

## Scoping Study: Incorporating Regional and TA Boundary Changes into WISE

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**Project team**

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**Product information**

WISE (Waikato Integrated Scenarios Explorer) is an Integrated Spatial Decision Support System (ISDSS) designed especially for the Creating Futures project funded by the New Zealand Foundation for Research, Science and Technology (FRST). WISE has been developed for the Waikato region to support the Waikato Regional Council's long term integrated spatial planning and decision-making. Information about the 'Creating Futures' project is available on the Internet, including an electronic copy of this report: <http://www.creatingfutures.org.nz>.

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# 1 Introduction

During the past four years, Waikato Regional Council (WRC) has lead the Creating Futures (CF) project in which among other things an Integrated Spatial Decision Support System, WISE (Waikato Integrated Scenarios Explorer) has been developed to analyse the impact of policy options and external factors on the future developments in the Waikato Region. About a month after the official closing of the CF project, the Waikato regional boundaries and some internal Territorial Authority (district) boundaries have changed. These changes could not be implemented in WISE during the CF project, because exact information about what the changes were going to be was not available until the changes had actually taken place. Appendix A provides some figures that depict the boundary changes.

This scoping study aims to provide a complete overview of the work that must be carried out to incorporate the boundary changes in WISE, including an estimate of the amount of time required to do that work provided by each involved partner. The required changes to WISE are explained in section 2. Section 3 provides an overview of all tasks, their interdependence, the involved organisations and the amount of work required.



## 2 Required changes to WISE

The changes that are required to update WISE to correctly represent the new regional and district boundaries are described below for each incorporated model. The identified changes only affect input data and model calibration, meaning no changes are required to the mathematical form of the models or the source code that implements this. However, some pre-processing may be required to generate the required input data in a form that can be properly interpreted by WISE. An overview of all tasks is provided in section 3.

### 2.1 Overall (not tied to any specific model)

Updated district maps will have to be generated. This includes a raster map at 200m resolution as well as a vector map, both in NZMG projection, that need to be provided by WRC (Derek Phyn). RIKS can subsequently update the WISE project file (Waikato.geoproj), such that various partners have the ability to verify their updates to data and parameters in WISE.

### 2.2 Climate model

The input maps for the climate model sufficiently cover the modelling area after the boundary changes. Some 'no data' values are present along the boundaries, but these pose no significant impact on the link with hydrology and water quality. Both those models use a linear spatial interpolation of the climate maps to account for the differences in resolution at which the models operate. This interpolation effectively 'smooths out' the 'no data' values.

As the climate maps are provided in a different projection than other maps in WISE, an additional map is provided to indicate the district and region boundaries on top of the climate maps. This layer will have to be updated to account for the boundary changes. This task can be undertaken by WRC (Derek Phyn).

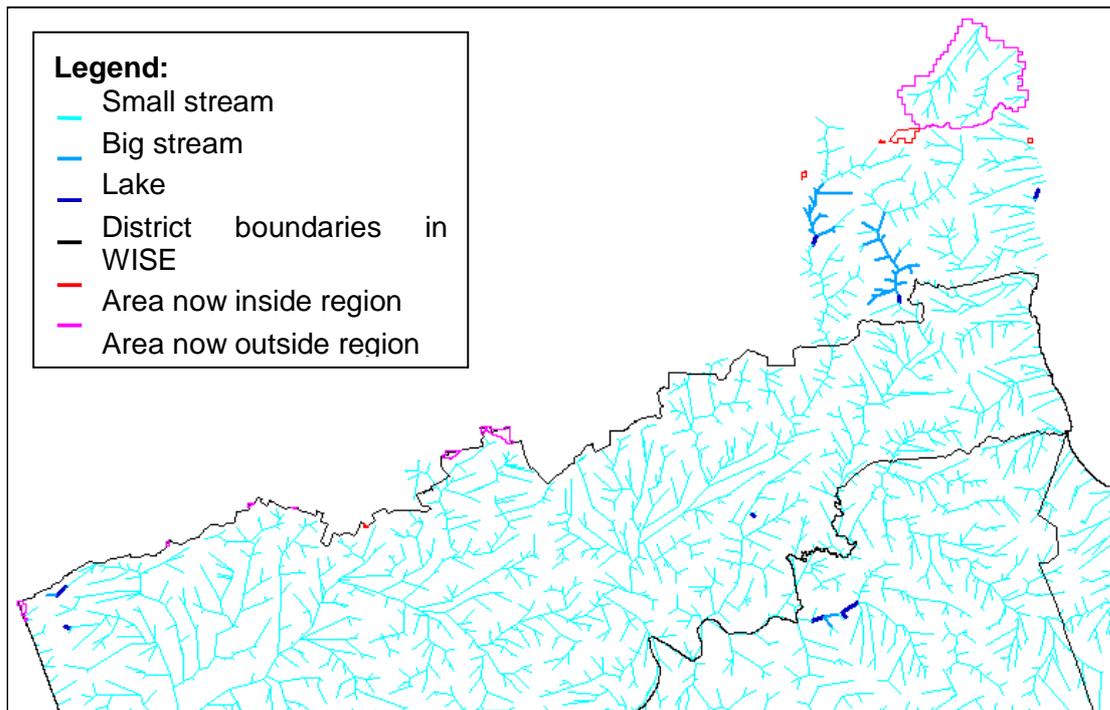
### 2.3 Hydrology model

The flow seasonality map (input) is missing data in some areas that were outside the Waikato region before the boundary changes and are now inside the Waikato region. However, the relevant patches are very small and are outnumbered, both in size and frequency, by the 'gaps' in the input data that are currently observable in WISE. That is, various cells along the region boundary (as currently displayed in WISE) have a 'no data' value in the flow seasonality map, including both land and water areas. In the output maps of the hydrology model, these cells also display a 'no data' value.

Hence, an update of the flow seasonality map is not warranted for the boundary changes per se. However, it can be performed to extend the coverage of the hydrological model to the full regional boundary. The benefit of this task should be weighed against the scoping study that is currently being undertaken to investigate required changes to the hydrological model in WISE.

### 2.4 Water quality model

The river network map (input) covers a small area that is outside the Waikato region boundary after the boundary changes – see figure 1-1, the area outlined in pink. This area features disjoint streams that do not flow into the Waikato region. Hence, these streams can be removed from the input map. This can be done by RIKS. No streams need to be added to cover areas that fell outside the Waikato region before the boundary changes and now fall inside the region – outlined in red in the figure below.



**Figure 1-1** Part of the river network in WISE that is affected by the boundary changes

In accordance with the changes to the input river network, the catchment raster map also needs to be updated. This can be done by RIKS as well, as it only requires the removal of some catchments from the map. Note that this map is only included in the system for displaying; it is not used by the model.

The catchment area lookup-table (input) in WISE needs to be updated to account for the regional boundary changes. This requires input from LCR and RIKS. LCR will generate an intersection of the catchments with the cells in the district raster map (from WRC) and compute surface areas from that intersection. LCR will then provide RIKS a map that assigns a 'pixel index' to each cell in the district raster map that falls within the Waikato region, as well as a table that lists the area (in m<sup>2</sup>) of a cell with specified pixel index that lies within each catchment (identified by its reach id). RIKS will process this information to be incorporated in WISE in order to reduce the required amount of disc space and speed up loading the data.

## 2.5 Economic model

The inputs (and projections) of the economic model will have to be updated to account for the new area inside the Waikato region. This includes initial household consumption, international exports, interregional exports, gross fixed capital formation and changes in inventories. These figures will already be updated by MEL in ongoing work for WRC on the EFM (stand-alone version of the model). Hence, the updated figures only need to be incorporated into WISE by RIKS. Based on these updated figures – including the land-use-to-sector correspondence (labelled "inverse correspondence" in WISE) – and an updated land use map (from LCR), RIKS can also generate the sector-to-land-use correspondence and land productivity in order to assure consistency between the economic and land use model.

## 2.6 Population model

As the population model operates on the scale of TAs it is most heavily affected by the boundary changes. The model will have to be updated to reflect the new district boundaries from 2006 (simulation start year) in order to prevent having to use two models – one for the period 2006–2010 using the old boundaries, and one from 2010 onwards using the new boundaries –, which is difficult to implement in WISE. Consequentially, the population figures for 2006 have to be updated as if the boundary

changes took place before 2006. These data cannot be provided by Statistics New Zealand for single-age categories, meaning they will have to be estimated from data for 5-year age categories at meshblock level. Since the meshblocks are not contiguous with the new regional boundary, some manual adaptations to the data may be necessary. In any case, the data will have to be disaggregated to single-age categories. The generation of the updated population figures for 2006 can be carried out by UoW (Michael Cameron).

The fertility rates, survivorship rates and migration rates will be updated by UoW based on the current calibrated values. UoW can verify that the results of the population model using the updated base population figures and parameters are valid. This can be done in WISE itself or using the stand-alone version of the model, as both models have been verified to provide the same results and the implementation of the model in WISE does not have to be altered.

The initial population density and population proportions will have to be updated. This requires figures from Waikato Regional Council on the average number of people per dwelling in the new Waikato and Hauraki districts, as well as total population figures per district for 2006 from UoW. Using these, in combination with the area of residential land use derived from the updated land use map and district map, RIKS can update the initial population density and population proportions using the same method as is applied in WISE currently.

## **2.7 Land use model**

The land use map for 2006 will need to be updated, as it currently indicates some cells within the new region boundary as 'Land outside study area' or 'Water outside study area'. This can be done by LCR, but will require some updated datasets to be provided by WRC. Note that it is not required for cells outside the new region boundary to indicate one of these land uses. In fact, it is beneficial to the land use model to have a ring (of 8 cells) around the study area with actual land use to prevent edge effect in the calculation of the neighbourhood potential. These cells are not allocated by the model and therefore remain static over the course of a simulation.

The suitability maps will have to be updated in accordance with the updated land use map. It has to be verified that where a vacant land use occurs in the initial land use map, the suitability for that land use is the highest (non-strict) among all vacant land uses. This prevents a vacant land use from changing into another vacant land use in the first time step. Updating the suitability maps can be performed by LCR if the same methodology is applied as has been done for WISE currently. This will require some updated datasets to be provided by WRC.

The zoning plans and interpretation thereof should be updated to reflect the district boundary changes. Though most zones and rules will be the same or similar for the moment, some new zones and rules will have to be added for those areas new to the region. Note that it is possible to delay the incorporation of the updates to zoning if desired.

The infrastructure networks incorporated in WISE do not have to be updated, as they sufficiently cover the area of the new Waikato regional boundary. However, the calibration of accessibility, as well as the neighbourhood rules will have to be verified against the updated land use map. This can be performed by WRC (Derek Phyn).

## **2.8 Terrestrial biodiversity model**

The LENZ map and protected areas map need to be updated to include the full Waikato region under after the regional boundary change. This requires LCR to make a cut-out of the national maps.

### 3 Overview of tasks

The table below presents an overview of all tasks required to update WISE to account for the changes in regional and TA boundaries. The tasks are denoted in the order in which they must be performed. Where one task is dependent on another, this is denoted in the 'Predecessor' column.

Task	Predecessors	Organisation	Person(s)	Estimate of work (hours)
1. Generate district raster map @200m		WRC	Derek Phyn	2
2. Generate district boundaries vector map in NZMG		WRC	Derek Phyn	1
3. Generate district boundaries vector map in NZGD1949.		WRC	Derek Phyn	1
4. Generate updated Waikato.geoproj file	1,2,3	RIKS	Jelle Hurkens	2
5. (Optional) Update flow seasonality map		NIWA	Ross Woods; Jochen Schmidt	
6. Generate updated datasets used as input for land use map and suitability maps	1,2	WRC	Derek Phyn	24
7. Generate updated land use map for 2006	1,6	LCR	Daniel Rutledge; Robbie Price	24
8. Generate updated suitability maps	1,6,7	LCR	Daniel Rutledge; Robbie Price	24
9. Generate catchment area lookup table and associated 'pixel index' raster map	1	LCR	Daniel Rutledge; Robbie Price	16
10. Generate updated LENZ and protected areas map	1	LCR	Daniel Rutledge; Robbie Price	8
11. Miscellaneous work LCR		LCR	Daniel Rutledge; Robbie Price	16
12. Provide initial population figures per district; update population parameters; verify population model results	2	UoW	Michael Cameron	24
13. Provide updated figures for initial household consumption, international exports, interregional exports, gross fixed capital formation and changes in inventories.	1,7,12	MEL	Garry McDonald	0
14. Update sector-to-land-use correspondence and land productivity	13	RIKS	Jelle Hurkens	1
15. Generate updated zoning plans and enter information in WISE	4,7	WRC	Derek Phyn	24
16. Verify land use model calibration	8,14,15	WRC	Derek Phyn	4

Task	Predecessors	Organisation	Person(s)	Estimate of work (hours)
17. Generate catchment area lookup table for input in WISE	9	RIKS	Jelle Hurkens	2
18. Remove streams outside Waikato region from input river network; update catchments raster map accordingly	2	RIKS	Jelle Hurkens	2
19. Provide figures for average number of people per dwelling per district	12	WRC	Derek Phyn	8
20. Generate initial population density and population proportions figures	19	RIKS	Jelle Hurkens	1
21. Verify and incorporate all updated model input in WISE	all above	RIKS	Jelle Hurkens	8

### 3.1.1.1 Planning

Ideally the tasks above could be performed within a timeframe of 2 months. However, this may not be attainable depending on availability of each of the involved organisations. In such a case, it is worthwhile to consider phasing the work. While there are a lot of tasks that need to be performed by different partners, there are also a lot of interdependencies between tasks, which means that there are only a few possibilities to incorporate the various updates in WISE in phases. The major tasks are: updating land use and suitability maps; updating the population figures; and updating the zoning information. It is possible to delay the incorporation of updated zoning information to a second phase, though this will imply that also a verification of the calibration of the land use model will have to be postponed, or has to be performed twice: once after the incorporation of various updated, excluding zoning; and once after updated zoning information has been incorporated.

The updates to the population model can be phased, but this would require extra work and would imply that both the old and new boundaries are present in WISE until the population model has been updated completely. The population model as it is currently available in WISE could be used until an updated model is available. This would require the district raster map as currently incorporated in WISE to be altered (by WRC) to represent the new boundary between the Waikato and Auckland regions without the new boundaries of the Hauraki and Waikato districts being incorporated, such that the Franklin district will remain present in the system. The affected areas in the Franklin district contain a few residential cells, meaning the population density and population proportions have to be updated to ensure model consistency (tasks 20–21). These tasks would therefore have to be performed two or three times in total if this option is selected: once when the updated districts map is incorporated, possibly once again when the updated land use map is incorporated (depending on whether residential cells are affected by the update) and finally when the updated population model is incorporated. Before the last step, it may be useful to display both the district boundaries as used by the land use model (including Franklin) and the new district boundaries (though not used by the model).



# Figures

This appendix provides some figures to illustrate the boundary changes that have taken place.

In the map in Figure A-1, the red dashed line is the old Waikato boundary and the solid blue line is the new boundary. The background displays the land use map from WISE. This figure also shows:

- The land that was originally outside the study area but is now inside (red fill – might be hard to see as the patches are quite small).
- The land that was originally inside the study area but is now outside (pink).
- The marine area that was originally outside the study area but is now inside (blue fill).
- The marine area that was originally inside the study area but is now outside (light blue).

In the map in Figure A-2, the thin red lines show the old district boundaries and the thick black lines show the new district boundaries. What used to be the Franklin district has been split between the neighbouring Auckland Council – i.e. not in Waikato Region – and the Waikato and Hauraki Districts. The “Marine District”, which is under the Waikato Regional Council’s administration, has also changed.

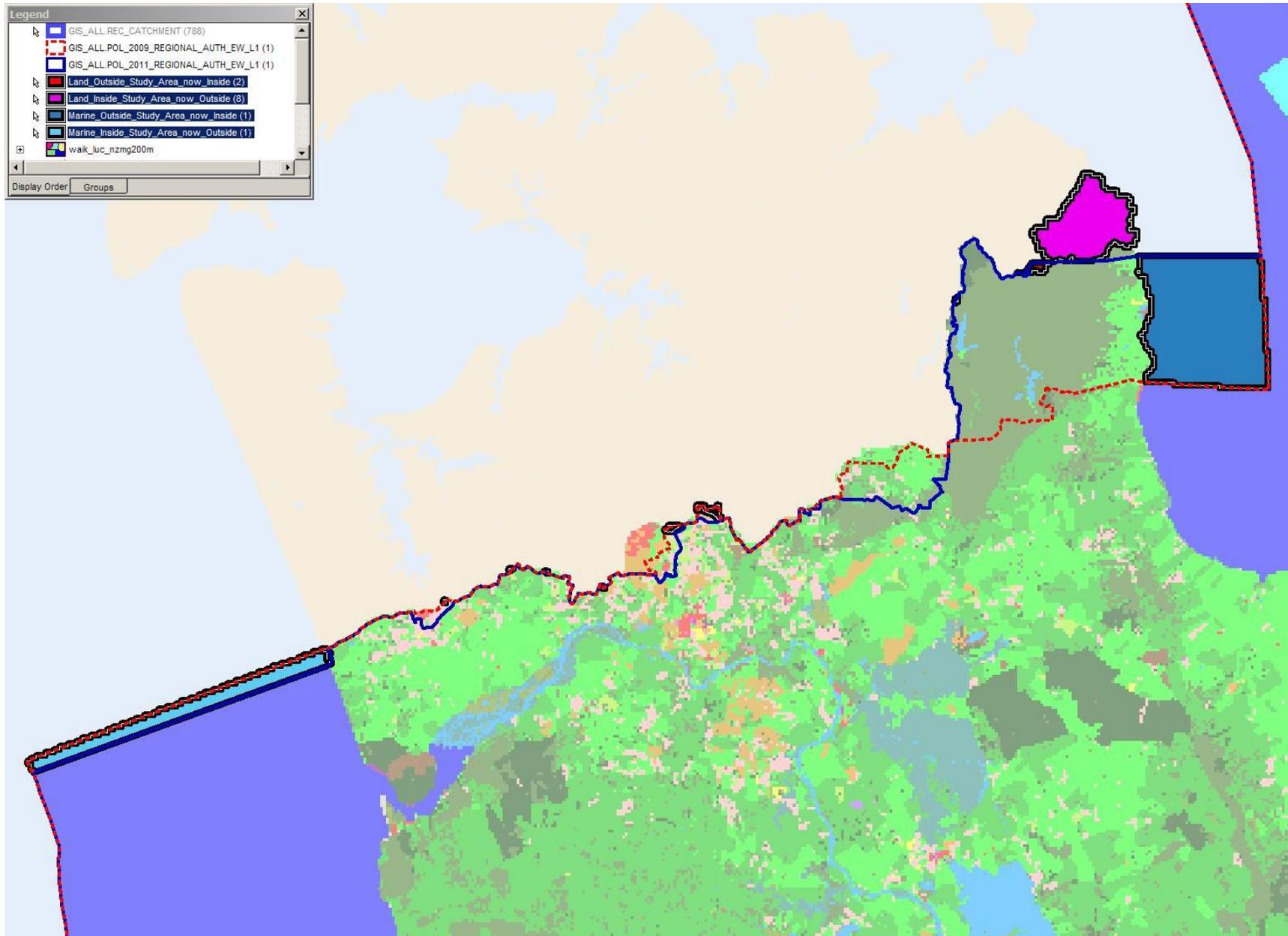
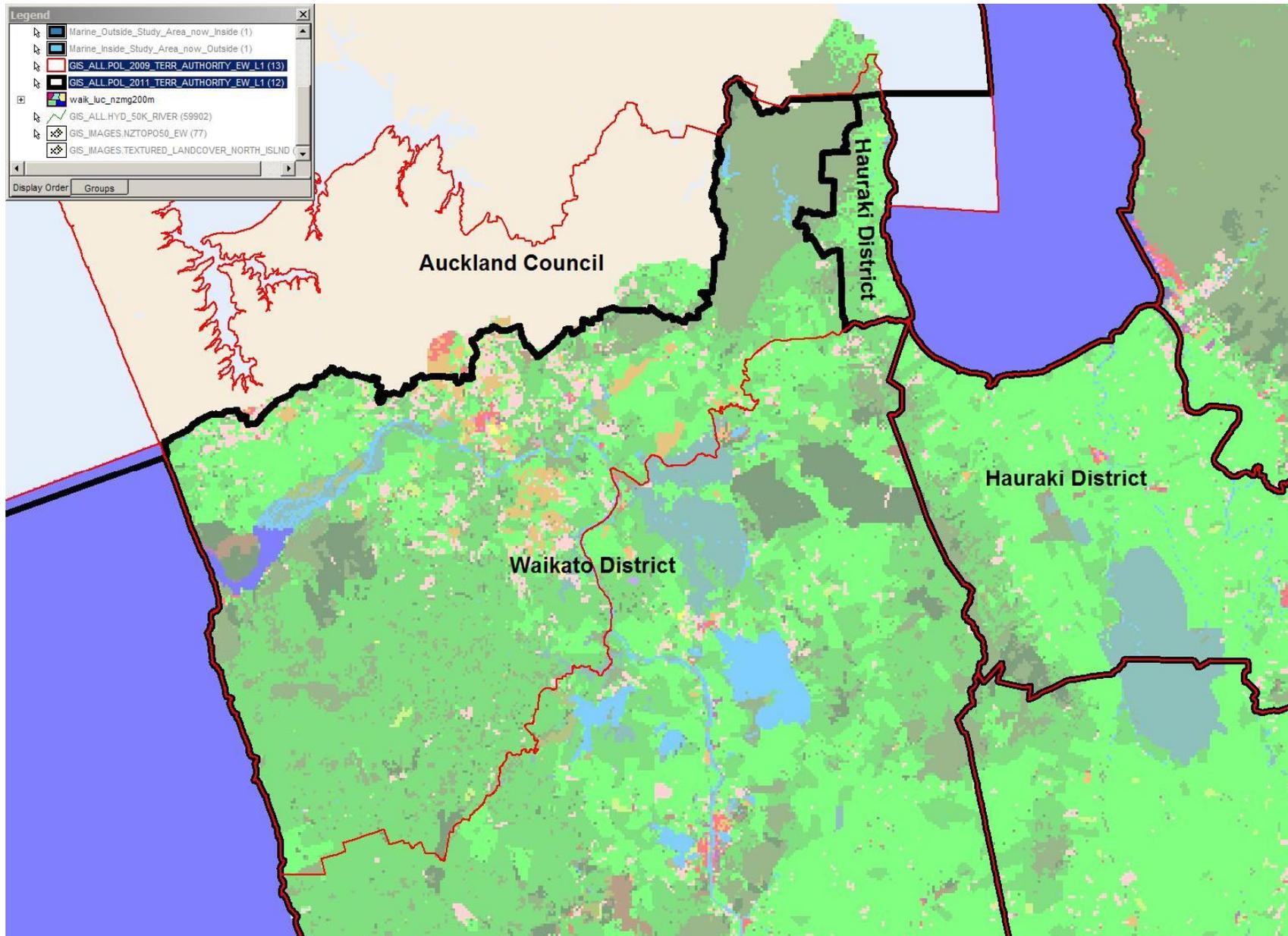


Figure A-1 Overview of changes to the Waikato regional boundary



**Figure A-2** Overview of changes to the TA (district) boundaries

