BEFORE THE AUCKLAND UNITARY PLAN INDEPENDENT HEARINGS PANEL

IN THE MATTER	of the Resource Management Act 1991 and the Local Government (Auckland Transitional Provisions) Act 2010
AND	
IN THE MATTER	of Topic 081a Rezoning and Precincts (Geographical Areas)

PRELIMINARY STATEMENT OF EVIDENCE OF KYLE OLIVER BALDERSTON ON BEHALF OF AUCKLAND COUNCIL

(CAPACITY AND FEASIBILITY MODELLING)

26 January 2016

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1. SUMMARY

1.1 My full name is Kyle Oliver Balderston. I hold the position of Growth Analyst in the Research and Evaluation Unit (RIMU) at Auckland Council.

1.2 This brief statement of preliminary evidence describes the further modelling of 'feasible plan enabled capacity' including the results of the remodelling of the Proposed Auckland Unitary Plan (**PAUP**) zoning (as notified in September 2013) and the Auckland Council Amended Provisions (**ACAP**) (uploaded on 12 August 2015[1]) following mediation on the Residential provisions, and is effectively a refinement of the information presented by Mr Adam Thompson, Mr Patrick Fontein and myself to the Topics 059-063 Residential hearing.

1.3 Note that the modelling undertaken to date and described in this preliminary evidence does NOT include the spatial rezoning proposed by Auckland Council, which will be undertaken once all the base zoning, precincts and overlays spatial data is finalised (being after this evidence is filed).

1.4 This evidence also includes a brief discussion of the further development of the ACDC15 Model which has been refined and updated via Further Topic 013 Expert Conferencing and is now referred to as 'Auckland Council Development Capacity Model Version 3' (**ACDCv3**). A fuller account of the details of the changes made to the ACDC Model will be included in the forthcoming report of the 013 Expert Group.

1.5 This evidence also outlines the results of the application of ACDCv3 to the PAUP zoning pattern and ACAP rules which will provide a new baseline for comparison of the forthcoming results of modelling the rezoning proposed and the revised rules – any change between these figures is then fully attributable to the effect of rezoning and rule changes rather than 'modelling' variations.

1.6 The results of the modelling runs completed and available at the time of writing (Run 3.6) suggest the PAUP spatial zoning pattern with the ACAP Residential Rules and PAUP Business Rules could provide between 198 and 256 thousand feasible dwellings (depending on 'choosing' scenario) from the residential and business zones tested. This compares to a range of 108 to 144 thousand

[1] Topics 059, 060, 062 and 063 – Mediation Joint Statement – Session 1 – 11 (27 – 31 July, 4 – 7 August and 10 – 11 August 2015.

(depending on price ceiling applied) from the same spatial zoning and rules inputs as assessed by Version 2 of the Model.

1.7 This evidence is additional to my previous Evidence in Chief and Evidence in Rebuttal dated submitted for Topic 013 RPS, Urban Growth (**Topic 013**) and Topic 059 – 063, Residential (**Topic 059 - 063**) which described at the high level the overall approach and results of the Capacity for Growth Study 2013 (Proposed Auckland Unitary Plan) (**CfGS PAUP**) and the overall approach and results of earlier versions of the 'Auckland Council Development Capacity Model' (**ACDC15**)

1.8 The spatial 'rezoning' modelling results are forthcoming (due to be lodged 1 March 2016), and are dependent on the supply of spatial GIS data reflecting the Council's final zoning, precinct and overlay positions as described in the evidence of Council's other witnesses, which at the time of writing was not completed nor available to me and is due to be completed on or about 26th January.

1.9 However, based on the base zoning pattern released publically in December 2015, I have undertaken some high level comparisons of the base zoning patterns, and presuming the overlays and precincts are generally similar in effect and extent to the as notified PAUP, the net effect on enabled capacity is likely to be positive as the extent and nature of 'up-zoning' significantly exceeds the limited 'down-zoning' that has occurred. Because the up-zoning is located in many areas which have high demand, that up-zoning is also likely, in my view, to result in a high proportion of the increases in plan enabled capacity translating to increases in feasible capacity.

1.10 I do note that the Council's final base-zoning pattern has been amended from the December 2015 release I have analysed, and the precincts and capacity constraining/enabling overlays are also quite different from the PAUP versions. Because of this, I have not offered a more refined estimate on how much of a difference they might result in from the presently modelled PAUP position in advance of receipt of the final data set and completion of modelling based on all the necessary data.

2. INTRODUCTION

2.1 My full name is Kyle Oliver Balderston. I hold the position of Growth Analyst in the Research and Evaluation Unit (**RIMU**) at Auckland Council.

2.2 I hold a Bachelor of Science Honours Degree with First Class Honours in Geography from the University of Auckland. I have over 11 years' experience in Auckland Local Government, the most recent three years as a Growth Analyst with Auckland Council. I have also previously held roles as Resource Consent Planner, then Strategic Advisor with Waitakere City Council. After local government reorganisation in Auckland I was employed by Auckland Council as a Strategic Planner in the Spatial Strategy Team (developing the Auckland Plan, specifically the Development Strategy) before moving to RIMU and my current role as Growth Analyst.

2.3 Fuller details of my qualifications and experience are at **Appendix A** to this evidence.

2.4 I am authorised by Auckland Council to provide evidence in relation to the Capacity for Growth Studies (**CfGS**), in particular the CfGS Model and the more recently created ACDC15 Model.

2.5 Over the past two and a half years I have had extensive day to day involvement in the development of CfGS, including the Capacity for Growth Study 2012 (Legacy Plans), a 'practice run' based on the Draft Auckland Unitary Plan, and the CfGS PAUP. I was one of the two authors of the CfGS PAUP technical papers. I have also been involved in previous CfGS Studies undertaken by the Auckland Regional Council (the 2008 Study), being Waitakere City Council's technical representative to this project, as well as a range of other regional and local growth related projects and strategies.

2.6 I have also undertaken (or will be) the amendments to the CfGS PAUP model, which required changes to the look up tables (containing the rule parameters) and some architecture changes required to model the Auckland Council amendments to spatial data inputs and the residential, business and rural provisions now being proposed. I have and will (re)run the ACDC 15 Feasibility Model on those capacity outputs, and summarised the results of both models into tables, graphs and maps as utilised in this evidence, the evidence of others and the 013 Expert Group reports.

2.7 I was also involved in all three rounds of the Topic 013 Urban Growth Further Expert Conferencing[2], having assisted in the development of the three model versions, including the supply of and creation of data for them, and discussions with the three pilot modellers. I was ultimately responsible for the development, running and creation of the ACDC15 Model in FME software which calculates feasibility. Further discussion of the model and process is included in Sections 5 and 6 below

2.8 I would note that these two models output a significant level of detail at a parcel scale, including spatial data (enabling mapping and spatial combination with other data). The information presented in this evidence is a high level summary of that very rich and detailed (and accordingly cumbersome) data based on those individual parcel scale assessments.

2.9 While the results are built up from the parcel scale results and it is important to appreciate the assumptions and limitations involved in this process, close review of individual parcel results (other than on a random or representative sample basis) is not considered to be appropriate – the model represents an 'average developers' response to building an 'average building' compliant with the rules as applied by the CfGS Model. Site specific knowledge, developments or proposals will always be different (better) than those assumed by the high level modelling process. This is due to the nature, amount and accuracy of information and the range of options able to be incorporated into site specific assessments by individual owners or developers, compared to the 'average' assumptions used in the modelling. In this sense, care must be taken to avoid assuming individual results within any sample population represent certain outcomes.

2.10 However the modelling does provide an indication of the relative probability of development occurring – the CfGS model firstly filters all sites to identify those with the potential to be developed under the rules. These sites have a higher probability of being developed than those without enabled potential. The ACDC model then tests if the enabled development potential is likely to provide a reasonable level of return - those sites that do show feasible potential have a higher probability of those with less feasible options, subject of course to economically rational behaviour and 'normal' future conditions.

[2] Refer under recently uploaded Documents for Completed Topic 013 Urban Growth on the IHP Website www.aupihp.govt.nz

3. CODE OF CONDUCT

3.1 I confirm that I have read the Code of Conduct for Expert Witness contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

4. SCOPE

4.1 I have been requested by Auckland Council and this Panel[3] to undertake amendments and modifications to:

(a) the CfGS Model (measuring plan enabled capacity)

(b) the ACDC15 Model (measuring feasible enabled capacity)

to calculate the effect of the Auckland Council's revised zoning patterns and provisions on plan enabled capacity and feasibility.

4.2 For the purposes of this evidence, only amendments to the ACDC15 Model have been completed and the model is run utilising existing data sets representing the as notified PAUP zoning pattern with the amended residential provisions only (consistent with the position utilised in the Evidence of Mr Fontein and Thompson and my Rebuttal Evidence to Topic 059-063) . The CfGS model is currently being amended as far as possible but cannot be run until all spatial data is available and been reviewed. Once the CfGS is rerun, the ACDCv3 will be used to identify the feasible capacity supplied, and the difference from the results presented in this evidence and the finalised rules and zoning patterns is the effect of rezoning and rule changes (in business areas). Effectively we are controlling for spatial changes in the zoning, precinct and overlay patterns, as well as adjustments to the business zone rules, precinct and overlay rules (residential *rule* amendments have already been included).

4.3 Effectively, the two models (CfGS and ACDC) are used to determine what the 'supply' of dwellings might be from the combination and interaction of existing cadastral patterns, land values, existing built development, various physical and manmade constraints, and the land use rules and zoning (which controls where the

[3] Memo from IHP dated 5 November 2015 regarding Further Demand and Supply Estimates.

land use rules apply) might be. When the rules or where they apply are amended (as is proposed in this Topic) the modelling attempts to show what the effect of this change might be, while holding all else constant, to isolate the influence of rezoning and rule changes (vs the PAUP) on the outcome.

4.4 This evidence concentrates on a description of the results of the revised ACDC15 Model (Version 3) on the existing PAUP Zoning and revised Residential Rules to provide a baseline against which results of the revised spatial zoning and rules can be compared (Due 1 March 2016). Table 1 below illustrates the various applications of the ACDC modelling iterations in evidence to date and currently programmed for the near future and the variation in input and outputs:

Model Iteration	**CfGS 2013 (PAUP)**	**ACDC15 (v1)**	**ACDC15 (v1)**	**ACDC15 (v2)**	**ACDC v3**	**ACDC v3**
Evidence for Topic	013 RPS Growth *(KB EIC)*	013EG Report	059-063 Residential *(KB EIC)*	059-063 Residential *(KB Rebuttal PF/AT EIC)*	081 Rezoning *(this Preliminary Evidence)*	081 Rezoning *(1 March Evidence)*
Spatial Pattern Tested	PAUP	PAUP	PAUP	PAUP	PAUP	Rezoning
Residential Rules Tested	PAUP	PAUP	ACAP	ACAP	ACAP	ACAP
Business Rules Tested	PAUP	PAUP	PAUP	PAUP	PAUP	ACAP
Rural Rules Tested[4]	PAUP	PAUP N/A	PAUP N/A	PAUP N/A	PAUP N/A	ACAP N/A
Enabled	181[Infill] to	565	967	1,109	N/A[6]	TBD

[4] Rural area capacity results are not tested for feasibility and represent capacity for <20,000 dwellings under the PAUP. Proposed Rule and zoning amendments may increase this figure. Note this capacity is not included in the Enabled Capacity total

Capacity[5]	322[redevt]					
Feasible Capacity[7]	N/A	64	181	108[LPC] to 144[HPC]	198[Largest] to 256[Maximum]	TBD

Table 1: Evolution of theCfGS & ACDC Model versions.

4.5 Note that the Council has proposed amendments to the business zone rules[8] but the CfGS model has not yet been amended to reflect them and the ACDC Model does not therefore assess them. Business land is tested for residential feasibility in the ACDC model only in those zones where residential activity is enabled (Centres and Mixed Use zones). The 1 March Evidence is intended to include the rule and spatial changes.

4.6 Rural rules have also been proposed for amendment by the Council, and the CfGS had been amended to reflect earlier iterations (as presented in Evidence to the Rural Subdivision Topic), but have not been finalised to the Council's final position. Rural development is not tested for feasibility via the ACDC Model which is primarily designed for assessing (re)development in built up urban areas.[9] It is not expected that the final rural rule and zoning position will be modelled (via CfGS only) by 1 March.

4.7 Future Urban land is not run through the CfGS or the ACDC Models as their future is both too indeterminate (FUZ could potentially be 'anything', but detailed development rules are required to set development parameters for the modelling) and is subject to various levels of structure planning processes that are a better indication of present intentions for that land. As greenfield areas, strategic intentions are a good indicator of ultimate outcomes, based on historic experience[10]. This intent helps set a path dependency for the long lead in time, expectations and investments needed to ultimately transform the land from its current state to be available for development. Any updates to strategic planning for the FUZ land will

[6] Due to the 9 to 18 options per site utilised in the methodology, this value is not able to be determined consistently with the previous values or meaningfully for ACDC Version 3.
[5] Residential and Business Zones within the residential and business zones in Urban areas and Rural Towns only. Some variation exists in the way the model(s) (re)calculates capacity tested on sites identified by the CfGS with development potential. Figures are rounded to nearest thousand.
[7] Residential and business Zones only. No PC, LPC and HPC refer to Low and High Price Ceilings applied in Version 2, in contrast to No Price Ceiling being applied in Version 1, amongst other adjustments. ACDC v3 results shown represent highest and lowest yielding of chosen scenarios. Figures are rounded to nearest thousand.
[8] Council's Business 051-054 Closing Remarks, Attachment A Revised Business Rules.
[9] The same principles could be applied to the various rural development options but would require full recalibration based on urban development costs and returns including transfers, bush restoration and protection and expected sale prices. Provisional 'take up' estimates are an appropriate alternative.
[10] Frederickson, C; November 2013, *Uptake of Capacity in Residential Greenfield Developments*, (Internal Auckland Council Report).

be advised by the staff responsible for that planning (and included in any supply totals) but will not be included in the CfGS or ACDC Modelling.

4.8 This preliminary evidence therefore primarily addresses the adjustments made to the ACDC model, the results and why they vary from Version 2, and what we might expect the changes to be from the rezoning and rule variations. The Report of the 013 Expert Group will outline in detail the model. The forthcoming 1 March Evidence will contain the results of running the revised and final council position on zoning and rules though this model, and highlight the difference from the results presented in this evidence:

Section 5 The key changes in the ACDC model and a summary of the key assumptions and limitations;

Section 8 Results from the PAUP/Residential ACAP Run (the new baseline);

Section 9 Summary of high level base zoning changes (PAUP vs December public release).

4.9 The justification and reasoning for the amendments to the PAUP provisions, rules, and zoning patterns along with submissions in relation to Residential zones, and in particular the implications of the modelling results for the amended residential rezoning and provisions in the PAUP and amendments proposed by Auckland Council are discussed in the evidence of other Council witnesses. This evidence is restricted to describing the impact of the changes made (or to be made) on 'enabled capacity' and 'feasible capacity'.

5. KEY CHANGES TO THE ACDC MODEL FOR VERSION 3

5.1 The key changes made to Version 3 from Version 2 are summarised below:

(a) Input dwelling floor areas have been calibrated to the ceiling prices to ensure the sale price of the dwellings are at or below the ceiling prices (i.e. all tested developments are 'sellable');

(b) Ceiling prices and sizes, and the sales location category have been reviewed against a range of data sources and have been confirmed as reasonable;

(c) A range of development typologies is tested on every site – these are small, medium and large sized, houses, terraces and apartments, (9 in total) tested as both infill and redevelopment (as appropriate, resulting in uptto 18 developments per site) – this compares with both previous model versions (1 and 2) where a only single 'optimised' development was tested as infill or redevelopment;

(d) The 'scale' of the typologies tested are controlled by the most binding of the sites zone controls and 'practicality' – i.e. 6 storey 'apartments' are not tested in the SHZ, rather 2 storey 'big house' developments with a dwelling up and downstairs (as the zone controls are binding). Conversely, in the THAB zone and above, 'House' typologies are limited to 3 storeys and need at least 200m2 of land, even though the height limits and density controls are more enabling (in this case 'practicability' is binding – going taller or smaller would push the effective development typology towards a 'terrace' or 'apartment' with different cost, price and yield characteristics which are already tested in those typologies; and

(e) From these development options that are feasible (if any), a single development is chosen to report – a range of 'scenarios' are possible depending on the choosing method applied (e.g. a focus on 'profitability' gives a different mix to a focus on 'affordability') providing a feasible supply 'range', better enabling consideration of demand and demonstrating the flexibility within the enabled supply.

5.2 In summary, the amendments made to the model have in my view generally improved the reliability and utility of its outputs, but at the cost of significant added complexity and detail of both input assumptions calculations, and weight of output data.

Calibration of Price Ceilings and Sales Locations

5.3 One of the key issues raised early on was the issue of whether the initial assumptions, largely developed for Version 2 of the model were appropriate.

5.4 Version 1 and 2 'Sales Locations' (10 categories of location) were established on the basis on sales information from Auckland Council's Rates Sales Record Audit File, of 'recent' standalone dwellings average price within a 2013 CAU geography manually adjusted by the PDEG to account for outliers, transitioning greenfields

areas, and low sales counts. Based on the established sales locations categorisations, a range of other adjustment factors and dwelling size data was also established on the basis of the sale location classifications so that dwellings are appropriately sized and priced, and costed for the 10 locations established.

5.5 In setting up Version 3, further data was purchased from CoreLogic to review and update these Sales Location Classifications and assist in refinements for each dwelling typology and location, as initially proposed by Mr Fontein.

5.6 The review concluded that the Sales Location categories were appropriate to remain as per Version 1 and 2 of the model, and though some minor adjustments could be made, on balance consistency was considered to be more important. Of the initial assumptions proposed by Mr Fontein most were found to be reasonable with the exception of the suggested floor area of some developments, which if sold for the $/m2 rate (which was confirmed as generally consistent with the data) would exceed the (confirmed) retail price for that typology in that location.

5.7 This issue (LUT size values generating houses with sale prices greater than the ceilings) was also a key area of contention in the transition from Version 1 to Version 2, where a price ceiling was imposed to filter out these 'over-priced' developments. In this version it was determined that it would be far better to not have the model build over specified dwellings in the first place, and therefore pre-calibrating the suggested dwelling sizes to the ceiling was undertaken. Only those that were above the ceiling price were adjusted, the other initial size settings (already below the ceiling) provided by Mr Fontein were maintained as reasonable.

5.8 Using the set ceiling prices multiplied by a factor (e.g. if the standard dwelling is $800k, and our typology is a large terrace that sells for 70% of that (or $560,000), the largest possible dwelling of the typology was able to be calculated. (*Price Ceiling = Maximum Ceiling Price x Typology Factor; Dwelling Sale price = dwelling floor area x sale price per m2* – we adjusted the floor area of only those where the initial suggestion above the ceiling to ensure the sale price was at or below the price ceiling)[11]

[11] Only those above the ceiling were adjusted downwards – those whose sale price was below the ceiling were not adjusted upwards – this would have the effect of probably increasing feasible dwelling supply but also increasing the price of dwellings and therefore affordability of the outputs.

5.9 The calculation is shown below, using an example of a terrace assuming a Sale Location Ceiling Price of a 'standard' standalone dwelling of $800,000, a typology sale price factor of 0.7, and at a sale price per m2 rate of $3000m², then the maximum floor area the terrace can be, in order to come in at or below our factored ceiling is ~186m², the values being rounded down to the nearest whole square meter:

*Maximum Saleable Floor area = ROUNDDOWN((800000*0.7)/3000=186.66),0)*

5.10 Some pertinent examples of the calibration process are shown below, where the LUT input parameters were being compared to data from long run building consent information averaged by inferred building type and sales location.

5.11 Figure 1 illustrates the relationship between observed attached (equivalent of Terrace and Apartments) development size and the averaged size range in the LUTs. Size increases slowly as the location value increases (with some fluctuations in observed values due to low numbers, but LUT values are well aligned with the general trend).

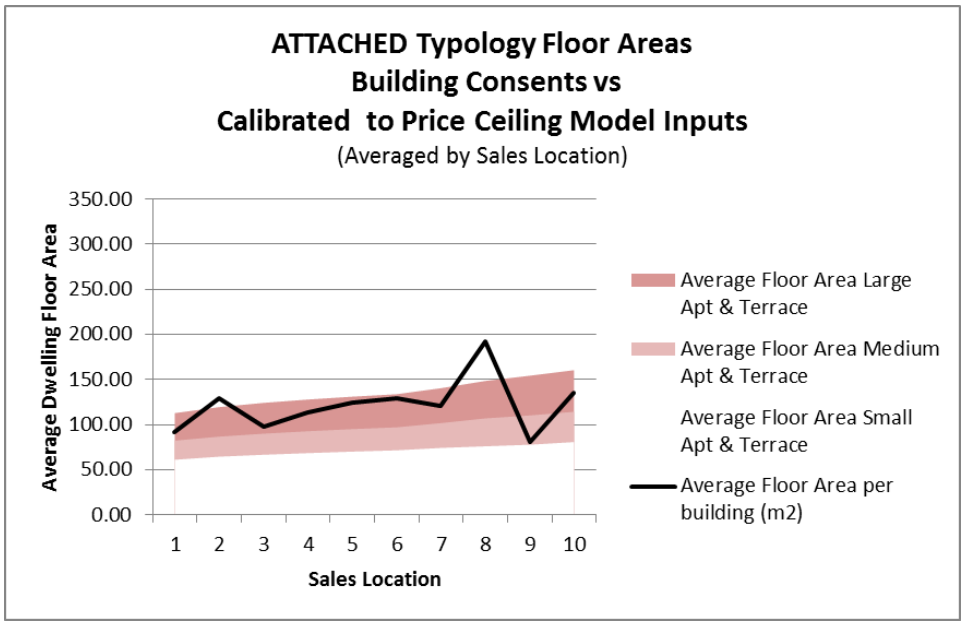


Figure 1: 'Attached' (Terrace and Apartment) input sizes vs Building Consents.

5.12 Figure 2 illustrates the relationship between observed Detached (aligns to House) development size and the average size range in the LUTs. The relationship

between dwelling size and location value is much stronger in the observed data than for attached, perhaps reflecting the volume of data points but also the much stronger relationship in the detached house typology between land and floorspace value due to the limited amount of floorspace able to be generated per unit of land under the House typology (c.f. attached developments that are able to use less land per unit allowing more smaller dwellings to be feasibly sold to recover the initial land cost). Interestingly, the observed data suggests the detached dwelling size to be much larger than the LUT inputs were able to be set to, due to the influence of the Ceiling Factors. However the sales data and the $m² information from that confirmed that houses of the average consented size could not be sold below the price ceilings we set, and so the input dwelling size was reduced accordingly.

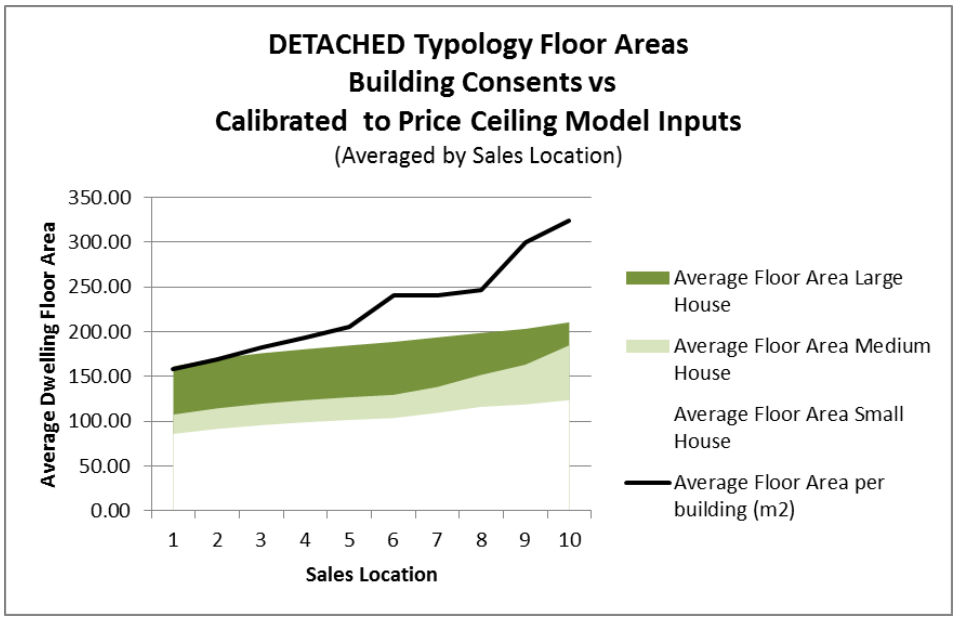


Figure 2: 'Detached' (House) input sizes vs Building Consents.

Testing multiple developments per site

5.13 A number of EG members questioned why a single development option was being tested per site, when, under the PAUP, a *range* of development opportunities were actually enabled (i.e. on sites enabling 4+ storey apartments it is still possible to build single storey houses at low densities). Other members also queried whether the single 'optimised' development tested was truly optimised, and proposed that a testing of a range of sizes might be an improvement. Other members also advocated that a very wide range of development be tested in very fine size/price increments to enable the production of a dataset that represented the very lowest

cost feasible dwelling possible per site[12] to better appreciate the PAUP's ability to deliver affordable dwellings in particular.

5.14 Taking all of these concerns into account was balanced against practical concerns of coming up with the multiple assumptions required for multiple developments and dealing with the resulting data outputs has resulted in the development of the approach incorporated into Version 3. This approach tests a range of dwelling typologies (House, Terrace and Apartments) at a range of different sizes (small, medium and large) resulting in a minimum of 9 different developments in total[13], all (at least as far as possible) within the twin limits set by the relevant zoning parameters and practicality.

5.15 This may result in none or many of those development options being feasible, providing for a wider range of potential outcomes across sites, neighbourhoods and the region as a whole. This is revealed as the difference (of around 100 to 150 thousand dwellings depending on scenario, refer Table 1) between the outputs of equivalent runs of Version 2 and Version 3 despite the CfGS inputs (reflecting the zoning and rule parameters) being exactly the same. In effect the difference in output numbers reflects that each site now has at least nine slightly different chances to 'pass' the feasibility test, all of which are under the price ceiling, instead of just a single 'optimised' one which may be excluded post-run due to being priced above the ceiling.

Typology Definitions

5.16 The definition of the typologies (being varying forms of physical (de)attachment) are important, as they delineate price, costs and also perceptions of the results. While initially proposed as a way to test the viability of lower density developments in high density zones it was applied to the whole input set (attached typologies in low density (often perceived as detached) zones). Some concern was also raised that the testing of apartments and terraces within low density zones in particular could be contrary to 'the intent of the rules' but such developments *can* potentially be realised within the low density zoning constraints under certain circumstances, and provided the site has sufficient land area for establishment of more than a single

[12] See *Re:ACDC15 Model Commissioning and Application, 12.10.2015* memo to IHP from Adam Thompson and Patrick Fontein.
[13] 18 development typologies are tested where the site has infill and redevelopment potential – 9 time for each capacity type.

'dwelling' under the density rules, an attached arrangement may, at least in theory, be possible.

5.17 In addition, the arrangement of the terrace and apartment forms in say Single House zone is not 'typical' (as is shown in Figure 3) below, and in most instances in these lower density zones, the typology differentiation is relatively nominal as

(a) Per site capacity values are usually low (1 maybe two dwellings per site)

(b) Capacity values are common to all typologies (as density controls are binding in these zones – you can only have 1 dwelling per <zone set minimum land area per dwelling> irrespective of built form)

(c) the build costs are greater than for an equivalent house and sale prices are lower than an equivalent house

(d) This combination of issues results in only rare instances where the more attached typologies are is feasible at all, and are never more profitable than a 'house'.

5.18 For the lower density developments in higher density zones, this approach did facilitate some 'less than maximum' development that was not identified previously, particularly as the land value, floorspace sale price decreased (lower value areas cannot always support high density developments).

5.19 Table 2Table 2 below outlines the possible combinations and outlines the definitions further and Figure 3 provides an illustration of the forms and the relative binding effect of practicality and rules in establishment of the various built forms tested:

Typology	Definition	Attached?	May Share Walls?	May Share Floor/ Ceiling?
House	Detached – Not attached to any other dwelling, direct access to separate ground level outdoor space.	No	No	No
Terrace	Horizontally attached to at least one other dwelling, direct access to separate ground level outdoor space.	**Yes**	**Yes**	No
Apartment	Vertically attached to at least one other dwelling, may not have direct access to ground level or outdoor space	**Yes**	**Yes**	**Yes**

Table 2: Typology Definition Matrix (Text)

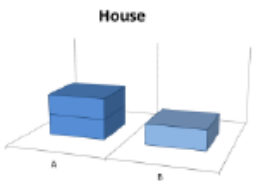
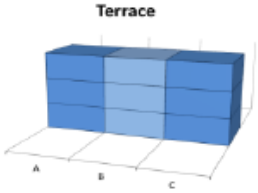
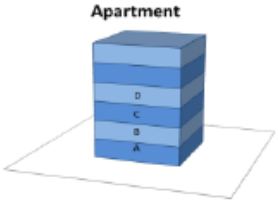
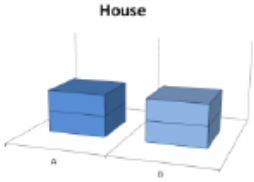
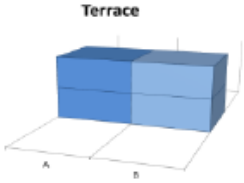
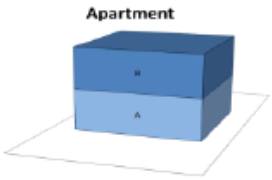
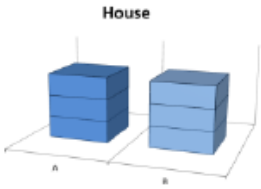
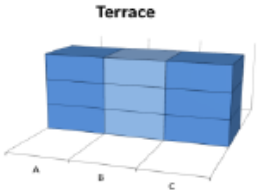
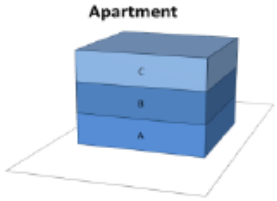
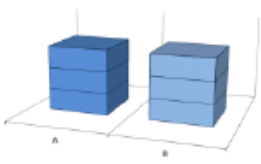
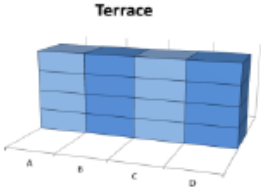
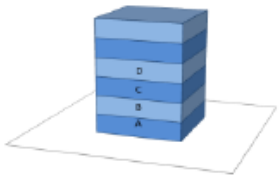
	House	Terrace	Apartment
Definition	**Stand alone - Not adjoining All dwellings have direct access to ground level outdoor space**	**Walls Shared/Adjoin All dwellings have direct access to ground level outdoor space**	**Ceiling/Floor/Walls Shared/Adjoin Not all dwellings have direct access to ground level outdoor space**
Typical or Common Example			
Development Examples	The tables below attempt to illustrate potential built form arrangements by typology within the 3 main groups of zonings on a nominal 1000m2 site, that potentially could comply with the relevant constraints. Depending on the typology and zone, compliance with the relevant rules or practical considerations will be the limiting factor for the total quantum of dwellings possible of each type. On smaller sites in the lower density residential zones actual differences between typologies are relatively nominal.		
2 Storey Max Residential Zones (Large Lot, Rural and Coastal Settlements, Single House			
Typology Notes	Much as per typical Example	Townhouses or units (Walls Adjoin)	Upstairs/Downstairs (Floor/Ceiling Adjoins)
Limiting Factor on Number of Dwellings per site	Rules (density)	Rules (density)	Rules (density)
2/3 Storey Terrace Zones (MHS, MHU)			
Typology Notes	Much as per typical Example	Much As per typical example	Upstairs/Downstairs (Floor/Ceiling Adjoins)
Limiting Factor on Number of Dwellings	Practicality/Rules	Rules (density, coverage, HIRB, building Seperation, Yards, Parking, Outlook/Privacy, Height)	Rules (density, coverage, HIRB, building Seperation, Yards, Parking, Outlook/Privacy, Height)
3 Storey + Apartment Zones (THAB, Mixed Use, Centres)			
Typology Notes	Much as per typical Example	Much As per typical example	Much As per typical example
Limiting Factor on Number of Dwellings	Practicality (Nature of Typology limits number of dwellings per site via min practical land area per 'house')	Practicality (nature of typology limites dwellings per site,via min practical land area per 'terrace'	Rules (Coverage, HIRB, building Seperation, Yards, Parking, Outlook/Privacy, Height)

Figure 3: Development Typology Matrix (Visual)

Choosing between multiple viable developments.

5.20 As noted above, Version 3 of the model is now testing 9 to 18 developments per site, of which zero, one, or more may be 'viable' (that is provide a gross return of more than 20% on costs when sold, before taxes), but only one viable development can be undertaken on the site – the 'option to develop' can be taken only once. Therefore for the results to be useful, we must choose a development from the viable options (which creates a single parcel with a single development data set that can be used in the same way as the Version 2 outputs). But how do we choose?

5.21 There are a variety of approaches which can be taken to selecting the development that might be taken by a developer from the viable options available. Given enough time a fully dynamic equilibrium seeking approach which dynamically selects the best development based on dynamic demand could be developed. However our supply and demand are not very dynamic ('demand' is in effect 'fixed' to the irregularly updated population projections[14], and only supply varies in response to 'planning'), and both have been established 'exogenously', that is external from each other and taken as a given. The approach I have taken to choosing, is a simple method that chooses from the viable developments, based on criteria *in the output supply data*[15], either individually (as I have done), or in a weighted combination (as Dr Fairgray has done), to create supply 'scenarios', that are then able to be compared with the exogenous population projection based demand.

5.22 For the information contained in this evidence, I have utilised 5 different individual criteria which in combination produce a range. The selection is only from those developments that are viable (and below the ceiling), these developments are ranked according to the criteria and the top (or bottom) ranked development chosen for that site – on sites with zero or one viable development that is the top ranked development for all scenarios. The criteria are designed to answer the question "*Of the Feasible Development options on the site (within the range tested) which is the scenario that delivers the <criteria name>*:

(a) **Maximum % Return**: This is the output which is most consistent with the 'actor based' approach to the modelling to date. While this is arguably the

[14] The headline Auckland Plan target of 400,000 dwellings by 2041 (or some proportion thereof depending on timeframes) is effectively being used as the 'design standard' for the plan – we are testing if this 'design target' is actually able to be accommodated within the details of the PAUP, and assume that if not, then adjustments to the supply side are needed, rather than there being a feedback effect on the projected population (as less people choose to move to or stay in Auckland due to high house prices or shortages).

[15] As opposed to choosing from the potential options based on some other external information such as demand.

most 'likely' (or developers first choice) development other factors may need to be considered[16] including demand, and the nature of the developer;

(b) **Lowest Project Cost:** This represents the lowest capital outlay for the developer which may be an important consideration especially for small firms or individuals which dominate the construction industry;

(c) **Largest Dwellings:** Size of dwelling affects possible dwelling yield (by decreasing it, also making this scenario the 'least number of dwellings' scenario) and also impacts on costs and sale price. It is often anecdotally suggested, that big houses are the most profitable (as price increases faster than build costs), and the outputs of this scenario are closely aligned with the 'maximum return' scenario correlating with that view;

(d) **Maximum number of Dwellings:** This scenario focusses on supply of dwelling units from each development, focussing on maximum supply of dwelling units;

(e) **Cheapest Dwellings:** This scenario focusses on identifying the development that produces the lowest priced dwelling units, focussed on the affordability of dwellings to the end purchaser – Mr Thompson identified this as a key consideration in his earlier evidence.

(f) **Version 2 (High Price Ceiling):** This is included as a cross check and to illustrate the variability in model outputs due to variations in input assumptions.

5.23 In reviewing the outputs, (see Section 6) the Maximum Return and Largest Dwelling scenarios are closely grouped, with Cheapest dwellings and Greatest Number of Dwelling Scenarios also closely aligned, with Lowest project costs and Version 2 somewhere in between the two 'extremes'. It appears that the model, via these scenarios give a broad range of outputs that can be viably supplied within a 'competitive market' (i.e. if demand for maximally profitable dwellings is fully supplied, there are options for the *n*th developer to supply an alternative, slightly less profitable development for which unmet demand exists), that appear suitable for comparing with exogenously projected demand. Version 2 also appears to be 'better' at assessing development in the CBD.

[16] Such as the required capital outlay (as per the Lowest Project Costs scenario), or an alternative approach based on gross or net dollar return, which may be an applicable approach for some self-financed or small scale developers.

Second Dwelling Conversions

5.24 It is also worth noting here that the modelling of dwellings in the CfGS and ACDC Models does NOT consider the potential for additional dwellings to be created via second dwelling conversions which is explicitly enabled in all residentially zoned sites with an existing dwelling excepting THAB. By our definition these converted dwellings would become Terrace or Apartment typologies (as the second dwelling must adjoin or attach the primary dwelling neither would be a 'house').

5.25 A significant amount of further work would be required to establish the costs of conversion (which would depend on many factors including the age and form of the existing structure and how the conversion might be undertaken). As the converted dwelling(s) are not able to be legally separated, and cannot be 'sold' individually in the same way as is presently considered by the ACDC model, this requires feasibility to be considered very differently. Perhaps as the difference in sale price and/or rental yield from a single dwelling, and the rent (or increased future sale price, based on rental yield "Home and income!") when an existing dwelling is converted into two, would pay for the conversion costs over a given time period.

5.26 Due to the wide range of potential solutions to a 'conversion' problem (only a minimum size for each dwelling is specified, and may involve the addition of completely new floorspace, not necessarily subdivision of existing floorspace) in any given specific existing dwelling situation, the wide variety of existing dwelling forms and structural details, this results in a very wide variability of potential costs of conversion and variation in potential returns. This practical issue compounded by the highly personalised decision making process for owner occupiers to add (usually) rental accommodation to their dwelling would make any modelling relatively indicative.

5.27 This is an area for further work, but the potential for dwelling conversions to act in contradictory ways to both potentially preclude comprehensive (re)development by way of increased improvement value and/or return to existing owners from the existing improvements, and conversely enable a significant source of additional affordable dwelling supply from those same improvements, should be noted.

Other Exclusions

5.28 In addition to the second dwelling conversions discussed above and there are a wide range of other exclusions discussed in my previous evidence[17], that are probably worth repeating in summary here. The evidence of Dr Fairgray accounts for some of these exclusions in the total supply tables:

(a) Amalgamation is not considered (all modelling is on the existing cadastral pattern – amalgamation and boundary adjustments may facilitate more, and/or more feasible development);

(b) Rural zone development is not included;

(c) Business site development for residential activities is limited to centres above ground level and mixed use zones;

(d) Housing New Zealand owned land is excluded from the results;

(e) SHA areas are in the model, but tested as if the SHA does not exist;

(f) FUZ land is not included;

(g) A number of precincts, or other areas subject to 'special' planning (CfGS special areas) are not included particularly if they are subject to further framework planning.

6. FEASIBILE CAPACITY ANALYSIS RESULTS (v3 PAUP Baseline)

6.1 As noted above, the outputs of the Version 3 model must first be 'chosen' to be utilised in a way consistent with previous modelling, by having a single 'chosen' development on each parcel. This approach (if more than one scenario is utilised) has the benefit of providing a range for comparison with demand, and also indirectly reflecting the inherent uncertainty in any forecasting.

6.2 Various Tables Maps and Graphs are included as **ATTACHMENT B**, and I include some summary information in Table 3 below. I have also included the equivalent results from a run of Version 2 as used in my evidence for the Topic 059-063 Residential Hearing utilising the same zoning and rule parameters.

[17] See in particular Kyle Balderston rebuttal evidence for Topic 059-063, which included maps illustrating what was in and what was out of Version 2 of the model. For Version 3 this information remains relevant.

Choosing Scenario (ACDCv3.6)	Total Feasible Capacity (n)	Average Sale Price ($)	Average Floorspace (m²)
Cheapest Dwellings	248,836	$ 814,054	128.2
Largest Dwellings	197,706	$ 985,356	176.5
Lowest Project Cost	222,212	$ 861,307	136.7
Maximum percentage return	209,931	$ 974,559	174.6
Maximum number of dwellings	255,881	$ 825,429	132.3
ACDC Version 2 (HPC)	144,165	$ 850,475	119.7

Table 3: Summary of Results from ACDCv3 Run 6, and ACDC15v2, High Price Ceiling.

6.3 Differences in the Feasible Capacity figures from Version 2 to Version 3 are due to changes in the approach taken to feasibility testing including dwelling size and in particular the large number of options tested per site, increasing the chance than at least one may pass.

6.4 Version 3 generally provides more feasible capacity in all locations excepting the CBD, where Version 2 appears to 'work better', in that the results concur with known sites of development interest or activity and overall quantum (results for the Waitemata Local Board are 20,000 higher in version 2, mostly from CBD apartments). Some refinement for Apartment typology and/or the CBD as a location in Version 3 may be warranted, but using Version 2 results for the CBD may be an acceptable workaround in the meantime.

7. ZONING AND RULE CHANGES AND ANTICIPATED CHANGES TO CAPACITY

7.1 I have undertaken a brief, and very high level analysis utilising the base zoning information released publically in December compared to the zoning in the PAUP as originally notified.

7.2 I have given each base zone within each zone class a ranking from 'least enabling' (1) to 'most enabling' (*n*th) as indicated in Table 4 below – this is a judgement call and differentiation in the lower orders of Business and Rural zone classes are quite subjective, however the Residential zoning ranking is in my view quite robust, being based on the dwelling density achievable in the zones and the zoning probably of most interest:

ZONE Name	ZONE Class	Rank
City Centre	Business	8
Metropolitan Centre	Business	7
Town Centre	Business	6
Local Centre	Business	5
Neighbourhood Centre	Business	4
Mixed Use	Business	3
General Business	Business	2
Business Park	Business	1
Light Industry	Business (Industry)	2
Heavy Industry	Business (Industry)	1
Terrace Housing and Apartment Buildings	Residential	6
Mixed Housing Urban	Residential	5
Mixed Housing Suburban	Residential	4
Single House	Residential	3
Rural and Coastal Settlement	Residential	2
Large Lot	Residential	1
Countryside Living	Rural	5
Mixed Rural	Rural	4
Rural Production	Rural	3
Rural Coastal	Rural	2
Rural Conservation	Rural	1

Table 4: Zone Intensity Rankings for Zone Change Map Analysis

7.3 I have then overlaid the revised December base zoning on the 'as notified' PAUP base zoning and calculated the difference in the two rankings (a positive change is upzoning (new zoning is 'more enabling' than PAUP zoning), a negative change indicates a down zoning, a zero value indicated no change). Some zones have also changed 'class', and these are also indicated in the maps enclosed at **ATTACHMENT C**

7.4 **PAUP VS DEC 2015 RELEASE BASE ZONING CHANGE MAPS**.

7.5 Based on my experience with the CfGS and ACDC Models to date I would expect the net result of these changes to do two things:

(a) The up-zoning will lead to more 'enabled capacity' – while there is some down-zoning it is more than offset by up-zoning.

(b) The resultant increase in enabled capacity should lead to more feasible capacity.

7.6 I would anticipate that there is a high likelihood that the increase in enabled capacity, which is widespread, but also concentrated in a number of high value locations, that had low levels of capacity previously, will lead to a discernible increase in feasible capacity. Therefore the overall numerical results of the

modelling presented in this evidence as a baseline (based on the PAUP pattern) are likely to be exceeded by the forthcoming modelling based on the revised spatial zoning position.

7.7 This high level conclusion cannot be more definitive at this stage as:

(a) The base zoning pattern has been further refined since the December data I have utilised in this section;

(b) The influence of precincts and overlays has not yet been considered and I have (at the time of writing) not sighted all of the overlays, precincts or their associated rules.

7.8 I will update this preliminary evidence with data from the spatial rezoning in the Evidence due 1 March 2016.

7.9 I am happy to provide any additional data in the form of maps, tables or graphs should this be required or of interest.

Kyle Balderston

26 January 2015

ATTACHMENT A

EMPLOYMENT SUMMARY & QUALIFICATIONS
KYLE OLIVER BALDERSTON

Employment Summary

August 2012 - Current	Growth Analyst, RIMU, Auckland Council
March 2012 – August 2012	Seconded to Research Investigations and Monitoring Unit "**RIMU"** for Capacity for Growth Study 2012
November 2010 – March 2012	Strategic Planner, Spatial and Infrastructure Strategy, Auckland Council
August 2006 - November 2010	Strategic Advisor, Strategy, Waitakere City Council
June 2003 – August 2006	Resource Planner, Waitakere City Council

Qualifications

2002 - 2003	Bachelor of Science (Honours) with First Class Honours, University of Auckland
1999 - 2001	Bachelor of Science (Geography), University of Auckland

ATTACHMENT B

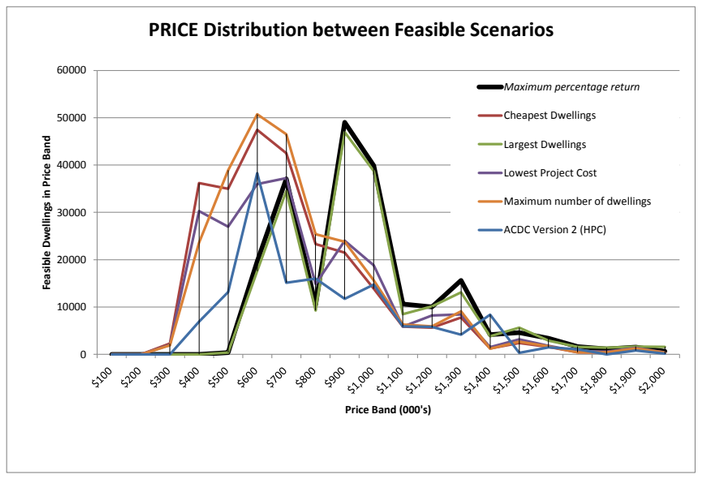
ACDC Version 3 Outputs (PAUP)

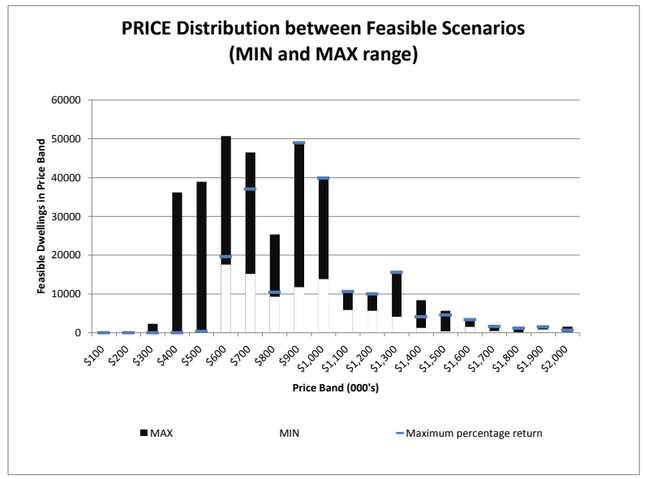
ATTACHMENT B1: SUMMARY TABLES AND GRAPHS

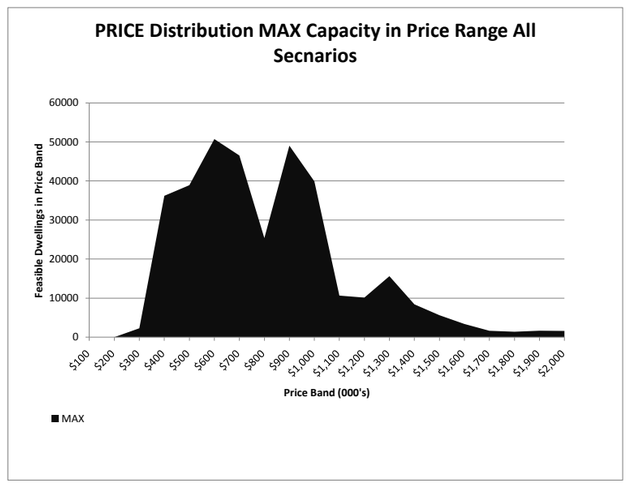
ATTACHMENT B2: SCENARIO MAPS

Of the Feasible Development options on the site (within the range tested) which is the scenario that delivers:

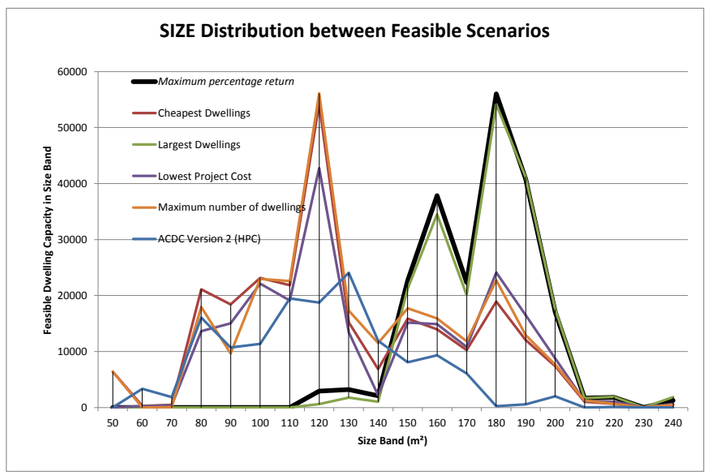
PRICE DISTRIBUTION																					
Sum of Capacity_with_FDC	Price Category																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Choosing Scenario	>= $100000 < $200000	>= $200000 < $300000	>= $300000 < $400000	>= $400000 < $500000	>= $500000 < $600000	>= $600000 < $700000	>= $700000 < $800000	>= $800000 < $900000	>= $900000 < $1000000	>= $1000000 < $1100000	>= $1100000 < $1200000	>= $1200000 < $1300000	>= $1300000 < $1400000	>= $1400000 < $1500000	>= $1500000 < $1600000	>= $1600000 < $1700000	>= $1700000 < $1800000	>= $1800000 < $1900000	>= $1900000 < $2000000	>= $2000000	
	$ 100	$ 200	$ 300	$ 400	$ 500	$ 600	$ 700	$ 800	$ 900	$ 1,000	$ 1,100	$ 1,200	$ 1,300	$ 1,400	$ 1,500	$ 1,600	$ 1,700	$ 1,800	$ 1,900	$ 2,000	SUM of ROW
Cheapest Dwellings	0	0	2279	36195	34963	47437	42512	23329	21497	13850	5867	5659	7757	1269	2408	1575	438	376	1074	351	**248836**
Largest Dwellings	0	0	0	0	386	17592	34505	9262	46923	38716	8489	10133	13119	3841	5626	2873	1597	1393	1655	1596	**197706**
Lowest Project Cost	0	0	2017	30264	26985	35971	37264	14843	24044	18803	5856	8210	8415	1527	3189	1806	669	570	1349	430	**222212**
Maximum percentage return	0	0	0	0	*386*	*19653*	*37095*	*10459*	*49032*	*39894*	*10645*	*10046*	*15618*	*4134*	*4612*	*3375*	*1637*	*1163*	*1530*	*652*	**209931**
Maximum number of dwellings	0	0	1932	23589	38910	50721	46523	25375	23795	15599	6299	5919	9117	1206	2683	1671	455	430	1271	386	**255881**
ACDC Version 2 (HPC)	0	0	0	6898	13170	38300	15131	16027	11748	14730	5940	5829	4138	8403	343	1474	1064	0	838	132	**144165**
MIN	0	0	0	0	386	17592	15131	9262	11748	13850	5856	5659	4138	1206	343	1474	438	0	838	132	**88053**
MAX	0	0	2279	36195	38910	50721	46523	25375	49032	39894	10645	10133	15618	8403	5626	3375	1637	1393	1655	1596	**349010**
Maximum percentage return	0	0	0	0	386	19653	37095	10459	49032	39894	10645	10046	15618	4134	4612	3375	1637	1163	1530	652	**209931**

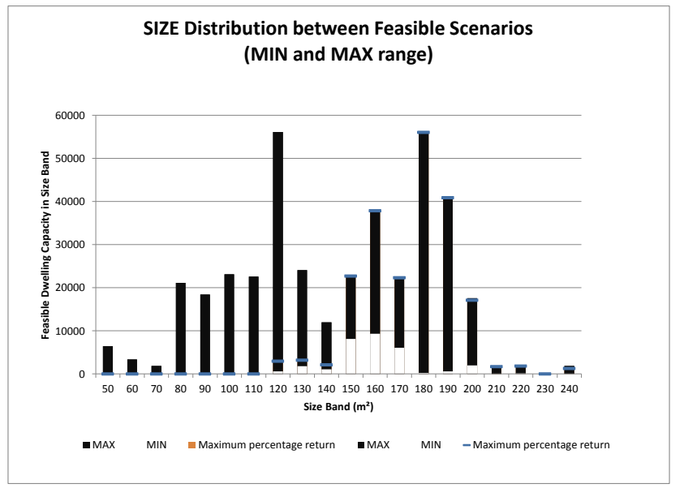


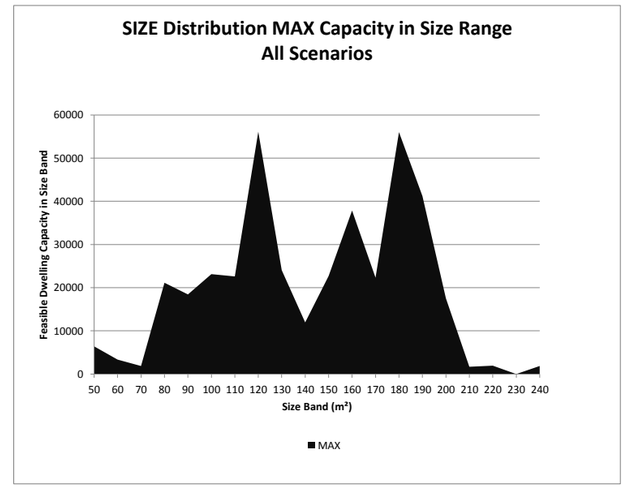




SIZE DISTRIBUTION																					
Sum of Capacity_with_FDC	Size Category																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Choosing Scenario	>=50m² <60m²	>=60m² <70m²	>=70m² <80m²	>=80m² <90m²	<100m²	<110m²	<120m²	<130m²	<140m²	<150m²	<160m²	<170m²	<180m²	<190m²	<200m²	<210m²	<220m²	<230m²	<240m²	>=240m² <m²>	
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	SUM of ROW
Cheapest Dwellings	6415	301	481	21133	18432	23131	21842	54300	15245	6904	15895	13990	10250	18951	12064	7387	1030	652	0	433	**248836**
Largest Dwellings	0	0	0	0	0	0	1	615	1782	1063	21235	34523	20096	54144	41200	17556	1685	1942	0	1864	**197706**
Lowest Project Cost	1	264	375	13654	15028	22125	19128	42753	13484	2177	15190	14919	10823	24109	16522	8800	1144	1061	0	655	**222212**
Maximum percentage return	0	0	0	18	0	0	1	2960	3204	2129	22709	37859	22308	56009	40865	17102	1688	1809	0	1270	**209931**
Maximum number of dwellings	6415	37	48	17953	9641	22972	22599	56106	17288	11507	17730	15901	11851	22746	12976	7672	1269	675	0	495	**255881**
ACDC Version 2 (HPC)	0	3345	1865	16072	10726	11372	19495	18752	24056	11955	8106	9350	6090	234	591	2011	0	103	0	42	**144165**
MIN	0	0	0	0	0	0	1	615	1782	1063	8106	9350	6090	234	591	2011	0	103	0	42	
MAX	6415	3345	1865	21133	18432	23131	22599	56106	24056	11955	22709	37859	22308	56009	41200	17556	1688	1942	0	1864	
Maximum percentage return	0	0	0	18	0	0	1	2960	3204	2129	22709	37859	22308	56009	40865	17102	1688	1809	0	1270	



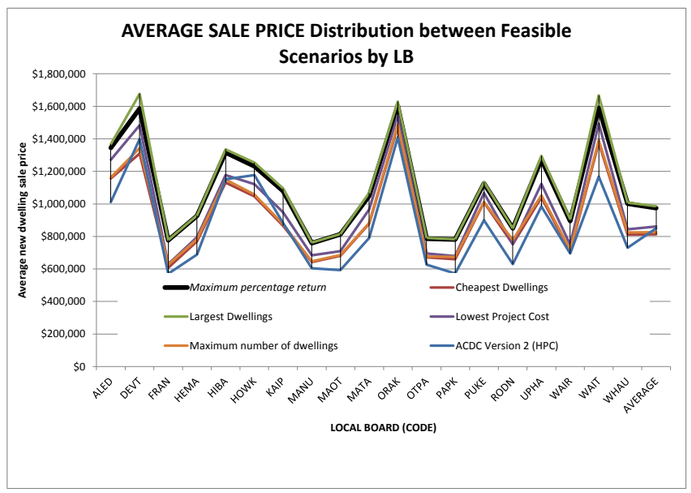


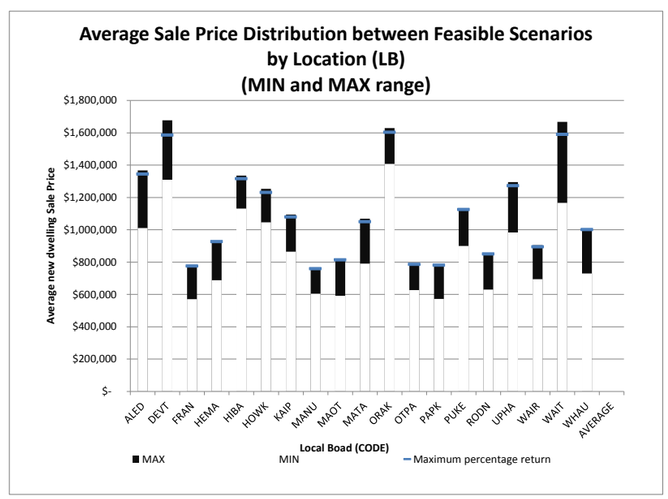


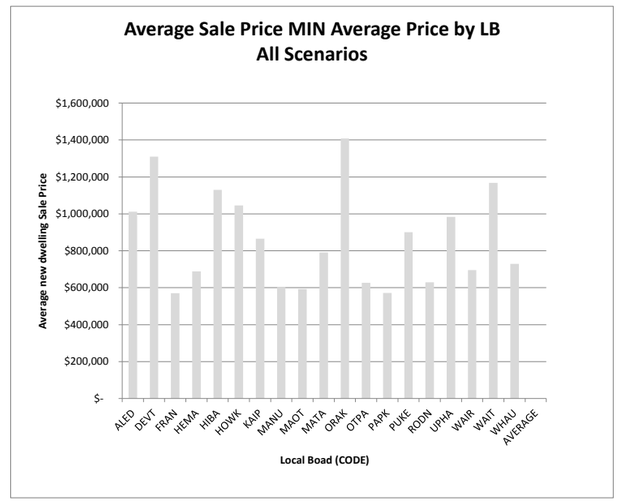
AVERAGE NEW FEASIBLE DWELLING SALE PRICE (INCL GST) BY LOCATION (LB)

Sum of Capacity_with_FDC																			
	ALED	DEVT	FRAN	HEMA	HIBA	HOWK	KAIP	MANU	MAOT	MATA	ORAK	OTPA	PAPK	PUKE	RODN	UPHA	WAIR	WAIT	WHAU	**AVERAGE**
Choosing Scenario																				
Cheapest Dwellings	$ 1,157,242	$ 1,310,070	$ 607,371	$ 769,547	$ 1,130,528	$ 1,045,774	$ 865,199	$ 642,220	$ 680,958	$ 879,332	$ 1,473,623	$ 671,115	$ 659,850	$ 1,008,911	$ 752,617	$ 1,039,667	$ 707,949	$ 1,377,355	$ 811,387	**$ 814,054**
Largest Dwellings	$ 1,367,610	$ 1,677,000	$ 777,970	$ 929,617	$ 1,335,410	$ 1,253,162	$ 1,095,046	$ 761,646	$ 815,224	$ 1,068,296	$ 1,629,573	$ 791,024	$ 783,632	$ 1,133,549	$ 850,126	$ 1,295,647	$ 905,184	$ 1,666,952	$ 1,007,796	**$ 985,356**
Lowest Project Cost	$ 1,272,120	$ 1,484,214	$ 629,169	$ 796,253	$ 1,177,547	$ 1,121,474	$ 948,352	$ 684,437	$ 709,437	$ 966,570	$ 1,543,648	$ 695,911	$ 678,760	$ 1,066,386	$ 753,421	$ 1,123,504	$ 750,037	$ 1,494,247	$ 843,132	**$ 861,307**
Maximum percentage return	$ 1,344,943	$ 1,585,610	$ 776,259	$ 926,794	*$ 1,316,184*	*$ 1,231,368*	*$ 1,079,571*	*$ 759,685*	*$ 813,978*	*$ 1,049,920*	*$ 1,603,594*	*$ 785,842*	*$ 780,958*	*$ 1,125,579*	*$ 850,126*	*$ 1,272,466*	*$ 894,587*	*$ 1,589,901*	*$ 1,001,507*	**$ 974,559**
Maximum number of dwellings	$ 1,163,254	$ 1,343,113	$ 626,212	$ 783,715	$ 1,149,624	$ 1,057,347	$ 875,230	$ 647,560	$ 684,903	$ 884,271	$ 1,489,207	$ 675,613	$ 674,224	$ 1,010,742	$ 777,759	$ 1,053,330	$ 717,784	$ 1,391,749	$ 824,373	**$ 825,429**
ACDC Version 2 (HPC)	$ 1,011,319	$ 1,399,644	$ 570,375	$ 688,721	$ 1,152,155	$ 1,177,668	$ 884,096	$ 604,506	$ 592,302	$ 790,607	$ 1,408,010	$ 626,400	$ 572,090	$ 900,123	$ 629,360	$ 984,262	$ 695,135	$ 1,167,275	$ 729,724	**$ 850,475**

MIN	$ 1,011,319	$ 1,310,070	$ 570,375	$ 688,721	$ 1,130,528	$ 1,045,774	$ 865,199	$ 604,506	$ 592,302	$ 790,607	$ 1,408,010	$ 626,400	$ 572,090	$ 900,123	$ 629,360	$ 984,262	$ 695,135	$ 1,167,275	$ 729,724	
MAX	$ 1,367,610	$ 1,677,000	$ 777,970	$ 929,617	$ 1,335,410	$ 1,253,162	$ 1,095,046	$ 761,646	$ 815,224	$ 1,068,296	$ 1,629,573	$ 791,024	$ 783,632	$ 1,133,549	$ 850,126	$ 1,295,647	$ 905,184	$ 1,666,952	$ 1,007,796	
Maximum percentage return	$ 1,344,943	$ 1,585,610	$ 776,259	$ 926,794	$ 1,316,184	$ 1,231,368	$ 1,079,571	$ 759,685	$ 813,978	$ 1,049,920	$ 1,603,594	$ 785,842	$ 780,958	$ 1,125,579	$ 850,126	$ 1,272,466	$ 894,587	$ 1,589,901	$ 1,001,507	



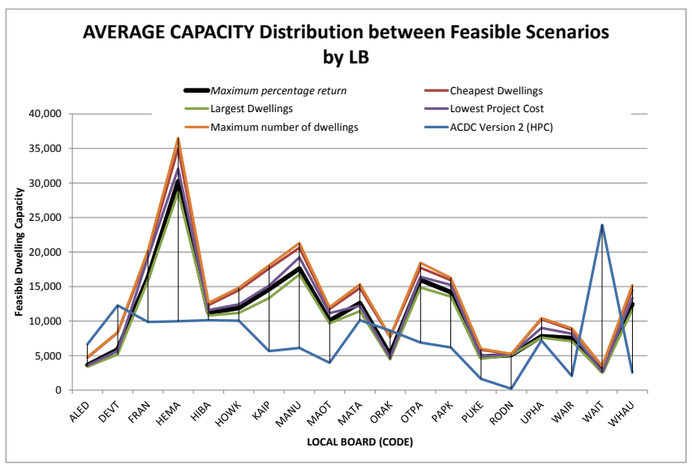


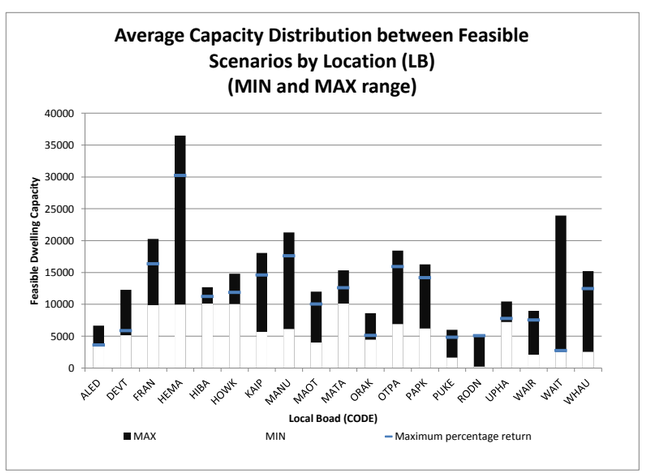


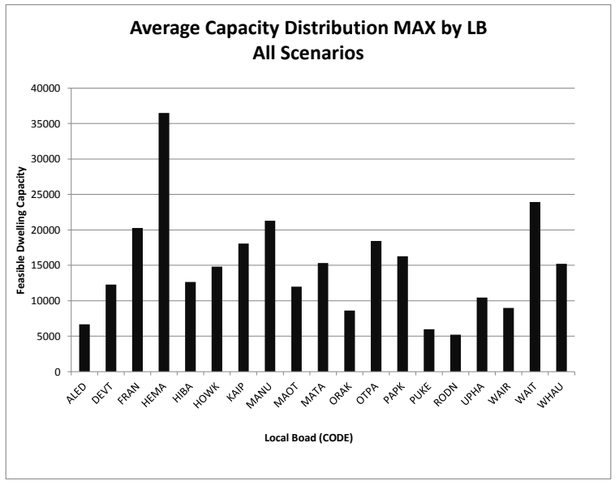
CAPACITY (Net Increase) BY LOCATION (LB)

Sum of Capacity_with_FDC																			
	ALED	DEVT	FRAN	HEMA	HIBA	HOWK	KAIP	MANU	MAOT	MATA	ORAK	OTPA	PAPK	PUKE	RODN	UPHA	WAIR	WAIT	WHAU	**TOTAL**
Choosing Scenario																				
Cheapest Dwellings	4732	8324	19792	35003	12312	14481	17618	20618	11750	14776	7706	17727	15928	5852	5206	10297	8746	3463	14505	**248836**
Largest Dwellings	3412	5161	15926	28640	10819	11195	13322	16738	9670	11461	4458	14876	13562	4550	5079	7603	7084	2525	11625	**197706**
Lowest Project Cost	3602	5696	19257	32072	11584	12441	15130	19215	11143	12249	4739	16420	15240	4917	5200	9021	8185	2721	13380	**222212**
Maximum percentage return	3630	5878	16379	30249	*11240*	*11893*	*14607*	*17619*	*10062*	*12611*	*5136*	*15943*	*14196*	*4832*	*5080*	*7797*	*7548*	*2751*	*12480*	**209931**
Maximum number of dwellings	4804	8399	20254	36501	12666	14820	18064	21286	12001	15324	7765	18435	16266	5989	5235	10439	8973	3463	15197	**255881**
ACDC Version 2 (HPC)	6669	12283	9857	9970	10125	10048	5673	6118	3987	10114	8627	6893	6190	1651	207	7214	2069	23926	2544	**144165**

MIN	3412	5161	9857	9970	10125	10048	5673	6118	3987	10114	4458	6893	6190	1651	207	7214	2069	2525	2544	
MAX	6669	12283	20254	36501	12666	14820	18064	21286	12001	15324	8627	18435	16266	5989	5235	10439	8973	23926	15197	
Maximum percentage return	3630	5878	16379	30249	11240	11893	14607	17619	10062	12611	5136	15943	14196	4832	5080	7797	7548	2751	12480	







ATTACHMENT B2: SCENARIO MAPS

NOTES ON MAPS

These maps illustrate the chosen development typology on each site with at least one feasible development. The mix of typologies varies depending on the criteria used to 'choose'.

These maps use colour to illustrate the typology in each site, within a palette similar to the previous modelling runs, but with colour tone used to differentiate between size as well – the larger typologies are darker than the smaller ones, and medium keeps the colours used for the typology from the previous versions.

Sites with capacity that is not feasible is shown as a dark grey, sites without capacity are not illustrated (and are 'out' of the model).

A wide range of other maps can be produced on request.

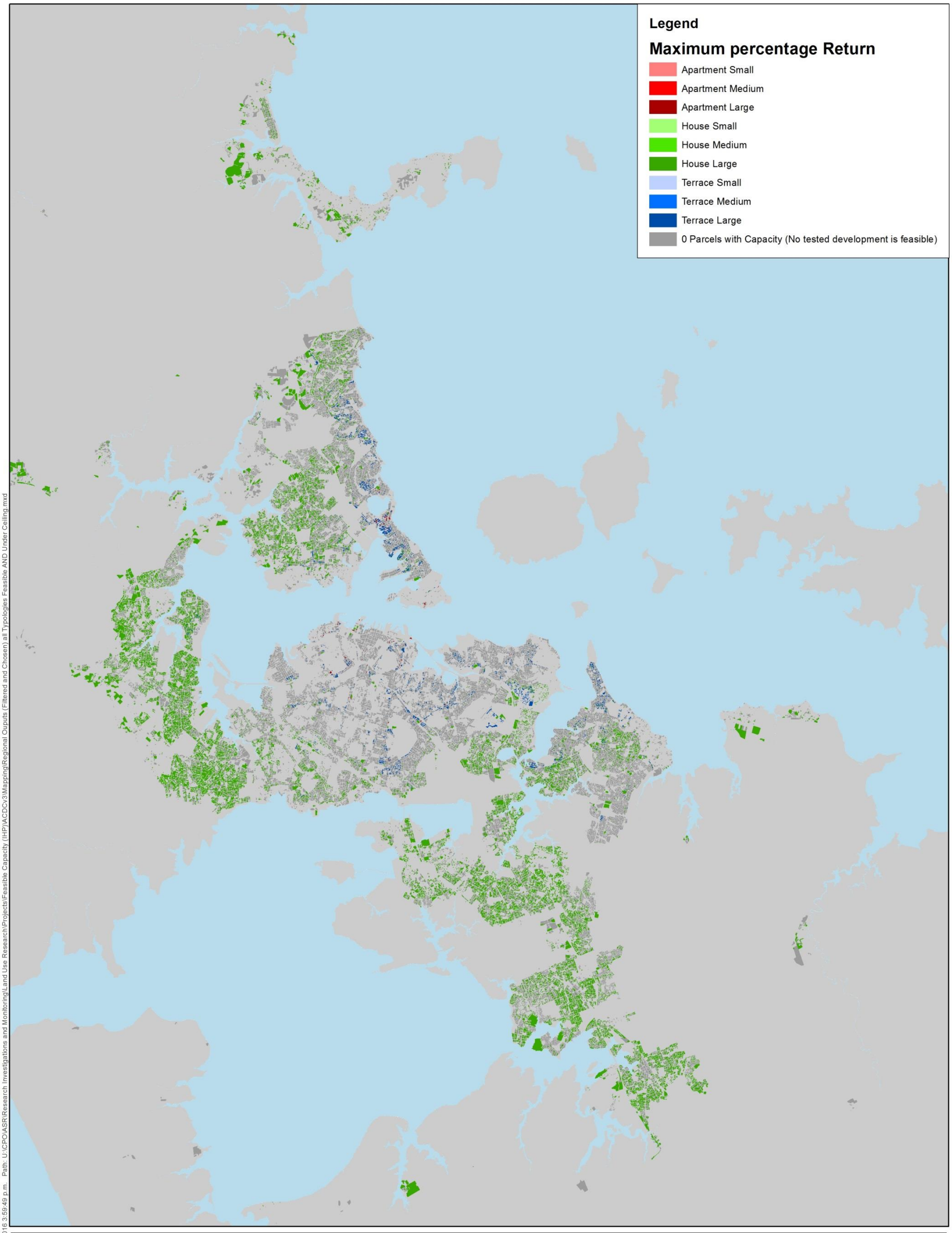
NOTES ON SCENARIOS

(from Para 5.5)

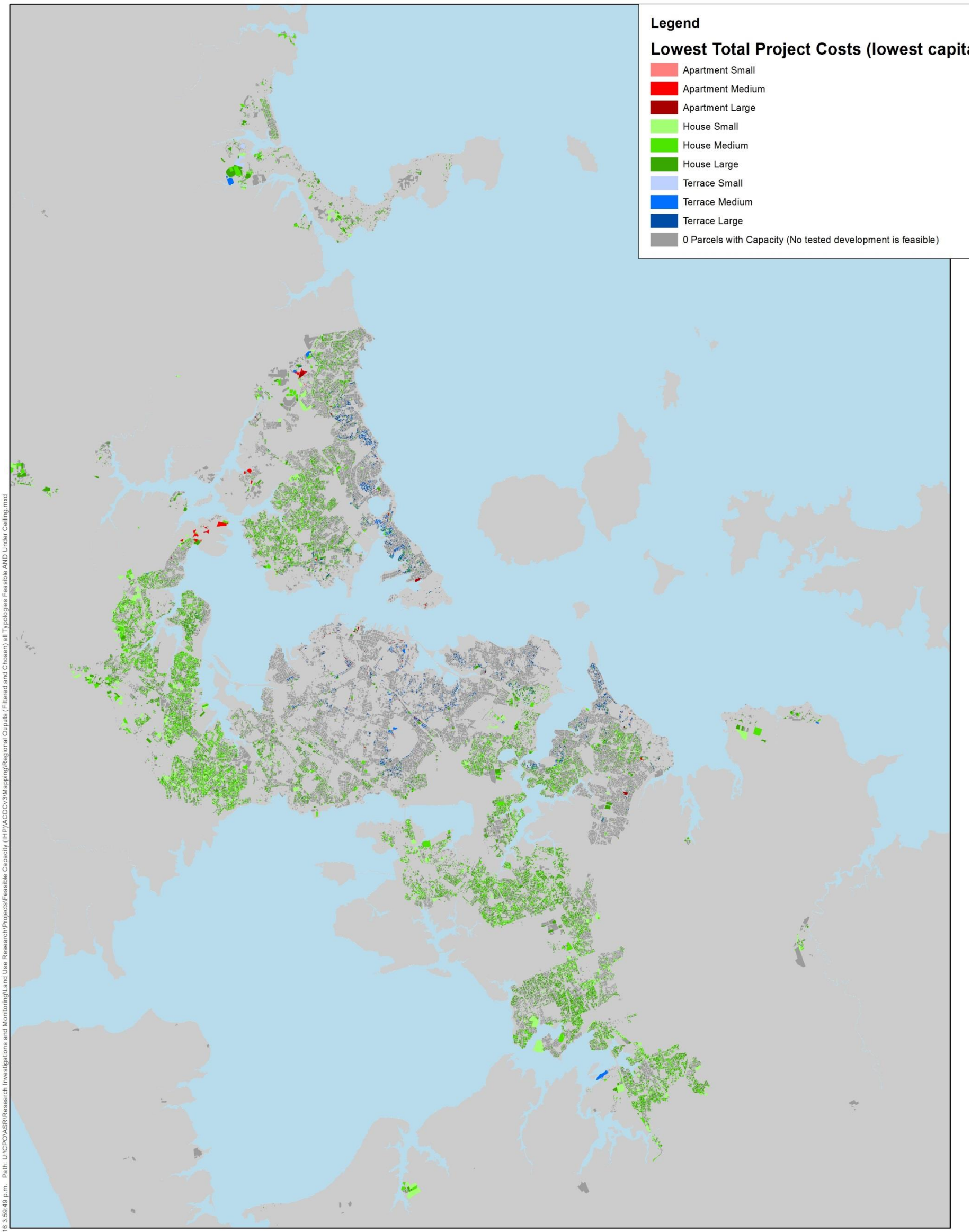
For the information contained in this evidence, I have utilised 5 different individual criteria which in combination produce a range. The selection is only from those developments that are viable (and below the ceiling), these developments are ranked according to the criteria and the top (or bottom) ranked development chosen for that site – on sites with zero or one viable developments that is the top ranked development for all scenarios. The criteria are designed to answer the question "*Of the Feasible Development options on the site (within the range tested) which is the scenario that delivers the <criteria name>*:

- **Maximum % Return**: This is the output which is most consistent with the 'actor based' approach to the modelling to date. While this is arguably the most 'likely' (or developers first choice) development other factors may need to be considered including demand, and the nature of the developer;
- **Lowest Project Cost**: This represents the lowest capital outlay for the developer which may be an important consideration especially for small firms or individuals which dominate the construction industry;
- **Largest Dwellings:** Size of dwelling affects possible dwelling yield (by decreasing it, also making this scenario the 'least number of dwellings' scenario) and also impacts on costs and sale price. It is often anecdotally suggested, that big houses are the most profitable (as price increases faster than build costs), and the outputs of this scenario are closely aligned with the 'maximum return' scenario correlating with that view;
- **Maximum number of Dwellings**: This scenario focusses on supply of dwelling units from each development, focussing on maximum supply of dwelling units;
- **Cheapest Dwellings**: This scenario focusses on identifying the development that produces the lowest priced dwelling units, focussed on the affordability of dwellings to the end purchaser – Mr Thompson identified this as a key consideration in his earlier evidence.
- **Version 2 (High Price Ceiling):** (*NOT INCLUDED: refer previous evidence for maps and tables*) This is included as a cross check and to illustrate the variability in model outputs due to variations in input assumptions.

Maximum % Return:



Lowest Project Cost:



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Chosen Development Option: See Legend
Filtered and 'Chosen' Outputs (Feasible)
Regional Run v3.6.01 21/01/2016
Feasible & Under Ceiling - All Typologies

Map Produced by
Land Use and Infrastructure Team
RIMU
Auckland Council

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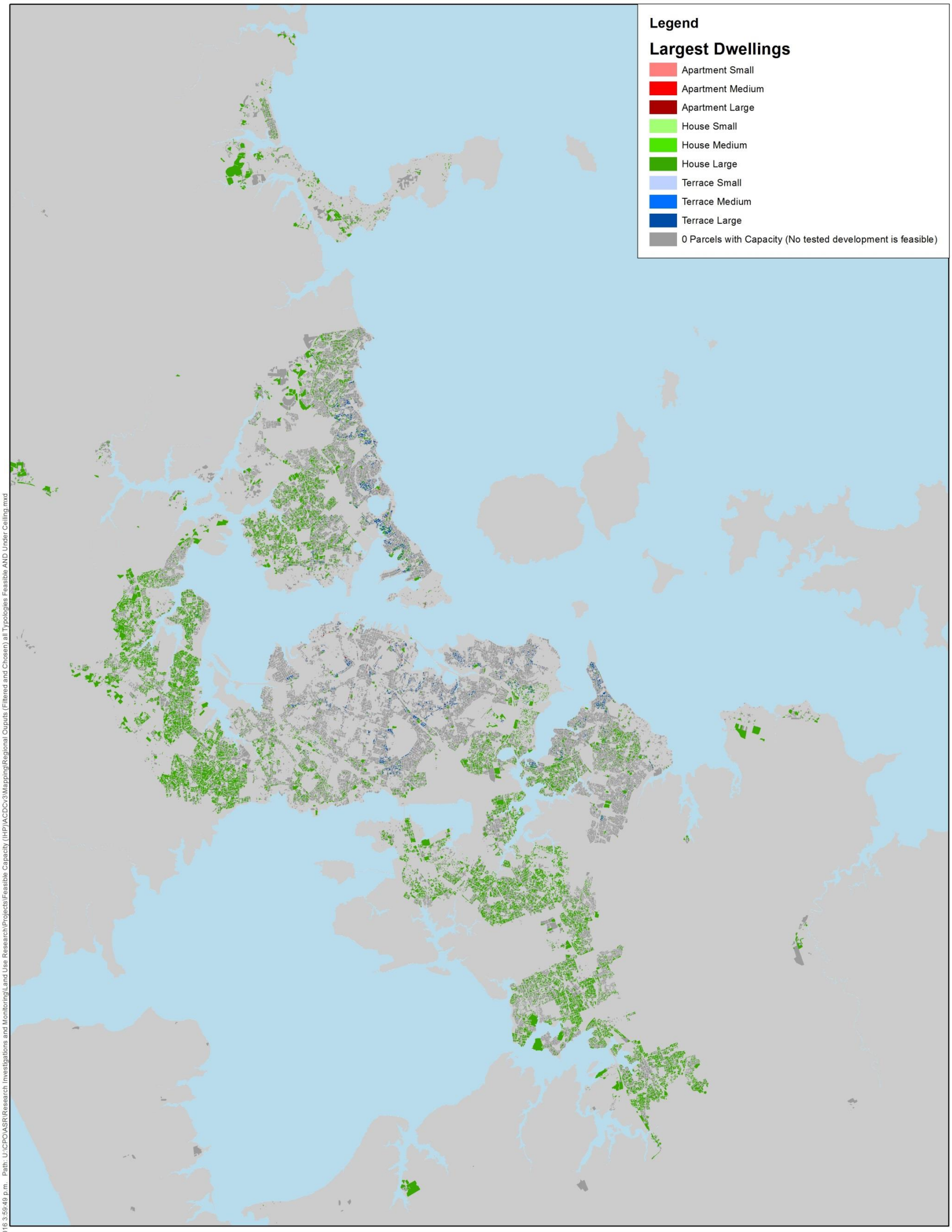
Te Kaunihera o Tāmaki Makaurau

Largest Dwellings:



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Chosen Development Option: See Legend
Filtered and 'Chosen' Outputs (Feasible)
Regional Run v3.6.01 21/01/2016
Feasible & Under Ceiling - All Typologies

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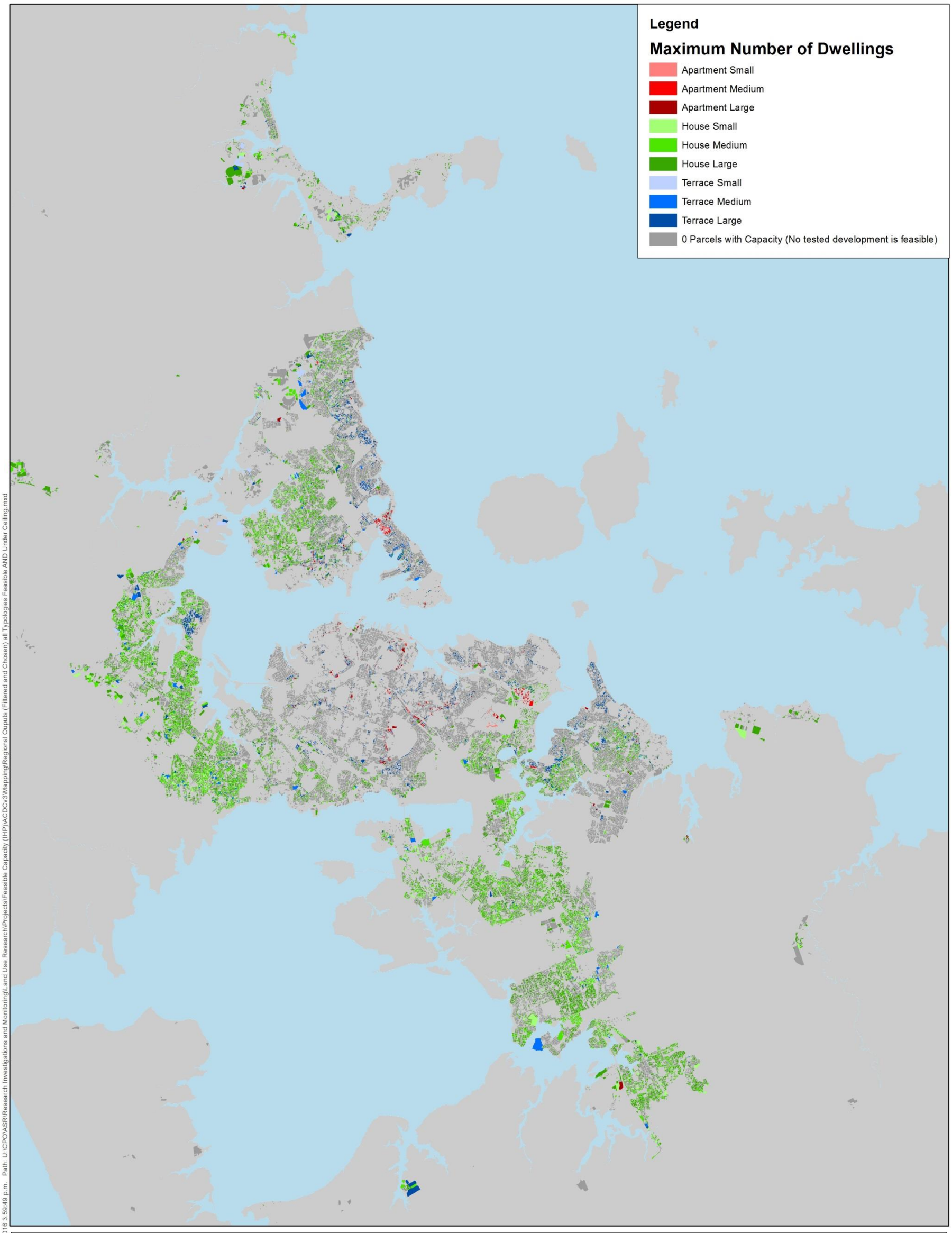
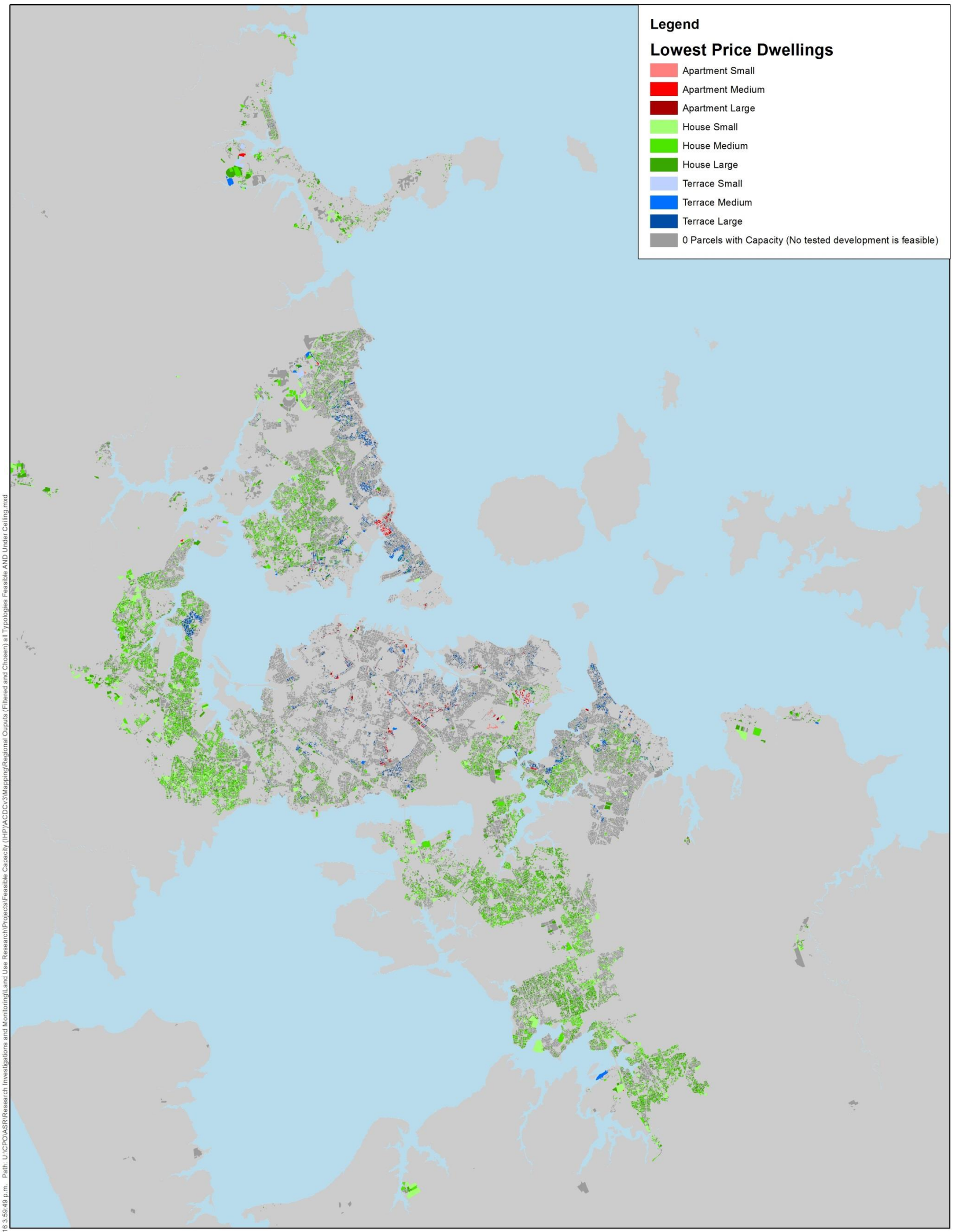
Maximum number of Dwellings:



Cheapest Dwellings



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Chosen Development Option: See Legend
Filtered and 'Chosen' Outputs (Feasible)
Regional Run v3.6.01 21/01/2016
Feasible & Under Ceiling - All Typologies

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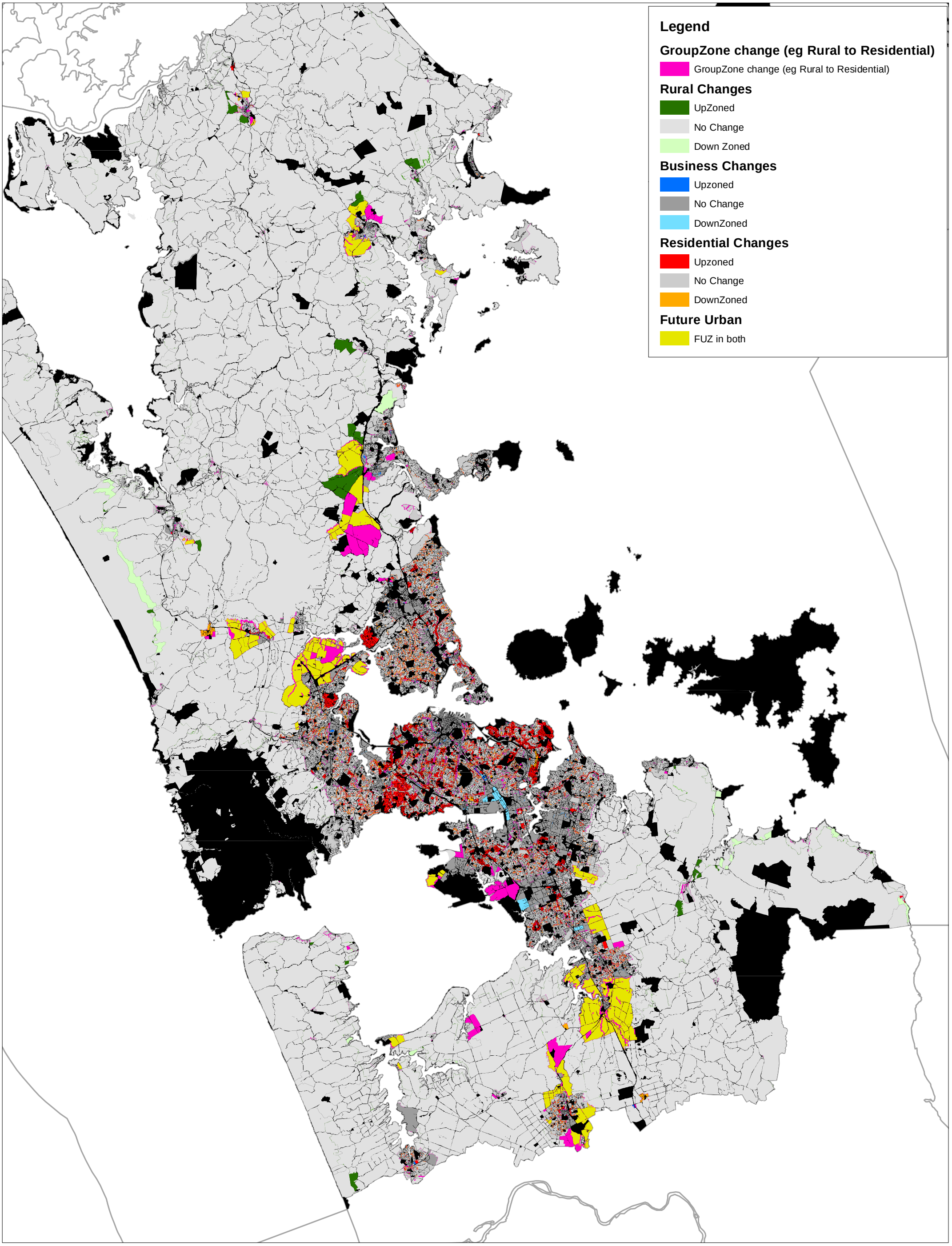
ATTACHMENT C

PAUP VS DEC 2015 RELEASE BASE ZONING CHANGE MAPS

ATTACHMENT C1: REGIONAL MAP

ATTACHMENT C2: MAIN URBAN AREA



PAUP to Rezone 'Up/Down Test'
FOR DISCUSSION ONLY

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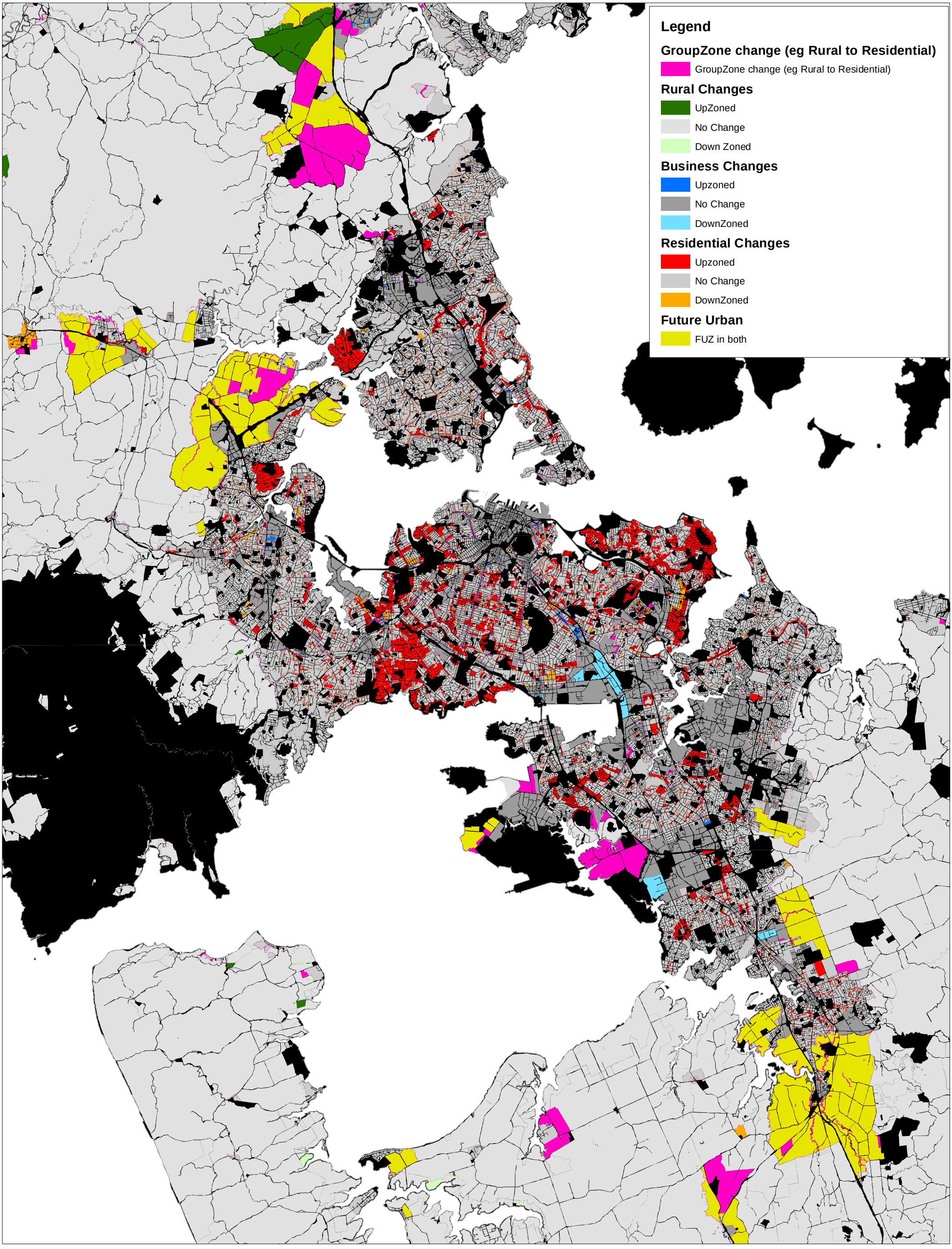

PAUP to Rezone 'Up/Down Test'
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