Table of Contents

Waikato Population and Economic Projections Meeting Minutes
Held on 19 April 2021

Attendees	Apologies
Aidan Smith – Taupo District Council Alan Moss – South Waikato District Council Amy Trigg – Waikato Regional Council Andrew Hoffmann – Waikato Regional Council Julie Ballantyne - Stantec Beat Huser – Chair – Waikato Regional Council Blair Keenan – Waikato Regional Council Craig Briggs – Waikato Regional Council David Totman – Waipa District Council Dennis Turton – Trust Waikato Donna Tracey – Waikato District Council Ernst Zollner – Ministry of Housing & Urban Development Garry McDonald – Market Economics Ltd Jackie Botha – Waikato Regional Council Jacqueline Henry – Waikato Regional Council Jojo Valero – Auckland Transport Katpaham Kasipillai – Waikato District Health Board Kimberley Atkins – South Waikato District Council Lana Gooderham – Hamilton City Council Mark Davey – Waikato District Council Mark Tamura – Waikato Regional Council Michael Cameron – University of Waikato Michael Hurley - Ministry of Housing & Urban Development Michelle Hollands – Te Waka Nichola Lennard – Ken Tremaine Consulting Ltd Nicholas Smith – Ministry for the Environment Pascal Cheon – Market Economics Ltd Paul Bowden – South Waikato District Council Peter Winder – McGredy Winder & Co Rebecca Thorby – Sport Waikato Shaun Lion-Cachet – Waipa District Council Susan Henderson – GMD Consultants Tony Fenton – Alchemists Ltd Upananda Paragahawewa – Waikato Regional Council Vishal Ramduny – Waikato District Council	Alejandro Cifuentes – Waikato Regional Council Angela Smith - Ministry of Housing & Urban Development Gary Knighton – Waipa District Council Greg Carstens – Hamilton City Council Hedwig van Delden – Research Institute of Knowledge Systems Luke O'Dwyer - Hamilton City Council Nathan Dalgety - Hamilton City Council Nick Carroll – Taupo District Council Rebecca Maplesden – Ministry of Housing & Urban Development Ruth Buckingham – Waikato Regional Council Sally Baguley – Ministry for the Environment

Introduction	**Beat Huser**

- The new projections presented today are based on the 2018 Census and will update and replace the previous projections that were based on the 2013 Census.
- The purpose of the Waikato projections is to provide a consistent, robust and shared datasets to support regional and local planning and decision making in the Waikato region.
- The projections parameters to be delivered, including the methods to be used, were identified, and agreed by the Projections Working Group consisting of all the TAs, some Government agencies (e.g., Waka Kotahi), before contracting the various agencies to do the modelling.

- All projected parameters (land use, population, household, labor force, employment and economic production/value-added) include regional/TA/SA2 level data (SA2 represent geographical areas of 2-6,000 people, communities that interact together socially and economically).
- Time horizon 50 years – 2018-2058.
- Three Scenarios: low, medium, high – describe plausible futures.
- Uncertainty increases the smaller the spatial scale (more in SA2 than districts) and the further out in time (we project 50 years. The focus should be on the next 10-30 years.
- Data and reports are available from website: www.creatingfutures.org.nz/waikato-projections-demographic-and-economic/2018-projections-outputs/
- An interactive and user-friendly web-based tool to search, analyse, visualisation and download projection data is currently being developed and will be available from the website by May 2021.
- Beat thanked the expert modellers from the different agencies for their fabulous efforts working in an interdisciplinary team and to an extremely tight deadline (due to significant delays with release of 2018 Census data).
- Equally important – and a critical factor for the robustness of the projections – was the assistance from TA staff to provide local data, information, their experience and knowledge in a timely manner.

Overall process and land use projections	**Tony Fenton**

- We updated the WISE model from the previous version to the current New Version 1.6. Essentially that involved upgrading the data inputs to 2018 start date.
- Revised the zoning layer, the accessibility layer, the facilities layer and the population model and its key things.
- Just before we ran the projections, went around the TAs, and asked for each area's near-term growth expectations. Now to 5 years and then a 5-to-10-year, including current consents for developments are in place, or the new areas that were being planned to be developed by developers in the near term.
- This is new process this time around to try and ensure that the initial start of the model, represented more closely what was in the pipeline for development rather than just relying on the WISE model~~,~~ to sort of guess where those were.
- The draft projections were sent out to all the TAs mid last year for input into whether there were any anomalies or issues with how we went about creating the land use layer. The processes have all been manually corrected and that ended up being the final Land Use layer. The Census results also feeds into the model and is updating the population and economic data.

Demographic projections	**Michael Cameron**

The population projections model:

- Adopts a 'bottom-up approach'.
  - In contrast with the 'top-down' approach of Stats NZ
- Projects population into the future for all TAs in New Zealand (except Chatham Islands Territory)
  - By single-year-of-age (up to 100+) and gender
- 2018 TA-level boundaries
- Base populations are the 2018 Estimated Resident Populations (ERP) on 30 June 2018
- Annual timesteps

The standard cohort component method (CCM)The population usually resident in area ~~i~~at the end of year

- The population usually resident in area "at the beginning of year"
- births to mothers residing in area "during year"
- deaths of residents of area "during year"
- inward migration from other regions into region "during year"
- outward migration of residents from area "to other regions during year"

- inward migration from overseas into region "during year"
- outward migration of residents from area to overseas "during year"

Data

- All national and subnational data were sourced from Statistics New Zealand (SNZ)
- Five-yearly Census of Population and Dwellings (1991, 1996, 2001, 2006, 2013, and 2018)
- SNZ national and subnational population estimates
- National and subnational period life tables
- National and subnational vital statistics data
- SNZ subnational demographic projections series, and the reported assumptions underlying those projections.

Assumptions – Fertility and mortality

- Fertility is based on the SNZ 2013-base subnational population projections assumptions.
    1. Scaled downward to better capture the trends in fertility over the period from 2017-2020
    2. The fertility rate for each territorial authority was assumed to follow the SNZ projections to 2043 then remain invariant after 2043.
- Mortality (survivorship) is based on the SNZ 2013-base subnational population projections assumptions.
    1. Life expectancy at birth for each territorial authority was assumed to follow the SNZ projections to 2043, then continue to improve in a linear fashion through until 2068.

Internal migration model

- We derive the internal migration flows using a gravity model.
    1. Estimated using 2013 and 2018 Census data on internal migration flows, population estimates, and inter-TA distances.
- Overall, the model explains around 84.9% of the variation in internal migration flows.
- This model is them embedded within the population model.
- This gives a measure of total internal migration flows, that are given an age-sex distribution based on in-migration profiles derived from 2018 Census data.

International Migration Assumptions

- International migration flows (emigration and immigration) are projected using an error correction model.
    1. This model takes a long-run average level of immigration and emigration, and 'decays' deviations from that long-run average over time, until the flows reach the average.
    2. The long-run average for both immigration and emigration was taken as the average annual level over the period from 1990-2020
- This gives a measure of total international migration flows.
    1. These are then distributed based on shares of population, that are modified to account for the fact that Auckland has a smaller share of emigration than expected, and Auckland, Hamilton, Wellington, Christchurch, and Queenstown-Lakes have a higher share of immigration than expected.
    2. These flows are given an age-sex distribution based on immigration and out-migration profiles derived from 2018 Census data.

The impact of the coronavirus pandemic

- We assume no change in fertility, mortality, or internal migration flows.
- We assume total immigration flows that are initially 82.6 percent lower than trend, and emigration flows that are 76.5 percent lower than trend.
- This is based on a comparison of migration flows from April to September 2020, compared with flows one year earlier.

Low-variant and high-variant projections

- Fertility (+/- 5%); constant across all TAs
- Mortality (+/- 2%); constant across all TAs
- International migration flows (+/- 10%); constant across all TAs
- No change in the internal migration model

Interpreting the projection scenarios

- There are two ways to interpret the scenarios:
    1. The medium-variant scenario represents approximately the center of the distribution of all potential scenarios generated with this model and within the plausible distribution of assumptions. The interval between the low-variant and high-variant projections should be expected to capture the actual future population approximately 67 percent of the time.
    2. The low-variant projection is broadly representative of the bottom one-third of all potential scenarios generated with this model and within the plausible distribution of assumptions, the medium-variant projection is broadly representative of the middle one-third and the top one-third.

Economic projections	**Gary McDonald**

Caveats

- We are not able to predict the future!
- Our results represent three 'plausible' scenarios (low, medium & high), underpinned by population, consumption, trade, capital formation, and land use-economy dynamics.
- Uniquely consider both ***supply*** and ***demand***, accounting for spatial interaction, zoning, land suitability and infrastructure accessibility, large investment and aspirations
- Development of SA2 projections is notoriously difficult, particularly at the 1D ANZSIC level.

Economic projections

- *2018-68 Employment* by 1-digit ANZSIC 2006 for RC, TA and SA2 areas as measured in Modified Employment Counts (MECs)
- *2018-68 Value added* by 1-digit ANZSIC 2006 for RC, TA and SA2 as measured in $\$_{2018}$m equivalents.
- Based on the 48 economic industries of WISE 1.6, with a 2018 base
- 242 SA2s x 20 industries (1D ANZSIC) x 50 years (2018-2068) x 3 projection series (low, medium, high) = 726,000 data points each for both *Employment* and *Value added*

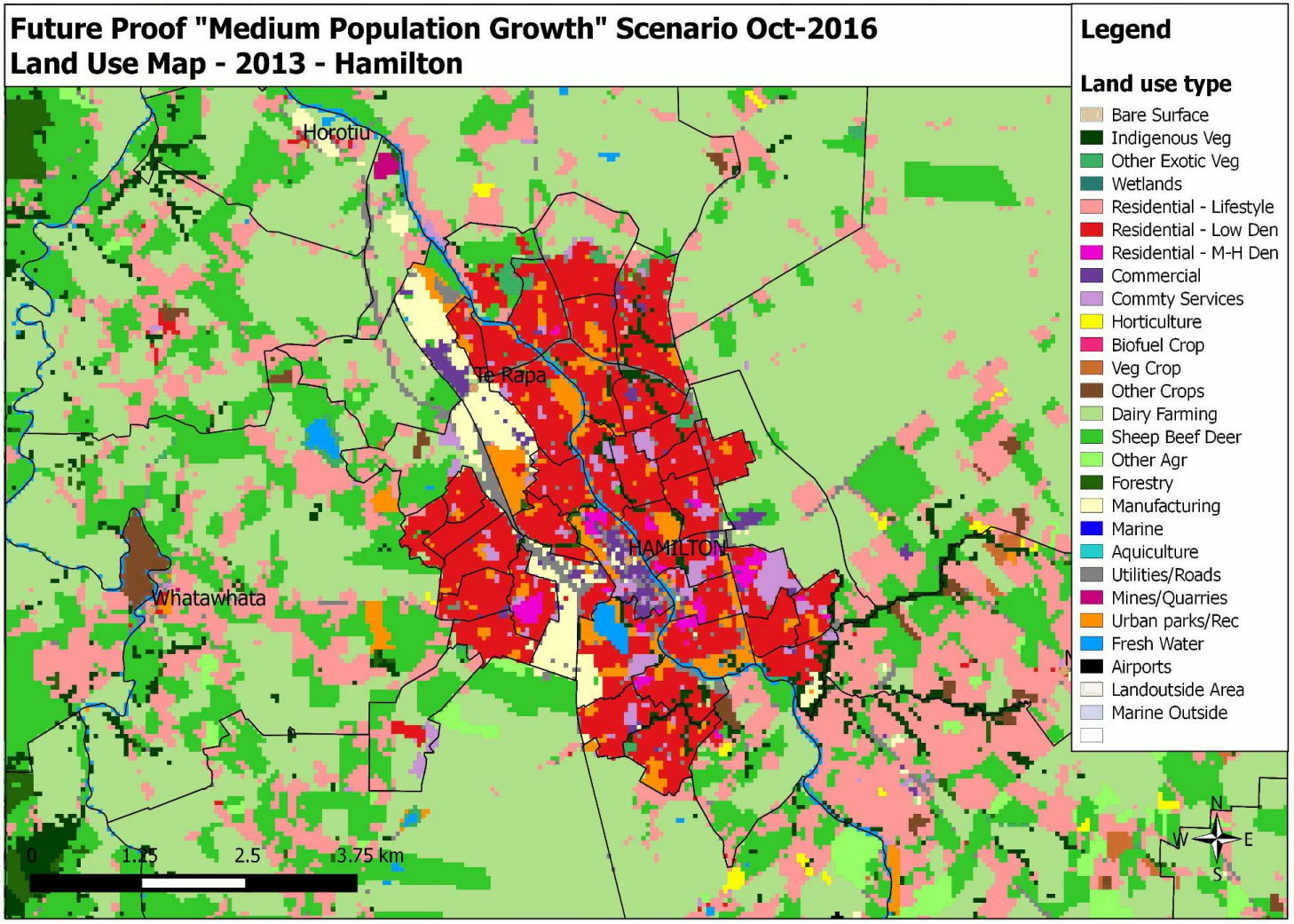
SA2 projection method

- SA2 employment projections for 1D ANZSIC were generated using statistical methods to:
    1. Identify important trends within the data and ranks them by transforming the base data.
    2. Runs regression analysis on identified trends.
    3. Project future outcomes
    4. Transform projections back into base data equivalents.

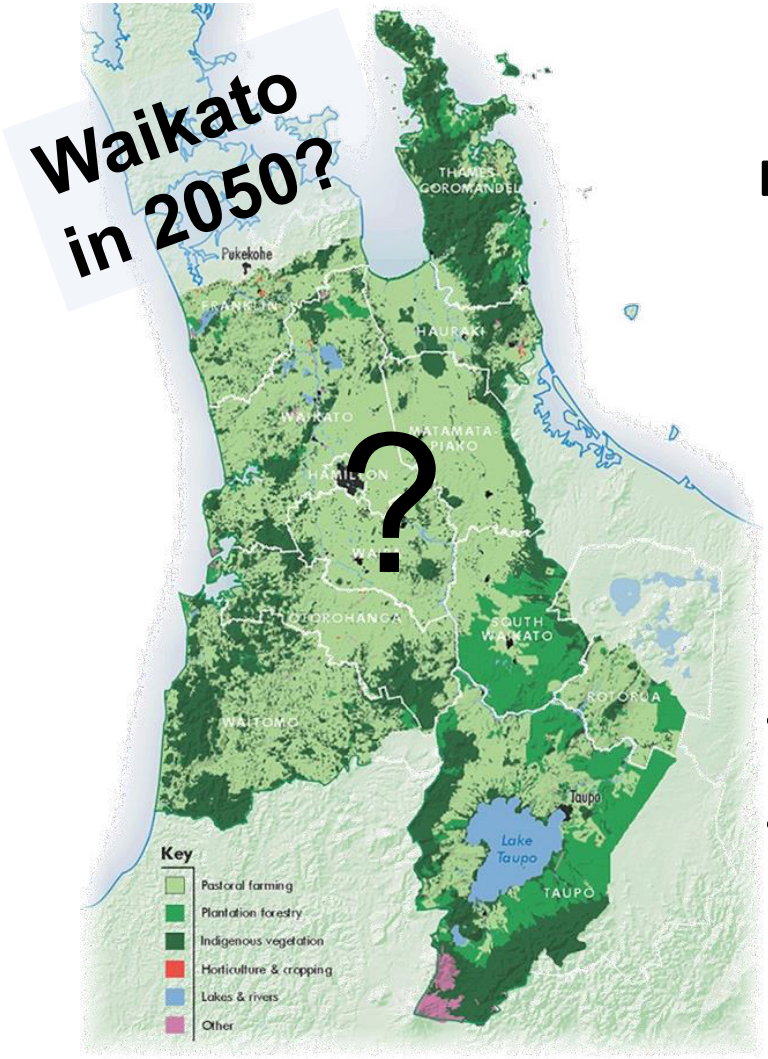
Waikato Projections 2018-2068

Purpose

Shared and robust evidence-base to support collaborative and consistent planning and decision-making



What Projections?



By TA / SA2 *(small area units: 2,000 - 6,000 people)*

- Land Use (by 25 land use classes, 100mx100m)
- Population (by gender/age cohorts; *SA2 total)*
- Households (by type; *SA2 total)*
- Labour force
- Employment
- Value Added ($m)

Time horizon: 50 years (2018-2068, 1-year steps)

Three scenarios: low, medium, high

Projection data and reports

Creating Futures : WISE

Search Go

Download WISE Contact Us

- Home
- WISE
- Reference Scenario
- Waikato Projections
  - Projections Group
  - 2018 Projections Outputs
  - 2013 Projections Outputs
- Case Studies
- Resources
- What's New

2018 Projections Outputs

Base Data for Projection Parameters based on Low,Medium and High growth projections

Data by Territorial Authority:

Note: regional projections include only part of Rotorua, Taupo and Waitomo that are in Waikato region. TA projections include total TAs, except for Rotorua (only part that is in Waikato region).

- Population (Low, Medium and High)
- Households (Low, Medium and High)
- Labourforce (Low, Medium, High)
- Employment and Value Add (Low, Medium, High)
- Land use (Low, Medium, High)

Data by Statistical Area (SA2):

- Population, Households and Labourforce
- Employment and Value Add (Low, Medium, High)
- Land use (Low, Medium, High)

Other Data:

Document on Projections Comparisons (comparing Waikato and Stats NZ estimates and projections).

Stats NZ final subnational population estimates 2018 (released 23 Sept 2020) - these are the base data used for the Waikato Projections 2018-2068.

Stats NZ subnational population projections 2018-2048 (at TA level, Stats NZ does not produce SA2 level population projections until later in 2021, and household projections in 2022).

Projection Reports:

Draft Reports:

- Population, Household and Labourforce projections_TA report - DRAFT
- Population, Household and Labourforce projections SA2 report - DRAFT 23 April
- Employment and Value Add projections TA and SA2 - DRAFT 20 April
- Land Use Projections TA and SA2 - DRAFT

Final reports on the Projection methodology will be available shortly

FAQ - Population Projections

FAQ - Household Projections

Interactively View and Manipulate Projections Data

www.creatingfutures.org.nz

In progress

Agenda

11.10 **Overall process, and Land Use projections** – (20min)

Tony Fenton, Alchemists Ltd

6

11.30 **Demographic projections** – (15min)

Michael Cameron, University of Waikato/NIDEA

11.45 **Economic projections** – (15min)

Garry McDonald & Pascal Cheon, Market Economics

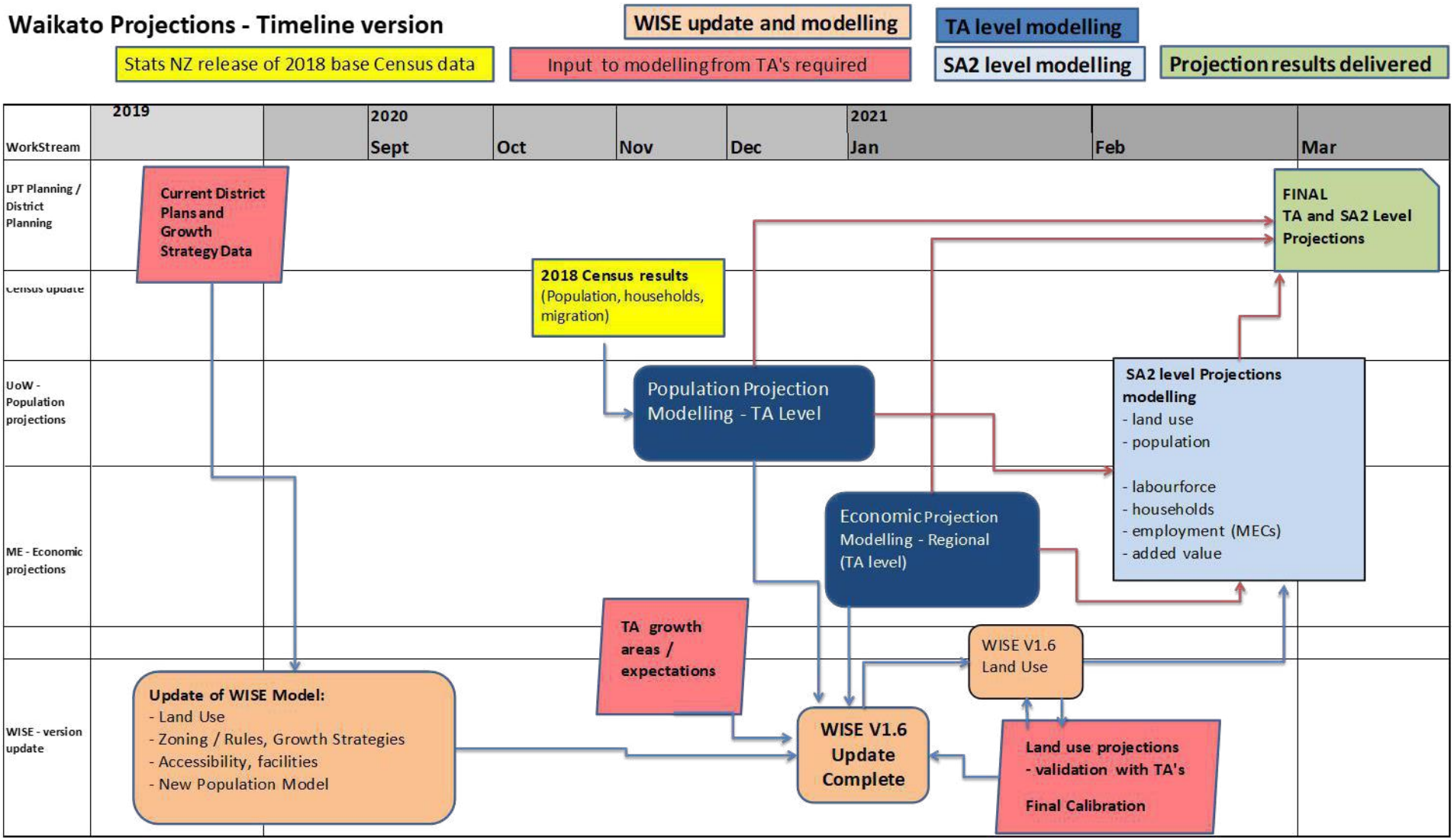
12.00 **Q & A session at the end** (30min)

[13.00 **Discussion with Future Proof Councils]**

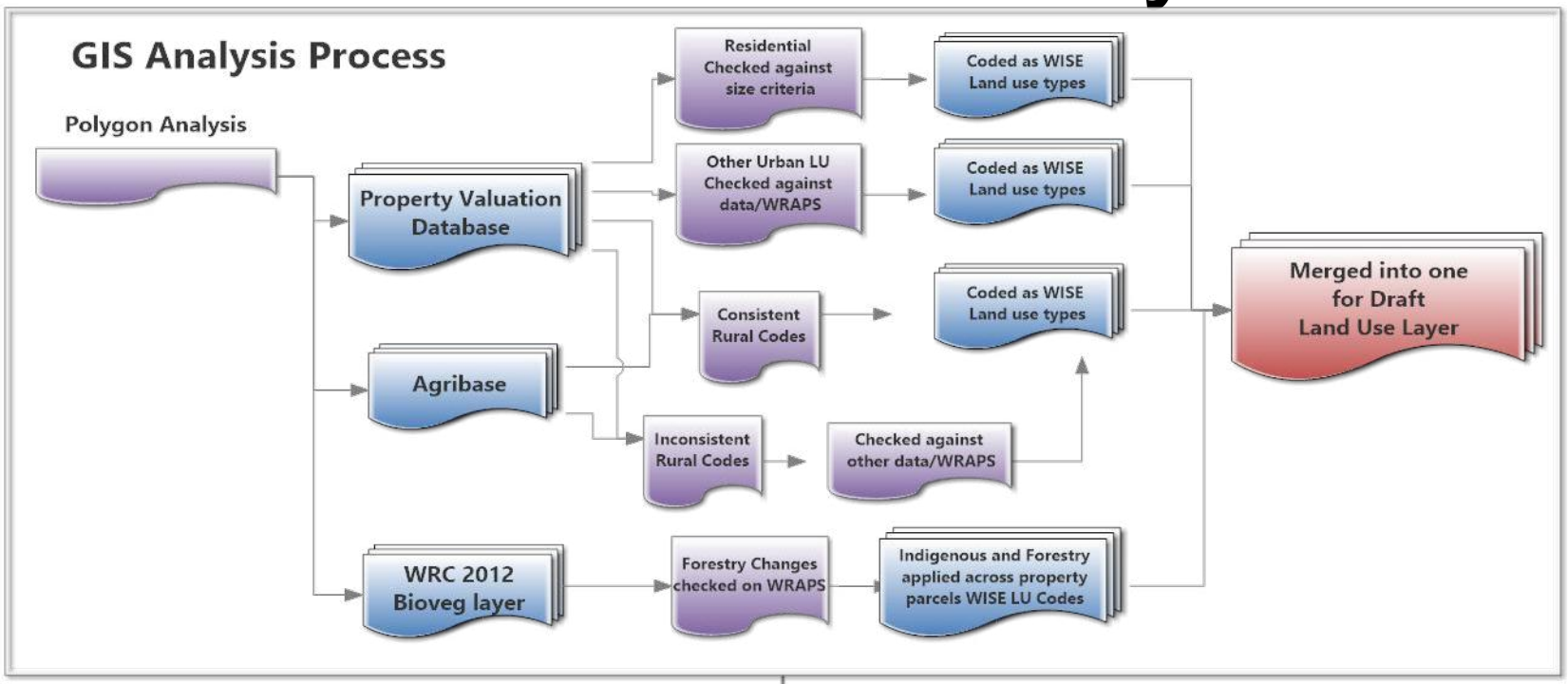
<u>Each projection topic to discuss:</u>

- Methodology
- Key assumptions used
- Main findings and trends, any surprises
- Main changes from previous projections (2013 Census)

Update Process



2018 Land use layer

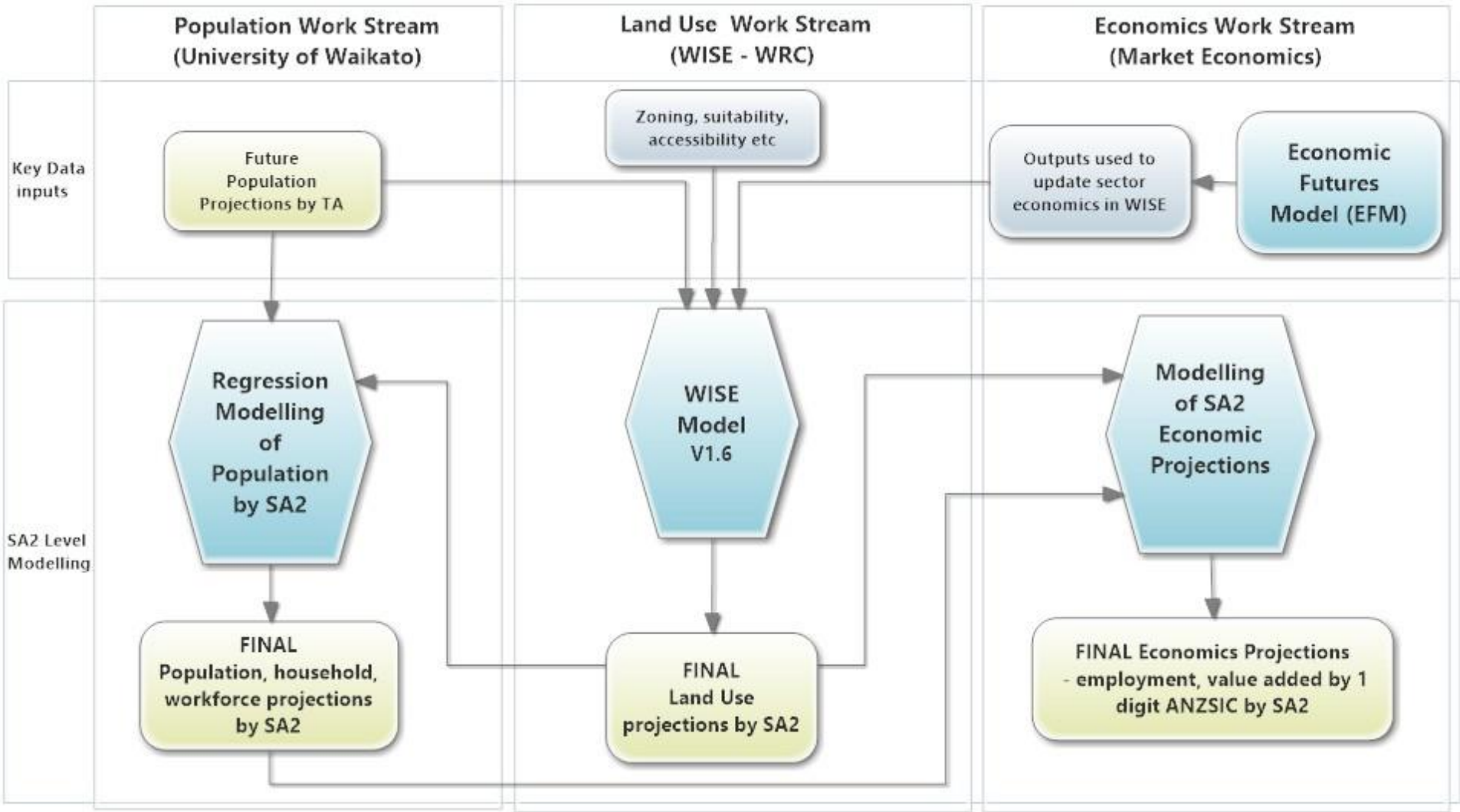


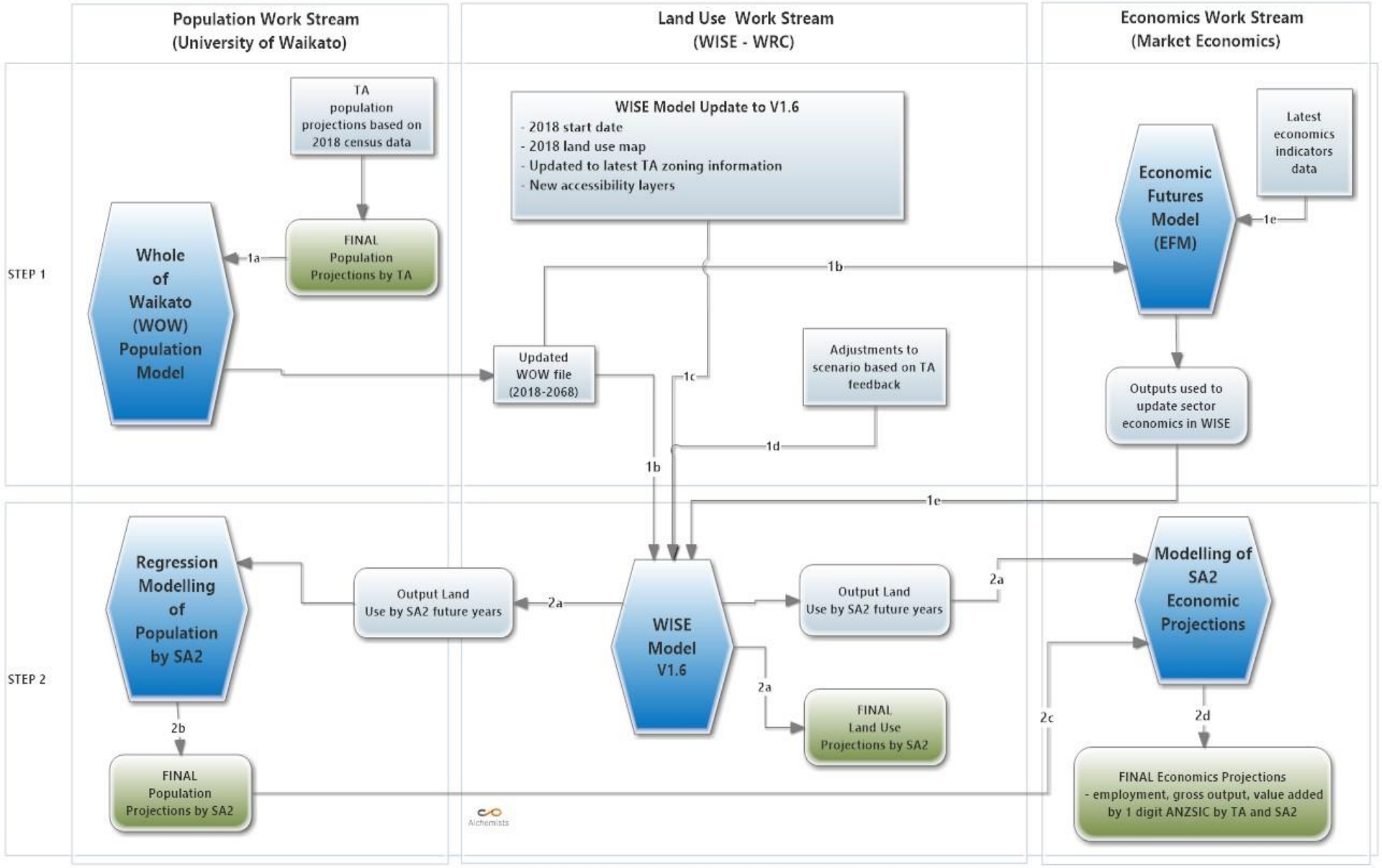
Validation with input from TA's - Draft data Layer loaded onto LASS Portal for access by TA's

Manual Corrections

Any anomalies identified are corrected manually based on:
- Feedback from TA's
- Map comparison analysis of 2013 and 2018 layers
- Other manual cross checking and comparison with aerial photos

Projections Process – Data Links




Population Work Stream
(University of Waikato)
Land Use Work Stream
(WISE - WRC)
Economics Work Stream
(Market Economics)
STEP 1
STEP 2
TA population projections based on 2018 census data
FINAL Population Projections by TA
Whole of Waikato (WOW) Population Model
1a
WISE Model Update to V1.6
- 2018 start date
- 2018 land use map
- Updated to latest TA zoning information
- New accessibility layers
Updated WOW file (2018-2068)
1b
1c
1d
Adjustments to scenario based on TA feedback
Economic Futures Model (EFM)
Latest economics indicators data
1e
Outputs used to update sector economics in WISE
Regression Modelling of Population by SA2
2b
FINAL Population Projections by SA2
Output Land Use by SA2 future years
2a
WISE Model V1.6
Output Land Use by SA2 future years
FINAL Land Use Projections by SA2
Modelling of SA2 Economic Projections
2c
2d
FINAL Economics Projections
- employment, gross output, value added by 1 digit ANZSIC by TA and SA2
Alchemists

Waikato Demographic Projections 2018-2068

Michael P. Cameron

University of Waikato

19 April 2021

The population projections model

- Adopts a ‘bottom-up approach’
  - In contrast with the ‘top-down’ approach of Stats NZ
- Projects population into the future for all TAs in New Zealand (except Chatham Islands Territory)
  - By single-year-of-age (up to 100+) and gender
- 2018 TA-level boundaries
- Base populations are the 2018 Estimated Resident Populations (ERP) at 30 June 2018
- Annual timesteps

The standard cohort component method (CCM)

- The population usually resident in area *i* at the end of year t

=	The population usually resident in area i at the beginning of year *t*
+	births to mothers residing in area *i* during year *t*
–	deaths of residents of area *i* during year *t*
+	inward migration from other regions into region *i* during year *t*
–	outward migration of residents from area *i* to other regions during year *t*
+	inward migration from overseas into region *i* during year *t*
–	outward migration of residents from area *i* to overseas during year *t*

Data

- All national and subnational data were sourced from Statistics New Zealand (SNZ)
  - Five-yearly Census of Population and Dwellings (1991, 1996, 2001, 2006, 2013, and 2018)
  - SNZ national and subnational population estimates
  - National and subnational period life tables
  - National and subnational vital statistics data
  - SNZ subnational demographic projections series, and the reported assumptions underlying those projections

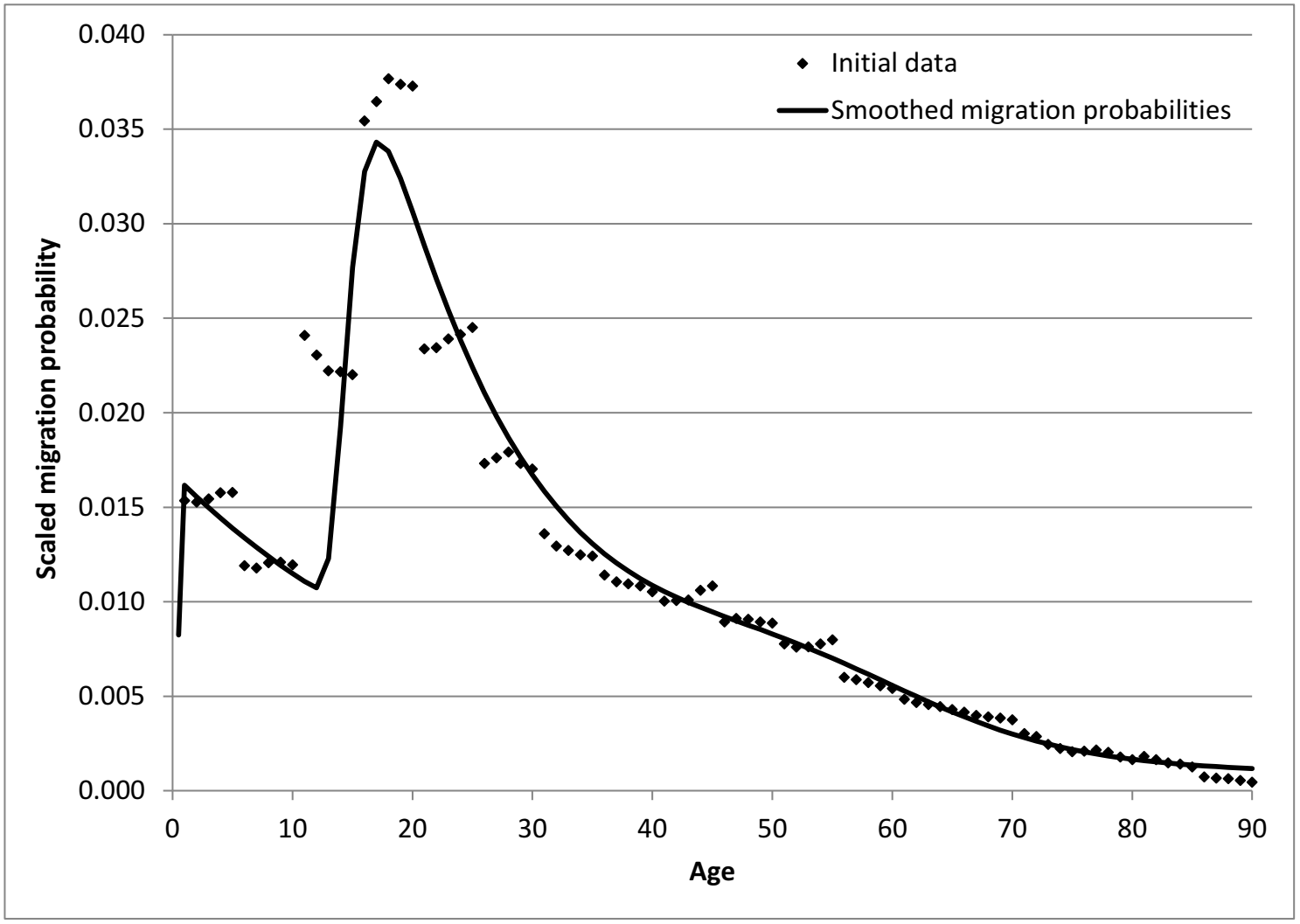
Assumptions – Fertility and mortality

- Fertility is based on the SNZ 2013-base subnational population projections assumptions
  - Scaled downward to better capture the trends in fertility over the period from 2017-2020
  - The fertility rate for each territorial authority was assumed to follow the SNZ projections to 2043 then remain invariant after 2043
- Mortality (survivorship) is based on the SNZ 2013-base subnational population projections assumptions
  - Life expectancy at birth for each territorial authority was assumed to follow the SNZ projections to 2043, then continue to improve in a linear fashion through until 2068

Internal migration model

- We derive the internal migration flows using a gravity model
  - Estimated using 2013 and 2018 Census data on internal migration flows, population estimates, and inter-TA distances
- Overall, the model explains around 84.9% of the variation in internal migration flows
- This model is them embedded within the population model
- This gives a measure of total internal migration flows, that are given an age-sex distribution based on in-migration profiles derived from 2018 Census data

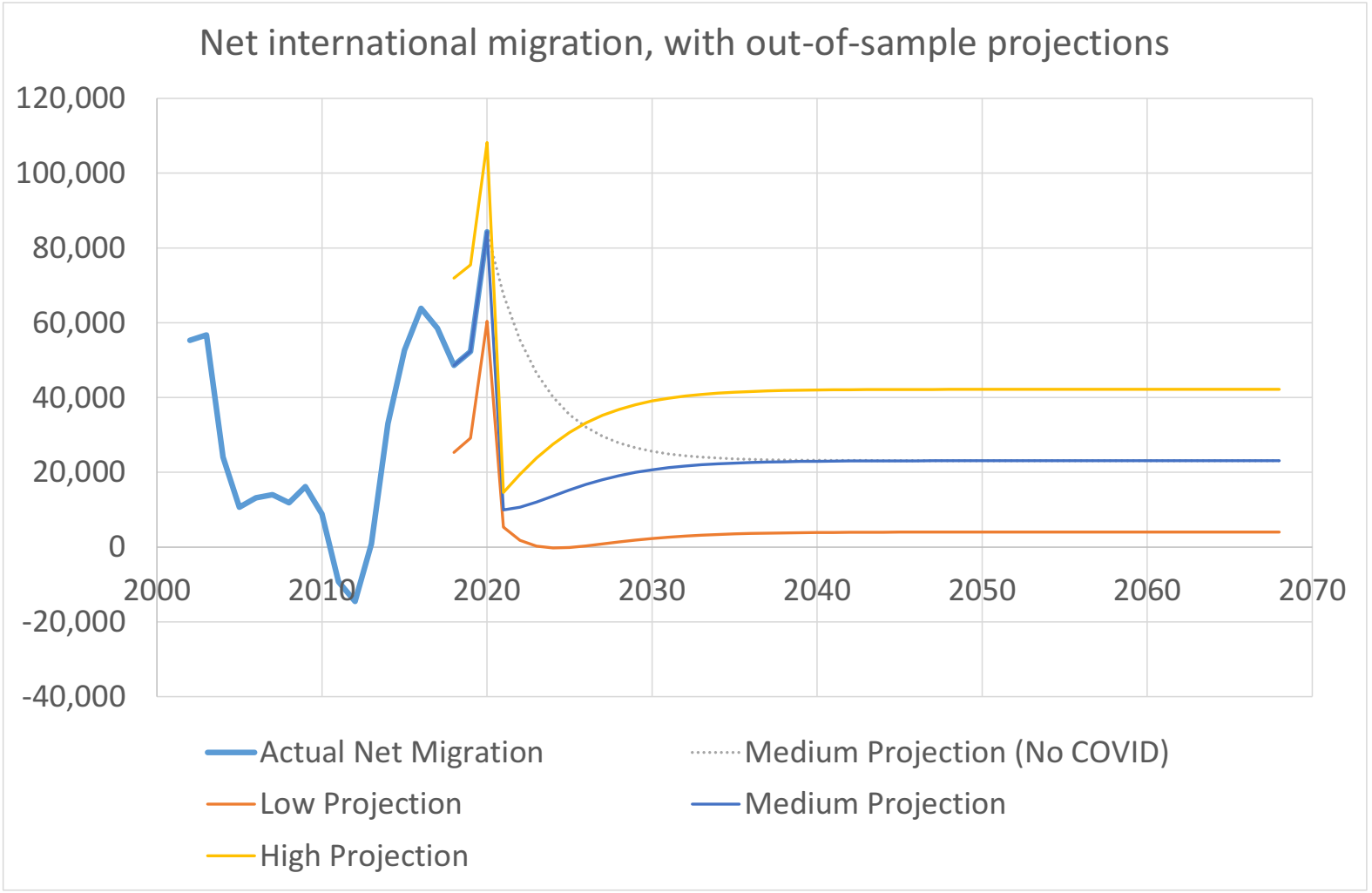
Age-specific in-migration profile for Hamilton City



International Migration Assumptions

- International migration flows (emigration and immigration) are projected using an error correction model
  - This model takes a long-run average level of immigration and emigration, and ‘decays’ deviations from that long-run average over time, until the flows reach the average
  - The long-run average for both immigration and emigration was taken as the average annual level over the period from 1990-2020
- This gives a measure of total international migration flows
  - These are then distributed based on shares of population, that are modified to account for the fact that Auckland has a smaller share of emigration than expected, and Auckland, Hamilton, Wellington, Christchurch, and Queenstown-Lakes have a higher share of immigration than expected
  - These flows are given an age-sex distribution based on immigration and out-migration profiles derived from 2018 Census data

Actual and projection national-level net international migration flows, 2002-2068



The impact of the coronavirus pandemic

- We assume no change in fertility, mortality, or internal migration flows
- We assume total immigration flows that are initially 82.6 percent lower than trend, and emigration flows that are 76.5 percent lower than trend
  - This is based on a comparison of migration flows from April to September 2020, compared with flows one year earlier

Low-variant and high-variant projections

- Fertility (+/- 5%); constant across all TAs
- Mortality (+/- 2%); constant across all TAs
- International migration flows (+/- 10%); constant across all TAs
- No change in the internal migration model

Interpreting the projection scenarios

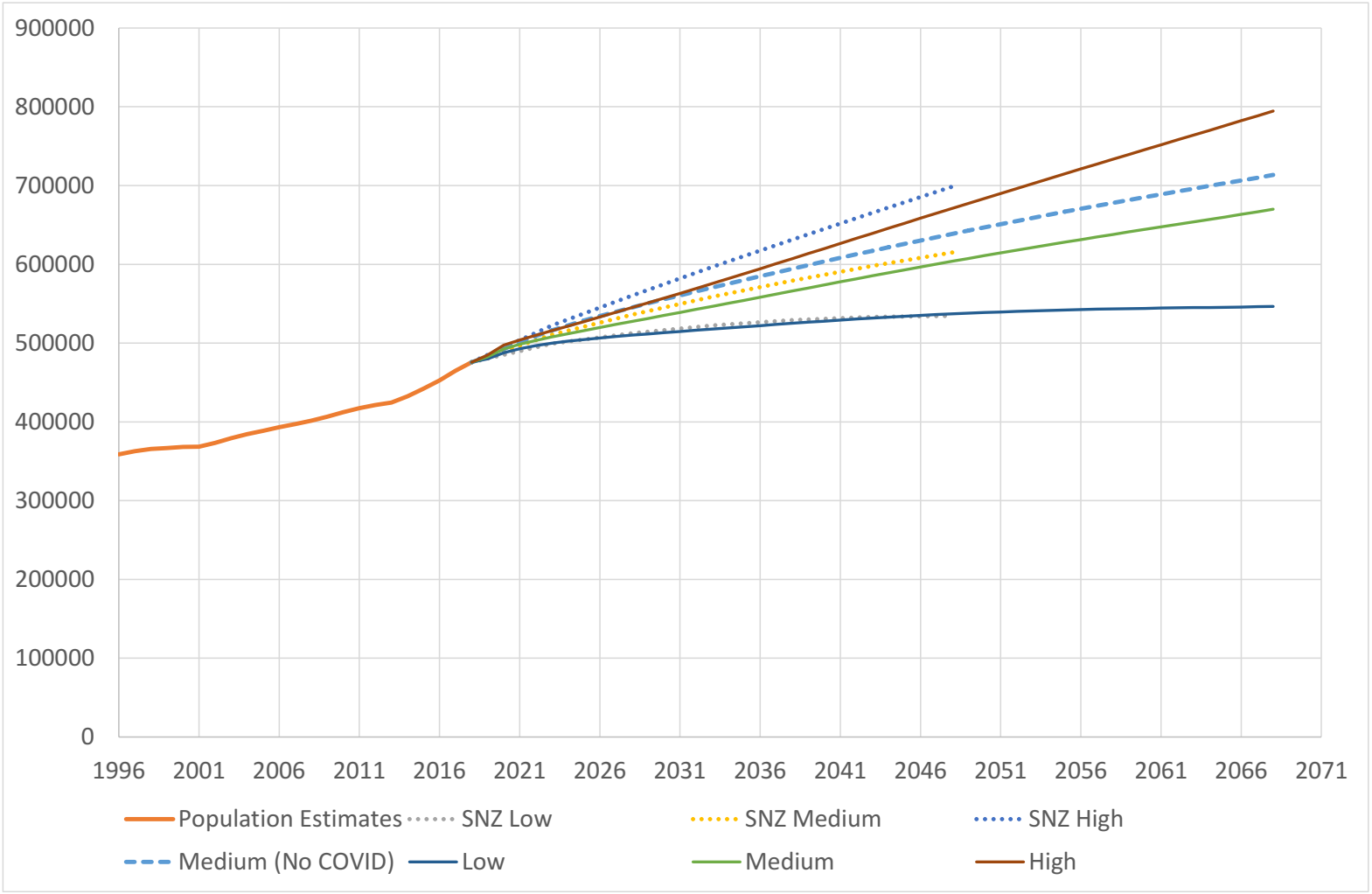
- There are two ways to interpret the scenarios:

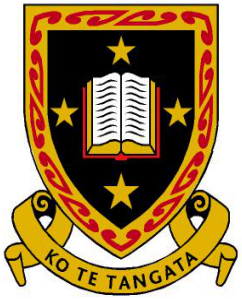
1. The medium-variant scenario represents approximately the centre of the distribution of all potential scenarios generated with this model and within the plausible distribution of assumptions. The interval between the low-variant and high-variant projections should be expected to capture the actual future population approximately 67 percent of the time
2. The low-variant projection is broadly representative of the bottom one-third of all potential scenarios generated with this model and within the plausible distribution of assumptions, the medium-variant projection is broadly representative of the middle one-third and the top one-third

Family and household, and labour force, projections

- Family and household projections are derived from the population projections by applying assumptions about living arrangement type rates to the population by age and sex
- Labour force projections are derived from the population projections by applying assumptions about labour force participation rates to the population by age and sex

Population projections for the Waikato region, 2018-2068





THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

WWW.WAIKATO.AC.NZ | 0800 WAIKATO

National Institute of
Demographic and Economic Analysis
Te Rūnanga Tātari Tatauranga
THE UNIVERSITY OF WAIKATO

WISE-based Economic Projections

Dr Garry McDonald & Dr Pascal Cheon

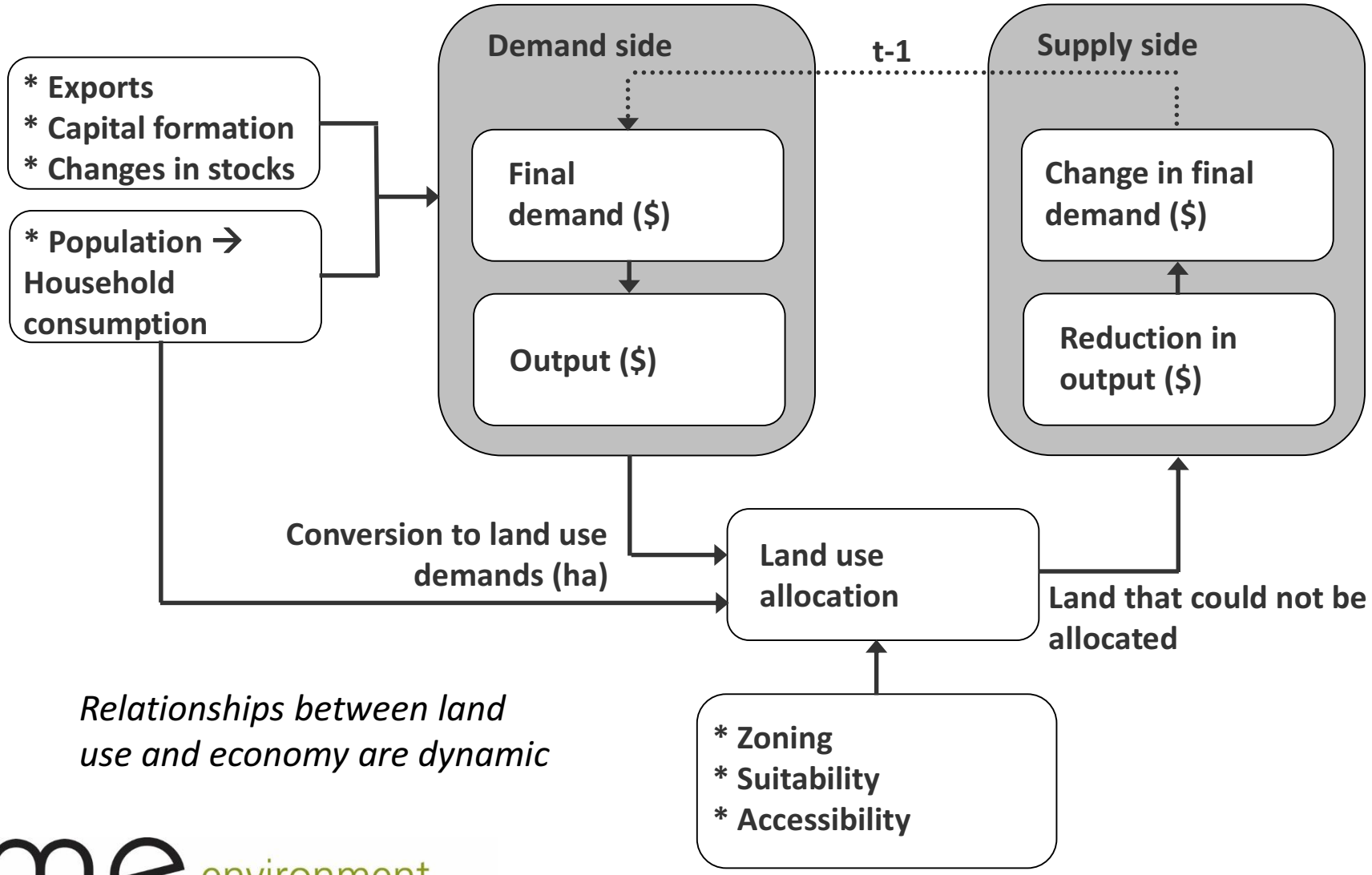
m.e environment

Caveats

- We are not able to predict the future!
- Our results represent three ‘plausible’ scenarios (low, medium & high), underpinned by population, consumption, trade, capital formation, and land use-economy dynamics
- Uniquely consider both ***supply*** and ***demand***; accounting for spatial interaction, zoning, land suitability and infrastructure accessibility, large investment and aspirations
- Development of SA2 projections is notoriously difficult, particularly at the 1D ANZSIC level

m.e environment

WISE economic module



Relationships between land use and economy are dynamic

m.e environment

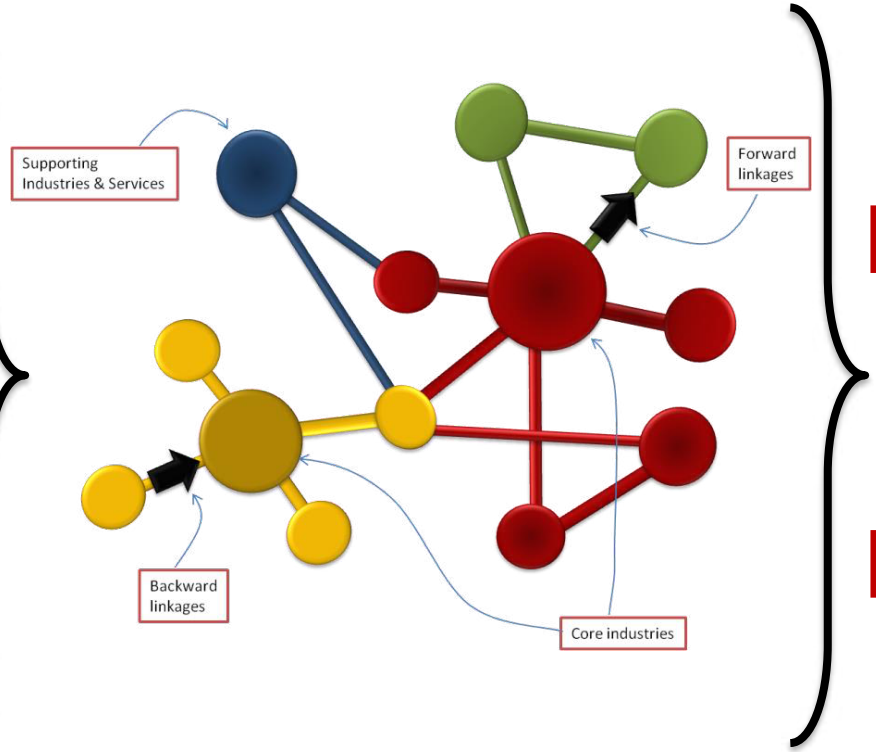
Economic model update

Households (Consumers)

Households (Labour)

Exports

Capital formation



Economic

Employment (MECs)
Value added
Gross output

Social

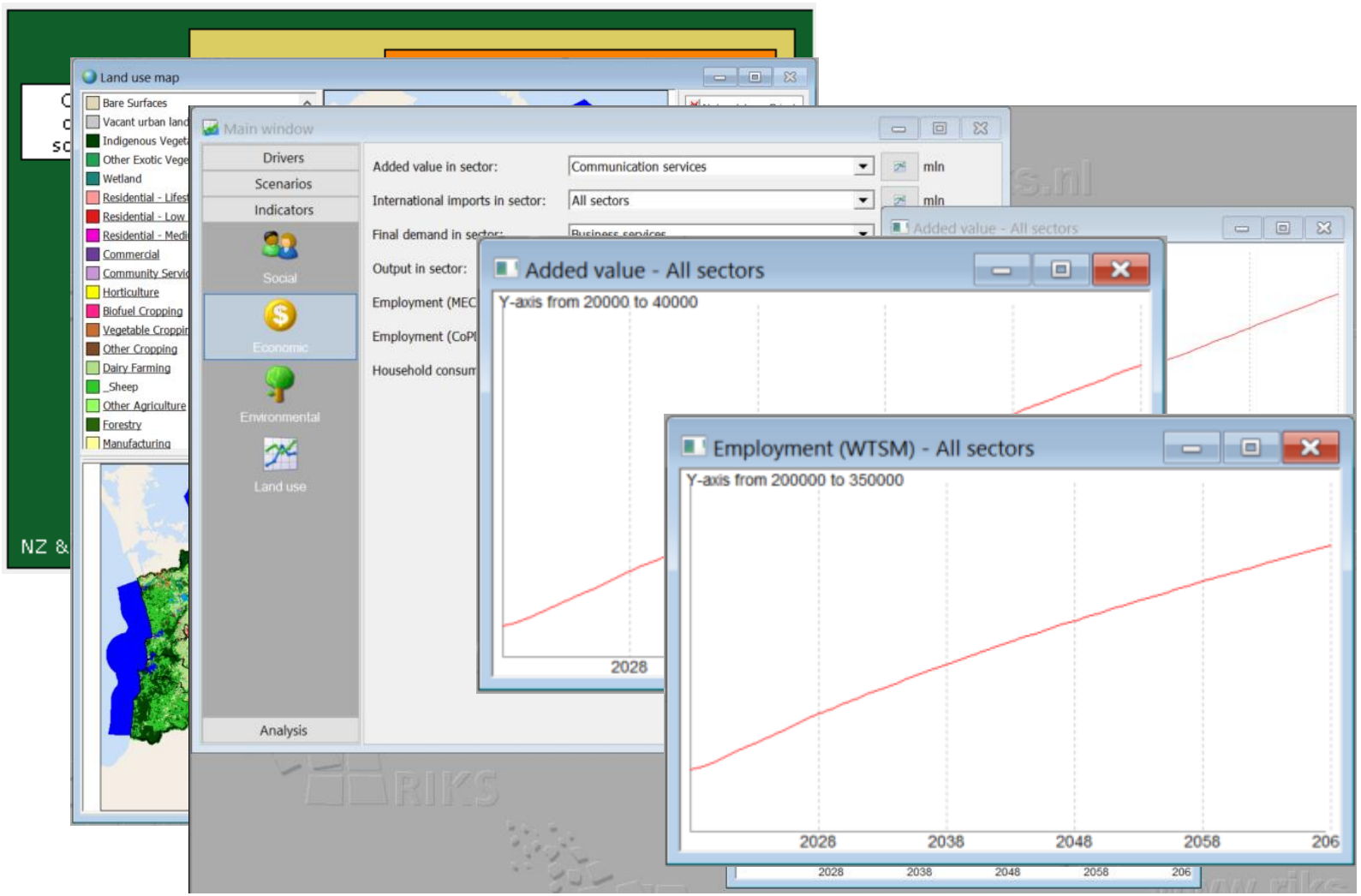
Skills
Occupations

Ecological

Energy use
Emissions (CO_2, N_2O, CH_4)
Solid waste
Footprints

m.e environment

WISE economic module



m.e environment

Economic Projections

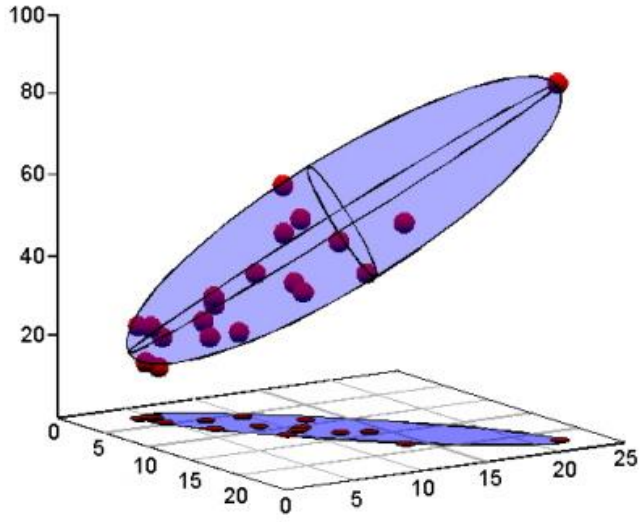
- *2018-68 Employment* by 1-digit ANZSIC 2006 for RC, TA and SA2 areas as measured in Modified Employment Counts (MECs)
- *2018-68 Value added* by 1-digit ANZSIC 2006 for RC, TA and SA2 as measured in $\$_{2018}$m equivalents
- Based on the 48 economic industries of WISE 1.6, with a 2018 base
- 242 SA2s x 20 industries (1D ANZSIC) x 50 years (2018-2068) x 3 projection series (low, medium, high) = 726,000 data points each for both *Employment* and *Value added*

m.e environment

SA2 projection method

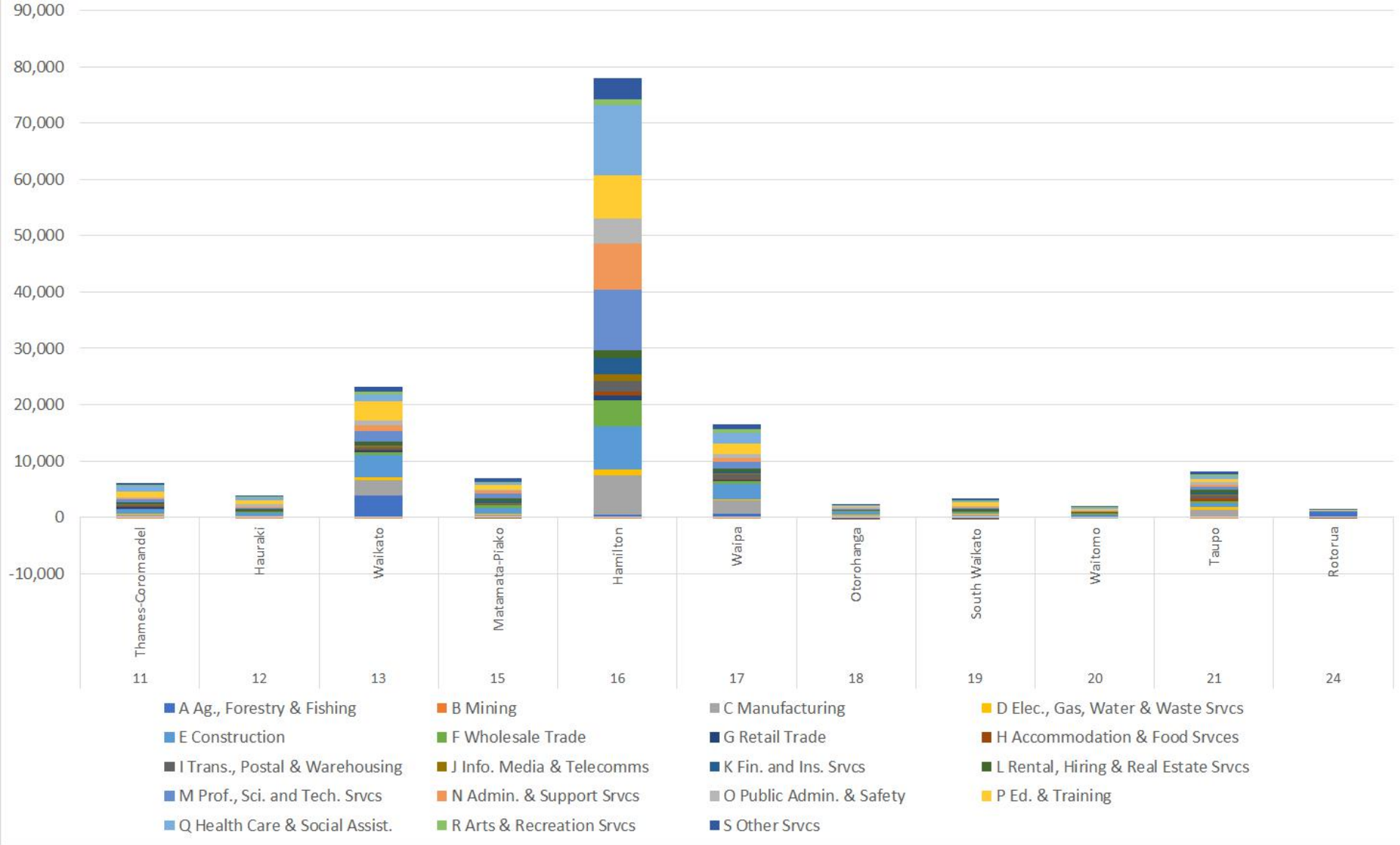
SA2 employment projections for 1D ANZSIC were generated using statistical methods

1. Identify important trends within the data and ranks them by transforming the base data
2. Runs regression analysis on identified trends
3. Project future outcomes
4. Transform projections back into base data equivalents

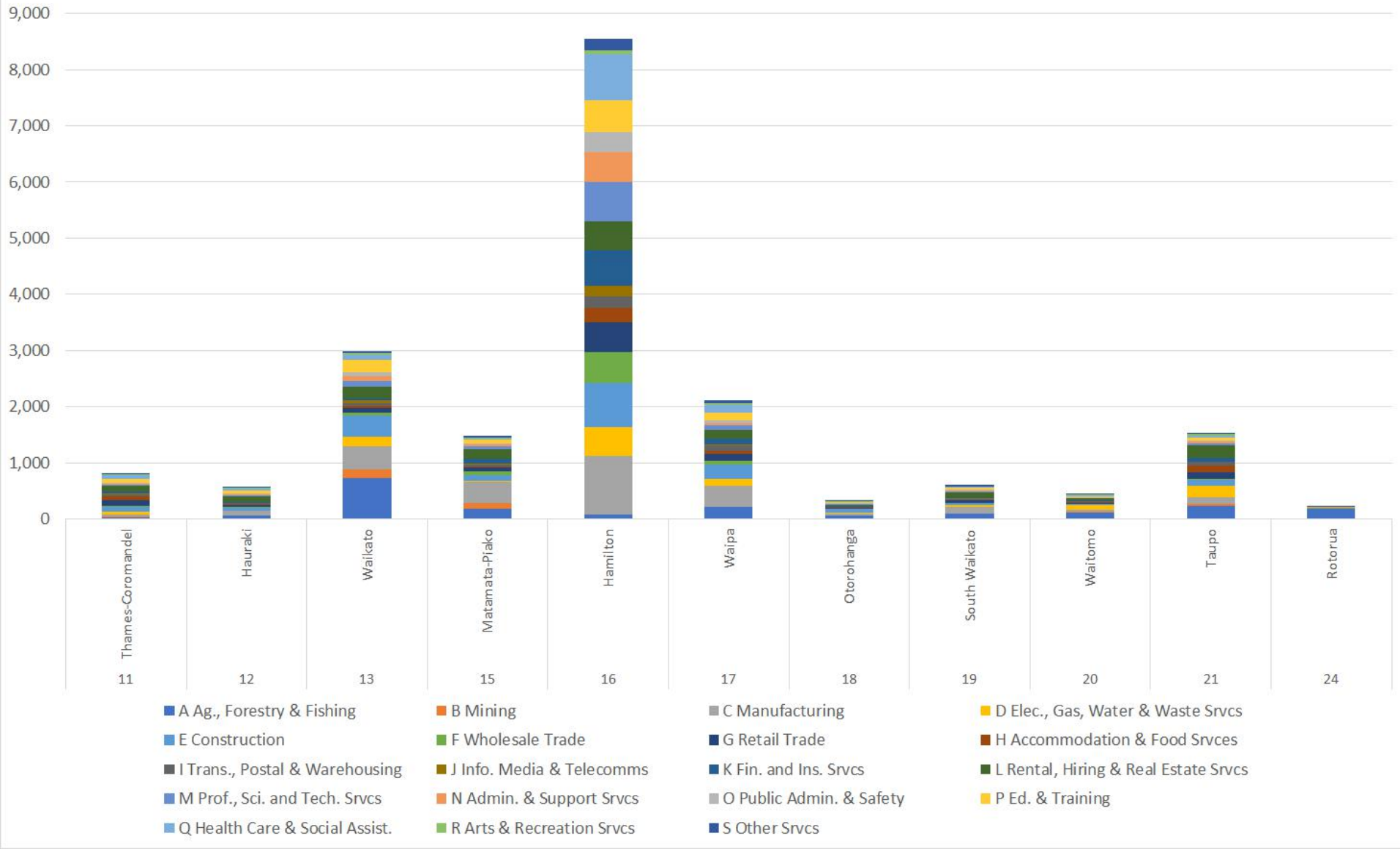


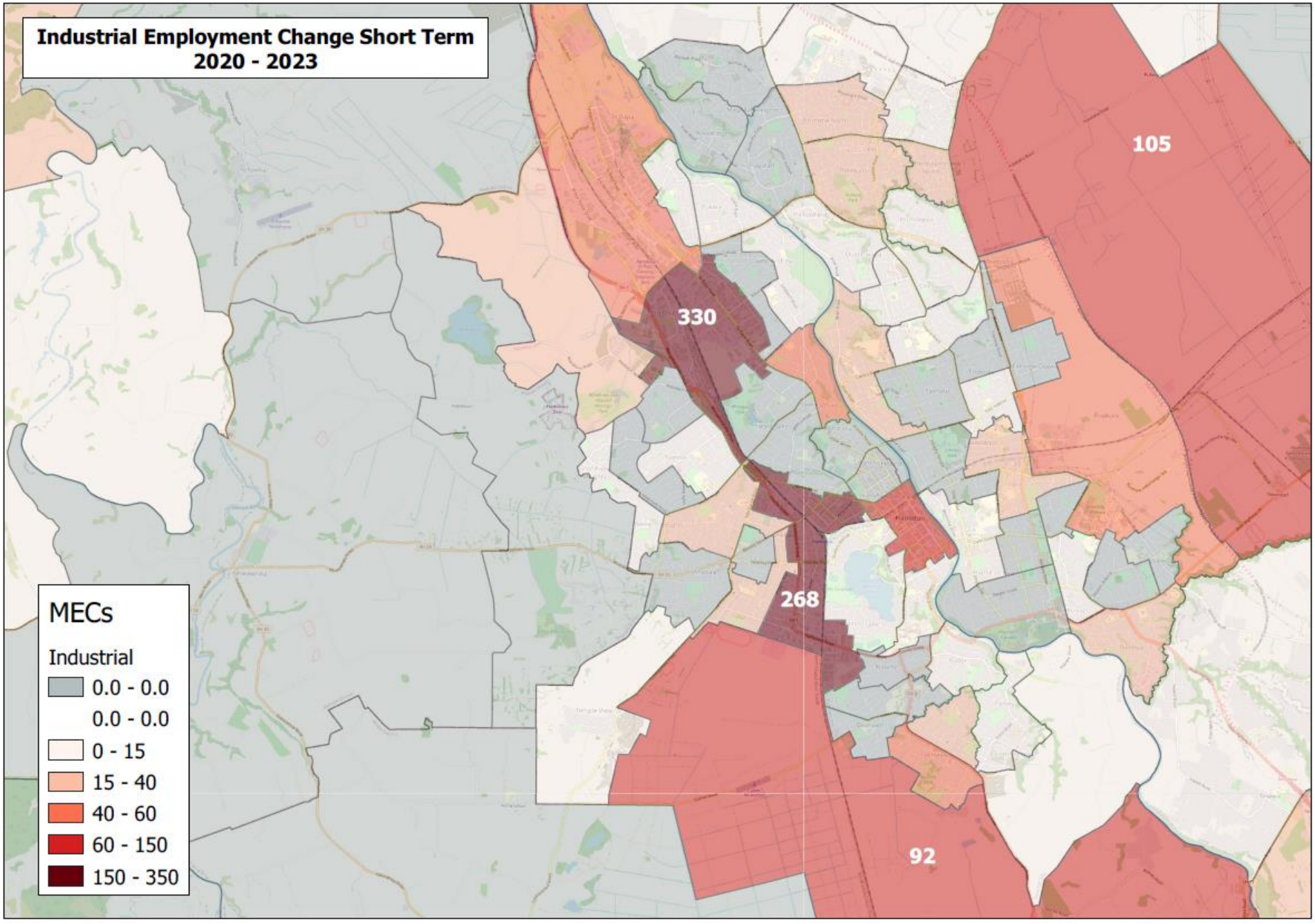
m.e environment

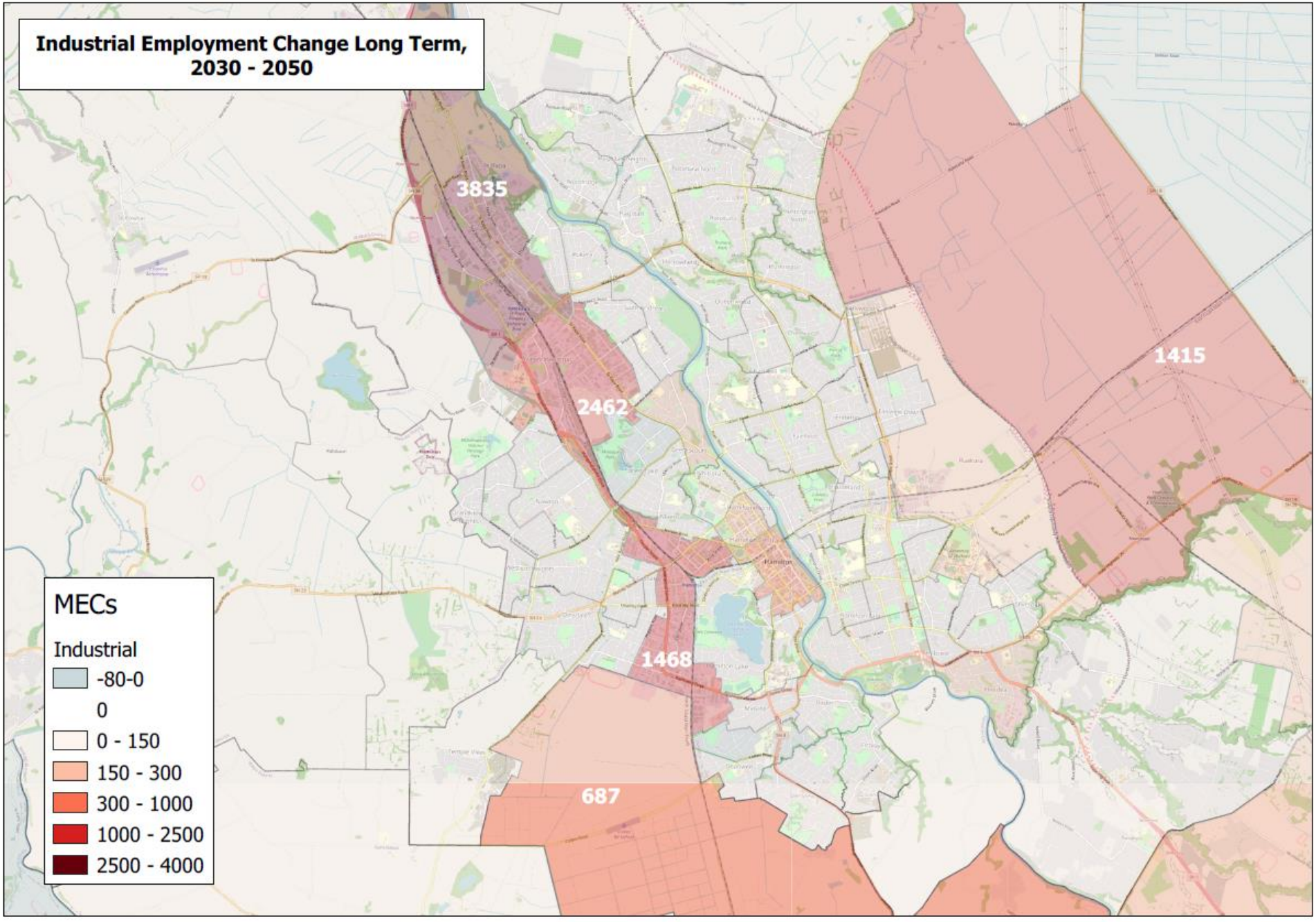
High Proj. Net Employment (MECs) by TA, 2018-68

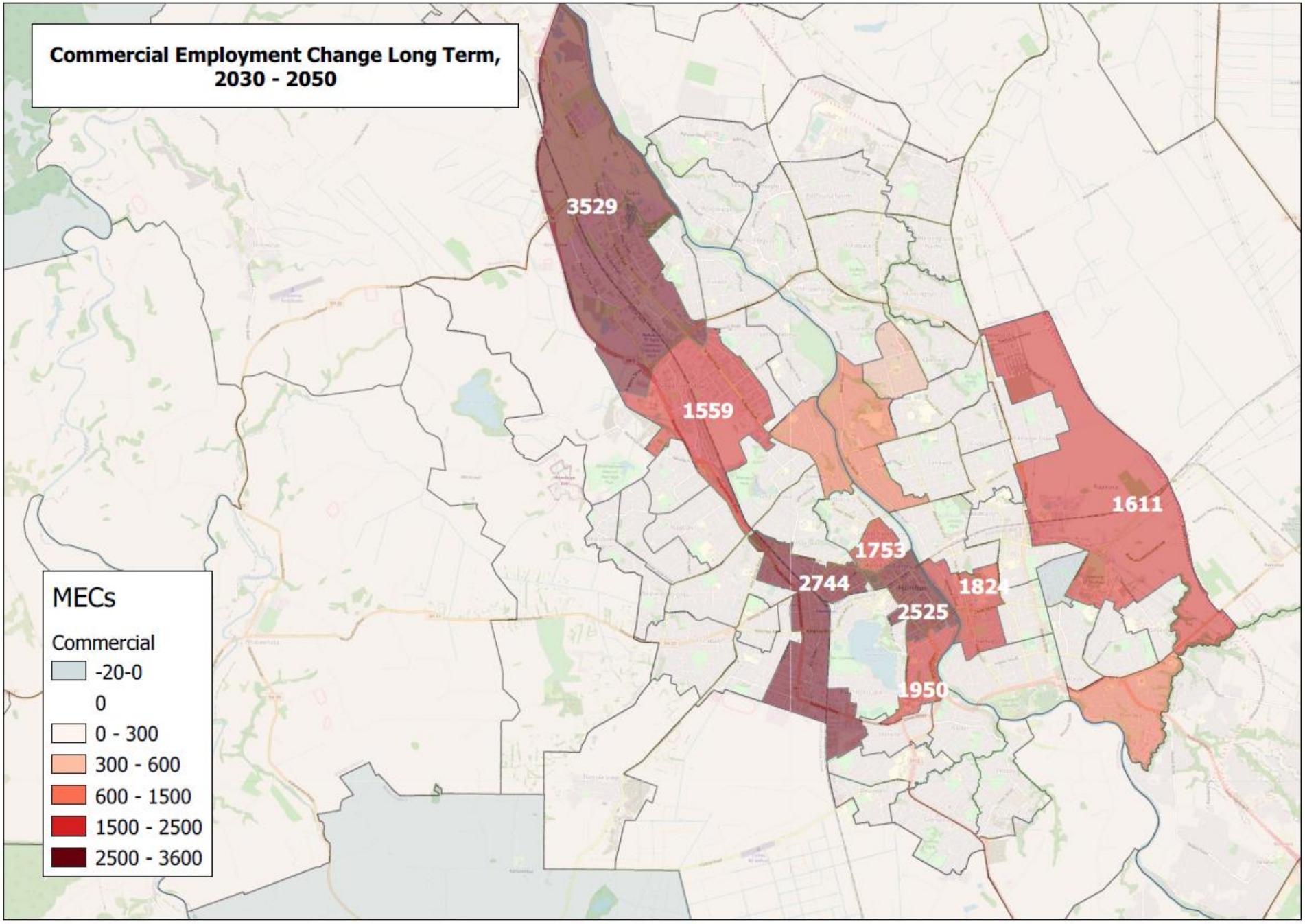


High Proj. Net Value Added ($\$_{2018}$m) by TA, 2018-68




Industrial Employment Change Short Term
2020 - 2023
105
330
268
92
MECs
Industrial
0.0 - 0.0
0.0 - 0.0
0 - 15
15 - 40
40 - 60
60 - 150
150 - 350


Industrial Employment Change Long Term, 2030 - 2050
3835
2462
1415
1468
687
MECs
Industrial
-80-0
0
0 - 150
150 - 300
300 - 1000
1000 - 2500
2500 - 4000


Commercial Employment Change Long Term, 2030 - 2050
3529
1559
1611
1753
2744
1824
2525
1950
MECs
Commercial
-20-0
0
0 - 300
300 - 600
600 - 1500
1500 - 2500
2500 - 3600