

# WRTM Interim Forecasts Update Process - Technical Memorandum

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# 1 Purpose of this Technical Memorandum

The base WRTM strategic model has been updated to include the latest 2018 Census results. All previous 2021/2031/2041/2051 future projection models were created from 2013-based projections of households, population, labour force, external flows and employment. These 2013-based projections are no longer considered applicable as interim Territorial Authority (TA) level 2018-based projections for households, population and labour force show significant differences from those expected in 2013.

Delays to the production of detailed “official” future year projections means that a set of “high-level” interim future year models need to be produced for the short-term so that network and land use assessments can continue. This technical memo details the process used to create the interim future land uses.

## 2 Land Use Changes

### 2.1 2018 Projection Base

The starting point for the interim future projections is the University of Waikato (UoW) medium scenario projections for households, population and labour force by TA. These projections use the 2018 Census results as a base and are only for TA's within the Waikato region. The WRTM includes parts of TA's outside the Waikato area and therefore also need an alternative source of future projections. For these outside TA's the most recent Statistics NZ medium projections were used.

The following tables show the sources used for the changes in TA totals for households, population and labour force as well as any adjustments needed to fit the model area.

**Table 2-1: Future Household Projection Source**

Area	Source	Comment
Thames-Coromandel District	UoW	Used directly
Hauraki District	UoW	Used directly
Waikato District	UoW	Used directly
Matamata-Piako District	UoW	Used directly
Hamilton City	UoW	Used directly
Waipa District	UoW	Used directly
Otorohanga District	UoW	Used directly
South Waikato District	UoW	Used directly
Waitomo District	UoW	Used directly
Taupo District	UoW	Used directly
Western Bay of Plenty District	StatsNZ	Factored by 2018 model ratio of model area households to total district households with values extrapolated beyond 2038
Tauranga City	StatsNZ	Used directly with values extrapolated beyond 2038
Rotorua District	StatsNZ	Factored by 2018 model ratio of model area households to total district households with values extrapolated beyond 2038
Papakura	StatsNZ	Factored from 2013 model growth increase using 2018 validated households as starting point

**Table 2-2: Future Population Projection Source**

Area	Source	Comment
Thames-Coromandel District	UoW	Used directly
Hauraki District	UoW	Used directly
Waikato District	UoW	Used directly
Matamata-Piako District	UoW	Used directly
Hamilton City	UoW	Used directly
Waipa District	UoW	Used directly
Otorohanga District	UoW	Used directly
South Waikato District	UoW	Used directly
Waitomo District	UoW	Used directly
Taupo District	UoW	Used directly
Western Bay of Plenty District	StatsNZ	Factored by 2018 model ratio of model area population to total district population with values extrapolated beyond 2048
Tauranga City	StatsNZ	Used directly with values extrapolated beyond 2048
Rotorua District	StatsNZ	Factored by 2018 model ratio of model area population to total district population with values extrapolated beyond 2048
Papakura	StatsNZ	Factored from 2013 model growth increase using 2018 validated households as starting point

**Table 2-3: Future Labour Force Projection Source**

Area	Source	Comment
Thames-Coromandel District	UoW	Factored to Employees using 2018 employee to labour force ratio
Hauraki District	UoW	Factored to Employees using 2018 employee to labour force ratio
Waikato District	UoW	Factored to Employees using 2018 employee to labour force ratio
Matamata-Piako District	UoW	Factored to Employees using 2018 employee to labour force ratio
Hamilton City	UoW	Factored to Employees using 2018 employee to labour force ratio
Waipa District	UoW	Factored to Employees using 2018 employee to labour force ratio
Otorohanga District	UoW	Factored to Employees using 2018 employee to labour force ratio
South Waikato District	UoW	Factored to Employees using 2018 employee to labour force ratio
Waitomo District	UoW	Factored to Employees using 2018 employee to labour force ratio
Taupo District	UoW	Factored to Employees using 2018 employee to labour force ratio
Western Bay of Plenty District	StatsNZ	Future year target population factored by adjusted 2018 labour force to population ratio
Tauranga City	StatsNZ	Future year target population factored by adjusted 2018 labour force to population ratio
Rotorua District	StatsNZ	Future year target population factored by adjusted 2018 labour force to population ratio
Papakura	StatsNZ	Future year target population factored by adjusted 2018 labour force to population ratio

## 2.2 Future Year Home-End Data Update Process

Each interim future year land use is based on the existing 2013-based medium projection land use used in the existing WRTM future models. This interim update takes the 2013-based distribution of land use within each TA and applies a pro-rata increase/decrease to each TA's internal land use by zone until the TA total for each land use equals the 2018-based projected total.

The process for each future year was as follows:

1. Assigned each model zone to a TA
2. Target TA totals were obtained for households, population, employed residents and total jobs
3. 2013-based TA totals for existing model future year were calculated
4. The change in existing model 2013-based future year households in each zone was calculated for each future year
5. The zonal changes in households calculated in step 4 were pro rata scaled within each TA until the 2018-based target TA household total is achieved
6. An initial iteration of population was calculated by multiplying the updated future year zonal households by the 2013-based future year persons/household
7. TA-level population factors converting the step 6 initial iteration populations to 2018-based target populations were applied to initial iteration populations within each TA to pro rata scale zonal populations within each TA until the 2018-based target TA population total was achieved
8. An initial iteration of available household vehicles was calculated by multiplying the updated future year zonal households by the 2013-based future year vehicles/household
9. Target TA-level vehicles/population ratios were calculated from the existing 2013-based future models using the assumption that the 2013-based TA ratios will stay the same in the interim update
10. TA-level vehicle factors converting the step 8 initial iteration available vehicles to 2018-based target vehicles were applied to initial iteration vehicles within each TA to pro rata scale zonal vehicles within each TA until the 2018-based target TA vehicle total was achieved
11. An initial iteration of household employees was calculated by multiplying the updated future year zonal households by the 2013-based future year employees/household
12. Target TA-level household employees within the Waikato area were calculated by factoring the 2018-based TA-level labour force projections by the 2018 Census TA-level employee/labour force ratio
13. For areas outside the Waikato area, the target TA-level household employees were calculated by using a TA-level employee/population ratio based on the 2018 Census results. These targets were further adjusted to reflect the average change in Waikato TA-level employee/population ratios from 2013-future year
14. TA-level vehicle factors converting the step 11 initial iteration household employees to 2018-based target household employees were applied to initial iteration household employees within each TA to pro rata scale zonal household employees within each TA until the 2018-based target TA household employees total was achieved.

## 2.3 Future Year Jobs Update

No 2018-based target TA-level job projections were available. After initial future land use testing using the changes described in Section 2.3 and retaining the current 2013-based jobs directly, it was found that this resulted in a significant and unacceptable redistribution of trips in some model areas based on our professional judgement of likely changes in travel trends over time. In particular, the flow balance along the border between the Tauranga/Rotorua areas and the rest of the model was not seen as a realistic response with too much flow flooding out of Tauranga and Rotorua into Waipa and Hamilton.

It was believed that this redistribution related to an imbalance in ratio of jobs to employee within each TA. It was therefore decided to maintain the 2013-based future year TA-level jobs/employee ratio using the new 2018-based forecast household employee values. The process was as follows:

1. 2013-based future year jobs were used as the initial iteration of projected future year jobs and initial TA-level job/employee ratios were obtained using the new household employee TA-level values
2. Target TA-level future year job/employee ratios were calculated from the existing 2013-based future models using the assumption that the 2013-based TA ratios will stay the same in the interim update
3. TA-level factors converting the step 2 initial iteration jobs to 2018-based target jobs were applied to initial iteration jobs within each TA to pro rata scale zonal jobs within each TA until the 2018-based target TA job/employee ratio was achieved.

### 2.3.1 Tauranga/Rotorua Border Flow Comparison

In Table 2-4 is a comparison between the current 2013-based future year border road flows and the updated 2018-based future flows. The locations used are SH29 at the Wairoa River Bridge, SH5 at the Bay of Plenty boundary and SH2 at the Bay of Plenty boundary south of Waihi.

This shows that whilst there are differences in flows, they are generally similar in all years and periods. Differences are likely to be as a result of the new overall changes in the land uses within each of the TA's, as a result of the 2018-based projections. It is noted that over time, 2018-based westbound flow along SH29 to Tauranga and westbound along SH5 to Rotorua both increase significantly over time compared to the previous 2013-based border flows. This inconsistent response may be a result of either:

1. The growth assumed for Tauranga, Rotorua, Western BOP and Auckland being from NZStats medium projections, rather than UoW projections, and adapted to be in line with the level of growth in the other areas in the model. These are the least reliable expansions and were not necessarily consistent with the UoW projections, but were the best available.
2. The model generation/distribution parameters have not been updated since the original WRTM model creation. These parameters were calculated from a detailed Household Interview Survey (HIS) that did not include the Tauranga, Rotorua, Western BOP areas. Large changes in the Tauranga and Rotorua area demographics may be resulting in unexpected trip interaction with the WLASS area, if the assumed distribution parameters are no longer applicable to the areas outside the WLASS area.

**Table 2-4: Tauranga/Rotorua – Waikato Border Flows**

Year	Location	AM		Interpeak		PM	
		2013-Based	2018-Based	2013-Based	2018-Based	2013-Based	2018-Based
2031	SH29 - EB	621	609	432	454	600	538
	SH29 - WB	783	553	926	833	744	1202
	SH5 - EB	684	609	264	327	269	349
	SH5 - WB	226	201	445	606	725	966
	SH2 - SB	988	1196	864	926	1007	989
	SH2 - NB	880	915	939	1012	1106	1376
2041	SH29 - EB	504	585	494	615	1002	1082
	SH29 - WB	1634	1585	1227	1094	586	1079
	SH5 - EB	564	552	236	452	307	601
	SH5 - WB	309	737	381	746	568	868
	SH2 - SB	869	1086	856	922	1196	1226
	SH2 - NB	1129	1276	963	1006	1065	1244
2051	SH29 - EB	466	635	570	820	1544	1969
	SH29 - WB	2353	2444	1411	1442	538	1207
	SH5 - EB	433	665	226	594	355	1008
	SH5 - WB	364	1590	332	801	452	848
	SH2 - SB	775	1041	893	951	1522	1623
	SH2 - NB	1451	1843	1004	981	1026	1124

## 2.4 Future Year External Vehicle Flow Update

21 external zones are included within the model to represent vehicles entering and leaving the model area at the boundaries with other areas. An assessment of traffic counts at each of the external sites was undertaken to determine the long-term linear growth of vehicle flow at each site. Directional flows for 2011, 2016 and 2020 were

interrogated to determine growth rates at each location. The years were chosen to ensure that growth was generally linear in shape.

Little difference in growth rates were found by direction and it was decided that a single growth rate was to be applied to each direction at each individual external location for both the light and commercial vehicles. The linear traffic flow growth rates used for each external location are shown in Table 2-5.

**Table 2-5: External Annual Flow Growth Rates**

Ext Number	Location	Annual Growth (% p.a.)
2480	Beach Road	1.89%
2481	SH1 North	2.40%
2482	Great South Road	2.15%
2483	Quarry Road	1.89%
2484	Ararimu Road	2.49%
2485	Portsmouth Road	1.89%
2486	Pararata Road	3.45%
2487	Puketutu Road	1.89%
2488	Pirrit Road	1.99%
2489	Pioneer Road	1.89%
2490	SH4 South	1.16%
2491	SH3 South	1.61%
2492	SH2 East	3.41%
2493	SH33 East	1.89%
2494	Highlands Loop Road	1.89%
2495	SH30 East	1.89%
2496	SH38 South	1.78%
2497	SH5 South	2.07%
2498	SH1 South	1.92%
2499	SH47 South	5.28%*
2500	SH41 South	0.03%*
Average		<b>1.89%</b>

\*These outlying external growth rates for zones 2499 and 2500 are for locations with low 2018 base vehicle flows and as such can vary in growth significantly from the norm.

### 3 Interim Future Year Land Use Totals

The interim TA-level land use totals for each future year are summarised below in Table 3-1 to Table 3-4. The 2013-based Census and 2018-based Census area land use totals have been included to show short-term historic trends in households, population, work force and employment for each TA. It should be noted that there is a slight definitional difference in population between the 2013-based model and the later models. The 2013 model was based on Usually Resident Population whereas the later models were developed using Expected Residential Population.

The projections all show the same general trend in employees/population and population/household except for Thames-Coromandel. UoW projections for Thames-Coromandel show it having generally lower population rates than the other TA's. This may be as a result of projected "partially" occupied holiday dwelling construction in the area.

**Table 3-1: Interim Projected Changes in Households 2013-2051**

Area	Year				
	2013	2018	2031	2041	2051
Thames-Coromandel	11497	13261	13987	14566	14944
Hauraki District	7288	7859	8897	9478	9930
Waikato District	22066	25869	31749	35543	38652
Matamata-Piako District	12009	13006	15034	16155	17098
Hamilton City	50448	57643	71196	80797	89764
Waipa District	17633	20342	23775	25845	27605
Otorohanga District	3126	3457	4150	4482	4721
South Waikato District	8478	8895	8877	9163	9524
Waitomo District	3412	3595	3547	3636	3744
Taupo District	12790	14502	15942	16766	17358
Western Bay of Plenty	14424	16207	18574	19317	20025
Tauranga City	45129	52956	62140	69300	76300
Rotorua District	22612	24419	27033	26955	26762
Papakura	16139	17962	27466	38238	49405
<b>TOTAL</b>	<b>247051</b>	<b>279973</b>	<b>332366</b>	<b>370241</b>	<b>405832</b>

**Table 3-2: Interim Projected Changes in Population 2013-2051**

Area	Year				
	2013	2018	2031	2041	2051
Thames-Coromandel	25145	30681	31385	31730	32370
Hauraki District	17300	20023	21618	22360	23427
Waikato District	61747	78261	93272	101878	109872
Matamata-Piako District	30297	34556	38062	39894	41693
Hamilton City	138080	168290	201855	221885	239548
Waipa District	45566	55281	62559	66905	70962
Otorohanga District	8199	9636	11386	12142	12841
South Waikato District	21906	25060	24755	25353	26440
Waitomo District	8962	9808	9341	9375	9617
Taupo District	31716	38310	40661	41965	43275
Western Bay of Plenty	36647	44453	51674	54643	57092
Tauranga City	112751	142575	168154	183968	199999
Rotorua District	59394	69569	74565	76442	77926
Papakura	44908	52477	69264	90291	112250
<b>TOTAL</b>	<b>642618</b>	<b>778980</b>	<b>898552</b>	<b>978830</b>	<b>1057310</b>

**Table 3-3: Interim Projected Changes in Household Employees 2013-2051**

Area	Year				
	2013	2018	2031	2041	2051
Thames-Coromandel	10923	14135	12767	12622	12184
Hauraki District	7261	9184	9096	9483	9589
Waikato District	28711	40689	47280	52762	55860
Matamata-Piako District	14515	17703	19383	20615	21475
Hamilton City	62530	84087	103726	120444	133107
Waipa District	22600	29385	32705	35580	37215
Otorohanga District	3957	5026	5917	6398	6742
South Waikato District	8680	11297	11143	11800	12414
Waitomo District	4212	5134	4876	5043	5244
Taupo District	14854	19773	20901	21895	22445
Western Bay of Plenty	16816	23033	26437	28620	29809
Tauranga City	49648	70781	82427	92322	100054
Rotorua District	25411	34380	36385	38186	38807
Papakura	21198	27303	35969	47322	59215
<b>TOTAL</b>	<b>291315</b>	<b>391909</b>	<b>449012</b>	<b>503091</b>	<b>544160</b>

**Table 3-4: Interim Projected Changes in Total Jobs 2013-2051**

Area	Year				
	2013	2018	2031	2041	2051
Thames-Coromandel	10013	11909	13224	14088	15968
Hauraki District	6021	7134	8424	9614	12283
Waikato District	16841	23574	29577	35662	39483
Matamata-Piako District	13296	15326	20922	23375	25141
Hamilton City	68838	79421	109427	130493	150660
Waipa District	16482	22078	27618	30930	34166
Otorohanga District	3648	3884	5453	6102	6989
South Waikato District	7647	8838	10445	11570	13468
Waitomo District	3993	4443	5489	6167	7289
Taupo District	13629	16517	20553	22590	25363
Western Bay of Plenty	13593	13213	21080	22229	22999
Tauranga City	48321	61882	74100	78170	82716
Rotorua District	25758	25408	37202	38228	38337
Papakura	18391	17352	23330	28797	34364
<b>TOTAL</b>	<b>266471</b>	<b>310979</b>	<b>406844</b>	<b>458015</b>	<b>509225</b>



## 4 Recognised Potential Limitations

It is recognised that the process used to create these interim future year models is simplified due to the lack of available detailed land use projections. As such, there are several limitations with the process that should be considered:

1. This process depends heavily on the validity of the original 2013 zonal forecasts. Changes to land use have been made at a TA level of detail and is therefore reasonable for capturing overall differences in TA level growth. However, this is unlikely to be the case at individual zone level if the overall expected 2018 pattern of future development varies from that assumed in 2013. This process maintained the “shape” of internal TA growth from the 2013 projections, but that “shape” may no longer be entirely appropriate for the new 2018 TA projections.
2. There will be limitations in any newly adopted growth areas as they may not have been included in the previous 2013 development growth assumptions.
3. This overall process may, in some rare situations, lead to zones in established areas exceeding their expected land use capacity. Every effort has been made to minimise the chances of this occurring by utilising the previously agreed year-to-year changes in land use rather than any absolute zonal growth. In addition, in many of the denser areas of the model, the 2018-based TA projections result in a reduction in the number of households compared to the 2013-based projections and therefore it is unlikely that capacities will be exceeded.