Supporting Growth

Drury-Opāheke and Pukekohe-Paerata Structure Plan

Draft Integrated Transport Assessment

2 April 2019

TE TUPU NGĀTAHI Supporting Growth

AT

NZ TRANSPORT AGENCY WAKA KOTAHI

Document Status

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Disclaimer:

At the time of production of this ITA, the SGA draft business case for the Southern Area has not been approved by both the Auckland Transport and NZ Transport Agency Boards (due by mid-2019). Projects identified in this ITA are therefore indicative only and subject to change. Projects are also yet to be prioritised for funding and delivery over the next 30 years, and will require further technical investigations and consultation to confirm detailed location and land requirements. They may also require statutory approvals, which will be subject to the Resource Management Act 1991 and the Land Transport Management Act 2003.

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Acronyms and Abbreviations

Acronym / Abbreviation	Description
Alliance (SGA)	Te Tupu Ngātahi (Supporting Growth Alliance)
AT	Auckland Transport
ATAP	Auckland Transport Alignment Programme
AUP-OP	Auckland Unitary Plan – Operative in Part
BC	Business Case
Council	Auckland Council
Development Ready	Has Bulk Infrastructure in place
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GPS	Government Policy Statement on Land Transport
HCV	Heavy Commercial Vehicle
IBC	Indicative Business Case
ITA	Integrated Transport Assessment
MSM	Macro Strategic Model
NIMT	North Island Main Trunk
NOP	Non-Owner Participant (AECOM, Beca, Bell Gully, Buddle Findlay)
NoR	Notice of Requirement
PT	Public Transport
RTN	Rapid Transit Network
SH	State Highway
TDM	Traffic Demand Management
TFUG	Transport for Future Urban Growth
the Transport Agency	The NZ Transport Agency
VPD	Vehicles Per Day

Executive Summary

Context

As part of its strategic response to growth, Auckland Council (Council) has identified 15,000 hectares (ha) of rural land for future urbanisation in the Auckland Unitary Plan Operative in Part (AUP-OP). Some 3,200ha of this land is located in the Drury-Opāheke and Pukekohe-Paerata areas in the rural south of the region. Council's Future Urban Land Supply Strategy (FULSS) envisages a staged release of these areas for development, with rezoning planned to occur in stages during the 2018-22, 2023-27 and 2028-32 periods, and development to proceed after rezoning. As a first step towards urbanisation, Council is undertaking Structure Plans for Drury-Opāheke and Pukekohe-Paerata.

Te Tupu Ngātahi (the Supporting Growth Alliance, or SGA) has been engaged by Auckland Transport (AT) to prepare this Integrated Transport Assessment (ITA) in fulfilment of the transport technical reporting requirements for these Structure Plans[1]. The purpose of the ITA is to outline the required transport network for the Structure Plan areas, how the transport network integrates with proposed land use, and assess the performance and effects of the transport network.

This ITA has been developed in parallel with the business case being developed by SGA for the Southern Growth Area in its entirety. The business case process takes a long-term strategic view towards defining the higher order transport networks required to support the full extent of growth in the south. This ITA builds on the transport networks emerging from the business case process by adding detail on land use integration, lower order networks, and staging.

Land Use

The land use scenario for the Structure Plan areas assessed in this ITA was provided by Council. Council has publicly consulted twice as part of the early Structure Planning process. Further consultation is expected to occur in the first half of 2019 on the Draft Structure Plan, for which this ITA is a technical reporting input. The aggregate full build-out yields from the land use scenarios are summarised in the table below:

Table 0-1 – Land Use Yields[2]

Area	Gross area (ha)	Net area (ha) [3]	Net developable area (ha) [4]	Dwellings	Jobs	Population
Drury-Opāheke Structure Plan area	1,907	1,349	853	22,474	11,700	60,680

[1] AUP-OP – Appendix 1 – Structure Plan Guidelines

[2] N.B. The quantities given in this table are taken from the draft land use provided by Council dated November 2018. Subsequent changes to the Structure Plan have resulted in small changes to these yields (see section 7.2 of this ITA).

[3] Net area is derived by deducting protection areas (e.g. floodplains) from gross area.

[4] Net developable area is derived by deducting an allowance of 30% for roads and reserves from the net area.

Area	Gross area (ha)	Net area (ha) [3]	Net developable area (ha) [4]	Dwellings	Jobs	Population
Pukekohe-Paerata Structure Plan area	1,262	995	569	13,444	5,372	36,300

The following transport factors were instructive in shaping key aspects of the land use scenarios:

- The increased provision of employment land to provide local employment opportunities with a view towards reducing outbound travel demand on the wider transport network;
- Integration of centre locations and associated land use with rail station locations and with key road frontages to ensure visibility where required for centre viability;
- Providing for intensification and transit-oriented development around probable public transport routes and rail stations.

Proposed Transport Networks

The SGA Indicative Business Case (IBC) process has developed a recommended network for the rapid and frequent public transport, strategic active mode connections, and the new and upgraded strategic and arterial roads required at full build-out in 2048. The IBC's recommended network has been largely adopted as an end-state assumption in the ITA, though several potential refinements and additions to that network have been identified primarily in response to land use integration opportunities. In particular, the following aspects have been analysed through the ITA:

- **Drury Central and Drury West rail station locations** – No changes to rail station locations as identified in the IBC are specifically recommended, but the trade-offs inherent in land use integration, catchment maximisation and station spacing are explained, and optimisation opportunities are identified;
- **Drury Centre road access strategy** – A road access strategy for the Drury Centre is identified including access to both the strategic and surrounding local networks;
- **Drury West Centre road access strategy** – A high level strategy including urbanisation of SH22, signalisation of major intersections and new collector roads is identified for the Drury West Centre;
- **Additional crossings of SH1 and the NIMT** – Opportunities for additional collector road crossings of SH1 (south of Drury Interchange) and the NIMT (west of Jesmond Road) are identified that were not identified in the IBC;
- **Mill Road South alignment** – The potential need to revise the proposed alignment of Mill Road South has been identified, having regard to the need to balance strategic transport functions and land use integration; and
- **Park-and-Ride facilities** – A high level strategy identifying the staging and relative size of park-and-ride facilities is identified. The potential for park-and-ride to act as transitional land use prior to subsequent development is also identified.

The key addition to the IBC network in the ITA is the collector road networks for the Structure Plan areas. These have been developed iteratively through the ITA process using transport planning and urban design principles derived from best-practice guidance. The resultant collector road network in conjunction with the elements adopted from the IBC demonstrates the desired urban form and connectivity outcome, and also demonstrates how the local public transport services and active mode networks fit into the strategic network.

The overall proposed transport network, as well as the probable extent of the public transport and active mode networks for both Structure Plan areas are shown at Figures 0-1, 0-2 and 0-3.

An itemised list of the projects required to support growth in the Structure Plan areas is provided in Table 0-2:

Table 0-2 – List of transport infrastructure required to support the Southern Structure Plan areas at full build out (2048+)

Grouping	Project
Public transport	Increased rail capacity to four tracks between Wiri and Pukekohe (IBC option MT9B), and frequent Southern Line electric train services terminating at Pukekohe.
	New rail station at Drury Central (IBC DC2).
	New rail station at Drury West (IBC DW3 or 4).
	New rail station at Paerata (IBC P2).
	Frequent and express bus services with priority measures to provide north-south service and additional capacity to supplement rail, potentially utilising the Great South Road, SH1 corridors and other arterial roads (IBC MT3C, MT4I, MT4K, MT4L).
	Connector bus network operating on arterial and collector roads as per section 6.8 of ITA.
	New park-and-ride facilities at Paerata and Drury West, with a smaller facility at Drury Central.
Active modes	Regional cycle route adjacent to SH1 and NIMT (IBC AT1-1 and 1-2), with grade-separated active mode crossings of SH1 and NIMT.
	Primary cycle route on Mill Road (IBC AT2-3).
	Primary cycle routes on all arterial roads.
	Secondary cycle routes on collector network as per section 6.9 of ITA.
	Greenways network (to be investigated).
Road Network	Strategic road – Mill Road (IBC SR2H).
	Strategic road – Pukekohe Expressway (IBC SR4F)
	Strategic road – SH1 widening to provide additional lanes for the Papakura to Bombay section and north of Takaanini (IBC SR1A)
	Strategic road – SH1 new interchange at Drury South.
	Arterial – upgrade of Opāheke and Ponga Roads (IBC AR7).
	Arterial – new road between Papakura industrial area and Waihoehoe Road (IBC AR10).
	Arterial – upgrade of Waihoehoe Road (IBC AR11).

Grouping	Project
	Arterial – upgrade and realignment of Bremner Road (IBC AR14a).
	Arterial – upgrade and extension of Jesmond Road (IBC AR16a, AR20).
	Arterial – SH22 improvements (IBC AR22d).
	Arterial – Pukekohe ring route (IBC AR25, AR37, AR38).
	Arterial – Pukekohe East/Mill Road improvements (IBC AR30).
	Arterial – SH22-Pukekohe Expressway connections (IBC SR14, AR24 and AR41).
	Collector road network for Opāheke/Drury East per ITA section 6.4.
	Collector road network for Drury West per ITA section 6.5.
	Collector road network for Paerata per ITA section 6.6.
	Collector road network for Pukekohe per ITA section 6.7.

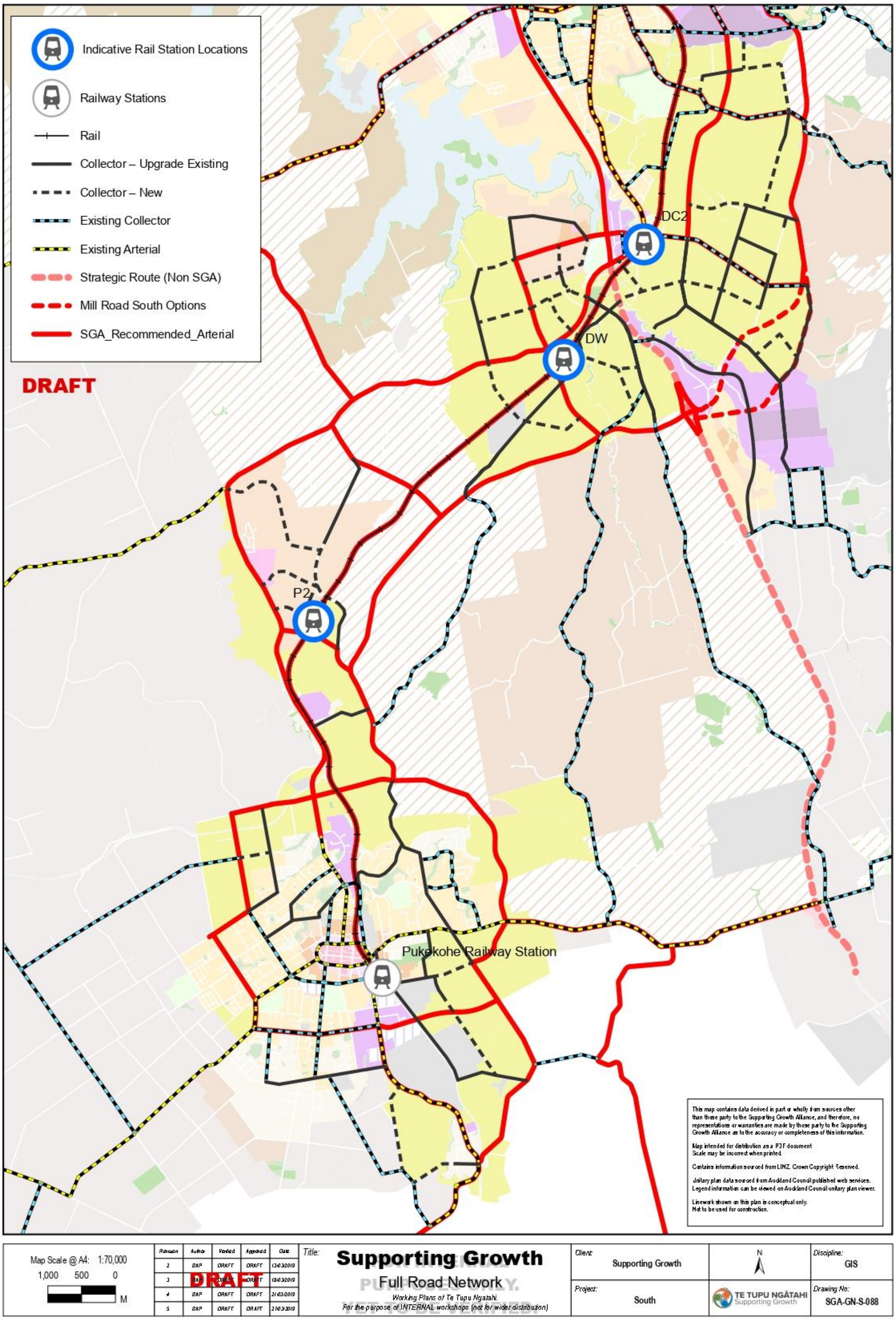

Figure 0-1 – Overall proposed transport network. Not to scale.

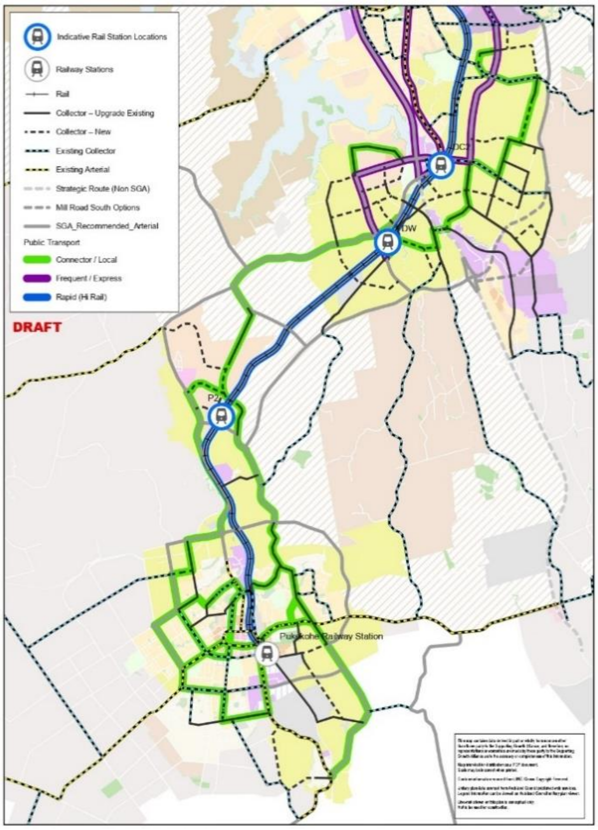

Figure 0-2 – Public transport network extent. Not to scale.

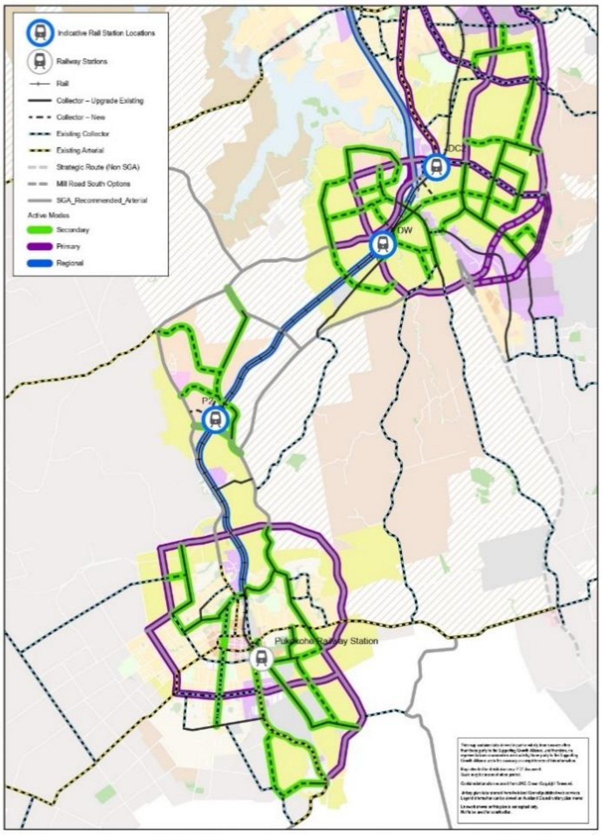

Figure 0-3 – Active transport network extent. Not to scale.

Influencing Travel Demand

The transport networks proposed in both the IBC and this ITA were developed considering strategies and design processes that sought to influence travel patterns within and through this area. The most influential components of this strategy include:

- Reducing the need to travel, primarily by providing for local employment and services;
- Encouraging a mode shift away from low occupancy private vehicles for both inbound and outbound trips through the timely provision of high capacity and attractive public transport facilities and safe, high quality facilities for active transport and micro-mobility (i.e. e-bikes and e-scooters) users; and
- Integrating land use and transport, particularly regarding the identification and management of competing movement and place functions of the network, and enabling transit-oriented development by maximising density around the planned public transport system.

Assessment of the Proposed Transport Network

The modelling assessment undertaken for the ITA follows a hierarchical structure comprising two interconnected components – the Macro Strategic Model (MSM) which relates land use to travel patterns at a regional level to derive overall travel demands, and a mesoscopic project model (SATURN) which applies regional demands to analyse traffic in more localised detail. This approach enables reporting against a range of performance measures, including:

- Expected trip generation and mode share for general traffic and public transport;
- Public transport indicators, including overall flows, accessibility, rail station boardings and rail crowding;
- General traffic measures, including daily traffic volumes and peak-period flows; and

Three scenarios were assessed:

- A 2048+ scenario to reflect the full build-out of the Structure Plan areas, and the full proposed transport network;
- A 2028 'constrained' scenario to reflect partial build-out of the Structure Plan areas, and only the components of the transport network with current funding commitments; and
- A 2028 'expanded' scenario to reflect partial build-out of the Structure Plan areas, and the components of the full transport network required to service the 2028 land use.

The key conclusions from the modelling assessment based on the assumed land use and transport network scenarios are summarised as follows:

- In the 2048+ scenario, daily household person trip rates are predicted to fall within the range of 7-10 trips per day. At the peak periods, the private vehicle rates are predicted to range from 0.39-0.5 trips in the AM peak, and 0.4-0.8 trips in the PM peak across the study area. These relatively low rates (by historic standards) are considered attributable to the high level of public transport provision proposed, and changing household composition (i.e. fewer working people per house);
- Predicted public transport mode share is strongly related to the level of investment assumed (see Figure 0-4). In the 2048+ scenario, public transport mode shares of 48% (for northbound trips) and 20% (overall) are predicted. In the 2028 'expanded' scenario, the predicted mode

shares fall to 35% and 14% respectively. In the 2028 'constrained' capacity, the predicted mode shares fall to 24% and 9% respectively.

- The Structure Plan areas are predicted to generate very high public transport passenger flows. In the 2048+ scenario, the AM peak period flow of northbound public transport users is predicted to be over 11,700 passengers. This necessitates a high frequency and high capacity rail services, supplemented by a network of frequent bus routes;
- Under all three modelling scenarios, the strategic network is predicted to experience the highest levels of congestion (see Figure 0-5). In particular:
    - Significant sections of SH1 are predicted to operate at or near capacity under all three modelling scenarios across all parts of the day. Congestion levels are the most severe in the 2048+ scenario, indicating that assumed capacity increases are exhausted by increasing demand;
    - SH22 is predicted to operate near its capacity for significant sections in the peak periods in the 2028 scenarios, but is alleviated in the 2048+ scenario by the Pukekohe Expressway. The Pukekohe Expressway in turn is predicted to operate near capacity for significant sections across all parts of the day when introduced in the 2048+ scenario; and
    - Sections of the Mill Road corridor is expected to operate near capacity in the peak periods in the 2048+ scenario.
- Given the expected peak-period congestion expected on some parts of the strategic network, the provision of high-quality public transport is critical to providing accessibility to employment and other opportunities required to support this area.
- The collector road network and other existing roads generally operate within capacity under all three modelling scenarios.

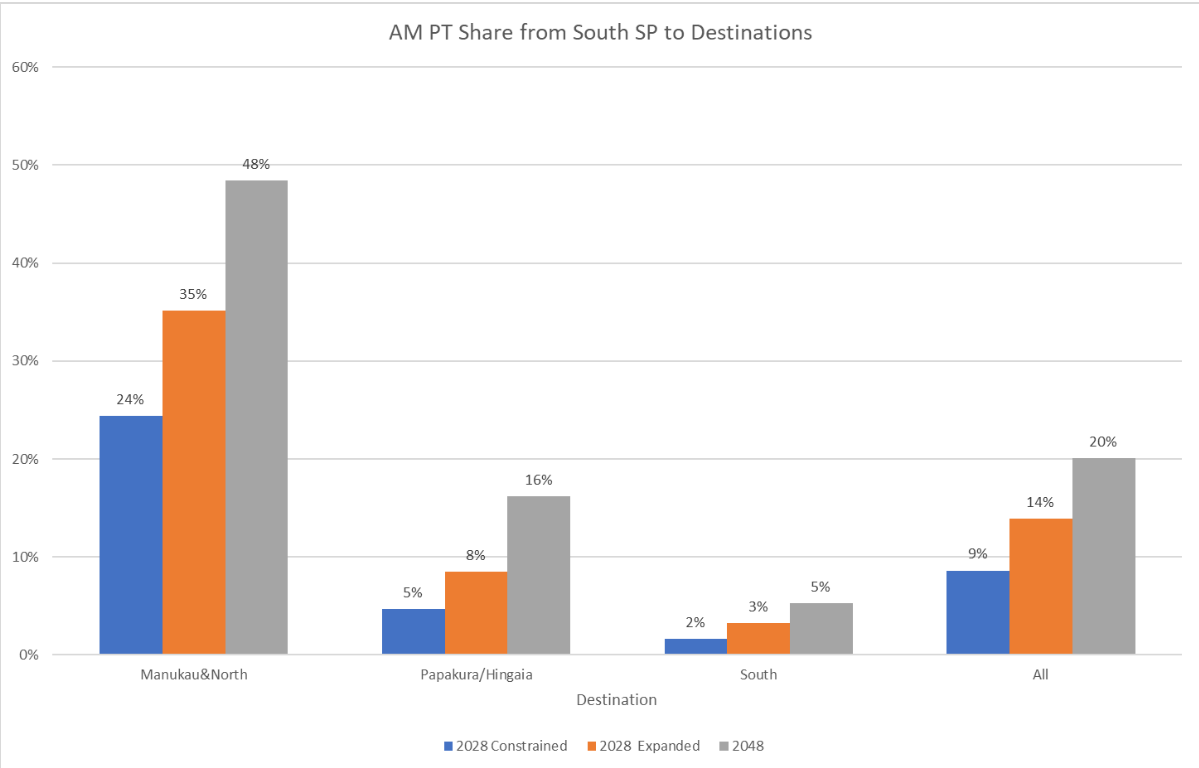

Figure 0-4 – Predicted public transport mode share by scenario and by destination.

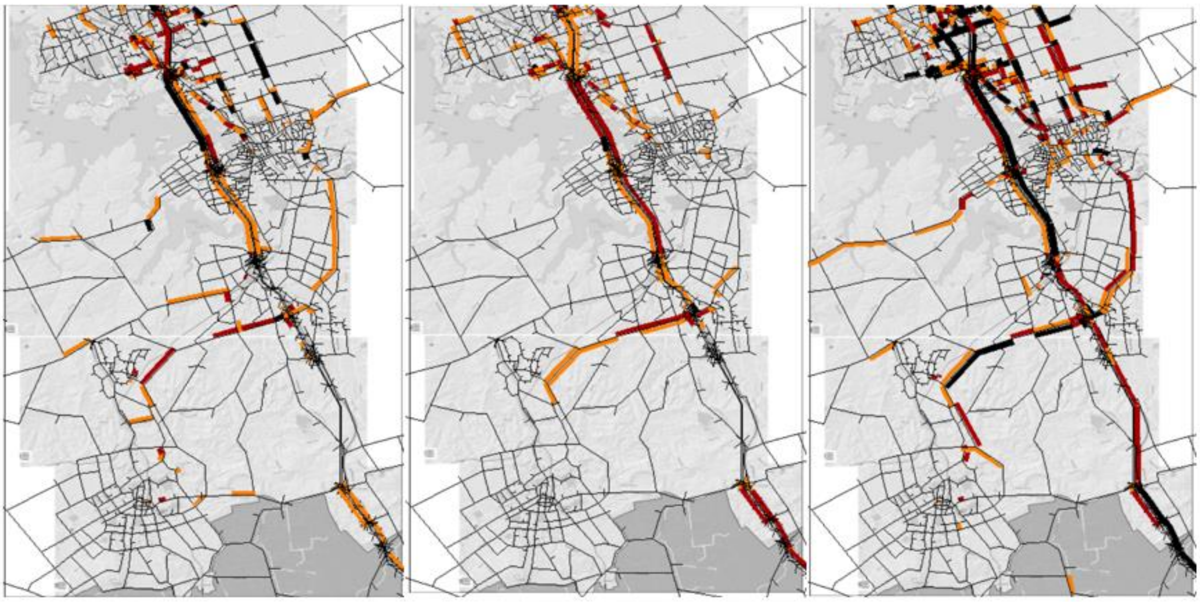

Figure 0-5 – Predicted congestion levels (VOC) in 2048+ scenario in AM peak, Interpeak and PM peak. Orange links are predicted to operate at >70% of capacity; red links at >85% of capacity, and bold lack links at >100%. All other links are predicted to operate at <70% of capacity.

Staging

A high level and principle-based approach to staging assessment has been adopted. This recognises that staging in many cases will either be determined by regional and inter-regional demands and priorities beyond the scope of the ITA, or would require more detailed modelling analysis which is not possible with the current level of information.

A set of principles is therefore developed, which links staging decisions to broader strategic goals regarding travel demand management and modal shift. The importance of identifying parallel, adjacent or inter-dependent projects is also emphasised.

Suggested staging strategies are derived from the principles in relation to key strategic transport infrastructure projects, including the following:

- The potential staging of rail stations at Paerata, Drury Central and Drury West;
- The potential staging of sections of the Mill Road corridor;
- The potential staging and inter-dependencies between the Pukekohe Expressway, the urbanisation of the SH22 corridor, the Drury West arterials and associated public transport and active transport improvements;
- The potential staging of development for the Opāheke/Drury East arterial roads and associated public transport and active transport improvements;
- The potential staging of the Pukekohe Ring Route and Pukekohe East Road; and
- The staging of the collector road network.

Ongoing Integration of Land Use and Transport

The ITA has identified key land use and transport integration opportunities to be examined in more detail at future more advanced stages of the land use and transport planning for the Drury-Opāheke and Pukekohe-Paerata areas. These include:

- Potential land use changes and refinements, particularly the configuration of centres and their integration with rail stations, provision for potentially further intensification around the public transport system, and further increases in local employment;
- Further assessment and design development of the entire proposed transport network, in particular key intersections, key accesses to centres, and integration with areas that are already 'live zoned';
- Further work to quantify funding and implementation risks associated with key collector roads; and
- Further development of staging strategies for both land use and transport.

1. Introduction

1.1. Purpose and context of this ITA

Auckland is New Zealand's largest and fastest growing city, and is predicted to require approximately 400,000 new homes and 277,000 new jobs over the next 30 years. As part of its strategic response to this growth, Auckland Council (Council) has identified some 15,000 hectares (ha) of rural land for future urbanisation in the Auckland Unitary Plan Operative in Part (AUP-OP), of which some 3,200ha is located in the Drury Opāheke and Pukekohe-Paerata areas in the rural south of the region. Council's Future Urban Land Supply Strategy (FULSS) envisages a staged release of these areas, split between the 2018-22, 2023-27, and 2028-32 periods[5].

As a first step towards urbanisation, Council is undertaking Structure Plans for Drury-Opāheke and Pukekohe-Paerata ('the Structure Plan areas'). Structure Planning is mandated through the AUP-OP[6] as a method for establishing a desired high-level pattern of land use and infrastructure for a defined area of urbanisation as a precursor to rezoning. In turn, Appendix 1 of the AUP-OP sets Structure Planning Guidelines[7], which require the preparation of an Integrated Transport Assessment (ITA) as a technical reporting input. These Guidelines relevantly state the Structure Plan (and by extension the ITA) should identify, investigate and assess the following:

1. *Integration of land use and development with the local and strategic transport networks*
2. *Lay out the transport network and facilities in a manner that is safe, attractive, efficient, and resilient to hazards, well connected to local facilities and integrated with land uses, the surrounding area and the wider transport network*
3. *Support for transport and accessibility that is multi-modal and interconnected with an appropriate number and location of access points*
4. *Transport effects on land uses and the management of these effects.*

Te Tupu Ngātahi (the Supporting Growth Alliance, or SGA) has been engaged by Auckland Transport (AT) to prepare an ITA on behalf of Council in fulfilment of these technical reporting requirements for the Structure Plans. In preparing the ITA, the Alliance has been guided by both the Structure Planning Guidelines, as well as AT's ITA Guidelines[8], which note that the primary objective of an ITA is to:

> *"ensure that the transportation effects of a new development proposal are well considered, that there is an emphasis on efficiency, safety and accessibility to and from the development by all transport modes where practical; and that the adverse transport effects of the development have been effectively avoided, remedied or mitigated. The preparation of an ITA seeks to ensure that appropriate thought is given to the zoning or land use proposed so that integrated transport and land use outcomes occur.*

[5] Future Urban Land Supply Strategy – Auckland Council, 2017.

[6] AUP-OP – Regional Policy Statement, B2.2.2(3), (7); B2.5.2(4)

[7] AUP-OP – Appendix 1 – Structure Plan Guidelines

[8] Integrated Transport Assessment Guidelines, AT, January 2015

A proposal that is achieving this integration will ensure consistency with the "four R's" being the ***right type of activity, in the right place, at the right intensity, and occurring at the right time****".*

This ITA has been prepared in parallel with the draft Indicative Business Case (IBC) being developed by SGA for the wider Southern Growth Area[9]. The IBC takes a strategic view with a long-term (2048) planning horizon to define the higher order transport networks required to support the growth areas in the South. To date, the IBC (and earlier business case phases) have built a case to invest in transport infrastructure to support growth in the South, and has identified a recommended network. The ITA builds on and refines the IBC assessment to identify the likely form and broad staging of transport infrastructure specifically within the Drury-Opāheke and Pukekohe-Paerata Structure Plan areas over time.

The ITA has been developed in close liaison with SGA's IBC team and Council's Structure Plan team to optimise and integrate both the land use and transport planning in an iterative process. This has included regular discussions with Council regarding the proposed land use, as well as substantial engagement with Council as partners for the IBC development. Given that the IBC is progressing as a parallel workstream and is yet to be approved by the AT and NZ Transport Agency ('the Transport Agency') Boards, assumptions have had to be made in the ITA regarding the potential final, approved outcomes of the IBC. In this regard, there may be a need to revisit elements of the transport network identified in this ITA to align with future business case decisions. It is also relevant that Auckland Council's proposed land use may evolve following further public consultation. Notwithstanding the potential for change to land use scenarios, it is noted that the ITA needs to consider a land use scenario. Should the land use scenario change significantly, then it stands to reason that the ITA will need to be reconsidered.

1.2. Scope of this ITA

The scope of the ITA has been approved by a Project Control Group (PCG) comprising SGA, AT and the Transport Agency.

This ITA addresses the following:

- The extent of the Drury-Opāheke and Pukekohe-Paerata study areas, including existing zoning and land use;
- Existing transport networks, known constraints, and committed transport projects;
- Relevant transport plans and strategies;
- Private developments and relevant background documents known to SGA at the time of report preparation;
- The future land use scenario as proposed by Council's Structure Plan team, including estimated residential and employment yields, as well as a high-level sequencing plan derived from the FULSS;
- The proposed transport network to support the future land use scenario, including arterial and collector roads, public transport including rapid transit, and strategic active mode networks;

[9] Includes the full extent of future urban land in the south – Drury-Opāheke and Pukekohe-Paerata (covered in this ITA and Auckland Council Structure Planning process), and Takaanini.

- The mode split and trip generation resulting from the proposed Structure Plan land use activities;
- Accessibility of proposed activities to various transport modes;
- Traffic modelling outputs, including expected mode share, patronage, accessibility, and expected traffic flow and network performance;
- Transport network staging and potential future refinements required to support Plan Change, Notice of Requirement (NoR) and/or site-specific proposals; and
- Considerations for subsequent planning processes to sustain the integration of land use and transport outcomes.

The ITA also discusses the potential staging of the draft proposed transport network based on an assumed sequencing of land release. The basis of land development staging used in this ITA is Council's FULSS, which only indicates three broad stages of land release. Accordingly, the staging strategies in this ITA should be read as indicative only, and should be used as a foundation for further transport assessments to be undertaken at future Plan Change, NoR and consenting stages as required when there will be greater certainty.

The relationship between the Structure Plan ITA and future assessments is summarised in Figure 1-1.

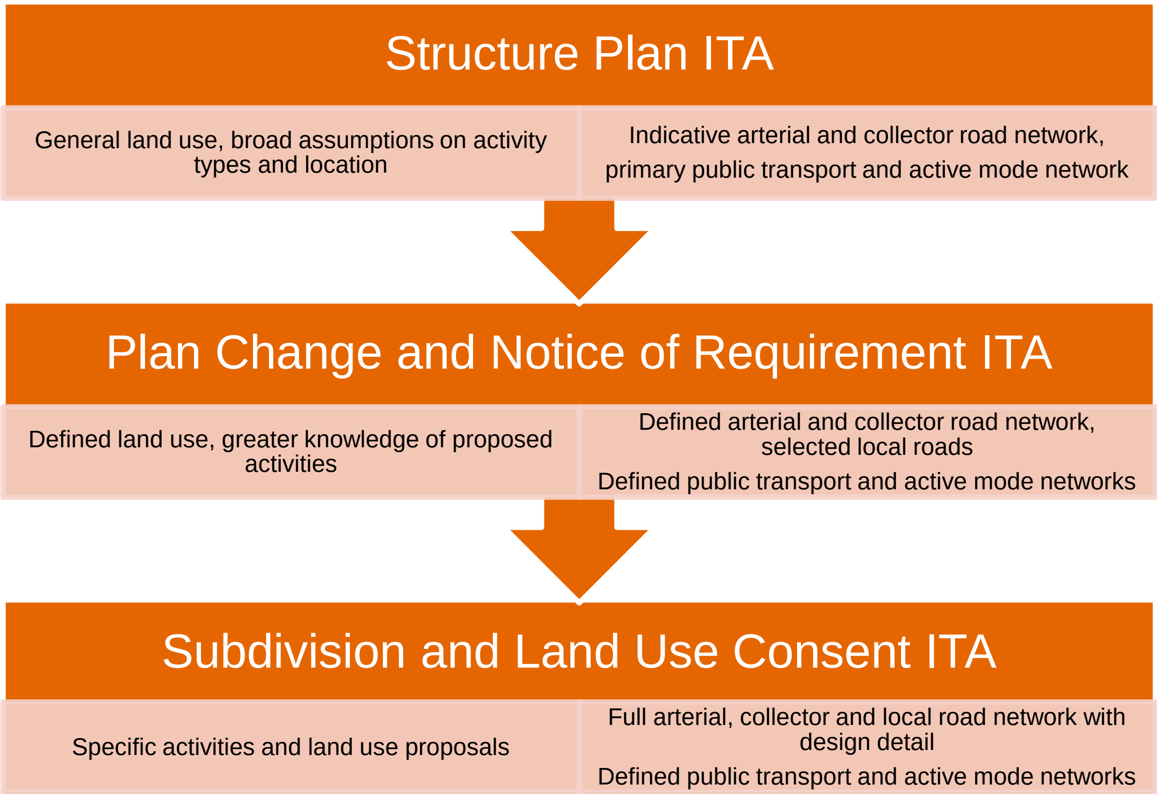

Figure 1-1 – ITA Level of Detail

Because the draft IBC is progressing in a parallel workstream and is still subject to final AT and NZ Transport Agency board approvals in 2019, this ITA has made assumptions regarding the potential final outcomes of the draft IBC. In this regard there is a risk that some elements of the ITA will need refreshing prior to subsequent planning processes.

2. Site Description

2.1. Site Locations

As noted above, this ITA covers two Structure Plan areas – the Future Urban Zoned (FUZ) areas of Drury-Opāheke and Pukekohe-Paerata.

2.1.1. Drury-Opāheke Structure Plan area

The Drury-Opāheke area (see Figure 2-1) is an area comprising some 1,921ha. It is located to the immediate south of Auckland's current urban fringe at Papakura, approximately 14km south of Manukau and 31km south of the City Centre. It can be divided into two areas centred on the Drury Interchange. The eastern area includes Opāheke in the north-east and Drury in the south-east; while the western area is referred to as Drury West. The entire area measures 5.5km east-to-west and 5.2km north-to-south at its widest points, and is bisected by north-south trunk infrastructure including SH1, the North Island Main Trunk railway (NIMT), and Transpower transmission lines. Land use is predominantly rural including countryside living and agriculture, with some business uses.

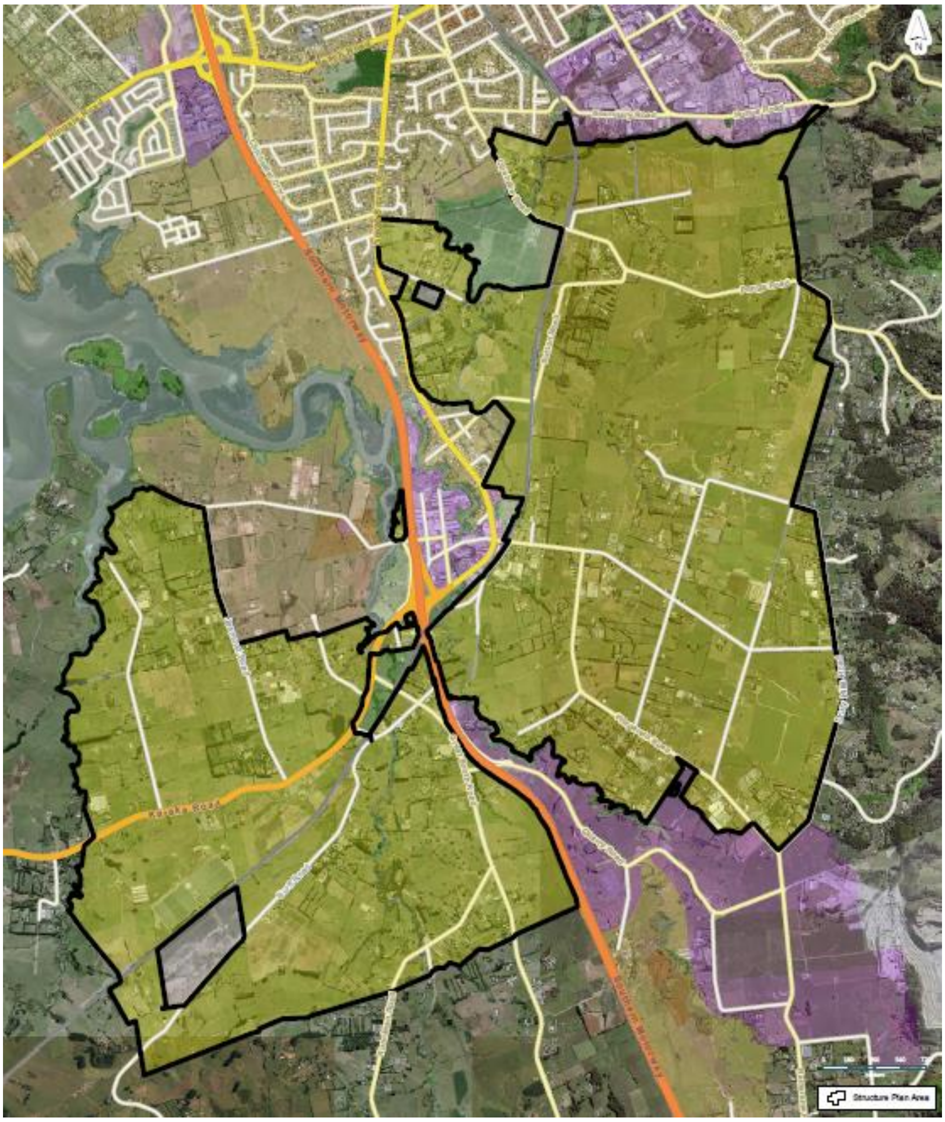

Figure 2-1 – Drury-Opāheke Structure Plan area (outlined in black).

2.1.2. Pukekohe-Paerata Structure Plan area

The Pukekohe-Paerata Structure Plan area (see Figure 2-2) comprises approximately 1,262ha, and is situated approximately 23km south of Manukau and 40km from the City Centre. It includes FUZ land on all sides of the existing Pukekohe urban area, as well as the FUZ area extending northwards towards the existing Wesley Special Housing Area (SHA) along SH22 Paerata Road. The area is located on the NIMT, and is connected to SH1 via SH22 and Pukekohe East Road at the Drury and Bombay Interchanges respectively. Land use is within the FUZ-zoned parts of the area is mainly rural including countryside living and agriculture. Pukekohe itself functions as a satellite town with a 2013 population of 21,000 with 7,600 jobs.

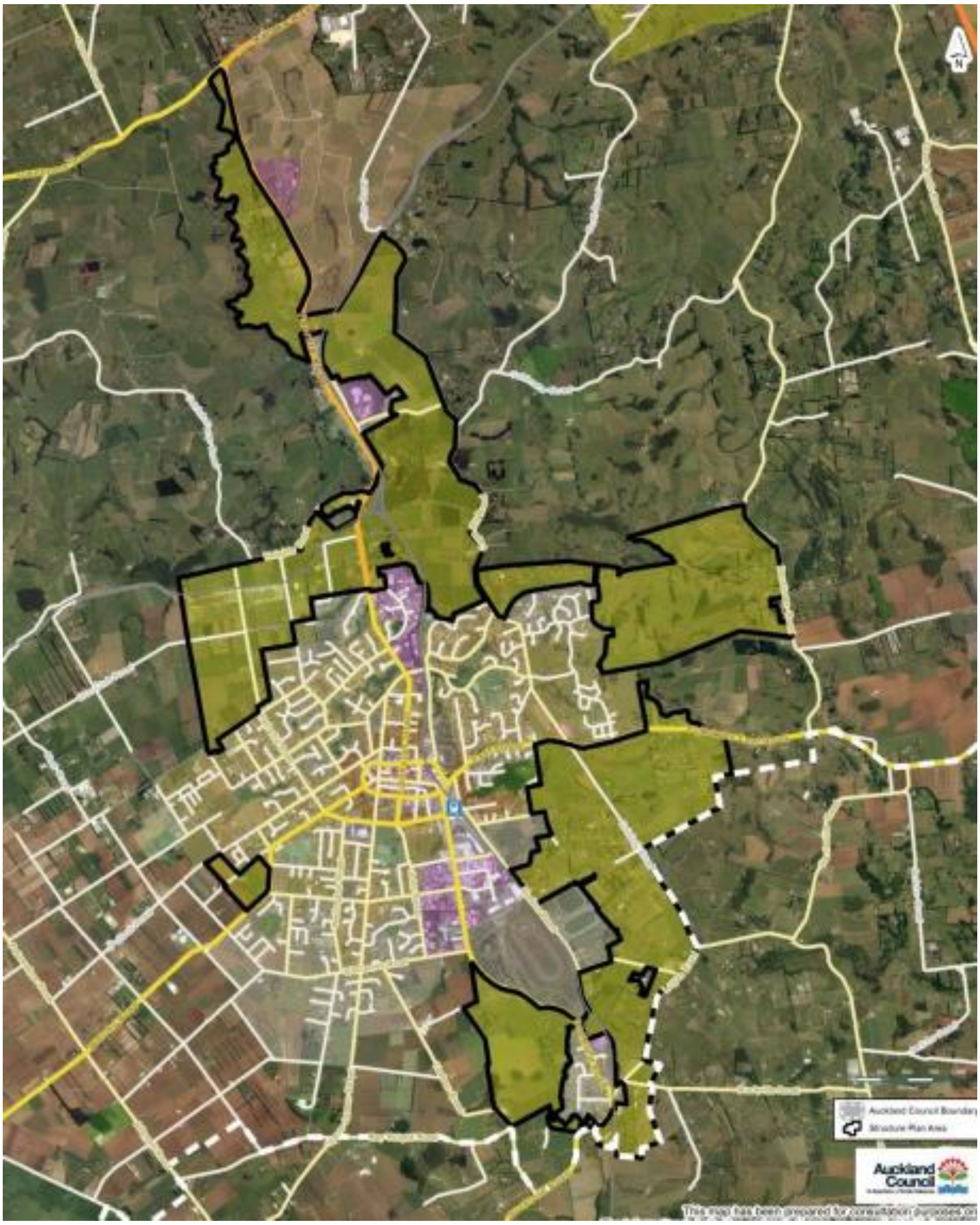

Figure 2-2 – Pukekohe-Paerata Structure Plan area (outlined in black).

2.2. Surrounding Areas

The Drury-Opāheke and Pukekohe-Paerata areas are located within Auckland's southern rural hinterland. The suburb of Papakura at the southern edge of the existing Auckland urban area is located to the immediate north of the study area, while the regional boundary with the Waikato is located to the south. Northern Waikato towns including Tuakau, Pokeno and Te Kauwhata form an important part of the growth context.

There are large areas of rural land to the west and east of the study area predominantly used for countryside living and agriculture. Townships in this wider area include Waiuku, Kingseat, Clarks Beach and Ramarama.

The dominant natural features in the surrounding areas include the Manukau Harbour to the north-west and its tributaries which drain much of the study area, and the Hunua Ranges which lie approximately 14km to the east of Drury.

2.3. Existing Unitary Plan context

The Structure Plan areas are zoned FUZ given their status as rural areas earmarked for future urbanisation. These clusters of FUZ land are bordered by the Rural Urban Boundary (RUB), outside of which a range of rural zones are applied including the Rural Production Zone, the Mixed Rural Zone, the Countryside Living Zone, and the Rural Coastal Zone.

The existing area of Pukekohe is subject to a range of urban zones, including the Town Centre, Mixed Use and General Business Zones in its centre, a range of residential zones (Terrace Housing and Apartment Building (THAB), Mixed Housing Urban (MHU) and Mixed Housing Suburban (MHS), Single House), areas of Light Industrial, and some Special Purpose Zoned areas such as the Pukekohe Park Raceway/Racecourse.

Selected areas immediately adjacent to the Structure Plan FUZ areas were given 'live' urban zoning through the Housing Accords and Special Housing Areas Act (HASHAA) process which created Special Housing Areas (SHA). Some areas have also been given live urban zoning through Plan Change processes after the AUP-OP became operative. Most (not all) are included in the AUP-OP as Precincts with bespoke provisions. These are summarised below.

Table 2-1 – Live Zoned Precincts and other live zoned areas adjacent to Structure Plan Areas

Precinct Name	Land Area (gross)	Zones Applied	Estimated yield	Status
Opāheke 1 (Bellfield Road)	27ha	MHU, MHS	350-500 dwellings	Earthworks and civil works underway.

[10] Gross land area figures have been taken from relevant AUP-OP Precinct descriptions (see AUP-OP South and Special Housing Area Precincts), relevant Plan Change documentation, and relevant HASHAA Orders in Council.

[11] Indicative yield figures have been taken from the FULSS (Auckland Council, 2017), the Structure Plan Background report (Auckland Council, 2018), and relevant Plan Change documentation.

Precinct Name	Land Area (gross)	Zones Applied	Estimated yield	Status
Hingaia 1-3	264ha	MHU, MHS, Neighbourhood Centre	3,000 dwellings, neighbourhood centre	Sporadic development underway.
Drury South (Industrial and Residential)	361ha	Light Industrial, Heavy Industrial, THAB, MHS, MHU	1,000 dwellings, approx. 260ha industrial land.	Civil works underway.
Drury 1 (Auranga A and B1)[12]	168ha	THAB, MHU, MHS, Local Centre	2,650 dwellings + local centre	Auranga A under construction; B1 provisions Operative in Part.
Franklin 2 (Wesley)	326ha	MHU, Local Centre	4,500 dwellings + local centre.	Under construction.
Belmont, Pukekohe[13]	72ha	Mixed housing suburban	~720 dwellings	Largely built out.

There are numerous designations and NoRs applying to land within the study area. Designations for existing infrastructure (i.e. given effect to) within the Southern Structure Plan areas (excluding existing schools in live-zoned areas) include:

- **Transport** – NZTA designations for SH1 (AUP-OP reference 6706) and SH22 (6704, 6705 and 6707), and the KiwiRail designations for the NIMT (6302) and the Mission Bush Branch Line (6306);
- **Electricity and Gas** – Transpower designation for the Drury Switching Station (8521), Counties Power designation for the Opāheke Substation (3006), and the First Gas designation for the Pukekohe to East Tamaki Gas Pipeline (9104);
- **Water supply** – Watercare designation for the Drury Pump Station (9566); and
- **Telecommunications** – Chorus and Spark designations for the Runciman Communications Site (2655, 7543).

Several NoRs within the study area have been recently lodged, with some advancing to notification, processing and confirmation. Further NoRs were known to be imminent at the time of writing this ITA. These are summarised in Table 2-2 below.

12 Note the figures for Drury 1 combine the Operative Auranga A SHA area; and the Operative in Part Auranga B1 area initiated through Plan Change 6.

13 Belmont is beyond the map extent and does not have a Precinct.

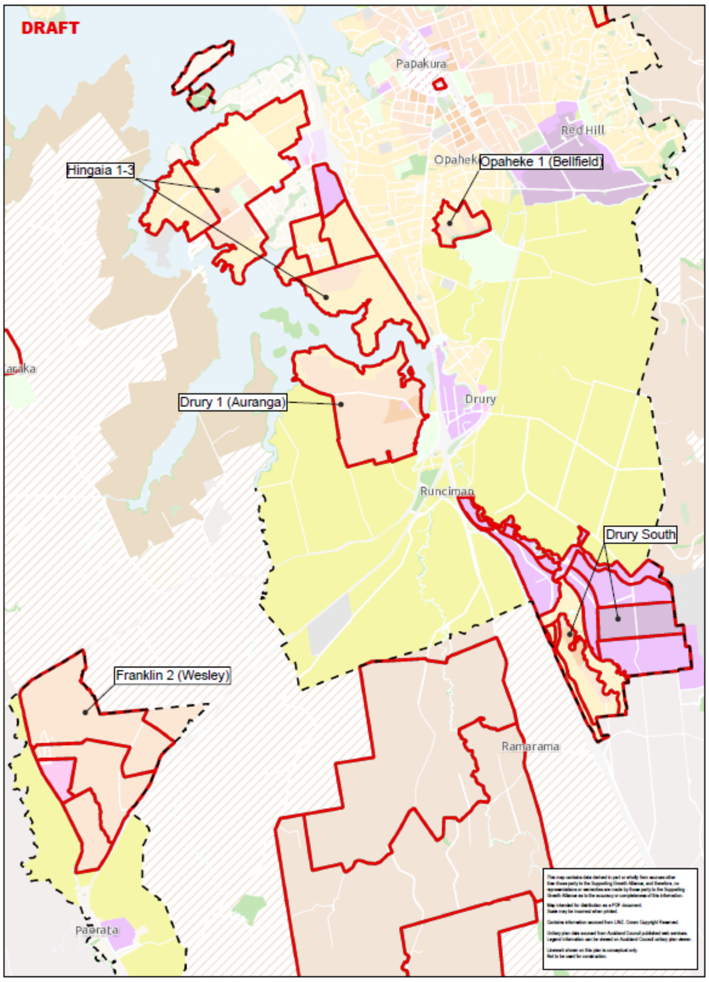

Figure 2-3 – Locations of Live Zoned Precincts adjacent to Structure Plan areas.

Table 2-2 – Recent and Upcoming Notices of Requirement and Designations

NoR name	Sites affected	Requiring Authority	Purpose	Stage in Process
Wesley Primary School	741 Paerata Road	Ministry of Education (MoE)	Educational Purposes – School and Early Childhood Centre.	Designation confirmed, in AUP-OP as designation 5061.
Drury Primary School	41 Burberry Road, 260, 160, 138 Bremner Road.	MoE	Educational Purposes – School and Early Childhood Centre.	NoR lodged, notified as at September 2018.
Drury South Substation	201 Quarry Road	Counties Power	New enclosed electricity substation.	NoR lodged.

3. Proposed Structure Plan

The land use scenario and estimated yields for both of the Structure Plan areas have been provided by Council and are summarised in the table and maps below. All figures are rounded to the nearest whole number.

The key land use features of the Drury-Opāheke Structure Plan area are as follows (refer to Council Structure Plan document for additional detail):

- A large town centre (Drury Central) to the south-east of the SH1 Drury Interchange, Great South Road and Waihoehoe Roads, and a local centre (Drury West) to the east of the SH22-Jesmond Road intersection;
- New industrial areas generally adjacent to existing industrial-zoned areas in the north of the Structure Plan area, to the south-west of the SH1 Drury Interchange, and south of Fitzgerald Road;
- Residential land use for much of the remainder of the Structure Plan area, with higher densities concentrated around the two main centres and planned public transport infrastructure.

The key land use features of the Pukekohe-Paerata Structure Plan area are as follows (refer to Council Structure Plan document for additional detail):

- Residential land use to the west and south of the existing Franklin 2 (Wesley) Precinct, including higher density to the south of the planned rail station at Paerata;
- A new local centre to the north of Pukekohe between the NIMT and Cape Hill Road;
- Generally low-to-medium density residential land use to the north-east of Pukekohe; and
- A mixture of medium density residential and light industrial to the north-west and south-east of Pukekohe.

The land use scenario for the Structure Plan areas was developed through an iterative, multi-disciplinary process. The process sought to reflect the symbiotic and inter-dependent nature of transport and land use, and has accounted for environmental and infrastructure constraints, land economics and market conditions.

The following transport factors were instructive in shaping key aspects of the land use scenarios:

- The increased provision of employment land to provide local employment opportunities with a view towards reducing outbound travel demand on the wider transport network (this is discussed further in sections 6.2.2, 7.2 and 8.5);
- Integration of centre locations with rail station locations to facilitate mode shift for both inbound and outbound trips, and with key road frontages to ensure visibility where required for centre viability;
- Providing for intensification and transit-oriented development around probable public transport routes with a view to facilitating modal shift by providing travel choice for local residents. This also ensures population density to support the relatively more efficient provision of public transport.

Plan Change processes will follow the completion of the Structure Plans to formally rezone land within the Structure Plan areas. A further ITA, providing more information and detail than was known at the time this ITA was prepared, will be required to support future Plan Change(s).

Table 3-1 – Council Land Use Scenario and Yields for Drury-Opāheke and Pukekohe-Paerata Structure Plan areas[14]

Area	Gross area (ha)	Net area (ha)	Net developable area (ha) [15]	Dwellings	Jobs	Population
Drury-Opāheke Structure Plan area	1,907	1,349	853	22,474	11,700	60,680
Pukekohe-Paerata Structure Plan area	1,262	995	569	13,444	5,372	36,300

Note: The above dwelling yield estimates from Council were adopted in the technical assessment. However, the population estimates (assessed as 2.7 people per household) are subject to revision through application of demographic trends, as undertaken by the Auckland Forecasting Centre to retain regional consistency.

[14] N.B. The quantities given in this table are taken from the draft land use provided by Council dated November 2018. Subsequent changes to the Structure Plan have resulted in small changes to these yields (see section 7.2 of this ITA).

[15] Net area is derived by deducting protection areas (e.g. floodplains) from gross area. Net developable area is derived by deducting an allowance of 30% for roads and reserves from the net area.

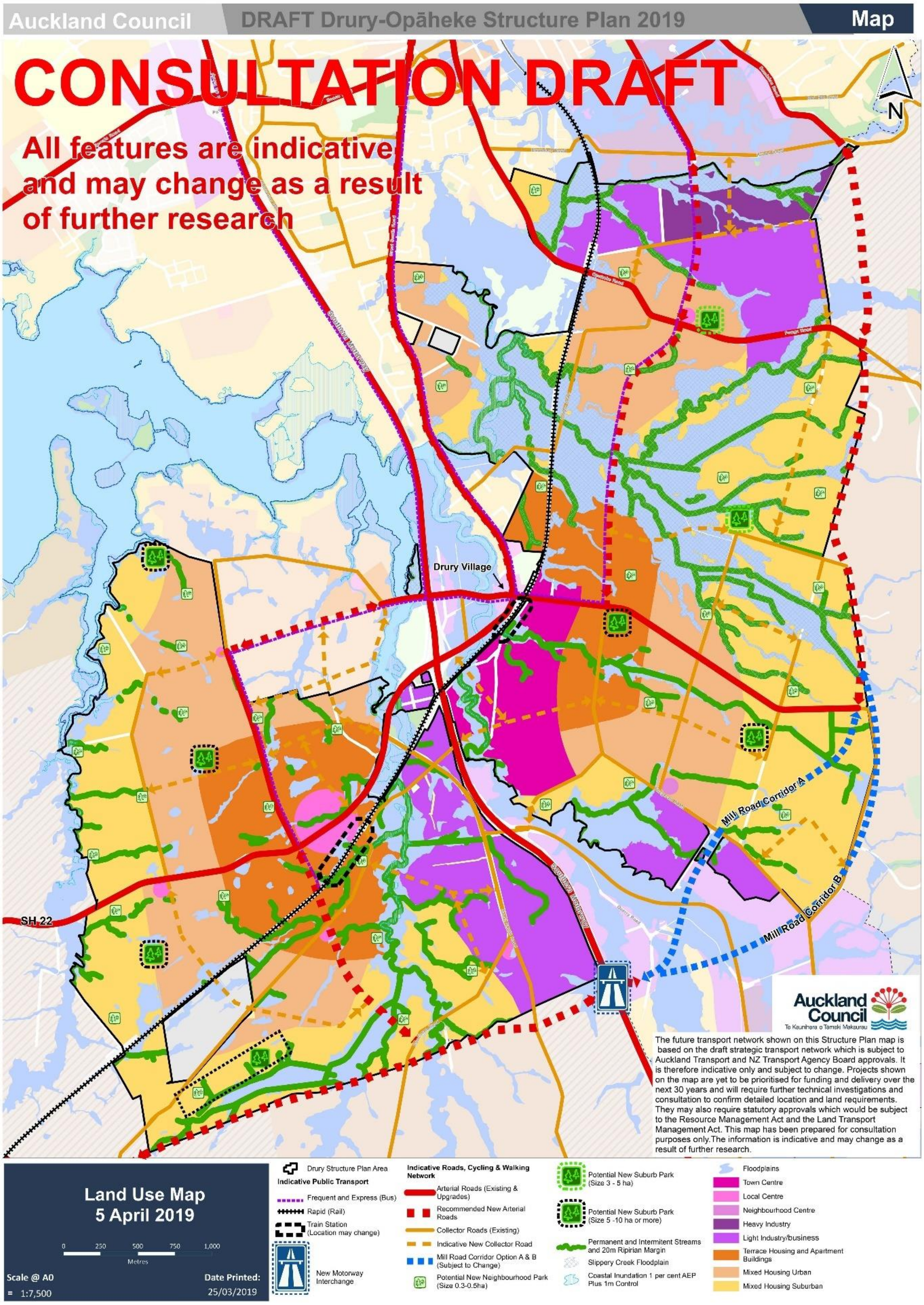

Figure 3-1 – Drury-Opāheke Structure Plan – Draft Land Use Scenario as at 29/3/19. Not to scale.

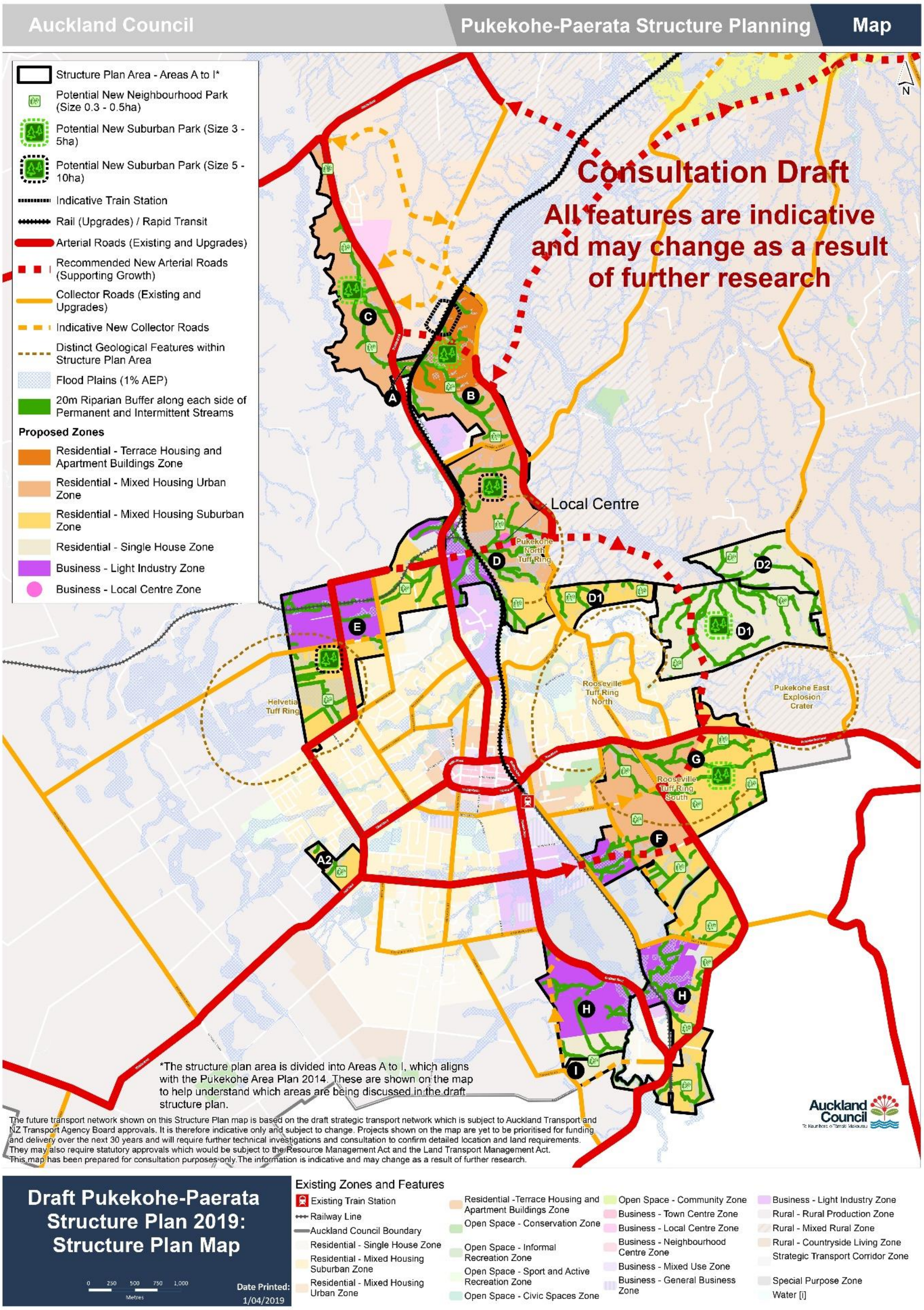

Figure 3-2 – Pukekohe-Paerata Structure Plan – Draft Land Use Scenario map as at 1/4/19. Not to scale.

4. Transport Planning Context and Background

4.1. Auckland Plan 2050

The Auckland Plan 2050[16] is a long-term (30-year) spatial plan developed by Auckland Council. The plan is required by legislation to contribute to Auckland's social, economic, environmental and cultural well-being.

The plan sets out high level strategic direction for transport and access, setting out three directions:

- **Direction 1** – Better connect people, places, goods and services;
- **Direction 2** – Increase genuine travel choices for a healthy, vibrant and equitable Auckland; and
- **Direction 3** – Maximise safety and environmental protection.

These directions are supplemented by seven focus areas:

- **Focus area 1** – Make better use of existing transport networks;
- **Focus area 2** – Target new transport investment to the most significant challenges;
- **Focus area 3** – Maximise the benefits from transport technology;
- **Focus area 4** – Make walking, cycling and public transport preferred choices for many more Aucklanders;
- **Focus area 5** – Better integrate land use and transport;
- **Focus area 6** – Move to a safe transport network, free from death and serious injury; and
- **Focus area 7** – Develop a sustainable and resilient transport system.

The Auckland Plan also provides high level strategic direction on land use through its development strategy, including a strategy of managed expansion into urban areas to meet growth needs. The Council's Future Urban Land Supply Strategy provides additional detail in respect of this direction. This is discussed in section 4.3 below.

4.2. Government Policy Statement (Land Transport)

The Government Policy Statement on Land Transport (GPS) outlines the Government's strategy to guide land transport investment over the next 10 years. The GPS influences decisions on how the National Land Transport Fund will be invested across activity classes. It also guides the Transport Agency and Local Government on the types of activities that should be included in the National Land Transport Programme and Regional Land Transport Plans.

The GPS strategic direction sets out the key objectives for the land transport system (see Figure 4-1). Improvements in safety, accessibility and transport choice, reductions in greenhouse gas emissions, and value for money are the key objectives. These objectives were a key input into the IBC.

[16] Auckland Plan 2050, Auckland Council, 2018.

Figure 4-1 – GPS Strategic Direction[17]

4.3. Future Urban Land Supply Strategy

The Future Urban Land Supply Strategy (FULSS)[18]identifies a programme to sequence the release of FUZ land for urbanisation over the next 30 years according to the planned staging of bulk infrastructure development. Table 4-1 and Figure 4-2 set out the planned staging and indicative yields as set out in the FULSS for the Southern Structure Plan areas.

For full context, it should be noted that there are a number of areas in the areas adjacent to the Structure Plan areas with existing live urban zoning, and accordingly are already considered 'development ready'. These areas are summarised in Table 2-1.

[17] Government Policy Statement (Land Transport), 2018/19-2027-28.

[18] Future Urban Land Supply Strategy – Auckland Council, 2017.

Table 4-1 – FULSS staging for the Southern Structure Plan areas

Area	Staging / Development Ready Date	Indicative Residential Yield (dwellings)
Paerata (remainder outside existing SHA area)	2018-2022	1,800
Drury West Stage 1	2018-2022	4,200
Pukekohe	2023-2027	7,200
Drury West Stage 2	2028-2032	5,700
Drury-Opāheke	2028-2032	7,900

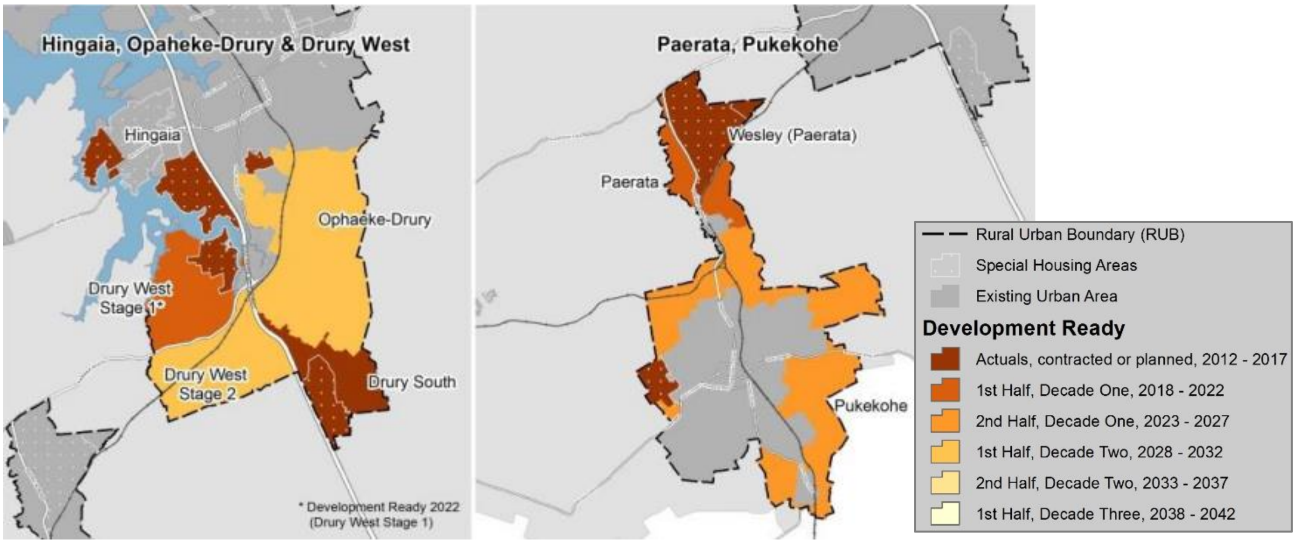

Figure 4-2 – FULSS maps for the Southern Structure Plan areas.

It should also be noted that 'development ready' in the FULSS does not necessarily mean that development will commence or will be complete in the timeframe indicated. Rather, the dates reflect when development could begin having regard to Council's intended date of initiating Plan Changes to live zone the land, and the planned staging of bulk infrastructure development. The actual timing of development will further be influenced by market attractiveness, developer readiness, land ownership patterns, and underlying regional growth trends.

4.4. Auckland Transport Alignment Project

The Auckland Transport Alignment Project (ATAP) is a joint project between the Council and the Government to determine an aligned strategic approach on transport for Auckland. The current (April

[19] Note – the yield figures in Table 4-1 are indicative figures taken from the FULSS. The Structure Plan land use yields noted in Tables 3-1 and 3-2 are more detailed, and are the figures used in the technical assessment in this ITA.

2018) iteration of ATAP)[20] focuses on investment priorities for the 2018-28 period, based on an assumed funding envelope of $28 billion over the decade. ATAP has provided guidance to statutory planning documents including the Government Policy Statement (GPS), National Land Transport Programme (NLTP) and the Regional Land Transport Plan (RLTP). It has also directly informed the Auckland Plan 2050.

The recommended 2018-28 investment package includes the following projects relevant to the Southern Structure Plan areas:

- SH1 Southern Corridor Improvements (Manukau-Papakura motorway widening);
- SH1 Papakura to Drury motorway widening (first stage of the Papakura-to-Bombay project);
- Mill Road Stage 1;
- Pukekohe Rail Electrification, and additional electric trains;
- Other greenfield transport infrastructure, being progressed through the Supporting Growth Programme.

4.5. National Land Transport Programme

The National Land Transport Programme (NLTP) is the Transport Agency's three-year investment programme under the Land Transport Management Act 2003. The NLTP allocates the Government's share of transport funding through the National Land Transport Fund, in a manner which gives effect to the GPS (see section 4.2). The projects committed through the current (2018-2021) NLTP pertinent to the Structure Plan areas are listed in section 5.5 of this ITA.

4.6. Regional Land Transport Plan

The Auckland Regional Land Transport Plan (RLTP) is a ten-year investment programme prepared by AT, together with the Transport Agency and KiwiRail under the Land Transport Management Act 2003. The RLTP contains the entire transport investment programme for the region enabled by all funding allocations (i.e. both from the Government via the NLTP, and Auckland Council via the Long Term Plan), and must give effect to the GPS (see section 4.2). The projects committed through the current (2018-2028) RLTP pertinent to the Structure Plan areas are listed in section 5.5 of this ITA.

4.7. Regional Public Transport Plan

The Auckland Regional Public Transport Plan (RPTP) is a statutory document prepared by AT under the Land Transport Management Act. The RPTP describes the public transport network that AT proposes for the region, identifies the services that are integral to that network over the next ten years, and sets out the policies and actions underpinning AT's approach to public transport planning, design, implementation and operation. The implications of the current (2018-2028) iteration of the RPTP pertinent to the Structure Plan areas are discussed in sections 5.2 (which discusses the current public transport network), and section 6.8 (which discusses the future public transport network).

[20] Auckland Transport Alignment Project, April 2018.

4.8. Supporting Growth

The Supporting Growth Programme (formerly known as the Transport for Future Urban Growth (TFUG)) was formed between the Transport Agency, Council and AT in order to plan the future transport networks and required urban infrastructure for four main growth areas of Auckland identified over the next 30 years – the North (Wainui, Silverdale and Dairy Flat), the North-West (Whenuapai, Redhills, Riverhead and Kumeu-Huapai), the South (Drury-Opāheke, Paerata and Pukekohe), and Warkworth.

The preferred TFUG network for the South from 2016 is shown below in Figure 4-3. The network has been refined and added to in the intervening period through the Business Case process, and has reached the IBC stage. The draft IBC network is shown at Figure 4-4, and forms a significant part of the transport network discussed in chapter 6 of this ITA. One of the key drivers for changes to the proposed network between TFUG and the IBC has been the evolution of land use scenarios over time, in particular the generally increasing development potential/yields

The key changes and additions to the preferred network made between 2016 TFUG network and the current recommended IBC network are as follows:

- Refinements to rail station locations;
- Active mode connection between Pukekohe and Drury;
- Four-tracking of the NIMT to Pukekohe;
- Several Frequent Transit Network (FTN) bus routes and associated new and upgraded roads;
- Capacity improvements on SH1;
- Recommended completion of the Pukekohe ring road;
- Capacity (four laning) and safety upgrade of Mill Road/Pukekohe East Road; and
- Safety upgrades to Buckland Road, Harrisville Road, and Blackbridge Road.

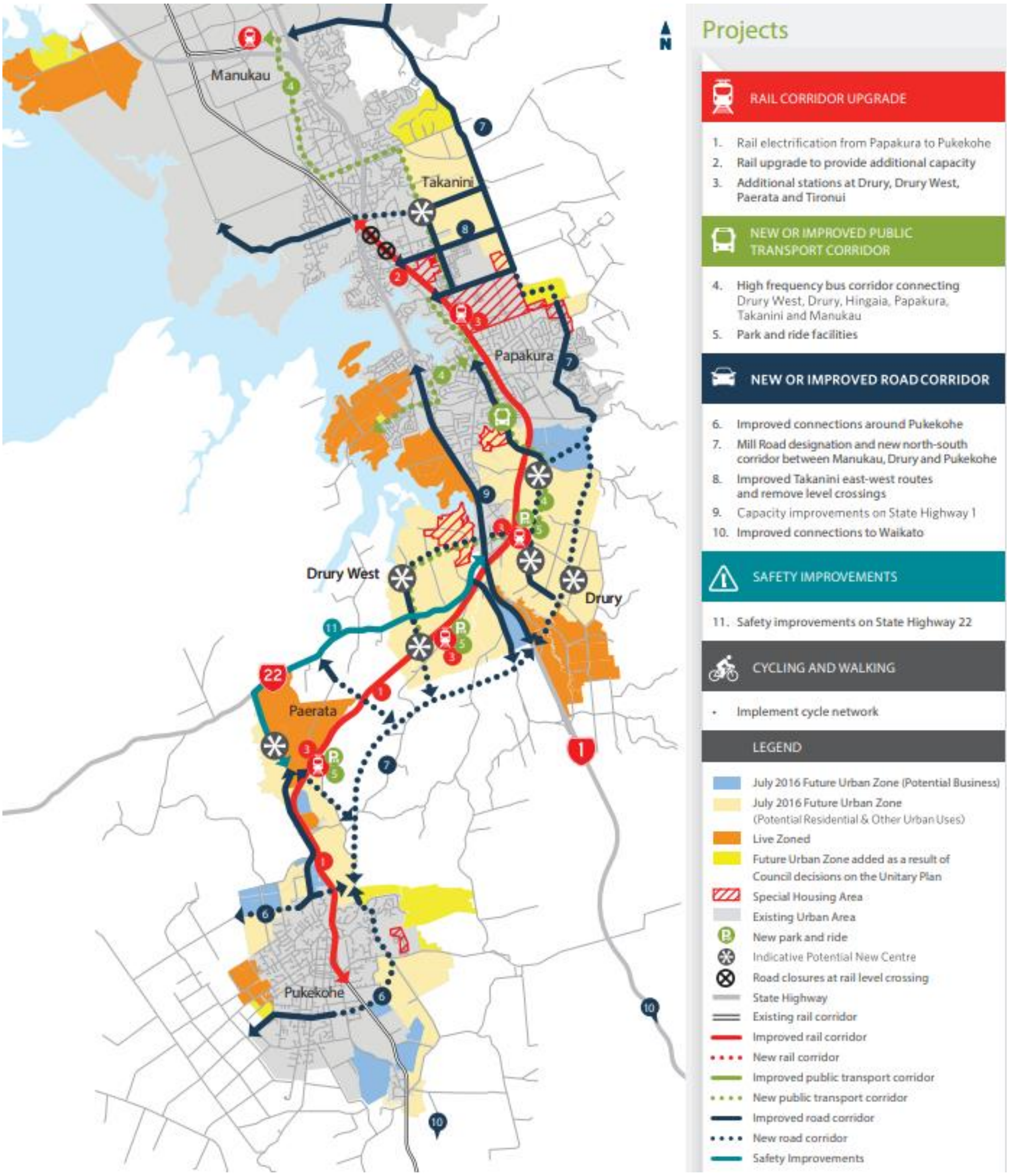

Figure 4-3 – Preferred TFUG (2016) network for the South.

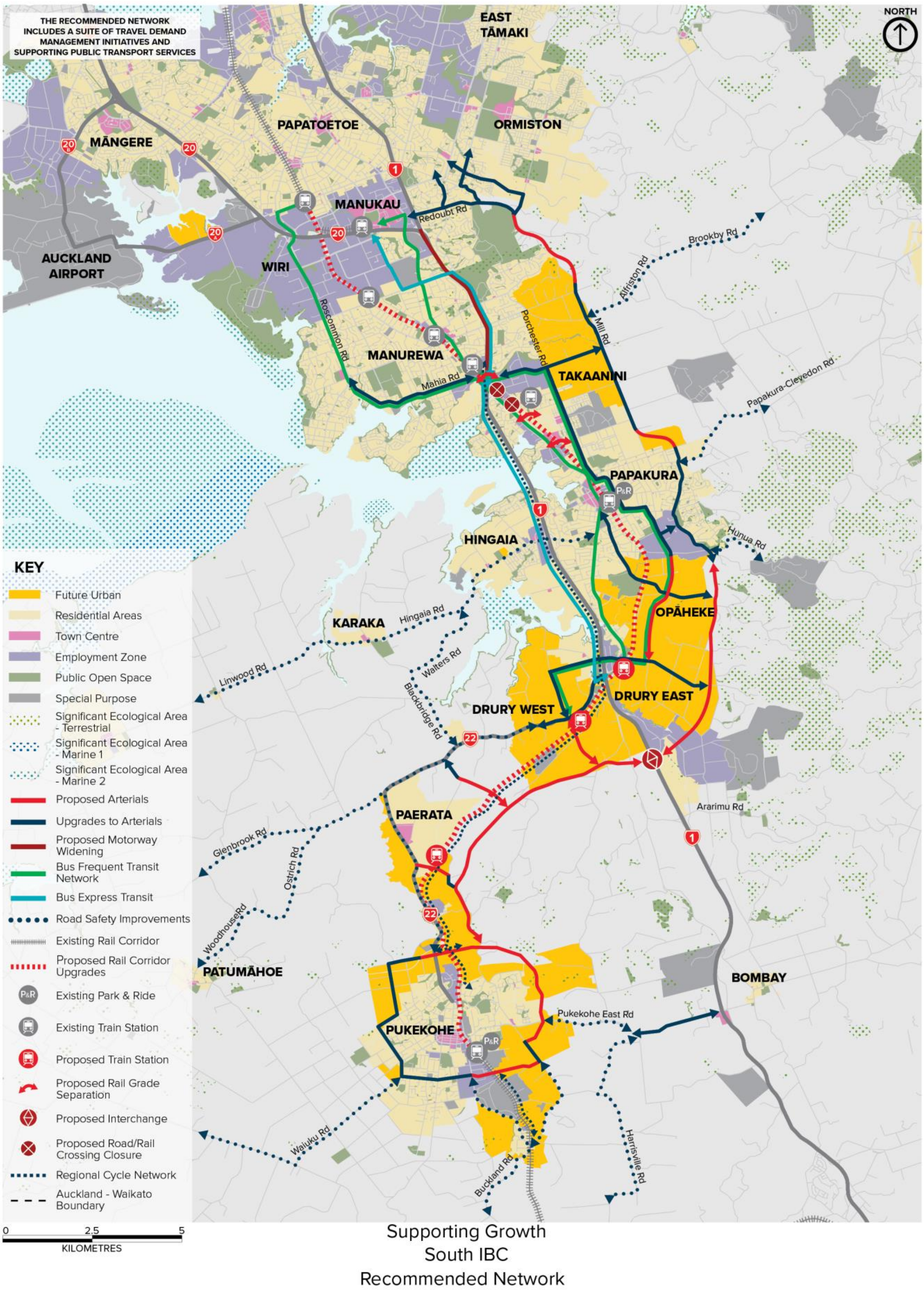

Figure 4-4 – Supporting Growth IBC draft recommended network for the South.

5. Land Use and Transport Environment

5.1. Existing Road and Rail Infrastructure

5.1.1. State Highway and Arterial Road Network

The Southern Motorway Corridor (SH1) is the critical national strategic and lifeline link connecting Auckland and the Waikato. It is classified as a National High-Volume Road under the One Network Road Classification, reflecting its national strategic function to support the economy as both an inter and intra-regional connection for people and freight. The SH1 Southern Corridor Improvements (SCI) project (see section 5.5.1) is currently underway and will provide additional general traffic capacity and walking and cycling improvements upon completion in late 2019.

SH1 between Papakura and Bombay is currently a four-lane (2-each way) motorway, with Average Daily Traffic (ADT) volumes ranging from 23,000 at Bombay to 43,000 at Takaanini. Between 8-12 per cent of trips along this section of SH1 are by heavy vehicles[21]. At present it is highly congested, in particular northbound during the morning peak, and an overall decline in the level of service in the evening peak (see Figures 5-2 and 5-3). In those figures darker colours reflect lower speeds/higher peak period congestion[22].

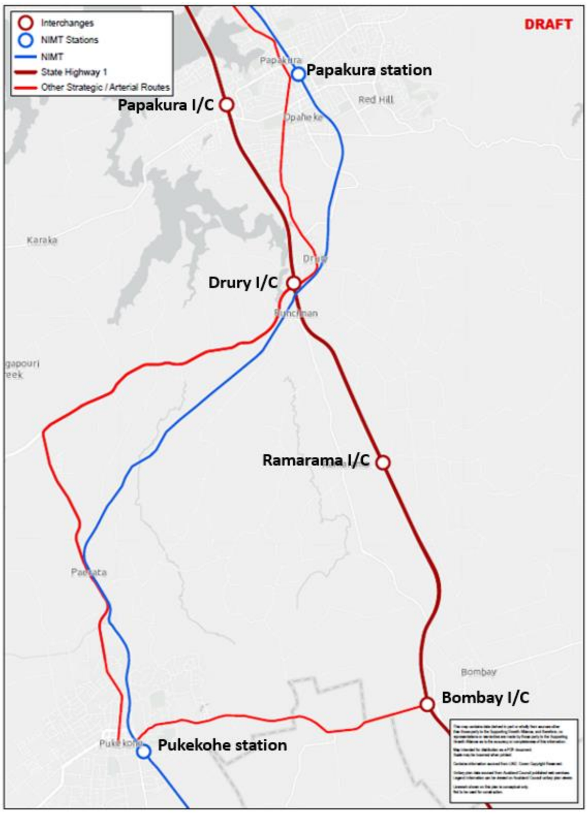

Figure 5-1 – Existing strategic transport infrastructure in the study area.

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[21] State Highway Traffic Volumes, NZTA, 2018.

[22] N.B. Some reported traffic volumes and levels of service may be affected by ongoing SH1 Southern Corridor works.

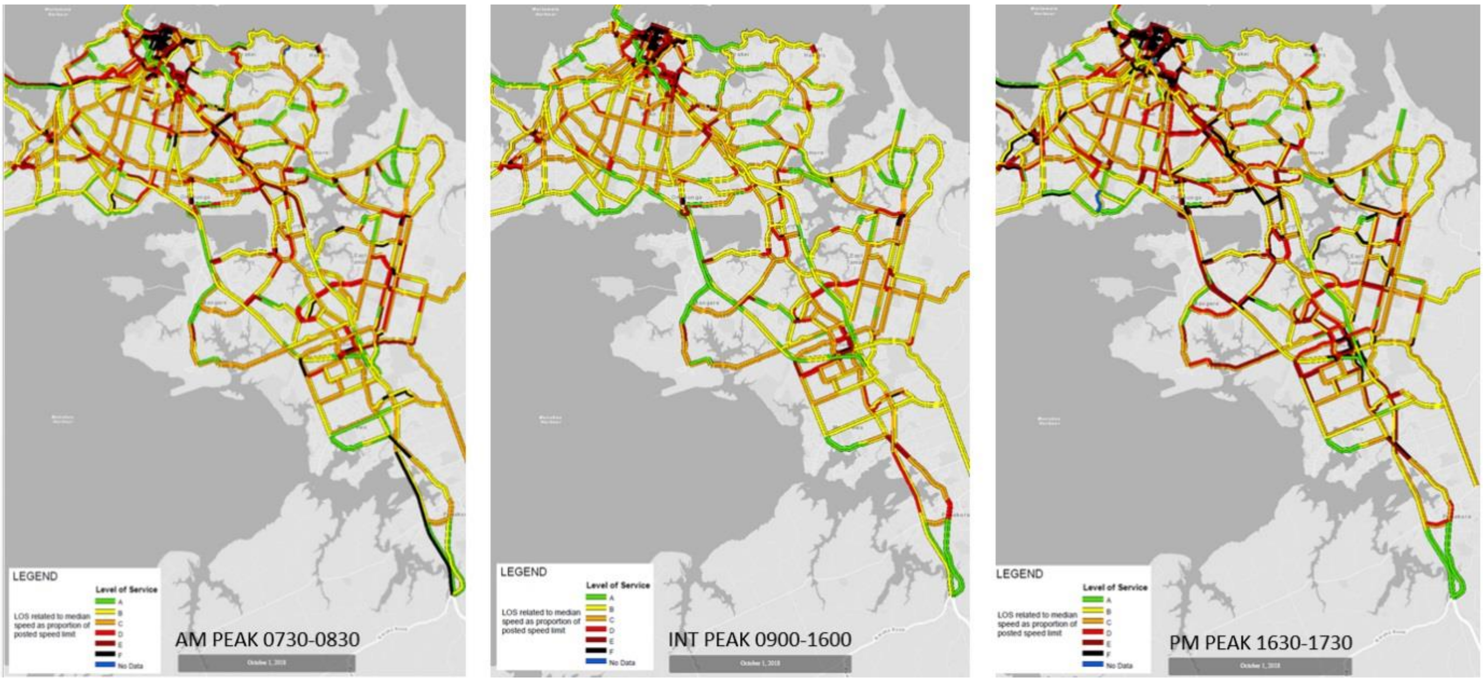


Figure 5-2 – LOS (vehicle speeds) as a proportion of posted speed limit. Study area in the bottom-right.

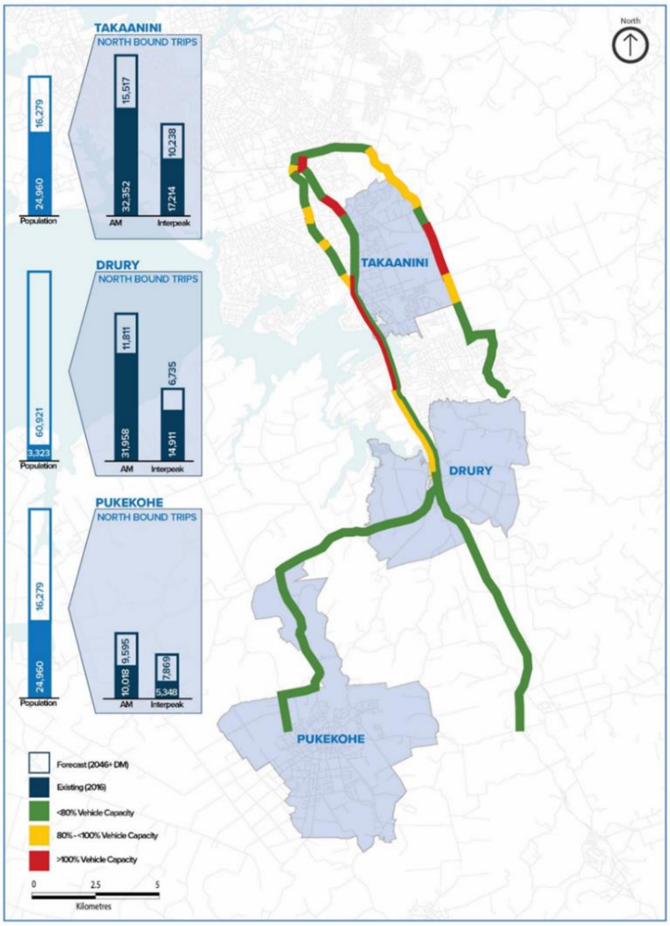


Figure 5-3 – Volume-capacity plot (present day) and forecast trips for study area (AM peak).

Motorway interchanges through the study area from north-to-south are located at Papakura, Drury, Ramarama and Bombay (see Figure 5-1).

Running parallel to the east of SH1 in the northern part of the study area is Great South Road (Urban Route 3) which runs from Mt Wellington to Drury as a two-lane arterial route with some four-lane sections. Great South Road then crosses under SH1 before turning south towards Bombay at its intersection with SH22.

SH22 runs east-west from its intersection with Great South Road (the section known as Karaka Road), until it turns south towards Paerata and Pukekohe (the section known as Paerata Road) at its intersection with Glenbrook Road (which runs further west towards Waiuku). The ADT volumes for SH22 range from 16,000 near Pukekohe to 26,000 near Drury, with a heavy vehicle percentage of between 4-6 per cent[23]. The Urban Route 3 section of Great South Road within the study area varies from 12,000-15,000 ADT, with a heavy vehicle percentage of approximately 10 per cent[24]. Congestion levels generally fall within the acceptable range along these routes within the study area.

The Pukekohe East Road/Mill Road corridor provides a linkage between Pukekohe and SH1 at the Bombay Interchange. The ADT volumes along this route range from 13,000 to 18,000, with a heavy vehicle percentage of between 9-16 per cent[25]. A number of north-south routes linking to the North Waikato also originate from this corridor, including Harrisville and Buckland Roads.

With the exception of SH1 and the urban parts of Pukekohe, the roads in the study area are of a variable rural highway standard.

5.1.2. Key non-arterial roads

Given much of the study area remains rural in character, the road network is sparse. Table 5-1 summarises the key non-arterial roads in the Structure Plan areas as they currently exist.

Table 5-1 – Key non-arterial roads in the study area

Road name	ADT volumes[26]	Condition
Opāheke Road / Ponga Road	1,900 (eastern end), 6,400 (western end)	Two-lane urban road with footpath, kerb-and-channel (western), two-lane rural road (eastern).
Waihoehoe Road	~2,000	Two-lane rural road.
Fitzgerald Road	1,600-2,000 (at Quarry Road roundabout)	Two-lane rural road.
Quarry Road	~500-600	Two-lane rural road.

[23] State Highway Traffic Volumes, NZTA, 2018.

[24] State Highway Traffic Volumes, NZTA, 2018.

[25] Traffic Counts, AT, 2018

[26] Traffic Counts, AT, 2018

Road name	ADT volumes[26]	Condition
Bremner Road	~700-1,000	Two-lane rural road (currently being upgraded as part of Auranga development).
Jesmond Road	No data available.	Two-lane rural road.

5.1.3. North Island Main Trunk railway line

The North Island Main Trunk (NIMT) railway line connecting Auckland and Wellington runs through the study area between Papakura and Pukekohe. The distance between these two stations is approximately 18km. The NIMT is a double-tracked, non-electrified line in this section (the Auckland electrified passenger network ends at Papakura), and is used by a mix of AT passenger shuttle services running between Papakura and Pukekohe, KiwiRail freight trains, and the Northern Explorer long distance passenger service between Auckland and Wellington which departs thrice weekly each way. The maximum line speed in this section is 110km/h for passenger trains, and 80km/h for freight.

There are rail stations at Papakura and Pukekohe which both have park-and-ride and bus interchange facilities, and enhanced interchange facilities at both stations are complete. There are 230 park-and-ride spaces at Papakura, and a further 87 at Pukekohe. There are currently no intermediate stations between Papakura and Pukekohe.

5.2. Existing Public Transport Services

5.2.1. Bus

A new bus network for South Auckland, including Pukekohe and Waiuku, was introduced in October 2016 as part of AT's region-wide restructure of bus services (the 'New Network').

Papakura Train Station serves as the key terminus and interchange point for buses serving Takaanini, Keri Hill, Red Hill, Opāheke, Drury Village, Pahurehure, Hingaia and Waiuku (see Figure 5-4). Given its land use remains largely rural, the Drury-Opāheke Structure Plan area currently has limited services, though the RPTP provides for service extensions to coincide with urbanisation (for example to Auranga). Apart from route 33 (a frequent route running between Papakura and Otahuhu), all of the bus services in and around Papakura are collector level services (defined in the current RPTP as running at least every 20 minutes between 7am-7pm daily, and every 30 minutes in the remainder of its hours of operation), local services (variable frequency and span of service), or peak-only services.

Pukekohe's bus services comprise three local 'loop' services within the town, and a further two services servicing Wesley College and Waiuku respectively (see Figure 5-5).

5.2.2. Rail

As noted above, access to commuter rail services in the Structure Plan areas are currently limited to the existing stations at Papakura and Pukekohe (see Figure 5-6). Given that the Auckland electrified passenger rail network ends at Papakura, rail services between Papakura and Pukekohe are currently diesel shuttles operating at a 20-minute headway (3 trains/hour) at peak periods, and hourly at other times. Passengers can transfer at Papakura to Southern Line services which terminate at Britomart. The Southern Line operates at a 10-minute headway (6tph) at peak periods, and between 20-30 minutes (2-3tph) outside of peak.

Figure 5-4 – Bus services in the vicinity of Papakura Station.

Figure 5-5 – Bus service in Pukekohe.

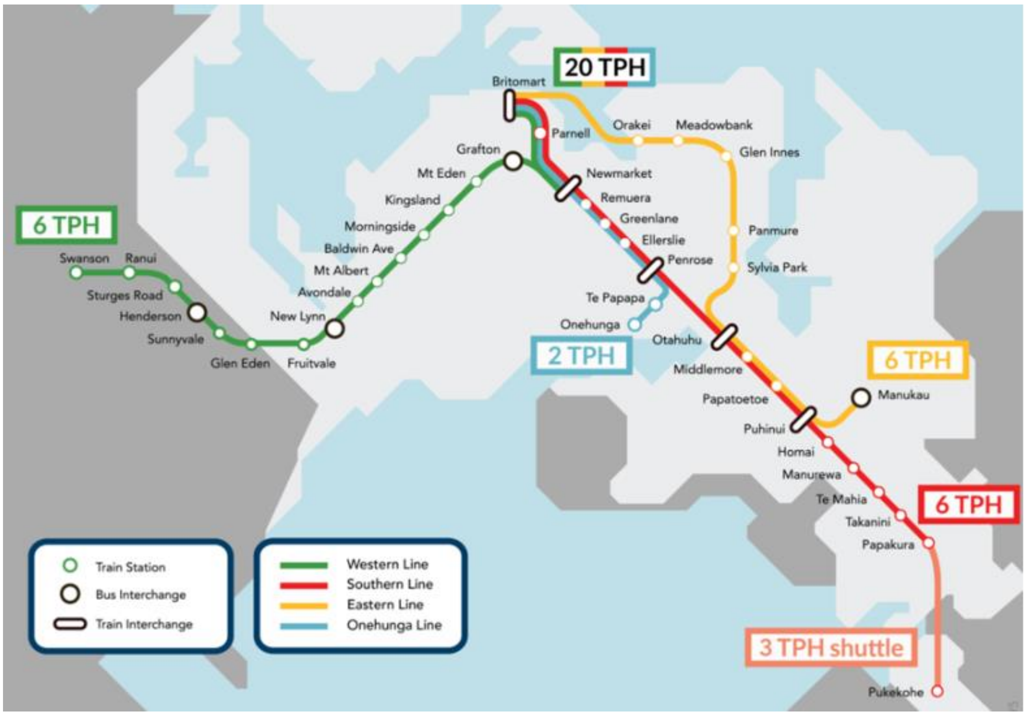


Figure 5-6 – Auckland rail service patterns, including the Southern Line in red and Pukekohe Shuttle in orange

5.3. Walking and Cycling Infrastructure

Given the rural character of both Structure Plan areas, the roads in the study area are of a variable rural highway standard, generally without footpaths or dedicated cycling facilities. The urbanised parts of the wider study area such as Papakura and Pukekohe have urban roads with footpaths and kerb-and-channel drainage, but very few dedicated on or off-road cycle routes. Current low volumes through much of the study area make many of these routes popular with leisure and sports cyclists, but this amenity is likely to be degraded as the area urbanises at which point dedicated infrastructure becomes necessary.

The Auckland Cycle Network (ACN) comprises planned/committed routes, and proposed routes with no likelihood of funding prior to 2028. Figure 5-7 shows the current ACN map as it applies to the study area. Apart from the planned walking and cycling facilities and safety improvements along SH1 and SH22 (see section 5.5 below), there are no funded walking and cycling projects for the study area. The active mode network proposed through SGA's business case is likely to supplement and supersede much of the ACN in this area (see section 6.9 of this ITA).

It should be noted that live zoned areas under development are generally providing upgrades of existing roads to urban condition, including facilities for active modes. These are generally not included on Figure 5-7. Section 5.5.7 provides some explanation of the scope of these improvements.

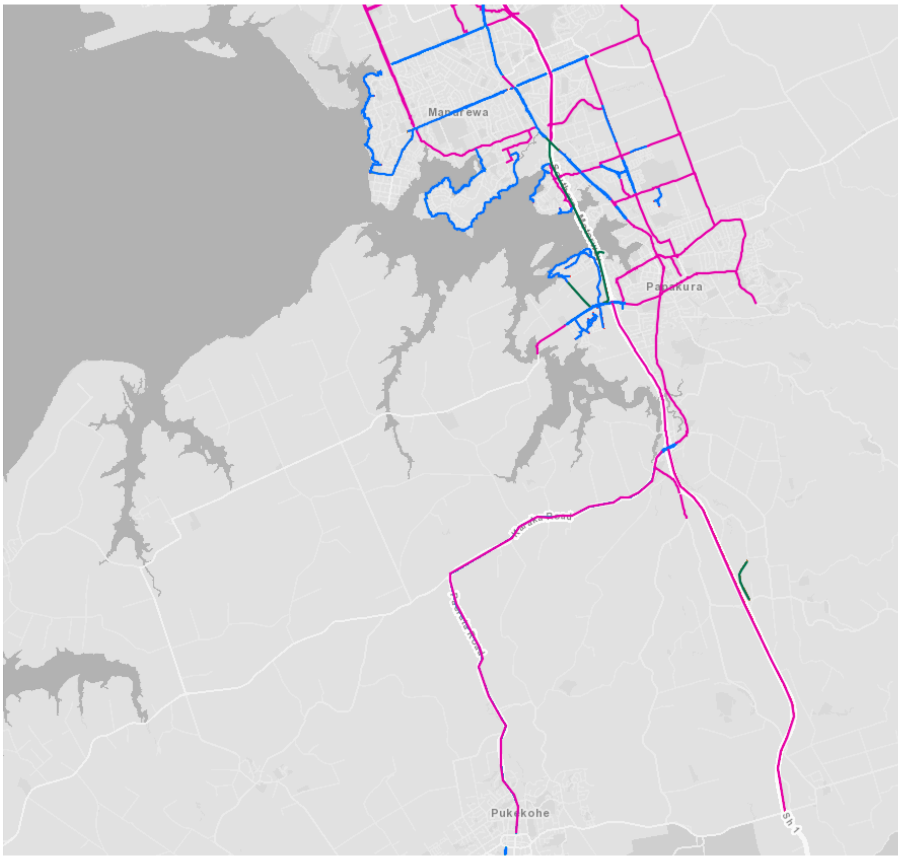


Figure 5-7 – Existing, planned and proposed routes on the current Auckland Cycle Network (ACN). Blue routes are existing, green routes are planned (i.e. committed), and pink routes are proposed (i.e. not yet committed). Note that the ACN is to be supplemented/superseded by SGA's proposed active mode network (see section 6.9 of this ITA).

5.4. Freight Infrastructure

Freight infrastructure in the study area comprises both roads and rail.

AT's Regional Freight Network (RFN) identifies key freight attracting/generating areas, and key road freight routes region-wide. The wider study area contains a number of areas classified as minor freight generating/attracting areas and future freight generating/attracting areas in the RFN (see Figure 5-8). These include Red Hill industrial area, Hunua Quarry, Drury Quarry, Glenbrook Steel Mill and Bombay Quarry (existing; and Drury South industrial area and Pukekohe (future).

Road freight routes in the RFN are organised according to a three-tier hierarchy. These are as follows:

- Level 1 (Red and Blue) – denotes strategic inter and intra-regional freight routes;
- Level 2 (Green) – denotes routes serving freight movements in areas such as industrial parks without sensitive land uses; and
- Level 3 (Orange) – denotes routes which are located in areas with sensitive land uses, but are used by necessity.

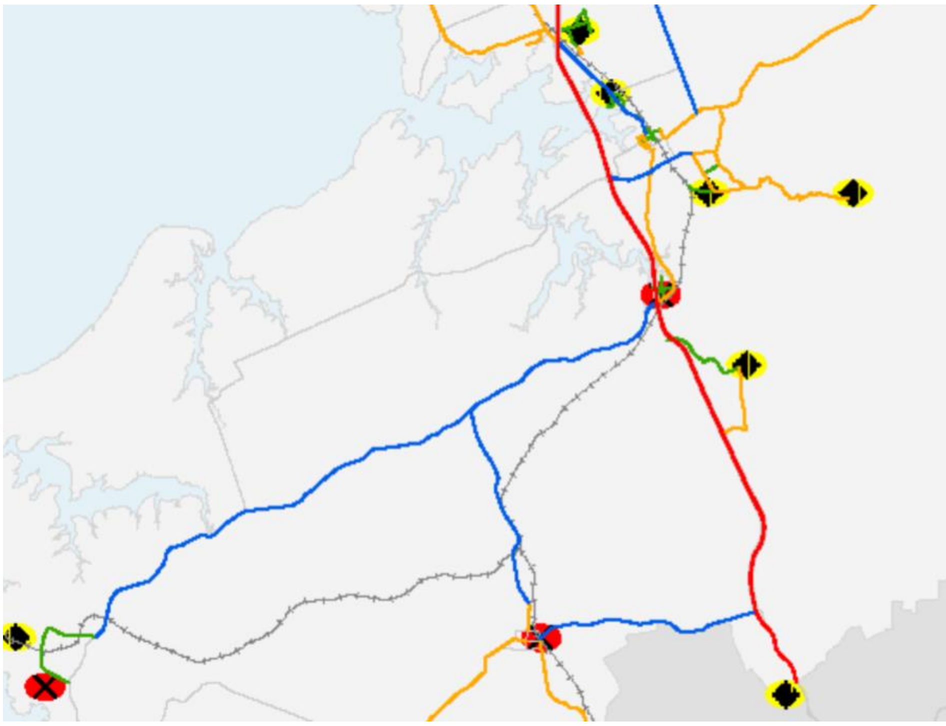


Figure 5-8 – Regional Freight Network (road) in the south.

The key freight routes on the RFN in the study area include:

- SH1 Southern Motorway (classified as a level 1A route);
- SH22 Karaka Road and Paerata Road (classified as a level 1B route);
- Pukekohe East Road (classified as a level 1B route);
- Glenbrook Road (classified as a level 1B route);
- Quarry Road (classified as a level 2 route)
- Great South Road between Papakura and Drury (classified as a level 3 route)[27];and
- Boundary Road and Hunua Road (classified as a level 3 route).

Over-Dimension Routes[28] within the Structure Plan areas include the following routes:

- SH1 between Drury and Bombay;
- Great South Road;
- SH22 Karaka Road and Paerata Road;
- Glenbrook Road; and
- Ararimu Road.

[27] N.B. While Great South Road is notionally classified as the freight route in the RFN and as an Over-Dimension route, the route is constrained by the SH1 bridge at the Drury Interchange which does not have sufficient clearance for over-height vehicles. Freight vehicles therefore deviate via Bremner Road, Victoria and Firth Streets. This issue will be rectified when the Interchange is rebuilt as part of the SH1 Papakura to Bombay project.

[28] Over-Dimension Vehicle Maps – NZ Transport Agency, 2007.

The NIMT railway line also plays an important role for freight movement in addition to passenger services, providing a strategic link between Auckland's Port and Inland Ports, and other strategic Ports including Tauranga and Wellington. The key constraint on rail freight is the constrained two-track section between Westfield and Wiri, which is currently at its operational limit of 12 passenger trains and two freight trains per hour at peak. The planned[29] addition of a third line will relieve this constraint, and further increase the strategic importance of the NIMT for both freight and passenger trains.

5.5. Committed[30] Transport Projects

5.5.1. SH1 Southern Corridor Improvements

The $268 million SH1 Southern Corridor Improvements project incorporates a range of improvements to the SH1 Southern Motorway corridor between Manukau and Papakura, including:

- Southbound widening to four lanes between the SH1/SH20 connection and Hill Road, and three lanes between Hill Road and Papakura;
- Northbound widening to three lanes between Papakura and Takaanini;
- Upgrade of the Takaanini Interchange to provide a freight lane, new ramps and improved safety;
- Walking and cycling improvements including a 4.5km shared use path between Takaanini and Papakura; and
- New LED lighting and barriers to improve safety.

The project is currently under construction and is scheduled for completion in December 2019.

5.5.2. SH1 Papakura to Bombay

The SH1 Papakura-to-Bombay project builds on the improvements being delivered as part of the Southern Corridor Improvements project, and forms an early priority for the Supporting Growth Programme. It is divided into two stages – the Papakura-to-Drury section to be delivered as a first decade (2018-28) implementation priority, and the Drury-to-Bombay section earmarked for route protection only in the first decade. The key transport benefits envisaged for the project include:

- Additional motorway lanes in both directions, and wide shoulders to future-proof for public transport services along the SH1 corridor;
- Enhanced walking-and-cycling including a shared use path parallel to the SH1 corridor, and new/enhanced local connections across the SH1 corridor;
- Improvements to Drury Interchange including enablement of additional rail lines and rail electrification;
- Potential northbound managed special vehicle lane to prioritise high-occupancy vehicles, ride-sharing, electric vehicles and freight to be investigated further; and

[29] See section 5.5.6 of the ITA for additional commentary on the Wiri to Quay Park rail improvements project.

[30] For publicly funded projects, "committed" means capital projects committed and/or funded in the current National Land Transport Programme (NLTP) and Auckland Regional Land Transport Plan (RLTP).

- An upgraded alignment, variable speed limits, and incident detection capacity to improve safety.

The current RLTP allocates approximately $412 million to the project over the 2018-28 decade.

5.5.3. SH22 Drury-to-Paerata (Safe Roads) project

The SH22 Drury-to-Paerata Safe Roads project is a road safety improvement along SH22 between the SH1 Drury Interchange and the Paerata township currently being planned by the NZTA Safe Roads Alliance to address deaths and serious injuries along this stretch of road. Key things being considered are safety improvements at key intersections, safety barriers, speed limit reviews and the removal of unsafe passing lanes.

The project is currently at the design stage. However, through this project, the Transport Agency has identified that improvements on this corridor will likely need to be delivered in a staged way over time to support both short-term safety needs and longer-term growth. Long term plans are therefore being developed in an integrated way with the wider Supporting Growth Programme, including how to respond to the potential demand for expedited urbanisation of sections of the SH22 corridor.

5.5.4. Mill Road

The proposed Mill Road corridor provides an additional strategic north-south corridor for southern Auckland, connecting Manukau and Drury with a route parallel to the east of SH1. Designations for the northern section of the project (comprising the first 8.9km of the corridor from the SH1 Redoubt Road interchange to the Mill Road/Popes Road interchange, including sections of Hollyford Drive and Murphys Road) have been secured. Route protection for the southern section of the project has not yet been undertaken. The SGA business case process is considering options for the corridor to pass through or around Papakura, and where/how the southern section of the corridor should connect to SH1. AT has always planned to implement this corridor in stages to support growth.

In 2018, approximately $500 million was allocated through the ATAP report and the RLTP to be invested over the 2018-2028 decade to undertake intersection and safety improvements, as well as protecting the whole corridor to enable construction in the future. As a result, SGA is currently undertaking a more detailed Mill Road Corridor Prioritisation Assessment to confirm the location, indicative concepts, and proposed timing for improvements (proposed within the 2018-2028 decade) on the corridor within the $500 million funding allocation. This assessment is expected to be confirmed in mid-2019.

While this process takes place, AT will be implementing safety improvements at the Redoubt Road-Murphys Road intersection in 2019, and is progressing the investigation into the provision of dynamic lanes on Redoubt Road between the SH1 Redoubt Road interchange and Hollyford Drive to provide an additional traffic lane for the peak direction.

5.5.5. Pukekohe Rail Electrification and additional electric trains

The electrification of the 18km stretch of the NIMT between Papakura and Pukekohe has been confirmed to be delivered in the 2018-28 decade in the NLTP/RLTP and the current Auckland Transport Alignment Project (ATAP) report. The NLTP and RLTP indicate funding of approximately $232-236 million between the 2018-2021.

A further $133 million has been allocated to an additional 15 electric trains to enable electric rail services to be extended to Pukekohe and to provide additional capacity on the rail network. The first of the new EMUs are expected to be operational in 2019.

5.5.6. Wiri to Quay Park rail corridor improvements

The NLTP/RLTP allocates approximately $172-182 million to NIMT improvements between Wiri and Quay Park. These include a third main line between Wiri and Westfield, and improvements at Westfield Junction and Quay Park. The overall purpose of the project is to provide additional capacity on the rail network to reduce conflicts between passenger and freight rail, and ensure more services can be run. The project is currently in its Detailed Business Case phase.

The project is not physically within the study area, but the rail service improvements assumed by SGA in the Southern Growth areas rely on the additional rail network capacity created by this project.

5.5.7. Developer Commitments

A number of the development areas summarised in Table 2-1 are committed to the provision of selected transport infrastructure upgrades as part of their developments. Some of these are partially publicly funded. Table 5-2 summarises the key projects (excluding lower order local roads) being delivered through development.

Table 5-2 – Transport Projects – Developer Commitments

Precinct	Projects	Funding arrangement
Hingaia 1-3	Upgrade of Hingaia and Park Estate Roads, various intersections and collector roads.	$5.6m public share included in RLTP as a Local Residential Growth Fund item. AT funds relate to arterial road upgrades, all others are developer funded.
Drury South (industrial and residential)	Spine Road, Quarry Road upgrade, Fitzgerald Road cycleway.	Cost share - $10m public share towards Spine Road included in RLTP as a funded project, with a further unfunded portion.
Drury 1 (Auranga or Bremner Road)	Upgrades of Bremner and Jesmond Roads, new east-west strategic connection.	Upgrades to generally be developer funded. AT have purchased some land required for east-west strategic connection.
Franklin 2 (Wesley)	Rail corridor crossing linking Paerata and Sims Roads.	No funding agreement in place. All new local roads developer funded. New connections being identified in IBC network.

5.5.8. Other projects

The Government has signalled an intention to introduce inter-regional rail services between Auckland, Hamilton and Tauranga as a means of supporting growth and housing, and improving inter-regional accessibility. While further investment in the rail network to meet forecast growth in passenger and freight services is a prerequisite to comprehensive inter-regional services, the NZTA has approved a $78 million five-year trial service between Hamilton and Papakura. The trial service will run two return trips daily.

5.6. Topography and Ecology

The high-level consideration of topographical and ecological constraints has been integral in the process of developing the transport networks proposed in both the IBC and this ITA. In considering these factors early on, the IBC and ITA seek to minimise the environmental impact of the future network, as well as ensure that projects are feasible to fund, consent and construct.

Generally, the Structure Plan areas are currently rural in character and are used mainly for countryside living and agricultural activities. The area has a varied topography, including harbour foreshore and coastal margins with associated mangroves and saltmarshes, fertile plains, undulating hills, and the foothills of the nearby Hunua Ranges.

The IBC notes numerous environmental features and constraints pertaining to the study area, many of which are protected by AUP-OP natural resources and natural heritage provisions. These include:

- Pahurehure Inlet (a tributary of the Manukau Harbour), is located to the north-west of the Drury-Opāheke study area. The Inlet contains Significant Ecological Areas (SEA) (wading bird and mangrove area), is of cultural importance to Mana Whenua, and contains an Outstanding Natural Feature (ONF) (coastal cliffs, ID198);
- Four Drury-Opāheke stormwater catchments drain to the Manukau Harbour via Pahurehure Inlet – Slippery Creek, Hingaia Stream, Ngakoroa Stream and Oira Creek. Approximately one-quarter of the Drury-Opāheke FUZ is within the floodplains of these four catchments;
- The coastal margins around Drury Creek are identified as an SEA Marine 1, and is also subject to the Coastal Inundation 1 per cent AEP plus 1m control in the AUP-OP;
- Drury Conservation Area adjoining Drury Creek is public conservation land and also part of the West Coast North Island Marine Mammal Sanctuary, both managed by the Department of Conservation;
- The Pukekohe-Paerata area also contains a number of streams, including the Whangapouri Stream, Oira Creek and their tributaries;
- The Pukekohe East tuff ring is identified as an ONF (ID169);
- The Coulthards Scenic Reserve east of Paerata is identified as an Outstanding Natural Landscape (ONL), and an SEA;
- Rooseville Park on the eastern fringe of Pukekohe is a suburban park with a large stand vegetation identified as an SEA; and
- Pukekohe Hill, approximately 3km south of the town centre.

Other management layers and controls in the AUP:OP relevant to the Drury area are:

- Natural Resources: High-Use Stream Management Areas Overlay
- High-Use Aquifer Management Areas Overlay in the south
- Quality-Sensitive Aquifer Management Areas Overlay in the south east
- Stormwater Management Area Controls in Hingaia
- Wetland Management Areas Overlay to the west
- Coastal Inundation 1 per cent AEP Plus 1m Control – 1m sea level rise in the coastal areas near Drury Creek.

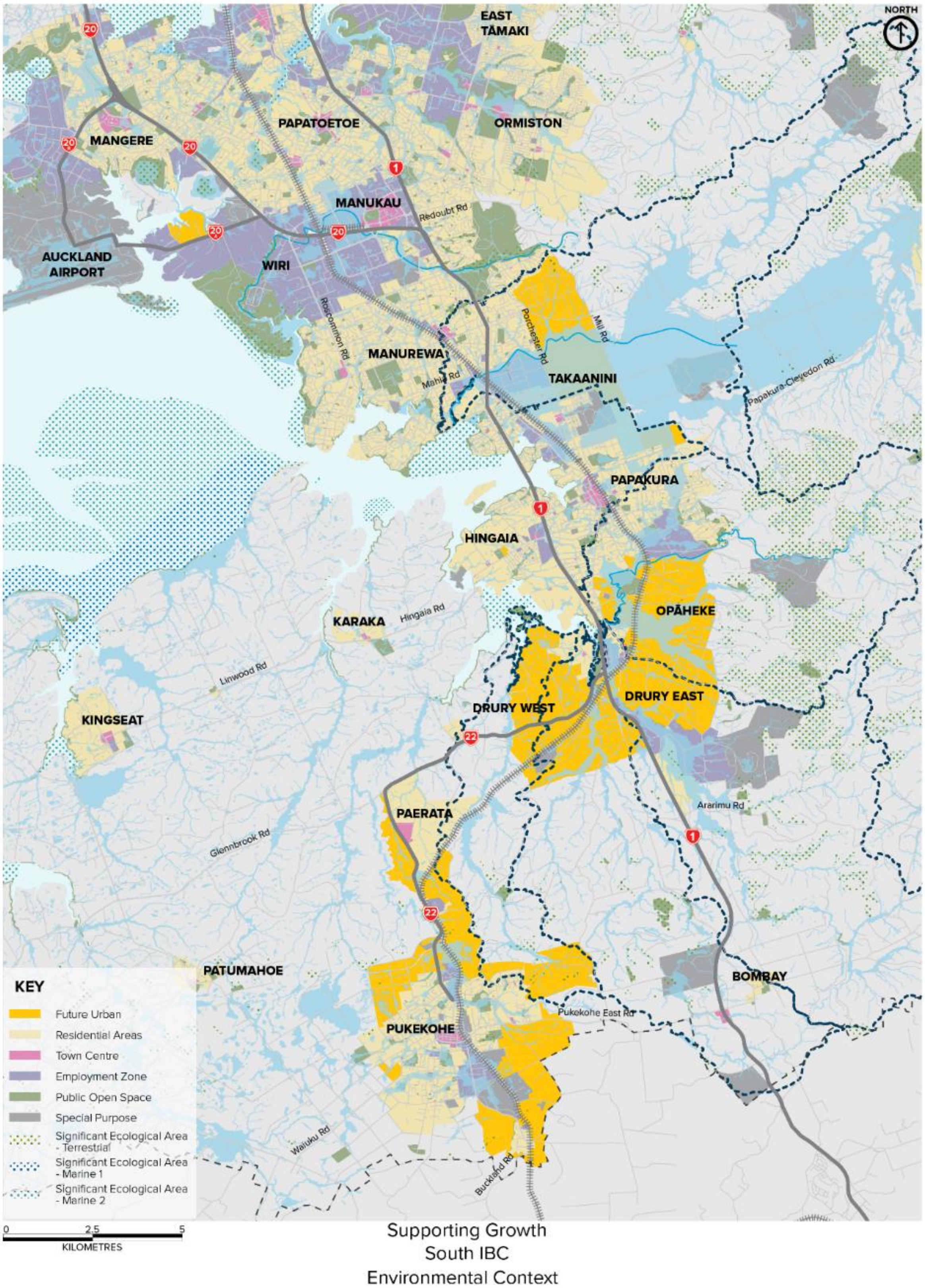


Figure 5-9 – Environmental Context map from IBC.

6. Proposed Transport Network

6.1. Network Development – introduction

6.1.1. Purpose, Scope and Relationship to IBC

The development of a proposed transport network for the Southern Structure Plan areas is a key objective of this ITA. This chapter documents the inputs considered and process followed in the ITA, and the resultant full transport network assumed for the full build-out year (2048+). Subsequent chapters assess the expected performance of the proposed network over time using 2028 as an intermediate year. Note that the IBC used a 2046+ horizon, which has been extended to 2048+ for this ITA to align with the Auckland Forecasting Centres shift in forecast years.

The proposed transport network developed in this ITA for the Southern Structure Plan areas comprises the following elements:

- Indicative strategic and arterial roads;
- Indicative collector roads;
- Indicative rapid, frequent and connector public transport networks; and
- Indicative regional, primary and secondary active mode network.

The strategic/regional networks being developed by SGA through the business case process are the basis for the ITA strategic/arterial transport network. Notwithstanding that, there are subtle differences between the ITA and IBC in focus, scope and granularity. The key differences are summarised in Table 6-1:

Table 6-1 – Business case and ITA networks – differences in scope, granularity and purpose

Factor	Business Case network	ITA network
Focus	The business case networks are being developed with a view towards establishing the route protection requirements for the strategic/regional networks. Indicative Business Case for the whole Southern growth area has been undertaken to identify a holistic network. More detailed refinement of the network is expected through subsequent Detailed Business Cases of individual projects.	The ITA network is being developed to demonstrate how transport responds to/services the defined Structure Plan land use scenario and sequencing. It is also intended to provide guidance on how a connected urban form is to be established, and on optimal land use-transport integration in the context of the Structure Plan areas. The ITA networks would be expected to be refined through more detailed Plan Change and subsequent subdivision consents
Spatial scope	Southern business case areas in their entirety including the Structure Plan areas.	Structure Plan areas only (Drury-Opāheke, Pukekohe-Paerata).

Factor	Business Case network	ITA network
Temporal scope	Focus on transport needs associated with full build-out only (assessment year 2048+).	Transport needs associated with partial build-out (interim assessment year 2028) and full build-out (2048+) to demonstrate potential sequencing.
Networks covered	Strategic/regional networks only – i.e. state highways, strategic/arterial roads, rapid and frequent public transport; and regional/primary active mode networks.	Per the business case networks, but with the addition of an indicative collector road network, connector public transport services, and secondary active mode networks.

Notwithstanding these important differences, the relationship between the business case and ITA transport networks is iterative. The recommended IBC network is a logical starting point for the ITA given that the strategic/regional networks already substantially shape the network for the Structure Plan areas and are supported by extensive analysis and optioneering. The key IBC network assumptions adopted in the ITA are discussed more extensively below through section 6.2.

The IBC is restricted in scope to the higher order transport networks, and there is limited information available at this stage of on detailed land use activities (such as the locations of schools, hospitals etc) and detailed local street network design. Accordingly, the ITA has needed to take a first principles approach to the development of a collector road network to sit below the strategic/regional networks. The transport planning and urban design first principles used in the development of the collector road network are documented in section 6.3.

6.1.2. Feedback loops and Network Refinement

The interplay of land use and transport in a Structure Planning process is such that the development of the transport network through the ITA is by necessity an iterative process. In this case, there are other notable feedback loops given the concurrent ongoing business case process.

The key feedback loops and associated opportunities for this ITA are as follows:

- **Business case** – As noted above, the IBC transport network has been adopted as a starting point for the development of the ITA network. While the IBC is substantially complete, there are several 'fluid' matters (discussed in section 6.2) requiring further consideration which will need to be resolved in the upcoming Detailed Business Case (DBC) process. The ITA can therefore help inform the DBC.
- **Structure Plan Land Use** – The land use scenario provided by Council has taken some account of optimising land use-transport integration, primarily from an employment perspective based on the evidence available to Council at the time. In particular the analysis underpinning centre locations, and the increased allowance for local employment land to reduce travel demand has evolved in response to transport inputs. Further opportunities to optimise land use, in particular to achieve travel demand management (TDM) objectives, have been identified (see sections 6.2.2, 7.2 and 8.5).

As noted above, the ITA networks and supporting plan provisions would be further developed and defined through specific Plan Changes. Similarly, the major transport infrastructure will continue to be developed through ongoing business case, consenting and detailed design processes. It is therefore important that parallel infrastructure/service and land use planning processes continue to be developed in an iterative and coordinated way, to maintain the desired outcome for integrated transport and land use systems.

6.1.3. Structure of this Chapter

This chapter documents the development of the proposed ITA transport network. The following sections of the chapter respectively cover these specific matters:

- Starting assumptions, including identification of matters to be adopted/refined from the IBC, and high-level travel demand management strategies (section 6.2);
- Collector road network rationale, design principles, and funding and implementation risks (section 6.3);
- Road networks:
  - Opāheke/Drury East network (section 6.4);
  - Drury West network (section 6.5);
  - Paerata network (section 6.6);
  - Pukekohe network (section 6.7);
- Public transport network (section 6.8);
- Active mode network (section 6.9); and
- Whole of network summary (section 6.10).

N.B. For the purposes of sections 6.4-6.7, the four geographic subdivisions are shown at Figure 6-1.

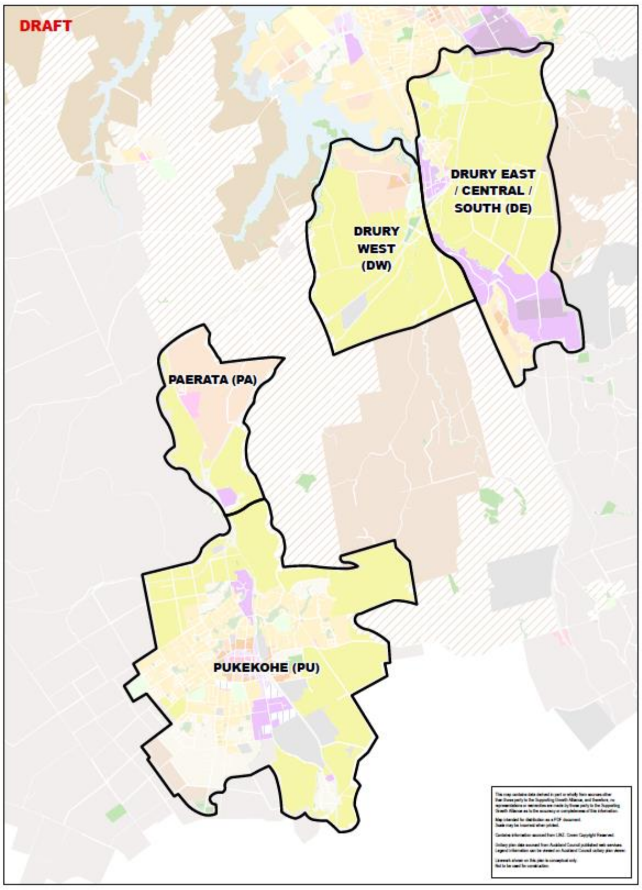


Figure 6-1 – Geographic subdivisions of Structure Plan areas.

6.2. Approach and Starting Assumptions

6.2.1. General Approach

The development of the transport network (including via the Indicative Business Case) was primarily driven by desired outcomes and design principles. Multi-modal transportation models have been used to check the potential demands and network performance, but not as the primary tool to develop the network (such as through traffic deficiency analysis). The general approach has included an iterative process that considers how land use and transport interact, how travel demands can be influenced, the key role/function of each part of the network (especially in relation to movement and place), what key strategic elements are (primarily taken from the IBC) and analysis of expected travel patterns and network outcomes.

6.2.2. Influencing travel demand

The IBC demonstrated that it is not feasible or economic to build transport infrastructure with a view to accommodating unconstrained travel demand, and that it is not possible to achieve desired mode share and other desired access and placemaking outcomes seeking to change historic patterns of travel behaviour and choice. Accordingly, the need to proactively plan to influence travel demand is being considered as an integral part of the Supporting Growth programme, and as a starting assumption for this ITA.

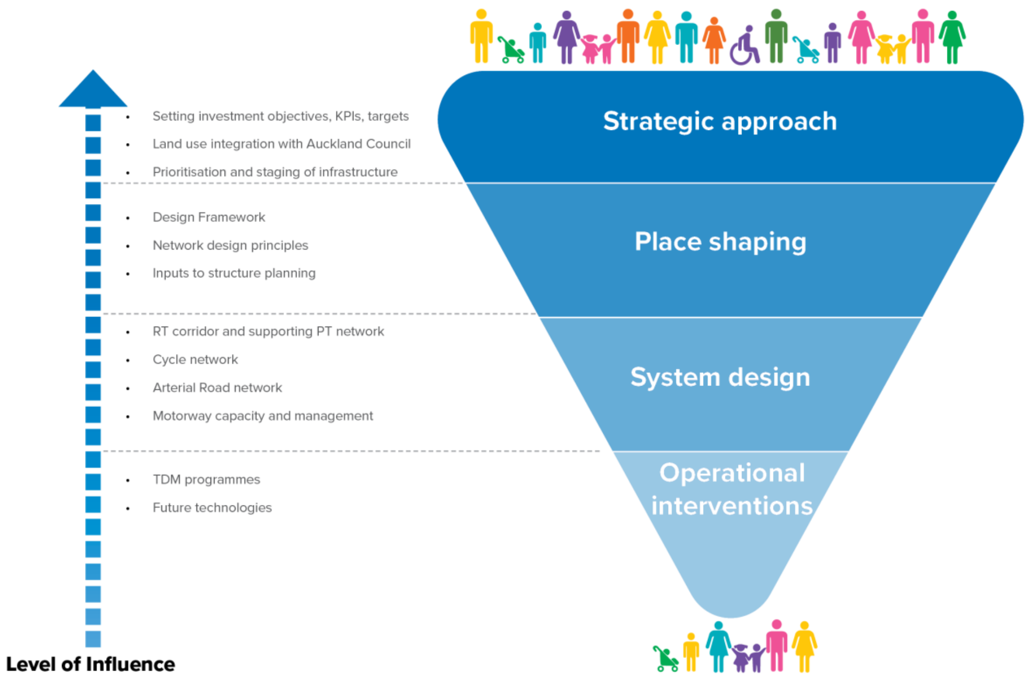


Figure 6-2 – Demand management influence through the project lifecycle.

Importantly, there are two complementary drivers which manifest slightly differently in terms of strategic response:

- Reducing the need to travel from an area to reduce pressure on the wider transport network – the strategic response of which is to generally increase the level of local employment/activity;

- Achieving a mode shift to provide transport choice/reduce general traffic congestion exposure – the strategic response of which is to intensify land use around public transport nodes and provide high quality public transport and active model networks.

Figure 6-2 shows that strategic transport decisions and land use planning are the most significant influences on travel demand. Accordingly, the process of developing the ITA and the Structure Plan presents the best opportunity to embed TDM strategies given it is sufficiently early in the planning process to influence key decisions, and is more spatially specific than the business case process.

Chapter 7 discusses the specific land use and transport characteristics of the Structure Plan land use scenarios and proposed transport networks which give effect to the goal of TDM, and how these characteristics manifest in trip generation rate and predicted performance in terms of inducing mode shift. However, at a high level, the opportunities identified to influence travel demand through the ITA and Structure Planning process are as follows:

- **Land use integration** – The land use scenario provided by Council has sought to influence travel demand by including a significant quantum of employment land, identifying a hierarchy of centres, providing for transit-oriented development by co-locating major centres and other high trip-generating activities (such as the Catholic School site in the case of Drury West) with rail station locations, and enabling density around public transport nodes. Increased local employment generally helps to substantiate a relative reduction in outbound travel demand, and a modal shift for both inbound and outbound trips. Furthermore, increased density around public transport routes will support the efficient provision of public transport services, which in turn is necessary to induce mode shift. Chapter 7 covers these matters in greater detail;
- **Transport network design** – The transport network needs to be conducive to a reduction in travel demand and a mode shift away from single-occupant private vehicles. From a network design perspective, this means ensuring that the overall urban form and configuration of transport corridors are walkable, cyclable, able to support efficient public transport provision, and conducive to the use of micro-mobility modes (e.g. e-bikes and e-scooters). Networks need to provide connectivity to key destinations including centres and employment, schools, retail and dining destinations, social and community facilities, and mixed-use residential areas; and
- **Influencing investment decisions** – The ITA will help inform future investment decisions and the sequencing of investment, which will in turn influence the level and type of travel demand over time. In particular, the early sequencing of improvements focused on public transport, active transport, and enabling micro-mobility will assist in embedding modal shift away from private vehicles early in the development cycle. To this end, chapter 9 of the ITA suggests staging strategies aimed at inducing early modal shift.

6.2.3. IBC recommended network – adoptions

The regional/strategic transport networks recommended in the IBC have been substantially adopted as end-state (2048+) assumptions for the purposes of the ITA given that the IBC covers the Structure Plan areas and has been subject to extensive analysis and optioneering.

Table 6-2 summarises the components of the IBC network adopted as end-state assumptions for the ITA (see also Figure 4-4):

Table 6-2 – Summary of IBC Recommended Network

Option grouping	Component	Description of recommended option	IBC reference(s)
Rapid Transit (heavy rail) upgrades	Rail corridor capacity upgrade	Increased rail capacity to four tracks between Wiri and Pukekohe.	MT9B
	New rail station locations	New rail stations at Drury Central, Drury West, and Paerata.	DC2, DW3 or 4, P2
Frequent transit (bus) network	Frequent bus routes and associated roads/priority improvements.	Variations on frequent bus services to provide north-south service, potentially utilising the Great South Road, SH1 corridors and other arterial roads (see section 6.8).	MT3C, MT4I, MT4K, MT4L.
Active mode network	Regional and primary walking and cycling connections.	• Regional cycle network connection along SH1 (between Takaanini and Drury) and the NIMT (between Drury and Pukekohe). • Primary cycle network on all arterials within the Drury-Opāheke area. • Primary cycle network on Mill Road. • Primary cycle network on Pukekohe arterials. • Grade-separated active mode crossings of SH1 and the NIMT.	AT1-1, AT1-2, AT2-1, AT2-2, AT2-3, AT2-4, AT2-5, AT2-7, AT2-8, AT 2-10.
Strategic road corridors	Mill Road	Strategic corridor to support improved local access to future urban areas, improve resilience by reducing reliance on SH1.	SR2A/B/C North; SR2 Central, SR2H South.
	Pukekohe Expressway	Pukekohe Expressway following edge of FUZ to support resilient access to Pukekohe and Paerata and enable urbanisation of SH22.	SR4F.
	SH1 upgrade	Additional lanes for the Papakura to Bombay section and north of Takaanini	SR1A
	Connection from SH22 to Pukekohe Expressway	Link connecting to two strategic corridors – Pukekohe Expressway and SH22.	SR14
Arterial network	Drury-Opāheke arterial network.	Arterial road corridors in the following general locations: • Upgrade of Opāheke and Ponga Roads between Great South and Mill Roads;	AR7, AR10, AR11, AR14a, AR16a, AR20, AR22d, AR45.

Option grouping	Component	Description of recommended option	IBC reference(s)
		• New north-south arterial between Papakura Industrial area and Waihoehoe Road; • Upgrade of Waihoehoe Road between Mill Road and Fitzgerald Road; • New east-west strategic connection (Bremner Road extension) between Jesmond and Great South Roads; • Upgrade Jesmond Road between Bremner Road and SH22; • Connection from Jesmond Road to Pukekohe Expressway; • Widening and safety improvements to SH22 between Drury and Paerata; • Safety upgrade to Blackbridge Road between SH22 and Linwood/Hingaia Roads.	
	Pukekohe-Paerata arterial network	Arterial road corridors in the following general locations: • Pukekohe 'inner ring route'; • Improvements to Pukekohe East/Mill Road; • Connection from SH22 to the Pukekohe Expressway; and • Safety upgrades to Buckland Road, Logan Road and Harrisville Road.	AR25, AR26a, AR38a, AR41, AR30, AR24, AR31, AR34, AR46.

6.2.4. IBC recommended network – refinements and additions

While the IBC has been subject to a lengthy analysis and optioneering process, there are several parts of the recommended network which remain fluid and will need to be resolved as part of the upcoming project DBCs. Additionally, there are matters not addressed in the IBC (e.g. collector roads, lower order public transport/active mode connections, and park-and-rides) requiring direction. The key matters are as follows:

- Drury Central and Drury West rail station locations;
- Drury Centre road access strategy;
- Drury West road access strategy and integration with rail station;
- Additional crossings of SH1 and the NIMT;
- Mill Road South alignment;
- Location of new east-west strategic connection in Drury West; and
- Station access and park-and-ride facilities.

The assumed strategic approach to the above matters is outlined below. Additional detail is provided where relevant in the road network sections of this chapter (see sections 6.4-6.7).

6.2.4.1. Drury Central and Drury West rail station locations

The IBC recommends indicative locations DC2 (south of Waihoehoe Road near the proposed large town centre) and DW3 or 4 (adjacent to the future extension of Jesmond Road) for the Drury Central and Drury West stations respectively (see Figure 6-3). These recommendations were based on a desire to achieve the following outcomes:

(a) Providing two stations to maximise rapid transit access for the Drury and Drury West catchments;
(b) Co-locating stations with centres to ensure they service a mix of land uses to maximise both mode shift (for both inbound and outbound trips), and the extent to which overall travel demand can be further reduced through local employment;
(c) Maximising the amount of developable land around stations to maximise patronage;
(d) Ensuring centres are both accessible by rail, and visible/accessible from major roads (particularly SH1 and SH22) to support their economic viability; and
(e) Maximising the operational efficiency and attractiveness of the rail services by ensuring fast travel times and aligning with technical rail and engineering specifications.

Figure 6-3 – Drury Central and Drury West rail station options (maps not to equivalent scale).

It should be noted that achieving all of the above factors is not always possible, and as such, trade-offs are required. Notwithstanding that, the key reasons for favouring the recommended locations are as follows:

- High total developable area and potentially high residential catchments for both locations;
- Stations are located in the vicinity of proposed centres, and the Catholic School site (in the case of Drury West);
- Moderate to high (~2-2.4km) separation distances between stations, which supports operational efficiency; and
- Well connected to the proposed bus network.

The ITA has adopted indicative location DC2 for Drury Central as per the IBC, and notes that no final decision regarding indicative locations DW3 and DW4 for Drury West has been made from a business case perspective. The Structure Plan and ITA mapping indicatively shows location DW4 for the reason that it is likely to better integrate with the currently assumed centre to the east of the SH22/Jesmond Road intersection.

There is an opportunity to further refine the transport network including rail station locations, particularly in the event that land use is developed further through the Structure Plan or Plan Change processes. The exact location of stations is also a function of design considerations such as platform length and configuration, and access arrangements for stations which will be considered further through the DBC process.

6.2.4.2. Drury Centre road access strategy

The IBC did not specifically address road access arrangements for the Drury Centre beyond identifying the strategic and arterial roads near the centre.

The ITA assumes the following by way of a broad vehicular access strategy:

- A connection to Great South Road between the SH1 Drury Interchange and Waihoehoe Road (i.e. integrated with or located north of the interchange signals). This connection is however subject to more detailed design and operational analysis as to specific location, form and feasibility. Such an access would likely need to provide for and/or be undertaken as part of the reconstruction of the Drury Interchange, which currently falls within the scope of the SH1 Papakura-to-Bombay project (see section 5.5.2) rather than Supporting Growth;
- Additional, direct connections between the centre and the SH1 motorway are generally not favoured due to the close proximity of the existing (Drury) and proposed (Mill Road) interchanges and the need to maintain the national strategic function of SH1;
- Secondary access to the centre via the arterial and collector network (addressed in further detail in section 6.4), including to the east (Fitzgerald Road), south (Quarry Road) and to the west (over SH1 to Burt Road/Gt South Road);
- Collector and local roads within the Drury Centre should be designed to discourage vehicular rat running through their design, access and function. Longer distance trips should remain on the strategic/arterial networks, and lower order roads within the centre should be designed to maximise ‘place’ value; and
- Public transport access via both the rail station, and by frequent buses likely operating on Waihoehoe and Great South Roads.

There is a clear need to consider the design and operational feasibility of the proposals in far greater detail with full involvement of the Transport Agency as more detailed proposals emerge. This is particularly true of the future configuration of the Drury Interchange and access to the centre from the north.

6.2.4.3. Drury West Centre road access strategy and integration with rail station

The IBC assumed additional capacity (four-laning) and safety upgrades would be required along SH22 as per option AR22d. The IBC did not address the specific detailed requirements associated with a town centre along SH22 as currently proposed in the Structure Plan, but has recommended other strategic links (e.g. Pukekohe Expressway) that support this by allowing the strategic through-traffic function to be removed from this section of SH22.

The Structure Plan favours a local centre generally east of the SH22/Jesmond Road intersection potentially straddling both sides of SH22. The ITA assumes the following by way of broad access strategies for this proposed centre with a view to identifying potential land use and transport integration opportunities (noting the need to develop these concepts further at more advanced planning and transport assessment stages):

- Urbanisation and lower traffic speeds along SH22 are required in addition to the increased capacity and safety upgrades already identified in the IBC to ensure the corridor condition is suitable for an urban town centre and appropriately balances both movement and place;
- The wider strategic network upgrades are needed to support the future place function of SH22, including the SH1 Drury South interchange and Pukekohe Expressway (and associated linkages) which would remove much of the current strategic function of SH22;
- Careful design consideration will be required for pedestrian/active mode crossing facilities to mitigate severance;
- There is a presumption in favour of traffic signals over roundabouts for the intersections in/around the centre where required to ensure that there are safe pedestrian/active mode crossing opportunities at regular intervals;
- A north-south collector road perpendicular to SH22 between Jesmond and Burberry Roads (addressed in further detail in section 6.5) could form a desirable connection to the train station if the centre is located north of SH22 and the station is located east of Jesmond Road. This could be a low volume, high-amenity street;
- SH22 is currently a limited access road. The maintenance of vehicular access restrictions in future is recommended to minimise conflicting movements; and
- There are a range of potential options for how the centre is configured, and integrated with both SH22, the Drury West rail station, and frequent bus services interchanging with rail from Jesmond Road.

6.2.4.4. Additional crossings of SH1 and the NIMT

The IBC discounted two options which sought to provide additional connectivity over SH1 and the NIMT respectively. These were:

- Option EW10a – a crossing of SH1 utilising the existing Quarry Road bridge between Great South Road and Fitzgerald Road via Brookfield Road. This option was discarded as a strategic or arterial road on the basis of relatively low benefit against SGA's investment objectives and
- Option AR21a – a new crossing of the NIMT west of Jesmond Road. This option was discarded as a strategic or arterial road on the basis of duplication with Jesmond Road.

Neither connection was advanced as a strategic or arterial road given relatively low traffic volumes (<4,000 ADT). They are nonetheless recommended to be included as part of the collector network given their benefits from a severance mitigation/urban form perspective. In particular, their benefit is in reducing the significant distances between crossings of SH1 and the NIMT (these benefits are quantified in greater detail in section 6.4 and 6.5). They also perform an important role in enabling potential future bus services.

An additional crossing of SH1 to the immediate south of the Drury Interchange (an extension of existing Pitt Road) will also be assumed as part of the collector road network (see sections 6.4 and 6.5) to provide additional severance mitigation and access to the Drury Centre. However, the significant scale of this connection would need to be subject to more detailed analysis in terms of costs, benefits and impacts.

It is noted these collector roads need to cross significant existing infrastructure (i.e. undevelopable or third-party land) beyond the control of any one land owner or developer. Accordingly, the funding of these roads would likely require a proportionally shared funding mechanism (further discussion at section 6.3.2).

6.2.4.5. Mill Road South alignment

The preferred alignment for Mill Road South (between Waihoehoe Road and the SH1 Drury South Interchange) has been narrowed through the parallel finalisation of the IBC and development of the ITA to two options to be investigated further through the DBC. These are as follows (see Figure 6-4):

- 'Link Road' option – which would swing north from the SH1 Drury South Interchange, utilise the 'Link Road' alignment from the Drury South Precinct Plan, and proceed east to the urban edge in the vicinity of Waihoehoe Road; or
- 'FUZ edge' option – which would head more directly east from the SH1 Drury South Interchange to align with the urban edge as far south as is practical.

Figure 6-4 – Mill Road South alignment options.

Both options have potential severance effects on adjacent land use. Under the 'Link Road' option, the alignment would affect areas proposed as residential in the Draft Structure Plan to the north of Fitzgerald Road. Conversely, under the 'FUZ edge' option, the alignment would avoid the severance of future residential areas, but would have an impact on the live-zoned Drury South Industrial Precinct including the commercial services sub-Precinct.

Further assessment to be undertaken through the DBC will determine which of these is the preferred option. This assessment will consider in particular the relative severance effects of the two options, potential mitigation measures, the relative sensitivity of different land uses to severance effects, and the relative impact of land use on the strategic functionality of the Mill Road corridor.

6.2.4.6. Location of new east-west strategic connection in Drury West

The IBC recommended option AR14a for the east-west strategic connection (Bremner Road extension) which runs between the existing Bremner Road bridge and Jesmond Road. Several variations on that alignment have been identified through the Plan Change 6 process by submitters. The alignment has not yet been agreed through that process at the time of writing.

For the purpose of the ITA, it is considered sufficient to note that an east-west arterial will be required in the general location shown, and that the collector roads in principle should utilise it to form a grid network (see section 6.5 for further detail). Changes to the alignment of the east-west strategic connection may have consequential changes for the locations of the collector roads.

6.3. Collector Road Network – rationale and principles

6.3.1. Rationale for developing a Collector Road Network

Collector roads form the middle tier of the road network between movement-focused strategic/arterial roads, and access-focused local roads. As documented in section 6.2, the IBC has largely defined the strategic/arterial networks for the Structure Plan areas. It is not considered necessary to develop a local road network for a Structure Plan of this scale. However, the Structure Plan and future Plan Changes may contain requirements to achieve a well-connected local road network at the time of subdivision and are likely to contain Precinct Plans which can identify specific local roads if required.

The collector road network however performs a range of transport functions (see Table 6-3) and is fundamentally important in determining the connectivity of the urban form and the integration of land use with the transport network. Furthermore, given that collector roads are funded and delivered by developers and vested in AT, there is value in providing guidance at the Structure Planning level.

Table 6-3 – Road Classification Criteria[31]

Function	Measure	Classification			
		Strategic	Arterial	Collector	Local
Public transport	Route type	High frequency & capacity, long distance routes.	Forms part of the FTN or Connector Network, priority required.	Lower frequency routes as part of the Connector or Local Network.	Limited bus services.

[31] Adapted from AT Code of Practice road classification and NZ Transport Agency One Network Road Classification.

Function	Measure	Classification			
		Strategic	**Arterial**	**Collector**	**Local**
Freight	Access and connections	Inter-regional.	Intra-regional + connections to major industrial areas and ports.	Connections between arterials and minor business areas.	Waste vehicle access.
Connectivity	Through traffic	Greatest through movement.	Predominantly through movement.	Some through movement.	Only local movement.
	Place connections	Between or through regions.	Connecting major destinations, suburbs and areas.	Connecting local communities and property access.	Access to property.
Traffic volumes	Daily flows (ADT)	>20,000	>15,000	>3,000	<2,000
	Heavy vehicles (daily)	>500	>300	>150	<150
Cycling	Segregation	Full	Full in urban areas	Segregation or low design speeds.	Lower design speeds.

For these reasons, it is considered necessary to develop an indicative collector road network as part of this ITA. Given the IBC is restricted in scope to the higher order strategic/regional transport networks, the ITA has taken a first principles approach in developing the collector network assumed to be necessary at full build-out in 2048. Collector roads are provided by developers and vested in AT, and therefore will not be within SGA's route protection scope. Accordingly, a first principles approach is considered sufficient for the purposes of providing guidance to the Structure Plan and developers. Subsequent ITAs will provide further detail to provide an evidence base for the Plan Change provisions required to follow through on the outcomes identified in this ITA.

6.3.2. Funding and Implementation Risks for Collector Roads

Collector roads are formed by developers at the time of subdivision and vested in AT as public assets. Given the reliance on developers to form collector roads, one of the principles followed in designing the indicative collector network has been to locate collector roads on developable land (see Table 6-4, principle 10). This principle ensures that collector roads serve/provide access to land as it develops, thereby facilitating rather than impeding reasonable use and development of the land.

However, the nature of the Structure Plan areas is such that some collector roads will need to cross significant infrastructure such as SH1 and the NIMT or floodplains (i.e. undevelopable and/or third-party land) to effectively perform their network role. A similar issue manifests where there are 'hold-out' land owners with no intent to develop which preclude the completion of connections. In many such instances, it is not possible or reasonable for a single developer to provide these connections, particularly when they require significant structures or works on third-party land. Sections 6.4-6.7 of the ITA identify specific connections that fall into this category. The effect of incomplete connections will vary in each case, but failure to complete the network will self-evidently result in a loss of overall connectivity and resilience. This risk will be particularly marked where connections are required for bus services and active mode routes (see sections 6.8-6.9).

Given that collector roads will not be publicly funded, it is essential that a funding and delivery model is developed to accompany the future 'live-zoning' of the area to ensure that the parts of collectors that are not the clear responsibility of a single developer are completed. This is likely to entail a funding mechanism that enables the costs to be shared proportionally between developers (e.g. targeted rate or targeted developer contribution), with the collection of funds and delivery of the road to be led by the relevant public agencies. The design of the funding mechanism and its integration with future Plan Change(s) will need to be led by Council.

6.3.3. Collector Network design principles

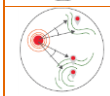
Best-practice guidance documents have been used in developing collector road network design principles. In particular, the SGA Design Framework and the AT Roads and Streets Framework (RASF)[32] have been instructive. The design principles most relevant[33] to designing a high-level network have been derived from these sources. Additionally, pragmatic considerations such as known developer plans and cadastral boundaries were considered.

These principles are consolidated and summarised in the following table, along with proposed high-level responses.

[32] Roads and Streets Framework. Note this is a draft document under ongoing review.

[33] N.B. Not **all** design principles in these documents are relevant to the high-level network design context. Several principles in the Design Framework for example relate to strategic project optioneering or design detail.

Table 6-4 – Collector Network design principles

Principle			High Level Responses
Environmental and Cultural		**1. Support and enhance ecology.**	• Avoid aligning new collector roads within floodplains, environmentally sensitive areas, or culturally significant sites where practical. • Avoid new roads that require multiple crossings of streams where practical. • Avoid aligning roads through areas that would exceed acceptable gradients or require significant earthworks where practical. • Acknowledge ridgelines with landscape and cultural significance, particularly ridgelines incorporating tuff rings; • Investigate potential utilisation of floodplains for walking and cycling routes. • Where relevant, align roads parallel to stream or park edges to ensure passive surveillance.
		**2. Support water conservation and enhance water quality.**	
		**3. Minimise land disturbance and respect existing topography.**	
		**4. Adapt to a changing climate.**	
		**5. Respect culturally significant sites and landscapes.**	
Land Use		**6. Corridors are appropriate to surrounding context and urban structure.**	• Ensure that the collectors are appropriate to the land use envisaged for the area in question. • Where appropriate, use roads to separate incompatible land uses.
		**7. Align corridors with density; and connect key nodes, employment and industry.**	• Seek to provide direct and legible connections and maximise connectivity to areas of high density, key destinations/activity centres, schools, and employment areas. • Ensure the location of roads responds to land uses which require road frontage where sufficient land use detail is known (e.g. centres, parks).
Transport Planning		**8. Seek connected urban form with multiple options for short and long trips.**	• Appropriately[34] space collector roads to provide connectivity through the site. • Seek a connected network structure where practical. • Minimise intersections on arterials.

[34] RASF guidance suggests 400m-1km in low density areas and 200-600m in high density areas for collector-arterial and collector-collector spacing.

Principle			High Level Responses
			• Ensure that shorter trips can be made via the collector network to relieve the strategic/arterial network. • Ensure the collector network does not duplicate and function as a de-facto strategic/arterial network.
		**9. Prioritise active modes and public transport.**	• Collector roads to include segregated active mode infrastructure, or a low design speed depending on traffic volumes and built form interface. • Collector roads to provide for logical bus operations to retain routing flexibility. • Network as a whole to facilitate direct connections to key public transport stations/interchanges. • Investigate potential utilisation of floodplains and riparian/stream-adjacent areas for greenways. • Design for appropriate interface with built form, including limited vehicle access where justified by strategic public transport and active transport modes, rear lanes and rear-loaded lots where appropriate etc.
		**10. Utilise existing routes and seek consistency with developer plans where possible.**	• All collector roads are assumed to be provided by developers, and therefore should generally lie within and serve development land. • Upgrade/urbanise existing routes rather than establish new routes where the existing route performs the function envisaged. • Seek consistency with developer plans where plans are consistent with other principles in this list. • Generally, seek to align roads along or parallel to cadastral boundaries where practical to maximise developable land and a safe practical alignment is not compromised.

The above principles were applied through an iterative workshopping process involving SGA planning, transport planning and urban design specialists; as well as AT and Transport Agency representatives. The resultant network is described and mapped through the relevant parts of sections 6.4-6.7.

For ease of referencing, the following naming conventions are followed in the naming of collector roads:

- Proposed upgrades of existing roads are referred to by their existing names.

- Proposed new roads are referred to using an abbreviated three-part lettering and numbering convention denoting the geographic subdivision (DE, DW, PA or PU; see Figure 6-1), the general orientation of the road (N-S or E-W); and a reference number.

6.4. Opāheke/Drury East road networks

6.4.1. Strategic and arterial network

As summarised in Table 6.2, the following strategic and arterial roads have been adopted from the IBC recommended network for the Opāheke/Drury East area. These are shown in Figure 6-5. A short rationale for each is provided below.

- State Highway 1 upgrade (IBC option SR1A) – provides supplementary north-south strategic network capacity, enables improved public transport use of the corridor, relieves pressure on local roads;
- Mill Road (IBC option SR2H South) – provides an additional corridor to supplement and provide an alternative to SH1 (note continued uncertainty as to alignment of southern section);
- Opākeke and Ponga Roads (IBC AR7) – enables grade-separation of the rail line and Opāheke Road, provides access to the proposed Mill Road corridor, provides east-west connectivity to the Structure Plan area;
- New north-south arterial between Papakura industrial area and Waihoehoe Road (IBC AR10) – provides north-south connectivity through the Structure Plan area;
- Waihoehoe Road (IBC AR11) – provides linkage to Drury Centre, ensuring a good residential catchment and connection to proposed employment.

6.4.2. Collector network

For the Opāheke/Drury East area, the network design process described in section 6.3 has identified thirteen key collector roads in addition to the IBC network assumed to be necessary at full build-out in 2048. Of these, two are proposed upgrades of existing roads; and the remaining eleven are either entirely new corridors or extensions of existing roads. Figure 6-5 maps the proposed collector roads for this area. Table 6-5 provides commentary on the rationale for each of the proposed roads with reference to the design principles.

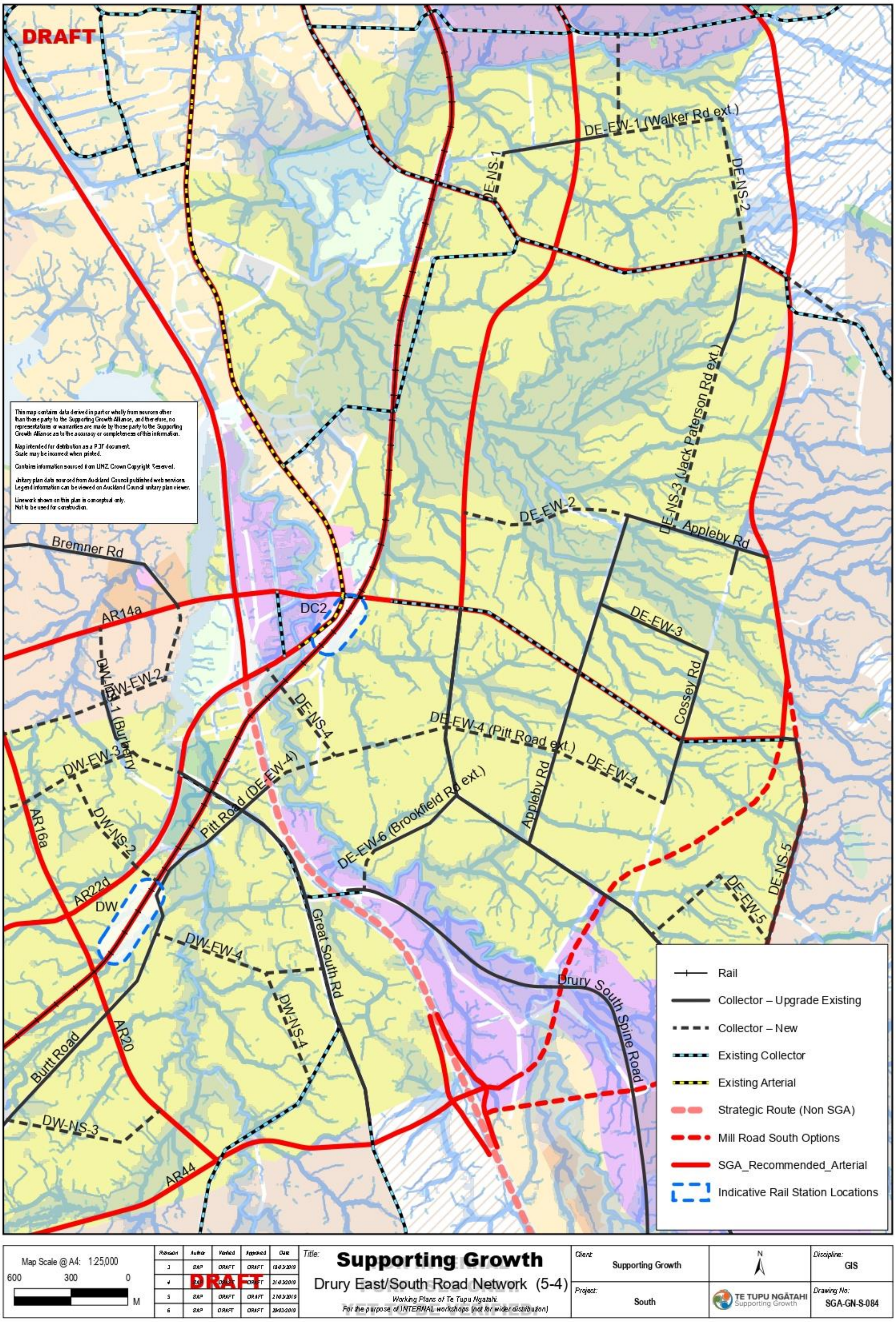


Figure 6-5 – Collector roads identified for the Drury East/Central/South areas. Not to scale.

Table 6-5 – Rationale for collector roads identified for Drury East/Central

Road name	Description	Commentary / Rationale
DE-NS-1	Additional connection between Walker Road and Opāheke Road (IBC ref AR7).	• Provides connectivity in the area north of Opāheke Road and facilitates a well-spaced grid network. • Removes traffic from current Walker/Opāheke Road intersection – safety benefit given proximity of existing intersection to a NIMT level crossing. • Utilises an existing road and generally follows a cadastral boundary. • Few natural constraints in this area.
DE-EW-1 (Walker Rd ext.)	Urbanisation and eastward extension of Walker Road.	• Utilises existing route which is already well located to ensure connectivity and facilitate a well-spaced grid network.
DE-NS-2	Connection between DE-EW-1 and the intersection of Ponga Road (IBC ref AR7) and Jack Paterson Roads.	• Enables a consolidated connection to the Ponga Road arterial at existing intersection with Jack Paterson – limits new arterial intersections. • Localised stream/flooding constraint. Westward movement would mitigate, but would trade off the transport benefit of limiting arterial intersections.
DE-NS-3 (Jack Paterson Rd ext.)	Urbanisation and southward extension of Jack Paterson Road to connect to Appleby Road.	• Utilises existing Jack Paterson Road route and connects to existing route at Appleby Road. • Forms north-south spine through residential area, ensures connectivity and facilitates a well-spaced grid network. • Five stream crossings present a significant natural constraint. Eastward movement of the alignment could avoid three of these, but would limit area served by the road to the east. • Eastward movement may also result in de-facto north-south arterial if it connects directly to Cossey Road. • Conceptual bus operating pattern indicates road could accommodate a route between Papakura and Drury Central/West.
Appleby Road	Urbanisation of Appleby Road.	• Utilises existing Appleby Road route, ensures connectivity, and facilitates a well-spaced grid network. • Northern section has floodplain and multiple stream constraints – however, road already exists.
DE-EW-2	Connection between Appleby	• Provides additional east-west connectivity perpendicular to the arterial route, and bisects the developable area to the west of the

Road name	Description	Commentary / Rationale
	Road and arterial (IBC ref AR10).	floodplain. Facilitates a connected grid network with consolidated access to the arterial. • New alignment rather than use of existing Harry Dodd Road to replace dogleg with T-intersection. • Significant stream and floodplain constraints. Only one stream crossing, but much of the alignment is in floodplain. Should the floodplain remain assumed to be undevelopable, road unlikely to be formed by a developer.
DE-EW-3	Connection between Appleby and Cossey Road.	• Provides additional east-west connectivity to facilitate a well-spaced grid network. • Alignment limits stream/flooding issues by locating between streams/floodplains, while enabling a stream-edge road frontage for passive surveillance.
Cossey Road	Urbanisation of the existing sections of Cossey Road; road stopping south of intersection with DE-EW-4.	• Utilises existing Cossey Road route, ensures connectivity and facilitates a well-spaced grid network through a residential area. • Stopping the existing southern section of Cossey at the intersection with DE-EW-4 ensures that intersections on Mill Road South (should it follow a more westerly alignment than shown in the IBC) are minimised/rationalised. • Alignment requires two stream crossings and crosses a floodplain. However, road already exists with exception of a ~400m section in the floodplain which is a paper road. Should land remain assumed to be undevelopable, road unlikely to be formed by developer. •
DE-EW-4 (Pitt Road ext.)	East-West connection bisecting the blocks between Waihoehoe and Fitzgerald; and potentially connecting to a crossing of SH1 to Pitt Road.	• Bisects three large blocks and provides east-west connectivity between centre and surrounding residential, facilitating a well-spaced grid network. • Mitigates the severance of SH1 by providing an additional crossing – general urban form benefit. Without this connection, there is a 1.7km gap between non-interchange crossings of SH1 at Bremner and Quarry Roads. This connection reduces the maximum gap to ~1km. • Crossing likely to present feasibility challenge given size of structure involved. • Few natural constraints in this area. • Potential for an active mode-focused collector given there is a parallel arterial.

Road name	Description	Commentary / Rationale
		• Stopping at intersection with Cossey Road ensures road does not connect to Mill Road – ensures efficiency of that corridor if it follows 'Link Road' option (may connect to DE-EW-5 if 'FUZ edge' option for Mill Road is chosen). • Potential for western section to be of use to buses – conceptual operating pattern shows route running Drury to Pukekohe via both Drury Centres via an additional SH1 crossing.
DE-EW-5	Connection between DE-NS-5 and Fitzgerald Road.	• Bisects large block, thereby facilitating a connected grid network in the residential area. • Few natural constraints in this area. • Does not link to Mill Road – ensures efficiency of that corridor if it follows 'Link Road' option (may connect to DE-EW-4 if 'FUZ edge' option for Mill Road is chosen'.
DE-NS-5	Connection between Waihoehoe (IBC ref AR-11) and Fitzgerald Roads.	• Provides north-south connectivity between east-west arterials and delineates the urban edge. • Few natural constraints in this area. • Not required if Mill Road 'FUZ edge' option is chosen.
DE-NS-4	Connection from Drury Interchange to Drury Centre.	• Facilitates direct access to Drury Centre from SH1 as per section 6.2.4.2 of ITA. While further design/operational detail is required, this is considered the likeliest solution. • Some constraints in form of Transpower corridor and stream/floodplain. Final alignment TBC.
DE-EW-6 (Brookfield Road ext.)	Extension of Brookfield Road to connect with Quarry Road bridge.	• Utilises existing sections of Brookfield Road and Quarry Road bridge to provide a SH1 crossing/access into southern end of Drury Centre. May negate need for Pitt Road crossing. • Potential to be of use to buses – conceptual operating pattern shows a service running via an additional SH1 crossing.

6.5. Drury West road network

6.5.1. Strategic and arterial network

As summarised in Table 6.2, the following strategic and arterial roads have been adopted from the IBC recommended network for the Drury West area. These are shown in Figure 6-6. A short rationale for each is provided below:

- State Highway 1 upgrade (IBC option SR1A) – provides supplementary north-south strategic network capacity, enables improved public transport use of the corridor, relieves pressure on local roads;

- Pukekohe Expressway (IBC SR4F) – an alternate strategic connection between Pukekohe and SH1/Mill Road which reduces reliance on SH22 and SH1 for shorter distance trips, improves freight reliability and contributes to network resilience;
- New east-west strategic connection (Bremner Road extension) (IBC AR14a, noting potential variation on that alignment as per section 6.2.4.6 of this ITA) – provides east-west connectivity, forms part of frequent bus network;
- Jesmond Road upgrade and extension (IBC AR16a, AR20) – provides north-south connectivity through the centre of Drury West harnessing catchment, forms part of frequent bus network; and
- SH22 capacity and safety improvements (IBC AR22d), noting the need to urbanise the corridor in the town centre environment as per section 6.2.4.3 of this ITA.

6.5.2. Collector network

For the Drury West area, the network design process described in section 6.3 has identified thirteen key collector roads in addition to the IBC network assumed to be necessary at full build-out in 2048. Of these, six are proposed upgrades of existing roads; and the remaining seven are either entirely new corridors or extensions of existing roads. Figure 6-6 maps the proposed collector roads for this area. Table 6-6 provides commentary on the rationale for each of the proposed roads with reference to the design principles.

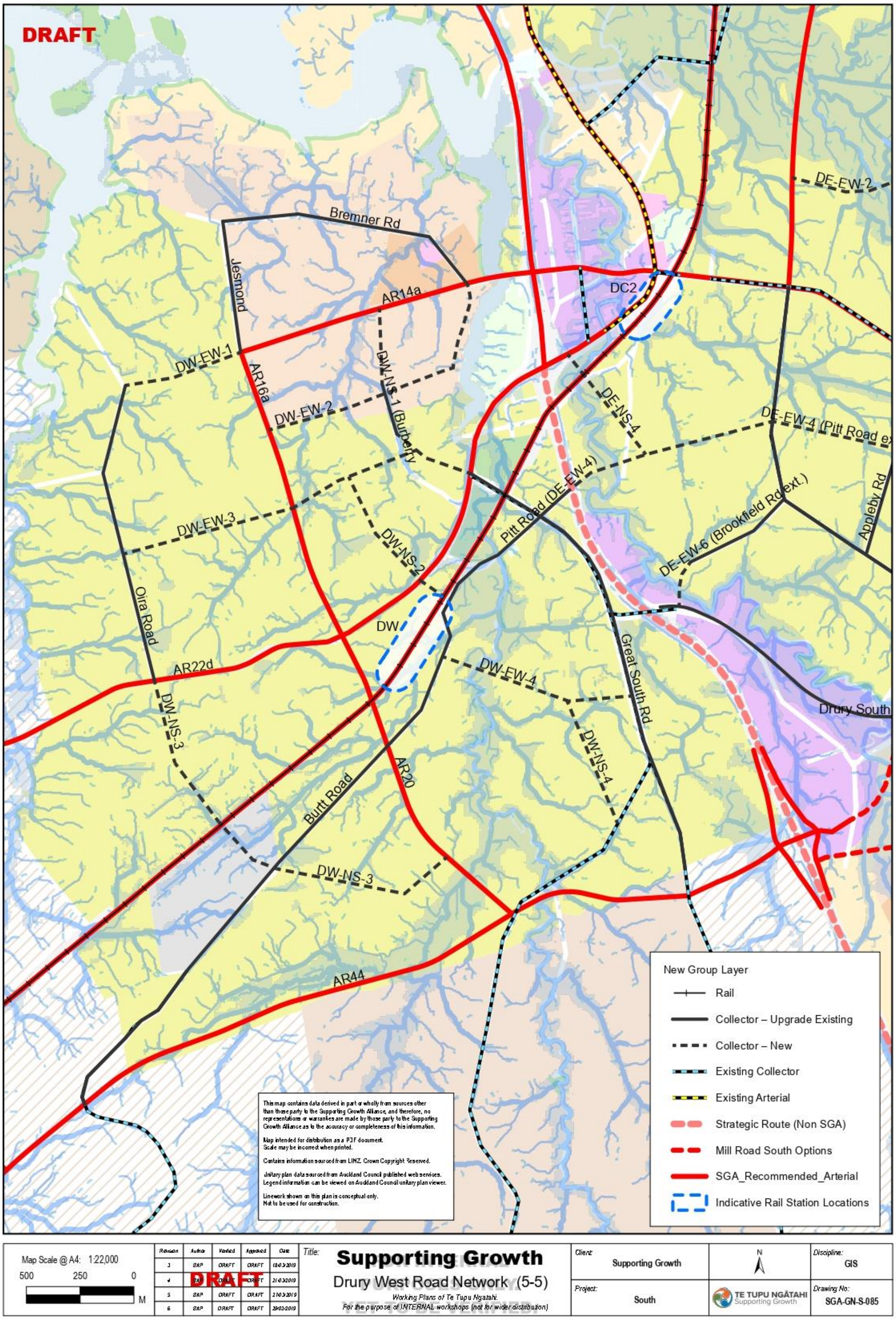


Figure 6-6 – Collector roads identified for Drury West. Not to scale.

Table 6-6 – Rationale for collector roads identified for Drury West

Road name	Description	Commentary / Rationale
Bremner Road	Urbanisation of existing section of Bremner Road (per Drury 1 Precinct plans).	• This upgrade is already underway as part of the Auranga development in accordance with the Drury 1 Precinct plans. Ensures good connectivity and road spacing for northern part of the area, and provides for conceptual bus operating pattern.
Jesmond Road	Urbanisation of northern section of Jesmond Road that falls outside scope of IBC option AR16a.	• Logical in context of Bremner being upgraded, and southern part of Jesmond being an arterial. • Ensures good connectivity, road spacing, and facilitates a grid network. Provides for bus services. • Minimal natural constraints. • Promotes direct connectivity to centre.
Oira Road	Urbanisation of existing Oira Road.	• Ensures good connectivity, road spacing and facilitates a grid network. Provides for bus services (conceptual bus operating pattern utilises Oira Road). • Relatively few natural constraints – majority of streams stop short to the west of Oira Road. • Delineates/separates low and medium density housing areas. • Ensures consolidated road accesses to SH22.
DW-EW-1	New east-west road linking to intersection of Jesmond and new east-west arterial (IBC option AR14a).	• Ensures good connectivity, road spacing and facilitates a grid network. Provides for bus services (conceptual bus operating pattern utilises Oira Road). • Logical to connect Oira and Jesmond, and extend IBC option AR14a alignment. • Minimal natural constraints. • The final location of the east-west arterial (IBC option AR14a, see section 6.2.4.6 of ITA) may impact on location of this road. In principle it is desirable to connect the two in a straight line, but this assumption may need to be revisited in future given potential impacts on existing properties.
DE-EW-2	New east-west road from intersection of Bremner Road and AR14a to Jesmond Road.	• Consistent with Drury 1 Precinct plan. • Ensures good connectivity, road spacing and facilitates a grid network.
DW-EW-3	New east-west road bisecting area, parallel	• Ensures good connectivity, road spacing and facilitates a grid network.

Road name	Description	Commentary / Rationale
	to DW-EW-1 and SH22.	• Limited natural constraints – crosses end of one stream.
DW-NS-1 (Burberry ext.)	Realignment, extension and urbanisation of existing Burberry Road.	• Realignment of southern section to align with Great South Road ensures consolidated access points to SH22. However, there are natural constraints in the form of a stream / floodplain crossing – feasibility to be confirmed. • Ability to connect to IBC option AR14a at the northern end will depend on final location of the option, and MoE decisions regarding school locations in that area – see section 6.2.4.6 of ITA. • Provides direct connection to MoE school sites from south.
DW-NS-2	North-south connection linking DW-EW-2 with SH22 and Drury West Centre and rail station.	• Promotes direct north-south connectivity to key destinations and transport nodes – Drury West Centre, SH22, and Drury West rail station (depending on the final location of the station). • Ensures a well-connected grid structure in the higher density part of the study area. • Crosses a stream (which also bisects the proposed centre) – natural constraint.
DW-NS-3	Connection between SH22/Oira intersection and IBC option AR20 (Jesmond South) via potential additional NIMT crossing.	• Mitigates the severance of the NIMT by providing an additional crossing – general urban form benefit. Without this connection, only two crossings of rail corridor in the 3.2km distance between SH1 and the western RUB, and a 1.6km distance between AR20 and the western RUB without a crossing. This connection halves that distance, which is a significant urban form benefit. • Delineates/separates low and medium density residential areas. • Stream and flooding constraints in this part of the study area – alignment avoids these where possible. • Development plans for the Catholic school site will be decisive in determining the feasibility of the precise crossing location shown in Figure 6-6.
Burtt Road	Urbanisation of existing Burtt Road.	• Provides east-west connectivity and bisects a large high-density residential area. • Eastern section likely to be useful to the bus network as per the conceptual operating pattern.

Road name	Description	Commentary / Rationale
		• Significant flooding and stream constraints at the eastern end – however, the road already exists. • Utilises existing route.
Pitt Road	Urbanisation of existing Pitt Road and potential SH1 crossing (as per DE-EW-4).	• Pitt Road SH1 crossing/extension mitigates SH1 severance and provides an additional bus routing option for services running between Drury and Drury West. • Crossing likely to present feasibility challenge given size of structure.
DW-EW-4	New road connecting Burtt Road with Great South Road.	• Provides connection between Burtt and Great South Roads. • Significant stream/flooding constraints and accordingly may be difficult to justify – however alignment crosses at narrowest point.
DW-NS-4	New road connecting DW-EW-3 with Runciman Road.	• Delineates/separates residential and industrial use. • Crosses ~2 streams – natural constraints.
Great South Road	Urbanisation of existing Great South Road south of SH22.	• Well placed to service proposed industrial area west of SH1. • Sections may be utilised by buses depending on final route structure and SH1 crossings. • Limited flooding and stream constraints at the northern end – however, the road already exists.

6.6. Paerata road network

6.6.1. Strategic and arterial network

As summarised in Table 6-2, the following strategic and arterial roads have been adopted from the IBC recommended network for the Paerata area. These are shown in Figure 6-7. A short rationale for each is provided below:

- Pukekohe Expressway (IBC SR4F) – an alternate strategic connection between Pukekohe and SH1 which reduces reliance on SH22 and SH1/Mill Road for shorter distance trips, improves freight reliability and contributes to network resilience;
- SH22 capacity and safety improvements (IBC AR22d); and
- SH22-Pukekohe expressway connections (IBC SR14, AR24 and AR41) – enable links between SH22 and the Pukekohe Expressway on arterial roads.

6.6.2. Collector network

Given that much of the Paerata area is live-zoned with Precinct provisions in the AUP-OP, an indicative road network has already been identified. This ITA essentially adopts the key components (not all) of the network included in the Precinct. This comprises five key collector roads in addition to the IBC network assumed to be necessary at full build-out in 2048. Of these, two are upgrades/extensions of existing roads; and three are new roads. Figure 6-7 maps the proposed collector roads for this area. Table 6-7 provides commentary on each of the proposed roads with reference to the design principles.

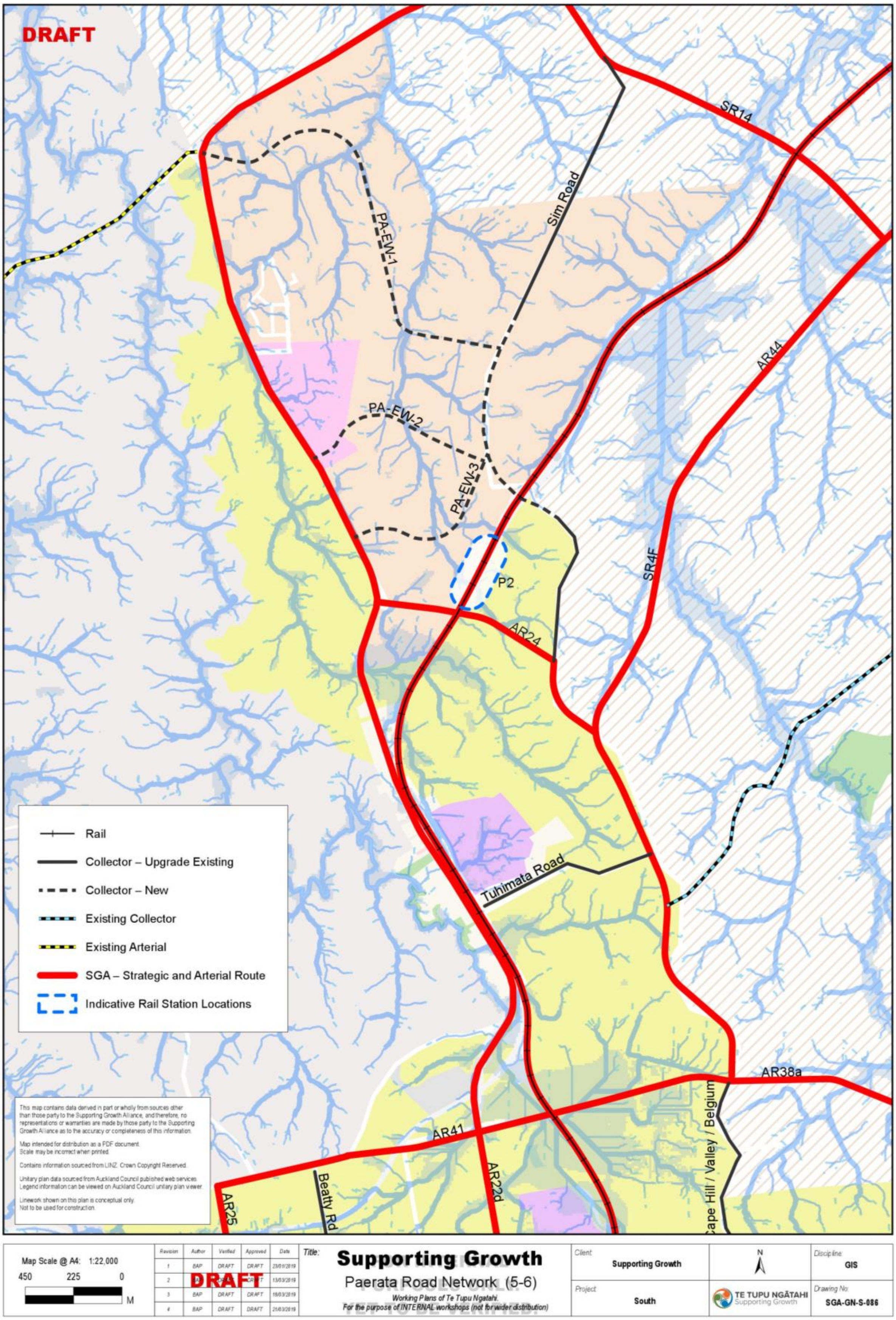


Figure 6-7 – Collector roads identified for the Paerata area. Not to scale.

Table 6-7 – Rationale for collector roads identified for Paerata

Road name	Description	Commentary / Rationale
PA-EW-1	Connection between SH22 (IBC option AR24d) and Sim Road.	• Generally consistent with AUP Franklin 2 Precinct Plan, noting that not all roads from the Precinct are shown. • Provides connectivity between SH22 and Sim Road, ensuring the 2km north-south distance in the Precinct is bisected. • Requires two stream crossings.
PA-EW-2	Connection between SH22/Paerata local centre and Sim Road.	• Generally consistent with AUP Franklin 2 Precinct Plan, noting that not all roads from the Precinct are shown. • Provides connectivity between SH22 and the Paerata local centre, and Sim Road. Further work is required to ascertain the interface between this road and rail station location P2. • Requires stream crossings.
PA-EW-3	Connection between SH22 (IBC option AR24d) and Sim Road ext.	• Generally consistent with AUP Franklin 2 Precinct Plan, noting that not all roads from the Precinct are shown. • Connects SH22 and Sim Road. • Note requires two stream crossings and crosses steep land near the rail line. • Further work is required to ascertain the interface between this road and rail station location P2. Alignment of this road closer to the rail station would ensure will likely enhance the accessibility of the rail station.
Sim Road ext.	Urbanisation and extension (across NIMT) of Sim Road between IBC options SR14 and AR24.	• Consistent with AUP Franklin 2 Precinct Plan, noting that not all roads from the Precinct are shown. • Alignment largely exists already, generally avoids streams and steep land in the area (apart from the rail crossing section). • Provides logical connection between/perpendicular to two arterials. • Along with arterial AR24, ensures road connections to north and south of station location P2. • Ensures buses between Pukekohe and Drury can be through-routed via a bus-rail interchange at Paerata Station. • Ensures that AR24 is not the only crossing of the rail corridor – general severance mitigation/urban form benefit. • Note rail crossing is steep and located beyond immediate developer's land. Will require grade-separation.

Road name	Description	Commentary / Rationale
Tuhimata Road	Urbanisation of existing Tuhimata Road between SH22 (IBC AR24d) and Pukekohe Expressway (IBC SR4F).	• Utilises existing road alignment to bisect the ~3km distance between IBC options AR24 and Pukekohe Expressway (SR4F). • Ensures connectivity between two arterials – SH22 (AR24d) and SR2H.

Further to the roads listed in Table 6-7, two further collector roads were analysed and discarded for the Paerata area. These were as follows:

- **North-south collector between Paerata and Pukekohe**, bisecting the area referred to as area in Figure 3-2. This has been discounted primarily on the basis of topographic constraints, particularly to the south of Tuhimata Road; and
- **Collector serving the area of Paerata west of SH22**, referred to in Figure 3-2 as area C. This has been discounted primarily on the basis of limited/narrow catchment given that much of the area is less than 500 metres wide and bisected by a stream. It is considered that the area will be adequately served by local roads at the time of subdivision, and that the maintenance of Limited Access Road status for SH22 will ensure sufficient control/rationalisation of accesses onto SH22.

6.7. Pukekohe road network

6.7.1. Strategic and arterial network

As summarised in Table 6.2, the following strategic and arterial roads have been adopted from the IBC recommended network for the Paerata area. These are shown in Figure 6-8. A short rationale for each is provided below:

- Pukekohe Expressway (IBC SR4F) - an alternate strategic connection between Pukekohe and SH1 which reduces reliance on SH22 and SH1/Mill Road for shorter distance trips, improves freight reliability and contributes to network resilience;
- SH22 capacity and safety improvements (IBC AR22d);
- Pukekohe ring route (IBC AR25, AR37 and AR38) – provides an alternative route relieving town centre congestion for all modes (particularly freight trucks serving local agricultural producers), supports future urban growth, and provides an important link between the southern end of the Pukekohe Expressway linking to the north and east; and
- Pukekohe East/Mill Road improvements (IBC AR30).

6.7.2. Collector network

For the Pukekohe area, the network design process described in section 6.3 has identified fourteen key collector roads in addition to the IBC network assumed to be necessary at full build-out in 2048. Of these, nine are upgrades of existing roads; and five are new roads. This does not include the existing collector network within the built-up area of Pukekohe which is assumed to remain in its current form.

Figure 6-8 maps the proposed collector roads in this area. Table 6-8 provides commentary on each of the proposed roads with reference to the design principles.

It should be noted that some sections of the roads identified in Figure 6-8 and Table 6-8 are located beyond the southern boundary of the Auckland region (e.g. Buckland Road, Logan Road), and accordingly are beyond AT's jurisdiction.

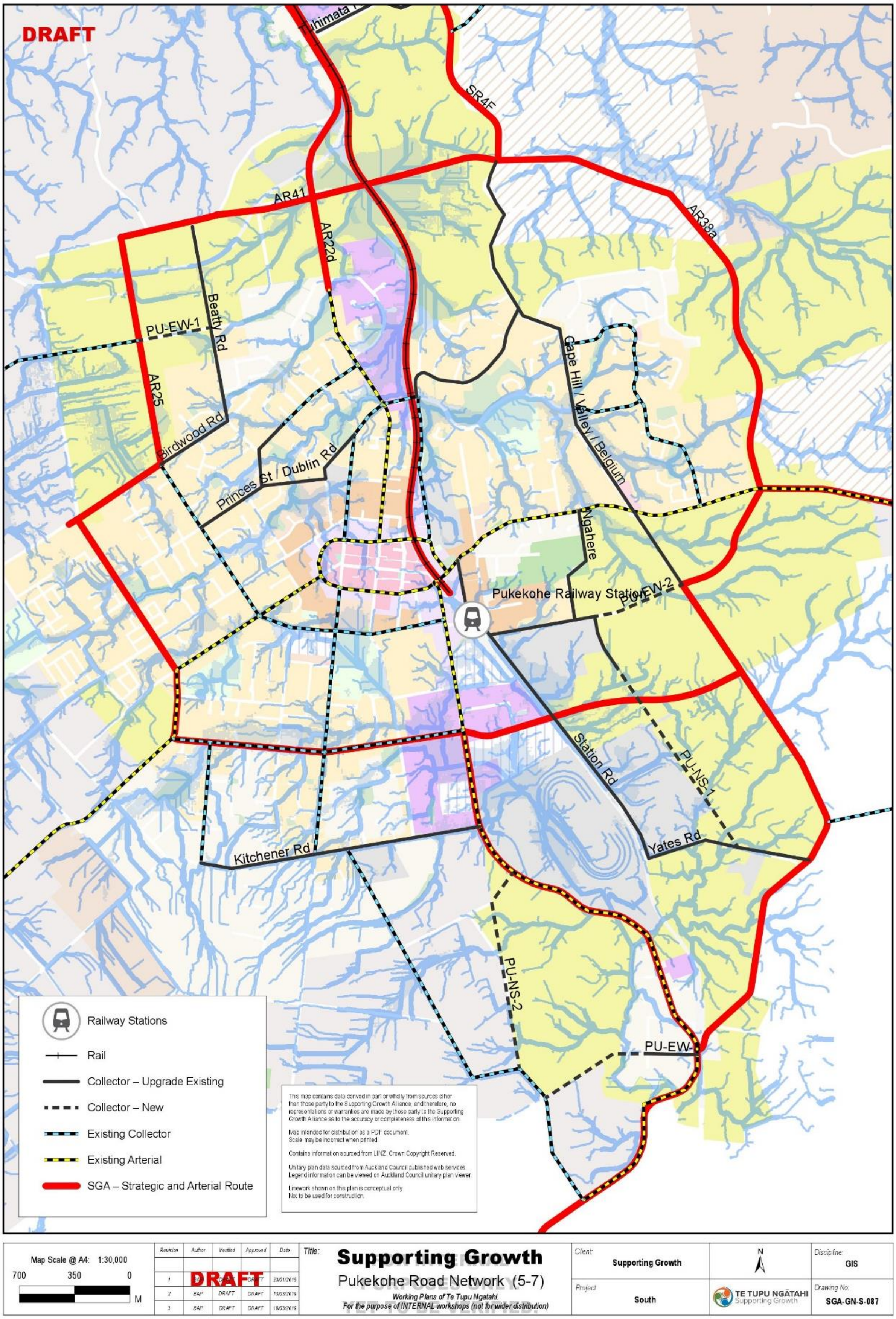


Figure 6-8 – Collector roads identified for Pukekohe area. Not to scale.

Table 6-8 – Rationale for collector roads assumed for Pukekohe

Road name	Description	Commentary / Rationale
Beatty Road	Urbanisation of existing Beatty Road north of Birdwood Road.	• Ensures well-spaced grid network – ~500m to parallel arterial. • Advantage of an existing bridge across the rail line on Beatty Road. • Steepness of parts of the route around stream a constraint.
PU-EW-1 (Gun Club Rd ext.)	Link between Heights and Beatty Roads.	• Ensures well-spaced grid network in north-western area. • Few natural constraints – relatively flat, no streams. • Delineates/separates industrial and residential land use. • Conceptual bus operating pattern utilises this alignment.
Birdwood Road	Upgrade of Birdwood Road between Beatty Road and Heights Road.	• Logical to connect Beatty Road collector to ring road (IBC AR25). • Utilises existing road, no natural constraints. • Conceptual bus operating pattern utilises this road.
Princess St / Dublin Rd	Upgrade of Princes Street and Dublin Road.	• Existing route provides east-west connectivity at an appropriate spacing from Birdwood Road to the north and the existing West Street arterial to the south (500m and 700m respectively). No natural constraints.
Cape Hill Road (southernmost portion)	Upgrade of Cape Hill Road.	• Provides east-west connectivity at a well-spaced interval to the north of existing East Street arterial (~800m). • Topographic, stream and floodplain constraints, so utilisation of existing route is logical. • Much of the route is immediately adjacent to/parallel to Whangapouri stream. • Existing bus route which is planned to remain.
Cape Hill / Valley / Belgium Rd	Urbanisation of existing Cape Hill / Valley / Belgium Roads.	• The sections of this road not included in the IBC as arterials form a logical collector road, such that it provides relatively

Road name	Description	Commentary / Rationale
		direct north-south connectivity through the north-eastern part of Pukekohe. • Topographic, stream and floodplain constraints, so utilisation of existing route is logical. • Conceptual bus operating pattern utilises this road.
Ngahere Rd	Urbanisation of existing Ngahere Road.	• Ensures north-south network connectivity bisecting the area between Station and Golding Roads. • Topography the only natural constraint – road already exists.
PU-EW-2 (Birch Rd ext.)	Urbanisation of Birch Road and extension to Golding Road.	• Facilitates well-spaced grid network by providing east-west connectivity between Golding and Station Roads. • Natural constraints in the form of gradient and a single stream crossing.
PU-NS-1 (Youngs Grove ext.).	Urbanisation of Youngs Grove and extension to Yates Road.	• Facilitates well-spaced grid network by providing north-south connectivity, bisecting an area of ~1.2m in width between Station and Golding Roads. • Natural constraints are limited – largely avoids flood-prone land, crosses a minor stream near Yates Road.
Station Road	Urbanisation of existing Station Road.	• Ensures north-south network connectivity with suitable spacing (0.8-1km) to parallel arterials to the west and east, thereby facilitating a connected network. • Some of the alignment is in floodplain, but already exists.
Yates Road	Urbanisation of existing Yates Road.	• Ensures east-west network connectivity between parallel north-south corridors, and is parallel ~900m south of the nearest arterial, thereby facilitating a connected grid network. • Delineates/separates proposed industrial and residential land uses. • Crosses two streams, but road already exists.

Road name	Description	Commentary / Rationale
PU-NS-2	Link between Buckland Road and Tuakau Road.	• Provides additional connectivity between Buckland and Tuakau Roads, delineates western edge of future industrial area. • Natural constraint – two stream crossings and steep land around each stream – alignment may require refinement to avoid (e.g. by utilising existing Quarry Road).
PU-EW-3	Link between Tuakau Road and the Buckland/Logan/George intersection.	• Provides east-west connectivity in the southernmost part of Pukekohe, reducing reliance on Tuakau and Buckland Roads. • Alignment shown has constraints in the form of a single stream crossing and existing houses. May require movement south. • Forming a crossroads intersection with Buckland and Logan Roads poses risk in the context of the adjacent level crossing. Closure or removal of level crossing may be required for connection to be workable. • Conceptual bus operating pattern utilises a variant on this road.

6.8. Public Transport Network

6.8.1. Service Layers and the IBC

AT's Regional Public Transport Plan (RPTP) outlines the hierarchy of services used to plan the public transport network in Auckland. The aspirational (2028) level of service definitions for each service layer as per the 2018-28 RPTP is summarised in Figure 6-9. AT intends to incrementally build towards these levels of service over time, and these improvements are underlying assumptions for the SGA business cases.

Aspiration					
Services Layer		RAPID	FREQUENT	CONNECTOR	OTHER SERVICES *(Local, rural-township, peak-only, school, Total Mobility and on-demand services)*
Defining Feature		CORE – ALL DAY NETWORK			SUPPORTING NETWORK
Minimum hours of operation		**5:30am – 11:30pm**			No minimum
City Centre Services Minimum Headway		**10 minutes**		**20 minutes**	Driven by need
Non-City Centre services Minimum Headway	**7am-7pm, 7 days**	**10 minutes**		**20 minutes**	
	Outside those times	*20 minutes*		*30 minutes*	
Achieving Efficiency and Reliability		Dedicated Right of Way	Whole-of-route priority	Priority measures	Limited priority measures

Figure 6-9 – Public transport service layers – aspirational (2028) levels of service

As noted in section 6.2.3, the rapid and frequent components of the public transport network for the Structure Plan areas have been adopted from the relevant IBC recommendations for 2048. These corridors are illustrated in Figure 6-10, and include the following key elements:

- Rapid network – Southern Line heavy rail services utilising the electrified and four-tracked NIMT with new stations at Drury Central, Drury West and Paerata;
- Frequent and Express network – Frequent and express bus services utilising SH1 and new and existing roads with priority measures will be required to supplement the rail network. Four main frequent bus corridors were proposed in the IBC. Note that these options are do not describe specific public transport services/routes, but rather describe the general corridors that services may utilise:
  - Option MT3C – Drury Central to Manukau via Great South Road;
  - Option MT4I – Drury West to Manukau via the Drury-Opāheke FUZ and SH1 bus shoulders;
  - Option MT4K – Drury West to Puhinui via SH1 bus shoulders, Mahia and Roscommon Roads; and
  - Option MT4L – Drury West to Airport via SH1 bus shoulders, Manukau and SH20.
- The above options do not preclude the identification of further frequent routes in future by AT.

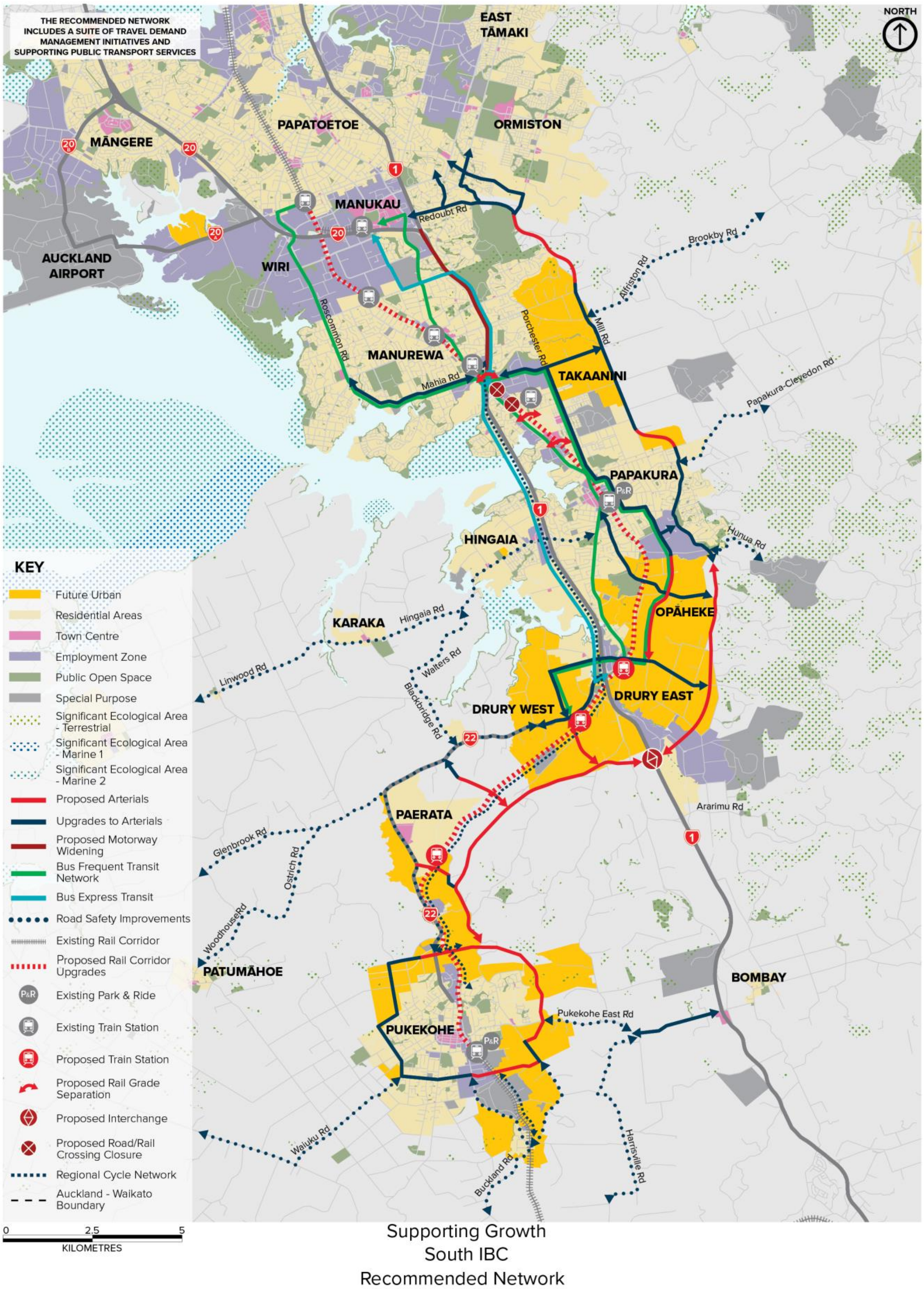


Figure 6-10 – IBC draft recommended network, with rail line labelled as the dashed red line, frequent bus routes in green, and SH1 express bus route in blue. N.B. Pukekohe will be served mainly by feeder (connector and local) routes with rail services operating as the backbone service.

6.8.2. Evaluation of proposed road network against wider bus network requirements

In addition to the rapid and frequent components of the public transport addressed above in the IBC discussion, AT has provided a conceptual full bus network plan which demonstrates how the connector and local service layers provide coverage/a wider user catchment beyond the rapid and frequent service catchments, and how network layers could intersect at key interchange points.

One of the guiding principles for the development of the ITA collector road network (and indeed the IBC arterial network) is that the network should where practical provide the connections necessary for direct and logical bus routing, operational flexibility, and the maximisation of coverage/service catchment (to the extent possible where patronage/directness is traded off against coverage). On that basis, the collector road network has been designed to ensure it can generally accommodate AT's conceptual bus network. As noted in section 6.3.2, failure to complete the collector road network will compromise the connectivity and operational efficiency of the bus network where routes rely on collector roads.

Given that long-term nature of Structure Planning and the intended staged release of land in the Structure Plan areas, detailed service planning for much of the study area is some way off. Accordingly, the focus has been on identifying the corridors likeliest to accommodate bus movements at a network-wide level at full build-out rather than examine specific routes, origins, destinations or staging.

At a high level, the ITA road network is generally consistent/generally provides for the coverage sought in AT's conceptual bus network. Key points pertinent to the connector and local service layers include:

- Multiple options for buses feeding the two Drury Stations, including potential feeders from the north (Opāheke/Drury East) and the south (Drury East/South and Ramarama)
- Multiple options for crossing SH1 either side of the Drury Interchange to avoid buses needing to navigate the Interchange;
- Multiple options for services between Drury, Pukekohe and Paerata with connections to train stations to expand the reach of rail where there are no stations;
- Maintaining the current general structure of bus services in Pukekohe while providing for expansion of the network.

Figure 6-11 shows the potential full extent of the bus network as it applies to the proposed road network.

6.8.3. Station Access and Park-and-Ride

The effective catchment for rapid transit stations can be significantly expanded through provision for vehicular, active mode and micro-mobility (e-bike and e-scooter) access. This is important in the context of maximising public transport mode share, particularly for long distance travel from the urban periphery. Although referred to here as 'Park-and-Ride', station access infrastructure also includes 'kiss-and-ride' (drop-off), 'hide-and-ride' (parking in nearby areas), ride sharing, and provision for walking, cycling and micro-mobility facilities (e.g. bicycle parking and lockers). Although access strategies for each element are needed at the detailed facility design stage, the following section outlines a general strategy for station access.

AT's RPTP sets out high level principles for Park-and-Ride facilities[35], noting that:

- New park-and-ride facilities should be located at the periphery of the public transport network to avoid the congestion effects of additional car travel;
- New park-and-ride facilities are most effective in areas that are car-dependent with minimal alternatives to access quality public transport services. These areas tend to be on the urban periphery where a bigger positive investment impact is possible as land is cheaper;
- Demand to be managed via pricing to enable the allocation of bays to those with a need to drive to public transport, and enabling some cost recovery; and
- As surrounding land is developed and land value increases over time, the opportunity to redevelop park-and-ride land becomes possible.

Park-and-ride sites have not been examined in detail through the IBC process, and it is anticipated that the DBC will provide detailed analysis on the topic. Station design, access and scale will require more detailed analysis than provided in this ITA, however the design principles and assumptions developed for the ITA are largely derived from the RPTP, and are as follows:

- In terms of relative size, the Paerata and Drury West sites are expected to ultimately function as the larger park-and-ride facilities. With the proposed full strategic and arterial network, they will be well placed to intercept commuter trips from the rural hinterland (west and south), including potential demand from the North Waikato. The established Papakura and Pukekohe centres will not have substantial facilities beyond what is already present given they are existing centres;
- In terms of staging, the Paerata and Drury Central sites are expected to be the initial park-and-ride facilities, given that access to Drury West from SH1 is dependent on the completion of the Drury South Interchange and the first section of the Pukekohe Expressway. However, given the status of Drury Central as the larger town centre, park-and-ride at Drury Central should be seen as a transitional land use to be supplanted later by Drury West (see section 9.4.1);
- Multiple access points to each park and ride facility should be provided to minimise congestion on key strategic routes and to provide reliable bus and active-mode access;
- It is recommended that parking will require controls and/or pricing to discourage use from areas with high-quality bus or active mode access (thereby retaining capacity for the intended more rural customers)
- That the design of the facilities retain flexibility in terms of circulation and parking, to support potential future increases in non-parking access (such as greater use of ride-sharing, micro-mobility and on-demand services); and
- It is recognised that park and ride can provide early use of transit stations and support development of commercial centres (via movement economy), but that strategies to transition to higher-amenity use as centres become full developed should be considered in their design.

It is not necessary at this stage to specify the precise number of spaces at each facility. Transport modelling assumptions can however influence Park-and-Ride demand to reflect a likely capacity. These assumptions are documented in Chapters 7 and 8 of the ITA.

[35] Regional Public Transport Plan, pp. 37-38 – AT, 2019

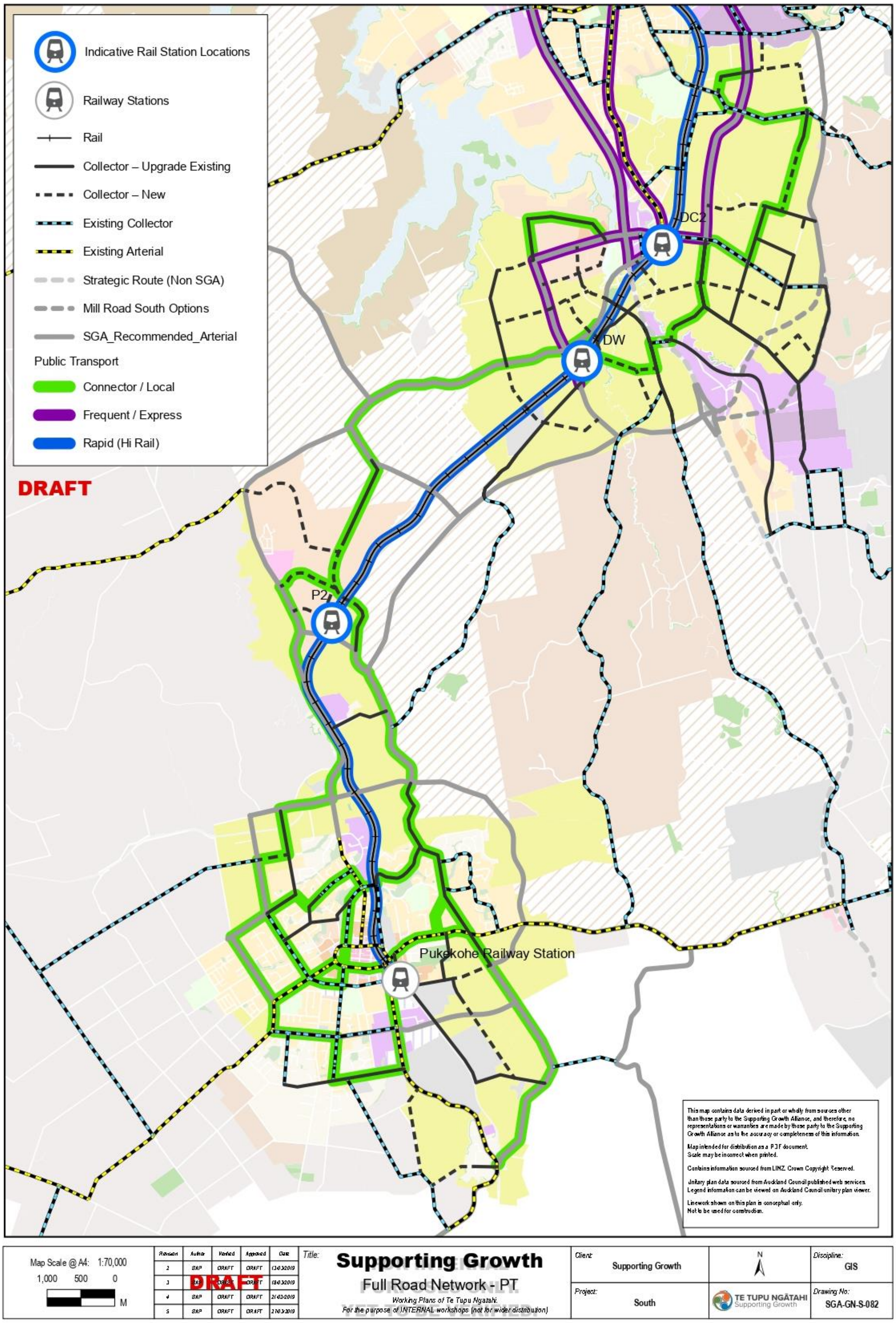


Figure 6-11 – Potential extent of public transport network. Not to scale.

6.9. Active Mode Network

6.9.1. Regional and Primary connections – IBC

As per the public transport network, the options identified in the IBC for active modes focus on the higher order regional and primary networks for walking, cycling and micro-mobility (e.g. e-bikes and e-scooters). The classification of the movement functions, along with existing examples of facilities is shown in Table 6-9.

Table 6-9 – Movement functions for active modes

Movement Function	Explanation
Regional	Connections that is intra-regional, often spanning rural land use between centres. Generally outside the road reserve. Example: SH16 NW Cycleway
Primary	Primary routes provide connections (primarily within the business cases) and higher level of service for the routes determined to have a significant spatial connection. Can be both in and outside the road reserve. Example: Nelson Street Cycleway and Grafton Gully
Secondary	Supplementary connections to the primary routes, needed to complete a successful network. For example, providing safe connections for the less significant spatial nodes. Example: New Lynn to Avondale Shared Path, Te Ara Mua – Future Streets
Local	Links to enable local neighbourhood trips for walking and active modes through quiet streets and greenways. Example: Papakura Greenways Plan, Te Ara Mua – Future Streets

Based on design principles developed for the IBC, the key regional and primary connections associated with arterial routes were identified as follows and are mapped at Figure 6-12.

- Regional walking and cycle route along SH1 (to Papakura) and the NIMT (between Papakura and Pukekohe);
- Primary cycle routes with footpaths on all IBC arterial roads for the Drury-Opāheke and Pukekohe areas;
- Primary cycle route with footpaths along Mill Road; and
- Grade-separated active mode crossings of SH1 and the NIMT.

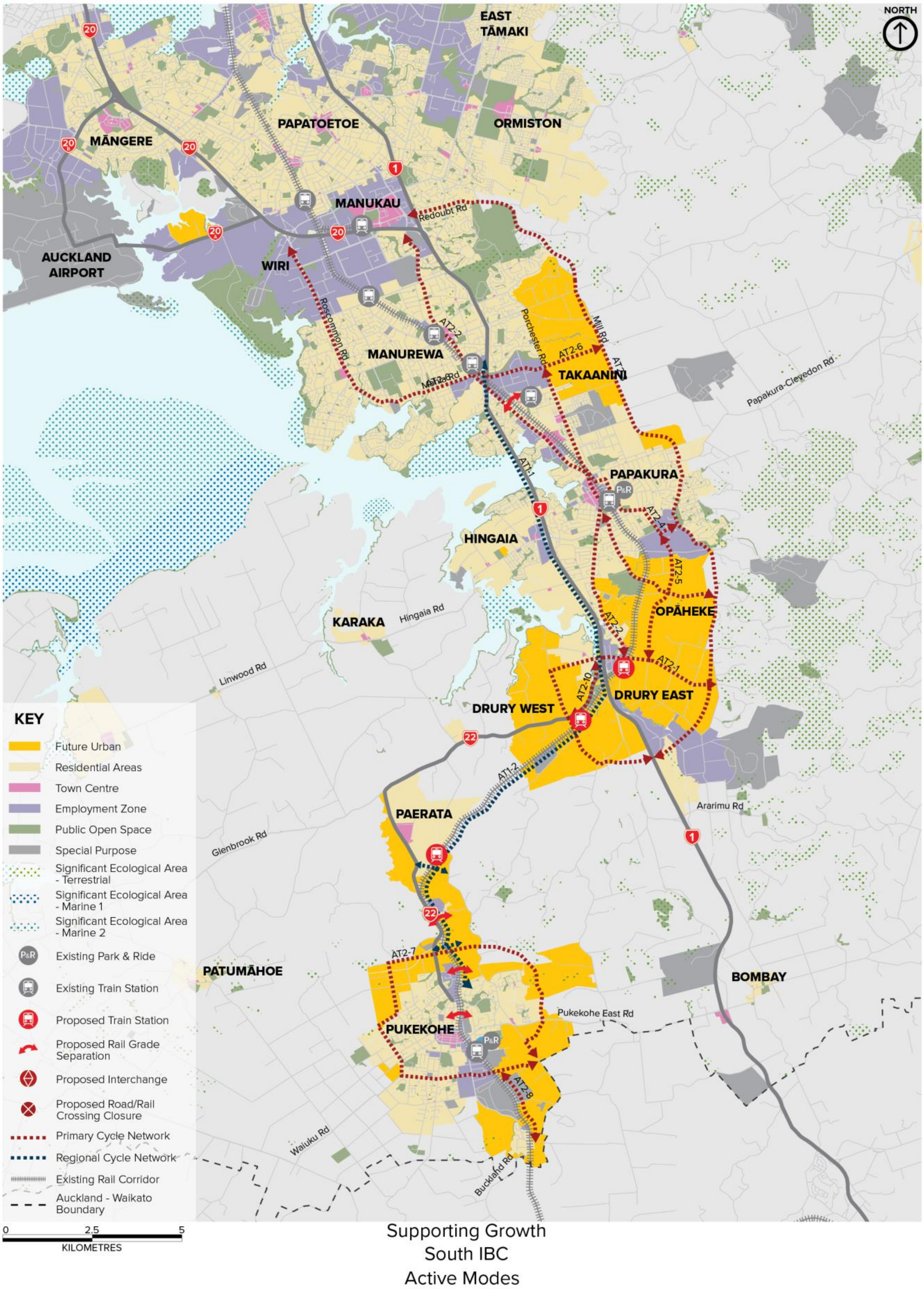


Figure 6-12 – IBC proposed active mode networks

6.9.2. Collector network – assumptions

While the IBC has already assumed a significant amount of strategic active modes infrastructure, the collector network has an important role to play in providing further walking and cycling accessibility. This is particularly true for active modes as they tend to involve shorter distances than other modes. Many of the principles (see Table 6-4) underpinning the design of the collector network also apply to the design of active mode networks.

As noted in Table 6-3, collector roads can provide for active modes and micro-mobility either with separated facilities or through a lower design speed depending on context (see section 8.4 for indicative cross-sections). Footpaths are assumed as a default part of any urban road for planning purposes.

Collector roads can also provide primary active mode and micro-mobility connections, as well as secondary and local routes. These primary routes were considered in the IBC stage and have been further refined through the development of the arterial and collector networks in this ITA. The principles used include:

- Connecting to key destinations in new and existing growth areas;
- Connecting routes to public transport;
- Provision of safe facilities separated from traffic and pedestrians that are legible, continuous, and connected routes between the communities and key destinations; and,
- Linking to local paths/greenways where they provide access to key destinations.

The key destination types are highlighted in Table 6-10. The outlined methodology from the Design Framework align with collector network principles highlighted in Table 6-4.

Table 6-10 – Destination Category

Key Destinations	Explanation
Town/Metro Centre	Higher intensity clustering of a variety of activities, with a focus around commercial activities and growth
Mass Transit Stations	Train, bus, and connections with walking/cycling routes.
Local Centre	Primarily for the local convenience for the surrounding residential areas, providing activities at a smaller scale than town centres.
Employment Centres	Provides a mix of business activities and employment. These tend to be located near centres, with a supplementary function, including business parks. Represents mixed use, and general business zones within the Auckland Unitary Plan (AUP).
Medium / High Density Housing	Enables greater intensity of development, predominantly located around centres and the public transport network, to ensure accessibility.
Residential Housing	Assumption is that this is a mixture of the other residential zones, and is less dense in nature, appearing more suburban.
Community Facilities	Accommodates community buildings/activities, including but not limited to: libraries, arts/cultural centres, halls, marae and healthcare (Based of AUP open-space community zone)

Key Destinations	Explanation
Education Facilities	Primary, Secondary, and Tertiary Institutions
Recreational Spaces	Based of AUP, this can include: Informal recreation (variety of outdoor activities, e.g. walking, running, cycling, socialising, relaxing), sport / active recreation (indoor and outdoor facilities), and civic spaces (squares, plazas in centres/urban areas)

The potential extent of the cycle network at full build-out assuming cycling facilities on collector roads is shown at Figure 6-13. Note that this network has not included full extent of routes potentially required for the current urbanised area of Pukekohe. This work will be undertaken in future.

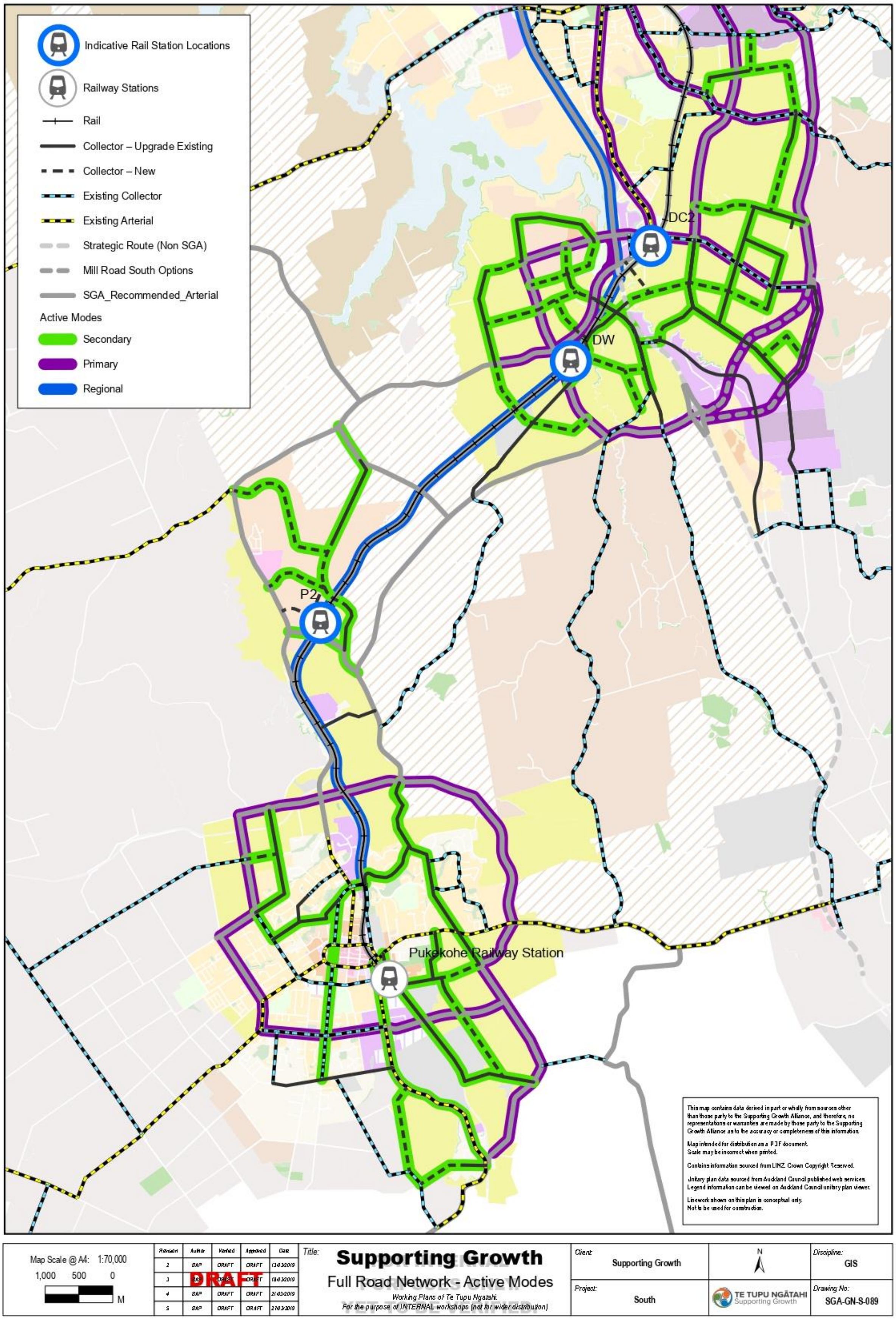


Figure 6-13 – Potential extent of active mode network. Excludes greenway networks. N.B: Further network planning within existing Pukekohe to be undertaken. Not to scale.

6.9.3. Greenways and trails – opportunities

Greenways and trails, predominantly on low-volume streets and through reserves, form an important part of the active mode network. Greenways typically function primarily as recreational facilities, but in some cases also form useful transport connections.

Greenways planning is undertaken by Council in conjunction with the relevant Local Boards. Given the lower order network role played by greenways and the relative degree of granularity in greenway plans, greenways have not been included in the network depicted in Figure 6-13. Two completed and endorsed greenway plans are relevant to the study area:

- Pukekohe-Paerata trails plan[36], endorsed by Council and the Franklin Local Board in 2018. This plan identifies 15 potential greenway connections in and around the Pukekohe-Paerata Structure Plan area. The majority of these utilise existing roads and are largely consistent with the network depicted in Figure 6-13. Off-road trails identified in the plan are predominantly located to north-east of Pukekohe.
- Papakura Greenway Plan[37], endorsed by Council and the Papakura Local Board in 2016. This plan covers the area to the immediate north of the Drury-Opāheke Structure Plan area.

Given that Council and the Franklin Local Board has not completed greenway planning for the entire Structure Plan area, the following further opportunities are identified to investigate greenways and trails:

- The high incidence of streams and floodplains in both Structure Plan areas presents an opportunity for stream-adjacent greenways/trails which warrants further consideration through the Structure Plan and subsequent Plan Change process. A number of locations have been judged too environmentally constrained for roads, but could conceivably be utilised for greenways/trails; and
- The potential to retain active mode connectivity on roads severed by (or diminished in strategic importance by) proposed strategic routes – e.g. Runciman Road.

6.10. Summary of Proposed Transport Network and indicative funding and delivery responsibilities

This chapter has documented the development of the proposed transport network required to support the full build-out of the Structure Plan areas.

Table 6-11 lists the full extent of this multi-modal network. It also provides:

- Indicative costs for the parts of the network included in SGA's IBC, and required for the Structure Plan areas;
- Indicative project owner/delineation of responsibility for the funding and delivery of each notional project.

[36] Pukekohe-Paerata trails plan – AC, 2018

[37] Papakura Greenways Plan – AC, 2016

High level cost estimates were developed by SGA to inform the IBC and option assessment process. Costs will be developed in more detail and value engineering applied to identify the most cost-effective ways to identify identified project outcomes. Costs remain subject to peer review and may change.

In terms of project ownership/delineation of responsibility, the following general assumptions are noted:

- The Transport Agency will be responsible for State Highway improvements including SH1 bus priority, motorway interchanges, and regional/strategic cycle facilities;
- AT will be responsible for new and upgraded arterial roads, public transport stations/interchanges, and public transport services, noting the following caveats:
  - A Transport Agency funding assistance rate (FAR) of 50% is assumed for AT projects.
  - AT projects are also likely to be partially funded from Development Contributions (DC) when listed in the Council's Long-Term Plan (LTP) depending on future contributions policy.
  - There are also likely to be opportunities for some AT and NZTA projects to be funded by developers via alternative funding mechanisms, particularly where a development necessitates a project to be brought forward;
- KiwiRail will be responsible for rail infrastructure excluding stations; and
- Developers will be responsible for all new and upgraded collector roads. As per the discussion at section 6.3.2 of this ITA, a funding and delivery model which enables proportionally shared funding needs to be developed to ensure that collector roads or parts of collector roads that are not the clear responsibility of a single developer are completed; and
- The relevant Auckland Council Local Boards are responsible for the development of the greenways network.

Apart from the projects listed in section 5.5 of this ITA that are committed/funded under the current NLTP and RLTP, all of the projects in Table 6-11 are currently **unfunded**.

The potential staging of the network is addressed at a high level in Chapter 9.

Table 6-11 – Proposed Structure Plan transport networks (as required at full build-out).

Grouping	Project	Indicative Project Owner	Indicative Capex Costs
Public transport	Increased rail capacity to four tracks between Wiri and Pukekohe (IBC option MT9B), and frequent Southern Line electric train services terminating at Pukekohe.	KiwiRail (KR), AT	TBC
	New rail station at Drury Central (IBC DC2).	AT	
	New rail station at Drury West (IBC DW3 or 4).	AT	
	New rail station at Paerata (IBC P2).	AT	
	Frequent and express bus network and associated priority – potentially utilising SH1 shoulders, Great South Road and various arterial and collector roads (IBC MT3C, MT4I, MT4K, MT4L).	NZ Transport Agency (NZTA), AT	

Grouping	Project	Indicative Project Owner	Indicative Capex Costs
	Connector bus network operating on arterial and collector roads as per section 6.8 of ITA.	AT	
	New park-and-ride facilities at Paerata and Drury West, with a smaller facility at Drury Central.	AT	
Active modes	Regional cycle route adjacent to SH1 and NIMT, with grade-separated active mode crossings of SH1 and NIMT.	NZTA	TBC
	Primary cycle route on Mill Road.	AT	
	Primary cycle routes on all arterial roads.	AT	
	Secondary cycle routes on collector network as per section 6.9 of ITA.	Developers	
	Greenways network (to be investigated).	Local Boards	
Road Network	Strategic road – Mill Road (IBC SR2H).	AT	TBC
	Strategic road – Pukekohe Expressway (IBC SR4F)	NZTA	
	Strategic road – SH1 widening to provide additional lanes for the Papakura to Bombay section and north of Takaanini (IBC SR1A)	NZTA	
	Strategic road – SH1 new interchange at Drury South.	NZTA	
	Arterial – upgrade of Opāheke and Ponga Roads (IBC AR7).	AT	
	Arterial – new road between Papakura industrial area and Waihoehoe Road (IBC AR10).	AT	
	Arterial – upgrade of Waihoehoe Road (IBC AR11).	AT	
	Arterial – upgrade and realignment of Bremner Road (IBC AR14a).	AT	
	Arterial – upgrade and extension of Jesmond Road (IBC AR16a, AR20).	AT	
	Arterial – SH22 improvements (IBC AR22d).	NZTA	
	Arterial – Pukekohe ring route (IBC AR25, AR37, AR38).	AT	
	Arterial – Pukekohe East/Mill Road improvements (IBC AR30).	AT	
	Arterial – SH22-Pukekohe Expressway connections (IBC SR14, AR24 and AR41).	AT	
	Collector road network for Opāheke/Drury East per ITA section 6.4.	Developers	TBC

Grouping	Project	Indicative Project Owner	Indicative Capex Costs
	Collector road network for Drury West per ITA section 6.5.	Developers	
	Collector road network for Paerata per ITA section 6.6.	Developers	
	Collector road network for Pukekohe per ITA section 6.7.	Developers	

7. Trip Generation and Mode Share

7.1. Introduction

This chapter documents the transport demands and patterns estimated for the land use proposed for the Southern Structure Plan and adjacent areas. In doing this, it establishes the transport demands which are subsequently used to assess the performance of the networks, as documented in Chapter 8.

The ITA uses a similar approach and tools as used for the IBC, albeit updated with the latest land use pattern proposed by Council for the Structure Plan areas. This approach recognises that travel patterns are a function of both the land use activity and the accessibility provided between them. This means, for example, that peak-period traffic generation and mode split is not fixed, but can be influenced by the accessibility and relative costs/attractiveness of the competing choices available to travellers. The ITA uses a multi-modal transport model that seeks to reflect the choices people make, and how they are influenced by the networks and services provided. These choices reflected in the model include:

- How many trips will be made (**generated**) each day: These are primarily a function of the population and activity types, but can be influenced by demographic inputs, car ownership, economic activity (GDP) etc
- Where people travel to: This choice of destination (trip **distribution**) is modelled as a function of the level of attractiveness of each destination (e.g. how many jobs) and the relative costs to travel there (by any mode);
- The **mode** people choose to travel: This is modelled as a function of the relative costs of travel by car or public transport. These choices consider both outbound and return travel costs;
- What **time** they travel: This is primarily a function of historic patterns but is altered by the change in congestion over time; and
- What **route**/service they use to get there: This is modelled assuming travellers seek the least-cost route through the network.

The above choices are heavily influenced by the estimated costs of travel, which are themselves a function of demand. This requires the above choice models to be iterated until convergence is reached (defined as travellers not being able to materially lessen their travel costs). The response to available travel choices differs by trip purpose. For example, while commuter and education trips have a high propensity to consider public transport and active modes, business trips are less likely to. Additionally, the travel patterns for the Structure Plan areas will be influenced by the land use in adjacent areas as well as across the region (especially in terms of employment). These interactions mean that for a land use of this scale it is not sensible to develop travel patterns in a sequential manner (such as trip generation, distribution and then mode split) in isolation of the surrounding context of land use and network performance.

The approach adopted was therefore to utilise the existing multi-modal transport model but to sense-check the resulting trip generation and mode split forecasts.

The modelling for the ITA documented in Chapters 7 and 8 follows a hierarchical structure, comprising the following interconnected components:

- The Macro Strategic Model (MSM), a strategic demand model which relates land use (such as population and employment) to travel patterns at a region-wide level and predicting the travel choices noted above; and

- A mesoscopic project model (SATURN) which applies the regional demands from MSM to analyse traffic in the Structure Plan areas in more localised detail. This enables reporting on key metrics including traffic volumes and congestion levels.

It should be noted that the MSM considers active modes up to trip generation but not any further. This means that all outputs presented from the models generally only consider car and PT modes. This means that car mode shares will be over-stated where active modes are not included.

Two forecast years have been used for the ITA assessment; 2048+ to reflect the full build-out of the Structure Plan areas' development capacity; and 2028 as an intermediate year to reflect partial build-out of Structure Plan areas' development capacity. An intermediate year has been included for this ITA given the relatively larger size of the Southern Structure Plan areas to other Structure Plan areas undertaken to date. The detail of land use assumed in each year is discussed in section 7.2.

In addition, three different transport network scenarios across the two forecast years are evaluated in Chapters 7 and 8 to reflect different potential funding scenarios. These are documented in section 7.3.

Figure 7-1 summarises the model structure used in the ITA.

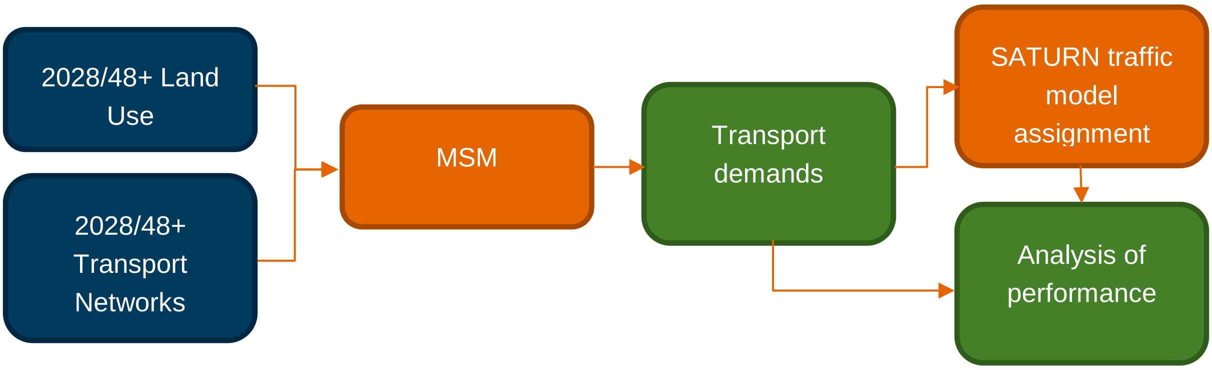


Figure 7-1 – ITA model structure.

7.2. Land Use Scenarios and Characteristics

7.2.1. 2048+ Scenario

The 2048+ land use scenario reflects the full build-out of the development capacity enabled by each of the AC Structure Plan land use scenarios (as summarised below). The total yields were developed by Council and are repeated and summarised below. The combined Structure Plan areas are estimated to yield some 36,000 dwellings, a population of 97,000 and some 17,000 jobs.

As noted in Chapter 3, the ITA assessment was based on a land use scenario provided by Council in November 2018. Subsequent refinements made by Council to the land use scenario in the intervening period for both Structure Plan areas have resulted in small changes to the yields which are shown in Table 7-1. These are not considered to be material in the context of a Structure Plan ITA, and accordingly the analysis remains a valid assessment of the proposed land use.

Table 7-1 – Structure Plan areas – summary of Council Land Use Scenarios and Yields

Area	Gross area (ha)	Net area (ha)	Net developable area (ha) [38]	Dwellings	Jobs	Population
Drury-Opāheke Structure Plan area (Nov 2018 scenario)	1,907	1,349	853	22,474	11,700	60,680
Drury-Opāheke Structure Plan area (refined scenario)	-	-	823	22,290	11,968	60,183
Pukekohe-Paerata Structure Plan area	1,262	995	569	13,444	5,372	36,300
Pukekohe-Paerata Structure Plan area (refined scenario)	-	-	528	12,549	4,994	33,883

There are several notable features of the Council's land use scenario aimed at managing travel demand generated by the Structure Plan areas:

- The provision of a significant quantum of employment land, which to an extent will assist in reducing outbound travel demand on the wider transport network by providing local employment opportunities. However, it is noted that the employment areas for the planned residents are still expected to be dominated by areas north, including Manukau, the Auckland CBD and the wider region. This results in only 0.5 new jobs provided for each additional household;
- On a related note, the employment-to-population ratios for the South more broadly (i.e. including areas beyond the Structure Plan areas) show relatively lower local employment opportunities at present than the regional average (see Table 7-2), and the situation is not predicted to improve significantly in the future (0.23 jobs per person improves to 0.25 jobs per person). Accordingly, provision for further local employment should be considered as part of a travel demand management strategy;
- The identification of a hierarchy of centres, and the co-location of significant centres (in the case of Drury Central and West) with rail station locations and key road frontages to enable transit-oriented development. This will assist in facilitating both the desired mode shift to public transport for both inbound and outbound journeys, and the desired reduction in outbound travel demand for all modes.
- Significant residential density in and around the larger centres, providing the opportunity for transit-oriented development which in turn both reduces overall travel demand and facilitates a mode shift towards public transport, walking and cycling for a large number of trips.

[38] Net area is derived by deducting protection areas (e.g. floodplains) from gross area. Net developable area is derived by deducting an allowance of 30% for roads and reserves from the net area.

- The gradation of residential density according to the proximity to public transport routes and centres. This assists in reducing overall travel demand and with facilitating a mode shift towards public transport, walking and cycling; whilst also ensuring that public transport can be efficiently and viably provides;
- The general orientation of both Structure Plan areas around the rail corridor.

Table 7-2 – Sub-Regional Population to Employment Ratios

Sub-Region	Employment		Population		Employment-Population Ratio	
	2016	2046+	2016	2046+	2016	2046+
Warkworth	3,000	6,800	5,300	22,700	0.57	0.30
North	16,500	40,800	55,000	181,900	0.30	0.22
North West	5,000	22,100	9,000	114,100	0.56	0.19
South	44,100	88,700	193,400	353,100	0.23	0.25
Non-Growth Areas	621,200	855,900	1,325,600	1,796,800	0.47	0.48
Total	689,800	1,014,300	1,588,300	2,468,600	0.43	0.41

The Council residential yield is based on estimated number of dwellings, with a simple conversion to population using an assumed 2.7 persons per household. However, the regional model is based on detailed demographic forecasts that include future changes in household size and composition (e.g. changes in population age and workers), which may differ from the simple assumption. The models adopted the Council household yields but retained regional and local trends in household size and demographics.

The resulting growth in households in the combined southern areas (combining Structure Plan and adjacent existing and growth areas are summarised in the following table. The modelled horizon year was called '2048+", which includes regional growth population forecasts to the year 2048, but with the Structure Plan areas assumed to be fully developed. The modelled demands therefore represent a planning horizon sometime after 2048. These forecasts show that the 36,000-household growth in the Structure Plan area is in the context of a total growth in the southern area of some 59,000 households.

Table 7-3 – Wider Southern Area Household Growth Forecasts

Area	2016	2048+	Growth
Drury East	812	10,776	9,964
Drury West	356	12,014	11,658
Pukekohe/Paerata	8,111	26,044	17,934
Runciman/Drury South	758	2,824	2,066
Hingaia/Karaka	1,240	7,122	5,882
Southwest/Kingseat/Waiuku/Clarks Beach	8,182	13,509	5,327

Area	2016	2048+	Growth
Southeast/Tuakau/Pokeno	6,746	13,123	6,377
Total	**26,204**	**85,412**	**59,208**

7.2.2. 2028 Intermediate Year Scenario

A 2028 intermediate year has been included to quantify the likely effects and transport requirements of a partial build-out of the development capacity enabled by each of the Council Structure Plan land use scenarios. The intermediate year has been included for this ITA given the relatively larger size of the Southern Structure Plan areas to other Structure Plan areas undertaken to date

The assumed 2028 land use scenario has been derived on the following basis:

- The **sequencing** of land release has been derived from Council's FULSS. As noted in section 4-3, the FULSS identifies a staging programme which indicates the intended date range for the live zoning of each grouping of FUZ land. Relevantly, the FULSS identifies (see Figure 7-2) the following development ready dates for the Southern Structure Plan areas:
  - 2018-22 – Paerata and Drury West Stage 1 (north of SH22);
  - 2023-27 – Pukekohe;
  - 2028-32 – Drury West Stage 2 (south of SH22) and Drury-Opāheke

  .

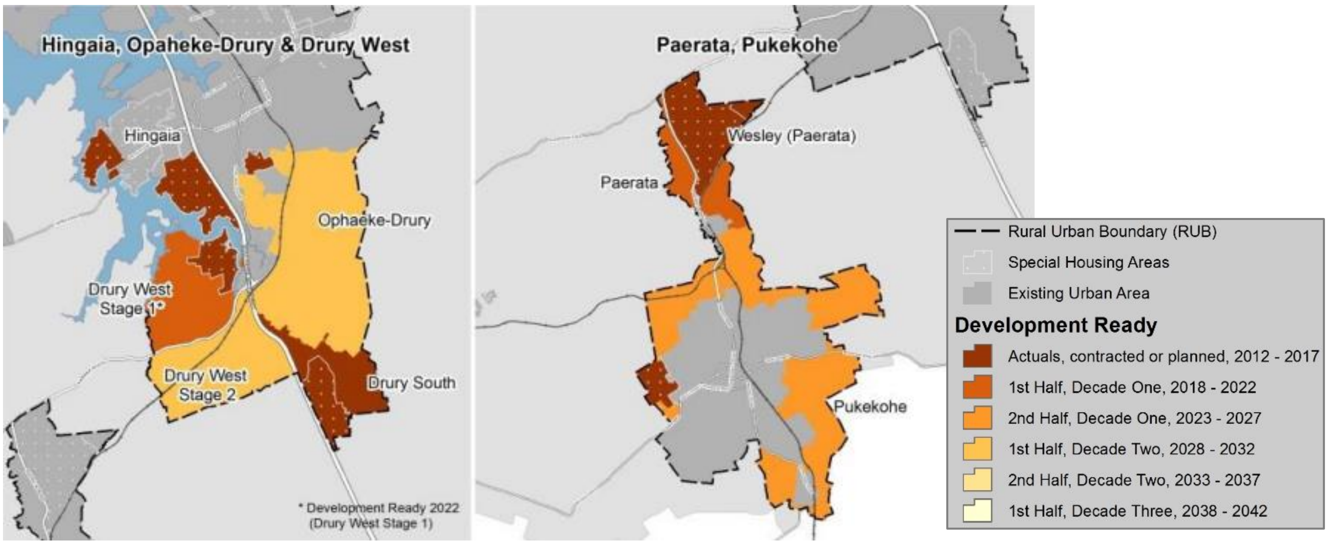


Figure 7-2 – FULSS sequencing for Southern Structure Plan areas.

- The proportion of development taken up by 2028 has been derived by applying Auckland Forecasting Centre (AFC) household, population and employment projections to the relevant MSM zones, and extrapolating the proportion of development uptake to Council's Structure Plan yields. This process reflects the reality that the FULSS simply states the intended date for live zoning to be applied, not necessarily that development will commence or be completed in the timeframe.

The resultant 2028 and 2038 land use estimates are summarised below for the wider area, inclusive of the Structure Plan growth. The year 2038 was not modelled, but is provided for context:

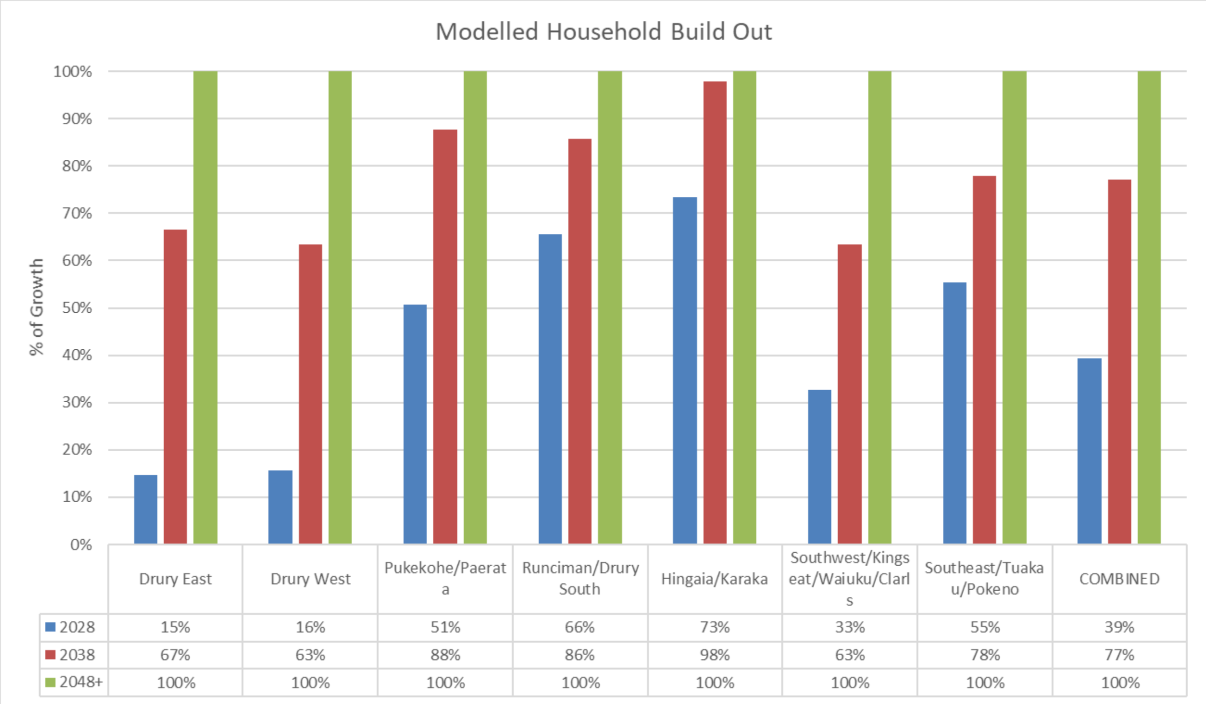


Figure 7-3 – Modelled Housing Growth Rate

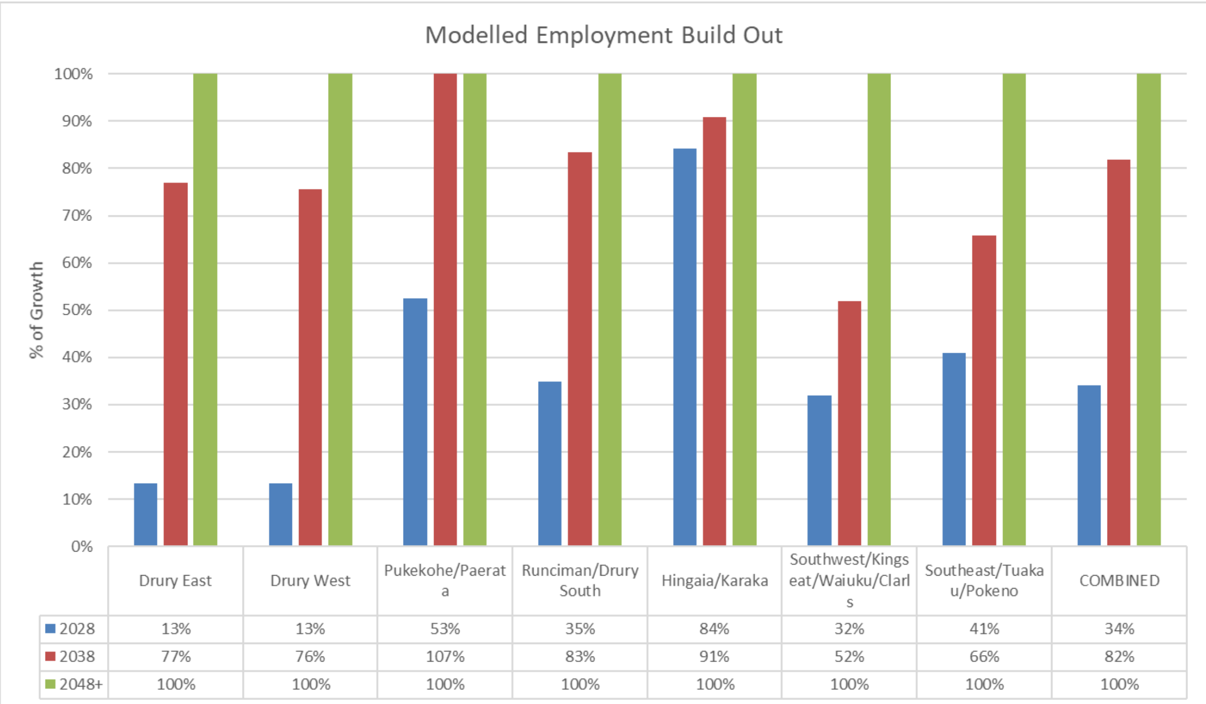


Figure 7-4 – Modelled Employment Growth Rate

It can be seen that the modelled land use assumes broadly similar build-out of the households and employment in the southern area, with households at 39% and 77% for 2028 and 2038 respectively, and combined employment at similar values of 34% and 82%. A key part of influencing demand in this area is the provision of local employment to reduce the need to travel and hence the success of this strategy requires pro-active provision of local employment to match (or even precede) the residential build.

7.3. Transport Network Scenarios

As noted in above, two forecast years have been used for the ITA assessment – 2048+ to reflect the full build-out of the Structure Plan areas' development capacity; and 2028 as an intermediate year to reflect partial build-out of Structure Plan development capacity. Between these two land use scenarios, three transport network modelling scenarios have been developed for SATURN modelling assessment:

- **2048+** – assumes the full road network (as per Table 6-11) is completed to service the full build-out of Structure Plan development capacity;
- **2028 Expanded** – includes the components of the road network assumed to be necessary to provide for 2028 land use; and
- **2028 Constrained** – includes only the components of the road network with current funding commitments.

The key differences in road network inclusions between these scenarios is summarised in Table 7-4 below. Note that while Table 7-4 only differentiates the road network components (given that SATURN only models road traffic), the impact of other transport modes is implicitly reflected in the trip generation rates applied to the SATURN model (see section 7.4).

It should be noted that these are high level scenarios intended to give a general idea of how the network functions with partial and full build-out of land use. They generally do not reflect a granular understanding of how the network will be staged. Chapter 9 of the ITA provides suggested staging strategies for the proposed key strategic transport infrastructure projects.

Table 7-4 – Differences between road network inclusions in the model scenarios

Item	2028 Constrained	2028 Expanded	2048+
Strategic road – Mill Road (IBC SR2H).	Northern section only.	✓	✓
Strategic road – Pukekohe Expressway (IBC SR4F)		SH1 to Jesmond Rd section only.	✓
Strategic road – SH1 widening to provide additional lanes for the Papakura to Bombay section and north of Takaanini (IBC SR1A)	6 lanes Papakura to Drury only.	6 lanes Papakura-Drury; 8 lanes Takaanini-SH20.	✓
Strategic road – SH1 new interchange at Drury South.		✓	✓
Arterial – upgrade of Opāheke and Ponga Roads (IBC AR7).		✓	✓
Arterial – new road between Papakura industrial area	✓	✓	✓

Item	2028 Constrained	2028 Expanded	2048+
and Waihoehoe Road (IBC AR10).			
Arterial – upgrade of Waihoehoe Road (IBC AR11).		✓	✓
Arterial – upgrade of Fitzgerald Road (probable, otherwise collector).		✓	✓
Arterial – upgrade and realignment of Bremner Road (IBC AR14a).		✓	✓
Arterial – upgrade and extension of Jesmond Road (IBC AR16a, AR20).		✓	✓
Arterial – SH22 improvements (IBC AR22d).	✓	✓	✓
Arterial – Pukekohe ring route (IBC AR25, AR37, AR38).		Eastern part only (AR38)	✓
Arterial – Pukekohe East/Mill Road improvements (IBC AR30).		✓	✓
Arterial – SH22-Pukekohe Expressway connections (IBC SR14, AR24 and AR41).			✓
Collector road network for Drury East/Central per ITA section 6.4.		Key roads included – Oira Road, Fitzgerald Road and Pitt Road ext. (DE-EW-4).	✓
Collector road network for Drury West, Paerata and Pukekohe per ITA sections 6.5-5.7.			✓

7.4. Trip Generation

7.4.1. Approach

Because of the large scale and mixed-use nature of the development being assessed there would be a very high proportion of 'trip linking' (i.e. trips 'generated' by one land use type are 'attracted' to another use), making estimation of stand-alone trip generation very difficult without double-counting.

Instead, the modelled multi-modal trip generation has been ‘sense-checked’ against other sources and locations at an aggregate, rather than detailed level. This is considered suitable for validating aggregate demands on the network, but recognises that local, detailed analysis at access points for specific land use activities would be required at later stages of land use planning.

The source of trip generation is the MSM. That model was recently validated to 2016 observed traffic and PT data, indicating that it generates appropriate levels of travel at an aggregate level.

The residential trip rates are the focus of this analysis, as the trip rates are expected to be reasonable consistent across areas. Business/employment trip rates are much more variable and dependant on the exact activity type. Current available data is only proposed AUP zone-type and resulting estimates of employment, without detailed knowledge of the activity types expected.

The residential trip rates have been undertaken on a per-household basis as this is the common measure for such rates. However, this does not reflect the expected change in demographics over time. For example, in the south the average number of people per household is expected to reduce over time, on average by some 10% by 2048. The model generates trips from the population, meaning that trip rates per household would be expected to reduce over time. Similarly, the forecast aging population includes a reducing proportion of workers, which arguably would further reduce commuter-peak trip rates. For example, in the south the ratio of workers per population is expected to reduce by 20% between 2016 and 2048. Not all peak period travel is related to ‘workers’, meaning the exact impact on household trip rates is hard to gauge. However, it can be concluded that a reducing trip rate per household is expected from the demographic changes included in the models.

The MSM estimates active mode generation based directly on land use data, but does not turn those into trip demands or flows. Those active trips are therefore only potential averages as they do not consider the quality of the active facilities available (i.e. active trip generation is expected to change as a function of the facilities provided).

Trip rates have been compared primarily on total daily mechanised travel (car and PT) because this is the most comparable with common data on trip rates (limited data on active mode trip generation rates are available). The combined car/PT trip rates are used here because the mode share will differ depending on the accessibility and competitive of PT for each zone, which is discussed in the next section.

7.4.2. Daily Trip Generation

The daily trip rates have been assessed for each MSM zone in the Drury-Opāheke and Pukekohe-Paerata areas. This has been done as follows:

- The MSM uses a large number of trip rates that vary by trip purpose, location and activity type. This analysis considers the implied average trip rate, by dividing the resulting total trips by the number of households;
- The ‘raw’ trip rate takes all car+PT trips to/from the zone and divides by the number of households;
- An ‘Adjusted’ car+PT rate adjusts the rates to account for trips generated by employment area. This cross-check was undertaken by removing an estimated generation from business trips. This estimate was based on an assumed rate of 6 trips per employee. Residential areas include employment so only the likely specific business-area employees were used.

Residential employment was assumed to be 8% of the population (based on existing data), with the employment above these values assumed to be business-area related; and

- Active mode trip rates are added from the model.

The daily trip rates in the Drury-Opāheke area are included in the following table, followed by similar data for the Pukekohe-Paerata area.

Table 7-5 – Implied Daily Trip Rates in Drury-Opāheke (excludes active modes)

MSM Zone	Location	HH	Jobs	Pop	Jobs/Pop	Raw HH Trip Rate	Adj HH Trip Rate	Active Rate	Total Rate
550	Drury Village North	438	1169	1250	93%	12.2	9.0	1.0	10.0
551	Opāheke North	99	32	340	9%	10.4	7.5	1.2	8.7
552	Opāheke Central	384	252	1120	23%	12.3	8.8	0.6	9.4
554	Drury Central	148	69	421	16%	10.7	7.7	1.1	8.8
555	Drury North	128	117	369	32%	7.6	7.4	1.2	8.5
556	Drury South	109	156	330	47%	45.0	9.9	1.4	11.3
557	Runciman West	79	65	221	29%	9.3	7.3	0.8	8.1
558	Runciman	76	51	132	39%	68.3	9.6	0.5	10.2
559	Burtt Road	59	134	186	72%	7.4	6.8	1.1	7.8
560	South of SH22	13	70	34	205%	7.3	7.2	1.0	8.2
561	Auranga	70	100	195	52%	7.2	7.1	1.0	8.1
562	Auranga West	60	144	175	82%	6.9	6.7	1.1	7.8
	Total	**1662**	**2360**	**4773**	**49%**	**10.2**	**7.5**	**1.1**	**8.5**

Table 7-6 – Implied Daily Trip Rates in Pukekohe-Paerata (excludes active modes)

MSM Zone	Location	HH	Jobs	Pop	Jobs/Pop	Raw HH Trip Rate	Adj HH Trip Rate	Active Rate	Total Rate
567	Paerata West	1583	344	4216	8%	6.9	6.9	1.3	8.2
568	Wesley	3617	826	9561	9%	6.9	6.8	1.2	8.0

MSM Zone	Location	HH	Jobs	Pop	Jobs/Pop	Raw HH Trip Rate	Adj HH Trip Rate	Active Rate	Total Rate
571	Paerata West	3162	777	8763	9%	7.9	7.8	1.3	9.1
572	Paerata East	339	182	828	22%	9.8	7.8	0.5	8.2
574	Paerata South	3346	747	8720	9%	7.9	7.8	1.3	9.1
575	Pukekohe NW	1940	1606	4926	33%	11.3	7.6	1.6	9.2
576	Pukekohe W	2240	446	5903	8%	7.3	7.3	1.7	9.0
577	Pukekohe Central	807	3126	1595	196%	38.2	15.9	1.3	17.3
578	Pukekohe E	3099	910	7677	12%	8.6	8.0	0.9	8.9
579	Pukekohe SE	873	803	2230	36%	14.0	9.7	0.8	10.5
580	Pukekohe E	1862	700	4642	15%	8.9	7.9	1.0	8.9
581	Pukekohe SE	2617	4003	7310	55%	17.2	9.4	1.8	11.1
583	Pukekohe NW	848	572	2162	26%	10.2	7.4	1.2	8.5
584	Paerata West	950	528	2547	21%	9.9	7.9	0.5	8.4
590	Pukekohe W	2958	1463	7467	20%	9.2	7.4	0.4	7.8
595	Pukekohe S	4554	1749	10488	17%	7.2	6.0	0.8	6.8
	Total	**34798**	**18782**	**89034**	**21%**	**9.7**	**7.7**	**1.1**	**8.8**

Here it can be seen that the daily car + PT trip rates for the predominantly residential zones are general in the range of 7-10 trips per day. The adjusted trip rates attempt to remove the effect of the business areas, which again show similar trip rates of between 7-10. These rates are similar to the average across Auckland (8.2) and typical expectations on trip rates. For example, a recent survey of a residential area in Warkworth found 8 trips per household per day[39].

The active modes add on average 1.1-1.2 trips per day, bringing the total person trip rates to typically between 8 and 11 (excluding predominantly business zones). The Auckland-wide average including active modes implied from the models is 9.7.

[39] Survey undertaken for the SGA Warkworth Integrated Transport Assessment.

Overall these daily trip rates are considered to be suitable for the scale and level of this structure planning. More detailed trip generation analysis would be expected for specific, known developments at subsequent plan change or subdivision consents.

7.4.3. Peak hour Vehicle Trip Generation

In terms of private vehicle trip rates, the implied 1-hour rates for the AM, interpeak and PM periods were assessed as summarised below. These rates are 'raw' rates, however the ratio of jobs/population provides an indication which zones are predominantly residential.

Table 7-7 – Implied Peak Hour Vehicle Trip Rates in Drury

MSM Zone	Location	Jobs/Pop	AM	Interpeak	PM
550	Drury Village North	93%	0.77	0.70	0.77
551	Opāheke North	9%	0.63	0.11	0.81
552	Opāheke Central	23%	0.84	0.06	0.98
554	Drury Central	16%	0.64	0.16	0.86
555	Drury North	32%	0.44	0.14	0.63
556	Drury South	47%	2.84	0.19	3.31
557	Runciman West	29%	0.57	0.06	0.69
558	Runciman	39%	4.38	0.17	4.99
559	Burt Road	72%	0.43	0.16	0.64
560	South of SH22	205%	0.43	0.16	0.63
561	Auranga	52%	0.43	0.12	0.59
562	Auranga West	82%	0.40	0.14	0.58

Table 7-8 – Implied Peak Hour Vehicle Trip Rates in Pukekohe/Drury

MSM Zone	Location	Jobs/Pop	AM	Interpeak	PM
567	Paerata West	8%	0.40	0.39	0.42
568	Wesley	9%	0.39	0.37	0.40
571	Paerata West	9%	0.51	0.44	0.49
572	Paerata East	22%	0.64	0.57	0.66
574	Paerata South	9%	0.50	0.45	0.50
575	Pukekohe NW	33%	0.71	0.66	0.74
576	Pukekohe W	8%	0.45	0.42	0.47
577	Pukekohe Central	196%	2.30	2.30	2.31

MSM Zone	Location	Jobs/Pop	AM	Interpeak	PM
578	Pukekohe E	12%	0.54	0.49	0.55
579	Pukekohe SE	36%	0.91	0.83	0.92
580	Pukekohe E	15%	0.58	0.51	0.58
581	Pukekohe SE	55%	1.11	1.02	1.09
583	Pukekohe NW	26%	0.61	0.62	0.64
584	Paerata West	21%	0.64	0.62	0.62
590	Pukekohe W	20%	0.63	0.53	0.62
595	Pukekohe S	17%	0.48	0.41	0.47

In the residential zones, the peak trip rates are in the range 0.39-0.5 for the AM peak and 0.4-0.8 in the pm peak. The wide range is influenced by the different mode split for each zone as well as the land use type and demographics. These peak-hour vehicle trip rates are lower than traditional surveyed vehicle trip rates, which could be expected to be in the range 0.6-0.8, especially for areas with low PT usage. As mentioned above, the reducing household size (people per house) and reducing proportion of workers suggest that a lower peak-hour rate could be expected. The high-quality PT provision proposed in this area is also expected to reduce the vehicle trip rates.

7.5. Public Transport Mode Share Estimates

The predicted uptake in PT is estimated via the multi-modal model. The resulting mode split will vary based on the trip purpose and destination of the movement. For example, commuter trips to the Auckland CBD would expect to have a high PT usage because of the high car costs (congested motorway travel + fuel costs + CBD parking costs), whereas local business trips within the south would be less likely to use PT due to lower costs of using a car.

The forecast AM peak mode split is summarised in the following figure for three modelled scenarios:

1. 2028 with a constrained network (i.e. without major transport investment)
2. 2028 with an expanded transport network (including rail stations in Drury and a section of Mill Road corridor)
3. 2048+ Full build out with the full preferred strategic network

For the fully developed 2048 network a high PT share approaching 50% is expected for longer-distance trips north, with a 16% share for trips to nearby areas such as Papakura and only 5% for local trips within the southern area itself. The overall average across all trips is 20%.

For the constrained 2028 network, the mode shares are much lower, being some 24% to the north, 5% nearby and 2% local. With rail stations are feeder bus services added in the 2028 Expanded network these increase to 35% north, 8% nearby, 3% local and 14% overall.

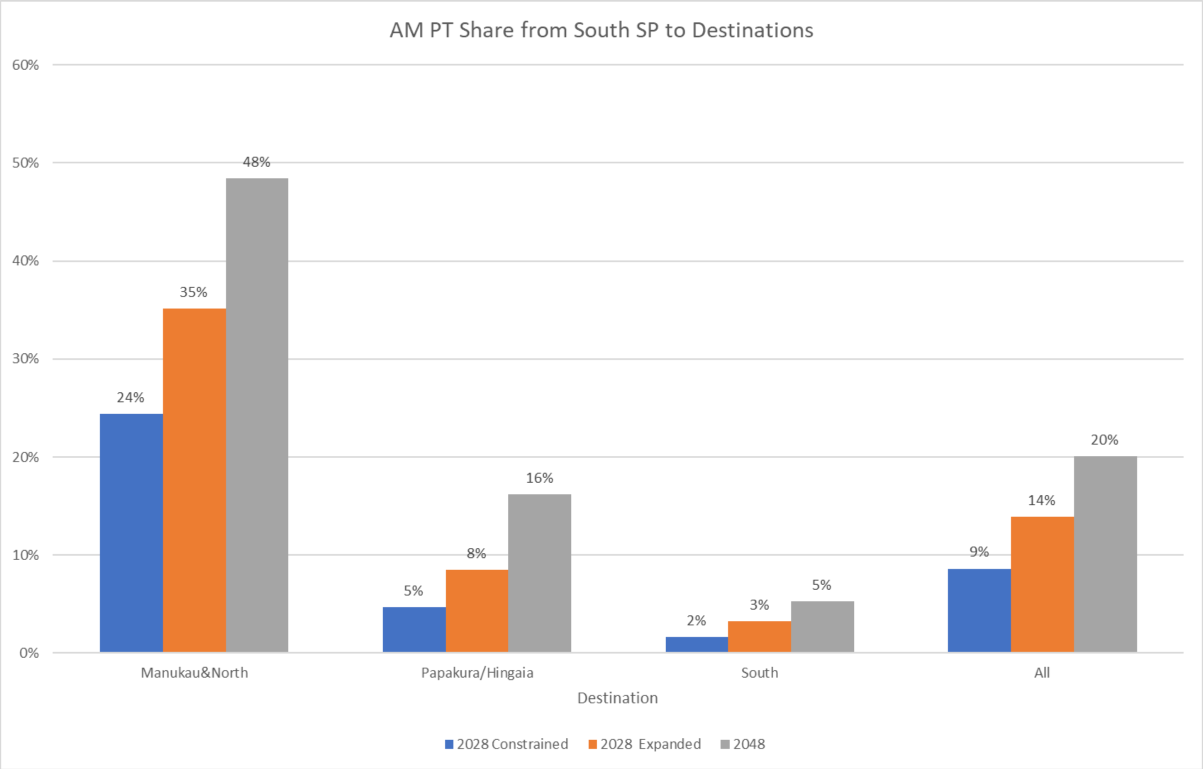


Figure 7-5 – AM Peak PT mode split (excluding active modes).

Although local bus services will provide an important service, very high share for PT for shorter, local trips are not expected under the current assumptions (such as current vehicle prices and parking provision).

These mode shares are considered plausible and reflect a significant shift in current travel behaviour. They also demonstrate the impact of the enhanced PT provision on the mode share.

8. Assessment of Proposed Transport Network performance

8.1. Performance Measures

This chapter summarises the performance of the proposed transport network against a range of performance measures:

- Public transport performance measures (section 8.2):
  - Public transport passenger flows;
  - Public transport accessibility;
  - Modelled boardings and alightings at each rail station; and
  - Rail crowding.
- Road network performance measures (section 8.3):
  - Modelled average daily traffic (ADT) volumes;
  - Modelled AM, PM and Interpeak Level of Service (LOS) using Volume-to-Capacity (V/C) ratios.

8.2. Public Transport Network Performance

8.2.1. Public Transport Flows

The predicted morning peak passenger flows (2048+ AM 2-hour peak) are indicated in the following figure. Key items to note include:

- Significant rail service flows, including:
  - 3,200 (2-way) passengers north of Pukekohe
  - 6,200 (2-way) passengers north of Paerata
  - 8,600 (2-way) passengers north of Drury West
  - 10,200 (2-way) passengers north of Drury Central
- Significant passenger flows in the proposed SH1 corridor express services, with some 1,000 (2-way) passengers on SH1 north of Drury
- Important bus routes such as:
  - Waihoehoe Road (430 passengers)
  - Porchester Road Arterial (330)
  - Bremner Road (200)
  - Hingaia Road (140)
  - SH22 (150)
  - Jesmond Road (140)
  - Ramarama Road (170)
  - Gt South Road north of Drury (210)

Together some 11,700 passengers (2-way, 2-hour) cross an east-west screenline north of Drury, which is equivalent to some 7,000 people per hour. This is roughly equivalent to 5-6 traffic lanes on an arterial road, demonstrating a significant contribution to north-south travel capacity. Importantly, it is clear that the rail corridor alone does not meet **all** north-south travel demands, which demonstrates the need for frequent bus services to supplement rail (see section 6.8).

Figure 8-1 – 2048+ AM Peak Predicted Passenger Flows (2-hour)

8.2.2. PT Accessibility

The access to local and rapid public transport services can be seen via the proposed routes and stations proposed for the network. A measure of the resulting change in accessibility to major destinations such as the Auckland CBD is shown the following figures for 2016 and 2048+. The data shown is the generalised costs of travel as used in the transport model. These are perceived costs of travel and can be used as proxy measure of accessibility. They include access time, waiting time, in-vehicle time, transfer penalties and fares, including perception factors on vehicle type and crowding.

The first figure shows the PT accessibility to the CBD in 2016, with the second the same in 2048+. The key thing to note is that in the 2016 model (also representative of today), the PT accessibility to the CBD is very poor, with all of the Structure Plan areas shown as having perceived costs greater than 155 minutes (black dots). By contrast, by 2048+ with the proposed strategic and local facilities and services, these costs reduce significantly, to be in the range of 90-130 minutes. These reflect reductions in perceived travel costs of 20-60 equivalent minutes.

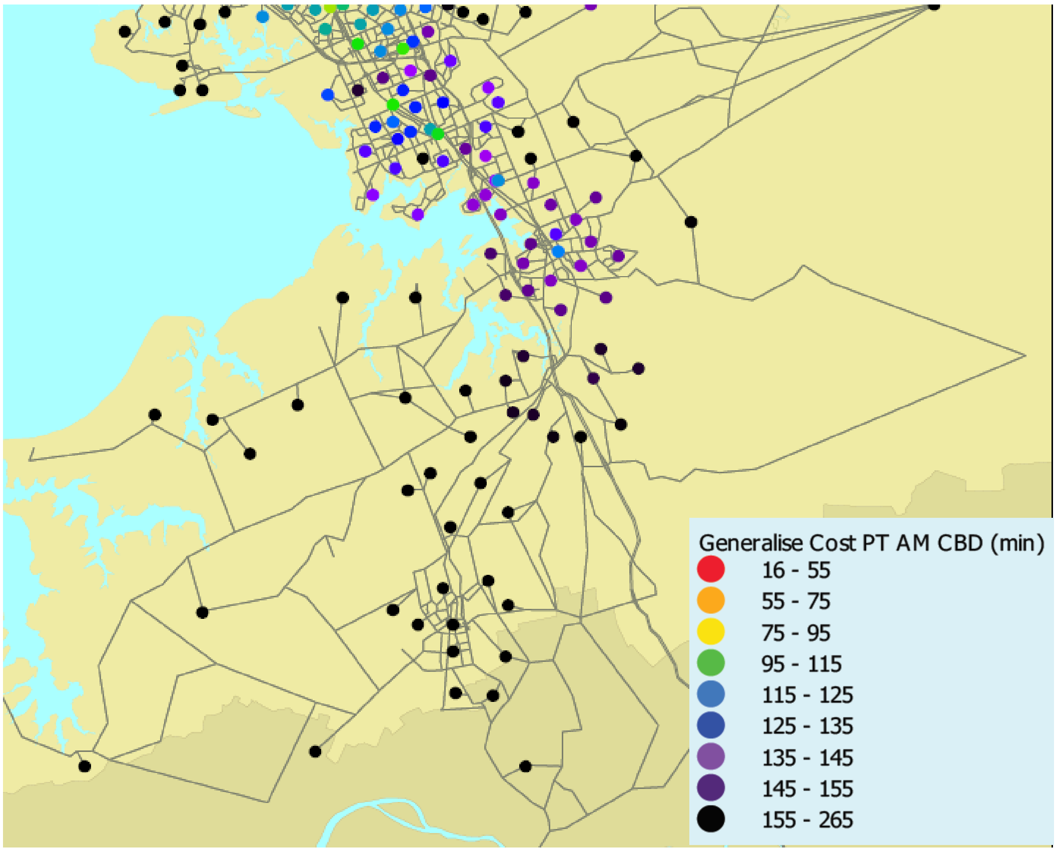


Figure 8-2 – 2016 AM Peak PT generalised costs to CBD.

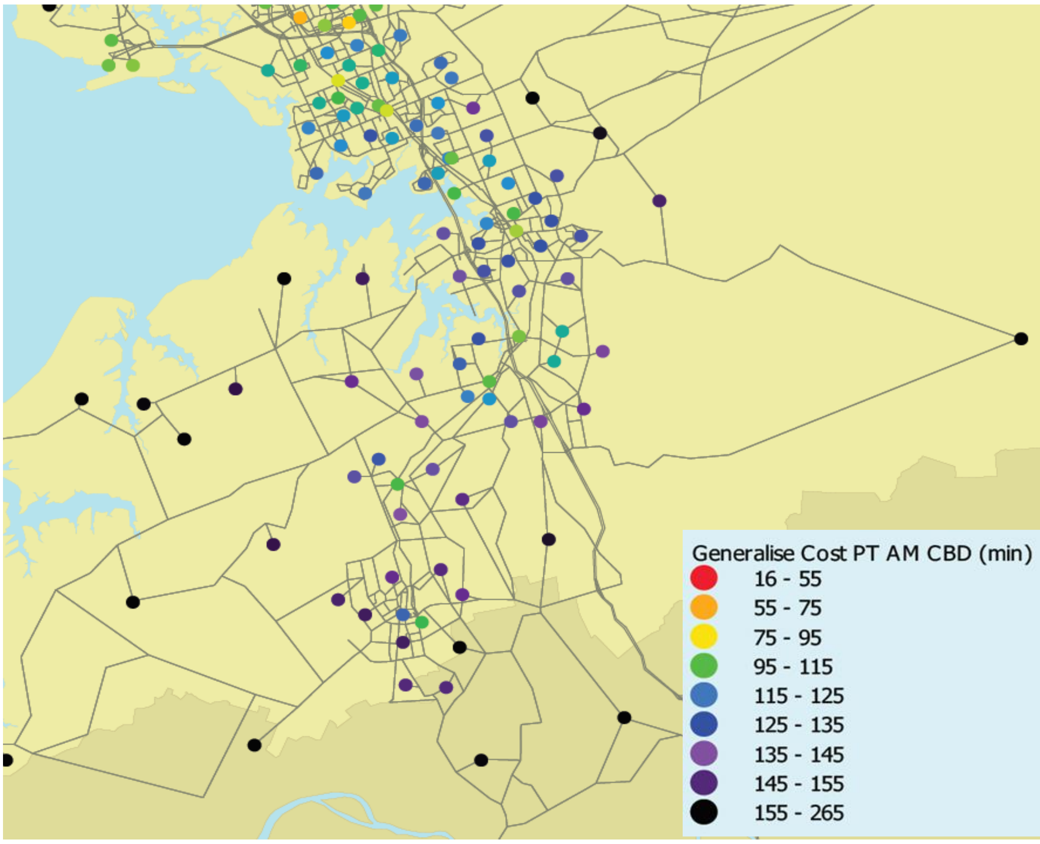


Figure 8-3 – 2048+ AM Peak PT generalised costs to CBD.

8.2.3. 2048 Rail Station Boarding/Alighting and Park and Ride

The modelled boarding and alighting on the rail services are indicated in the following graph for the 2048+ AM peak. This shows significant passenger boarding from the southern stations, each roughly similar in scale to those boarding at Manukau. Northbound the major alighting occurs at Puhinui, as this is the access point for both Manukau City and the Airport. Southbound in the morning peak the boarding and alighting at the southern stations is much lower, but with a larger number alighting at the Pukekohe Station. It should be noted that these models do not include inter-regional rail.

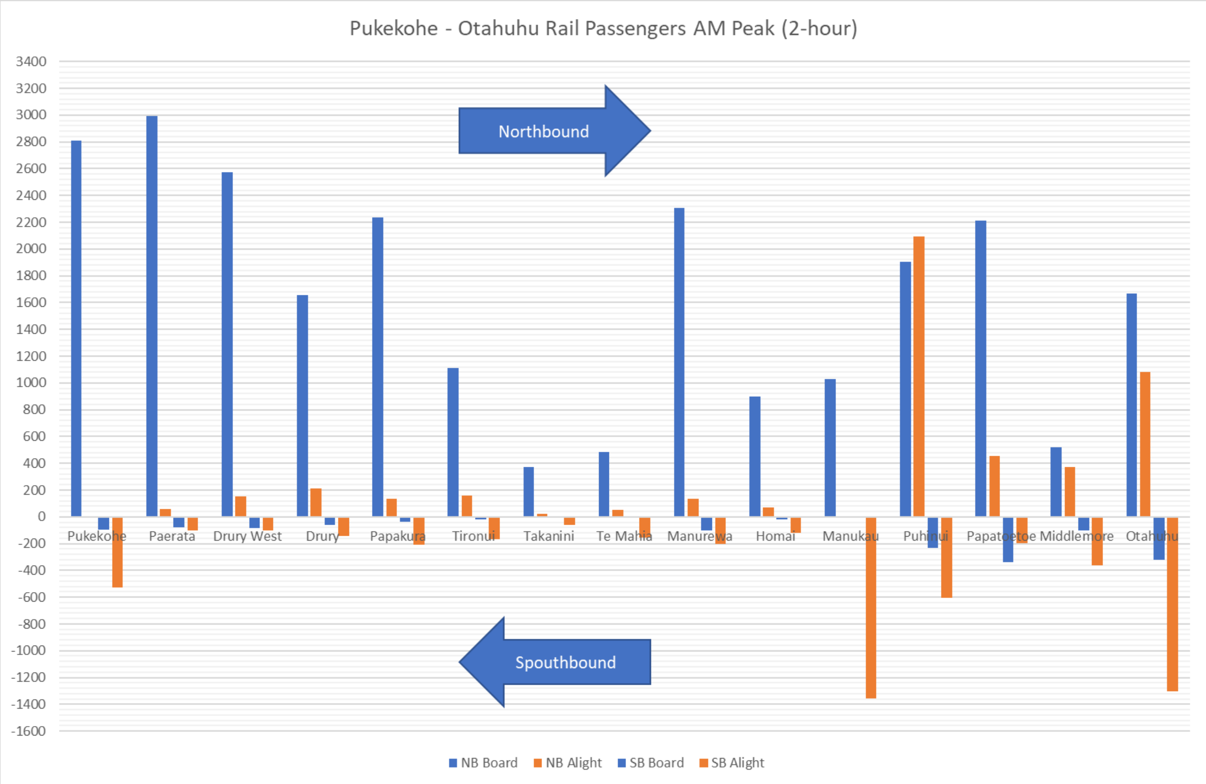


Figure 8-4 – 2048+ AM peak Rail Station Usage[40]

The boarding is heavily influenced by the predicted park and ride usage in this area, which itself is a function of the access, capacity and any management/pricing applied. The MSM does not explicitly reflect parking supply and uses manually-defined catchment areas. This means that the park and ride estimates should not be considered as precise predictions at specific stations, but rather indications of overall potential demand. Those demand estimates are able to be influenced by capacity and management policies that have not yet been defined. For modelling purposes, parking prices were applied at the park and ride sites as a proxy for the potential supply/management strategy that favours greater use in Paerata and Drury West, with smaller or more actively managed facilities in Pukekohe and Drury Central. The model included assumed parking charges of $5 in Pukekohe, Papakura and

[40] These station boarding figures are high-level estimates derived from strategic-level modelling and should not be taken as detailed forecasts for each station. Specific boarding estimation figures are subject to more detailed design and demand estimation in the DBC.

Drury Central with $3 in Drury West and Paerata. These should not be seen as confirmed pricing strategies, but rather representative of desired supply/management strategy.

Also, it should be noted that in the model, the 'Park and Ride' function is better described as vehicle access, as it includes access by 'kiss and ride' (vehicle drop-off) and 'hide and ride' (where people park in adjacent areas rather than in designated spaces). Arguably it also represents micro-mobility type access (such as e-scooters/e-bikes) where the speed and range of access is greater than via walking. This means that the modelled demand does not reflect the number of formal parking spaces required. For example, previous data at Silverdale indicated morning peak bus boarding of some 800 passengers when only some 400 formal spaces were available.

The modelled 2048+ AM peak contribution to station boarding is show below. These suggest largest park and ride contributions at Paerata and Drury West (which is likely to reflect the lower assumed parking charge), with lesser park and ride demand at Pukekohe and Drury Central. Collectively, it can be seen that park and ride provides a significant contribution to the train patronage.

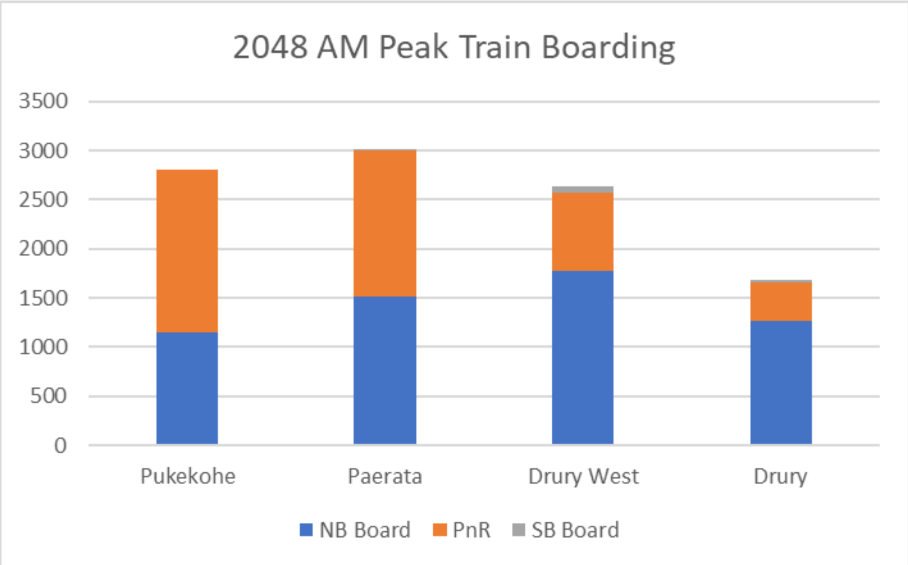


Figure 8-5 – 2048+ AM Rail Station Boarding by type[41]

8.2.4. Rail Crowding

The 2048+ models assume significant increases in rail capacity, including high frequencies, extra rail lines (to accommodate increased passenger, freight and inter-regional frequencies), and larger trains. Even with these increases, there remain constraints on the capacity of the downstream rail network (i.e. there is not infinite capacity to simply add more services or longer trains). The models reflect constraints on capacity by 'crowding', which impacts the perceived attractiveness by passengers. This reflects that as passenger numbers exceed the seated capacity of the trains the perceived attractiveness is reduced.

41 These station boarding figures are high-level estimates derived from strategic-level modelling and should not be taken as detailed forecasts for each station. Specific boarding estimation figures are subject to more detailed design and demand estimation in the DBC.

This is due to a lower probability of being seated, less comfortable travel and can involve queueing at entry/exit points. The level of ‘crowding’ differs for each service. However, given that the study area is shown in Figures 8-1 and 8.2 to be adding over 10,000 northbound peak (2-hour) period trips to the rail network, it is prudent to be planning for 9-car trains at a frequency of 24 trains per hour by 2048[42].

8.3. Road Network Performance

8.3.1. 2048+ Scenario

8.3.1.1. Daily traffic volumes

Figure 8-6 is an ADT plot showing predicted traffic volumes for the wider Structure Plan study area in the 2048+ scenario, organised by volume bands/ranges.

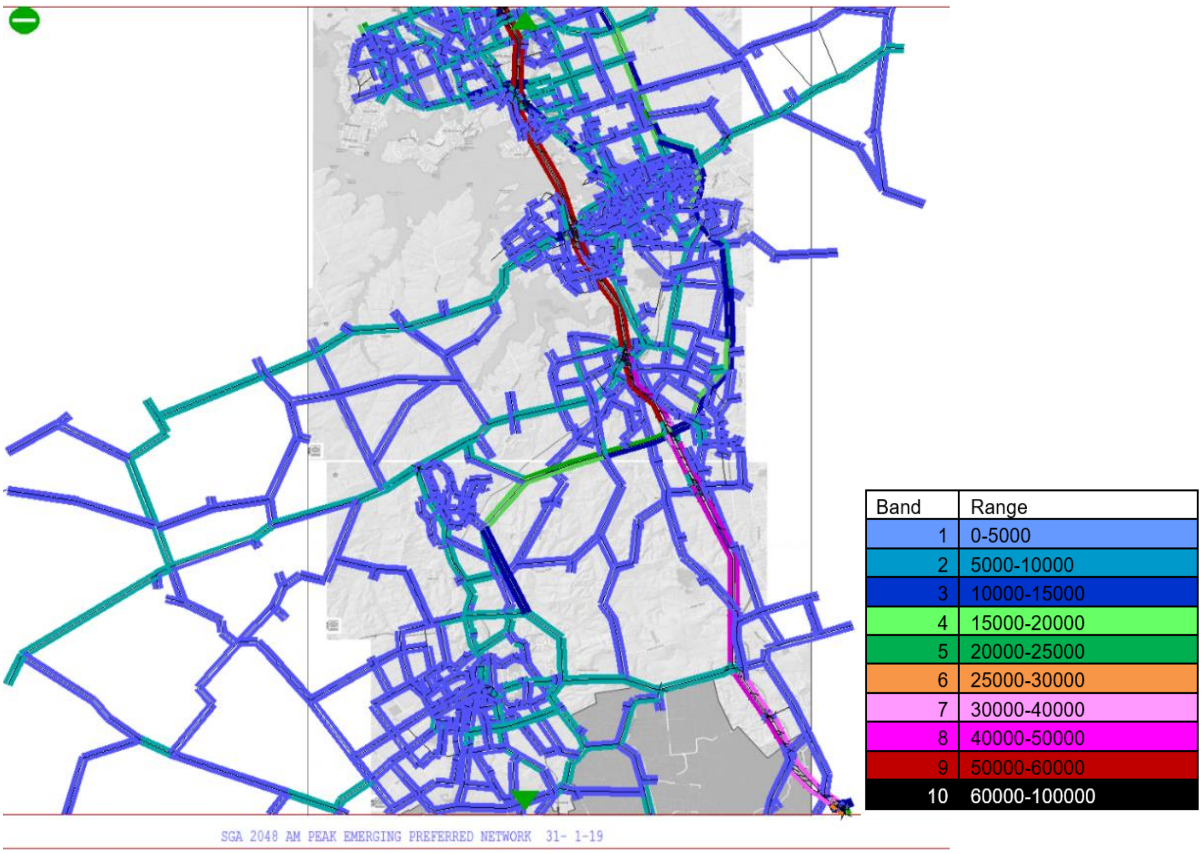


Figure 8-6 – 2048+ Scenario ADT volume plot.

The following inferences can be drawn from the ADT plot:

[42] The current six-car train sets have a full (sitting and standing) capacity of 900 passengers, equating to an hourly capacity of 10,800 if operated at 24 trains per hour (5-minute headways). Increasing to nine-car trains enables an hourly capacity of over 16,000.

- The strategic corridors (SH1, Mill Road and the Pukekohe Expressway) experience the highest ADT volumes, indicating these corridors are generally fulfilling their intended high-volume roles:
  - SH1 volumes fall into Bands 7-9 (30,000-60,000 ADT) on all links throughout the study area, with volumes generally higher in the northern part of the study area;
  - Mill Road and the Pukekohe Expressway links fall into Bands 3-5 (10,000-25,000 ADT), with the highest volumes occurring on Mill Road in the northern part of the study area, and on the Pukekohe Expressway between Drury West and Paerata.
- The majority of SH22 operates within Band 2 (5-10,000 ADT), indicating that the Pukekohe Expressway has attracted the growth in trips which would otherwise have used this route;
- The Pukekohe Expressway also attracts some movements (~2,000 ADT compared with the 2028 scenarios) from Cape Hill Road;
- The arterial routes including Great South Road, route AR10, Waihoehoe Road, Bremner extension, Jesmond Road, and the Pukekohe ring road fall within Bands 1 and 2 (<10,000 ADT, indicating that four lanes for general traffic may not be warranted in all scenarios[43]; and
- Virtually the entire collector road network falls within Bands 1 and 2 (<10,000 ADT). This indicates that the collector network is fulfilling its intended role of meeting both movement and access needs, and is not attracting large volumes of through movement.

8.3.1.2. Level of Service

Figures 8-7, 8-8 and 8-9 respectively show LOS plots for the AM peak, Interpeak and PM peak periods at 2048+, using Volume-to-Capacity (V/C) ratios as the performance measure. The colours on the plots indicate the following:

- Links where volumes fall in the range of 70-85% of the period capacity are shown in orange;
- Links where volumes fall in the range of 85-100% of the period capacity are shown in red; and
- Links where volumes are >100% of the period capacity are shown in black.

[43] N.B. The SGA will be considering the required function and cross-section to a greater level of detail through the DBC process. While predicted flows may not justify four general traffic lanes, an equivalent cross-section may nonetheless be required for example to provide for public transport or active mode priority.

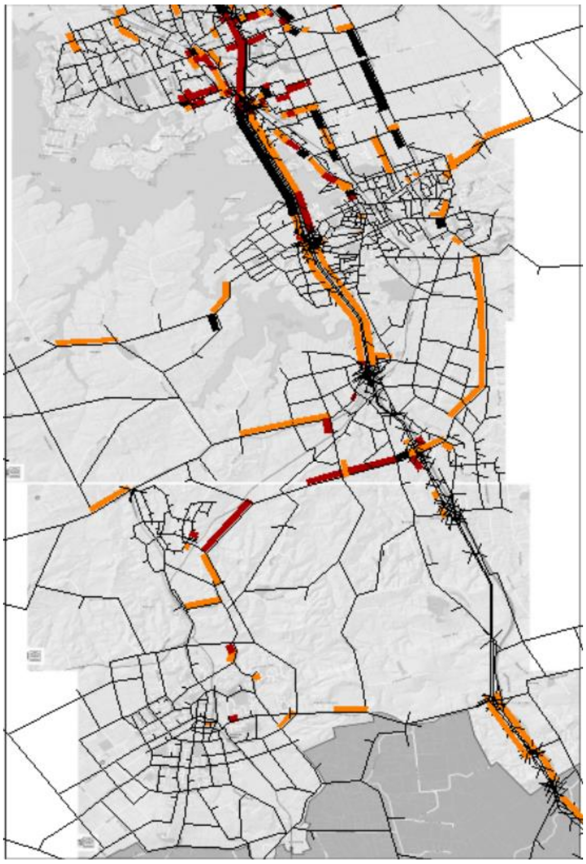


Figure 8-7 – 2048 AM Peak V/C

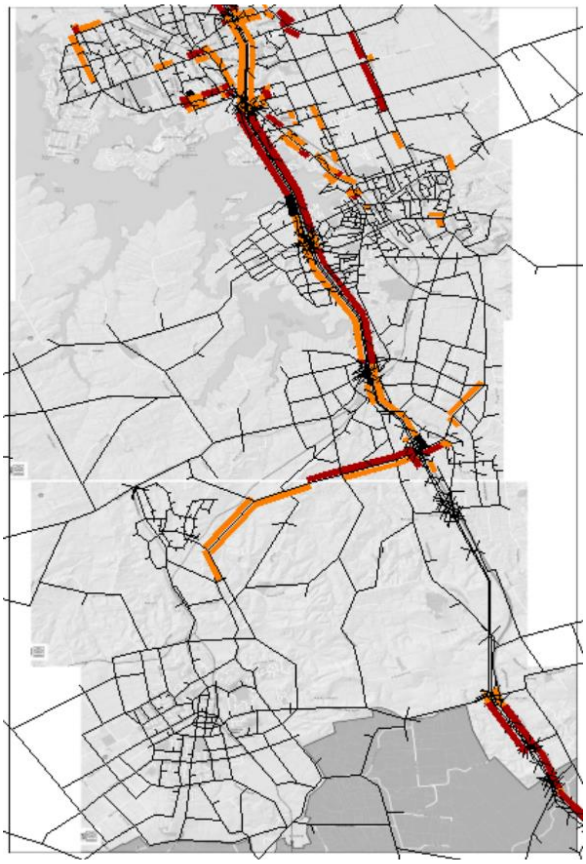


Figure 8-8 – 2048 IP V/C

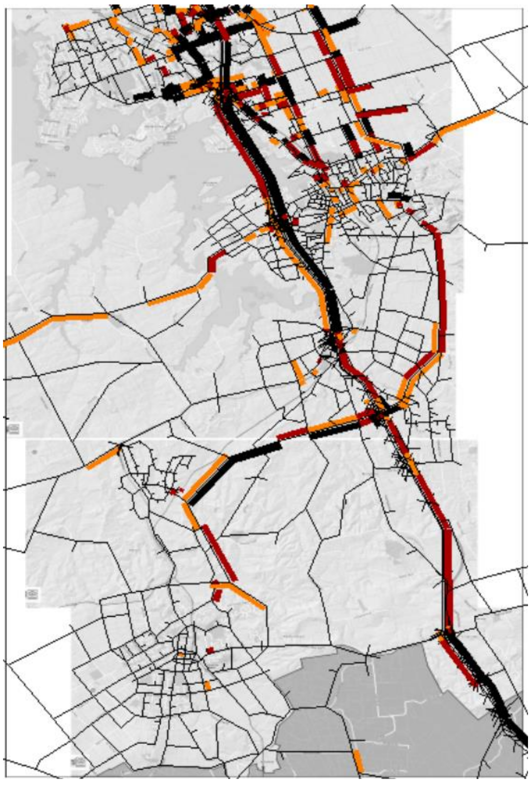


Figure 8-9 – 2048 PM Peak V/C

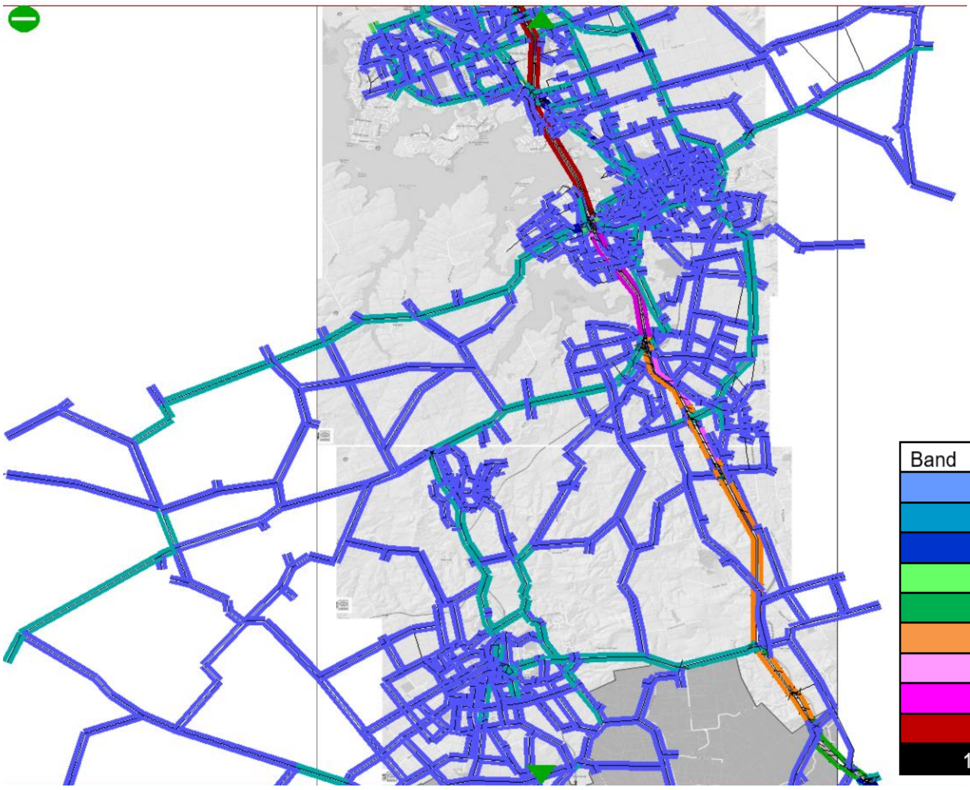
The following inferences can be drawn from the V/C plots:

- Sections of SH1 are operating at or beyond capacity, particularly in the southbound direction in the PM peak period where links in the southbound direction to the north of Drury and south of Bombay Interchanges are operating at >100% of capacity. At the AM peak, the section of SH1 between Takaanini and Papakura Interchanges is operating at >100% of capacity in the northbound direction. In the AM, PM and IP periods, much of the remainder of SH1 operates at >70% of capacity.
- Mill Road operates at or near capacity in the northbound direction in the AM peak period, and in both directions in the PM period. The most constrained sections are to the north of the study area in the vicinity of Takaanini, and the section to the immediate north of the Drury South Interchange.
- Much of the Pukekohe Expressway operates at >85% capacity in the northbound direction in the AM peak towards the Drury South Interchange, and conversely with some sections at >100% capacity in the southbound direction in the PM peak. Much of the corridor operates at >70% in the Interpeak. Conversely, this has relieved congestion on other routes such as Cape Hill Road compared with the 2028 scenarios; and
- The remainder of the arterial and collector network operates within capacity, with the exception of localised congestion around the SH22/Jesmond Road intersection, motorway interchanges, and selected intersections in north-east Pukekohe.

8.3.2. 2028 Expanded Scenario

8.3.2.1. Daily traffic volumes

Figure 8-10 is an ADT plot showing predicted traffic volumes for the wider Structure Plan study area in the 2028 Expanded scenario, organised by volume bands/ranges.



Band	Range
1	0-5000
2	5000-10000
3	10000-15000
4	15000-20000
5	20000-25000
6	25000-30000
7	30000-40000
8	40000-50000
9	50000-60000
10	60000-100000

Figure 8-10 – 2028 Expanded Scenario ADT Volume Plot

The following inferences can be drawn from the ADT plot:

- SH1 volumes range from Band 5 to Band 9 (25,000 to 60,000 ADT), with volumes progressively increasing south-to-north. Notably, the sections north of the Papakura Interchange fall into the same band as in the 2048+ scenario (Band 9), while volumes in the Bombay section are comparable to today (Band 5).
- The Mill Road corridor at 2028 operates largely within Band 2 (<10,000 ADT) within the study area, while the assumption that the Pukekohe Expressway will only be complete as far as Jesmond Road does not appear to have resulted in significant increases in volumes elsewhere on the network.
- The SH22 corridor operates largely within Band 2 (<10,000 ADT).
- The remainder of the arterial and collector network falls within Bands 1 and 2 (<10,000 ADT), indicating that all corridors are well within their capacity in terms of daily volumes.

8.3.2.2. Level of Service

Figures 8-11, 8-12 and 8-13 respectively show LOS plots for the AM peak, Interpeak and PM peak periods at 2048+, using V/C ratios as the performance measure.

The following inferences can be drawn from the V/C plots:

- Much of SH1 operates at in a congested condition during all periods, in particular the section between Takaanini and Papakura which operates at >85% V/C in the northbound and southbound directions respectively in the AM and PM peaks (with localised sections operating at >100%) and at >70% in the Interpeak. The corridor south of Drury is most congested in the southbound direction at the PM peak with much of that section operating at >85% V/C.
- Much of SH22 is operating at >70% V/C (with localised sections of >85%) in the AM peak in the eastbound direction, and at >85% V/C in the westbound direction. The addition of the Pukekohe Expressway is shown to partially alleviate this congestion in the 2048+ scenario (see Figures 8-7, 8-8 and 8-9).
- Mill Road only experiences congestion of >70% V/C in the Takaanini section in the AM and PM peaks. The remainder of the corridor is predicted to operate within peak period capacity in 2028.
- Sections of Pukekohe East Road, Tuhimata Road and Cape Hill Road are all shown to be operating near or at capacity in the AM (north and east bound) and PM (south and west bound) peaks. The addition of the Pukekohe Expressway is shown to alleviate this congestion in the 2048+ scenario (see Figures 8-7, 8-8 and 8-9).

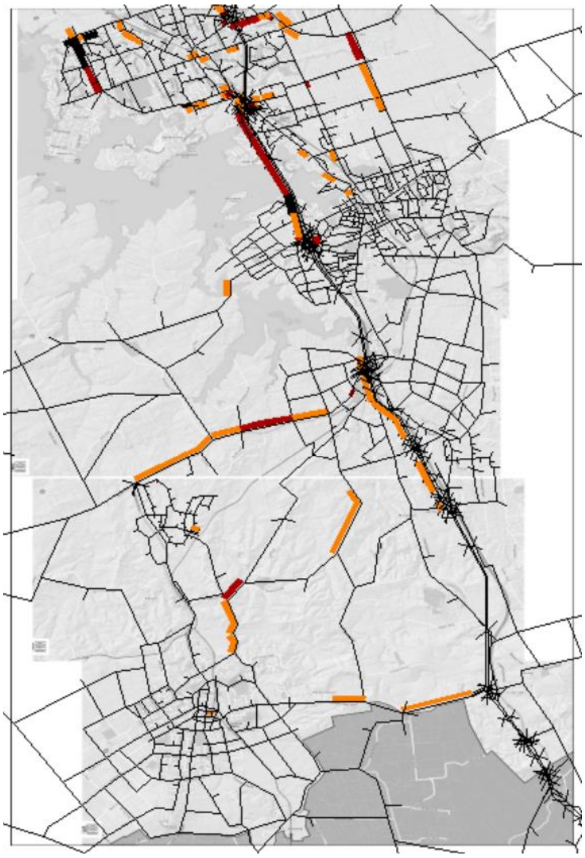


Figure 8-11 – 2028 Expanded AM Peak V/C

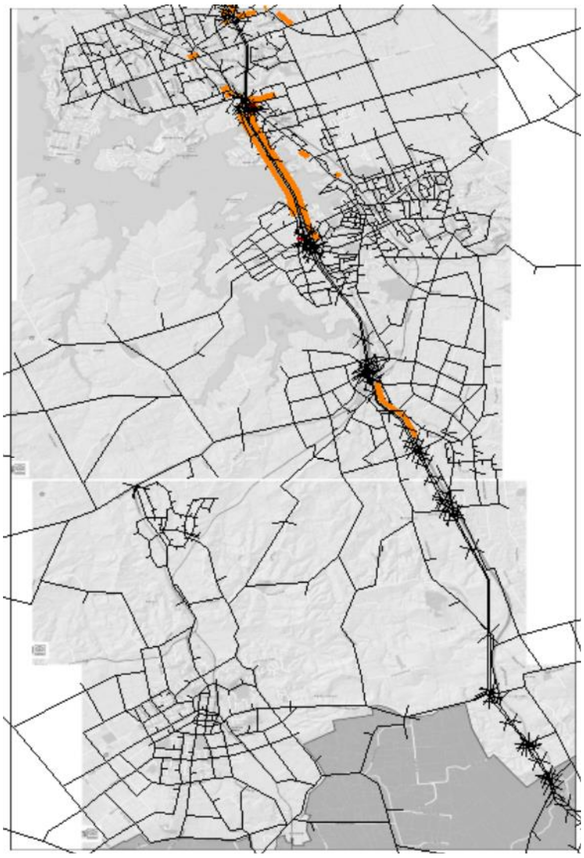


Figure 8-12 – 2028 Expanded IP V/C

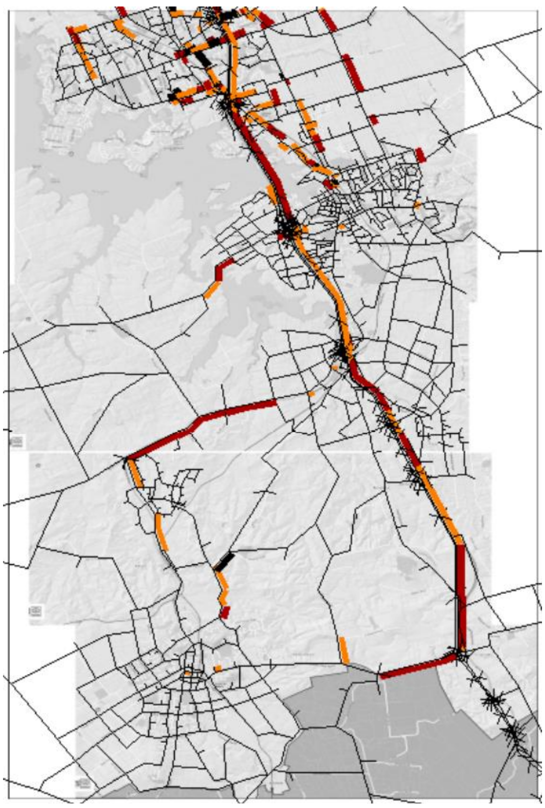


Figure 8-13 – 2028 Expanded PM Peak V/C

8.3.3. 2028 Constrained Scenario

8.3.3.1. Daily traffic volumes

Figure 8-14 is an ADT plot showing predicted traffic volumes for the wider Structure Plan study area in the 2028 Constrained scenario, organised by volume bands/ranges.

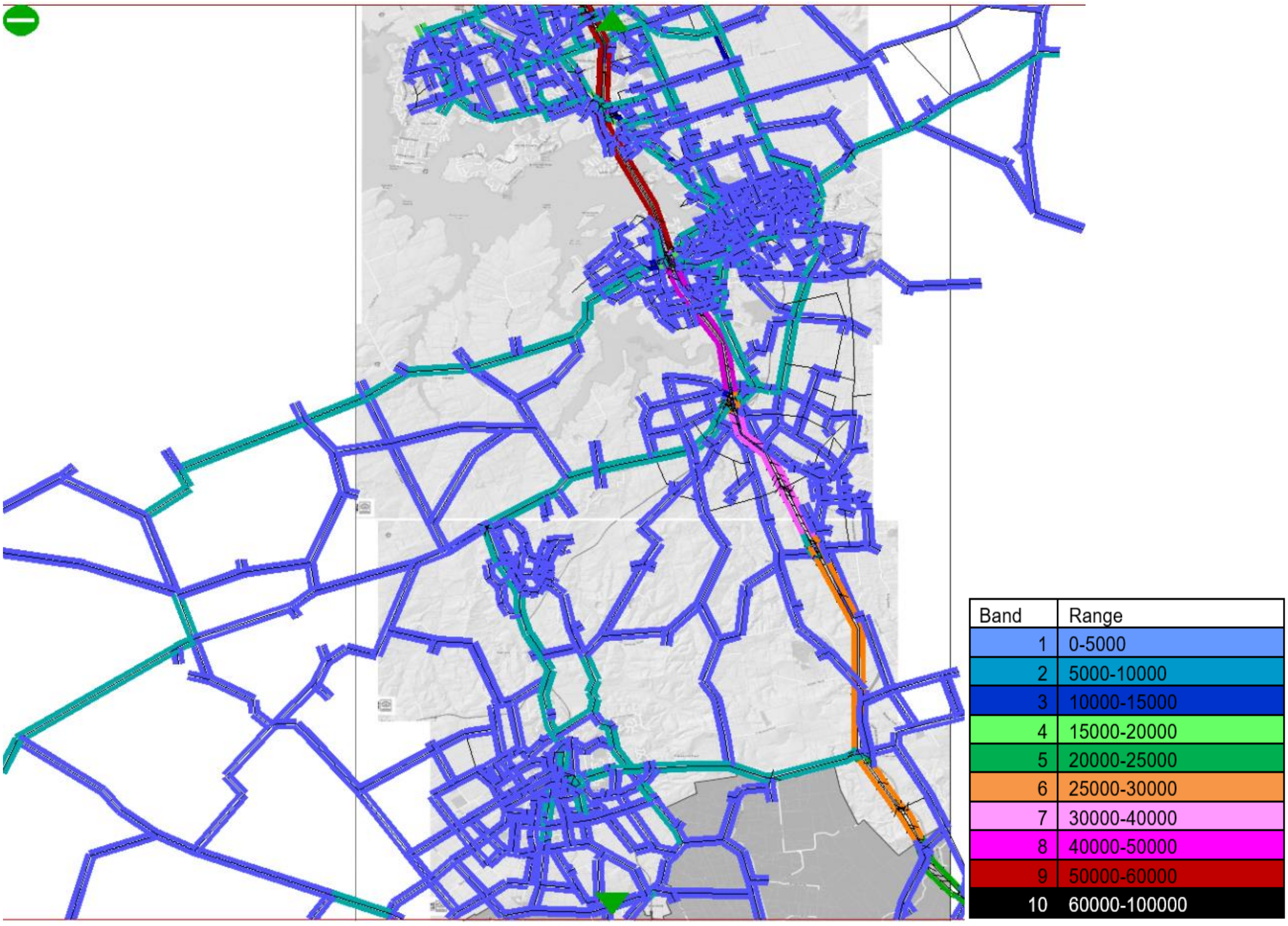


Figure 8-14 – 2028 Constrained Scenario ADT Volume Plot

The demands on the network in the 2028 and 2028 Constrained scenarios are identical. The only differences are the exclusion of various road links from the model as per Table 7-4 to reflect which projects have current funding commitments.

The most substantive difference to the road network between the two scenarios is the exclusion of Mill Road South, the Pukekohe Expressway, and additional widening of SH1 north of Takaanini. This manifests most clearly in the following ways:

- Relatively higher volumes on SH1 between Papakura and Drury South;
- Higher volumes on the AR10 arterial route and Great South Road which in this scenario both operate in Band 2 (<10,000 ADT); and
- Higher volumes on Cape Hill Road.

8.3.3.2. Level of Service

Per the above section, the demands on the network are identical between the 2028 Expanded and 2028 Constrained scenarios, with the only substantive differences being the exclusions of road links from the model as per Table 7-4 to reflect which projects have funding commitments.

The key differences in congestion levels as shown in Figures 8-15, 8-16 and 8-17 are as follows:

- SH1 congestion conditions are worse at both the AM and PM peaks, with the northbound direction operating at >70% V/C north of Ramarama (with localised sections at >100% between Takaanini and Papakura), and lengthier sections operating at >85% and >100% (particularly between Takaanini and Papakura) in the southbound direction at the PM peak.
- Localised congestion appears in the vicinity of the SH22/Jesmond Road intersection at both peaks.
- Tuhimata and Burtt Roads experience significantly longer sections of congestion in the constrained scenario.

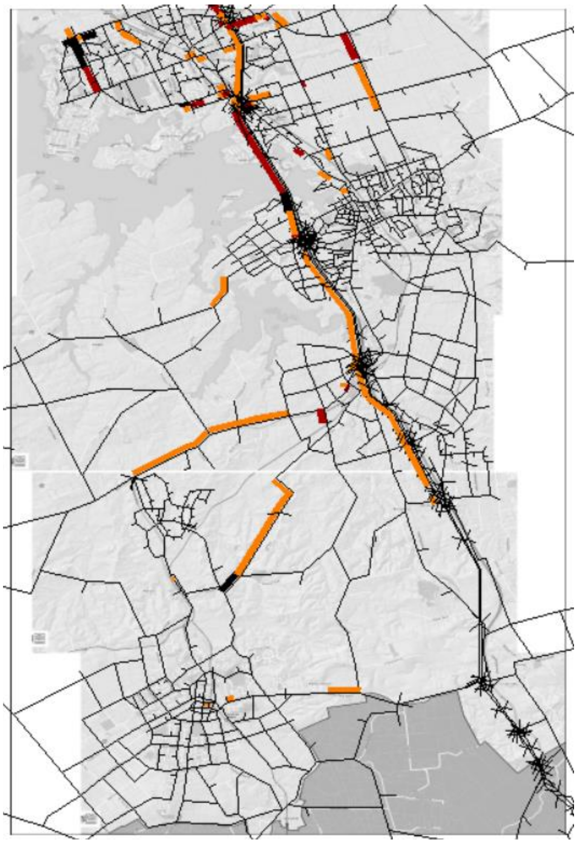


Figure 8-15 – 2028 Constrained AM Peak V/C

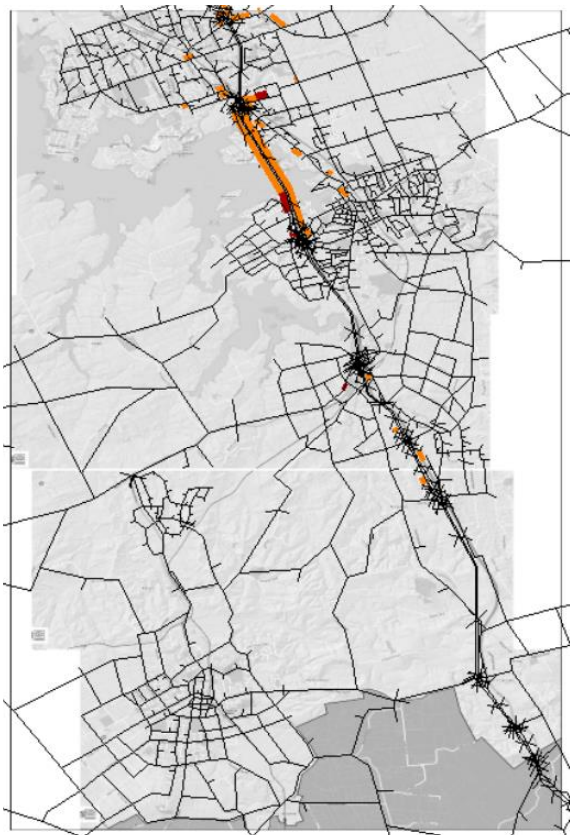


Figure 8-16 – 2028 Constrained IP V/C

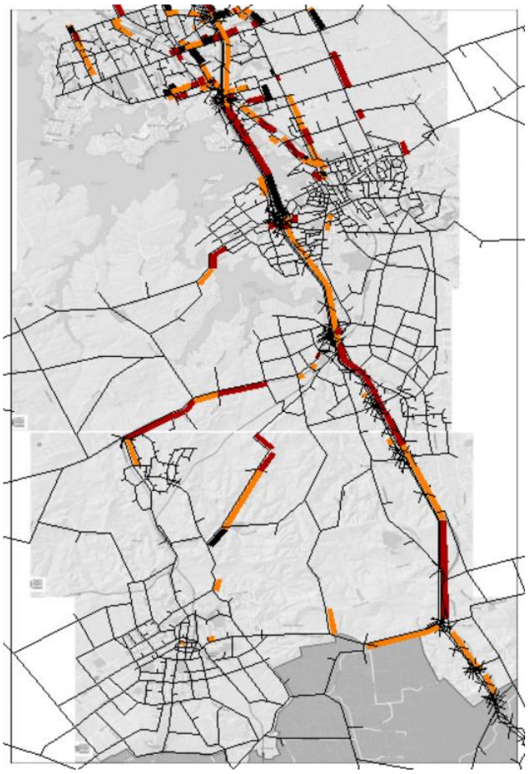


Figure 8-17 – 2028 Constrained PM Peak V/C

8.4. Road cross sections and intersection layouts

8.4.1. Road cross-sections

Excluding strategic roads (e.g. SH1, Mill Road and Pukekohe Expressway) and strategic active mode connections (e.g. walking and cycling facilities parallel to SH1 and the NIMT), three indicative cross-sections have been developed by SGA to apply to the arterial and collector roads within the Structure Plan areas. Like the collector network design principles outlined in section 6.3.3 of this ITA, the process of developing these cross-sections drew on the functional requirements of roads as defined in road classification criteria as well as the AT Roads and Streets Framework[44] which defines road typologies according to land use context.

These cross-sections provide an indication of preferred design standards, but further design detail and flexibility will be required, particularly where localised constraints prevent the cross-sections being fully achieved. It should be noted that there are local exceptions to the below cross-sections in further advanced areas such as Auranga where earlier agreed cross-sections are now incorporated into Precinct provisions.

- **Urban Arterial (32m)** – 32m corridor boundary-to-boundary, accommodating separated walking and cycling, public transport facilities, and four lanes for public transport, freight and general traffic (see Figure 8-18). Intended to apply to arterials identified in the IBC catering to all modes, including public transport and/or freight priority where required (the need for the full four lane cross-section generally arises at >15,000 ADT, or when public transport/freight priority is required).
- **Urban arterial (25m)** – 25m boundary-to-boundary, accommodating separated walking and cycling, public transport facilities, and two lanes for public transport and general traffic (see Figure 8-19). Intended to apply to arterials identified in the IBC where demand can be managed within a two-lane corridor.
- **Collector road (21m)** – 21m boundary-to-boundary, accommodating separated walking and cycling, potential public transport facilities and/or parking shoulders, and two general traffic lanes (see Figure 8-20). Intended to apply where possible to all new collector roads and existing roads requiring upgrade to urban collector standard identified in the ITA. To be formed by developers.

[44] Roads and Streets Framework. Note this is a draft document under ongoing review.

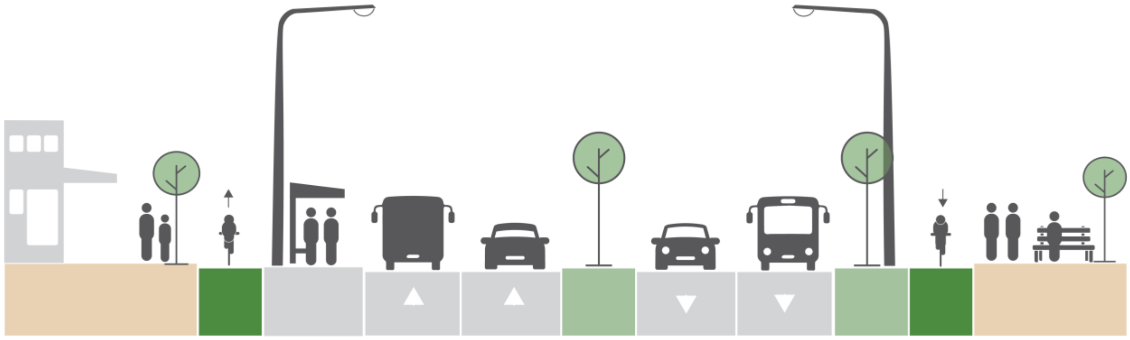


Figure 8-18 – Urban arterial (32m) indicative cross-section.

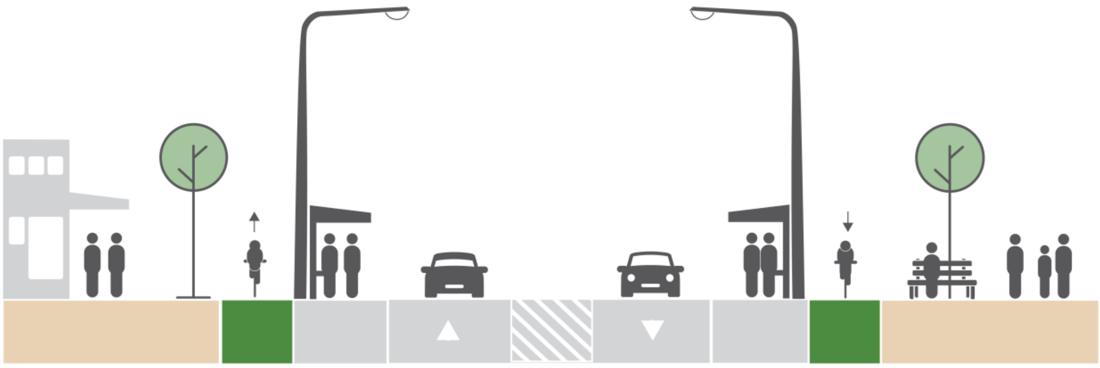


Figure 8-19 – Urban arterial (25m) indicative cross-section

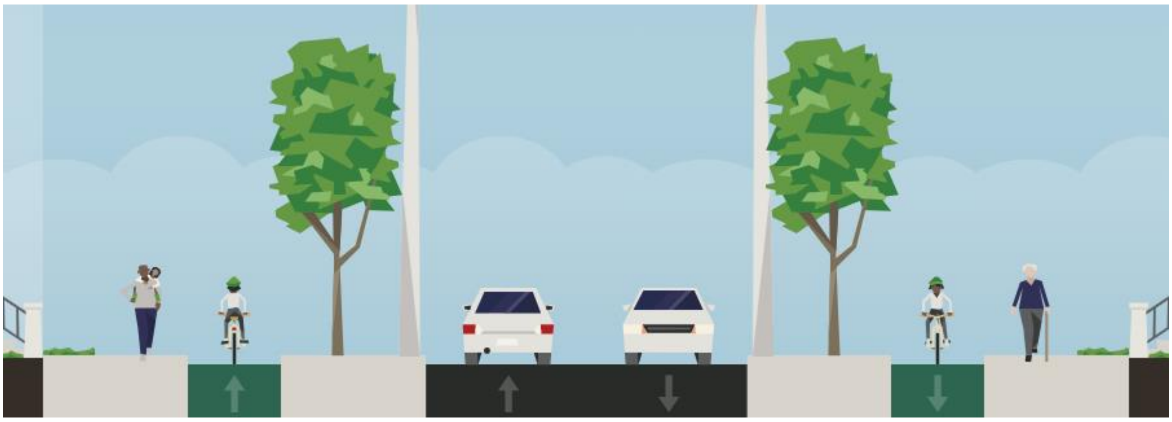


Figure 8-20 – Urban collector (21m) indicative cross-section

8.4.2. Intersection layouts

As this ITA focuses on a 'macro' level of assessment, future transport assessment stages will need to provide more detailed analysis and design on intersections. Given the influence of intersection design on general walkability, amenity and safety, this additional detail will be particularly important considering the desired reduction in outbound travel demand and mode shift towards active modes. Assessment will therefore need to consider the merits of layout on walkability, amenity and safety as well as general traffic level of service metrics.

At this high level of assessment, these strategic drivers are reflected in a general presumption in the modelling in favour of traffic signals in street-oriented centres (e.g. Drury West), though roundabouts have been assumed on key intersections for much of the strategic network to reflect the higher movement role of these corridors.

8.5. Requirements for 'Next Stage' Integrated Transport Assessments

As noted in sections 1.2 and 6.1.2, this ITA is a 'macro' level assessment developed to a level of detail appropriate to Structure Planning. Further refinements to the ITA or new assessments will need to be undertaken to support future Plan Change or Notice of Requirement processes, such that these processes require a greater level of detail than provided this ITA. In this respect, this ITA forms part of an ongoing feedback loop between the transport planning (being led by SGA through the business case and subsequent route protection processes), and the land use planning (being led by Council through Structure Plans and subsequent Plan Changes).

The following issues have been identified for further investigation through these future refinements and iterations of the ITA:

Table 8-1 – Issues for further investigation in future ITAs

Issue	Explanation
Land use changes	Through the Structure Planning and subsequent Plan Change processes, there is potential for further refinements to the land use scenario. From a transport perspective, key opportunities to further optimise the land use scenario have been identified in this ITA. Future assessments will need to both substantiate any changes to land use, and account for the effects of any changes. These may include the following: • Refinements to the location and configuration of the Drury Central and West Centres (and potentially rail station locations) could eventuate, depending on the final resolution of the trade-offs identified in section 6.2.4.1 of this ITA; and • The potential to provide for further intensification and/or employment around identified rapid and frequent public transport corridors to maximise land use-transport integration, and the opportunities to induce modal shift and manage travel demand.
Further consideration of local employment to manage travel demand	The commentary in Chapter 7 notes that the Structure Plan land use provides for 0.5 new jobs per new household. Accordingly, provision for further local employment should be considered as part of a travel demand management strategy.

Issue	Explanation
Future Plan Change guidance	The ITA has developed a draft proposed network required to support the Structure Plan. Further refinement to the network (see below) through future ITAs will be necessary to support Plan Changes. These future ITAs should also provide an evidence base to support the future Precinct provisions, which should seek to adopt and 'follow through' on the network design principles and access strategies identified in this ITA and through the IBC. Provisions may include: • Indicative road alignments and road widths; • Transport infrastructure thresholds/triggers, including funding and delivery mechanisms (see below); and • Potential transport and urban form controls – e.g. further guidance on block size/structure and intersection density, frontage/access controls, bespoke parking provisions.
Collector road funding and implementation risks	As per section 6.3.2 of this ITA, there are significant risks associated with sections of collector roads that fall beyond the responsibility of a single developer where roads need to cross significant infrastructure corridors, streams/floodplains, 'hold out' sites, and other third-party land. Future ITAs will need to give direction to the Council's Finance and Plans and Places teams to enable the development of an appropriate funding and delivery model to ensure that these connections can be equitably funded and delivered. The information required will include: • Identification of the specific sections of collector road which need to cross significant infrastructure corridors, streams/floodplains, and known 'hold out' sites; and • Costing and benefit area analysis for each section of the collector road network to assist Council in the design of a funding mechanism.
Further assessment and design development of network 'hot spots'	Several high-level approaches to site-specific issues have been identified through this ITA where to date the IBC has not provided guidance. Through subsequent ITAs and/or the DBC process, further/more refined assessment and design development of these 'hot spots' will be required to confirm the approaches identified in this ITA are feasible. These items include: • Finalisation of the alignment of Mill Road South and configuration of the Drury South Interchange; • Drury Centre road access strategy, including the configuration and operational efficiency of the Drury Interchange; • Drury West road access strategy and integration with the rail station;

Issue	Explanation
	• Additional crossings of SH1 and the NIMT identified in the collector road network; and • Access to the existing strategic network more generally.
Integration with operative Precincts	There is ongoing need for integration between SGA's ongoing transport planning and currently operative/live zoned Precincts that are/will shortly be under development. Most obviously, further work through the DBC and future land use planning processes are required to ensure consistency with: • The Drury 1 (Auranga) Precinct, particularly in respect of the location of the east-west strategic connection; • The Drury South Precinct, particularly in respect of the location of Mill Road; • The Franklin 2 (Wesley) Precinct, particularly in respect of how the indicative road network interacts with SGA's preferred location for Paerata Station.
Further development of staging strategies	The staging strategies outlined in Chapter 9 of this ITA will need to be further developed. This will be enabled by further work on route protection and staging strategy to come through the DBC, as well as the results of the Mill Road Corridor Prioritisation Assessment. Future staging scenarios will need to demonstrate the effect of project sequencing decisions on network performance, and specifically mode shift and TDM.
General design detail	In addition to the above, additional design detail is required across the board, particularly at key intersections. For the transport infrastructure to be route protected by SGA, this will need to occur through the DBC and subsequent NoR process.
Further development of the secondary active mode network and greenways	The ITA at section 6.9 recommends that the secondary active mode network be accommodated primarily on the collector road network, and identifies further opportunities for greenways planning. There will be opportunities through the Plan Change process and future Local Board greenways planning to further refine these networks.
Further development of Station Access and Park-and-Ride strategy	The ITA outlines a high-level Station Access and Park-and-Ride strategy at section 6.8.3 in lieu of IBC guidance on the matter. Subsequent ITAs and/or the DBC process will need to provide additional detail on the size, access, configuration, demand profile, and pricing of facilities.

Generally, it should be noted that the majority of transport infrastructure identified in this ITA is not currently funded and accordingly there is potential for the delivery of this infrastructure to lag behind future Plan Change processes. There will need to be consideration in any Plan Change provisions to encourage land owners/developers to seek the same transport and land use outcomes as identified in this ITA. This may require collaborative design processes and alternative funding mechanisms as noted above to deliver planned transport infrastructure in a timely manner.

9. Transport Network Staging

9.1. Context and Issues

There are a number of critical issues to be noted in respect of this staging assessment:

- The staging assessment has been prepared in the context of the Council's Structure Planning for Drury-Opāheke and Pukekohe-Paerata. The scope of the ITA is therefore targeted at the 'macro' level of detail available for the Structure Plan rather than the specific location of land use activities;
- The strategic and arterial networks for this area have been identified by SGA through the IBC process. The IBC indicates these networks for the wider Southern growth area, again at a 'macro' level of detail subject to refined investigation and design development;
- The growth in the Structure Plan areas is significant, but is occurring in the context of strong growth in adjacent areas including existing urban areas to the north, and the Waikato to the south. This means that transport demands (and therefore staging considerations) are influenced by regional and inter-regional growth for the strategic networks, not just growth in the Structure Plan areas;
- The staging of transport networks within this area is highly influenced by the proposed release of FUZ area by Council through Plan Changes. The Council's proposed sequencing of land release is identified in the FULSS. The FULSS however is a broad rather than granular strategy;
- There are known growth pressures from land owners and developers for accelerated growth in some areas which may result in a different timing and sequencing of land release than is indicated in the FULSS; and
- The IBC has identified the need for significant transport infrastructure, the scale of which would be likely to have extended delivery timeframes.

The key context to be taken from these issues is as follows:

- The timing of strategic transport infrastructure will largely be based on regional and inter-regional demands and priorities, which are beyond the scope of Structure Planning and this ITA;
- Given the relative uncertainty regarding the timing and form of specific land use activities, analysis of staging is to be principle-based and linked to assumed sequencing of land release, rather than on precise analysis of specific land use activities. This suggest that staging cannot be released on detailed modelling analysis at this point of the process, as it would simply reflect the limited current knowledge of land use activities;
- Accordingly, this staging analysis can only be considered as indicative, and subject to change and influence from beyond the Structure Plan areas; and
- The staging of the collector network in turn is development driven (given that collector roads are formed by developers), with the timing of development assumed to be driven by FULSS land release and subsequent Plan Change timeframes.

9.2. Outcomes and Principles

Key principles for staging have been developed that seek to assist in delivering the desired transport and land use outcomes. These outcomes include:

- Integrating land use and transport to support:

- Place making;
- Influencing travel, particularly reducing the need to travel, and inducing a mode shift away from single-occupant cars;
- Maintaining accessibility to unlock socio-economic opportunities;

- Providing safe and attractive travel choices; and
- Providing network resilience and value for money.

It is recognised that although significant elements of the networks would be expected to be provided by land developers (e.g. local and collector streets), these elements are also critical to achieving desired outcomes, so need to be developed in a coordinated an integrated way.

9.2.1. Assumptions and Staging Principles

The following assumptions and principles have informed the suggested staging strategies set out in section 9.4:

- The release of land is assumed to be based on the FULSS (see section 9.3);
- Seek to influence travel patterns and urban form in order to manage travel demand from the outset by:
    - Providing lead TDM interventions that support strong public transport and active mode use;
    - Supporting development of employment areas and local services, not just residential areas; and
    - Avoiding induced general traffic demand by not over-providing road capacity.
- Support the ‘place’ function at key locations in conjunction with interventions that change the ‘movement’ function. For example:
    - Urbanisation and lower traffic speeds along SH22 in Drury West should be considered in relation to the timing of the northern section of the proposed Pukekohe Expressway and the potential concurrent development of the Drury West centre along the SH22 corridor;
    - Enhancing the amenity on Manukau Road in central Pukekohe should be considered in conjunction with the removal of through traffic by the proposed Pukekohe ring route, particularly in the north-east of Pukekohe.
- Consider the interactions between parallel, adjacent or inter-dependent elements. For example:
    - How various elements of the proposed Mill Road corridor could affect upstream and downstream elements through attracted or induced traffic;
    - How Mill Road and the proposed north-south arterial in the Opāheke-Drury East area (AR10) can best be sequenced to support frequent public transport and avoid induced private vehicle travel demand;
    - How Drury Central Station and the extent to which it can service the Auranga development is dependent upon the sequencing of the Bremner Road Bridge upgrade and associated SH1 Papakura-to-Bombay project; and
    - Use TDM interventions such as Park and Ride to support early station usage and commercial development, with a possible transition in use over time (e.g. Drury Central);
- Collector and local streets are to be provided by land developers and progress with development. Accordingly, it is assumed at present that the staging of these lower order connections will be the most strongly influenced by FULSS sequencing. However, these should

be guided by network design principles related to overall transport outcomes such as those identified in Chapter 6 of this ITA; and

- Active mode networks are largely reliant (with the exception of strategic routes and greenways) on the provision of arterial and collector roads, and so the staging of these roads will also impact on active mode connectivity.

9.3. FULSS staging and implications

As noted in sections 4.3 and 7.2, this ITA has been developed on the basis that the release/live zoning of land will follow the sequencing outlined in the Council's FULSS. This strategy does not provide granular detail, but sets out the following general 'development ready' dates for each part of the study area. Section 9.4 explains how the FULSS sequencing has manifested in the suggested staging strategies for this ITA.

- 2018-22 – Paerata and Drury West Stage 1 (north of SH22);
- 2023-27 – Pukekohe;
- 2028-32 – Drury West Stage 2 (south of SH22), and Drury-Opāheke.

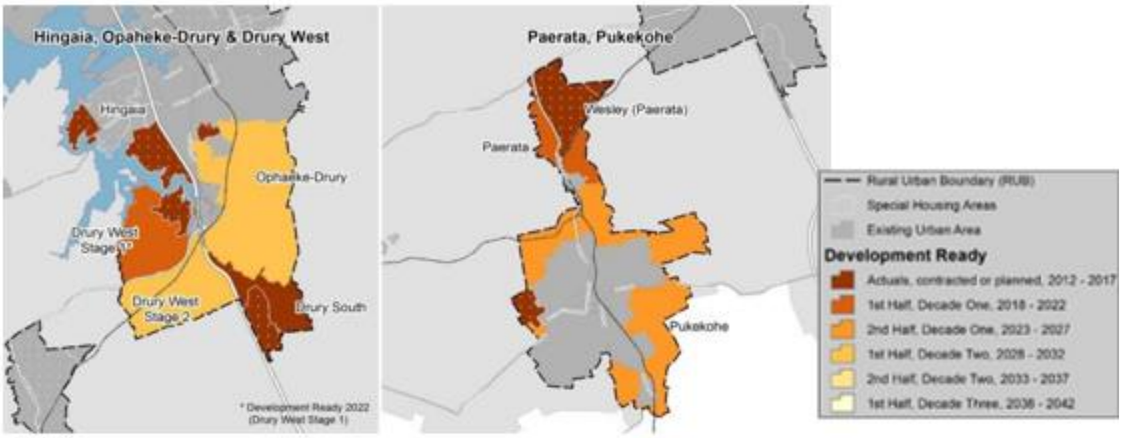


Figure 9-1 – FULSS sequencing for Southern Structure Plan areas

9.4. Suggested Staging Strategies

9.4.1. Rail Stations and Park-and-Ride

The following high-level strategy is suggested in respect of the sequencing of the three new rail stations (see Figure 9-2):

- **Paerata Station** (including a park-and-ride facility) should be the first of the three new stations to be developed given that it: (a) serves land that is already live-zoned and under development, and (b) is well placed to intercept car trips from the rural hinterland to the west and south. There is a need to resolve final road access arrangements to the station (see section 6.6). Access to the station will be from the north side of the rail line initially (noting the need to upgrade the SH22/Glenbrook Road intersection to enable this). Access from the south will likely be driven by the sequencing of the Pukekohe Expressway. Park-and-ride pricing will likely be required from the outset to ensure that spaces remain available for wider rural users, and not just nearby residents.

- **Drury Central** (including an interim park-and-ride facility, later transitioning to development) will be the first of the two Drury stations to be developed given that it: (a) most directly serves live-zoned land at Auranga and the Drury West Stage 1 land (scheduled for release in 2018-22 under FULSS sequencing), and (b) is well placed as a park-and-ride facility to intercept car trips from the south without significant access road dependencies. The key dependency for this station's ability to directly service the Auranga development is the planned upgrade of the SH1 Bremner Road bridge, which in turn is linked to the SH1 Papakura-to-Bombay project (see section 5.5.2).
- **Drury West** (including a park-and-ride facility to substantially replace the Drury Central facility as it develops) will be the last of the new stations to be built, given that: (a) the FULSS land release sequencing for Drury West Stage 2 is not until 2028-32, and (b) it depends on the initial section of the Pukekohe Expressway to be provided for its road access.

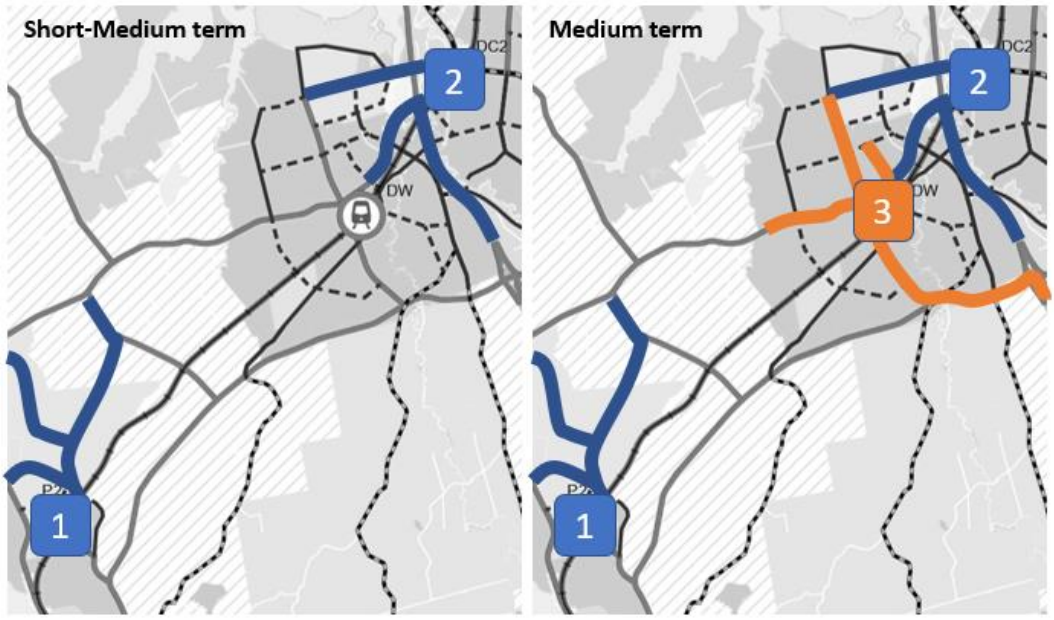


Figure 9-2 – Potential rail station sequencing including key accesses

The actual date at which the stations are required remains unclear. However, given the desire to embed public transport options early to induce mode shift, the Paerata and Drury Central stations would likely be required in the mid-to-late part of the 2018-2028 decade (noting that both remain unfunded). Drury West would likely be post-2028 under this scenario.

A possible variation on the above scenario would delay Drury Central on the basis that the Opāheke/Drury East area is not scheduled to be released under the FULSS until 2028-32, and bring Drury West forward on the basis that the development of the Drury West centre (scheduled for release as part of Drury West Stage 1) should be integrated with the station. This scenario would require further investigation given the lack of granularity in the FULSS land release sequencing.

9.4.2. Mill Road

As noted in section 5.5.4, SGA is undertaking a detailed Mill Road Corridor Prioritisation Assessment to confirm which sections of the corridor are to be implemented within the 2018-2028 decade within the available funding envelope. Accordingly, sequencing decisions on this project largely fall beyond the scope of this ITA.

However, the following general strategies have been identified to be investigated further:

- The section between Waihoehoe Road and SH1 is likely to be the highest priority section within the Structure Plan areas given that it traverses live-zoned land at Drury South. The exact sequencing will depend on: (a) the build-out of the Drury South Precinct, (b) the sequencing of the Drury South Interchange (which in turn will be influenced by the SH1 Papakura-to-Bombay project), and (c) the sequencing of the northernmost section of the Pukekohe Expressway (which in turn is driven by Drury South Stage 2 and the associated urbanisation/detuning of SH22);
- The Papakura section and section between Papakura and Waihoehoe Road will likely be a later priority, particularly in the event that the north-south arterials in the Opāheke/Drury East area add further north-south capacity and provide for development access.

It should be noted that the nuances of this potential sequencing are generally not captured in the modelling scenarios (see section 7.3 of the ITA).

9.4.3. Pukekohe Expressway, SH22 and Drury West arterial roads

The following potential staging strategy has been identified for the Pukekohe Expressway, SH22 and Drury West arterial roads as identified in the IBC and discussed sections 6.2.3-6.2.4 and 6.5-6.7 of this ITA. These items are inter-dependent and accordingly have been grouped together. The staging strategy is depicted in Figure 9-3.

- The new east-west strategic connection (IBC option AR14a) is to be completed as an early priority in line with development of Auranga Precinct. This improvement in turn is linked to the need for an upgrade of the SH1 Bremner Road bridge;
- Jesmond Road upgrade and extension is to be completed in a north-south direction along with development. The south section should be sequenced to coincide with the completion of the SH1-Jesmond Road section of the Pukekohe Expressway;

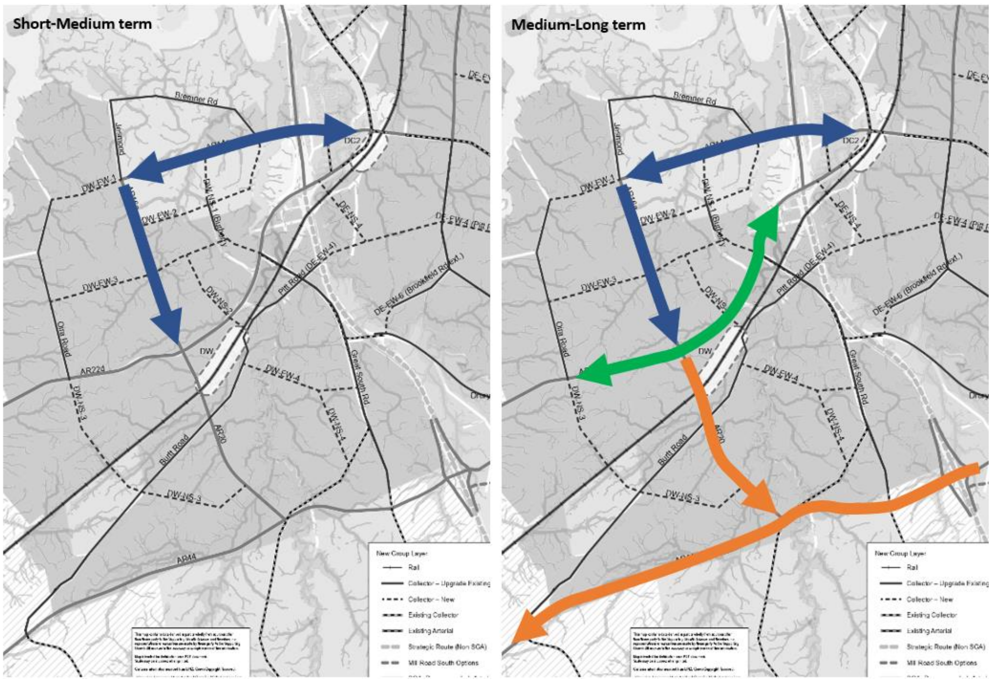


Figure 9-3 – Potential staging concept for Pukekohe Expressway, SH22 and Drury West arterials.

- The SH1 to Sim Road section of the Pukekohe Expressway should be the first section of the Pukekohe Expressway built, working in an east-to-west direction. This directly facilitates the progressive urbanisation of SH22 by creating a new route for strategic movements;
- The SH22 urbanisation is in turn necessary to support the Drury West centre and surrounding development, which is planned in the FULSS to be released in the 2018-28 period; and
- The subsequent sections of the Pukekohe Expressway from Sim Road to Paerata, and from Paerata to the Pukekohe Ring Road should generally be provided in line with development, potentially linked to infrastructure thresholds/triggers on SH22 traffic flows and safety outcomes along Burtt Road.

It should be noted that the nuances of this potential sequencing are generally not captured in the modelling scenarios (see section 7.3 of the ITA), which include most these improvements in the 2028 'expanded' scenario. Only the SH22 improvements are captured in the 2028 'constrained' scenario.

9.4.4. Opāheke/Drury East arterial roads

The following potential staging strategy (see Figure 9-4) has been identified for the Opāheke/Drury East arterial roads identified in the IBC (see section 6.4). Where development has been noted as a driver for transport sequencing, it should be noted that the notional FULSS sequencing for the Opāheke/Drury East area is for land release in the 2028-32 period.

Figure 9-4 – Potential staging scenario for Opāheke/Drury East arterials.

- North-South arterials:
  - Great South Road to be sequenced first and progressively upgraded over time, with bus priority to enable frequent bus services initially, with further improvements occurring as parallel routes are developed to increase overall north-south capacity;
  - Provide new arterial (AR10) from south-to-north to along with development. This may push back the need for the Papakura-to-Waihoehoe Road section of Mill Road given that that the additional arterial will provide north-south capacity for all modes whilst facilitating development access.
- East-West arterials:

- Provide the upgrades of Opāheke/Ponga and Waihoehoe Roads in a west-to-east direction along with development. Connect Waihoehoe Road with Fitzgerald Road and Drury South roads for bus circulation.
- The sequencing of Waihoehoe Road may be influenced by the SH1 Bremner Road bridge which is required to access the Auranga Precinct and broader Drury West area.

It should be noted that the nuances of this potential sequencing are generally not captured in the modelling scenarios (see section 7.3 of the ITA), which include most these improvements in the 2028 'expanded' scenario. Only the new north-south arterial (AR10) is captured in the 2028 'constrained' scenario.

9.4.5. Pukekohe Ring Route and Pukekohe East Road

The following potential staging strategy has been developed for the Pukekohe Ring Route and Pukekohe East Road. Where development has been noted as a driver for transport sequencing, it should be noted that the notional FULSS sequencing for the Pukekohe area is for land release in the 2023-2027 period.

- Pukekohe East Road safety improvements to be implemented as an early priority independently of urbanisation;
- Each section of the Pukekohe Ring Road to be completed in line with development, potentially linked to infrastructure triggers/thresholds relating to Pukekohe main street traffic.
- It is anticipated that the north-eastern section of the Ring Road (IBC option AR38a) will be completed first. This is reflected in the transport modelling scenarios (see section 7.3 of the ITA).

9.4.6. Collector Roads

As noted in section 9.1, the staging of the collector network is development-driven such that collector roads are to be formed by developers at the time of subdivision and vested in AT (see section 6.3 of the ITA for detailed discussion). The collector roads identified in sections 6.4-6.8 are therefore assumed to generally follow the staging scenario outlined in the FULSS, noting that there will be a 'lag' between the FULSS dates (which provide timeframes for 'live zoning'/land release) and actual build-out.

As noted in sections 6.3 and 8.5, further work is required to identify the most critical sections of collector roads in terms of the overall connectivity of the network; and the specific sections of collector roads which cross significant third-party constraints. These sections may need to be prioritised or sequenced differently from the rest of the collector network, depending on how they are ultimately funded and delivered.

10. Consultation Summary

10.1. Internal and Partner Consultation

SGA has worked closely both internally and with its project partners Council, AT and the Transport Agency to ensure that the ITA is integrated with both the Structure Planning process, and the parallel SGA business case process. In particular:

- Council, AT and Transport Agency specialists participated in all SGA business case workshops and technical discipline meetings for the Southern area throughout 2018. These workshops and meetings directly informed the development of the IBC and the recommended network (much of which has been adopted in the ITA);
- Mana whenua have been engaged by SGA as programme partners throughout the business case process, including participation in all SGA business case workshops, and cultural specialists' workshops. A variety of issues and opportunities have been raised by mana whenua throughout the business case process, focused primarily on the health of waterways and significant ecological areas. These have in turn been captured in SGA's Urban Design Framework which has been adopted as an input to the network design process in this ITA (see section 6.3.3);
- SGA has facilitated a Council Integration Forum with senior management and officers which has met regularly since mid-2018, and has ensured that all parties are informed of the latest developments on the Structure Plans, business cases, and the ITA;
- Several workshops between Council, AT, the Transport Agency and SGA on detailed Structure Planning matters, in particular land use scenarios and yields;
- The Southern Infrastructure Forum in August 2018 which included utility providers; and
- Specific internal and partner consultation on this ITA has included:
  - Fortnightly meetings with AT and Transport Agency Owner Interface Managers and specialists providing progress updates on all SGA ITAs;
  - A technical workshop on 17 December 2018 with SGA, AT and Transport Agency specialists discussing key matters pertaining to the ITA transport network, and numerous follow-up technical discipline meetings; and
  - Regular internal engagement within SGA's ITA and IBC teams.

10.2. External consultation

Public engagement has taken place primarily through organised events conducted by SGA as part of its business case programme, and Council as part of its Structure Planning programme. Council has publicly engaged twice on its Structure Planning process – first in late 2017, and subsequently a joint consultation period with SGA in September and October 2018. The 2018 consultation included six open days focusing on the short-listed options being analysed through the IBC process for key parts of the strategic networks. Public feedback broadly aligned well with the options ultimately adopted in the IBC, in particular the proposed rail stations and upgrades, walking and cycling connections, arterial roads, and the inclusion of an alternative corridor to SH1.

Further consultation is expected to occur in the first half of 2019 on the Draft Structure Plan, for which this ITA is a technical reporting input.

SGA has also consulted key landowners and developers in the Structure Plan areas as the business case, Structure Plans and ITA have developed.

11. Conclusion

This ITA has been prepared in fulfilment of the technical reporting requirements for the Drury-Opāheke and Pukekohe-Paerata Structure Plans being undertaken by Auckland Council. The ITA has identified the multi-modal transport networks required to support the identified Structure Plan land use scenario. In doing so, the ITA has drawn on the recommended networks in SGA's IBC, identified potential refinements to those networks, and developed entirely new transport networks in the case of collector roads.

The ITA has identified how the proposed transport networks integrate with Auckland Council's proposed land use, has analysed the overall performance of the identified network against a range of measures, and has identified potential high-level staging scenarios. With the proposed transport networks in place, the ITA has broadly shown that the proposed land use can be supported from a transport perspective, albeit with high levels of general traffic congestion on strategic routes and high levels of demand for public transport services.

The size of the study area for this ITA is such that a 'macro' level of assessment has been adopted by necessity. Accordingly, future stages of the SGA business case process and future transport assessments undertaken to support Plan Changes and Notices of Requirement will need to build on the findings of this ITA at a more detailed level of assessment, particularly the items specifically identified throughout the ITA as requiring further investigation.