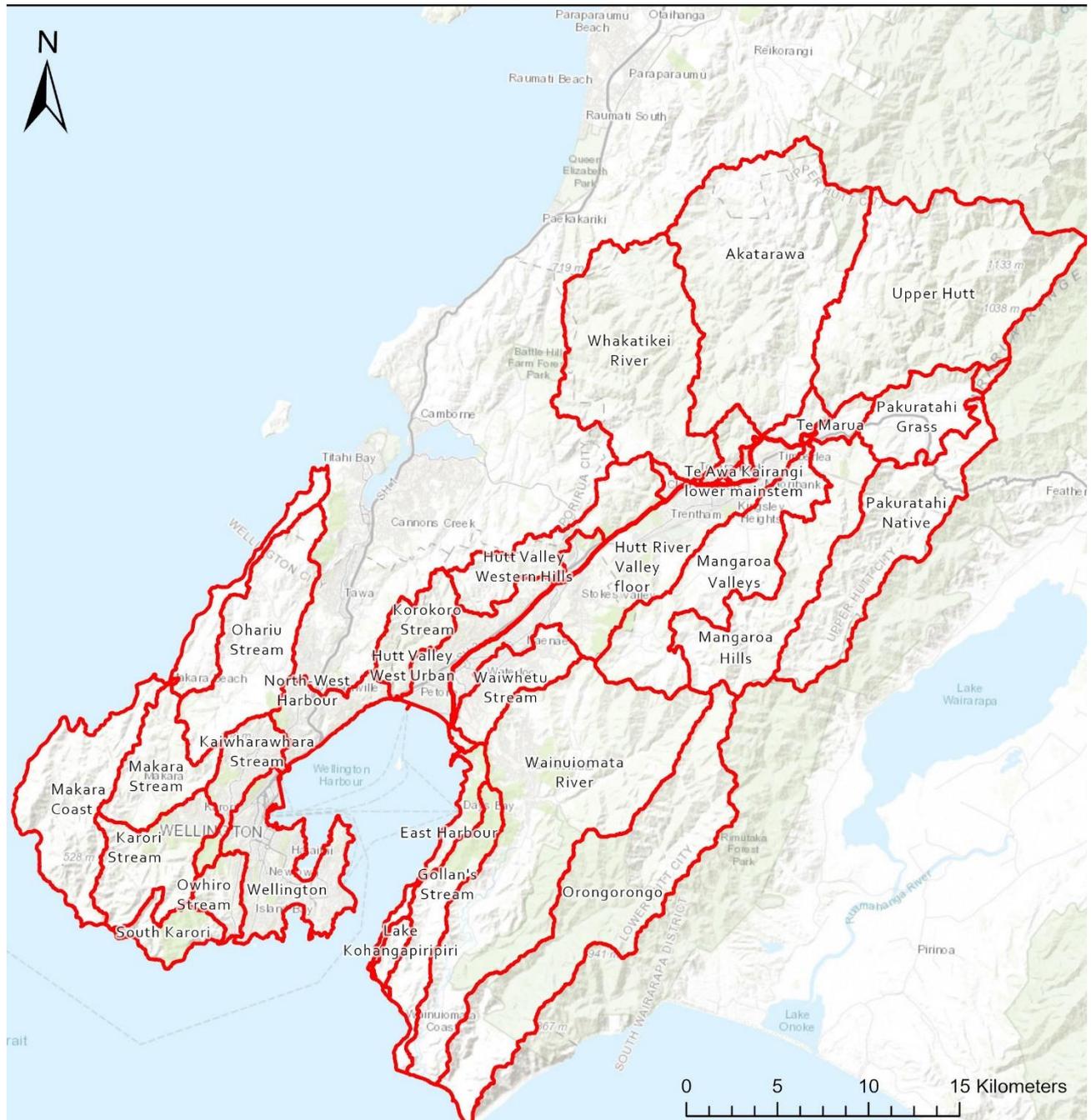
- Selecting 'High producing exotic grassland' and 'Low producing grassland' from the LCDB dataset and intersecting this with the Agribase farm layer as well as the parcel base data to get areas of useable land (land where stock can live)
- Joining the useable area back to the original Agribase layer and dividing the total stock numbers of beef, sheep, deer and dairy by the useable area to get the stocking rates for each of the four stock classes for each farm.
- Assigning an Agribase Farm ID and stocking rates to each parcel by intersecting the base parcel data with the modified Agribase dataset.
- Multiplying the stocking rates by the useable area and by the daily usage rates (below) for each parcel to get estimated stock water use per parcel
  - Beef – 45L a day
  - Sheep – 7L a day
  - Deer – 7L a day
  - Dairy – 140L a day
- Where Agribase data wasn't available, the base parcel data was intersected with the 2013 Land use layer and assigned a land use of either dairy or mixed sheep and beef
- A stocking rate was applied to each of these parcels by averaging the Agribase stocking rates (excluding a few outliers). The stocking rates used were:
  - Beef – 1.9 ha
  - Sheep – 8.0 ha
  - Dairy – 1.6 ha
- In the case of mixed sheep and beef, both the sheep and beef rates and subsequent water use was applied.

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<sup>2</sup> Domestic water use of 230L a day per person has been taken from "Report to Whaitua Te Whanganui-a-Tara Committee - Drinking Water Report, September 2019"

## 4 Results

The tables below summarise the water take values generated in the GIS model. Figure 2 Illustrates the sub-catchment distribution used in the analysis.



**Figure 2 – TWT Sub-catchments**

The Mangaroa catchment was analysed for surface water abstraction in the 'Modelling the Magnitude of Unconsented Surface Water Use in the Wellington Region, 2011 report'. The differences between the analysis presented here and previous reporting is largely down to the data used. This report uses the latest parcel information (2019) and the latest census population information targeted to the Mangaroa catchment resulting in a population density closer to 3 people per property as opposed to 0.95. This analysis also uses 230L a day for domestic water use as opposed to 300L.

## 4.1 Groundwater

Groundwater wells supplied by GWRC meeting the requirements outlined in Section 3.1 were intersected with the base parcel dataset and summarised below. It was assumed that all domestic and stock water was extracted from a well where one was present.

Table 1 – Estimated Groundwater Abstraction

Catchment Name	RMA s14 Estimated Domestic Groundwater Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Estimated Stock Groundwater Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Total Groundwater Take (m <sup>3</sup> day <sup>-1</sup> )
Akatarawa			
East Harbour			
Gollan's Stream	0.6		0.6
Hutt River Valley floor		4.3	4.3
Hutt Valley West Urban			
Hutt Valley Western Hills			
Kaiwharawhara Stream			
Karori Stream		0.7	0.7
Korokoro Stream	2.8		2.8
Lake Kohangapiripiri			
Makara Coast	0.6		0.6
Makara Stream		0.2	0.2
Mangaroa Hills			
Mangaroa Valleys	1.9	5.2	7.0
North-West Harbour			
Ohariu Stream			
Orongorongo			
Owhiro Stream			
Pakuratahi Grass		0.8	0.8
Pakuratahi Native	1.3		1.3
South Karori			
Te Awa Kairangi lower mainstem			
Te Marua			
Upper Hutt			
Wainuiomata River			
Waiwhetu Stream			
Wellington			
Whakatikei River			
<b>Total</b>	<b>7.2</b>	<b>11.2</b>	<b>18.4</b>

## 4.2 Surface Water

The total surface water take has been calculated by adding the domestic take to the stock take in each sub catchment. The adjusted water take assumes one out of five domestic water takes is from surface water with the rest abstracted from rainwater tanks. The adjusted calculation divided the

domestic take by 5 and added it to the stock take<sup>3</sup>. This assumes all stock water is taken from surface water and not rainwater tanks which may not always be the case particularly on lifestyle blocks.

Table 2 – Estimated Surface Water Abstraction

Catchment Name	RMA s14 Estimated Domestic Surface Water Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Estimated Stock Surface Water Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Total Surface Water Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Adjusted Total Surface Water Take (m <sup>3</sup> day <sup>-1</sup> )
Akatarawa	93.0	21.0	114.0	39.6
East Harbour	0.7	0.04	0.7	0.2
Gollan's Stream	2.0	25.4	27.3	25.8
Hutt River Valley floor	41.1	0.8	42.0	9.1
Hutt Valley West Urban	30.3	1.7	32.0	7.8
Hutt Valley Western Hills	36.2	57.1	93.3	64.4
Kaiwharawhara Stream	1.9	4.0	5.8	4.3
Karori Stream	24.7	14.0	38.7	18.9
Korokoro Stream	41.8	5.5	47.3	13.8
Lake Kohangapiripiri		0.8	0.8	0.8
Makara Coast	12.5	136.8	149.3	139.3
Makara Stream	83.3	56.1	139.4	72.7
Mangaroa Hills	45.5	24.2	69.6	33.3
Mangaroa Valleys	353.6	194.6	548.2	265.3
North-West Harbour	10.4	0.8	11.2	2.9
Ohariu Stream	89.5	229.3	318.7	247.1
Orongorongo	2.0	9.4	11.3	9.7
Owhiro Stream	3.4	0.2	3.7	0.9
Pakuratahi Grass	67.4	124.6	192.0	138.1
Pakuratahi Native	0.6	0.0	0.6	0.1
South Karori	1.8	6.7	8.5	7.0
Te Awa Kairangi lower mainstem		0.2	0.2	0.2
Te Marua	20.6	21.9	42.5	26.0
Upper Hutt	3.5		3.5	0.7
Wainuiomata River	140.5	83.8	224.2	111.8
Waiwhetu Stream				
Wellington				
Whakatikei River	27.3	40.9	68.2	46.4
<b>Total</b>	<b>1133.3</b>	<b>1059.8</b>	<b>2193.1</b>	<b>1286.4</b>

<sup>3</sup> Domestic water ratio used in the adjusted total surface water take sourced from - REPORT-Modelling-Permitted-Surface-Water-Use-in-Te-Awarua-o-Porirua-Whaitua-23-May-2017

### **4.3 Total Water Abstraction and PNRP Allocation**

The Proposed Natural Resources Plan 2019 (PNRP) provides rules (R136) for permitted water abstraction on properties greater than 20 hectares (20,000L per day) and less than 20 hectares (10,000L per day). We note that as all titles in this analysis assume stock and domestic uses are occurring additional to permitted water takes and no sensitivity has been considered for blocks which may have one type of use or horticultural uses as examples.

There are no known water races in the area, so exclusions associated with takes under R138 are not required in this assessment.

The Permitted Water Take numbers presented in table 3 have been calculated by summarising the number of titles in each sub catchment and assigning water based on the size of the title as a theoretical maximum take that would be permitted under R136. The titles considered were those that were not on the reticulated network in each catchment, allowing for a more accurate comparison to the estimated current water take. Figure 3 illustrates total water take distribution across the sub catchments.

Table 3 – Estimated current water take and permitted take under the PNRP rules

Catchment Name	R136 Permitted Water Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Adjusted Total Surface Water Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Total Groundwater Take (m <sup>3</sup> day <sup>-1</sup> )	RMA s14 Total Combined Water Take (m <sup>3</sup> day <sup>-1</sup> )	Total Permitted Water Allowance (m <sup>3</sup> day <sup>-1</sup> )
Akatarawa	3060.0	39.6		39.6	3099.6
East Harbour	180.0	0.2	0.0	0.2	180.2
Gollan's Stream	220.0	25.8		26.4	246.4
Hutt River Valley floor	1570.0	9.1	4.3	13.3	1583.3
Hutt Valley West Urban	830.0	7.8		7.8	837.8
Hutt Valley Western Hills	1190.0	64.4		64.4	1254.4
Kaiwharawhara Stream	400.0	4.3		4.3	404.3
Karori Stream	1200.0	18.9	0.7	19.7	1219.7
Korokoro Stream	960.0	13.8	2.8	16.6	976.6
Lake Kohangapiripiri	40.0	0.8		0.8	40.8
Makara Coast	430.0	139.3	0.6	139.9	569.9
Makara Stream	2200.0	72.7	0.2	73.0	2273.0
Mangaroa Hills	1240.0	33.3		33.3	1273.3
Mangaroa Valleys	7050.0	265.3	7.0	272.3	7322.3
North-West Harbour	550.0	2.9		2.9	552.9
Ohariu Stream	2600.0	247.1		247.1	2847.1
Orongorongo	230.0	9.7		9.7	239.7
Owhiro Stream	170.0	0.9		0.9	170.9
Pakuratahi Grass	1630.0	138.1	0.8	139.0	1769.0
Pakuratahi Native	140.0	0.1	1.3	1.4	141.4
South Karori	330.0	7.0		7.0	337.0
Te Awa Kairangi lower mainstem	140.0	0.2		0.2	140.2
Te Marua	790.0	26.0		26.0	816.0
Upper Hutt	110.0	0.7		0.7	110.7
Wainuiomata River	3550.0	111.8		111.8	3661.8
Waiwhetu Stream	200.0				200.0
Wellington	10.0				10.0
Whakatikei River	910.0	46.4		46.4	956.4
<b>Total</b>	<b>31930.0</b>	<b>1286.4</b>	<b>18.4</b>	<b>1304.9</b>	<b>33234.9</b>

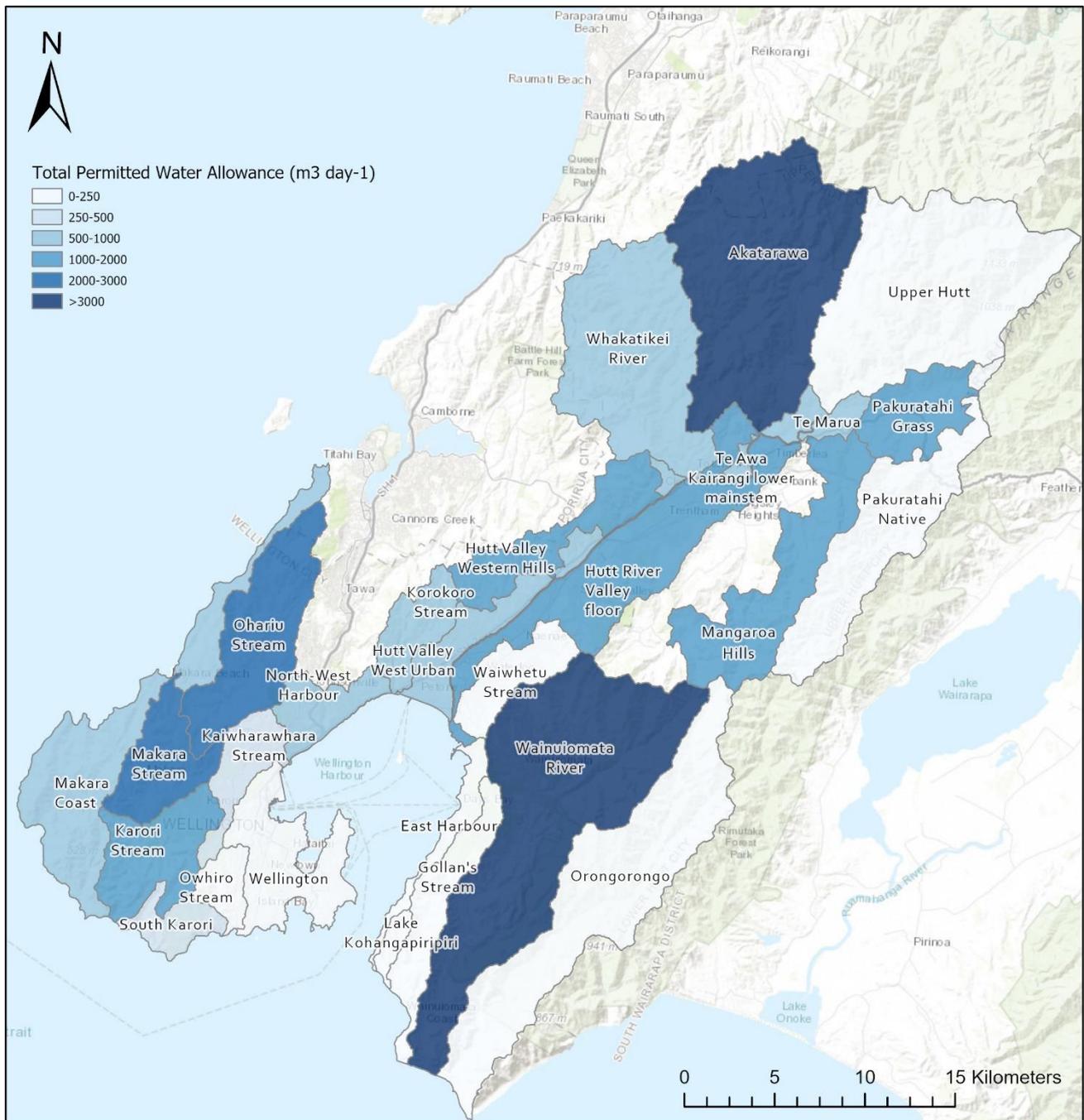


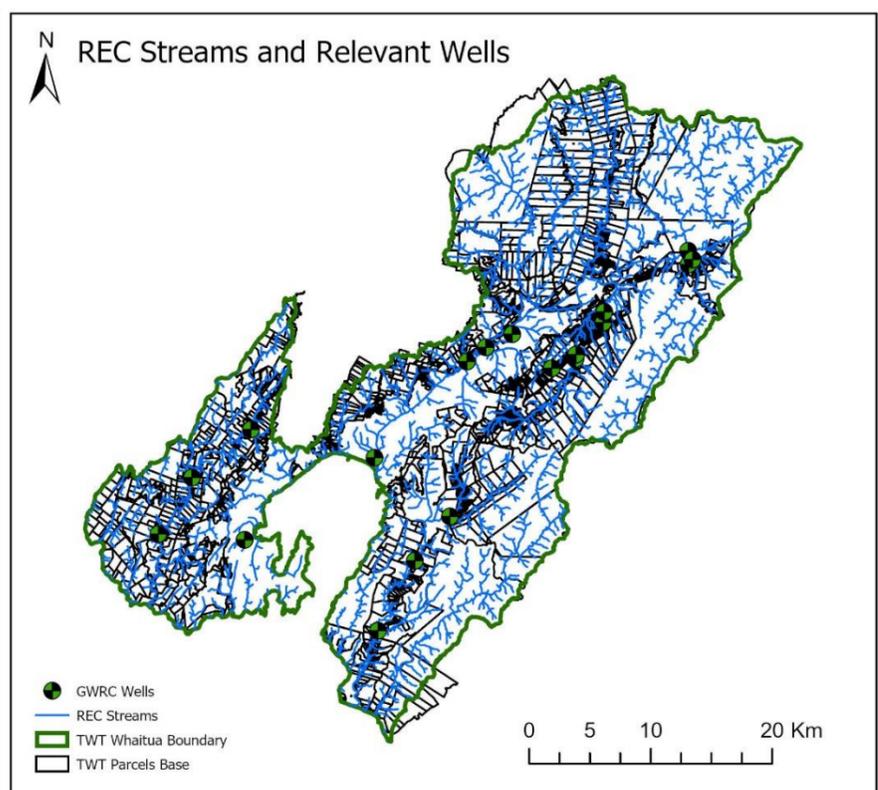
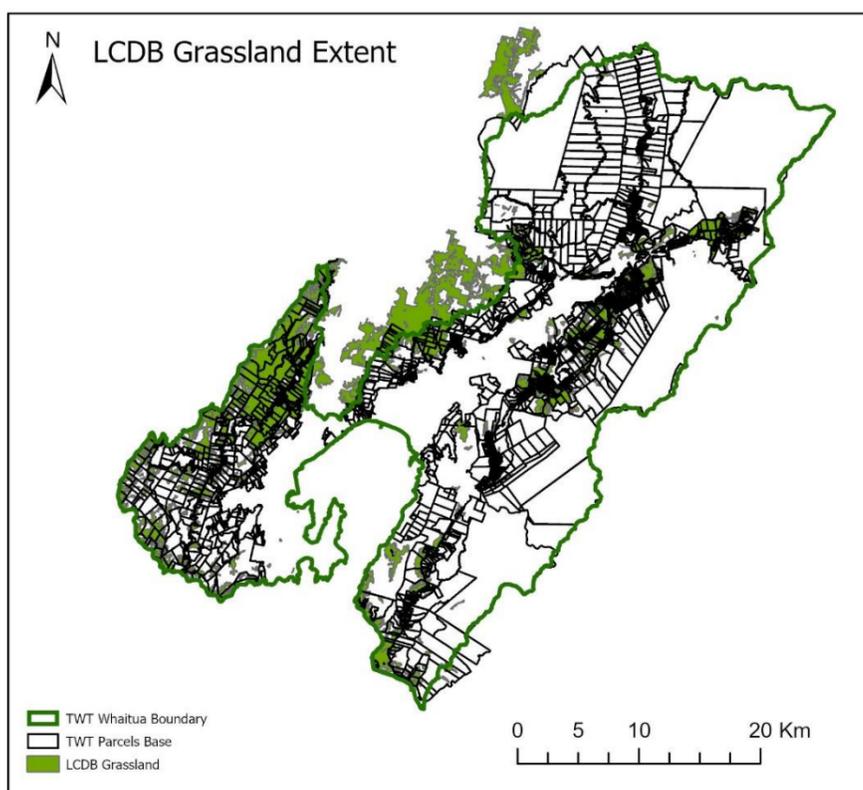
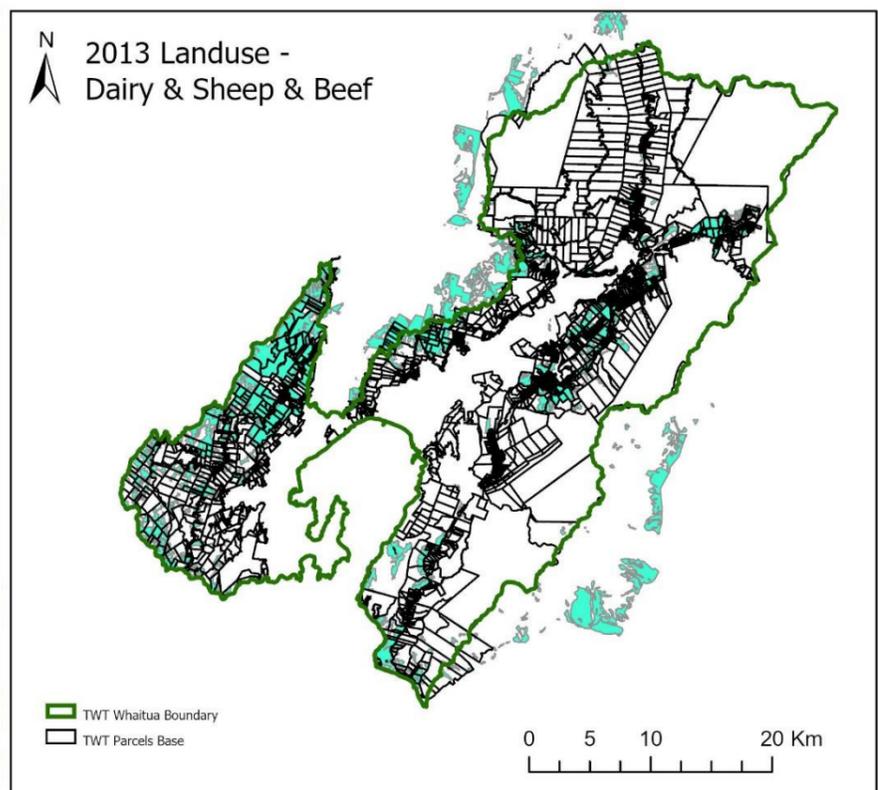
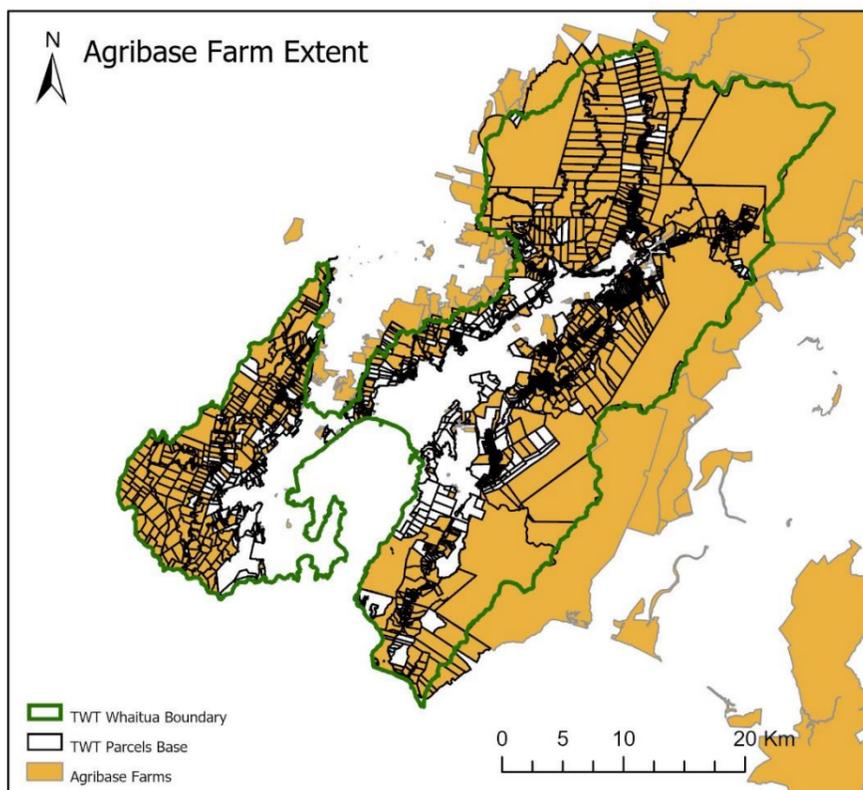
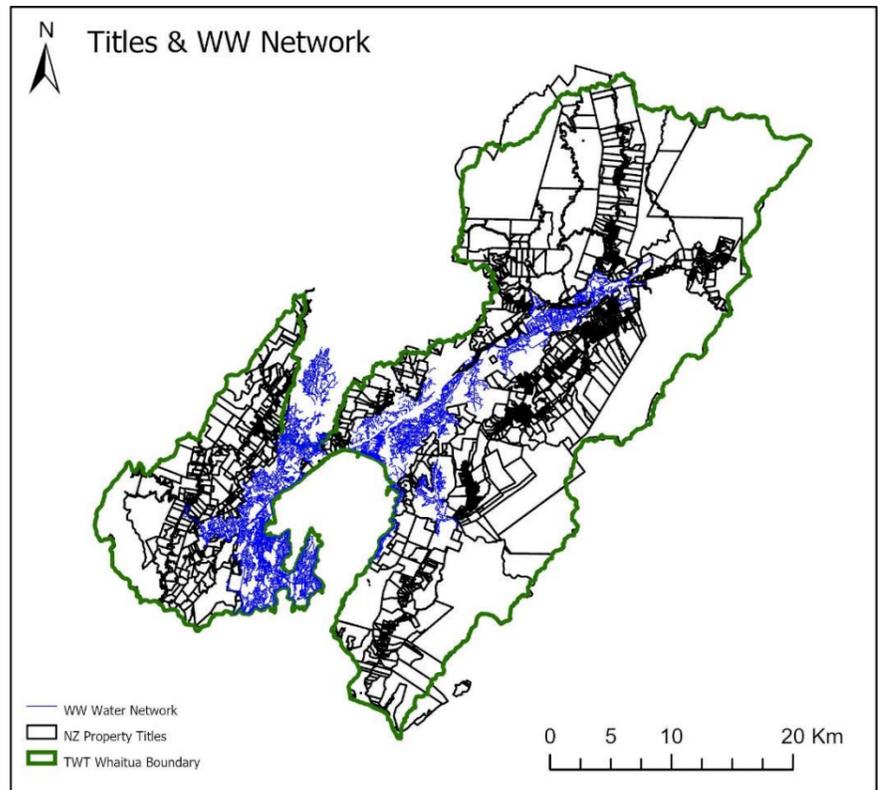
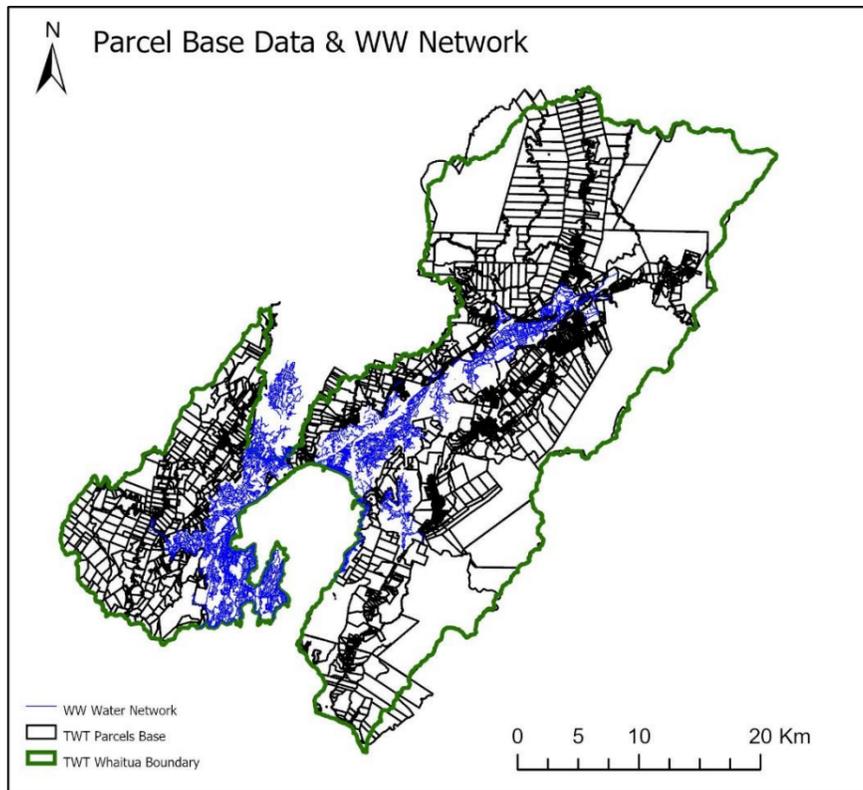
Figure 3 – Permitted Water Allowance

## 5 Model Refinement and Further Analysis

The analysis presented in this report can be refined and extended. Listed below are some considerations:

1. The current model uses parcels as the base data while a future iteration could create and analyse an accurate property layer. This would allow water use to be more confidently assigned to an individual property and would allow the use of REC stream data to better understand rainwater vs surface water abstraction.
2. There is scope to modify land use and stocking rates in the catchment based on proposed or theoretical developments such as dairy conversion or housing subdivision to assess how different development scenarios may affect water abstraction.
3. The permitted water assessment presented here could be compared against the water allocation framework to assess what contribution permitted water use has on-catchment water allocation.

# Appendix A – Base Data Mapping



## Appendix B – GIS Base Layer Metadata

Field	Description
Shape	Geodatabase requirement
id	LINZ CRS Parcel Attribute
appellation	LINZ CRS Parcel Attribute
parcel_intent	LINZ CRS Parcel Attribute
topology_type	LINZ CRS Parcel Attribute
statutory_actions	LINZ CRS Parcel Attribute
land_district	LINZ CRS Parcel Attribute
titles	LINZ CRS Parcel Attribute
survey_area	LINZ CRS Parcel Attribute
calc_area	LINZ CRS Parcel Attribute
NotRetic_TWT	Parcels not on the reticulated network and within the TWT boundary
TWT_ID	Unique ID for joining data
Statistical_Area	2018 Census Statistic Area Used to join density count
Shape_Length	Geodatabase requirement
Shape_Area	Geodatabase requirement
Improvements	Improvement description from the valuation table, used to determine dwelling type
Residence	Is there a residence on the parcel, from the Improvements attribute
Density	Population density per parcel based, joined from the title dataset that divided the number of people in each statistical area by the number of titles
Duplicate_Titles	If the parcel is deemed to be a duplicate of another title. Used to limit domestic water calculations to unique titles and not unique parcels
DomesticWaterUse	Density multiplied by 230L a day
LCDB_Grassland_Area	Area (m2) of LCDB high/low producing grassland intersecting the parcel
Beef_Stock_Rate	Beef stocking rate per hectare from the Agribase farm that the parcel resides in.
Sheep_Stock_Rate	Sheep stocking rate per hectare from the Agribase farm that the parcel resides in.
Deer_Stock_Rate	Deer stocking rate per hectare from the Agribase farm that the parcel resides in.
Dairy_Stock_Rate	Dairy stocking rate per hectare from the Agribase farm that the parcel resides in.
Beef_Water_Use	Beef water use by multiplying the stocking rate by the area of grassland (divided by 10000 to get hectares) and then by 45L a day
Sheep_Water_Use	Sheep water use by multiplying the stocking rate by the area of grassland (divided by 10000 to get hectares) and then by 7L a day
Deer_Water_Use	Deer water use by multiplying the stocking rate by the area of grassland (divided by 10000 to get hectares) and then by 7L a day
Dairy_Water_Use	Dairy water use by multiplying the stocking rate by the area of grassland (divided by 10000 to get hectares) and then by 140L a day
OBJECTID	Geodatabase requirement
affected_surveys	LINZ CRS Parcel Attribute
Total_Stock_Use	Addition of Beef, Sheep, Deer and Dairy water use fields
Agribase_ID	The Agribase ID of the farm the parcel resides in
Landuse_nonAgri	The landuse that the parcel resides in in the absence of Agribase data
Parcels_to_Remove	Parcels in the TWT boundary that should be removed from any calculations (only touching the boundary, road and hydro parcels)
Building_Age	Joined from the valuation dataset used in the septic tank analysis
Well_No	Well number from the GW wells dataset, only Irrigation, domestic, stock and dairy user codes were joined
User_Code	User code for the residing well
REC_Order	Rec order 2 and above that intersects the parcel
Total_title_area	Area of the title as opposed to the parcel, not used
SubCatchment	Subcatchment that the parcel resides in
Building	Does the parcel have a building (has to have resident tag)
Survey_Date	Date added as a result of a spatial join with the LINZ Survey dataset
title_issue_date	The date the title was issued. Use as a proxy for building date where building date data was not present
Septic	Assumed to have a septic tank