Housing Assessment for the Auckland Region

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Auckland Council
Te Kaunihera o Tāmaki Makaurau

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Executive summary

In August 2020, the National Policy Statement on Urban Development (NPS-UD) came into effect with the purpose of boosting the competitiveness of the housing and urban markets as a mechanism to improve access to affordable homeownership through better planning decisions. As part of evidence-based decision-making, the NPS-UD requires that the Auckland Council develop a Housing and Business Development Capacity Assessment (HBA) that provides information on the demand and supply of housing and business land, over the short, medium, and long-term, and the impact of council's planning and infrastructure decisions.

The NPS-UD is prescriptive in nature and shares commonalities with its predecessor, the National Policy Statement on Urban Development Capacity (NPS-UDC) 2016, but does not provide details for implementation. The NPS-UD differs from its predecessor in that it provides space for users to refine the terminology used and develop appropriate assessment methods, tailored to the context of individual territorial authorities.

Since the adoption of the Auckland Unitary Plan (AUP), Auckland's annual dwelling supply has reached an all-time high, and the latest consenting data from the council and Stats NZ shows this increase continuing. This HBA is the latest in a long series of housing and business development capacity supply monitoring work for Auckland, and aims to meet the requirements of the NPS-UD. It builds on previous monitoring work by analysing the impact of housing supply on housing affordability, that is, it assesses affordability through the lens of ordinary home buyers who are experiencing increased difficulty in entering the housing market. However, there are aspects that are not included in this HBA and are left for future assessments and research.

The key findings and implications of this HBA are summarised below.

Development capacity

1. Total net infill development capacity is 101,649 dwellings and the total net redevelopment capacity is 909,179 across Auckland's urban zoned land. If all suitable sites are all redeveloped to the maximum as enabled by the plan, Mixed Housing Urban and Mixed Housing Suburban combined could provide 678,851 additional dwellings or 75 per cent of the total net redevelopment capacity.
2. If development potential is maximised, Franklin and Howick local boards provide 28 per cent (28,310 dwellings) of the total net infill capacity. The combined areas of Henderson-Massey and Howick have the potential to supply 23 per cent (210,556) of the total net redevelopment capacity.
3. To identify capacity that is commercially feasible, two capacity scenarios are used – the maximum percentage of profit yield and the minimum priced dwelling units

scenarios. Approximately 840,000 dwellings are commercially feasible for the maximum percentage of profit yield scenario, where the average sales price is $1.66 million and terrace housing comprise most of the feasible typology. Under the minimum priced dwelling scenario, about 1.4 million dwellings are commercially feasible, where the average price is $1.04 million with an average floorspace of 107 square metres. Apartments and terrace housing comprise over 84 per cent of the feasible dwellings tested under the minimum priced dwelling scenario.

Infrastructure-ready

1. Water supply, wastewater, and stormwater infrastructure, at a network (bulk) infrastructure level, is broadly adequate to cater for projected growth over the short, medium, and long-term. Land transport capacity is not included in this HBA and ongoing work to develop land transport assumptions will be included in the next HBA.
2. The initial assessment of the bulk water supply and wastewater networks indicates that of net plan enabled capacity, 57 per cent is infrastructure ready in the short-term, 77 per cent in the medium-term, and 99 per cent in the long-term.
3. Although constraints exist within the existing networks, projects funded through the Long-term Plan and identified in the Infrastructure Strategy will continue to unlock further development capacity across the region. This assessment is not required to, and therefore does not, take into account local infrastructure requirements (which is usually developer built), and may play a significant role in enabling growth in specific areas.

Competitiveness margin

1. The expected level of residential demand plus the relevant competitiveness margin over the next 30 years ranges from 332,000 to 384,000 dwellings. It is anticipated that the short-term (including 20 per cent margin, year 0-3) growth is approximately 36,000, the medium-term (including 20 per cent margin, year 3-10) growth ranges from 88,000 to 104,600, and the long-term (including 15 per cent margin, year 10-30) growth ranges from 200,000 to 207,000.

Demand and sufficiency of capacity

1. The primary objective of the NPS-UD is to test the sufficiency of development capacity to meet growth demand over the next 30 years. The HBA findings have identified both the plan-enabled development capacity and the feasible development capacity are sufficient to meet the projected growth demand plus competitiveness margins. It is acknowledged that some development capacity is infrastructure

constrained at the bulk network level which the council is addressing though planned investment in the Long-term Plan and Infrastructure Strategy.

2. Delving deeper in the housing demand-supply paradigm, this HBA uses the concept of intermediate market households as a benchmark to assess the affordability aspects of the competitive market due to the influence of the NPS-UD (i.e., greater releases of land capacity). The intermediate households consist of private renter households and the level of income required to affordably pay the mortgage on a dwelling purchased at the lower quartile dwelling sale price. Required income is $132,300 for a sales price of ($770,000) (Mitchell 2019, 2020).
3. Two additional demand scenarios are constructed to provide detailed analyses for the short and medium-term – the likely and the high-growth scenarios over the next 10 years. Relative to 2021, in 2026 and 2031 about 41,000 and 77,000 additional households will demand a dwelling under the likely scenario; and, about 58,000 and 110,000 in the high-growth scenario.
4. In 2021 intermediate households numbered 97,156 and 104,128 households for the likely and high-growth scenarios respectively. By 2031 there will be approximately 9600 additional intermediate households demanding a dwelling under the likely scenario; and, about 32,600 in the high-growth scenario.
5. To assess the sufficiency of affordable housing development capacity, five supply scenarios are constructed to represent the whole spectrum of the housing market. At one end, the Upper-range and Mid-range scenarios reflect existing housing stock delivered at prices capped at $1.6 or $1.35 million, respectively. Then the Minimum-priced, Full-spectrum and Conditional-affordable scenarios represent relatively more affordable conditions.
6. Simulations of the supply scenarios and a sample of households reveal a large discrepancy between the distribution of prices of new dwellings (deemed as commercially feasible) and the incomes of households. For the Upper-range scenario, a large share of households cannot afford to buy a dwelling. Out of the 6000 additional feasible dwellings, only 392 would be bought (rate of take-up of 6.5%). The average price of bought dwellings is $1.56 million and the average income of the buyers is $214,000. For the rest of the scenarios, it is observed that the lower prices result in a greater rate of take-up where even lower-income households (earning approximately $60,000) manage to become homeowners. However, the traded dwellings' floorspace is on average 62 square metres, (representing an average sized one-bedroom apartment) and the bulk of buyers correspond to couples or couples with children.
7. A metric of the effectiveness of affordability policies could be defined by how long it would take to halve the size of the intermediate market (to 48,578 households). Under the core assumptions of the NPS-UD, that halving would occur within a generation (18 years) only if the rate of growth of the supply of affordable housing (dwellings

priced at $770,000 or less) is 25 per cent annually. For the same halving to occur within a decade, the rate of growth should be 45 per cent annually. If the rate of growth of affordable housing is equal to household growth (2.2%), the mathematical model fails to find a finite solution. Thus, the lowest rate of growth admissible to find a finite solution is five per cent which implies at least 124 years for the halving to occur.

Key conclusions

1. The AUP has enabled a vast amount of housing development capacity within the existing urban area and much of the capacity is commercially viable under the current market conditions.
2. That being said, it is likely that any affordability improvements influenced by the NPS-UD assumptions could be concentrated on households earning well above Auckland's median income.
3. Realisation of the commercially viable capacity at an affordable level becomes uncertain because of the discrepancy (or incompatibility) between the high prices and the purchase power of households. That is, a dwelling may not be realised unless there is someone who can pay for it.
4. More dwellings entering the market does not imply that lower-income households will be able to buy a dwelling. Market efficiency is still achieved, the market remains competitive, as intended in the NPS-UD, but the social outcome is increasingly harder to achieve as revealed by this HBA.
5. The HBA then shows that on a yearly basis, the capacity reasonably expected to be realised could be negligible or at least incompatible to a large share of the population represented in the form of intermediate households.
6. Housing capacity and supply are only parts of the equation. While providing an enabling planning policy environment is fundamental to create greater development potential, there are many other dimensions of complexity out of the scope or control of territorial authorities that may have a greater impact on affordability and competitiveness. The NPS-UD could have an impact on prices over time as more supply enters the markets, enables capacity in accessible locations and provides the opportunity to revisit planning provisions and zoning. However, overall, any improvements on affordability for intermediate households (or any other target groups earning below the median income) are likely to be small, if not negligible, until intervened via other means to deliver housing by volume and at pace.

Table 1 maps the report structure to NPS-UD subpart 5 and details how this HBA satisfies the corresponding requirements of the NPS-UD.

Table 1: Report structure in relation to NPS-UD Subpart 5 requirements

Subpart 5 – Housing and Business Assessment (HBA) – housing clauses	Section(s) in report
3.22 Competitiveness margin	**3.3**
3.23 Analysis of housing market and impact of planning	**3.1, 3.6**
3.24 Housing demand assessment	**3.4**
3.25 Housing development capacity assessment	**3.2**
3.26 Estimate what is feasible and reasonably expected to be realised	**3.2, 3.3, 3.4**
3.27 Assessment of sufficient development capacity for housing	**3.5, 3.6**

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1.0 Introduction

Housing affordability has become one of the most discussed policy issues in New Zealand. For which, policy efforts and actions have been undertaken in the last decade with differing degrees of success. In August 2020, the National Policy Statement on Urban Development (NPS-UD) came into effect with the purpose of improving the competitiveness of the housing and urban markets as a mechanism to increase housing supply through an enabling policy environment and better decision-making.

As part of evidence-based decision-making, the NPS-UD requires that the Auckland Council develop a Housing and Business Development Capacity Assessment (HBA) every three years that provides information on the demand and supply of housing and business land, and the impact of council's planning and infrastructure decisions.

One of the tasks of the HBA is to quantify the development capacity that is sufficient to meet expected demand for housing and for business land in the short-term (0-3 years), medium-term (3-10 years) and long-term (10-30 years) (Government of New Zealand, 2020). Capacity is then assessed on how well it meets the current and future housing demands by Māori and other population groups (e.g., older people, renters, homeowners, low-income households, visitors, and seasonal workers), including the demand for different types and forms of housing (e.g., lower-cost housing, papakāinga, and seasonal worker or student accommodation). If imbalances between supply and demand are evident, then it must be identified whether it is because of stringent planning rules, lack of infrastructure, or both. Hence, the NPS-UD assumes that policy solutions to housing unaffordability may be found by increasing the opportunities for commercially feasible development, which would result in a more competitive housing market.

Considering that the NPS-UD posits a broad scope of actions for the Auckland Council to explore affordability and competitiveness of land and housing markets, and the HBA is fundamental to inform RMA planning documents, development strategies, and long-term plans, the purpose of this report is to develop the HBA for the Auckland region.

This report is structured as follows:

- Section 2 describes the methods used to construct the HBA. In preparing this assessment we rely on quantitative approaches to model housing development capacity and demand: the Capacity for Growth Study model (CfGS), the Auckland Council Development Capacity model (ACDC), and the Conditional Housing Allocation and Tenure Assessment model (CHATA); as well as

desktop research to carry out the impact analysis of planning and infrastructure decisions on supply.

- Section 3 presents the results and how they are aligned with the requirements of the NPS-UD regarding the HBA.
- Section 4 discusses the empirical findings (including high level infrastructure capacity assessments) and implications, and suggests research avenues regarding the housing needs of Aucklanders. It also maps out the assessment gaps, caveats and items to be included for the next HBA.
- Section 5 concludes.

2.0 Methods

2.1 Overview

To undertake this HBA the Auckland Council has triangulated three modelling techniques to assess the supply and demand in the urban zone of Auckland. The interaction and outputs of these techniques are outlined in Figure 1.

The core of the modelling approach relies on the assumption behind the NPS-UD that, through intensification or land releases, greater development capacity will have a direct and positive impact on dwelling supply and, consequently, on affordability. The modelling starts with the CfGS and ACDC models constructing supply profiles of plan-enabled and commercially feasible dwellings deemed as additional capacity. The CHATA model then simulates the uptake of those dwellings conditional to their location and the purchasing power of households. Conditional figures to the uptake then imply that this HBA measures the compatibility (or discrepancy) between what the market feasibly delivers within the limits set by the current RMA documents and what households may purchase. The modelling does not assess any other demand-side policies or initiatives (e.g., targeting-and-retention of dwellings, inclusionary zoning, progressive homeownership) as they are out of the scope of the NPS-UD.

The ACDC model assesses the commercial feasibility of development decisions based on the likelihood of achieving a return for the cost, effort and risk involved. The model estimates the net return from the sale of new dwellings based on the costs of land, construction and site development, professional fees, development contributions, service connections, finance, and costs of sale. The sales price of dwellings obeys developers' profit driven behaviour within a competitive economy where there are no subsidy or grants. After the developer buys land, the model looks up the development typology (e.g., standalone dwellings, terraces, apartments) most suitable for that parcel conditional to planning constraints. The model then calculates the development costs for that parcel and built form typology (e.g., how many dwellings are possible on the parcel). Developments with a positive profit margin are considered as economically feasible. Conversely, if a development provides insufficient financial return, then the developer will not commence the project or, alternatively, the funding source (e.g., a bank) will not fund such development.

Nonetheless, as encompassed in the NPS-UD, there are several stages of analysis regarding capacity, starting from the plan-enabled capacity, passing through infrastructure ready, then commercially feasible and finally the expected to be realised. This latter stage is linked to the distribution of prices attached to the new or additional

dwellings potentially entering the market. In other words, those dwellings reasonably expected to be realised consist of those that are expected to be sold in the open market so that developers remain profitable. As the prices are key determinants of households' decisions to buy any of the new dwellings, the demand assessment in this HBA is then structured under the rationale that the NPS-UD aims to improve housing affordability. In particular, the assessment examines affordability levels through the lens of first home buyers, which is a critical benchmark to test whether the NPS-UD is most impactful or not in addressing affordability.

The CHATA model sets up the interaction between supply and demand at multiple price points and locational preferences. This interaction is a representation of a matching process where households search and bid for a dwelling but without imposing constraints forcing that every new dwelling must be sold or that every renting household must become an owner. That is, the model can accommodate the potential incompatibility between the purchase power of households (or target population groups in general) and dwelling prices. This metric of the potential uptake of dwellings provides a realistic picture of what is reasonable to be realised based on a purely market-driven perspective. The CHATA model is implemented through mixed integer mathematical programming and mimics the competitive behaviour of the market where every households maximises utility and developers remain profitable and willing to deliver dwellings (Fernandez, 2019b; Fernandez & Martin, 2020a).

To characterise the profiles of demand, we explore various growth projections to estimate the overall regional growth of households over the next 30 years. Subsequently, we rely on research reports by Mitchell (2019, 2020) from which we construct two scenarios of the intermediate market households. The intermediate households consist of private renter households, with at least one person in paid employment, who cannot affordably purchase a dwelling at the lower quartile price at standard bank lending conditions. This concept not only captures overall households' growth but also is a meaningful representation of those households that are willing (and in need) to search and bid for a dwelling and become homeowners. Therefore, the concept of the intermediate households provides an adequate representation of the size of the affordable market segment, which is arguably the target of any housing policy[1] that aims to improve housing affordability, including the NPS-UD. That is, by focusing the analysis of the HBA on current renters, it is possible to isolate potentially confounding effects of including (for example) investors in the simulations. As investors arguably have higher levels of accumulated wealth and assets, they could

[1] Due to the absence of specific demand definitions from MfE, approaches and demand definitions may vary between councils.

outbid current renters on bidding for new dwellings so that any potential changes of affordability measures may be misleading (Fernandez, 2019b).

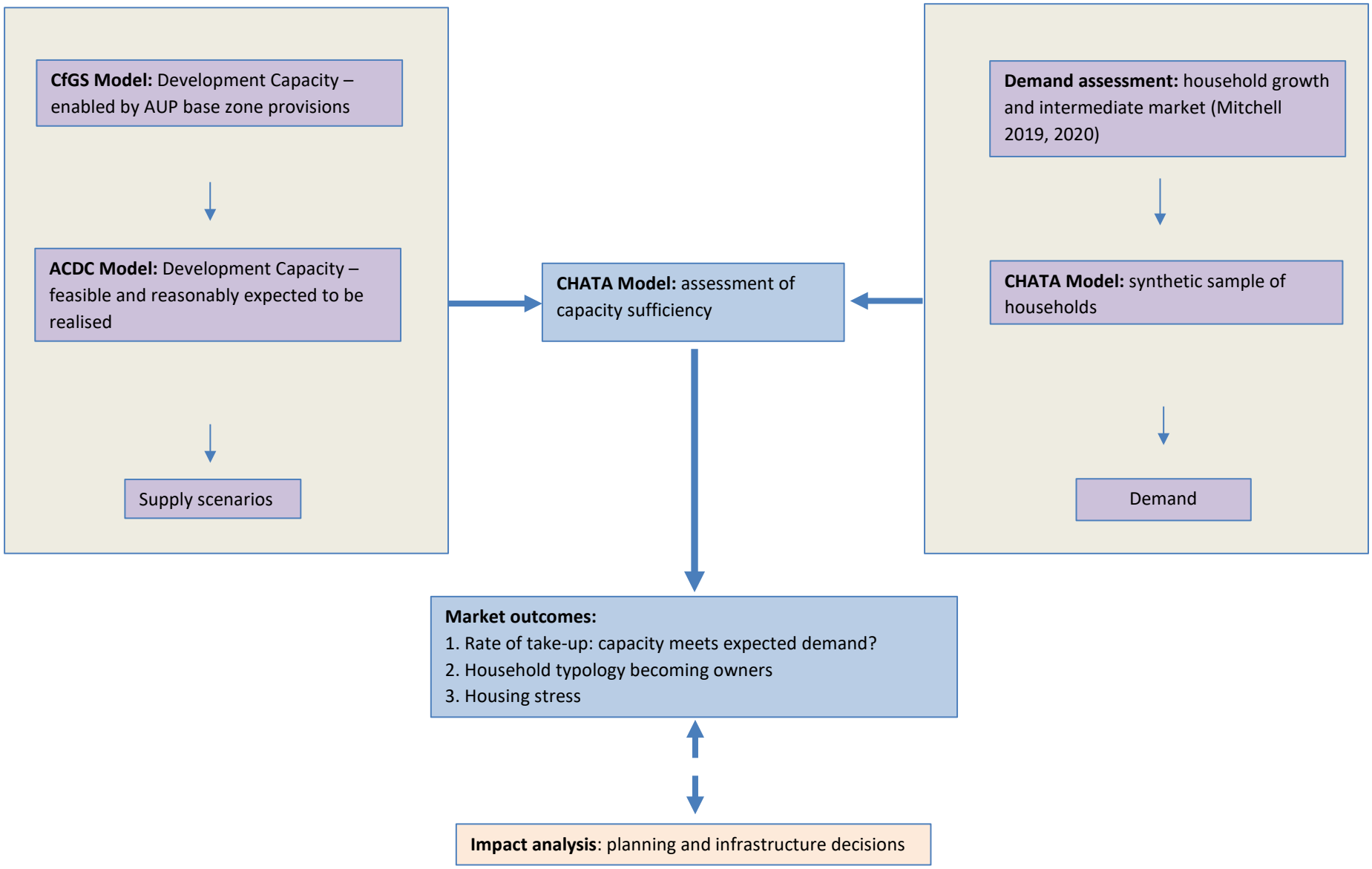
To construct meaningful metrics of the dwellings reasonably expected to realise, the CHATA model sets up a competitive market where households are willing to buy a new dwelling. For simulation purposes, a sample of synthetic households is constructed and processed in the CHATA model to mimic the behaviour of current renters when searching and bidding for a new dwelling across Auckland's submarkets. This approach is then a representation of the relocation potential when a household trades-off housing attributes to become a homeowner. As the sample represents those households that are more likely to buy a dwelling because of income and the relative homogeneity within submarkets; it overlaps with the intermediate market households.

Overall, the modelling approach (CfGS + ACDC + CHATA) responds directly to the NPS-UD requirements for the HBA.

In tandem, an impact analysis of planning and infrastructure decisions is carried out. It is based on desktop research and is a component that will inform the interpretation of the modelling outcomes as well as the development of potential policy inputs that target housing unaffordability.

The components of the methodological approach are described in detail below. Other technical details are described in the appendices or the references.

Figure 1: Representation of the methodological approach



2.2 Housing development capacity and housing supply scenarios

2.2.1 The Capacity for Growth Study (CfGS) model

The NPS-UD defines housing development capacity as the land area to be developed for housing under the relevant RMA planning documents. The CfGS model focuses on the development capacity of the urban environment including both the existing urban zones and areas planned for future urban use. The starting point for this HBA is then the Auckland Unitary Plan Operative in Part (AUP) as of October 2020, which sets the 'upper-limit' to what can be developed within the territorial boundary of the region[2].

The CfGS model processes the AUP provisions and converts them into the quantity and availability of development capacity. The algorithm and data input of the model reflect aspects of the AUP rules that depict elements that should be included or excluded from the analysis (see Appendix 1). For example, precinct provisions are not incorporated in order to streamline the modelling process so that the base zone capacity can be compared across the region. The assessment team has acknowledged that some precinct provisions could either enable or restrict development capacity. Also, designations are filtered, and some (such as carparks) are deemed non-capacity restricting. The model entails a staged process as follows:

1. Set up the modelling environment with relevant datasets.
2. Process all collected information via a geographic information system to calculate capacity for all developable sites.
3. Collate and analyse the results to ensure they are aligned with the NPS-UD requirements.

The CfGS model then determines the maximum volumetric development capacity of individual urban zoned sites within the constraints of the current planning regime and its physical land characteristics. Given these parameters, a range of potential development opportunities are tested, which are then fed as input data to the ACDC model. An overview of the development opportunities modelled are in Table 2.

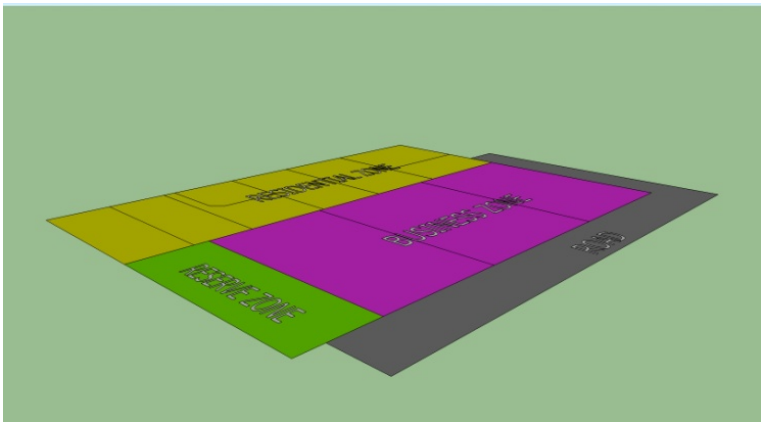
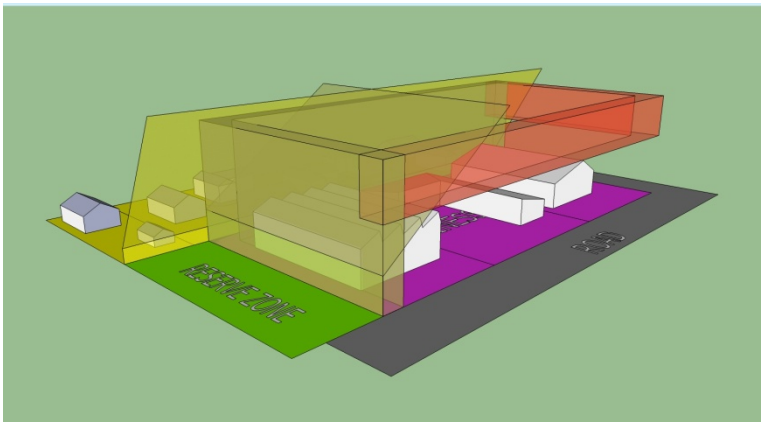
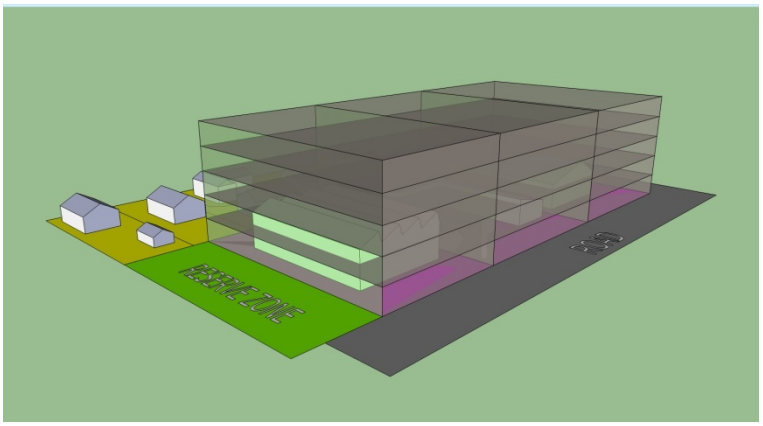
[2] Rural housing development capacity is not modelled in this HBA. Though rural land does provide some development opportunities, its potential is deemed relatively low. Furthermore, the AUP provisions for the rural land areas were not fully operative at the time of assessment.

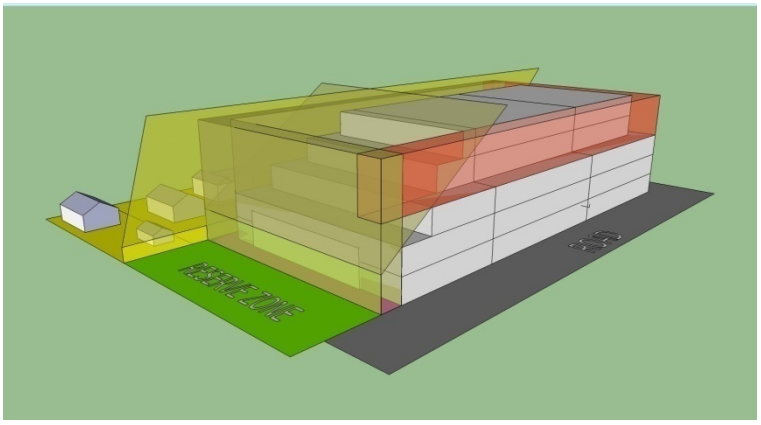
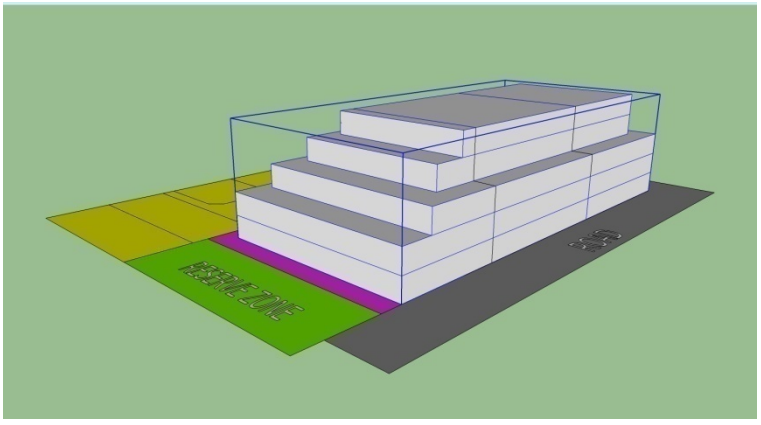
Table 2: Plan-enabled housing development capacity types assessed

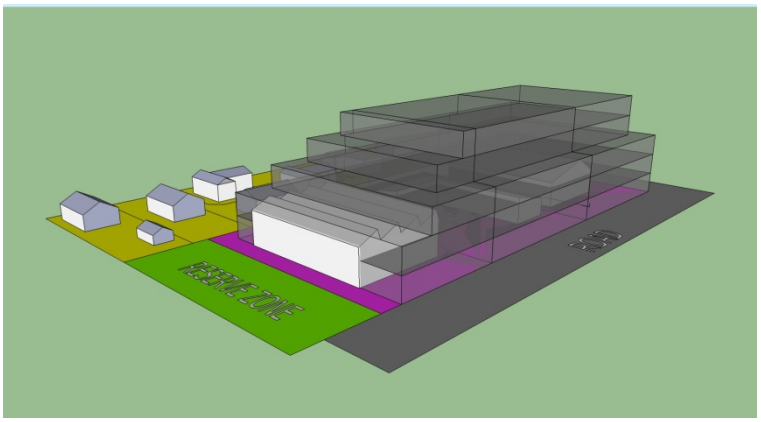
Capacity type	Definition of capacity type
Residential vacant	Capacity for dwelling units on residential zoned sites that are currently wholly vacant (no dwellings or buildings), either via further subdivisions or construction of a dwelling as of right.
Residential infill	Net capacity for additional dwelling units on residential zoned sites that are partially vacant and have subdivision potential (based on the modelled consent category from AUP provisions) and are less than 2000 square metres.
Residential vacant potential	Net capacity for additional dwelling units on residential zoned sites that are partially vacant and have subdivision potential (based on the modelled consent category from AUP provisions) and are equal to or greater than 2000 square metres.
Residential redevelopment	Net capacity for additional dwellings on residential zoned sites presuming that all existing dwellings/structures are removed, and the sites are redeveloped to yield the maximum dwelling units permitted (based on the modelled consent category from AUP provisions)
Residential rollover	This category relates to capacity sourced from non-modelled areas.

The adopted volumetric approach of the CfGS model was initially developed to assess business floorspace in the 2013 capacity study (Balderston & Fredrickson, 2014). This approach incorporates the latest development trends observed since the adoption of the AUP: the evolution of residential development from the traditional infill (e.g., adding another one or two dwellings at the rear site via subdivision) to constructing median density terrace housing or 3-level walk-up apartments. The volumetric approach then provides a better estimation of optimal land use and entails the six stages described in Table 3. The assessment starts by calculating the maximum plan-enabled building envelope and net buildable floorspace after considering existing building structure. While the assessment is used to calculate developable floorspace, how it is applied to individual development sites differs depending on the development typology assessed.

Table 3: Conceptual basis of volumetric capacity modelling

Description/step	Image
Modelling step 1: Organisation of base zones and parcel data Append AUP base zone attribute to individual sites to determine applicable AUP provisions	
Modelling step 2: Spatial creation of building constraining rules and inter zone/site relationships required to apply rules The zoning provisions that constrain/restrict development potential (via setbacks, recession planes, height in relation to boundary etc.) that must be modelled.	
Modelling step 3: Extrude sites to maximum zone storey height or alternative zone height/overlay height that is permitted by the AUP.	

Description/step	Image
Modelling step 4: Calculate and apply setbacks, recession planes, yard setbacks etc. Remove those storeys and parts of storeys within encroaching affectations. Each affectation type is converted to a spatial overlay that exists at each storey level, these overlays are used to clip the extruded storeys from Step 1 at the ceiling level.	
Modelling step 5: As above, but with affectation overlaps removed, reveal the 'permitted building envelope' within which floor space can exist. This is the visual 3D output. Calculations are then done for the maximum storey footplates within (less than or equal to) this envelope after accounting for maximum tower dimension or site coverage limits (applied as a maximum per centage of site area that the area of the calculated envelope may be greater).	

Description/step	Image
Modelling step 6: Calculate the difference in the maximum floor space potential from Step 3 and any existing development (this net difference equals capacity for additional floor space).	

Notes: adapted from Balderston & Fredrickson (2014)

Four development typologies are tested to generate both the infill and redevelopment capacity. Relative to past applications of the CfGS model, this HBA introduces further refinements to improve accuracy, namely:

- The smallest geographic unit modelled has moved away from individual parcel to 'site', which clarifies land ownership. Site is the smallest possible aggregation of associated parcels, titles, and rates assessments.
- Shared access lot and shared rear site access laneways are disregarded and removed from capacity calculations. This avoids generating housing development capacity on land areas not suitable for additional development.
- Alternative heights in relation to boundary provisions are incorporated in the modelling to account for higher density development opportunities enabled by the AUP.
- Effective building heights are adjusted to reflect height controls outcome intended by the AUP. Previously, height restrictions were determined by the most restricted control (lowest building height permitted) by base zone provisions or height control overlays. The latest update relaxed this mechanism and allowed height controls to reflect alternative height control provisions as opposed to base zone height limits. Hence, permitted building heights can be higher than base zone heights.

In addition, some assumptions and limitations apply:

- The NPS-UD requires councils to examine housing development capacity for the short-, medium- and long-term using both the current and proposed district plans to assess land areas planned for housing development. Given the AUP has been operative in part since November 2016, it is still within its 10-year life span and no proposed new plan is developed, it is assumed that no changes occur to the existing zoning provisions beyond the 10-year lifespan of the operative AUP.
- AUP provisions adopted for this HBA are based on the version as of October 1st, 2020. Any plan changes, variations, or results of appeal settlements after this date have not been considered.
- AUP Precinct areas are modelled using base zone provisions. Thus, any precinct rule that is more restrictive than base zone provisions, is not accounted for and is not reflected in the capacity assessment.
- The capacity results are a hypothetical measurement of 'what the current planning system allows'. Whether this capacity will be realised (or not) has not been a consideration, nor is it implied that because the plan enables a certain kind of development it will necessarily occur, or because a development has not been identified that it will not occur.
- Parcels or titles identified as having a designation on them that would severely restrict or prevent development of the parcel or title have been excluded from assessment for potential capacity.
- Capacity for minor dwellings, conversion of a dwelling into two, internal subdivisions, and parcels/titles amalgamations are not assessed. The combination of these development options is likely to yield additional development potential that is higher than the current assessment output.

2.2.2 The Auckland Council Development Capacity (ACDC) model

The primary purpose of the ACDC model is to estimate commercially feasible development capacity in the Auckland region. The model incorporates the Future Urban Land Zone, structure plans and changes to the intensification rules prescribed by the AUP (IHP, 2015).

The model is an adaptation of the 'residual value' approach, which is widely used across the development sector to estimate the costs associated with a potential dwelling size and typology, as well as expected sales price and location. The model simulates profit-driven developers buying land and investigating development alternatives at site-level (standalone dwellings, terraces, apartments), where alternatives are conditional on the zoning constraints. The model calculates the development costs for that site and built form typology (e.g., how many dwellings are

possible on the parcel). The model incorporates wide input data on costs of land, construction and site development, professional fees, development contributions, service connections, finance, and costs of sale (see Appendix 1). Costs are then used to estimate the net return from the sale of new dwellings, price data comes from imputations of sales in neighbouring dwellings obtained from the Valuation and Rates Dataset of the Auckland Council. Hence, the model assesses the commercial feasibility of development decisions based on market prices as well as the likelihood of achieving a return for the cost, effort and risk involved.

A range of potential developments, all equal to or less than the upper limits set by the regulations (being the parameters set by the plan-enabled capacity assessment), are tested given these parameters. Those that are providing a positive return are assumed to be 'feasible'. These feasible developments are then filtered to generate 'scenarios' to reflect the kinds of developers who are motivated by different commercial drives.

Inherited from the 2017 HBA (Auckland Council, 2017), the same commercial feasibility assessment method has been deployed. The assessment consists of two components, as follows:

1. For the existing urban zones, the model tests sites identified with development capacity either from the plan-enabled capacity assessment, or land areas for future urban zones (FUZ).
2. While the overarching assessment methodology for plan-enabled capacity and FUZ is the same, additional components are introduced to replicate the development costs and processes required to convert raw greenfield land to developable sections that are serviced by local infrastructure (e.g., roads, water supply and wastewater pipes, and stormwater drainage).

Table 4 summarises the differences between the two assessment components.

Table 4: Conceptual difference between existing and future urban area capacity and feasibility modelling

Location	Existing site	Servicing	Feasible section development	Feasible dwelling development
Existing urban area	Sites with AUP Zoning and HBA plan enabled capacity	Assumed serviced/serviceable. All bulk infrastructure will be in place and payments towards upgrade costs (if any) are as per current development contribution policy.	N/A. Existing cadastre assumed to be base site for modelling. Some provision for reduced gross site area for access, yards etc. but not roads, parks etc.	The ACDC Model (re)develops sites with plan enabled capacity filters out a range of existing uses and outputs feasible plan enabled dwellings
Future urban area	Sites that are live zoned or FUZ[3], in Future Urban Land Supply Strategy (FULSS) or Structure Plans that are indicative residential[4].	Assume no existing services. New roads, reserves etc. are netted from sites. Assume all bulk infrastructure will be in place and payments to wards costs are as per current development contribution policy.	GF-Land Development Model removes non-developable areas, required roads, services, land for wholesale (parks, schools, hospitals etc.), and develops remaining net area for sections into serviced sections. Output is feasible sections	GF-ACDC Model[5] develops GF-LDM Feasible Sections using assumed blanket zoning[6] and filters out a range of existing uses and designated sites, HNZ and Outputs feasible dwellings

The ACDC constructs a profile of commercially viable dwellings that are likely to enter the housing market: the housing supply. Supply then represents the net increase in housing development, facilitated by changing rules or regulations in the Auckland context but driven by market forces. The analysis aligns to the working assumption of the NPS-UD, that is, significant releases of land will directly translate into additional housing capacity and improvements in housing affordability (Fernandez, 2019b; Government of New Zealand, 2016).

[3] Future Urban Zone does not permit intensive residential development; rather it is a 'holding zone' for future structure plans that will determine zoning and plan changes to enable development. Therefore, modelled development in FUZ is not strictly 'plan enabled'.
[4] FULSS is developed to provide indicative high-level indications for bulk infrastructure planning, consultations, and modelling purposes, as summarised in the latest FULSS. Indicative business, reserves and other activities are excluded from residential development. Various non-developable exclusion areas (various hazards and environmental features) are netted off remaining residential titles.
[5] This model is functionally the same as the ACDC model and uses the same lookup tables but is optimised for the consumption of GF-LDM outputs rather than CfGS model outputs.
[6] As areas tested are predominantly FUZ, and one of the purposes of the modelling is to indicate market preferences, blanket zoning assumptions informed by the FULSS and structure plans are applied to test outcomes. As the structure planning process advances, adjustments can be made to reflect decisions already made, or where appropriate feed new zoned and serviced sections into the ACDC model directly.

The ACDC model tests nine development options per site. Hence, a selection process is required to determine which of the nine options is best suited to reflect the Auckland housing market. An initial feasibility filter is applied to select feasible developments:

- Dwellings not generating negative profits.
- Total gross profit of individual sites is not greater than 10 per cent.
- Dwelling sales price is not greater than 1.2 times of the perceived price ceiling to remove developments that are deemed unreasonable (e.g., combination of ultra-expensive dwellings per site).

A second filter is then applied to generate the supply scenarios.

2.2.3 Capacity and supply scenarios

Capacity scenarios

Of all the feasible scenarios modelled, two are selected to represent the two extreme ends of the behaviour of developers, as follows:

- **Maximum per centage of profit yield** – this scenario reflects the current housing market enabling developers to make use of profit maximising business models while prices continue to soar.
- **Minimum priced dwelling units** – this scenario tests the likelihood of developers delivering dwelling units at the lower end of the price spectrum considering the following:
    - emerging trends of supplying housing at below median dwelling price have been observed recently,
    - the increasing price trend is unlikely to be sustainable in the long run (due to bank lending restrictions and monetary policy interventions), and
    - developers are likely to choose a combination of dwelling typologies to service demand for as many groups as possible, as well as at various locations.

Supply scenarios

For the purposes of simulating the interaction of supply and demand, and test the sufficiency of capacity from the Capacity scenarios, further five subset scenarios with maximum data samples between 6000-6300 dwelling units are prepared, namely:

- **Upper-range scenario (maximum profit)** – This scenario includes the first 6000 most profitable dwelling units across the region under $1.6 million (an

upper limit set by the assessment team). It tests the matching between supply and demand at the upper price range, which reflects the housing stock delivered recently in Auckland. Dwellings priced above $1.6 million are not tested as they are most likely to be bought by investors and/or existing homeowners upscaling from their current homes. Demand and affordability assessments for investors and existing homeowners are out of the scope of this HBA.

- **Mid-range scenario (maximum profit)** – This scenario includes the first 6000 most profitable dwelling units across the region under the sales price cap of $1.35 million. This scenario can be considered as the 'average priced' housing stock and, most importantly, reflects a large portion of the existing housing stock. It tests the locations where dwellings can be delivered at this price range under the current market conditions, and the affordability of the existing stock.
- **Full-spectrum scenario (maximum profit)** – This scenario includes the first 800 most profitable dwellings of each of the 10 dwelling price range groups (approximately 6300 dwelling units in total) from less than $600,000 to no greater than $1.6 million. This scenario tests the full range of housing stock across the region and its level of affordability by various household income groups.
- **Minimum-priced scenario (maximum profit)** – This scenario includes the first 6000 lowest priced dwelling units that are still yielding the maximum per centage of profit. It aims to match supply and demand at the tail end of the housing market where profit-driven developers are delivering housing options at the cheapest price range.
- **Conditional-affordable scenario (minimum dwelling price)** – This scenario includes the first 6000 lowest priced dwelling units, which represents a developer delivering feasible dwelling units at the lowest retail price, but not necessarily being the most profitable options. This can be considered as a scenario driven by incentives to supply affordable housing.

Table 5 summarises the distribution of dwellings by supply scenarios extracted from the ACDC model and by submarkets (see Subsection 2.4.4).

Table 5: Supply scenarios extracted from the ACDC model

Submarket	Upper-range		Mid-range		Full-spectrum		Minimum-priced		Conditional-affordable	
	Av. Price ($)	No.	Av. Price ($)	No.	Av. Price ($)	No.	Av. Price ($)	No.	Av. Price ($)	No.
1			1,336,500	11	914,687	15			400,687	1
2			1,336,500	1	743,807	37	632,856	2	372,480	2
3			1,336,500	319	1,006,046	2				
4	1,561,925	636	1,336,500	2426	864,811	218	848,626	421	498,872	625
5	1,566,338	5	1,336,500	51	862,064	465			389,436	55
6	1,566,574	795	1,336,500	405	951,925	136	850,907	131	500,832	156
7	1,563,863	1664	1,336,500	1160	1,191,396	2301	843,458	2052	493,598	3418
8			1,336,500	311	1,252,848	104	857,902	77	487,761	73
9	1,563,565	1551			1,251,819	2417	883,405	2936	488,697	1232
10	1,566,338	79	1,336,500	214					393,076	48
11	1,565,771	1225	1,336,500	1102	922,296	383	859,969	379	426,809	48
12	1,576,003	45					889,780	2	561,871	342

2.3 Infrastructure-readiness

2.3.1 Defining infrastructure readiness

Clause 3.2(2)(b) of the NPS-UD describes that, for development capacity to be sufficient to meet expected demand for housing, capacity must be infrastructure-ready. For the previous HBA, prepared under the National Policy Statement on Urban Development Capacity (NPS-UDC), an infrastructure readiness assessment was not required and therefore there is no inherited methodology for this HBA.

The council must look at infrastructure availability at a whole of Auckland regional level, rather than focus on specific areas. Under clause 3.4(3) of the NPS-UD, for development capacity to be considered as 'infrastructure ready' it must:

- in the short-term (0-3 years) have adequate existing development infrastructure to support development of land
- in the medium-term (3-10 years), have either adequate existing development infrastructure or have funding for adequate infrastructure identified in the council's long-term plan
- in the long-term (10-30 years), either ensure that the above definitions apply or are identified in the council's infrastructure strategy.

The definition of 'development infrastructure' focuses the council to consider network (bulk) infrastructure for water supply and wastewater, stormwater, and land transport. 'Local' infrastructure capacity has not been included. However, it is recognised that there are limitations due to 'local' infrastructure capacity requirements.

2.3.2 Defining development infrastructure

Water supply

The water supply bulk network consists of the following:

- Transmission mains up to and inclusive of the bulk supply points.
- The water treatment plant capacity is not assessed as part of the NPS-UD network infrastructure. However, Watercare plans treatment capacity upgrades based on regional growth projections and includes a head room factor to account for uncertainty in population growth.

Wastewater

The wastewater bulk network consists of the following:

- Transmission mains (interceptors and branch sewers).
- Wastewater treatment plant capacity is not assessed as part of the NPS-UD network infrastructure. However, as above, Watercare plans the plant capacity based on regional growth projections and wastewater loads.

Land transport

The transport network consists of the following:

- The transport network, 'land transport', as defined by the Land Transport Management Act 2003 entails any transport on land by any means, and the infrastructure, goods and services facilitating that transport. This includes arterial roads and footpaths, public transport including bus, rail and ferry and cycling infrastructure.

However, the transport network excludes state highways as they are managed and controlled by Waka Kotahi, not the council.

Stormwater

The stormwater network consists of the following:

- The piped network is the primary system. New networks are required to have a design capacity (under the Stormwater Code of Practice) for the 10 per cent AEP flow / 10-year ARI storm event. In many brownfield areas the existing systems will rarely have the design capacity (as the AUP has up-zoned land disregarding existing stormwater network capacity, overland flow paths or flood risk).
- Overland flow paths (i.e., where flows exceed the capacity of the primary system) are considered to be the secondary system.
- Public stormwater infrastructure[7] also includes manholes, public streams, ponds, wetlands etc.

[7] Note: private streams and overland flow paths form part of the "drainage network", as they are not public assets, they are not considered to be stormwater infrastructure as such

2.3.3 Infrastructure-readiness assessment

Water supply and wastewater

To assess infrastructure readiness for water supply and wastewater, bulk network capacity, which is based on the 'transmission network', was identified using information on known constraints and planned projects such as the Central Interceptor and the Northern Interceptor.

Stormwater

The capacity of the stormwater network was not assessed in detail for this HBA. However, the public stormwater network is considered to have limited or no capacity. For this assessment, public stormwater capacity is not deemed a 'hard constraint' on development as the council currently takes the position that, in most instances, appropriate solutions can be found to mitigate or minimise any impact upon the receiving environment. As long as the stormwater network is still able to manage stormwater runoff to minimise flood damage and adverse effects on both built and natural environments (i.e., not making the network worse) then a workable solution can usually be found. Typically, a developer must make a financial decision weighing up cost feasibility of the stormwater solution/mitigation required.

Taking a more detailed 'catchment by catchment' capacity approach was not feasible for this assessment due to timing and information available as it would require specific detail, e.g., as to the location of possible new dwellings and typology.

Land transport

Land transport has not been considered in this assessment as the Auckland Council and Auckland Transport are working to develop transport assumptions for the next HBA, due by 2024. The key reasons land transport is not included are:

- Auckland's transport system is complex and has many interdependencies and variables such as trip origins, destinations, and network effects and does not work in isolation.
- Further time is needed for a robust assessment of transport capacity in the short, medium, and long-term. The Auckland Council and Auckland Transport are developing a methodology to test the required approach at a network level.

Once developed, the methodology will be applied to test various scenarios using the tools and mechanisms such as: Future Connect, Macro Strategic Model (MSM), Regional Land Transport Plan (RLTP), Auckland Transport Alignment Project (ATAP),

Brownfields Business Case and Supporting Growth Alliance assessments in greenfields.

2.4 Growth projections and housing demand

Clause 3.24 of the NPS-UD prescribes that the HBA must estimate the demand for additional housing in the region and set out a range of projections of housing demand in the short-term, medium-term, and long-term. Furthermore, Section 9.1 of the guidance document on the HBA mentions that the selection of projections should be based on sound assumptions and explanations. As clarified by the guidance document, the selected growth scenario should not be constrained by development capacity so it can be used to assess capacity sufficiency. Multiple projections are considered for this HBA, which are either sourced from Stats NZ directly or constructed based on Stats NZ's official projections. Growth projections considered are as follows:

- Stats NZ subregional (Auckland) medium growth population projection 2018 (2013 base)-2048 (projected onwards to 2053) released in March 2017 (SNZ2013).
- Stats NZ subregional (Auckland) medium growth population projection 2018 (base)-2048 (projected onwards to 2053) in December 2020 (SNZ2018).
- i11v6 population projection 2018-2051 (projected onwards to 2053) released in August 2020 (land-use growth assumptions adopted for the Auckland Council 2021/2023 Long-term Plan).
- Household growth likely scenario 2023-2033 (Mitchell 2019, 2020).
- Household high-growth scenario 2023-2033 (Mitchell 2019, 2020).

This subsection outlines the growth projections and estimates the required competitiveness margins to calculate the additional housing demand. It is worth noting that data issues relating to the 2018 Census are acknowledged. For the purposes of this HBA, data sourced from Stats NZ are assumed to be accurate and correct.

2.4.1 Projected population and household growth

Projecting growth is a complex modelling exercise that requires input datasets from multiple sources, and both high-level and granular assumptions to either boost or restrict the rate of growth. The NPS-UD prescribes that demand must be measured in dwelling numbers. Therefore, all projected growth numbers go through a conversion process that converts population to household units, and then to household(s) occupied dwelling unit(s). Each step of the process requires thorough examinations of assumptions adopted before the next step can proceed. Thus, this HBA is not a

discussion document that delves deep into these projection matters. That being said, this HBA provides simple explanations to help readers to understand the basics of projecting growth and the rationale of selecting the preferred projection. Table 6 shows the population and household projections analysed to meet the NPS-UD requirements.

Table 6: Growth projections analysed

Projected population size	2018	2020	2023	2028	2031	2033	2038	2043	2048	2051	2053	Average annual growth
SNZ 2013 base	1,699,900	1,763,660	1,859,300	1,990,100	2,063,240	2,112,000	2,222,700	2,339,202	2,461,811	2,539,232	2,590,846	25,456
SNZ 2018 base	1,654,800	1,704,360	1,778,700	1,891,800	1,957,800	2,001,800	2,107,000	2,207,800	2,302,900	2,362,418	2,402,096	21,351
i11v6	1,577,806	1,630,184	1,704,547	1,836,247	1,916,802	1,960,438	2,066,121	2,164,698	2,258,995	2,314,409	2,351,352	22,101
Projected household number	**2018**	**2020**	**2023**	**2028**	**2031**	**2033**	**2038**	**2043**	**2048**	**2051**	**2053**	**Average annual growth**
Assumed household size	2.99	2.97	2.95	2.90	2.89	2.88	2.84	2.80	2.76	2.76	2.76	
SNZ 2013 base	576,644	593,096	630,716	685,223	713,194	733,142	783,129	836,626	893,175	921,265	940,290	10,390
SNZ 2018 base	552,649	573,154	603,375	651,377	676,746	694,888	742,365	789,629	835,521	857,114	871,788	9,118
i11v6	526,936	547,975	578,220	632,249	665,383	680,531	727,961	774,214	819,591	839,964	853,371	9,327
Mitchell (2019, 2020) – Likely growth	-		567,082	608,275		632,990	-	-	-		-	6,591
Mitchell (2019, 2020) – High-growth	-		643,158	696,893		747,104	-	-	-		-	10,395

Note: Italics represent interpolated or pro rata figures for projections not available all the way to 2053.

2.4.2 Assumptions, uncertainties, and risks

Noted by Stats NZ (Stats NZ 2016), the accuracy of population projections depends on the starting base population estimates, components of change (births, deaths, migration), and the end population forecast. To grasp the basics of any projected population growth, two basic elements need to be introduced: *population concept* and *population growth driver*.

Population concept defines how the size of a population group is measured. Stats NZ provides several ways of categorising population. For example, census night population count captures all people enumerated by census which includes both residents in New Zealand, as well as visitors from overseas. Census Usually Resident Population (URP) only captures residents in New Zealand and excluding all overseas visitors and residents that are temporarily overseas. Estimated Resident Population (ERP) counts all NZ residents, both on-shore and temporarily off-shore.

Population growth driver determines the pace of population change and consists of three main components: births, deaths, and migration. Of the three components, migration is the primary driver of population increase. It is also a key input into population estimates and projections[8].

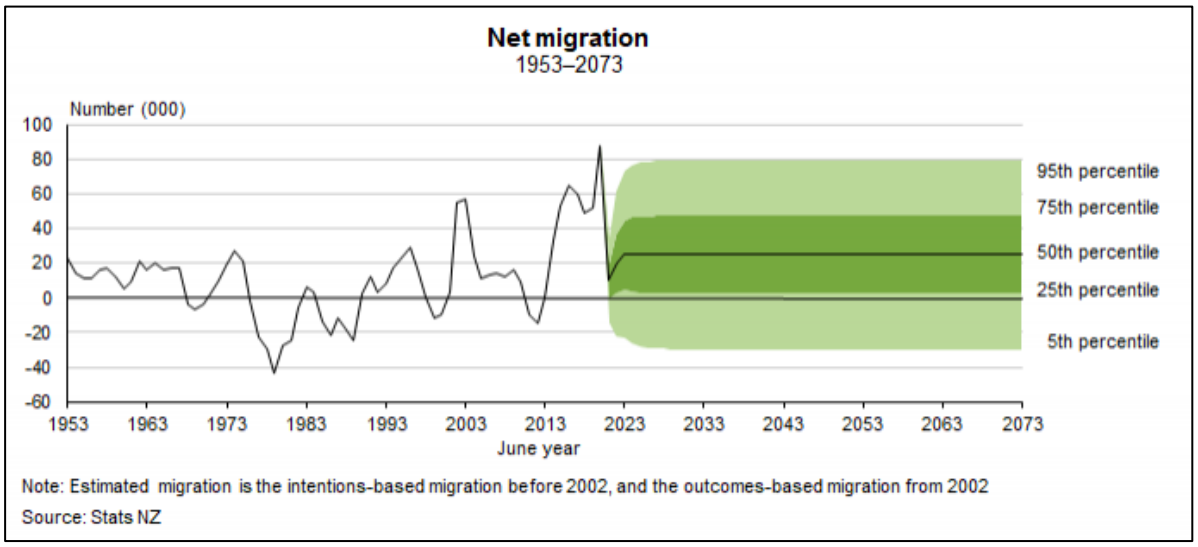
The two Stats NZ projections incorporate the most up to date ERP at the time the datasets were released (one was based on the 2013 Census ERP and the latter was the 2018 Census based ERP). The i11v6 is the land-use growth assumption developed as part of the COVID emergency budget and adopted by the Auckland Council for the 2021/2031 Long-term Plan. It is an updated version of the growth assumption of the Auckland Plan Development Strategy that incorporated a revised population starting point based on the 2018 URP in August 2020 as it is the best available information at the time and best suited for assessing the population that is serviced by council. All three population projections' starting points are derived from the census data. As the 2013 Census has been superseded by the latest census, SNZ2018 and i11v6 are better suited for assessing the upcoming housing demand. The only difference between SNZ2018's and i11v6's starting points is the absence of residents that are temporarily overseas.

Migration uncertainty poses the main challenge for projecting population growth into the future. This is largely due to the current border closure in response to stop the spread of COVID-19. Since March 2020, long-term migration has dropped significantly. As the worldwide pandemic situation continues to fluctuate, the border is likely to

[8] https://www.stats.govt.nz/news/migration-drives-high-population-growth

remain closed for a prolonged time. Moreover, upcoming changes to immigration policies signalled by the Government have resulted in lower net migration gain forecast comparing to previous assumptions. Hence, both SNZ2018 and i11v6 are expecting a much lower average annual population growth than SNZ2013 in the short- term, and are projecting net migration below the medium annual net migration of 25,000 (50th per centile) over the medium and long-term (Figure 2). However, what differs between SNZ2018 and i11v6 is the assumption of medium-term border closure and international long-term migration. SNZ2018 takes a conservative view that migration level is going to remain at a moderate level going forward. The i11v6 assumes towards the end of the first 10 years from 2021 that migration will rebound at a level similar to pre-COVID to sustain the level of growth Auckland is currently experiencing since the Global Financial Crisis.

Figure 2: Long-term net migration trend[9]



Family and household formation is an assumption of living arrangements by each age-sex group. This arrangement is determined by various factors such as cultural values, education, employment status, health condition, income level, personal preference, etc. This HBA makes no attempt to replicate a full-scale household formation model due to time constraints, instead, it approaches this matter by applying high-level average household size assumptions adopted from i11v6 to convert the projected population size into household estimates.

It is acknowledged that household size varies across Auckland and that areas of lower socioeconomic groups tend to have larger households (e.g., 3.9 people in Māngere-Ōtāhuhu), and smaller households are often observed in affluent or rural areas (e.g.,

[9] https://www.stats.govt.nz/information-releases/national-population-projections-2020base2073#projection

2.0 people on Aotea / Great Barrier Island). The average regional household size is set at 2.99 people per household at the starting year 2018 and gradually reduces over time. By 2053, the average household size across Auckland is projected to be at 2.76 people per household (see Table 6). Based on the three population projections, average annual household growth ranges between 9000s to 10,000s over the 30-year period.

Like family and household formation, household to dwelling conversion is equally challenging. Not only does it need to assess an individual household's current and future financial situation and its ability to purchase or to rent a dwelling unit, but also the wider external housing market factors need to be considered, such as housing stock availability, future market conditions and labour force supply to sustain construction activity and the economy overall. This supply and demand matching through the lens of affordable housing and is explored in detail in Section 3.4. To simplify this matter at a regional level, the household-dwelling concept is adopted, which assumes the projected household growth will result in an equal number of dwelling units in demand over the next 30 years (2021-2051).

2.4.3 Intermediate market households

Understanding demand is a key component of the NPS-UD. The specific demand profiles in this HBA are based on the concept of intermediate market households contained in the growth likely scenario 2023-2033 (Mitchell 2019, 2020), and the household high-growth scenario 2023-2033 (Mitchell 2019, 2020). The selection of these projections relies on two reasons:

1. The construction of the intermediate market projections is nested in the projections of total households. That is, the trend of growth of the intermediate households tracks that of the overall population.
2. The construction of the intermediate households' concept is linked to affordability and economic aspects related to the housing market, which is the core of the NPS-UD.

The two demand profiles in this HBA provide an in-depth analysis of the efficiency of labour and housing markets to inform long-term plans (LTPs), and strategies for economic development. Furthermore, within the context of the CHATA model, the (ex-ante) evaluation of affordability policies could be modelled within the boundaries set by the size and composition of the intermediate households.

The approach used in Mitchell (2019) to estimate the size of the intermediate market consists of developing a profile of Auckland, based on demographic characteristics by

local board. The approach enables an estimate of the number of private renter households and the level of income required to affordably pay the mortgage on a dwelling purchased at the lower quartile dwelling sales price. The affordability criteria assumes that no more than 30 per cent of gross household income is spent on either paying rent or servicing a mortgage. Thus, the number of employed private renter households unable to affordably service a loan at the lower quartile dwelling sales price is estimated. Subsequently, a profile for Auckland and each local board is modelled based on household growth projections between 2013 and 2018. The projections will enable an estimate of the income required to purchase a lower quartile sales price, and the number of households unable to purchase a dwelling between 2008 and 2018 affordably. Further details of the intermediate households market method are found in Mitchell (2019) and Mitchell (2020).

Mitchell (2019) estimates that for 2020 the size of the intermediate market in Auckland is 95,400 households, 16.5 per cent of total households and 40.2 per cent of renter households. Mitchell (2020) updates the estimates based on more recent census data, where slower population growth rates imply slower rates in household formation with consequences on housing demand. The revised estimates amount to 89,190 households in the intermediate market. Considering the data-driven projections of households growth, for the purposes of this HBA we label the projections of Mitchell (2019) as the high-growth scenario, and Mitchell (2020) as the most likely scenario of households in the intermediate market. Hence, the modelling approach in this HBA is fit for purpose to the NPS-UD requirements about demand for housing being expressed in terms of numbers of dwellings.

2.4.4 Sample of synthetic households

Figure 3 summarises the steps to construct the sample of synthetic households. We rely on an updated version of the CHATA model constructed for the purposes of the NPS-UDC (Auckland Council, 2017). The updates are as follows:

First, the model now constructs households' profiles based on Statistical Areas (SA2) rather than Census Area Units (CAU). An initial profile for 100 households is constructed and no imputations are performed for income or rent figures if observations are missing or confidential or where the population is very low. The profile for income, rent, household type (single person, couple without children, couple with children, and single-parent households) and SA2 fixed effects is constructed based on regression analysis.

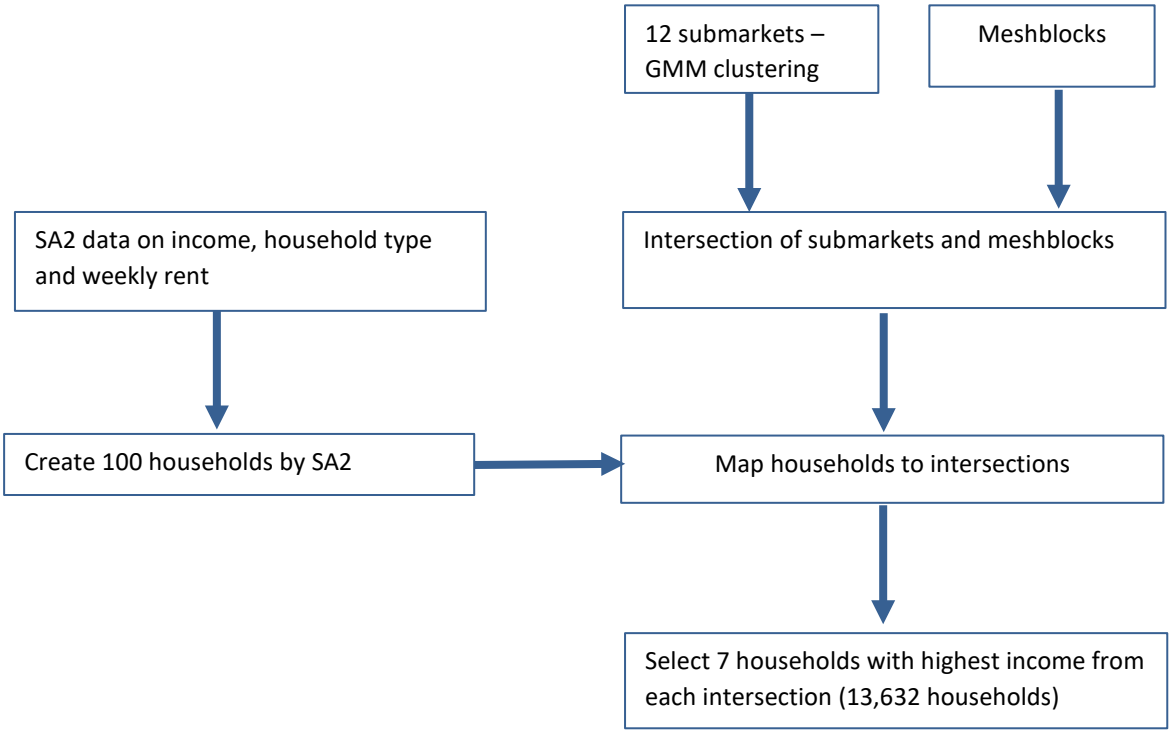
Secondly, 12 submarkets are constructed to model relocation alternatives as identified through Gaussian mixture (GMM) clustering and sales data for transactions between 2011 and 2019, (Figure 4).

The advantages of GMM relative to other clustering approaches is that it allows the potential overlap of clusters, particularly for highly heterogeneous or spread-out data points. Clustering variables include latitude, longitude, and distances to the nearest beach, waterway, road, open space, and school; sales price, floorspace, distance to the CBD, slope, and elevation. The clustering model predicts the submarket where the dwellings extracted from the ACDC scenarios are located.

The literature on the identification of housing submarkets is extensive, the clustering approach is then selected as an exploratory instrument to identify structures or groups based on a set of attributes or features. This is a first stage to mimic relocation potential across the region. Submarkets are then intersected with meshblocks to model the potential alternatives of relocation across Auckland. Households are then mapped to the intersected meshblocks and submarkets, and from each intersection those households with the seven highest incomes are selected and are assumed as those with the greatest likelihood to buy a dwelling (strongest preferences because of income), resulting in 13,632 households.

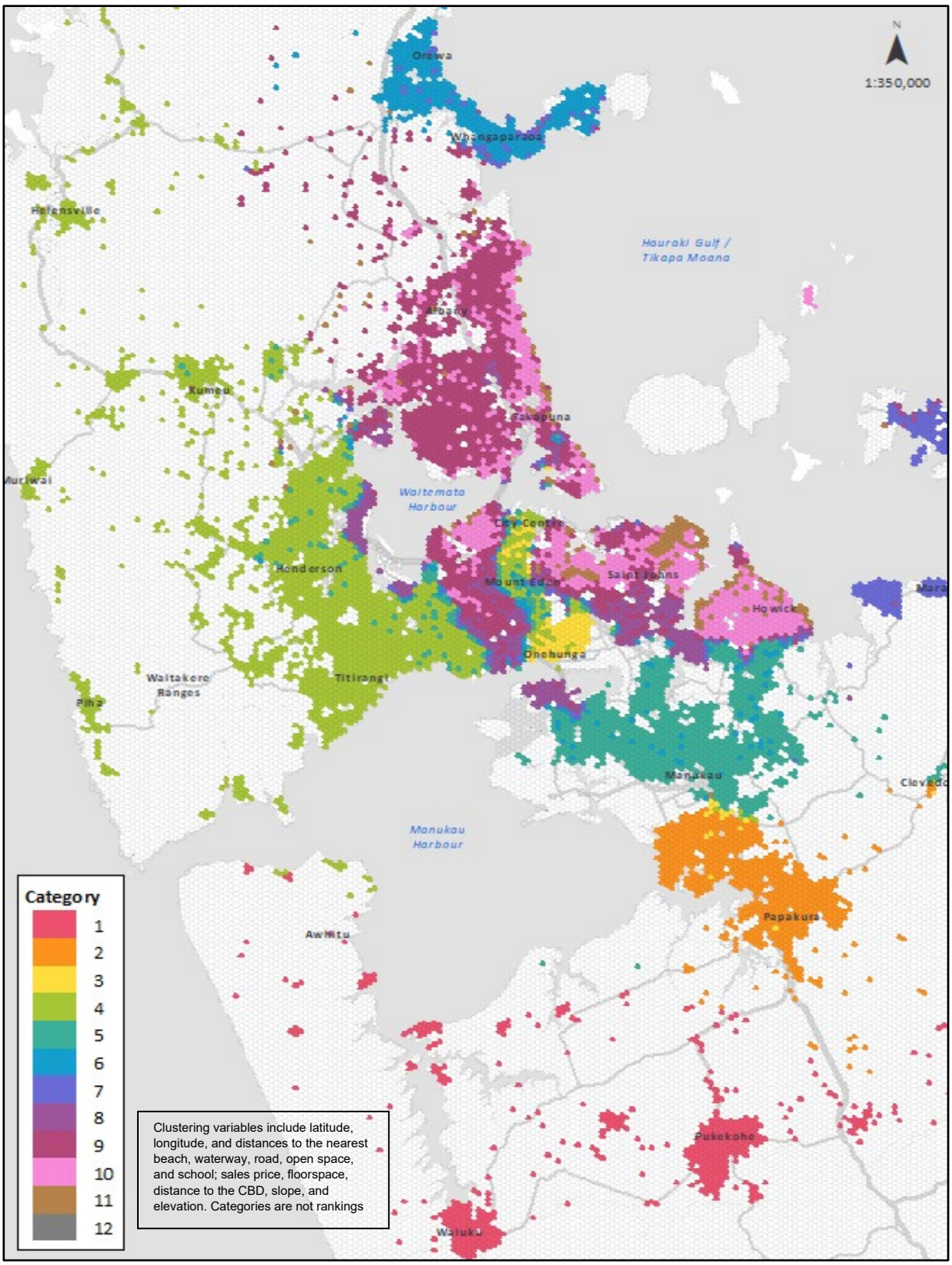
Thirdly, after a first round of bidding, if households cannot afford a dwelling within their corresponding submarket, they are allowed to search and bid on the immediate two above and below in a second round of bidding. This modification introduces greater flexibility when modelling the supply scenarios.

Figure 3: Construction of the sample of Synthetic Households



Note: Adapted from Fernandez (2019b)

Figure 4: Housing submarkets identified through GMM clustering



The purpose of the CHATA model (and the sample of synthetic households) is to mimic the relocation alternatives of households when searching and bidding for a dwelling, and consequently the compatibility (or discrepancy) between purchase power and prices. That is, in order to develop a better-informed landscape of the capacity that is reasonable to be realised, the model constructs a metric about the rate of take-up considering that the sample is representative of those households that are the most likely become to homeowners considering their relatively high incomes compared to others within the market segment where they currently rent (see further technical details in Appendix 3 and Fernandez & Martin, 2021; Fernandez, 2019b; Fernandez & Martin, 2020a).

Table 7 and Table 8 compare households between the whole Auckland region and the sample of synthetic households and by submarkets, dispersion rates and shares of household types differ because of the ranking used to select households from the mapping between meshblocks and submarkets. Though the sample could be expanded to include lower-income households, this would be immaterial as they will still be outbid due to the competitive market setting of the model.

Table 7: Descriptive statistics for Auckland and the sample of synthetic households

Household type	No.	%	Annual income	
			Average ($)	Standard deviation
Synthetic households				
Couple (no children)	3708	27.2%	153,320	31,767
Single parent (with children)	2832	20.8%	101,473	23,593
Single person	3299	24.2%	53,983	15,947
Couple (with children)	3793	27.8%	143,857	34,239
Total	13,632		115,876	48,447
Auckland region				
Couple (no children)	98,697	20.8%	154,487	104,488
Single parent (with children)	53,553	11.3%	101,043	81,185
Single person	85,533	18.0%	55,475	57,302
Couple (with children)	147,183	31.0%	146,610	105,067
Multi-family	89,133	18.8%		
Total	**474,099**		**120,381**	

Note: multi-family households are not included in the modelling.

Source: Stats NZ

Table 8: Descriptive statistics of the sample of synthetic households by submarket

Submarket	No.	Annual income	
		Average income ($)	Standard deviation
1	257	124,861	42,770
2	1127	105,759	45,843
3	1191	122,802	48,596
4	289	97,938	38,677
5	2676	106,082	43,337
6	1747	103,120	45,138
7	783	116,523	43,231
8	151	116,657	42,786
9	1547	122,154	46,348
10	1907	123,424	53,409
11	598	116,150	45,643
12	1359	137,680	53,975

2.5 Sufficiency of development capacity and demand

The core of this section relies on the ties between development capacity and affordability. The NPS-UD does not provide guidance about the method(s) to measure what is reasonably expected to be realised. Nonetheless, for any dwelling to be realised, it implies that there should be any household that would be willing to buy it. Such purchase will occur only if prices are compatible with households' incomes. Furthermore, as the NPS-UD revolves around capacity meeting the expected housing demand, the fairness aspects of the market outcomes is conditional to whether a dwelling is bought by a wealthy or poor household.

As the NPS-UD posits a wide scope of actions, this HBA introduces formality and structure by using validated concepts and models to construct transparent metrics about affordability and the desirability of the market outcomes. Therefore, the concepts of housing bottom lines and sufficiency of capacity cannot be disconnected from identifying who are buying the new dwellings. Hence, this HBA sets up proper benchmarks or references for the interpretation of the quantitative findings on affordability through the lens of first-home buyers and, in particular, the intermediate market households.

2.5.1 The Conditional Housing Allocation and Tenure Assessment (CHATA) model

To assess the market outcomes and the sufficiency of the development capacity for housing we rely on the CHATA model. The model allows us, not only to meet the requirements of the NPS-UD about the HBA, but also to address several policy questions, namely:

- What characterises the households that buy a particular dwelling?
- Is the rate of housing take-up high enough to guarantee commercial viability? Or, is it quantitatively equivalent to the capacity that is reasonable to be realised?
- Are the distributions of dwelling prices set by developers and the income distribution of households compatible with housing affordability?

The setup of the model entails a housing market represented by a set of 13,632 synthetic households, and about 6000 new dwellings entering the market, which is roughly the annual increment of additional capacity in Auckland (Auckland Council, 2017; Fernandez, 2019; IHP, 2015). Each household rents a dwelling and is willing to buy a new one if their willingness to pay (WTP) is greater or equal to the dwelling price (or mortgage payments if in annualised terms). Households have a preference relation defined over the new dwellings and are individually rational, they buy a dwelling that is at least as good as the one they are currently renting (Sönmez & Ünver, 2011). The CHATA model orders households starting with the one with the largest WTP who buys the dwelling of their preference (and that they can afford). Once the purchase is complete both the household and the dwelling leave the market. This process is repeated for the remaining households and dwellings (Fernandez, 2019b).

The outcome of the model is a matching, where each dwelling has a price and each household buys the best dwelling that they can afford (Sönmez & Ünver, 2011), and the decentralised nature of the model results in a competitive equilibrium. It is assumed that a higher price is associated with a better-quality and well-located dwelling that renders higher utility to the household (Alonso, 2005). The model is suitable for the purposes of the NPS-UD as it mimics the competitive nature of the housing market where households bid for a dwelling up to a maximum amount (the WTP). Some modelling assumptions apply:

- Households are restricted to buy only one dwelling from a set of acceptable dwellings (Klaus et al., 2016), which is controlled by the submarkets.

- Developers set prices and mix of dwellings so that they maximise profitability under different conditions and incentives.
- The analysis includes current renters only (i.e., first-home buyers).

Therefore, the model is an ex-ante analysis about the consistency (or discrepancy) between the price's distribution and the ability of households to buy the new dwellings. A caveat applies: the conceptualisation and setup of the modelling approach was a complex exercise because of time constraints, and the wide scope of the NPS-UD, which requires providing information on supply and sufficiency in the short, medium, and long-term. However, constructing demand and capacity models incorporating time dynamics are major and complex investments that would take a long time to construct and validate. Hence, this HBA provides great spatial detail of the results at the expense of the time dimension, but without compromising the generality, application and validity of the quantitative findings and implications.

The implementation of the CHATA model and other technical details are described in Appendix 3, Fernandez (2019a, 2019b) and Fernandez & Martin (2020).

2.6 Impact analysis of planning and infrastructure decisions

This component of the HBA reviews planning and infrastructure interventions that may have affected the affordability and competitiveness of the local housing market. This is a high-level review relying on desktop research. Sources are multiple and consist of academic journal papers, grey literature, Auckland Council publications, and expert opinion from council staff.

It is worth mentioning some conditions for the analysis:

- As not all the assessed interventions have been subject to research or evaluation, sources of evidence are of varying nature. In multiple instances, it is not possible to identify a clear link between the design or purpose of the interventions with affordability and competitiveness.
- Interventions are not comparable and, consequently, it is not possible to develop a unique baseline for the impact assessment. Moreover, even though some of the sources do indicate assessments on affordability or competitiveness, it is not possible to define a uniform set of metrics of performance.
- Beyond the sources identified in the literature review, we do not undertake any statistical analysis to identify causality effects for interventions. This is a correlational analysis (at the best) where we do not elaborate on the baseline

or counterfactual scenarios of what would have happened without the implementation of any of the interventions.

- The review should not be considered as an investigation of welfare impacts due to interventions (e.g., cost-benefit or cost-effectiveness analysis). Therefore, to identify conclusive and unambiguous impacts on affordability or competitiveness, further research is necessary, which falls out of the scope of this HBA.

This subsection relies heavily on the work undertaken by the Auckland Council's Affordable Housing Work Programme. This programme identifies a range of opportunities for the Auckland Council to leverage its planning, consenting, and development contributions policy to support delivery of affordable housing (Auckland Council, 2018).

3.0 Housing assessment

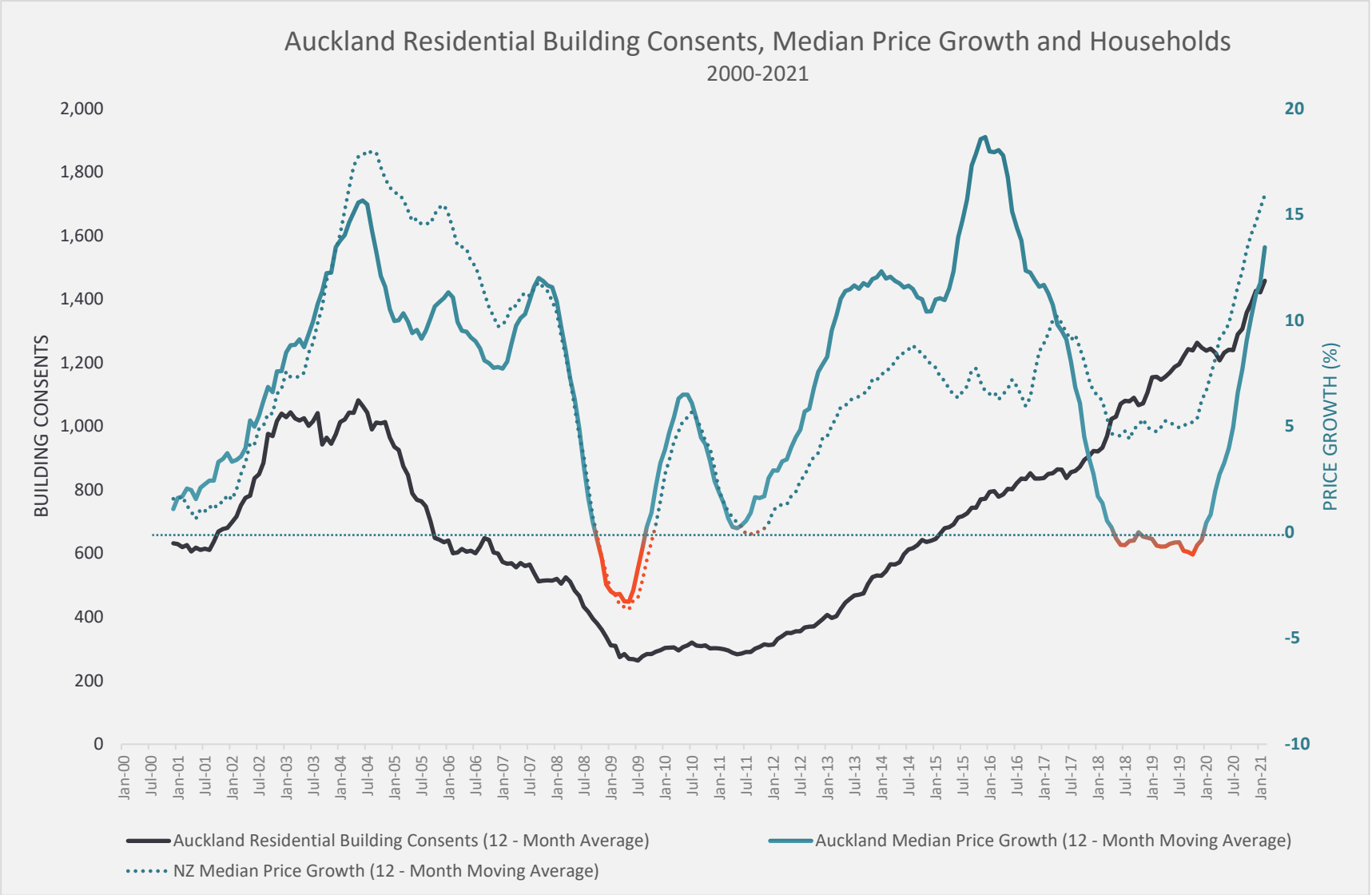
This section presents the empirical findings and implications derived from the modelling approach behind this HBA. Subsection 3.1 sets up the landscape of the housing sector in Auckland. Subsection 3.2 describes the development capacity, infrastructure capacity and housing supply scenarios. Subsection 3.3 describes growth projections of population. Subsection 3.4 characterises household growth, intermediate market households, and the sample of synthetic households feeding as input to the CHATA model. Subsection 3.5 carries out the affordability assessment through the interaction of the ACDC and CHATA models. Subsection 3.6 corresponds to the impact analysis of planning and infrastructure decisions on competitiveness and affordability.

3.1 The current and past landscape

Auckland's population is currently estimated to be approximately 1.7 million and its land area amounts to 489,363 hectares, with the core urbanised area of the region covering just over 50,550 hectares. As well as being large, Auckland is also growing; in the last 10 years the region's population grew by 16 per cent or by 223,900 people. The region's population is projected to continue growing with an anticipated increase of 833,000 people between 2013 and 2043 – this increase accounts for more than half of New Zealand's population growth over this time (Stats NZ, 2018). As well as an increase in population, the core urbanised area of the region is also expected to increase in size; the extent of the 'urban' and 'future urban' type zones classified in the AUP covers 59,453 hectares, potentially increasing the region's main urban area by 18 per cent.

To set up the landscape of the housing market in Auckland, Figure 5 shows the relationship between new dwellings consented and dwelling price growth over time. Before November 2016, as prices increased, consenting activity also increased. This is sensible as increasing prices imply that the potential to make a profit developing and selling dwellings also increases. After the AUP became operative in 2016, development capacity, especially in highly desired brownfields areas, increased significantly. At this point, it seems as though the increase in development potential was at least partially responsible for flat dwelling prices for the next couple years. However, going into 2020 the past pattern seems to have returned.

Figure 5: Auckland Residential Building Consents, Median Price Growth and Households 2000-2021



3.2 Housing development capacity (supply)

- This section fulfils the requirements of Clauses 3.25 (1), (2); 3.26 (1), (2), (4) of the NPS-UD.
- Clause 3.25 (b) has been assessed except for transport capacity which is not included.

3.2.1 Plan-enabled capacity

This subsection presents the results of the plan-enabled development capacity assessment. The capacity results are separated in two categories:

1. net residential capacity with infill opportunities
2. net residential capacity with redevelopment opportunities.

The two capacity opportunities are aggregated through different methods and have different constituents that make up each of their totals.

The AUP identifies FUZ areas as suitable for urbanisation, but they are mainly served for transitional purposes as they will be progressively developed after they are structure planned, live zoned, and serviced by bulk infrastructure. Until then, these areas are not to be used for urban activities as they are mainly used for farming. Hence, FUZ areas do not provide readily available sections to be built upon and are not part of the plan-enabled assessment.

Table 9 shows the net development capacity across the region, where plan-enabled capacity is estimated for the different assessment types. Total infill capacity and total redevelopment capacity are not a sum across all sub development types. While total infill capacity is the sum of residential infill, residential vacant and residential vacant potential of individual development sites; the total redevelopment capacity is the maximum value of either residential redevelopment or the sum of residential vacant and residential vacant potential of individual development sites. Hence, the assessment suggests that the total net infill development capacity is 101,649 dwellings and the total net redevelopment capacity is 909,179 across Auckland's urban zoned land. Comparing to the previous HBA 2017 (as part of the NPS-UDC 2016), net infill capacity has decreased by 17,657 and net redevelopment capacity has decreased by 167,088. Some modelling updates have been introduced, where reductions are mainly resulting from development opportunities being taken up. However, due to further land fragmentation, in situ infill and/or redevelopment opportunities have diminished as shown in Figure 6.

Figure 6: Intensification and further land fragmentation

If all suitable sites are redeveloped to the maximum as enabled by the plan, Mixed Housing Urban and Mixed Housing Suburban combined could provide 678,851 additional dwellings or 75 per cent of the total net redevelopment capacity (Table 10).

Table 9: Housing development capacity by assessment types

Existing urban area (residential zones only)	**Total**
Residential vacant	81,867
Residential infill	2,454
Residential vacant potential	17,328
Residential redevelopment	815,580
Residential rollover	-
Total Infill	**101,649**
Total Redevelopment	**909,179**
Compare to NPS-UDC HBA 2017 (reduction)	
Total infill (HBA 2017)	119,306 (-17,657)
Total Redevelopment (HBA 2017)	1,076,267 (-167,088)

Table 10: Housing development capacity by Auckland Unitary Plan base zones

Unitary Plan base zone	Net infill	Net redevelopment
Large Lot Zone	2,296	2,323
Mixed Housing Suburban Zone	26,359	327,125
Mixed Housing Urban Zone	25,281	351,726
Rural and Coastal Settlement Zone	2,500	2,504
Single House Zone	25,211	28,586
Terrace Housing and Apartment Building Zone	20,002	196,915
Total	**101,649**	**909,179**

At local board level, sites within Franklin and Howick provide 28 per cent (28,310 dwellings) of the total net infill capacity. The combined areas of Henderson-Massey and Howick have the potential to supply 23 per cent (210,556) of the total net redevelopment capacity (Table 11). Spatial distributions of the two types of development capacity are illustrated in Figure 7 and Figure 8.

Table 11: Net housing development capacity by Auckland local board areas

Local board	Net residential infill capacity	Net residential redevelopment capacity
Albert-Eden	614	42,064
Devonport-Takapuna	591	30,245
Franklin	14,472	55,393
Henderson-Massey	9,959	113,131
Hibiscus and Bays	11,506	46,062
Howick	13,838	97,425
Kaipātiki	1,773	48,408
Manurewa	2,835	44,094
Māngere-Ōtāhuhu	1,047	42,600
Maungakiekie-Tāmaki	2,341	57,939
Ōrākei	4,693	54,689
Ōtara-Papatoetoe	1,875	47,934
Papakura	9,517	51,100
Puketāpapa	532	34,736
Rodney	10,954	17,345
Upper Habour	11,078	37,868
Waitākere Ranges	2,542	18,194
Waitematā	405	13,491
Whau	1,077	56,461
Total	**101,649**	**909,179**

Figure 7: Residential sites with infill capacity

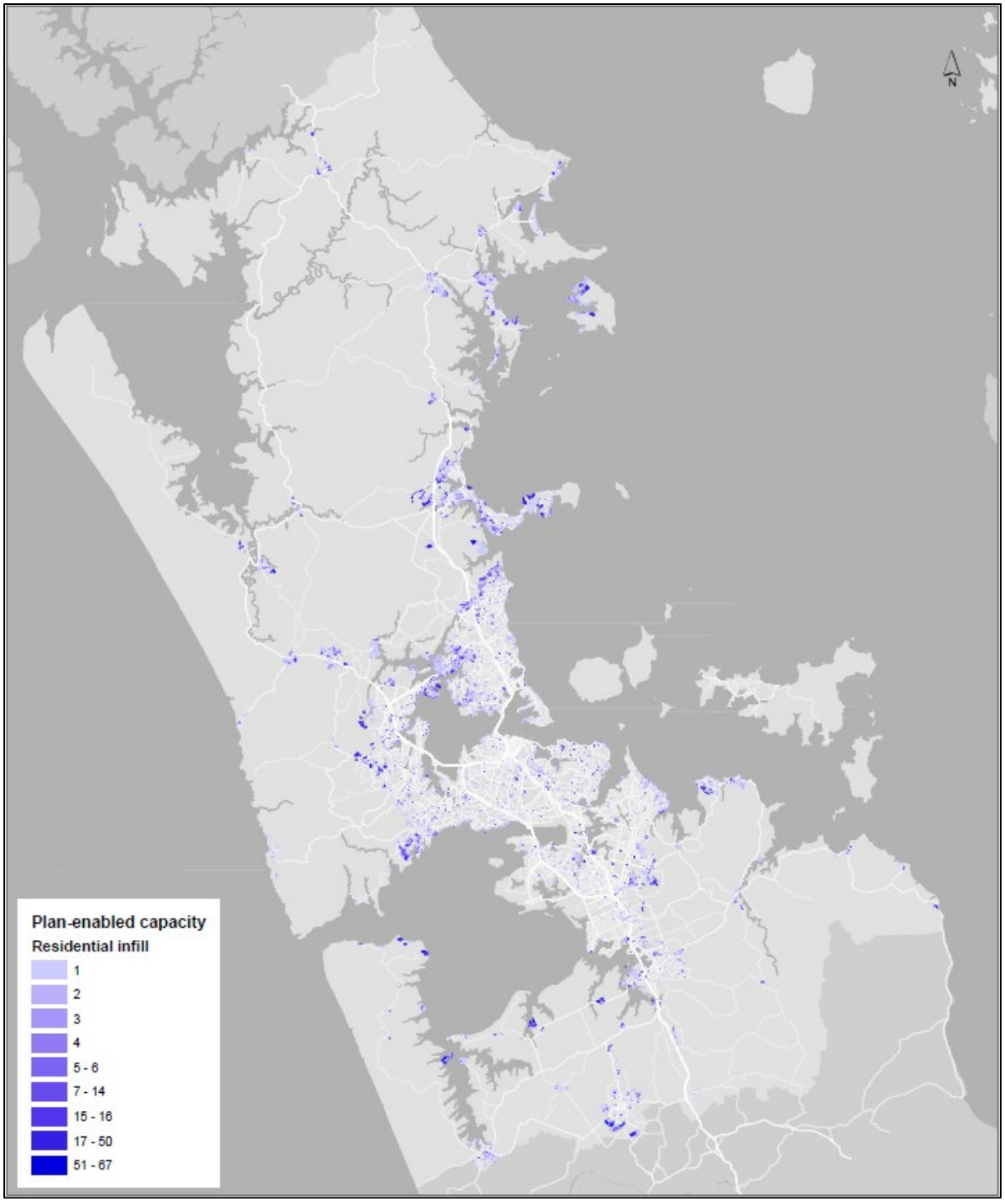
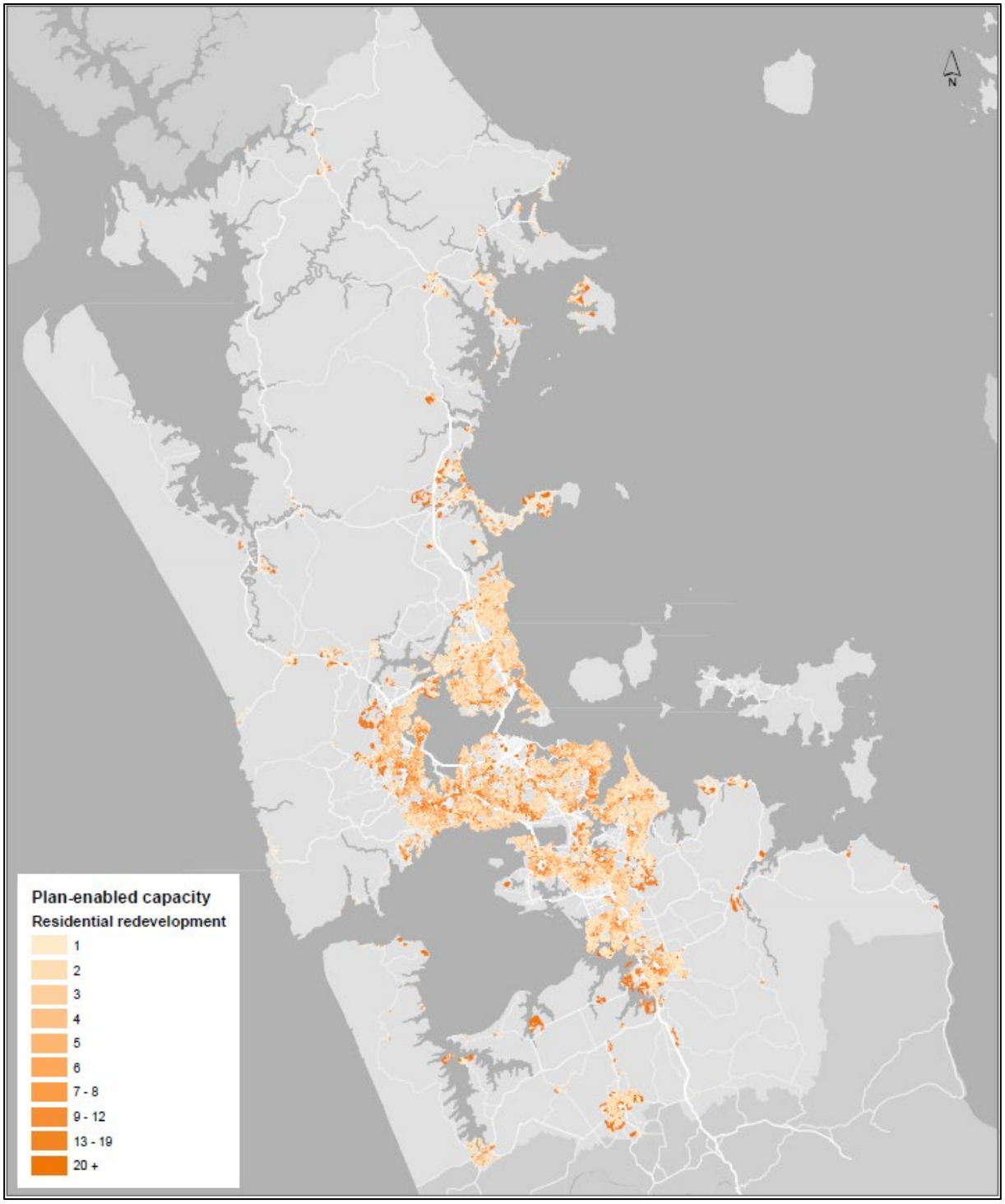


Figure 8: Residential sites with redevelopment capacity



Hauraki Gulf Islands are not assessed in this HBA because the underlying zoning provisions are regulated by the Auckland Council District Plan – Hauraki Gulf Islands Section – Operative 2018 not the AUP. While some modifications have occurred since the formation of the Auckland Council, relevant planning provisions that regulate residential development have not changed. Therefore, previous residential development capacity assessment completed by utilising the district plan provisions is still deemed valid. The estimated capacity of residential zoned land in the Hauraki Islands is in Table 12.

Table 12: Residential development capacity – rollover from Capacity for Growth Study 2013

Residential development capacity – rollover	Aotea / Great Barrier	Waiheke
Total residential capacity (dwellings) utilising infill	2,317	1,058
Total residential capacity (dwellings) utilising redevelopment	3,812	1,618

3.2.2 Infrastructure bulk capacity

Water and wastewater

The infrastructure readiness assessment has found that water supply, wastewater, and stormwater infrastructure, at a network (bulk) infrastructure level, is broadly adequate to cater for projected growth over the short, medium and long-term. The assessment of the bulk water supply and wastewater networks indicates that of net plan enabled capacity, 57 per cent is infrastructure ready in the short term, 77 per cent in the medium-term and 99 per cent in the long-term.

Figure 9 shows the indicative capacity across the Auckland region for water supply, and Figure 10 for wastewater networks. Areas in green are considered to have existing capacity or capacity available in the short-term (0-3 years); areas in yellow have capacity that will become available in the medium-term (3-10 years); areas in red have capacity that will become available in the long-term (10-30 years); and, areas in black are unserviced areas.

Where areas are shown to be constrained over different time periods, this does not imply that there is no capacity available, as a proportion of development is still able to occur. There are proposed projects within Watercare's 30-year Asset Management Plan (AMP) that will unlock constrained areas.

Figure 9, showing indicative water supply network capacity, indicates that most of the Auckland region is expected to have capacity in the long-term, apart from areas that are unserviced. Areas such as Pakuranga and parts of the North Shore will have

increased capacity over the medium-term for example. Other areas such as Dairy Flat South, Paerata and other areas in south Auckland have greater capacity in the long-term.

Figure 10, illustrating indicative wastewater network capacity, shows that large parts of the Auckland region are constrained in the short-term. Most of the central isthmus, south Auckland and the North Shore have capacity in the medium-term. Also, areas such as Drury, west Auckland, Dairy Flat and Warkworth south show greater capacity in the long-term. Most of the region is expected to have capacity in the long-term.

The Central Interceptor is a key example of a bulk wastewater project which unlocks significant development capacity across the majority of the isthmus over the medium-term. It will be integral to effectively managing wastewater within the region, to protect public health and the environment by reducing overflows and to provide for growth.

Figure 9: Water supply indicative capacity: (a) short-term (0-3 years), (b) medium-term (3-10 years), (c) long-term (10-30 years)

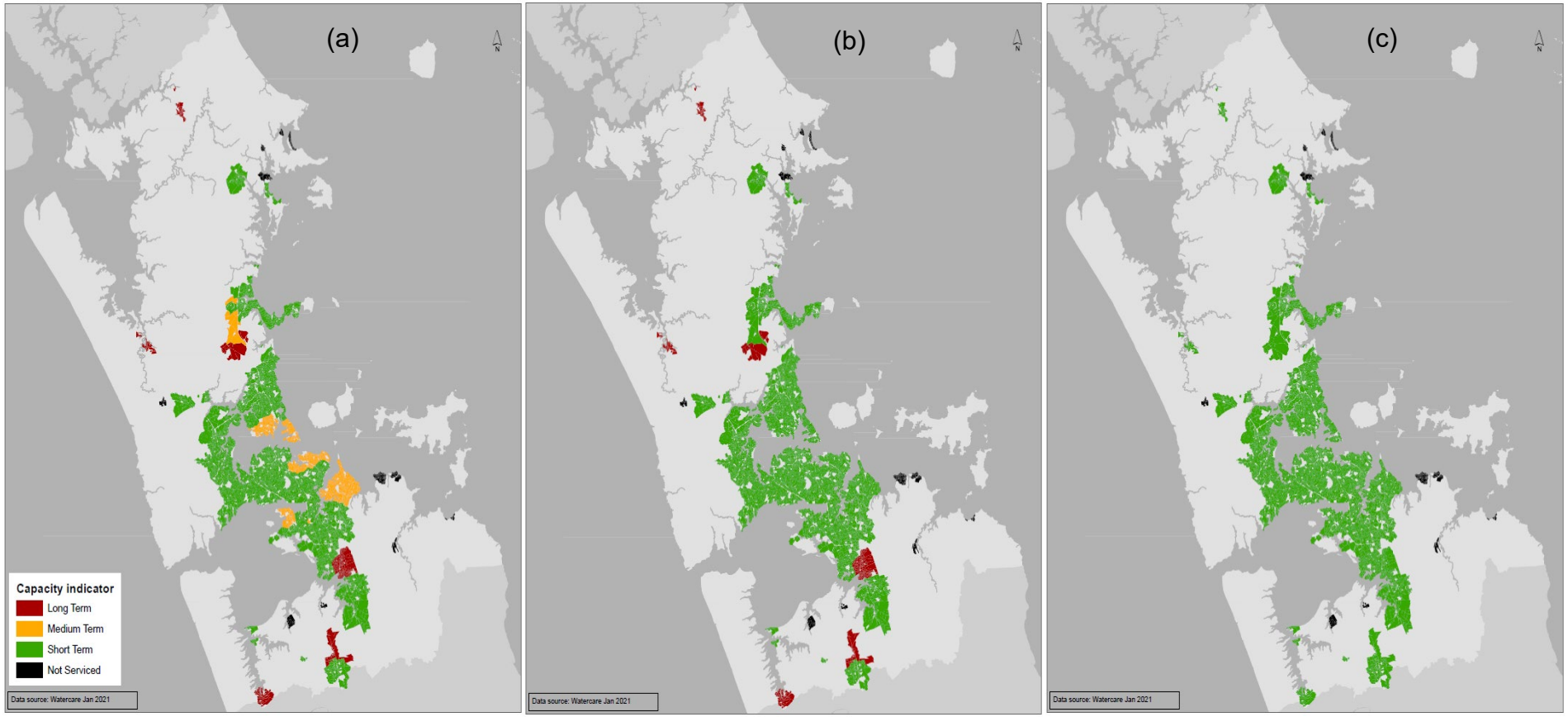
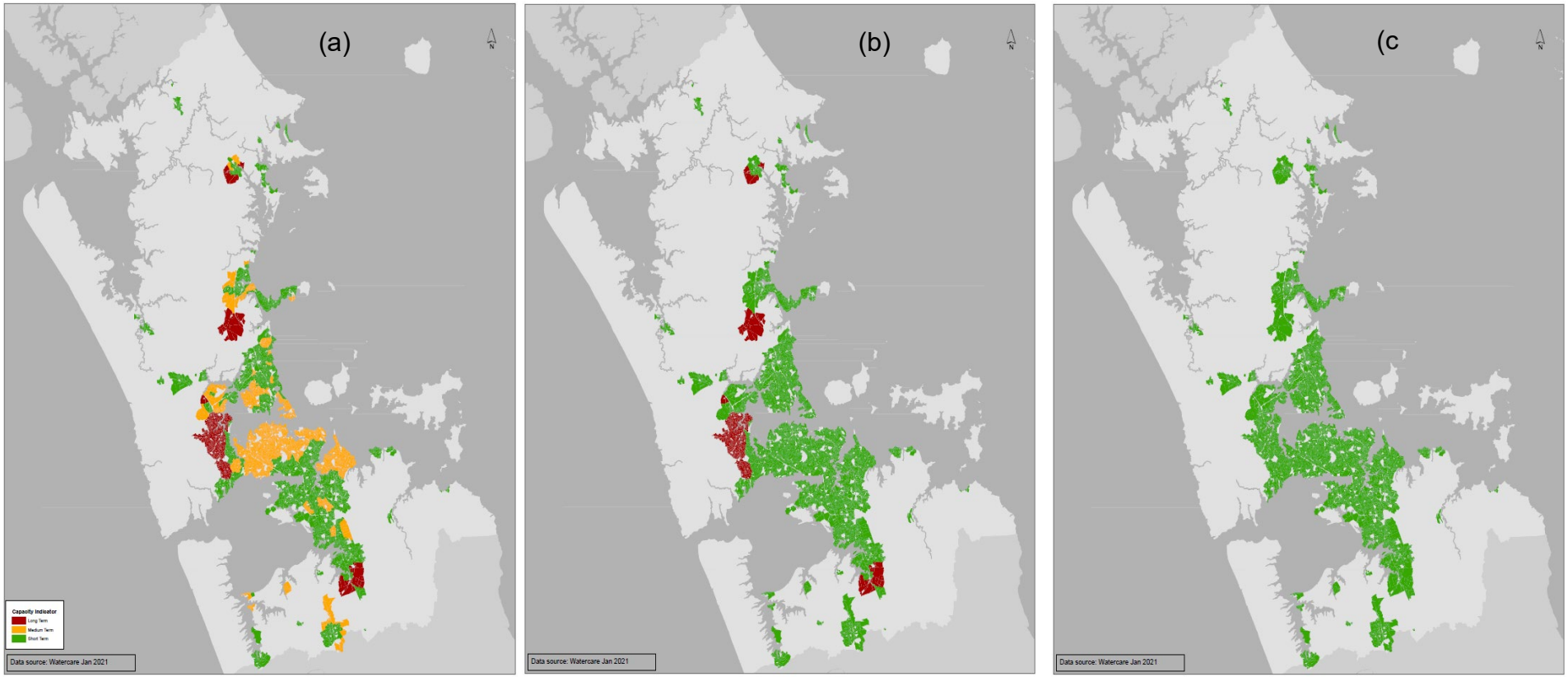


Figure 10: Wastewater indicative capacity: (a) short-term (0-3 years), (b) medium-term (3-10 years), (c) long-term (10-30 years)



Stormwater

The stormwater network is considered to have limitations but is generally not a hard constraint on development and therefore solutions to create capacity are expected to be available over the short, medium and long-term. There are exceptions such as Takaanini North and Drury East where infrastructure providers have advised that there are significant limitations. Large floodplains exist in those areas and there is currently no technical solution or budget in the current Long-term Plan.

3.2.3 Availability of additional infrastructure

Clause 3.5 of the NPS-UD requires local authorities to be satisfied that the additional infrastructure to service the development capacity is likely to be available. The NPS-UD defines 'additional infrastructure' as including community infrastructure, public open space, land transport that is not controlled by local authorities, social infrastructure such as schools, healthcare facilities, telecommunications networks and electricity or gas networks.

The Auckland Plan Development Strategy provides information on infrastructure that is not council-controlled. Based on this, and the following information, it is considered that 'additional infrastructure' to service the development capacity is likely to be available.

Community facilities and parks and open space

The Community Facilities Network Plan 2015[10] sets out how Auckland Council will invest in community facilities over the next 20 years and address challenges such as Auckland's growing and diverse population. The Parks and Open Spaces Strategic Action Plan 2013[11] identifies challenges, opportunities, priorities, and actions for Auckland Council's involvement in parks and open spaces over the next 10 years. The Open Space Provision Policy 2016[12] informs investment decisions to create a high quality open space network that contributes to Aucklanders' quality of life.

[10] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/community-social-development-plans/docscommunityfacilities/community-facilities-network-plan.pdf

[11] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/parks-sports-outdoor-plans/Documents/parks-open-spaces-strategic-action-plan.pdf

[12] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-policies/Documents/open-space-provision-policy.pdf

Land transport (not council-controlled)

Waka Kotahi, the New Zealand Transport Agency, manages and controls the state highway network. The National Land Transport Programme (NLTP)[13] is a three-year programme that outlines how Waka Kotahi will use national land transport funding to provide all users of the system with a safe and integrated network. The Waka Kotahi Investment Proposal 2021-31[14] for the Auckland region sets out the programme of activities proposed for inclusion in the 2021-24 National Land Transport Programme. The Proposal outlines the investment approach for state highway maintenance and improvements, and nationally delivered programmes. In the Auckland Region, and as part of the Auckland Transport Alignment Project (ATAP), a key focus is to improve freight connections by increasing capacity and optimising the state highway network to reduce congestion on key freight routes. Enhancing the resilience of the state highway network is also a key priority in responding to climate change. There are numerous committed projects.

Education

It is anticipated that the Government will be able to service development capacity despite growth pressures. The National Education Growth Plan to 2030 (Auckland and Tai Tokerau)[15] highlights unprecedented population growth challenges and recognises Auckland as a high growth area. The plan sets out targeted responses on a "catchment" basis and shows how sufficient capacity in the school network will be delivered in the right place at the right time. The solution to accommodating growth will require a range of different solutions such as enrolment zones, network restructure, roll growth funding and establishment of new schools. Long-term planning, beyond 2030, will need to be an ongoing process to successfully meet education demand.

Electricity and gas

Transpower's Transmission Planning Report 2020[16] identifies that the Auckland region has some of the highest load densities in New Zealand along with relatively low levels of local generation. As Auckland's generation is less than the region's peak demand, the deficit is imported through the National Grid. Transpower identifies the need for major refurbishment work on transmission lines, customer projects to facilitate

[13] https://www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/

[14] https://www.nzta.govt.nz/assets/planning-and-investment/docs/waka-kotahi-investment-proposal-2021-31-regional-summary-auckland.pdf

[15] https://www.education.govt.nz/assets/Documents/Ministry/Budgets/Budget2019/NEGP/AucklandTaiTokerauplans.pdf

[16] https://www.transpower.co.nz/sites/default/files/uncontrolled_docs/TPR 2020.pdf

development in housing and transport and forecasted population growth as key issues impacting transmission infrastructure. An Auckland Strategy has been developed which takes a long-term approach. Since 2010, Transpower has made substantial improvements to the transmission network. This investment means the core network is now in place, providing adequate capacity beyond 2040. Transpower's approach seeks to ensure secure transmission into and within the Auckland region into the future.

Vector owns the network lines that deliver power to Aucklanders and delivers products and services across electricity, gas, fibre, metering, and new technologies. Vector recognises that Auckland is growing rapidly with significant demand for new electricity connections. Vector's Electricity Asset Management Plan 2021-2031[17] (AMP), which focuses on their electricity distribution network, identifies their 'Symphony' strategy which seeks to create a system for its customers that fits the future. There is uncertainty over future electricity demand and the impact of climate change, and the AMP seeks to set out investments to deliver the best outcomes. Substantial investment in infrastructure has been and is driven by growth, the need to replace, upgrade and maintain.

Healthcare

Auckland currently has three DHBs; Waitematā DHB, Counties Manukau DHB and Auckland DHB which are responsible for the health of the population who live within the district and are the Government's funder and provider of health services. However, the recent announcement by the Minister of Health will see the replacement of the country's health boards and the creation of a national health organisation. The National Asset Management Programme (NAMP) for district health boards: Report 1: The current-state assessment 2020[18] is the first consistent nationwide report and is part of a government-wide focus to improve capital funding decisions, capital investment plans and asset management plans to ensure investments deliver the best value. The findings highlighted the accumulated underinvestment in this area. NAMP and other work programmes in the Ministry's Health Infrastructure Unit, will support the development of a long-term investment strategy which will better inform decisions.

[17] https://blob-static.vector.co.nz/blob/vector/media/vector2021/vec224-amp-2021-3031_310321.pdf

[18] https://www.health.govt.nz/system/files/documents/publications/national-asset-management-programme-district-health-boards-report-current-state-assessment9june2020.pdf

3.2.4 Commercially feasible housing development capacity

Of all the feasible scenarios modelled, two are selected for reporting purposes: the maximum percentage of profit yield and the minimum priced dwelling units. Approximately, 840,000 residential dwellings are commercially feasible and are yielding the maximum per centage of profit on residential and future urban zones across Auckland. The average sales price is $1.66 million and terrace housing make up most of the feasible typology (Table 13). Dwelling price and dwelling size reflect the underlying assumptions that larger dwelling units are associated with higher dwelling price. Dwellings located along coastal areas and in the Isthmus are likely to be sold at premium prices that are higher than the estimated average (over $1.6m). Terrace houses are the main form of housing typology in areas associated with higher dwelling price (Figure 14-16).

Under the minimum priced dwelling scenario, about 1.4 million residential dwellings are commercially feasible where the average sales price is $1.04 million with an average floorspace of 107 square metres. Apartments and terraces comprise over 84 per cent of the feasible dwellings tested (Table 14). As shown in Figures 11 to 16, though dwellings prices are sold at the minimum level, coastal areas and central isthmus areas are higher than outer suburbs and urban fringe areas. Terrace housing forms the majority of the feasible development typology and dwelling size is considerably smaller than the maximum profit scenario.

Table 13: Commercially feasible development capacity modelling results – maximum per centage profit scenario

Feasibility threshold	Feasible built form	Average sales price	Average floorspace	Feasible dwellings
0-10%	Apartment	$2,105,020	146	622
	House	$1,288,110	175	4,524
	Terrace	$1,468,476	151	66,536
10-20%	Apartment	$2,089,107	147	482
	House	$1,332,741	178	19,942
	Terrace	$1,610,880	158	115,713
20-30%	Apartment	$2,126,012	150	206
	House	$1,454,442	184	28,087
	Terrace	$1,705,446	163	159,100
30-50%	House	$1,580,037	191	62,074
	Terrace	$1,916,173	174	226,306
+50%	House	$1,659,137	195	51,888
	Terrace	$2,303,085	190	102,791
Average		$1,659,957	172	838,271

Table 14: Commercially feasible development capacity modelling results – minimum priced dwelling scenario

Feasibility threshold	Feasible built form	Average sales price	Average floorspace	Feasible dwellings
0-10%	Apartment	$1,080,527	86	378,761
	House	$1,047,516	125	24,031
	Terrace	$988,676	107	560,057
10-20%	Apartment	$1,054,195	82	89,880
	House	$969,622	131	4,417
	Terrace	$1,140,802	113	248,691
20-30%	Apartment	$918,446	68	21,980
	House	$1,134,000	167	11
	Terrace	$1,081,571	107	44,116
30-50%	Apartment	$888,789	68	15,265
	Terrace	$1,182,866	107	16,758
+50%	Apartment	$943,755	70	188
	Terrace	$1,135,256	105	702
Average		$1,041,932	107	1,404,857

Figure 11: Estimated dwelling sales price distribution for urban and greenfield areas – maximum profit scenario

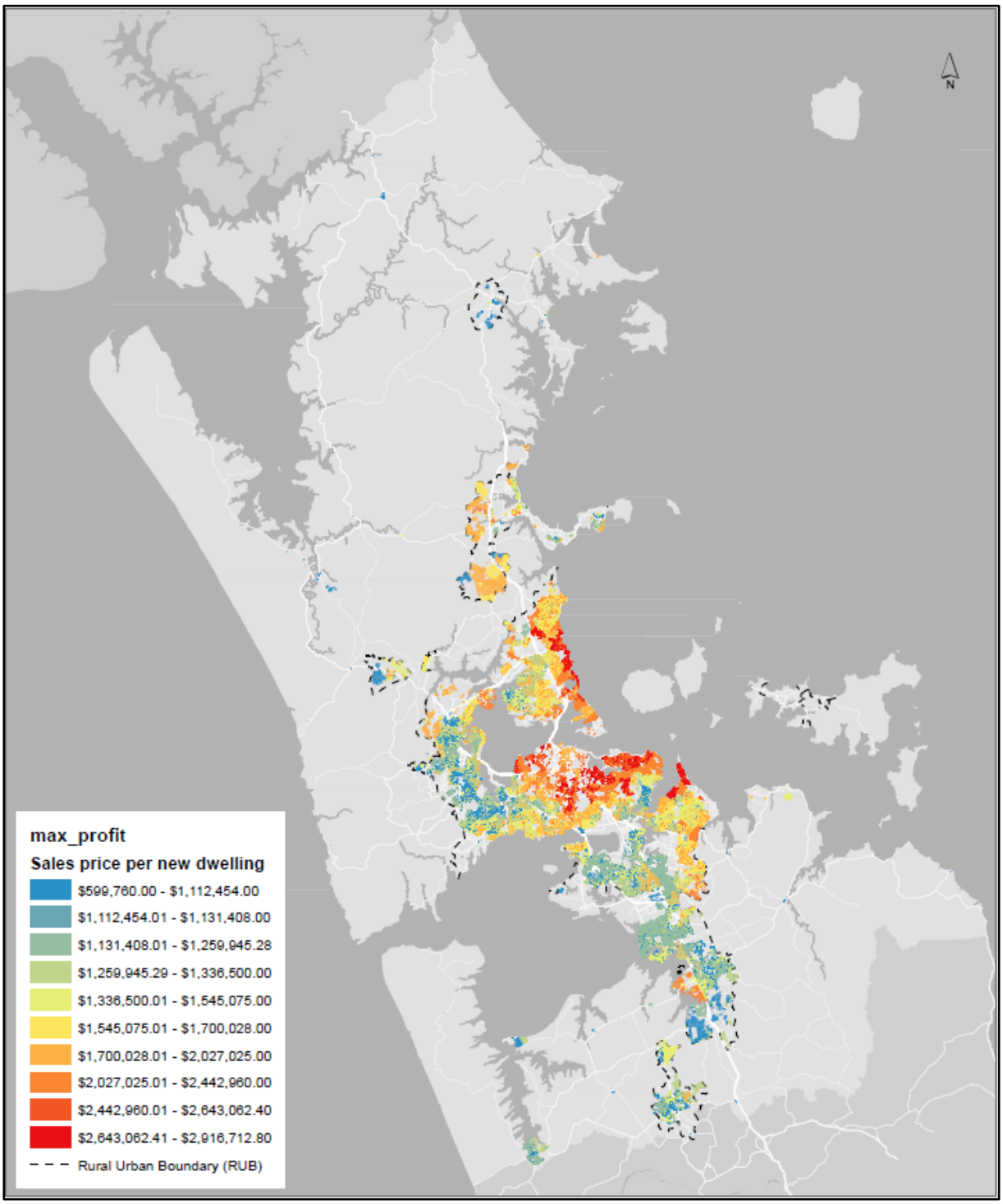


Figure 12: Feasible dwelling typology distribution for urban and greenfield areas – maximum profit scenario

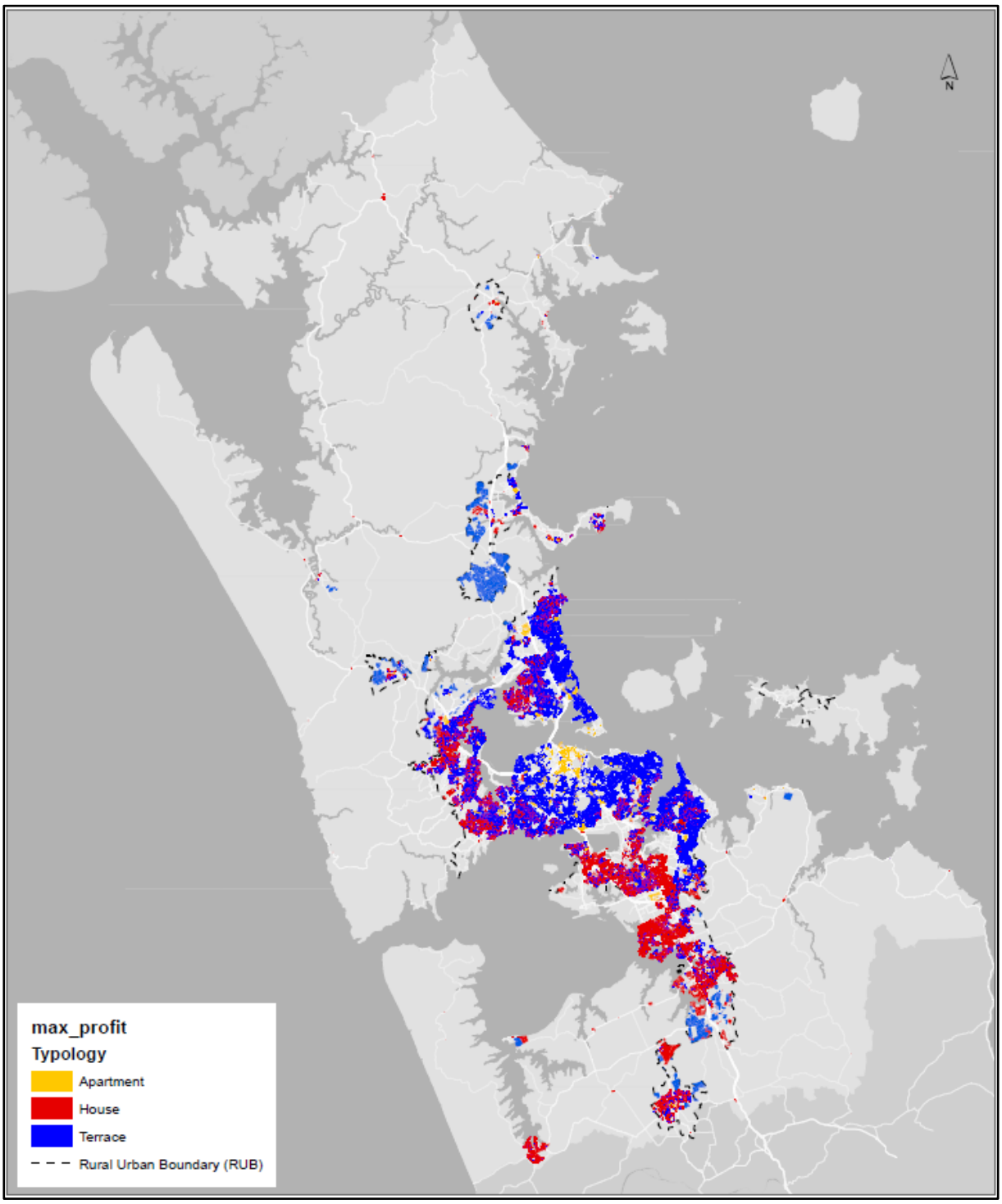


Figure 13: Estimated average dwelling floorspace distribution for urban and greenfield areas – maximum profit scenario

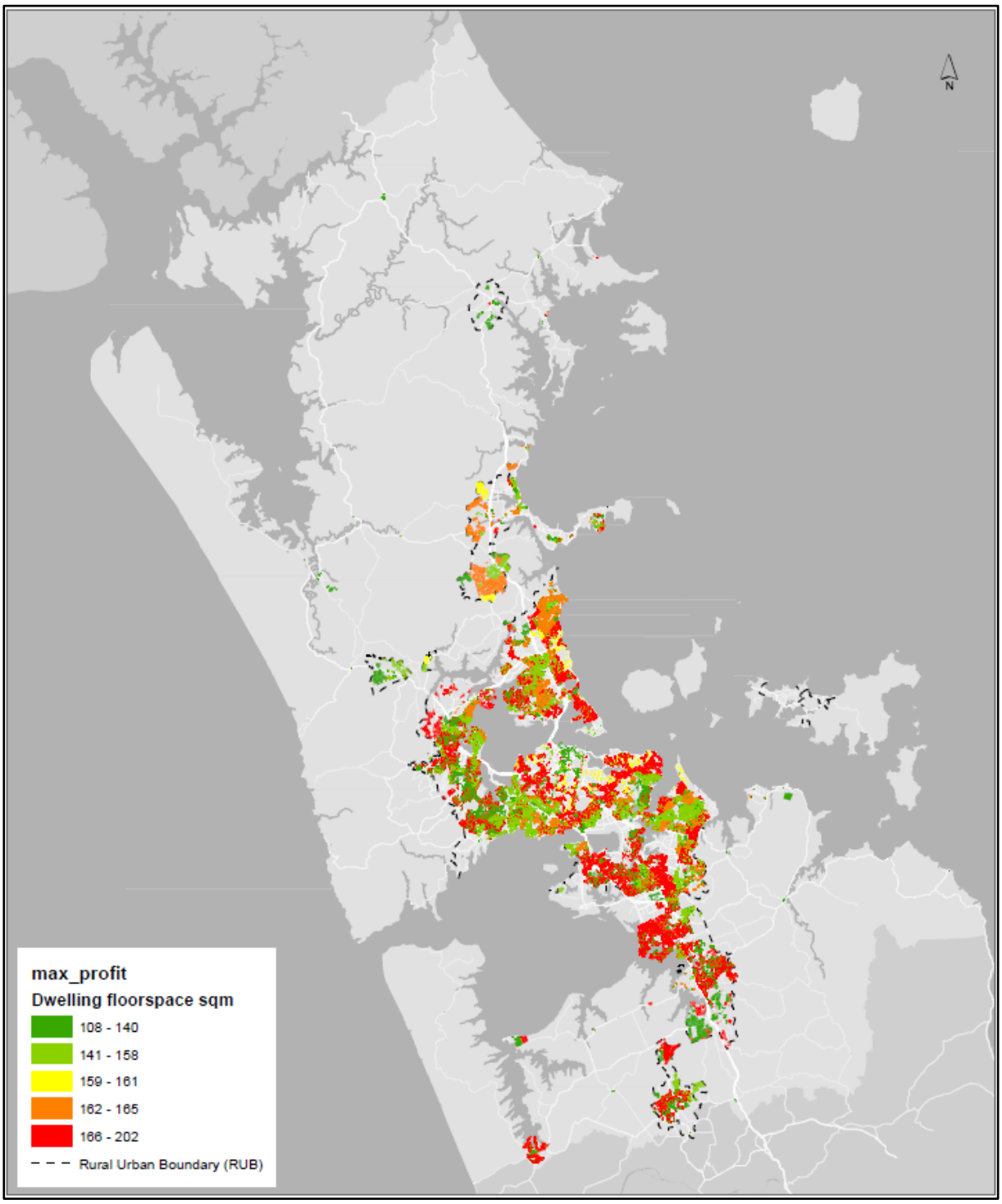


Figure 14: Estimated dwelling sales price distribution for urban and greenfield areas – minimum priced dwelling

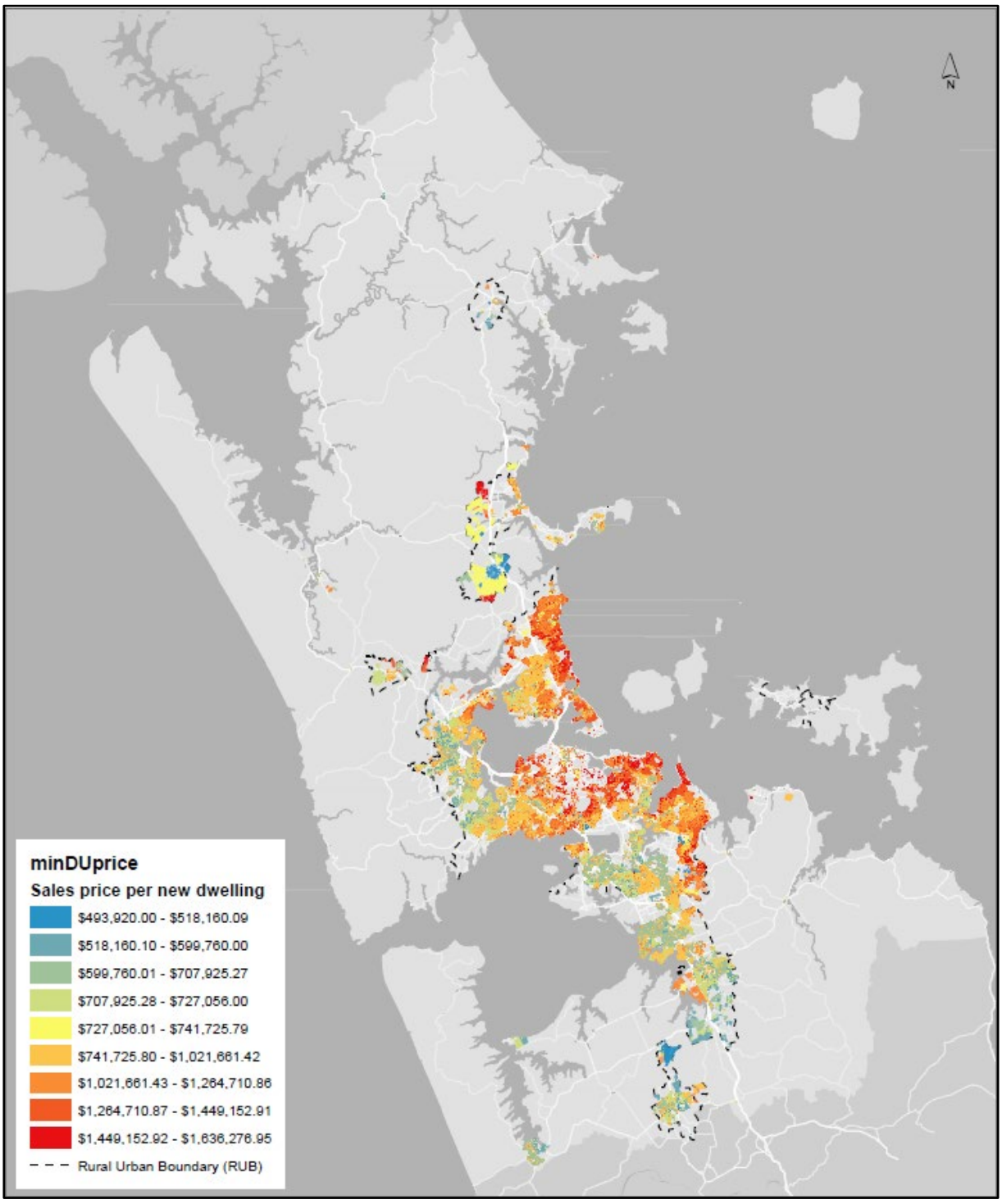


Figure 15: Feasible dwelling typology distribution for urban and greenfield areas – minimum dwelling price

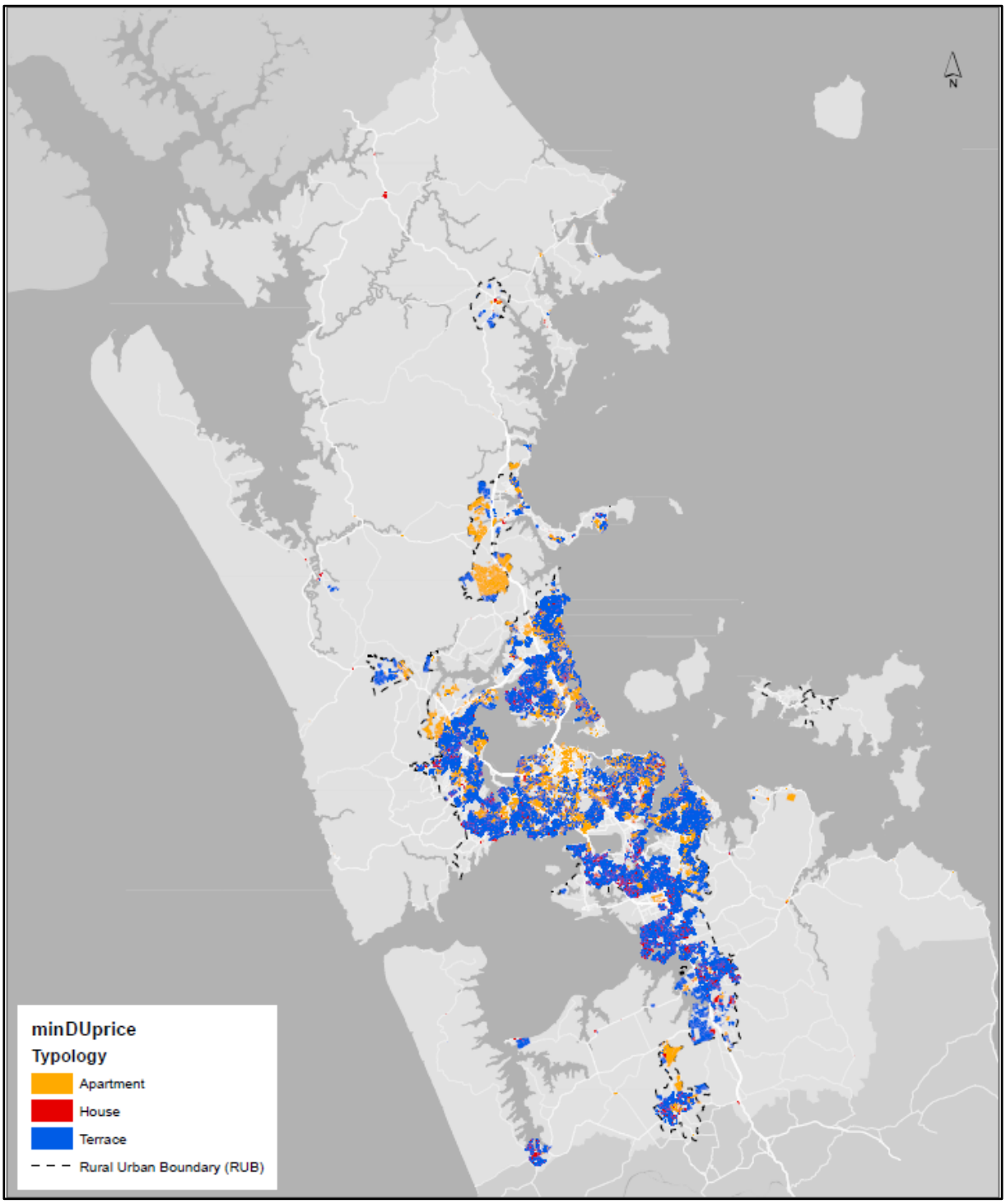
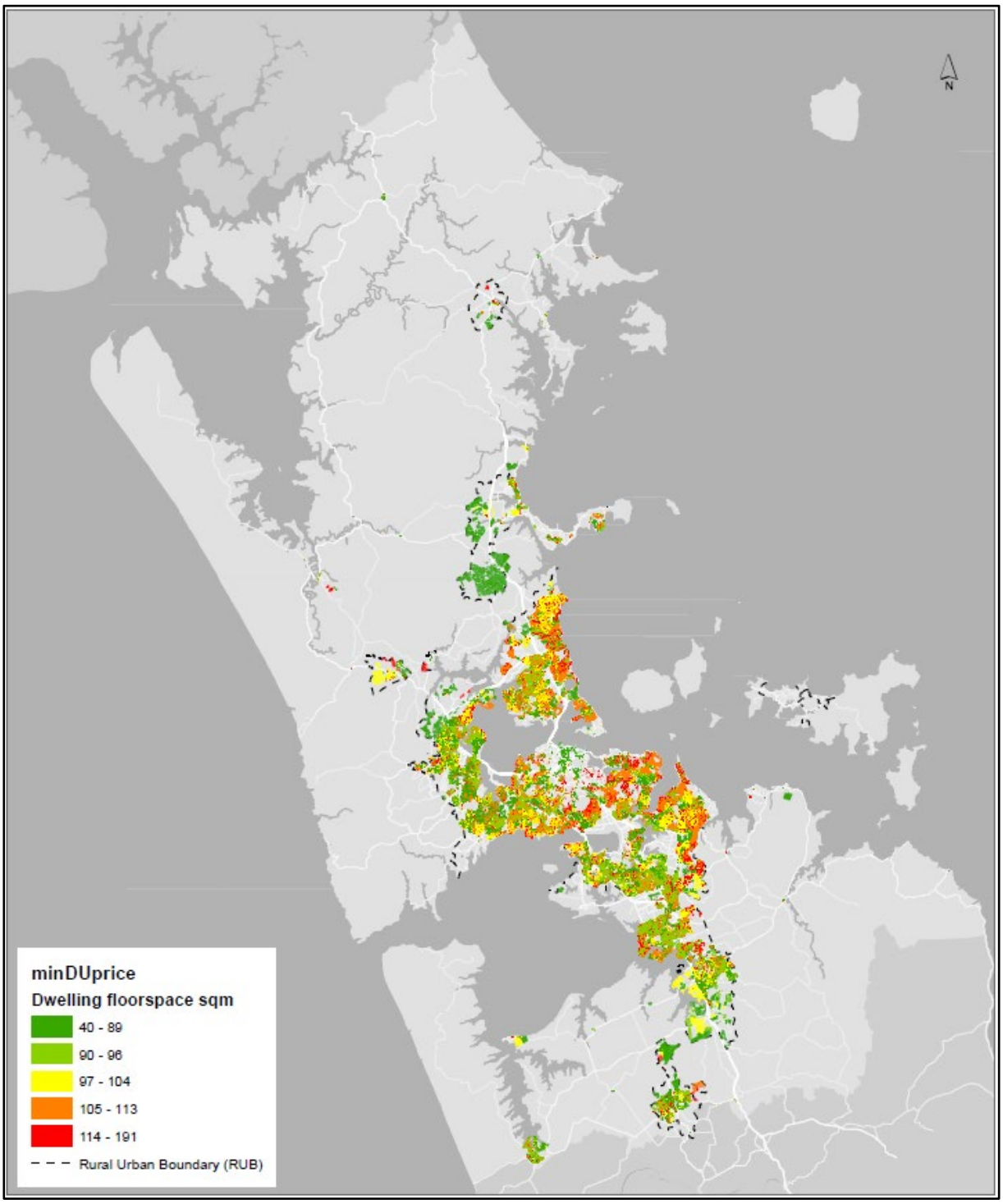


Figure 16: Estimated average dwelling floorspace distribution for urban and greenfield areas – maximum profit scenario



3.3 Competitiveness margin and the 'most likely scenario'

This section fulfils the requirement of Clause 3.22 (1), (2) and 3.24 (5) (a)-(c) of the NPS-UD.

Competitiveness margins are applied to the SNZ2013, SNZ2018 and i11v6 projections. Table 15 shows that the expected level of residential demand plus relevant competitiveness margin over the next 30 years ranges from 332,000 to 384,000 dwellings.

Table 15: Household growth projections with competitiveness margins

	Growth projection scenario		
Projected growth + competitiveness margin	**SNZ 2013 base**	**SNZ 2018 base**	**i11v6**
Short-term demand	37,620	30,221	30,245
Short-term + 20%	**45,144**	**36,265**	**36,294**
Medium-term demand	82,478	73,372	87,163
Medium-term + 20%	**98,973**	**88,046**	**104,595**
Long-term demand	208,071	180,368	174,581
Long-term + 15%	**239,282**	**207,423**	**200,768**
Total 30-year	**383,399**	**331,734**	**341,658**

Given the current pandemic situation, the prolonged border closure, as well as uncertainties of upcoming government policies, there is no sound reason or robust assumption to determine which scenario will be the most likely. However, if a scenario must be selected to meet the NPS-UD requirements, then i11v6 would be the preferred choice as it is the overarching land use scenario adopted for the 2021/2023 LTP that aligns with council's strategic goals and funding capabilities.

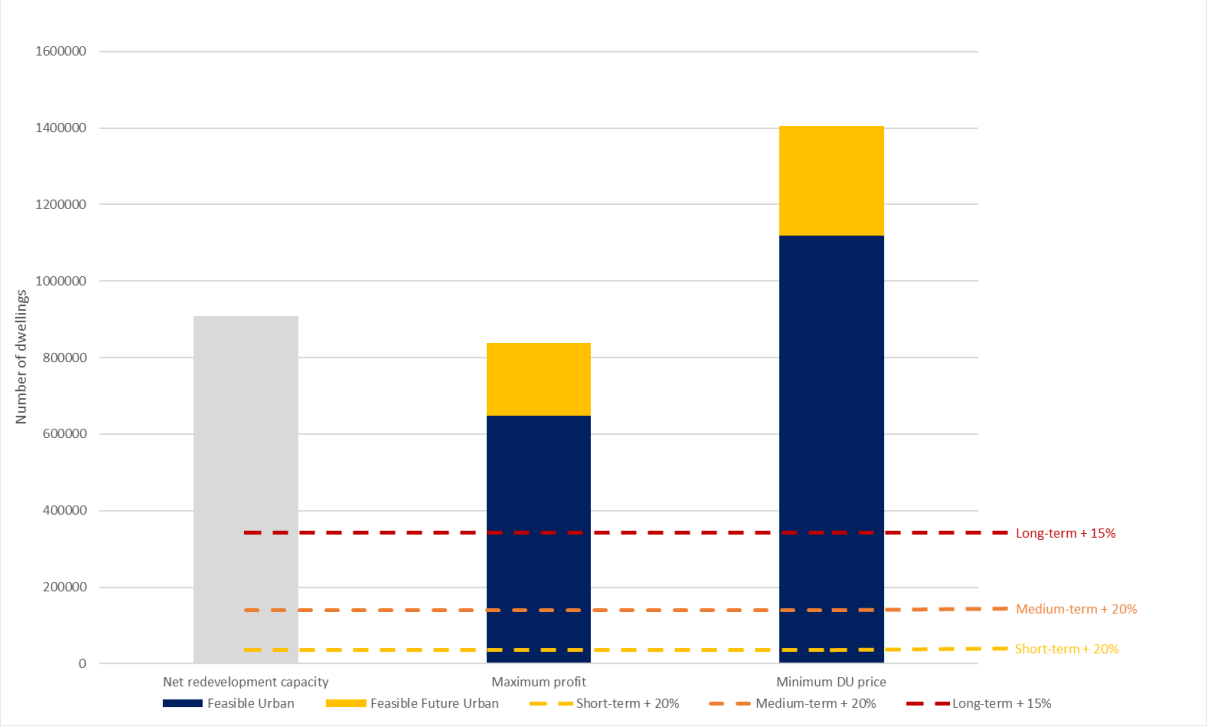
3.4 Housing demand and housing development sufficiency

- The section fulfils requirements of the NPS-UD Clauses, 3.23 (3); 3.24 (1), (4); 3.27 (1), (2), (3).
- NPS-UD Clause 3.23 (2) is not assessed as part of this HBA and will be examined in the next HBA.

3.4.1 Housing development sufficiency and overall housing demand

One of the main goals of the HBA is to examine whether the current operative (and proposed) planning documents have enabled enough development capacity to meet future demand. Both the plan-enabled housing development capacity (additional 909,000 dwelling units) and the commercial feasible development capacity (between 838,000 and 1.4 million dwelling units) have demonstrated that there is sufficient capacity to meet the expected household growth (between 331,000 and 384,000) over the short, medium and long-term (Figure 17).

Figure 17: Comparison of short, medium, and long-term household growth with plan-enabled capacity and feasibility scenarios



Calculating the sufficiency of demand for housing using the assessment outputs shows that there is no shortfall of supply over the next 30 years. Auckland's operative planning documents have provided an adequate amount of development opportunities to meet demand in theory.

Since the adoption of the AUP at the end of 2016, housing supply has reached an all-time high and a greater mix of housing typologies has been observed over the past few years. However, home ownership levels, housing choice and affordability have worsened dramatically. Questions such as ‘who are the targeted audiences’, and ‘which market are the policies tailored towards’ arise and require further analyses to answer them.

3.4.2 Total households and intermediate market households 2021-2031

This subsection characterises the projections of household growth and of the intermediate housing market, as well as a description of the sample of synthetic households generated for modelling purposes.

Projections in this section circumscribe to the two constructed from Mitchell (2019, 2020): the likely and high-growth scenarios.

Table 16 shows the increasing number of households until 2033, which implies that, relative to 2021, in 2026 and 2031 about 41,000 and 77,000 additional households will demand a dwelling under the likely scenario; and, about 58,000 and 110,000 in the high-growth scenario.

The number of intermediate households is also increasing. In 2021 it amounts to 97,156 and 104,128 households for the likely and high-growth scenarios respectively. Relative to 2021, in 2026 and 2031 respectively, about 12,700 and 29,600 additional intermediate households will demand a dwelling under the likely scenario; and, about 13,900 and 32,600 in the high-growth scenario. Thus, the differences between scenarios are arguably due to faster household growth rates in the high-growth scenario and the worsening of affordability conditions in Auckland (Mitchell, 2019).

Table 16: Intermediate Housing Market and Total households by scenario

	Likely scenario		High-growth scenario	
	Intermediate households	Total households	Intermediate households	Total households
2021	97,156	550,605	104,128	617,604
2022	99,812	558,844	107,054	630,471
2023	102,467	567,082	109,980	643,158
2024	104,900	575,321	112,654	654,204
2025	107,332	583,559	115,328	665,098
2026	109,764	591,798	118,002	675,842
2027	112,196	600,036	120,676	686,439
2028	114,628	608,275	123,350	696,893
2029	117,061	616,513	126,024	707,205
2030	119,493	624,752	128,698	717,380
2031	121,925	628,047	131,372	727,420
2032	124,357	629,695	134,046	737,327
2033	126,789	632,990	136,720	747,104

Notes: Calculations based on Mitchell (2019) and Mitchell (2020).

Table 17 shows projections of the number of households by tenure (owners or renters) and scenario. In the likely scenario, by 2033 about 45 per cent of households will live in a rented dwelling, an increase from 41.2 per cent in 2021. This contrasts with a decline in the share of owners from 58.5 per cent in 2021 to 55.1 per cent in 2033. A similar pattern is observed in the high-growth scenario. That is, economic and demographic conditions (e.g., high net immigration gains, worsening affordability) result in the increasing significance of the renting sector in the next decade. Thus, as households struggle to become owners, it is of interest to explore whether increasing development capacity will suffice on reverting the increasing trend of unaffordability as well as the implications on the renting sector.

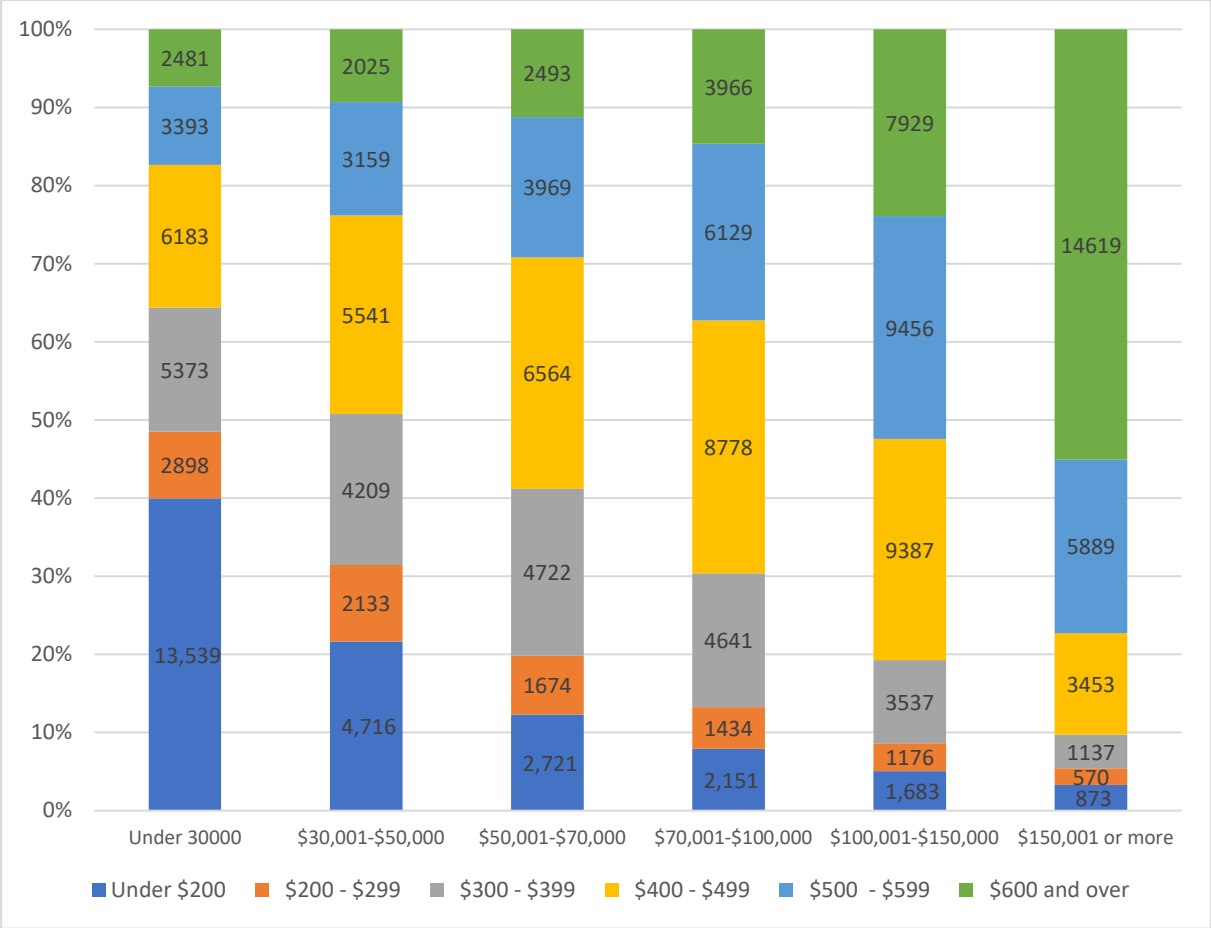
Table 17: Households by tenure and scenario

	Number of households				Per centage of households			
	Likely scenario		High-growth scenario		Likely scenario		High-growth scenario	
	Renters	Owners	Renters	Owners	Renters	Owners	Renters	Owners
2021	228,404	322,201	258,619	358,985	41.5%	58.5%	41.9%	58.1%
2022	233,529	325,315	265,688	364,784	41.8%	58.2%	42.1%	57.9%
2023	238,705	328,377	272,749	370,409	42.1%	57.9%	42.4%	57.6%
2024	243,931	331,390	279,177	375,027	42.4%	57.6%	42.7%	57.3%
2025	249,207	334,352	285,599	379,499	42.7%	57.3%	42.9%	57.1%
2026	254,534	337,264	292,014	383,828	43.0%	57.0%	43.2%	56.8%
2027	259,911	340,125	298,423	388,016	43.3%	56.7%	43.5%	56.5%
2028	265,339	342,936	304,825	392,067	43.6%	56.4%	43.7%	56.3%
2029	269,231	347,282	309,615	397,591	43.7%	56.3%	43.8%	56.2%
2030	274,766	349,986	316,006	401,374	44.0%	56.0%	44.1%	56.0%
2031	278,162	349,885	322,392	405,027	44.3%	55.7%	44.3%	55.7%
2032	280,844	348,851	328,774	408,553	44.6%	55.4%	44.6%	55.4%
2033	284,276	348,714	335,151	411,953	44.9%	55.1%	44.9%	55.1%

Notes: calculations based on Mitchell (2019) and Mitchell (2020).

Figure 18 shows weekly rent paid by income group in 2018, about 75 per cent of households earning above $150,000 pay rents of $600 and above, and less than 10 per cent pay rents below $400. Rents between $400 and $499 are frequent across all income groups, ranging from 16 per cent of the lowest income group and peaking at about 37 per cent of households earning between $50,000 and $70,000. About 40 per cent of the households earning less than $30,000 tend to concentrate on rents below $300.

Figure 18: Weekly rent paid by household income group – 2018



Source: Stats NZ

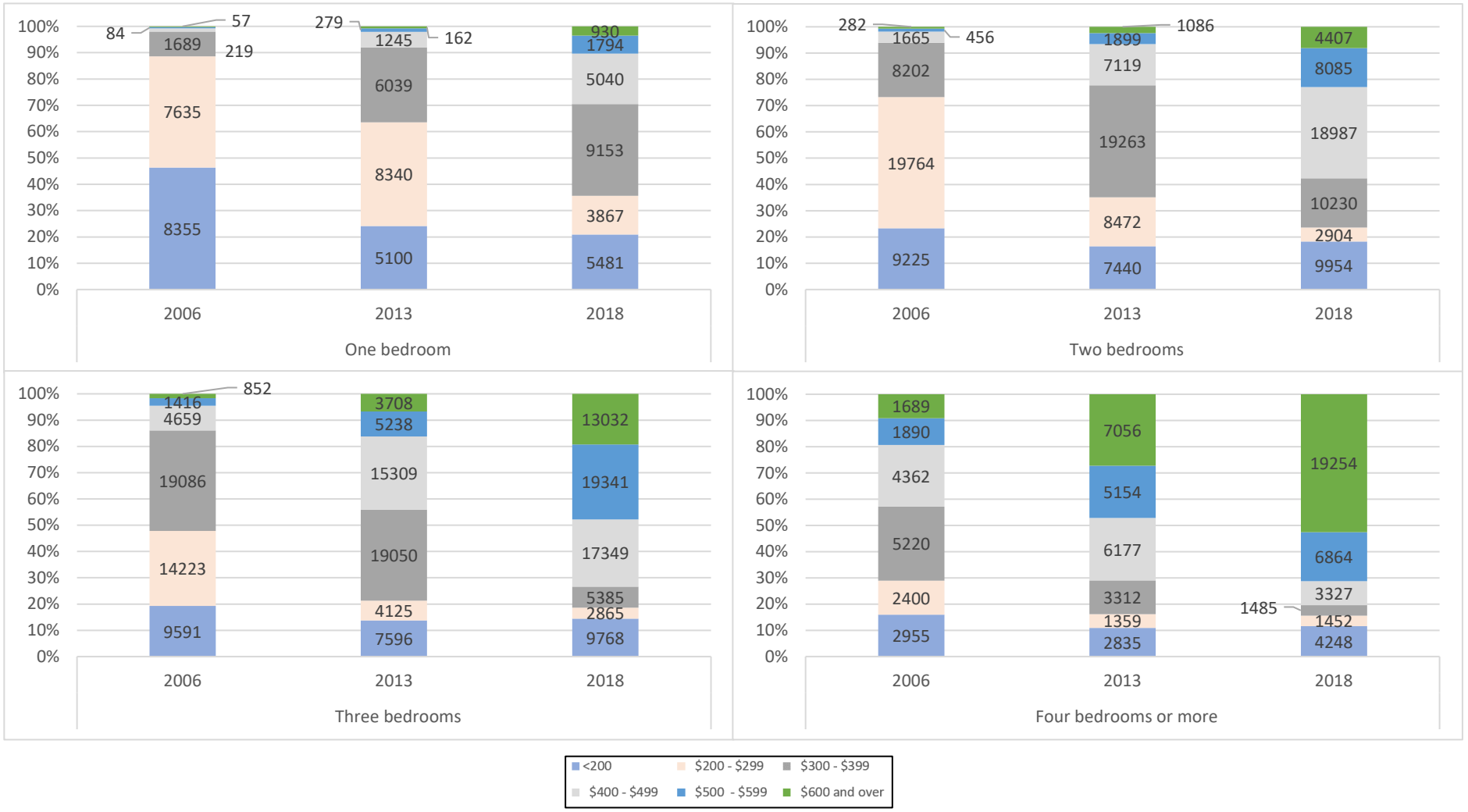
Figure 19 shows the weekly rent paid by number of bedrooms for 2006, 2013 and 2018. There are indications of the worsening conditions of rental affordability (in nominal terms). The share of one-bedroom dwellings where weekly rents are between $300 and $399 has increased from about 10 per cent in 2006 to 33 per cent in 2018. Also, in 2006 less than one per cent of households paid between $400 and $499 for a one-bedroom dwelling, this share has increased to about 20 per cent in 2018. Similarly, the share of two-bedroom dwellings with rents between $400 and $499 increases from 4 per cent to 35 per cent between 2006 and 2018. That is, the share of dwellings with rents between $200 and $399 has shrunk significantly. Similar shifts occur for three and four-bedroom dwellings. Nonetheless, for four bedroom-dwellings, more than half have rent payments above $600 and less than 20 per cent have payments between $100 and $399.

Some considerations worth mentioning:

1. the analysis and interpretation of Figure 19 does not assume that the comparison between censuses is relative to the same dwelling with quality held constant
2. we do not incorporate the effects of the apartment boom in Auckland in the last decade
3. we do not incorporate any other effects from inflation or financial bubbles.

Table 18 shows that private renters remain above 80 per cent of the renting market, and that the participation of state-owned initiatives remains relatively stable. Also, though operations of some small Māori and other community providers started being recorded after 2013, their scale is relatively small and their participation in the renting market remains yet to be assessed.

Figure 19: Weekly rent paid by number of bedrooms



Source: Stats NZ

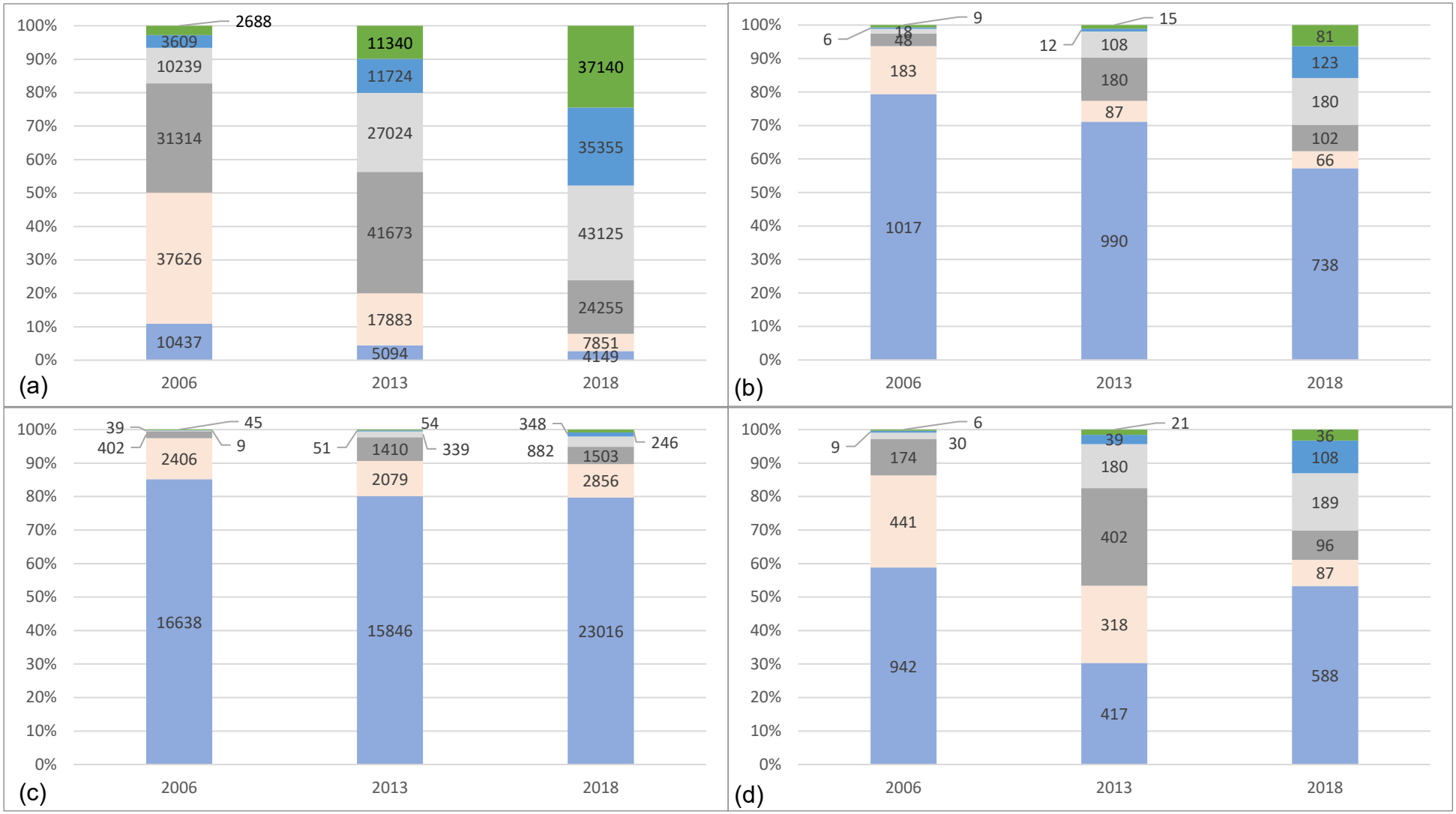
Table 18: Number of renters by sector of landlord

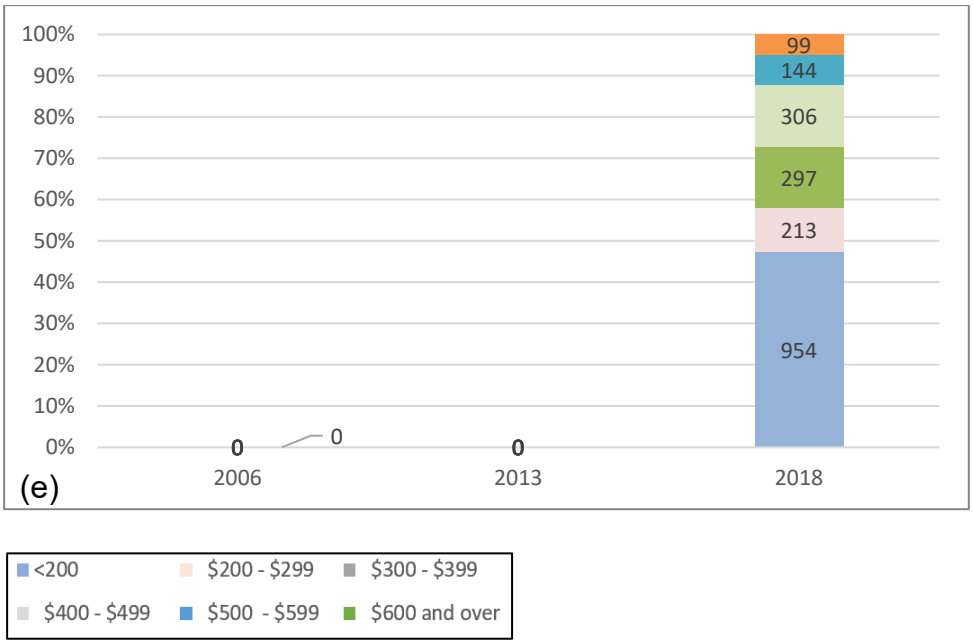
	Households			Percentage		
	2006	**2013**	**2018**	**2006**	**2013**	**2018**
Private person, trust, or business	95,913	114,738	151,875	81.1	83.6	82.0
Local authority or city council	1,281	1,392	1,290	1.1	1.0	0.7
Housing New Zealand Corporation	19,539	19,779	28,851	16.5	14.4	15.6
Iwi, hapu, or Māori land trust			237	0.0	0.0	0.1
Other community housing provider			1,776	0.0	0.0	1.0
Other state-owned corporation or state-owned enterprise, or government department or ministry	1,602	1,377	1,104	1.4	1.0	0.6
Total	**118,335**	**137,286**	**185,133**	**100.0**	**100.0**	**100.0**

Source: Stats NZ

Figure 20 shows that weekly rent paid by sector of landlord and census year. The most significant shifts toward more expensive dwellings occur on the private renting market (Panel a). The share of dwellings with rents between $400 and $499 has increased significantly relative to those charged less than $400. In the sector of local council or Housing NZ (Kāinga Ora) (Panels b and c), there have been shifts toward more expensive rates but at the lower renting tiers. That is, from those charged below $100 toward between $100 and $200. Considering the differing goals between the profitability of private renters and social outcomes of local and central governments, increases in the latter may follow inflation adjustment.

Figure 20: Weekly rent paid by sector of landlord and census year: (a) Private person, trust, or business; (b) Local authority or city council; (c) Housing New Zealand Corporation; (d) Others (iwi, hapu, Māori land trust and community housing); (e) Other state-owned corporation





Source: Stats NZ

Table 19 shows the dwelling dampness indicator by tenure of households, which could be interpreted as an aspect within the well-functioning environment framework of the NPS-UD. It is noticeable that, relative to owners, those renting households are about five times more likely to indicate that their dwelling is always damp. Also, the share of renters indicating no dwelling dampness is almost half of owners.

Table 19: Dwelling dampness indicator

	Number of dwellings			Percentage		
	Dwelling owned or partly owned	**Dwelling not owned and not held in a family trust**	**Dwelling held in a family trust**	**Dwelling owned or partly owned**	**Dwelling not owned and not held in a family trust**	**Dwelling held in a family trust**
Always damp	2,853	13,776	654	1.4%	8.6%	1.0%
Sometimes damp	33,522	49,536	7,284	16.1%	31.1%	11.3%
Not damp	171,732	96,219	56,733	82.5%	60.3%	87.7%
Total	**208,107**	**159,531**	**64,671**			

Source: Stats NZ

Table 20 shows individual homeownership by ethnicity group. Individual home ownership indicates whether a person aged 15 years and over owns (or partly owns) the dwelling they usually live in or holds the dwelling in a family trust[19]. Homeownership

[19] http://datainfoplus.stats.govt.nz/Item/nz.govt.stats/af303a0f-adc8-403f-b1ca-5cce9dd58b39

for Europeans has decreased from 52.7 per cent to 49.8 per cent between 2013 and 2018, whereas for Māori there is an increase from 7.9 per cent to 9 per cent. Higher growth rates in ownership are observed for Asians, from 20 per cent to 26.1 per cent. Nonetheless, caveats about this variable arise because for households whose tenure of household is 'owned', not every household member may be an owner. For those consisting of a couple, both people may be owners, but for other household types (e.g., households of unrelated people), only one household member may own the dwelling[20]).

Table 20: Individual homeownership by ethnicity

	Total – people			Percentage of total		
	2006	**2013**	**2018**	**2006**	**2013**	**2018**
European	556,470	631,509	680,952	51.2%	52.7%	49.8%
Māori	88,890	94,734	123,573	8.2%	7.9%	9.0%
Pacific Peoples	111,927	127,185	165,081	10.3%	10.6%	12.1%
Asian	183,846	246,414	356,559	16.9%	20.6%	26.1%
Middle Eastern/Latin American/African	13,683	18,843	27,525	1.3%	1.6%	2.0%
Other ethnicity	80,526	12,348	12,972	7.4%	1.0%	0.9%
Not elsewhere included	52,521	67,626	-	4.8%	5.6%	-
Total	**1,087,863**	**1,198,659**	**1,366,662**			

Source: Stats NZ

From the perspective of the intermediate market, Mitchell (2019) and Mitchell (2020) report that $132,300 is the household income required to affordably service a mortgage on a lower quartile priced dwelling ($770,000). In addition, income should amount $99,000 or $90,000 to affordable pay a median or lower quartile rent, respectively, where the affordability criteria entail that no more than 30 per cent of household gross income is allocated to mortgage or rent payments. In detail, Table 21 shows that Waitematā has the highest number of intermediate households, followed by Albert-Eden, Howick and Maungakiekie-Tāmaki. Though locations on the fringe of urban Auckland may have lower proportions of intermediate households relative to more centrally located local boards, the ACDC output shows (see Figures 27 to Figure 32) that it is in these areas where an important share of new dwellings may locate.

[20] http://datainfoplus.stats.govt.nz/Item/nz.govt.stats

Table 21: Size of the intermediate housing market by local boards

	2021		2026		2031	
	High-growth scenario	**Likely scenario**	**High-growth scenario**	**Likely scenario**	**High-growth scenario**	**Likely scenario**
Rodney	3,199	2,745	3,626	3,101	4,201	3,582
Hibiscus and Bays	5,613	5,392	6,360	6,092	7,369	7,037
Upper Harbour	3,582	3,170	4,059	3,581	4,703	4,137
Kaipātiki	6,169	6,285	6,992	7,101	8,101	8,202
Devonport-Takapuna	3,887	4,020	4,405	4,541	5,104	5,246
Henderson-Massey	7,032	7,233	7,969	8,172	9,233	9,439
Waitākere Ranges	2,599	2,386		2,695	3,412	3,113
Aotea / Great Barrier	44	44	49	49	57	57
Waiheke	688	512	780	578	903	668
Waitematā	12,765	9,150	14,466	10,338	16,760	11,941
Whau	5,110	5,098	5,791	5,760	6,710	6,653
Albert-Eden	8,921	8,224	10,110	9,292	11,714	10,733
Puketāpapa	3,898	3,769	4,418	4,258	5,118	4,919
Ōrākei	5,067	4,782	5,742	5,403	6,652	6,241
Maungakiekie-Tāmaki	7,207	6,656	8,167	7,519	9,463	8,686
Howick	7,851	8,497	8,897	9,599	10,308	11,088
Māngere-Ōtāhuhu	4,084	3,627	4,628	4,098	5,362	4,734
Ōtara-Papatoetoe	4,848	4,521	5,494	5,107	6,366	5,899
Manurewa	4,444	4,325	5,036	4,886	5,835	5,644
Papakura	3,276	3,072	3,712	3,471	4,301	4,009
Franklin	3,844	3,649	4,356	4,123	5,047	4,762
Total Auckland	**104,128**	**97,156**	**118,002**	**109,764**	**136,720**	**126,789**

Notes: calculations based on Mitchell (2019) and Mitchell (2020). Shares of age groups based on 2018 estimates.

Table 22 shows that the intermediate households have a slight propensity to live in separate dwellings, which is explained by the current configuration of supply in Auckland. Nonetheless, as the ACDC model introduces terraces and apartments as alternatives, the profiles of supply may be simulated to estimate how demand will uptake the additional dwelling capacity (see Subsection 3.5).

Table 22: Intermediate households living in different typologies – 2021

	2021		2026		2031	
	High-growth scenario	**Likely scenario**	**High-growth scenario**	**Likely scenario**	**High-growth scenario**	**Likely scenario**
Separate house	55,188	51,493	62,541	58,175	72,462	67,198
Multi-unit	46,858	43,720	53,101	49,394	61,524	57,055
3 stories	39,569	36,919	44,841	41,710	51,954	48,180
4+ stories	7,289	6,801	8,260	7,683	9,570	8,875
Other	2,083	1,943	2,360	2,195	2,734	2,536
Total	**104,128**	**97,156**	**118,002**	**109,764**	**136,720**	**126,789**

Notes: calculations based on Mitchell (2019) and Mitchell (2020). Shares of age groups based on 2018 estimates

Table 23 shows the number of intermediate households by age of the reference person. A bulk of households concentrate in age groups less than 49 years. Mitchell (2019) argues that increases in the age of the reference person reflects the difficulties to attain homeownership which implies a growing number of households living in rented dwellings for longer.

Table 23: Intermediate housing market by household reference person's age – 2021

	2021		2026		2031	
	High-growth scenario	**Likely scenario**	**High-growth scenario**	**Likely scenario**	**High-growth scenario**	**Likely scenario**
Less than 30 years	24,991	23,317	28,320	26,343	32,813	30,429
30 to 39 years	28,115	26,232	31,861	29,636	36,914	34,233
40 to 49 years	26,032	24,289	29,501	27,441	34,180	31,697
50 to 64 years	20,826	19,431	23,600	21,953	27,344	25,358
Over 65 years	4,165	3,886	4,720	4,391	5,469	5,072
Total	**104,128**	**97,156**	**118,002**	**109,764**	**136,720**	**126,789**

Notes: calculations based on Mitchell (2019) and Mitchell (2020). Shares of age groups based on 2018 estimates.

Table 24 shows the number of intermediate households by household composition for 2021. Couples with or without children account for about 55 per cent of the intermediate market. That is, considering the persistently increasing prices, at least 45 per cent of the intermediate households (with single incomes) will not afford to buy at the lower quartile dwelling sale price (Mitchell 2019).

Table 24: Intermediate housing market by household composition – 2021

	2021		2026		2013	
	High-growth scenario	**Likely scenario**	**High-growth scenario**	**Likely scenario**	**High-growth scenario**	**Likely scenario**
Couples without children	20,542	19,166	23,279	21,653	26,971	25,012
Couples with children	36,792	34,328	41,694	38,783	48,307	44,798
One parent	18,194	16,976	20,618	19,178	23,888	22,153
One person	19,832	18,504	22,474	20,905	26,039	24,148
Other	8,769	8,182	9,938	9,244	11,514	10,678
Total	**104,128**	**97,156**	**118,002**	**109,764**	**136,720**	**126,789**

Notes: calculations based on Mitchell (2019) and Mitchell (2020). Shares of age groups based on 2018 estimates.

Table 25 shows the distribution of intermediate households across multiple dwelling typologies and by age of the reference person. Households will still concentrate on separate dwellings, but multi-units remain relevant as one of the housing alternatives, in particular for age groups between 30 and 39 years. The frequency gap narrows for age groups above 65 years because of downsizing.

Table 25: Intermediate households by dwelling typology and age of reference person (table continues on next page)

		0-29 years	30-39 years	40-49 years	50-64 years	>65 years	Total
2021 High growth	Separate house	11,378	15,202	15,014	10,986	2,351	54,932
	Multi-unit: 3 stories	9,999	11,425	8,698	7,350	2,100	39,573
	Multi-unit: 4 stories	3,354	2,053	878	627	110	7,021
	Other	517	596	658	643	188	2,602
	Total	25,248	29,276	25,248	19,606	4,749	104,128
2021 Likely	Separate house	10,616	14,184	14,009	10,251	2,193	51,254
	Multi-unit: 3 stories	9,330	10,660	8,116	6,858	1,959	36,923
	Multi-unit: 4 stories	3,129	1,916	819	585	102	6,551
	Other	483	556	614	600	175	2,427
	Total	23,558	27,316	23,558	18,294	4,431	97,156
2026 High growth	Separate house	12,894	17,228	17,015	12,450	2,664	62,251
	Multi-unit: 3 stories	11,331	12,948	9,857	8,330	2,380	44,846
	Multi-unit: 4 stories	3,801	2,327	995	710	124	7,957
	Other	586	675	746	728	213	2,948
	Total	28,612	33,177	28,612	22,219	5,381	118,002
2026 Likely	Separate house	11,994	16,025	15,827	11,581	2,478	57,905
	Multi-unit: 3 stories	10,540	12,044	9,169	7,748	2,214	41,715
	Multi-unit: 4 stories	3,535	2,164	925	661	116	7,401
	Other	545	628	694	677	198	2,742
	Total	26,615	30,861	26,615	20,667	5,006	109,764
2031 High growth	Separate house	14,940	19,961	19,714	14,425	3,087	72,126
	Multi-unit: 3 stories	13,129	15,001	11,421	9,651	2,757	51,959
	Multi-unit: 4 stories	4,404	2,696	1,152	823	144	9,219
	Other	679	782	864	844	247	3,416
	Total	33,151	38,440	33,151	25,743	6,235	136,720

		0-29 years	30-39 years	40-49 years	50-64 years	>65 years	Total
2026 Likely	Separate house	13,854	18,511	18,282	13,377	2,862	66,887
	Multi-unit: 3 stories	12,175	13,912	10,591	8,950	2,557	48,185
	Multi-unit: 4 stories	4,084	2,500	1,069	763	134	8,549
	Other	630	725	801	782	229	3,168
	Total	30,743	35,647	30,743	23,873	5,782	126,789

Notes: calculations based on Mitchell (2019) and Mitchell (2020). Shares of age groups based on 2013 estimates.

3.4.3 Serviceability of mortgages and affordability

To further the understanding between households' preferences and affordability in Auckland, the Serviceability and Affordability Model[21] (SAM) constructs a housing affordability index by incorporating median dwelling price, deposit requirements, median household income, household size, and interest rates. The index uses December 2006 as a reference point about changes in affordability. At this point it is assumed that a median income household could save the 20 per cent deposit required to purchase a median Auckland dwelling ($84,500 since the median dwelling was approximately $422,500). The SAM assumes that households can spend 35 per cent of the gross income on a 30-year mortgage at current interest rates. Because interest rates were so high in 2006, this means that the 2006 median household could afford a dwelling at 71 per cent of the median price.

Changes in household income over time proxy the ability of households to save for a bigger deposit. If a median household could save $84,500 in December 2006, since household income increased 40 per cent between December 2006 and 2016, it is assumed that the median household in December 2016 could save $118,600 ($84,500 * 140%) over the same period. The impact of this is that the median household that could afford a median home in 2006 could only afford a home at 64 per cent of the median price in 2016. By December 2020, this figure had improved to 73 per cent by this metric – slightly above the affordability in the reference year. Notably, the lending criteria required by most high street banks for a 20 per cent deposit is extended to a 50 per cent deposit requirement for dwellings with a floor area of less than 40 square metres. This restriction is not modelled in the demand assessments, but should be considered in the application of the findings

Figure 21 shows the last 18 years of the SAM calculations. Whenever the SAM is positive (above the x-axis), housing is more affordable than at the reference point, and when SAM is negative (below the x-axis), housing is less affordable than the reference point. Figure 21 then implies that housing was much more affordable at the turn of the century, but affordability reduced considerably (and quickly) up until the Global Financial Crisis (GFC). After this, affordability improved markedly through to the end of the recovery from the GFC, after which, the cycle started to repeat. Over the following three years, housing reached the least affordable point in June 2015. While dwelling prices then were much lower than they are now, incomes were also lower and interest rates were much higher. Since then, housing in Auckland has become

[21] https://www.aucklandcouncil.govt.nz/about-auckland-council/business-in-auckland/docsoccasionalpapers/auckland-economic-quarterly-feb-2017.pdf

increasingly more affordable, though the uptick in prices in 2021 will no doubt bring that figure down.

As the SAM captures both deposit requirements and mortgage serviceability in a metric that looks at housing affordability, it may reveal a contrasting landscape. While back in 2006, the primary impediment to affordability was high interest rates, in present times, it is the inability to assemble a deposit large enough to qualify for a (low interest rate) mortgage.

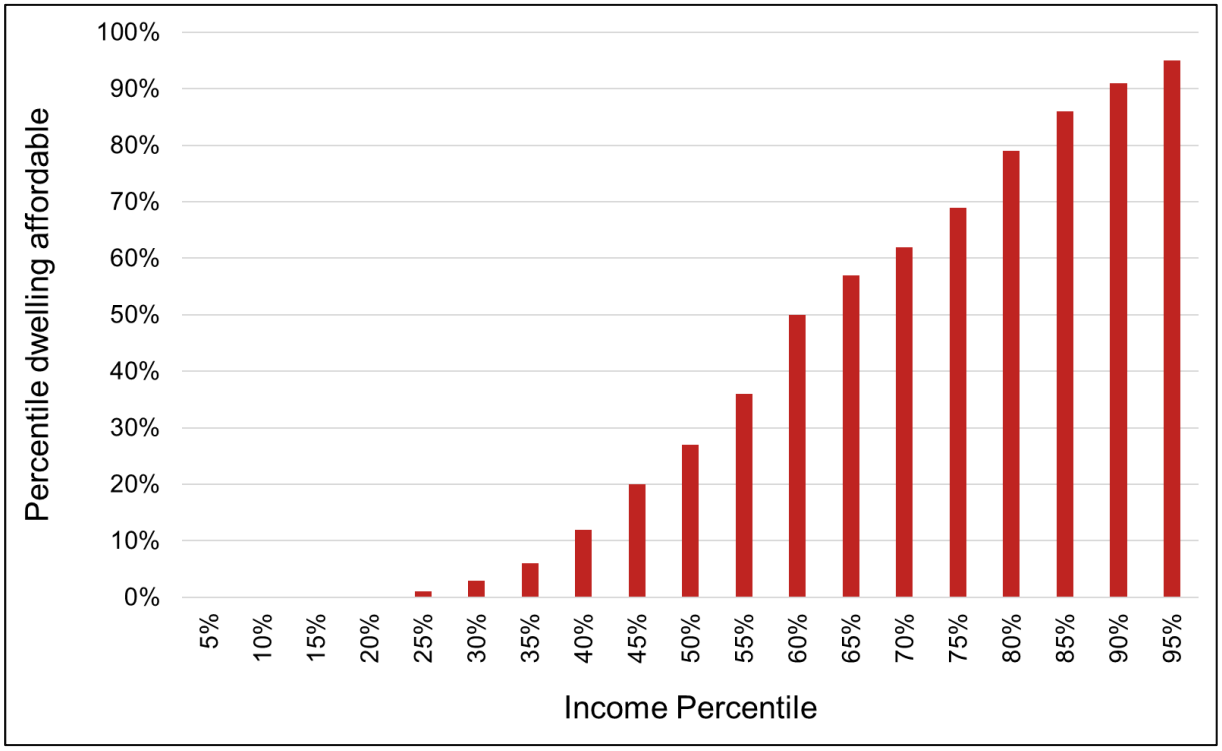
Figure 21: SAM median dwelling price affordability, relative to December 2006

Furthermore, the policy question at hand is to identify who can buy which dwellings in Auckland and how much income would be needed[22]. Housing affordability may be measured by the highest per centile of the dwelling price that is affordable to a household. In 2017, a household on Auckland's median household income could afford only the 18th per centile dwelling. A median income household has a higher income than 50 per cent of all households but could only afford 18 per cent of the dwellings sold in 2017. Similarly, households in the 60th per centile of income could only afford 36 per cent of the housing stock sold in 2017.

[22] https://www.aucklandcouncil.govt.nz/about-auckland-council/business-in-auckland/docsoccasionalpapers/who-can-buy-Aucklands-dwellings-june-2018.pdf

Though it is not straightforward to update these figures to 2021 (because current income data at the levels required are not available), to get a general idea of how affordability has fared, it is assumed that households across the income spectrum have all seen the same per centage increase in incomes in the last four years. Hence, Figure 22 shows that households need to be in the 25th per centile of income before being able to afford any dwelling in Auckland. This assumes that a household at that income level could save the requisite deposit. The median household in 2020, if it had a deposit saved, could afford the 28th per centile dwelling. And, similarly, households in the 60th per centile of income could afford a median dwelling. A household must have been in the 45th per centile for income before it could afford a KiwiBuild dwelling of $650,000.

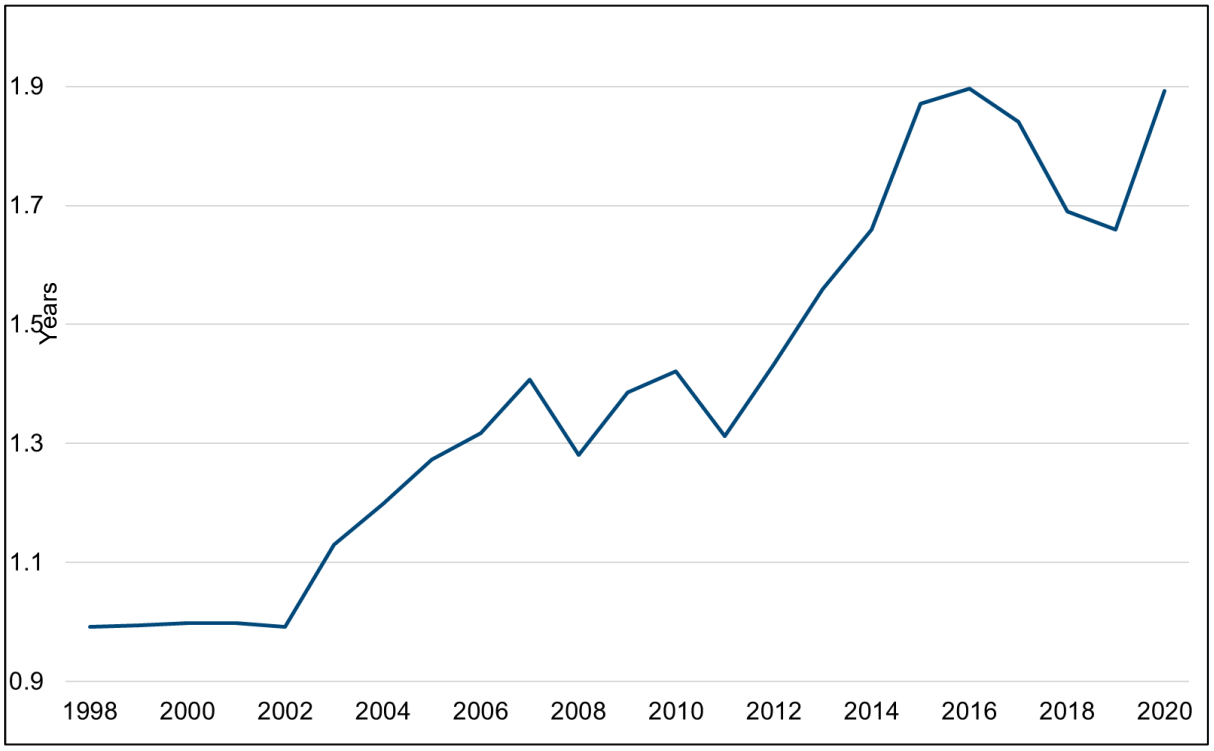
Figure 22: Affordable dwelling per centiles in 2020, with 20 per cent deposit



Likewise, it is of interest to calculate how many years of income a household would need to have saved to accumulate a 20 per cent deposit on a median dwelling. Figure 23 shows that from 1998 until about 2002, a deposit on the median Auckland dwelling was roughly one year of gross median household income. By 2016, the years of income required to save a deposit increased by 90 per cent to 1.9 years. The flat housing prices between 2017, and 2019 meant that saving a deposit got a bit easier during that time. But by 2020, the income required for a deposit returned to 1.9 years of gross household income. The first few months of 2021 have, no doubt, made this even worse.

Therefore, while affordability, as compared to the past decade or so, is not appreciably worse (and is actually better), provided a household can save a deposit and qualify for a mortgage, the ability to save a deposit has worsened. At current, record-low interest rates, the amount of a loan that can be serviced affordably is considerably higher than previously. However, in an environment where dwelling prices have proliferated and wage growth has been more modest, the ability to form a deposit has fallen appreciably in the past few years and locks entire segments of the population out of the dwelling buying market.

Figure 23: Years of gross median household income required to save deposit for a median dwelling



3.5 Market outcomes: sufficiency of capacity

This section fulfils requirements of Clause 3.23 (3) of the NPS-UD.

This section shows the output of the CHATA model. The analysis takes the form of an ex-ante assessment on whether the additional housing capacity (enabled by the NPS-UD) is compatible with the purchase power and preferences of households. This compatibility is measured by the number of dwellings actually bought compared to those that are initially deemed as feasible by the ACDC model.

Results in Table 26 show that the high prices in the Upper-range scenario imply that a large share of households cannot afford to buy a dwelling. Out of the 6000 additional feasible dwellings, only 392 would be purchased (rate of take-up of 6.5 per cent). The average price of bought dwellings is $1.56 million and the average income of the buyers is $214,000. For the Mid-range scenario (price cap set at $1.35 million), the number of buyers increases to 1446 (take-up of 24.1 per cent), and the average income of buyers is almost $190,000. In comparison, under the relatively lower prices of the Full-spectrum and Minimum-priced scenarios, the rate of take-up increases to 45.7 per cent and 51.7 per cent, with average income of buyers equal to $165,080 and $154,000, respectively. That is, at least 62 per cent higher than Auckland's median household income. For the Conditional-affordable scenario, the rate of take-up is significantly higher (72.3 per cent) though the average income of buyers is $144,373. That is, 51 per cent higher than Auckland's median household income.

In context, to inform the capacity that is reasonably expected to be realised, the size of the intermediate market is 97,156 households in 2021 where $132,300 is the household income required to affordably service a mortgage on a lower quartile priced dwelling ($770,000). Table 26 shows the number of buyers earning less than $132,300, where the share relative to the intermediate market is a metric of how each supply scenario serves the intermediate market. The highest number of buyers corresponds to the Minimum-priced (0.8 per cent) and Conditional-affordable scenarios (1.8 per cent).

That is, assuming no household growth and that on an annual basis the market will deliver the same amount of affordable housing (dwellings priced below $770,000), for the Minimum-priced and Conditional-affordable scenarios, it would take about 61 or 29 years, respectively, to halve the size of the intermediate market to 48,578 households (Panel a of Figure 24). Nonetheless, incorporating the average rate of growth of households (2.2 per cent from Table 16), the supply of affordable housing should grow by at least 25 per cent annually to halve the size of the intermediate market within a

generation (about 18 years). For the same reduction to occur within a decade, growth should be at least 45 per cent.

Results are similar if the policy target switches to filling the housing shortfall of 25,000 estimated for Auckland (Chief Economist Unit, 2021). Assuming no household growth and that on an annual basis the market will deliver the same amount of affordable housing, for the Minimum-priced and Conditional-affordable scenarios, it would take about 31 or 15 years, respectively, to fill the housing gap. Incorporating the average rate of growth of households (2.2 per cent), the supply of affordable housing should grow by at least 35 per cent annually to fill the housing gap within a decade. For the same change to occur within a generation (about 18 years), growth should be at least 20 per cent.

Most importantly, for both Panels a and b of Figure 24, if the supply of affordable housing (priced at $770,000 or less) grows at an annual rate equal to households' (2.2 per cent) or if it grows at a rate lower than 4.5 per cent, the mathematical model fails to find a finite solution, that is, the housing unaffordability situation of Auckland becomes permanent.

Table 26: Rate of take-up of feasible dwellings and descriptive by scenario

	Upper-range	Mid-range	Full-spectrum	Minimum-priced	Conditional - affordable
Market outcomes					
Take-up (%)	392 (6.5%)	1446 (24.1%)	2780 (45.7%)	3104 (51.7%)	4341 (72.3%)
Average income of buyers	213,994	190,211	165,080	153,675	144,373
Standard deviation of income	11,036	14,956	24,532	28,911	40,528
Average price of dwellings bought	1,559,419	1,336,500	885,336	809,136	490,724
Standard deviation of price	11,571	0	103,807	66,548	45,768
Floorspace (square metres)	158.8	180	117.5	117.8	62.0
Standard deviation of floorspace	25.3	0	10.6	9.37	15.7
Intermediate market households (households earning less than $132,300)					
Number of intermediate households becoming homeowners	0	0	195	821	1736
Share relative to actual buyers	0%	0%	7.0%	26.4%	40.0%
Share relative to all intermediate households in Auckland in 2021 (97,156)	0%	0%	0.2%	0.8%	1.8%

Figure 24: Years and rate of growth of affordable housing needed to (a) halve the size of the intermediate market (b) fill the housing shortfall (25,000 dwellings)

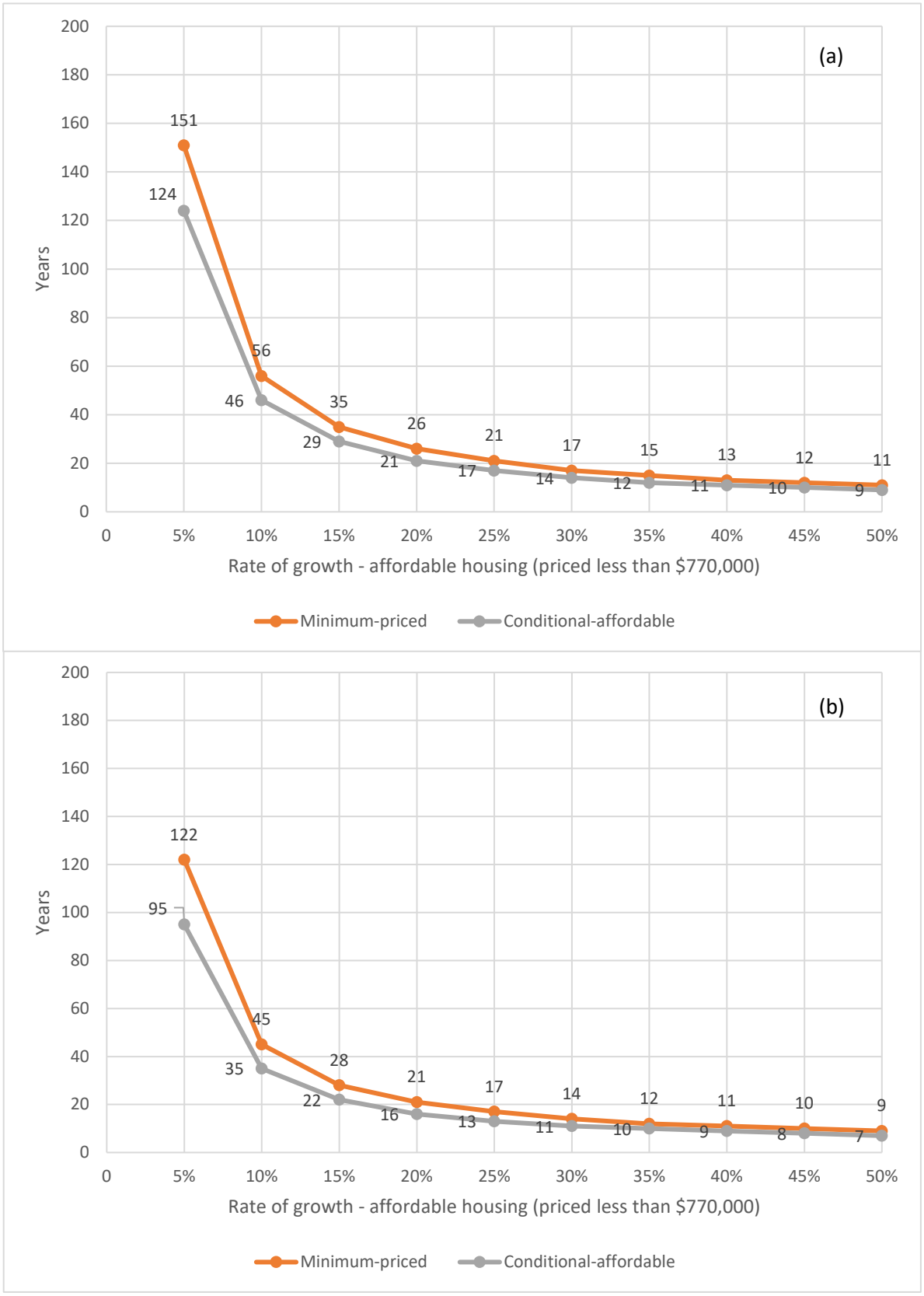


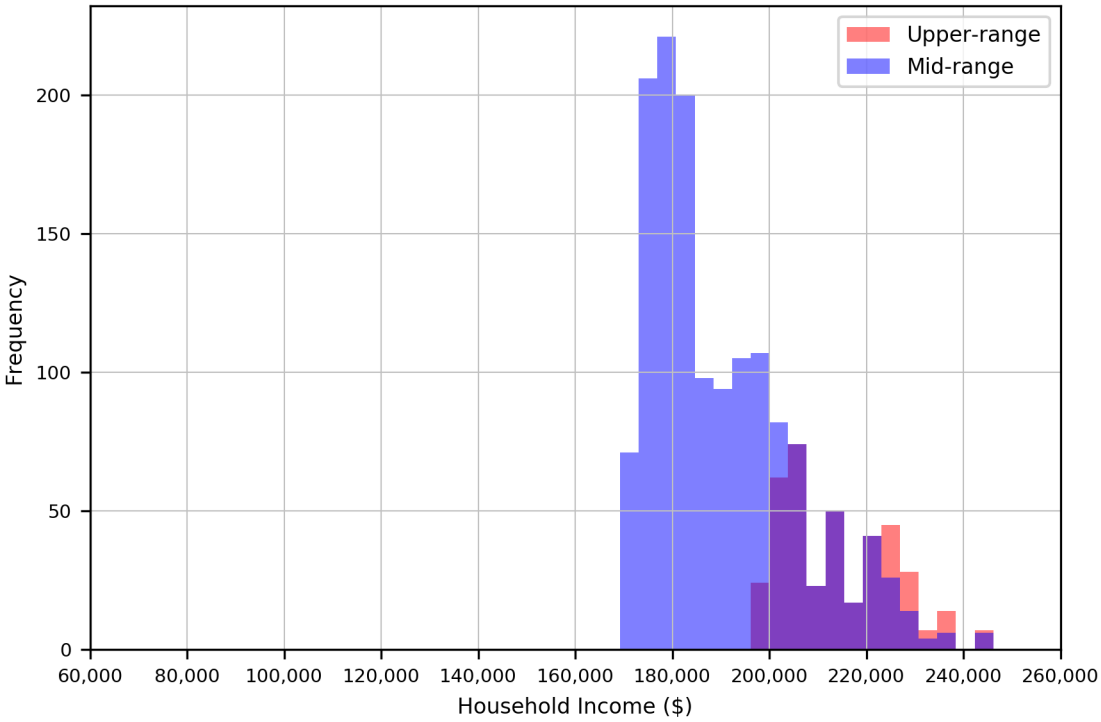
Table 27 shows the typology of buyers and of the bought dwellings by scenario. A particularity of both the Upper-range and Mid-range scenarios is that the ACDC model finds “dwellings” as the only feasible typology, which are all bought by couples. In turn, for the affordable scenarios, the distribution is more dispersed toward terraces, though it is still couples who dominate the share of buyers. That is, two incomes are necessary to be able to afford a dwelling even for the most affordable scenarios simulated.

Table 27: Typology of Buyers and Bought Dwellings by Scenario

		Apartment	House	Terrace	Total
Upper-range	Couple	0	214	0	214
	Couple with children	0	178	0	178
	Single parent family	0	0	0	0
	Total	0	392	0	392
Mid-range	Couple	0	827	0	827
	Couple with children	0	618	0	618
	Single parent family	0	0	0	0
	Total	0	1445	0	1445
Full-spectrum	Couple	2	329	1151	1482
	Couple with children	0	277	951	1228
	Single parent family	0	9	61	70
	Total	2	615	2163	2780
Minimum-priced	Couple	13	246	1216	1475
	Couple with children	11	227	1123	1361
	Single parent family	0	21	247	268
	Total	24	494	2586	3104
Conditional-affordable	Couple	976		741	1717
	Couple with children	851	2	859	1712
	Single parent family	500		407	908
	Total	2327		2007	4338

Figure 25 shows the distribution of buyers’ income by scenario. It is noticeable that for the Upper-range and Mid-range scenarios, income concentrates for figures above $170,000. The Full-spectrum, Minimum-priced and Conditional-affordable scenarios show a wider range of income values with great overlaps, reflecting the comparatively better affordability conditions due to lower prices. Nonetheless, for the Full-spectrum and Minimum-priced scenarios, the modelling results do not report buyers whose incomes are below $100,000. That is, prices are still high and median-income households are not capable of affording a dwelling across the simulation scenarios. Therefore, any improvements on housing affordability due to the NPS-UD concentrates on households with incomes above the median. The Conditional-affordable scenario report buyers with incomes above $60,000, which is the only one serving households earning less than Auckland’s median income.

Figure 25: Distribution of Buyers Income by Scenario



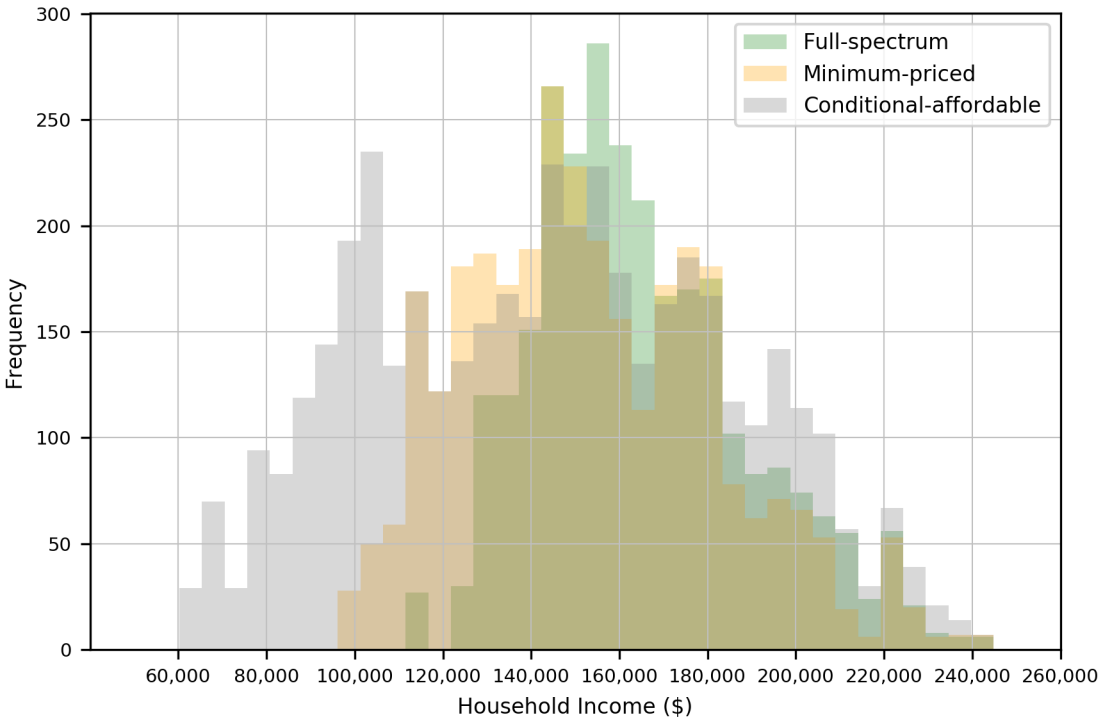
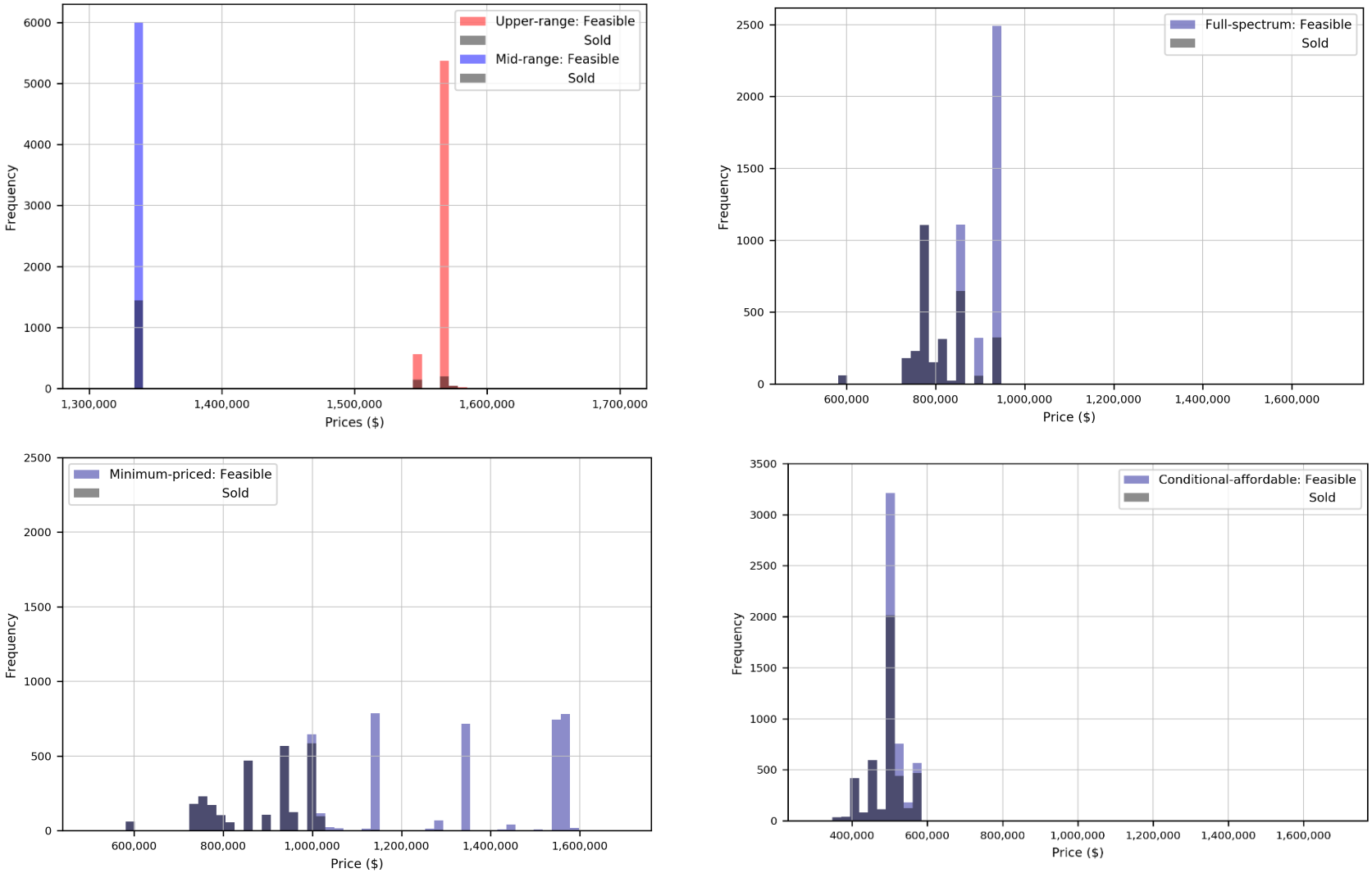


Figure 26 shows the distribution of prices for both the feasible dwellings identified by the ACDC model, and those bought and identified by the CHATA model. As expected, the lowest priced dwellings are the first ones to be sold, which subsequently determine the rates of take-up shown in Table 26. The Upper and Mid-range scenarios depict developers maximising profit by setting prices as high as possible considering the greater development opportunities that are arguably induced by the NPS-UD. In turn, the rest of the scenarios depict a greater segmentation of the housing market where it is implicitly assumed that incentives occur for the delivery of a wider variety of dwellings, which may include lower-priced ones. As a core modelling assumption is that households will search and bid for the dwellings with the highest price they can afford (because it implies a greater level of satisfaction); consequently, the wider range of dwelling typologies and price points (and the market segmentation embedded in the CHATA model) implies that wealthy households will not bid for the same dwelling against lower-income households. Therefore, the rate of take-up is higher.

Figure 26: Distribution of Prices (Feasible and Sold Dwellings)



Figures 27 to 31 show the spatial distribution of the feasible and bought dwellings. Data is aggregated through Hexagonal Binning to manage the problem of having too many points that overlap each other at different map scales. Essentially, the surface of polygon 'bins' is uniformly tiled across a map area. The number of points falling within each bin is counted and stored as part of the overlying polygon. Any bins with a count greater than 0 are then plotted using a colour range[23]. That is, the 6000 sample points created to model if a dwelling has sold or remains unsold under a given scenario are binned into a hexagon grid overlaying the Auckland region. If most of dwellings within a given hexagon bin have been modelled as 'sold' under a scenario, the hexagon bin itself is then shown as blue, representing 'sold'. Likewise, if the majority of properties within a bin remain unsold, then the bin shows as red.

For the Upper-range scenario, feasible dwellings concentrate in the isthmus, North Shore and east Auckland. Nonetheless, while other pockets of development are in the west and south Auckland, high prices imply that only a few of those dwellings are actually sold. In turn, the more affordable scenarios reveal that development would be more dispersed and scatter mainly in west and south Auckland. For the Full-spectrum scenario, take-up is comparatively higher in west Auckland but lower in the North Shore. For the minimum-priced scenario, feasible developments are scarce in the isthmus and North Shore, instead locating in west and south Auckland, where take-up is comparatively higher.

[23] There are a number of reasons for using hexagons as the shape of choice for binning data – six is the maximum number of sides a polygon can have to create a regular tessellation over a surface. The more sides a polygon has (i.e., the closer to a circle it is), the more efficient the data aggregation is around a bin centre. In other words, considering polygons with equal area, the more similar to a circle the polygon is, the closer to the centre the points located around the edges are – with a hexagon being the closest polygon to a circle which works as a regular tessellation (triangle and square being the other options).

Figure 27: Spatial Distribution of Feasible and Sold dwellings: Upper-range Scenario

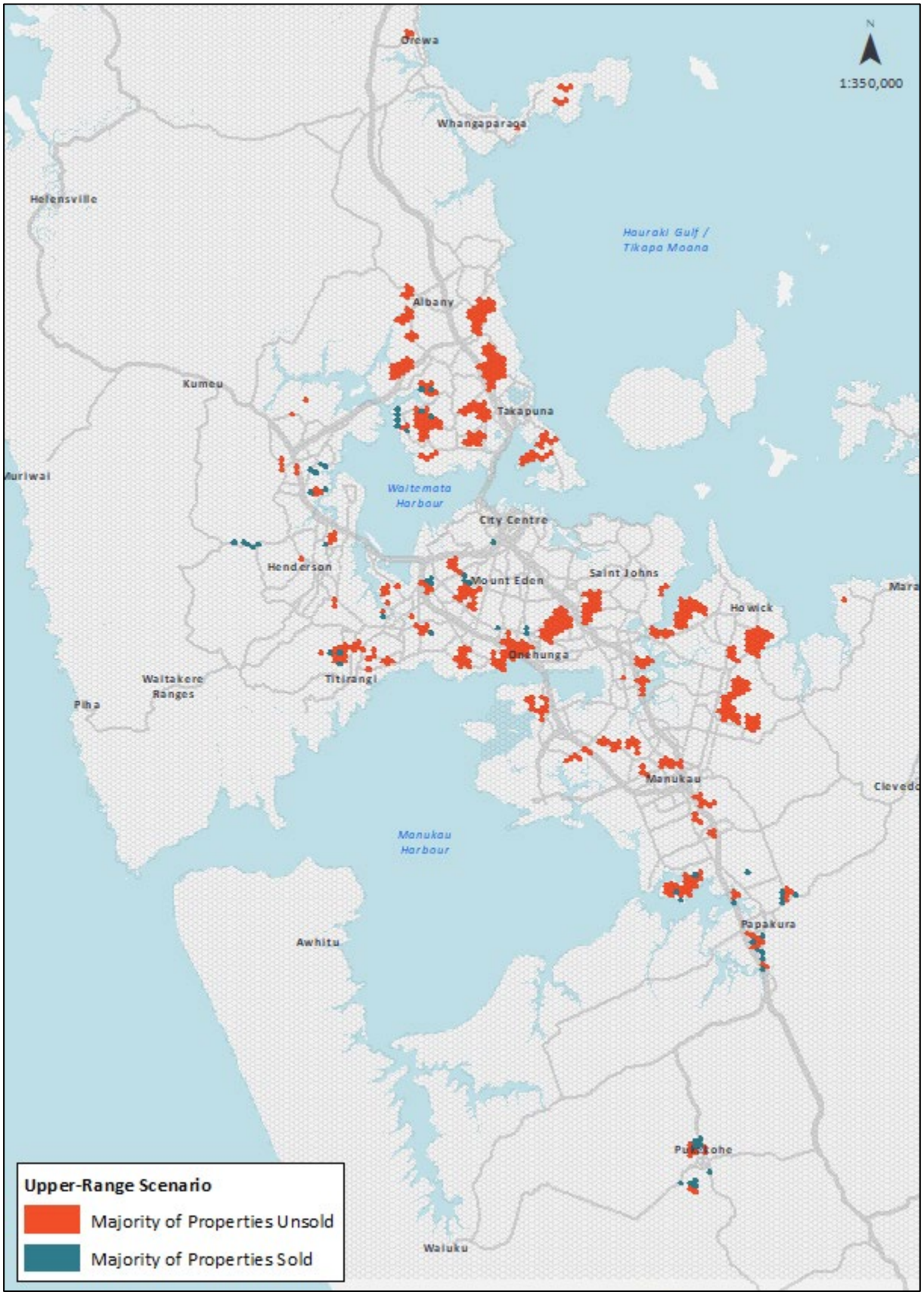


Figure 28: Spatial Distribution of Feasible and Sold dwellings: Mid-range Scenario

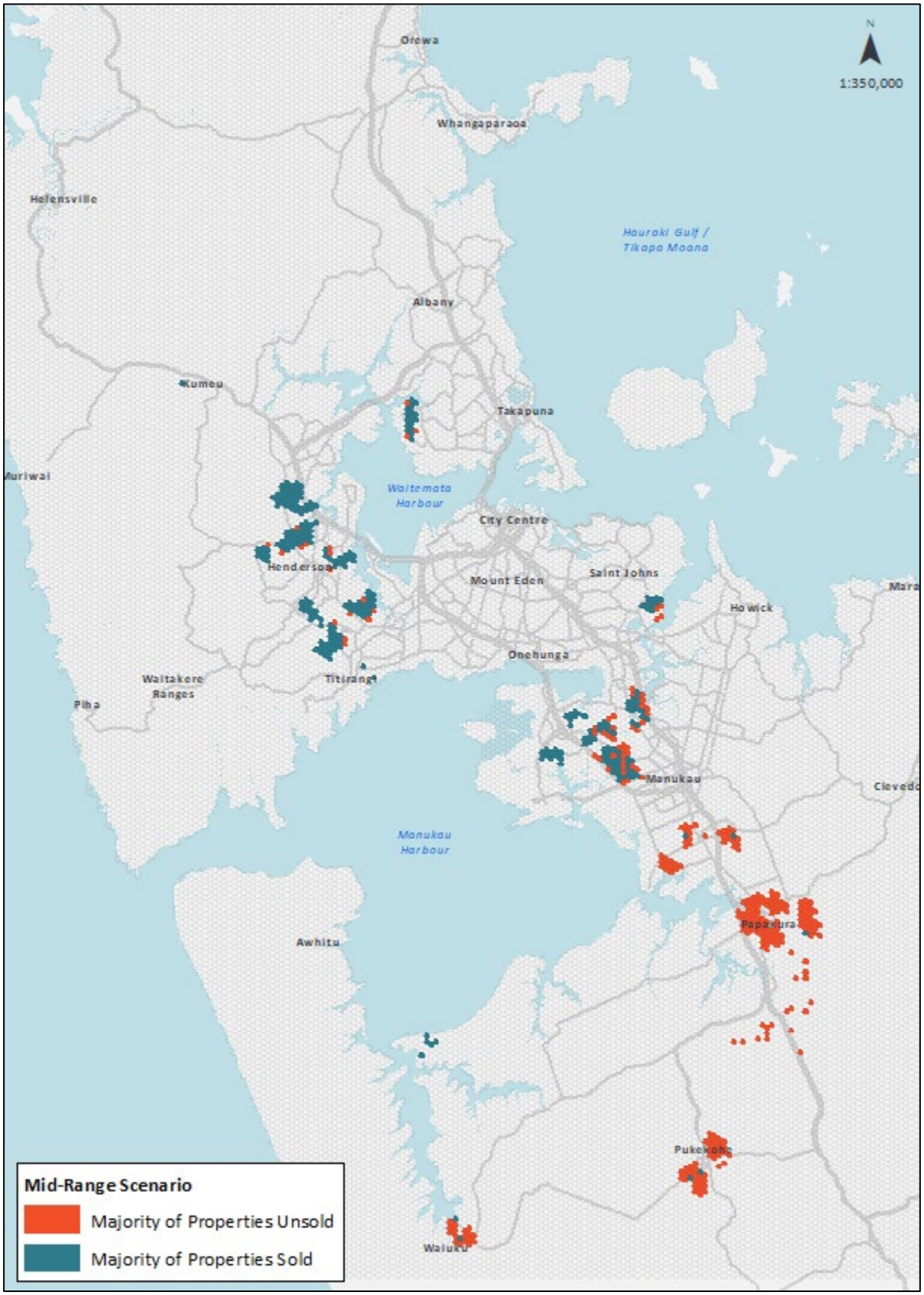


Figure 29: Spatial Distribution of Feasible and Sold dwellings: Full-spectrum scenario

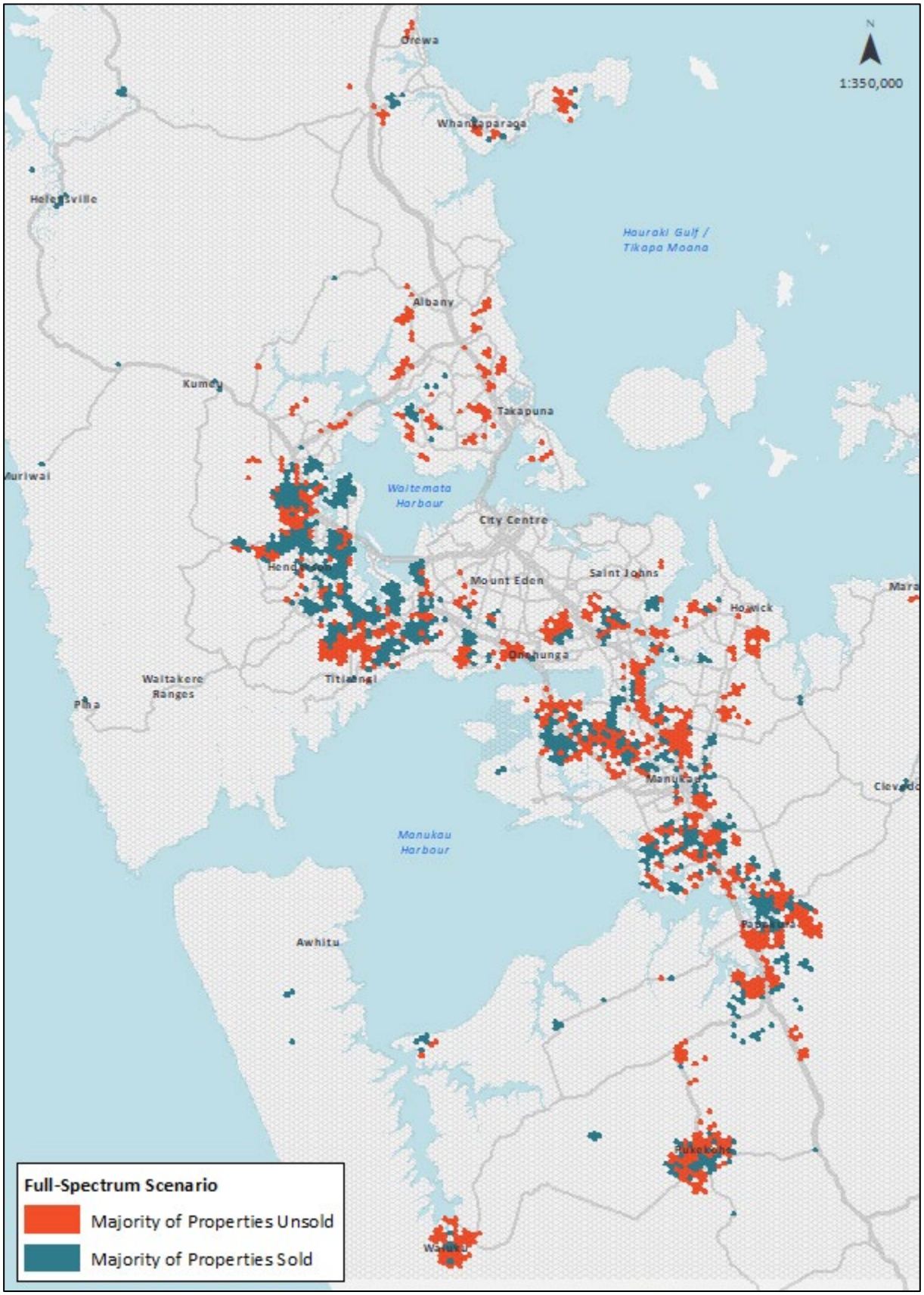


Figure 30: Spatial Distribution of Feasible and Sold dwellings: Minimum-priced scenario

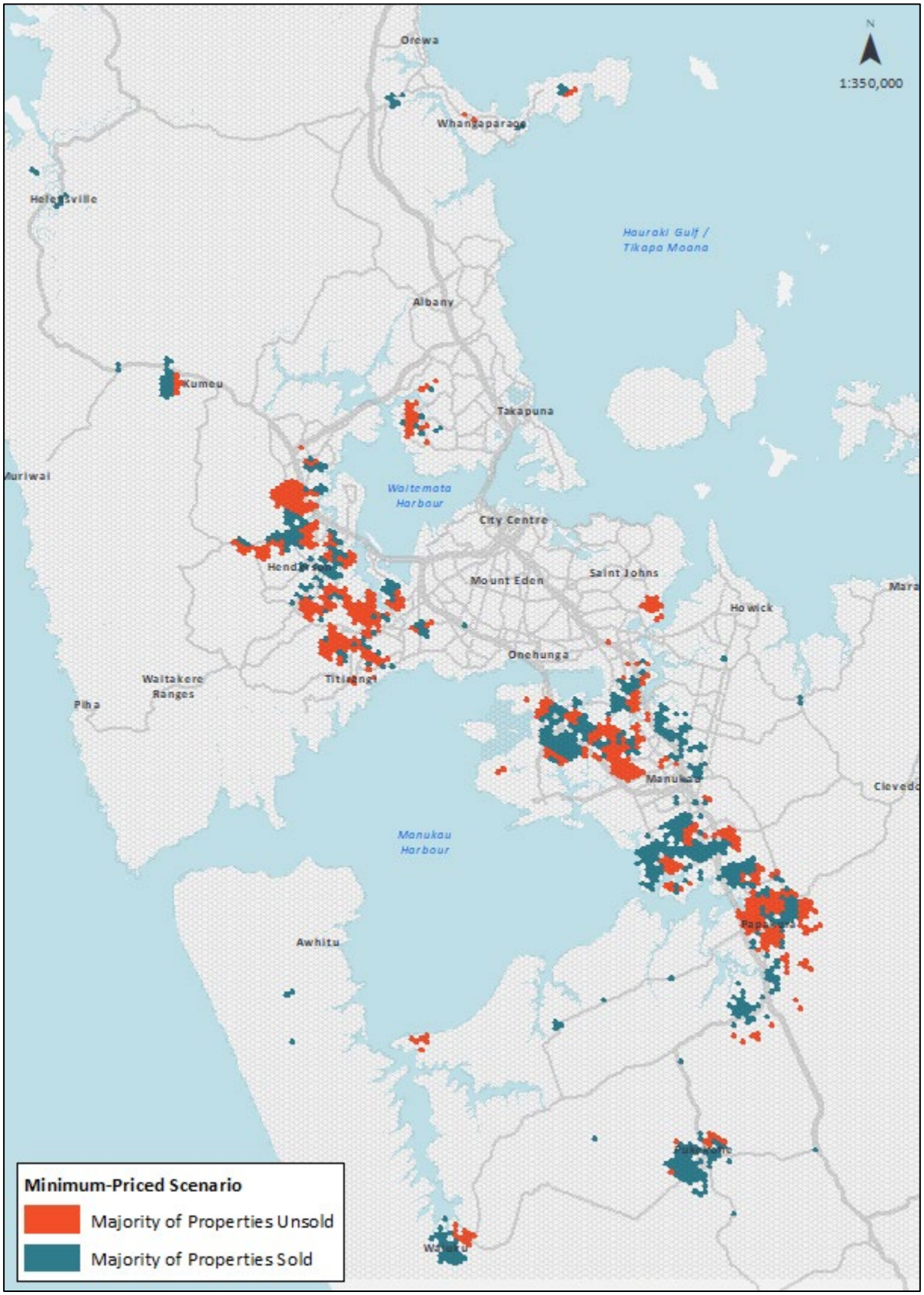
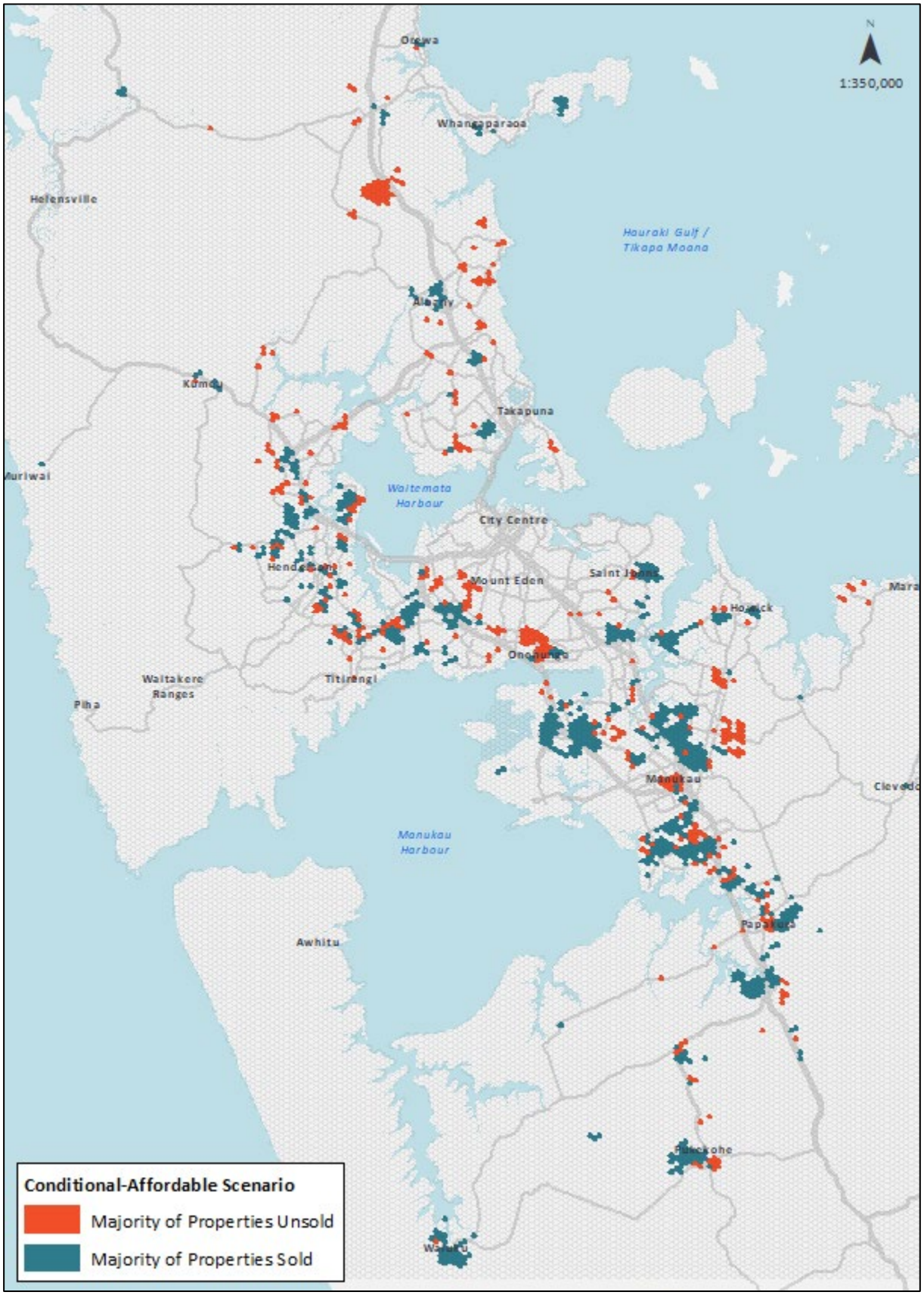


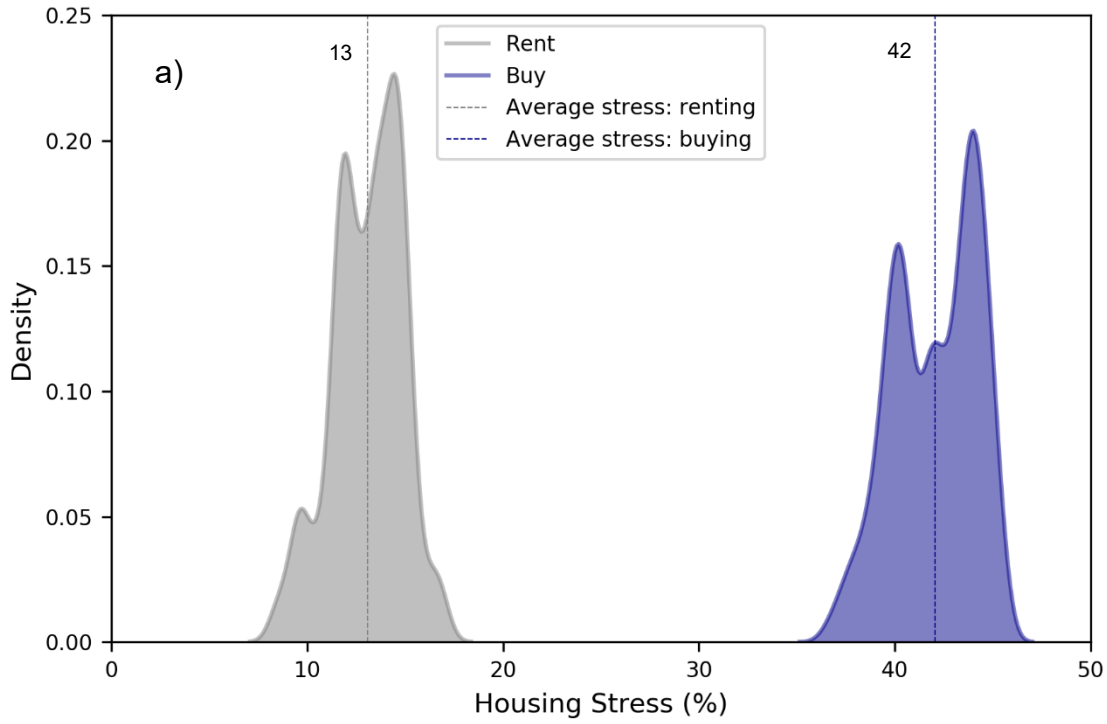
Figure 31: Spatial Distribution of Feasible and Sold dwellings: Conditional-affordable scenario

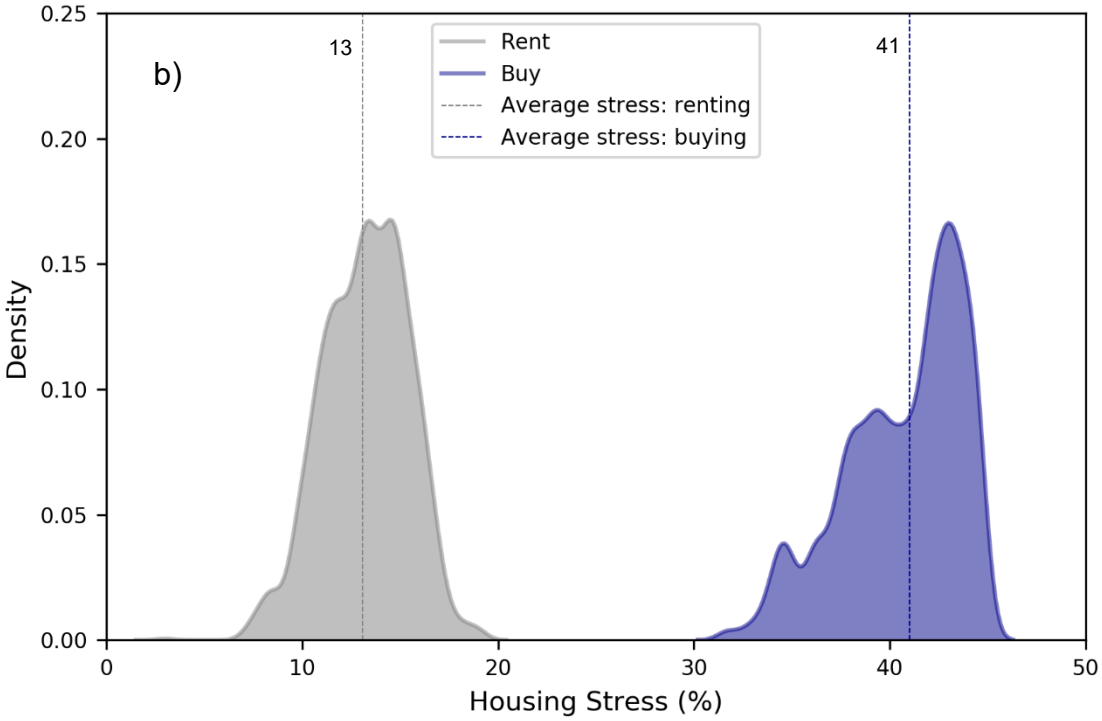


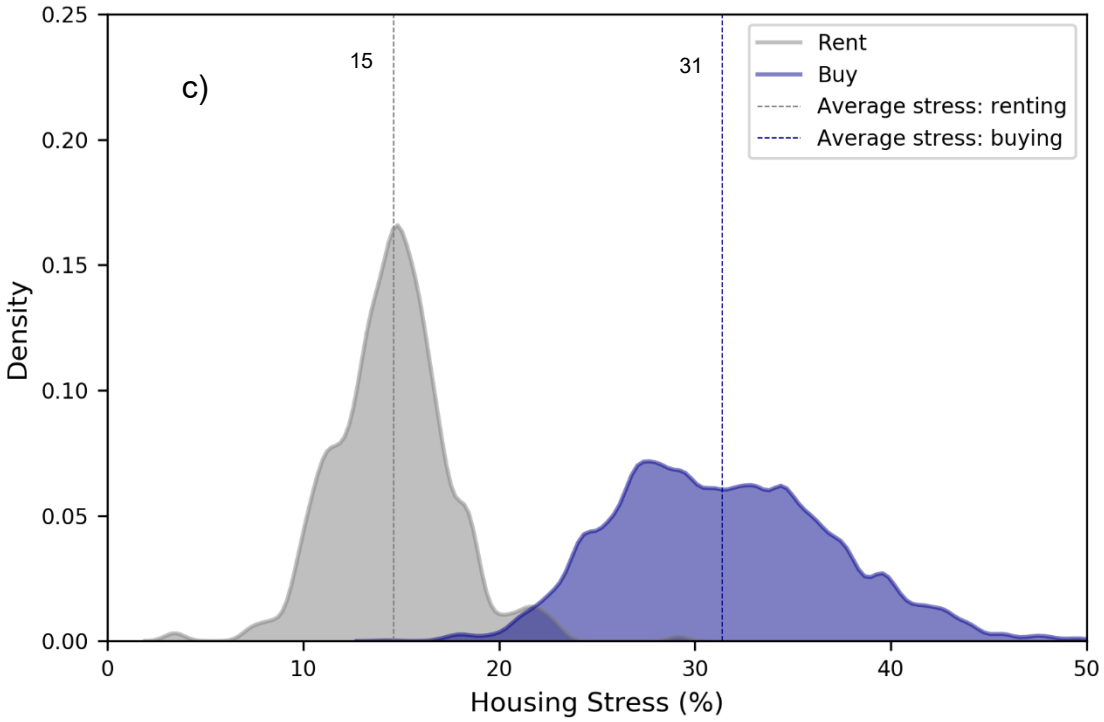
Housing stress may be defined as the share of household income used to service a mortgage and is an outcome of the (assumed) additional capacity stimulated by the NPS-UD. As housing stress may imply negative pressures on the economic and social lives of individual, households, and communities, it falls within the framework of the well-functioning environment embedded in the NPS-UD.

Figure 32 shows stress levels for buying households when servicing a mortgage or paying a rent, which is the baseline for the analysis. For the Upper-range and Mid-range scenarios, mortgage payments imply that stress increases by a factor of three, whereas for the Full-spectrum and Minimum-priced scenarios by a factor of two. Furthermore, the distribution of stress for the Upper-range and Mid-range scenarios are distant, which implies that none of the buying households will have stress levels lower than their initial renting conditions. Nonetheless, there is an overlap between the stress curves for the Full-spectrum, Minimum-priced and Conditional-affordable scenarios, which implies that it is likely that stress levels may remain similar (with respect to renting) for a share of the households who manage to become homeowners.

Figure 32: Housing stress by scenario: (a) Full-range, (b) Mid-range; c) Full-spectrum; d) Minimum-priced; e) Conditional-affordable




b)
13
41
Rent
Buy
Average stress: renting
Average stress: buying
Density
Housing Stress (%)
0.25
0.20
0.15
0.10
0.05
0.00
0
10
20
30
40
50


c)
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Rent
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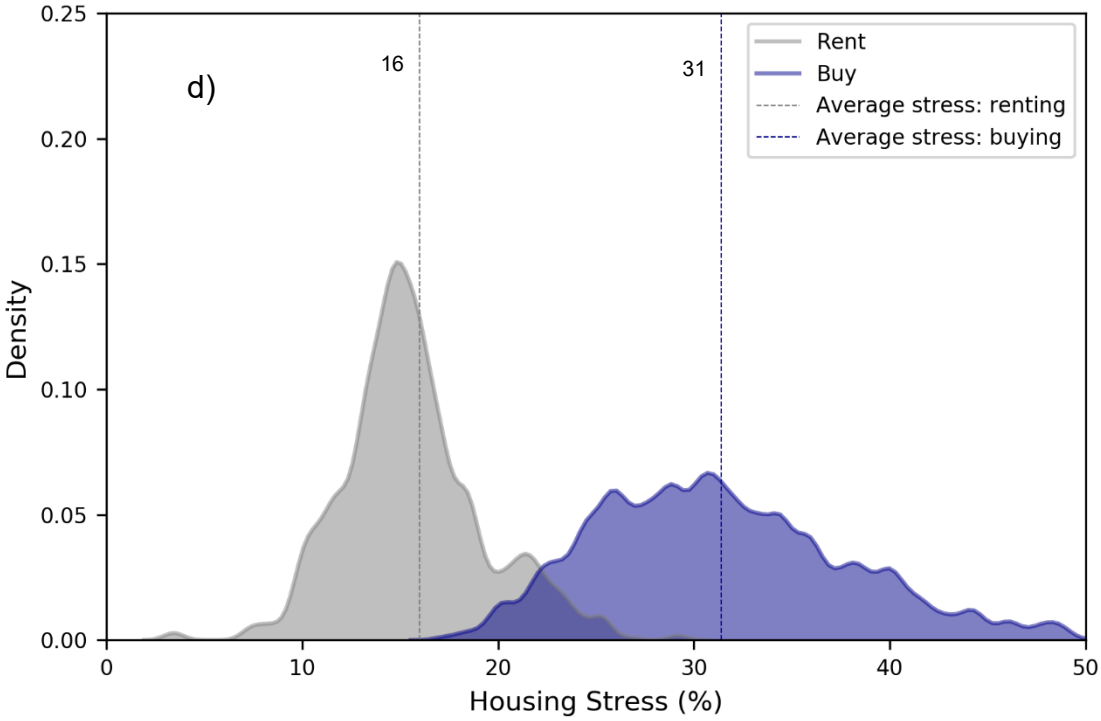
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Average stress: renting
Average stress: buying
Density
Housing Stress (%)
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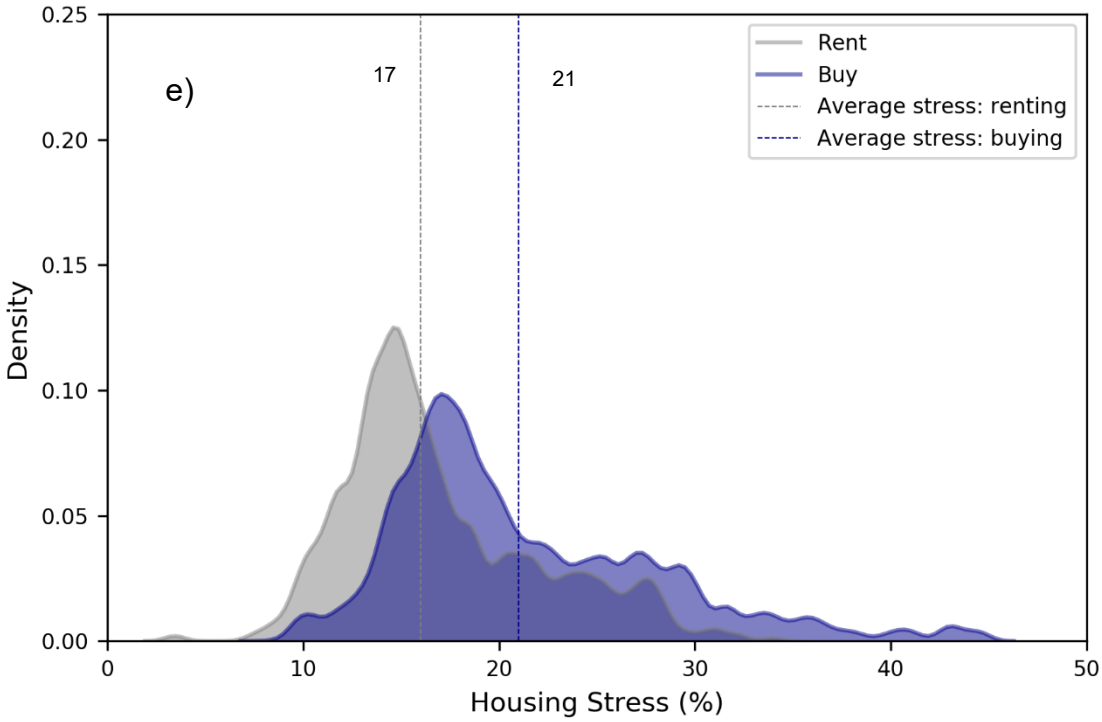
e)
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Rent
Buy
Average stress: renting
Average stress: buying
Density
Housing Stress (%)
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3.6 Analysis of the impact of planning and infrastructure on competitiveness and affordability

This section fulfils the requirement of Clause 3.23 (1) of the NPS-UD.

This section analyses planning and infrastructure interventions that may have affected the affordability and competitiveness of the local housing market.

At a strategic level, the Auckland Plan 2050 Development Strategy proposes a plan for how and where significant development or intensification are anticipated over the next 30 years and provides information on where and when investment in planning and infrastructure will be needed. The Development Strategy is a key tool used to assist in integrating land supply/development capacity and provision of infrastructure. It takes a 'quality compact' approach to accommodating growth and sets out the high-level pipeline needed to accommodate 30 years growth, by growing up (within the existing urban area), as well as out (in the future urban areas). Information from the Future Urban Land Supply Strategy, 2017, sequencing and timing formed the basis for the future urban areas.

The remainder of this section is separated into two aspects. The first looks at the impacts specified by the NPS-UD and the second looks at broader aspects that may also influence housing market affordability and competitiveness. The discussion for each intervention is separated in three components:

1. Context: background about the interventions and their purpose.
2. Features: inherent characteristics that qualify the intervention as associated to aspects of affordability or competitiveness.
3. Impact and limitations: analysis about effects on affordability or competitiveness.

Impacts are analysed with a focus on 'planning decisions' and the 'provision of infrastructure', as defined by the NPS-UD, namely:

- a regional policy statement or proposed regional policy statement
- a regional plan or proposed regional plan
- a district plan or proposed district plan
- a resource consent
- a designation
- a heritage order
- a water conservation order.

Of the planning decisions listed above, regional policy statements, regional plans and district plans are those with the greatest potential impact on the affordability and competitiveness of the local housing market. In Auckland, the AUP incorporates the regional policy statement, regional plan, and district plan. Discussion of the impact of intensification and rezoning through the AUP is set out below.

3.6.1 Intensification and Rezoning through the Auckland Unitary Plan (AUP)

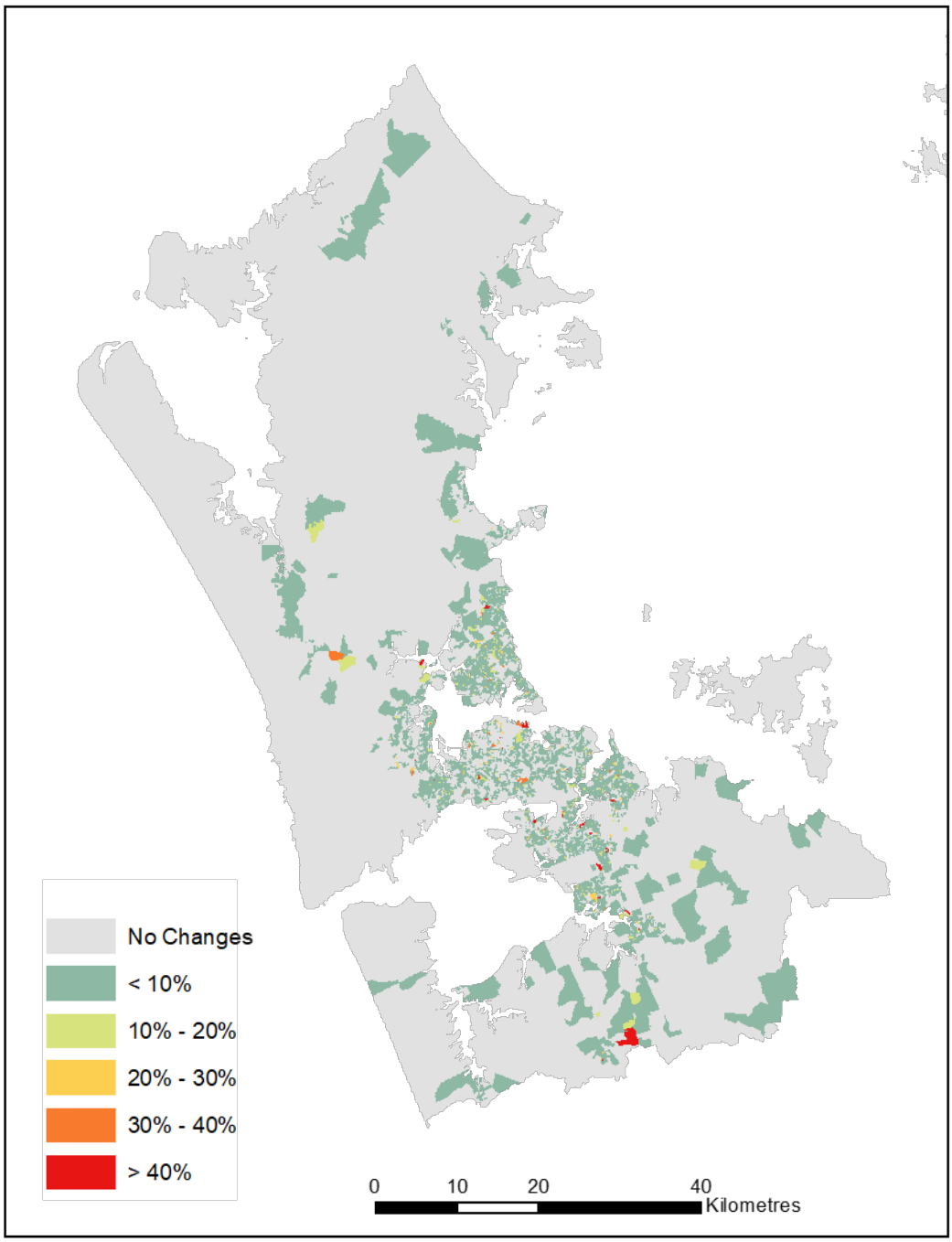
Context

The AUP came into force on November 15, 2016 (pending the results of any outstanding appeals), and sets rules for what, where and how buildings can be built in the region, where its main priorities are to meet economic and housing needs (Fernandez & Martin, 2020b). Also, it has an explicit goal to promote housing affordability by encouraging increased housing supply through relaxing a variety of land use regulations in targeted areas of the region.

Features

The AUP allows owners to improve, augment, or demolish and replace an existing residential structure, potentially creating an option for more intensive residential redevelopment. Figure 33 shows the AUP's zoning changes across Auckland: the changes in residential capacity averaged by meshblock. Though in many cases capacity changes are negligible, many other meshblocks have the potential to increase housing capacity by over 10 per cent. There are a number of areas with high intensification changes scattered across Auckland central and other pockets in the North Shore and south Auckland. Many of these zoning changes were first proposed in the original draft unitary plan in 2013, and were further discussed and refined as the plan evolved into the proposed AUP and during the public hearings leading up to the enacted version of the AUP (Fernandez & Martin, 2020).

Figure 33: Capacity Changes because of AUP rezoning Impact and limitations



The AUP has been the largest change in zoning rules in New Zealand's history. It increased development capacity by around two million dwellings. This is several times Auckland's projected housing demand over the next 30 years. The bulk of the new development opportunities are in brownfield areas. The AUP identifies approximately 15,000 hectares of future urban land, with an anticipated capacity for 137,000 dwellings (Future Urban Land Supply Strategy, 2017). A separate Future Urban Land Supply Strategy (FULSS), sequences the development of future urban land, identified in the AUP, over 30 years (Chief Economist Unit, 2019b; Future Urban Land Supply

Strategy, 2017). Nonetheless, the upzoning created by the AUP does not necessarily locate in proximity to the most desirable areas near jobs and other amenities (Chief Economist Unit, 2018). By June 2018, 85 per cent of all growth in new dwellings consented was in brownfield areas, from which 53 per cent correspond to more intensive building typologies (i.e., terraces and apartments).

Nonetheless, upzoning inflated the redevelopment premium embedded in the price of land, potentially increasing rather than decreasing the value of housing (Greenaway-McGrevy et al., 2020). Also, intensification created a demand shift from the protection of heritage towards flexibility on the development options of land (Fernandez & Martin, 2020), which may not necessarily imply affordable housing. In addition, as infrastructure is announced in greenfield land, windfall gains occur which may not convert to landowners delivering land to the retail market to boost housing supply (Chief Economist Unit, 2019). Therefore, it cannot be concluded that zoning changes improved affordability though they may have improved competitiveness by releasing (at least in principle) land supply or development opportunities. During the development of the draft AUP, it was decided not to incorporate inclusionary zoning as an alternative mechanism to approach unaffordability, although this did occur in the Special Housing Areas (see section 3.6.7 below).

Broader interventions potentially impacting housing affordability

This subsection looks at interventions from a housing affordability perspective as this HBA adds an affordability lens to the council's history of housing and business development capacity supply monitoring work. In this context it is important to understand the influence of different interventions.

The discussion for each of the interventions below relies on the work undertaken by the Auckland Council's Affordable Housing Work Programme, which identifies a range of opportunities for the Auckland Council to leverage its planning, consenting, and development contributions policy to support delivery of affordable housing (Auckland Council, 2018).

As mentioned in Subsection 2.6, the sources of evidence are varied in nature, and in some instances no impact assessments have been carried out. Therefore, the assessment in this HBA is indicative only and no causality links are identified.

3.6.2 Regulatory consents – Existing Business Improvement Process[24]

Context

From the applicant perspective, consenting processes can be costly and time-consuming. In particular, smaller scale affordable housing providers have limited understanding of the process (Joynt, 2019). Thus, it is difficult to establish meaningful interactions or build their understanding when different consultants are used for each project. Thus, the purpose of this intervention was to streamline consenting processes to avoid incomplete applications and delays.

Features

Council's Regulatory Services created service streams depending on the complexity of applications and whether certain types of businesses are high volume or repeat customers (Auckland Council, 2020). Streams are as follow:

1. Premium Service – A project management service to ensure that large complex projects receive additional support in applying for resource consent, building consents and engineering approvals. This service is time charged.
2. Qualified Partner Service – A programme management service to ensure high volume, repeat build customers receive additional support in applying for resource consent, building consents and engineering approvals. This service requires both parties to commit to quality and business improvement, and high engagement. Several large-scale home builders are already qualified partners. Fees apply to access this programme.
3. Streamline – A dedicated service for fast, simple consents where Regulatory Services commits to a 10-day processing timeframe. This service is time charged.
4. Custom – Business as usual processing through area-based teams. This service is time charged.
5. Key Account support – Relationship management support for high profile customers in the resource consent space. This support tends to be reactionary, and issue based. Key Account support is currently free for one-off queries, more active Key Account customers incur a fee for more robust support. Providers of affordable housing who access key account support are KiwiBuild, CORT and NZ Housing Foundation. VisionWest has also received support of this nature in the past.

[24] Source: Affordable housing work programme: Qualitative assessments of proposed interventions

Other initiatives within Regulatory Consent's intervention are as follows:

1. Auckland Housing Programme (AHP): Regulatory Services established a one-off specific governance programme for the Kāinga Ora Auckland Housing Programme. This solution was recommended due to the profile of the AHP programme, the scale of consent lodgement and because there was one applicant or accountable party. The governance programme has established regular meetings, metrics, and reporting on the quality of applications, number of requests for information, consents lodged and approved and tracking of on-hold days and total working days for consents to be issued.
2. Sharing information: Regulatory proactively provides practice notes to the industry on relevant matters, interpretations, and decisions by the Environment Court or MBIE.

Impact and limitations

Due to constraints in the SAP software used, the council cannot monitor affordable housing delivery, apart from social housing by Kāinga Ora. Also, multiple entities can submit applications where it is difficult to "tag" KiwiBuild homes. In addition, resource consenting is a small part of many projects and all applicants for combined subdivision and land use should factor in 18 months – two years to complete a project from design to delivery.

Retention and recruitment of specialised planning professionals is constrained by a limited resource pool and competition for specialists from the private sector. Successful implementation of all the aforementioned regulatory tools is contingent on the recruitment and retention of skilled planning professionals.

3.6.3 Partnered developments[25]

Context

Council/Eke Panuku facilitates affordable housing for the intermediate housing market through developing council surplus sites e.g., Barrowcliffe and Wilsher Village, Henderson Valley Road Haumaru Housing. These priority development locations entail new dwellings at higher density to provide opportunities for affordable dwellings in proximity to services, transport and community facilities. This intervention helps community housing providers, mana whenua or mataawaka trusts or organisations

[25] Source: Affordable housing work programme: Qualitative assessments of proposed interventions

who may not have enough capital funds to acquire and develop land but who still have a range of other expertise to offer (Auckland Council, 2020).

Key partners include council, Eke Panuku, mana whenua, mataawaka trusts or organisations and central government.

Features

Developments in Barrowcliffe – Manukau, Henderson Valley Road Haumaru Housing are targeted for elderly. The Barrowcliffe 'Kōtuitui Place' for example will deliver 330 new homes, half of them labelled as affordable (including assisted affordable, shared equity ownership, social and KiwiBuild homes).

Haumaru Housing is a community housing provider (CHP) that provides housing for older people who are eligible for social housing and able to live independently. It is a joint venture between Auckland Council and the Selwyn Foundation.

Eke Panuku Housing Mix Guidance encourages residential choices and facilitates a range of housing choices at different price points, tenures, and typologies for all priority development locations to support wider town centre regeneration.

Impact and limitations

The intervention has been a minor contribution in terms of number of people that benefit directly from new dwellings. The number of CHPs and mana whenua or mataawaka trusts or organisations operating in Auckland is limited, which constrains the number of projects delivered. Thus, the intervention does not have a large-scale funding and legislative backing to introduce significant changes on affordability and competitiveness of the wider market beyond direct beneficiaries. Though the council's involvement is helpful, partners still need to raise capital to invest and build. Thus, projects may take 2-5 years to plan and deliver. In addition, budgetary and fiscal impacts of COVID-19 further limit the ability to scale up the number of projects delivered.

3.6.4 Housing for older people[26]

Context

Auckland's population (like New Zealand's) is ageing. Over the next 30 years, a larger number of people will be aged 65 years and over. There can be challenges for older people to find suitable and affordable housing. Costs of owner-occupied and private

[26] Source: Affordable housing work programme: Qualitative assessments of proposed interventions

rental housing are increasing, and social housing may be difficult to secure (there were 18,520 applicants on the MSD's housing register waitlist at 30 June 2020). Projected demand of housing for older people in Auckland indicates an additional 3700 units will be required by 2043 at a cost of $2.3 billion.

Features

This intervention overlaps with other partnered developments. Key stakeholders include Eke Panuku, the Selwyn Foundation, Haumaru Housing, Auckland Council, external developers, and older people on the social housing waiting list in Auckland

Haumaru Housing is a CHP established in 2016 through a joint venture between the Auckland Council and the Selwyn Foundation. Haumaru Housing's redevelopment programme was established via council provision of a $20 million development funding loan. The redevelopment programme is led by Eke Panuku. Haumaru Housing also has funding assigned to it through the Long-term Plan to undertake maintenance and capital upgrades of properties that will not be redeveloped in the short to medium-term. Haumaru has a goal of building a minimum of 200 new units by 2028, increasing current stock from 1542 to 1742 units.

Funding loan enabled the development of Wilsher Village on council owned land at 33 Henderson Valley Road. The development provides 40 one-bedroom, wheelchair accessible homes and 527 capital upgrades have been completed.

Impact and limitations

Haumaru Housing, along with other CHPs, face challenges in raising capital to purchase land to develop community housing. In the context of COVID-19 council and Eke Panuku's revenue streams have been negatively impacted. It may not be feasible to continue financial support over and above what is currently planned.

3.6.5 Use of public land for Māori housing[27]

Context

This intervention consists of land exchange, long-term lease, or potential rezoning to enable marae to expand their footprint including housing. The council assesses proposals to enable marae to control and manage associated and adjoining reserves and provide for housing on these reserves under the Reserves Act or as a permitted or controlled activity under the AUP.

[27] Source: Affordable housing work programme: Qualitative assessments of proposed interventions

Land exchanges take place where a piece of equal value land is offered to exchange with existing crown/local government public land. The land exchange must have a net benefit to the community. Land transfers can also be used, where a piece of public land is transferred to a party for development.

Features

Papakura Marae Kaumatua Housing: Papakura Marae created a kaumatua housing plan that consists of nine units, six of which were built in 2020. The units are disability and tamariki-friendly and are used by kaumatua of the marae. The marae raised $2.7 million in funding, through both central government and local government grants.

Te Henga Land Transfer: In 2018, a land transfer from Auckland Council to Te Kawerau a Maki enabled the iwi to develop a marae and papakāinga at Te Henga (Bethells Beach). For the land transfer to occur, the Environment and Community Committee recommended that the Minister of Conservation revoke the reserve classification on the piece of land. The Finance and Performance Committee then voted to transfer a 2.6-hectare block of land to the iwi. The land is now zoned Special Purpose Zone – Māori Purpose, under the Auckland Unitary Plan.

Impact and limitations

Any exchange or transfer of powers of reserve land needs to go through a lengthy political process that may include central government, which can be costly and time consuming. Also, sales of land go through a stringent financial process, potential plan changes, rezoning and consents costs can be costly and lengthy.

In addition, suitable public land may be limited as it may not have supporting infrastructure in place, such as wastewater/stormwater, roading, community facilities etc, and this carries a high cost for development. There has also been opposition from community who use existing reserves as public open space.

3.6.6 Kāinga Strategic Action Plan[28]

Context

This intervention assesses a proposal from the Independent Māori Statutory Board to develop and improve provisions in the AUP to enable papakāinga on general land (either owned or not owned by Māori). Under the AUP provisions, land may be under

[28] Source: Affordable housing work programme: Qualitative assessments of proposed interventions

the category of ‘Integrated Residential Development’, which is currently used for retirement villages and co-housing, without additional consents processes.

Features

Features of this intervention may include a papakāinga project at Te Māhurehure Cultural Marae in Point Chevalier (15 dwellings delivered); Kāinga Tuatahi developed by Ngāti Whātua Ōrākei (30 dwellings delivered); and Estall Road – Kaipara Resource Consent approved for an integrated Māori development located on approximately 12ha of treaty settlement land (30 dwellings delivered).

Impact and limitations

Mana whenua and mataawaka face barriers to developing papakāinga in urban areas due to high land costs. In addition, due to the difficulty in being able to clarify all the components of papakāinga, it is difficult to ascertain the extent to which the AUP provides for the papakāinga on general land.

3.6.7 Special Housing Areas[29]

Context

The Special Housing Areas (SHAs) had similar traits to voluntary inclusionary zoning (IZ) programmes, which are considered ground-breaking approaches to generate affordable housing through focused and flexible local policy rather than through distant and rigid national prescription (Calavita & Grimes, 1998; Fernandez et al., 2019). It was expected for the SHAs to deliver affordable housing that would not otherwise be produced without resorting to public subsidies or by producing the affordable units in segregated, stigmatised and geographically dispersed areas (Kontokosta, 2015; Schuetz et al., 2011). The SHA’s programme relied on the fast-tracking of the resource consenting processes to decrease transaction costs for the developers to motivate them to deliver more (affordable) housing into the market.

Features

The SHAs were the key instrument of the Housing Accord and Special Housing Areas Act (HASHA) and the Auckland Housing Accord (AHA) as a temporary measure until the AUP became operative by late 2016. Any project above 14 dwellings was requested to allocate at least 10 per cent of housing at prices that were affordable to specified income groups. To define housing affordability, the SHAs had to meet either

[29] Source: A snapshot of issues and opportunities to increase affordable housing for Aucklanders

of two criteria: Criteria A, dwelling prices did not exceed 75 per cent of the Auckland region median house price; or, Criteria B, dwellings were sold or rented to households earning up to 120 per cent of the median household income for Auckland and at or below a price such that the household spends no more than 30 per cent of its gross household income on rent or mortgage repayments (Fernandez et al., 2019).

The AHA provided the Auckland Council access to new flexible powers to streamline resource consenting, where processing time reduced to a 20-day waiting period for the council to reach a decision, compared to the lengthier period under the ordinary consenting process through the Resource Management Act (RMA).

Impact and limitations

By 2017, roughly 3100 homes were completed inside the SHAs (Ministry of Business Innovation and Employment, 2017). By 30 June 2016, 154 SHAs had been declared in 10 separate tranches (Figure 34) with an estimated final capacity of almost 62,500 dwellings if fully developed. Nonetheless, only 5,527 dwellings were consented in the 45 months to June 2017, even as landowners enjoyed the windfall gain of being upzoned ahead of the AUP[30]. Disestablishment of the SHAs began in September 2016, and the last one was disestablished in May 2017. The AHA had set an initial target of 39,000 housing units to be built inside the SHAs, but official ex post reviews of the programme rather emphasised the speed of the consenting process and the volume of consents issued (Fernandez et al., 2019; Ministry of Business Innovation and Employment, 2017), and little attention was given to the volume of affordable housing generated, let alone the effects of SHAs on housing prices (Murphy, 2016).

We select two SHAs as case studies: Ōtāhuhu Strategic Area and the Tāmaki Regeneration Area. The latter is analysed in subsection 3.6.8.

Figure 35 shows that average prices in the Ōtāhuhu Strategic Area are below Auckland's average prices but have followed the increasing trend since 2012. Ōtāhuhu North and Ōtāhuhu West prices have revolved around $750,000. Nonetheless, Figure 36 shows decreasing rents in Ōtāhuhu East and Ōtāhuhu North, though it is not possible to attribute these changes to the SHAs programme.

Moreover, one of the shortcomings of the SHAs programme is that it is not possible to ascertain how many affordable dwellings were built and whether the amount was high enough to impact market behaviour. Figure 37 may suggest an increase of sales as a percentage of stock in Mount Wellington South during the years of the programme, but

[30] https://www.aucklandcouncil.govt.nz/about-auckland-council/business-in-auckland/docsoccasionalpapers/auckland-economic-quarterly-feb-2019.pdf

there is no conclusive evidence. In the remaining areas the ratio is not showing a noticeable pattern change. Figure 38 shows that there is a large parcel of undeveloped residential land corresponding to the Grange Golf Club. Also, the closest industrial land is shown in Figure 39, where the ratio of land values relative to residential land is between 0.69 and 0.89. It is not known if this ratio may have changed because of the SHA programmes.

Figure 34: Special Housing Areas in Auckland

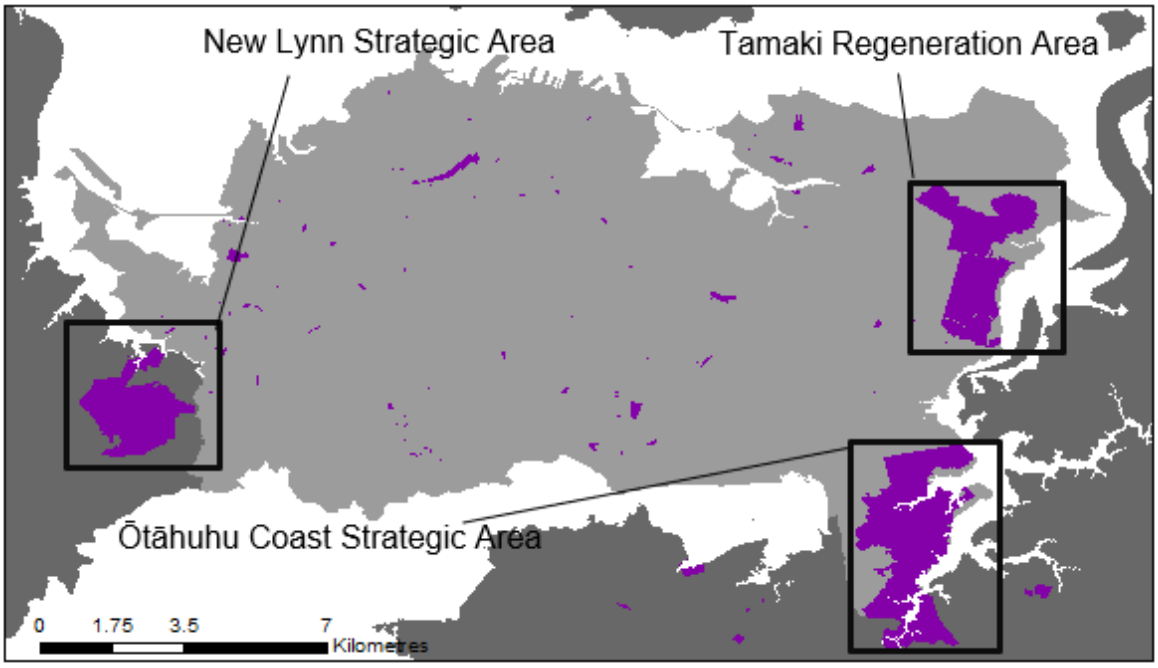


Figure 35: 12-month rolling Dwelling sales prices (inflation adjusted) – Ōtāhuhu Coast Strategic Area

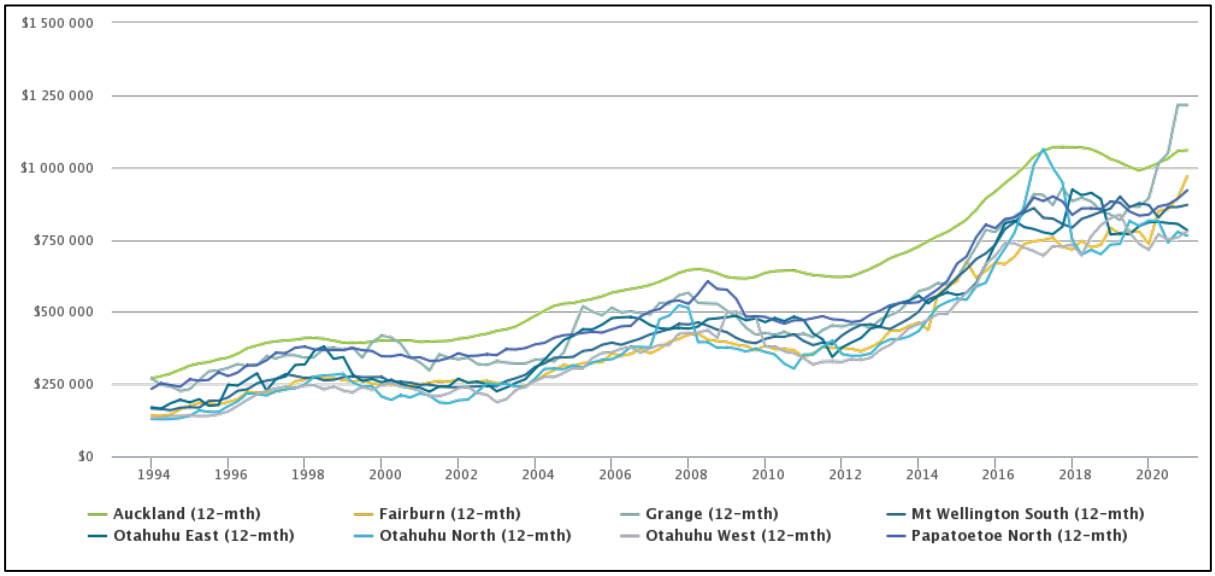


Figure 36: 12-month rolling Dwelling rents (inflation adjusted) – Ōtāhuhu Coast Strategic Area

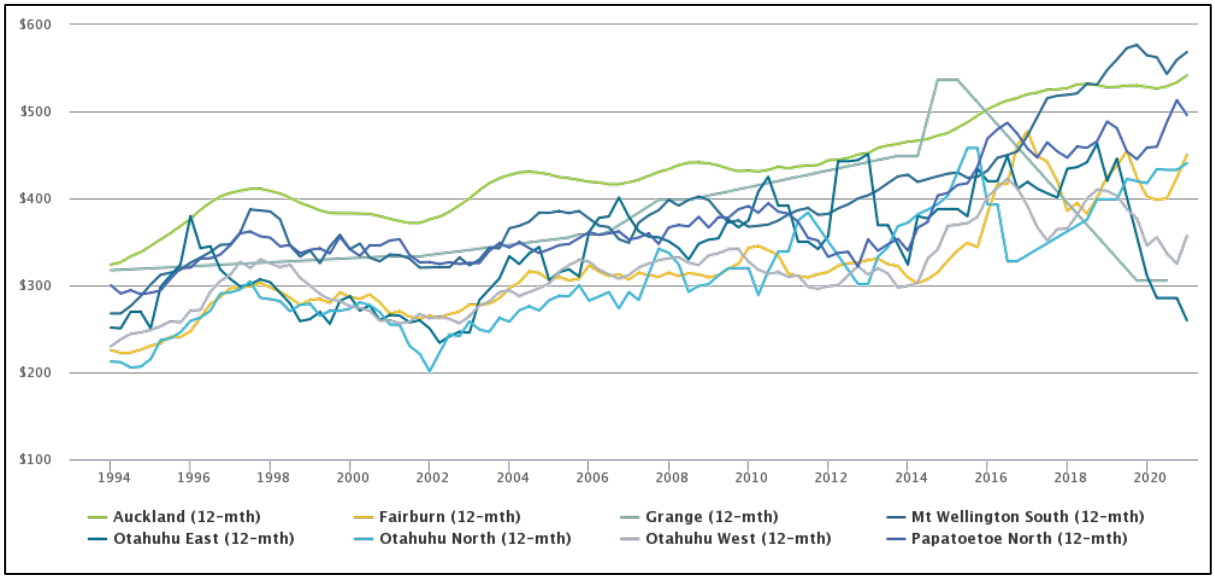


Figure 37: 12-month rolling dwellings sales volume as a per centage of total residential stock – Ōtāhuhu Coast Strategic Area

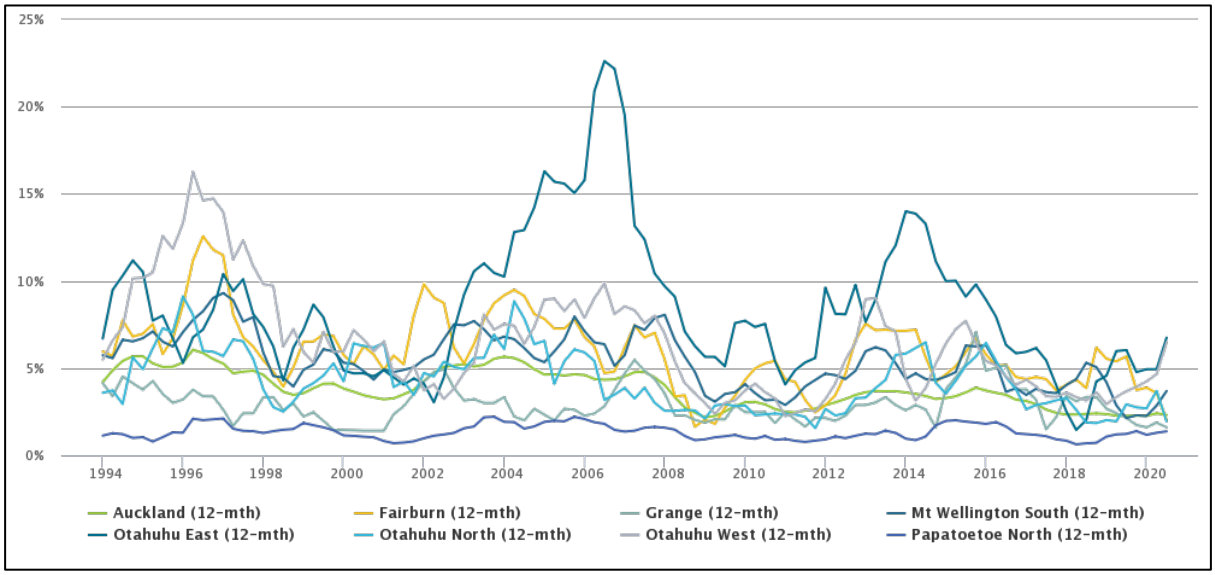


Figure 38: Location of largest 20 undeveloped residentially zoned land parcels in the Ōtāhuhu Coast Strategic Area

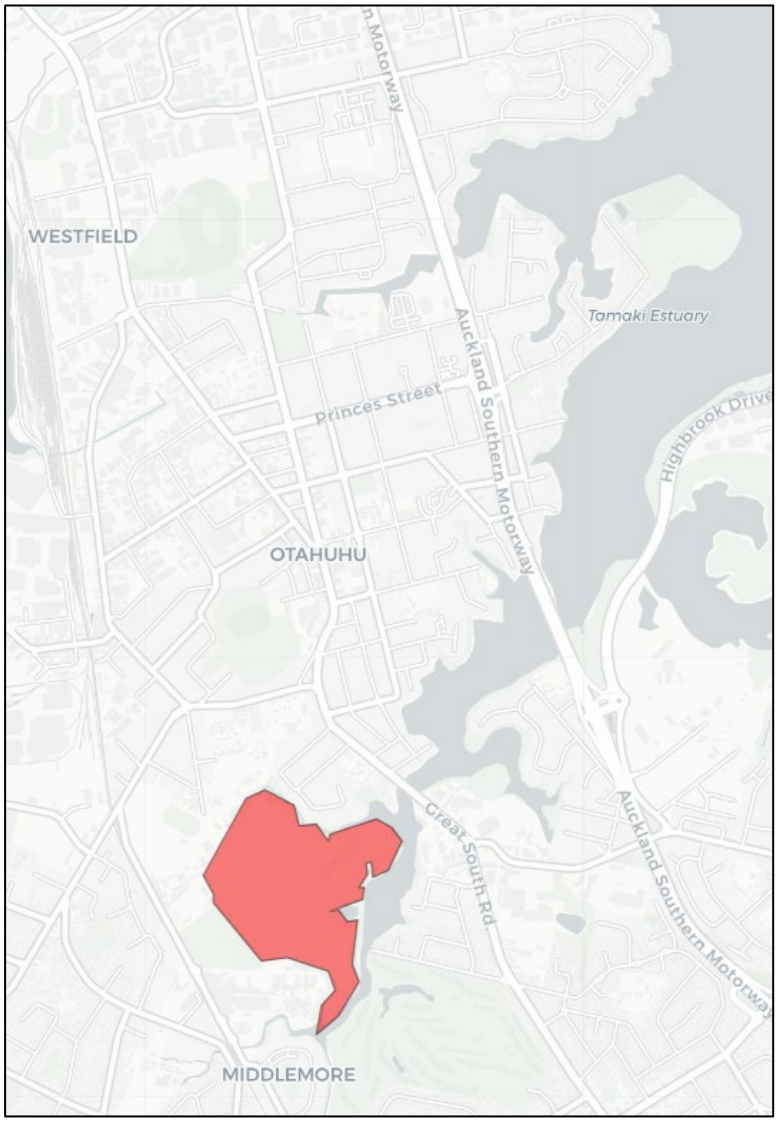
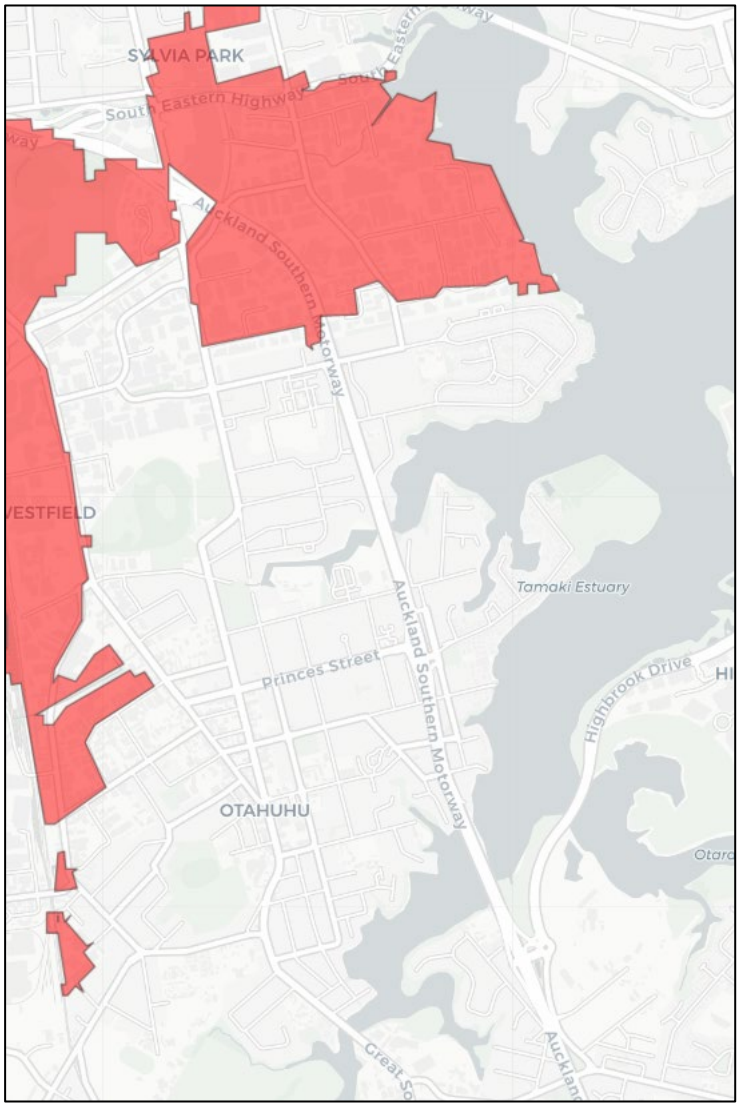


Figure 39: Parcel land values near industrial zone boundaries – Ōtāhuhu Coast Strategic Area



3.6.8 Tāmaki Regeneration Project

Context

The Tāmaki Regeneration Company (TRC) is a joint entity between the Crown and Auckland Council with four key mandated areas: Social Transformation, Economic Development, Placemaking and Housing Resources. Its purpose is to intensify the density of Glen Innes, Panmure and Point England. The development is phased over 25 years and is driven by the Ministry for Housing and Urban Development. The economic model consists of Crown land sold to private buyers and reinvestment of the profit from sales into state housing (Tāmaki Regeneration Company 2016).

Features

The Government provided 2700 single unit large-lot properties to be sold for private ownership, and rental housing, with a third of the new development to be retained for state tenants (Henry et al., 2019; Tāmaki Regeneration Company, 2016).

Early markers within this area have been the ongoing projects to redevelop the Glen Innes and Panmure town centres, delivered in partnership with the Maungakiekie-Tāmaki Local Board, Auckland Council family, and key stakeholders. During FY20, the TRC reached an agreement with the Auckland Council to commence a formal land exchange process.

Infrastructure (in-ground, transport, and social) delivery is regarded a key enabler of the TRC (Tāmaki Regeneration Company, 2020a). Since September 2019 TRC assisted 31 whānau to move along the housing continuum, including three families who have progressed into an affordable rental property, and 12 whānau who have progressed into a shared home ownership property. Through the Pathways to Housing Independence programme, 120 local families have become mortgage ready. TRC has rehoused more than 200 families since 1 April 2016, maintaining the commitment that those who wish to stay in Tāmaki will have the opportunity to do so.

Through the Tāmaki Education Strategy and Implementation Plan, the Ministry of Education confirmed investment into the education infrastructure ($70 million for Tāmaki Primary School and Sommerville Special School), and the inclusion of a long-term infrastructure investment plan for Tāmaki in the Ministry of Education Auckland Area Growth Plan.

Impact and Limitations

The program has delivered 696 homes since 2012, with 152 delivered in FY20. This includes 59 new healthy, state homes and 21 affordable homes. (Tāmaki Regeneration Company, 2020b). Nonetheless, there is an ongoing concern from private and social housing residents about the lack or loss of facilities during the development, in particular walkability, safety, and security (Tāmaki Regeneration Company Neighbourhood Survey 2016). There have also been concerns that the time elapsed between the temporary relocation of whānau in the TRC area has resulted in permanent displacement of some families, while those that re-establish in the area can be subjected to a loss of community cohesion and voice (Gordon, Collins & Kearns, 2017).

The area of influence of the TRC was also zoned as a SHA (see Figure 34). Figure 40 shows that prices within the TRC area increased until stabilisation in 2018. Prices in

Tāmaki, Glen Innes and the Panmure Basin are even higher than the Auckland average since 2017. From Figure 41 it may be observed that average rents are higher than the Auckland average. Also, Figure 42 shows that historically in the area the sales volume as per centage of residential stock is higher than the Auckland average (except for Glen Innes North). No affordability indicators in the MBIE dashboard exist for this level of disaggregation. Nonetheless, it may be argued that the scale of the TRC intervention has not been significant to drive prices down or to massively improve affordability overall in the area. This area characterises the infrastructure availability and streamlining of process, which is the actual purpose of the TRC.

Figure 43 shows that there is one undeveloped parcel in Glen Innes and no other is found in the TRC area. Figure 44 shows that there are five industrial parcels where there is ratio of land values of 0.431 relative to residential.

Figure 40: 12-month Dwelling sales prices (inflation adjusted) – Tāmaki Regeneration Area

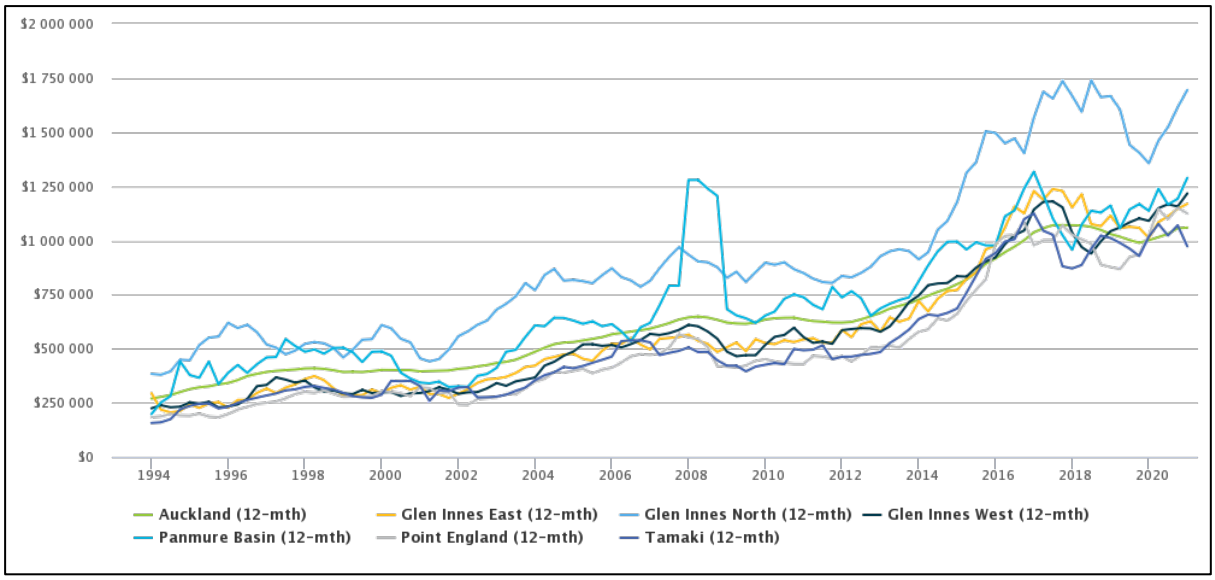


Figure 41: 12-month rolling Dwellings rents (inflation adjusted) – Tāmaki Regeneration Area

Figure 42: 12-month rolling dwellings sales volume as a per centage of total residential stock – Tāmaki Regeneration Area

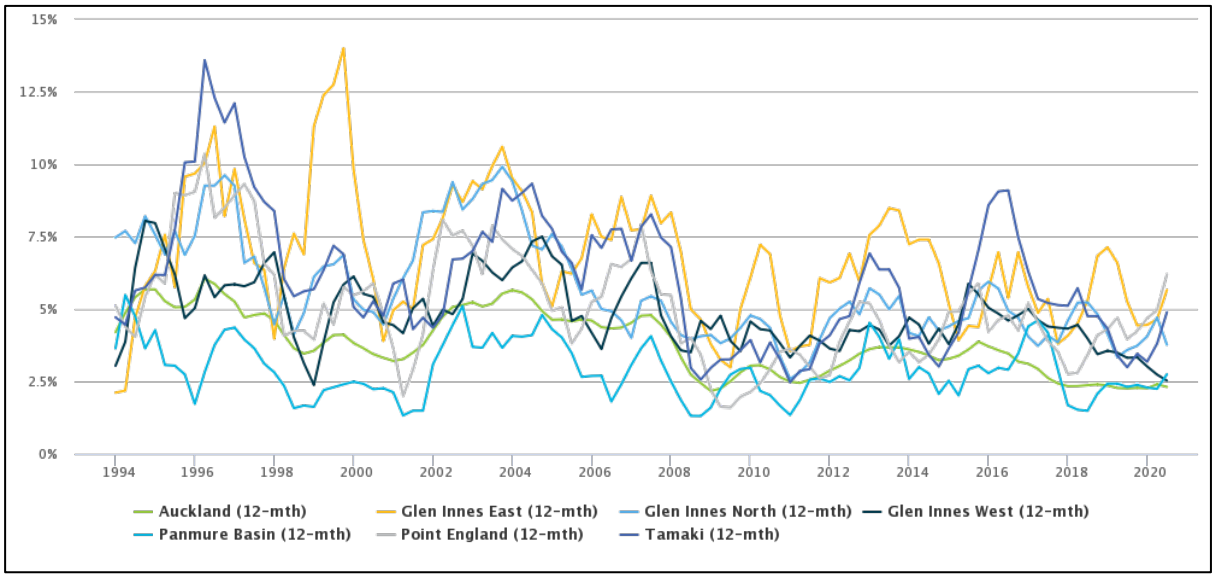


Figure 43: Location of the Largest 20 Undeveloped Residentially Zoned Land Parcels – Tāmaki Regeneration Area

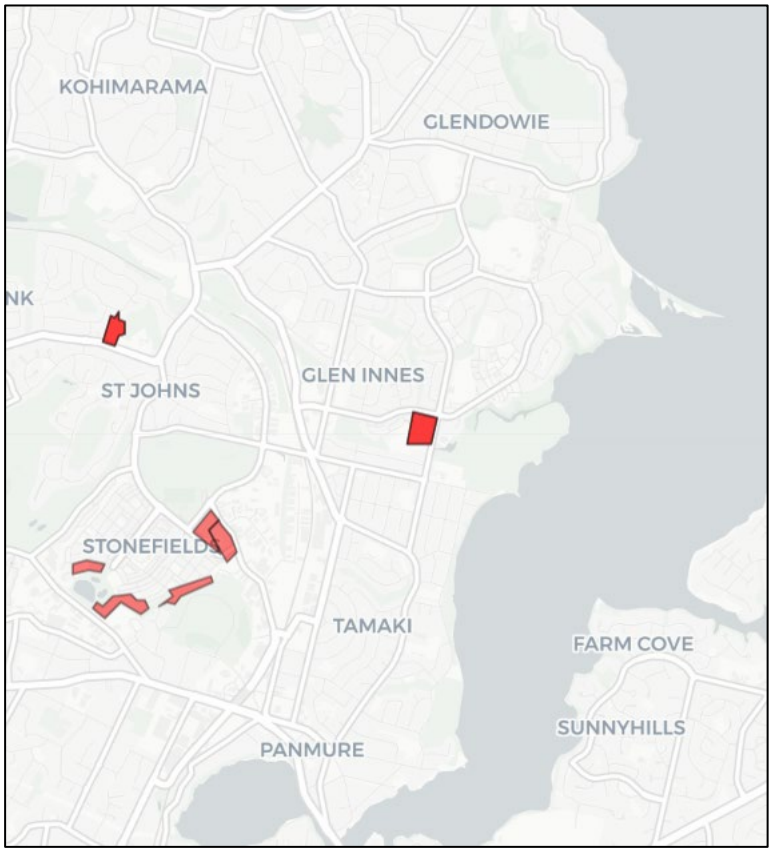
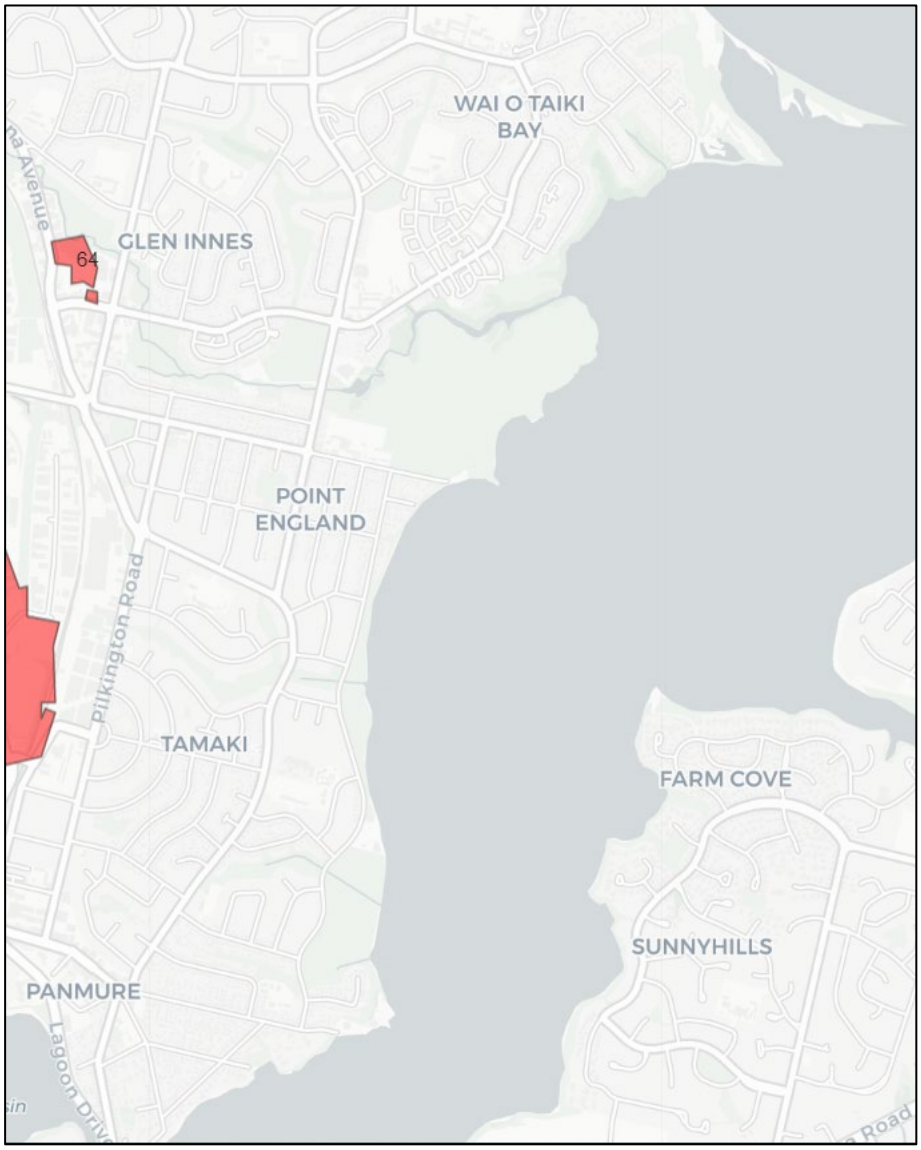


Figure 44: Parcel land values near industrial zone boundaries – Tāmaki Regeneration Area



3.6.9 Supporting Growth Programme

Context

The Supporting Growth Programme (SGP) is a collaboration between Auckland Transport and the Waka Kotahi NZ Transport Agency to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years.

Features

The AUP identified 15,000 hectares of rural land for urbanisation (Future Urban Land Supply Strategy) located in areas as follows: Warkworth, Wainui, Silverdale, Dairy Flat,

Whenuapai, Redhills, Kumeū-Huapai, Riverhead, Takānini, Opāheke, Drury, Paerata and Pukekohe.

Impact and limitations

The effects on affordability have not been identified though further development opportunities may be created from this intervention. Nonetheless, the SGP is adapting to the effects of COVID-19 on budget reductions, which means that some of the SGP have now been put on hold.

3.6.10 Mayoral Housing Taskforce

Context

Research and advocacy are one of the roles that the council carries out about housing affordability debates. A cross-council and interdisciplinary group developed strategies and assessments regarding council's advocacy role in the development of external policies and initiatives to address housing affordability.

Features

Since 2018 the group has developed research on retained minimum affordable housing planning requirements with cost-offsetting incentives, shared ownership, strategic role of the council and CCOs, initiatives to facilitate institutional development and management of rental properties (such as build-to-rent), legislation to improve rental tenure security, reforms to make the Accommodation Supplement more effective, and partial and progressive ownership arrangements such as rent-to-buy, shared equity, co-housing, papakāinga housing and leasehold of public land.

Impact

Some of the work of the groups has been validated in multiple instances as pertinent to inform council's role on affordable housing. Nonetheless, other research avenues are discussed in Section 5.

4.0 Discussion

The NPS-UD posits a wide scope of actions within the HBAs to explore affordability and the competitiveness of land and housing markets. In particular, the generation of evidence to inform long-term planning. The core of the NPS-UD revolves around sufficient development capacity to meet expected demand for housing. Nonetheless, there are several layers of analysis regarding capacity, starting from the plan-enabled capacity, passing through infrastructure ready, then commercially feasible and finally the expected dwellings to be realised. For this, the NPS-UD is explicit in advising that councils may use any appropriate methodology.

Hence, this HBA is structured on three models that have been extensively applied in past assessments and projects similar to the HBA. Significant updates and modifications were introduced to accommodate the latest developments in Auckland and New Zealand regarding housing and land markets. Most importantly, modelling assumptions and conceptual interpretations are needed about the purpose and direction of the NPS-UD. This leads this HBA to be carried out through the lens of first-home buyers, those currently renting, as we identify such is the rationale of the NPS-UD. The concept of intermediate market households is selected as a benchmark to measure how the competitive market serves this target group that may represent a submarket in the need for affordable housing. Therefore, the modelling framework accommodates multiple research and policy questions, and, consequently, is fit for purpose to respond to the HBA requirements of the NPS-UD.

This section summarises the findings of the HBA, describes how it meets the Objectives described in Section 2.1 of the NPS-UD, and sets up the stage for the roles that any local council may undertake relative to the unaffordability crisis.

4.1 Alignment of this HBA with the NPS-UD

The NPS-UD requires the Auckland Council to produce a housing and business assessment every three years, with the first part of this assessment focusing on housing supply and demand to be delivered by July 2021. The assessment requirements are that councils provide information on the demand and supply of housing and business land, assess the impact of planning and infrastructure decisions on demand and supply, inform RMA planning documents, future development strategies, and long-term plans; and, quantify if development capacity is sufficient to meet expected demand for housing and business land in the short-term, medium-term and long-term. The HBA should serve as an evidence base from which to monitor the

progress of development goals and adjust constraints, with the intent being to maximise land supply for housing and business.

Findings and implications in this HBA describe the current and potential future landscape of the housing market in Auckland. Thus, it informs policy actions targeted to improve the functioning of Auckland's urban environment while considering affordability as a social outcome (Objective 1). This HBA also feeds into the long-term development in response to the changing needs of households seeking to own a dwelling (Objective 4). Furthermore, as the ACDC model incorporates infrastructure planning and funding as part of the commercial feasibility of housing, the infrastructure cost is then passed over to prices, which consequently influence demand responses and generates market outcomes. These outcomes then develop the spectrum of scenarios that characterise Auckland's housing market, on which informed decisions should be based (Objective 6). As more information and data become available, our modelling approach could be expanded to answer other policy or research questions (Objective 7). Finally, within the boundaries of desktop research, and not of empirical causal analysis, the impact analysis in this HBA explores how planning and infrastructure decisions have (or have not) affected affordability and competitiveness of the housing and land markets (Objective 2).

Table 28 summarises the structure of the report relative to the NPS-UD and how this HBA satisfies its requirements.

Table 28: Report structure in relation to NPS-UD Subpart 5 requirements

Subpart 5 – Housing and Business Assessment (HBA) – housing clauses	Section(s) in report
3.22 Competitiveness margin	3.3
3.23 Analysis of housing market and impact of planning	3.1, 3.6
3.24 Housing demand assessment	3.4
3.25 Housing development capacity assessment	3.2
3.25 (1)(b) Infrastructure-ready	3.2
3.26 Estimate what is feasible and reasonably expected to be realised	3.2, 3.3, 3.4
3.27 Assessment of sufficient development capacity for housing	3.5, 3.6

The modelling approach relies on the assumption of the NPS-UD that affordability improvements will be an outcome of land releases that subsequently lead to unlocking additional housing supply. The ACDC model constructs supply profiles of feasible dwellings that are deemed as additional capacity. The CHATA model then simulates the uptake of those dwellings conditional to their location and the purchasing power of households. Hence, this HBA measures the consistency (or discrepancy) between what the market may deliver and what households may be able to buy. We do not model any demand-side policies or initiatives (e.g., targeting-and-retention of dwellings, inclusionary zoning, progressive homeownership).

The overarching finding is the significant discrepancy between what households can actually afford and the expensive dwellings entering the market. That is, additional housing capacity does not guarantee that affordability will improve. Prices in a competitive market are set by developers based on profitability decisions, whereas dwellings in the affordable market segment incorporate traits of fairness or equity criteria tied to lower prices. Hence, there is no mechanism that guarantees that more affordable housing will be delivered only because a different set of development options are induced by the planning system or the NPS-UD.

Notwithstanding, though the effects of the NPS-UD-type policies may be small in their impact when compared to the size of the unaffordability crisis; in the margin, additional housing may imply welfare changes for a share of households because of better purchase conditions. That is, though the additional capacity may not improve affordability overall, it may still generate implications for the design of more comprehensive policies (Metcalf, 2018).

4.2 Council's role set in the broader context

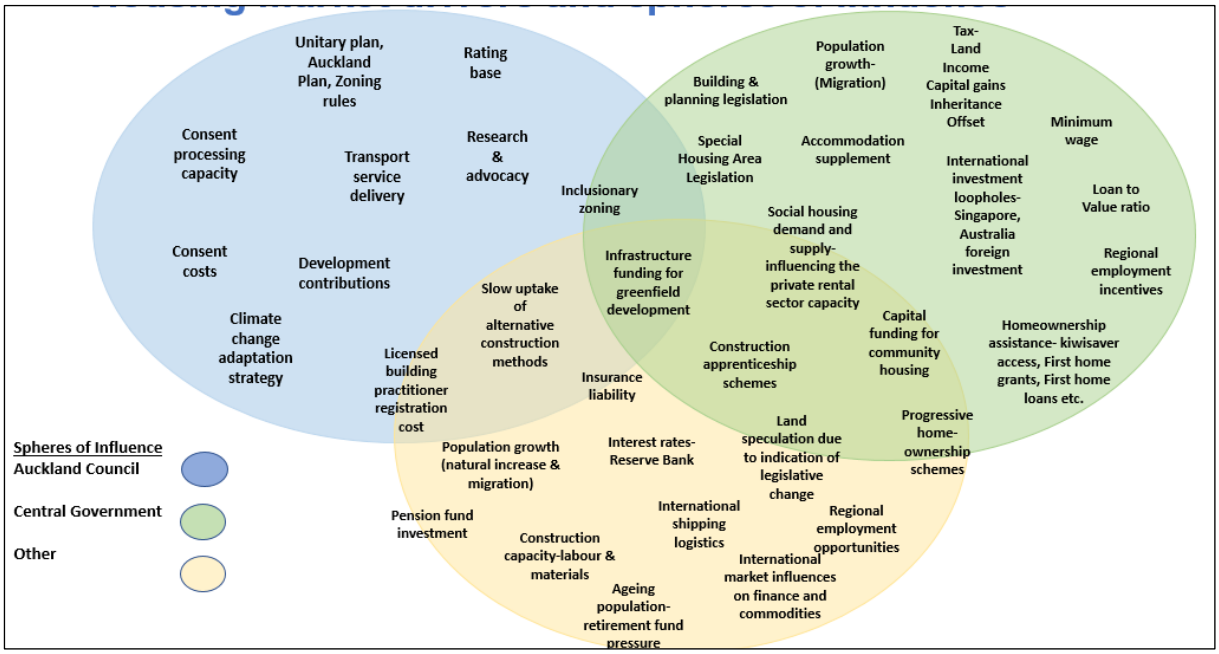
The extent of the council's influence on the housing market must also be considered in summarising this work. This HBA indicates that although there is sufficient plan-enabled development capacity to meet demand in Auckland, under the current conditions, it is unlikely to make a material difference to housing affordability for the majority of potential first home buyers. Drivers of the housing market are myriad, many of which are outside the direct sphere of council's influence.

Figure 45 represents an inexhaustive list of the factors that drive the housing market, directly and indirectly, through both supply and demand factors. Some of the drivers fall directly within a singular sphere of influence, whereas others are contingent on policies and initiatives from local government, central government, the private sector as well as international political and economic contexts. In brief, the impact of a local government on housing markets is limited. Auckland Council neither builds dwellings, nor finances buyers. Construction capacity and material availability are also outside of the remit of the council. Infrastructure funding is largely allocated and does not cover out of sequence private plan changes, and any further increase in rates would be unpalatable to Aucklanders, and furthermore would further exacerbate financial hardship for those in the intermediate market. Development contributions do not reflect the full cost of infrastructure provision, particularly in greenfields, and thus will not result in a significant expansion of infrastructure capacity.

As noted in the preceding section, the most critical levers that the council can use are actively applied Although it is recognised that there is still room for improvement in

efficiency and acceptance of innovation. The increases in consenting volumes, release of land and relaxation of planning provisions have demonstrably maximised development potential. However, most of the most critical drivers of house price growth are beyond council's sphere of influence.

Figure 45: Housing market drivers and spheres of influence of the Auckland Council



It remains therefore that research and advocacy are the council's primary levers for impacting housing affordability in Auckland. The council can lobby central government to improve fiscal conditions for first homebuyers, through wage growth, and homeownership assistance. While controlling demand using taxes, addressing the commodification of housing as a tool for wealth accumulation by incentivising alternative investment options. In addition, supply can be boosted through investment in alternative technologies and expansion of the construction labour force. This summary serves as a reminder of the limitations of council's role in addressing housing affordability issues, which is the premise of the NPS-UD.

4.3 Next steps, caveats, and limitations

The NPS-UD posits a broad scope of actions for the Auckland Council to explore affordability and competitiveness of land and housing markets, where the HBA is fundamental to inform RMA planning documents, development strategies, and long-term plans, the purpose of this report is to develop the HBA for the Auckland region.

The modelling approach has been tested and validated extensively in order to provide reliable and robust evidence about the reactions of the housing market with respect to policy stimulus such as those embedded in the NPS-UD. Relevant modelling assumptions and conceptual interpretations of the HBA have been discussed in the corresponding sections for consistency purposes. Nonetheless, there are other caveats and limitations worth mentioning, as follows:

- This HBA does not analyse particular demand groups such as Māori, older people, students, visitors, and seasonal workers, due to lack of available data disaggregation or, most importantly, time constraints.
- The council has a relatively limited role in large scale redevelopment projects that are carried out by central government agencies.
- Transport infrastructure capacity is still under assessment and will be incorporated into the next HBA due in 2024.
- Funding and financing of infrastructure are still uncertain considering the economic outlook of New Zealand and Auckland.

Finally, Table 29 summarises relevant gaps identified during the research process that need to be investigated to construct a comprehensive picture of the housing and land markets in Auckland. The council will endeavour to liaise with relevant parties and stakeholders to carry out this research plan.

Table 29: Gap analysis and relevant research

Focus area	Planned and confirmed research	Research gaps – opportunities
Māori housing	Develop a work programme and timeline for work on demand analysis for housing by Māori (Mana Whenua and Mātāwaka) and how the demand is likely to be met in future, including identifying levers for affordable housing, and the demand for different types and forms of housing such as community housing, lower-cost housing and papakāinga. Provide the work programme and timeline to the council's Planning Committee (PLA/2021/77). Tāmaki Regeneration planned research on culturally appropriate apartment design for Māori and Pacific whānau. Recommendations under the Kainga Strategic Action Plan require that provisions under the AUP are investigated and improved to enable papakāinga on general land and other otherwise viable Māori housing outcomes. This includes: The Plans and Places department investigated a possible plan change to the Integrated Residential Developments activity of the AUP to classify Papakāinga and kaumātua housing as a type of Integrated Residential Development if they meet the 2000m² minimum site size and provide supporting communal facilities.	Remaining gaps in our understanding of Māori affordable housing needs and opportunities in Tāmaki Makaurau, including: The effects of inclusionary zoning on Māori outcomes and the growth of both community housing providers and Māori housing providers. Housing typology preferences for Māori including a decision driver for housing choice i.e., cost, employment access, community belonging, family. Papakāinga developments funding opportunities and barriers-including institutional financial barriers. Tracking intergenerational change for whānau Māori with multi-layered analyses looking at all Tāmaki Makaurau, all Māori etc.

Focus area	Planned and confirmed research	Research gaps – opportunities
	Assessing the potential effects on the provision of Māori housing if this activity class is removed. Part of this research may investigate and is not limited to: • how the legacy district plans of the Tāmaki Makaurau region catered for papakāinga and/or kaumātua housing • how the papakāinga activity was dealt with at the AUP Independent Hearings Panel recommendations. • what types of resource consent activity classes are being used to provide Māori housing that have supporting communal facilities.	
Growth of the Intermediate Housing Market (IHM) using census updates		The next planned census is 2023. At which point the IHM data can be updated. Currently, the Auckland Council does not plan to commission further research on the IHM in the interim.
Experience of housing in Auckland	Auckland Affordable Housing Survey (2021). Aims to understand the impact of financial stress: including trade-offs made to balance high rent costs with essentials COVID-19 impacts crowding impacts	The first Auckland Affordable Housing Survey will be run in late 2021. Relevant findings on the experience of housing in Auckland will be included in the next iteration of the HBA.

Focus area	Planned and confirmed research	Research gaps – opportunities
	intentions: for example, plans and strategies to purchase homes, remain in Tāmaki Makaurau etc impacts of/need for different typologies location specific data different experiences and needs by demographic grouping	
Impacts of COVID and construction sector capacity on development	The New Zealand Infrastructure Commission (Te Waihanga) commissioned Deloitte to undertake a COVID-19 recovery study of the infrastructure-related construction sector. Including interviews with key peak bodies, augmented with existing research, sector surveys and data published in November and December 2020	Any future policy decisions and investment announcement resultant from this, or other relevant work, on construction capacity will be monitored and incorporated into future HBAs.
Kāinga Ora (KO) – and the urban growth agenda (UGA)	The Auckland Housing programme seeks to build 22,000 new homes in Auckland between 2020-2035. The governments “Land for Housing’ programme has resulted in 26 hectares of land at Unitec’s Mt Albert campus to build a community of up to 3000 homes. Further public private partnerships with developers and the government to deliver housing under KiwiBuild has resulted in Ockham residential delivering 47 KiwiBuild apartments. Māori housing has explicitly been identified as an area for partnership under the UGA. An Iwi and Māori Partnership Programme has been established	Due to the abandonment of the 100,000 KiwiBuild programme target it is unclear how much extra housing capacity, beyond that currently in development, will be delivered by government. The Auckland Council will continue to work with KO and partners to acquire relevant data for future modelling of the HBA.

Focus area	Planned and confirmed research	Research gaps – opportunities
	to assist iwi and Māori groups who want to develop housing, particularly mixed-tenure developments. To date the projected housing yield from this partnership is yet to be confirmed.	
Community housing sector	Community finance was launched in 2019 with an objective of scaling up affordable housing build development using social impact investment – the finance model provides opportunities for the creation of investment portfolios in community housing and has the potential for significant scale up. Large scale investment funds are being explored to access KiwiSaver, NZ Super and ACC. Options currently being explored by the sector-include complete turnkey delivery of community housing at scale through acquisition of construction companies.	The Auckland Council will remain informed about the progression of these ventures through ongoing consultation and data gathering with the community housing sector.
Business assessment -		As businesses tend to be more dynamic and adaptive to the use of available space, it is unlikely that extensive sector consultation on demand requirements is needed for the HBA, however this will be monitored through collaboration with Auckland Unlimited who compile the Auckland Growth monitor on economic growth by sector.

Focus area	Planned and confirmed research	Research gaps – opportunities
Development contributions (DCs)	The Auckland Council development contributions are currently standardised. Research is being undertaken to determine if the DCs can be charged to better reflect the cost of infrastructure provision in proximity to a development. Should a change in DCs be implemented the yield of houses at a regional scale is unlikely to be affected, however some impact on spatial distribution of new housing may be impacted.	Modelling will be required to fully understand the impacts of changes of DCs on housing yield. In addition to testing whether intuitive assumptions about the impacts are shared with developers.
Transport infrastructure	Data generated from the 2018 census, provided information on over a million trips in Auckland. Recording 750,000 journey to work (JTW) and 325,000 for journey to employment (JTE) (on a typical day). Spatial data on modal type, trip length was also generated by this work. As was an understanding of employment sector accessed and social deprivation index trends of modal type. Other research undertaken by AT is limited to AT metro patronage, safety and community transport evaluations, traffic counts, cycle and walkway use monitoring, new route feasibility reports for large infrastructure projects such as the Waitemata crossing.	For reasons discussed earlier, transport capacity was unable to form part of this HBA's 'infrastructure-ready' assessment. The Auckland Council and Auckland Transport will continue to collaborate to provide this information to inform the next HBA. Other research gaps include electric vehicle (EV) infrastructure demand and projected requirements.
The impact of the three waters reforms		The rationale for three water reforms is to increase efficiency and meet the infrastructure funding deficit. This may have some bearing on future HBAs; however, the existing water

Focus area	Planned and confirmed research	Research gaps – opportunities
		infrastructure is not currently a factor limiting feasible development for Auckland's projected growth, and therefore the reforms are unlikely to have a material difference on feasible development capacity.
Utilities and Social infrastructure	The Ministry of Education have agreed to collaborate with AC to provide data on demand for education to align with the growth strategy. This data will be used to inform the next HBA.	Further collaboration with providers of utilities, telecommunication, healthcare infrastructure is required to access data to be included in the next HBA.
Noted in HBA guidance section 5.3 – Engaging other information holders (clause 3.21(1)(c)) Clause 3.21(1)(c) also requires that local authorities consult with "anyone else who has information that may materially affect the calculation of the development capacity". This includes a wide range of people, such as large landholders, group housing providers (e.g., student housing or retirement villages), seasonal accommodation providers (e.g., for tourism or labourer hostels), or community housing providers. Relevant groups will be specific to each local authority.		
		As developers were widely represented through submissions on the AUP, and the AUP provides sufficient feasible development capacity it was premature to engage with them prior to the completion of this HBA. It will however be useful to engage with developers and access data detailing how their future development programmes have changed because of the NPS-UD. In addition, research is required to determine any changes to plans to bring forward out of sequence plan

Focus area	Planned and confirmed research	Research gaps – opportunities
		changes in the future urban land zone because of the NPS-UD.
Retirement housing, student and visitor accommodation, and boarding houses		Under the AUP, retirement villages, boarding houses and visitor accommodation are currently a permitted activity in the mixed housing urban zone for up to 10 units and restricted discretionary for over 10 units. This means that unlike in other district plans, where there are specific zones applied for these activities, the plan is agnostic to the land use and a developer can build apartments, retirement villages or visitor accommodation in this zone. Therefore, developers will provide accommodation which meets the demand of the market in that location. There is no mechanism within this plan zone to require provision of affordable accommodation. Further research with the tertiary education sector will be required to determine demand for student accommodation for the next HBA. Currently provision of student accommodation is a permitted activity under the Tertiary Education Zone of the AUP. Work undertaken in 2020 as part of the affordable housing programme explored options for increasing the

Focus area	Planned and confirmed research	Research gaps – opportunities
		stock of housing for older people and showed that there is limited research available on the needs of older people from migrant or diverse cultural backgrounds. Further research would enable us to better plan and support delivery of appropriate typologies including homes that are of sufficient size, culturally appropriate and accessible. The Auckland Council in collaboration with the Selwyn foundation provides community housing for the elderly through Haumaru Housing. The council's ability to widen stock profile of housing for high needs elderly groups is limited due to council being unable to receive income related rent subsidy directly. The council is advocating for change to central government, which, if successful, could improve feasible capacity of housing for older people. The impacts of COVID-19 on visitor numbers are likely to have reduced demand in the short term. Auckland Unlimited monitor visitor numbers. Future HBAs will be informed by any assessment undertaken by this agency on likely future demand for visitor accommodation.

Focus area	Planned and confirmed research	Research gaps – opportunities
Other	Connection between planning and supply	Effects of land banking on supply Effects of planning on housing density in a dynamic setting Reaction of developers to planning -delays on delivering affordable housing

5.0 Concluding remarks

This HBA has leveraged data-led evidence and research to analyse and critique the current and future state of land-supply and housing affordability in Auckland. The approach used in this HBA answers the purpose and requirements of the NPS-UD.

Concluding remarks are as follows:

First, unpredictable changes are inevitable. Thus, how changes will manifest is impossible to predict over a 30-year horizon. Auckland may face natural or anthropocentric induced geophysical hazards, health crises or be subject to the external impacts of global financial shocks. In the short-term, immigration may be stymied, but in the long-term the onset of climate change may result in New Zealand experiencing unprecedented inward migration. Likewise, the viable land for development in the current climatic conditions may not be feasible under future conditions. As many of the potential hazards that could impact on both supply and demand are beyond the direct control of New Zealand, opportunities for mitigating the risks are limited. Therefore, it is impractical to model all potential development delivery scenarios, as it is not possible to predict the multiple futures that could affect Auckland with confidence.

Secondly, in response to the implied assumption of the NPS-UD that availability of plan enabled capacity and regionally available infrastructure will eventuate in affordable housing; this HBA finds that even though development capacity surpasses households, actual dwellings entering the market may not be necessarily affordable. A large share of current renters may not be able to become homeowners. In a dynamic setting, the unaffordability of housing in Auckland may become permanent unless affordable housing supply grows at a pace much higher than the growth of population.

Furthermore, the typologies of feasible, affordable housing for the intermediate households, are unlikely to meet the needs of the primary groups of households (families with children) as they will be small apartments, or located on the outer reaches of Auckland where transport costs to access employment and amenities may create considerable financial implications. There are also considerable practical implications of using the outputs of this HBA as a specific number or housing target to which the council can commit. The HBA cannot project precisely how developers will utilise the land becoming available to them. Developers are economically rational and will adapt their proposals to maximise profit within the context of the day, as influenced by many social, economic, and environmental factors. For example, if land supply becomes unrestricted, developers may slow the release of housing, decreasing supply in turn putting pressure on demand.

Finally, capacity in the form of housing supply is only a part of the equation. There are many other dimensions of complexity out of the scope or control of local councils that may have greater impact on affordability and competitiveness. This does not disregard the impact that the NPS-UD could have on prices over time as more supply enters the markets, enabling capacity in accessible locations and providing the opportunity to revisit planning provisions and zoning. In summary, any improvements on affordability for intermediate households (or any other target groups earning below the median income) are likely to be small, if not negligible.

Abbreviations

ACDC	Auckland Council Development Capacity model
AEP	Annual Exceedance Probability
AHA	Auckland Housing Accord
AHP	Auckland Housing Programme
AMP	Asset Management Plan
ARI	Annual Recurrence Interval
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
AUP	Auckland Unitary Plan
Av.	Average
CAU	Census Area Unit
CBD	Central Business District
CfGS	Capacity for Growth Study
CHATA	Conditional Housing Allocation and Tenure Assessment model
CHP	Community Housing Provider
CORT	Community of Refuge Trust
CV	Capital Value
DCs	Development Contributions
DVRs	District Valuation Roll property sales records
ERP	Estimated Resident Population
EV	Electric vehicle
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GF	Greenfield
GFACDC	Auckland Council Development Capacity model - Greenfield module
GFC	Global Financial Crisis
GMM	Gaussian mixture
HASHA	Housing Accord and Special housing Areas
HBA	Housing and Business Development Capacity Assessment
HNZ	Housing New Zealand (now Kāinga Ora)
HNZC	Housing New Zealand Corporation (now Kāinga Ora)
i11v6	Auckland Council's land-use scenario i version 11.6
IGCs	Infrastructure Growth Charges
IHM	Intermediate Housing Market
IHP	Independent Hearing Panel
IV	Improvement Value
IZ	Inclusionary zoning
JTE	Journey to employment
JTW	Journey to work
KO	Kāinga Ora
LCV	Latest Capital Value
LIV	Latest Improvement Value

LLV	Latest Land Value
LTP	Long-term Plan
LUT	Look-up table
LV	Land Value
MBIE	Ministry of Business, Innovation and Employment
MSM	Macro Strategic Model
NAMP	National Asset Management Programme
NLTP	National Land Transport Programme
NPS-UD	National Policy Statement on Urban Development
NPS-UDC	National Policy Statement on Urban Development Capacity
RLTP	Regional Land Transport Plan
RMA	Resource Management Act 1991
SA2	Statistical Area 2
SAM	Serviceability and Affordability Model
SGP	Supporting Growth Programme
SHAs	Special Housing Areas
Stats NZ	Statistics New Zealand
TRC	Tāmaki Regeneration Company
UFB	Ultra-Fast Broadband
UGA	Urban Growth Agenda
URP	Census Usually Resident Population
WTP	Willingness to pay

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Appendix 1: Capacity for Growth Study look up tables

Table 1: Unitary Plan Residential zone and modelling classification

CFGS_UID	CFGS_NAME	MODEL_TYPE	ASSESSMENT_TYPE	NOTES	ZONE_HEIGHT	ZONE_STOREYS	AHCO_IMPACT	SECOND_DWELLING_PERMITTED	MHU_PERMITTED	VSS_PARCEL_AREA_MIN_QUALIFIER	VSS_PARCEL_AREA_MIN_INFILL	VSS_ACCESS_WIDTH_MIN_1	VSS_ACCESS_WIDTH_MIN_2_5	VSS_ACCESS_WIDTH_MIN_6_10	VSS_SITEHAPEFACTOR_MINDIM	VSS_SITEHAPEFACTOR_MINAREA	VSS_SITEHAPEFACTOR_MINDIMSQ	FRONT_YARD_SETBACK	SIDE_YARDS_SETBACK	REAR_YARDS_SETBACK	ALTERNATIVE_REARANDSIDE_YARDS_SETBACK	HIRB_VERTICAL_HEIGHT	HIRB_ANGLE_DEG	ALT_HIRB_VERTICAL_HEIGHT	ALT_HIRB_ANGLE	ALT_HIRB_VAR	ALTERNATIVE HIRB_VAR_NOTE	BUILDING_MAXPC_COVERAGE	BUILDING_MAXM2_COVERAGE	ISA_MAXPC_COVERAGE	ISA_MAXM2_COVERAGE
ZN_2_23	Residential - Large Lot Zone	Residential	Density		8	2	Constraint	0	1	8000	4000	2.5	3	5.5	8,15	120	11	10	6	6							Big Yard Setbacks	0.2	400	0.35	1400
ZN_2_18	Residential - Mixed Housing Suburban Zone	Residential	Volume		8	2	Constraint	1	1	650	400	2.5	3	5.5	8,15	120	11	3	1	1	0	2.5	45	3.6	60	20	Not apply when Common Wall	0.4		0.6	
ZN_2_60	Residential - Mixed Housing Urban Zone	Residential	Volume		11	3	Constraint	1	0	500	300	2.5	3	5.5	8,15	120	11	2.5	1	1	0	3	45	3.6	60	20	Not apply when Common Wall	0.45		0.6	
ZN_2_20	Residential - Rural and Coastal Settlement Zone	Residential	Density		8	2	Constraint	1	1	5000	2500	2.5	3	5.5	8,15	120	11	5	1	1		2.5	45				Does NOT apply from Any Business,	0.2	200	0.35	1400
ZN_2_19	Residential - Single House Zone	Residential	Density		8	2	Constraint	1	1	1200	600	2.5	3	5.5	8,15	120	11	3	1	1		2.5	45				Not apply when Common Wall	0.35		0.6	
ZN_2_8	Residential - Terrace Housing and Apartment Building Zone	Residential	Volume		16	5	Constraint OR Bonus	1	0	1400	1200	2.5	3	5.5	15,20	300	17.3	1.5	1	1	0	3	45	8	65	20	Front Zon - Does Not apply when Common Wall	0.5		0.7	

Table 2: Designations that affect capacity calculation

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
1	Airways Corporation of New Zealand Ltd	100	YES	Y
1	Airways Corporation of New Zealand Ltd	101	YES	Y
2	Ardmore Airport Ltd	200	NO	Y
3	Auckland Council	609	NO	Y
3	Auckland Council	429	NO	Y
3	Auckland Council	602	NO	Y
3	Auckland Council	500	YES	Y
3	Auckland Council	517	NO	Y
3	Auckland Council	610	NO	Y
3	Auckland Council	420	YES	Y
3	Auckland Council	419	YES	Y
3	Auckland Council	552	YES	Y
3	Auckland Council	540	NO	Y
3	Auckland Council	502	YES	Y
3	Auckland Council	550	NO	Y
3	Auckland Council	414	YES	Y
3	Auckland Council	522	NO	Y
3	Auckland Council	513	YES	Y
3	Auckland Council	503	YES	Y
3	Auckland Council	532	YES	Y
3	Auckland Council	504	YES	Y
3	Auckland Council	516	NO	Y
3	Auckland Council	611	NO	Y
3	Auckland Council	601	NO	Y
3	Auckland Council	523	NO	Y
3	Auckland Council	551	YES	Y
3	Auckland Council	515	NO	Y
3	Auckland Council	415	NO	Y
3	Auckland Council	547	YES	Y
3	Auckland Council	622	NO	Y
3	Auckland Council	509	NO	Y
3	Auckland Council	508	NO	Y
3	Auckland Council	512	NO	Y
3	Auckland Council	413	YES	Y
3	Auckland Council	553	NO	Y
3	Auckland Council	411	NO	Y
3	Auckland Council	430	NO	Y
3	Auckland Council	432	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
3	Auckland Council	616	NO	Y
3	Auckland Council	605	NO	Y
3	Auckland Council	401	NO	Y
3	Auckland Council	403	NO	Y
3	Auckland Council	603	NO	Y
3	Auckland Council	404	NO	Y
3	Auckland Council	402	NO	Y
3	Auckland Council	604	NO	Y
3	Auckland Council	400	NO	Y
3	Auckland Council	600	NO	Y
3	Auckland Council	418	NO	Y
3	Auckland Council	427	NO	Y
3	Auckland Council	527	NO	Y
3	Auckland Council	554	NO	Y
3	Auckland Council	506	NO	Y
3	Auckland Council	507	NO	Y
3	Auckland Council	417	NO	Y
3	Auckland Council	614	NO	Y
3	Auckland Council	425	NO	Y
3	Auckland Council	617	YES	Y
3	Auckland Council	613	YES	Y
3	Auckland Council	623	NO	Y
3	Auckland Council	426	NO	Y
3	Auckland Council	416	NO	Y
3	Auckland Council	428	YES	Y
3	Auckland Council	608	NO	Y
3	Auckland Council	424	YES	Y
3	Auckland Council	556	NO	Y
3	Auckland Council	612	NO	Y
3	Auckland Council	620	NO	Y
3	Auckland Council	542	YES	Y
5	Auckland Transport	1425	NO	Y
5	Auckland Transport	1423	NO	Y
5	Auckland Transport	1424	NO	Y
5	Auckland Transport	1421	NO	Y
5	Auckland Transport	1469	NO	Y
5	Auckland Transport	1716	NO	Y
5	Auckland Transport	1420	NO	Y
5	Auckland Transport	1428	NO	Y
5	Auckland Transport	1474	NO	Y
5	Auckland Transport	1620	NO	Y
5	Auckland Transport	1478	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
5	Auckland Transport	1476	NO	Y
5	Auckland Transport	1836	NO	Y
5	Auckland Transport	1700	NO	Y
5	Auckland Transport	1422	NO	Y
5	Auckland Transport	1473	NO	Y
5	Auckland Transport	1427	NO	Y
5	Auckland Transport	1426	NO	Y
6	Chorus New Zealand Ltd	2670	YES	Y
6	Chorus New Zealand Ltd	2669	YES	Y
6	Chorus New Zealand Ltd	2667	YES	Y
6	Chorus New Zealand Ltd	2668	YES	Y
6	Chorus New Zealand Ltd	2666	YES	Y
6	Chorus New Zealand Ltd	2665	YES	Y
6	Chorus New Zealand Ltd	2630	YES	Y
7	Counties Power Ltd	3004	NO	Y
7	Counties Power Ltd	3006	YES	Y
7	Counties Power Ltd	3005	NO	Y
7	Counties Power Ltd	3008	YES	Y
8	Kordia Ltd	3301	NO	Y
9	Maritime New Zealand	3500	NO	Y
10	Meteorological Service of New Zealand Ltd	3702	NO	Y
10	Meteorological Service of New Zealand Ltd	3700	NO	Y
11	Minister of Corrections	3900	YES	Y
11	Minister of Corrections	3901	YES	Y
11	Minister of Corrections	3910	YES	Y
11	Minister of Corrections	3903	YES	Y
12	Minister for Courts	4100	YES	Y
12	Minister for Courts	4101	YES	Y
12	Minister for Courts	4102	YES	Y
12	Minister for Courts	4105	YES	Y
12	Minister for Courts	4104	YES	Y
12	Minister for Courts	4103	YES	Y
13	Minister of Defence	4302	YES	Y
13	Minister of Defence	4300	YES	Y
13	Minister of Defence	4309	NO	Y
13	Minister of Defence	4308	NO	Y
13	Minister of Defence	4305	YES	Y
13	Minister of Defence	4306	YES	Y
13	Minister of Defence	4301	YES	Y
13	Minister of Defence	4307	NO	Y
13	Minister of Defence	4310	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
13	Minister of Defence	4312	NO	Y
13	Minister of Defence	4313	YES	Y
13	Minister of Defence	4314	YES	Y
13	Minister of Defence	4303	YES	Y
14	Minister of Education	4662	YES	Y
14	Minister of Education	4660	NO	Y
14	Minister of Education	5062	NO	Y
14	Minister of Education	4716	YES	Y
14	Minister of Education	4527	YES	Y
14	Minister of Education	4760	YES	Y
14	Minister of Education	5059	YES	Y
14	Minister of Education	4506	YES	Y
14	Minister of Education	4508	YES	Y
14	Minister of Education	4709	YES	Y
14	Minister of Education	4600	YES	Y
14	Minister of Education	4607	YES	Y
14	Minister of Education	4520	YES	Y
14	Minister of Education	4993	YES	Y
14	Minister of Education	4555	YES	Y
14	Minister of Education	4925	YES	Y
14	Minister of Education	5021	YES	Y
14	Minister of Education	5024	YES	Y
14	Minister of Education	4500	YES	Y
14	Minister of Education	5025	YES	Y
14	Minister of Education	4938	YES	Y
14	Minister of Education	4788	YES	Y
14	Minister of Education	4723	YES	Y
14	Minister of Education	4998	YES	Y
14	Minister of Education	4525	YES	Y
14	Minister of Education	4927	YES	Y
14	Minister of Education	5057	YES	Y
14	Minister of Education	4507	YES	Y
14	Minister of Education	4561	YES	Y
14	Minister of Education	4501	YES	Y
14	Minister of Education	4597	YES	Y
14	Minister of Education	4703	YES	Y
14	Minister of Education	4705	YES	Y
14	Minister of Education	4706	YES	Y
14	Minister of Education	4707	YES	Y
14	Minister of Education	4708	YES	Y
14	Minister of Education	4504	YES	Y
14	Minister of Education	4503	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4505	YES	Y
14	Minister of Education	4599	YES	Y
14	Minister of Education	4509	YES	Y
14	Minister of Education	4510	YES	Y
14	Minister of Education	4512	YES	Y
14	Minister of Education	4710	YES	Y
14	Minister of Education	4513	YES	Y
14	Minister of Education	4514	YES	Y
14	Minister of Education	4711	YES	Y
14	Minister of Education	4515	YES	Y
14	Minister of Education	4712	YES	Y
14	Minister of Education	4562	YES	Y
14	Minister of Education	4601	YES	Y
14	Minister of Education	4713	YES	Y
14	Minister of Education	4563	YES	Y
14	Minister of Education	4516	YES	Y
14	Minister of Education	4714	YES	Y
14	Minister of Education	4602	YES	Y
14	Minister of Education	4603	YES	Y
14	Minister of Education	4978	YES	Y
14	Minister of Education	4717	YES	Y
14	Minister of Education	4719	YES	Y
14	Minister of Education	4720	YES	Y
14	Minister of Education	4604	YES	Y
14	Minister of Education	4517	YES	Y
14	Minister of Education	4721	YES	Y
14	Minister of Education	4605	YES	Y
14	Minister of Education	4606	YES	Y
14	Minister of Education	4722	YES	Y
14	Minister of Education	4518	YES	Y
14	Minister of Education	4608	YES	Y
14	Minister of Education	4725	YES	Y
14	Minister of Education	4726	YES	Y
14	Minister of Education	4727	YES	Y
14	Minister of Education	4609	YES	Y
14	Minister of Education	4729	YES	Y
14	Minister of Education	4519	YES	Y
14	Minister of Education	4521	YES	Y
14	Minister of Education	4610	YES	Y
14	Minister of Education	4522	YES	Y
14	Minister of Education	4730	YES	Y
14	Minister of Education	4564	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4731	YES	Y
14	Minister of Education	4523	YES	Y
14	Minister of Education	4732	YES	Y
14	Minister of Education	4565	YES	Y
14	Minister of Education	4613	YES	Y
14	Minister of Education	4614	YES	Y
14	Minister of Education	4615	YES	Y
14	Minister of Education	4616	YES	Y
14	Minister of Education	4617	YES	Y
14	Minister of Education	4733	YES	Y
14	Minister of Education	4618	YES	Y
14	Minister of Education	4934	YES	Y
14	Minister of Education	4935	YES	Y
14	Minister of Education	4568	YES	Y
14	Minister of Education	4569	YES	Y
14	Minister of Education	4524	YES	Y
14	Minister of Education	4619	YES	Y
14	Minister of Education	4734	YES	Y
14	Minister of Education	4735	YES	Y
14	Minister of Education	4623	YES	Y
14	Minister of Education	4736	YES	Y
14	Minister of Education	4624	YES	Y
14	Minister of Education	4570	YES	Y
14	Minister of Education	4625	YES	Y
14	Minister of Education	4945	YES	Y
14	Minister of Education	4528	YES	Y
14	Minister of Education	4957	YES	Y
14	Minister of Education	4626	YES	Y
14	Minister of Education	4530	YES	Y
14	Minister of Education	4739	YES	Y
14	Minister of Education	4628	YES	Y
14	Minister of Education	4572	YES	Y
14	Minister of Education	4629	YES	Y
14	Minister of Education	4740	YES	Y
14	Minister of Education	4742	YES	Y
14	Minister of Education	4959	YES	Y
14	Minister of Education	4531	YES	Y
14	Minister of Education	4744	YES	Y
14	Minister of Education	4745	YES	Y
14	Minister of Education	4746	YES	Y
14	Minister of Education	4747	YES	Y
14	Minister of Education	4532	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4630	YES	Y
14	Minister of Education	4749	YES	Y
14	Minister of Education	4750	YES	Y
14	Minister of Education	4751	YES	Y
14	Minister of Education	4534	YES	Y
14	Minister of Education	4535	YES	Y
14	Minister of Education	4536	YES	Y
14	Minister of Education	4753	YES	Y
14	Minister of Education	4537	YES	Y
14	Minister of Education	4754	YES	Y
14	Minister of Education	4755	YES	Y
14	Minister of Education	4632	YES	Y
14	Minister of Education	4573	YES	Y
14	Minister of Education	4757	YES	Y
14	Minister of Education	4758	YES	Y
14	Minister of Education	4539	YES	Y
14	Minister of Education	4759	YES	Y
14	Minister of Education	4964	YES	Y
14	Minister of Education	4576	YES	Y
14	Minister of Education	4761	YES	Y
14	Minister of Education	4762	YES	Y
14	Minister of Education	4763	YES	Y
14	Minister of Education	4577	YES	Y
14	Minister of Education	4764	YES	Y
14	Minister of Education	4765	YES	Y
14	Minister of Education	4650	YES	Y
14	Minister of Education	4975	YES	Y
14	Minister of Education	4540	YES	Y
14	Minister of Education	4976	YES	Y
14	Minister of Education	4634	YES	Y
14	Minister of Education	4767	YES	Y
14	Minister of Education	4768	YES	Y
14	Minister of Education	4637	YES	Y
14	Minister of Education	4769	YES	Y
14	Minister of Education	4770	YES	Y
14	Minister of Education	4638	YES	Y
14	Minister of Education	4640	YES	Y
14	Minister of Education	4578	YES	Y
14	Minister of Education	4771	YES	Y
14	Minister of Education	4772	YES	Y
14	Minister of Education	4773	YES	Y
14	Minister of Education	4543	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4983	YES	Y
14	Minister of Education	4984	YES	Y
14	Minister of Education	4774	YES	Y
14	Minister of Education	4738	YES	Y
14	Minister of Education	4775	YES	Y
14	Minister of Education	4641	YES	Y
14	Minister of Education	4776	YES	Y
14	Minister of Education	4643	YES	Y
14	Minister of Education	4544	YES	Y
14	Minister of Education	4582	YES	Y
14	Minister of Education	4782	YES	Y
14	Minister of Education	4783	YES	Y
14	Minister of Education	4784	YES	Y
14	Minister of Education	4545	YES	Y
14	Minister of Education	4995	YES	Y
14	Minister of Education	4546	YES	Y
14	Minister of Education	4547	YES	Y
14	Minister of Education	4647	YES	Y
14	Minister of Education	4648	YES	Y
14	Minister of Education	4785	YES	Y
14	Minister of Education	4549	YES	Y
14	Minister of Education	4550	YES	Y
14	Minister of Education	4585	YES	Y
14	Minister of Education	4551	YES	Y
14	Minister of Education	4586	YES	Y
14	Minister of Education	4587	YES	Y
14	Minister of Education	4649	YES	Y
14	Minister of Education	4789	YES	Y
14	Minister of Education	4790	YES	Y
14	Minister of Education	4651	YES	Y
14	Minister of Education	4652	YES	Y
14	Minister of Education	4588	YES	Y
14	Minister of Education	4552	YES	Y
14	Minister of Education	4538	YES	Y
14	Minister of Education	4553	YES	Y
14	Minister of Education	4554	YES	Y
14	Minister of Education	4791	YES	Y
14	Minister of Education	4792	YES	Y
14	Minister of Education	4793	YES	Y
14	Minister of Education	4589	YES	Y
14	Minister of Education	4590	YES	Y
14	Minister of Education	4591	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4556	YES	Y
14	Minister of Education	4654	YES	Y
14	Minister of Education	4592	YES	Y
14	Minister of Education	4593	YES	Y
14	Minister of Education	4794	YES	Y
14	Minister of Education	4594	YES	Y
14	Minister of Education	4796	YES	Y
14	Minister of Education	4655	YES	Y
14	Minister of Education	4656	YES	Y
14	Minister of Education	4798	YES	Y
14	Minister of Education	4595	YES	Y
14	Minister of Education	4657	YES	Y
14	Minister of Education	4559	YES	Y
14	Minister of Education	4560	YES	Y
14	Minister of Education	4596	YES	Y
14	Minister of Education	4658	YES	Y
14	Minister of Education	4621	YES	Y
14	Minister of Education	5012	YES	Y
14	Minister of Education	4902	YES	Y
14	Minister of Education	5029	YES	Y
14	Minister of Education	5030	YES	Y
14	Minister of Education	4905	YES	Y
14	Minister of Education	4906	YES	Y
14	Minister of Education	4907	YES	Y
14	Minister of Education	5031	YES	Y
14	Minister of Education	4908	YES	Y
14	Minister of Education	4909	YES	Y
14	Minister of Education	5032	YES	Y
14	Minister of Education	4910	YES	Y
14	Minister of Education	4911	YES	Y
14	Minister of Education	4912	YES	Y
14	Minister of Education	4913	YES	Y
14	Minister of Education	4914	YES	Y
14	Minister of Education	4916	YES	Y
14	Minister of Education	4917	YES	Y
14	Minister of Education	5013	YES	Y
14	Minister of Education	5014	YES	Y
14	Minister of Education	4918	YES	Y
14	Minister of Education	5015	YES	Y
14	Minister of Education	4919	YES	Y
14	Minister of Education	4715	YES	Y
14	Minister of Education	5016	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4921	YES	Y
14	Minister of Education	4922	YES	Y
14	Minister of Education	4923	YES	Y
14	Minister of Education	4924	YES	Y
14	Minister of Education	4926	YES	Y
14	Minister of Education	4928	YES	Y
14	Minister of Education	4724	YES	Y
14	Minister of Education	5033	YES	Y
14	Minister of Education	4529	YES	Y
14	Minister of Education	4930	YES	Y
14	Minister of Education	5017	YES	Y
14	Minister of Education	4635	YES	Y
14	Minister of Education	4932	YES	Y
14	Minister of Education	4566	YES	Y
14	Minister of Education	5034	YES	Y
14	Minister of Education	4936	YES	Y
14	Minister of Education	4937	YES	Y
14	Minister of Education	5035	YES	Y
14	Minister of Education	4939	YES	Y
14	Minister of Education	5018	YES	Y
14	Minister of Education	4941	YES	Y
14	Minister of Education	4942	YES	Y
14	Minister of Education	4943	YES	Y
14	Minister of Education	4946	YES	Y
14	Minister of Education	4947	YES	Y
14	Minister of Education	4949	YES	Y
14	Minister of Education	5022	YES	Y
14	Minister of Education	4951	YES	Y
14	Minister of Education	4952	YES	Y
14	Minister of Education	4953	YES	Y
14	Minister of Education	4954	YES	Y
14	Minister of Education	4955	YES	Y
14	Minister of Education	4956	YES	Y
14	Minister of Education	4994	YES	Y
14	Minister of Education	5036	YES	Y
14	Minister of Education	4741	YES	Y
14	Minister of Education	4958	YES	Y
14	Minister of Education	4960	YES	Y
14	Minister of Education	4961	YES	Y
14	Minister of Education	5019	YES	Y
14	Minister of Education	4963	YES	Y
14	Minister of Education	4575	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	5037	YES	Y
14	Minister of Education	4966	YES	Y
14	Minister of Education	4967	YES	Y
14	Minister of Education	5020	YES	Y
14	Minister of Education	5023	YES	Y
14	Minister of Education	5038	YES	Y
14	Minister of Education	4968	YES	Y
14	Minister of Education	4969	YES	Y
14	Minister of Education	4971	YES	Y
14	Minister of Education	4972	YES	Y
14	Minister of Education	4973	YES	Y
14	Minister of Education	4974	YES	Y
14	Minister of Education	5040	YES	Y
14	Minister of Education	4980	YES	Y
14	Minister of Education	5042	YES	Y
14	Minister of Education	5043	YES	Y
14	Minister of Education	5044	YES	Y
14	Minister of Education	5045	YES	Y
14	Minister of Education	5046	YES	Y
14	Minister of Education	5047	YES	Y
14	Minister of Education	4981	YES	Y
14	Minister of Education	5026	YES	Y
14	Minister of Education	4982	YES	Y
14	Minister of Education	5004	YES	Y
14	Minister of Education	4579	YES	Y
14	Minister of Education	4985	YES	Y
14	Minister of Education	4986	YES	Y
14	Minister of Education	4987	YES	Y
14	Minister of Education	5027	YES	Y
14	Minister of Education	4988	YES	Y
14	Minister of Education	5048	YES	Y
14	Minister of Education	4989	YES	Y
14	Minister of Education	4581	YES	Y
14	Minister of Education	4990	YES	Y
14	Minister of Education	4992	YES	Y
14	Minister of Education	4584	YES	Y
14	Minister of Education	4748	YES	Y
14	Minister of Education	4636	YES	Y
14	Minister of Education	4996	YES	Y
14	Minister of Education	5028	YES	Y
14	Minister of Education	5050	YES	Y
14	Minister of Education	4999	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	5000	YES	Y
14	Minister of Education	4900	YES	Y
14	Minister of Education	5052	YES	Y
14	Minister of Education	5053	YES	Y
14	Minister of Education	5001	YES	Y
14	Minister of Education	5054	YES	Y
14	Minister of Education	5055	YES	Y
14	Minister of Education	5041	YES	Y
14	Minister of Education	5002	YES	Y
14	Minister of Education	5003	YES	Y
14	Minister of Education	4795	YES	Y
14	Minister of Education	5005	YES	Y
14	Minister of Education	5006	YES	Y
14	Minister of Education	5007	YES	Y
14	Minister of Education	5008	YES	Y
14	Minister of Education	5009	YES	Y
14	Minister of Education	5010	YES	Y
14	Minister of Education	5011	YES	Y
14	Minister of Education	4787	YES	Y
14	Minister of Education	4583	YES	Y
14	Minister of Education	4639	YES	Y
14	Minister of Education	4574	YES	Y
14	Minister of Education	4622	YES	Y
14	Minister of Education	4548	YES	Y
14	Minister of Education	4901	YES	Y
14	Minister of Education	4903	YES	Y
14	Minister of Education	4701	YES	Y
14	Minister of Education	4702	YES	Y
14	Minister of Education	4704	YES	Y
14	Minister of Education	4511	YES	Y
14	Minister of Education	4979	YES	Y
14	Minister of Education	4920	YES	Y
14	Minister of Education	4728	YES	Y
14	Minister of Education	4611	YES	Y
14	Minister of Education	4612	YES	Y
14	Minister of Education	4933	YES	Y
14	Minister of Education	4567	YES	Y
14	Minister of Education	4620	YES	Y
14	Minister of Education	4940	YES	Y
14	Minister of Education	4526	YES	Y
14	Minister of Education	4944	YES	Y
14	Minister of Education	4571	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4948	YES	Y
14	Minister of Education	4627	YES	Y
14	Minister of Education	4533	YES	Y
14	Minister of Education	4766	YES	Y
14	Minister of Education	4752	YES	Y
14	Minister of Education	4756	YES	Y
14	Minister of Education	4970	YES	Y
14	Minister of Education	5049	YES	Y
14	Minister of Education	4542	YES	Y
14	Minister of Education	4580	YES	Y
14	Minister of Education	4642	YES	Y
14	Minister of Education	4778	YES	Y
14	Minister of Education	4991	YES	Y
14	Minister of Education	4786	YES	Y
14	Minister of Education	4997	YES	Y
14	Minister of Education	4653	YES	Y
14	Minister of Education	5051	YES	Y
14	Minister of Education	4797	YES	Y
14	Minister of Education	4557	YES	Y
14	Minister of Education	4558	YES	Y
14	Minister of Education	4915	YES	Y
14	Minister of Education	4777	YES	Y
14	Minister of Education	4718	YES	Y
14	Minister of Education	4644	YES	Y
14	Minister of Education	4737	YES	Y
14	Minister of Education	4965	YES	Y
14	Minister of Education	4950	YES	Y
14	Minister of Education	4743	YES	Y
14	Minister of Education	4502	YES	Y
14	Minister of Education	4904	YES	Y
14	Minister of Education	4598	YES	Y
14	Minister of Education	4931	YES	Y
14	Minister of Education	4631	YES	Y
14	Minister of Education	5039	YES	Y
14	Minister of Education	4780	YES	Y
14	Minister of Education	4646	YES	Y
14	Minister of Education	4663	YES	Y
14	Minister of Education	5063	YES	Y
14	Minister of Education	4661	YES	Y
14	Minister of Education	5056	YES	Y
14	Minister of Education	5058	YES	Y
14	Minister of Education	5060	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
14	Minister of Education	4659	YES	Y
14	Minister of Education	5061	YES	Y
15	Minister of Immigration	5500	NO	Y
16	Minister of Police	5715	NO	Y
16	Minister of Police	5717	YES	Y
16	Minister of Police	5703	YES	Y
16	Minister of Police	5718	YES	Y
16	Minister of Police	5722	YES	Y
16	Minister of Police	5707	YES	Y
16	Minister of Police	5738	YES	Y
16	Minister of Police	5732	YES	Y
16	Minister of Police	5723	YES	Y
16	Minister of Police	5710	YES	Y
16	Minister of Police	5728	YES	Y
16	Minister of Police	5716	YES	Y
16	Minister of Police	5714	YES	Y
16	Minister of Police	5719	YES	Y
16	Minister of Police	5701	YES	Y
16	Minister of Police	5720	YES	Y
16	Minister of Police	5704	YES	Y
16	Minister of Police	5721	YES	Y
16	Minister of Police	5705	YES	Y
16	Minister of Police	5706	YES	Y
16	Minister of Police	5708	YES	Y
16	Minister of Police	5709	YES	Y
16	Minister of Police	5725	YES	Y
16	Minister of Police	5727	YES	Y
16	Minister of Police	5729	YES	Y
16	Minister of Police	5735	YES	Y
16	Minister of Police	5736	YES	Y
16	Minister of Police	5700	YES	Y
16	Minister of Police	5713	YES	Y
16	Minister of Police	5737	YES	Y
16	Minister of Police	5702	YES	Y
16	Minister of Police	5724	YES	Y
16	Minister of Police	5726	YES	Y
16	Minister of Police	5734	YES	Y
16	Minister of Police	5731	YES	Y
18	Minister for Tertiary Education, Skills and Employment	6102	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
18	Minister for Tertiary Education, Skills and Employment	6100	NO	Y
18	Minister for Tertiary Education, Skills and Employment	6101	NO	Y
19	KiwiRail	6303	NO	Y
19	KiwiRail	6307	NO	Y
19	KiwiRail	6306	NO	Y
19	KiwiRail	6301	NO	Y
19	KiwiRail	6300	NO	Y
19	KiwiRail	6302	NO	Y
19	KiwiRail	6304	NO	Y
19	KiwiRail	6305	NO	Y
19	KiwiRail	1556	NO	Y
20	New Zealand Refining Company Ltd	6500	NO	Y
20	New Zealand Refining Company Ltd	6501	NO	Y
21	New Zealand Transport Agency	6727	NO	Y
21	New Zealand Transport Agency	6749	NO	Y
21	New Zealand Transport Agency	6774	NO	Y
21	New Zealand Transport Agency	6731	NO	Y
21	New Zealand Transport Agency	6773	NO	Y
21	New Zealand Transport Agency	6747	NO	Y
21	New Zealand Transport Agency	6722	NO	Y
21	New Zealand Transport Agency	6769	NO	Y
21	New Zealand Transport Agency	6762	NO	Y
21	New Zealand Transport Agency	6758	NO	Y
21	New Zealand Transport Agency	6757	NO	Y
21	New Zealand Transport Agency	6760	NO	Y
21	New Zealand Transport Agency	6761	NO	Y
21	New Zealand Transport Agency	6706	NO	Y
21	New Zealand Transport Agency	6764	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
21	New Zealand Transport Agency	6736	NO	Y
21	New Zealand Transport Agency	6776	NO	Y
21	New Zealand Transport Agency	6742	NO	Y
21	New Zealand Transport Agency	6723	NO	Y
21	New Zealand Transport Agency	6741	NO	Y
21	New Zealand Transport Agency	6738	NO	Y
21	New Zealand Transport Agency	6766	NO	Y
21	New Zealand Transport Agency	6743	NO	Y
21	New Zealand Transport Agency	6768	NO	Y
21	New Zealand Transport Agency	6725	NO	Y
21	New Zealand Transport Agency	6744	NO	Y
21	New Zealand Transport Agency	6740	NO	Y
21	New Zealand Transport Agency	6756	NO	Y
21	New Zealand Transport Agency	6753	NO	Y
21	New Zealand Transport Agency	6751	NO	Y
21	New Zealand Transport Agency	6750	NO	Y
21	New Zealand Transport Agency	6718	NO	Y
21	New Zealand Transport Agency	6715	NO	Y
21	New Zealand Transport Agency	6734	NO	Y
21	New Zealand Transport Agency	6763	NO	Y
21	New Zealand Transport Agency	6759	NO	Y
21	New Zealand Transport Agency	6701	NO	Y
21	New Zealand Transport Agency	6735	NO	Y
21	New Zealand Transport Agency	6765	NO	Y
21	New Zealand Transport Agency	6732	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
21	New Zealand Transport Agency	6728	NO	Y
21	New Zealand Transport Agency	6729	NO	Y
21	New Zealand Transport Agency	6710	NO	Y
21	New Zealand Transport Agency	6770	NO	Y
21	New Zealand Transport Agency	6771	YES	Y
21	New Zealand Transport Agency	6713	NO	Y
21	New Zealand Transport Agency	6717	NO	Y
21	New Zealand Transport Agency	6704	NO	Y
21	New Zealand Transport Agency	6705	NO	Y
21	New Zealand Transport Agency	6707	NO	Y
21	New Zealand Transport Agency	6721	NO	Y
21	New Zealand Transport Agency	6730	NO	Y
21	New Zealand Transport Agency	6726	NO	Y
22	Prime Minister	7100	YES	Y
23	Radio New Zealand Ltd	7300	YES	Y
24	Spark New Zealand Trading Limited	7547	YES	Y
24	Spark New Zealand Trading Limited	7551	YES	Y
24	Spark New Zealand Trading Limited	7550	YES	Y
24	Spark New Zealand Trading Limited	7549	YES	Y
24	Spark New Zealand Trading Limited	7546	YES	Y
24	Spark New Zealand Trading Limited	7548	YES	Y
24	Spark New Zealand Trading Limited	7518	YES	Y
24	Spark New Zealand Trading Limited	7500	NO	Y
25	Television New Zealand Ltd	8301	NO	Y
25	Television New Zealand Ltd	8300	YES	Y
26	Transpower New Zealand Ltd	8519	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
26	Transpower New Zealand Ltd	8510	YES	Y
26	Transpower New Zealand Ltd	8534	NO	Y
26	Transpower New Zealand Ltd	8527	YES	Y
26	Transpower New Zealand Ltd	8500	YES	Y
26	Transpower New Zealand Ltd	8502	NO	Y
26	Transpower New Zealand Ltd	8504	YES	Y
26	Transpower New Zealand Ltd	8528	NO	Y
26	Transpower New Zealand Ltd	8516	NO	Y
26	Transpower New Zealand Ltd	8515	YES	Y
26	Transpower New Zealand Ltd	8512	NO	Y
26	Transpower New Zealand Ltd	8507	NO	Y
26	Transpower New Zealand Ltd	8521	YES	Y
26	Transpower New Zealand Ltd	8514	YES	Y
26	Transpower New Zealand Ltd	8513	NO	Y
26	Transpower New Zealand Ltd	8505	YES	Y
26	Transpower New Zealand Ltd	8506	YES	Y
26	Transpower New Zealand Ltd	8509	YES	Y
26	Transpower New Zealand Ltd	8517	NO	Y
26	Transpower New Zealand Ltd	8525	YES	Y
26	Transpower New Zealand Ltd	8530	NO	Y
26	Transpower New Zealand Ltd	8529	YES	Y
26	Transpower New Zealand Ltd	8503	YES	Y
26	Transpower New Zealand Ltd	8532	NO	Y
26	Transpower New Zealand Ltd	8531	NO	Y
26	Transpower New Zealand Ltd	8533	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
27	Vector Ltd	8842	NO	Y
27	Vector Ltd	8914	YES	Y
27	Vector Ltd	8904	NO	Y
27	Vector Ltd	8840	YES	Y
27	Vector Ltd	8850	YES	Y
27	Vector Ltd	8859	YES	Y
27	Vector Ltd	8903	YES	Y
27	Vector Ltd	8906	YES	Y
27	Vector Ltd	8912	YES	Y
27	Vector Ltd	8907	YES	Y
27	Vector Ltd	8911	NO	Y
27	Vector Ltd	8831	NO	Y
27	Vector Ltd	8905	YES	Y
27	Vector Ltd	8879	YES	Y
27	Vector Ltd	8908	YES	Y
27	Vector Ltd	8909	YES	Y
27	Vector Ltd	8910	YES	Y
27	Vector Ltd	8913	YES	Y
29	Watercare Services Ltd	9463	NO	Y
29	Watercare Services Ltd	9530	YES	Y
29	Watercare Services Ltd	9466	NO	Y
29	Watercare Services Ltd	9468	NO	Y
29	Watercare Services Ltd	9563	YES	Y
29	Watercare Services Ltd	9566	YES	Y
29	Watercare Services Ltd	9372	NO	Y
29	Watercare Services Ltd	9560	NO	Y
29	Watercare Services Ltd	9564	NO	Y
29	Watercare Services Ltd	9565	NO	Y
29	Watercare Services Ltd	9461	NO	Y
29	Watercare Services Ltd	9559	YES	Y
29	Watercare Services Ltd	9465	NO	Y
29	Watercare Services Ltd	9534	NO	Y
29	Watercare Services Ltd	9533	NO	Y
29	Watercare Services Ltd	9370	NO	Y
29	Watercare Services Ltd	9464	NO	Y
29	Watercare Services Ltd	9373	YES	Y
29	Watercare Services Ltd	9561	YES	Y
29	Watercare Services Ltd	9562	YES	Y
29	Watercare Services Ltd	9568	YES	Y
29	Watercare Services Ltd	9374	YES	Y
29	Watercare Services Ltd	9462	NO	Y
29	Watercare Services Ltd	9363	NO	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
29	Watercare Services Ltd	9570	NO	Y
29	Watercare Services Ltd	9546	YES	Y
29	Watercare Services Ltd	9347	YES	Y
29	Watercare Services Ltd	9545	YES	Y
29	Watercare Services Ltd	9364	YES	Y
29	Watercare Services Ltd	9361	YES	Y
29	Watercare Services Ltd	9544	YES	Y
29	Watercare Services Ltd	9539	YES	Y
29	Watercare Services Ltd	9547	YES	Y
29	Watercare Services Ltd	9502	YES	Y
29	Watercare Services Ltd	9328	YES	Y
29	Watercare Services Ltd	9314	YES	Y
29	Watercare Services Ltd	9348	YES	Y
29	Watercare Services Ltd	9537	YES	Y
29	Watercare Services Ltd	9362	YES	Y
29	Watercare Services Ltd	9356	YES	Y
29	Watercare Services Ltd	9538	YES	Y
29	Watercare Services Ltd	9359	YES	Y
29	Watercare Services Ltd	9511	YES	Y
29	Watercare Services Ltd	9310	YES	Y
29	Watercare Services Ltd	9311	YES	Y
29	Watercare Services Ltd	9503	YES	Y
29	Watercare Services Ltd	9519	YES	Y
29	Watercare Services Ltd	9535	YES	Y
29	Watercare Services Ltd	9337	YES	Y
29	Watercare Services Ltd	9340	YES	Y
29	Watercare Services Ltd	9467	YES	Y
29	Watercare Services Ltd	9419	YES	Y
29	Watercare Services Ltd	9427	YES	Y
29	Watercare Services Ltd	9541	YES	Y
29	Watercare Services Ltd	9410	YES	Y
29	Watercare Services Ltd	9409	YES	Y
29	Watercare Services Ltd	9558	YES	Y
29	Watercare Services Ltd	9408	YES	Y
29	Watercare Services Ltd	9513	YES	Y
29	Watercare Services Ltd	9557	YES	Y
29	Watercare Services Ltd	9556	YES	Y
29	Watercare Services Ltd	9442	YES	Y
29	Watercare Services Ltd	9456	YES	Y
29	Watercare Services Ltd	9421	YES	Y
29	Watercare Services Ltd	9552	YES	Y
29	Watercare Services Ltd	9536	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
29	Watercare Services Ltd	9309	YES	Y
29	Watercare Services Ltd	9554	YES	Y
29	Watercare Services Ltd	9367	YES	Y
29	Watercare Services Ltd	9501	YES	Y
29	Watercare Services Ltd	9322	YES	Y
29	Watercare Services Ltd	9543	YES	Y
29	Watercare Services Ltd	9324	YES	Y
29	Watercare Services Ltd	9338	YES	Y
29	Watercare Services Ltd	9555	YES	Y
29	Watercare Services Ltd	9306	YES	Y
29	Watercare Services Ltd	9548	YES	Y
29	Watercare Services Ltd	9550	YES	Y
29	Watercare Services Ltd	9371	YES	Y
29	Watercare Services Ltd	9510	YES	Y
29	Watercare Services Ltd	9303	YES	Y
29	Watercare Services Ltd	9308	YES	Y
29	Watercare Services Ltd	9417	YES	Y
29	Watercare Services Ltd	9366	YES	Y
29	Watercare Services Ltd	9512	YES	Y
29	Watercare Services Ltd	9437	YES	Y
29	Watercare Services Ltd	9302	YES	Y
29	Watercare Services Ltd	9304	YES	Y
29	Watercare Services Ltd	9507	YES	Y
29	Watercare Services Ltd	9508	YES	Y
29	Watercare Services Ltd	9444	YES	Y
29	Watercare Services Ltd	9432	YES	Y
29	Watercare Services Ltd	9418	YES	Y
29	Watercare Services Ltd	9553	YES	Y
29	Watercare Services Ltd	9542	YES	Y
29	Watercare Services Ltd	9323	YES	Y
29	Watercare Services Ltd	9341	YES	Y
29	Watercare Services Ltd	9321	YES	Y
29	Watercare Services Ltd	9500	YES	Y
29	Watercare Services Ltd	9329	YES	Y
29	Watercare Services Ltd	9368	YES	Y
29	Watercare Services Ltd	9353	YES	Y
29	Watercare Services Ltd	9301	YES	Y
29	Watercare Services Ltd	9336	YES	Y
29	Watercare Services Ltd	9335	YES	Y
29	Watercare Services Ltd	9300	YES	Y
29	Watercare Services Ltd	9460	YES	Y
29	Watercare Services Ltd	9531	YES	Y

SUBTYPE	SUBTYPE_resolved	SCHEDULE	PARCEL_BASED _resolved	Capacity _Impacting
29	Watercare Services Ltd	9532	YES	Y
29	Watercare Services Ltd	9459	YES	Y
30	Wiri Oil Services Ltd	9701	YES	Y
32	Minister for Children	3800	YES	Y
32	Minister for Children	3801	YES	Y
32	Minister for Children	3802	NO	Y

Appendix 2: Auckland Council Development Capacity Model look up tables

Introduction

The Auckland Council Development Capacity Model (ACDC) is an FME31 based model that attempts to replicate a commercial developer's site scale development feasibility process using information about urban zone plan enabled opportunities for residential development (capacity) as supplied to it by the Capacity for Growth Study (CfGS) Model.

This document outlines the detailed look up tables (LUTs) utilised by the ACDC Model version 5.0. These Excel tables are updated and attempted to replicate current market conditions. They can be manually varied to test the effect of changes in typology, floorspace, costs and prices on the feasibility of input plan enabled capacity to be commercially realisable given the assumed market.

Variations to zoning or capacity (including spatial application of the zoning) must however be first supplied to the CfGS Model to calculate and supply to the ACDC model the appropriate parcel level data.

[31] Feature Manipulation Engine, an increasingly popular spatially enabled data transformation software package developed by Safe Software www.safe.com

Summary of model

The model has been designed and used to test the potential implications for 'average' development commercial feasibility of variation in planning provisions from the perspective of an 'average' commercially oriented residential developer.

The model uses an approach which is largely 'typical behaviour based' and 'instantaneous' and produces a measurement (not a forecast or projection) of the potential for commercially feasible development in this instant by the developer 'actors', which the model attempts to simulate.

In effect the model assesses, if it is commercially viable to undertake a development in accordance with the rule parameters being tested given current prices and costs. This is not an indication of development definitely occurring either now, or soon, but rather a further filter on plan enabled capacity indicating a cascade of probability from highly possible to very unlikely. Given a population of 'all sites', we assume that sites with plan enabled capacity have a higher probability of development than sites without plan enabled opportunities, and of those with plan enabled potential, where that potential is feasible are more likely to have that potential realised than those that do not. In other words, the assessment is probabilistic, not deterministic.

The outputs therefore are not a 'growth forecast' but rather a more refined or filtered version of plan enabled capacity that is a measure of the opportunities for the development market to deliver under "today's" conditions presuming also that the planning rules and zoning being tested also applied. Considerations of other instants and other actors might require different approaches, including the extension of the results into a forecast also requiring consideration of the potential effect on the n+1th supplier given the nth suppled dwelling and subsequent demand interactions on prices and costs.

The 'actors' whose decision-making process the model attempts to replicate is an 'average developer' who builds and sells dwellings on the sites with dwelling capacity within the model in accordance with the parameters set by the LUTs around costs and prices – specific site conditions are accounted for by influencing the input capacity and development options, land values, site conditions, various costs to overcome constraints, and, expected sale prices.

The model is 'instantaneous' in two ways –

Firstly, the costs and prices are fixed by the LUT as at the time of LUT construction. For this assessment, land, improvement, and overall development site costs are based on the 2017 Valuations with sales locations based 'factoring' to inflate the land component from 2017 and October 2020.

Secondly, the expected costs and prices do not vary in response to 'supply' (being feasible developments produced from other sites within the model irrespective of if this

is low or high) or ‘demand’ – which is entirely exogenous to the model – if the development option on the particular site in front of the models ‘average developer’ will return more than 20 per cent on costs (or wherever the feasibility threshold happens to be set), then the site is reported as being commercially feasible by the model.

In this sense the model is very strongly a ‘commercial’ model – testing the relative attractiveness for development of sites tested against all the other sites that are tested – it is NOT an ‘economic’ model (which would account for all of the individual suppliers actions in consideration of both the actions of consumers AND other suppliers) , nor can the feasibility output be considered a ‘forecast or projection’ – it is a measure of sites passing our thresholds given an instantaneous assessment – in reality developers will be cognisant of the demand and supply situations within which they operate and the costs, prices and market response rarely remains static particularly over the long term.

The outputs of the model may be considered as an instantaneous supply curve – demand is considered only implicitly in the model by way of consideration of the expected sale price, or externally by comparing a quantum of demand (over some time period) against the instantaneous supply.

However, the outputs of this ‘commercial’ modelling will provide for a much-refined filtering of potential development outcomes than the CfGS provides (being the totality of the opportunities provided by regulation) and furthermore dynamic economic modelling and analysis that can account for these complex interactions, including over time can be undertaking using this information.

ACDC Model

The model is developed and run in FME software. Input site capacity data is input as a file geodatabase (a polygon geometry representing the shape of the site, and an attribute table associated with the details about the site) and filtered to different development building pathways depending on zoning, each site with capacity (infill or redevelopment) is then cloned, once for each of the typologies to be tested, and each clone is allocated a specific development option and its associated costs and prices to calculate feasibility. The individual site clone's developments are then filtered for feasibility, those that are feasible (return greater than minimum threshold) are ranked according to the feasibility scenario, such as maximum percentage return or cheapest dwellings. On sites with a single feasible option that same development will occur in all scenarios, on those with multiple feasible developments will vary.

FME uses the 'Joiner' transformer to attach the appropriate value based on Typology and Sales Location Category from the relevant Lookup Table (LUT) to each site (or site clone) passing though the model. This report outlines the LUTs that are joined, and a brief description of their function.

The Model undertakes its operations in three key stages, each with its own workbench.

Stage 1: Convert CfGS output for feasible calculation

Stage 2: Feasibility Calculations (this calculates the feasibility of each of the nine development typologies possible within the zone and practical limits of the parcel per infill or redevelopment opportunity identified by the CfGS)

Stage 3: Parcel Filtering (this step removes parcels for various non-zoning reasons such as HNZC ownership or existing uses)

Stage 4: Scenario Choosing (this step choses from the (up to) 18 development options per site, a single feasible development (or none if none are feasible) that best matches the Scenario. Maximum Return (highest gross profit) to the developer is used as the 'default' in most results reporting as this will generally reflect a developers first choice option, however the other scenarios provide an indication of the scope for the market to deliver alternate, still feasible development opportunities.

Figure 1a and 1b below illustrates the FME workbench for Stage 2, with numbers relating to each Joiner and LUT in the order in which they are tagged to each parcel.

The following sections of this memo contain the relevant Lookup Tables as they have been utilised in Version 5.0 of the model

Figure 1a: ACDC v5.0 Model Workspace: Primary FDC Model with LUT joiner locations in workflow order of join (part 1)

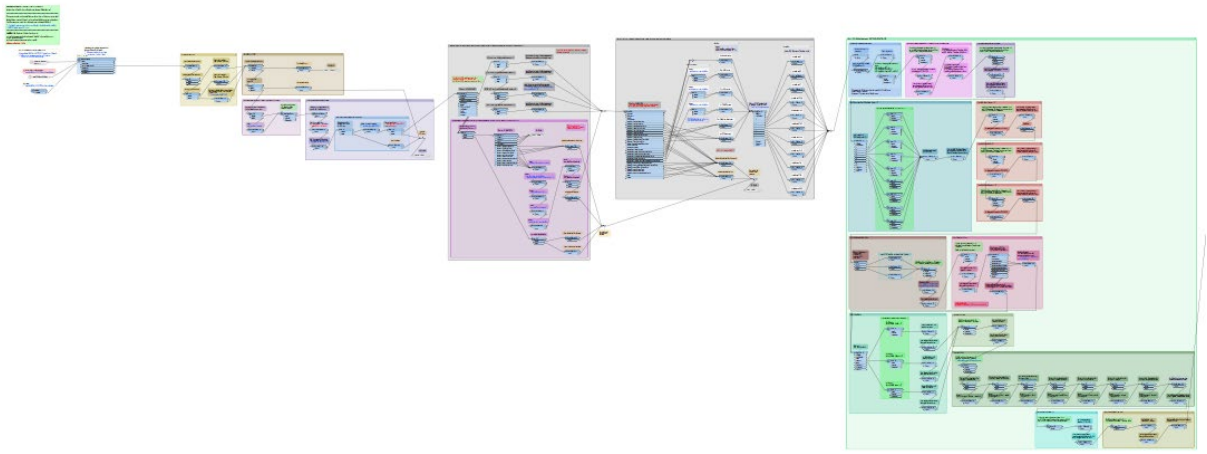


Figure 1b: ACDC v5.0 Model Workspace: Primary FDC Model with LUT joiner locations in workflow order of join (part 2)

Table 1: LUT Joiners

Change from v3.7	Joiner Flow Order	Joiner ID	Group	LUT	Joined on Attribute	Establishes	Reason to Update?	What has been done (2021)
	1	0	Sales (Location)	Sales_Location_Category_LUT.xlsx	CAU	Sales Location Category (SLC)	Changes to spatial distributions of dwelling prices	Updated using past two years property transaction records
	2	12	Sales (Price)	Sales_PriceCeilings_LUT.xlsx	SLC (1-10)	Reference Price Ceiling for 'standard' dwelling in SLC	Changes to price distributions of dwelling sales	Updated using past two years property transaction records
	3	13	Floorspace	Typology_Matrix_Code_LUT	Built Form ID (1-9)	Establish 9 Typologies (SML, HTA)		Not changed
	4	4	Floorspace	FloorspaceTypologyCode_LUT.xlsx	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Floorspace_typology_Initial	Changes to rules	Not changed
	5	18	Floorspace	FloorspaceTypologyCode_BuildCosts_LUT	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Dwelling Typology Code (A-K), by 9 Locations		Not changed
	6	19, 8, 10, 20, 21, 22, 23, 24, 25	Floorspace	FloorspaceArea_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	Based on the Built Form ID, each dwelling form/parcel clone has a floorspace table	Changes to rules	Not changed
NEW!	7	9	Floorspace	FloorspaceBuiltForm_Density_LUT	FDC_DwellingFloorspace_Typology_Code	Max Storeys, Building Coverage, Imperviousness and Density based on zoning and typoology	Changes to Rules	Not changed - reflect AUP rule
NEW!	8	28	Floorspace	FloorspaceBuiltForm_FAR_LUT	FDC_DwellingFloorspace_Typology_Code	Maximum practical/rule limited FAR	Changes to Rules	Not changed - reflect AUP rule
	9	27	Floorspace	FloorspaceBuiltForm_SLFactor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	FDC_BuiltForm_Factor - Adjustment factor for XXX based on typology		Not changed
	10	2	Costs	Costs_ProfFees_LUT.xlsx	FDC_dwelling_typology_code	Per unit and site % fees	Changes to costs (time)	Not changed
	11	3	Costs	Costs_Demolition_LUT.xlsx	FDC_dwelling_typology_code	Single Unit demo Cost and multiunit multiplier factors	Changes to costs (time)	Adjusted by inflation rate - CGPI 2020Q3 Land clearing and establishment
MAJOR AMENDMENT	12	6	Costs	Costs_DCsandConnections_LUT.xlsx	FDC_BuiltForm (Apartment, House, Terrace)	DCs (HUE and SW/m2) and Phone and Power Connections	Changes to costs (time) or changes to DC Policy	Adjusted to 2019 DC and WSL IGC
	13	15, 16, 17	Costs	Costs_FSBuild_**<size>**_LUT.xlsx	FDC_Dwellingnfloorspace_BuildCost_Typology_Code	One Table for each S, M, L based on location	Changes to costs (time)	Adjusted to reflect external consultant input
	14	5	Costs	Costs_SiteCivil_LUT.xlsx	FDC_dwelling_typology_code	Site Civil Costs per site m2	Changes to costs (time)	Adjusted by inflation rate - CGPI 2020Q3 Earthmoving and site work
	15	7	Costs	Costs_Constraints_LUT.xlsx	FDC_dwelling_typology_code	Site costs related to intersection with constraints	Changes to costs (time) and constraints	Not changed
	16	14	Sales (Price)	Sales_PriceCeiling_Factor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	Adjustment to standard dwelling ceiling based on typology	Changes to price distributions of dwelling sales	Recent sales data
	17	11	Sales (Price)	Sales_PriceFS_LUT.xlsx	FDC_Dwelling_BuildCost_Typology_Code	Sale Price per m2 based on location and typology	Changes to price distributions dwelling sales	Recent sales data
NEW!	18	26	Costs	Costs_SiteCV_Adjustment_LUT.xlsx	SLC (1-10)	Developable Site costs to model to account for difference between LCV and modelling date	Changes to costs (time), price and spatial distributions of dwelling sales	Updated with latest CV and recent sales data

Table 2: LUT Details and relationships

Group	LUT	Joined on Attribute	Establishes
Sales (Location)	Sales_Location_Category_LUT.xlsx	SA2	Sales Location Category (SLC)
Sales (Price)	Sales_PriceCeilings_LUT.xlsx	SLC (1-10)	Reference Price Ceiling for 'standard' dwelling in SLC
Floorspace	Typology_Matrix_Code_LUT	Built Form ID (1-9)	Establish 9 Typologies (SML, HTA)
Floorspace	FloorspaceTypologyCode_LUT.xlsx	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Floorspace_typology_Initial
Floorspace	FloorspaceTypologyCode_BuildCosts_LUT	FDC_Floorspace_Typology_Initial (A1 - K15)	FDC_Dwelling Typology Code (A-K), by 9 Locations
Floorspace	FloorspaceArea_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	Based on the Built Form ID, each dwelling form/parcel clone has a floorspace table
Floorspace	FloorspaceBuiltForm_Density_LUT	FDC_DwellingFloorspace_Typology_Code	Max Storeys, Building Coverage, Imperviousness and Density based on zoning and typoology
Floorspace	FloorspaceBuiltForm_FAR_LUT	FDC_DwellingFloorspace_Typology_Code	Maximum practical/rule limited FAR
Floorspace	FloorspaceBuiltForm_SLFactor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	FDC_BuiltForm_Factor - Adjustment factor for XXX based on typology
Costs	Costs_ProfFees_LUT.xlsx	FDC_dwelling_typology_code	Per unit and site % fees
Costs	Costs_Demolition_LUT.xlsx	FDC_dwelling_typology_code	Single Unit demo Cost and multiunit multiplier factors
Costs	Costs_DCsandConnections_LUT.xlsx	FDC_BuiltForm (Apartment, House, Terrace)	DCs (HUE and SW/m2) and Phone and Power Connections
Costs	Costs_FSBuild_**<size>**_LUT.xlsx	FDC_Dwellingnfloorspace_BuildCost_Typology_Code	One Table for each S, M, L based on location
Costs	Costs_SiteCivil_LUT.xlsx	FDC_dwelling_typology_code	Site Civil Costs per site m2
Costs	Costs_Constraints_LUT.xlsx	FDC_dwelling_typology_code	Site costs related to intersection with constraints
Sales (Price)	Sales_PriceCeiling_Factor_LUT.xlsx	FDC_DwellingFloorspace_Typology_Code	Adjustment to standard dwelling ceiling based on typology
Sales (Price)	Sales_PriceFS_LUT.xlsx	FDC_Dwelling_BuildCost_Typology_Code	Sale Price per m2 based on location and typology
Costs	Costs_SiteCV_Adjustment_LUT.xlsx	SLC (1-10)	Developable Site costs to model to account for difference between LCV and modelling date

Sales_Location_Category_LUT

This LUT is a list of all SA2s in Auckland region tagged with a 'Sales Location Category' and a 'GF_Sales_Location_Category' from one to ten inclusive.

This works in conjunction with the Sales_PriceCeiling_LUT in the next section.

The 'reference development' is a 'standard' house on a 600 square metre (sqm) section. Values are based on recent sales (past two years) of standalone dwellings, but manually adjusted for various known anomalies including lack of standalone dwelling sales (e.g., City Centre) and inflated average prices due to greenfield developments (e.g., Flat Bush, Hobsonville). Sales Location Categories from v3.9 have been reused, reflecting the narrative that prices have risen since 2017.

A new Field, GF_Sales_Location_Categories are set using average sale prices of NEW dwellings from websites and advertising, Sales Audit File (DVRS from Rates) and other information on current asking and sales prices, which are then classified against the Sales Location Category Price Ceiling LUT min and max ranges. As a general rule, the GF Sales Location Category is higher than the 'other half' of the SA2, sometimes several steps higher. This may reflect a potentially over inflated greenfield market, or an underestimated adjoining urban area assumption. The GF vs existing SLC differential is most noticeable in outer edge and rural town peripheries. The GF Sales Location Categories are only used by the GF_ACDC Model but all SA2s have been classified.

Sales Location Category 1 Locations are areas where the lowest average expected sales values in the region would be expected, Sales Location Category 10 locations are those where the highest sales values would be expected for an 'average' standalone dwelling.

The Central and East Coastal areas are typically higher value with prices decreasing by distance from these areas, largely reflecting the underlying land value per sqm patterns – these reflect where the market has determined that access to amenities is highest, and therefore dwellings tend to sell for more, all else being equal. The predominant amenities are generally accepted to be proximity to the City Centre and views of the Hauraki Gulf. Other more localised factors do also play a role in providing texture to the land value patterns, including school zoning (the Double Grammar Zone effect), localised views and access to smaller centres or transport.[32] These highly

[32] For more on the potential factors driving variation in house prices due to amenities see also Nunns, Peter, Hitchins, Hadyn and Balderston, Kyle (2015). *The value of land, floorspace and amenities: a hedonic price analysis of property sales in Auckland 2011-2014*. Auckland Council technical report, TR2015/012 and Nunns, P., Allpress, J and Balderston, K (2016). *How do Aucklanders value their parks? A hedonic analysis of the impact of proximity to open space on residential property values*. Auckland Council technical report, TR2016/031.

specific locational issues are somewhat smoothed (lost) by the SA2 level price settings.

Pockets of low sale price areas within the urban areas are concentrated in South Auckland and to a lesser degree West Auckland, and some of the remote areas.

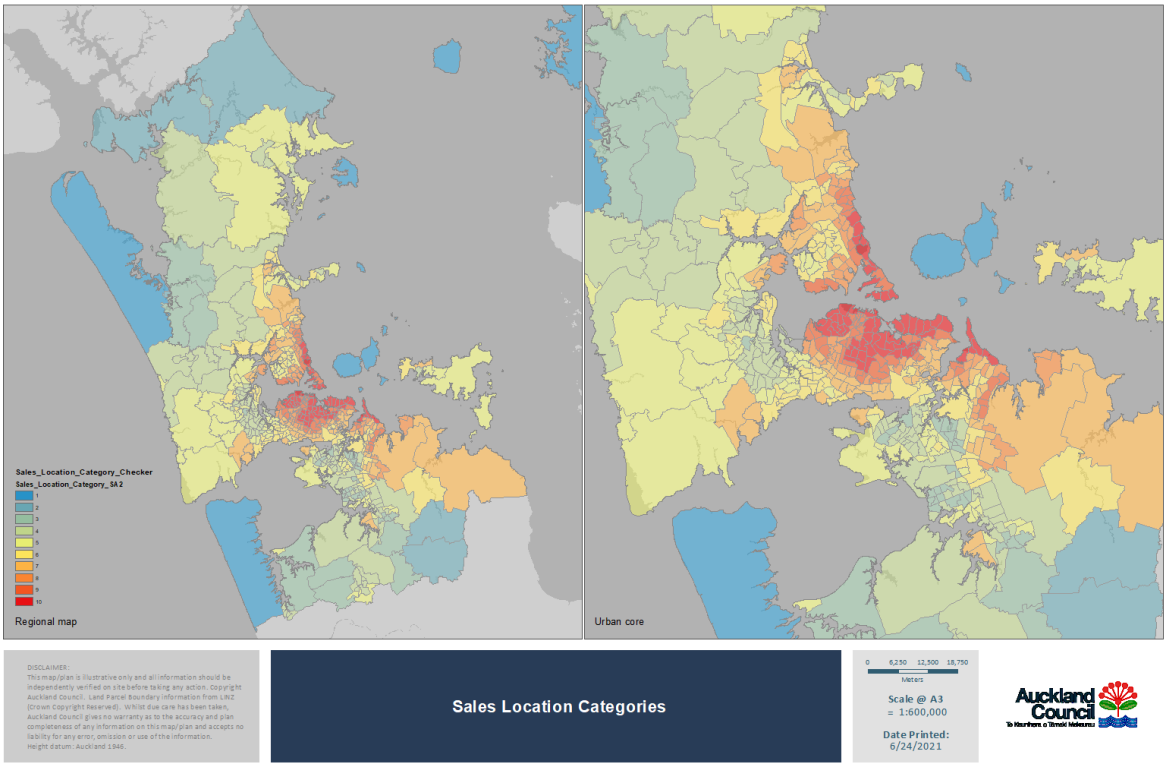
A sample table (the actual table is over 500 rows) is shown in Table 3 below, and maps showing the Categorisation for both ACDC and GFACDC (highlighting the SA2s that apply) are shown in

Figure **2:** below.

Table 3: Extract from Sales Location Category LUT (example only)

SA2_Code	SA2_Description	GF_Sales_Location_Category_Check	Sales_Location_Category_Check
110900	Dome Valley-Matakana	3	8
111100	Warkworth West	1	6
111200	Puhoi Valley	1	7
112800	Hatfields Beach	8	7
113000	Orewa Central	2	6
114100	Silverdale South (Auckland)	5	5
114300	Gulf Islands	1	3
114400	Vipond	1	8
114700	Kumeu Rural West	3	10
114800	Okura Bush	6	10
115100	Stanmore Bay East	2	4
121300	Sunnynook North	3	9
136700	Titirangi South	1	7
137300	Green Bay North	2	7
137500	Laingholm	8	7
138900	Blockhouse Bay South	4	9
140600	Three Kings West	3	9
141700	Epsom South	10	10

Figure 2: Sales Location Category LUT



Sales_PriceCeilings_LUT

This LUT exists to moderate the effect of the Floorspace_Area and Sales_FS_Price per sqm LUTs (floorspace area x floorspace price = dwelling sale price) constructing dwellings that are too far out of the price range (mainly above) for the sales location to support. However, ideally the Floorspace Area would be calibrated to ensure that when multiplied by the Sale Price per sqm value would not exceed the Price Ceiling.

The price ceiling is based on the reference sale price (based on an expected sale price for a 'standard' standalone dwelling of average age and condition in that location – effectively a Medium House) used to classify the Sale Locations in the first place, (note the legend in the map on the preceding pages).

The Price ceiling is set for each Typology by a combination of the Reference Sale Price Max from the Sales_PriceCeilings_LUT below and the Price Ceiling Factor based on the form in the FloorspaceBuiltForm_LUT.

Typology Price Ceiling = Reference Sale Price Max x Typology Price Ceiling Factor

This is variable by typology due to the relationship between the cost of 'new' dwellings generally (which the model is building and selling) and all existing dwellings which include a proportion of second hand dwellings (which would sell at a discount to new product all else being equal), and the relativity between prices paid for various typologies and the reference dwelling (standalone) – a detached dwelling will typically sell at a premium to attached products, all else being equal.

Ideally, the combination of dwelling floor area and sale price per sqm will be reviewed and the floor area calibrated to the (typology factored) Sale price celling prior to running the model. Testing the feasibility of dwellings that are too expensive for the location is unnecessary, as while they may be 'feasible' it is likely because they are overpriced, and therefore would not sell.

Table 4: Price ceilings LUT

Sales_Location_Category	Reference_Sale_Price_Min	Reference_Sale_Price_Max
1		600000
2	600000	760000
3	760000	870000
4	870000	980000
5	980000	1090000
6	1090000	1200000
7	1200000	1350000
8	1350000	1550000
9	1550000	1800000
10	1800000	

Note that location 10 has no upper limit on prices so a ceiling is not imposed (all commercially feasible developments are carried forward)

Change Narrative vs v3.9

Minimum and Maximum ceiling prices are updated to reflect current market conditions.

Typology_Matrix_Code_LUT

This LUT sets up the relationship between the typologies and their names.

In order to test nine different developments per capacity opportunity, each site is 'cloned' nine times, the FDC_Built_Form_ID joins to the Clone iteration ID (Table 5).

More or less development options are possible but would require population of all of the other LUTs to match, and it is expected that the nine developments below would cover most requirements.

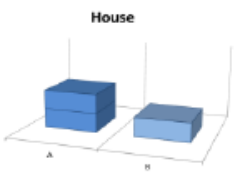
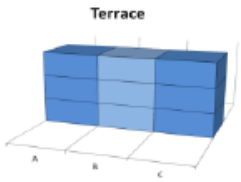
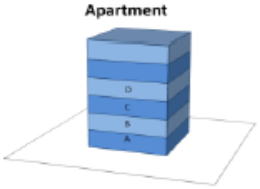
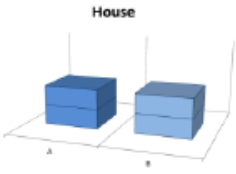
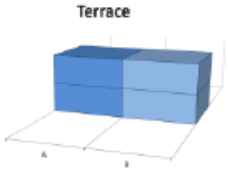
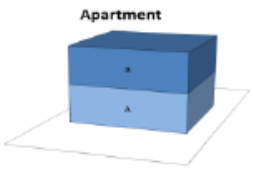
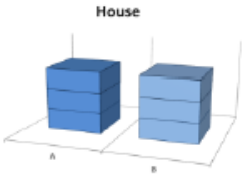
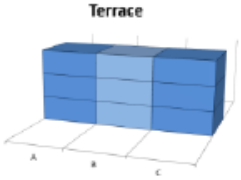
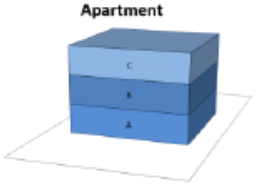
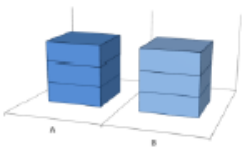
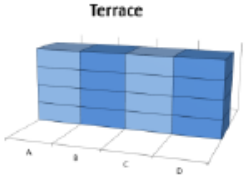
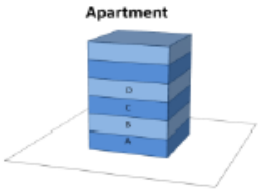
Table 5: Typology Matrix Code LUT

FDC_BuiltForm_ID	FDC_BuiltForm	FDC_BuiltForm_Size	FDC_BuiltForm_Name
1	Apartment	Small	Apartment Small
2	Terrace	Small	Terrace Small
3	House	Small	House Small
4	Apartment	Medium	Apartment Medium
5	Terrace	Medium	Terrace Medium
6	House	Medium	House Medium
7	Apartment	Large	Apartment Large
8	Terrace	Large	Terrace Large
9	House	Large	House Large

This approach was established in version 3 due to the thoughts, for example, the single optimised development per site may not be well optimised, and that depending on various factors, the most intensive development per site will not always be feasible (e.g., terrace developments occur in apartment zones, etc.). In this application, more intensive forms are also tested on sites that in theory would not permit them, but

Figure **4** below should provide some further reference points for why this may not necessarily be the case.

Figure 4: Typology formats within different densities/zones

	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)

Change Narrative vs v3.9

No change applied.

FloorspaceTypologyCode_LUT

This LUT is arguably no longer required, as the initial typology set by the model (based on zoning and capacity of the incoming development site) is maintained (all typology options are equal across typologies).

It was quicker to maintain this LUT in an amended form than amend the model to deal with its absence. The retention of the LUT also permits future models to have more complex (or simpler) arrangements with the floorspace typology options if required.

Table 6: Floorspace Typology Code LUT

FDC_Floorspace_Typology_Initial	1	2	3	4	5	6	7	8	9
Typology Name	Apartment Small	Terrace Small	House Small	Apartment Medium	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
A1	A1	A1	A1	A1	A1	A1	A1	A1	A1
B1	B1	B1	B1	B1	B1	B1	B1	B1	B1
C1	C1	C1	C1	C1	C1	C1	C1	C1	C1
F1	F1	F1	F1	F1	F1	F1	F1	F1	F1
F2	F2	F2	F2	F2	F2	F2	F2	F2	F2
F3	F3	F3	F3	F3	F3	F3	F3	F3	F3
G1	G1	G1	G1	G1	G1	G1	G1	G1	G1
G2	G2	G2	G2	G2	G2	G2	G2	G2	G2
G3	G3	G3	G3	G3	G3	G3	G3	G3	G3
K1	K1	K1	K1	K1	K1	K1	K1	K1	K1
K2	K2	K2	K2	K2	K2	K2	K2	K2	K2
K3	K3	K3	K3	K3	K3	K3	K3	K3	K3
K4	K4	K4	K4	K4	K4	K4	K4	K4	K4
K5	K5	K5	K5	K5	K5	K5	K5	K5	K5
K6	K6	K6	K6	K6	K6	K6	K6	K6	K6
K7	K7	K7	K7	K7	K7	K7	K7	K7	K7
K8	K8	K8	K8	K8	K8	K8	K8	K8	K8
K9	K9	K9	K9	K9	K9	K9	K9	K9	K9
K10	K10	K10	K10	K10	K10	K10	K10	K10	K10
K11	K11	K11	K11	K11	K11	K11	K11	K11	K11
K12	K12	K12	K12	K12	K12	K12	K12	K12	K12
K13	K13	K13	K13	K13	K13	K13	K13	K13	K13
K14	K14	K14	K14	K14	K14	K14	K14	K14	K14
K15	K15	K15	K15	K15	K15	K15	K15	K15	K15

FloorspaceTypologyCode_BuildCosts_LUT

This LUT is no longer required. However, the process is kept to enable dwelling typology tests.

This table sets the details of the Floorspace typology building costs as set by the previous Floorspace Typology Code, which varies by Dwelling Typology Code (small Apartment though Large House).

E.g., on sites identified as an A1 Floorspace Typology Code option, a Small Apartment (Dwelling Typology 1) costs are drawn from Dwelling Typology Code I costs, but a small House is developed using A costs. These may vary by location depending on the values in the LUTs that reference this code and relate mainly to the density of the final product (which is a function of the rules – large houses in single House zone have A costs, B costs in the Mixed Housing Suburban and Urban Zones but C costs in more intensive zones)

(these Cost LUTS include Site Civil Costs, Constraints, Demolition Costs, and Professional fees)

Table 7: FloorspaceTypologyCode_BuildCosts_LUT

FDC_Dwelling_Typology_Code	1	2	3	4	5	6	7	8	9
Typology_Name	Apartment Small	Terrace Small	House Small	Apartment Mediu m	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
A1	I	D	A	I	D	A	I	D	A
B1	I	D	B	I	D	B	I	D	B
C1	I	E	B	I	E	B	I	E	B
F1	I	F	C	I	F	C	I	F	C
F2	I	F	C	I	F	C	I	F	C
F3	I	F	C	I	F	C	I	F	C
G1	J	G	C	J	G	C	J	G	C
G2	J	G	C	J	G	C	J	G	C
G3	J	G	C	J	G	C	J	G	C
K1	K	H	C	K	H	C	K	H	C
K2	K	H	C	K	H	C	K	H	C
K3	K	H	C	K	H	C	K	H	C
K4	K	H	C	K	H	C	K	H	C
K5	K	H	C	K	H	C	K	H	C
K6	K	H	C	K	H	C	K	H	C
K7	K	H	C	K	H	C	K	H	C
K8	K	H	C	K	H	C	K	H	C
K9	K	H	C	K	H	C	K	H	C
K10	K	H	C	K	H	C	K	H	C

FDC_Dwelling_Typology_Code	1	2	3	4	5	6	7	8	9
Typology_Name	Apartment Small	Terrace Smal l	House Smal l	Apartment Mediu m	Terrace Medi um	House Medi um	Apartment Large	Terrace Larg e	House Larg e
K11	K	H	C	K	H	C	K	H	C
K12	K	H	C	K	H	C	K	H	C
K13	K	H	C	K	H	C	K	H	C
K14	K	H	C	K	H	C	K	H	C
K15	K	H	C	K	H	C	K	H	C

FloorspaceArea_LUT

Based on the Typology Code set up previously, the expected floorspace area of the dwelling is set based on the dwelling's location and typology. The LUT has been coloured to highlight the range of values.

Note that it is this set of inputs that are adjusted to calibrate the dwelling sale prices to the price ceilings (this is the reason for the sub m² values), on the basis that the per sqm build costs are relatively fixed and knowable33, and the floor area of the building is both easily adjustable by the developer and has a direct influence on consumers purchase price behaviour.

Dwelling Floorspace Area values are joined on the Dwelling Floorspace Typology Code by Sales Location, with a sheet for each dwelling typology (small apartment (code 1) though large house (code 9).

Figures (5a and 5b) below illustrate the variation between Typology (and Size) and Location using the top and bottom rows of the following tables (being A1: Single House on 500m^2 and k15 Town Centre 30+ levels).

As an example, within a Sales Location 10 area, Large Houses could be between 300 and 200m^2 depending on zone small apartments could be between 120 and 49m^2 depending on zone. In Sales Location 1 areas the range of potential size options is much narrower reflecting the reduced flexibility possible within much lower budgets/price ceilings.

Ultimately the size and zone variations alone allow the testing of 10 Sales Locations x 9 Development Typologies x24 Floorspace Typology Codes = 2160 different dwelling possibilities across the urban zones of the region. While this may seem like many options it is a fraction of the permutations of consented construction and a very small fraction of all the permutations run that are not progressed by developers and owners.

Conversely, this level of diversity imposes a significant deadweight on checking, reviewing, and updating the model and as can be seen in the tables many of the rows have minimal variation (e.g., all K types over five stories have the same values).

[33] In this instance the calibration assumption assumes the relationship between build cost and size are directly linear, which is incorrectly, but probably appropriate

Figure 5a: Dwelling size variation by sales locations

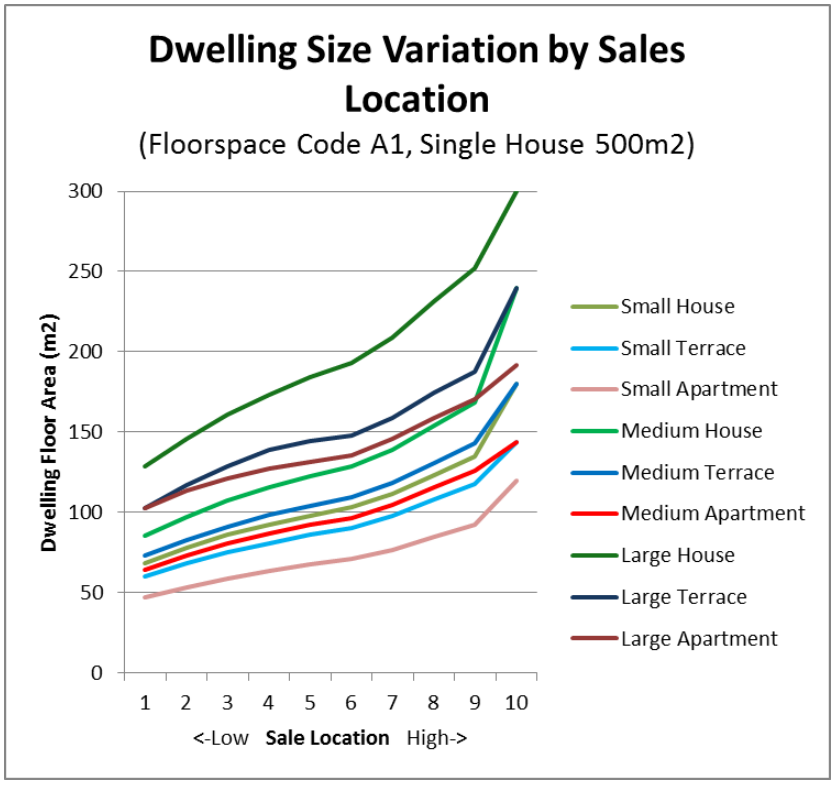


Figure 5b: Dwelling size variations by sales locations

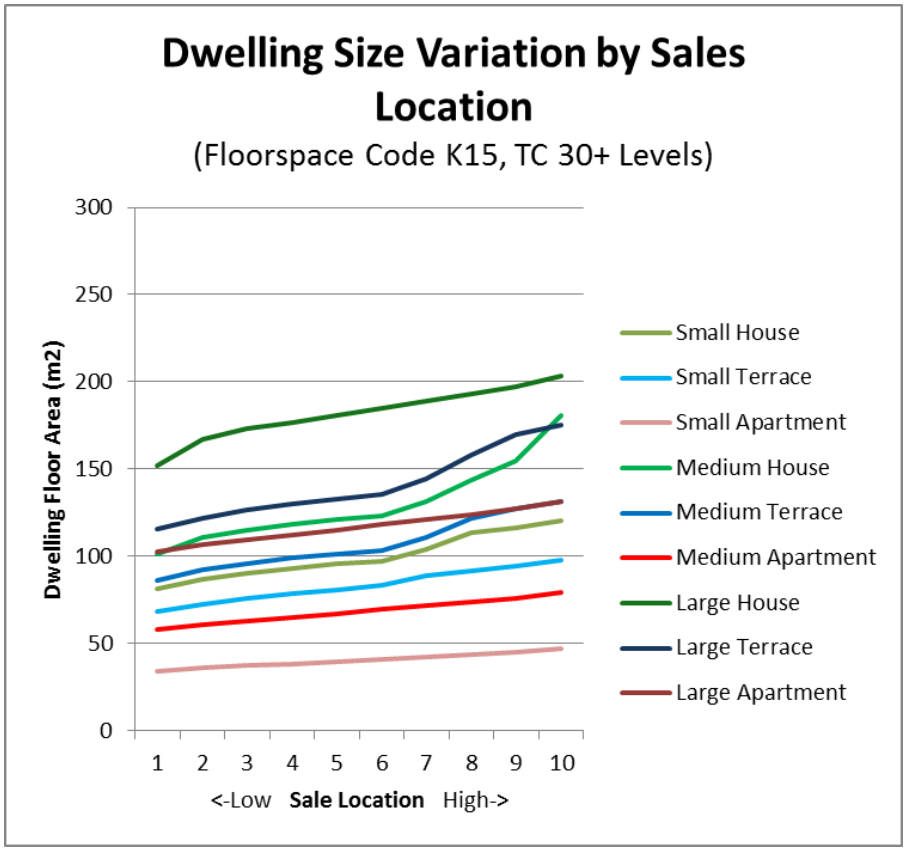


Table 8: Floorspace Area LUT, Small Apartment

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	47.14	53.59	59.05	63.58	67.50	70.92	76.61	84.81	92.54	120.00
B1	MH Sub: 4	51.56	58.97	64.03	69.19	74.45	76.76	79.87	83.81	87.81	91.08
C1	MH Urb: 4	47.60	51.17	54.81	58.52	61.68	63.63	65.61	67.62	69.66	72.38
F1	THAB 3 Le	42.08	43.99	45.46	46.95	48.46	50.00	51.55	53.13	54.73	56.87
F2	THAB 4 Le	37.80	39.53	40.85	42.20	43.56	44.95	46.35	47.78	49.22	51.15
F3	THAB 5 Le	37.35	39.06	40.38	41.71	43.07	44.44	45.84	47.25	48.69	50.60
G1	MU 3 Leve	42.08	43.99	45.46	46.95	48.46	50.00	51.55	53.13	54.73	56.87
G2	MU 4 Leve	37.80	39.53	40.85	42.20	43.56	44.95	46.35	47.78	49.22	51.15
G3	MU 5 Leve	37.35	39.06	40.38	41.71	43.07	44.44	45.84	47.25	48.69	50.60
K1	TC 3 Level	38.25	39.99	41.33	42.68	44.06	45.45	46.87	48.30	49.76	51.70
K2	TC 4 Level	37.80	39.53	40.85	42.20	43.56	44.95	46.35	47.78	49.22	51.15
K3	TC 5 Level	37.35	39.06	40.38	41.71	43.07	44.44	45.84	47.25	48.69	50.60
K4	TC 6 Level	36.90	38.60	39.90	41.23	42.57	43.94	45.32	46.73	48.15	50.05
K5	TC 7 Level	36.68	38.36	39.66	40.98	42.32	43.68	45.06	46.46	47.88	49.78
K6	TC 8 Level	36.45	38.13	39.43	40.74	42.08	43.43	44.81	46.20	47.62	49.50
K7	TC 9 Level	36.23	37.90	39.19	40.50	41.83	43.18	44.55	45.94	47.35	49.23
K8	TC 10 Lev	36.00	37.67	38.95	40.26	41.58	42.93	44.29	45.68	47.08	48.95
K9	TC 11 Lev	35.78	37.43	38.71	40.01	41.33	42.67	44.03	45.41	46.81	48.68
K10	TC 12 Lev	35.55	37.20	38.48	39.77	41.09	42.42	43.78	45.15	46.55	48.40
K11	TC 13-15 L	35.33	36.97	38.24	39.53	40.84	42.17	43.52	44.89	46.28	48.13
K12	TC 16-18 L	35.10	36.74	38.00	39.29	40.59	41.92	43.26	44.63	46.01	47.85
K13	TC 18-25 L	34.88	36.50	37.76	39.04	40.34	41.66	43.00	44.36	45.74	47.58
K14	TC 25-30 L	34.65	36.27	37.53	38.80	40.10	41.41	42.75	44.10	45.48	47.30
K15	TC 30+ Le	34.43	36.04	37.29	38.56	39.85	41.16	42.49	43.84	45.21	47.03

Table 9: Floorspace Area LUT, Small Terrace

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	60.00	68.20	75.16	80.92	85.91	90.26	97.50	107.94	117.78	144.00
B1	MH Sub: 4(	65.63	77.78	84.00	89.09	93.33	96.92	104.00	108.00	112.00	115.00
C1	MH Urb: 4(	65.63	77.78	84.00	89.09	93.33	95.95	97.85	99.75	101.65	104.50
F1	THAB 3 Le	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
F2	THAB 4 Le	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
F3	THAB 5 Le	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G1	MU 3 Leve	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G2	MU 4 Leve	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G3	MU 5 Leve	70.00	75.83	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
K1	TC 3 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K2	TC 4 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K3	TC 5 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K4	TC 6 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K5	TC 7 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K6	TC 8 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K7	TC 9 Level	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K8	TC 10 Lev	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K9	TC 11 Lev	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K10	TC 12 Lev	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K11	TC 13-15 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K12	TC 16-18 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K13	TC 18-25 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K14	TC 25-30 L	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01
K15	TC 30+ Le	68.11	72.39	75.76	78.57	80.98	83.13	88.99	91.67	94.37	98.01

Table 10: Floorspace Area LUT, Small House

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	68.57	77.95	85.90	92.49	98.18	103.16	111.43	123.36	134.61	180.00
B1	MH Sub: 4(	75.00	88.89	96.00	101.82	106.67	110.77	120.00	129.60	134.40	138.00
C1	MH Urb: 4(	75.00	88.89	96.00	101.82	106.67	110.77	120.00	126.00	128.40	132.00
F1	THAB 3 Le	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
F2	THAB 4 Le	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
F3	THAB 5 Le	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
G1	MU 3 Leve	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
G2	MU 4 Leve	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
G3	MU 5 Leve	83.33	90.95	96.00	100.07	103.47	106.36	111.03	113.77	116.52	120.40
K1	TC 3 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K2	TC 4 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K3	TC 5 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K4	TC 6 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K5	TC 7 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K6	TC 8 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K7	TC 9 Level	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K8	TC 10 Lev	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K9	TC 11 Lev	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K10	TC 12 Lev	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K11	TC 13-15 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K12	TC 16-18 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K13	TC 18-25 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K14	TC 25-30 L	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40
K15	TC 30+ Le	81.08	86.82	90.35	93.17	95.51	97.50	104.20	113.77	116.52	120.40

Table 11: Floorpsace_Area_LUT, Medium Apartment

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	64.29	73.08	80.53	86.71	92.04	96.71	104.47	115.65	126.20	144.00
B1	MH Sub: 4(	70.31	81.00	87.00	93.00	99.00	101.00	104.00	108.00	112.00	115.00
C1	MH Urb: 4(	70.31	83.33	90.00	95.00	99.00	101.00	103.00	105.00	107.00	110.00
F1	THAB 3 Le	72.90	76.17	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
F2	THAB 4 Le	68.09	71.15	73.48	75.85	78.26	80.70	83.17	85.68	88.22	91.63
F3	THAB 5 Le	63.36	66.22	68.40	70.62	72.86	75.14	77.46	79.80	82.18	85.36
G1	MU 3 Leve	72.90	76.17	78.66	81.19	83.75	86.36	88.99	91.67	94.37	98.01
G2	MU 4 Leve	68.09	71.15	73.48	75.85	78.26	80.70	83.17	85.68	88.22	91.63
G3	MU 5 Leve	63.36	66.22	68.40	70.62	72.86	75.14	77.46	79.80	82.18	85.36
K1	TC 3 Level	64.80	67.70	69.92	72.17	74.45	76.76	79.10	81.48	83.89	87.12
K2	TC 4 Level	64.08	66.96	69.16	71.39	73.66	75.95	78.28	80.64	83.03	86.24
K3	TC 5 Level	63.36	66.22	68.40	70.62	72.86	75.14	77.46	79.80	82.18	85.36
K4	TC 6 Level	62.64	65.47	67.64	69.84	72.07	74.34	76.63	78.96	81.32	84.48
K5	TC 7 Level	61.92	64.73	66.88	69.06	71.28	73.53	75.81	78.12	80.46	83.60
K6	TC 8 Level	61.56	64.36	66.50	68.68	70.88	73.12	75.40	77.70	80.04	83.16
K7	TC 9 Level	61.20	63.98	66.12	68.29	70.49	72.72	74.98	77.28	79.61	82.72
K8	TC 10 Lev	60.84	63.61	65.74	67.90	70.09	72.32	74.57	76.86	79.18	82.28
K9	TC 11 Lev	60.48	63.24	65.36	67.51	69.70	71.91	74.16	76.44	78.75	81.84
K10	TC 12 Lev	60.12	62.87	64.98	67.12	69.30	71.51	73.75	76.02	78.32	81.40
K11	TC 13-15 L	59.76	62.50	64.60	66.74	68.90	71.10	73.34	75.60	77.90	80.96
K12	TC 16-18 L	59.40	62.12	64.22	66.35	68.51	70.70	72.92	75.18	77.47	80.52
K13	TC 18-25 L	59.04	61.75	63.84	65.96	68.11	70.30	72.51	74.76	77.04	80.08
K14	TC 25-30 L	58.68	61.38	63.46	65.57	67.72	69.89	72.10	74.34	76.61	79.64
K15	TC 30+ Le	58.32	61.01	63.08	65.18	67.32	69.49	71.69	73.92	76.18	79.20

Table 12: Floorpsace_Area_LUT, Medium Terrace

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	72.86	82.82	91.27	98.27	104.32	109.61	118.40	131.07	143.02	180.00
B1	MH Sub: 4(	79.69	94.44	102.00	108.18	113.33	117.69	127.50	141.67	154.55	161.00
C1	MH Urb: 4(	79.69	94.44	102.00	108.18	113.33	117.69	127.50	136.50	139.10	143.00
F1	THAB 3 Le	88.54	96.64	102.00	106.33	109.93	113.01	121.48	129.28	132.41	136.81
F2	THAB 4 Le	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
F3	THAB 5 Le	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
G1	MU 3 Leve	88.54	96.64	102.00	106.33	109.93	113.01	121.48	129.28	132.41	136.81
G2	MU 4 Leve	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
G3	MU 5 Leve	88.54	96.64	102.00	106.33	109.93	113.01	121.13	124.11	127.12	131.34
K1	TC 3 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K2	TC 4 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K3	TC 5 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K4	TC 6 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K5	TC 7 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K6	TC 8 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K7	TC 9 Level	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K8	TC 10 Lev	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K9	TC 11 Lev	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K10	TC 12 Lev	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K11	TC 13-15 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K12	TC 16-18 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K13	TC 18-25 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K14	TC 25-30 L	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34
K15	TC 30+ Le	86.15	92.24	96.00	99.00	101.48	103.59	110.72	121.69	127.12	131.34

Table 13: Floorspace_area_LUT, Medium House

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	85.71	97.43	107.37	115.61	122.72	128.95	139.29	154.20	168.26	240.00
B1	MH Sub: 4(	93.75	111.11	120.00	127.27	133.33	138.46	150.00	166.67	181.82	207.00
C1	MH Urb: 4(	93.75	111.11	120.00	127.27	133.33	138.46	150.00	166.67	181.82	187.00
F1	THAB 3 Le	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	186.44
F2	THAB 4 Le	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
F3	THAB 5 Le	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
G1	MU 3 Level	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	186.44
G2	MU 4 Level	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
G3	MU 5 Level	104.17	115.83	122.00	126.91	130.93	134.32	144.08	158.81	171.38	180.96
K1	TC 3 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K2	TC 4 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K3	TC 5 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K4	TC 6 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K5	TC 7 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K6	TC 8 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K7	TC 9 Level	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K8	TC 10 Lev	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K9	TC 11 Lev	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K10	TC 12 Lev	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K11	TC 13-15 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K12	TC 16-18 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K13	TC 18-25 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K14	TC 25-30 L	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96
K15	TC 30+ Le	101.35	110.57	114.82	118.16	120.86	123.13	131.32	144.04	154.51	180.96

Table 14: Floorspace_Area_LUT, Large Apartment

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	102.86	113.64	121.00	127.08	131.43	135.60	145.69	158.82	170.27	192.00
B1	MH Sub: 4(	100.00	111.11	120.00	127.27	133.33	138.46	145.60	151.20	156.80	161.00
C1	MH Urb: 4(	100.00	110.50	117.00	123.50	128.70	131.30	133.90	136.50	139.10	143.00
F1	THAB 3 Le	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
F2	THAB 4 Le	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
F3	THAB 5 Le	105.56	111.02	114.00	117.01	120.04	123.09	126.18	129.28	132.41	136.81
G1	MU 3 Level	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
G2	MU 4 Level	105.56	113.69	118.56	121.69	124.84	128.02	131.22	134.45	137.71	142.29
G3	MU 5 Level	105.56	111.02	114.00	117.01	120.04	123.09	126.18	129.28	132.41	136.81
K1	TC 3 Level	102.70	108.52	112.94	116.47	119.38	121.88	130.25	134.45	137.71	142.29
K2	TC 4 Level	102.70	108.52	112.94	116.47	119.38	121.88	130.25	134.45	137.71	142.29
K3	TC 5 Level	102.70	108.52	112.94	116.47	119.38	121.88	126.18	129.28	132.41	136.81
K4	TC 6 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K5	TC 7 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K6	TC 8 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K7	TC 9 Level	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K8	TC 10 Lev	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K9	TC 11 Lev	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K10	TC 12 Lev	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K11	TC 13-15 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K12	TC 16-18 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K13	TC 18-25 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K14	TC 25-30 L	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34
K15	TC 30+ Le	102.60	106.58	109.44	112.33	115.24	118.17	121.13	124.11	127.12	131.34

Table 15: Floorspace_Area_LUT, Large Terrace

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500	102.86	116.92	128.85	138.73	144.57	147.84	158.81	174.71	187.30	240.00
B1	MH Sub: 4(	110.00	122.22	132.00	140.00	146.67	152.31	165.00	183.33	200.00	218.50
C1	MH Urb: 40	110.00	122.22	132.00	140.00	146.67	152.31	165.00	183.33	192.60	198.00
F1	THAB 3 Le	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
F2	THAB 4 Le	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
F3	THAB 5 Le	118.56	127.42	134.20	139.60	144.03	147.75	158.49	166.49	170.17	175.47
G1	MU 3 Leve	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
G2	MU 4 Leve	118.56	127.42	134.20	139.60	144.03	147.75	158.49	171.69	175.49	180.96
G3	MU 5 Leve	118.56	127.42	134.20	139.60	144.03	147.75	158.49	166.49	170.17	175.47
K1	TC 3 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	180.96
K2	TC 4 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	180.96
K3	TC 5 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K4	TC 6 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K5	TC 7 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K6	TC 8 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K7	TC 9 Level	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K8	TC 10 Lev	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K9	TC 11 Lev	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K10	TC 12 Lev	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K11	TC 13-15 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K12	TC 16-18 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K13	TC 18-25 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K14	TC 25-30 L	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47
K15	TC 30+ Le	115.35	121.63	126.31	129.97	132.95	135.44	144.45	158.44	169.96	175.47

Table 16: Floorspace_Area_LUT, Large House

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9	10
A1	Single-500m2	128.57	146.15	161.06	173.41	184.09	193.42	208.94	231.30	252.39	300.00
B1	MH Sub: 400m2	140.63	166.67	180.00	190.91	200.00	207.69	225.00	248.40	257.60	264.50
C1	MH Urb: 400m2	140.63	166.67	180.00	190.00	198.00	202.00	206.00	210.00	214.00	220.00
F1	THAB 3 Level T	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
F2	THAB 4 Level T	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
F3	THAB 5 Level T	156.25	168.95	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
G1	MU 3 Level Tce	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
G2	MU 4 Level Tce	156.25	173.52	177.61	181.72	185.84	189.98	194.13	198.30	202.49	208.58
G3	MU 5 Level Tce	156.25	168.95	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K1	TC 3 Level Apr	152.03	167.39	173.65	178.50	182.40	185.63	194.13	198.30	202.49	208.58
K2	TC 4 Level Apr	152.03	167.39	173.65	178.50	182.40	185.63	194.13	198.30	202.49	208.58
K3	TC 5 Level Apr	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K4	TC 6 Level Apr	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K5	TC 7 Level Apr	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K6	TC 8 Level Apr	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K7	TC 9 Level Apr	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K8	TC 10 Level Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K9	TC 11 Level Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K10	TC 12 Level Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K11	TC 13-15 Level	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K12	TC 16-18 Level	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K13	TC 18-25 Lev A	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K14	TC 25-30 Lev A	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09
K15	TC 30+ Lev Ap	152.03	167.39	172.94	176.94	180.95	184.98	189.03	193.08	197.16	203.09

Change Narrative vs v3.9

No change applied.

FloorspaceBuiltForm_Density_LUT

This LUT provides a mix of practical and regulatory limits to the built form being tested, particularly a maximum storeys, coverage, and density (land area per unit).

The limitations work in isolation and combination to ensure the particular typology being tested does not exceed either the regulatory limitation (e.g., 600m^2 maximum density in A1 (Single House) for all typologies) or practical limitation (e.g., 120m^2 maximum density for Medium Houses in Mixed Use and Centre Zones.

This is because while the mixed use and centre zones have no regulatory density limits, as a matter of practical reality, a 'house' (of around 180m^2 floor area in this case) will need at least 200m^2 of land. Compare this with 180m^2 floor area terrace in the same zones which has a practical limit of 100m^2 of land per unit.

Max Building Coverage is utilised in combination with the lowest of Maximum Effective Storeys (a value from the input data based on the combination of zone heights, bonus heights and volcanic viewshafts limits) to ensure the floorspace is also limited.

Max Impervious Coverage is used in the calculation of stormwater Development Contributions.

The model calculates the dwelling yield on the site using all of these approaches and will choose the minimum yielding result to carry forwards. House typologies (and all development in zones with density rules, namely the Single House Zone) are rounded down to the nearest integer, Terrace and Apartment developments are rounded to the nearest integer reflecting the greater flexibility inherent within more intensive forms.

Table 17: FloorspaceBuiltForm_Density_LUT

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	Max_Storeys	Max_Building_Coverage	Max_Impervious_Coverage	1	2	3	4	5	6	7	8	9
A1	Single Hs: 500m2+	2	0.35	0.60	600	600	600	600	**600**	**600**	600	600	600
B1	Mixed House Suburban	2	0.40	0.60	75	120	190	100	**135**	**210**	125	150	250
C1	Mixed House Urban	3	0.45	0.60	50	100	190	70	120	210	90	140	250
F1	THAB 3 Level	3	0.50	0.60	35	90	190	60	110	210	80	130	250
F2	THAB 4 Level	4	0.50	0.60	25	90	190	45	105	210	65	120	250
F3	THAB 5 Level	5	0.50	0.60	23	90	190	40	105	210	55	120	250
G1	Mixed Use 3 Level	3	1.00	1.00	22	80	180	38	105	200	52	130	240
G2	Mixed Use 4 Level	4	1.00	1.00	20	80	180	35	100	200	48	120	240
G3	Mixed Use 5 Level	5	1.00	1.00	17	80	180	30	100	200	40	120	240
K1	TC 3 Level	3	1.00	1.00	25	80	180	45	105	200	65	130	240
K2	TC 4 Level	4	1.00	1.00	22	80	180	38	100	200	52	120	240
K3	TC 5 Level	5	1.00	1.00	18	80	180	31	100	200	43	120	240
K4	TC 6 Level	6	1.00	1.00	15	80	180	25	100	200	37	120	240
K5	TC 7 Level	7	1.00	1.00	12	80	180	21	100	200	32	120	240
K6	TC 8 Level	8	1.00	1.00	10.5	80	180	18	100	200	28	120	240
K7	TC 9 Level	9	1.00	1.00	9.2	80	180	15.5	100	200	24	120	240
K8	TC 10 Level	10	1.00	1.00	8.0	80	180	13.5	100	200	20	120	240
K9	TC 11 Level	11	1.00	1.00	7.0	80	180	11.5	100	200	17.5	120	240
K10	TC 12 Level	12	1.00	1.00	6.0	80	180	10.0	100	200	15	120	240
K11	TC 13-15 Level	15	1.00	1.00	5.4	80	180	9.0	100	200	13.5	120	240
K12	TC 16-18 Level	18	1.00	1.00	4.8	80	180	8.0	100	200	12	120	240
K13	TC 18-25 Level	25	1.00	1.00	4.0	80	180	7.0	100	200	10.6	120	240
K14	TC 25-30 Level	30	1.00	1.00	3.5	80	180	6.0	100	200	9.2	120	240
K15	TC 30+ Level	99	1.00	1.00	3.0	80	180	5.0	100	200	8	120	240

Change Narrative vs v3.9

No change applied.

Costs_ProfFees_LUT

This Table provides the basis for the majority of Professional Fees. These are generally higher where the project is more complex and/or the sales value is higher.

pcBuild_x values are applied as a percentage of the total construction costs. For example, if Construction costs are $100, design fees are another (100*0.030) = $3

The values are increased for more complex building projects – e.g., the design fees on a TC Apartment (Typology K) are 12%, compared with 6% for a Single House in lower sales value areas (1-5) which would typically be spec built or a 'catalogue' house where the design costs can be spread across may similar products, to 8% for Single Houses in 6-10 Sales categories which would be expected to be (on average) slightly more bespoke and potentially architecturally designed.

pcSale_x values are applied as a percentage of the total expected sale price.

pcLCV_x values are applied as a percentage of the LCV as an annual payable amount (total rates bill), which must be pro rata for the development period (i.e., x1.5 for an 18 month build timeframe).

Table 18: Costs_ProfFees_LUT

FDC_Dwelling_typology_Code	pcBuild_BuildDesignFees	pcBuild_Planner	pcLCV_Rates	pcBuild_LegalnSurvey	pcBuild_DevelopmentMgmt	pcBuild_ContingencyFees	pcBuild_FundingCosts	pcSale_SalesnMktg
A_1_5	0.0600	0.0030	0.0034	0.0020	0.0100	0.0300	0.0400	0.0350
A_6_10	0.0600	0.0040	0.0034	0.0020	0.0150	0.0500	0.0400	0.0350
B	0.0600	0.0040	0.0034	0.0040	0.0120	0.0500	0.0400	0.0350
C	0.0600	0.0040	0.0034	0.0040	0.0130	0.0500	0.0400	0.0350
D	0.0800	0.0040	0.0034	0.0150	0.0150	0.0500	0.0400	0.0350
E	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
F	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
G	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
H	0.0800	0.0040	0.0034	0.0150	0.0250	0.0800	0.0500	0.0350
I	0.1200	0.0030	0.0034	0.0150	0.0300	0.1000	0.1000	0.0350
J	0.1200	0.0030	0.0034	0.0150	0.0300	0.1000	0.1000	0.0350
K	0.1200	0.0030	0.0034	0.0150	0.0300	0.1000	0.1000	0.0350

Table 19: Professional Fees Groupings

Fee Group	Professional Fees	Applied as a multiple of
pcBuild_	BuildDesign Planner LegalnSurvey DevelopmentManagement Contingency FundingCosts (i.e., interest and fees etc)	Sum of all other build costs (ex GST)
pcSale_	SalesnMarketing	Expected Sale price (incl GST)
Pc_LCV	Rates (Payable over the development period)	LCV, for each whole year of construction (note rates are based on valuation, irrespective of market movements since)

Costs_Demolition_LUT

This table provides the basis for demolition costs based on the typology code and sales location.

The demolition costs looked up are applied as a demolition cost per unit on the site, factored via a log function.

Costs to demolish a low quality one or two storey standalone dwelling (Type A in Sales Location 1) with good access and boundary setbacks are much lower per unit than demolishing a high rise built to the boundaries in a high value town centre (Type K in Sales Location 10).

The Log function is applied to recognise the economies of scale of dealing with multiple units per site as follows:

$$Site\ Demolition\ Costs\ Scale\ Factor = < ScaleFactor\_Logn > x\ \mathrm{Logn}(number\ of\ units\ to\ demolish) + < ScaleFactor\_plus >$$

$$Site\ Demolition\ Costs = Typology: Location\ Code\ Cost\ x\ Site\ Demolition\ Costs\ Scale\ Factor$$

Table 20: Costs_Demolition _LUT

FDC_BuildCost_Typology_Name	FDC_Dwelling_Typology_Code	1	2	3	4	5	6	7	8	9	10	ScaleFactor_Logn_of_COUNT_RA	ScaleFactor_plus
House: Single	A	18120.95	19253.50	20386.06	21518.62	22651.18	24916.30	27181.42	29446.54	31711.66	33976.77	1.5069	0.5926
House: MHS, MHU	B	18120.95	19253.50	20386.06	21518.62	22651.18	24916.30	27181.42	29446.54	31711.66	33976.77	1.5069	0.5926
House: THAB,TC	C	18120.95	19253.50	20386.06	21518.62	22651.18	24916.30	27181.42	29446.54	31711.66	33976.77	1.5069	0.5926
Terrace: Single, MHS	D	18120.95	19253.50	20386.06	21518.62	22651.18	24916.30	27181.42	29446.54	31711.66	33976.77	1.5069	0.5926
Terrace: MHU	E	18120.95	19253.50	20386.06	21518.62	22651.18	24916.30	27181.42	29446.54	31711.66	33976.77	1.5069	0.5926
Terrace: THAB	F	18120.95	19253.50	20386.06	21518.62	22651.18	24916.30	27181.42	29446.54	31711.66	33976.77	1.2502	0.6214
Terrace: Mixed Use	G	36241.89	38507.01	40772.13	43037.25	45302.36	47567.48	49832.60	52097.72	54362.84	56627.96	1.0318	0.6426
Terrace: Town Centre	H	58893.07	61158.19	63423.31	65688.43	67953.55	70218.66	72483.78	74748.90	77014.02	79279.14	0.7044	0.7939
Apmt: Sing,MH,THAB	I	36241.89	38507.01	40772.13	43037.25	45302.36	47567.48	49832.60	52097.72	54362.84	56627.96	1.0172	0.8761
Apmt: Mixed Use	J	58893.07	61158.19	63423.31	65688.43	67953.55	70218.66	72483.78	74748.90	77014.02	79279.14	0.7044	0.7939
Apmt: Town Centre	K	67953.55	73616.34	79279.14	84941.93	90604.73	96267.52	101930.32	107593.12	113255.91	118918.71	0.5148	0.8789

Change Narrative vs v3.9

Demolition costs are adjusted by inflation rate.

Costs_DCsandConnections_LUT

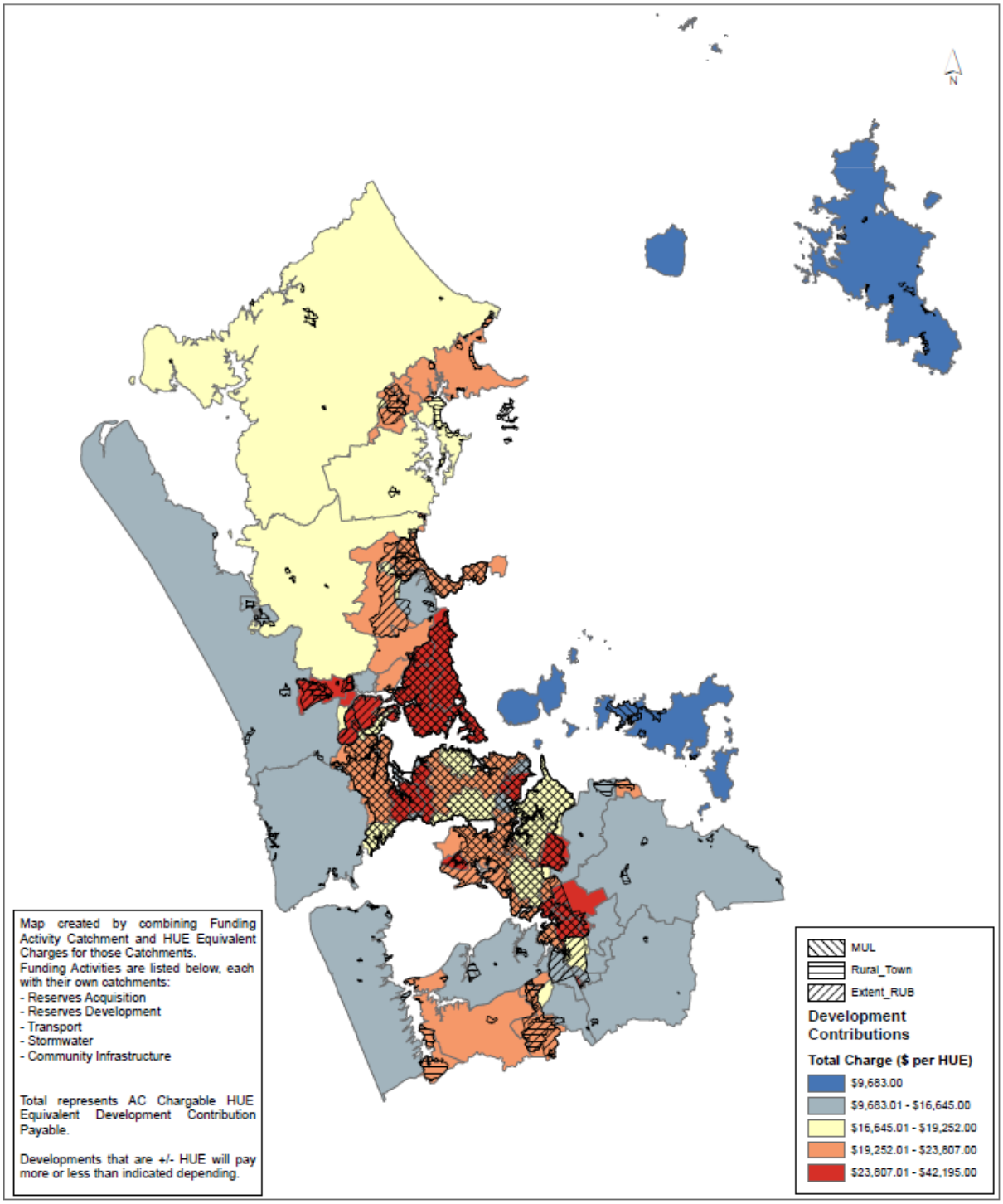
This table has been replaced by a more complex spatial and table-based approach that more completely replicates the operative Development Contributions Policy, Watercare IGC Charges, Telecoms (Chorus) and Electrical (Vector) Connections Fees.

This information is initialised via the parcel setup process to tag parcels with the ‘activity catchment’ that they fall within, covering Stormwater, Transport, Reserves Development, Reserves Acquisitions and Community Facilities. Each development option is then individually calculated based on the typology and estimated additional impervious surface area to calculate the estimated Development Contribution for the site, in accordance with the relevant activity, which is then netted of any credits. (for e.g., a high-rise apartment may pay a lesser charge for say transport than a standalone house, and these changes will vary by location)

Watercare IGC Changes, Electrical and Telecommunications connections fees are also calculated.

The map below indicates the spatial distribution of a Household Unit Equivalent (HUE) charge summed across all five Council Activities.

Figure 6: Development contributions funding catchments



Watercare IGCs are charged for every dwelling (with a discount for sub 65 sqm dwellings) in accordance with the published schedule (Table 21).

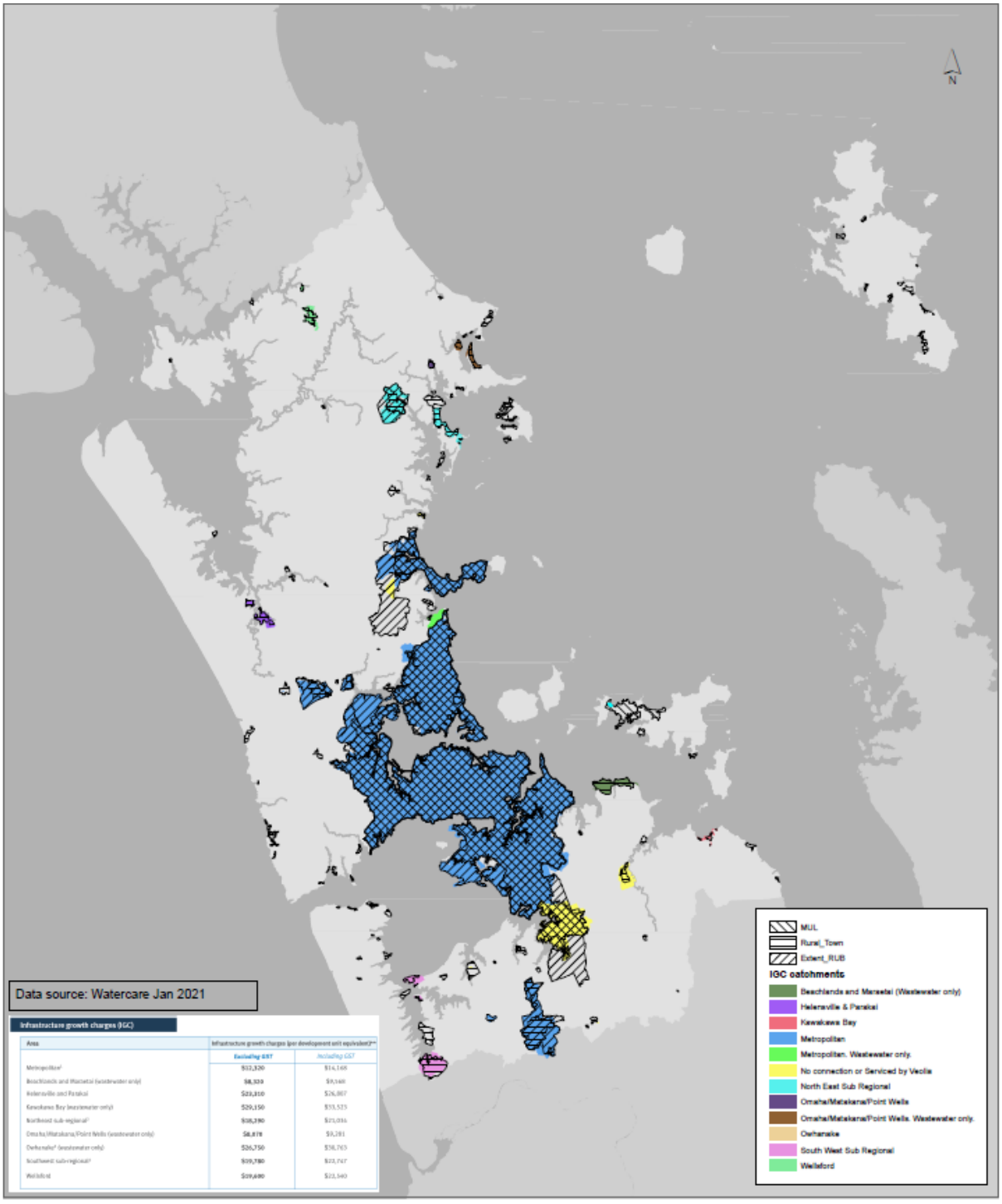
The Metropolitan Service Area covers the main urban area and the 'inner' main towns, some of the outer towns and villages have different charges, where they are serviced.

Water meters are charged on a per dwelling basis, and one inspection per ‘site’ is assumed

Table 21: Watercare Infrastructure Growth Charges LUT

Location_Name	Service_provided	Comments	IGC_exl_GST	Watermeter_Charge_Redev_exl_GST	Watermeter_Charge_Vacant_exl_GST	Process_Inspection_Charge_exl_GST	Dwelling_lt_65m2_factor
Metropolitan	All	The Metropolitan network area covers customers supplied by Watercare's contiguous water supply system and/or serviced by any of Watercare's wastewater treatment plants at Mangere, Rosedale, Army Bay or Pukekohe. It includes the Hibiscus Coast, Kumeu, Huapai, Riverhead, Paerata, Pukekohe and Bucklands.	12320	420	1015	275	0.67
Beachlands and Maraetai	Wastewater only		8320	420	1015	275	0.67
Helensville and Parakai	All		23310	420	1015	275	0.67
Kawakawa Bay	Wastewater only		29150	420	1015	275	0.67
Northeast sub-regional	All	The Northeast sub-regional IGC applies to Warkworth, Snells Beach and Algies Bay (currently serviced by the Warkworth and Snells Beach wastewater treatment plants). The Northeast sub-regional IGC replaced the Snells Beach IGC from 1 July 2018 and Warkworth IGC from 1 October 2018.	18290	420	1015	275	0.67
Omaha/Matakana/Point Wells	Wastewater only		8070	420	1015	275	0.67
Owhanake	Wastewater only	The Owhanake (Waiheke) IGC is payable in the case of existing commercial connections, where that connection first becomes liable for the IGC (for example, where demand increases) under Watercare's infrastructure growth charge terms and conditions included in our customer contract. Connections for new customers are available subject to completion of staged upgrades to the wastewater treatment plant.	26750	420	1015	275	0.67
Southwest sub-regional	All	The Southwest sub-regional IGC applies to areas of Franklin where the wastewater treatment plant the property connects to is not the Pukekohe or Māngere wastewater treatment plant. The Southwest sub-regional IGC replaced the Clarks Beach IGC and Franklin IGC from 1 July 2018.	19780	420	1015	275	0.67
Wellsford	All		19600	420	1015	275	0.67
Bombay	No connection available		0	0	0	0	0
Kingseat	No connection available		0	0	0	0	0
Muriwai	No connection available		0	0	0	0	0
Waiwera	No connection available		0	0	0	0	0
Veolia	All	Assumed standard metropolitan charges apply*	12320	420	1015	275	0.67
Okura	Wastewater only	Assumed Beachlands and Maraetai charges apply*	8320	420	1015	275	0.67
No connection	No connection available		0	0	0	0	0
Outside serviced area	No connection available		0	0	0	0	0

Figure 7: Watercare Infrastructure Growth Charges funding catchments



Electrical Connection Fees are based on discussions with Vector.

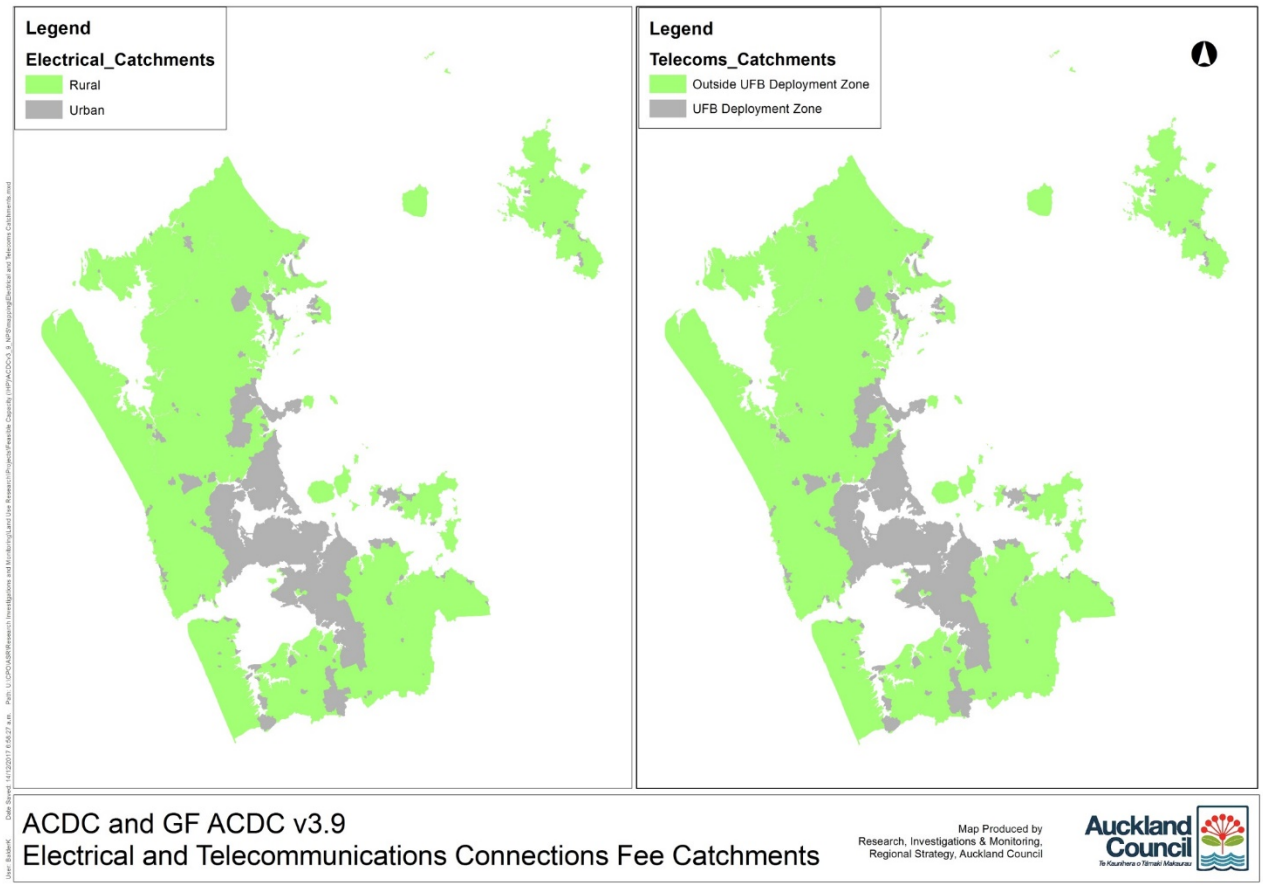
Fees vary based on the site being ‘rural’ or ‘urban’. For the purposed of this model all modelled developments are urban, (which is not defined on Vectors site), so Residential, Business and FUZ zones are assumed to be Urban, all else rural (see, and charged a single site fee and a per dwelling fee, depending on typology as outlined in Figure 8**:** .

Vector is not the only wholesaler in the Region, and their site advised indicative costs only, but the general principles and costs identified are considered to be a reasonable basis for comparative modelling. Both the website and discussions with developers highlight that site context, development, and network conditions can influence costs considerably. The approach taken, while more complex than v3.8, is still relatively simplistic and could be further complicated if required and further information was available.

Table 22: Electrical Connections Fees

Electrical_Fee_Catchment	Single_SiteFee_exclGST	Single_UnitConnection_exclGST	MDU_SiteFee_exclGST	MDU_UnitConnection_exclGST
Urban	2500	1000	2500	1000
Rural	2000	500	2000	500

Figure 8: Electrical and Telecoms Connections Fee Catchments (based on AUPOIP Zoning)



Telecommunications Connections Charges are charged in a similar way to Electrical connections, with a single site fee and a per dwelling fee applied, that varies by typology and location. Table below outlines these, which are based on discussions with developers and a review of Chorus.co.nz. Similar to Electrical Connections, site

context, development particulars and network conditions may vary actual costs but for comparative modelling this simple approach is considered reasonable.

For example, a four dwelling development that are of House typology would pay (1 site fee x$0) + (4 dwelling fee x $1200) = $4800 excl GST, but a 4-terrace development would pay (1 site fee x$1200) + (4 dwellings fee x $500) = $3200 excl GST

The present extent of the UFB Deployment area for the purposes of connections fees is unclear, but is assumed to eventually be rolled out in all Residential and Business Zones and Future Urban Areas as shown in in Figure 8**:** . For the purposes of this modelling, there are therefore no modelled locations outside of the UFB Deployment Zone. This could be varied if required.

Table 23: Telecommunications Connections Charges

Telecoms_Fee_Catchment	Single_SiteFee_exclGST	Single_UnitConnection_exclGST	MDU_SiteFee_exclGST	MDU_UnitConnection_exclGST
UFB Deployment Zone	0	1200	1200	500
Outside UFB Deployment Zone	0	1600	0	1600

Change Narrative vs v3.9

Electrical fees increased by $500, telecommunications connection charges remain unchanged.

Costs_FSBuild_<size>_LUT

These tables apply the 'build' cost applied as a $ value per sqm of floorspace of each dwelling.

Values are joined on the Dwelling_BuildCost_Typology_Code and relevant Typology (Types 1, 4, and 7 get small, 2, 5, 8, get medium, 3, 6, 9 get large) and applied by Sales Location.

Note how the costs per sqm vary by costs location but also by typology, and there are small efficiency gains in moving from the small to the medium /large sizes. (smaller dwellings are slightly less efficient on a cost per sqm basis to construct). This is because the floor to wall/kitchen/bathroom ratio is more efficient in larger dwellings (i.e., a kitchen and bathroom cost about the same and are about the same area, in a $50m^2$ or $80m^2$ apartment, but in the larger apartment the costs can be spread over 50% more floorspace and the walls needed take out less useable floorspace

The site development build cost is the Floorspace of dwellings x the number of dwellings constructed x Costs_FS_build

The cost generally increases as the sales location rises, reflecting materials, fit and finish, building layout (bathrooms per bedroom, stories, etc) and 'architectural flair'. Costs also increase with 'density' due to increasing complexity and specialist skills and equipment and the requirement to pay for ancillary items that are not 'in' the floorspace being sold (like they are in the house) but still must be accounted for such as access ways, corridors, lifts and stairs, building systems services and structures and etc

Table 24: Costs_FSBuild_Small_LUT

FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
House: Single	2090	2145	2310	2475	2750	2970	3520	3850	4180	4950
House: MHS, MHU	2090	2145	2310	2475	2640	2860	3190	3520	3850	4400
House: THAB, TC	2090	2145	2310	2475	2640	2860	3190	3520	3850	4400
Terrace: Single, MHS	3025	3080	3135	3190	3245	3465	3575	3740	3850	4125
Terrace: MHU	3025	3080	3135	3190	3245	3465	3575	3740	3850	4125
Terrace: THAB	2970	3025	3080	3135	3190	3410	3520	3630	3795	4070
Terrace: Mixed Use	3025	3080	3135	3190	3245	3465	3465	3465	3465	4180
Terrace: Town Centre	3080	3135	3190	3245	3300	3465	3575	3850	3960	4290
Apmt: Sing, MH, THAB	4290	4290	4290	4400	4510	4620	4730	4840	5060	5280
Apmt: Mixed Use	4290	4290	4290	4400	4510	4675	4785	4895	5115	5390
Apmt: Town Centre	4290	4290	4400	4510	4620	4840	5060	5225	5335	5500

Table 25: Costs_FSBuild_Medium_LUT

FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
House: Single	1900	1950	2100	2250	2500	2700	3200	3500	3800	4500
House: MHS, MHU	1900	1950	2100	2250	2400	2600	2900	3200	3500	4000
House: THAB, TC	1900	1950	2100	2250	2400	2600	2900	3200	3500	4000
Terrace: Single, MHS	2750	2800	2850	2900	2950	3150	3250	3400	3500	3750
Terrace: MHU	2750	2800	2850	2900	2950	3150	3250	3400	3500	3750
Terrace: THAB	2700	2750	2800	2850	2900	3100	3200	3300	3450	3700
Terrace: Mixed Use	2750	2800	2850	2900	2950	3150	3150	3150	3150	3800
Terrace: Town Centre	2800	2850	2900	2950	3000	3150	3250	3500	3600	3900
Apmt: Sing, MH, THAB	3900	3900	3900	4000	4100	4200	4300	4400	4600	4800
Apmt: Mixed Use	3900	3900	3900	4000	4100	4250	4350	4450	4650	4900
Apmt: Town Centre	3900	3900	4000	4100	4200	4400	4600	4750	4850	5000

Table 26: Costs_FSBuild_Large_LUT

FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
House: Single	1900	1950	2100	2250	2500	2700	3200	3500	3800	4500
House: MHS, MHU	1900	1950	2100	2250	2400	2600	2900	3200	3500	4000
House: THAB, TC*	1900	1950	2100	2250	2400	2600	2900	3200	3500	4000
Terrace: Single, MHS	2750	2800	2850	2900	2950	3150	3250	3400	3500	3750
Terrace: MHU	2750	2800	2850	2900	2950	3150	3250	3400	3500	3750
Terrace: THAB	2700	2750	2800	2850	2900	3100	3200	3300	3450	3700
Terrace: Mixed Use	2750	2800	2850	2900	2950	3150	3150	3150	3150	3800
Terrace: Town Centre	2800	2850	2900	2950	3000	3150	3250	3500	3600	3900
Apmt: Sing, MH, THAB	3900	3900	3900	4000	4100	4200	4300	4400	4600	4800
Apmt: Mixed Use	3900	3900	3900	4000	4100	4250	4350	4450	4650	4900
Apmt: Town Centre	3900	3900	4000	4100	4200	4400	4600	4750	4850	5000

Interestingly build costs are generally lower for house dwellings in low value areas than for apartments, but as house build costs rise much faster than apartment costs though the sales areas, this is reversed in the higher end locations. This reflects that house standards in these high value areas are typically very high-end construction commensurate with the underlying land values.

Change Narrative vs v3.9

Updated according to price information provided by quantity surveyors.

Costs_SiteCivil_LUT

This table provides information on the site works, civil (installation of underground services and connections, etc.) and landscaping costs within the boundary of each property and are applied as a $ value per sqm of land area.

Site Total Civil Costs = parcel_area x Costs_SiteCIvil

Variation is provided between typologies (detached developments have lower landscape in a site/civil costs on a per sqm basis) and sales location value (largely reflecting a greater emphasis on quality and quantity of landscaping including specialist designers and planting as sales values rise).

Table 27: Costs_SiteCivil_LUT

FDC_Typology_Code	FDC_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	Single House	47.87	77.79	107.72	137.64	167.56	203.46	239.37	275.27	311.18	359.05
B	MH Suburban House	47.87	77.79	107.72	137.64	167.56	203.46	239.37	275.27	311.18	359.05
C	MH Urban House	38.30	62.24	86.17	110.11	134.05	162.77	191.49	220.22	248.94	287.24
D	MH Suburban Terrace	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
E	MH Urban Terrace	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
F	THAB Terrace	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
G	Mixed Use Terrace	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
H	Town Centre Terrace	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
I	THAB Apartment	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
J	Mixed Use Apartment	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21
K	Town Cent Apartment	59.84	77.79	95.75	113.70	131.65	167.56	203.46	239.37	275.27	299.21

Change Narrative vs v3.9

Adjusted by inflation rate – CGPI 2020Q3 Earthmoving and site work

Costs_Constraints_LUT

This table provides information on the additional costs potentially imposed by various constraints.

The values are imposed as a single site cost value added to the site costs if the site intersects with the spatial feature representing the constraint.

These figures were initially developed by the 013EG for version 1 as a placeholder pending improved information. For v3.8 these initial values have simply been inflated by the general cost increases suggested by Mr Fontein for the other building related costs (4.17%).

The costs are considered to represent the cost of obtaining a specialist report relating to the constraint feature, and the cost of review of this report via the consent process. Costs of 'changing design' are not included as it is presumed the findings of the specialist report obtained by the developer has been used in the site layout and design process (i.e., the presence of these features is no surprise), and there is no loss of overall development potential[34] as a result (e.g., notable trees in the corner of the site are worked around by slightly more clustered development in the remainder).

Potential improvements could involve

variable costs dependent on area of constraint, however, the cost of overcoming some constraints is not necessarily 'area of constraint' dependent

variable costs dependent on number of constraints (e.g., a scale factor) however some constraints are not as costly to overcome as others (i.e., area != cost)

consideration of other costs and constraints not listed (e.g., resource consent category, infrastructure capacity constraints)

consideration of applying 'negative costs' (i.e., benefits as a cost reduction) from positive aspects (e.g., reduced time cost from SHA processing, or known site specific amenities e.g., good views etc.)

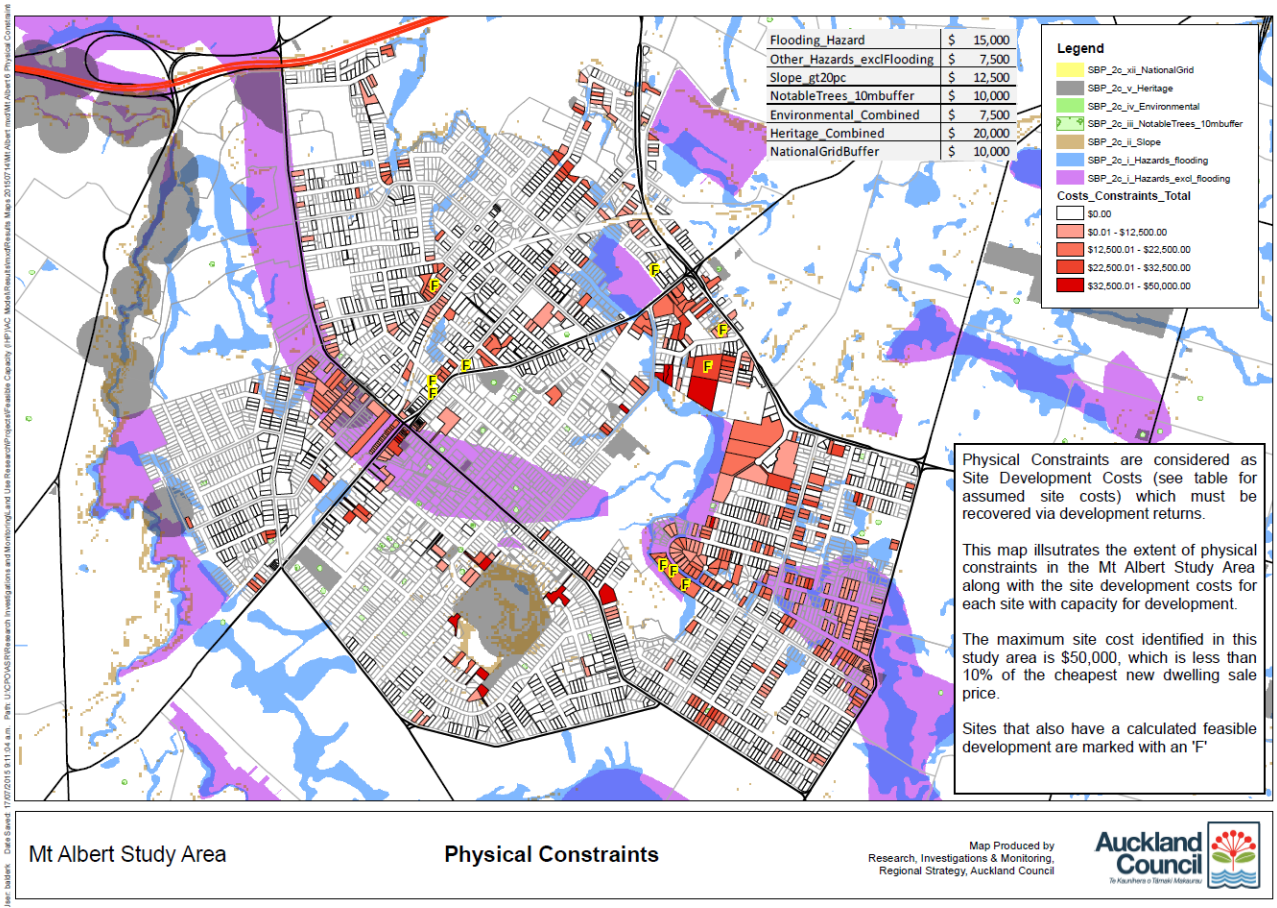
[34] This is also reflected in the way the costs are applied to the site as a whole – development options with more dwellings (higher density) can amortise any imposed site costs across more dwellings (noting that the profitability of more intensive developments is also generally tighter).

Table 28: Costs Constraints LUT

FDC_Typology_Code	FDC_Typology_Name	Flooding_Hazard	Other_Hazards_exclFlooding	Slope_gt20pc	NotableTrees_10mbuffer	Environmental_Combined	Heritage_Combined	NationalGridBuffer
A	House: Single	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
B	House: MHS, MHU	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
C	House: THAB,TC	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
D	Terrace: Single, MHS	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
E	Terrace: MHU	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
F	Terrace: THAB	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
G	Terrace: Mixed Use	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
H	Terrace: Town Centre	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
I	Apmt: Sing,MH,THAB	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
J	Apmt: Mixed Use	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67
K	Apmt: Town Centre	15625.00	7812.50	13020.83	10416.67	7812.50	20833.33	10416.67

The Map in Figure 9 below illustrates how the constraint costs (as used in a previous version of the model) been applied in a sample area illustrating the wide spatial variability in the presence of constraints and combinations thereof:

Figure 9: Physical Constraints: Location and Costs Mapping



Change Narrative vs v3.9

No change.

Sales_PriceCeiling_Factor_LUT

This table works in conjunction with Sales_PriceCeilings_LUT (which sets the reference dwelling price) to establish the relative ceiling for each typology.

A Large House typology development on an A1 (Single House Zone) site is expected to sell for 1.5x the reference price ceiling (being closest to the Medium House typology), but a small Apartment has a ceiling of 0.75x of the reference price ceiling. Differentials on a K15 site (high rise town centre) would be 1.2x for a Large House and 0.55x for a Small Apartment.

Table 29: Sales Price Ceiling Factor LUT

FDC_DwellingFloorspace_Typology_Code	Floorspace_Typology_Description	1	2	3	4	5	6	7	8	9
		Apartment Small	Terrace Small	House Small	Apartment Medium	Terrace Medium	House Medium	Apartment Large	Terrace Large	House Large
A1	Single Hs: 500m2+	0.75	0.85	0.9	0.85	0.9	1.2	1.2	1.3	1.5
B1	Mixed House Suburban	0.65	0.75	0.85	0.8	0.85	1.1	1.2	1.2	1.4
C1	Mixed House Urban	0.65	0.75	0.85	0.8	0.85	1.1	1.2	1.2	1.4
F1	THAB 3 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.3
F2	THAB 4 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.3
F3	THAB 5 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.3
G1	Mixed Use 3 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
G2	Mixed Use 4 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
G3	Mixed Use 5 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K1	TC 3 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K2	TC 4 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K3	TC 5 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K4	TC 6 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K5	TC 7 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K6	TC 8 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K7	TC 9 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K8	TC 10 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K9	TC 11 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K10	TC 12 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K11	TC 13-15 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K12	TC 16-18 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K13	TC 18-25 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K14	TC 25-30 Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2
K15	TC 30+ Level	0.55	0.7	0.8	0.75	0.85	1	1.1	1.1	1.2

Change Narrative vs v3.9

No change.

Sales (Price) Sales_PriceFS_LUT

This table supplies the estimated sales price of the constructed dwellings, on a $ per sqm basis, excluding GST.

This is calculated using the floorspace assumed from FloorspaceArea_LUT multiplied by the values in this table.

The values reflect the expected average sale price of the dwelling typology (per sqm of floorspace) in the sales location based on expert opinion.

This reflects the relative expected price of the single dwelling in that location – while the primary driver of the sale price is the area (in floorspace) of the dwelling, the typologies do have variable prices within the typologies reflecting some variation in the amount of land (e.g., while A1 and B1 typologies are the same (Houses) A1 dwellings will have a larger section than B1 Houses.

While existing evidence suggests floorspace is the largest factor explaining variability in sale prices potential improvement may be to take a price = a + bx approach to explicitly price and sell the (quite variable) land associated with each dwelling.

Table 30: Sales Price FS LUT

FDC_Dwelling_BuildCost_Typology_Code	FDC_BuildCost_Typology_Name	1	2	3	4	5	6	7	8	9	10
A	House: Single	7088	7759	8424	9108	9790	10469	11146	11819	12837	13851
B	House: MHS, MHU	6480	6804	7425	8093	8748	9389	10017	10631	11583	12515
C	House: THAB,TC	6480	6804	7425	8093	8748	9389	10017	10631	11583	12515
D	Terrace: Single, MHS	5832	6350	7128	7946	8748	9534	10303	11057	12215	13349
E	Terrace: MHU	5832	6350	7128	7946	8748	9534	10303	11057	12215	13349
F	Terrace: THAB	5832	6350	7128	7946	8748	9534	10303	11057	12215	13349
G	Terrace: Mixed Use	5832	6350	7128	7946	8748	9534	10303	11057	12215	13349
H	Terrace: Town Centre	5832	6350	7128	7946	8748	9534	10303	11057	12215	13349
I	Apmt: Sing,MH,THAB	5994	6653	7574	8535	9477	10400	11305	12191	13549	14878
J	Apmt: Mixed Use	5994	6653	7574	8535	9477	10400	11305	12191	13549	14878
K	Apmt: Town Centre	5994	6653	7574	8535	9477	10400	11305	12191	13549	14878

Change Narrative vs v3.9

Blanket increase of 35% over v3.9.

Costs_SiteCV_Adjustment_LUT

This Table imposes an inflation adjustment on the site purchase costs based on assumed differences in the LCV (based on 2017 Auckland Council valuations) used as the regional base cost for every site in the region and the 'current market value' of developable sites by zone and sales location at the 'strike' date.

Table 31: Costs_CV_Adjustment

CfGS_Dwelling_typol	Zone Group	1	2	3	4	5	6	7	8	9	10
A	**Single House**	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
B	**MH Suburban**	1.3	1.3	1.3	1.31	1.32	1.33	1.35	1.33	1.31	1.3
C	**MH Urban**	1.35	1.36	1.37	1.38	1.39	1.4	1.41	1.4	1.39	1.38
F	**THAB**	1.5	1.52	1.54	1.56	1.58	1.6	1.7	1.8	2	2
G	**Mixed Use**	1.6	1.62	1.64	1.66	1.68	1.7	1.7	1.8	2	2
K	**Town Centre**	1.4	1.42	1.44	1.46	1.48	1.5	1.5	1.48	1.46	1.44

Change Narrative vs 3.9

Adjustment rates are not updated as the housing market conditions continue to soar beyond the 2017 valuation.

Appendix 3: The Conditional Housing Allocation and Tenure Assessment model

This section relies on Fernandez & Martin (2021), Auckland Council (2017), Fernandez (2019) and Fernandez & Martin (2020a).

The CHATA model consists of n households that are potential buyers and m indivisible objects (dwellings) that become available in the market, and $n > m$. The model is implemented through a mathematical program described as follows:

Indices and sets:

$i = 1,2, \dots, n$ number of households in the sample

$hb = 1, \dots, m$ number of new dwellings entering the market

$z = 1, \dots, 13$ number of submarkets in Auckland

Data

$Cost_{hb,z}$ annualised cost to buy and relocate into the new dwelling

$Bid_{i,z}$ bid of household i that buys a dwelling at submarket z (willingness to pay - WTP)

$MortgagePayment_{hb,z}$ Mortgage payments

$Income_{i,z}$ household income

$StressFactorBuyer$ maximum share of income to be allocated on mortgage payments

$Deposit_{i,hb}$ deposit

$Minimum$ share of housing price to be paid upfront as deposit

Decision Variables

$BUYHOUSE_{i,hb,z}$ dichotomic variable that in the optimal solution takes the value of 1 if a dwelling is bought, and 0 otherwise

Model

maximise $Welfare = \sum_{i,z,hb}(Bid_{i,z} - Cost_{hb,z}) * BUYHOUSE_{i,z,hb}$ (1)

subject to

$$MortgagePayment_{hb,z} * BUYHOUSE_{i,hb,z} \leq Income_{i,z} * StressFactorBuyer, \forall \text{ i}, hb, z \quad (2)$$

$$Deposit_{i,hb} \geq Minimum * Price_{hb,z} * BUYHOUSE_{i,hb,z}, \quad \forall \text{z} \quad (3)$$

$$\sum_{hb} BUYHOUSE_{i,hb,z} \leq 1, \quad \forall \text{i}, \text{z} \quad (4)$$

$$\sum_i BUYHOUSE_{i,hb,z} \leq 1, \quad \forall hb, z \quad (5)$$

$$BUYHOUSE_{i,hb,z} = \{0,1\}, \quad \forall i, \forall hb, \forall z \quad (6)$$

Model (1) to (6) is a mixed integer program for the matching (housing allocation) problem. The objective function (Equation 1) maximises the difference between WTP and price, where WTP is represented as bid rents to keep utility constant (Alonso, 1960; Senior & Wilson, 1974). The difference between WTP and price is the consumer surplus resulting from the additional housing capacity given the take-up capabilities of demand (Miyagawa, 2001; Ng & Lo, 2015). This approach is appropriate as long as housing demand outstrips supply ($n > m$), the choice spaces of low-income households are constrained relative to wealthy households (Johnson, 2007), and preferences are quasilinear (income is held constant by the time of the transaction). The willingness of a prospective buyer to pay a price for a particular dwelling will then depend on the buyer's income as well as her current housing arrangements, relocation deadlines, and the likelihood of finding more desirable properties (Albrecht et al., 2007).

The primal problem consists on the maximisation of bid rents for different dwellings at different locations (Alonso, 1960), which is equivalent to the minimisation of actual rents paid in the dual (Senior & Wilson, 1974). Similar to the Herbert-Stevens model, the matching model aims to keeping a pre-specified (anticipated) utility level, where housing characteristics are fixed exogenously and do not adjust to consumer demand.

Constraint (2) limits mortgage payments to 50 per cent of the household income; this limit is set by a stress factor. Mortgage payments embed the development costs and profit margin for the developer, estimated at a time-horizon of 25 years and five per cent discount rate. Constraint (3) indicates that the deposit should be at least 20 per cent of the price, though this is an exogenous calculation. The key to access to a dwelling falls on the serviceability of the mortgage. Constraints (4) and (5) control that a household will purchase one dwelling only and that a dwelling is purchased only by one household. Every dwelling is occupied by the highest bidder, but the model does

not constraint that market clears, that is, that every household should buy a dwelling or that every additional dwelling is sold in the market (Miron, 2017).

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