TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe Appendix A: Strategic Case

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and Waka Kotahi NZ Transport Agency (Waka Kotahi). This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and Waka Kotahi. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Acronym/Term	Description
ADT	Average Daily Traffic
AFC	Auckland Forecasting Centre
AT	Auckland Transport
ATAP	Auckland Transport Alignment Plan
AUPOIP	Auckland Unitary Plan - Operative in Part
BCR	Benefit Cost Ratio
CFAF	Corridor Form and Function
CoP	Code of Practice for Land Development and Subdivision
DBC	Detailed Business Case
Development ready	Bulk infrastructure is in place to service development, including three waters, transport, and social infrastructure
DoC	Department of Conservation
DSIs	Deaths and serious injuries
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GHG	Greenhouse gases
GPS 2018	Government Policy Statement on Land Transport 2018/19 – 2027/28
GPS 2021	Draft Government Policy Statement on Land Transport 2021/22 – 2030/31
ha	hectare
HIF	Housing Infrastructure Fund
IBC	Indicative Business Case
ILM	Investment Logic Map
IOs	Investment Objectives
IQA	Investment Quality Assurance
ITA	Integrated Transport Assessment
KPIs	Key Performance Indicators
LOS	Level of Service

Acronym/Term	Description
MCA	Multi Criteria Analysis
MDRS	Medium Density Residential Standards
MfE	Ministry for the Environment
MHS	Mixed Housing Suburban
MHU	Mixed Housing Urban
MoE	Ministry of Education
MoT	Ministry of Transport
MSM	Auckland Regional Transport Model (Macro Strategic Model)
MSQA	Management, Surveillance, and Quality Assurance
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NoR	Notice of Requirement
NPS	National Policy Statement
NPS-UD	National Policy Statement on Urban Development
NPS-FM	National Policy Statement on Freshwater Management
NPS-HPL	National Policy Statement for Highly Productive Land
N-S	North-South
OIM	Owner Interface Manager
Partners	Collectively refers to Auckland Transport, Waka Kotahi NZ Transport Agency, manawhenua and Auckland Council
PBC	Programme Business Case
PBIOs	Problems, benefits and investment objectives
PPP	Private Public Partnership
PT	Public transport
RASF	Roads and Streets Framework
RLTP	Regional Land Transport Plan
RMA	Resource Management Act 1991
RPTP	Regional Public Transport Plan
SEA	Significant Ecological Area

Acronym/Term	Description
SGA	Supporting Growth Alliance (referred to as Te Tupu Ngātahi)
SH1	State Highway 1
TDM	Travel Demand Management
Te Tupu Ngātahi	Supporting Growth Alliance
TFUG	Transport for Future Urban Growth
THAB	Terraced Houses and Apartment Buildings
The Council	Auckland Council
The Programme	The Supporting Growth Programme
VKT	Vehicle Kilometres Travelled
vpd	Vehicles per day
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1. Introduction

The purpose of the Te Tupu Ngātahi programme (the programme) is to identify the recommended transport networks for route protection to support Auckland's planned greenfield growth over the next 30 years and beyond.

The Pukekohe-Paerata Detailed Business Case (DBC) covers the Pukekohe, Paerata and West Drury elements of the South Indicative (IBC) Transport Network that followed on from the outcomes identified at the Programme Business Case (PBC) stage. It further investigates and confirms a fit-for-purpose transport network for Pukekohe, Paerata and West Drury. The DBC:

- Identifies changes since the development of the IBC.
- Reviews the IBC assumptions, evidence and main findings.
- Develops and assesses options and confirms the preferred option.
- Develops the economic case and measures expected benefits and outcomes.
- Identifies the arrangements needed for delivery and route protection.

This Strategic Case is focussed on the case for investment for the individual elements that comprise the DBC transport network. Whilst the emphasis of the DBC is on meeting travel demands generated by future urban growth around Pukekohe-Paerata, it is acknowledged the identified network will also support growth at West Drury. Accordingly, references in the DBC to the Pukekohe-Paerata or Pukekohe network generally also refer to the network elements supporting West Drury growth, unless explicitly noted otherwise.

1.1 The Pukekohe-Paerata and West Drury growth area

Pukekohe, Paerata and West Drury are located at the southernmost extent of the Auckland region, approximately 50km from Auckland city centre, and 30km south of Manukau city centre. Pukekohe sits on the Auckland – Waikato regional boundary and relates closely to the nearby Waikato towns of Pōkeno and Tuakau in particular. It is identified as a satellite town in the Auckland Plan and will act as a rural node that serves both the surrounding rural communities as well as connecting to urban Tāmaki Makaurau /Auckland. A key feature of a satellite town is the ability for people to live and work within Pukekohe and Paerata and its surrounds, which provides opportunity to reduce the distance and number of trips for employment. Currently however only 30%[1] of residents work within the Pukekohe-Paerata area, with the remainder travelling further afield to the rural hinterland or the nearby towns of Drury, Takanini, Papakura or further afield. This trend is likely to continue, despite a forecast growth in local jobs.

The planned population growth in Pukekohe-Paerata will on its own generate more trips in the future. Whilst work is underway to enhance the rapid transit rail service connecting Pukekohe, Paerata and West Drury to the rest of the region (see the Supporting Growth Alliance Rail DBC), without any further investment in an arterial network or alternative modes supporting access to train stations, the majority of these additional trips will continue to be undertaken by private vehicles, giving rise to a significant increase in Vehicle Kilometres Travelled (VKT) on an absolute and per household basis. Such growth will as a result also introduce a deterioration in road safety and limit transport access

[1] Census 2018 data from Paerata East and Paerata West catchments

and network resilience, thereby constraining the full development potential of identified Future Urban Zones (FUZ) due to a lack of integration between new and existing urban areas.

Therefore, a high functioning arterial network with integrated and well-connected walking and cycling facilities, alongside the ongoing RTN rail upgrades, will best support future growth potential whilst also providing multi-modal options for a lower carbon transport response.

The Pukekohe, Paerata and West Drury FUZ areas will generally develop along existing transport corridors, albeit that these will not generally be sufficient to support such growth. These FUZ areas will develop on current rural land but generally abut existing urban areas, resulting in a larger but more consolidated urban form.

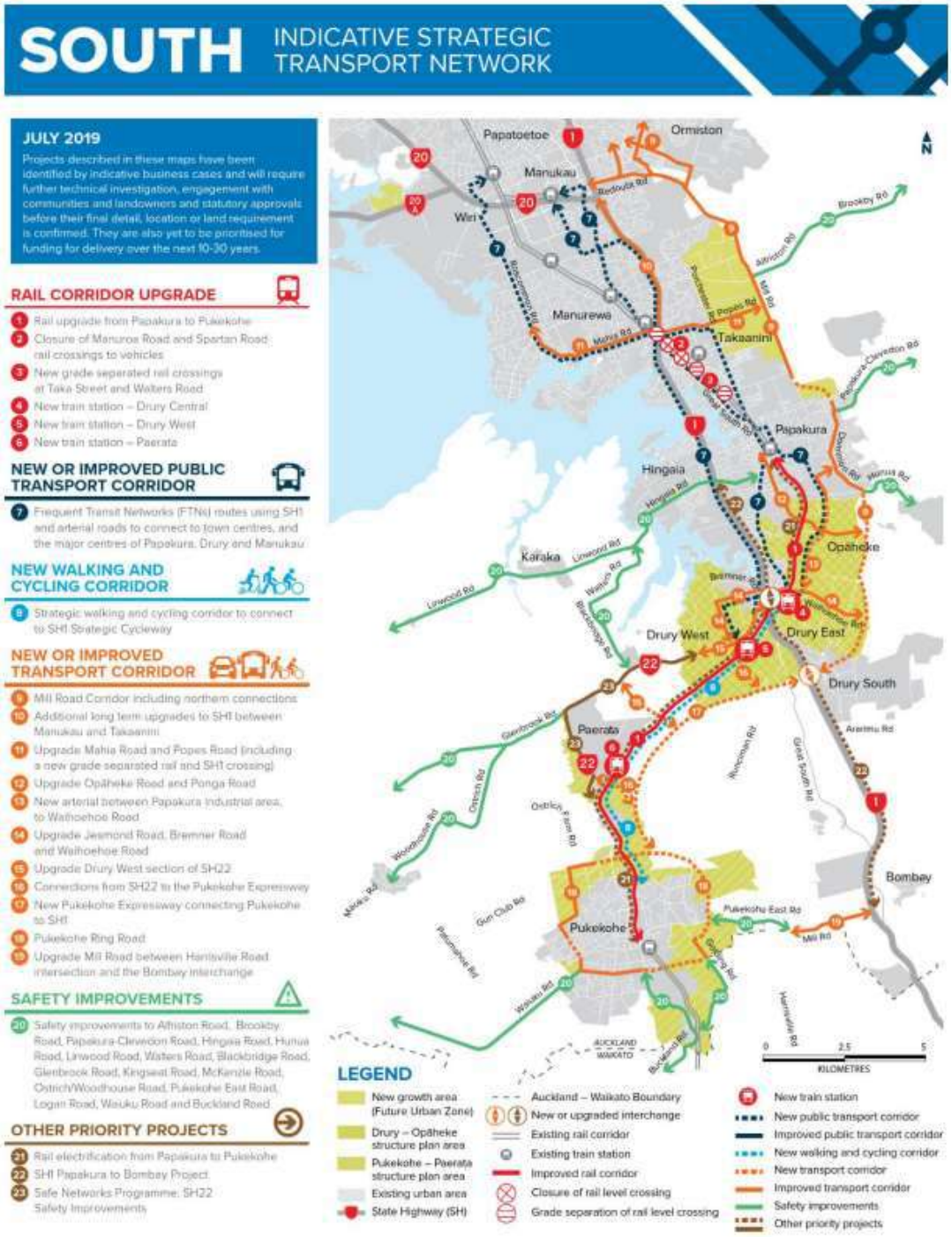
The 2,233 ha of current rural land earmarked as FUZ supplements existing live zoned land of 522 ha, enabling significant future business and residential growth. This growth is based on the Future Urban Land Supply Strategy (FULSS) and at full build out just beyond 2048 this growth is anticipated to reach[2]:

- 55,000 additional people.
- 22,000 new houses.
- 9,000 new jobs.

The infrastructure identified in the IBC to support the Pukekohe Paerata growth is shown in Figure 1-1.

[2] This full build out is based on the Future Urban Land Supply Strategy modelled as per the 2048+ modelling scenario which uses Land use scenario i11.6. Figures are from 2019 Structure Plans for Pukekohe-Paerata and Drury-Opāheke.

Figure 1-1: Pukekohe-Paerata IBC Indicative Transport Network



The DBC encompasses 4 key projects from the IBC Indicative Strategic Transport Network. Together these projects form a cohesive transport response to respond to planned future growth. The projects incorporate a wide range of transport investment including new strategic connections, new and upgraded urban corridors and rural road upgrades, with all incorporating separated dedicated walking and cycling facilities. The timing for implementation will vary and will be dependent on the release of surrounding land use.

The transport response identified in the IBC enables an integrated transport system with a range of strategic and local elements supporting mode choice. It is predicated on creating a more formalised local and strategic arterial network that mitigates the effects of growth on the existing urban areas and enables greater uptake of walking and cycling for short trips and rapid transit (rail) for longer distance trips to neighbouring centres where most job needs will be met.

The development of the strategic network is also a response to the significant contribution the Pukekohe and hinterland area makes to the regional economy, where freight access and efficiency, primarily for inter-regional movement of fruit, vegetables and associated industries is of upmost importance.

This Strategic Case provides a breakdown of each element within this system – noting that the collective benefit of the network as a whole outweighs the individual benefits to each element. The DBC considers the case for investment and refinement of options for the following projects identified in the previous IBC phase:

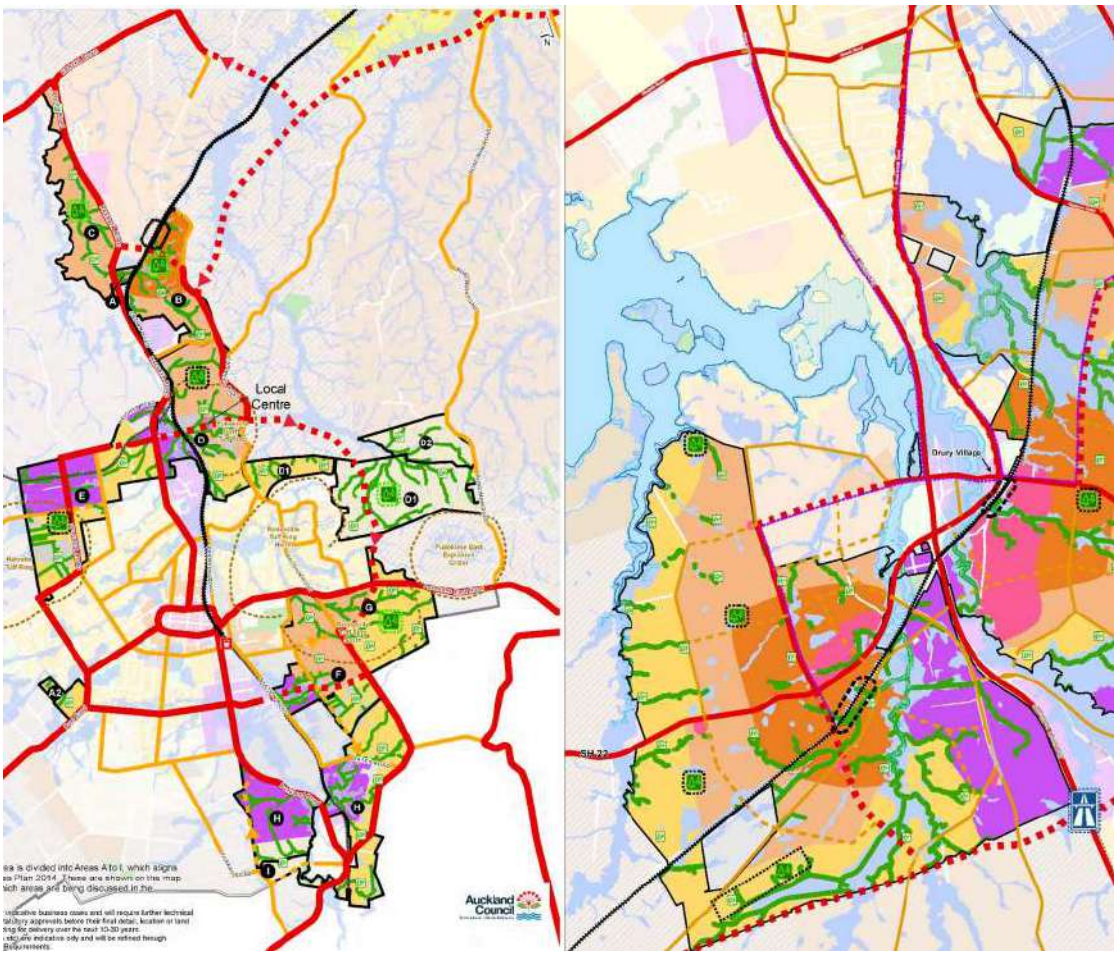
- Pukekohe Urban Arterial / Expressway
- SH22 Connectors
- Northeast urban arterial and Pukekohe Ring Road
- Pukekohe local road enhancements

These projects form the arterial roads for the area but it is acknowledged that there will also need to be a complementary collector road network, other active mode connections, an improved public bus network and broader travel demand management interventions to optimise outcomes over time. These are outside the scope of this DBC but have been accounted for in the process of developing the future arterial network and route protection proposals.

1.2 Future land use

Both the Pukekohe-Paerata and Drury-Opāheke structure plans were adopted by Auckland Council in August 2019. They set out the pattern of land uses and supporting infrastructure network for the future growth of Pukekohe-Paerata-West Drury areas as shown in Figure 1-2 below.

Figure 1-2 Pukekohe-Paerata and Drury-Opāheke Structure Plan areas



The DBC responds to future growth as currently identified in the FULSS, which indicates most land is to be zoned and development ready by 2028, however there is significant development activity already under way across these areas, demonstrating development pressure across these areas of varying natures. At the time of writing the project team is aware of the following significant private land developments as shown by:

- The ongoing development of Paerata Rise
- Plan Change 74 - Golding Meadows, Pukekohe (82.66 ha)
- Plan Change 76 – Kohe, Pukekohe (30.61 ha)
- Plan Change 87 – Buckland Road, Pukekohe (7.8 ha)

These will have varying degrees of impact and where the proposed plan changes are within the existing future urban zoned land – these impacts would largely be focused on the staging and sequencing impacts and the resulting pressure on strategic transport infrastructure. These plan changes also provide opportunity to help deliver parts of the future transport network.

The project team is not aware of any development proposals identified outside the FUZ which could have a wider implication on the proposed network as it generates additional demand where previously there was none.

2. What has changed since the IBC?

2.0 Summary of changes in the strategic context since the IBC

Table 2-1 below provides a summary of the key changes in the strategic context since the preparation of the South IBC in mid-2019 (which covered the areas of Takaanini, Opāheke Drury, Drury West, Pukekohe-Paerata and Clarks Beach) and during the preparation of this DBC. The table also includes a summary of how the DBC has responded to these changes.

Overall, the recommendations from the IBC remain valid despite the changes in strategic context. It is noted that the DBC has taken specific actions for managing land use uncertainty and reassessing all corridors against the stronger policy shift towards emission reductions.

Table 2-1: Summary of Key Strategic Context Changes since the IBC

Change Since South IBC		DBC Response
Land use policy and strategic alignment	• Auckland 2050 • National Policy Statement (NPS-UD) on Urban Development • Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021. • NPS on Freshwater Management (NPS-FM). • Proposed NPS for Indigenous Biodiversity. • Proposed NPS for Highly Productive Land. • Waka Kotahi Arotaki	The optioneering process to date has used multi criteria analysis (MCA) to assess a wide range of social and environmental impacts. The impact of the new NPS criteria will be considered further during the options assessment phase. The NPS-UD requires councils to plan for growth and ensure a well-functioning urban environment for all people, communities, and future generations with a key requirement to enable intensification along public transport routes. The Resource Management Amendment Act strengthens the NPS:UD and includes a new Medium Density Residential Standards(MDRS) which allow development up to three homes of three storeys on most sites without a resource consent. This differs from the Auckland Unitary Plan which has designated zones for Mixed House Urban which is the most similar zoning to the proposed MDRS. Council expects this will result in more intensified residential development in Paerata than first envisaged in the structure plan. This is obviously less coordinated than through a Structure Plan process and is harder to predict where intensification might occur as it depends on public and private developer appetites and availability of suitable sites. It is understood that the MDRS is seeking to enable faster residential development, rather than increasing the population in Auckland, so the overall growth assumptions for Auckland remain valid, though it is potentially the timing and location of the development at a local level which is uncertain. To manage this uncertainty in the DBC it is intended that each corridor in the recommended DBC network will be assessed at a high level to consider how the recommended footprint might change should higher intensification materialise in the adjacent land use. For example, could a change in residential land use intensification adjacent the corridors change the recommendation from a 2-lane cross section to a 4 lane cross section.

Change Since South IBC		DBC Response
		The impact of the environmental based NPS criteria has been considered in the DBC by specialists as part of the MCA process. Significant ecological areas and outstanding natural features are a key feature in Pukekohe Paerata. It is noted that the Arataki view for Auckland Urban Roads is there is likely to be a short term reduced demand for personal travel which could improve journey reliability in the short term, returning to pre covid levels in the medium term with growth in the long term. This will be considered as part of the staging strategy for the Pukekohe DBC.
Climate Change	• The Climate Change Response (Zero Carbon) Amendment Act 2019 • Amendments support contribution to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels and allow New Zealand to prepare for, and adapt to, the effects of climate change. • Ministry for the Environment Te hau Mārohi ki anamata: Transitioning to a low-emissions and climate-resilient future. Includes an emissions reduction plan.	The IBC was built on the premises of: • **Transport and land use integration** – a guiding principle to provide a transport network that supports land use development and good urban form. • **Prioritising mode choice** – specifically focusing on improved public transport reliability and services and creation of a well-connected walking and cycling network. The result is a recommended transport system which creates improved travel choice, thereby reducing reliance on private vehicles and shifting trips to low carbon alternatives. The DBC also continues to build on demand management principles adopted in the IBC and does not provide for unconstrained demand but rather seeks opportunities to influence and reduce demand alongside the recommended infrastructure. The MfE emissions document details the proposed approach to reducing light vehicle emissions by 20% by 2035 such as by integrating land use and transport and providing travel choice. The premise of this DBC aligns well to these goals and as such, the DBC is well positioned to respond to climate change outcomes. Specific actions to be undertaken in the DBC will include a Te Tupu Ngātahi climate change assessment of the corridors to ensure proposed investment is consistent with climate change targets.
Land Use Assumptions and	Formal land use assumption changes include: • The Pukekohe-Paerata Structure Plan was adopted in August 2019.	The DBC is cognisant of any changes in the land use assumptions and utilises the most current land use assumptions available. Of those identified to date, there are no significant changes to base land use assumptions from the IBC.

Change Since South IBC		DBC Response
development pressures.	Increasing development pressure has been identified in Pukekohe Paerata including: • Plan Change 74 - Golding Meadows, Pukekohe • Plan Change 76 – Kohe, Pukekohe • Plan Change 87 – Buckland Road, Pukekohe	Generally, the DBC responds to growth as currently identified and scheduled in the FULSS. However, there is evidence of ongoing development pressure in Pukekohe Paerata that could accelerate growth earlier than envisaged. These will have varying degrees of impact. Where the proposed plan changes are within the existing future urban zoned land (as current private plan changes are) these impacts would largely be focused on the staging and sequencing impacts and the resulting pressure on strategic transport infrastructure. There is currently no evidence of any development proposals that are located outside the FUZ which could have a wider implication on the proposed network as it generates additional demand where previously there were none. Where some certainty of information is available e.g., for Plan Change 74, 76 and 87, the DBC has considered the proposed land use changes to understand how this might impact the proposed transport network. Where possible the team has spoken with developers and landowners directly and found that proposals are largely consistent with the DBC and provide the opportunity for network components to be delivered as part of ongoing developer activity.
Modelled Growth Assumptions	• Overall growth projections in Pukekohe Paerata remain generally consistent in terms of full build out quantum. • Growth projections are expected to be slightly slower and more linear in terms of full build realisation.	The overall quantum of growth in land use model i11.6 remains largely the same as i11.4 which was used in the IBC. As these growth assumptions were the basis on which the transport network was developed, the overall conclusions of the South IBC remain valid. Potential impacts from the MDRS have not been included in AFC land use models as yet so the impact of intensification has been considered qualitatively for each corridor during the optioneering process. The change in growth timing could potentially impact the recommended timing of implementation of transport projects in the DBC.
Transport Policy and Strategic Alignment	• Ministry of Transport Outcomes Framework establishes 5 outcome areas where mode neutral improvements to the transport system can be made to enhance wellbeing. • An updated GPS on Land Transport (2021) has been released, with strategic priorities of safety,	There have been some key changes to the policy and strategic direction since the IBC. These changes are however still consistent with the overarching outcomes sought from the IBC. These include access, mode shift, environmental sustainability, and safety. The GPS 2021 also has a greater focus on climate change, with further direction provided in Te hau mārohi ki anamata: Towards a productive, sustainable and inclusive economy; Aotearoa New Zealand's first emissions

Change Since South IBC		DBC Response
	better travel options, climate change and improving freight connections. These replace those set in 2018 of safety, access, environment and value for money. Safety is retained whilst value for money is captured elsewhere in the broader intent of the GPS. Access and environment are given greater emphasis by reframing as better travel options, to reflect the need for improved mode choice; and climate change, to reflect the growing emphasis on reducing emissions from the land transport sector. • Road to Zero 2020-30 was published in November 2019, placing emphasis on 5 focus areas to achieve a zero road toll, starting with a 40% reduction in death and serious injury by 2030.	reduction plan. This sets a target of a 20% reduction in light VKT by 2035 through improved urban form and better travel options. With these continuing objectives it is considered that the IBC conclusions are well aligned with the current transport strategic and policy directions. The problems and assessment in the DBC have been refined to accommodate these GPS changes. More details on how the network will support addressing climate change will be included.
Transport Projects	These projects have been implemented on SH22: • Glenbrook Road Roundabout • Great South Road intersection • Safer speeds between Drury and Paerata • Jesmond Road Right Turn Bay There is ongoing planning, funded through NZUP, for transport enhancements along SH22 to support West Drury growth.	There has been little change that would have demonstrable effect on the conclusions in the IBC. There has been a focus on SH22 road safety projects, with a drop in speed limits along SH22 between Paerata and the SH1 Drury interchange, as well as a number of intersection improvements, notably at Glenbrook Road, which also provides access to the Paerata Rise development. There is ongoing planning for transport development to support land use change along and adjacent to the SH22 corridor in West Drury, including ongoing residential growth, a major Fisher and Paykel development and construction of the West Drury station. This development is largely in line with that anticipated in the South IBC, as signalled by the Drury-Opāheke Structure Plan.
COVID19	The impact of COVID19 on the transport system has three key impacts. • Resilience of public transport operations. • Change in funding levels and type.	While the response to COVID19 has had a direct and immediate impact on public transport and transport demand, it is expected in the longer-term horizon, such as that assessed in the DBC that transport demands will return to projected levels.

Change Since South IBC		DBC Response
	• A kick start for working from home.	The realisation of work from home opportunities following COVID19 is considered important for Pukekohe Paerata's role as a satellite town where a future aspiration might be for residents to live in Pukekohe Paerata and commute some days to urban Tāmaki Makaurau. COVID19 has shown that this type of flexible working can be possible. Additional uptake in work from home will have an impact consistent with longer term aspirations for reduced travel demand, which is already predicated in the base modelling assumptions. Given the long-term nature of the DBC no specific COVID19 related changes to land use and travel demand assumptions are considered necessary.

3. Investment Themes

The investment themes for the DBC area consist of problems, benefits and investment objectives to provide a framework to maximise the outcomes from transport investment through appropriate option development, assessment and refinement. The following sections discuss:

- Potential outcomes of not investing
- Development of DBC problems
- Why these problems exist
- DBC Investment logic mapping

3.1 What could happen if there is no investment?

Key issues were identified that could occur if growth occurs across the DBC area without the appropriate investment in transport infrastructure. These issues are summarised in Table 3-1.

Table 3-1: Key issues for Pukekohe-Paerata-West Drury

Key issues	Potential outcome
Existing transport network cannot accommodate additional transport demands	• The current transport network is already under pressure (e.g. SH22 approaching SH1 at Drury and Pukekohe East Road / Mill Road approaching SH1 at Bombay). Future transport demands will exacerbate existing issues thus limiting Pukekohe Paerata' s growth potential. • The existing network does not provide suitable access to future land uses, resulting in indirect/longer trips between existing and future key destinations. • Population growth itself will generate more trips in the future. Without any investment in alternative modes or the means to access them (rail station access) the majority of trips will continue to be undertaken by private vehicles. The additional VKT from the growth, unchecked, would be expected to more than double on the existing transport network.
Poor land use integration	• Limited opportunities to encourage public transport, walking and cycling, resulting in private car use to continue at existing levels. • Does not support the delivery of the desired compact urban form. • Inability to match employment land with the transport network will not enable Pukekohe to have more local employment options and limit its ability to operate as a satellite town and as a sub-regional rural economy economic and employment hub. • Place making within the urban extents will be compromised if the land uses and transport infrastructure are not integrated. This could also result in reduced protection of the scale and character of the rural township which is critical to the identify and ongoing profile of Pukekohe and Paerata. • Inability of the transport network to respond flexibly to changing densities from land use policies such as the NPS:UD and MDRS resulting in residential intensification that is not supported by low

Key issues	Potential outcome
	carbon transport network options and reinforces the current private vehicle preferences. • Opportunity to provide lead infrastructure which supports mode shift, i.e., walking and cycling, is lost due to unconnected development. • Pukekohe-Paerata-West Drury growth potential is limited. • Liveability outcomes are compromised.
Limited travel choice	• Limited investment in walking and cycling to key locations reinforces high private vehicle dependence and compounds existing car dominance, especially in central Pukekohe. • Limited investment in active mode facilities will result in a network which is not legible, unsafe and not well connected. • Unmanaged growth in demand for private vehicle travel, which will result in traffic volumes on existing roads above their designed capacity resulting in severe congestion and severance. • Strategic network resilience risk associated with only a single access to Pukekohe Paerata via the state highway network (SH22). Over-reliance of this connection for both strategic and local activities compromises both functions.
Contribution to climate change	• Without investment in transport choice, private cars will continue to dominate. With growth this will increase the number of private vehicle trips and potentially increasing transport emissions, depending upon the uptake of low emission vehicles. This does not support the development of a low carbon transport system. • A poorly connected walking and cycling network, or a network with missing links will reduce the potential for mode shift and miss the opportunity to capture new active mode users for short internal trips to centres and stations. • Space will continue to be prioritised for vehicles rather than people movement through a range of modes.
Safety	• Existing safety risks are likely to increase on key corridors such as SH22, despite recent improvements, as traffic volumes increase with limited investment in safe solutions. There have been 65 DSI crashes in the five years to 2022. As arterial corridors reach capacity and rural volumes increase, safety issues along these corridors will become more prevalent. • Active mode safety issues will be exacerbated (14 DSI's in the five years to 2022) without investment in suitable and safe walking and cycling facilities.
Environmental challenges	• Pukekohe Paerata has localised poor ground conditions, drainage issues, extensive floodplains, streams and identified Significant Ecological Areas (SEA's). These challenges could limit opportunities for north-south and east-west corridor provision resulting in severance within the future transport network. • Without consideration, the transport network may not be able to adapt to climate change challenges like increased severity and occurrence of flooding.

Key issues	Potential outcome
	• Missed opportunities to secure better environmental outcomes by leaving development of the network to the market rather than working with landowners, Iwi and specialists to collaborate on solutions.

3.2 Pukekohe Paerata Problems

During the IBC phase problem statements, benefits, and investment objectives (PBIOs) were identified for the Southern growth area, which incorporated Pukekohe, Paerata and West Drury. The IBC demonstrated a strong case for investment and was focused around two key problem areas:

- Capacity of the existing transport network to respond to growth, and
- Integration and Route Protection of the transport system with the scale and pace of growth.

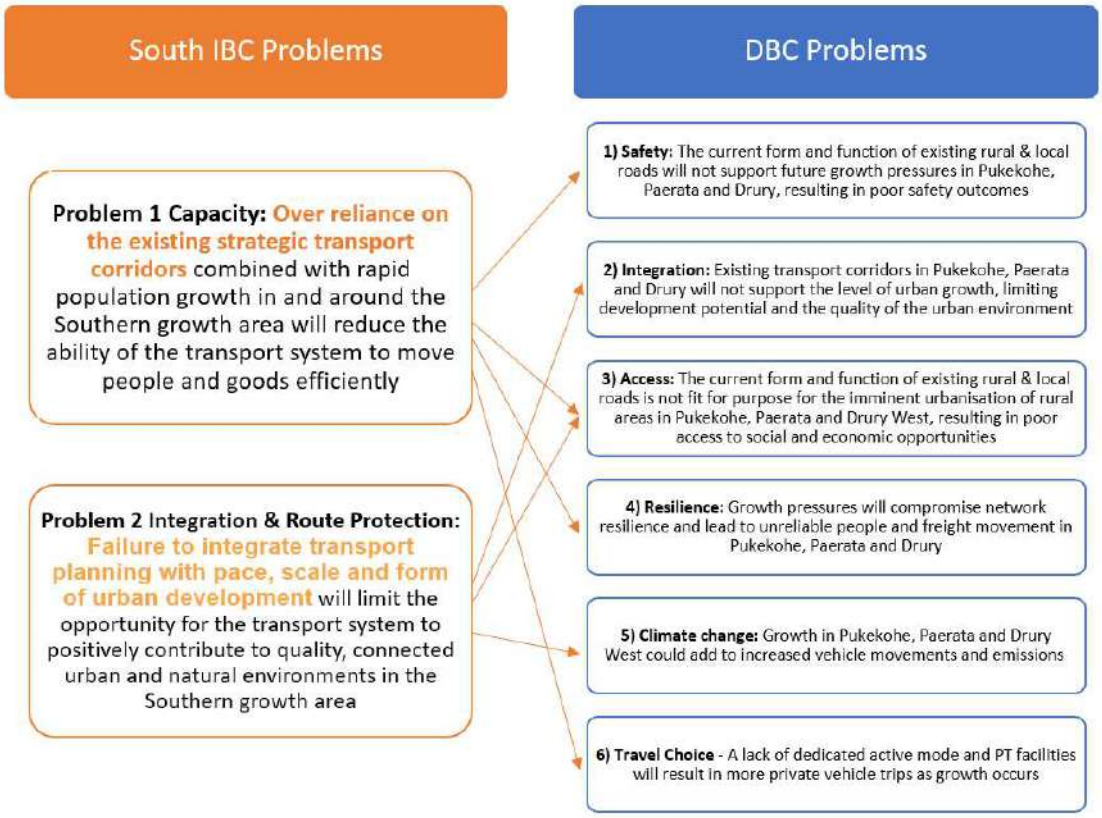
Investment in these elements were determined to maximise land use and transport integration and align with the Ministry of Transport (MoT) Transport Outcomes Framework and GPS 2018 goals at the time.

At the commencement of this DBC, these investment areas were carefully reconsidered with respect to changes since the IBC and discussions with Auckland Transport and Waka Kotahi. This DBC has decoupled the two original IBC problems into six individual problems. The core elements of these remain the same, however the additional detail provides the opportunity for individual corridor assessments to be more targeted and to provide better clarity on how the individual corridor contributes to the delivery of the overall package outcomes.

Whilst this DBC is primarily assessing how to accommodate future growth and its impacts on the transport system in Pukekohe, Paerata and West Drury, it is acknowledged that the policy framework has shifted since the IBC to have a greater focus on climate change. Therefore, it is appropriate that a specific climate change problem is now added as the sixth problem to the suite of problem themes.

As a result of this process, the six key problem areas for investment in Pukekohe, Paerata and West Drury were confirmed as shown in Figure 3-1.

Figure 3-1: Evolution of Pukekohe Paerata problems from IBC to DBC



3.2.1 Problem definition

The access, resilience, travel choice, safety and integration problems remain significant and are supported by the evidence detailed in the IBC. This evidence is summarised in Table 3-2. The changes in policy and growth since the IBC will result in more intensification than previously assumed and will further exacerbate these significant problems. The increase in Plan Changes and developer activity is further evidence of the pressure on the area to respond to growth.

Table 3-2 Summary of evidence

Problem	DBC Problem description	Evidence presented in IBC
Access	The current form and function of corridors, lack of active mode facilities and missing transport connections does not support future growth and will constrain access to economic and social opportunities in Pukekohe Paerata and West Drury.	Transport network is not of the right form and function and capacity to provide for future demands. Existing provision does not connect future land uses. MDRS intensification will further exacerbate this problem.
Reliability/ Resilience	As transport demand grows, without new transport corridors network resilience will be limited and public transport, private vehicles and freight will experience unreliability as	There is currently no alternative to SH22 for accessing SH1 north, which is forecast to reach its capacity as both Drury West, Paerata and Pukekohe grow. The trip generation from future growth will exceed capacity on the existing network resulting in congestion, severance

Problem	DBC Problem description	Evidence presented in IBC
	they share corridors with significantly larger volumes of traffic.	and unreliability. Local road alternatives are not suitable for future transport requirements alone.
Travel Choice	A lack of dedicated active mode facilities will result in more private vehicle trips as growth occurs.	Geographical size of Pukekohe Paerata and West Drury is relatively compact which supports active mode share. 91% of trips are currently by private vehicle. Limited walking and cycling facilities that do not connect trip generating activities, aren't continuous and have limited crossing opportunities. Infrequent public transport routes.
Safety	A lack of safe active mode facilities and existing safety issues will be exacerbated by the future growth in Pukekohe Paerata.	There were 65 DSI crashes across the area in the 5 years to 2022, including 14 active mode DSI's. There is an additional risk for active mode users with a lack of safe and separated facilities which results in users feeling unsafe, even for short trips. High vehicle speeds on existing rural roads will continue unless it is urbanised.
Integration	The existing transport corridors are not commensurate with the level of urban growth in this area limiting development potential and the quality of the urban environment.	Provision of local employment is critical to achieving the desired mode share and transport connections important for land use viability. Current urban form does not support public transport and active mode travel.

Climate change is a new problem since the IBC and has been defined for this DBC as:

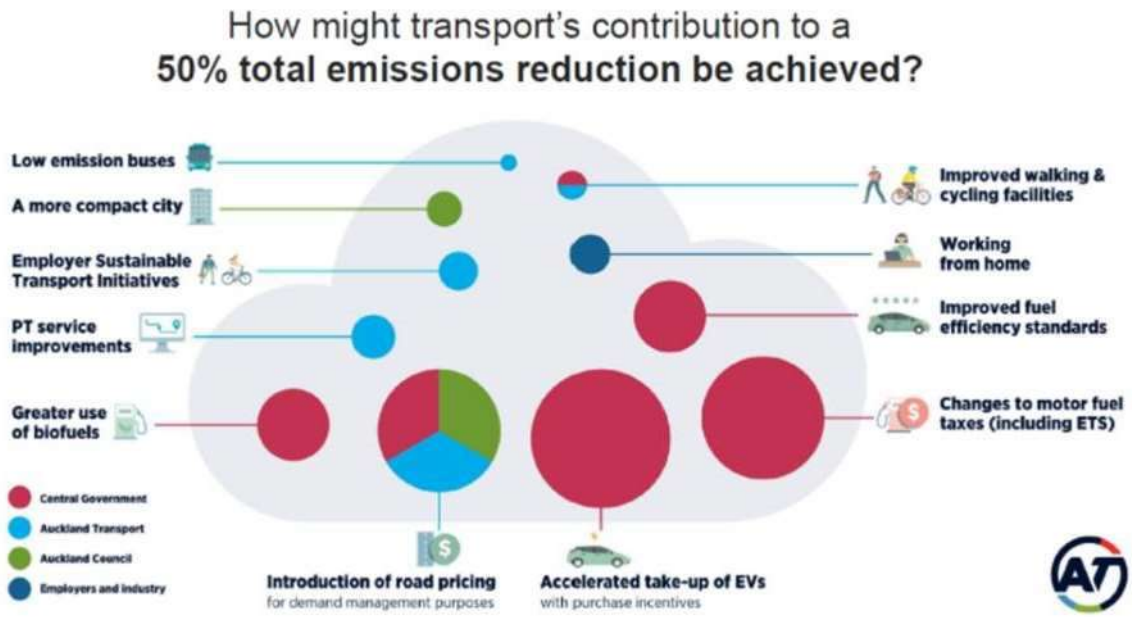
" The current transport system has an over-reliance on private vehicles. This combined with limited low carbon transport alternatives results in significant transport emissions which is incongruent with current climate change goals".

The IBC had a premise of mode shift and was focused on creating a future network that reduced reliance on private vehicles. As part of its development, it already considered which parts of the network would be required to support this mode shift and form part of the mitigation response for the impacts of climate change.

The IBC principles of land use integration, travel demand management, transport hierarchy and sustainable outcomes all supported the underlying desire for a low carbon transport network. Therefore, this new problem was already being considered implicitly as part of the IBC. The DBC does however take the opportunity to specifically highlight climate change.

It is noted that the transport response to climate change goals and the reduction of transport emissions is made up of many factors as shown in Figure 3-2. This shows that the concepts of a compact town and improved walking and cycling facilities are just smaller parts of the climate change response and in fact the movement to the use of biofuels, electrification of the fleet and road pricing are considered the heavy lifters in addressing climate change.

Figure 3-2: Transports contribution to transport emission reduction (source: Auckland Transport)



The DBC cannot influence these wider policy decisions, but it can support with contributions through network provision to support mode shift, associated reductions in VKT and management of embodied carbon.

Therefore, it was decided to focus the climate change problem for this DBC on a response to maximise mode shift to active modes and facilitate multi-modal train station access for longer trips (acknowledging the net outflow from the area for employment) to achieve an overall reduction in VKT. The reduction in emissions of the remaining private vehicles trips will need to be addressed through biofuels or fleet electrification, as well as progressive improvement of the bus based services currently around Pukekohe and Paerata. The DBC will also consider the impacts of embodied carbon during the optioneering stages.

Pukekohe Paerata West Drury is heavily reliant on private vehicles with a current mode share of 91%. Without alternative low carbon travel choices, this mode share will not change in the future. By addressing the other five problems this over reliance on private vehicles will in fact be reduced. The provision of better access for all modes, land use integration with the transport infrastructure, improved reliability for the network and provision of active mode facilities will collectively encourage mode shift. Growth itself will increase the number of transport trips, but the measure of success will be how many of these new (and existing) trips can be undertaken on a low carbon transport network.

It is acknowledged that the climate change response is not just restricted to mode shift, however this is the main lever identified for this DBC. As a route protection DBC, the main focus is on mitigation measures and ensuring the appropriate transport corridors or facilities are provided in the right places to support the growth. That is, that the enabled carbon is reduced through better travel choices being made.

The DBC does not reach the level of design which focus on more adaptive measures such as materials but it does consider this concept of embodied carbon and resilience at a higher level during the climate change assessment and subsequent option selection.

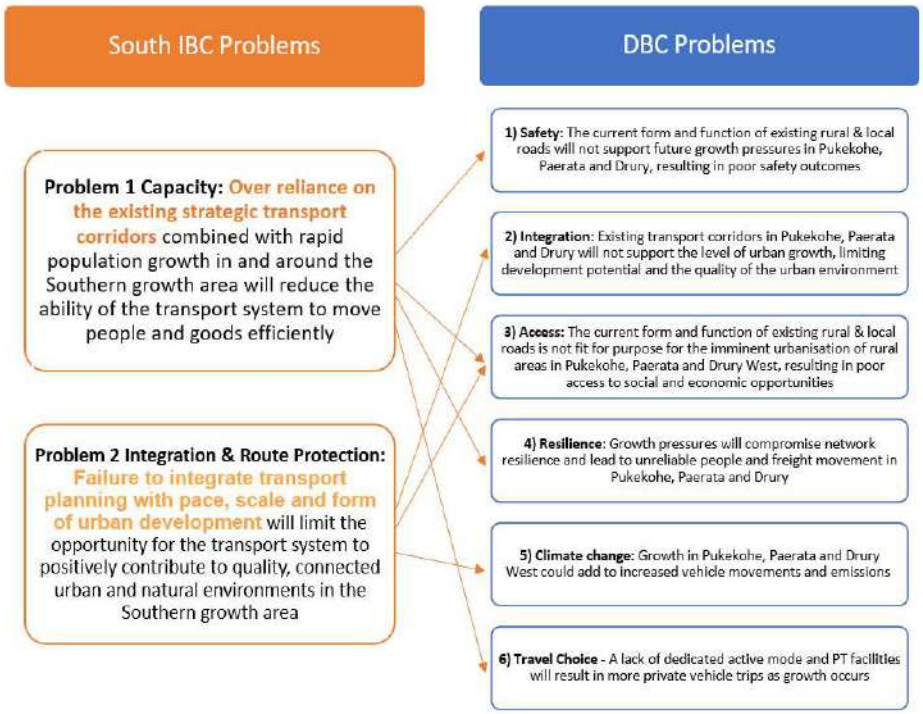
Specific climate change tasks undertaken include:

- Each project has been considered during gap assessment against a climate change lens to understand the corridors role in developing a low carbon transport network. This assessment has tested potential impacts on enabled carbon, construction carbon and land use changes. The intervention framework considered elimination/avoidance, reduction/deferral and optimisation/offsetting for the proposed corridors. This has been of particular importance to the strategic infrastructure of the proposed Southern Interchange. Refer to **Appendix L: Climate Change Response** for further details on this assessment.
- The resilience problem includes consideration of responses to climate change issues like 100 year flooding and the resulting availability of alternative routes. This is primarily for new greenfield corridors and will factor in the location of new alignments. In addition, any new infrastructure that is required on existing roads such as bridges have had their footprint considered with respect to flooding levels.

3.2.2 Problem Mapping

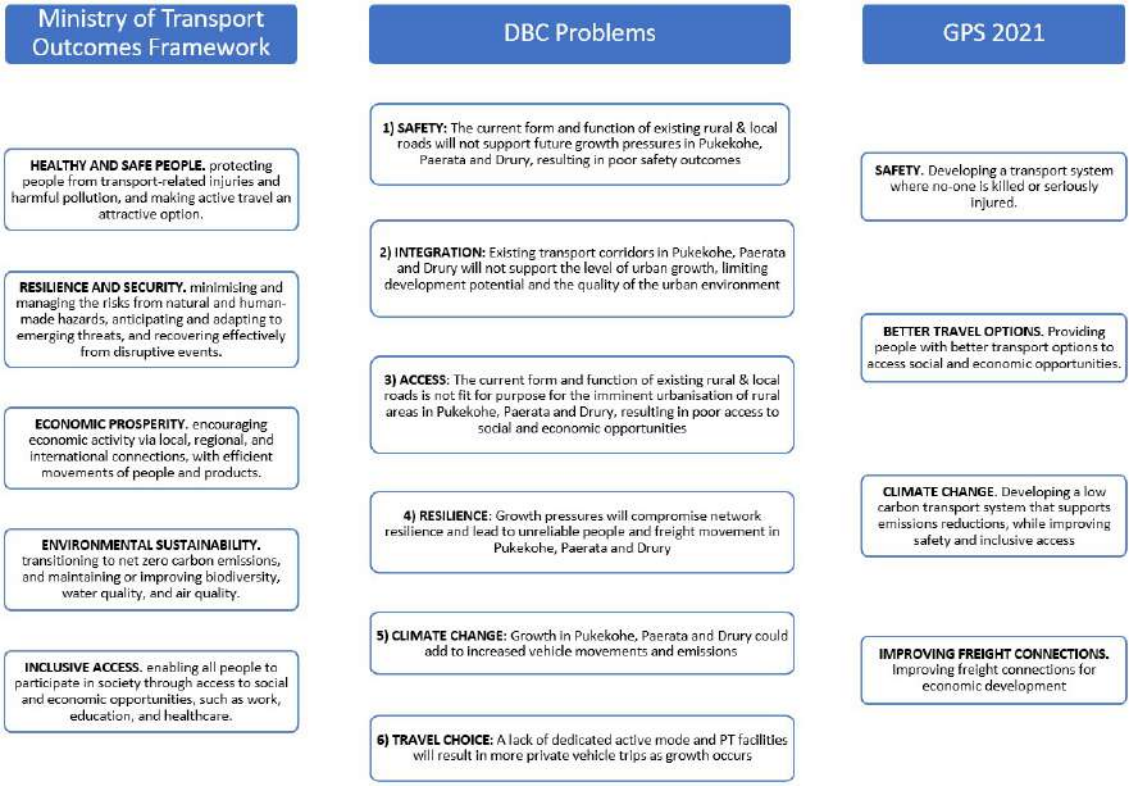
There is a direct line of sight between the IBC and DBC problems, as shown in Figure 3-3. This confirms that the problems identified in the IBC and in the DBC continue to be valid and applicable at both an area level for Pukekohe Paerata West Drury, and as detailed further in this Strategic Case on a per project basis.

Figure 3-3: IBC and DBC problem mapping



Investment in addressing these problem statements will maximise land use and transport integration and align with the GPS 2021 and MoT Transport Outcomes Framework. The DBC problem themes as identified above have also been mapped against both of these strategic guiding documents in Figure 3-4 to demonstrate how the DBC is well aligned to the outcomes being sought.

Figure 3-4: Mapping of DBC Problems to Current Strategic Policy Direction



The mapping shows that the identified problems map closely to the four strategic priorities of the GPS. Safety and Better Travel Options remain cornerstones of the Pukekohe Paerata West Drury network. The GPS emphasis on improving freight connections is particularly relevant for this DBC given the significant rural economy Pukekohe acts as a hub for, and the need for efficient and resilient access to SH1 north and south.

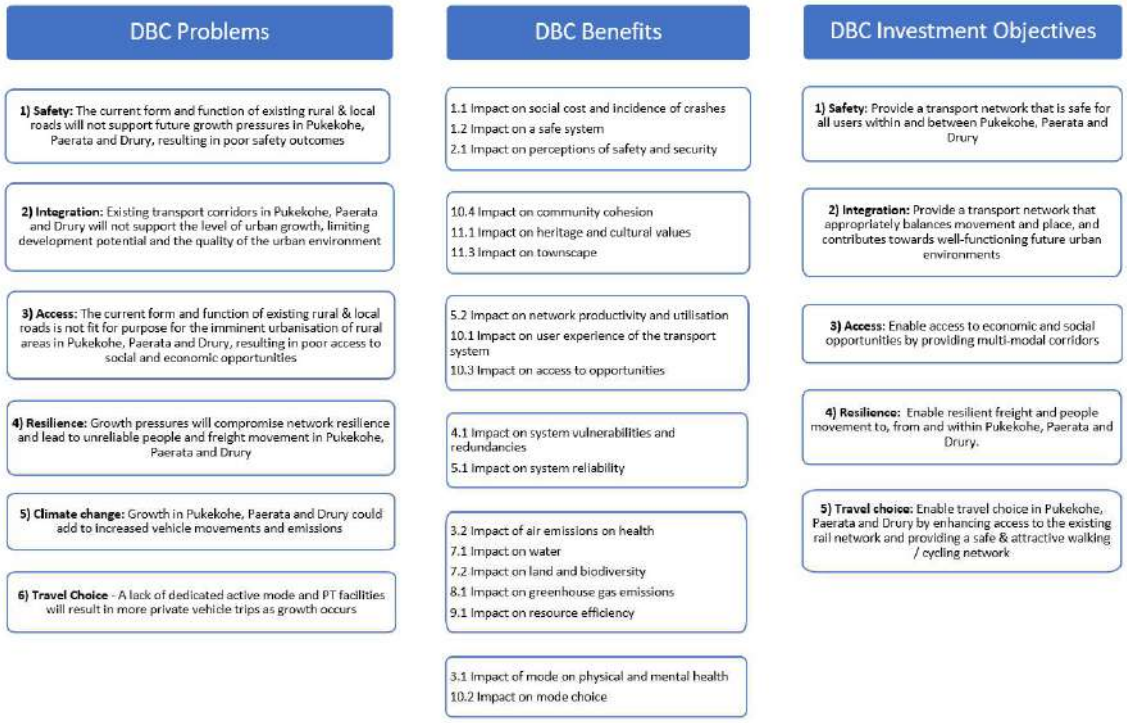
The mapping to the MoT Transport Outcomes Framework also confirms alignment with the five key outcomes to improve wellbeing and liveability through inclusive access, healthy and safe people, economic prosperity, environmental sustainability and resilience and security.

Therefore, it is considered that the problems identified align closely with broader strategic goals. Accordingly, investment will realise outcomes that support the development of a low carbon transport system that safely and efficiently connects peoples and goods to key social and economic opportunities.

3.3 Investment Logic Map

The Investment Logic Map (ILM) for the DBC is shown in Figure 3-5. The identification of benefits and investment objectives were discussed with the project team and key representatives from Auckland Transport and Waka Kotahi. The measures identified all align with the new Waka Kotahi Benefits Management Framework (2021).

Figure 3-5 Pukekohe Paerata ILM



In general, the DBC problems map directly with an investment objective. The one exception is the Climate Change problem. A separate Climate Change investment objective was considered, however, it was felt that the intentions of this objective to develop a low carbon transport system that supports emission reductions while improving safety and inclusive access is already collectively achieved by the other investment areas and would be essentially double counting. For example:

- **Travel choice** investment objectives include measures for mode shift, mode share and reduction in emissions associated with this mode shift.
- **Resilience** measures already include an assessment of the susceptibility of infrastructure to climate change (in particular Q100 flooding).

Whilst climate change does not have a specific investment objective, this DBC does provide additional commentary on how Pukekohe Paerata as well as individual projects themselves contribute to addressing climate change. This commentary is included in the climate change assessment section, option summaries and the outcomes reports. This approach remains consistent with the wider Te Tupu Ngātahi programme assessments.

The key benefits from addressing these problems are:

- Improved accessibility for local and interregional trips.
- Improved network reliability and resilience for the strategic transport network.
- Improved infrastructure resilience.
- High quality compact urban form enabled with improved urban mobility.
- Integrated land use and transport outcomes.
- Reduced reliance on private vehicles with increased active mode share and support for RTN access.
- Contribution to the development of a low carbon transport network and associated reductions in transport emissions.
- Improved actual and perceived safety for active modes.
- Reduced occurrence of deaths and serious Injuries.

4. Project specific investment outcomes

The previous section has detailed the overarching investment themes for the DBC. Each corridor has also been considered individually to understand its specific contributions to the overall outcomes. Whilst each corridor likely contributes in some way to all five investment themes, they have been split into level of contributions as detailed in Table 4-1. The corridors contributions have been split as follows:

- The primary themes (dark green) are where the corridor has a strong contribution to achieving outcomes for that theme.
- The secondary themes (light green) are where there is expected to be some impact, but it's not the primary reason for investing.
- The tertiary themes (yellow) are where the corridors have a lower-level impact and may contribute as part of a greater network effect rather than the specific project itself.

Table 4-1 DBC project contributions to investment themes

	Projects	Safety	Integration	Access	Resilience	Travel Choice
1	Drury West Arterial					
2	South Drury Arterial					
3	SH22 Connection					
4	Drury-Paerata Link					
5	Sim-Sim Connection					
6	Paerata Station Connection					
7	Paerata Arterial					
8	North-east Arterial					
9	South-east Arterial					
10	South-west Arterial Upgrade					
11	North-west Arterial					
12	Pukekohe East Road / Mill Road (Bombay) Upgrade					

The investment cases for these projects are discussed further in Section 5 below.

STRATEGIC CASE: DRURY TO PUKEKOHE LINK

Provision of a new link and connections between Pukekohe and SH1 at Drury via Paerata and West Drury.

Project Background

- 'Pukekohe Expressway' identified in PBC (TFUG) in 2016 as a priority for route protection. Needed to support north Pukekohe FUZ and Paerata growth to access to SH1.
- Part of a "Balanced Response plus Rapid Transit Network" Preferred Programme. Strategic and arterial road improvements to enable efficient movement of goods and people and provide access and connections.
- Enabling the development of the greenfield areas in line with the Future Urban Land Supply Strategy by providing bulk infrastructure to enable growth consistent with the Auckland Plan.





- Expressway further developed and confirmed in indicative strategic transport network IBC. Edge of FUZ West Drury alignment.
- Functional intent to support resilient access to Pukekohe and Paerata and provide alternative route for SH22 to reduce traffic in Drury which will facilitate place making
- Providing appropriate road form will increase safety by reducing reliance on minor rural roads to deliver access to the proposed business (industrial) land, maintain reliability for freight and inter-regional travel on SH1
- SH22 connections at West Drury, Paerata, rural zone New SH1 interchange Drury South. Connection at Pukekohe north-east arterial.

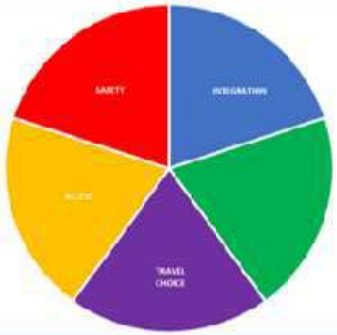
Detailed Business Case Proposal

- Functional intent confirmed as the need to provide a strategic arterial linking Pukekohe, Paerata to West Drury and SH1 that provides for inter regional travel, especially for freight.
- Comprises seven individual projects staged for delivery over time (2028 to 2038+) to enable and integrate with adjacent growth in Future Urban Zones, encourage active mode use and ultimately complete a strategic connection from Pukekohe to Drury.
- Seven projects all require route protection, packaged into NoR 1 (Drury West Arterial by AT) NoR 2 (South Drury Arterial, SH22 Connection Drury-Paerata Link, Paerata Arterial by WK) and NoR 3 (Sim to Sim Connection, Paerata Station Connection by AT).
- All projects two-lane median divided roads at 60-80 km/h posted speed limits to deliver 5-star safety outcomes. Dedicated separated walking and cycling facilities to all corridors with connections into local networks.
- Engineering design and route refinement optimised to balance transport outcomes, construction costs and property impacts with flood risks, ecological and community impacts

Key Considerations

- Drury West Arterial links SH22 to new South Drury Arterial, passing through FUZ and enhancing access to Drury West station whilst providing relief to SH1 Drury interchange. Local connections at Runciman Road and Burtt Road.
- South Drury Arterial connects with Drury West Arterial and new South Drury interchange project at east end, providing enhancing functionality for strategic inter-regional traffic on SH22 and supports greater urbanisation of West Drury sections of SH22.
- Western end tie in with new SH22 connection through rural zone further enhancing strategic inter-regional travel by providing an alternative to the increasingly urbanised SH22 through West Drury.
- Paerata Arterial skirts the edge of the north Pukekohe FUZ at its northern extent and then through the FUZ at its southern end in order to balance transport outcomes with the benefits of integration with urban development. This enhances IBC outcomes where full edge of FUZ alignment was anticipated
- The Drury-Paerata link is staged to be delivered last. This will maximise integration of arterials with urban growth in the short term and drive mode shift to active and shared modes, with high levels of access to stations at West Drury and Paerata. The timing of this final connection will be influenced by levels of service elsewhere in the network.

CONTRIBUTION TO INVESTMENT OBJECTIVES: DRURY TO PUKEKOHE LINK



Drury to Pukekohe link primarily contributes to safety, integration, access and travel choice investment objectives

SAFETY

Urban growth across the Pukekohe, Paerata and West Drury Future Urban Zones will result in significantly increased travel demands on SH22, especially in Drury West where increased urbanisation will lead to a higher proportion of active mode users as well as general traffic conflicting with inter-regional traffic and freight.

Evidence

- Forecast travel demands on SH22 without the link would increase average daily traffic by 40% from 22,000 vpd to over 28,000 vpd, with the heavy commercial vehicle share growing from 6% to 8%.
- A five-fold increase in traffic volume of Burtt Road as traffic disperses away from strategic routes.
- The current safety record on SH22 is poor, with 10 DSI's in the last 10 years.

What if we do nothing?

- With increased urbanisation through this area, excess traffic volume, including heavy freight, will mix with greater numbers of walkers and cyclists and local traffic, creating conflicts and increased risk of death and serious injury.
- Traffic and accident migration to avoid congestion will also grow on rural parts of the network e.g. Burtt Road, Runciman Road.

INTEGRATION

Existing form and function of SH22 is not appropriate for the level of future urban growth anticipated. The Drury to Pukekohe Link will integrate with urban growth at north Pukekohe, Paerata and West Drury providing alternative ways to get around the network and ease impacts on existing infrastructure allowing the full development potential of future urban zones to be realised.

Evidence

- A two-thirds increase in volumes on SH22 at Paerata from 16,000 to 26,000 vpd at 2048+.
- Forecast travel demands on SH22 at West Drury increase by 40% from 22,000 to over 28,000 vpd.
- A five-fold increase in traffic volume on Burtt Road as traffic disperses away from strategic corridors.

What if we do nothing?

- If the Link is not provided the quality of the future urban environment will be effected, limiting its attractiveness and failing to fully realise the development potential of future urban zones like Drury West.
- The ability to fully integrate active mode facilities into networks will be severely limited through lack of space and safety concerns.

ACCESS

The existing strategic network will not provide sufficient access for future urban zones to realise their full development potential or enable communities to access economic and social opportunities.



Evidence

- The Drury to Pukekohe Link will provide improved access from Future Urban Zones to the rest of the urban area and to the strategic transport system.
- The absence of the Link would force collector roads within new development to connect onto the existing network, primarily SH22 as well as rural roads such as Runciman Road, Burtt Road, Sim Road and Tuhimata Road.
- Access would be constrained by the limited ability of these corridors to accommodate the nature and scale of the growth involved.
- Provision of the Link increases the opportunities for local road networks to connect to strategic corridors, enhancing future communities ability to move safely and efficiently within it.

What if we do nothing?

- Without the Link access to the Drury West rail station will be restricted to SH22 and will rely upon future development to provide access from the south. The absence of a strategic network in addition to SH22 will severely impact access as reliance will be heavily placed on the provision of a collector road network having to meet multiple needs.
- Paerata and Pukekohe north FUZ areas will also be reliant on an internal collector road network accessing SH22. The ability to provide this safely and efficiently will be constrained by the need to preserve the strategic function of SH22.

TRAVEL CHOICE

Future urban development in the absence of the Drury to Pukekohe Link will force traffic through local road networks and onto SH22, impacting upon urban form and undermining the safety and convenience of active modes.

Evidence

- Not providing for active modes is linked to high car dependency other negative outcomes.
- The provision of an active mode network as part of urban development makes these modes attractive, safe and more convenient for short and medium distance trips.
- Opportunity exists to establish high quality walking and cycling links between Pukekohe, Paerata and West Drury as urban development happens to influence travel behaviour as populations grow and communities develop.

What if we do nothing?

- Growing travel demands will filter through local networks creating congestion and safety concerns. Limited space for cycle facilities will compound safety concerns and limit the travel choices of residents.
- Traffic growth on SH22 will make cycling and walking unattractive and place too much emphasis on this corridor.
- SH22 meets a limited range of origin / destination needs for the Future Urban Zones, offering limited functionality for short/medium distance active mode trips.

STRATEGIC CASE: PUKEKOHE ARTERIALS

Establishment of an arterial network around Pukekohe through the provision of new corridors and upgrades to existing corridors.

Project Background

- 'Pukekohe Inner Link' identified in PBC in 2016. Needed to address Pukekohe congestion and support future urban growth envisaged at the time. Identifies new and upgraded corridor to NW, NE, SE and SW Pukekohe
- Part of a "Balanced Response plus Rapid Transit Network" Preferred Programme. Strategic and arterial road improvements to enable efficient movement of goods and people and provide access and connections.
- Enabling the development of the greenfield areas in line with the Future Urban Land Supply Strategy by providing bulk infrastructure to enable growth consistent with the Auckland Plan.





- "Ring route" investigated in IBC at short list stage. Inner bypass around west, south-east and north-east of Pukekohe forms recommended option. Structure planning completed.
- Functional intent to unlock Pukekohe growth but especially southern areas. Two new rail crossings to unlock commercial potential in north and south.
- Connects to Pukekohe Expressway, maximising the potential to reduce traffic on SH22.
- Attracts through-routing traffic away from the Pukekohe town centre, easing congestions and providing a more reliable journey for freight to access the strategic road network.

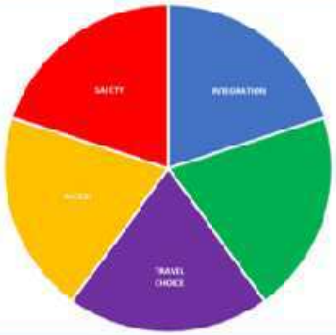
Detailed Business Case Proposal

- Functional intent confirmed as the need to provide strategic arterial linkages around Pukekohe to enhance north-south-east-west movement that is not required to traverse town centre roads and connects to strategic networks. Corridors will incorporate dedicated separated active mode facilities.
- Comprises four individual projects staged for delivery over time (2038 to 2048) to enable and integrate with adjacent growth in Future Urban Zones, encourage active mode use and ultimately complete a strategic arterial network around Pukekohe.
- Four projects all require some form of route protection by AT, packaged into NoR 4 (Pukekohe North-east Arterial), NoR 5 (Pukekohe South-east Arterial), NoR 6 (Pukekohe South-west arterial by) and NoR 7 (Pukekohe North-west arterial). NoR 6 generally only involves designation of property for intersection improvements to enable active mode provision.
- All projects (except SW arterial) will enable two-lane median divided roads with 50 km/h posted speed limits to deliver 5-star safety outcomes and dedicated separated walking and cycling facilities on both sides. The SW arterial will be upgrade to deliver a bi-directional cycle facility on one side of the road.

Key Considerations

- Designating property within the existing urban areas of Pukekohe have been kept to a minimum. Typically this has occurred on the South-west arterial to ensure safe active mode facilities at road intersections The mid-block upgrades will be delivered within the existing road reserve.
- Both north-west and south-east arterials have a mix of widened existing corridor made possible through designation or designation of entirely new corridor within Future Urban Zone. This will allow for optimal integration with adjacent development and support developer led provision of much of the arterial network.
- The north-east arterial from SH22 to Pukekohe East Road arcs the north-east of Pukekohe and is an entirely new corridor, linking east and west Pukekohe growth areas to both the Drury to Pukekohe Link and Pukekohe East Road / Mill Road to the Bombay interchange.
- The corridor passes primarily through Future Urban Zone land, allowing for maximum integration with land use and local networks, however a section east of Cape Hill Road traverses land.

CONTRIBUTION TO INVESTMENT OBJECTIVES: PUKEKOHE ARTERIALS



Pukekohe Arterials primarily contribute to safety, integration, access and travel choice investment objectives

SAFETY



Urban growth across the Pukekohe will result in significantly increased travel demands, especially where increased urbanisation will lead to a higher proportion of active mode users as well as general traffic conflicting with inter-regional traffic and freight.

Evidence

- Waka Kotahi data from the CAS database demonstrates a high number of crashes within the centre of Pukekohe and in the suburban area, including a number of fatal and serious crashes on the future arterial corridors

What if we do nothing?

- With increased urbanisation excess traffic volume, including heavy freight, will mix with greater numbers of walkers and cyclists and local traffic, creating conflicts and increased risks.

INTEGRATION

The magnitude of growth anticipated around the periphery of Pukekohe in comparison to the existing urban area makes a defined arterial network essential for the effective integration of future growth and the management of effects on the transport system.

Evidence

- Traffic volumes on key links around Pukekohe forecast to increase between 25% and 250% as a result of full build out of the Future Urban Zones around the town centre

What if we do nothing?

- Existing local and collector roads already congested at peak times will become worse increasing delays and unreliability leading to rat running in the absence of defined fit for purpose corridors.

ACCESS

The existing local network will not provide sufficient access for future urban zones to realise their full development potential or enable communities to access economic and social opportunities.



Evidence

- The Pukekohe Arterials will provide improved access from Future Urban Zones to the rest of the urban area and to the strategic transport system.
- The absence of the arterials would force new local and collector roads within new development to connect onto the existing network, compounding existing safety and congestion issues.
- Access would be constrained by the limited ability of these corridors to accommodate the nature and scale of the growth involved.
- Provision of the arterials increases the opportunities for local road networks to connect to strategic corridors, enhancing future communities ability to move safely and efficiently within it.

What if we do nothing?

- Without the arterials there will remain a lack of clear differentiation between roads with traffic growth continuing to congest existing roads and constrain access for all modes.
- The absence of a strategic network in addition to SH22 will severely impact access as reliance will be heavily placed on the provision of a collector road network having to meet multiple needs.
- Pukekohe FUZ areas will also be reliant on an internal collector road network accessing existing roads. The ability to provide this safely and efficiently will be constrained.

TRAVEL CHOICE

Future urban development in the absence of the arterials will force traffic through local road networks and onto SH22, impacting upon urban form and undermining the safety and convenience of active modes.

Evidence

- Not providing for active modes is linked to high car dependency other negative outcomes.
- The provision of an active mode network as part of urban development makes these modes attractive, safe and more convenient for short and medium distance trips.
- Opportunity exists to establish high quality strategic walking and cycling links around Pukekohe as part of local network development in FUZ areas and in existing neighbourhoods to influence travel behaviour as populations and communities grow

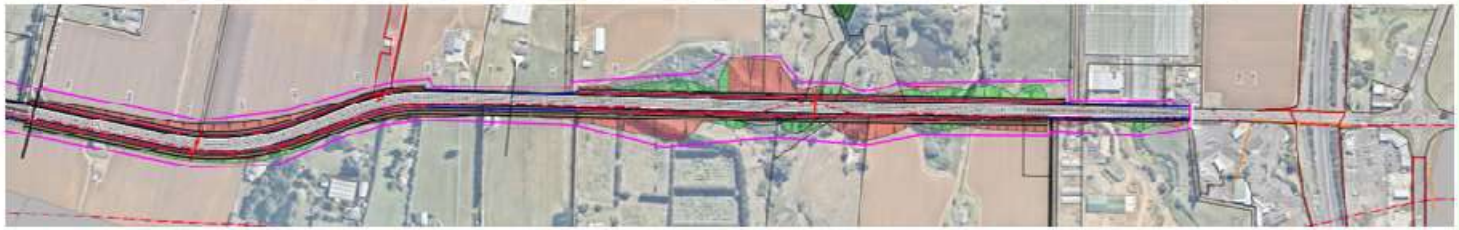
What if we do nothing?

- Growing travel demands will filter through local networks creating congestion and safety concerns
- Limited space for cycle facilities will compound safety concerns and limit the travel choices of residents
- People who do choose to cycle put at risk by lack of dedicated facilities and car dominance of existing infrastructure.

STRATEGIC CASE: PUKEKOHE EAST ROAD & MILL ROAD UPGRADE

Upgrade to Pukekohe East Road and Mill Road from North-east arterial SH1 at Bombay.





Project Background

- Pukekohe East Road and Mill Road identified in IBC in 2019 as a priority.
- Upgrades to deliver safety improvements on Pukekohe East Road and an improved transport corridor (four lanes) from Harrisville Road to SH1.
- Four-laning further west (Pukekohe East Road) rejected to avoid impacts of tuff crater.
- Harrisville to SH1 serves important inter-regional traffic function for Waikato and 4 laning had strong public support
- Provides upgraded and safer strategic connection from Pukekohe arterials to SH1 Bombay



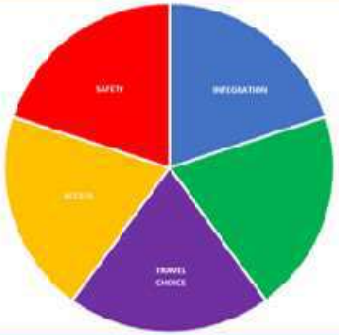
Detailed Business Case Proposal

- Functional intent confirmed as the need to provide a strategic arterial linking Pukekohe and Harrisville Road traffic from Waikato to SH1 at Bombay.
- Pukekohe East Road upgrade provides dedicated separated active mode facilities from north-east arterial to Harrisville Road via widening to the southern side by way of a designation (NoR8).
- Harrisville to SH1 Bombay comprises 4-laning with dedicated separated active mode facilities on the south side. Also via NoR8, with designation both sides.

Key Considerations

- Ties-in with SH1 Bombay interchange upgrade project as part of P2B stage 2 and 3 delivery. Active mode facilities on south side to be integrated with P2B active mode corridor on west side of SH1.
- Extensive corridor refinement has minimised property impacts along corridor, loss of indigenous biodiversity and mature trees and impacts on streams.
- Tie-in at west end integrates active mode facilities for Pukekohe south-east arterial and north east arterial.

CONTRIBUTION TO INVESTMENT OBJECTIVES: PUKEKOHE EAST ROAD & MILL ROAD UPGRADE



Pukekohe East Road and Mill Road Upgrade primarily contributes to safety, access, resilience and travel choice investment objectives

SAFETY

Urban growth across the Pukekohe, Paerata and West Drury Future Urban Zones will result in significantly increased travel demands on Pukekohe East Road and Mill Road, especially at Golding Road, north-east arterial and Harrisville Road intersections, with increased freight, traffic and active mode users.

Evidence
- East of Golding Road volumes forecast to grow from 9,500 to 14,000 vpd
- East of new north-east arterial connection volumes forecast to grown from 15,000 vpd to 19,000 vpd
- East of Harrisville Road volumes forecast to grow from 18,000 to 32,000

What if we do nothing?
- Traffic growth along corridor will increase risk of conflicts with cyclists and make pedestrian crossings essential to avoid increased pedestrian risks.
- Doubling of traffic volumes between Bombay and Harrisville Road with 50% increase in proportion of heavy vehicles.
- Segregated active mode facilities and 2 lanes in each direction will reduce conflicts

ACCESS

Existing form and function of Pukekohe East Road and Mill Road is not appropriate for the level of future growth anticipated. The improvements will integrate with south-east and north-east arterials, enhancing access from suburban Pukekohe to SH1 at Bombay.

Evidence
- Active mode facilities provided continuously along the corridor will overcome the increased risks that will arise from the increase in traffic along the corridor ranging from 50% to 80%.
- Four laning east of Harrisville will enhance inter-regional access from Waikato to the south.

What if we do nothing?
- The quality of the future urban environment in Pukekohe will be effected, limiting its attractiveness and failing to fully realise the development potential of future urban zones arcund Pukekohe.
- The ability to fully integrate active mode facilities into networks will be severely limited through lack of space and safety concerns.

RESILIENCE

The upgrade of the link provides an enhanced strategic connection to SH1 as an alternative to the Drury-Pukekohe link and SH22 at Drury, especially from the Waikato and southern and eastern areas of Pukekohe.

Evidence
- Current strategic traffic function of the link is limited with 2 lanes east of Harrisville presenting a future constraint on the resilience of the corridor.

What if we do nothing?
- Traffic from the Waikato will be delayed accessing SH1 at Bombay or seek alternative routes, increasing pressure on other parts of the network.
- Alternatives routes will be limited when there are unplanned events on the strategic network.



TRAVEL CHOICE

Continuous segregated dedicated active mode facilities along the corridor completes a strategic triangle of connections, linking with both the Pukekohe arterials and the P2D cycleway to the west of SH1.

Evidence
- Not providing for active modes is linked to high car dependency other negative outcomes.
- The provision of an active mode network as part of urban development makes these modes attractive, safe and more convenient for short and medium distance trips
- Opportunity exists to establish high quality walking and cycling links between Pukekohe Paerata and West Drury as urban development happens to influence travel behaviour as populations grow and communities develop.

What if we do nothing?
- Limited space for cycle facilities along the link will compound safety concerns and limit travel choices for residents.
- Traffic growth on the link will make cycling and walking unattractive.
- More experienced cyclists will continue to mix with freight and general traffic increasing the risk of a serious injury or fatality.

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe Appendix B: Options Assessment Report

May 2023

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

Responsibility	Name
Author	[redacted]
Reviewer	[redacted]
Approver	[redacted]

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft would subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Glossary

Acronym/Term	Description
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
ATCOP	AT Code of Practice
AUP:OP	Auckland Unitary Plan: Operative in Part (2016)
Council	Auckland Council
CHI	Cultural Heritage Inventory
CIA	Cultural Impact Assessment
CPTED	Crime Prevention through Environmental Design
DBC	Detailed Business Case
FTN	Future Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
IBC	Indicative Business Case
MCA	Multi-Criteria Assessment
N/A	Not Applicable
NES	National Environmental Standard
NES:FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NES:Soil	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NPS	National Policy Statement
NPS:FM	National Policy Statement on Freshwater Management
NPS:HPL	National Policy Statement on Highly Productive Land
NPS:UD	National Policy Statement on Urban Development
NIMT	North Island Main Trunk
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NoRs	Notices of Requirement
NZ	New Zealand

Acronym/Term	Description
NZUP	New Zealand Upgrade Programme
ONF	Outstanding Natural Feature
ONL	Outstanding Natural Landscape
P2B	SH1 Papakura to Bombay Project
P2P	Papakura to Pukekohe rail electrification Project
Partner	Manawhenua, Auckland Council, Auckland Transport, and Waka Kotahi
PBC	Preliminary Business Case
RLT	Auckland Regional Land Transport Plan
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
SH1	State Highway 1
SH22	State Highway 22
SMAF	Stormwater Management Area: Flow
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
TDM	AT's Transport Design Manual
VKT	Vehicle Kilometres Travelled
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
Zero Carbon Act	Climate Change Response (Zero Carbon) Amendment Act 2018

1 Introduction

1.1 Purpose of this Report

The Supporting Growth Programme is identifying the preferred transport network to support growth in the Drury, Paerata and Pukekohe areas of Auckland. In selecting the preferred transport network, a wide range of options have been developed and evaluated, including transport infrastructure corridors and routes to be protected via designations (or other planning measures).

This Options Assessment Report addresses the options development and assessment process and outcomes for the Detailed Business Case (DBC) being prepared for the Pukekohe Transport Network.

This report provides a summary of the preceding South Indicative Business Case (IBC) Options Assessment (as it relates to Pukekohe Business Case) including the long list and short list phases and describes the DBC options assessment process through to recommendation of a preferred transport network.

The following diagram outlines the process undertaken through the IBC and DBC phases:

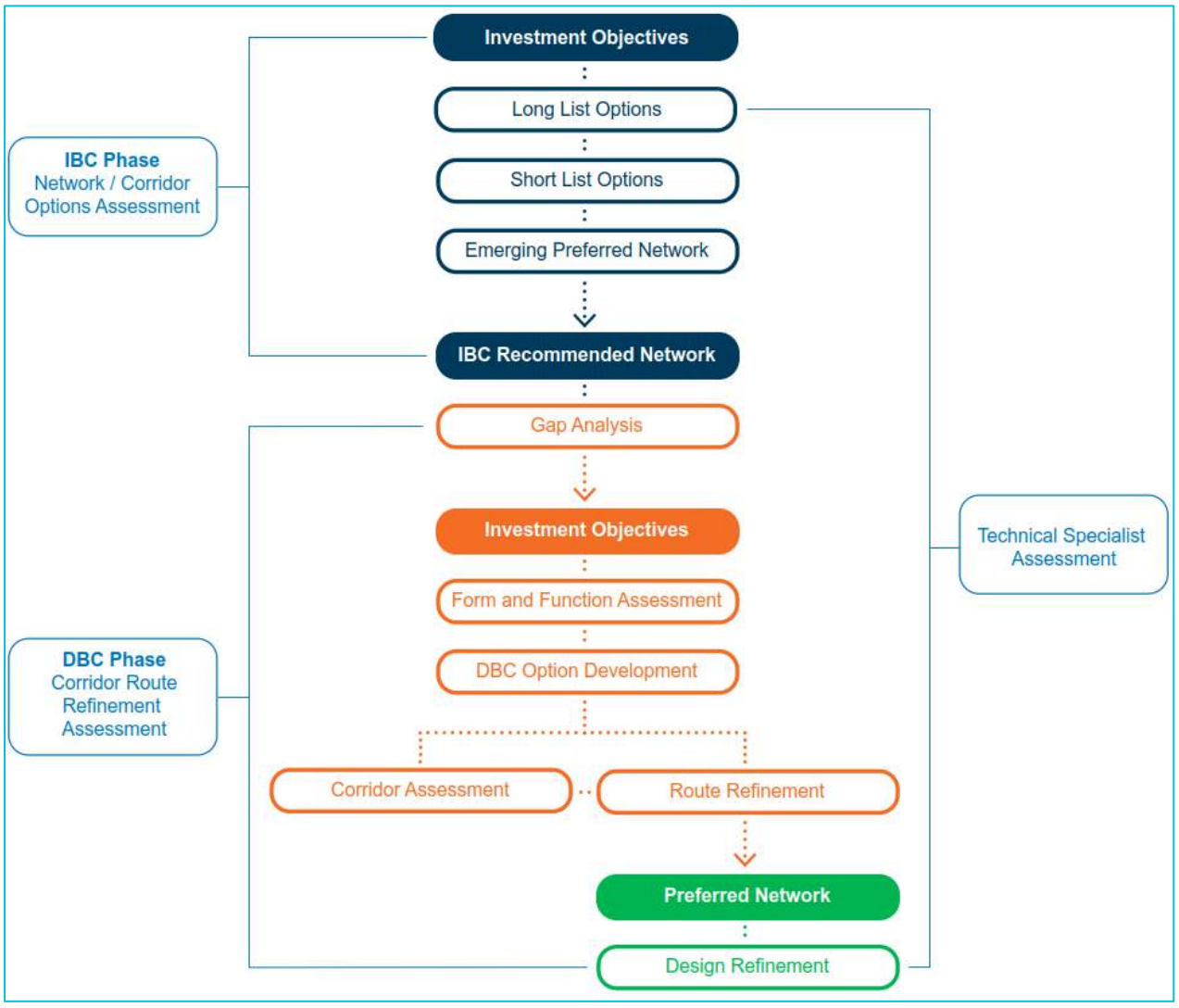

Figure 1-1 Overall Options Assessment Process

1.2 Structure of this Report

The report is structured as shown in Table 1-1.

Table 1-1: Structure of this report

Section	Heading	Description
1	Introduction	This introduction – sets out the purpose and structure of this report.
2	Background	Background to this options report, context around the Pukekohe growth area and previous project phases.
3	Overview of the Option Development and Evaluation Process for the DBC	The DBC option development and evaluation process: gap analysis, option development and evaluation, engagement, form and function and approach to stormwater processes.
4	Corridor Assessment	Sets out the corridor assessment for the Pukekohe DBC components- grouped into option packages: • Drury West Local • Paerata Local • North-South • Network Package Assessment (for Drury West Local, Paerata Local and North South) • Pukekohe Local
4	Route Refinement Assessment	Sets out the route refinement assessment for the Pukekohe DBC components- grouped into option packages: • Drury West • South Drury • SH22 Connection • Drury to Paerata Link • Paerata Arterial • Paerata Connections • Mill Road – Pukekohe East Road • Pukekohe NE Arterial • Pukekohe SE Arterial • Pukekohe SW Arterial • Pukekohe NW Arterial
6	The Emerging Preferred Network	Summarises the Emerging Preferred Network for the Pukekohe DBC

2 Background

Auckland is New Zealand's largest city, home to approximately 1.69 million people. The city is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and from other parts of New Zealand. In 2017, Auckland attracted 36,800 new residents; more than the rest of the country combined. The Auckland Plan Development Strategy (2050) signals that Auckland could grow by another 720,000 people to reach 2.4 million over the next 30 years.

The Auckland Plan anticipates that this growth would generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities. In response to this demand, the Auckland Unitary Plan – Operative in Part (AUP-OIP) identified 11,000 hectares (ha) of predominantly rural land for future urbanisation. This land is equivalent to an area 1.5 times the size of urban Hamilton.

To enable urban development on this land, appropriate bulk infrastructure needs to be planned and enabled. To provide clarity and certainty about when the land identified in the AUP-OIP would be 'development ready', Auckland Council (the Council) developed the Future Urban Land Supply Strategy (FULSS) in 2015. The FULSS provides for sequenced and accelerated greenfield growth in the following areas of Auckland:

- Warkworth
- North: Orewa-Silverdale, Dairy Flat
- North West: Whenuapai-Redhills, Westgate, Kumeū, and Huapai
- South: Takaanini, Drury – Ōpāheke and Pukekohe - Paerata.

In July 2017, the FULSS was updated in line with the AUP-OIP zoning, with an increase to 15,000 hectares of land allocated for future urbanisation.

In response to the FULSS, Auckland Transport (AT), Waka Kotahi New Zealand Transport Agency (Waka Kotahi), and the Council (collectively referred to as the partners) identified a need to determine the most appropriate transport responses to support this envisioned urban growth. A tripartite governance group was formed to develop a response to two key issues:

- Inability to respond in a timely way to the pace and scale of greenfield development would restrict access to jobs, education and other core services around and in growth areas.
- Inability of the regional transportation system to cope with the growing demand of greenfield expansion would reduce travel choice and efficient movement of people and goods.

This joint approach recognised that the proposed growth is likely to require significant new additions to the arterial, local, and public transport network, and integration of such networks with new and existing urban form. It would also likely have impacts on and require improvements to the existing arterial, public transport, and state highway network, and to planning frameworks and/or policy.

The Supporting Growth Programme (Te Tupu Ngātahi) is a collaboration between AT and Waka Kotahi to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years. AT and Waka Kotahi have partnered with Auckland Council, Manawhenua and KiwiRail Holdings Limited (KiwiRail) and are working closely with stakeholders and the community to develop the strategic transport network to support Auckland's growth areas.

2.1 Southern Growth Area

The Southern growth area is approximately 20km south of Auckland's central city and is approximately 30 km in length. This area makes up the largest proportion of future urban areas in

Auckland (45%). It includes the large future urban areas of Takaanini, Opāheke, Drury, Drury West, and Pukekohe-Paerata, and is shown in the wider future urban zones planned in Auckland in Figure 2-1 below.

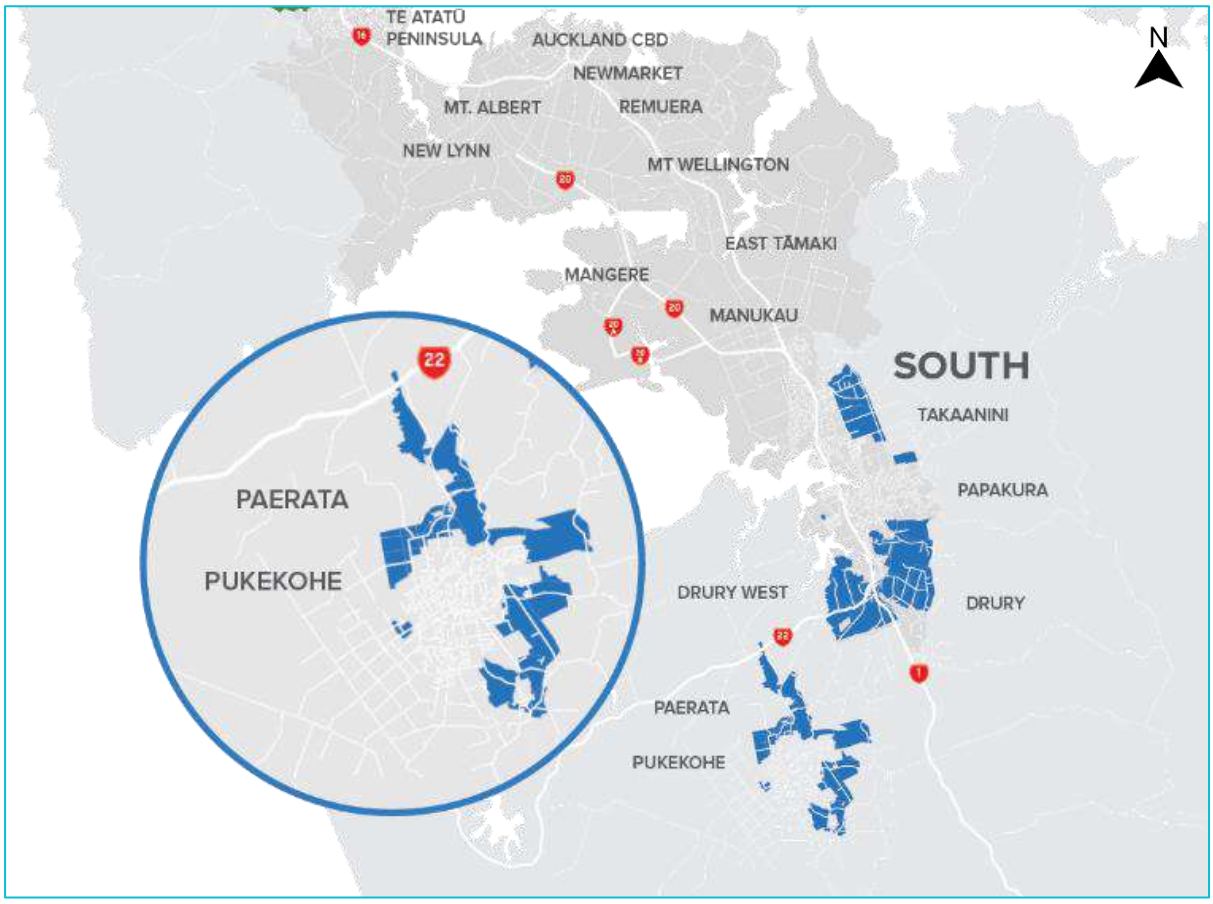

Figure 2-1 South Auckland's future urban growth areas (Pukekohe-Paerata inset)

Growth in the South and within the Pukekohe-Paerata and Drury West is forecast to increase substantially over the next 30 years. In summary:

- Housing in the Pukekohe, Paerata and Drury West is forecast to increase from 12,000 in 2016 to 33,000 in 2048+, a 275% increase, with a corresponding increase in population from 31,000 in 2016 to 86,000 in 2048+.
- Provision of employment opportunities is expected to rise from 11,000 in 2016 to 20,000 (180%) in 2046 in the Pukekohe region.

2.2 Transport for Future Urban Growth Programme Business Case

The draft preferred transport network identified in the PBC by the Transport for Future Urban Growth Programme[1] was informed by an optioneering process, which at a high level, compared various levels of investment for all FUZ growth areas across the region.

[1] *Transport for Future Urban Growth Programme Business Case* developed by Auckland Transport, Waka Kotahi and Auckland Council (2016)

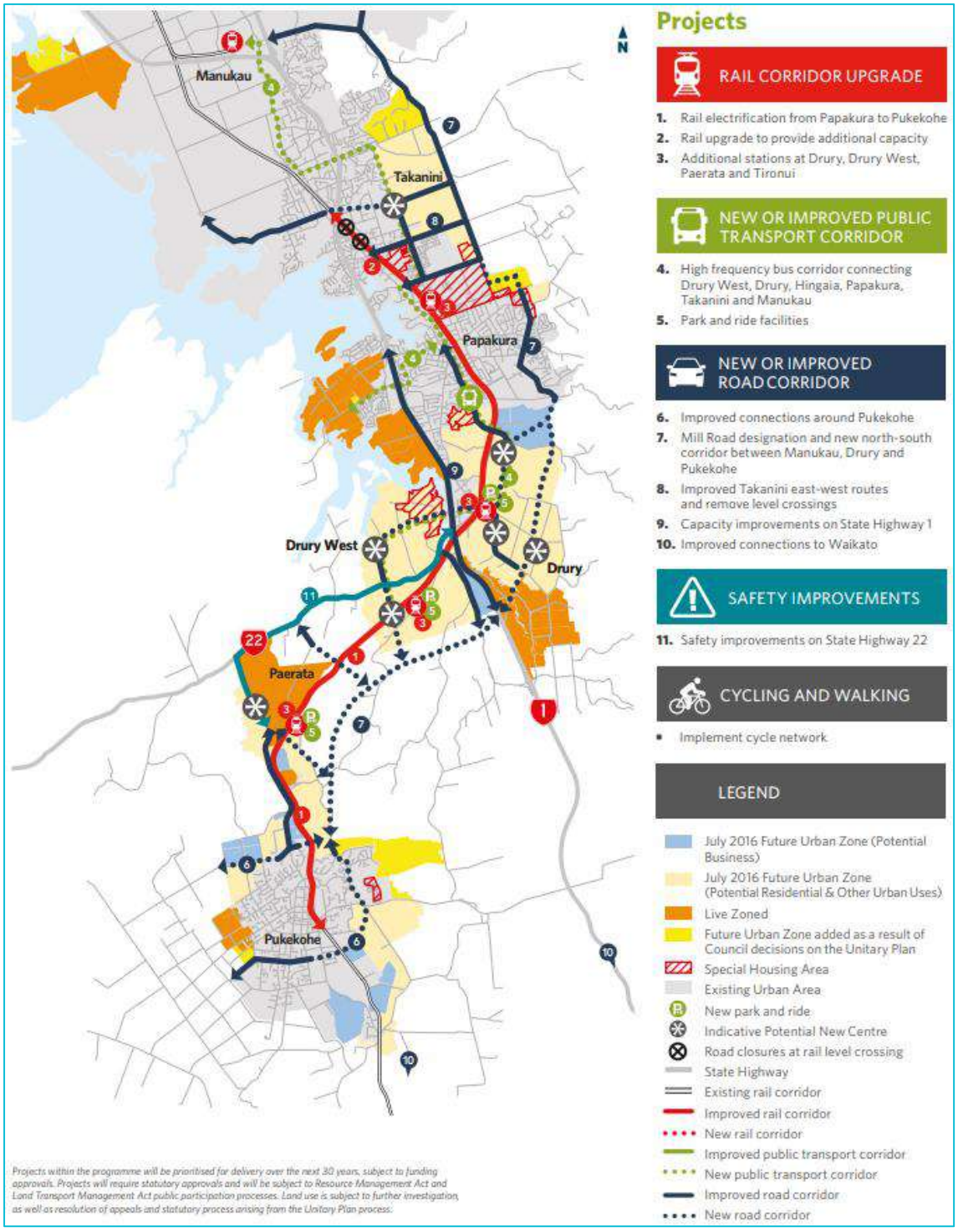

Figure 2-2 TFUG PBC Preferred South Transport Network

Of relevance to Pukekohe, the following issues were raised:

- Pukekohe and Paerata rely on rural highways with limited capacity and safety issues at intersections.
- In the long term, the lack of frequent and efficient public transport network options would trigger poor social and economic outcomes.

- More time spent in congestion (people and goods) impacts economic productivity and ultimately, adversely affects regional liveability indicators, compromising the vision that the future urban areas were established to provide.
- A significant proportion of trips originating in the southern growth area travelled no further north than Auckland Airport.
- The existing public transport network does not connect with many of the larger employment areas in south Auckland.

Options for local and regional roads were considered through the PBC for the southern growth area. Of these, the following three Pukekohe interventions were included in the preferred network to be investigated further in the South IBC:

- Pukekohe Expressway;
- Mill Road upgrade; and
- Pukekohe 'Inner Link'.

The South IBC was completed in 2019 recommending the Indicative Strategic Network for the future urban growth areas in south Auckland. This is discussed in more detail in the next section.

2.3 South Indicative Business Case (2019)

For the South IBC, around 460 options were initially identified, comprising:

- Strategic Connections – 242 options
- Opāheke/Drury – 88 options
- Pukekohe-Paerata – 92 options
- Takaanini – 62 options

The initial long list of 460 options was then filtered to exclude options that were:

- Considered beyond the scope of the IBC (i.e., outside the project area);
- Land use options (opportunities were discussed separately with Auckland Council)
- Already part of a designated/consented/funded project;
- Considered business as usual, so would otherwise be implemented (for example: use of staging);
- Considered unfeasible due to significant physical constraints – based on a high-level engineering assessment (for example, “new train line from South to East - Pakuranga”)
- Duplicates of another option.

Through the filtering process 151 options were taken through to the long list MCA process (further discussed in sections 4,4.2,4 and 4.5).

The South IBC recommended the Indicative Strategic Transport Network for south Auckland growth areas shown in Figure 2-3. This network was endorsed by the Auckland Transport (AT) board in February 2019 and the Waka Kotahi NZ Transport Agency (Waka Kotahi) board in May 2019.

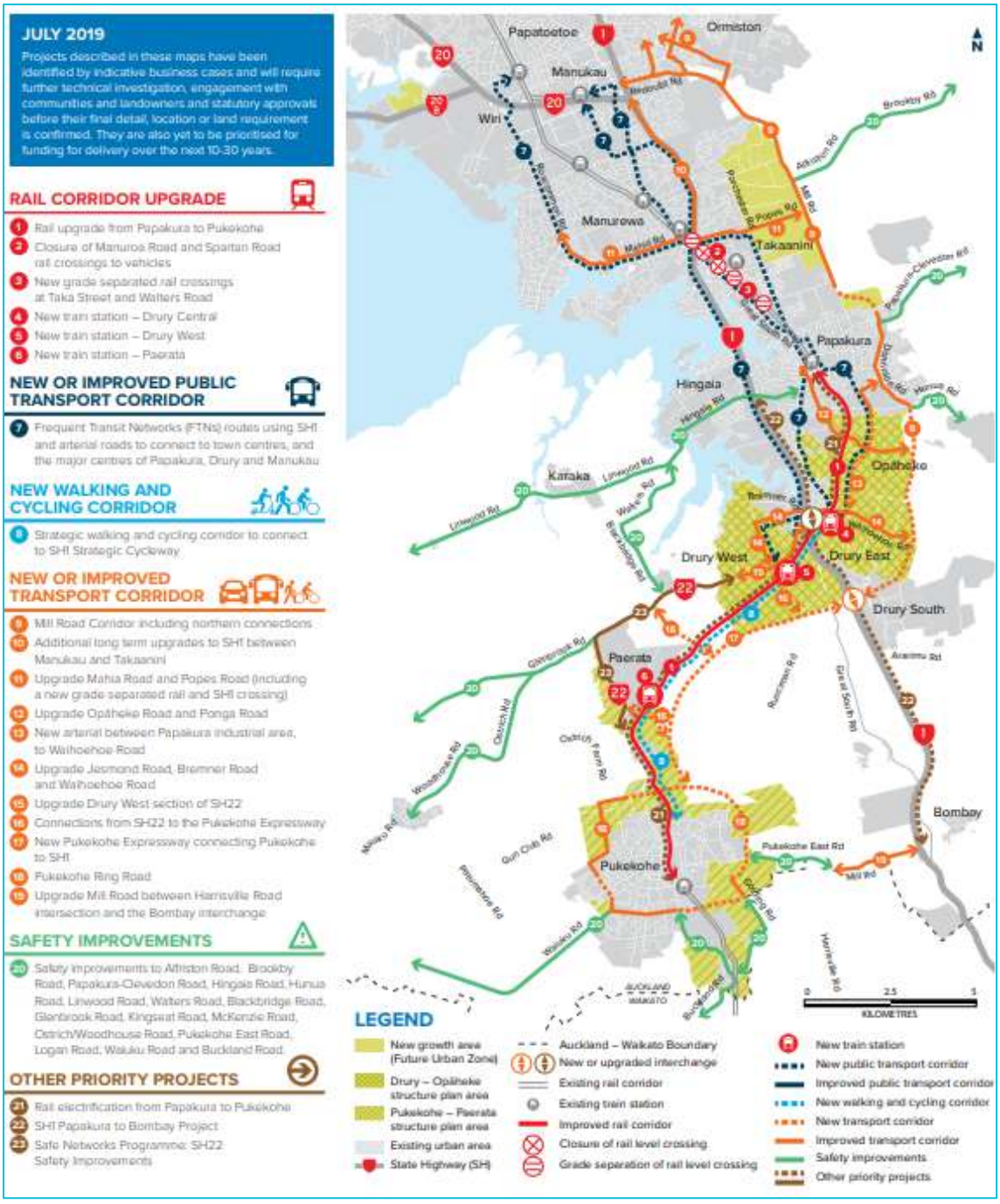

Figure 2-3 Southern growth area – Indicative Strategic Transport Network

2.4 Draft Strategic South Detailed Business Case

After endorsement of the Indicative Strategic Transport Network, the Strategic South DBC commenced which included the “strategic” components of the southern growth areas. This included the Pukekohe Expressway and connections including the north-east section of the “ring route” in Pukekohe.

The Strategic South DBC undertook options assessment on these components and recommended preferred options. Later in 2020, the New Zealand Upgrade Programme (NZUP) announced funding for implementation of the Mill Road components of the Strategic South DBC.

Due to a change in priorities, some of the Strategic South DBC projects were reallocated. The Pukekohe Expressway and connections were included in the Pukekohe DBC. While the Pukekohe projects were not pursued through the Strategic South DBC, they did progress through route refinement options assessment and to public engagement in 2020. The Pukekohe Expressway and Pukekohe Urban Arterial (North East) options were presented to the community for feedback.

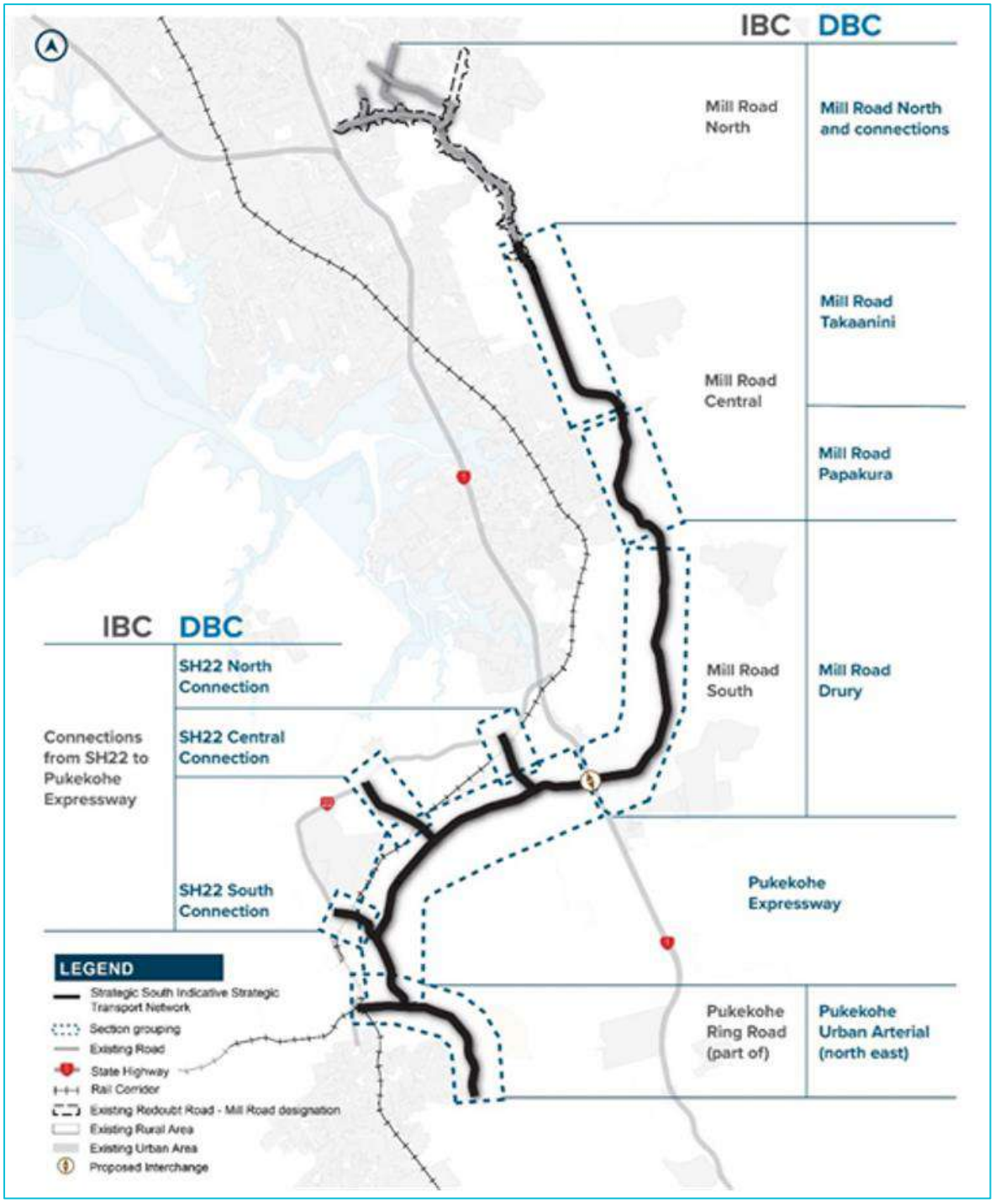

Figure 2-4 Summary of IBC and Strategic South DBC components

3 Detailed Business Case Assessment Process

3.1 Assessment Process

An overview of the DBC option assessment process is provided in Figure 3-1 and further detail described in Table 3-1.

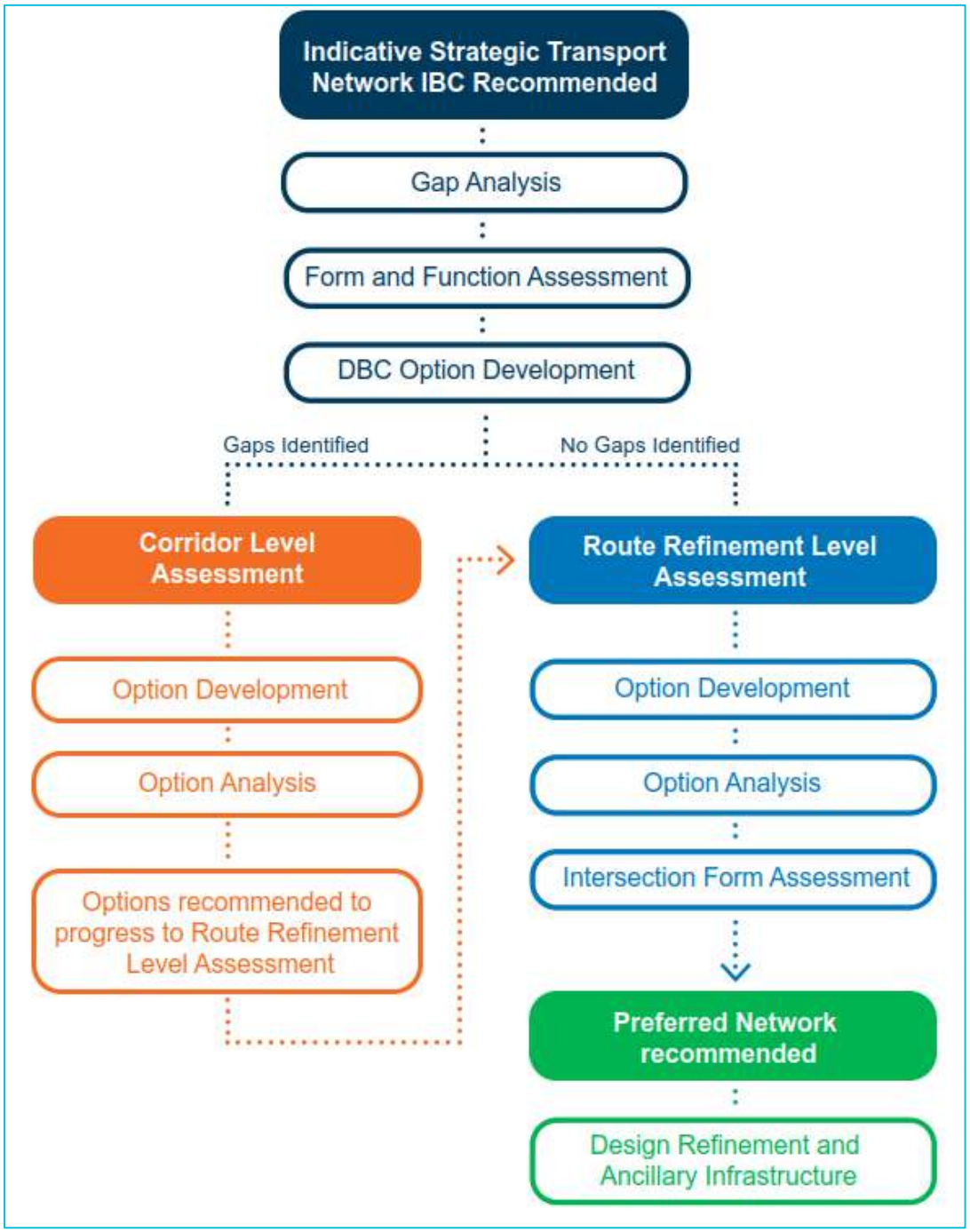

Figure 3-1 Overview of DBC Option Assessment process

Table 3-1 Summary of Options Assessment Process

Stage	Description
SGA GIS Options Assessment Viewer	All options were uploaded to the SGA GIS viewer, an interactive tool to allow all technical experts to view options and known constraints as well as add any additional constraints identified. Due to Covid19 restrictions, the constraints analysis was largely done via desktop analysis. However, a site visit with specialists was held as soon as restrictions lifted in June 2022 to ground-truth the assessments.
Site Visits	31 March 2022 - Project Team, Auckland Transport, Waka Kotahi 1 June 2022 - Manawhenua, Auckland Council, Project Team
Briefing Packs	A briefing pack was provided to technical experts with an outline of the options to be assessed, the criteria to be used in undertaking this assessment including the MCA framework, and a pre-scoring spreadsheet. The pack provided details on the planning and land use context for the various study areas, as well as the programme-wide approach to considering the existing and future environment in the MCA. A briefing session was also held to explain all options and answer any questions from specialists.
Pre-scoring	All technical specialists were asked to review the options in the online tool and map constraints and opportunities within each study area for each project and to pre-score options using the MCA tool prior to the workshop. Supporting each score was an explanation (reason) for the score.
Interdisciplinary workshops	MCA scores were presented and challenged in interdisciplinary workshops. Experts were given the opportunity to amend their scores considering the discussion at the workshop, if they felt that was appropriate. The presence of the design team at the workshop provided a valuable opportunity for experts to clarify / confirm the nature of all the options before confirming or assigning their final scores.
Analysis and testing of results	Following the workshop, the results were reviewed by the project team. This included consideration of how option segments interacted with each other, and how they best fit together. Where necessary, technical experts reviewed the scores and provided additional information. During the route refinement options assessment process, specialists identified several areas where further design considerations could be considered, or refinements should be made to deliver a better outcome. Once a preferred option was selected the Project Team, designers and specialists worked together to identify and make design refinements with the purpose of further minimising impacts of the preferred option through the route refinement assessment. This process was particularly useful where each option assessed had both positive and negative impacts, allowing a more balanced approached that adopted positive, and avoided negative, impacts where possible. Where design refinements were made, they are outlined in the discussion of the Project's preferred options for each option.
Partner engagement	**AT, Waka Kotahi and KiwiRail Specialist Matter Experts (SMEs)**

Stage	Description
	Workshops were held with SMEs to inform and seek feedback on the options developed and the MCA scoring. Their input was sought, and refinements were made where appropriate. **Manawhenua** Regular manawhenua hui were held to explain the options assessment process and seek feedback on the options. It is the preference of manawhenua to provide feedback rather than providing a quantitative analysis of options through the MCA.
Identification of emerging preferred options	Once assessment of the findings of the technical workshops was complete, the Project Team identified emerging technical preferred option(s).
Community Engagement	Following identification of the preferred options after the route refinement assessment, an engagement period took place with the community. This was an opportunity for the public to provide feedback on the preferred options.
Analysis and testing of results	Upon completion of the engagement period, the Project Team met to review the technical preferred option(s) considering the feedback received through engagement and refine the options as necessary.

3.2 Gap Analysis

Due to the length of time between the IBC (approved in 2019), the projects relevant to the Pukekohe DBC that were partially completed through the Strategic South DBC (2020) (that adopted the general corridor alignments from the IBC), and commencement of the Pukekohe DBC (2022) a gap analysis of the options assessment for the IBC was undertaken. The gap analysis included the following:

- Review of Supporting Growth Programme Business Case (formerly Transport for Urban Growth (TFUG)) recommendations.
- Review the South IBC (main document and Options Assessment Report), including the long list and the short list options, and the reasons why options were recommended or discounted.
- Review of the draft Strategic South DBC options assessment and public feedback received.
- Background research, including previous project phases where this assisted understanding of previously identified issues.
- The alignment of the previously recommended options with relevant policy documents (for example, Government Policy Statement on Transport, AUPOIP). In particular, to see if anything has changed since the previous recommendations.
- Alignment with strategic plans other statutory documents and developer aspirations that may have progressed from the previous recommendations. For example, structure plans, plan changes (or appeals), recent Notices of Requirement and developer plans.
- Interaction with other projects in the area.

From the gap analysis, recommendations were made on the approach to developing options.

In summary, the gap analysis recommended corridor assessment of all components of the Pukekohe DBC transport components. This was due to:

- Government policy changes in climate change and response - in particular the GPS for Transport 2021 and Zero Carbon Act (2021) (which amended the Climate Change Response Act 2002).
- Funding of new rail stations in Paerata and Drury.
- Numerous private plan changes lodged or approved.
- Pukekohe Local corridors (apart from the NE Arterial) had not been assessed since 2019 at IBC level.

Specific recommendations are summarised in the corridor assessment for each package of options in section 4. In summary the gap analysis recommended that:

- Further alternatives should be considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads and maximising connectivity to the rail stations, integration with future urban development and increasing mode shift.
- The form and function of the Pukekohe Expressway should be re-assessed and the need for the expressway confirmed.
- As a number of connections including the SH22 connection, Drury West connection and north east quadrant of the Pukekohe arterials interact with the Pukekohe Expressway these also need to be re-assessed based on any movement of the expressway.
- Form and function of the Pukekohe Arterial routes need to be confirmed to inform options assessment (e.g. 2 vs. 4 lane) and if a two lane arterial, consideration needed to be given to upgrading existing roads rather than the offline options recommended in the IBC.

As a result, four groups of options were developed for corridor assessment:

- **Drury West Local** - local connectivity in the FUZ to the station and strategic corridors;
- **Paerata Local** - local connectivity in the FUZ to the station and strategic corridors;
- **North-South** - strategic or local connections between Drury, Paerata and Pukekohe; and
- **Pukekohe Local** – local connections around Pukekohe as alternatives to the current main connection through the Pukekohe centre.

Further details from the gap analysis are contained within each of the options assessment sections in this report (Drury West, Paerata, North South and Pukekohe Local).

3.3 Options Development

A long list of preliminary options was developed for each group, considering the indicative transport network identified in the IBC, the gap analysis and a high-level assessment of key engineering/design constraints including:

- Geology
- Contours and potential earthworks requirements
- Floodplains and flood sensitive areas
- Live zoning, plan changes and structure plans
- Sensitive areas such as AUP:OP overlays, critical services and special purpose zones.

The initial options were loaded into the Pukekohe GIS Constraints Online tool. This viewer included numerous constraints and management layers that can be turned on and off, including constraints/opportunities tagged during the IBC phase, all AUP:OP management layers and zoning, the public CHI register, Auckland Council geomaps landbase and Environment, and Cultural Heritage Environmental Assets.

The options were drawn in the GIS viewer as corridor centrelines with 50m route buffers either side of the centreline for new corridors and 30m from the centreline for upgrades to existing corridors. Each option segment had a unique code.

An analysis of initial constraints/opportunities assessments was carried out and recommendations were made for the long list of options to modify, discount or add new options.

3.4 Option Evaluation

To evaluate and compare options, a Te Tupu Ngātahi programme-wide assessment framework which included a Multi-Criteria Assessment (MCA), was developed by the Project Team in consultation with AT, Waka Kotahi and Manawhenua to be used throughout the Te Tupu Ngātahi.

An MCA framework is a common tool that is often used to assist in the decision-making process and provides an opportunity to understand how different options compare against a set of standard and grouped criteria.

The MCA framework developed by the Project Team was applied at both the IBC and DBC phases of Te Tupu Ngātahi and involved the following:

- Assessment criteria: Investment Objectives and the four well-beings: Cultural, Social, Environmental and Economic.
- Additional inputs: Partners, stakeholder and public feedback where this helped to differentiate between options.

Options were assessed using the MCA framework set out in

Table 3-3and where appropriate, scored on an eleven-point scale shown in Table 3-2. Assessment of the criteria was completed by subject matter experts and discussed at MCA workshops.

Table 3-2 MCA Scoring Scale

Effects criteria	Scoring
Very high adverse impact	-5
High adverse impact	-4
Moderate adverse impact	-3
Low adverse impact	-2
Very low adverse impact	-1
Neutral impact	0
Very low positive impact	1
Low positive impact	2
Moderate positive impact	3
High positive impact	4
Very high positive impact	5

Table 3-3 Te Tupu Ngātahi MCA Framework

Investment Objective				Measure
Investment Objectives				Options assessed against the investment objectives: • Safety - Provide a transport network that is safe for all users within and between Pukekohe, Paerata and Drury West • Integration - Provide a transport network that minimises conflict between movement and place, and contributes towards well-functioning future urban environment • Access - Enable access to economic and social opportunities by providing multi-modal corridor • Resilience - Enable resilient freight and people movement to, from and within Pukekohe, Paerata and Drury West • Travel choice - Enable travel choice in Pukekohe, Paerata and Drury West by enhancing access to the existing rail network and providing a safe and attractive walking and cycling network
Well-being	**MCA topic**	**#**	**Criteria**	**Measure**
Cultural	**Heritage**	1a	Heritage	Extent of effects on: • sites and places of valued heritage buildings, scheduled trees (with heritage value) and places. • sites and places of archaeological value. • sites and places of European cultural heritage value
Social	**Socio – economic impacts**	2a	Land use futures / integration with planned landuse	To what extent would the option impact on the future development of land (within the corridor, adjacent to it and impacted by it – i.e., consider all three scales), in relation to: • Integration with the future land use scenario (including any Structure Plans or Plan Changes) • Size and shape of potential development parcels to enable appropriate building typologies
		2b	Urban design	To what extent does the option support a quality urban environment (both current and future planned state), particularly relating to: • Context and planned place making considerations • An inviting, pleasant and high amenity public realm • Open space integration • Active interface between public and private realm • Scale of long-term impact on the amenity and character of the surrounding environment.

Investment Objective				Measure
		2c	Land requirement / property	The extent of property effects: • Scale of public / private land (m2 / number of properties / special status of impacted property) required to deliver the option • Ability to consolidate residual land • Access
		2d	Social cohesion	Impact on, use, connectivity / accessibility for and to the existing urban areas including use and access to: • Employment • Other communities or within the same community • Shops / services / other community and cultural facilities / 'attractors' • Severance of the existing community (including consented) • Scale of effect on existing community facilities community and open space • Public access to the coast, rivers and lakes
		2e	Human Health and Wellbeing	Would the option potentially affect any sensitive land uses nearby or consented (adjacent residential, childcare centres, hospitals, rest homes, marae and schools)? particularly relating to: • Air Quality • Contaminated land • Noise and vibration
Environment	**Natural Environment**	3a	Landscape / visual	The extent of effects on: • The natural landscape and features such as streams, coastal edges, natural vegetation and underlying topography – acknowledging planned changes to area in light of urban land use / zoning • Natural character and outstanding natural features/landscapes including geological features (mapped and protected features) • Visual effects
		3b	Stormwater	Impact of operational stormwater (both quantity and quality) on the receiving environment, including: • Potential flooding effects of the option within the catchment • Extent and consequences of likely mitigation measures • Consideration of future climate change scenarios
		3c	Ecology	Extent of effects on: • Significant indigenous flora; • Significant habitats of indigenous fauna; • Indigenous biodiversity; • Stream / waterway ecology • Marine ecology

Investment Objective				Measure
		3d	Natural Hazards	Extent of effect on adverse geology; steep slopes; seismic impacts; other resilience risks (low level infrastructure near coastlines, inundation areas)
	Construction impacts	4a	Embodied carbon emissions	Consider the following design requirements: • Length (in km) • Area of impervious surface/ volume of earthworks • Specific infrastructure requirements (e.g. bridges, viaducts, tunnels etc.)
		4b	Construction impacts on utilities / infrastructure	Requirements for relocation / design of existing infrastructure, including: • Consideration of safety impacts • Risk of continuity of service over construction • Opportunities for integration with other bulk infrastructure
		4c	Construction Disruption	Construction impacts on people and businesses regarding: • Traffic & noise • Earthworks related effects including dust • Quality of life and amenity • Economic impacts on businesses / community / town centres
	Cost & Construction Risk	5a	Construction costs / risk / value capture	Assessed cost for construction of options including: • Complexity and risk in construction (including consideration of constructability, earthworks cut/fill balance and material reuse) • Complexity in programme • Cost and complexity of safely undertaking works (including works on contaminated land) • Extent to which the option can use a value capture mechanism to offset construction costs.

3.5 Engagement

As set out in the section above, feedback from partners, stakeholders and the community is an important part of the options assessment process. Below sets out where and when feedback was sought during the options assessment process.

3.5.1 Partners

Partners includes representatives from Auckland Transport and Waka Kotahi (SMEs), KiwiRail, Auckland Council and Manawhenua. Partners were given the opportunity to provide feedback throughout the development and the options assessment of both corridor and route refinement assessments.

This section sets out some of the key dates and activities with partners. Feedback received throughout the process is set out in each of the options assessment tables in this report (corridor and route refinement for each package of options in section 4 and section 4.5).

Eight workshops were undertaken with Te Tupu Ngātahi partners at the beginning of the project including representatives Waka Kotahi, Auckland Transport, manawhenua, Auckland Council and KiwiRail. The purpose of the workshops was to gain feedback on the options development and corridor assessment of the North South, Drury West and Paerata packages.

- **Workshop 1** – 8 April 2022 – introduction to workshop series to collectively test Pukekohe Expressway's role in the network, considering whether alternative options could achieve outcomes sought, and how changing policy direction could impact timing and sequencing.
- **Workshop 2** – 22 April 2022 - an overview of the project area history, site context, features and constraints.
- **Workshop 3** – 6 May 2022 – Waka Kotahi, Auckland Transport, KiwiRail and manawhenua perspectives on the project area.
- **Workshop 4** – 20 May 2022 - Auckland Council's perspectives on the project area. The project team also presented outcomes sought for the Pukekohe Transport Network.
- **Workshop 5** – 3 June 2022 - to provide an overview of network outcomes with and without Pukekohe Expressway.
- **Workshop 6** – 17 June 2022 - to present and discuss options assessment process and provide an overview of the approach to packaging corridor options into Drury West, Paerata and North South options.
- **Workshop 7** – 30 June 2022 - to present the outcomes of corridor assessments for each package and seek feedback.
- **Workshop 8** – 29 July 2022 – to present the recommended corridor options as a network and next steps (approach to route refinement and public engagement).

The below sets out feedback received at the partner workshops relevant to the project area. Specific feedback on individual options is included in each options assessment tables in section 4 and section5).

During the partner workshops, there was discussion around Pukekohe's role as a satellite town – to be as self-sufficient as possible, i.e., providing employment opportunities, not just housing. It was suggested that environmental and cultural landscape outcomes should be prioritised with a target of enhancing environment and landscape rather than just preserving it as it is.

Auckland Transport shared their perspective on the importance of each part of the South Indicative Strategic Transport Network and how it functions together. The following was suggested when considering the Pukekohe Transport Network options:

- Traffic volumes on unsafe rural corridors and minor roads.
- Crossing points across the railway tracks.
- Connection of communities to the strategic network, park and ride, and walking / cycling.
- Growth is already occurring in Pukekohe, Paerata and Drury with more planned via Private Plan Changes.
- Significant development pressure outside of the area as well for example in Waikato.
- Glenbrook Steel Mill has expansion plans.
- Staging and sequencing of interventions is critical to respond to growth.

Auckland Transport also noted that Options NS4 and NS5 might still require interim safety upgrades.

Waka Kotahi expressed the following key issues:

- Uncertainty around growth forecasts with the NPS-UD and MDRS.
- Consider different growth scenarios and sensitivities.
- Gap around increasing employment in Pukekohe.
- Emissions Reduction Plan - 20% reduction in vehicle kilometres travelled across NZ.
- Auckland Council Future Development Strategy (FDS) - need to assess interrelated projects around Pukekohe and Drury, such as:
    - SH1 P2B - section between Drury and Bombay interchange planned for route protection.
    - Drury south interchange connection tie in.
    - Bombay interchange.
    - Safety and capacity issues would require long term major upgrade. Interim safety improvements are underway.
    - NZUP - SH22 urbanisation is part of shortlisted projects that are being progressed. Carefully consider what investment is required at SH22 and Mill Road (Bombay) if Pukekohe Expressway does not occur.

KiwiRail shared the following perspectives:

- Electrification of railways expected to be complete by 2025, which would result in higher frequencies of services. Need to consider how development would occur across the railway, including permeability.
- Ensure railway operation continues during the construction of Pukekohe Expressway.
- Considerations of connections to the three new rail stations in the project area.

Auckland Council shared the following perspectives:

- Two Private plan changes have been lodged along Golding Road.
- Developer activity around Helvetia Road and west of SH22.
- Difficult to anticipate developer pressures resulting from NPS-UD.
- Less constrained sites are likely to have more developer interest (example Wesley, Paerata Heights).

Manawhenua raised the following matters:

- Concern that the Pukekohe Expressway has the potential to induce more growth areas currently zoned rural.
- Two Pā sites within the study area.
- Preference for Waiohua to lead the conversations - Te Ākitai Waiohua, Ngāti Te Ata Waiohua and Ngāti Tamaoho.
- Protection and preservation of Waahi Tapu.
- Iwi governance should be considered.
- Significant cultural landscape locations within the study area noted:
    - Tuhimata Pā.
    - Raventhorpe reserve SEA.
    - Pukewhau bowl.
    - Pukekura / Red Hill.
    - Ngaakoroa stream.
    - Oira Creek.
    - Whangapouri Stream.

- Manawhenua do not support further growth outside of the FUZ land. Difficult to justify two-lane arterial through greenfield rural zoned areas as this could induce further development on both sides. Advocates for four lanes as this is future proofing given predicted growth. But this does depend on potential impacts on bat movement and stream crossings.
- Any tolling roads should be done with consideration for road users who do not have viable alternatives.

Summary of SME Activities

After the initial partner workshops as described above, further SME workshops were held with Auckland Transport, Waka Kotahi and KiwiRail as the project progressed through options assessment. These forums provided the SMEs an opportunity to provide feedback on the options development, assessment and recommendations. Specific feedback (when this was provided) is set out in each of the options assessment tables in this report (corridor and route refinement for each package of options in section 4 and section 05).

Summary of Manawhenua engagement activities

Manawhenua are a partner in Te Tupu Ngātahi and regular two weekly hui is set up with southern manawhenua. The project team attended a number of hui to share progress on options development and seek feedback during options assessment. Table 3-4 below identifies manawhenua representative attendance at each hui. As mentioned earlier, specific feedback (when this was provided) is set out in each of the options assessment tables in this report (corridor and route refinement for each package of options in section 4 and section 5).

Table 3-4 Manawhenua representative attendance by hui

Date of hui	Manawhenua representative in attendance
March 3 2022	Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Maru, Te Patu Kirikiri, Ngai Tai Ki Tamaki
April 7 2022	Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Maru, Ngāti Paoa Trust Board
April 26 2022	Ngāti Tamaoho, Te Ākitai Waiohua, Ngāi Tai ki Tāmaki, Ngāti Tamaoho, Ngāti Whanaunga, Ngāti Tamaterā
May 5 2022	Ngāi Tai ki Tāmaki, Ngāti Maru, Ngāti Tamoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Tamaterā
June 2 2022	Ngāti Maru, Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitai Waiohua, Ngāti Tamaterā, Ngāti Te Ata
June 21 2022	Ngāti Tamaoho, Te Ākitai Waiohua, Ngāti Whanaunga, Ngāti Maru
July 7 2022	Ngāti Tamaoho, Ngāti Paoa Trust Board, Ngāti Tamaterā, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Whanaunga
July 8 2022	Ngāti Te Ata Waiohua, Ngāti Tamaoho
July 28 2022	Site visit with Ngāti Tamaoho and Ngāti Te Ata Waiohua
August 4 2022	Ngāti Tamaoho, Ngāti Tamaterā, Te Ākitai Waiohua, Ngāti Whanaunga
August 23 2022	Ngāti Tamaoho, Te Ākitati Waiohua, Ngāti Whanaunga, Ngāti Maru, Ngāi Tai ki Tāmaki
September 27 2022	Te Ākitai Waiohua, Ngāti Whanaunga, Ngāti Tamaterā, Ngāti Paoa Trust Board
October 6 2022	Te Ākitai Waiohua, Ngāti Te Ata Waiohua, Ngāti Tamaoho, Ngāti Tamaterā

October 12 2022	Ngāti Te Ata Waiohua (including site visit)
October 25 2022	Te Ākitai Waiohua, Ngāti Tamaoho, Ngāti Tamaterā, Ngāti Whanaunga, Te Ahiwaru, Ngāti Maru, Ngā Tai Ki Tāmaki
December 1 2022	Te Ākitai Waiohua, Ngāti Tamaoho, Ngāti Whanaunga
December 15 2022	Te Ākitai Waiohua, Ngāti Tamaoho
December 19 2022	Ngāti Te Ata Waiohua

3.5.2 Stakeholders and Community

Between 1 November and 20 December 2022, Te Tupu Ngātahi asked the community, and key stakeholders for feedback on the emerging preferred options for the future transport network for south Drury, Paerata and Pukekohe. The options presented focused on the route refinement options assessment. However, parts of the corridor assessment were also presented in some instances to show the range of options assessed. Feedback was collected using an interactive map and an online survey. The project team also held two community open days on 12 November 2022 (Franklin: The Centre) and 3 December 2022 (Pukekohe Memorial Hall) and attended the Waka Kotahi Papakura ki Pukekura – Papakura to Bombay open day on 10 December 2022. All open days were well attended by the community.

Key stakeholders were also met with or provided feedback included:

- Local developers
- Bus and Coach Association New Zealand
- Federated Farmers of New Zealand
- Grace James (and surrounds) Residents Group
- Karaka Residents and Ratepayers Association
- Pukekohe Business Association
- Waikato District Council – Mayor Jacqui Church

One on one meetings were also held with landowners where this was requested.

Feedback received on specific options (or group of options) is set out in each of the options assessment tables in this report (corridor and route refinement for each package of options in section 4 to section 4.5).

3.6 Form and Function

3.6.1 Form and Function Considerations

During the IBC phase of the business cases, detailed recommendations on form and width were largely deferred to the DBC investigation phase. This level of detail was generally considered beyond the scope of the IBC phase. As such, during the DBC phase, assessments were undertaken to determine the form and function of DBC projects. This section outlines the form and function assessment process.

At a programme level for the DBCs at Te Tupu Ngātahi, a form and function assessment tool has been developed to support consistent decision making. The intent of the tool is to encourage well-

rounded thinking about both the place and movement function of corridors and avoid focus being placed on a single element, for example the role of the corridor in moving general traffic.

The output of the assessment is a desired cross section for the corridor being assessed. Typical cross sections for the Supporting Growth Programme were confirmed through a collaborative process with AT and Waka Kotahi. This included a set of standard cross section typologies that could be implemented across the Supporting Growth Programme and its networks. This decision was then socialised with the project owner (AT or Waka Kotahi) and approval obtained to proceed to design and options assessment.

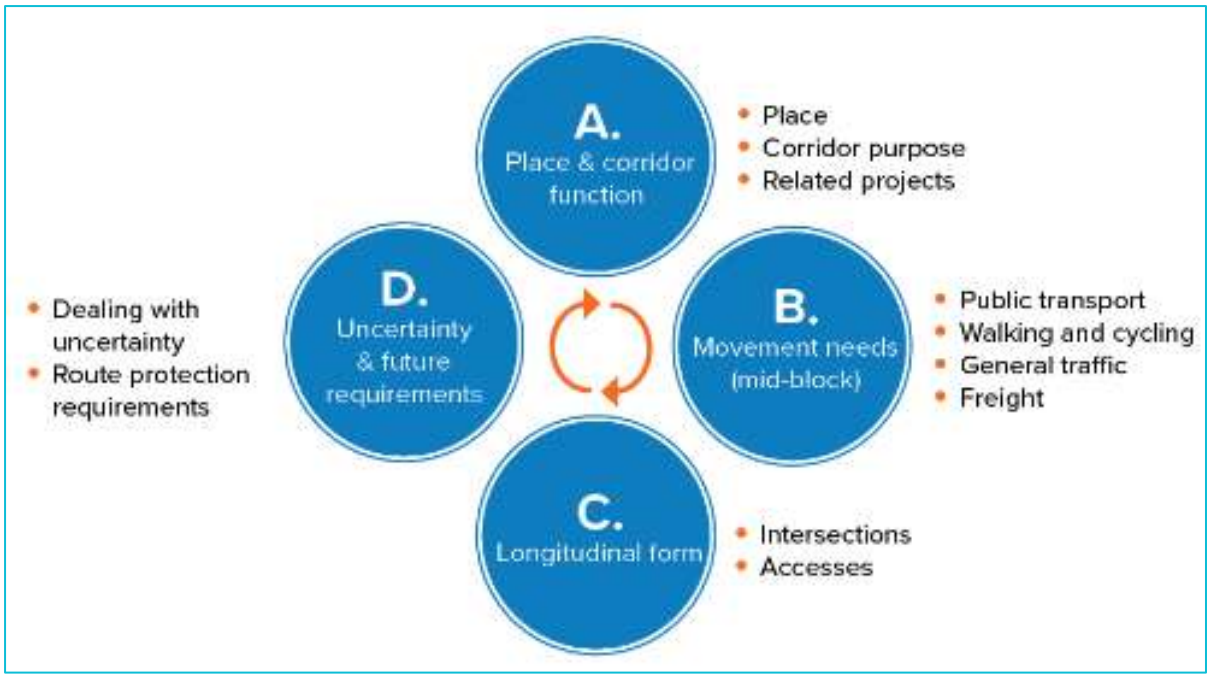

Figure 3-2 Form and function principles

The form and function assessment undertaken for each Pukekohe corridor is summarised in each of the sections route refinement assessments in section 5 . Figure 3-3 provides an overview of the form and function for the Pukekohe projects.

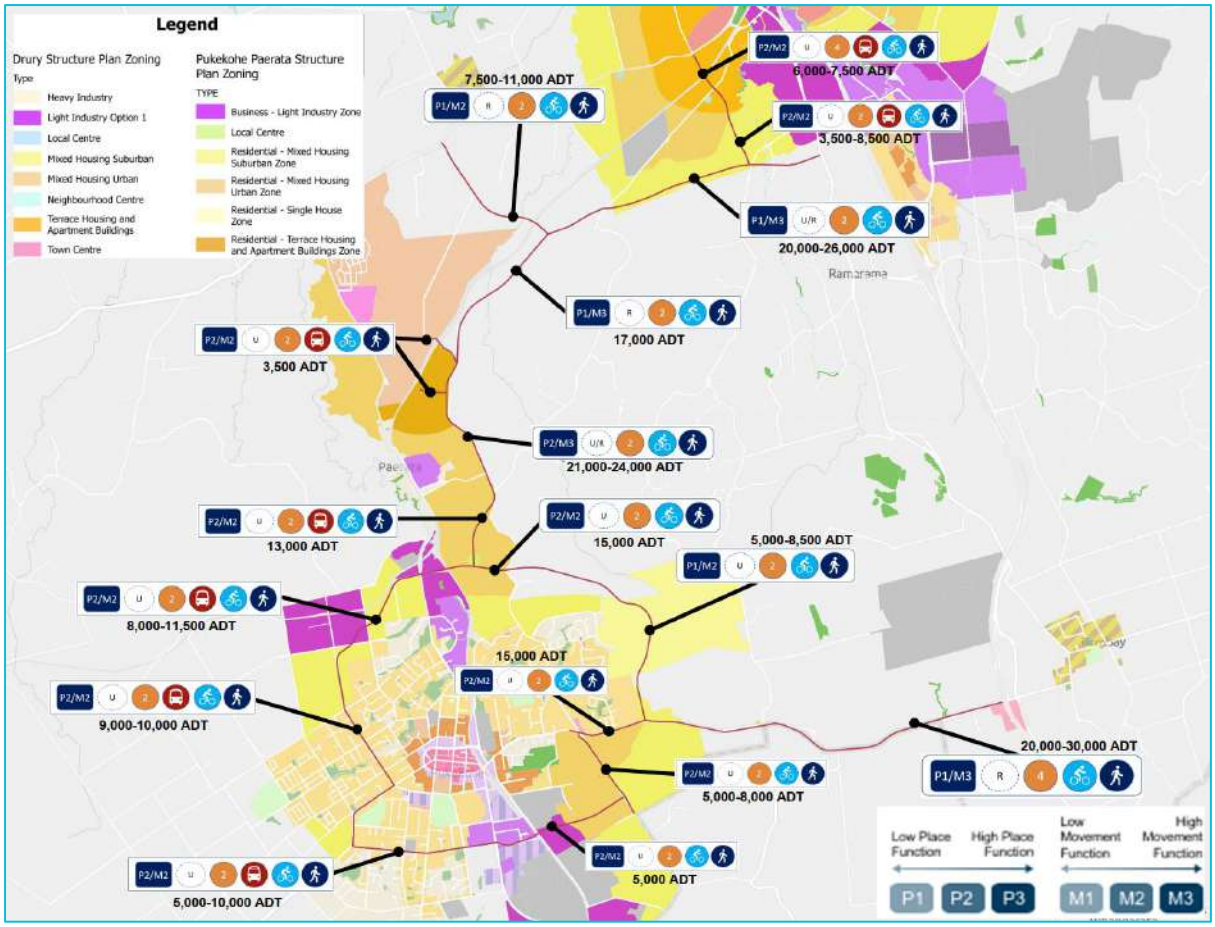

Figure 3-3 Pukekohe projects Form and Function

3.6.2 Interdependencies in the network

Table 3-5 provides an overview of the interdependencies and relationships between Pukekohe Projects and other projects in the wider South Auckland Area.

Table 3-5 Interrelated transport projects

Package	Project(s)	Inter-relationships with Pukekohe DBC
Drury Arterials	Frequent transit network (FTN) and Arterial Upgrades to Jesmond Rd, Bremner Rd and Waihoehoe Rd West (all designations confirmed in the AUP)	The functional intent of the FTN route in Drury is to provide north-south, and east west connectivity across the Drury area, and to form part of the Southern FTN connecting to the rail network and proposed Mill Rd improving multimodal connection. These projects interact with the Drury West Arterial (part of the Pukekohe DBC projects) that connects from SH22/Jesmond Road intersection and the Drury West rail station to the south of the Drury FUZ.

Package	Project(s)	Inter-relationships with Pukekohe DBC
	Upgrade of SH22 between Oira Road and the SH1 Drury interchange (alteration to SH22 designation confirmed in the AUP)	This upgrade provides walking and cycling connections and better accommodates freight and general traffic to support current and future residents. This section of SH22 is important in the context of the urbanisation of the surrounding area, and the proposed rail upgrades and new rail stations. To support the urban growth in Drury, the upgrade to SH 22 proposes a change in the form and function from a State highway to an urban arterial (with an associated reduction in speed). In the longer term, as growth increases in the area and subsequently the volume of trips along this road, a strategic alternative connection is required to alleviate regional traffic flows and allow SH 22 to retain its urban arterial function. The Drury West Arterial (part of the Pukekohe DBC projects) interacts with this project at SH22/Jesmond Road intersection.
Rail DBC / Stations NoR	Rail capacity improvements between Pukekohe and Papakura (and associated grade separations at road/rail crossings)	Additional and more reliable rail capacity is anticipated to improve mode shift in the southern growth area. This would result in alleviating traffic pressures off the network, improving capacity along strategic routes. The Pukekohe DBC projects provide a number of new bridge crossings across the NIMT.
	New rail stations at Drury Central, Drury West and Paerata	Two new stations are proposed in Drury and one in Paerata. Drury Central and Paerata rail stations have been confirmed, the Drury West rail station NoR (and resource consents) has been lodged. The Pukekohe DBC projects provide new connections to the Drury West and Paerata rail stations.
	Proposed Regional Active Mode Corridor (AMC) between SH 1 and North Island Main Trunk Line (NIMT)	The Regional Active Mode Corridor provides a direct connection to stations/centres along the NIMT. The Pukekohe DBC projects interact with the proposed AMC where projects propose new crossings of the NIMT.
Mill Road DBC	Proposed Mill Road Corridor	A proposed new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South. The corridor links into the proposed Drury South Interchange. Funding was announced for implementation of Mill Road through NZUP. The status of the Mill Road corridor is uncertain at this stage. The Pukekohe DBC projects interact with the proposed alignment of the Mill Road at the proposed Drury South Interchange.

SH1 Papakura-to-Bombay (P2B) (NZUP)	The P2B project is being delivered by Waka Kotahi as a mixture of implementation works and route protection (for future implementation). The Papakura to Bombay project builds on the Southern Corridor Improvements, and includes upgrading the alignment to six lanes, providing wide shoulders to future-proof for bus services along the SH 1 corridor; interchange improvements; and a shared path. The Pukekohe DBC projects interact with P2B corridor at the proposed Drury South Interchange.
Safe Roads SH 22 Karaka Road (Safe Network Programme)	Waka Kotahi Safe Network Programme (SNP) includes SH22. The Glenbrook Road and SH22 roundabout has recently been constructed. SNP also includes other safety improvements at other locations along SH22 corridor, as well as reviewing the speed limits. The Pukekohe DBC projects interact with SH22 in a number of places.
Papakura to Pukekohe rail electrification	Funding has been allocated for an additional 15 electric trains to enable electric rail services to be extended to Pukekohe and to provide additional capacity on the rail network. Rail electrification removes the need for passengers to change trains at Papakura, increasing the attractiveness of public transport in the South. Construction works are already underway for this project. The Pukekohe DBC projects provide new crossings of the NIMT in a number of places.

3.7 Intersection Form Assessment Process

Once the preferred route refinement options were identified, an assessment was undertaken to determine preferred intersection forms across the network. Figure 3-4 outlines this process of deciding on the typology, where an intersection is required.

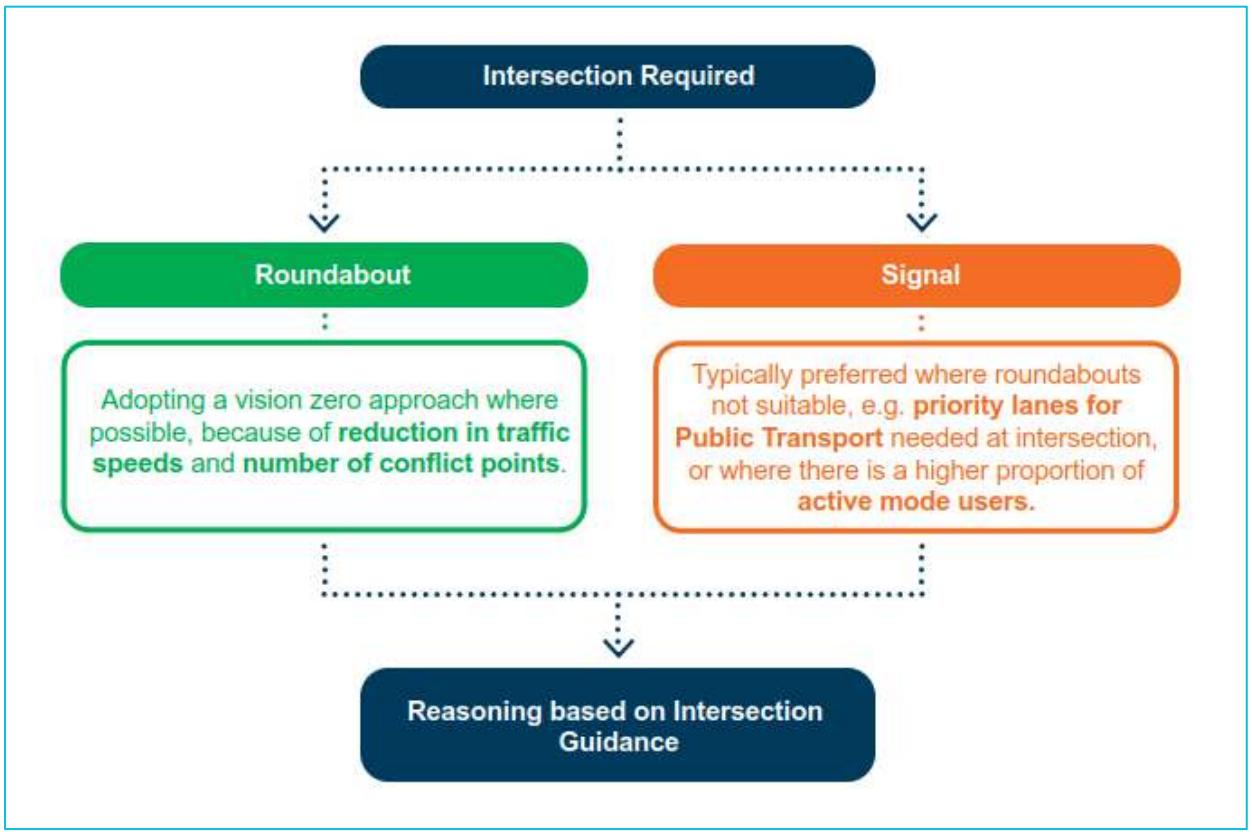

Figure 3-4 Intersection typology decision-making

Considerations for intersections in Pukekohe included:

- Maintaining access to private property where practicable, but not in a way that precluded efficient movement along the corridor, particularly for PT and active modes
- Adequate consideration of modal needs at intersections, for example priority intersection requirements for FTN and safe and efficient crossing opportunities for active modes
- Intersection size (determined by SiDRA modelling), particularly in more constrained existing urban areas
- Ensuring each intersection had sufficient space for queuing length and the level of service is acceptable

Where an intersection is required, Programme Wide guidance is used to determine whether this should be a roundabout or a signalised intersection. The guidance considers a number of factors including operational performance, safety, road environment and different road users. The guidance adopts a 'Safe Systems' approach and recommends roundabouts as the first choice for at-grade intersections due to the safety benefits for vehicular traffic resulting from slowing down through traffic and reducing the number of conflict points. However, where roundabouts are not appropriate, signalised intersections are then analysed. For either intersection typology chosen, design features are also considered to ensure that the intersection meets the needs of different users safely and effectively and responds to the site-specific factors. These factors are summarised in Figure 3-5.

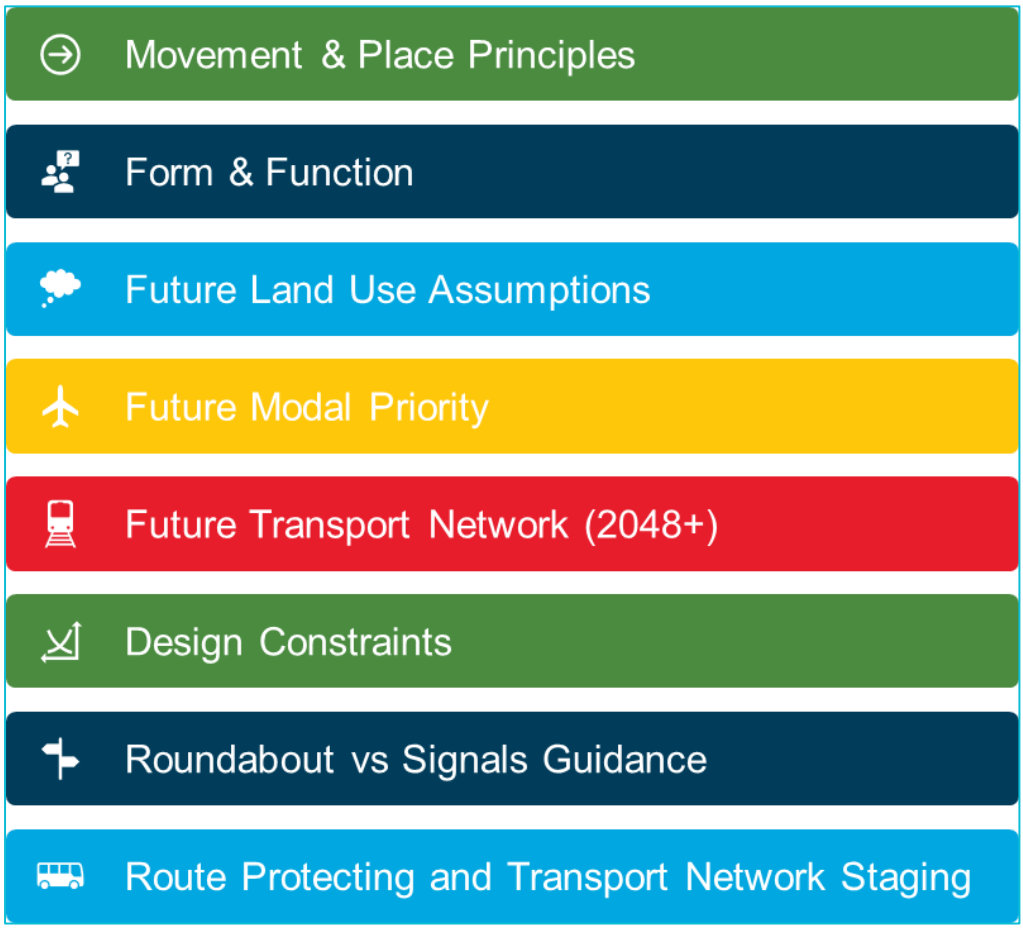

Figure 3-5 Intersection considerations

3.8 Approach to Stormwater Infrastructure

The additional land required to construct, operate and maintain the transport network for stormwater infrastructure is dependent upon the type of stormwater management devices chosen for each transport corridor. In order to determine the type and location of stormwater infrastructure a design process was undertaken. This process is summarised below:

1. Identification of existing stormwater infrastructure and management devices,
2. Develop a shortlist of appropriate stormwater management devices for each corridor,
3. Assess the size for these devices depending on if treatment, retention, detention and/or attenuation is needed,
4. Identify stormwater management device locations and sizes, and
5. Include stormwater infrastructure within the proposed designation boundary.

The type of stormwater management devices identified for use was based on a number of factors including the surrounding land-use, form of the transport route, road hierarchy and how connectivity to any adjacent properties is to be provided. This approach is summarised in Table 3-6.

Table 3-6 Stormwater System Design Approach Summary

Stormwater Design Environment	Treatment	Conveyance	Attenuation[2]	Diversion
Existing Urban	Proprietary treatment devices or treatment wetland	Pits and pipes	Above ground devices, attenuation wetland or underground tanks	N/A
Future Urban[1]	Proprietary treatment devices or treatment wetland	Pits and pipes	Above ground devices, attenuation wetland or underground tanks	Cut-off channels as required
Rural	Treatment swales or treatment wetland	Conveyance channels	Attenuation swale or wetland	Cut-off channels as required

Note: [1] Assuming direct driveway access from future residential to the main corridor is restricted. To align with the overall project objective, developable land adjacent to the corridors within this environment should be maximised.

[2] Attenuation is typically only required in the upper half of the larger catchment where the wetland is located.

The following approach was generally taken to determine the need for, and location of attenuation devices such as stormwater wetlands, noting that stormwater attenuation devices tend to be most efficient where sited at a centralised location to capture larger catchments:

- Assess the catchment between two geometric high points in the road alignment,
- Calculate the wetland area as a percentage of this catchment (10% was used for catchments that require 1% AEP attenuation and 6% for catchments that do not require attenuation),
- The lowest point of the road is then located, and a wetland is placed in the best suited position to:
    - Reduce impacts on sensitive ecological areas,
    - Reduce impacts on waterways and floodplains,
    - Where possible, avoid steep land where excessive earthworks would be required,

    - Provide clearance from proposed road design cut batters, and
    - Maximise use of orphaned land parcels where possible.
- Model the earthworks for the wetlands to ascertain the footprint required within the proposed designation.
- Indicatively design the pipe or swale network required to convey all flows to the wetland location.

If it was determined that a stormwater wetland was required, the location of the wetland was identified by placing the wetland at a low point along the transport corridor alignment and close to the corridor for easy access and maintenance. Also required is an outlet structure to discharge to a nearby natural stream. Where environmental constraints had been identified by technical specialists through constraint mapping and the options assessment process, these were also considered.

Bridges have been designed at all watercourse crossings where the upstream catchment is larger than 80 hectares. Culverts are included on flowpaths where the catchment is less than 80 hectares. The width of each bridge is approximately three-quarters of the floodplain as defined by Auckland Council's floodplain layer. Bridges and culvert structures are subject to a future resource consent process. The details and sizing of those structures will be determined at a later date to meet the council requirements and other legislation at the time of design and implementation.

4 Corridor Assessment

This section sets out the corridor assessment for the Pukekohe DBC transport components. Through the gap analysis (set out in section 3.2), four groups of options were developed for corridor assessment as set out below.

- **Drury West Local** – local connectivity in the FUZ to the station and strategic corridors;
- **Paerata Local** - local connectivity in the FUZ to the station and strategic corridors;
- **North-South** - strategic connections between Drury, Paerata and Pukekohe; and
- **Pukekohe Local** – local connections around Pukekohe as alternatives to the current main connection through the Pukekohe centre.

The Drury West Local, Paerata Local and North South options were assessed individually. Then the recommended corridors from Drury West Local and Paerata Local assessments were tested with a short list of the North South options as network packages. This was to test the individual recommendations from each of the geographic areas with each other to make an overall recommendation as an integrated transport network.

The Drury West Local and Paerata Local corridor assessments focused on maximising access to the proposed Drury West and Paerata rail stations, mode shift, and connectivity to existing strategic corridors (SH22 and SH1) and within the FUZ. The North South options investigated the need for the strategic North South connections when coupled with the Drury West Local and Paerata Local recommended corridors.

Pukekohe Local corridor options were assessed individually. However, were tested through assessing the interactions/tie ins with the recommended corridors of the North-South and Paerata Local recommended options at route refinement.

Route refinement options occurred on the recommended corridor options for each geographic area.

4.1 Drury West Corridor Assessment

4.1.1 Background - South IBC / Draft Strategic South DBC Assessment Summary

As set out in section 3.6 (gap analysis between IBC to DBC), options have been reassessed for the Drury West area in for the DBC. The IBC and draft Strategic South DBC provide important background to the previous rounds of options assessment. The options assessment at these phases are summarised below.

A number of new and upgraded arterials in Drury west were investigated at the IBC phase. The figure below shows the short list options considered in the IBC. The alignment of AR20 was recommended forming a connection between the IBC recommended Pukekohe Expressway, Drury west rail station and SH22 and Jesmond Road.

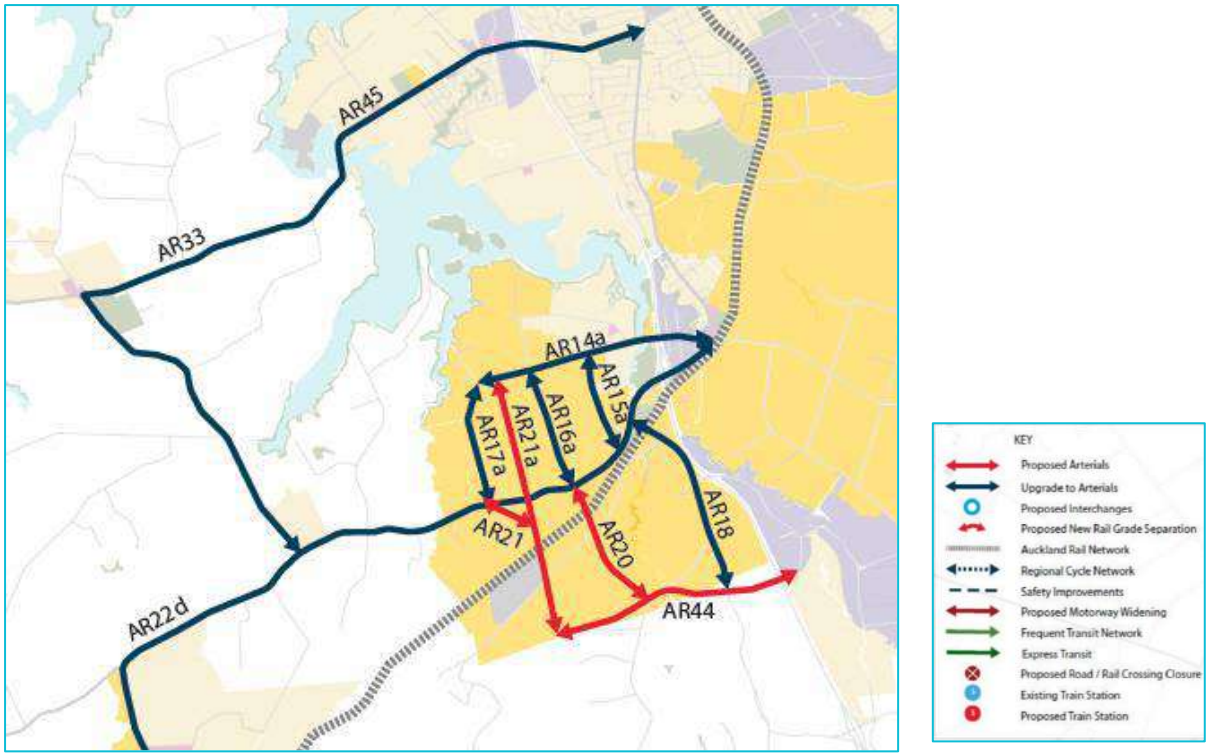

Figure 4-1 IBC Drury West Short List Options (Source: South IBC Options Assessment Report 2018)

Through the IBC, the AR20 alignment was recommended as a 2 lane, 24m wide cross section. This was developed further through the Strategic South DBC to 4 lane, 30m wide cross section. Two options (Option A and Option B) were developed for the SH22 North Connection for the Strategic South DBC:

- Option A – South alignment connecting Jesmond Rd and the Pukekohe Expressway to the west of Runciman Road and
- Option B – North alignment connecting Jesmond Rd and Pukekohe Expressway.

Both options scored similarly. A hybrid of both options, which generally follows the Option B alignment in the north section, and Option A alignment in the southern section was recommended. The tie-in point at Pukekohe Expressway is largely constrained by the Transpower electricity transmission lines and spacing of pylons.



Figure 4-2 Summary of Option A and Option B (Source: Draft Strategic South DBC, July 2020)

4.1.2 Gap analysis- IBC to DBC

Table 4-1 provides a summary for Drury West components of the Pukekohe DBC, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC and a recommendation for the Pukekohe DBC.

Table 4-1 Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and Draft Strategic South DBC	Recommendation(s)
Provides access to Drury West station from SH22, crosses the rail line and connects to the Pukekohe Expressway. Two options were investigated at the Strategic South DBC. Interacts with the location of the Pukekohe Expressway. The access to the Drury West station needs consideration based on any revisit to the Pukekohe Expressway.	Drury West Plan changes within close proximity, which may influence the number of trips that may use the Drury West connector. GPS 2021/Zero Carbon Act – Climate change lens. Consider implications of NPS FM and NES FW – adopt avoidance of wetlands where possible as principle in first instance.	Corridor assessment considering the following: • Interaction with Pukekohe Expressway. • East-west connectivity through FUZ – maximise access to proposed Drury West Station. • Consideration of natural wetlands under NPS FM. • Connections to existing strategic network (SH22 and SH1).

4.1.3 Option Development

The options developed within the Drury West area connect Drury to the new Drury South interchange, from SH22/Jesmond Road to Great South Road (GSR), providing connectivity to the wider strategic network (SH1, SH22, FTN Network and North Island Main Trunk), future town centre, new Drury West Rail Station and for future Drury West communities. There are two proposed transport projects that all options provide a connection between, these are:

- Proposed Drury West Rail Station – a Notice of Requirement (NoR) for a new designation has been lodged by KiwiRail; and
- Proposed Drury South Interchange (SH1) – A NoR for a new designation (or an alteration to the existing designation) is being sought by Waka Kotahi.

All options extend south from the accessway proposed by the Drury West Rail Station at the intersection of SH22 and Jesmond Road and connect to the proposed extent of the Drury South Interchange (SH1) at Great South Road. The Drury West options also interface with the following transport projects:

- State Highway 22 (SH22) Upgrade (Waka Kotahi) and Jesmond to Waihoehoe West FTN Upgrade (Auckland Transport) – NoRs by Waka Kotahi and AT were lodged in 2021 and recently confirmed (part of the Supporting Growth Programme).
- SH1 Papakura to Bombay Project (Waka Kotahi) – Stage 1 of this project which is between Papakura and Drury is under construction. This includes the upgrade of the existing Drury/SH22/SH1 interchange. Waka Kotahi will soon be lodging a NoR for the Drury South to Bombay section, which includes the proposed new Drury South Interchange.
- The future collector roads indicated in the Drury – Ōpāheke Structure Plan are expected to be developed through developer contributions (or delivered by developers) as areas are urbanised.

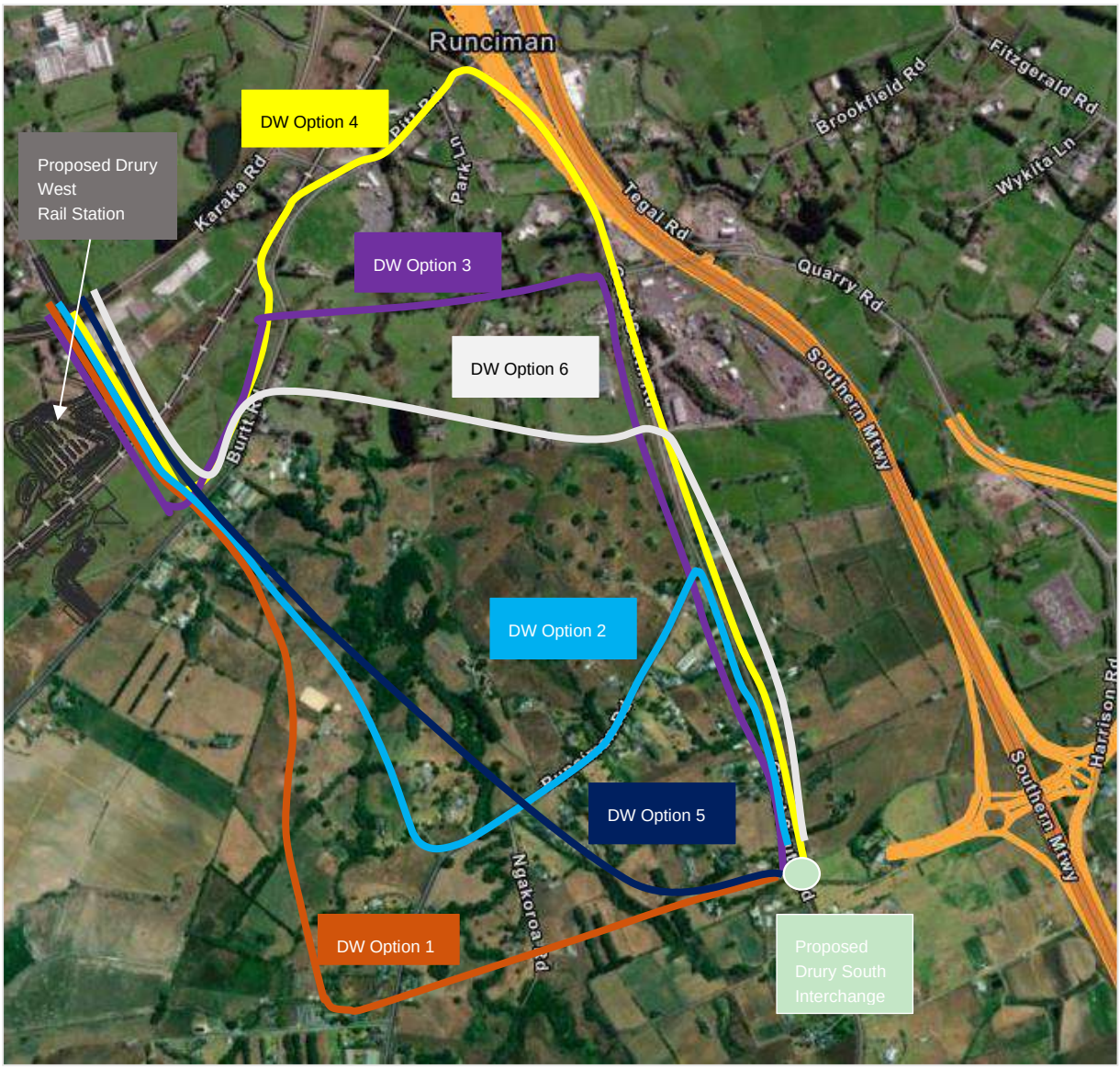

Figure 4-3 Summary of Drury West options

4.1.4 Option Assessment

Six options were assessed for the Drury West corridor assessment against the MCA framework by each subject matter expert. Table 4-2 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-2 Drury West option MCA scoring result

MCA Criteria	Scores					
Options	**DW1**	**DW2**	**DW3**	**DW4**	**DW5**	**DW6**
Investment objectives						
IO1 – Safety	1	1	2	3	1	2
IO2 – Integration	2	2	1	1	2	2

IO3 - Access	3	2	2	1	3	2
IO4 – Resilience	3	2	1	0	3	1
IO5 – Travel Choice	1	1	2	1	1	2
Cultural						
Heritage	0	-3	-3	-3	0	-3
Social						
Land use futures / integration with planned landuse	1	3	2	2	1	2
Urban design	2	-2	-1	-2	1	1
Land requirement / property	-3	-2	-2	-2	-3	-2
Social cohesion	2	2	2	1	1	1
Human health and wellbeing	-1	-1	-1	0	-1	-1
Environment						
Landscape / visual	-2	-1	-2	0	-2	-2
Stormwater	-2	-2	-3	-1	-2	-1
Ecology	-4	-3	-4	-2	-4	-3
Natural hazards	-3	-2	-3	-1	-4	-2
Construction impacts						
Embodied carbon emissions	-3	-3	-3	-3	-3	-3
Construction impacts on utilities / infrastructure	-1	-2	-2	-2	-1	-2
Construction Disruption	-1	-2	-2	-2	-1	-2
Construction costs / risk / value capture	-2	-2	-2	-2	-2	-2

Table 4-3 Drury West option assessment findings summary

Criteria	Summary of performance
Investment Objectives	DW1 and DW5 were preferred providing a high degree of connectivity and access to support the growth. DW3 and DW6 improve E-W connectivity for active modes and buses but would need additional local connections to support growth. DW4 was least preferred as it would provide less network resilience.
Heritage	Options DW1 and DW5 have no recorded heritage.

Criteria	Summary of performance
	DW4 is the least preferred given it has the largest number of features being potentially impacted. This includes the Clarke homestead, villas, Herkt's petrol station, Runciman Tennis club, and Māori huts close to Ngakoroa Stream.
Social	**Land use** DW2 was preferred as it connects to the proposed Drury West rail station, directly to two business centres and traverse multiple future residential areas as well as future light industry. DW1 was least preferred given it is the longest stretch of new corridor and would take up a greater amount of developable land. DW5 was also less preferred due to impacts on developable land albeit partly located within a stream/floodplain. **Urban design** DW1 was preferred for taking a direct route to the proposed Drury South interchange over those options that deviate through the industrial area. DW2 is least preferred as it is not a direct connection, adding distance and reducing legibility. **Land requirement** DW4 was preferred as it requires partial acquisitions of large plots. DW1 and DW 5 were least preferred as these options would require full acquisitions of residential areas. **Social cohesion** DW2 is preferred as it provides the best connectivity between areas and crosses the Ngākoroa Stream at an existing crossing point. **Health and wellbeing** DW4 predominantly traverses light industrial area, which is not a sensitive land use and uses existing roads, where air quality, noise and vibration effects are existing and expected.
Environmental	**Landscape and visual** DW4 was preferred due to its use of existing road alignment and the proximity to FUZ. Effects would likely be limited to rural residential properties within the localised setting of the western part of the route. However, seen in the context of the anticipated future urban zoning. The area of new roading would likely result in the loss of a limited area of established planting. **Stormwater** DW4 was preferred as it contains the least new impervious area compared to the other options, however, it also has several small culverts that would be difficult to upgrade and crosses several flood plains. DW3 was the least preferred as the alignment follows the same path as a large stream and would require stream modification / realignment to accommodate the road, nearly all of this alignment is the 1% AEP floodplain and would require significant earthworks to mitigate displacement effects of the road embankment. **Ecology** While DW4 impacts a similar number of streams and wetlands as other options there are pre-existing impacts hence the magnitude of effects is

Criteria	Summary of performance
	likely to be lower and, in some cases, upgrading undersized bridges / culverts would improve ecological integrity. DW3 and DW5 were least preferred due to significant impacts on streams, requiring realignment. DW1 is also least preferred due to potentially high impact on bat movement. **Natural Hazards** The alignment is entirely within alluvium with a risk of soft soil/liquefaction. DW4 was preferred as it requires mostly widening on existing alignments and only crosses one floodplain, where the other options cross three. DW2 and DW6 also use the existing alignment but still crossed three flood plains making them potentially less attractive from a hazards point of view. DW3 and DW5 were least preferred.
Construction impacts	**Embodied carbon emissions** DW1 is preferred as it has low lane kilometres (likely lower materials and construction emissions) and no addition features which might adversely differentiate option based on earthworks or major structures. DW3 is least preferred as one of the longest (implies greater materials and construction fuel/energy). The corridor crosses a floodplain and would require a longer bridge and significant earthworks (greater materials emissions related to bridge, and construction emissions for earthworks). **Construction impacts on infrastructure/utilities** The alignment would require protection of the First Gas transmission pipe, overhead powerlines and transmission lines. DW2 , DW3 and DW6 are also likely to require undergrounding of overhead powerlines and relocation or protection of the water distribution pipe making them less preferred. **Construction disruption** Majority of route is greenfield. DW2, DW3, DW4 and DW6 are likely to require temporary traffic control making them less preferred. **Construction costs** All options require a number of bridges and there was limited differentiation between them.
Partner feedback	Key feedback from KiwiRail during workshops included: • Support a direct, multi modal, connections to the Drury West Station. Relating to the option to upgrade Burtt Road to an arterial, an upgrade is required regardless due to the that due to the future development around the station and also noting the catholic school. Key points from AT and WK SMEs during workshops were: • Consideration of accessibility to the proposed Drury West options through FUZ areas currently in floodplain (that likely can't be developed). • Access across the NIMT is crucial to reduce severance. Manawhenua during hui expressed preference for reducing impacts on the Ngakoroa Stream

Criteria	Summary of performance
	Manawhenua also advised that there are two Pā sites within the study area and are keen to work with Te Tupu Ngātahi to understand other features and constraints in the area.

4.1.5 Discarded Options

Table 4-4 Options to be discarded

Option	Reason
DW1 (southern portion)	The southern part of the option is located outside the FUZ and this part of the corridor does not integrate or serve the FUZ well. A higher amount of land is required for this option. This option also has a potentially high impact on bat movement. Southern portion was discounted.
DW3	Follows a significant portion of the Ngakoroa Stream requiring significant stream diversion/realignment. Has higher construction costs and environmental impacts through the assessment.
DW4 and DW6	These options do not travel effectively through the growth area. Great South Road has the corridor width to be upgraded in a separate future project as this route is more focussed through industrial / business areas.

4.1.6 Recommended Corridor Option

It was recommended that a corridor between DW1 and DW2 be taken forward to test with the Paerata Local and North South recommended corridor options at a network level (see Section 4.4). This corridor provides good connectivity and access to support the growth and is a direct connection. At route refinement assessment, options will look to reduce impacts on the Ngakoroa Stream.

4.2 Paerata Local Corridor Assessment

4.2.1 South IBC / Strategic South DBC assessment summary

The Paerata Local component was considered as part of the North-South Connection in the IBC. See Section 4.3.1 for more details.

4.2.2 Gap analysis

Table 4-5 provides a summary for Paerata Local transport components of the Pukekohe DBC, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC and a recommendation for the Pukekohe DBC.

Table 4-5 Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Provides access to Paerata station, crosses the rail line and connects to the Pukekohe	• A focus on climate change in government policy and future	Corridor assessment considering the following:

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Expressway – known as the Southern Connector.	direction (impending with RMA reform): • The Government Policy Statement on Land Transport (2021) requires investment decisions to be consistent with transformation to a low carbon transport network. • Auckland Council's declaration of climate change emergency. • Increased scrutiny on the impacts on climate change from transport corridors, affordability, socio-political pressure. • Funding of Paerata Rail Station through NZUP. • Active development in Paerata Rise.	• The form and function of the Pukekohe Expressway is re-assessed and the need confirmed which influence the connections in Paerata. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • Maximise connectivity to the proposed rail stations (NZUP) and associated mode shift through strategic connections. • Through any optioneering processes new information such as impacts on wetlands (under the NPS FW) and opportunities to integrate with urban development are identified.

4.2.3 Option Development

The options developed within the Paerata area investigate local connectivity to the proposed Paerata Station and to SH22 and within the Paerata and north Pukekohe future urban areas. Five options were considered. The Paerata options at the southern extent interact with the Pukekohe Local options – with the north-east section of the Pukekohe arterials. They also interact with the north-south options.

At the time of assessment, KiwiRail had lodged a Notice of Requirement for the Paerata Station confirmed through the COVID fast track process. Construction of the station is expected to commence in 2023.

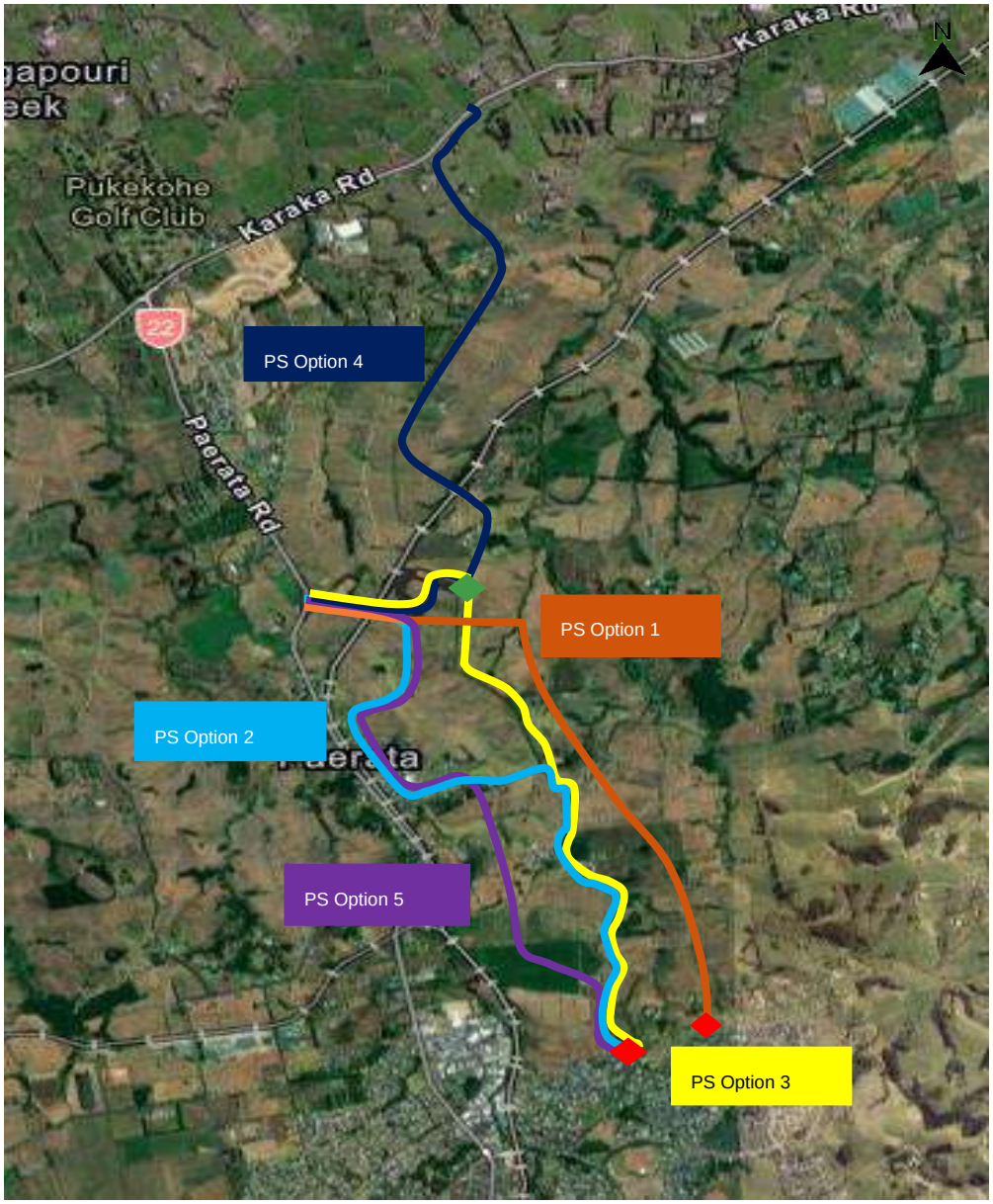

Figure 4-4 Summary of Paerata corridor options

4.2.4 Option Assessment

Five options were assessed against the MCA framework by each subject matter expert. Table 4-6 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-6 Paerata Local option MCA scoring

MCA Criteria					
Options	**PS1**	**PS2**	**PS3**	**PS4**	**PS5**
Investment objectives					
IO1 – Safety	2	3	3	3	2

IO2 – Integration	0	3	2	3	3
IO3 - Access	1	3	2	3	3
IO4 – Resilience	3	2	1	3	3
IO5 – Travel Choice	-1	2	2	2	3
Cultural					
Heritage	0	-2	0	-1	-2
Social					
Land use futures	1	2	2	1	3
Urban design	-3	-1	1	-1	-1
Land requirement / property	-2	-2	-2	-1	-2
Social cohesion	0	2	1	2	2
Human health and wellbeing	-1	-1	0	-1	-1
Environment					
Landscape / visual	-2	-2	-2	-1	-2
Stormwater	-2	-2	-1	-1	-2
Ecology	-4	-3	-3	-2	-3
Natural hazards	-2	-1	-1	-1	-3
Construction impacts					
Embodied carbon emissions	-3	-3	-3	-3	-3
Construction impacts	-2	-2	-2	-2	-2
Construction Disruption	-1	-2	-2	-2	-2
Construction costs / risk	-2	-2	-2	-2	-3

Table 4-7 Paerata Local corridor option assessment findings summary

Criteria	Summary of performance
Investment Objectives	PS2 and PS5 are preferred as these options increase connectivity between FUZ areas across the rail corridor. Consideration of a more direct option for PS5 was recommended (for route refinement). PS4 also scored favourably but was likely to have a different function to the other options and would need to be combined with other options.

Criteria	Summary of performance
	PS1 was least preferred due to lack of integration with FUZ and limited benefits for mode choice.
Heritage	PS1 and PS3 have no recorded heritage and were the preferred options. PS2 and PS5 had the potential to impact early mid-20th century heritage: railway workers cottages, Paerata dairy factory, dairy factory workers cottages and Paerata bowling club. PS4 had the potential to impact 2 heritage barns close to Sim Road.
Social	**Land use** PS5 was preferred as it connects the proposed rail station to future urban areas and provides good integration. This option would create large, viable areas of developable land. In addition, the route provides for large volumes of vehicles to travel around the future residential areas providing best integration for these future land uses. PS2 and PS3 were less preferred as the corridor is partly outside the FUZ/planned residential areas, reducing the amount of developable land being impacted and potentially creating a future conflict between those residential land uses and high-volume road corridor reducing integration. PS1 was the least preferred as it was within the rural zone and too far from the FUZ and did not provide good integration with current and future land uses. It also was considered to encourage development outside the FUZ. **Urban design** PS3 is preferred as it runs along the edge of the FUZ on an existing corridor, defining the rural/urban boundary, and would separate traffic from future residential development. PS2, PS4, PS5 traverse an area identified as THAB in the Structure Plan which may create challenges around future development creating a positive interface with the road corridor. The topography has potential to negatively affect character and amenity and create poor interface outcomes, particularly in the southern area. PS1 was the least preferred as it is outside the FUZ and there are no place making opportunities. This option was considered likely to create pressure to extend FUZ and create a Rural Urban Boundary. Due to running through Rural area this option would have an adverse effect on the amenity and character of the area. **Land requirement** PS4 was the preferred option as it required the acquisition of the least number of properties. PS1, PS2, and PS5 had greater impacts on properties. PS3 was also less preferred but it was noted that by following the southern side of Sim Road this could be mitigated and would be similar to PS4. **Social cohesion** PS2, PS4 and PS5 create a link through rural land and past an existing industrial area to an existing residential. PS3 creates a link to the existing residential area. PS1 is least preferred as it does not provide a direct connection to existing urban areas. **Health and wellbeing** PS1, PS2, PS4, PS5 were similar. The options would have a negative impact introducing a new corridor near existing and future residential areas and Country

Criteria	Summary of performance
	Village Preschool. PS3 was the preferred option as while it is in proximity to residential land use it is not close to any other sensitive receivers.
Environmental	**Landscape and visual** PS4 was the preferred option. While there were likely to be effects on rural character, there was an opportunity to provide planting along the new road corridor to integrate the road into the landscape. PS1, PS2, PS3 and PS5 were less preferred as the proposed route would result in the road being located upon steep topography and potentially impacting a stand of vegetation on Cape Hill Road identified as an SEA. **Stormwater** PS3 and PS4 are the preferred options. PS1 would require water quality detention and attenuation via wetlands. PS2 and PS5 cross a number of small tributaries and run alongside / over a flood prone area near the NIMT rail. Mitigation would be required to balance flood effects on the railway line and upstream properties. **Ecology** PS4 was preferred as reduces potential impacts on wetlands PS1 and PS5 were the least preferred due to potential impacts on nationally critical long-tailed bats recorded in Paerata Scenic Reserve (1km West) and Coulthards Scenic reserve (1km East). Fragmentation of numerous stream corridors and bush fragments likely to provide key habitat corridors for bats. PS2 and PS3 were also not preferred due to potential impacts along the east side of Cape Hill Road, where indigenous vegetation occurs in the SEA_T_4380. **Natural Hazards** PS2, PS3 and PS4 manages to avoid most of the problematic terrain. PS1 was not preferred as it mostly crosses undulating terrain associated with volcanic deposits (mostly tuff and basalt) with numerous flood plains in gullies. PS5 was the least preferred as involves new construction on swamp in southern section, adjacent to Whangapouri Creek.
Construction impacts	**Embodied carbon emissions** There was limited differentiation between options. PS3 was the preferred option as it is mostly the widening of existing roads and may benefit from reusable materials and previous works, from a construction emissions perspective. **Construction impacts on infrastructure/utilities** There was limited differentiation between options as a number of services would need to be protected or relocated including first gas, overhead transmission lines and power lines. **Construction disruption** PS1 was the preferred option. All other options would require lane narrowing or temporary traffic control needs to be implemented during construction on the existing roads. **Construction costs** All options have challenging terrain, and some require a bridge to cross the railway.

Criteria	Summary of performance
Partner feedback	During workshops KiwiRail shared insights on railway electrification (by 2025) and construction of railway / Paerata and Drury Rail Stations. During the workshop AT and Waka Kotahi SMEs raised following matters: • AT shared existing and potential plan changes within the study area. • Auckland Transport raised that due to the narrow extent of Paerata FUZ, an arterial through the middle of it may have some integration issues. Benefits were acknowledged for the option on the edge of the FUZ supported by a local road within the FUZ as development progresses. • Consideration of the efficiency of the freight network in terms of journey time and emissions. A number of intersections may delay movement. • Acknowledgement of topographical constraints on Cape Hill Road. • Discussion on a network that reduces VKT whilst supporting development. Manawhenua shared at hui: • Ngāti Tamaoho highlighted development in the Paerata area and suggested liaison with developers to reduce any potential overlap. • Ngāti Te Ata Waiohua queried the weighting of cultural and environmental impacts in options assessment and the project t confirmed these will be critically considered while developing and assessing options.

4.2.5 Discarded Options

Table 4-8 Options to be discarded

Option	Reason
PS1	Almost completely outside of the FUZ, within existing and future rural land. Provides the least connection to employment, communities, and facilities. Does not meet the project objectives (-1 for mode choice). Highest ecological potential impact on bats and waterways. However, this option may be revisited if the Pukekohe Expressway option is chosen.
PS2	Discounted due to potential impacts on heritage items and potential flooding effects.
PS4	Discounted as Paerata Rise Development is providing collector roads that have a similar function.

4.2.6 Recommended Corridor Option(s)

It is recommended that PS3 and PS5 (a corridor within the Paerata FUZ) be taken forward to tested with the Drury West Local and North South recommended corridor options at a network level (see Package Assessment in Section 4.4). PS4 and PS5 provide good connectivity and access to support the growth.

Recommendations for route refinement include a more direct route for PS5 and consideration of topographical constraints of upgrading Sim Road/Cape Hill Road for PS3. Also to consider the connection to the Paerata Station (formerly known as the Southern Connector at Draft Strategic South DBC).

4.3 North-South Corridor Assessment

4.3.1 South IBC / Draft Strategic South assessment summary

4.3.1.1 South IBC

At the IBC phase, several options were investigated (mutually exclusive from each other but relating to other strategic routes such as Mill Road, or the arterial routes in Pukekohe) to test multiple locations and alignments for a Pukekohe Expressway providing a direct link to SH1 from Pukekohe, therefore, taking traffic off SH22, which traverses both Pukekohe and Drury west growth areas.

The longlist of options is shown in Figure 4-5 below and included:

- SR4A – central alignment: Drury South Interchange to Pukekohe East Road
- SR4B – alignment on edge of FUZ connecting to Drury South Interchange
- SR4C – eastern alignment: Drury South Interchange to Pukekohe East Road
- SR4D – Ramarama interchange connecting to SH22 south of Paerata
- SR4E – Upgrade Pukekohe East Road and widen Mill Road connecting to Bombay Interchange
- SR4F – northern alignment: Drury South Interchange along edge of Drury west FUZ connecting to SH22 south of Paerata
- SR19 – central alignment: Drury South interchange along the edge of Drury west FUZ to Pukekohe East Road (amalgamation of options).
- MT10 provides a bus rapid transit option between Pukekohe and Drury at SH1. This was not given a specific alignment as it would be located on SR options.

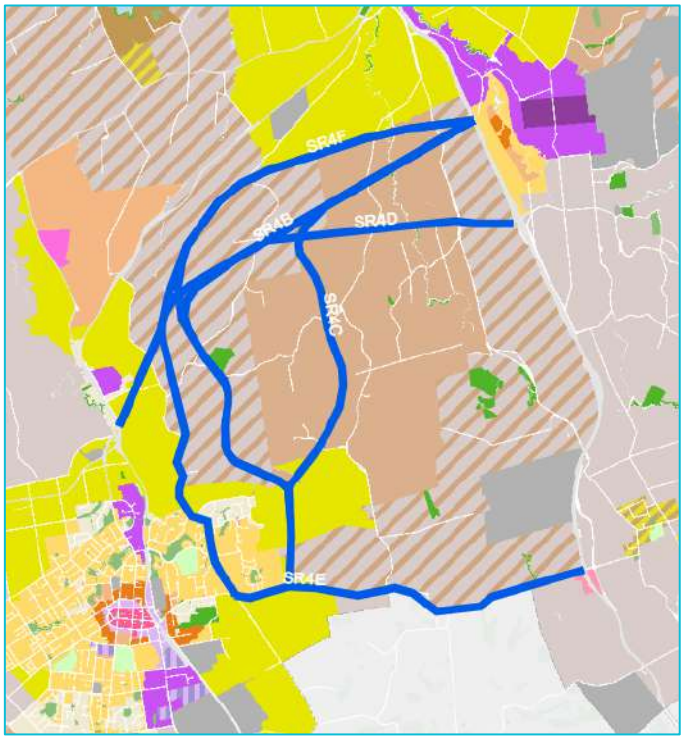

Figure 4-5 South IBC long list options

Short List

Options SR4E, SR4F and SR19 were recommended for the short list as they all scored positively against all three investment objectives. Option MT10 was also recommended for the short list for further investigation.

Options SR4A, 4B, 4C and 4D were discarded due to the potential moderate to high adverse environmental effects, inability to achieve all the investment objectives, and lack of integration with future or existing communities.

Following this, SR4E was packaged separately from the other two Pukekohe Expressway options, where it was taken forward as an option under 'Strategic Connections'. Option SR4F (including the main trunk of SR19) was the recommended option for the Pukekohe Expressway as it aligns best with future land use at north-east Pukekohe, avoids proximity to the Outstanding Natural Landscape (ONL) - Coulthards Scenic Reserve and provides a more direct route compared with SR19.

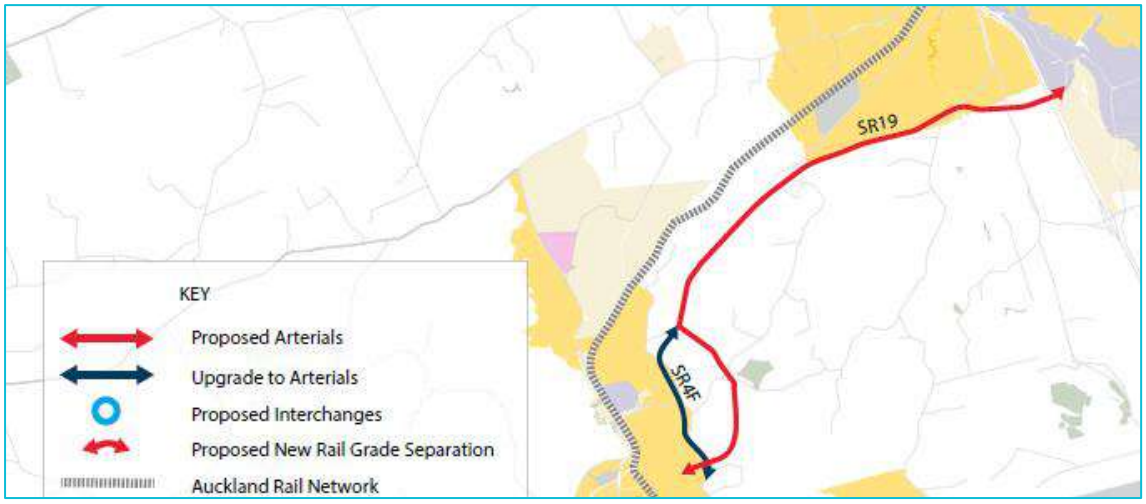

Figure 4-6 South IBC short list options (the southern section of SR19 and SR4F are mutually exclusive)

4.3.1.2 Draft Strategic South DBC

The Strategic South DBC divided the Pukekohe Expressway into two sections – Pukekohe Expressway (A) and (B). Section B was progressed to a corridor assessment to investigate if impacts could be avoided.

- Three options were developed for the Pukekohe Expressway (B) section during the SS DBC (Options A, B and C as shown in the option sketch). Option A was identified as the IBC recommended option. Option B and C track further to the west of Option A, before connecting to the Pukekohe Urban Arterial (NE).
- Following the option development at the route refinement level, the Pukekohe Expressway was divided into four segments, identified by constraints in the area and interaction with other options.
- Two options were developed for segment 3, and three options were developed for Segments 1,2 and 4.

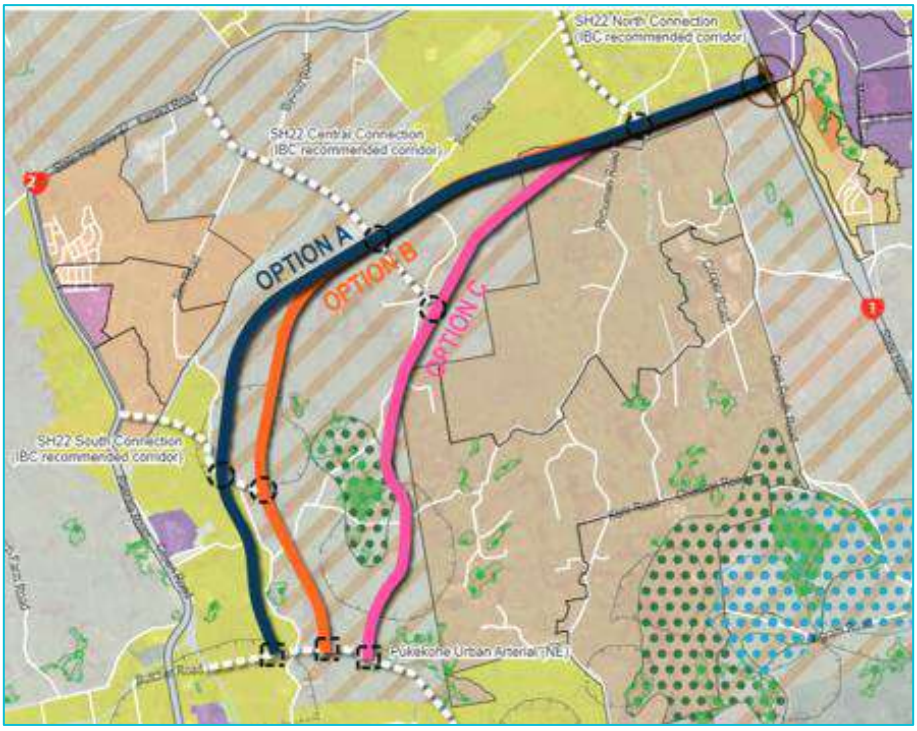

Figure 4-7 Summary of Pukekohe Expressway (B) options (Source: Strategic South Detailed Business Case, July 2020).

It was recommended that Option A and Option B be progressed to route refinement in the form of a hybrid option, broken down into the following segments:

- Segment 1: Option B - Offline, south of Transpower line
- Segment 2: Option B - Offline, south of Transpower line
- Segment 3: Option A - Offline, south of NIMT line, west of Oira Stream
- Segment 4: Option C - Offline, east of Cape Hill Road

The hybrid option would broadly follow the Option A alignment between SH22 Central Connection and the SH22 Southern Connection, and the Option B alignment from the SH22 South Connection to the Pukekohe Urban Arterial. The form and function recommended in the Strategic South DBC was for a 4 lane arterial.

This preferred option was selected as it would be far west of the identified pā site/volcanic feature as practicable and is better aligned with the FUZ.

4.3.2 Gap analysis - IBC to DBC

Key transport and environmental policy direction have changed since the recommendations made by the South IBC and Draft Strategic South DBC on Pukekohe Expressway. This includes:

- A focus on climate change in government policy and future direction (with RMA reform coming).
- The Government Policy Statement on Land Transport (2021) requires investment decisions to be consistent with transformation to a low carbon transport network.
- Auckland Council's declaration of climate change emergency.
- Increased scrutiny on the impacts on climate change from transport corridors, affordability, socio-political pressure.

In considering the above changes, the following carbon emissions assessment methodology was formed to further test the alignment of the preferred network with this new policy direction:

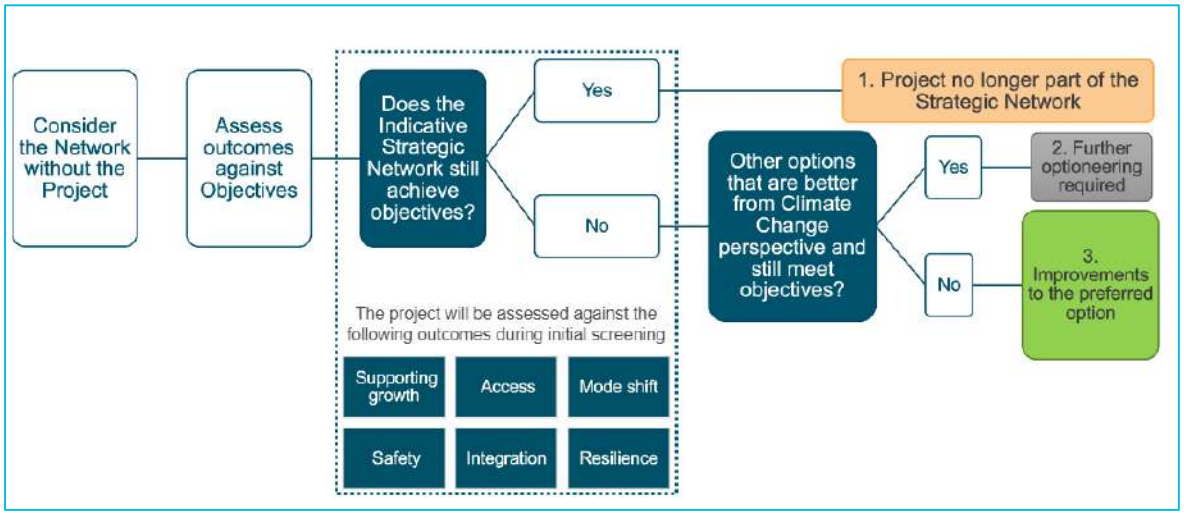

Figure 4-8 carbon emissions assessment methodology

Table 4-9 provides a summary of the Pukekohe Expressway transport components of the Pukekohe DBC, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC and a recommendation for the Pukekohe DBC.

Table 4-9 Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
The Draft Strategic South DBC took the recommended option from the IBC and investigated another two options (three in total) – and then undertook a route refinement assessment.	GPS 2021/Zero Carbon Act – Climate change lens – implications on the need for a four lane "expressway" that will induce light vehicle travel. Risk that road projects are challenged due to their contribution to greenhouse gasses – contrary to legislative direction to reduce emissions. Consider implications of NPS FM and NES FW – adopt avoidance of wetlands where possible as principle in first instance. Engagement undertaken as part of the Strategic South DBC included opposition to the Pukekohe Expressway. Concerns around potential loss of rural lifestyle/outlooks and property values. Three new rail stations were confirmed through NZUP (funding confirmed).	Corridor assessment considering the following: • The form and function of the Pukekohe Expressway is re-assessed and the need confirmed. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • Maximise connectivity to the proposed rail stations (NZUP) and associated mode shift through strategic connections. • Through any optioneering processes new information such as impacts on wetlands (under the NPS FW) and opportunities to integrate with

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
		urban development are identified.

Through the gap analysis it was concluded that the changes in the policy direction of the Government and Auckland Council and the need for the Project warranted further investigation of alternative corridors.

4.3.3 Option Development

The primary purpose of the North-South options is to provide a direct route from Drury West to Pukekohe, to reduce pressure on the SH22 corridor and existing surrounding rural roads and to provide for the urbanisation of the Drury West, Paerata and Pukekohe areas.

The project aims to increase accessibility to a range of transport choices and increased people movement within the area to provide connections to employment, industrial areas, existing and future residential areas, and rail stations, within the study area.

The options include the recommendations from the Draft Strategic South DBC (a four lane high speed state highway) as well as new options that investigate upgrading existing rural roads, upgrading existing strategic roads, new corridors and a combination of these.

As set out earlier, the North South corridor assessment options were assessed separately. However, a short list of the options were tested with the Drury West and Paerata options from a network perspective. This network assessment is set out in section 4.4.

Nine options were initially developed for the North-South package (shown in Figure 4-9 and identified in Table 4-10 below) and two additional options were added (set out in Table 4-11 Additional North-South options description summary

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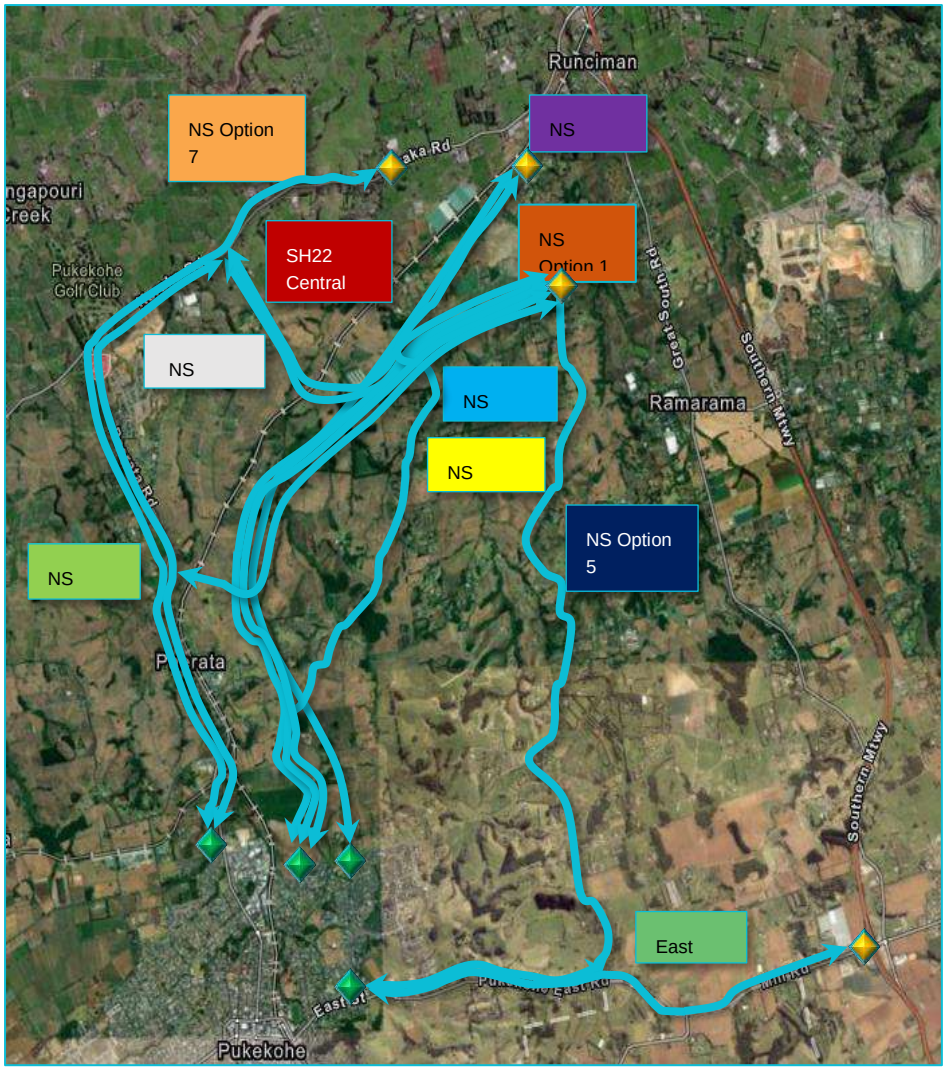

Figure 4-9 Summary of North-South options

Table 4-10 North-South Option description summary

Option	Route	Form & Function
NS1	New corridor from the proposed Drury South interchange connection at GSR to the edge of the Pukekohe FUZ area.	• Rural four-lane • New corridor: 8.7 km • 30 m cross-section • 80 kph
NS1A		• Urban two-lane • New corridor: 8.7 km • 24 m cross-section • 50 kph
NS2	New corridor between the proposed Drury South interchange at Great South Road and Paerata, where it then uses the existing Cape Hill Rd to Pukekohe.	• Urban two-lane / rural • New corridor: 5.6 km • Upgrade roads: 3.7 km • 24 m • Urban - 50 kph / rural - 60 kph to 80 kph

Option	Route	Form & Function
NS3	Between the Drury West station and Pukekohe. Uses Burtt Road, with a new connection between Burtt Road and Paerata Station. Uses Cape Hill Road to Pukekohe.	• Rural two-lane high speed / urban two-lane • New corridor: 2.4 km • Upgrade roads: 6.2 km • 24 m cross-section • Urban - 50 kph / rural - 60 kph to 80 kph
NS4	Between Drury West station and Pukekohe. Uses Burtt Rd, Tuhimata Road and Cape Hill Road.	• Rural two-lane • Upgrade roads: 8.7 km • 24 m cross-section • Urban - 50 kph / rural - 60 kph to 80 kph
NS5	Follows Runciman Road between the Great South Road / Runciman Rd south of Drury West station and Pukekohe East Rd west, through to East Street / Valley Road.	• Rural two-lane high speed / urban two lane • Upgrade roads: 10.3 km • 24 m cross-section • Urban - 50 kph, rural - 60 kph to 80 kph
NS6	A new corridor from the proposed Drury Interchange at Great South Road to SH22. Then uses the existing SH22 until it reaches Pukekohe centre	• Rural two-lane high speed / urban four lane arterial • New corridor: 5.5 km • Upgrade roads: 6.9 km • 24 m cross-section from Great South Rd to SH22 / Sim Rd and 30 m cross-section from Sim Rd / SH22 to Butcher Rd / SH22. • Urban - 50 kph, rural - 60 kph and 80 kph
NS7	Upgrades the existing SH22 to four-lanes between Oira Creek and Butcher Rd / SH22.	• Rural four-lane high speed rural / urban four lane arterial • Upgrade roads: 8.8 km • 30 m cross-section • Urban - 50 kph, rural - 60 kph and 80 kph
NS8	A new connection from the proposed Drury South interchange at Great South Road to Paerata Station.	• Rural two-lane high speed / urban two-lane arterial • New corridor: 6.8 km • 24m cross-section • Rural - 60 kph to 80 kph. urban - 50 kph
East	Upgrade to the existing Mill Road and Pukekohe East Road from Bombay / interchange to Golding Rd / Belgium Rd.	• Four-lane arterials (Urban-Rural Edge) • Upgrade roads: 6 km • 30 m cross-section • 60 to 80 kph
SH22 Central	New corridor connecting Karaka Rd / SH22 to Runciman Road.	• Rural two-lane high speed • Upgrade roads: 750 m • New corridor: 4.8 km • 24 m cross-section • 50 kph

Two new options were added after the first round of assessment. These are shown in Table 4-11 **Additional North-South options description summary**

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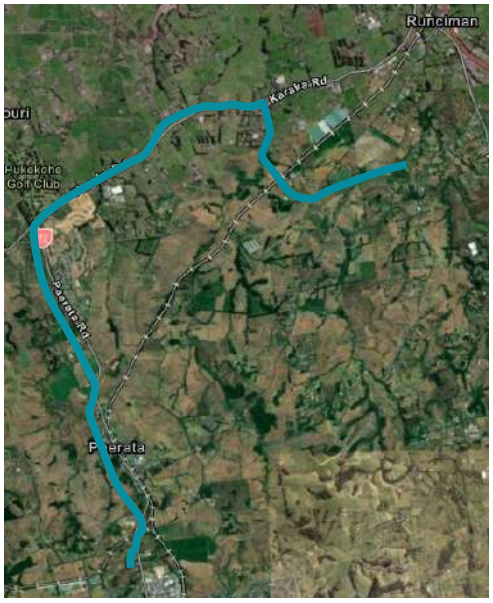
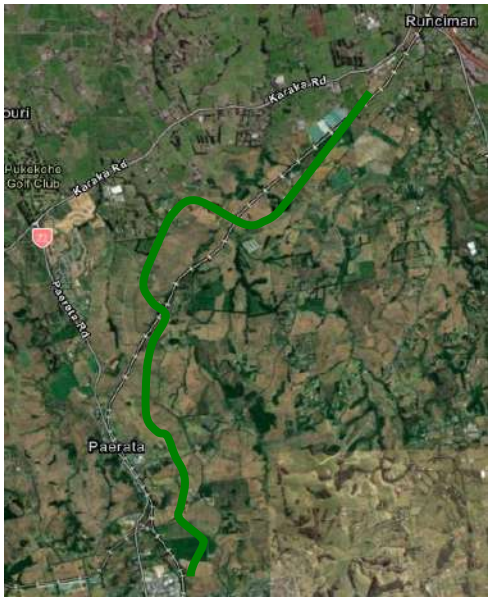
Table 4-11 Additional North-South options description summary

Option	Description / Reason	
NS9	An upgrade of SH22 along with a new section of transport corridor to Drury.	
NS10	Refinement of the NS3 and SH22 Central Options – including an upgrade of Burtt Road along with a new section of road across the NIMT then utilising Sim Road within the Paerata Rise development as well as an upgrade of Sim Road (south) and Cape hill Road.	

4.3.4 Option Assessment

Eleven options were assessed against the MCA framework by each subject matter expert. Table 4-12 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-12 North-South corridor assessment MCA scoring

MCA Criteria	Scores												
Options	**NS1**	**NS1A**	**NS2**	**NS3**	**NS4**	**NS5**	**NS6**	**NS7**	**NS8**	**NS9**	**NS10**	**East**	**SH22**
Investment objectives													
IO1 – Safety	4	4	3	3	2	1	2	3	2	2	3	2	2
IO2 – Integration	3	3	3	3	1	1	2	2	1	2	3	2	1
2IO3 - Access	2	2	3	3	1	0	2	1	1	2	3	1	1
IO4 – Resilience	4	4	3	3	1	1	1	1	2	1	2	2	1
IO5 – Travel Choice	-2	-1	1	1	1	0	1	1	1	1	2	1	1
Heritage													
Heritage	0	0	0	-2	-2	-5	-2	-2	0	-2	-2	-1	0
Social													
Land use futures	3	1	2	3	2	1	2	3	1	2	2	1	1
Urban design	-4	-4	-2	-1	-2	-1	-3	-2	-2	-2	-2	-1	-1
Land requirement	-3	-3	-2	-1	-1	-2	-3	-3	-2	-2	-3	-1	-2
Social cohesion	2	2	2	2	2	2	2	2	2	2	2	1	1
Human health	-1	-1	-1	-1	-1	-1	-2	-2	-1	-2	-1	-1	-1
Environment													
Landscape / visual	-2	-2	-2	-2	-3	-4	-2	-2	-2	-2	-2	-3	-2
Stormwater	-2	-2	-2	-1	-1	-1	-2	-1	-2	-2	-2	-1	-2
Ecology	-4	-4	-4	-4	-4	-4	-4	-3	-4	-4	-3	-3	-4
Natural hazards	-3	-3	-2	-2	-1	-3	-3	-1	-3	-3	-2	-2	-3
Construction impacts													

Embodied carbon	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
Construction impacts	-2	-2	-2	-2	-2	-3	-2	-2	-2	-2	-2	-2	-1
Construction Disruption	-1	-1	-2	-2	-2	-2	-2	-2	-1	-2	-2	-2	-1
Construction costs / risk	-4	-3	-3	-3	-3	-3	-3	-2	-2	-3	-3	-2	-3

Table 4-13 North-South corridor assessment findings summary

Criteria	Summary of performance
Investment Objectives	**Safety** NS1 and NS1a scored the highest for safety as they will significantly reduce the likely future traffic using unsafe rural roads (Burt Road and Runciman) and also reduce traffic growth on SH22 which will result in further safety benefits. Options NS7, NS 9 and NS10 provide some safety improvements but do not address all safety concerns. NS5 scored the lowest for safety concerns as it doesn't resolve existing and future safety issues and would need major improvements to SH22, Sim Road, Cape Hill Road and local connections in Paerata and Drury West. **Integration** NS1, 1a, 2, 3 and 10 all scored the highest for integration, with good network-wide integration with Pukekohe, Paerata and Drury West. These options also provide significant movement integration with general traffic and limited amount with PT and active modes. Option NS 4, 5 8 are scored the lowest for integration. Option NS 4 and 5 scored lower due to the options being outside of the FUZ (less integrated). This is less preferred and has limited network-wide benefits to reduce the conflict between movement and place in Pukekohe, Paerata and Drury West. NS 8 provides good integration between Drury West and Paerata but limited integration between Paerata and Pukekohe. **Access** NS1, 1a, 2, 3 and 10 provide significant improvement in access to key destinations. They provide significant improvement to general traffic and PT and modest improvement for active modes. NS2 and 3 scored the highest. The East option does not provide the same connection as the other options and alone will not provide the same strategic benefits as the other north south options. However, it is beneficial in combination with the north south options and should be progressed in conjunction with a north-south option(s). NS 5 scored the lowest with very limited improvement in access to key destinations and limited access improvement by all modes. **Resilience** NS1 and 1a scored the highest with high network-wide improvement in resilience, but over supplying of resilience may result in auto-dependency.

Criteria	Summary of performance
	NS 2 and 3 provide for medium to high network-wide improvements in resilience. NS 4 – 9 and the central and east options scored the lowest for access with limited network-wide improvement in resilience. **Travel Choice** NS 10 scored the highest regarding travel choice with medium to high improvements in general traffic, modest benefit to public transport and active modes. This option will increase car mode share slightly and significantly reduce VKT. NS1 and NS1a scored the lowest regarding travel choice with significant improvement in general traffic, but disbenefits to public transport and limited improvement to active modes. These options have a significant amount of enabled carbon, will increase car mode share significantly and reduce VKT. Other options either had medium to high improvement in general traffic, but little benefit to public transport and modest improvement to active modes or else had little improvement to general traffic and to public transport but modest to high improvement to active modes. **Overall** Options NS2 and NS3 were preferred as these would best enable network-wide benefit to support growth. NS4 and NS5 are least preferred as they have a limited ability to address the network wide investment objectives.
Heritage	Options NS1, NS1a, NS2, NS8 and SH22 Central have no recorded heritage. NS5 and East have the potential to impact on heritage due to the number of features along the corridor, including the Pukekohe East Presbyterian Church, which was the site of an 1863 battle at the beginning of the Waikato Invasion, which makes it a highly significant site. NS5 scored the lowest. Both NS9 and NS10 the potential to impact on heritage items in the CHI including the Paerata Community Hall, Paerata Station Water Tower and early 20th century Villa. The remaining options have minor impacts on heritage features and can be mitigated.
Social	**Land use** Options NS1, NS3 and NS7 were preferred due to the greatest integration with the FUZ catchment/planned development in the Drury West, Paerata and Pukekohe areas. NS3 provides the most direct connection between the two stations and multiple future residential areas. NS1 was preferred over NS1a, as a four-lane, high-speed arterial, located outside the FUZ avoids severance effects and does not reduce developable land. A two-lane low-speed arterial located outside the existing and future urban area was not considered to integrate with the land use. Options NS1a, NS5, NS8, NS9, NS10, East Option and SH22 Central were least preferred due to reduced integration with the FUZ catchment and/or the creation of small residual pockets of rural land between the FUZ and the option, which may encourage development beyond the FUZ/structure plan area. The East Option in particular, provided the least connection between FUZ areas. **Urban design**

Criteria	Summary of performance
	All options had challenges creating a positive interface with the road corridor and topography. The East Option is preferred as it follows an existing corridor into Pukekohe, avoiding the steep topography of Pukekohe north. Options NS1 and NS1a are least preferred as they cut through the rural area, which would adversely impact the existing amenity and character and provide minimal interface opportunities. **Land requirement** NS3, NS4 and the East option have the least property impacts, being existing routes. Of these, NS4 is preferred as the impact on dwellings can be mitigated if the alignment follows one side of the existing road. Options NS1 and 1A are least preferred given the significant property acquisitions required. **Social cohesion** NS7 is the preferred option as it provides a new connection to existing facilities, including the Paerata Rise development. The East Option provides the least connected to employment, communities, and facilities, being more isolated than the other options. **Health and wellbeing** NS4 is preferred as it predominantly traverses existing roads, where air quality, noise and vibration effects are existing and expected. NS5 was considered slightly less preferable as it is closer to a school which is considered a sensitive receiver. Options NS6 and NS7 were least preferred as they would create a new corridor close to existing residential areas and several schools, which introduces new air quality, noise and vibration effects to these receivers. Although this option scores the same as NS7, NS7 is predominantly within existing road, therefore effects here are generally anticipated.
Environmental	**Landscape and visual** NS7 is preferred given it traverses an existing roading alignment, where only limited amounts of vegetation would be required to be removed. Potential visual amenity effects would be limited to residences within existing and future developed areas. NS5 is least preferred (-4) due to the nearby Outstanding Natural Feature (ONF) and potential effects on rural character, visual amenity and notable trees. **Stormwater** There is limited differentiation between options. All options impact upon overland flow paths but would have manageable stormwater impacts. In general, new roads have more impact on stormwater (Options NS1, NS1a, NS2, NS6, NS8 and SH22 Central) and options that involve upgrading existing assets have less impact on stormwater (Options NS3, NS4, NS5, NS7, NS9 and NS10 and East Option). **Ecology** All options would either impact nationally critical bats, bird species, SEAs, streams, wetlands or a combination of these features, earning high negative scores.

Criteria	Summary of performance
	NS7 and the East Option are entirely upgrades of existing infrastructure and therefore are more preferred as the impacts are already present. Options NS1 and NS1A are new corridors that run entirely outside the FUZ, potentially impacting a large number of streams, wetlands and identified habitat for species of significance including bats and birds. These are less preferred. **Natural Hazards** Existing roads score slightly better, as they are already stabilised. Options NS4 and NS7 are preferred as these are mainly existing corridors. The East Option, while also an existing road is adjacent to the tuff crater. NS1 and NS1A were least preferred as involved new construction over undulating alluvium with potentially liquefiable soils at the eastern end.
Construction impacts	**Embodied carbon emissions** While NS8 is a new corridor, with more involved earthworks, it is a short two-lane corridor, which is likely to indicate lower construction emissions overall. Therefore, this option is preferred. NS9 and NS6 are least preferred given its length, the need for two bridges, likely significant earthworks, four-lane cross section and greenfield development for half the corridor. **Construction impacts on infrastructures and utilities** The SH22 Central option is preferred as it requires a smaller amount of earthworks given its short corridor. NS5 is least preferred given the number of impacts to existing infrastructure, such as two First Gas Transmission pipes, a water distribution pipe and the Transpower electricity transmission lines. **Construction disruption** In general, options passing through greenfield areas (Options NS1, NS1A, NS8 and SH22 Central) encounter less disruption than options passing through existing and future urban areas. **Construction costs** NS7 is preferred as it has less earthworks as it upgrades an existing corridor. NS1 is least preferred due to the length of new corridor through rural greenfield and steep topography, as well as the construction of five bridges.
Partner feedback	The following matters were raised by partners during workshops: • Auckland Council provided an update on the existing and potential private plan changes in the study area highlighting the growth planned in the near future. • Waka Kotahi highlighted inter-related projects around Pukekohe and Drury such as safety improvements on SH22, SH1 Upgrade (Papakura to Bombay). • North Waikato perspectives highlight the significant growth pressure on existing local connections if Waikato Growth Strategy is followed through. Investment needed in active mode infrastructure and public transport networks to make these modes competitive to private vehicle use. • Waka Kotahi emphasised the importance of climate change / vehicle kilometres travelled (VKT) reduction being considered in the options assessment and supported the alternatives being considered.

Criteria	Summary of performance
	• Auckland Council confirmed that no additional Council initiated rezoning of rural zoned land is currently being considered. Manawhenua representatives raised the following key matters at hui: • A representative from Ngāti Tamaoho advocated for future proofing for four lanes given predicted growth (dependent on ecology matters). • Ngāti Tamaoho highlighted that careful consideration will be required for corridors outside Future Urban Zones (FUZ) and expressed concerns of inducing further development Ngāti Te Ata Waiohua stated that all options have an impact on cultural values/integrity and taonga.

4.3.5 Discarded Options

Table 4-14 summarises the reasons for discounting the options individually.

Table 4-14 Options to be discarded

Option	Reason
NS4	Too far east and does not achieve the investment objectives.
NS5	Too far east and does not achieve the investment objectives.
SH22 Central Option and NS6	Duplicate NS7 and do not offer significant additional connection.
NS8	Duplicates NS2 and the Paerata options.
NS9	Provides limited network wide resilience, greater potential carbon emissions and potential heritage impacts
NS10	Higher property impacts and construction costs and potential heritage impacts

4.3.6 Recommended Corridor Options

The north south corridor options investigated new corridors, upgrading existing strategic corridors (SH22 and Mill Road Bombay), upgrading existing rural roads and a combination of these.

It was recommended that the following North South corridors are progressed to the Package Assessment (short list) to be tested with the Drury West Local and Paerata Local recommended corridor options:

- NS7 - Upgrade of the existing SH22 to four lanes (Drury to Pukekohe): this corridor improves safety, upgrades an existing strategic corridor and scored marginally better through the assessment because of this. However, upgrading the existing corridor does not improve network resilience.
- East option – upgrading existing Mill Road Bombay and Pukekohe East Road: The East option does not provide a similar north south connection as the other options and alone will not provide the same strategic benefits as the other north south options. However, this corridor does provide

benefits for movements between Pukekohe and the strategic transport network (SH1) and was progressed to the Package Assessment to further understand it's benefits in the network.

- NS3 – Upgraded and new section of corridor between the Drury West station and Paerata. Upgrades Burtt Road, with a new connection between Burtt Road and Paerata Station and connects to the Paerata Arterial at Cape Hill Road: This option was one of the preferred options through the investment objective assessment as it would best enable network-wide benefits to support growth.
- NS2 – A new two lane connection from the proposed Drury South interchange at Great South Road to Paerata Station. This was one of the preferred options from a transport perspective as it would best enable network-wide benefit to support growth.
- NS1 – A new four lane, high speed corridor from the proposed Drury South interchange at GSR to the edge of the Pukekohe FUZ area (formerly known as the Pukekohe Expressway). While this option has high network resilience scoring, it does not score favourably in terms of investment objective 5 – travel choice. While this option induces light vehicle movements significantly and provides reduced benefits in terms of public transport, it was progressed to the Package Assessment to compare against the other packages.

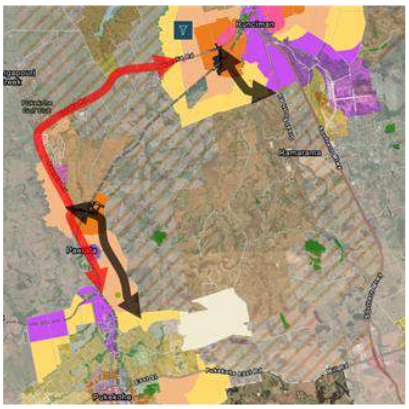
4.4 Network Package Assessment (Drury West, Paerata and North South)

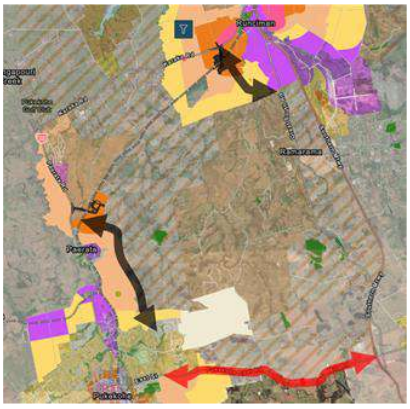
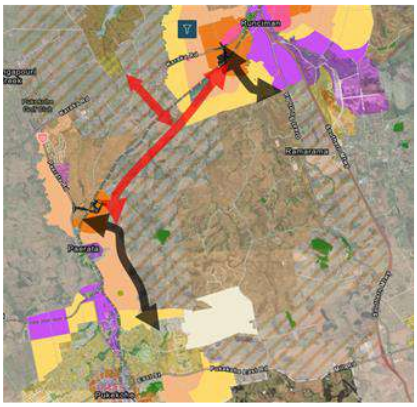
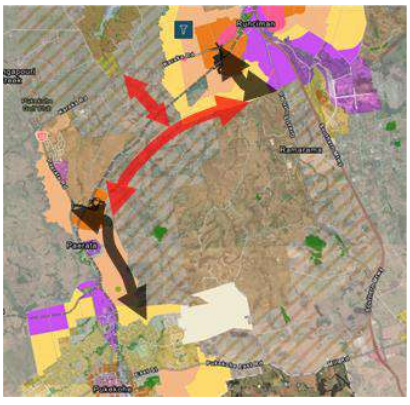
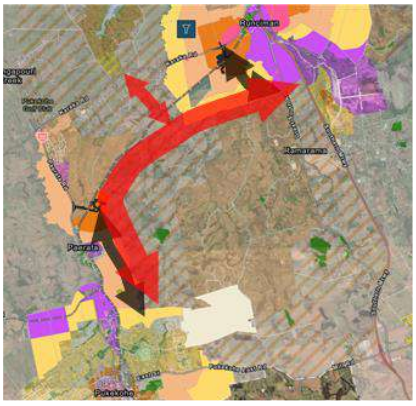
To determine the preferred network solution, the recommended corridor options from the Drury West Local and Paerata Local were considered with a short list of North South options.

4.4.1 Package Development

The package assessment options were grouped into five packages as shown in Table 4-15.

Table 4-15 Network Package description summary

Option	Routes	Overview Image
Package 1	Drury West Arterial (DW5) Paerata Arterial (PS5) Upgrade of existing SH22 (NS7), adding an additional lane each way to four lanes.	

Option	Routes	Overview Image
Package 2	Drury West Arterial (DW5) Paerata Arterial (PS5) South connection (upgrading Mill Road and Pukekohe East Road), (East Option), adding an additional lane each way to four lanes.	
Package 3a	Drury West Arterial (DW5) Paerata Arterial (PS5) New and upgraded connection between Drury and Paerata (NS3), two lanes.	
Package 3b	Drury West Arterial (DW5) Paerata Arterial (PS5) New two lane connection between Drury and Paerata (NS8), two lanes.	
Package 4	New connection between Drury and Paerata (NS1), four lanes.	

4.4.2 Package Assessment

Five options were assessed against the MCA framework by each subject matter expert. The packages were assessed quantitatively against the investment objectives and qualitatively by other technical specialists. Table 4-16Table 4-6 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-16 Package assessment MCA scoring

MCA Criteria	Scores				
Options	**Package 1**	**Package 2**	**Package 3a**	**Package 3b**	**Package 4**
Investment objectives					
IO1 – Safety	2	2	3	3	4
IO2 – Integration	1	1	3	3	3
IO3 - Access	1	1	3	3	2
IO4 – Resilience	1	2	3	3	4
IO5 – Travel Choice	1	1	1	1	-2

Table 4-17 Package assessment findings summary

Criteria	Summary of performance
Investment Objectives	Package 1 improves safety on SH22 for all users but has limited network-wide safety benefits. It does not resolve future safety issues on rural roads and compromises urban corridor function of SH22 at Drury West and Paerata. Package 2 Improves safety for local connectivity including active modes but provides limited network-wide safety benefits. Does not resolve future safety issues on rural roads. It will also require other north-south projects to better serve Pukekohe, Paerata and Drury West. It does provide an important strategic upgrade and should be progressed together with another package. Package 3a reduces future traffic using rural roads, reduces traffic growth on SH22, improves safety and integration in Drury West, provides an improvement to general traffic, PT and active modes. It is however likely to put pressure on Drury West collector network and interacts with a future school on Burtt Rd. Speeds will need to be reduced for safety which will influence the strategic function of the corridor. Package 3b has the same benefits as Package 3a, except that it does not interact with a school and adds resilience to the network, reduces the pressure on existing local roads more than 3a. Like 3a, it provides improvements for all modes - general traffic, PT and active modes being located within/adjacent to the FUZ. Package 4 Reduces traffic growth on SH22: significantly improves safety and integration in DW.Reduces future traffic using rural roads Significant increases network resilience and safety. However, mode shift scores poorly (-2). This package induces light fleet travel which undermines mode shift. It is has less desirable route or benefit for PT or active modes.

Criteria	Summary of performance
Heritage	Limited differentiation between the DW and PS options here and in other packages. Package 1 would potentially impact on a villa, probably early 20th century (CHI item 22338), Paerata community hall, date unknown, now demolished (CHI item 14979), Paerata train station water tower, date unknown, now demolished (CHI item 22218), World War II memorial plaque (CHI item 14978), Karaka Methodist Church, date unknown (CHI item 15106). Package 2 potentially impacts on Pukekohe East Community Hall, built 1959 (CHI item 19320) and Tennis courts (CHI item 22321). Package 3a potentially impacts on a late 19th / early 20th century villa (CHI item 22279). There was no recorded heritage for Packages 3a, 4 or 5.
Social	**Land use** Package 3a was the most preferred as it provides good integration and a more direct connection including direct connections to the proposed Drury and Paerata arterials. Package 1 was second most preferred as it connects both train stations and the Pukekohe town centre, which provides for good integration. Provides an alternate, parallel route at Paerata to increase access to residential catchment. Packages 3b and 4 also had positive effects for integration as they connect both train stations and the Pukekohe town centre, which provides for good integration Package 2 was the least preferred due to limited integration with town centre, other FUZ areas, proposed arterials and train stations. **Urban design** Package 1 and Package 3a uses existing corridors which reduces the visual impact but the rural areas to the north will not be able to respond to the alignment. Topography has potential to negatively affect character and amenity. Package 3b provides a direct connection but impacts on amenity and character in the rural area and traverses an area identified as THAB in the Paerata-Pukekohe Structure Plan. Package 4 cuts through the rural area, which will adversely impact the existing amenity and character. Its alignment away from the FUZ in the southern section may create pressure to extend the FUZ to the east. **Land requirement** Package 1 has fewer full acquisitions than Package 3b and Package 4. Package 3a requires only partial acquisitions. **Social cohesion** Package 1 was the most preferred as it connects the Drury community through Paerata to Pukekohe through rural land to existing residential. Connects Treetops Learning - Early Childhood Pukekohe Hill, new Paerata development, Paerata School, Wesley College, and existing light industrial and business areas. Packages 3a, 3b and 4 connect the Drury community through Paerata to Pukekohe through rural land to existing residential and provide an additional connection to SH22 provides greater indirect connection to Paerata Rise development and alternative route through existing communities. While Package 2 provides a link to shops in the precinct area it does not provide a connection to or directly between proposed Drury and Paerata arterials.

Criteria	Summary of performance
	Health and wellbeing Package 4 was the preferred option as there are no nearby sensitive land uses. Packages 2, 3a and 3b are in proximity to existing residential land use. While Package 1 is mostly an upgrade to existing road it is in proximity to residential land uses and is adjacent Wesley College, Paerata School, Country Village Preschool and is therefore the least preferred.
Environmental	**Landscape and visual** Package 1 includes potential effects on notable trees proximate to Paerata Road and effects on rural character. Package 2 includes potential effects on rural character and amenity and potential for impacts on the Pukekohe Tuff Ring Outstanding Natural Feature (ONF). Package 3a would result in the road being located upon steep topography and into adjacent catchments, including a stand of vegetation on Cape Hill Road identified as a Significant Ecology Area (SEA). Package 3b and 4 include the potential to impact on rural character and would require the removal of limited areas of mature vegetation. **Stormwater** Packages 1, 3a 3b has no new floodplain structures are needed and so impact of flooding is minimal. Package 2 will add minimal hardstand, however culverts and bridges will be required and WQ detention will be required via wetlands or raingardens. **Ecology** Nationally critical long-tailed bats recorded in Paerata Scenic Reserve (1km West) and Coulthards Scenic reserve and likely to occur in Oira Creek and Ngakoroa Stream. Bat effects likely for all packages. Package 1 would potentially have a direct impact on Paerata Scenic Reserve (SEA_T_4384), with known bat use. Package 2 avoids impacts on SEAs and significant areas of bush however likely to still be impacts to bats. Package 3a was preferred over Packages 1 and 2 as partially within FUZ, reducing overall impact on streams, wetlands and bat habitat. For Package 3b effects were similar to 3a, however, a two lane highway easier to mitigate than four lanes. Package 4 was the least preferred as it is four lanes and more difficult to mitigate as well as being outside the FUZ. **Natural Hazards** Those routes which used existing roads (Packages 1, 2 and 3a) were more preferred. Packages 3b and 4 included potential liquefiable areas.
Construction impacts	**Embodied carbon emissions** Packages 2 and 3b were preferred option due to being a shorter route and only two lanes. Package 3a was slightly less preferred due to length. Packages 1and 4 were less preferred due to four lanes and their length.

Criteria	Summary of performance
	Construction impacts on infrastructures and utilities All packages required protection of a First Gas Transmission pipe. Packages 1 – 3b also required protection or relocation of local services. **Construction disruption** All packages required upgrading the existing rural corridor and the new corridors on the greenfield. Package 4 was preferred due to less disruption compared to other packages. **Construction costs** Package 4 was likely to be the most expensive due to steep topography and the number of bridges likely to be required. Packages 1, 2 and 3a were not likely to require any major engineering works and the associated cost is lower.
Partner feedback	Key feedback during workshops on the packages from partner SMEs included: • That the upgrade Mill Road (East Option) should be progressed with the preferred package. It is an important strategic connection between Pukekohe, State Highway 1 and south into Waikato (Package 2). • North Waikato is also experiencing significant growth (Package 2). • Consideration of development adjacent to SH22 in Drury and Paerata. Is going to put increasing pressure on SH22 (with reference to Package 1). • Safety on existing rural roads is a high priority to AT (all packages). • The preferred package needs to support transit oriented development. • Grafton Downs (Paerata) are developing the next stages of their development. Engagement to take place shortly. • Support for Package 3b that provides more of a bypass rather than directing traffic through the centre of Drury West – Package 3a. • Support for investigating alternatives to Package 4 (which was recommended in 2018 through the South IBC) due to a number of central government changes in approach to climate change. In particular, decarbonising the transport network. The key feedback from Manawhenua representatives during hui were: • Planned schools in the area should be considered. Supported consideration of schools during options assessment (reference to Package 3a). • Support for future proofing for four lanes (for all packages), but consideration of impacts on ecological features is important. • All packages have an impact on cultural values, integrity and taonga. Package 4 has the greatest impact. • One representative raised concern towards the potential for arterials in rural areas which may encourage growth around the new roads rather than an 'expressway' (strategic connection between Drury and Pukekohe). This, in the representative's view, was a higher speed road with more limited access. • One representative noted that there are several water courses and cultural sites in the proposed network footprint, and that the project team needed to physically understand the environment rather than digitally.

4.4.3 Discarded Package Options

Table 4-18 Options to be discarded

Option	Reasons for being discarded
Package 1	Does not resolve future safety issues on rural roads and compromises urban corridor function of SH22 at Drury West and Paerata.
Package 2	Does not resolve future safety issues on rural roads such as Runciman Road and Burtt Road. It will also require other north-south projects to better serve Pukekohe, Paerata and Drury West. SH22 integration outcomes with planned urban development are also poor with this package. It does however provide an important strategic upgrade and should be progressed together with the preferred North South package.
Package 3a	Likely to put pressure on Drury West collector network and interacts with a future school on Burtt Rd. Speeds will need to be reduced for safety which will influence the strategic function of the corridor.
Package 4	Induces the most amount of light fleet travel and has limited benefits for PT and active modes. It scores poorly against mode shift investment objective (-2).

4.4.4 Recommended Package Option

Following the MCA assessment and consideration of feedback received from project partners, Package 3b is the preferred package. Package 3b was preferred because:

- Provides an alternative to SH22 and SH1 – significantly improving network resilience.
- Reduces future traffic using existing rural roads which reduces safety concerns.
- Improves safety and integration in Drury West urban development as well as providing improved access and resilience for general traffic, PT and active modes.
- Induces less light vehicle travel than Package 4.
- Is located close to FUZ to integrate with future urban development further supporting active modes.
- Has reduced potential impact on ecological features such as streams and wetland environment compared to other packages.
- Has reduced impact on potential bat habitat compared to other options.
- Has reduced potential impact on archaeology and built heritage compared to other options.

Package 3b will be developed further through route refinement assessment. Recommendations for the report refinement options were to minimise impact on private properties where possible, the consideration of property access and reducing impacts on ecological features.

The East Option – was also recommended to progress with Package 3b to route refinement. This option is an important strategic corridor between Pukekohe, SH1 and south to Waikato. Upgrading this corridor has significant benefits for freight movement and supports future urban growth in Pukekohe and north Waikato. Recommendations for route refinement for the East Option were to reduce impacts on the ONF Pukekohe Tuff Ring.

4.5 Pukekohe Local Corridor Assessment

4.5.1 South IBC – Pukekohe Arterials

At the IBC phase, several options were investigated to test multiple locations and alignments for a 'ring route' around the Pukekohe township. The ring route arterials provide an alternative route to going through the town centre and to support future urban growth. The other arterial options improve capacity for all modes of transport as well as support future urban growth and offer the opportunity for complete street solutions where all modes of transport can be sufficiently improved. The options (shown in Figure 4-10) included:

- Existing arterial upgrades (AR24, AR30, AR31, AR46)
- Western ring route options (AR25, AR29, AR35, AR40)
- Eastern ring route options (AR28, AR34, AR38, AR39, AR41, AR42, AR43)
- South-eastern ring route options (AR26, AR27, AR36, AR37)

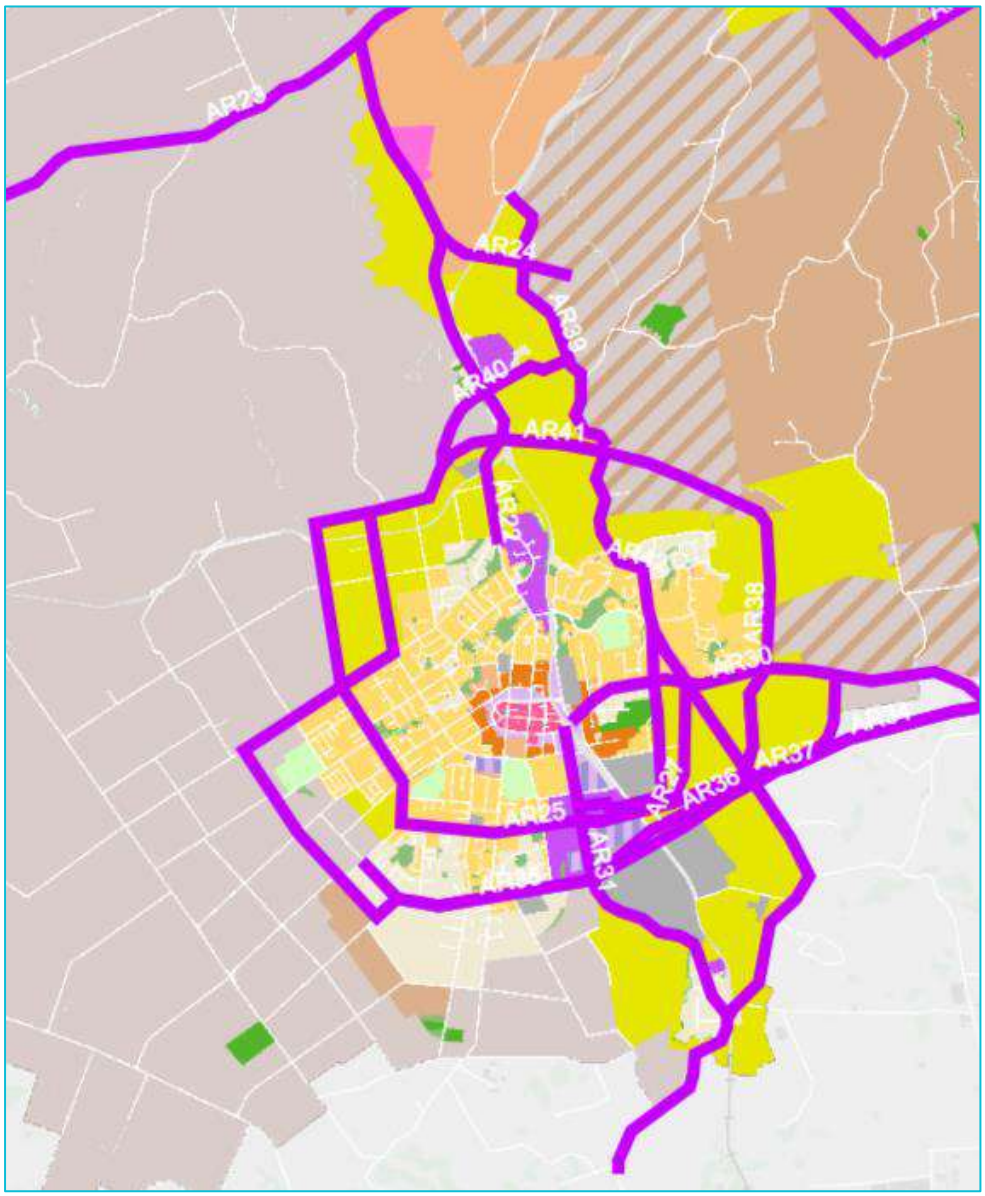


Figure 4-10 South IBC long list options

Many these options were recommended for the short list (Figure 4-11) as these were to be tested further in combinations with the strategic routes.

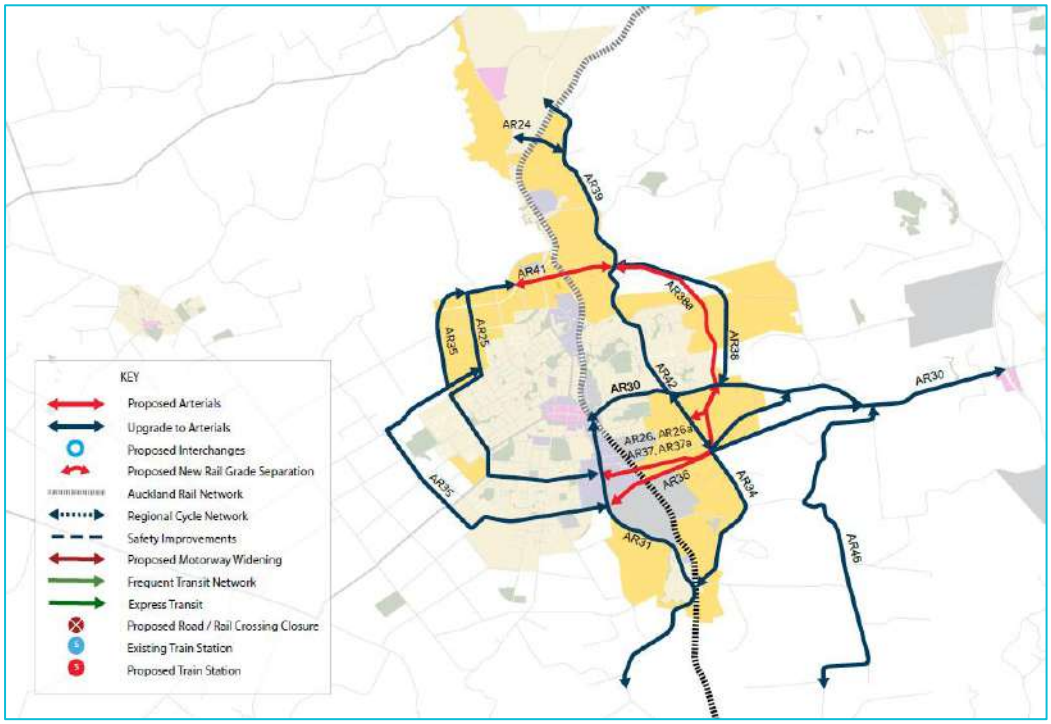


Figure 4-11 South IBC short list options

4.5.2 Pukekohe Local Option Development

For corridor assessment, the Pukekohe Local Arterials were split into four quadrants for assessment purposes (and further segments in some cases) as shown in the figure below.

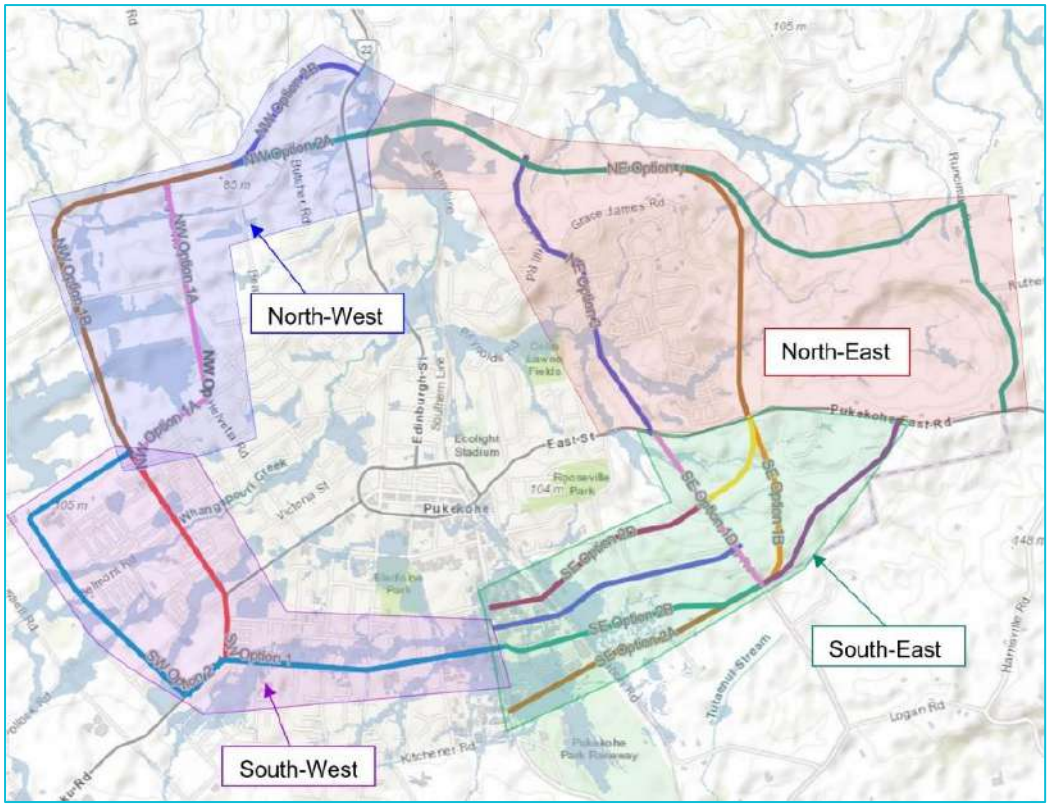


Figure 4-12 Summary of Pukekohe options

Each of the four quadrants are set out in the following sections.

4.5.3 Pukekohe North East Corridor Assessment

4.5.3.1 South IBC / Strategic South DBC assessment summary

- 7 options (referred to as AR28, AR34, AR38, AR39, AR41, AR42, AR43) were identified during the IBC longlist development.
- 7 options were taken through to the IBC short list assessment.
- AR38a was added during the short list assessment by engineering refinement. This option involves safety upgrades with no widening of the corridor.
- 2 options (AR41 and AR38a) were recommended in the IBC.
- AR41 has high benefits assuming that it connects to the Pukekohe Expressway, also acting as a supportive link to a wider network. Both options were selected for the following reasons:
    - To enable quality access from/to Paerata rail station
    - To enable freight traffic to avoid town centre
    - Allows through traffic to use strategic roads avoiding town centre.

Functional intent of these options is to facilitate an alternative north/south movement, linking the eastern growth areas. IBC recommended 4 lane arterial with walking and cycling provided.

The draft Strategic South DBC developed the Pukekohe Urban Arterial (NE Arterial) to connect the former Pukekohe Expressway. Two options were developed with a preference for an alignment that followed the FUZ boundary and was located further away (in the southern section) from the Pukekohe Tuff Ring (ONF).

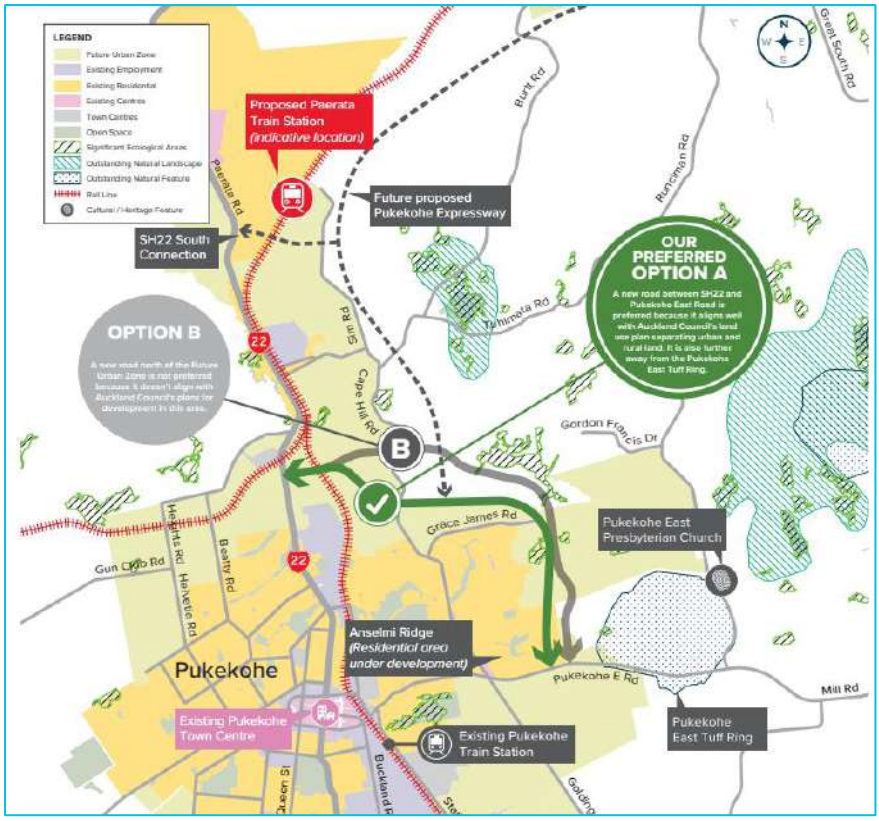


Figure 4-13 - Pukekohe Urban Arterial (NE Arterial) from Draft Strategic South DBC

4.5.3.2 Gap analysis IBC – DBC

Table 4-19 provides a summary for Pukekohe North East Arterial transport components of the Pukekohe DBC, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC and a recommendation for the Pukekohe DBC.

Table 4-19 Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Arterial route connecting from SH22 west to Heights Road. Provides a strategic link to PEX and relieves the through-town traffic. The alignment was planned to be 4 lanes for vehicles with no planned PT lanes.	Developer interest / resource consents lodged. GPS 2021/Zero Carbon Act – Climate change lens, which may have implications on former Pukekohe Expressway alignment. Consider implications of NPS FM and NES FW – adopt avoidance of wetlands where possible as principle in first instance.	Corridor assessment considering the following: • Form and function of the Pukekohe Arterials to be confirmed. The options have not been assessed since the IBC (2019) which left the form and function to be confirmed in the DBC. The arterials are likely to be two lanes which may influence their placement over a four lane corridor. • The form and function of the Pukekohe Expressway is re-assessed and the need confirmed. This interacts and

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
		is likely to influence the NE Arterial. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • Through any optioneering processes new information such as impacts on wetlands (under the NPS FW) and opportunities to integrate with urban development are identified.

4.5.3.3 Option Development

Three options were developed for the Pukekohe North East Arterial corridor assessment as shown in the figure below.

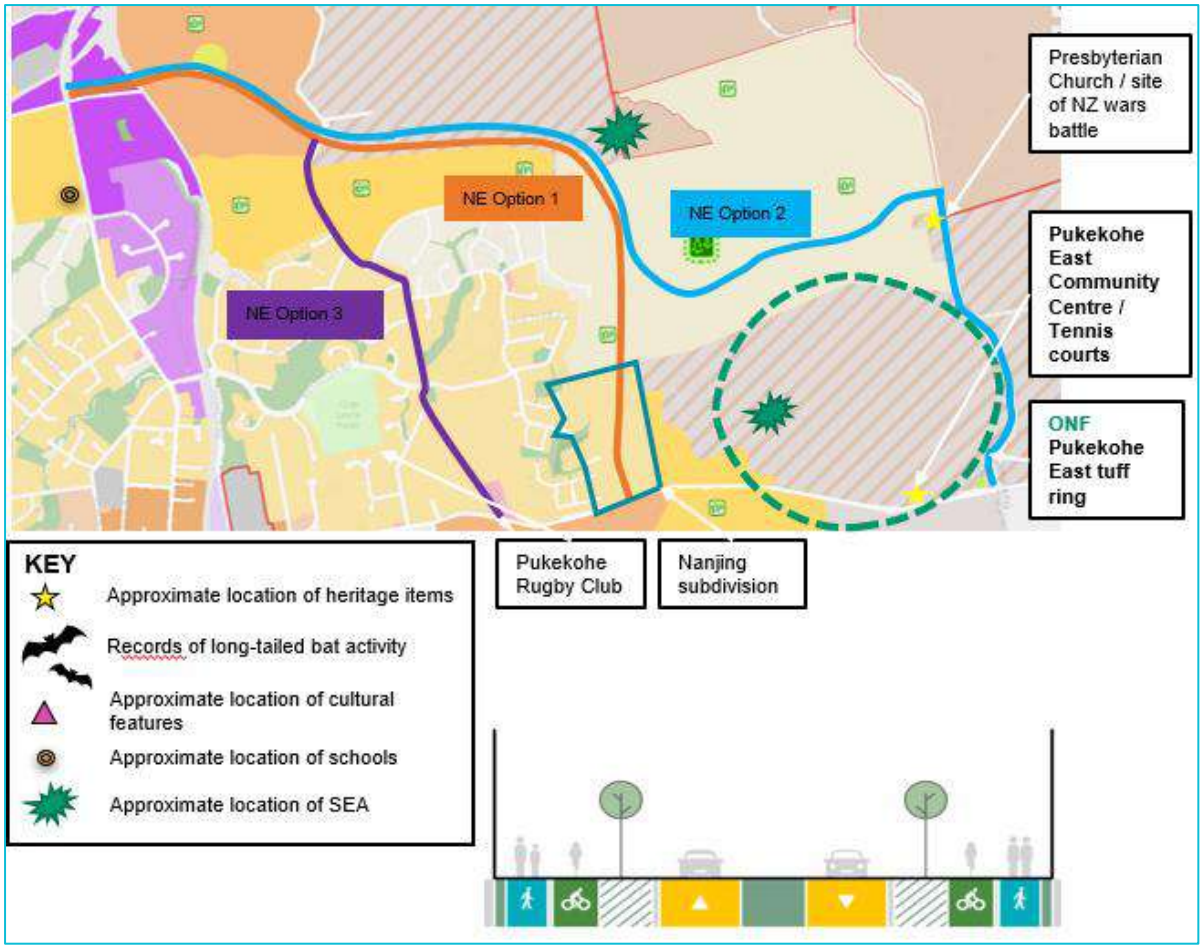


Figure 4-14 Pukekohe North East Arterial Corridor Assessment Options with Receiving Environment



Figure 4-15 Pukekohe North East Arterial Corridor Assessment Options

4.5.3.4 Option Assessment

Three options were assessed against the MCA framework by each subject matter expert in Table 4-20. Table 4-21 Table 4-20provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-20 Pukekohe Local – North-East corridor option MCA scoring

MCA Criteria	Scores		
Options	**NE1**	**NE2**	**NE3**
Investment objectives			
IO1 – Safety	2	1	0
IO2 – Integration	2	1	0
IO3 – Access	2	2	0
IO4 – Resilience	3	1	-1
IO5 – Travel Choice	1	1	1
Cultural			
Heritage	0	-5	0
Social			
Land use futures	-1	1	1
Urban design	-1	-1	-2
Land requirement / property	-2	-1	-3
Social cohesion	2	1	1
Human health and wellbeing	-1	-1	0
Environment			
Landscape / visual	-3	-4	-1
Stormwater	-3	-3	-1
Ecology	-4	-4	-2
Natural hazards	-3	-3	-2
Construction impacts			
Embodied carbon emissions	-3	-3	-3
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-1	-1	-2

Construction costs / risk / value capture	-3	-3	-2

Table 4-21 Pukekohe Local – North-East option assessment findings summary

Criteria	Summary of performance
Investment Objectives	NE1 is preferred as it scored most favourably against the objectives overall. NE3 is the least preferred as has limited benefits for active modes and the pressure on other modes would increase. Does not provide network resilience by upgrading a road in an existing urban area.
Heritage	NE1 and NE3 did not have any recorded heritage. NE2 potentially impacts the Sharp residence, a memorial plaque and flagpole, Pukekohe East Presbyterian Church, and the site of an 1863 battle at the beginning of the Waikato Invasion and a significant site. It therefore scores very poorly (-5).
Social	**Land use** NE3 was the preferred option as it would integrate the best with future development. While NE1 connects the most future land uses, it goes through a future subdivision which is advanced to a stage where the design cannot be adjusted to accommodate the new corridor. NE2 would reduce the amount of developable land and provides less direct connections between higher density residential areas. **Urban design** NE1 is preferred on the basis of future development having the opportunity to respond to the corridors. **Land requirement** NE2 was preferred as it involved mostly partial acquisition of mixed rural or future urban zoned land. NE3 would require the full acquisition of approximately a large number of homes, mostly new builds (<10 years old). **Social cohesion** NE1 provides the greater connection between areas and crosses existing residential areas, with indirect access to the Rugby Club and direct access to two reserves. NE2 has a lack of connection within the existing environment as it traverses the FUZ and rural areas. **Health and wellbeing** NE3 is predominantly an existing road, with less sensitive activities nearby. NE2 was the least preferred as it passes a school which was considered a sensitive receiver.
Environmental	**Landscape and visual** NE3 was preferred due to alignment relating to underlying landscape patterns (topography and vegetation), notable trees and the level of potential visual effects. NE2 was least preferred due potential impacts on the ONF (Tuff Crater), through SEA's and not following the underlying landscape patterns, and potential effects on rural character, visual amenity and notable trees. **Stormwater** NE3 was preferred as it involves upgrading existing roads and would cross less streams and floodplains than the other options. **Ecology**

Criteria	Summary of performance
	NE3 was preferred as it uses existing roads and avoids impacts on wetlands, indigenous vegetation and bats. NE1 and NE2 both impact the edge of several SEAs and are likely to impact smaller stands of indigenous vegetation and numerous streams and wetlands outside SEA areas. **Natural Hazards** NE3 is widening only, follows mostly existing roads. NE1 and NE2 cross peat swamp, NE1 has greater stability issues.
Construction impacts	**Embodied carbon emissions** NE3 is neutral overall as it is a short corridor with no major earthworks or structures. NE2 is the longest option and involves mostly new development through rural greenfield. Requires significant earthworks and two bridges. **Construction impacts on infrastructure/utilities** All options require relocation or protection of the first gas transmission pipe and scored the same. **Construction disruption** NE1 and NE2 were likely to have minimal impacts on the community as they are greenfield development. NE3 was least preferred as it would require lane narrowing and disruption for upgrades to the existing urban and rural corridor. **Construction costs** NE1 and NE2 were likely to have higher construction costs as they would include new corridor and bridge structures. NE3 was preferred as it involved upgrades to the existing road only.
Partner feedback	Key feedback from SMEs from workshops included: • Queries on option NE3 in terms of what improvements would be required of the existing roads. • Option NE3 currently carries a higher proportion of freight which will increase and needs consideration. • Feedback on the active urban development in the area and the interaction with a proposed development north of Pukekohe East Road (Nanjing) for NE1. During the manawhenua Site Visit (28 July 2022), the following matters were raised: • Ngaati Te Ata Waiohua noted that both the Tuff Ring and SEAs were in the area. • Next steps for route refinement were discussed in the context of developing options to avoid urban development and the reduce impacts on significant features. • Ngaati Te Ata Waiohua is not supportive of option 3 (NE3) due to the potential impact on existing residential areas. A preference for Option 1 (NE1) over the other two options. However, noted the dew urban development occurring in the area north of Pukekohe East Road.

4.5.3.5 Discarded Options

Table 4-22 Options to be discarded

Option	Reason
NE2	Potential to impact a significant heritage site. Scores low positives against the investment objectives, as a longer, less attractive route.
NE3	Upgrades existing road in an existing urban area. Does not integrate with FUZ. Scores poorly against resilience objective.

4.5.3.6 Recommended Corridor Option

NE1 is the recommended corridor option as it provides increased resilience in the transport network and scores most favourably against the investment objectives.

Recommendations for route refinement are to reduce impacts on active development around the Pukekohe East Road area.

4.5.4 Pukekohe South East Corridor Assessment

4.5.4.1 South IBC assessment summary

See IBC long list and short list figures in section 4.5.1.

- 4 south-eastern ring route options (AR26, AR27, AR36, AR37) were identified in IBC longlist assessment.
- 4 options were taken through to the IBC short list assessment (AR26, AR26a, AR37 and AR37a).
- AR26a and AR37a were added during the shortlist development by engineering refinement.
- The IBC recommended AR26a - an inner bypass around south-eastern side of Pukekohe from Manuka Rd to Pukekohe East Rd via Svenden Rd and Anselmi Ridge. This option was selected for the following reasons:
  - To service further development south of Pukekohe town centre
  - To enable freight traffic to avoid town centre
  - To enable existing alignments to be more flexible
  - Allows through traffic to use strategic roads avoiding town centre

Functional intent of these options was to link south-eastern growth areas providing improved access to SH1 via Mill Road and also supports access to Pokeno and Tuakau. IBC recommended 4 lane arterial with walking and cycling provided.

4.5.4.2 Gap analysis IBC to DBC

Table 4-23 provides a summary for Pukekohe South East Arterial transport components of the Pukekohe DBC, key changes since the previous recommendations made by the South IBC and Strategic South DBC and a recommendation for the Pukekohe DBC.

Table 4-23 Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
From Svendsen Rd over the rail tracks to Golding Rd, heading north to Pukekohe East Rd.	Developer interest / resource consents lodged.	• Corridor assessment considering the following:

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Enables freight to travel around Pukekohe for greater efficiency and a reduction in congestion within Pukekohe town centre.	GPS 2021/Zero Carbon Act – Climate change lens, which may have implications on PEX alignment. Consider implications of NPS FM and NES FW – adopt avoidance of wetlands where possible as principle in first instance.	• Form and function of the Pukekohe Arterials to be confirmed. The options have not been assessed since the IBC (2019) which left the form and function to be confirmed in the DBC. The arterials are likely to be two lanes which may influence their placement over a four lane corridor. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • A number of plan changes have been lodged (or are planned) in proximity to this corridor – in particular along Golding Road. Opportunity to better integrate with these developments. • Through any optioneering processes new information such as impacts on wetlands (under the NPS FW) and opportunities to integrate with urban development are identified.

4.5.4.3 Option Development

The South East Arterial was split into two segments for assessment purposes:

- Segment 1 – four options east of and including Golding Road.
- Segment 2 – four options west of Golding Road connecting between Golding Road and Manukau Road.



Figure 4-16: Pukekohe South East Corridor Option Development



Figure 4-17: Pukekohe South East Corridor Option Development



Figure 4-18: Pukekohe South East Corridor Assessment Options

4.5.4.4 Option Assessment

Options were assessed against the MCA framework by each subject matter expert. Table 4-24 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-24 Pukekohe Local – South-East corridor option MCA scoring

MCA Criteria	Scores							
Options	**SE1A**	**SE1B**	**SE1C**	**SE1D**	**SE2A**	**SE2B**	**SE2C**	**SE2D**
Investment objectives								
IO1 – Safety	1	1	1	2	1	2	2	2
IO2 – Integration	1	2	2	1	2	2	2	2
IO3 - Access	1	1	1	1	1	2	2	2
IO4 – Resilience	2	2	2	0	3	3	3	3
IO5 – Travel Choice	1	1	1	1	1	1	2	2
Cultural								
Heritage	0	0	0	0	0	0	-1	0
Social								
Land use futures	1	2	2	2	1	2	1	1

Urban design	-2	-2	-2	0	-2	-1	-2	-2
Land requirement / property	-1	-2	-1	-1	-2	-2	-2	-3
Social cohesion	0	0	1	1	-1	2	-2	-2
Human health and wellbeing	-1	-1	-1	0	-1	-1	-2	-2
Environment								
Landscape / visual	-3	-2	-1	-1	-1	-1	-2	-2
Stormwater	-1	-1	-1	-1	-2	-2	-2	-2
Ecology	-4	-3	-3	-1	-2	-2	-2	-2
Natural hazards	-3	-3	-2	-2	-3	-3	-2	-2
Construction impacts								
Embodied carbon emissions	-3	-3	-3	-3	-3	-3	-3	-3
Construction impacts	-1	-1	-1	-2	-2	-2	-2	-2
Construction Disruption	-1	-1	-1	-1	-2	-2	-2	-2
Construction costs / risk	-2	-2	-2	-2	-2	-2	-2	-2

Table 4-25 Pukekohe Local – South-East option assessment findings summary

Criteria	Summary of performance	
	Segment 1	**Segment 2**
Investment Objectives	All options result in improved safety and provide balanced land-use and transport outcomes. SE1A, 1B and 1C provide an alternative connection to Golding Road and improve resilience and stronger freight connections. 1A scored slightly lower as it is located on FUZ fringe, has reduced integration and has a reduced catchment.	SE2C and SE2D were preferred as these options would significantly improve E-W access and were closer to Pukekohe Town Centre and rail station. These options also improved travel choice between the existing environment and likely future environment for all modes but also closer to jobs and schools.
Heritage	No recorded heritage.	SE2C had the potential to impact on early 20th century villa (CHI item 22335), 1920s railway workers cottages (CHI item 22373). No other recorded heritage.
Social	**Land use** SE1A is the least preferred as is it provides less integration with the FUZ. All	**Land use** SE2B was preferred as it avoids all precincts and the Franklin Showground a regionally important venue.

Criteria	Summary of performance	
	other options provided good integration with FUZ areas. **Urban design** SE1D was preferred as uses an existing corridor alignment and topography appears to be less challenging in this location. By being outside of FUZ area the alignment increases development flexibility. **Land requirement** SE1B was the least preferred as it would have the largest property impact in terms of acquisitions and betterment. All other options were similar. **Social cohesion** SE1C and SE1D preferred as provides an upgraded existing direct route and includes walking cycling connections closer to existing residential. **Health and wellbeing** SE1D is preferred as involves only upgrades to existing roads, the remaining options were less preferred.	**Urban design** SE2B was preferred as provides a connection to the SW options and uses an existing corridor and avoids community assets and is preferred on this basis. **Land requirement** SE2D was the least preferred due to negative impact to commercial properties along subway road, Saleyards and Franklin Agricultural Society land and a number of full and partial acquisitions. **Social cohesion** SE2B was preferred as provides a connection over the rail line between existing rural, business and light industrial indirectly to Pukekohe town centre. **Health and wellbeing** SE2A and SE2B were preferred as do not impact the showgrounds.
Environmental	**Landscape and visual** SE1C and SE1D were preferred due to underlying landscape patterns (topography and vegetation), notable trees and the level of potential visual effects. SE1A presents new road infrastructure within the rural environment and within the productive landscape and has potential effects on notable trees and was the least preferred. **Stormwater** There was limited differentiation between options. SE1 crosses several streams in the headwaters of the Whangapouri Creek catchments which would require culverts sized for flow and fish passage. However, no significant flooding effects expected. **Ecology** SE1D was preferred as upgrading the existing 2 lane design would largely avoid impacts on streams and would upgrade	**Landscape and visual** SE2A and SE2B were preferred due to underlying landscape patterns (topography and vegetation). SE2C and SE2D were not preferred as these options would sever the Pukekohe Showgrounds which represents a publicly accessible facility and would result in adverse visual effects to its users. **Stormwater** There was limited differentiation between options. For SE2 new hardstand would require water quality, detention and attenuation via wetlands and options pass through floodplain mostly on the western side of the railway line and would require mitigation to offset the displacement effects of the earthworks. **Ecology** Preferred SE2B as impacts would be minor, relating to individual scattered native / exotic trees. **Natural Hazards**

Criteria	Summary of performance	
	existing infrastructure (upgrade undersized culverts). **Natural Hazards** The preferred options are primarily within tuff and basalt (SE1C and SE1D). The options were within alluvium, with likely soft and compressible conditions.	The preferred options are primarily within tuff and basalt (SE2C and SE2D). The options were within alluvium, with likely soft and compressible conditions.
Construction impacts	**Embodied carbon emissions** SE1C was preferred as a short new development through rural greenfield. However, this option was likely to require two bridges. **Construction impacts on infrastructure/utilities** For SE1 services require protection where the new alignment intersects with existing roads. SE1D was least preferred as existing overhead powerlines are likely to require undergrounding on Golding Rd. **Construction disruption** For SE1 construction of a new corridor in a rural greenfield. Minimal impacts on the community. SE1D was the least preferred as would require lane narrowing / temporary traffic control. **Construction costs** Limited differentiation between options.	**Embodied carbon emissions** SE2C and SE2D were both preferred. **Construction impacts on infrastructure/utilities** For SE2 impacts on local network utilities only. Protection of services or relocation is likely required. **Construction disruption** For SE2 all options are likely to require lane narrowing / temporary traffic control, as well as direct access to businesses likely to be affected during construction. **Construction costs** Limited differentiation between options.
Partner feedback	Kay matters raised during partner SME workshops included: • Lots of active or planned plan changes in the immediate area that interact with the options. Provides opportunities to work with developers. • Consideration of how collector roads with the development will connect with the options. • Consideration of upgrading existing intersections such as Pukekohe East/Golding Road to make more efficient in the future. • Support for new crossing over the rail corridor and that this will be attractive for freight. • Consideration of gradient of transport corridors for active modes. Lots of active development Key matters raised by a Ngaati Te Ata representative in hui were: • Plan change 76 discussed. Golding Road SE1D option allows for Auckland Transport to work with developers either side of Golding Road through private plan changes. Additionally, terrain is more difficult on the east side of Golding Road, with numerous ecological features. Ngaati Te Ata support the upgrade of Golding Road SE1D. • Ngaati Te Ata Waiohua supported not to affecting the AMP showgrounds and Trotting Club.	

Criteria	Summary of performance	
	• Ngaati Te Ata Waiohua supported keeping away from plan change areas that are advanced.	

4.5.4.5 Discarded Options

Table 4-26 Options to be discarded

Option	Reason for being discarded
SE1A	Due to impacts on landscape features specifically the tuff ring and potential ecological impacts on wetlands and potential bat habitat.
SE1B	Requires the largest amount of land, traverses a number of gullies, wetlands, difficult topography.
SE1C	Traverses a number of gullies, wetlands, difficult topography.
SE2A	Significant property impacts including Auckland trotting club and Golding Road development.
SE2C	Impacts A&P showgrounds a significant regional facility.
SE2D	Impacts A&P showgrounds a significant regional facility.

4.5.4.6 Recommended Corridor Option

Options SE1D and SE2B are the emerging preferred options as:

- SE1D was most preferred through MCA assessment. This is already a busy corridor and will have a significant public transport function in future. Has reduced potential impacts on stormwater, landscape and visual, and ecology than other options. This option provides opportunities to work with developers to deliver the upgrade.
- SE2B: Avoids the Auckland Trotting Club/Golding Road active development and Franklin A&P showgrounds and provides the most direct east-west connection for freight and general traffic.

Recommendations for route refinement are:

- SE1D: A section of Pukekohe East Road will also need to be upgraded to support this route.
- SE2B: Further investigation in the best place to cross the existing rail line and reduce property impacts.

4.5.5 Pukekohe South West Corridor

4.5.5.1 South IBC assessment summary

See IBC long list and short list figures in section 4.5.1.

The IBC looked at the southwest and north west together as “western arterials”. This included:

- 4 western ring route options (AR25, AR29, AR35, AR40) were identified during the IBC longlist assessment.

- A third option between AR25 and AR35 was considered during an internal alliance review, but due to a reserve, versatile soils and an irregular form of the urban edge this was not included in the longlist for assessment.
- Two western ring routes (AR25 and AR35) were taken through to the IBC shortlist assessment.
- The IBC recommended AR25 – an inner bypass around west of Pukekohe from Height Rd in the north to Manukau Rd in the south. This option was selected for the following reasons:
    - To enable freight traffic to avoid town centre
    - To enable existing alignments to be more flexible
    - Allows through traffic to use strategic roads avoiding town centre

Functional intent is to facilitate movement of traffic north/south linking growth in the western areas.

4.5.5.2 Gap Analysis IBC – DBC

Table 4-27 provides a summary for Pukekohe South East Arterial transport components of the Pukekohe DBC, key changes since the previous recommendations made by the South IBC and Strategic South DBC and a recommendation for the Pukekohe DBC.

Table 4-27 Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Facilitate movement of traffic north/south linking growth in the western area. Enables movements around Pukekohe for greater efficiency and a reduction in congestion within Pukekohe town centre.	Developer interest / resource consents lodged. GPS 2021/Zero Carbon Act – Climate change lens, which may have implications on PEX alignment. Consider implications of NPS FM and NES FW – adopt avoidance of wetlands where possible as principle in first instance.	Corridor assessment considering the following: • Form and function of the Pukekohe Arterials to be confirmed. The options have not been assessed since the IBC (2019) which left the form and function to be confirmed in the DBC. The arterials are likely to be two lanes which may influence their placement over a four lane corridor. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • A number of plan changes have been lodged (or are planned) in proximity to this corridor – in particular along Golding Road. Opportunity to better integrate with these developments. • Through any optioneering processes new information

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
		such as impacts on wetlands (under the NPS FW) and opportunities to integrate with urban development are identified.

4.5.5.3 Option Development

Three options were developed for the Pukekohe South West Arterial as shown in Figure 4-19 and Figure 4-20.

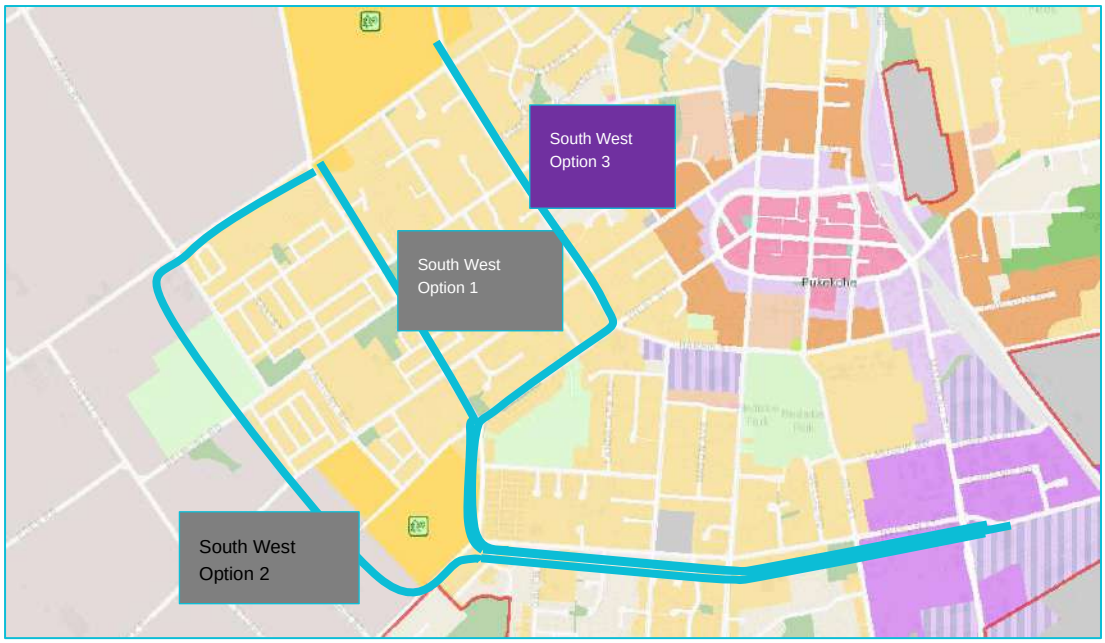


Figure 4-19 Pukekohe South West Corridor Assessment Option

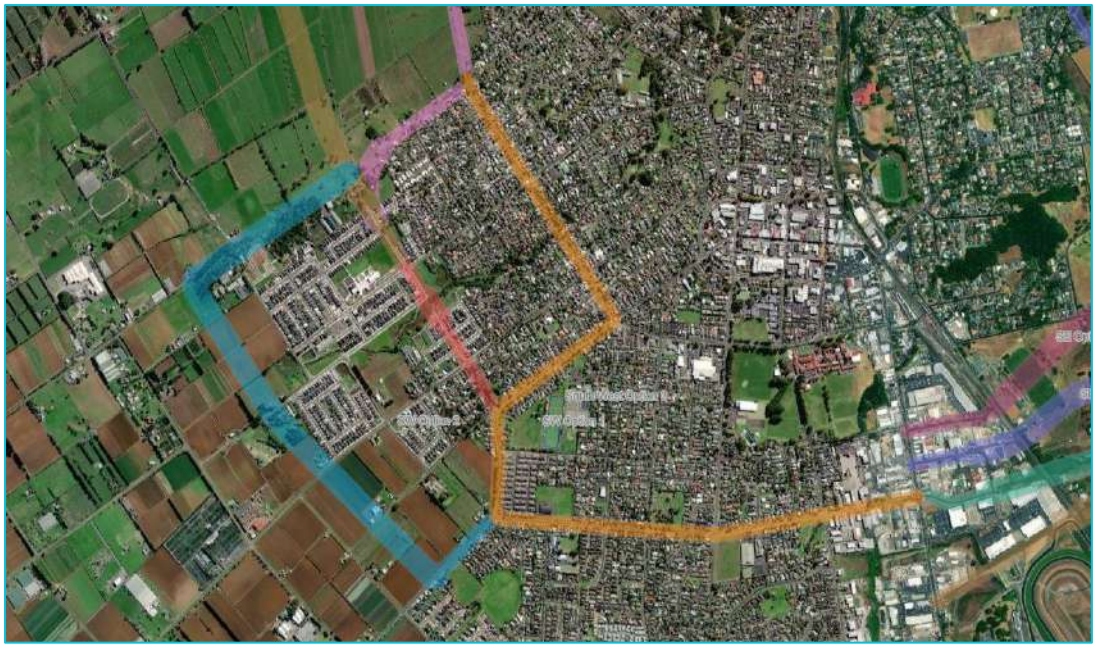


Figure 4-20 Pukekohe South West Corridor Assessment Options

4.5.5.4 Option Assessment

Three options were assessed against the MCA framework by each subject matter expert in

Table 4-28. Table 4-29 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-28 Pukekohe Local – South-West corridor option MCA scoring

MCA Criteria	Scores		
Options	**SW1**	**SW2**	**SW3**
Investment objectives			
IO1 – Safety	1	1	2
IO2 – Integration	1	1	2
IO3 - Access	2	1	3
IO4 – Resilience	1	1	1
IO5 – Travel Choice	2	1	2
Cultural			
Heritage	-4	-4	-4
Social			
Land use futures / integration with planned landuse	2	1	1

Urban design	-3	-2	-2
Land requirement / property	-3	-3	-2
Social cohesion	2	-1	2
Human health and wellbeing	-1	-2	0
Environment			
Landscape / visual	-2	-3	-2
Stormwater	-1	-1	-1
Ecology	-2	-5	-3
Natural hazards	-3	-3	-2
Construction impacts			
Embodied carbon emissions	-3	-3	-3
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-2	-2	-2
Construction costs / risk / value capture	-2	-2	-2

Table 4-29 Pukekohe Local – South-West option assessment findings summary

Criteria	Summary of performance
Investment Objectives	All options have a positive effect on safety and improve connectivity for the strategic network and travel choice. SW1 introduces a freight route close to a school, which is not ideal and would likely be subject to further speed reductions. SW2 is less direct freight and general traffic would likely use the existing Helvetia Rd and Seddon St instead. Neither of these options is ideal and option along Helvetia Road (SW3) was preferred.
Heritage	All options have impacts to heritage. Including potential impacts on the Borough Power House, 20th century (CHI item 15070), plaque marking the site of the First Presbyterian Church from 1868 (CHI item 12531), Pukekohe multidenominational Cemetery, from 1882, and War Memorial (CHI item 19319), Nehru Hall from 1953 (CHI item 15868)
Social	**Land use** SW3 was the preferred option as it provides a more direct connection, integrates more directly with the FUZ, serves more of the existing urban area. SW2 creates areas of residual land within the rural area, which may encourage development beyond the FUZ and existing urban areas. Both SW1 and SW2 provide similar connections. **Urban design** All options have interface issues. The second segment of SW2 runs along the urban boundary and would define the urban edge and this is the preferred option.

Criteria	Summary of performance
	Land requirement SW3 was the preferred option as partial acquisitions only would be required. SW1 would require approximately 40 full residential acquisitions and would also impact the cemetery on Nelson Street. SW2 would require 5 properties zoned rural production would be adversely affected, potentially requiring full acquisition. The cemetery, residential properties and commercial properties along Nelson Road would be similarly impacted in SW2. **Social cohesion** All options provide a connection to Franklin Care Centre, Pukekohe Indian Community Centre, Pukekohe Cemetery and Pukekohe Hill School and Tamaoho School. SW3 was the preferred option. SW1 severs open space (reserve) where there is an existing connection. SW2 has less existing residential catchment in being located partially within the rural area, less connections to facilities and it severs a large open space. **Health and wellbeing** Existing urban area, receivers including Franklin Care Centre, Cemetery, Indian Community Centre, Pukekohe Hill School, Tamaoho School. SW1 was preferred as involves upgrade to existing corridor rather than completely new road.
Environmental	**Landscape and visual** SW1 visual amenity effects likely limited to residences immediately adjacent to corridor. SW2 would have a limited loss of vegetation required to facilitate the route along existing corridor, however vegetation required to facilitate the route in the rural environment, including a block of vegetation to the north west (SEA). SW1 was the preferred option. **Stormwater** There are existing floodplains and existing culverts under these roads, all may require culvert upgrades and flood effect mitigation depending on flood displacement of the upgrade works. SW3 was the preferred option as there would be minimal new hardstand and no flooding effects are expected. **Ecology** SW3 was the preferred option as it impacts limited individual and scattered mature trees (largely exotic) and provided the opportunity to avoid the stream corridor. SW1 had one new stream crossing (Whangapouri), with potential associated wetlands and limited impacts to individual and scattered mature trees (including exotic trees in Jutland Road South Playground). SW2 involved the partial or complete loss of SEA_T_5384 (Regionally - Critically Endangered WF8 - Kahikatea, pukatea forest). Impacts on a stand of mature indigenous forest (including potential bat risk) and smaller areas of indigenous forest and a potential natural wetland and was the least preferred option. **Natural Hazards** SW3 was the preferred option as the majority of the alignment lies on volcanic soils. Both SW1 and SW2 interacted with the tuff crater, with soft and compressible soils anticipated, passing in to basalt and tuff. At Whangapouri Creek soft/compressible soils are anticipated.
Construction impacts	**Embodied carbon emissions**

Criteria	Summary of performance
	Limited differentiation between options. SW3 was preferred due to reduced extent of earthworks. **Construction impacts on infrastructure/utilities** All options have impacts on local network utilities only. Protection of services or relocation is likely required. **Construction disruption** All options require lane narrowing or temporary traffic control needs to be implemented during construction on the existing roads. **Construction costs** There was limited differentiation between options.
Partner feedback	Key feedback from SMEs during workshops included: • Acknowledgement in the difficulty in providing for a safe and direct cycle route and freight corridor in the existing urban environment. • A preference for option 3 as is generally already used by freight. Option 1 is likely to impact a number of new residential areas. Ngaati Te Ata Waiohua supported an upgrade to cycleway and path and supports reducing impacts on property in existing urban areas.

4.5.5.5 Discarded Options

Table 4-30 Options to be discarded

Option	Reason
SW2	Impacts a SEA with critically endangered species. Indirect, people would use existing roads.
SW1	Next to school (30km speed reduction). Not ideal location for freight movement.

4.5.5.6 Recommended Corridor Option

SW3 is the preferred option. It had slightly better scoring of investment objectives, is indicated as an AT future bus route and has a better catchment for existing and future areas.

Recommendations for route refinement are to investigate upgrading the existing road reserve (20m wide cross section rather than a 24m wide cross section) to reduce property impacts. This corridor is in an existing urban areas with many residential houses along the alignment.

4.5.6 Pukekohe North-West Corridor Assessment

4.5.6.1 South IBC assessment summary

See South West section 4.5.5.1

4.5.6.2 Gap Analysis IBC to DBC

See South West section 4.5.5.2.

4.5.6.3 Option Development

The Pukekohe North West options were split into two segments as shown in the figures Figure 4-21.

- Segment 1 – north south: two options
- Segment 2 – east west: two options

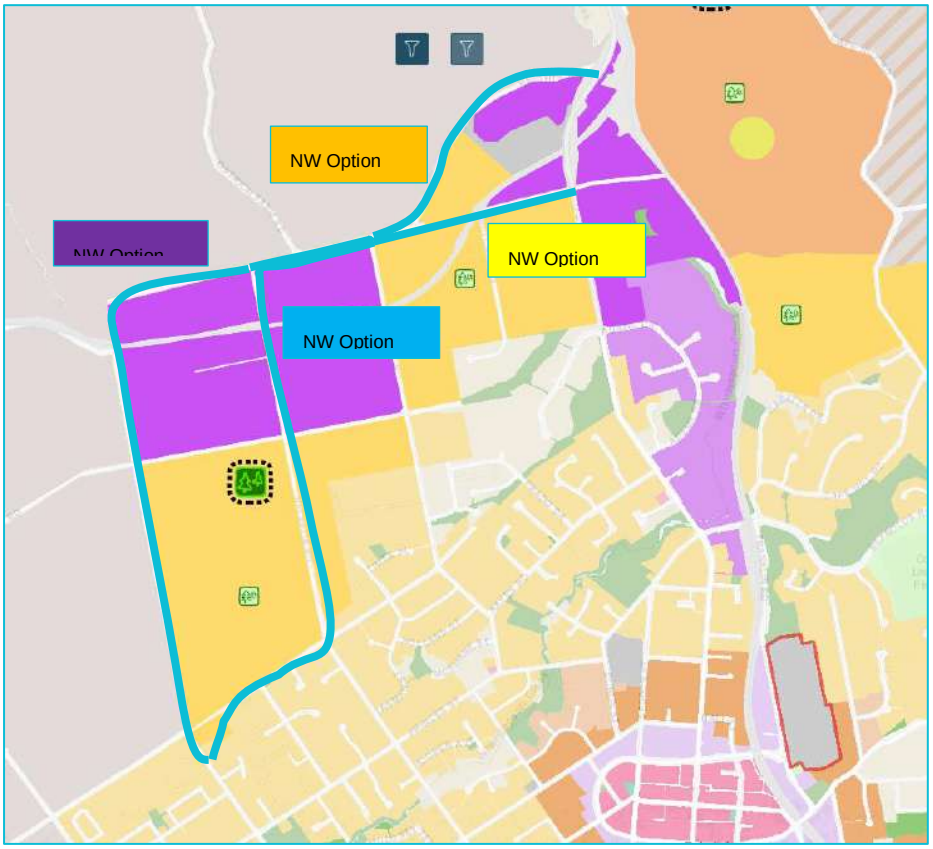


Figure 4-2122: Pukekohe North West Corridor Assessment Option



Figure 4-23 Pukekohe North West Corridor Assessment Options

4.5.6.4 Option Assessment

Table 4-31 Pukekohe Local – North-West Corridor option MCA scoring

MCA Criteria	Scores			
Options	**NW1A**	**NW1B**	**NW2A**	**NW2B**
Investment objectives				
IO1 – Safety	3	1	3	2
IO2 – Integration	3	2	3	1
IO3 - Access	3	2	3	2
IO4 – Resilience	1	2	3	1
IO5 – Travel Choice	2	1	3	1
Cultural				
Heritage	-2	0	0	0
Social				

Land use futures	3	1	3	1
Urban design	-1	0	-1	0
Land requirement / property	-3	-2	-1	-1
Social cohesion	1	0	0	0
Human health and wellbeing	0	-1	-1	0
Environment				
Landscape / visual	-2	-3	-1	-1
Stormwater	-3	-2	-1	-1
Ecology	-2	-5	-3	-2
Natural hazards	-4	-3	-4	-1
Construction impacts				
Embodied carbon emissions	-3	-3	-3	-3
Construction impacts on infrastructure	-2	-2	-2	-1
Construction Disruption	-1	-1	-1	-1
Construction costs / risk / value capture	-2	-2	-2	-2

Table 4-32 Pukekohe Local – North-West option assessment findings summary

Criteria	Summary of performance	
	Segment 1	**Segment 2**
Investment Objectives	NW1A is the preferred option. It aligns best with the investment objectives. NW1B does not address existing safety issues on the roads.	NW2A is the preferred option. It aligns best with the investment objectives. NW2B has poor integration as some growth areas south of Heights Road are poorly connected and little benefit for access and travel choice.
Heritage	NW1B is the preferred option. NW1A has possible impacts on Pukekohe Police Lockup.	Limited differentiation between options.
Social	**Land use** NW1A is the preferred option over NW1B under this criteria as NW1B creates areas of residual land within the rural area, which may encourage development beyond the FUZ and existing urban areas. Both options provide similar connections. While providing a corridor outside the FUZ reduces the amount of developable land taken up, the connections created are less	**Land use** NW2A is our preferred option over NW2B under this criteria as NW2B would potentially encourage development within the rural area. Both options provide similar connections, however, the corridor within the FUZ would provide greater integration as a central connection. **Urban design**

Criteria	Summary of performance	
	direct and less integrated with the existing and future urban areas. **Urban design** All NW options have minor access and interface challenges. NW1A would bring traffic through the middle of a residential area, reducing amenity outcomes.NW1B is preferred. **Land requirement** NW1B was preferred due to the reduced property impact. A greater number of acquisitions required by NW1A. **Social cohesion** NW1A was preferred over NW1B as it provides greater connection between existing residential areas. **Health and wellbeing** Existing industrial and residential receivers. NW1A was the preferred option as it predominantly uses existing roads, where air quality, noise and vibration effects are existing and expected.	NW2A may isolate some areas while NW2B allows more flexibility in terms of access and future development. **Land requirement** NW2B was not preferred as it follows an existing route and preference was for NW2A as a new connection. **Social cohesion** While NW2A and NW2B have the same score, NW2A was preferred. The differentiator being that it is a more direct route, slightly closer to Pukekohe residential and business areas. It also provides two crossings over the rail line. **Health and wellbeing** Existing industrial and residential receivers. NW2B was the preferred option as it predominantly uses existing roads, where air quality, noise and vibration effects are existing and expected.
Environmental	**Landscape and visual** NW1B does not logically follow the underlying topography and cuts across an incised catchment and stream system within its northern reaches. **Stormwater** NW1B was preferred as it had a much lower interaction with floodplain areas and overland flowpaths. **Ecology** NW1A was preferred as it avoids stream or wetland impacts. Kauri trees impacted on Kauri Road; however, these are planted and not mature. NW1B comprises two very high value stream crossings, within SEA_T_5281. Regionally Critically endangered (WF7) Puriri Forest, nationally critical long-tailed bats recorded and was least preferred. **Natural Hazards** All options involved partial new construction through swamp/tuff crater, with associated soft/compressible soils. Preference was for NW1A which is mostly upgrade of existing roads.	**Landscape and visual** NW2A and NW2B both scored the same due to underlying landscape patterns (topography and vegetation), notable trees and the level of potential visual effects. **Stormwater** NW2B was preferred as it would add minimal new hardstand (impervious area) to the catchment. **Ecology** NW2B follows existing road and therefore impacts likely minimal. **Natural Hazards** Options involved partial new construction through swamp/tuff crater, with associated soft/compressible soils. Preference for NW2B as a short option and upgrades mostly to existing roads.

Criteria	Summary of performance	
Construction impacts	**Embodied carbon emissions** There was a negligible difference in lane km and structures. There was limited differentiation between NW1A and NW1B. **Construction impacts on infrastructure/utilities** NW1A and NW1B scored the same as both require local protection or relocation of gas transmission pipe. NW1B could also require overhead powerline to be undergrounded. **Construction disruption** Currently a greenfield site in rural area with limited sensitive receivers. Limited differentiation between options. **Construction costs** There was limited differentiation between options due to complex construction over the rail crossing.	**Embodied carbon emissions** NW2A was preferred as it was the shorter option. **Construction impacts on infrastructure/utilities** NW2B was preferred as it would interfere the least with infrastructure/utilities. **Construction disruption** Currently a greenfield site in rural area with limited sensitive receivers. Limited differentiation between options. **Construction costs** There was limited differentiation between options due to complex construction over the rail crossing.
Partner feedback	Key feedback from SMEs at workshops included: • Grade separation is required where corridors intersection with the Glenbrook rail line. • Discussion on the ongoing use of the rail line by Glenbrook Steel Mill and their plans to expand. • Option NWB navigates a sharp turn at Helvetia/Heights Road. • The topography at Heights Road needs to be carefully considered. Key matters raised during hui with manawhenua representatives included: • NW1B is not supported as it impacts SEA, Puriri forest, and includes 2 new crossings of the Whangapouri stream. • Ngaati Tamaoho discussed plans for papakaainga development at the Marae that backs on to Helvetia Road. On a site visit with Ngaati Te Ata and Ngāti Tamaoho in July 2022 the following matters were discussed: • The SEA was viewed from the end of Helvetia Road. Ngati Tamaoho emphasised the preference for option NW1A avoiding the route (NW1B) near the SEA. • In terms of the Butcher Road option – Ngaati Te Ata Waiohua noted no issue with taking a new alignment (NW2A) and not selecting the upgrade of Heights Road (NW2B). • Regarding the Pukekohe Local Arterials corridor assessment, Ngāti Te Ata supported the rationale: SEAs have been avoided, use of existing roads, moving roads closer to existing infrastructure (rail and pylons), supports the work undertaken.	

4.5.6.5 Discarded Options

Table 4-33 Options to be discarded

Option	Reason
NW1B	The option most negatively scored and mentioned by specialists as least preferred. It will impact a SEA (endangered Puriri forest), likely to impact known location of bats, requires two new stream crossings (-5).
NW2B	Steep topography, poor integration with the growth areas south of Heights Road. Would involve a large crossing of NIMT, Glenbrook rail line and Whangapouri Stream to connect to the NE quadrant.

4.5.6.6 Recommended Corridor Option

Options NW1A and NW2A are the recommended corridor options as they were the most positively scored through the MCA. NW1A avoids a SEA and requires no new stream crossings.
NW2A provides the most direct connection and reduces complexity in connection to the NE quadrant.

Recommendations for route refinement include further investigation of crossing the Glenbrook rail line and connection with SH22 and Pukekohe NE quadrant.

4.6 Corridor Assessment Conclusion

The following options are recommended for route refinement assessment which will refine the alignment of each option and form an integrated transport network for the Drury West, Paerata and Pukekohe areas.

Table 4-34: Summary of Recommended Corridor Options to be taken forward to Route Refinement

Corridor Assessment Option Package	Recommended Corridor Option	Recommendations for Route Refinement
Drury West	DW1 and DW2	• Reduce impacts on the Ngakoroa Stream.
Paerata Local	PS3 and PS5	• A more direct route for PS5. • Consideration of topographical constraints of upgrading Sim Road/Cape Hill Road for PS3. • Consideration of a connection to the Paerata Station (formerly known as the Southern Connector at Draft Strategic South DBC) and connectivity with Paerata Rise development.
North South	NS8; and East Option	• For NS8 - reduce impacts on private properties where possible and consideration of property access.

Corridor Assessment Option Package	Recommended Corridor Option	Recommendations for Route Refinement
		• The East Option – to reduce impacts on the ONF Pukekohe Tiff Ring.
Pukekohe Local		
Pukekohe North East Arterial	NE1	• Reduce impacts on active development around the Pukekohe East Road area.
Pukekohe South East Arterial	SE1 D and SE2B	• SE1D: A section of Pukekohe East Road will also need to be upgraded to support this route. • SE2B: Further investigation in the best place to cross the existing rail line and reduce property impacts.
Pukekohe South West Arterial	SW3	• Investigate upgrading the existing road reserve (20m wide cross section rather than a 24m wide cross section) to reduce property impacts. This corridor is in an existing urban areas with many residential houses an social infrastructure along the alignment.
Pukekohe North West Arterial	NW1A and NW2A	• Further investigation of crossing the Glenbrook rail line and connection with SH22 and NE quadrant.

5 Route Refinement Assessment

Route refinement assessment further refines the recommended option from the relevant corridor assessment set out in the sections above. The assessment uses the same MCA framework as corridor assessment.

The recommended corridor options were split into components (or packages) for the route refinement assessment. These are set out in Figure 5-1 and Table 5-1.

An initial form and function assessment of the options is undertaken at corridor assessment, and this is confirmed at the route refinement stage to inform option development and assessment.

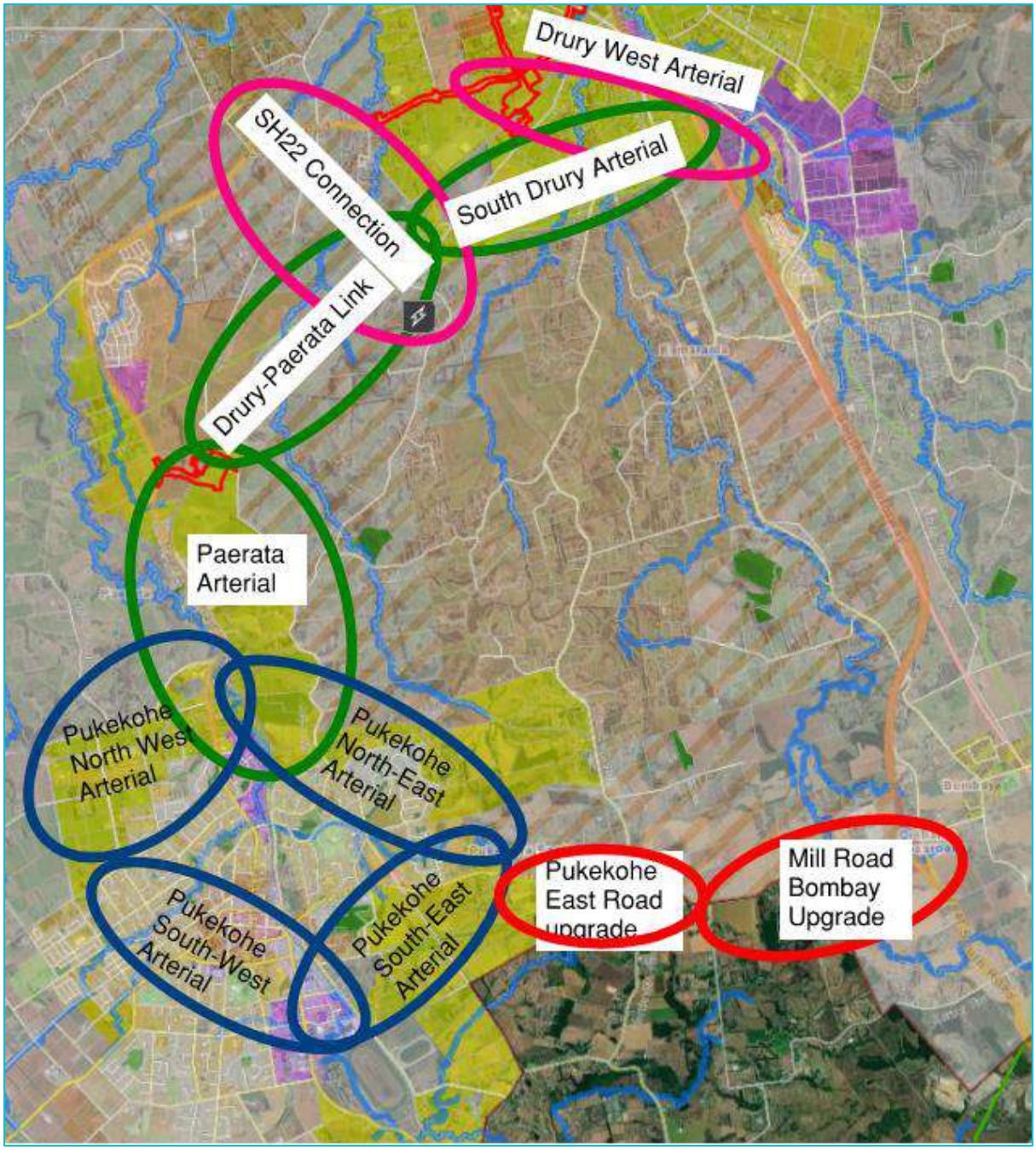


Figure 5-1 Route Refinement Options Assessment Packages

Table 5-1 - Refinement Packages and Options

Route Refinement Package	Options
Drury West Arterial	• Drury West Arterial Option 1 (DW_1) • Drury West Arterial Option 2 (DW_2)
South Drury Arterial	• South Drury Arterial Option 1 (SD_1) • South Drury Arterial Option 2 (SD_2) • South Drury Arterial Option 3 (SD_3)
SH22 Connection	• SH22 Connection Option 1 (SH22_1) • SH22 Connection Option 2 (SH22_2) • SH22 Connection Option 3 (SH22_3) • SH22 Connection Option 4 (SH22_4)
Drury-Paerata Link	• Drury-Paerata Link Option 1 (PL_1) • Drury-Paerata Link Option 2 (PL_2)
Paerata Arterial	• Paerata Arterial Option 1 (PA_1) • Paerata Arterial Option 2 (PA_2)

Mill Road Bombay Upgrade – Pukekohe East Road Upgrade	• Mill Road upgrade
	  ○ Option 1 MR_1
	  ○ Option 2 MR_2
	  ○ Option 3 MR_3
	• Pukekohe East Road upgrade
	  ○ Option 1 PE_O1
	  ○ Option 2 PE_O2

Pukekohe South-East Arterial	• Pukekohe South-East Arterial Segment 1
	  ○ Option 1 (PSEA_S1_O1)
	  ○ Option 2 (PSEA_S1_O2)
	  ○ Option 3 (PSEA_S1_O3)
	• Pukekohe South-East Arterial Segment 2
	  ○ Option 1 (PSEA_S2_O1)
	  ○ Option 2 (PSEA_S2_O2)
	  ○ Option 3 (PSEA_S2_O3)
	• Pukekohe South-East Arterial Segment 3
	  ○ Option 1 (PSEA_S3_O1)
	  ○ Option 2 (PSEA_S3_O2)
	  ○ Option 3 (PSEA_S3_O3)

Pukekohe North-West Arterial	• Pukekohe North-West Arterial Segment 1
	  ○ Option 1 (PNWA_S1_O1)
	  ○ Option 2 (PNWA_S1_O2)
	  ○ Option 3 (PNWA_S1_O3)
	• Pukekohe North-West Arterial Segment 2
	  ○ Option 1 (PNWA_S2_O1)
	  ○ Option 2 (PNWA_S2_O2)

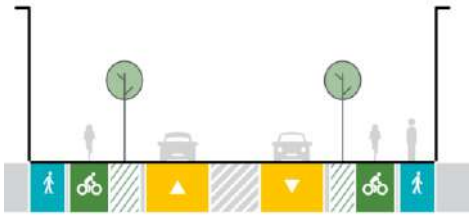
	○ Option 3 (PNWA_S2_O3)
Pukekohe North-East Arterial	• Pukekohe North-East Arterial Segment 1 ○ Option 1 (PNEA_S1_O1) ○ Option 2 (PNEA_S1_O2) ○ Option 3 (PNEA_S1_O3) • Pukekohe North-East Arterial Segment 2 ○ Option 1 (PNEA_S2_O1) ○ Option 2 (PNEA_S2_O2) • Pukekohe North-East Arterial Segment 3 ○ Option 1 (PNEA_S3_O1) ○ Option 2 (PNEA_S3_O2)
Pukekohe South-West Arterial	• Assessment of options within the existing road reserve.

5.1 Drury West Route Refinement

5.1.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken for the Drury West connection to inform the route refinement assessment. Table 5-2 provides a summary of the assumptions and outcomes of the assessment.

Table 5-2 Drury West Form and function assumptions and summary

Criteria	Summary
Purpose	Provides an arterial connection from SH22/Jesmond Road to the edge of FUZ. Connecting to Drury West Town Centres, Drury West Rail Station and access to the strategic corridors (SH1, SH22). It also provides a new rail crossing over the rail line improving local connectivity in Drury West area.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	P2 - Attracts activity from across a subregion or neighbouring local board area M2 - Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	9,000
Speed	50 kph speed limit

Criteria	Summary
Public transport (indicative 2048)	27 buses per hour (section from Jesmond to Rail line) 11 buses per hour(section from Rail line to Runciman Road) Priority lanes north of rail line and intersections south of rail line
Freight	Level 3 Route

5.1.2 Option Development

Two Drury West options DW7 and DW8 underwent a route refinement assessment through the MCA framework by each subject matter expert. These are shown in Figure 5-2.

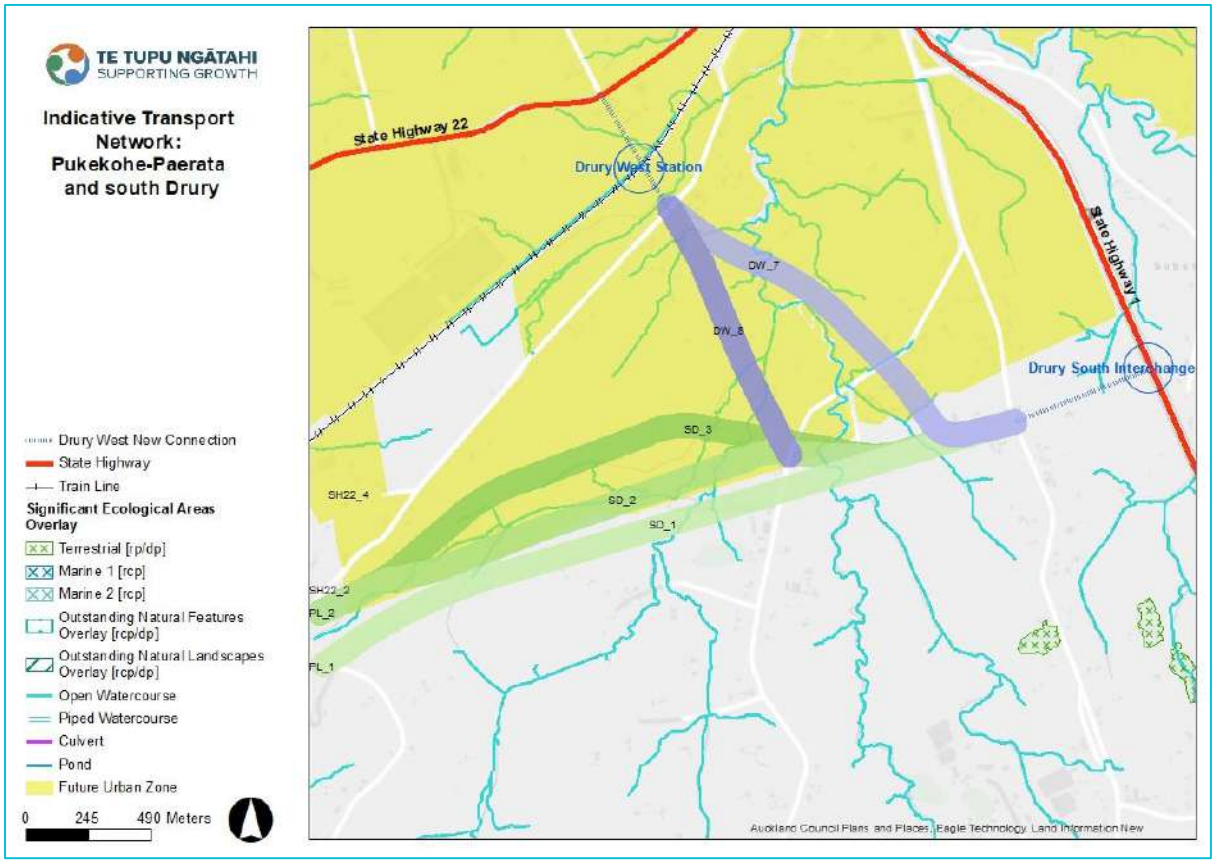


Figure 5-2 Drury West Route Refinement Options

5.1.3 Option Assessment

Options were assessed against the MCA framework by each subject matter expert, refer to Table 5-3. Commentary is provided in Table 5-4

Table 5-3 Drury West Route Refinement MCA scoring

MCA Criteria	Scores	
Options	**DW7**	**DW8**

Investment objectives		
IO1 – Safety	2	2
IO2 – Integration	1	2
IO3 - Access	1	2
IO4 – Resilience	2	2
IO5 – Travel Choice	2	2
Cultural		
Heritage	0	0
Social		
Land use futures / integration with planned landuse	1	3
Urban design	0	1
Land requirement / property	-3	-2
Social cohesion	1	1
Human health and wellbeing	-1	-1
Environment		
Landscape / visual	-2	-1
Stormwater	-2	-3
Ecology	-4	-4
Natural hazards	-2	-2
Construction impacts		
Embodied carbon emissions	-2	-1
Construction impacts on utilities / infrastructure	-2	-2
Construction Disruption	-1	-1
Construction costs / risk / value capture	-2	-2

Table 5-4 Drury West route refinement assessment findings summary

Criteria	Summary of performance
Investment Objectives	Both options have a positive effect on safety and improve connectivity for the strategic network and travel choice.

Criteria	Summary of performance
	DW7 provides multi-modal access but serves a smaller catchment for Drury West areas particularly on the western side. DW8 serves a higher residential catchment on both sides within Drury West areas.
Heritage	No recorded heritage features. No difference between options.
Social	**Land use** Both options connect directly to the station and adjacent to the proposed industrial centre which integrates with the FUZ. DW7 the integration is limited due to the presence of the flood plain. DW8 was preferred as it provides better integration with the FUZ. Identified developer interest to the north-east. No known granted consents/plan changes in this area. **Urban design** Both options include a large amount of earthworks which would limit the ability of the corridor to present an active interface between the public and private realm in these locations. Being located in the FUZ, future development can respond to the corridor, mitigating some amenity effects. DW8 was the preferred option because it was considered slightly more flexible for future development to respond to the corridor. **Land requirement** DW8 is the preferred option due to less impacts on property. DW7 requires greater land acquisition compared to DW8. **Social cohesion** No difference between options. Both provide access between two strategic corridors, improves access to employment and communities. **Health and wellbeing** No difference between options. Existing rural residential receivers. Construction effects and operational noise for existing dwellings.
Environmental	**Landscape and visual** DW7 and DW8 avoid all landscape related overlays and notable trees. Visual amenity effects were limited to rural residential properties within the localised setting of the southern part of the route for both DW7 and DW8. DW8 was preferred as it avoided areas of established vegetation and only occasional shelterbelts being affected. **Stormwater** DW7 was preferred as it is shorter overall and more direct, this would result in less new impervious surfaces and therefore less of an effect on the hydrology of the area. **Ecology** DW7 and DW8 were likely to have impacts on planted native / exotic riparian vegetation, likely used by TAR species bats and copper skink. Overall likely impact for both options was considered to be high. **Natural Hazards** DW7 was preferred due to the terrain, mostly poorly consolidated dune sand.

Criteria	Summary of performance
	The embankments for DW8 were likely subject to settlement from prospective compressible deposits and the rest of the terrain was variable including liquifiable deposits.
Construction impacts	**Embodied carbon emissions** There was a negligible difference in lane km and structures. DW7 was least preferred due to impact on wetlands and biomass (that can act as carbon sinks). **Construction impacts on infrastructure/utilities** Limited differentiation between options. Localised protection or relocation required. Co-ordination required with Transpower in detailed design phase to confirm vertical clearance. **Construction disruption** Currently a greenfield site in rural area with limited sensitive receivers. Limited differentiation between options. **Construction costs** DW7 was considered least preferred due to potentially higher costs associated with a longer crossing of an identified minor natural hazard.
Partner and public feedback	**Partner** A matter raised in SME workshops was the consideration of how the collector network will connect with the Drury West options in the future. There are a number of stream crossings and flood plains in this area. A manawhenua representative gave feedback on the preference for the proposed Drury West Arterial to limit crossings of the Ngakoroa (Ngaakooroa) Stream, due to iwi aspirations of leaving the stream in a better condition than it is currently. **Public** Limited feedback was received on the Drury West Arterial options during public engagement. Potential property impacts were raised in the limited feedback – in particular on working farms. At the public open days, there was general conversations with some attendees on support for connections to the proposed rail stations such as the Drury West station.

5.1.4 Discarded Options

Table 5-5 summarises the reasons for discounting the options individually.

Table 5-5 Discarded options and reasons

Option	Reason
DW7	DW7 was discounted because it has a smaller residential catchment, is in a greater area of flood plain and has greater impacts on vegetation including riparian vegetation.

5.1.5 Preferred Option

DW8 was the preferred option because it has a larger future residential catchment, better integrates with future development, affects fewer properties, and has reduced landscape and visual impact.

Further considerations for design refinements include:

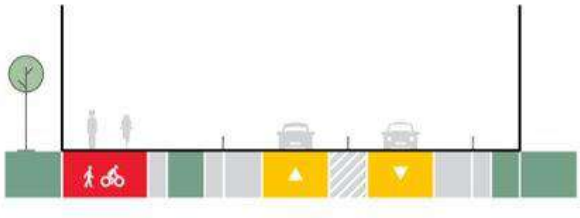
- Refinement of intersection forms (for example single or multi lane roundabouts).
- Access for properties to the south on Ngakoroa Road and realigned Runciman Road.

5.2 South Drury Option Refinement Assessment

5.2.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-6 provides a summary of the assumptions and outcomes of the assessment.

Table 5-6 South Drury form and function assumptions and summary

Criteria	Summary
Purpose	Provides an arterial connection in Drury West. It runs east-west on the edge of the FUZ providing a strategic connection to Drury South Interchange and connecting Drury West with Paerata.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side
Function	P1 - Predominantly local function with a small catchment of users M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	22,000-24,000
Speed	50-60 kph speed limit
Public transport (indicative 2048)	8-10 buses per hour Priority at intersections is required
Freight	Level 2 connects to regional freight corridor on SH1

5.2.2 Option Development

Three options were developed as shown in Figure 5-3 below.

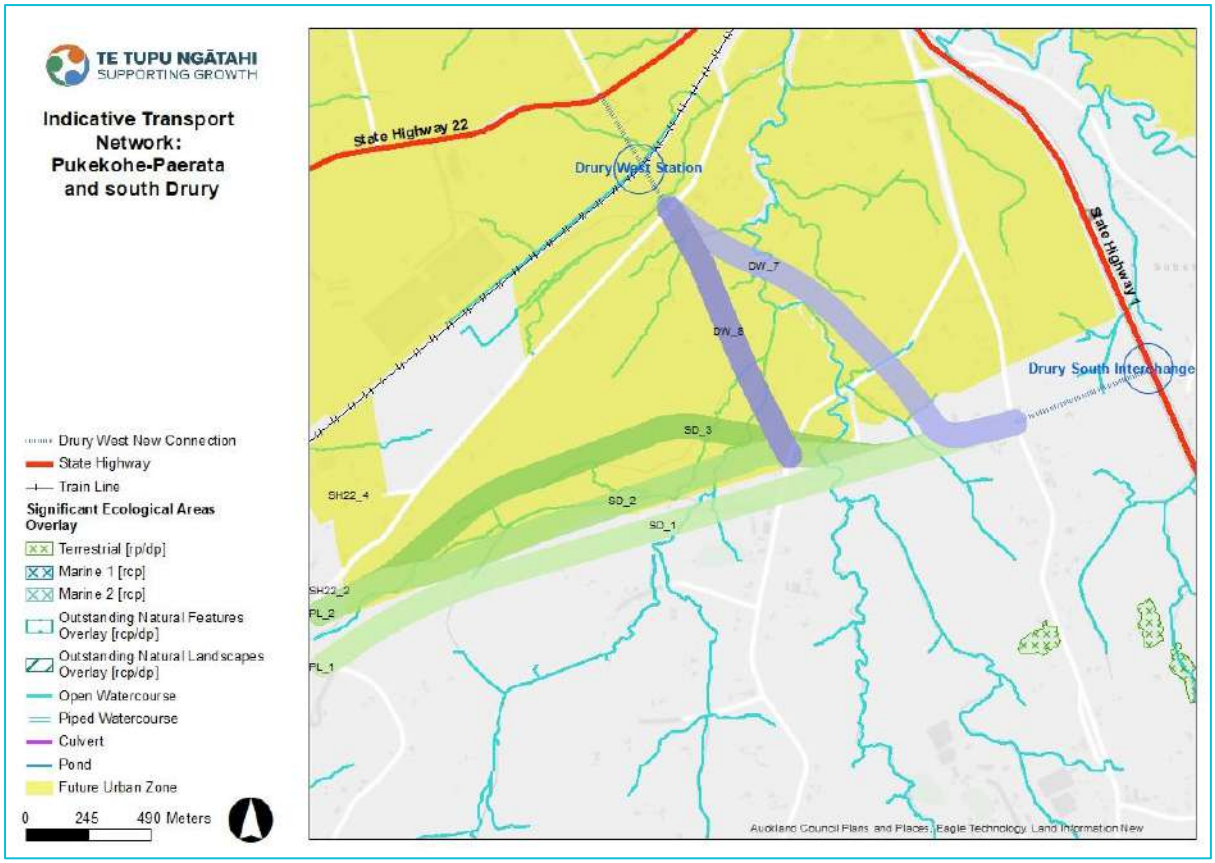


Figure 5-3 Summary of South Drury options

5.2.3 Option Assessment

Options were assessed against the MCA framework by each subject matter expert, refer to Table 5-7. Commentary is provided in Table 5-8

Table 5-7 South Drury Route Refinement MCA scoring

MCA Criteria	Scores		
Options	**SD_1 South**	**SD_2 Centre**	**SD_3 North**
Investment objectives			
IO1 – Safety	3	3	1
IO2 – Integration	2	2	0
IO3 - Access	1	1	1
IO4 – Resilience	2	2	1
IO5 – Travel Choice	1	2	2
Cultural			
Heritage	0	0	0

Social			
Land use futures / integration with planned landuse	-1	1	2
Urban design	-3	2	1
Land requirement / property	-3	-2	-3
Social cohesion	1	1	1
Human health and wellbeing	0	0	0
Environment			
Landscape / visual	-2	-3	-2
Stormwater	-2	-3	-3
Ecology	-4	-4	-4
Natural hazards	-2	-4	-4
Construction impacts			
Embodied carbon emissions	-1	-2	-1
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-1	-1	-1
Construction costs / risk / value capture	-2	-2	-3

Table 5-8 South Drury route refinement MCA assessment findings summary

Criteria	Summary of performance
Investment Objectives	All options reduce the likely future traffic on rural roads, reduce traffic on SH22 and improve access to key destinations. Option SD_3 was least preferred due to the high traffic volumes within the FUZ increases the potential for movement and place conflicts. SD_2 which follows the FUZ edge was preferred as it was considered to provide the best integration with actives modes and PT.
Heritage	No recorded heritage.
Social	**Land use** SD_2 was preferred as it integrates with future development, defines the rural urban boundary and increase separation between the Transpower Pylons and future residential development. SD_1 was not considered to be well integrated and SD_3 was not preferred as it would reduce the amount of developable land in the FUZ. **Urban design**

Criteria	Summary of performance
	SD_2 was the preferred option as it would assist in defining the rural urban boundary and increase separation between the Transpower Pylons and future residential development. SD_1 was the least preferred as the alignment was within the rural zone and considered unable to respond to the corridor. This option would create an awkward linear area of FUZ between the rural area and the flood plain. SD_3 is also not preferred, but it was noted this alignment was within the FUZ and would be able to respond to the corridor, mitigating some amenity effects, however, would still have an impact. **Land requirement** SD_2 would have the least impact on property and was the preferred option. SD_1 would impact the greatest number of properties and was the least preferred option. SD_3 would impact on a number of large agricultural blocks. **Social cohesion** The design is for a two-lane arterial on the edge of the FUZ zone so it is unlikely there will be significant severance effects for any option. **Health and wellbeing** All options provide a new corridor which introduces new sources of noise and air emissions. However, the route is in a rural area with limited sensitive receivers (existing community).
Environmental	**Landscape and visual** All options avoid landscape related overlays. Visual amenity are limited to rural residential properties (south of FUZ). SD_2 was the preferred option as it would result in minimal vegetation loss. SD_1 would likely involve the loss of mature vegetation (shelterbelt planting). SD_3 was not preferred as it affects two potential parks identified in structure plan. **Stormwater** SD_1 was the preferred options as it is more direct and would have the least effect on hydrology. SD_2 and SD_3 would have greater effect on hydrology / stream erosion. **Ecology** SD_2 was the preferred option as effects on existing environment likely lower as within the FUZ i.e. the environment would be subject to change and disruption prior to the construction of the project. SD_1 and SD_3 were not preferred as wetland offset requirements could be significant. Monitoring and mitigation required such as bat hop over-vegetation and lighting controls. **Natural Hazards**
Construction impacts	**Embodied carbon emissions** SD_1 and SD_3 were considered more preferable based on lane km and structure. SD_2 was least preferred based on lane km and structures. **Construction impacts on infrastructure/utilities** Limited differentiation between options. A number of overhead powerlines require localised protection or relocation.

Criteria	Summary of performance
	Construction disruption Majority of the work to be undertaken offline through the greenfield. Disruption to the local traffic is expected as the new intersection gets built, might require localised diversion route due to construction works **Construction costs** Similar road corridor both requiring road widening and construction of structures. SD_3 was the least preferred due to ground conditions (hazards) which would increase construction complexity and cost.
Engagement	**Partners** Key feedback from SMEs at workshops included: • Consideration of the tie in with Burtt Road. • Consideration of highly productive soils in the rural zone. Manawhenua agree alignment should be north of pylons. **Public** Limited feedback was received for the South Drury Connection options during public engagement. Potential property impacts was raised. In particular, to working farms.

5.2.4 Discarded Options

Table 5-9 summarises the reasons for discounting the options individually.

Table 5-9 Options to be discarded

Option	Reason
SD_1	SD_1 was discounted because it is not well integrated with future development as it is located within the rural zone, would result in odd shaped parcels of land outside the FUZ in the rural zone, and affected the greatest number of properties.
SD_3	SD_3 was discounted because as it would be likely to result in movement and place conflict in the future urban communities (as the corridor will be used by large number of vehicles travelling through the area) and provided less network resilience compared to the other two options. It also had the greatest effect on hydrology/stream erosion and presented difficult ground conditions (hazards) for design and construction.

5.2.5 Preferred Option

SD_2 is the preferred option as it provides a good interface at the urban edge of the FUZ and can assist in defining the rural urban boundary, has less impact on developable land, has less potential impacts on vegetation.

5.2.6 Preferred Option Refinement

Following the identification of a preferred route refinement option for Drury West (assessment in section 5.2.6) and South Drury Connection there was a further assessment undertaken to determine

the tie in between the two transport corridors.Figure 5-4**Error! Reference source not found.****Error! Reference source not found.**.

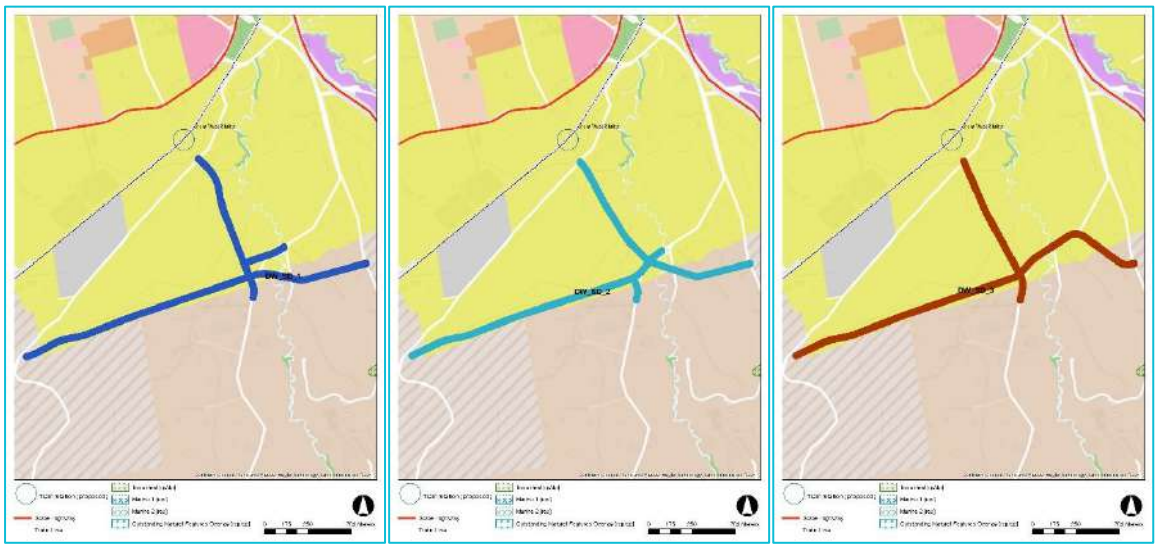


Figure 5-4 Summary of Drury West / South Drury Arterial options

Table 5-10 Description of tie in options for Drury West / South Drury Arterial

Tie In Option	Description / Reason
Drury West – South Drury Connection Option 1 (DW_SD_1)	Creates a new tie in with Runciman Road and a new intersection with the proposed Drury West connection and South Drury Connection.
Drury West – South Drury Connection Option 2 (DW_SD_2)	Creates a new four leg intersection with Runciman Road, Drury West, the proposed South Drury Connection and a new three-leg intersection with Runciman Road further to the south.
Drury West – South Drury Connection Option 3 (DW_SD_3)	Creates a new four leg intersection with Runciman Road, Drury West, the proposed South Drury Arterial and re-aligns Runciman Road to integrate with the Drury South Interchange.

Table 5-11 Drury West and South Drury tie in options MCA scoring

MCA Criteria	Scores		
Options	**DW_SD_1**	**DW_SD_2**	**DW_SD_3**
Investment objectives			
IO1 – Safety	1	1	0
IO2 – Integration	2	1	-1
IO3 - Access	2	1	1
IO4 – Resilience	3	2	1
IO5 – Travel Choice	3	2	1

Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned landuse	2	2	1
Urban design	2	2	1
Land requirement / property	-3	-2	-2
Social cohesion	1	1	1
Human health and wellbeing	-1	-1	-1
Environment			
Landscape / visual			
Stormwater	-2	-2	-2
Ecology	-4	-4	-3
Natural hazards	-3	-3	-3
Construction impacts			
Embodied carbon emissions	-2	-2	-1
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-2	-2	-2
Construction costs / risk / value capture	-3	-3	-2

Table 5-12 Drury West tie in option MCA key findings

Criteria	Summary of performance
Investment Objectives	**Safety** DW_SD_1 and 2 scored the same, however, DW_SD_1 is preferred over the other options as it is more direct and separates local and regional trips better. DW_SD_3 scored less than the other two options due to the mix of local and strategic corridors, which makes it more difficult for active modes. **Integration** DW_SD_1 is preferred as it is on the FUZ boundary and provides good integration with strategic corridor not travelling through urban areas. DW_SD_2 and 3 is mostly on FUZ boundary but due to mixing local and strategic functions, scored lower. **Access** DW_SD_1 is preferred as there is more access opportunities for all modes. DW_SD_2 and 3 has reduced access due to the alignment. **Resilience**

Criteria	Summary of performance
	DW_SD_1 segregates local and strategic traffic improving resilience and therefore is preferred compared to DW_SD_2 and 3. **Travel choice** All options provide more travel choice for all road users, with the most travel choice being provided through DW_SD_1, which scored the highest out of the three options.
Heritage	No recorded heritage.
Social	**Land use** The corridor predominantly traverses the FUZ, however, does traverse the Rural Zone at the eastern end. DW_SD_1 and 2 scored the same. DW_SD_3 is less preferred as it is favourable to keep the route on the edge of the FUZ to maximise developable land. **Urban design** DW_SD_3 leaves an area of FUZ on the south side of the option in the eastern segment. DW_SD_1 and 2 scored the same and are therefore preferable as the corridor defines the edge of the FUZ. **Land requirement** DW_SD_1 is least preferable as it requires the greatest numbers of property acquisition (with potentially 9 full acquisitions and 10 partial). DW_SD_1 and 2 have a similar score with option 2 being marginally more preferrable due to a lesser impact on two properties. Both DW_SD_1 and 2 require approximately 8 full acquisitions either 9 or 8 partial acquisitions respectively. **Social cohesion** All options were scored the same and they all provide access between two strategic corridors, improving access to employment and communities. **Health and wellbeing** All options have existing rural residential receivers and scored the same.
Environmental	**Landscape and visual** All options scored the same and include construction of new roading infrastructure within existing rural area (within the eastern portion of the alignment). This will result in the loss of small areas of vegetation. The northern part of the route is located within the Structure Plan area of anticipated future urban development (Industrial, THAB, MHS). All options avoid landscape overlays, however, there will be visual amenity effects to rural residential properties. **Stormwater** All options require 6 stream crossings, and significant floodplain filling. DW_SD_3 is preferred. **Ecology** DW_SD_1 and 2 will have high overall ecological impacts and are scored the same. DW_SD_3 will have moderate ecological impacts and therefore, is there preferred option. **Natural Hazards** All options are scored the same and entail construction on extensive deposits of variable (potentially soft) alluvium.

Criteria	Summary of performance
Construction impacts	**Embodied carbon emissions** DW_SD_3 reduces the overall construction of new road infrastructure and may not require construction of two new bridges as active modes bridge could be constructed instead. This is therefore the preferred option scoring higher than the other two options. **Construction impacts on infrastructure/utilities** DW_SD_1 and 2 cross the 1200 CS watermain at Runciman Road. All options interact with the Transpower line and are scored the same. **Construction disruption** For DW_SD_1 and 2, the majority of the work to be undertaken offline through the green field. For all options, disruption is likely with the build of the new intersection. This is likely to have an increased adverse effect for DW_SD_3. All options are scored the same. **Construction costs** DW_SD_3 is the preferred option reduces the overall construction of new road infrastructure. It may not require construction of two new bridges as active modes bridge could be constructed instead.

5.2.7 Discarded Refined and Preferred Options

Error! Reference source not found. summarises the reasons for discounting the options individually.

Table 5-13 Options to be discarded

Option	Reason
DW_SD_2	Has the potential to create movement and place conflict as has some mix of local and strategic functions. Has impacts on access.
DW_SD_3	Provides less improvement in resilience. The mix between local and strategic functions will make it more difficult for active modes and movement and place conflict. This option leaves an area of FUZ on the south side of the proposed alignment reducing the available developable land.

The preferred option for the tie in was DW_SD_1. This option is located at the FUZ boundary providing better integration that the other tie in options. The option was considered likely to provide more access opportunities for all modes and improved resilience.

5.2.8 Preferred Option Summary

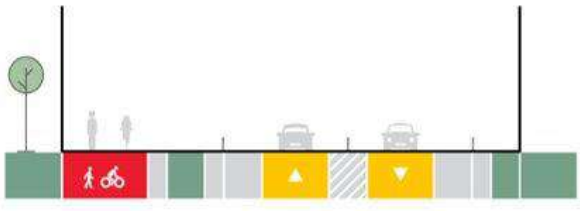
The emerging preferred option for South Drury Connection is SD_2 with the DW_SD_1 tie in. These provides a good interface at the urban edge of the FUZ and can assist in defining the rural urban boundary, has less impact on developable land, has less potential impacts on vegetation.

5.3 SH22 Connection Route Refinement

5.3.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-14 provides a summary of the assumptions and outcomes of the assessment.

Table 5-14 SH22 Connection form and function assumptions and summary

Criteria	Summary
Purpose	Connects SH22 to the new north-south corridor. This connection improves travel options, with access to the strategic active modes corridor, crosses the NIMT, improves local access between Drury West and Paerata, provides an alternative to SH22 and direct connectivity to proposed Drury South Interchange at SH1.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side with integration with SH22
Function	P1 - Predominantly local function with a small catchment of users M1 - Low strategic network significance. Provides predominantly local access for people, goods and services
Flows (ADT 2048)	10,000
Speed	60-85 kph speed limit
Public transport (indicative 2048)	N/A
Freight	Level 2/3

5.3.2 Option Development

Four options were developed for the SH22 Connection as shown in the figure below.

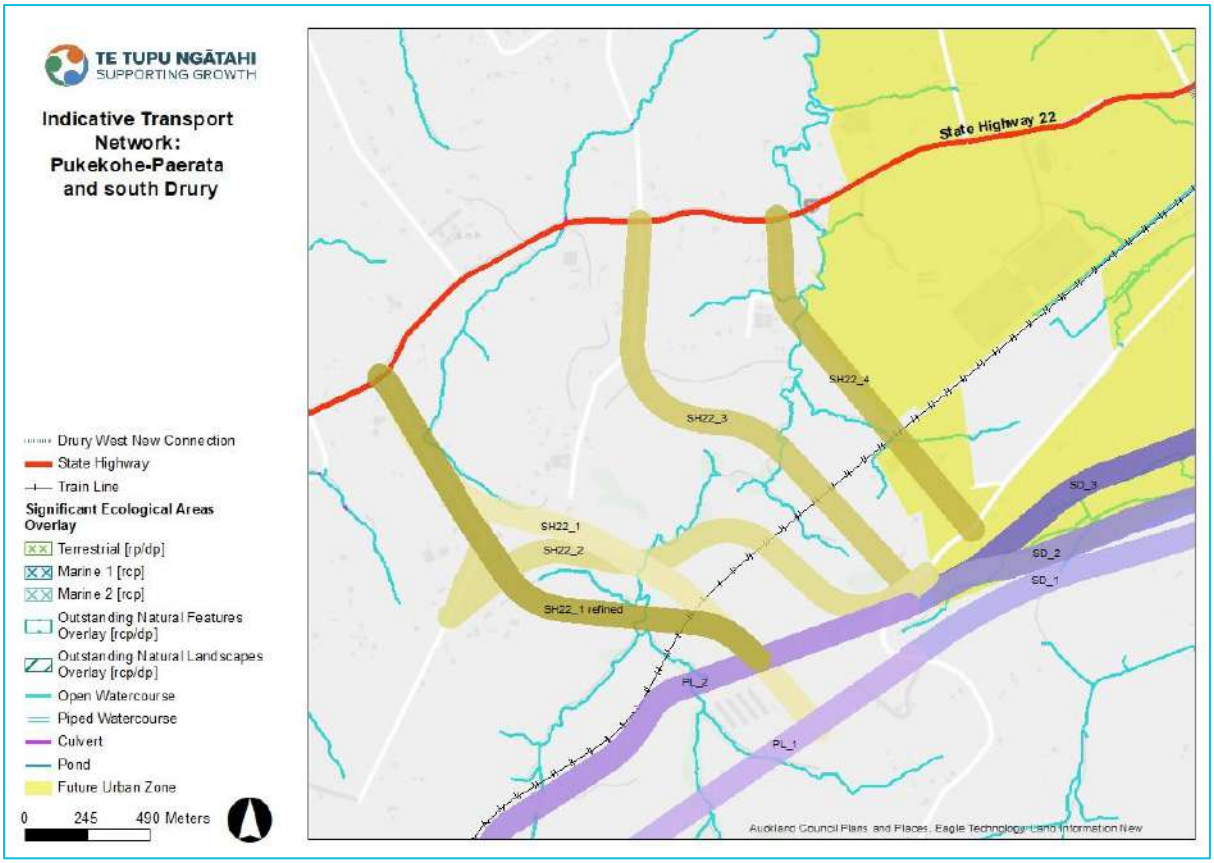


Figure 5-5 SH22 Connection Route Refinement options

5.3.3 Option Assessment

Options were assessed against the MCA framework by each subject matter expert.

Table 5-15 SH22 Route Refinement MCA scoring

MCA Criteria	Scores			
Options	**SH22 Connection Option 1 (SH22_1)**	**SH22 Connection Option 2 (SH22_2)**	**SH22 Connection Option 3 (SH22_3)**	**SH22 Connection Option 4 (SH22_4)**
Investment objectives				
IO1 – Safety	1	0	1	1
IO2 – Integration	2	1	1	1
IO3 - Access	2	1	1	1
IO4 – Resilience	3	2	1	1
IO5 – Travel Choice	2	1	1	1
Cultural				

Heritage	0	0	0	-2
Social				
Land use futures / integration with planned landuse	1	-1	-2	2
Urban design	-2	-2	-2	1
Land requirement / property	-2	-1	-1	-1
Social cohesion	2	1	1	1
Human health and wellbeing	0	0	0	-1
Environment				
Landscape / visual	-1	-2	-2	-2
Stormwater	-1	-2	-1	-1
Ecology	-4	-4	-4	-4
Natural hazards	-2	-2	-2	-3
Construction impacts				
Embodied carbon emissions	-2	-2	-2	-1
Construction impacts on utilities / infrastructure	-2	-3	-2	-2
Construction Disruption	-2	-2	-2	-2
Construction costs / risk / value capture	-2	-3	-2	-2

Table 5-16 SH22 route refinement assessment findings summary

Criteria	Summary of performance
Investment Objectives	All options provide some benefits for integration, access, resilience and travel choice. However, SH22_1 provided better network wide integration with SH22, better balancing of movement and place and significant network-wide improvement in resilience compared to other options. SH22_2 and SH22_3 provide limited or no access improvements. SH22_4 provides limited integration and could create movement and place conflicts.
Heritage	No heritage recorded for SH22_1, SH22_2 and SH22_3. SH22_4 had the potential to impact Karaka Railway station and was the least preferred.
Social	**Land use** SH22_4 was the preferred option as it is located adjacent to / within the FUZ and includes the upgrade of existing roads.

Criteria	Summary of performance
	SH22_1 was not preferred as it was considered to provide access benefits for the existing Paerata Rise community by providing a better connection from the south at Sim Road, however, could encourage development outside the FUZ. SH22_2 was less preferred as it was predominantly within rural land and considered to have limited integration and would impact on highly productive soils. SH22_3 was considered the least preferred as it was also within rural land and resulted in less integration, impacts on highly productive soils and could result in development outside the FUZ. **Urban design** SH22_1, SH22_2 and SH22_3 were likely to change the character and amenity of the area and due to being in the rural zone were considered less likely to have the opportunity to respond to the corridor in the future. SH22_4 also had limited capacity for development to respond to change however, provided the opportunity for a defined edge for FUZ north of the railway. **Land requirement** SH22_4 was preferred as it impacts on the least number of properties but does require at least one full acquisition. SH22_1 was least preferred as it was likely to impact on the greatest number of properties. **Social cohesion** SH22_1 was the preferred option as it resulted in improved connection for Paerata Rise community and Karaka School. All other options result in improved access to Karaka School. **Health and wellbeing** SH22_4 was the least preferred due to its proximity to 485 Burtt Road (catholic St Ignatius of Loyola Catholic College). Limited differentiation between other options with
Environmental	**Landscape and visual** SH22_1 was preferred as it has reduced stream crossings, follows natural topography and would minimise vegetation loss. SH22_2 would likely require the loss of established vegetation. SH22_3 would also require some vegetation loss including shelterbelts and blocks of trees affected adjacent to the stream. SH22_4 had vegetation loss anticipated along Woodlyn Drive and nearby streams. **Stormwater** SH22_3 was the preferred option as it also has a lower impact on hydrology and includes the use of existing roads. SH22_2 was the least preferred as it would have the greatest impact on hydrology, part of the alignment will directly fill a stream tributary and will require stream diversion. SH22_1 had a low impact on streams and a medium impact on hydrology and SH22_4 had the least impact on hydrology but would require some channel bank works to protect the crossing. Both these options were considered acceptable. **Ecology**

Criteria	Summary of performance
	SH22_4 was the preferred option due to its location (partially) within FUZ. It was recommended the alignment go east of Oira Creek, within FUZ, avoiding the need for a large bridge crossing. SH22_2 was the least preferred option due to significant direct habitat loss and fragmentation of key habitat corridors for bats and wetland birds. SH22_1 and SH22_3 largely avoided direct habitat impacts but fragmentation of key habitat corridors was still a concern. The magnitude of effects on existing environment was likely to be higher as outside the FUZ. **Natural Hazards** SH22_4 was the least preferred as the alignment along Woodlyn Road along valley margin will extend length over settlement-susceptible and possibly liquefiable alluvium (Q1al). For all other options the majority of the alignment is over terrain underlain by Takaanini (Puketoka) Formation soils with a sections near the Oira Creek over variable alluvium.
Construction impacts	**Embodied carbon emissions** SH22_4 was the preferred option based on lane km and large structures. All other options scored the same. **Construction impacts on infrastructure/utilities** SH22_2 was the least preferred due to the number of utilities which required localised protection or relocation. All options impacted some utilities including overhead powerlines. **Construction disruption** Limited differentiation between options. Disruption to current local traffic (temporary traffic management including lane narrowing) due to works on existing roads and crossing of rail line for all options. **Construction costs** SH22_2 was the least preferred due to the length of the road corridor and auxiliary works to Sim Road which would require road widening and construction of structures. All other options were similar and would require road widening and bridges.
Engagement	**Partners** Key feedback from SMEs during workshops was: • Consideration of highly productive soils • Growth pressure around transport corridors in the rural zone Ngāti Te Ata support the rationale whereby the connection is closer to Paerata Rise to capture traffic from the west to use the alternative connection to SH22. Manawhenua are also supportive of avoidance of SEAs, and designation being moved closer to existing infrastructure such as rail and pylons. Overall, supportive of proposal. **Public** Those that provided feedback on the State Highway 22 Connection during public engagement, wanted additional connections to support traffic to and from Karaka (to the north of the project area).

5.3.4 Discarded Options

Table 5-17 summarises the reasons for discounting the options individually.

Table 5-17 SH22 Connection Options to be discarded

Option	Reason
SH22_2	SH22_2 was discounted as it is less integrated with existing or proposed development, provides a less direct connection, has increased impacts on ecological features including streams and wetlands.
SH22_3	SH22_3 was discounted as it provides limited access improvements, is less likely to take traffic off SH22 due to its location to the east and was least preferred in terms of flooding and ecology due to the earthworks in and around streams.
SH22_4	SH22_4 was discounted as it has the potential for movement place conflict being close to FUZ with the amount of through traffic using the connection, and has potential impacts on heritage item Karaka Railway station.

5.3.5 Preferred Option

Preferred option is SH22_1 with a refinement to move to the southwest close to the Paerata Rise development (SH22_1A).

SH22_1 (with design refinement SH22_1A) is recommended because it provides a direct and attractive connection between SH22 and south Drury and the Paerata to Drury link and provides accessibility benefits to the Paerata Rise development. SH22_1 generally follows the natural topography and has reduced stream crossings, minimal vegetation loss and reduced impacts on ecological features including streams and wetlands.

5.3.6 Preferred Option Refinement

Once the preferred SH22 Connection option was selected (SH22_1A) which utilises Sim Road, it was then investigated which side of the road to widen. The three options for widening were to widen to one side (east or west) or both sides (central). The assessment of the SH22 Connection Sim Road widening are set out Table 5-18. Commentary is provided in Table 5-19.

Table 5-18: Sim Road widening MCA scoring

MCA Criteria	Scores		
Options	**SH22 - Sim Road widening SR_1 (west)**	**SH22 - Sim Road widening SR_2 (centre)**	**SH22 - Sim Road widening SR_3 (east)**
Investment objectives			
IO1 – Safety	1	1	1
IO2 – Integration	2	2	2
IO3 - Access	2	2	2

IO4 – Resilience	3	3	3
IO5 – Travel Choice	2	2	2
Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned landuse	1	1	1
Urban design	0	0	0
Land requirement / property	-1	-1	-1
Social cohesion	1	1	1
Human health and wellbeing	-1	-1	-1
Environment			
Landscape / visual	-1	-1	-1
Stormwater	-1	-1	-1
Ecology	-1	-1	-2
Natural hazards	0	0	0
Construction impacts			
Embodied carbon emissions	-1	-1	-1
Construction impacts on utilities / infrastructure	-1	-1	-1
Construction Disruption	-1	-1	-1
Construction costs / risk / value capture	-1	-1	-1

Table 5-19: Sim Road widening option MCA key findings

Criteria	Summary of performance –Sim Road widening options
Investment Objectives	**Safety** All options scored the same and will reduce the likely future traffic on SH22 resulting in safety benefits. **Integration** All options scored the same and will provide better network wide integration with SH22 and better balancing movement and place. **Access** All options scored the same and will provide improved access between Paerata and Drury West FUZ. By mode significant improvement to freight and general traffic, a modest improvement in access for active modes. **Resilience**

Criteria	Summary of performance –Sim Road widening options
	All options scored the same and will provide significant network-wide improvement in resilience. **Travel Choice** All options scored the same and will provide significant improvement for general traffic and freight. The options will increase car mode share and reduce VKT.
Heritage	No recorded heritage affected Sim Road widening options.
Social	**Land use** SR_1, 2 and 3 are scored the same, as it is within the existing rural zone and there is a low likelihood of change in the future environment. **Urban design** SR_1, 2 and 3 are scored the same as they are outside of FUZ and will have impact on amenity and character of immediately adjacent sites. **Land requirement** SR_1, 2 and 3 are scored the same. Multiple acquisitions required, SR_1 (west) is the least preferred due to the potential impact on the existing dwellings. SR_2 (centre) is the most preferred due to least impact on the dwellings on either side of the road. **Social cohesion** SR_1, 2 and 3 all upgrade of existing road and are scored the same. **Health and wellbeing** Existing rural residential receivers for SR_1, 2 and 3, which all scored the same.
Environmental	**Landscape and visual** SR_1, 2 and 3 are all scored the same and follow existing Sim Road alignment. This will have visual amenity impacts on surrounding houses. There are no landscape related overlays impacted. **Stormwater** SR_1, 2 and 3 are all scored the same and follow the terrain ridge along Sim Road. There is only very limited local effects from widening on either side or centrally. New pavement will have local effects and can be mitigated. **Ecology** SR_1, 2 and 3 has impacts which are limited to mature vegetation, SR_2 is preferred. SR_3 is least preferred and there is potential impact on stream / riparian corridor east of Sim Road. **Natural Hazards** SR_1, 2 and 3 all scored the same as there are limited impacts on natural hazard.
Construction impacts	**Embodied carbon emissions** SR_1, 2 and 3 all scored the same as it is a standard road widening construction. **Construction impacts on infrastructure/utilities** SR_1, 2 and 3 all scored the same and will have low adverse effects existing local utilities network. **Construction disruption**

Criteria	Summary of performance –Sim Road widening options
	SR_1, 2 and 3 all scored the same and will have low adverse effects on disruption during construction as existing households are quite spaced from each other and future land use is rural. **Construction costs** SR_1, 2 and 3 will have low adverse effect as it is a standard road widening exercise, and all scored the same.

5.3.7 Discarded Refined Options and Preferred Refined Options

Error! Reference source not found. summarises the reasons for discounting the options individually.

Table 5-20 Options to be discarded Sim Road Widening

Option	Reason
SR_1 (west)	This option has the highest property impacts and some limited impacts on vegetation.
SR_3 (east)	This option has the potential for the highest ecological effects.

For the widening of Sim Road, the preferred option is SR_2 to widen on both sides of the road (centre) to reduce impacts on ecological features to the west of the alignment while providing the best opportunity for integration. Through further design refinement, it is recommended to reduce impacts on existing dwellings where possible.

5.3.8 Preferred Option Summary

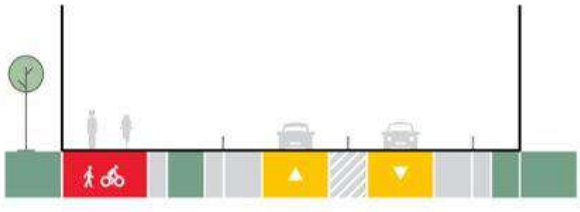
SH22_1 (with design refinement SH22_1A) is recommended because it provides a direct and attractive connection between SH22 and south Drury and the Paerata to Drury link and provides accessibility benefits to the Paerata Rise development. SH22_1 generally follows the natural topography and has reduced stream crossings, minimal vegetation loss and reduced impacts on ecological features including streams and wetlands. Widening on both sides (SR_2) of Sim Road is recommended to reduce impacts on ecological features with opportunities to reduce impacts on existing dwellings.

5.4 Drury-Paerata Link Route Refinement

5.4.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. **Error! Reference source not found.** provides a summary of the assumptions and outcomes of the assessment.

Table 5-21 Drury-Paerata Link form and function assumptions and summary

Criteria	Summary
Purpose	Improves the wider network connectivity, safety and resilience between Drury West and Pukekohe with a primary general traffic and freight function.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side
Function	P1 - Predominantly local function with a small catchment of users M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	20,000-23,000
Speed	80 kph speed limit
Public transport (indicative 2048)	N/A
Freight	Level 2

5.4.2 Option Development

Two options were developed for the Drury-Paerata Link route refinement assessment as shown in Figure 5-6.

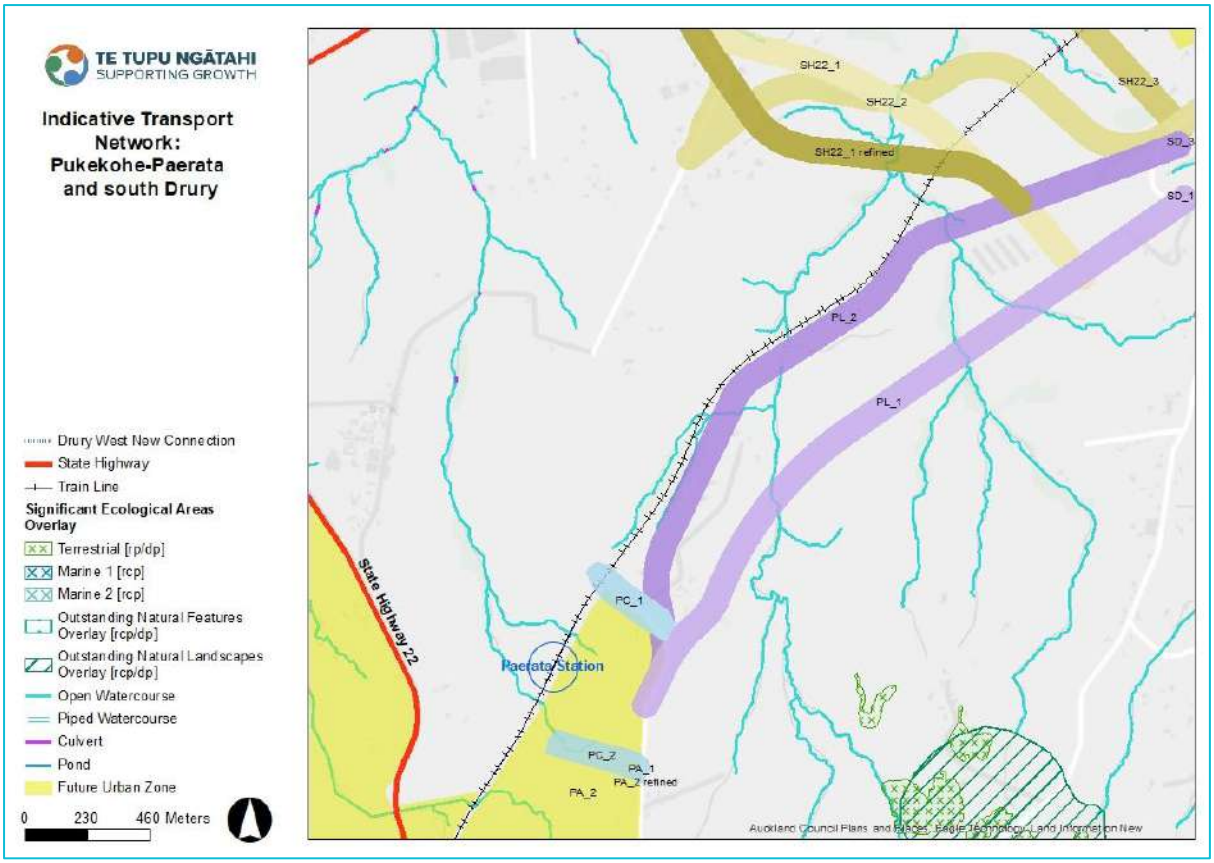


Figure 5-6 Summary of Drury Paerata Link options

5.4.3 Options Assessment

Two options were assessed against the MCA framework by each subject matter expert for the Drury-Paerata Link route options in **Error! Reference source not found.** with commentary provided in **Error! Reference source not found.**.

Table 5-22 Drury Paerata Link Route Refinement MCA scoring

MCA Criteria	Scores	
Options	**PL_1 South**	**PL_2 North**
Investment objectives		
IO1 – Safety	2	2
IO2 – Integration	1	1
IO3 - Access	2	2
IO4 – Resilience	2	2
IO5 – Travel Choice	2	2
Cultural		
Heritage	0	0

Social		
Land use futures / integration with planned landuse	1	2
Urban design	-3	-2
Land requirement / property	-1	-2
Social cohesion	0	0
Human health and wellbeing	0	0
Environment		
Landscape / visual	-2	-2
Stormwater	-1	-1
Ecology	-4	-4
Natural hazards	-3	-2
Construction impacts		
Embodied carbon emissions	-1	-1
Construction impacts on utilities / infrastructure	-1	-1
Construction Disruption	-1	-1
Construction costs / risk / value capture	-2	-2

Table 5-23 Drury Paerata Link route refinement assessment findings summary

Criteria	Summary of performance
Investment Objectives	Both options were considered to improve access between Drury West and Paerata areas, although limited improvements for active mode access were identified. There were significant network-wide improvements in safety and resilience.
Heritage	No recorded heritage.
Social	**Land use** Both options were considered to provide a new connection between Drury and Paerata FUZ and an interface with Paerata station. PL_2 was preferred as it follows the existing train line so does not have such an impact on the availability of developable land (albeit rural zoned). **Urban design** Both options were likely to result in impacts on the character and amenity of rural zoned land which is unable to respond to the new corridor. However, PL_2 was preferred as co-locating the new road with the NIMT corridor would reduce the impacts on character and amenity. **Land requirement**

Criteria	Summary of performance
	Both options impacted the same number of properties. PL_1 was likely to require only partial acquisitions and was slightly preferred. **Social cohesion** There was limited differentiation between options as the area is mostly rural with some small businesses. The design is for a two-lane arterial so it is unlikely there will be significant severance effects. **Health and wellbeing** While the alignment would introduce a new corridor no sensitive receivers were identified.
Environmental	**Landscape and visual** Both corridors were similar and require the loss of established vegetation present along the stream corridors and an established block of vegetation north of Sim Road. Visual amenity effects limited to rural residential properties within the localised setting of the route. However, a slight preference for PL_2 due to the potential to co-locate infrastructure. **Stormwater** PL_1 was preferred as it had a lesser impact on hydrology. PL_2 was less preferred due to the need to upgrade rail culverts and would have a greater impact on hydrology. **Ecology** Strong preference for PL_2 as the magnitude of effects on existing environment likely lower as associated with existing rail corridor. For PL_1 significant direct habitat loss and fragmentation of key habitat corridors for bats and wetland birds. Due to limited existing vegetation effects may be difficult to mitigate. **Natural Hazards** PL_2 preferred as crosses less of the volcanic deposits and is more closely aligned to topographic contours. PL_1 crosses areas of possible liquefaction, and the alignment may be transiting across several landslides.
Construction impacts	**Embodied carbon emissions** Options were considered likely to have similar embodied emissions profile. **Construction impacts on infrastructure/utilities** Both options similarly crosses utilities which required protection or relocation. **Construction disruption** Greenfield site so limited disruption. Options scored the same however for PL_2 coordination with Kiwi Rail will be required. **Construction costs** There was limited differentiation between options as they require road widening and new bridge structures. PL_2 is slightly shorter than PL_1.
Engagement	**Partners** Key feedback from SMEs during workshops included: • Opportunities to tie in with the proposed regional active mode corridor (along NIMT).

Criteria	Summary of performance
	• Leaving adequate clearance for rail crossings to allow for future four tracking and future regional active mode corridor. During the 12 October 2022 Hui– Ngāti Te Ata Hui supported the Drury to Paerata Link alignment being closer to the rail corridor (Option PL_2). **Public** There was high level support from the wider community for improved connections for future generations.

5.4.4 Discarded Options

Table 5-24 Options to be discardedsummarises the reasons for discounting the options individually.

Table 5-24 Options to be discarded

Option	Reason
PL_1	PL_1 was discounted because it has greater potential ecological effects (on wetlands, streams, vegetation and habitat loss) and visual impacts could result in fragmentation the rural zoned land.

5.4.5 Preferred Option

PL_2 is preferred as co-locates transport and rail corridor, has reduced visual impact and less potential ecological effects on wetlands, streams, vegetation and habitat loss. It also has less fragmentation of rural land including productive soils.

5.4.6 Preferred Option Refinement

Following the identification of preferred options for the SH22 Connection, South Drury and Drury-Paerata Link, there was a further assessment to determine the tie ins. Three options for the tie in were investigated as set out in Figure 5-7.



Figure 5-7 Summary of further SH22 Connection tie in options

Table 5-25 Description SH22 Connection tie in options

Option	Description / Reason
SH22_PL_1	Option 1 – Includes a new four leg intersection connection SH22 connection project, South Drury project and Drury-Paerata Link project and a realigned Burtt Road. This option includes a major realignment of Burtt Road.
SH22_PL_2	Option 2 – Includes a new four leg intersection connection SH22 connection project, South Drury project and Drury-Paerata Link project and a realigned Burtt Road. This option includes a minor realignment of Burtt Road.
SH22_PL_3	Option 3 – Includes two new intersections, one with the SH22 connection project to the Drury-Paerata Link project and other intersection is a four leg intersection includes Drury Paerata Link project, South Drury project and Burtt Road. This option includes the minor realignment of Burtt Road.

Table 5-26 SH22 Connection Route Refinement – Tie in MCA scoring

MCA Criteria	Scores		
	SH22 tie in		
Options	**SH22 - Paerata Link Option 1 (SH22_PL_1)**	**SH22 - Paerata Link Option 2 (SH22_PL_2)**	**SH22 - Paerata Link Option 3 (SH22_PL_3)**
Investment objectives			
IO1 – Safety	1	1	2
IO2 – Integration	2	2	2
IO3 - Access	1	1	2
IO4 – Resilience	1	1	2
IO5 – Travel Choice	2	2	2
Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned landuse	1	1	1
Urban design	-1	-1	-1
Land requirement / property	-2	-2	-2
Social cohesion	1	1	1
Human health and wellbeing	-1	-1	-1
Environment			

Landscape / visual	-2	-2	-2
Stormwater	-1	-1	-1
Ecology	-3	-2	-3
Natural hazards	-2	-2	-2
Construction impacts			
Embodied carbon emissions	-2	-2	-1
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-2	-2	-2
Construction costs / risk / value capture	-3	-3	-2

Table 5-27 SH22 Connection Route Refinement – Tie in Findings Summary

Criteria	Summary of performance:
Investment Objectives	**Safety** SH22_PL 1 and 2 result in easier access to rural roads reducing safety. SH22_PL 3 is safer as it separates rural, local and strategic traffic, and therefore scored the highest. **Integration** SH22_PL 1, 2 and 3 all improve integration in the wider network with has limited differences between options. All options scored the same. **Access** SH22_PL 3 scored the highest with slightly better access improvement than SH22_PL 1 and 2. **Resilience** SH22_PL 3 scored the highest with slightly better resilience improvement than SH22_PL 1 and 2. **Travel Choice** SH22_PL 1,2 and 3 all scored the same with equal improvement to travel choice.
Heritage	No recorded heritage affected by the tie in options.
Social	**Land use** All options are within the rural zone where there is a low likelihood of change, except SH22_PL 3, which integrates with the FUZ. SH22_PL3 is therefore preferred. **Urban design** SH22_PL 1, 2 and 3 are scored the same all options are outside of FUZ, will have impact on amenity and character of immediately adjacent sites from earthworks **Land requirement**

Criteria	Summary of performance:
	SH22_PL 1, 2 and 3 are scored the same. SH22_PL 1 potentially requires one full acquisition and potentially one other property. It aligns with property boundaries which reduces impacts on property. SH22_PL 2 has similar impacts but avoids the full acquisition of one land parcel and is the preferred option. SH22_PL 3 has similar impacts to SH22_PL 1 but is least preferred due to the full acquisitions two properties. **Social cohesion** SH22_PL 1,2 and 3 all provide a new connection for Paerata Rise and are scored the same. **Health and wellbeing** No sensitive receivers for SH22_PL 1,2 and 3.
Environmental	**Landscape and visual** SH22_PL 1,2 and 3 are all scored the same and include the construction of new roading infrastructure within existing rural area, connecting with existing Sim and Burtt Roads. The here options avoid landscape related overlays but does not follow topography and crosses respective streams. All options will result in vegetation loss. **Stormwater** SH22_PL 1,2 and 3 are all scored the same and result in stream crossings. **Ecology** SH22_PL 1,2 and 3 will all impact streams and wetlands. SH22_PL 2 is scored higher than SH22_PL 1 and 3 and is therefore preferred as appears to minimise impacts on streams and wetlands. **Natural Hazards** SH22_PL 1,2 and 3 have scored the same and have similar ground conditions, but SH22_PL 1 is preferred due reduced earthworks.
Construction impacts	**Embodied carbon emissions** SH22_PL 1 and 2 are scored the same as the road corridor and bridge structure length is similar. **Construction impacts on infrastructure/utilities** SH22_PL 1,2 and 3 are all scored the same and require coordination with Transpower, as the options run under the Transpower line south of Runciman Road. Potentially more adverse effect (relocation of pylons) if vertical clearance insufficient. **Construction disruption** SH22_PL 1,2 and 3 have all scored the same and will result in disruption to current local traffic. There will also be disruption crossing the rail line. **Construction costs** Both options SH22_PL 1 and 2 require significant road extension of Burtt Road. Road corridor and bridge length similar for these options. SH22_PL 3 is preferred despite challenging topography.

5.4.7 Discarded Refined Options and Preferred Refined Options

Table 5-28 summarises the reasons for discounting the options individually.

Table 5-28 Options to be discarded

Option	Reason
SH22_PL_1	This option provides reduced access improvements and resilience. It also has higher construction costs as requires a significant extension of Burtt Road. This has the greatest potential impacts on wetland.
SH22_PL_2	Similar to Option 1 this option provides reduced access improvements and resilience as well as higher construction costs due to the extension of Burtt Road.

SH22_PL_3 was the preferred option for the tie in due to the better access improvements and greater improvements in resilience. SH22_PL_3 also had the least development within identified highly productive land.

5.4.8 Preferred Option Summary

PL_2 is preferred as co-locates transport and rail corridor, has reduced visual impact and less potential ecological effects on wetlands, streams, vegetation and habitat loss. It also has less fragmentation of rural land including productive soils.

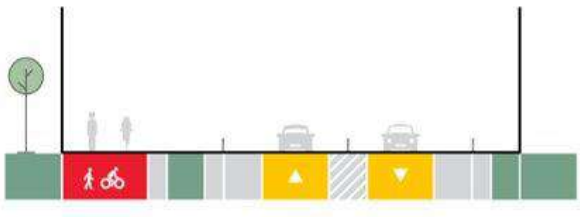
SH22_PL_3 is the preferred option for the tie in due to the better access improvements and greater improvements in resilience. SH22_PL_3 also had the least development within identified highly productive land.

5.5 Paerata Arterial Route Refinement

5.5.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-29 provides a summary of the assumptions and outcomes of the assessment.

Table 5-29 Paerata Arterial form and function assumptions and summary

Criteria	Summary
Purpose	Runs through the eastern edge of Paerata FUZ, increasing connectivity to Paerata station and town centre. The corridor is proposed as an urban arterial with connection to Paerata and Drury West in north and to Pukekohe local connections to the south.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side with integration with SH22
Function	P2 - Attracts activity from across a subregion or neighbouring local board area

Criteria	Summary
	M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	15,000 - 18,000
Speed	50 kph speed limit
Public transport (indicative 2048)	10-12 buses per hour Priority at intersections is required
Freight	Level 3

5.5.2 Option Development

Two options were developed for the Paerata Arterial route refinement assessment as shown Figure 5-8.

Figure 5-8

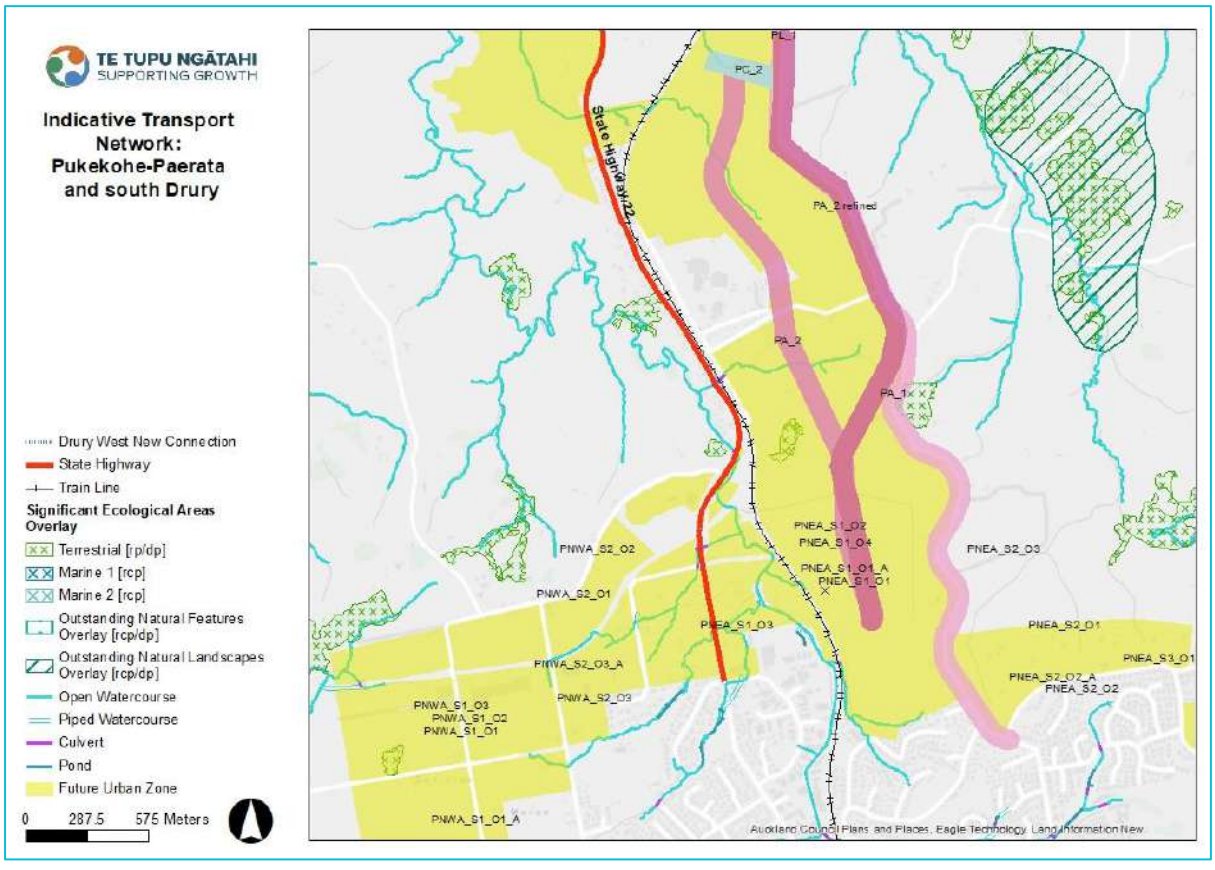


Figure 5-8 Summary of Paerata Arterial options

5.5.3 Option Assessment

Two options were assessed for the Paerata Arterial route refinement assessment against the MCA framework by each subject matter expert in Table 5-30. Commentary is provided in Table 5-31.

Table 5-30 Paerata Arterial Route Refinement MCA scoring

MCA Criteria	Scores	
Options	**PA1**	**PA2**
Investment objectives		
IO1 – Safety	3	2
IO2 – Integration	3	2
IO3 - Access	2	3
IO4 – Resilience	2	2
IO5 – Travel Choice	2	3
Cultural		
Heritage	0	-2
Social		
Land use futures / integration with planned landuse	1	2
Urban design	1	-3
Land requirement / property	-1	2
Social cohesion	0	0
Human health and wellbeing	0	2
Environment		
Landscape / visual	-2	-2
Stormwater	-1	-3
Ecology	-3	-3
Natural hazards	-2	-3
Construction impacts		
Embodied carbon emissions	-2	-1
Construction impacts on utilities / infrastructure	-2	-1
Construction Disruption	-3	-1
Construction costs / risk / value capture	-3	-2

Table 5-31 Paerata Arterial route refinement assessment findings summary

Criteria	Summary of performance
Investment Objectives	PA_1 was the preferred option as it minimises movement place conflicts in the urban environment and provides good integration between key destinations. This

Criteria	Summary of performance
	alignment also improves resilience for general traffic and freight movements between Paerata and Pukekohe. PA_2 integrates with Paerata FUZ on both sides. However, has a higher movement place conflict due to the number of through movements using the corridor. The route will improve resilience in the local Paerata area. However, this is limited without upgrades on Cape Hill Road for better traffic and freight movements between Paerata and Pukekohe.
Heritage	PA1 was the preferred option as no recorded heritage. PA_2 had the potential to impact on Paerata Primary school building.
Social	**Land use** PA_1 is located with Paerata FUZ on one side and rural zoning on the other. The location of the route the outside of the FUZ allows higher vehicle movements to pass on the outside of future residential development. This alignment also maximises future development opportunity in the FUZ and overall is considered to be better integrated. PA_2 was less preferred as the route cuts through the FUZ resulting in less developable land and the potential earthworks required could reduce the area of FUZ available to develop. **Urban design** PA_1 was the preferred option and scored positively as it could be used to define the rural urban boundary and provides maximum development flexibility. Moreover, using the existing road corridor would limit impacts on the character and amenity of the surrounding area. PA_2 provides a connection through the middle of the FUZ, directly connecting to the Paerata Station in a legible manner. However, it would limit the opportunities for development of FUZ. **Land requirement** PA_2 was preferred as it had less impact on properties. However, this option would have a significant impact on several large rural blocks. The route may impact on the development potential of the FUZ zoned land. PA_1 potentially impacted a greater number of properties, however, there was an opportunity to use the existing road which could mitigate some acquisition. **Social Cohesion** PA_1 scored slightly higher as was likely to provide an alternative connection with existing light industrial area near Paerata centre. PA_2 is mostly rural with some small businesses. The design is for a two lane arterial it is unlikely there would be significant severance effects. **Health and wellbeing** Both options were considered to introduce a new corridor with limited sensitive receivers.
Environmental	**Landscape and visual** PA_1 was the preferred option as visual impacts were likely to be limited within the localised setting of the route with the potential to provide mitigation planting and sensitive design outcomes along Cape Hill Road. PA_2 was not preferred as runs through a block of established vegetation south of Tuhimata Road and an area for a proposed new suburban park (5ha-10ha) in the structure plan.

Criteria	Summary of performance
	Stormwater PA_1 was preferred as it follows the ridge and existing road, this option crosses no streams and uses existing pavement to the maximum extent, this option has minimal impact on stream hydrology, flooding or water quality. PA_2 is a new road crossing and impacts several small streams and number of smaller flow paths. The southern extent passes through floodplain and would generate flood effects that would need mitigation. **Ecology** Both options were likely to impact on bats. PA_1 was slightly preferred as while it had the potential to impact the east side of Cape Hill Road, where indigenous vegetation occurs in the SEA_T_4380 and other small fragments adjacent to the road it mostly avoids streams and wetlands. **Natural Hazards** PA_1 was preferred due to the terrain. Although the alignment is based on widening existing roads, the narrow Sim Road ridge could entail significant earthworks to accommodate the road width, especially on the east side where the ground falls away steeply. PA_2 crosses a mapped geological fault in this low-lying ground raises the prospect of liquefaction risk and the need to mitigate it.
Construction impacts	**Embodied carbon emissions** PA_2 was preferred based on the lane kilometres of road. However, PA_1 includes the opportunity to reuse material. **Construction impacts on infrastructure/utilities** Both options cross overhead powerlines and other utilities which would require local protection or relocation. PA_1 was least preferred as it also crosses the gas transmission line. **Construction disruption** PA_1 was least preferred as disruption to local traffic (temporary traffic management including lane narrowing and potentially requiring a temporary road as a diversion) on Sim Road, Cape Hill Road and Valley Road for 3.8km. PA_2 involves construction in greenfield area with limited receivers. **Construction costs** PA_2 was preferred as PA_1 is significantly longer and requires full reconstruction of the existing road to improve existing horizontal and vertical alignments.
Partner and Public Feedback	**Partner** Key feedback from SMEs at workshops included: • A request for consideration of a new corridor to connect the extents of Sim to Sim (paper road) across the NIMT be included in the network. This would increase accessibility and provide an alternative crossing of the rail corridor which would relieve through movements past the Paerata Station. • Support for PA_2 as the arterial and a future collector delivered by developers being the spine for PT and active modes. **Public** Limited feedback was provided on the Paerata Arterial in public engagement. However, from the feedback received, potential property impacts were a concern

Criteria	Summary of performance
	on Sim Road (south) and Cape Hill Road and the potential effect on farms. There were also some concerns raised that a four-lane road is no longer proposed.

5.5.4 Discarded Option

PA_1 was discarded as it has a higher movement place conflict due to the number of through movements using the corridor. It would also require upgrades on Cape Hill Road for better traffic and freight movements between Paerata and Pukekohe.

5.5.5 Preferred Option

PA_2 (with a refinement) is preferred as it minimises movement place conflicts in the urban environment being located on the edge of the FUZ. It provides good integration between key destinations. This alignment also improves resilience for general traffic and freight movements between Paerata and Pukekohe. Through the assessment, a hybrid alignment was proposed which included the northern extent of PA_1 to use Sim/Cape Hill Road and then moving west to more closely align to PA_2 in the southern portion to avoid the SEA and steep topography.

Further considerations for design include:

- Minimise property effects (in particular at the southern end near Sim Road) and consider access for these properties
- Discuss opportunities for the AMC corridor with Auckland Transport KiwiRail
- Investigation of connections to the Paerata Rail Station and across the rail corridor to the Paerata Rise development. See next section.

5.6 Paerata Connections

5.6.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-32 provides a summary of the assumptions and outcomes of the assessment.

Table 5-32 Paerata Connections form and function assumptions and summary

Criteria	Summary
Purpose	The Paerata Connections provide key connections to SH22, Sim Rd, Paerata station, Paerata Rise Development and centres. These two connections are the primary east-west connection for all modes and crossing over the railway (NIMT).
Cross Section	The indicative cross-section is 24m wide and includes two general vehicle lanes and active transport on both sides of the transport corridor. Both connections cross over the NIMT.

Criteria	Summary
	
Function	M2 - Medium strategic network significance with increasing volume of users. P2 - Attracts activity from across a subregion or neighbouring local board area.
Flows (ADT 2048)	3,200 – 3,500
Speed	50 kph speed limit
Public transport	8-12 buses per hour (priority at intersections)
Freight	Level 3 Freight Route - connecting to/between strategic freight areas where planning and design should consider the efficient movement of freight

5.6.2 Option Development

Two options were developed for each segment of the Paerata Connections, as shown in the Figure 5-9 below:

- Paerata Station Connection: PC_2A and 2B provide a connection between Sim Road (Paerata Arterial) and the Paerata Rail Station. PC_2B from Sim Road and interacts with facilities supporting the Paerata Rail Station.
- Sim Connection: PC_1A and 1B provide a connection over the railway (NIMT) between the Paerata Arterial to Sim Road (north). PC_1A follows the Sim Road paper road and PC_1B provides a new road connection.

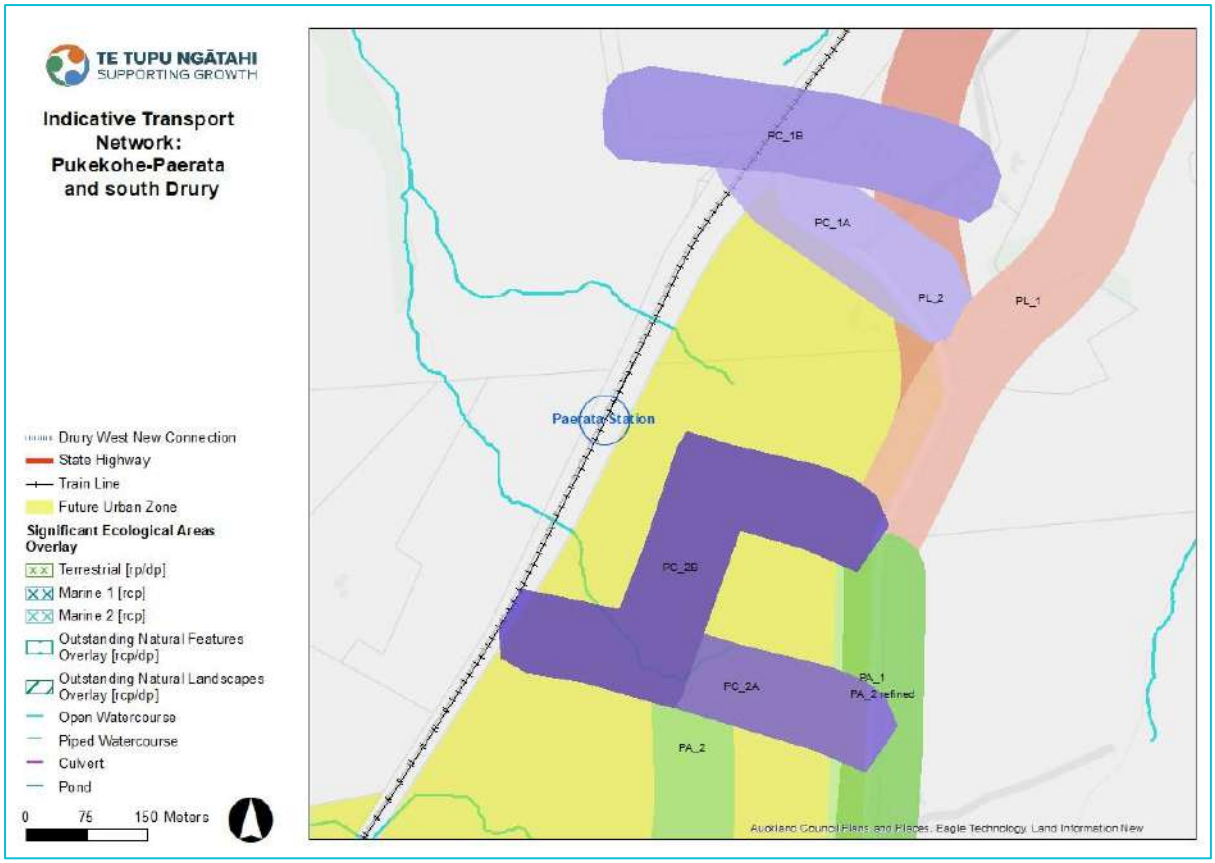


Figure 5-9 Summary of Paerata Connection options

5.6.3 Option Assessment

Two options were assessed for each of the Paerata Connections route refinement assessment against the MCA framework by each subject matter expert shown in Table 5-33. Commentary is provided in Table 5-34.

Table 5-33 Paerata Connections Route Refinement MCA scoring

MCA Criteria	Scores			
Options	**Paerata Rail Station**		**Sim Connection**	
	PC_2A	**PC_2B**	**PC_1A**	**PC_1B**
Investment objectives				
IO1 – Safety	2	2	2	2
IO2 – Integration	3	2	3	2
IO3 - Access	3	2	3	2
IO4 – Resilience	2	2	2	2
IO5 – Travel Choice	3	3	2	2
Cultural				

Heritage	0	0	0	0
Social				
Land use futures / integration with planned landuse	3	2	3	2
Urban design	3	2	3	1
Land requirement / property	-1	-1	-1	-2
Social cohesion	0	0	2	2
Human health and wellbeing	0	0	-1	-1
Environment				
Landscape / visual	-1	-1	-1	-1
Stormwater	-1	-1	-1	-1
Ecology	-3	-2	-3	-3
Natural hazards	-3	-3	-2	-2
Construction impacts				
Embodied carbon emissions	-1	-1	-2	-2
Construction impacts on utilities / infrastructure	-1	-1	-1	-1
Construction Disruption	-1	-1	-1	-1
Construction costs / risk / value capture	-2	-3	-2	-3

Table 5-34 Paerata Connections route refinement assessment findings summary

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
Investment Objectives	**Safety** PC_2A and PC_2B scored the same. However, 2A has a safer geometry being a straight connection. **Integration** PC_2A integrates better with the FUZ on both sides and with the Paerata Rail Station, compared with PC_2B, and therefore scored higher. **Access** PC_2A and 2B enable better localised access to opportunities on both sides, shorter, multi-modal access for buses and active modes connecting to Paerata rail station. PC_ 2B would require a slightly longer trip compared to PC_2A for	**Safety** PC_1A and 1B both result in shorter trips over the railway crossing and will improve overall safety of the network. Both options scored the same. **Integration** PC_1A and 1B provide network wide integration by better connecting communities which may be affected by rail severance. PC_1A is preferred as it runs closer to the FUZ boundary. **Access** PC_1A and 1B improve access within Paerata areas for all modes and provides better connectivity due to proximity to the FUZ. This is more so the case for PC_1A

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
	both buses and active modes connecting to the Paerata Railway Station, hence why PC_2A is preferred. **Resilience** Both options provide improved resilience in the local Paerata area. Strategic traffic gets a shorter and more direct alignment. PC_2B will result in traffic accessing very close to the Paerata Station therefore reducing overall resilience resulting in PC_2A being a preferred choice. **Travel Choice** Both options are scored the same and provide significant improvement for all modes and will reduce VKT.	as it provides better connectivity, being located closer to the FUZ, hence why PC _1A scored higher. **Resilience** PC_1A and 1B scored the same. Both options provide improved resilience in the local Paerata area. Strategic traffic gets a shorter and more direct alignment **Travel Choice** Both options are scored the same and provide significant improvement for all modes and will reduce VKT.
Heritage	No heritage recorded.	No heritage recorded.
Social	**Land use** PC_2A and 2B provide for a transport corridor through FUZ land, which the Pukekohe Paerata Plan Structure Plan show planned to be THAB zone. PC_ 2B is slightly less integrated due to the dog leg in the road. **Urban design** PC_2A and 2B provide clear and direct connection over the NIMT corridor, connecting Paerata rise with the Paerata Station and the new area of FUZ providing for connected communities. PC_2A is preferred as the sFtraight connection provides for development flexibility adjacent to the station location, compared to option2 which the weave in the route may reduce legibility. **Land requirement** PC_2A and PC_2B, scored the same as only one property is impacted for both options. **Social Cohesion** PC_2A and 2B have no existing urban areas. **Health and wellbeing** PC_2A and B introduce a new corridor and no existing sensitive receivers identified.	**Land use** PC_1A and 1B increase connectivity over the NIMT, past the Paerata Rail Station and connect directly to the Paerata Rise development, providing for integration with land use development. PC_ 1B has slightly reduced integration due to being located only within the rural zone and further away from the FUZ. **Urban design** PC_ 1B scored lower than PC_1A due to being located in the rural zone bringing changes to character of the area, where development is not expected to occur. PC_1A provides a direct and clear connection over the NIMT corridor, connecting Paerata Rise with the new area of FUZ providing for connected communities. The location of the corridor on the edge of the FUZ can assist in defining the urban boundary at the north of the FUZ. **Land requirement** PC_1B is less integrated with the FUZ, and solely within rural land, increasing property effects, resulting in the preferred option being PC_1A. PC_1B may also result in residual land in the rural zone. **Social Cohesion** PC_1A and 1B allow movements past the Paerata Rail Station and connect directly to the Paerata Rise development,

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
		providing for integration with the development. Both options scored the same. **Health and wellbeing** PC_1A and 1B score the same as the corridor connects to Paerata Rise development. There is currently no development in this location. The development will be provided at phase 4 based on Paerata Rise master plan, resulting in some impacts. However, there is opportunity for construction of Paerata Connection at same time as urban development, resulting in less adverse effects than if urban environments were existing.
Environmental	**Landscape and visual** PC_2A and B propose a new road alignment through FUZ land, and the alignment appears to avoid all other landscape related overlays. There is limited visual amenity effects anticipated as the alignment spans through FUZ land. Both options scored the same. **Stormwater** Both options scored the same as neither option involve stream crossings. Options have minimal impact on stream hydrology, flooding or water quality. **Ecology** PC_2A and B are likely to avoid streams and wetlands. PC_2A may have an indirect impact on Puriri Forest, which is not the case for PC_2B. Therefore, PC_2B is slightly more preferred ecologically. **Natural Hazards** PC_2A and B involve the construction of a new corridor in rural greenfield for segment one. Most of the alignment will lie on undifferentiated tephra (Qut), which are likely to be weaker soils than the lithic tuff (Qst). PC_2B is slightly favourable option due to more investigation data near the proposed alignment (DH122 & DH129), however, both options scored the same.	**Landscape and visual** PC_1A and 1B scored the same. Both options may result in adverse visual amenity effects existing rural properties proximate to the alignment. **Stormwater** Both options scored the same as neither option involve stream crossings. Options have minimal impact on stream hydrology, flooding or water quality. **Ecology** PC_1A and 1B will have moderate ecological effects, due to impacts on mature exotic trees and portions of the scrub which are likely to be utilised by TAR bat and lizard species (i.e., long-tailed bats and copper skinks). Both options scored the same. **Natural Hazards** Both options scored the same with no available geotechnical information in the vicinity of the options. The options crossover three geologies: Lithic Tuff (Qst), Undifferentiated tephra (Qut) and Takaanini Formation (PPQt).
Construction impacts	**Embodied carbon emissions**	**Embodied carbon emissions**

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
	PC_2A and B scored the same. PC_2A is shorter, and both options do not require bridging. **Construction impacts** PC_2A and B cross chorus comms, spark cable, FX network and overhead power at intersection with Sim Road. Both options scored the same. **Construction disruption** PC_2A and B are scored the same and are currently greenfield rural sites within the FUZ. The options may result in minor disruption on Sim Road. **Construction costs** PC_ 2A is the shortest option and therefore preferred, compared to PC_2B.	PC_1A and 1B scored the same. PC_1B is slightly shorter, and both options require bridging which increases embodied carbon emissions **Construction impacts** PC_1A and 1B scored the same. Services are overhead powerlines, chorus comms, FX network, Spark, and Vodafone. **Construction disruption** PC_ 1B will result in disruption to local traffic (temporary traffic management including lane narrowing) due to works on Sim Road for 0.4km. This is also the case for PC_ 1a, but to a lesser extent (0.15km). **Construction costs** PC_1A is preferred as the bridge crossing the rail at optimum angle (perpendicular to rail line) which will help minimise the bridge length and associated costs.
Partner and Public Feedback	**Partner** Option PC 1A and 1B directly respond to feedback from SMEs at workshops where a request was made for consideration of an additional corridor to connect the extents of Sim Road across the NIMT to assist in relieve through movements past the Paerata Station.	

5.6.4 Discarded Option

For segment 1 (Paerata Rail Station Connection) option PC_2B was discarded as was a longer option resulting in slightly longer trips than PC_2A for both buses and active modes connecting to the Paerata Railway Station. Additionally, option PC_2B did not integrate as well with the FUZ on both sides and the Paerata Rail Station.

For segment 2 (Sim Connection), option PC_1B was discarded because it requires more complex bridge construction and is less integrated with the FUZ.

5.6.5 Preferred Option

PC_2A (Paerata Rail Station) is preferred as it is the most direct route to both the Paerata Rail Station and the Paerata Rise development and onwards to SH22, reducing travel time and providing a direct and legible connection. It also best integrates with the FUZ on both sides.

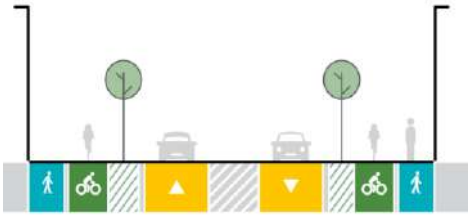
PC_1A (Sim Connection) is preferred as it provides good integration between key destinations, utilises a paper road, integrates better with the FUZ and has a less complex bridge construction.

5.7 Pukekohe North East Arterial Route Refinement

5.7.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-35**Error! Reference source not found.** provides a summary of the assumptions and outcomes of the assessment.

Table 5-35 Pukekohe Local – North-East form and function assumptions and summary

Criteria	Summary
	North East Arterial
Purpose	Arterial corridor from SH22 in the north-west to Pukekohe East Road in the south-east. Its primary function is for general traffic, freight, and active mode links between neighbourhoods and alleviating traffic on Cape Hill and Valley Road.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	P1 - Predominantly local function with a small catchment of users M2 - Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	7,000-10,000
Speed	50 kph speed limit
Public transport (indicative 2048)	N/A
Freight	Level 2

5.7.2 Option Development

The North East Arterial was split into three segments for the route refinement assessment as shown in the figure below.

- Segment 1: three options between SH22 and Cape Hill Road
- Segment 2: two options between Cape Hill Road and the end of Grace James Road
- Segment 3: two options north south from the end of Grace James Road to Pukekohe East Road.

After public engagement and significant opposition to the route refinement options for the Pukekohe NE Arterial in particular, segment 2 option PNEA_S2_02 (upgrading Grace James Road) and

Segment 3 option PNEA_S3_01, further options were developed (PNEA_S1_04, PNEA_S2_03 and PNEA_03_03) and options re-tested with the new information obtained to inform the options assessment. All options are shown in Figure 5-10.

The new information included:

- Public feedback – opposition to the upgrade of Grace James Road from residents in the area and freight community.
- Additional transport modelling.
- Site visits by project team to further understand ecological features.

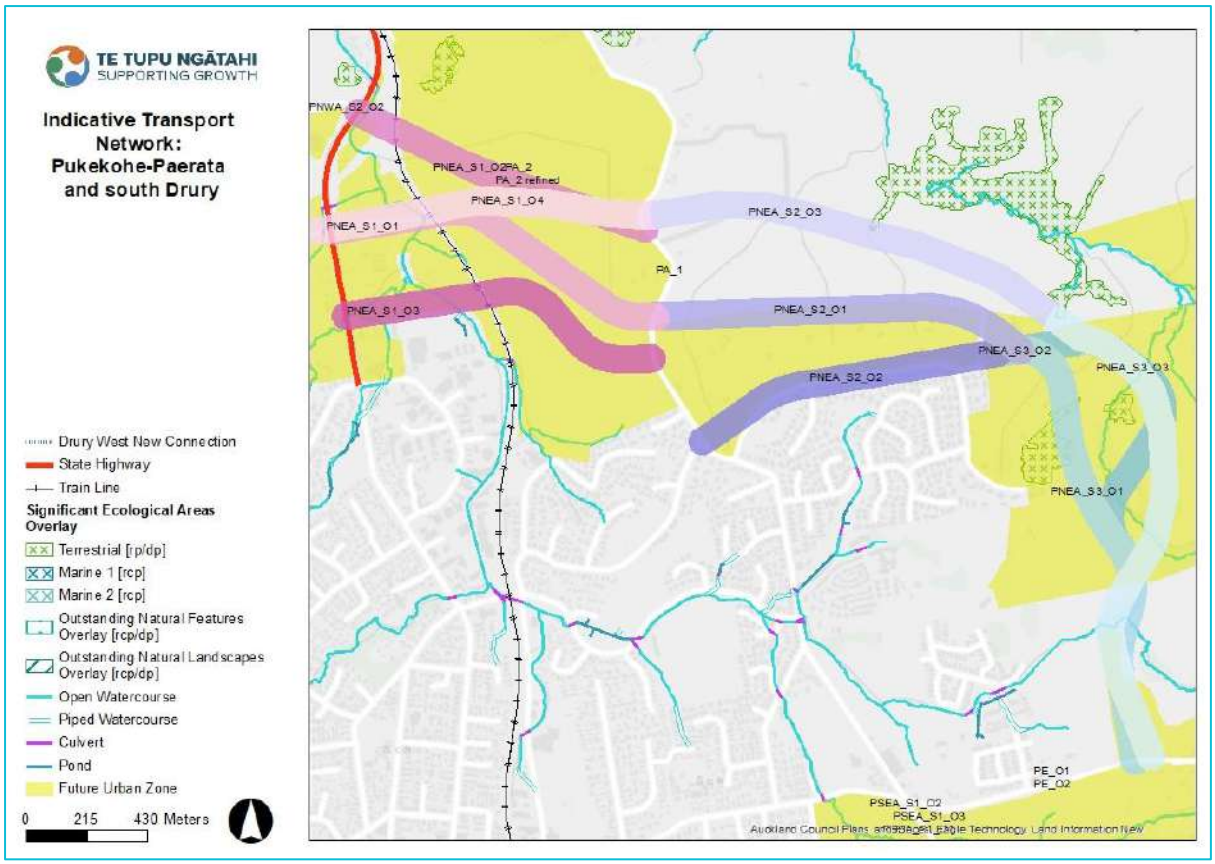


Figure 5-10 North East Arterial Route Refinement Options (three segments)

5.7.3 Option Assessment

The options were assessed against the MCA framework by each subject matter expert in Table 5-36. Commentary is provided in Table 5-37.

Table 5-36 Pukekohe Local – North-East Route Refinement MCA scoring

MCA Criteria	Scores									
Options	**PNEA_S1_O1**	**PNEA_S1_O2**	**PNEA_S1_O3**	**PNEA_S1_O4**	**PNEA_S2_O1**	**PNEA_S2_O2**	**PNEA_S2_O3**	**PNEA_S3_O1**	**PNEA_S3_O2**	**PNEA_S3_O3**
Investment										

objectives										
IO1 – Safety	1	1	1	1	1	1	1	1	1	1
IO2 – Integration	2	2	2	3	2	0	2	2	1	2
IO3 - Access	3	1	3	2	2	1	2	2	1	2
IO4 – Resilience	2	2	2	2	2	2	2	2	1	2
IO5 – Travel Choice	2	2	2	2	2	2	2	2	2	2
Cultural										
Heritage	0	0	0	0	0	0	0	0	0	0
Social										
Land use futures / integration with planned landuse	2	2	2	2	1	2	1	2	2	1
Urban design	0	1	0	1	0	-2	-2	-2	-3	-3
Land requirement / property	-1	-1	-1	-1	-2	-1	-1	-2	-1	-1
Social cohesion	0	0	0	0	0	0	0	0	0	0
Human health and wellbeing	0	0	0	-1	0	-1	-1	-1	-1	-1
Environment										
Landscape / visual	-1	-1	-2	-1	-4	-1	-4	-3	-3	-3

Stormwater	-2	-1	-2	-1	-2	-1	-2	-1	-1	-1
Ecology	-2	-4	-3	-2	-4	-2	-4	-4	-4	-4
Natural hazards	-4	-4	-4	-2	-2	-1	-3	-2	-2	-3
Construction impacts										
Embodied carbon emissions	-1	-2	-2	-1	-2	-1	-1	-1	-2	-1
Construction impacts on utilities / infrastructure	-3	-3	-2	-1	-1	-2	-1	-1	-1	-1
Construction Disruption	-1	-1	-1	-2	-1	-2	-2	-1	-1	-2
Construction costs / risk / value capture	-2	-2	-3	-2	-3	-2	-2	-2	-2	-2

Table 5-37 Pukekohe Local – North-East route refinement assessment findings summary

Criteria	Summary of performance		
	Segment 1	Segment 2	Segment 3
Investment Objectives	PNEA_S1_O1 and PNEA_S1_O3 would both integrate well with urban environments, improve access and resilience for all modes and provides equal access opportunities on both sides. PNEA_S1_O4 was preferred as it was considered to provide better network integration is better for traffic from	PNEA_S2_O3 was the preferred option as the alignment outside the FUZ would likely reduce movement conflicts and provide better network integration for high traffic coming off Paerata Arterial. The alignment was also likely to facilitate direct east west connection from Pukekohe NW arterials. PNEA_S2_O1 would maximise the development	PNEA_S3_O1 and PNEA_S3_O3 were preferred as they better integrate with the urban/suburban development. PNEA_S3_O2 was not preferred as it is further from residential developments in the western end, will reduce the integration benefits. Moreover, the indirect alignment for active mode

Criteria	Summary of performance		
	Paerata Arterial and Pukekohe NW arterial. PNEA_S1_O2 was the least preferred as does not provide good access opportunities to a lot of existing and future developments.	potential of the FUZ and improves access and resilience for all modes. PNEA_S2_O2 was not preferred as it is very close to existing residential development, will increase movement place conflict in urban environments.	users, reduce access benefits.
Heritage	No recorded heritage.	No recorded heritage.	No recorded heritage.
Social	**Land use** There was limited differentiation between options as a new corridor which integrates with FUZ to the south east. **Urban design** PNEA_S1_O2 was the preferred option as it has the least earthworks and shortest bridge. PNEA_S1_O1 and PNEA_S1_O3 had slightly increased earthworks for bridge abutments. **Land requirement** PNEA_S1_O2 was least preferred as it impacts a number of properties. **Social cohesion** There was limited differentiation between options the design is for a two lane arterial it is unlikely there will be significant severance effects. **Health and wellbeing** Limited differentiation between options. Introducing new corridor within an area with a small number of sensitive receivers (rural residential)	**Land use** PNEA_S2_O2 was preferred as the upgrade to existing road, the corridor is contained within the FUZ / existing residential area. It will integrate the best with future development and limit the development of land outside the FUZ. **Urban design** PNEA_S2_O1 was the preferred option. PNEA_S2_O2 was not preferred due to the impact on the adjacent housing with earthworks encroaching on the front yards. **Land requirement** PNEA_S2_O2 was the preferred option. PNEA_S2_O1 and PNEA_S2_O3 would have more impact on rural land by not following existing route. **Social cohesion** There was limited differentiation between options, as the design is for a two lane arterial it is unlikely there will be significant severance effects. **Health and wellbeing** PNEA_S2_O1 and PNEA_S2_O3 were	**Land use** All options provide a new corridor primarily within the FUZ with some areas zoned rural. Both options interact with some private plan changes in the area. **Urban design** Due to topography, there are some larger areas of earthworks. PNEA_S3_O1 was preferred as it is the more direct alignment of the two. **Land requirement** PNEA_S3_O2 was the preferred option as reduced number of full acquisitions. **Social cohesion** There was limited differentiation between options and the design for a two lane arterial is unlikely to generate significant severance effects. **Health and wellbeing** Limited differentiation between options with effects on small number of rural residential receivers or all options.

Criteria	Summary of performance		
		preferred as there are limited sensitive receivers. PNEA_S2_O2 was not preferred as existing residential receivers on Grace James Drive. Look to minimise effects by widening on north side.	
Environmental	**Landscape and visual** PNEA_S1_O2 was the preferred option as would result in a limited extent of vegetation removal. PNEA_S1_O1 and PNEA_S1_O3 would affect large established trees along property boundaries. **Stormwater** PNEA_S1_O2 is the preferred option as it has minimal interaction with floodplain. PNEA_S1_O3 would also have minimal interaction with the floodplain. **Ecology** PNEA_S1_O1 is the preferred option as one stream crossing and bridge structure could avoid impacts to stream and riparian margin PNEA_S1_O2 and PNEA_S1_O3 were not preferred and have greater impacts on wetlands and streams. **Natural Hazards** There was limited differentiation between options. Complex ground conditions with some adverse consequences coincides with complex engineering requirement.	**Landscape and visual** PNEA_S2_O2 was the preferred option due to minimal vegetation removal and limited visual amenity effects to residential properties along the existing settlement edge. PNEA_S2_O1 was not preferred due to very complex topography. This option would require substantial alteration to this landform and landscape character. **Stormwater** PNEA_S2_O2 was the preferred option as the road follows the ridge and has no culverts or floodplain interaction. There were also reduced impacts to water quality and hydrology with his option. PNEA_S2_O1 was not preferred the new road will have the largest water quality and hydrology effects. **Ecology** All options have the potential to impact lizards. PNEA_S2_O2 was the preferred option as impacts on vegetation limited to planted indigenous vegetation, no new stream crossings (upgrading an existing corridor). PNEA_S2_O1 and PNEA_S2_O3 were considered likely to result in wetland and stream loss,	**Landscape and visual** PNEA_S3_O2 was the preferred option as it avoids impacts on an SEA. PNEA_S3_O1 was least preferred as it result in loss of established vegetation within an identified SEA and gullies and along property boundaries. The impact was considered likely to result in alteration to the landform and effects on landscape character. **Stormwater** PNEA_S3_O1 was the preferred option, and it would have the least impact on water quality and hydrology. PNEA_S3_O3 was similar to PNEA_S3_O1 but slightly longer which would have a higher impact on hydrology. **Ecology** PNEA_S3_O2 was the preferred option as better avoids higher value habitat, (SEAs and indigenous wetlands). PNEA_S3_O2 was not preferred as potentially significant wetland and stream loss and direct impact and fragmentation of SEA_T_4374. **Natural Hazards** There was limited differentiation between options. Terrain mostly underlain by volcanic soils bridge crossing over

Criteria	Summary of performance		
		with requirement for offset mitigation. **Natural Hazards** PNEA_S2_O2 was preferred as avoids stream and less earthworks required.	alluvium with potential for liquefiable soils.
Construction impacts	**Embodied carbon emissions** PNEA_S1_O1 was the preferred option. **Construction impacts on infrastructure/utilities** PNEA_S1_O3 was the preferred option. All options required localised protection of utilities (overhead powerlines). PNEA_S1_O1 and PNEA_S1_O2 were less preferred as also require relocation or protection of gas transmission line. **Construction disruption** There was limited differentiation between options. Currently all options are on greenfield in a rural area which would result in limited disruption. Coordination with Kiwirail required. **Construction costs** PNEA_S1_O1 and PNEA_S1_O2 both have a similar road corridor length requiring road widening.	**Embodied carbon emissions** PNEA_S2_O2 was the preferred option as it had less earthworks. **Construction impacts on infrastructure/utilities** PNEA_S2_O1 was preferred as less utilities requiring protection or relocation. PNEA_S2_O2 would require relocation services are underground power, chorus comms, watermain (100mmØ uPVC), and stormwater watercourses and pipes (up to 375mmØ). **Construction disruption** PNEA_S2_O1 was preferred as greenfield site. PNEA_S2_O2 not preferred due to disruption to local traffic (temporary traffic management including lane narrowing) due to works on Grace James Road **Construction costs** PNEA_S2_O2 was preferred as opportunity to use the existing road (and kerb on the north side).	**Embodied carbon emissions** There was limited differentiation between options. PNEA_S3_O1 was the preferred option as it had less earthworks. **Construction impacts on infrastructure/utilities** There was limited differentiation between options. Crossing of 630mmØ watermain (distribution) and overhead powerline at intersection of Pukekohe East Road **Construction disruption** There was limited differentiation between options. Currently greenfield site (but FUZ). **Construction costs** There was limited differentiation between options. Similar length of road widening. PNEA_S3_O3 was least preferred due to complex topography.
Partner and Public Feedback	**Partner** Key feedback during SME workshops included: • Freight is a key consideration in Pukekohe • Consideration of how the collector network will connect with the NE Arterial • Grace James Road will change over time as the FUZ develops on the northern side. • Acknowledgement that the topography is challenging in this area. • Consideration of highly productive soils. Key feedback from Manawhenua representatives in hui included:		

Criteria	Summary of performance		
	• Opportunities for the restoration of the Whangapouri Creek. The water quality in the stream has degraded and its mauri has diminished; the whole catchment needs to be restored. • During 19 December 2022 Hui, Ngāti Te Ata supported the recommended options for the Pukekohe NE Arterial in principal PNEA_S1_O4, PNEA_S2_O3, PNEA_S3_O3 subject to further technical assessments being undertaken which Ngāti Te Ata would like to be engaged on. **Public** In general, there was support for the Pukekohe Arterials during public consultation. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas However, here was significant community opposition through feedback on options to the upgrade of Grace James Road (PNEA_S2_O2) which was shown in public engagement material) from local residents and freight community.		

5.7.4 Discarded Options

Table 5-38 summarises the reasons for discounting the options individually.

Table 5-38 Options to be discarded

Option	Reason
PNEA_S1_O1	Less integration compared with PNEA_S1_O4.
PNEA_S1_O2	discounted as it is more complex to construct with large bridge structure crossing the rail corridor with significant earthworks near a stream and crosses a gas pipeline.
PNEA_S1_O3	discounted because it is more complex to construct with two bridge structures crossing the rail corridor and stream with significant earthworks, and may impact on ecological features such a wetlands and bird habitat.
PNEA_S2_O1	discounted because of the impacts on ecological features such as wetlands, streams and vegetation, more complex construction due to topography and earthworks.
PNEA_S2_O2	Proximity to existing residential development, has the potential to increase movement place conflict in urban environments.
PNEA_S3_O1	Provides limited connectivity and greater impact on properties.
PNEA_S3_O2	It provides a less direct connection, is less integrated with likely future land use, affects a proposed (potential location) suburban park identified in the structure plan and requires greater earthworks.

5.7.5 Preferred Option

The preferred options for the Pukekohe North East Arterial are:

PNEA_S1_O4 – This option provides the best integration for existing urban areas and the provides better network integration from Paerata Arterial and Pukekohe NW Arterial. The alignment also

improves resilience and access for all modes. It has less of earthworks than other options, providing the opportunity for future development to establish an active interface to the corridor. It creates a direct east-west connection through the FUZ providing the most flexibility for future development.

PNEA_S2_O3 – This option provides better network integration for high traffic flows coming off Paerata Arterial and provides a direct east west connection from Pukekohe NW arterials to Pukekohe East Road.

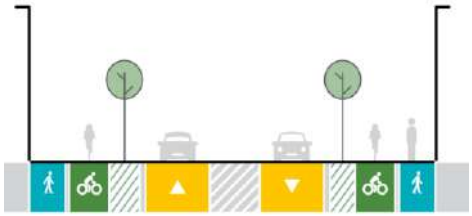
PNEA_S3_O3 - This option integrates better (than the other options) with the urban/suburban developments and provides more opportunities for access for all modes and improves the resilience for all modes. In particular, for the eastern portion of FUZ land (Runciman Road).

5.8 Pukekohe South East Route Refinement

5.8.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-39provides a summary of the assumptions and outcomes of the assessment.

Table 5-39 Pukekohe Local – South-East form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor from Pukekohe East Road, Golding Road and a new section to connecting across the NIMT to existing Pukekohe urban area. It serves an east-west function for general traffic, PT and active modes increasing connectivity and access within the FUZ to existing urban Pukekohe.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	P2 - Attracts activity from across a subregion or neighbouring local board area M3 -
Flows (ADT 2048)	With developer connections 12,000-14,000 Without developer connections +20,000
Speed	50 kph speed limit
Public transport (indicative 2048)	8-10 buses per hour Priority lanes or priority at intersections required
Freight	Level 1B

5.8.2 Option Development

The South East Arterial was split into three segments for route refinement assessment:

- Segment 1: three options to widen Golding Road – on one side (east or west) or both sides (central)
- Segment 2: three options east-west between Golding Road and the NIMT.
- Segment 3: crossing across the NIMT to the industrial area.

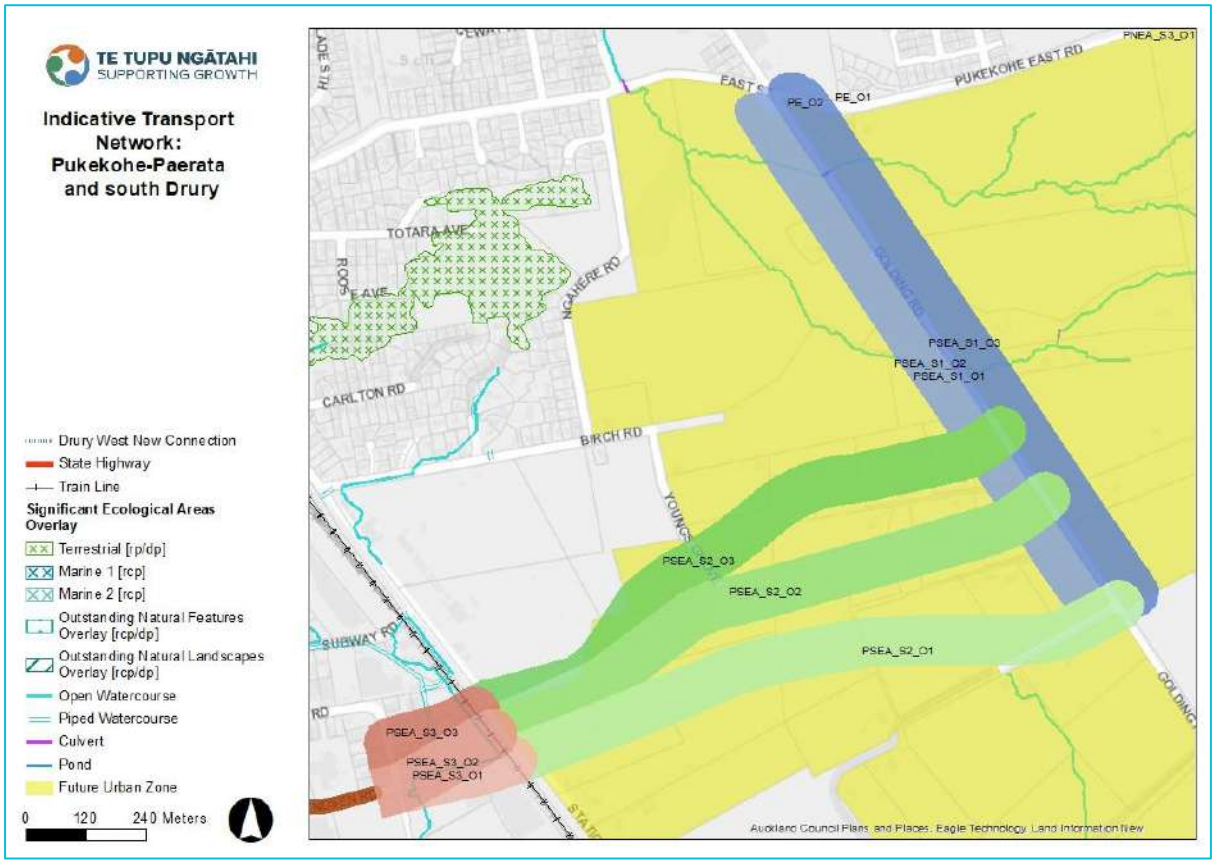


Figure 5-11 – Pukekohe South-East Arterial route refinement options (three segments)

5.8.3 Option Assessment

Options were assessed against the MCA framework by each subject matter expert in Table 5-40. Commentary is provided in Table 5-41.

Table 5-40 Pukekohe Local – South-East Route Refinement MCA scoring

MCA Criteria	Scores								
Options	**PSEA_S1_O1**	**PSEA_S1_O2**	**PSEA_S1_O3**	**PSEA_S2_O1**	**PSEA_S2_O2**	**PSEA_S2_O3**	**PSEA_S3_O1**	**PSEA_S3_O2**	**PSEA_S3_O3**
Investment objectives									

IO1 – Safety	1	1	1	1	1	1	1	1	1
IO2 – Integration	2	2	2	2	2	2	2	2	1
IO3 - Access	2	2	2	2	2	2	2	2	1
IO4 – Resilience	2	2	2	2	2	2	2	2	2
IO5 – Travel Choice	2	2	2	2	2	2	2	2	2
Cultural									
Heritage	0	0	0	0	0	0	0	0	0
Social									
Land use futures / integration with planned landuse	3	2	2	2	3	2	1	1	1
Urban design	1	1	1	0	1	0	-1	-1	-1
Land requirement / property	-1	-1	-1	-1	-2	-2	-1	-2	-1
Social cohesion	0	0	0	1	2	2	1	2	2
Human health and wellbeing	-1	-1	-1	0	0	0	0	0	0
Environment									
Landscape / visual	-1	-2	-2	-1	-2	-2	-2	-2	-2
Stormwater	-1	-1	-2	-1	-2	-2	-2	-2	-1
Ecology	-1	-2	-2	-2	-3	-3	-3	-2	-1

Natural hazards	-2	-2	-1	-3	-2	-2	-2	-2	-2
Construction impacts									
Embodied carbon emissions	0	0	0	0	0	0	0	0	0
Construction impacts on utilities / infrastructure	-1	-1	-1	-1	-1	-1	-1	-1	-2
Construction Disruption	-2	-2	-2	-1	-1	-1	-3	-3	-3
Construction costs / risk / value capture	-2	-2	-2	-2	-2	-2	-2	-2	-2

Table 5-41 Pukekohe Local – South-East route refinement assessment findings summary

Criteria	Summary of performance		
	Segment 1	Segment 2	Segment 3
Investment Objectives	All options would result in safety improvements from taking strategic traffic from Pukekohe East Road and Pukekohe town centre and significantly improve access and access Pukekohe Town Centre and rail station. There would be significant improvements in resilience around Pukekohe town centre and improvements in mode choice through FUZ areas. Limited differentiation in options.	All options will reduce pressure on existing local roads and improve safety. All options provide positive integration for both existing and future land use and significantly improve E-W access. With any of the new alignments there will be a significant improvement in resilience around Pukekohe town centre and improved mode choice particularly through FUZ areas. Limited differentiation in options.	All options will reduce pressure on existing local roads and improve safety. All options provide positive integration for both existing and future land use and significantly improve E-W access. With any of the new alignments there will be a significant improvement in resilience around Pukekohe town centre and improved mode choice particularly through FUZ areas. Limited differentiation in options.
Heritage	No recorded heritage.	No recorded heritage.	No recorded heritage.

Criteria	Summary of performance		
Social	**Land use** Proposed plan changes on both sides (Birch Land Development Consultants on western side and Traffic Planning Consultants Limited on eastern side). PSEA_S1_O1 (central option) was preferred as it provided better integration opportunities. **Urban design** Limited differentiation between options. Minimal impact on the character and amenity of the surrounding environment. FUZ on either side will have opportunity to respond to the corridor. **Land requirement** Limited differentiation between options. Acquisition impact shared by all property owners along the route. **Social cohesion** Limited differentiation all options upgrade to Golding Road to support improved links between Golding Road and existing industrial development in Pukekohe. **Health and wellbeing** Limited differentiation between options. Existing corridor limited sensitive receivers identified generally rural land.	**Land use** PSEA_S2_O2 was the preferred option as a new corridor well integrated with FUZ. PSEA_S2_O1 was not preferred as it interacts with Birch Land Development proposal to the south. PSEA_S2_O3 was not preferred as it interacts with showgrounds special use zoning to the north. **Urban design** PSEA_S2_O2 was the preferred option as it provides more flexible future development environment and an opportunity to transition the interface with Pukekohe Showgrounds. PSEA_S2_O1 was the least preferred as it leaves a small pocket of industrial land of an awkward shape. **Land requirement** PSEA_S2_O1 was the preferred option as it had the least number of property acquisitions. **Social cohesion** PSEA_S2_O1 was the least preferred as it was limited in providing a link between Golding Road and industrial development in Pukekohe. **Health and wellbeing** Limited differentiation between options. Existing corridor limited sensitive receivers identified generally rural land.	**Land use** There was limited differentiation between options. While these options would provide a connection from FUZ to the industrial area the existing development limits opportunities for integration. **Urban design** There was limited differentiation between options, however PSEA_S3_O3 was lest preferred as there were more intersections to navigate e.g. active modes. **Land requirement** PSEA_S3_O1 was not preferred due to concerns over proximity to the Mitre 10 receiving yard and the impact that the bridge over the railway line will have. PSEA_S3_O2 and PSEA_S3_O3 would have a similar impact on properties. **Social cohesion** PSEA_S3_O1 was the least preferred as it would impact existing industrial development. Impacts to Mitre 10 complex located on the southern boundary of the culvert including loading and servicing. PSEA_S3_O2 and PSEA_S3_O3 would have a similar impact on existing development. **Health and wellbeing** Limited differentiation between options. Existing corridor limited sensitive receivers identified generally rural land.
Environmental	**Landscape and visual**	**Landscape and visual**	**Landscape and visual**

Criteria	Summary of performance		
	Visual amenity effects limited to properties located along the Golding Road corridor. PSEA_S1_O1 was preferred as road widening along both sides of the road will limit overall loss of amenity. **Stormwater** PSEA_S1_O2 was the preferred option as downstream widening will have the least effect on flooding. However, two existing culverts were likely to need lengthening and negligible floodplain effects from earthworks were predicted. **Ecology** PSEA_S1_O1 was the preferred option as it avoids mature indigenous trees along eastern side. PSEA_S1_O3 was the least preferred due to impact on mature indigenous vegetation / trees. **Natural Hazards** PSEA_S1_O3 preferred as stays away from volcanic explosive centre. PSEA_S1_O1 was the least preferred as crosses settlement-susceptible or liquefiable soils.	PSEA_S2_O2 was located on more complex topography which includes a localised knoll and rising landform. PSEA_S2_O3 was also not preferred as it spans through a number of existing house sites. PSEA_S2_O1 was the preferred option as it avoids stream corridors and visual amenity effects limited to within the localised setting of the route. **Stormwater** PSEA_S2_O1was preferred as it has a low impact on floodplains and streams. **Ecology** PSEA_S2_O1 was the preferred option and would likely result in minor impacts as it is within a highly disturbed landscape. PSEA_S2_O2 and PSEA_S2_O3 were not preferred due to impacts on a stand of mature indigenous forest and potential for species including lizards and bats. **Natural Hazards** There was limited differentiation between options. Part of alignment located on Q1df alluvial fan deposits variable and potentially adverse soils.	PSEA_S3_O3 was the preferred option as minimal vegetation loss is anticipated. PSEA_S3_O1 and PSEA_S3_O2 were not preferred due to the loss of a daylighted stream corridor. However, it was noted there would be limited visual amenity effects due to the existing urban (industrial) environment. **Stormwater** PSEA_S3_O3 was the preferred option as downstream widening will have the least effect on flooding. PSEA_S3_O2 was the least preferred as upstream widening will have the largest effect on flooding with the largest floodplain effects from earthworks. PSEA_S3_O1 was also not preferred as it would have a moderate effect on flooding and would require the removal of the artificial channel. **Ecology** PSEA_S3_O3 was the preferred option as it avoids streams and wetlands. PSEA_S3_O1 and PSEA_S3_O2 were not preferred due to impacts within riparian margin / and stormwater runoff channel. **Natural Hazards** There was limited differentiation between options. Part of alignment located on Q1df alluvial fan deposits variable and potentially adverse soils.
Construction impacts	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities**	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities**	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities**

Criteria	Summary of performance		
	All options were similar with a number of services requiring protection or relocation. **Construction disruption** Disruption to local traffic (temporary traffic management including lane narrowing) due to works on Golding Road. **Construction costs** All options have the same length and involve road widening and were scored the same.	All options were similar and crossed local power at isolated locations only and crosses rail line and local roads. **Construction disruption** There was limited differentiation between options. All alignments cross the rail line at Station Road. Co-ordination with KiwiRail is required to minimise disruption. **Construction costs** All options have a similar length requiring road widening.	PSEA_S3_O3 was the least preferred as the protection or relocation of more local services would be required compared to Option 1 and 2 due to running through Austen Place. **Construction disruption** There was limited differentiation between options. All alignments cross the rail line at Station Road. Co-ordination with KiwiRail is required to minimise disruption. **Construction costs** All options have a similar length requiring road widening.
Engagement	**Partner** • Key feedback from SME workshops included: • Interaction with a number of private plan changes • Golding Road is a key connection to Waikato • Discussion on freight movement • Support for increased accessibility over the NIMT Manawhenua support upgrade of Golding Road. **Public** In general, there was support for the Pukekohe Arterials during public consultation. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas. There was a request to look at options further south (in Waikato) to connect further east on Mill Road. In particular, for freight movements.		

5.8.4 Discarded Options

Table 5-42 summarises the reasons for discounting the options individually.

Table 5-42 Options to be discarded

Option	Reason
PSEA_S1_O2	reduced integration opportunities with planned and future development
PSEA_S1_O3	reduced integration opportunities with planned and future development, had the greatest effect on the floodplain and on mature and native vegetation

Option	Reason
PSEA_S2_O1	likely to impact on proposed urban development due to topography on Golding Road intersection and Pukekohe Showgrounds
PSEA_S2_O3	affects a greater number of properties, may impact the Pukekohe Showgrounds and impacts on a stand of mature indigenous forest
PSEA_S3_O1	Significant property impacts including on a large commercial centre including the access
PSEA_S3_O3	results in a less direct connection including more intersections to navigate particularly for active modes, and requires additional existing services to be relocated adding to construction cost

5.8.5 Preferred Option

The preferred options for Pukekohe SE Arterial are:

Segment 1 - PSEA_S1_O1 was the preferred option (widening on both sides) as it is better integrated with future development, shares property impacts equally, reduced impacts on mature and native vegetation.

Segment 2 – PSEA_S2_O1 (southern) was preferred as better integrates with future development, affects the least number of properties, does not require any stream crossings.

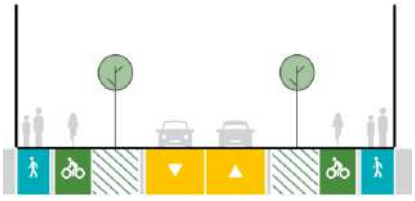
Segment 3 – PSEA_S3_O2 was preferred because it provides a direct connection and reduces impacts on large commercial centre including the access.

5.9 Pukekohe South West Route Refinement

5.9.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-43provides a summary of the assumptions and outcomes of the assessment.

Table 5-43 Pukekohe Local – South-West form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor from Manukau Road in the east to Helvetia Road west in Pukekohe. It is a primary east-west road which helps in detracting general traffic and freight away from the town centre. Its primary function is for general traffic, freight and a focus on increasing active mode connectivity.
Cross Section	 20m cross section, two general vehicle lanes, active modes.

Criteria	Summary
Function	P2 - Attracts activity from across a subregion or neighbouring local board area M2 - Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	8,000-14,000
Speed	50 kph speed limit
Public transport (indicative 2048)	12 buses per hour
Freight	Level 2

5.9.2 Option Development

Following the identification of a preferred route for the South West Arterial at the corridor assessment stage (see Section 4.5.5) there was a further assessment to determine the upgrade of existing roads reflecting the existing urban environment.

Due to the spatial constraints along this corridor, as it is completely within the existing built up urban area of Pukekohe, options were developed to utilise the existing road reserve and had a bespoke options assessment process.

The options developed included:

- A 20m cross-section with active modes on both sides of the road. Three options were developed:
    - Option 1: a 6.8m uni directional cycle facility on each side
    - Option 2: a 6.5m uni directional cycle facility on each side
    - Option 3: a 5.25m uni directional cycle facility on each side
- Two-way cycleway on northern / eastern side only (3.2m cycleway on one side, 1.8m walking facility and 1.2 berm on each side) – Option 4.
- Two-way cycleway on southern / western side only (3.2m cycleway on one side, 1.8m walking facility and 1.2 berm on each side) – Option 5.

The South West Arterial alignment was separated into three sections for assessment purposes as shown in Figure 5-12.

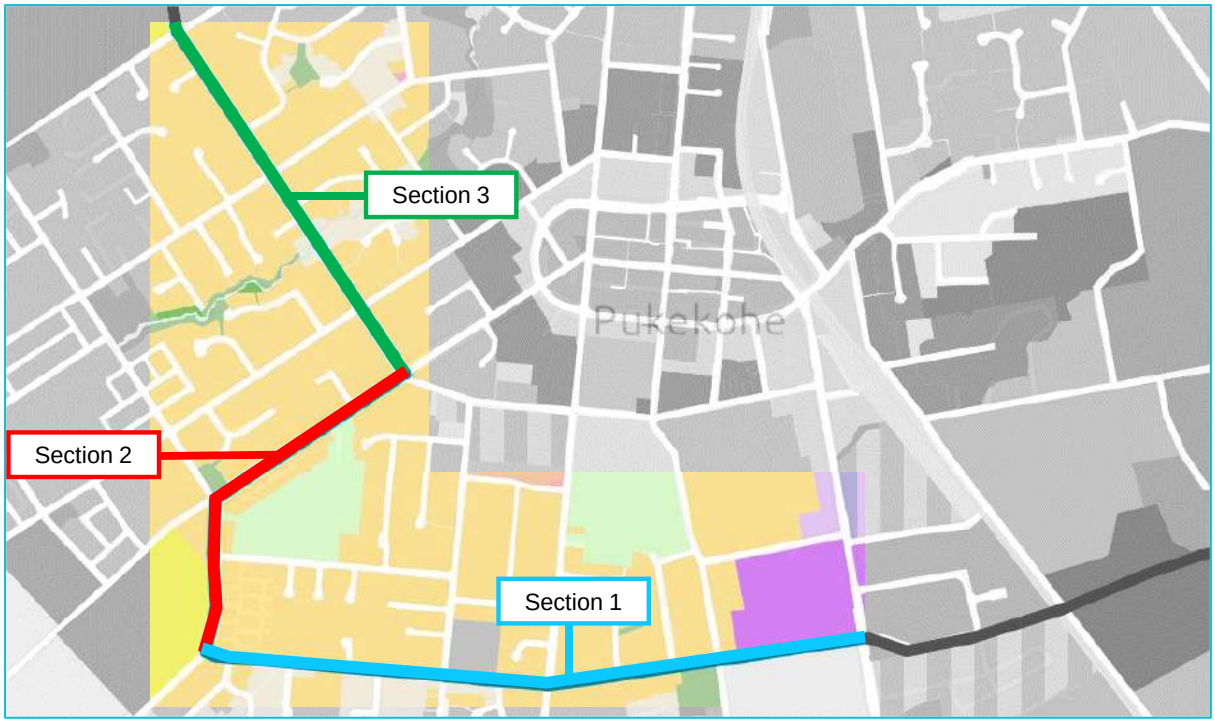


Figure 5-12 Sections assessed for South West Corridor

5.9.3 Option Assessment

The assessment process is set out in Figure 5-13 and included a comparative analysis of the level of service for active modes, property impacts and construction cost.

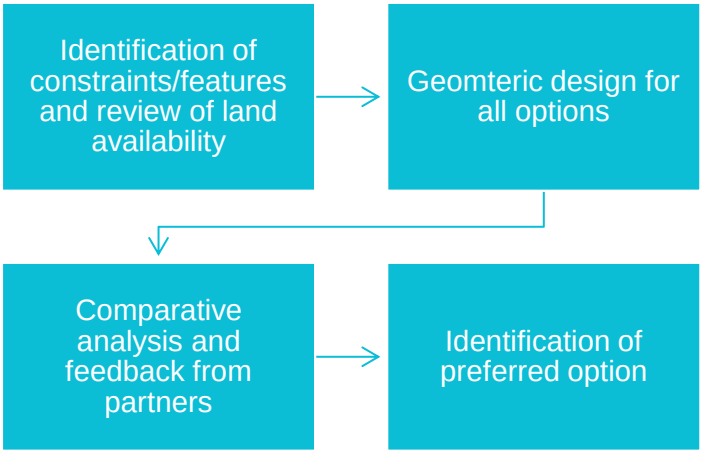


Figure 5-13 Comparative assessment for Pukekohe South West Arterial

The comparative assessment involved rating each of the scenarios against the key indicators: walking safety, cycling safety, property impact and cost. The options were assessed either positively (ticks), indicating a positive outcome, with the higher number of ticks representing the highest benefit or their level of disbenefit (crosses), with the higher number of crosses representing the level of disbenefit. Table 5-44 provides a summary of the comparative assessment undertaken for the Pukekohe South West Arterial.

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Table 5-44 Summary of comparative assessment for South West Corridor

Criteria	Summary											
	Section 1				Section 2				Section 3			
	Cycle safety	Walking safety	Property	Cost	Cycle safety	Walking safety	Property	Cost	Cycle safety	Walking safety	Property	Cost
Option 1 Uni-directional cycleway (6.8m)	√√√√	√√√√	XXXX	XXXX	√√√√	√√√√	XXX	XXXX	√√√√	√√√√	XXXX	XXXX
Option 2 Uni-directional cycleway (6.5m)	√√√√	√√√√	XXXX	XXXX	√√√√	√√√√	XXX	XXXX	√√√√	√√√√	XXXX	XXXX
Option 3 Uni-directional cycleway (5.25m)	√√√√	√√√√	XX	XXX	√√√√	√√√√	XX	XXX	√√√√	√√√√	XXX	XXX
Option 4 Bi-directional cycleway on North / East side	√√√	√√√√	XX	X	√√√	√√√√	√√√	X	√√√	√√√√	XX	XX
Option 5 Bi-directional cycleway on South / West side	√√√	√√√√	XX	X	√√√	√√√√	XX	X	√√√	√√√√	XX	X

Partner Feedback

SMEs provided the following feedback at workshops:

- Recognition of the highly constrained area and support to assess alternatives to reduce property impacts.
- Principle support for bi-directional cycleway to reduce property impacts in the existing urban area.
- A request to consider the provision of lighting and trees within the cross section and integration with future bus stops.

5.9.3.1 Discarded Options

Table 5-45 summarises the reasons for discounting the options individually.

Table 5-45 Options to be discarded

Option	Reason
Option 1	High property impacts and large cost for construction
Option 2	High property impacts and large cost for construction
Option 3	High property impacts and large cost for construction

5.9.4 Preferred Option

Option 4 was recommended for segments 1 and 2 and Option 5 was recommended for segment 3.

Options 4 and 5 (both being a bi-directional cycle facility on one side of the road) were preferred as they best utilise the existing road reserve, minimise impacts on property along the route, reduce costs, while still ensuring adequate accessibility.

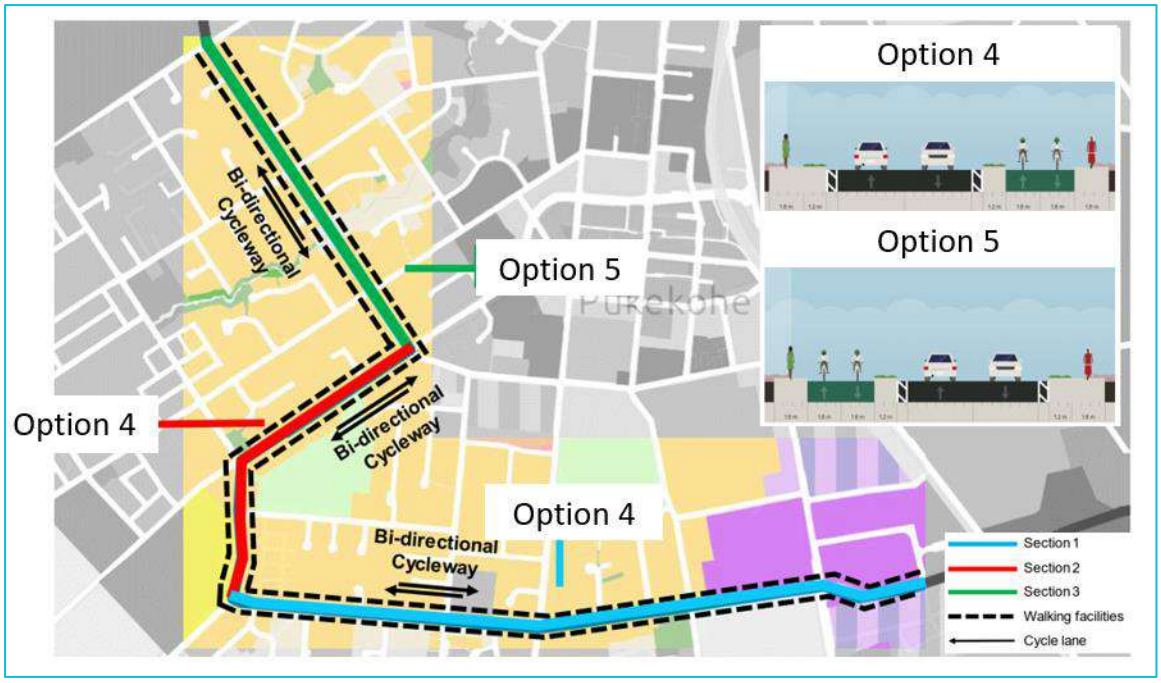


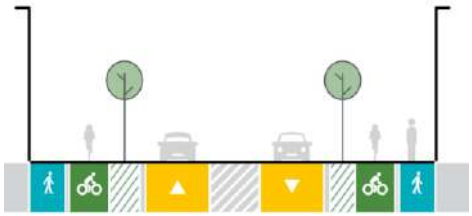
Figure 5-14 Preferred Option for South West Corridor

5.10 Pukekohe North West Route Refinement

5.10.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken.Table 5-46 provides a summary of the assumptions and outcomes of the assessment.

Table 5-46 Pukekohe Local – North-West form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor connecting SH22 to Ward St in Pukekohe. It is the primary north-south route for all modes in Pukekohe West.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	P2 - Attracts activity from across a subregion or neighbouring local board area M2 - Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	6,000-10,000
Speed	50 kph speed limit
Public transport (indicative 2048)	10-12 buses per hour
Freight	Level 2/3

5.10.2 Option Development

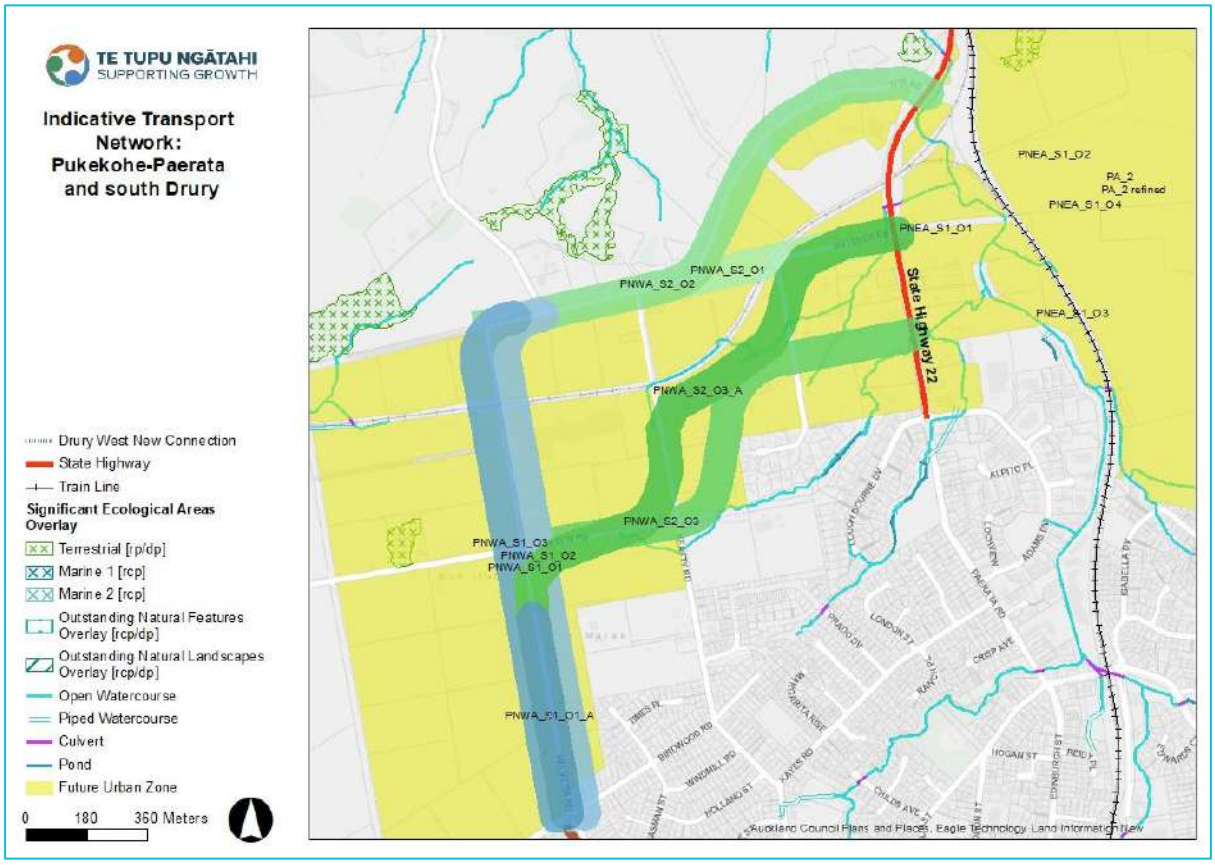


Figure 5-15 Summary of North-West options

5.10.3 Option Assessment

Options were assessed against the MCA framework by each subject matter expert as set out in **Error! Reference source not found.**.Commentary is provided in Table 5-48.

Table 5-47 Pukekohe Local – North-West Route Refinement MCA scoring

MCA Criteria	Scores					
	Segment 1 (widening of Helvetia Road)			Segment 2 (east west connection)		
Options	**PNWA_S1_O1 (Centre)**	**PNWA_S1_O2 (East)**	**PNWA_S1_O3 (West)**	**PNWA_S2_O1 (Butcher Rd)**	**PNWA_S2_O2 (Heights Rd)**	**PNWA_S2_O3 (New)**
Investment objectives						
IO1 – Safety	1	1	1	2	1	2
IO2 – Integration	2	2	2	1	1	1
IO3 - Access	2	2	2	2	1	2

IO4 – Resilience	1	1	1	2	1	2
IO5 – Travel Choice	2	2	2	2	1	2
Cultural						
Heritage	0	0	0	0	0	0
Social						
Land use futures / integration with planned landuse	3	2	2	3	1	3
Urban design	1	1	1	0	1	0
Land requirement / property	-1	-1	-1	-1	-1	-2
Social cohesion	-1	-1	-1	2	0	2
Human health and wellbeing	-1	-1	-1	0	0	-1
Environment						
Landscape / visual	-2	-1	-3	-1	-1	-3
Stormwater	-1	-2	-1	-1	-1	-2
Ecology	-2	-2	-2	-3	-1	-3
Natural hazards	-4	-4	-4	-2	-1	-2
Construction impacts						
Embodied carbon emissions	0	0	0	0	0	0
Construction impacts on utilities / infrastructure	-2	-2	-2	-2	-1	-1
Construction Disruption	-2	-2	-2	-2	-2	-1

Construction costs / risk / value capture	-2	-2	-2	-2	-2	-2

Table 5-48 Pukekohe North West route refinement assessment findings summary

Criteria	Summary of performance	
	Segment 1	Segment 2
Investment Objectives	There was limited differentiation between options (widening Helvetia Road). All options have positive safety effects from taking strategic traffic from Pukekohe town centre and improved integration with urban environments., multi-modal access for all road users and improvements to resilience.	Option PNWA_S2_O2 (Heights Rd) was least preferred (to upgrade Heights Road). It has a less direct connection to SH22 and the NE quadrant and wider strategic network. PNWA_S2_O1 and O3 provide better opportunities for active modes and public transport as are more integrated with the FUZ.
Heritage	No recorded heritage.	No recorded heritage.
Social	**Land use** Includes area within private plan change. Opportunity for developer to deliver part. **Urban design** All options involve minimal earthworks. However, are likely to result in heavy traffic through the middle of a residential area reducing amenity. **Land requirement** All options require at least one full acquisition. There was limited differentiation between options. However, widening on both sides of the road shares more equally the property impacts. **Social cohesion** There was limited differentiation between options and as a two lane arterial it is unlikely there would be significant severance effects. **Health and wellbeing** Existing industrial and residential receivers. There were limited differentiation between options.	**Land use** Includes area within private plan change. PNWA_S2_O1 and PNWA_S2_O3 mainly existing roads and integrates best with FUZ. **Urban design** Preference for PNWA_S2_O2 due to minimal impact on character. PNWA_S2_O1 and PNWA_S2_O3 have the potential to isolate the industrial area between the alignment and the railway. **Land requirement** PNWA_S2_O1 and PNWA_S2_O2 require only partial acquisitions. PNWA_S2_O3 is the least preferred. **Social cohesion** Two lane arterial it is unlikely there would be significant severance effects. PNWA_S2_O1 and PNWA_S2_O3 this route provides an improved connection with local shops on Paerata Road. **Health and wellbeing** Existing corridor limited sensitive receivers. PNWA_S2_O2 considered the need to consider access to the cemetery from Heights Road. PNWA_S2_O3 has existing residential receivers located on Butchers Road.

Criteria	Summary of performance	
Environmental	**Landscape and visual** PNWA_S1_O1 effects vegetation along both sides of road. The alignment proximate to an identified Notable Trees within the AUP on the western side of the road. PNWA_S1_O3 includes loss of vegetation along the western side of road including northern corner. PNWA_S1_O2 was preferred due to the limited loss of established vegetation along the eastern side of the road. **Stormwater** PNWA_S1_O1 would have a moderate effect on flooding. PNWA_S1_O2 required upgrades to existing culverts and the upstream widening would have the largest effect on flooding. PNWA_S1_O3 was preferred as downstream widening of the road would have the least effect on flooding. **Ecology** No stream or natural wetland impacts. Historical wetlands appear to have been entirely drained and converted to pasture (historically would have been a peat bog / fen). Likely to impact stormwater ponds (potential for At Risk - Declining Copper skink and Dabchick on ponds) on east side and mature Totara (at property 130 Helvetia Rd, Gun Club Rd and 166 Heights Rd) on west side. PNWA_S1_O3 is the preferred option as minimises the impacts on ecology. **Natural Hazards** Preference is for PNWA_S1_O1. Options involved partial new construction through swamp/tuff crater, with associated soft/compressible soils. All options cross unnamed fault and anthropogenic fill.	**Landscape and visual** The alignment follows more complex topography (steep slopes and catchments). PNWA_S2_O2 was the preferred option as involves reduced loss of vegetation. PNWA_S2_O3 includes steeper slopes and gullies and loss of vegetation associated with the stream margins, shelter belts and planting lining Gun Club Road. PNWA_S2_O1 also involves loss of groupings of trees along the existing road edge. **Stormwater** PNWA_S2_O1 was preferred as it would have a minimal effect on flooding. PNWA_S2_O2 has no interaction with culverts or floodplains. PNWA_S1_O3 was the least preferred as it had higher flood effects. **Ecology** PNWA_S2_O2 was preferred as it avoids all streams, potentially impacts to wetlands at junction with SH22 and impacts likely restricted to mature exotic trees. PNWA_S2_O3 includes impacts to several stands of mature vegetation and riparian vegetation. PNWA_S2_O3 includes impacts to indigenous forest and potentially the SEA. **Natural Hazards** Preference is for PNWA_S2_O2 mostly over terrain underlain by volcanic soils. PNWA_S2_O1 crosses a geological fault. PNWA_S2_O3 includes geology which may include some soft compressible layers or possibly some loose materials subject to liquefaction.
Construction impacts	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** All options have a similar road corridor length requiring road widening. **Construction disruption**	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** All options have a similar road corridor length requiring road widening. PNWA_S2_01 will require relocation or strengthening of a gas pipeline. PNWA_S2_01 requires a significant

Criteria	Summary of performance	
	All options require protection or relocation of all services. **Construction costs** All options include disruption to local traffic.	bridge crossing over the Glenbrook line and Butcher Road will need to be raised impacting SH22. **Construction disruption** All options require protection or relocation of all services. **Construction costs** All options include disruption to local traffic.
Engagement	**Partners** Key feedback from SMEs at workshops included: • Acknowledgement of the construction/engineering challenges due to rail crossings (Glenbrook line) and topography. • Proposed plan changes in the area. Opportunities to work with developers. **Public** In general, there was support for the Pukekohe Arterials during public consultation. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas. Specifically for the NW Arterial, sentiment was mixed. Feedback indicated that people clearly do want a solution for traffic congestion but disagree with the proposal's route connecting future urban areas, including housing developments. Feedback also raised concerns of heavy vehicle (freight) movements through what is perceived as an already congested route or through existing (or proposed) residential areas. A request was made for a more western arterial in the rural zone. In particular for freight. This request was progressed by the project team as it did not support the future urban zone and the planned urban growth.	

5.10.3.1 Discarded Options

Table 5-49 summarises the reasons for discounting the options individually.

Table 5-49 Options to be discarded

Option	Reason
PNWA_S1_O2	Impacts several stands of mature indigenous trees along east side of Helvetia Road.
PNWA_S1_O3	Impacts vegetation along the western side of road.
PNWA_S2_O1	More complex to construct with new rail crossings and more complex topography (steep slopes and catchments) and is adjacent to SEA and indigenous vegetation.
PNWA_S2_O2	More complex to construct with more complex topography (steep slopes and catchments). The topography will limit its attractiveness for active mode users, less direct connection to SH22 and NE quadrant. It is also adjacent to SEA and indigenous vegetation.

5.10.4 Preferred Option

PNWA_S1_O1 is preferred as it is better integrated with future development, shares potential property acquisition evenly on both sides of the road, and provides opportunity to reduce impacts on features.

PNWA_S2_O3 is preferred because it is less complex to construct, provides more benefits for active modes and PT, reduces impacts on vegetation, uses existing roads (including a paper road), and reduces impacts on existing residential.

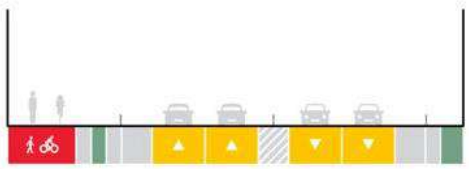
Further design considerations include making the alignment as direct as possible but making best use of existing roads including paper road.

5.11 Mill Road / Pukekohe East Road Upgrade Route Refinement

5.11.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken. Table 5-50 provides a summary of the assumptions and outcomes of the assessment.

Table 5-50 Mill Road / Pukekohe East form and function assumptions and summary

Criteria	Summary	Summary
	Pukekohe East Road	Mill Road
Purpose	Existing arterial section from the north-eastern ring road to Belgium Road. It has a high east-west function for general traffic and freight but also needs to accommodate buses and active modes.	Mill Road (Pukekohe) forms a primary east-west connection from SH1 to Pukekohe urban areas. This corridor is a strategic connection for traffic and freight, with a major rural active mode connection and has the potential to take on a State Highway function.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side	 30m cross section, 4 General Traffic, walking and cycling on one side
Function	P2 - Attracts activity from across a subregion or neighbouring local board area M3 - High strategic significance with higher volume of users	P1 - Predominantly local function with a small catchment of users M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	With developer connections: 12,000-14,000 Without developer connections: +20,000	30,000-32,000
Speed	50 kph speed limit	80 kph speed limit
Public transport (indicative 2048)	8-10 buses per hour Priority at intersections required	N/A
Freight	Level 1B	Level 1B

5.11.2 Option Development

Three options were developed for the widening of Mill Road Bombay (to four lanes) – to widen on one side (north or south) or both sides (centre). The widening of Mill Road Bombay is proposed to

Harrisville Road. From this point, Pukekohe East Road is proposed to have an active mode upgrade into Pukekohe. As this is within the rural zone, a shared path will be placed on one side of the existing road. Two options were developed for the shared path to be placed on the north or south side.

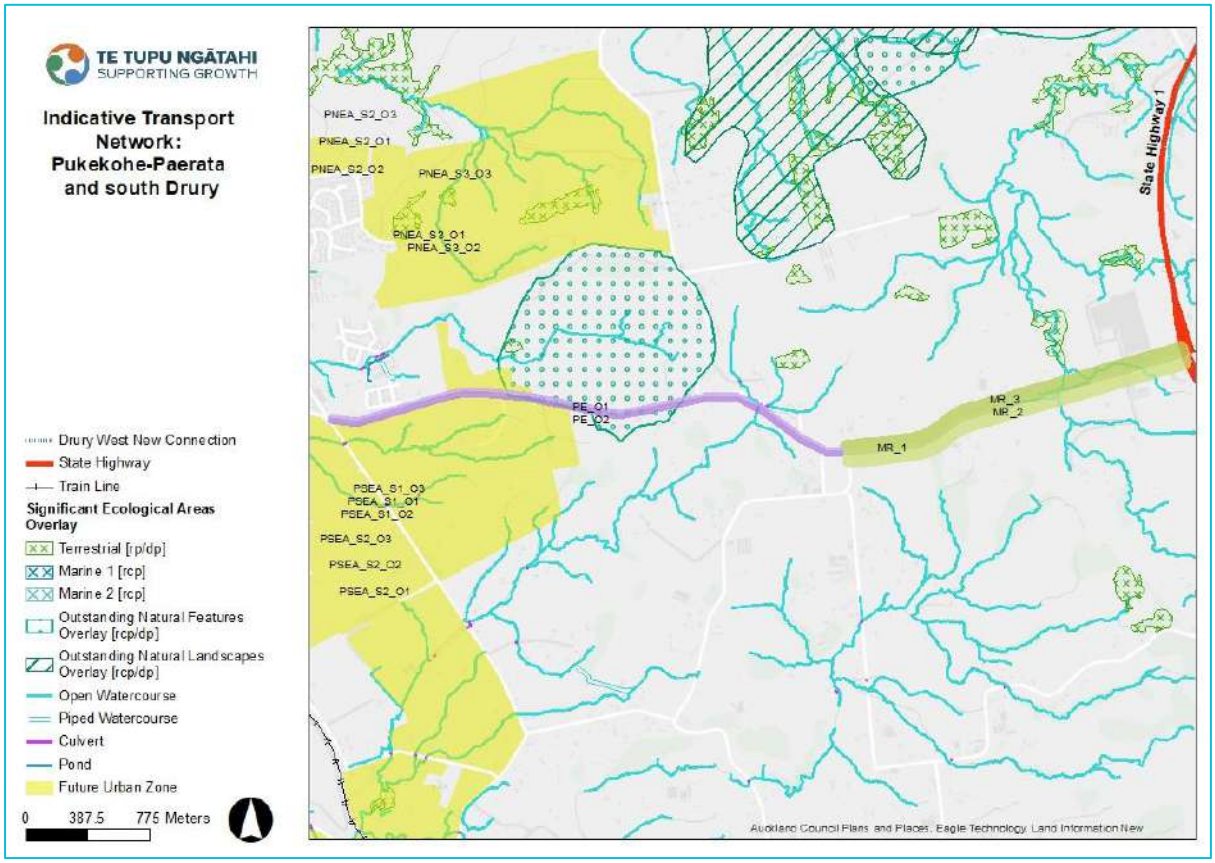


Figure 5-16 Mill Road Bombay Route Refinement Options

5.11.3 Option Assessment

Options were assessed against the MCA framework by each subject matter expert as set out in Table 5-51. Commentary is provided in Table 5-52.

Table 5-51 Mill Road Bombay and Pukekohe East Road Upgrade Route Refinement MCA scoring

MCA Criteria	Scores				
	Mill Road			Pukekohe East Road	
Options	**MR_1 Centre**	**MR_2 South**	**MR_3 North**	**PE_O1 (north)**	**PE_O2 (south)**
Investment objectives					
IO1 – Safety	1	1	1	2	2
IO2 – Integration	0	0	0	2	2
IO3 - Access	1	1	1	2	2
IO4 – Resilience	3	3	3	2	2

IO5 – Travel Choice	1	1	1	2	2
Cultural					
Heritage	0	0	0	0	0
Social					
Land use futures / integration with planned land use	3	1	2	1	1
Urban design	0	0	0	1	2
Land requirement / property	-1	-2	-2	-1	-1
Social cohesion	0	-1	0	-1	0
Human health and wellbeing	0	0	0	0	0
Environment					
Landscape / visual	-2	-3	-3		
Stormwater	-1	-2	-1	-1	-1
Ecology	-3	-3	-3	-3	-3
Natural hazards	-1	-1	-1	-3	-2
Construction impacts					
Embodied carbon emissions	0	0	0	0	0
Construction impacts on utilities / infrastructure	-2	-2	-2	-2	-2
Construction Disruption	-3	-3	-3	-2	-2
Construction costs / risk / value capture	-2	-2	-2	-2	-2

Table 5-52 Mill Road Bombay route refinement assessment findings summary

Criteria	Summary of performance	
	Mill Road	**Pukekohe East Road**
Investment Objectives	There was limited differentiation between options. All options provide increased reliance in the network, will take strategic traffic from SH1 to Pukekohe and south to Waikato and have positive safety benefits. As is located in the rural zone, there is no place and movement conflict.	PE_O2 was the preferred option as it provides access to key destinations and crossings from SH1 to Golding Road.

Criteria	Summary of performance	
	All options improve active mode access and provide network-wide improvement in resilience.	
Heritage	No recorded heritage.	No recorded heritage.
Social	**Land use** All options provide an improved connection to the local centre at the intersection of SH1. MR_1 was preferred as it upgrades both sides of the road. MR_2 was not preferred as it was considered to have the potential for more significant impacts to the local centre and MR_3 would similarly impact on growers on the northern side of Mill Road. **Urban design** All options were considered to impact on the existing character and amenity as the upgrade of the existing road is within the Rural Zone reducing the ability for future development to respond to the corridor. **Land requirement** MR_1 was the preferred option as would limit the impact on the BP Service Station complex as well as the hothouse facility at 187 Mill Rd. MR_2 would impact BP Service station and potential issues with contaminated land. MR_3 would impact NZ Hothouses complex at 187 Mill Rd. **Social cohesion** MR_2 was the least preferred due to the impact on the local centre at the intersection with SH1. MR_1 and MR_3 were equally preferred. **Health and wellbeing** There was limited differentiation between options. This is an existing corridor in the rural area with limited receivers there are some houses and community facilities.	**Land use** PE_O2 was preferred as it would better integrate with FUZ to the south of Pukekohe East Road. **Urban design** PE_O2 was preferred as it provides connection to future growth areas and existing activity in Bombay on south side of road. **Land requirement** Both Options will have an impact on large properties at the SH1 interchange. PE_O2 was slightly preferred due to impacts on the commercial development. **Social cohesion** PE_O2 was preferred as PE_O1 had the potential to impact on Pukekohe East Hall. **Health and wellbeing** Small number of existing rural residential receivers unlikely to be impacted by walking and cycling upgrades.
Environmental	**Landscape and visual** MR_1 was the preferred option. There would be some vegetation loss and loss of stream corridors north and south of the road. The southern and northern options would also directly impact properties close to the existing road. **Stormwater** There were no significant difference to hydrologic or water quality effects between	**Landscape and visual** Both options could impact on the Pukekohe Tuff Ring (ONF). PE_O2 is the preferred option as it avoid the majority of the tuff ring on the north side of Pukekohe East Road. **Stormwater** No major difference to Active Mode Path (AMP) on either the northern or southern side with regard to stormwater effects.

Criteria	Summary of performance	
	options. MR_1 was likely to have a medium impact on flood effects. MR_2 was the least preferred as upstream widening have the greatest impact on flood effects. MR_3 was the preferred option as widening downstream would have the least impact on flood effects. **Ecology** A stand of mature Kauri trees is located the south of the existing road corridor. All options were likely to impact potential bat habitat. MR_2 was the preferred option based on the least earthworks. However, protection of the Kauri trees are significant and should be protected. **Natural Hazards** MR_2 was the preferred option. All options avoid areas of soft soil. MR_3 was least preferred as extends further into the valley of the Ngakaroa stream tributary and likely to encounter more alluvium of a variable nature and likely to entail greatest volume of earthworks.	**Ecology** Overall preferred as less potential impact on wetlands, streams and mature indigenous vegetation. **Natural Hazards** Both options cross the mapped St Stephens Fault. PE_O2 was slightly preferred as PE_O1 had a greater risk of land instability.
Construction impacts	**Embodied carbon emissions** No difference between options. **Construction impacts on infrastructure/utilities** All options require protection or relocation of all services and there was limited differentiation between options. **Construction disruption** All options include disruption to local traffic (temporary traffic management including lane narrowing) due to works on Mill Road. **Construction costs** All options have the same road corridor length and bridge structure length requiring road widening and construction of structures.	**Embodied carbon emissions** No difference between options **Construction impacts on infrastructure/utilities** All options require protection or relocation of all services and there was limited differentiation between options. **Construction disruption** All options include shoulder closure of a high speed road and there was limited differentiation between options. **Construction costs** All options have extensive cut and fill and there was limited differentiation between options.
Engagement	**Partners** Key feedback from SMEs during workshop included: • To continue interface discussions with Waka Kotahi P2B team and the future Bombay Interchange upgrade. • Manoeuvring space is required within the BP complex.	

Criteria	Summary of performance	
	Ngāti Te Ata would not oppose upgrading Pukekohe East Road (which is within the extent of the ONF area). This upgrade could provide an opportunity for more visibility of the tuff ring (through a walking / cycling path and viewing platform). **Public** Through public engagement, strong support was received for the upgrade f Mill Road and Pukekohe East Road. Feedback acknowledged that this road is a key strategic route into Pukekohe, with some pieces of feedback directing that the four-lane upgrade should be applied to the entire route.	

5.11.4 Discarded Options

Table 5-53 summarises the reasons for discounting the options individually.

Table 5-53 Options to be discarded

Option	Reason
MR_2	Greater impacts on grower operation on north side of corridor and properties adjacent to the existing road. Impacts on native and mature vegetation.
MR_3	Impacts on local centre at intersection of SH1 and properties adjacent to the existing road. Impacts on native and mature vegetation.
PE_O1	Greater impacts on commercial development and social infrastructure. A greater impact on ecology (wetlands) and a greater risk of land instability. PE_O1 also did not provide the same connectivity to future growth areas and existing activity at SH1.

5.11.5 Preferred Option

The preferred option for Mill Road is MR_1 (central widening) as it has less impact on local centre at the SH1 interchange and potential effects on ecological features on either side of the corridor can be reduced through design.

Further considerations for design include:

- Investigation of stormwater treatment whether swales or kerb and channel (with wetlands) or a mixture of these.
- Integration with Waka Kotahi Papakura to Bombay project (SH1).
- Reduce impacts on ecological features on south and north side. In particular, likely significant kauri trees on southern side of road reserve.
- Reduce property effects where possible.

The preferred option for Pukekohe East Road is PE_O2 as it better integrates with future growth areas and existing activity in Bombay on south side of the road. PE_O2 also avoid the reduces impacts on Pukekohe East Tuff Ring an ONF. Widening to the south side also provides an opportunity to work with developers within the FUZ

Further considerations for design include:

- Sensitive design and consideration of the Pukekohe East Tuff Ring (ONF).

6 Pukekohe DBC Emerging Preferred Network

The emerging preferred network is shown in Figure 6-1. The recommended transport network for the Pukekohe DBC includes the following components:

- Drury West Arterial
- South Drury Connection
- SH22 Connection
- Drury-Paerata Link
- Paerata Arterial
- Paerata connections: Paerata Rail Station Connection and Sim to Sim Connection
- Pukekohe North-East Arterial
- Pukekohe South-East Arterial
- Pukekohe South-West Upgrade
- Pukekohe North-West Arterial
- Mill Road and Pukekohe East Road Upgrade

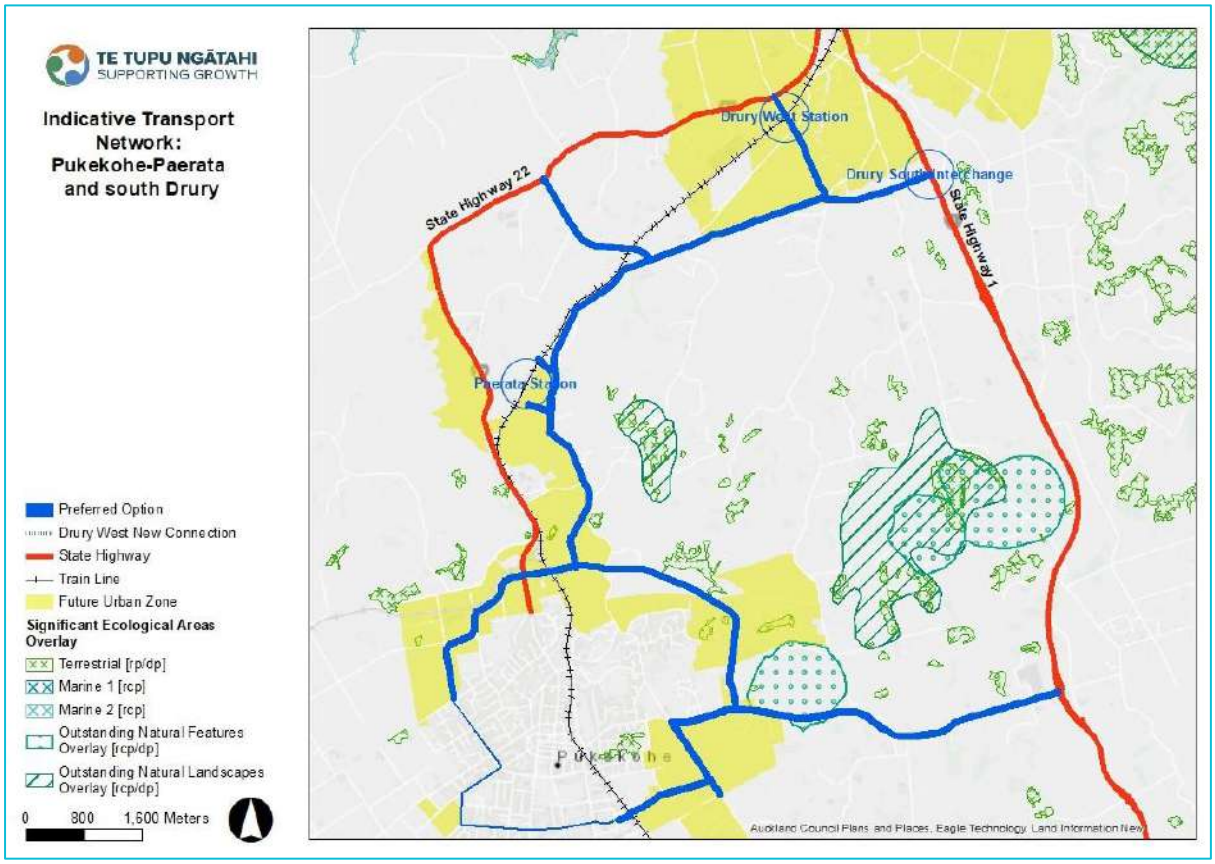


Figure 6-1 Emerging Preferred Network

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe Economic Assessment

April 2023

Version 3

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Appendices

Appendix 1 - Model Extents

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1 Introduction

1.1 Purpose

This report details the economic appraisal for the Pukekohe Detailed Business Case (Pukekohe DBC) Reference network at the Supporting Growth Alliance (Te Tupu Ngātahi) programme. The Pukekohe DBC identifies future transport routes for route protection and interventions across the wider network that integrate with the strategic network. This work follows on from earlier indicative business case (IBC) phases, further developing and confirming an appropriate transport network to support the future Pukekohe – Paerata growth areas. The evaluation is primarily based on the standard evaluation methods for transport infrastructure, which is typically dominated by travel time savings, although this has been extended to reflect the particular conditions of the appraisal.

The Pukekohe DBC considers 11 projects that are split into strategic and arterial corridor interventions. Each project has been developed in an integrated preferred strategic transport network that responds to the forecast future growth along with the wider set of supporting local and collector roads. Each has been considered as stand-alone cases for investment. For the purposes of this economic assessment the projects are grouped as follows:

Pukekohe DBC corridor package (shown in **Figure 1)** includes:

- South Drury Arterial
- SH22 Connection
- Drury-Paerata Link
- Paerata Arterial
- Mill Road (Bombay) Upgrade
- Drury West Arterial
- Pukekohe Arterial (North-West)
- Pukekohe Arterial (North-East)
- Pukekohe Arterial (South-East)
- Pukekohe Arterial (South-West)

An economic appraisal has been undertaken on these packages. This appraisal is undertaken in accordance with Waka Kotahi New Zealand (NZ) Transport Agency's Monetised Benefits and Costs Manual (MBCM). All costs are reported in NZD unless otherwise stated. Non monetised benefit measures were calculated in intermediate steps in the process of monetising benefits for the present economic analysis.

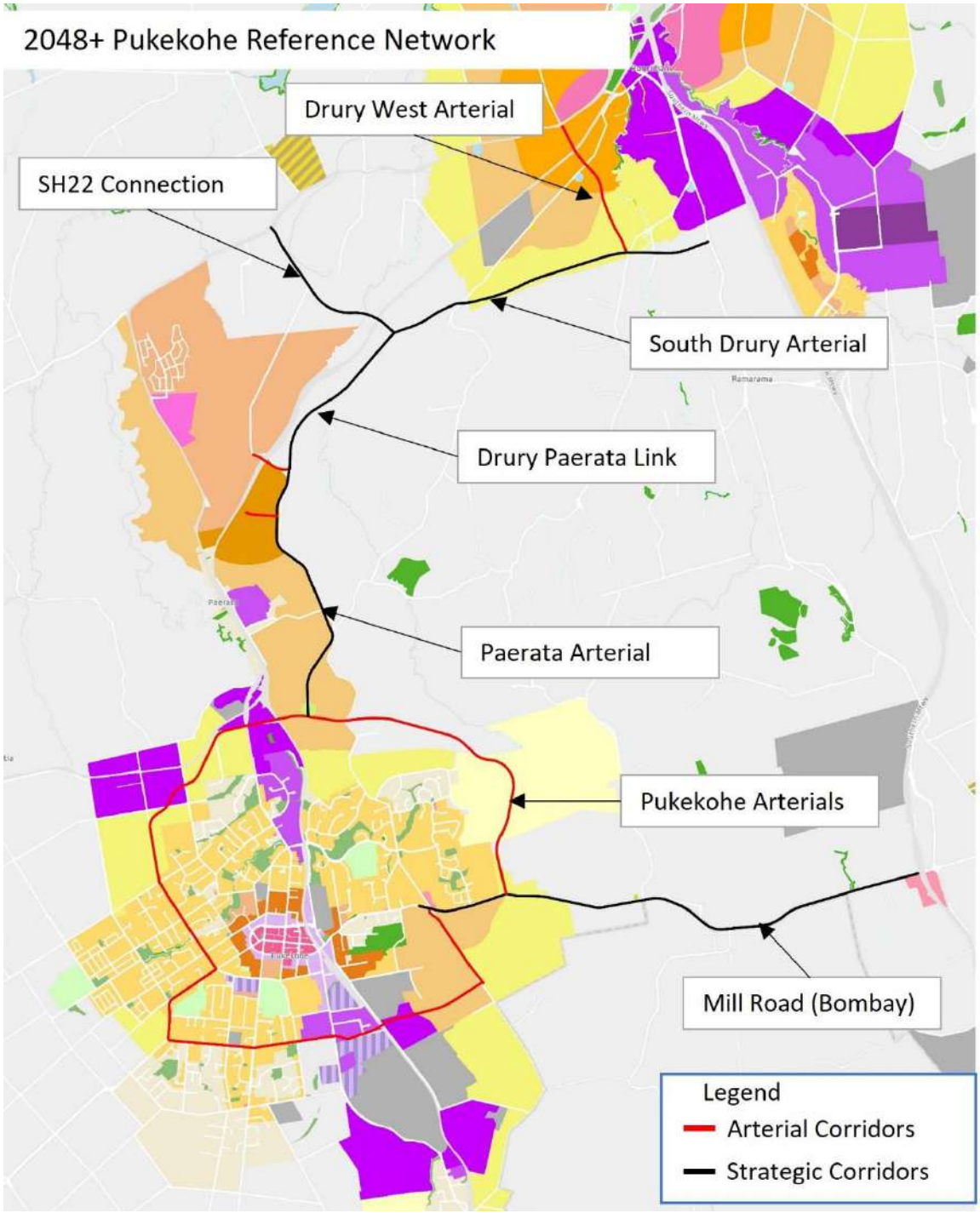

Figure 1: Strategic corridors in Pukekohe DBC

1.2 Approach and Key Issues

The Pukekohe DBC is for the purposes of route protection, rather than imminent implementation. The appraisal has therefore been targeted at this decision (to progress to route protection), rather than at a more detailed assessment that could be expected for an implementation decision. The appraisal has also been undertaken in the context of the following key issues:

- Estimates of the type, scale, sequencing and rate of growth have been made for the DBC. However, the resulting growth is highly uncertain and subject to other regulatory processes such as Structure Plans, Plan Changes, sub-division consents and economic demand.
- The Te Tupu Ngātahi Programme, via its owners and partners, will make decisions on the implementation of specific projects based on separate prioritisation and decision processes over the next 30+ years
- The Te Tupu Ngātahi business cases have focused on the transport elements and footprints to support the long-term, full build-out of the area. The actual land use development is likely to occur progressively in stages, which allows more detailed sequencing and staging decisions (e.g. some corridors could be improved with initial upgrades that are expanded in later years). This is particularly important given the unknown long-term effects of COVID19 pandemic.
- The Te Tupu Ngātahi programme identified a network of improvements to support the growth with the desired outcomes for this area. However, the Te Tupu Ngātahi network is planned to comprise a part of a wider network, including projects such as SH1 widening from Papakura to Bombay, Drury Arterials and FTN, Drury South Interchange connections and Mill Road South. Whilst those projects are independent of the Te Tupu Ngātahi programme elements, the appraisal of the Te Tupu Ngātahi programme elements is dependent on the assumptions made about the timing of those other elements. It is currently assumed those other elements will be implemented progressively between 2028 and 2038, but this is still subject to funding being confirmed.

Based on the purpose, scope and identified issues, the appraisal has adopted some key principles:

- A level of detail suitable to the route protection decision, rather than imminent implementation
- A focus on the appraisal of the full build-out project rather than analysis of fine-grained staging options
- Simplified modelling approach with limited analysis of project inter-dependencies, rather than extensive analysis of the various possible combination of project sequencing in the wider network
- Analysis of the project under a range of potential scenarios of project timing, discount rates etc, rather than a focus on a single BCR
- The Pukekohe DBC scenarios have been assessed by either adding schemes to a ‘reference’ Do Minimum or by removing schemes from the ‘reference’ option. These scenarios are assessed against a ‘reference’ Do Minimum scenario (that includes an assumed sequencing of adjacent projects), rather than a ‘true’ Do Minimum that includes only committed projects. This is to avoid the potential for double counting of common benefits that would be assigned to whichever project is assumed to be implemented first
- The overall combination of Te Tupu Ngātahi programme elements termed as “Reference Network” in this report, has been considered against an overall Do Minimum package. This provides a framework to enable consideration of the combined benefits of the Te Tupu Ngātahi programme elements, as there are anticipated to be benefits arising from the combination of network elements that may not be captured in the evaluation of each individual element.

- Further to assess the project sequencing that add up to the “Reference Network’ the individual project segmentation are compared against a ‘reference’ Do Minimum scenario.

The phasing of the project components of the Te Tupu Ngātahi Business Cases are uncertain, since the DBC purpose is for route protection, rather than imminent implementation. Hence, for the modelling purpose it is assumed that the 2048+ model will have long term, full buildout project components implementation. The interim year 2048 will have the same full buildout network elements, while 2038 will include a subset of network. However, there is some uncertainty around the exact timing of 2048+ and therefore sensitivity tests are conducted to inform land use and traffic variations.

The wider future transport projects assumed to be in place in the southern growth areas, in addition to the Pukekohe Package are summarised as follows, **Table 1**:

Table 1: Future Transport Projects in southern growth areas

Package	Project
Rail DBC Package	Additional rail capacity between Pukekohe and Papakura (and associated grade separations at road/rail crossings)
	New rail stations at Drury Central, Drury West and Paerata
	Regional north-south cycle route between Drury and Pukekohe, with grade-separated active mode crossings of SH1 and NIMT
South Strategic DBC	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South
	FTN on Porchester / Mahia / Roscommon Roads and Great South Road from Drury to Manukau
SH1 Papakura-to-Bombay	Stage 1 of the P2B project includes an upgrade to the existing Drury interchange, which connects to and is interdependent with the SH22 upgrade project. The Interchange upgrade will also need to provide for proposed rail upgrades. There is also a direct inter-relationship with the Bremner Upgrade/FTN project, as P2B will necessitate an upgrade/replacement of the existing Bremner Road crossing of SH1.
SH22 Drury-to-Paerata (Safe Network Programme)	The Safe Network Programme is in the funding application process for short-term safety improvements in the SH22 area. Parts of this programme are being prioritised including a roundabout at the intersection of SH22 and Glenbrook Road, and the recently completed right-turn bay into Jesmond Road.
	Longer term upgrades on SH22 between SH1 and Oira Road are being looked at by SGA as part of this Drury Local package. These upgrades are proposed to improve safety, amenity and capacity along the route to enable urbanisation of the area and are envisaged to ultimately be supplemented by a new route in the long term (the proposed Pukekohe Arterials).
Drury Strategic Transport Network	State Highway 22 Arterial Upgrade (NoR D1)
	Jesmond to Waihoehoe East FTN Arterial upgrade (NoR D2)
	Waihoehoe Road East Arterial Upgrade (NoR D3)
	Opāheke North-South FTN Arterial (NoR D4)
	Ponga Road / Opāheke Road Arterial Upgrade (NoR D5)

Package	Project
Mill Road	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South (4 lanes with lower speeds)
Takaanini DBC Package	New FTN on GSR and other Takanini area road upgrades. This includes the grade-separation and/or closure of level crossing, urbanisation of Takanini Industrial areas, Takanini interchange upgrades.
Pukekohe General	Indicative New Collector Roads
	Crown Road closure
	Speed limit changes in Auckland

All the above projects have been derived from wider South Auckland projects and are considered both in the Reference Network and Do minimum scenarios for this BCR assessment, See **Figure 2**.

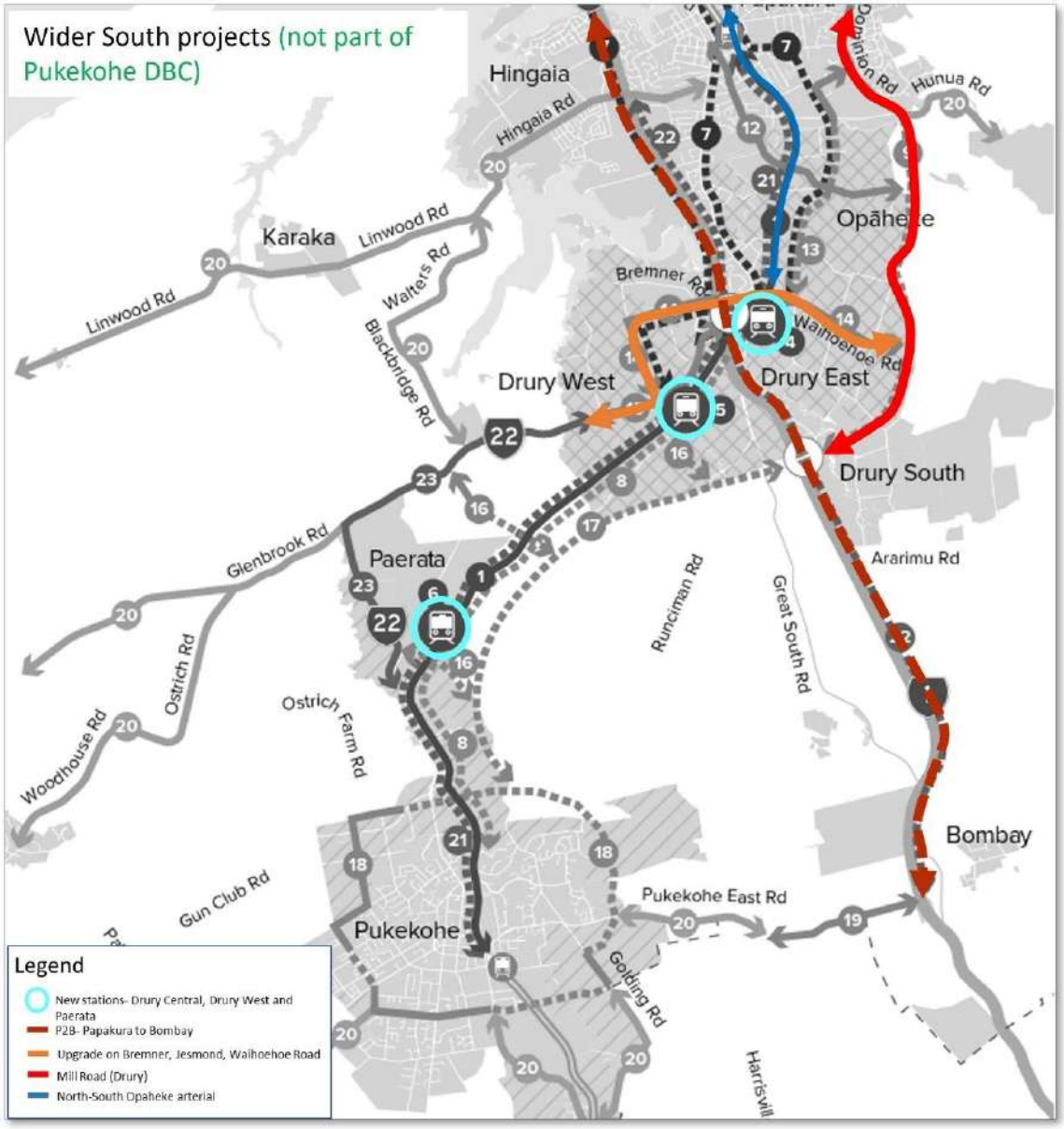

Figure 2: Wider South Projects included in Reference and Do-Minimum network assumptions

1.3 Modelling Tools and Assumptions

1.3.1 Modelling Tools

The transport user costs and benefits have been estimated based on a suite of transport models owned by the Auckland Forecasting Centre (AFC). The models include:

- **The regional, multi-modal, macro strategic model (MSM)**. This creates estimates of car, truck, and public transport (PT) movements at a regional level based on land use, network, and policy inputs. This model is the primary tool to estimate future regional PT usage and provides the basis for the more detailed forecasts for the road network described below. Generally, these models are run using regional assumptions as per recent Auckland Transport Alignment Project (ATAP) planning, but with scenario-specific inputs in the Te Tupu Ngātahi growth areas. Models for years 2038, 2048 and 2048+ have been run and their outputs were used for obtaining traffic matrices for SATURN models, PT benefits, crash savings, and wider economic benefits (WEBs).
- **A local traffic model (SATURN)**. This uses the traffic demands from MSM on a more detailed representation of the road network. For the economic analysis, the outputs from SATURN are extracted from the same scenarios i.e., reference option and do minimum scenarios for the modelled years 2038, 2048 and 2048+. For the economic assessment of individual project segmentation, the 2048 and 2038 benefits are estimated by factoring the 2048+ benefits.
- **A strategic active modes model (SAMM)**. This tool gives strategic-level estimates of walking and cycling demands that respond to land use, the quality of the walking and cycling network, and the relative change in costs for competing car and PT modes. It derives land use and network data directly from MSM whilst using a more refined zone system. MSM zones are disaggregated to a smaller zone system for use in SAMM, i.e., MSM covers the Auckland region via some 600 zones, while SAMM covers the same area via some 1,100 zones. The refined zone system was deemed necessary to obtain more precise trip costs, particularly for shorter and intra-zonal trips. The model has a strong interface with MSM to provide key inputs but can be operated independently to assess specific changes to the active modes network.

MSM is used to derive PT user benefits and provides traffic demand estimates for the SATURN model. The SATURN model is used to estimate benefits to general traffic, while SAMM was used to estimate benefits to walking and cycling, as shown in **Figure 3**. Each mode (PT, general traffic, walking and cycling) are appraised separately, albeit with the changes in mode share reflected in the demands for each mode. Since, the Pukekohe DBC is a roading corridor project further check was carried out for understanding the benefits pattern of vehicular traffic (light and heavy vehicles) and are presented in **Appendix 1**. The sector-sector matrices show that the trend is reasonable with major portion of travel time benefits coming from the areas the improvement have been carried out (Pukekohe and Paerata sector).

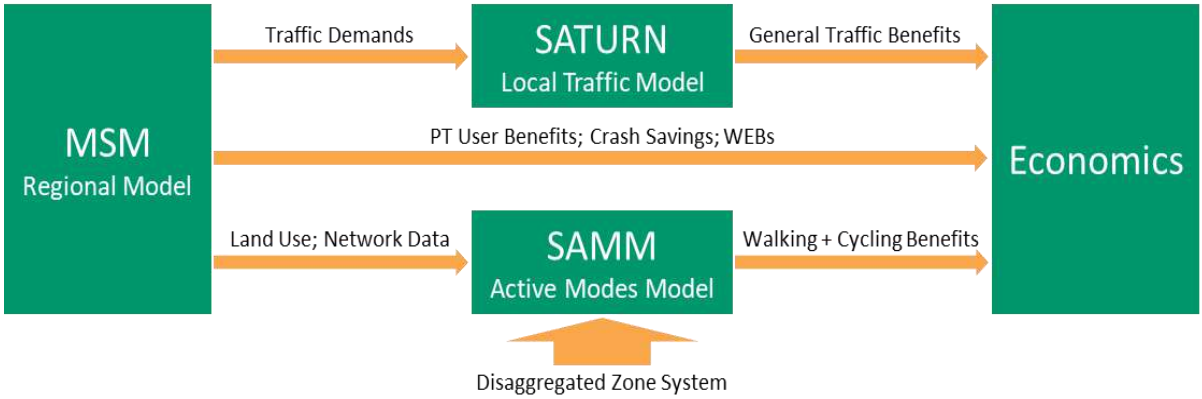

Figure 3 : Suite of Transport Models

Although the regional model was suitably validated against observed 2016 conditions, analysis against 2013 census data indicated that not all 2016 commuter trip distribution patterns were well replicated. However, because the land use in the growth areas will significantly transform travel patterns in this area, those 2013 patterns will be of limited relevance to those future conditions. This means that while the changes in the predicted travel patterns and benefits which form the key element of this economic appraisal appear plausible, the total travel movements will continue to have some uncertainty. Additionally, longer term changes in travel behaviour due to COVID-19 could eventuate such as higher frequency of working from home. As these remain highly uncertain, no changes have been made to the model inputs or parameters to reflect COVID-19 changes in travel pattern. Considering this however, sensitivity tests have been undertaken (see **Section 4.2**), including with less benefits, which to a large extent would cover this issue.

1.3.2 Modelling Key Principles and Assumptions

Land Use Information

The modelling has been based on the regional growth assumptions reflected in land use 'scenario i11.6' forecasts released by AFC in mid 2020.

The scenario i11.6 forecasts are based on Statistics NZ medium population growth estimates for Auckland. In those forecasts the staging of greenfield growth is based on the direction indicated in Auckland Council's Future Urban Land Supply Strategy (FULSS). The standard Scenario i11.6 forecasts extend to the year 2048, however, an additional scenario was developed for Te Tupu Ngātahi referred to as 2048+. This is based on the standard 2048 forecasts but reflects full build-out in the greenfield growth areas which would occur beyond 2048. The timing for full development buildout is uncertain, however for the purposes of this appraisal the 2048+ model results were allocated- to the year 2053, estimated from the typical rate of growth predicted for the area. The land use as per the Opaheke-Drury Structure plan and Pukekohe-Paerata Structure Plan is shown below in **Figure 4**.

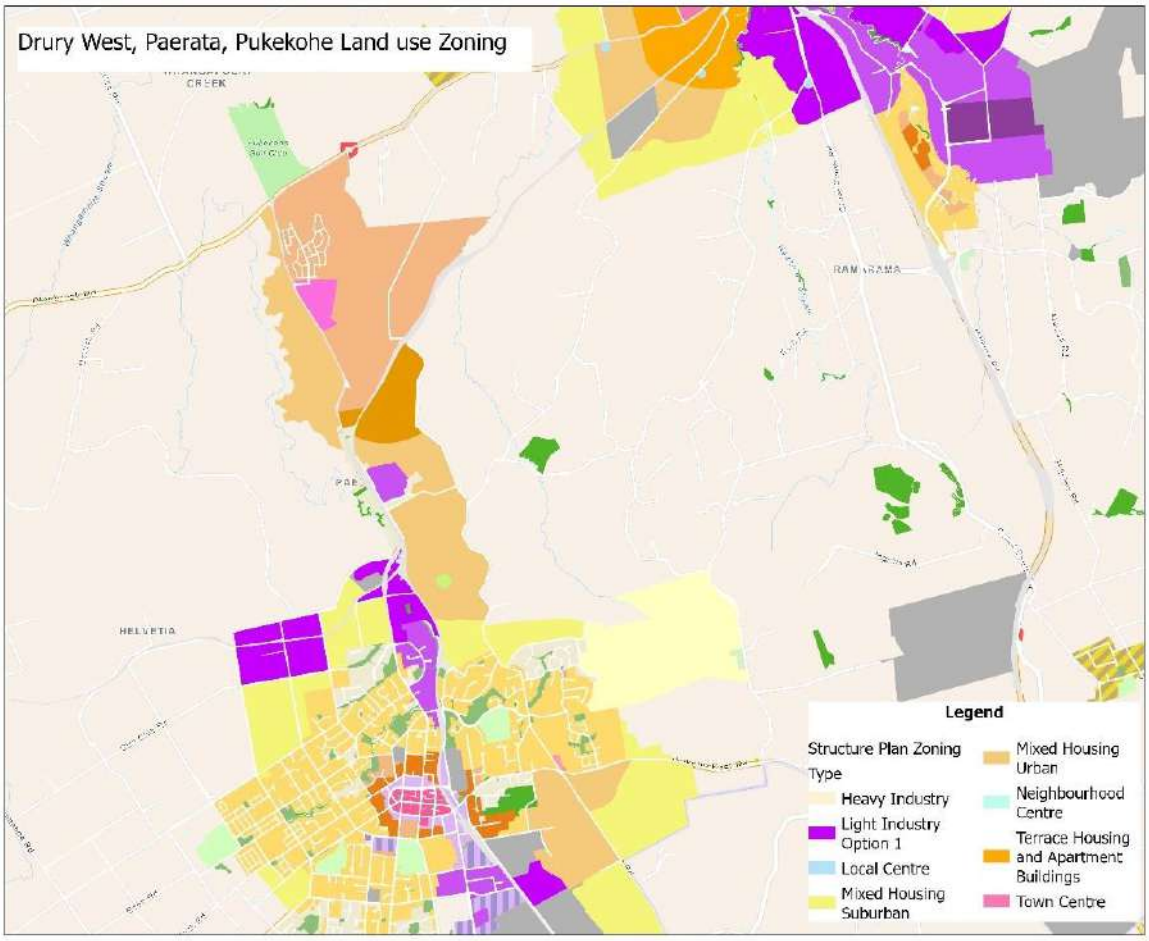

Figure 4: Structure Plan Zoning within the study area

Reference Network and Do Minimum Model Development Process

Due to the interdependencies with other projects in this area, Do minimum and Reference Network scenarios were created for each modelled year, based on a reference scenario. The reference scenario included an assumed sequencing of the full indicative business case (IBC) network. For example, the 2038 reference model only included a subset of the DBC networks, while the 2048+ reference model included the full DBC network, see **Figure 5**.

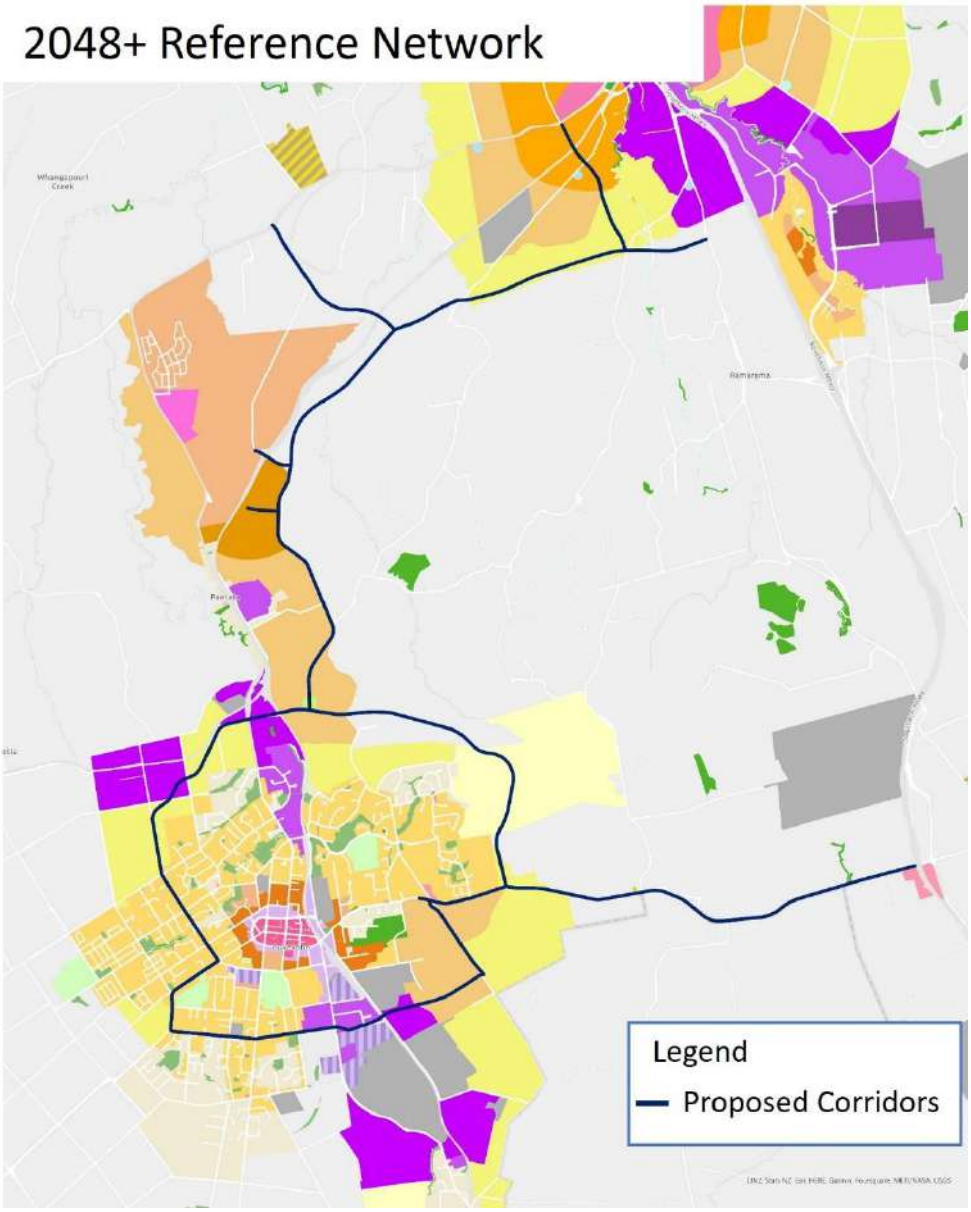

Figure 5: 2048+ Reference Network

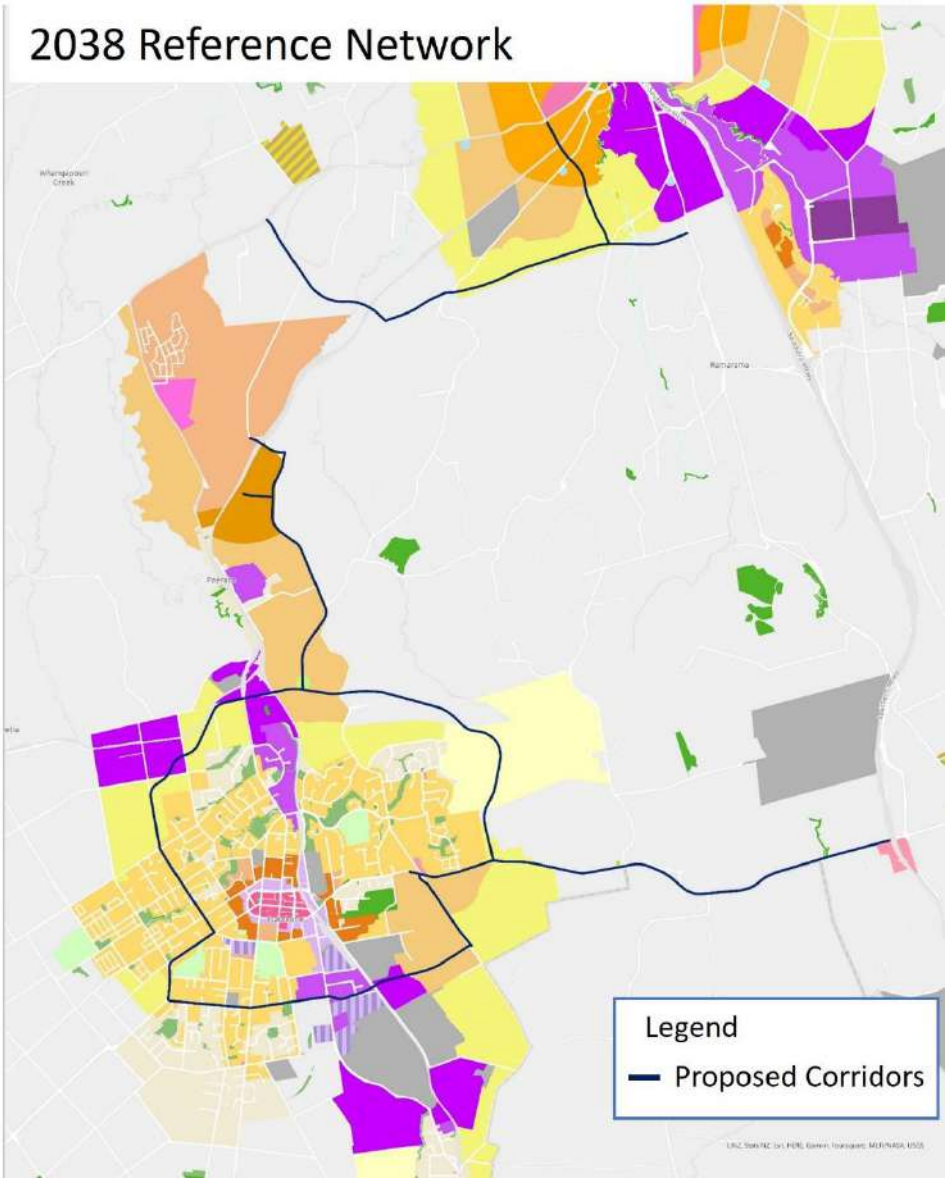

Figure 6: 2038 Reference Network

If the project being appraised (e.g. the Pukekohe Arterials), was included in the Reference Network for the forecast year, then this was used as the option scenario. A matching "Do minimum" was then created for that year that excluded the project being assessed (e.g. Scenario F, Pukekohe Arterials- from Ref. If the Reference Network did not include the candidate project, then this was adopted as the Do minimum. An option scenario was then created by adding the candidate project (e.g., Scenario G, Pukekohe Arterials- from DM). This scenario assumed the early staging of Pukekohe Arterial, while the rest of the DBC schemes were not in place.

Another example would be the 2038 Reference Network which was adopted by removing the Drury-Paerata link for the BCR assessment. The Do minimum for 2038 was created by removing all Pukekohe DBC schemes from the 2038 Reference Network. A comparison between a Do Minimum scenario (no projects from Pukekohe schemes) and the Reference Network (all Pukekohe DBC schemes) was made to understand the benefits associated with this project.

For the overall assessment of all Pukekohe DBC schemes, the Do minimum was developed by removing "All projects" from Reference Pukekohe Network.

Pukekohe DBC Components Assumptions

There are some uncertainties around the project implementation year. Hence, some broad assumptions are made on the construction start date based on the expected implementation period. The construction periods were assumed based on advice from the Te Tupu Ngātahi Pukekohe DBC design team, as below:

- **Drury West & IC Connection (Figure 9)** - the project is assumed to be implemented by 2038 (including the upgrades to the Drury West station access road from Jesmond Intersection
- **SH22 Connection (Figure 10)** (Drury West & IC Connection + South Drury) - the project is assumed to be implemented by 2040 (including the tie-ins to Great South Road intersection)
- **Drury-Paerata Connection I (Figure 11)** - this project is assumed to be the last connection within the Reference Network and will only be implemented after 2050
- **Drury Paerata Connection II (Figure 12)** (Drury Paerata Connection I + Paerata Arterials) - assumed to be implemented after 2050
- **Pukekohe Arterials (Figure 13)** (NE+SE+SW+NW) - assumed to be implemented by 2038
- **Pukekohe East Connections (Figure 14)** (Pukekohe East Road + Mill Road Bombay Upgrade)- assumed to be implemented by 2048

The time zero is the date that all future cost and benefit streams are discounted to. Time zero for all proposed activities is standardised to 1 July of the financial year in which the analysis is submitted. Time zero is independent of the construction date of a proposed activity and therefore all options being assessed must use the same time zero. The 'time zero' and the project construction period for Pukekohe DBC projects are given in **Table 4**.

1.3.3 Modelling of the Public Transport Benefits

The PT benefits are directly derived from MSM Models for all the modelled years for the strategic and local projects as discussed in Section2.6. The proposed PT network for 2048+ is shown below, **Figure 7**

The Drury West arterial and Paerata Arterial schemes contribute to PT benefits and usage as follows:

- The majority of the Public Transport benefits come from Drury West Arterial, which connects the Drury West station and further to the FTN route on Jesmond Road. This new north-south arterial improves access to frequent, reliable and faster PT services within Drury West future urban areas. Moreover, this attracts users from cars, improving congestion on the network.

- The Cape Hill Road (Paerata Arterial) connection to Paerata Station provides a better-connected arterial network, facilitates the movement across the rail line for PT services and services most of the Paerata FUZ

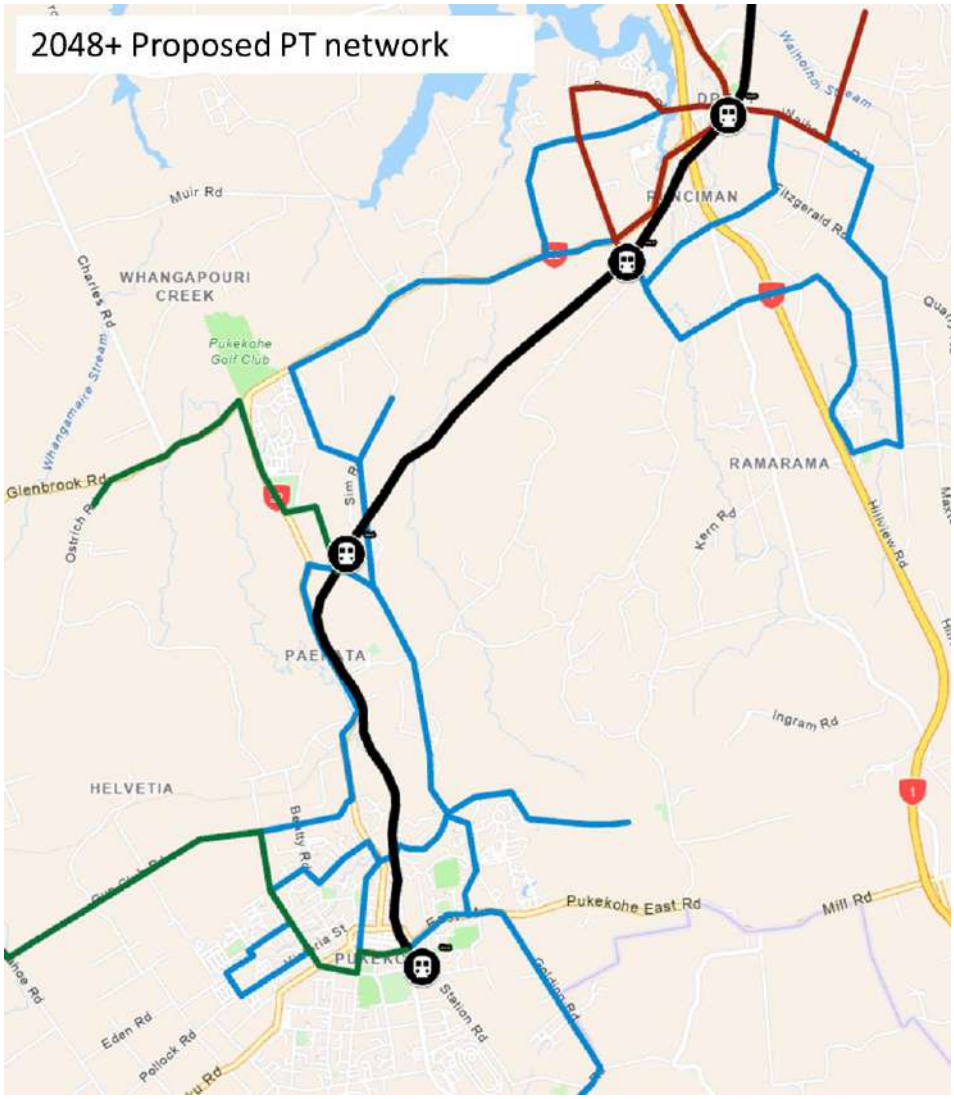

Figure 7: 2048+ Proposed Public Transport Network

1.3.4 Modelling of Walk/Cycle Benefits

The SAMM model was run only for the full build-out 2048+ scenario, with benefits allocated to earlier years based on assumed growth profiles. The SAMM model was run with the full Pukekohe Reference Network and for a scenario without the upgrades and projects outlined within the Reference Network (Do Minimum).

The Pukekohe Reference Network is expected to contribute to walking and cycling benefits as follows:

- Providing dedicated and separated active mode facilities along the arterial network in Drury West, Paerata and Pukekohe to encourage the uptake of active modes.
- Providing safe active mode facilities, reducing the risk of exposure for those choosing to walk or cycle in Drury West, Paerata and Pukekohe, particularly to Drury West and Paerata Station.
- Providing a complete, connected and legible active mode network improving accessibility to key employment and social destinations within Drury West, Paerata and Pukekohe future urban areas.

1.3.5 Modelling of Traffic Benefits

The traffic benefits are calculated from the Pukekohe SATURN South model which covers the region between Drury and Pukekohe as shown in **Figure 8.**

The Pukekohe Reference Network is expected to contribute to traffic benefits as follows:

- Strategic connection to Drury South Interchange and SH1 (via the South Drury and SH22 connection). This connection will reduce the congestion on SH22 and provides alternate high-movement corridor through the Paerata and Drury West FUZ boundary.
- Improving accessibility to high-density residential land use in Paerata (via Paerata Arterial and Sim Road) and Drury West (via Drury West Arterial). These growth areas are expected to have 21,000 new houses and 9,000 additional employment opportunities by 2048+. This will service the future growth areas and provide much needed transport infrastructure.
- The Pukekohe arterials will alleviate traffic through Pukekohe town centre and improve the efficiency of the internal collectors. The arterial connections around the future urban areas connects many key destinations and fills the network gaps which reduces traffic detours.
- The Mill Road (4-laning) improves safety and resilience of the network. It provides key general traffic and freight access to SH1 Bombay Interchange, reducing traffic on unsafe rural roads.



Figure 8: Indicative Network area from South SATURN model

1.3.6 Modelled Scenarios

For the purpose of economic assessment, scenarios were modelled in MSM and SATURN. **Table 2** summarises the 2048 + scenarios modelled in MSM and SATURN for the economic assessment. The Reference Network and Do-Minimum scenarios were modelled for the years – 2038, 2048, 2048+. Considering the long term nature of the projects the year 2028 was excluded from this BCR assessment.

The detailed description of the modelled Scenarios are as below:

- **Scenario A** is the "All Pukekohe projects" scenario, also termed as "Full package". For 2048+ and 2048 it is developed by using the Reference Network", **Figure 5** and removing all proposed corridors. For 2038 it is developed by using the Reference Network , **Figure 6** and removing the proposed corridors.
- **Scenario B** is the Drury West and Interchange connection. The option model is the "Drury West arterial" connection, which is an extension of FTN corridor on Jesmond Road in the North and Runciman Road in the south, and the east-west corridor on South Drury arterial east of Runciman Road up to Drury South Interchange. The Do-minimum model for this

scenario is developed by taking out this Drury West and Interchange connection (same for all model years 2038, 2048, 2048+), see **Figure 9**.

- **Scenario C** is the SH22 Connection which is highly interdependent to Scenario B. Scenario C is an extension of Scenario B west of Runciman Road connecting it to SH22 between Paerata and Drury West FUZ areas. The option model is developed by adding this connection to Do-minimum scenario and the Do-minimum excludes this corridor for all model years 2038, 2048, 2048 +, see **Figure 10**.
- **Scenario D** is the Drury Paerata Link which is the shortest central link connecting Paerata arterials to the SH22 Connection. This is an independent link, which if assumed not in place for (e.g., in 2038) will lead to Paerata collectors. For model years 2048, 2048+ the option model is the Reference Network and the Do-minimum model is the Reference Network excluding this particular link, see **Figure 11**.
- **Scenario E** is the extension of the Drury Paerata Link including Sim Road and Paerata station access road up to Pukekohe Northeast arterial. This corridor is a combination of new link (Drury Paerata link) and upgrades to existing corridors (Cape Hill/Sim Road). For model years 2048, 2048+ the option model is the Reference Network, **Figure 5** and the Do-minimum model is the Reference Network excluding Drury-Paerata link and downgrading Cape Hill/Sim Road. For 2038 the option model is the Reference Network, **Figure 6** and the Do-minimum model is the Reference Network with downgraded Cape Hill/Sim Road, see **Figure 12**.
- **Scenario F** is the Pukekohe arterials (from Reference) which is a combination of new connections and upgrades to existing corridors around the Pukekohe urban areas. For model years 2038, 2048, 2048 + the option model is the Reference Network, and the Do-minimum model is the Reference Network without the new links and downgrading the existing links, see **Figure 13.**
- **Scenario G** is the Pukekohe arterials (from DM) which is similar to Scenario F in corridor alignment, but a slightly different starting point. For model years 2038, 2048, 2048+ the option is the Do-minimum model with Pukekohe arterials added to it and the Do-minimum model is the all project Do-minimum, see **Figure 13**.
- **Scenario H** is a subset of Scenario F, where the Pukekohe arterials are further broken down to NW, SE and SW Pukekohe arterials. For model years 2038, 2048, 2048 + the option model is the Reference Network, and the Do-minimum model is the Reference Network excluding the new links and downgrading the existing links on this connection, see Figure 13.
- **Scenario I** is the Pukekohe East Road connections. The corridor comprises of Pukekohe NE arterials to Harrisville Intersection (Pukekohe East Road) and Harrisville Road to Bombay Interchange (Mill Road). Like Scenario F the option model is the Reference Network, and the Do-minimum model is the Reference Network downgrading the Pukekohe East and Mill Road connections, see **Figure 14**
- **Scenario J** is similar to Scenario I, but with a different starting point. The option model is the Do-minimum model with Pukekohe East Road and Mill Road (Bombay) connection added to it and the Do-minimum model is the all project Do-minimum, see **Figure 14**.

In addition, the 2048+ project segmentation were modelled only in SATURN to determine the individual traffic benefits and use the information for fractioning other economic benefits.

It should be noted that for the existing corridors in Paerata and Pukekohe there is no change in terms of the number of lanes, but the corridor capacity, speed and intersection form was updated from the Do Minimum to reflect arterial function in the Reference Network. These are termed as upgrades in the Scenario list. However, the Mill Road upgrades (from Harrisville Road intersection to Bombay Interchange) will be upgraded from 2-lane corridor to 4-lane corridor. The **Figure 9** to **Figure 14**, below shows the project segmentation (highlighted red), with respect to the 2048+ Reference Pukekohe DBC Network.

The project segmentations were modelled only in SATURN using fixed demand matrices from the relevant MSM Reference scenario.

Table 2 : Scenario List

BCR Scenario	Name	Option Scenario	Do minimum Scenario	Modelling Suite used
All projects	Scenario A	Reference Network with full Pukekohe DBC projects included	No projects from Reference Network	MSM, SATURN
Drury West & IC Connection	Scenario B	Do Minimum scenario with only Drury West and IC connection	No projects from Reference Network	SATURN
SH22 Connection	Scenario C	Do Minimum scenario with Drury West and IC connection, SH22 Connection	No projects from Reference Network	SATURN
Drury-Paerata Connection I	Scenario D	Reference Network with full Pukekohe DBC projects included	Reference Network "All projects" without the Drury-Paerata Link	SATURN
Drury-Paerata Connection II	Scenario E	Reference Network with full Pukekohe DBC projects included	Reference Network "All projects" without the Drury-Paerata Link and upgrades on Paerata Arterials	SATURN
Pukekohe Arterials (from Ref)	Scenario F	Reference Network with full Pukekohe DBC projects included	Reference Network "All projects" without the Pukekohe Arterial connections (new and upgrades)	SATURN
Pukekohe Arterials (from DM)	Scenario G	Do Minimum scenario with Pukekohe Arterial connections (new and upgrades)	No projects from Reference Network	SATURN
SW+SE+NW only	Scenario H	Reference Network with full Pukekohe DBC projects included	Reference Network "All projects" without the Pukekohe Arterial connections (new and upgrades) on SW, SE and NW	SATURN
Pukekohe East Connections (from Ref)	Scenario I	Reference Network with full Pukekohe DBC projects included	Reference Network "All projects" without the Mill Road Upgrades	SATURN
Pukekohe East Connections (from DM)	Scenario J	Do Minimum scenario with Mill Road upgrades	No projects from Reference Network	SATURN

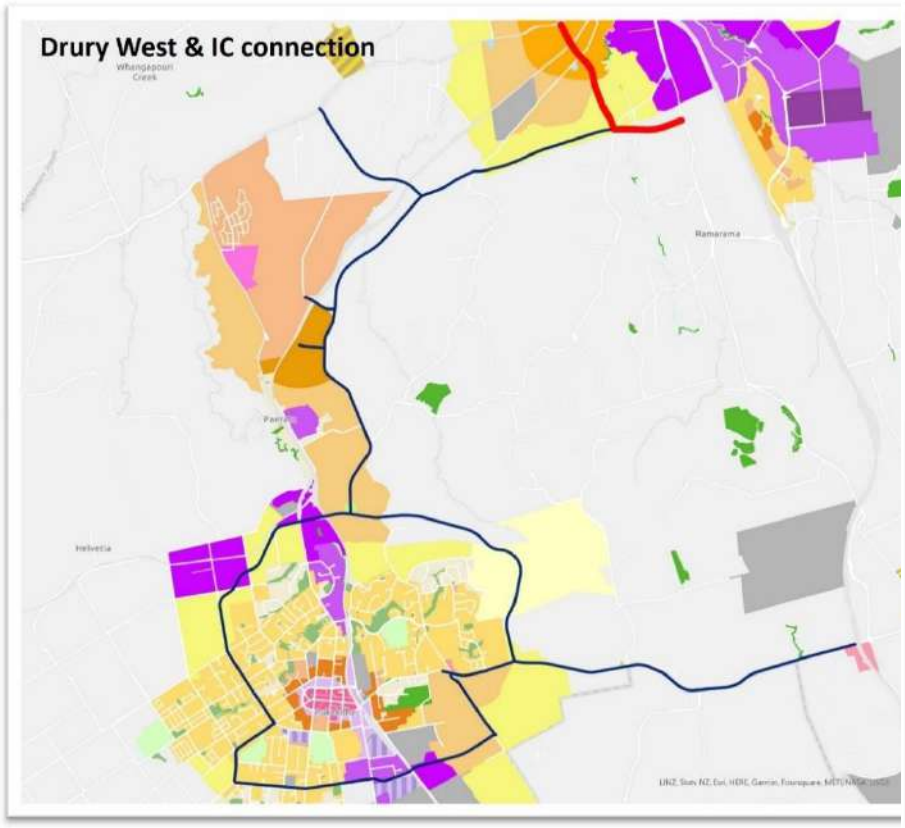

Figure 9: Project Segmentation, Drury West & IC connection

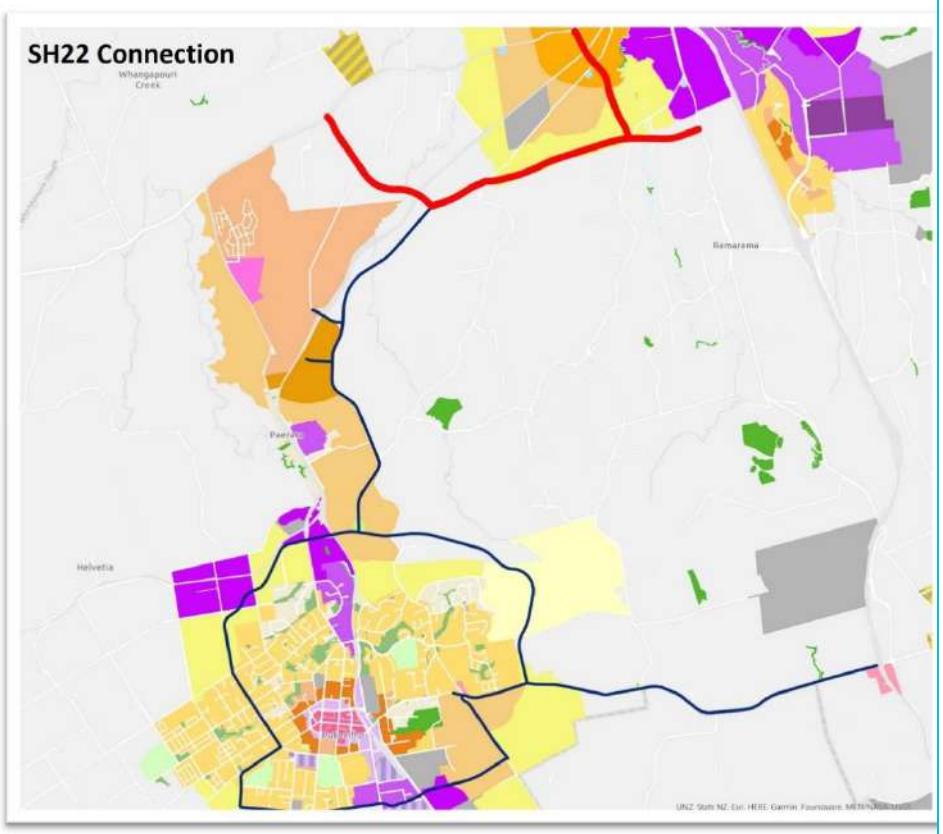

Figure 10:Project Segmentation, SH22 connection

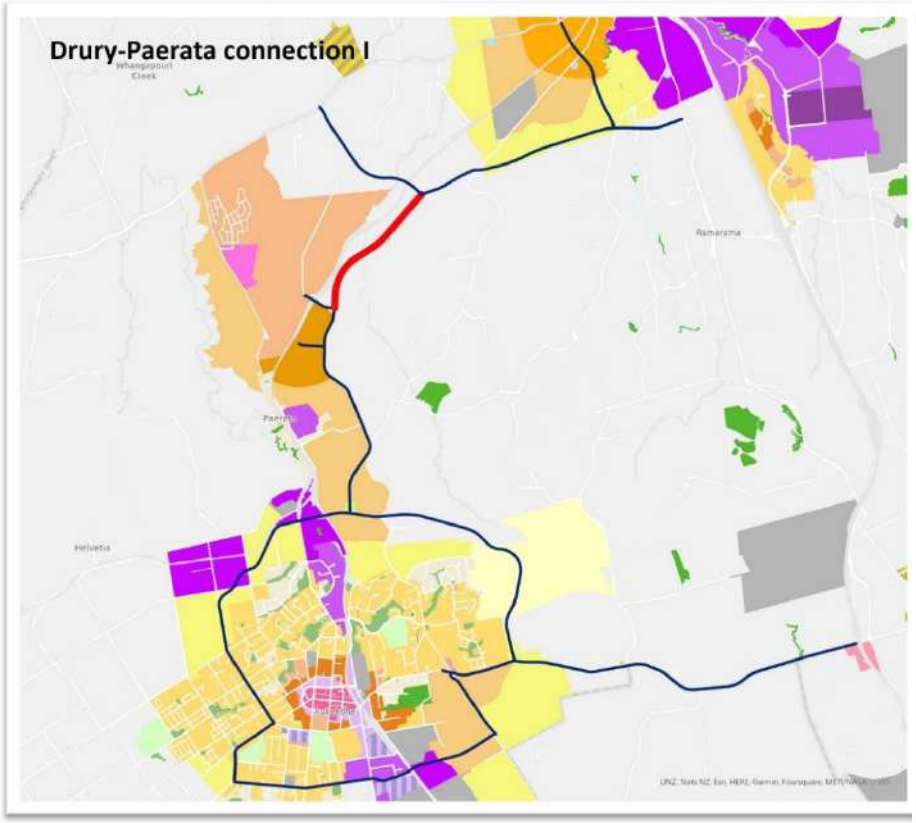

Figure 11: Project Segmentation, Drury-Paerata Connection I

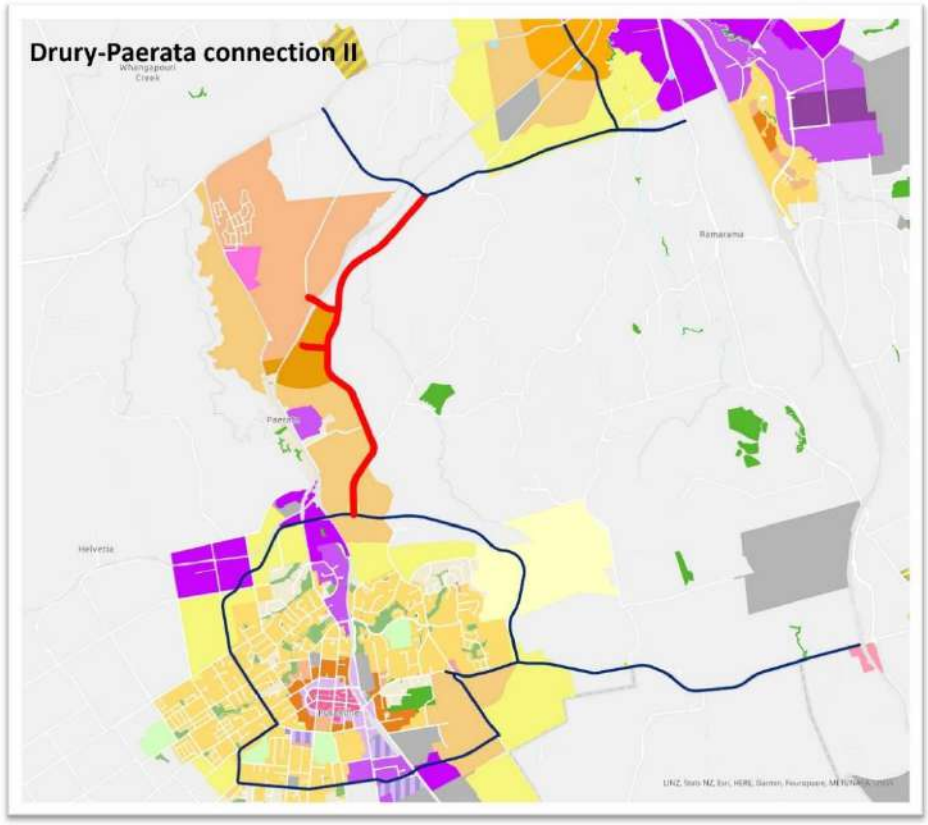

Figure 12: Project Segmentation, Drury-Paerata Connection-II

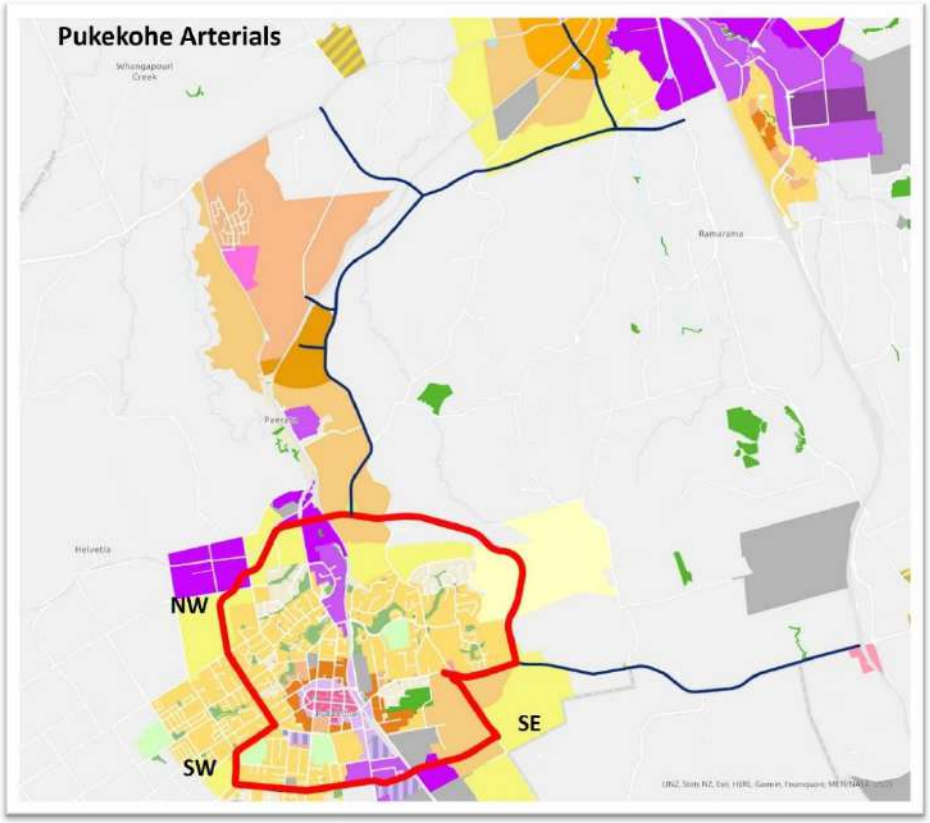

Figure 13: Project Segmentation, Pukekohe Arterials

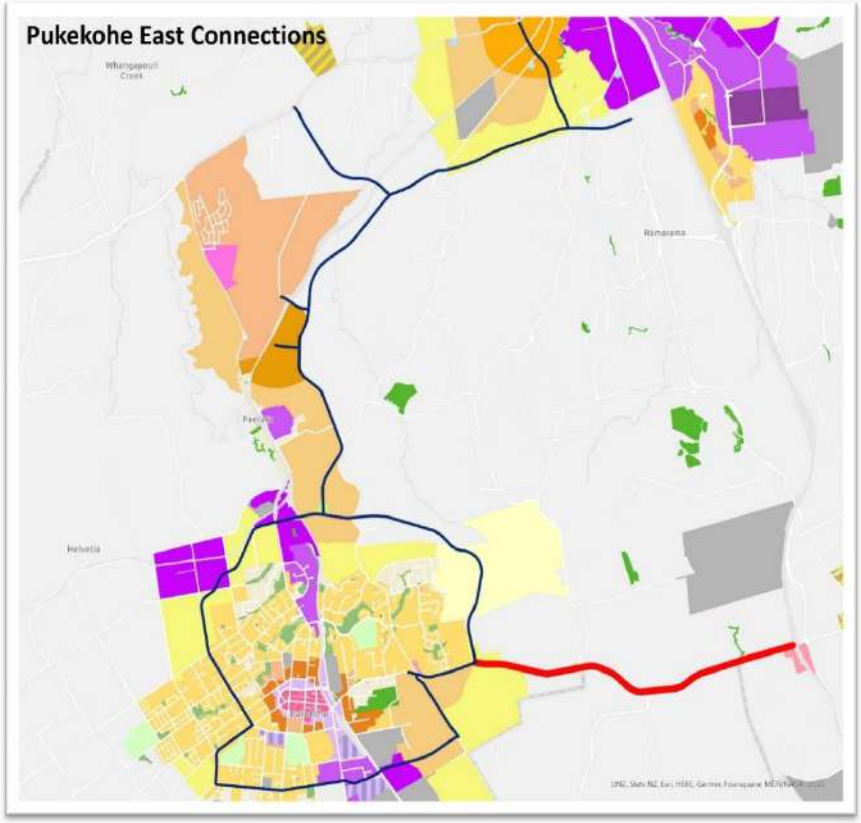

Figure 14: Project Segmentation, Pukekohe East Connection

Wherever possible, the benefits from individual project segmentation were estimated by “reducing from Reference Network” and “ adding to Do-Minimum Network” to account for the different start times. For the purpose of overall benefits check, the benefits for the Pukekohe DBC Program-wide have been assessed by comparing the Reference Network “All projects” with an absolute Do-minimum scenario (which excludes South-Drury and SH22 Connection, Paerata Arterials, Pukekohe Arterials and Mill Road upgrades).

It was found that the summation of the individual project traffic benefits was slightly higher than the total package benefits. This could be due to number of reasons - analysis of the individual schemes have been done taking into account the year of construction and construction period, whereas the combined appraisal only looks at 10 year intervals and assumes a constant growth of benefits, in addition there is a build up of benefits in the first 10 years for the combined scheme whereas the individual schemes do not include any build up , or any possible interaction between the projects. However, it has been noted that either way the BCR is similar and is discussed in detail in **Section 1.7**.

During the assessment it was also noted that the combined Pukekohe schemes considers project appraisal at 10-year intervals, therefore assuming a constant growth of benefits over the period. Whereas the individual project schemes assume a tentative start date and varied benefit periods, which is closer to real life implementation. This oddity was acknowledged during the assessment considering the uncertainty around the development of transport projects which commences as the land use growth unfolds.

While summing up the individual packages, some projects were added to Absolute Do-Minimum, while others were reduced from Reference Networks. This assumption might discount some of the “double-counting” which occurs when all the summed projects are determined from Do-Minimum. Therefore, this economic assessment is, by and large, reasonable in calculation.

Two scenarios were modelled in SAMM for Year 2048+. The reference option was developed by adding all Pukekohe schemes to the MSM Do-Minimum network, relevant cycle facility upgrades and zone connector refinements. **Table 3** lists the active mode models developed in SAMM for Year 2048+. The benefits of the full package were assessed from these two scenarios.

Table 3 : SAMM Scenario List

No.	SAMM Assessed Scenarios	Comparison
1	Pukekohe Reference Active Mode Scenario	Option
2	Pukekohe Do-Minimum Active Mode Scenario	Do-min

1.4 Evaluation Framework

The economic evaluation is consistent with the Waka Kotahi NZ Transport Agency’s MBCM, 2021.

1.4.1 Economic evaluation approach

The overall economic evaluation is based on the following assumptions:

- Base values of time (VoT), vehicle operating costs (VOC), etc. are derived from the values set out in the MBCM, updated to current values with a base date of 1 July 2021.
- Assessment of base and congested travel time benefits from the SATURN models due to reasons detailed in **Section 1.3.5**
- Assessment of base running vehicle operating costs (VOC) from the SATURN models
- Time Zero, construction start date and duration specified for each sub-project as in **Table 4**
- Analysis period is 40 years, but sensitivity tested at 60 years
- Discount rate of 4% applied to all annual benefits and costs, but sensitivity tested for 3% and 6%
- Traffic reliability benefits assumed as 8% of the base travel time benefit, as a standard approach
- PT reliability benefits was assumed to be 20% of the PT user benefits in the peaks.
- Carbon dioxide (CO_2) benefits are calculated from the vehicle emissions prediction model (VEPM) version 6.3, with (upper bound) rates as per the MBCM and specified in **Table 18**.
- Travel time user cost is based on urban arterial road type as per Table 16, MBCM.
- Walking and cycling benefits were estimated based on trip demand and travel cost matrices from SAMM, using the same method as used for PT benefits in MSM, and using the same approach as the Rail and Drury DBCs.
- As a sensitivity test, WEBs were calculated, in accordance with the MBCM, then applied to the project using an adopted percentage uplift on the conventional benefits. The analysis is done for three principal types of WEBs (agglomeration impact, imperfect competition impact, and labour supply impact).
- Since the proposed improvements are constructed in phases, the benefits start date have been phased out accordingly. It is assumed that upon implementation of SH22 Connection and Pukekohe Arterial connections, about 90% of the total benefits can be realised by 2045.
- Beyond the 2048+ modelled year (assumed to be allocated to year 2053) benefit growth is dampened out over 10 years and there after assumed to remain constant with no further benefits growth. **Figure 15** shows the benefits profile for a 40-year analysis period to demonstrate how benefits are treated over time. The earlier year benefits are staggered since as discussed above it is assumed that partial benefits can be realised upon the completion of construction of the SH22 Connection and Pukekohe Arterials.

The key assumptions and parameters are discussed in further detail below.

Table 4: Time Zero, Construction Start Date and Period Assumption

Project Components	Time Zero	Construction Start Year from Time Zero	Construction period (in years)
Scenario A	1 July 2023	15	9
Scenario B	1 July 2023	15	2
Scenario C	1 July 2023	15	4
Scenario D	1 July 2023	15	2
Scenario E	1 July 2023	15	5
Scenario F	1 July 2023	15	5

Project Components	Time Zero	Construction Start Year from Time Zero	Construction period (in years)
Scenario G	1 July 2023	15	5
Scenario H	1 July 2023	15	4
Scenario I	1 July 2023	15	3
Scenario J	1 July 2023	15	3

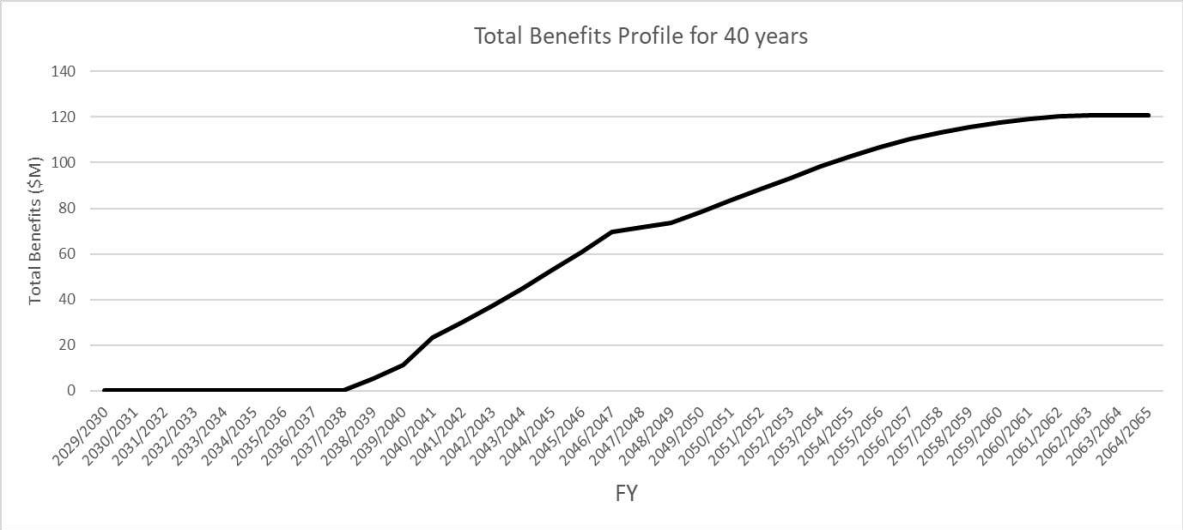

Figure 15: 40-year Benefits profile (Reference network vs Do Minimum Scenario)

Table 5: Update factors for benefits

Item	Base date	Update factor
Travel time costs	July 2002	1.59
Vehicle operation costs	July 2015	1.15
Crash cost savings	July 2015	1.10
Passenger transport user benefits	July 2008	1.28
Walking and cycling benefits	July 2018	1.06

Table 6: Update factors for cost

Calendar year in which estimate prepared	Factor to adjust to July 2020
2017	1.06

1.5 Expansion of Benefits from Transport Models

Annualisation factors for private transport are shown in the following tables. The below factors are based on analysis of current traffic patterns.

Table 7: Traffic annualisation factors (1-hr SATURN models)

Period	Modelled period used	Equivalent hours per day	Days per year
Weekday AM	AM	2	245
Weekday PM	PM	2	245
Weekday Interpeak	IP	7.2	245
Weekday evening/night	IP	3.9	245
Weekend / holiday	IP	13	120

Table 8: Traffic annualisation factors (2-hr MSM models)

Period	Modelled period used	Equivalent hours per day	Days per year
Weekday AM	AM	1	245
Weekday PM	PM	1	245
Weekday Interpeak	IP	3.6	245
Weekday evening/night	IP	1.9	245
Weekend / holiday	IP	6.5	120

A different set of factors was used for Public Transport indicators, as its usage profile is different from the private cars.

Table 9: Annualisation factors for public transport (2-hr models)

Modelled Period	Annual factor
AM	245
Interpeak	1524
PM	245

The SAMM model provides daily estimates of travel, so an expansion factor of 365 was assumed.

1.6 Analysis Period

The economic analysis was carried out for a 40-year analysis period as a base estimate, but sensitivity tested for 60 years.

1.7 Estimation of Individual project Benefits contribution

Most Pukekohe DBC projects are expected to enable future growth and provide general traffic improvements. Therefore, individual projects were modelled in SATURN only to inform respective contribution to overall project benefit. Ideally, the summation of Scenarios- C, E, G, I should be equal to the “All projects” combined benefits as shown in **Figure 16**.

Traffic benefits contribution

When the full Pukekohe DBC benefits were compared with the summation of individual components benefits it was found that the summation of packages exhibits slightly higher benefits.

When modelled separately the vehicle travel time benefits of projects (Scenario C, E, G, I) add up to $63 million in 2048+ compared to full package (Scenario A) benefits of $55 million, i.e., 1.2 times higher. To provide a reasonable allocation of the benefits for the 2048 individual schemes, this uplift was reflected across the 4 project segments and carried over while factoring the general traffic benefits for year 2048, see **Table 10** .

These factors were applied on all SATURN benefits for 2048 such as CO_2, CRV and VOC.

The assessment shows that the benefits derived by the summation of individual project schemes is around 15% higher than the full package. There is some possibility of over-estimation of benefits that is acknowledged as a limitation during this assessment and should be duly addressed as there is more certainty around the project implementation timings and land use changes. However, the BCR assessment using the summation of individual project or the full project are very similar and thus should be fit for purpose considering the intent to inform route protection measures.

Table 10 : Benefit factorisation for 2048

Uplift Factor 1.16		
Project Segments	Composition	Including uplift factor
Scenario C	37%	43%
Scenario E	26%	31%
Scenario F	33%	39%
Scenario I	18%	21%
Total	**100%**	

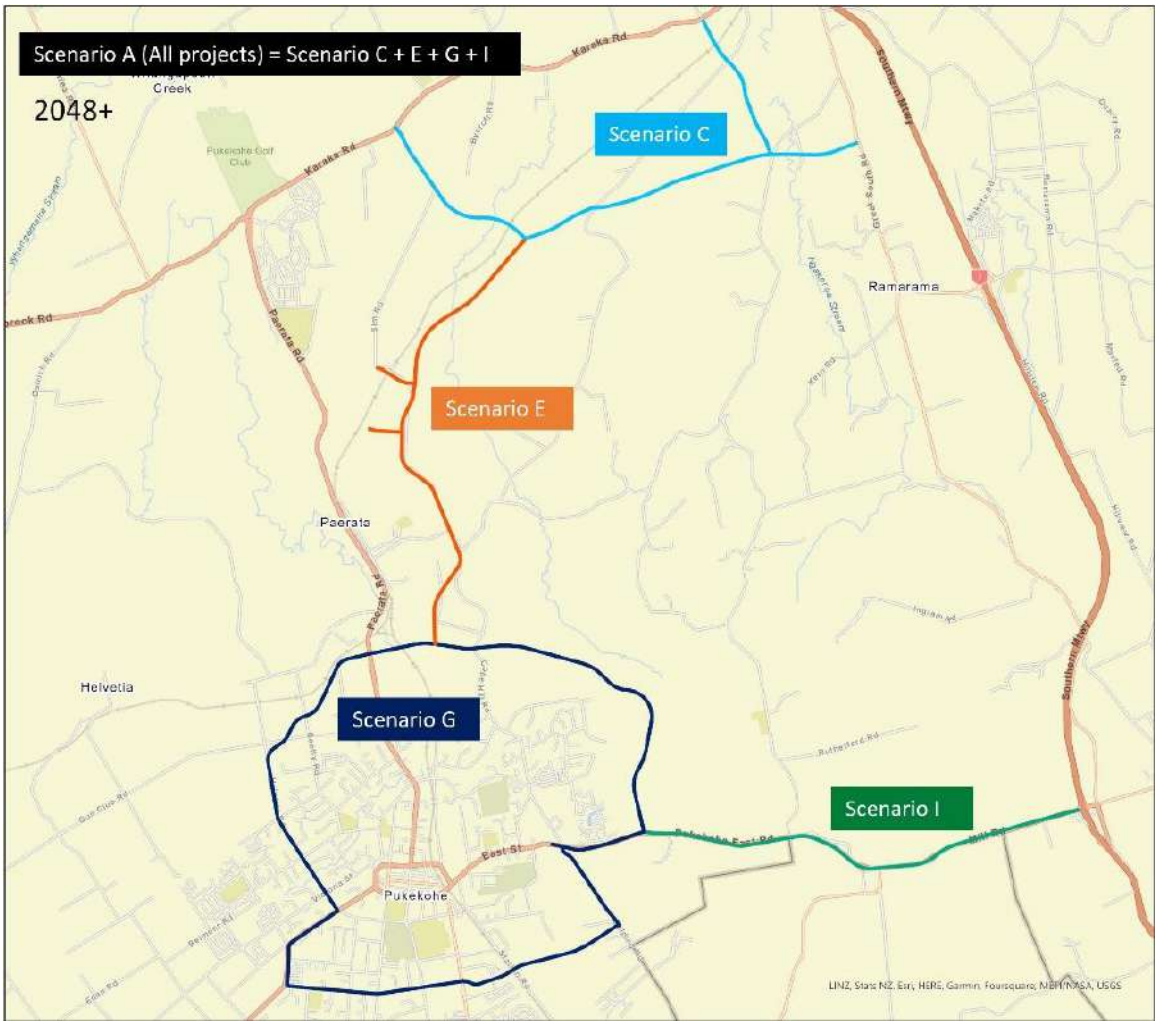

Figure 16: Project segmentation that comprise the 2048 Reference Network

A similar methodology was adopted for allocating individual benefits to 2038 network, see **Figure 17**, which excluded Drury-Paerata Link (Scenario D). The benefits of Scenario D were reduced from the 2048+ summation of packages and re-factored using the same uplift factor of 1.33, see **Table 11** below.

Table 11: Benefit factorisation for 2038

Uplift Factor 1.16		
Project Segments	Composition	Including uplift factor
Scenario C	41%	48%
Scenario E	18%	21%
Scenario G	37%	43%
Scenario I	20%	23%
Total	**100%**	

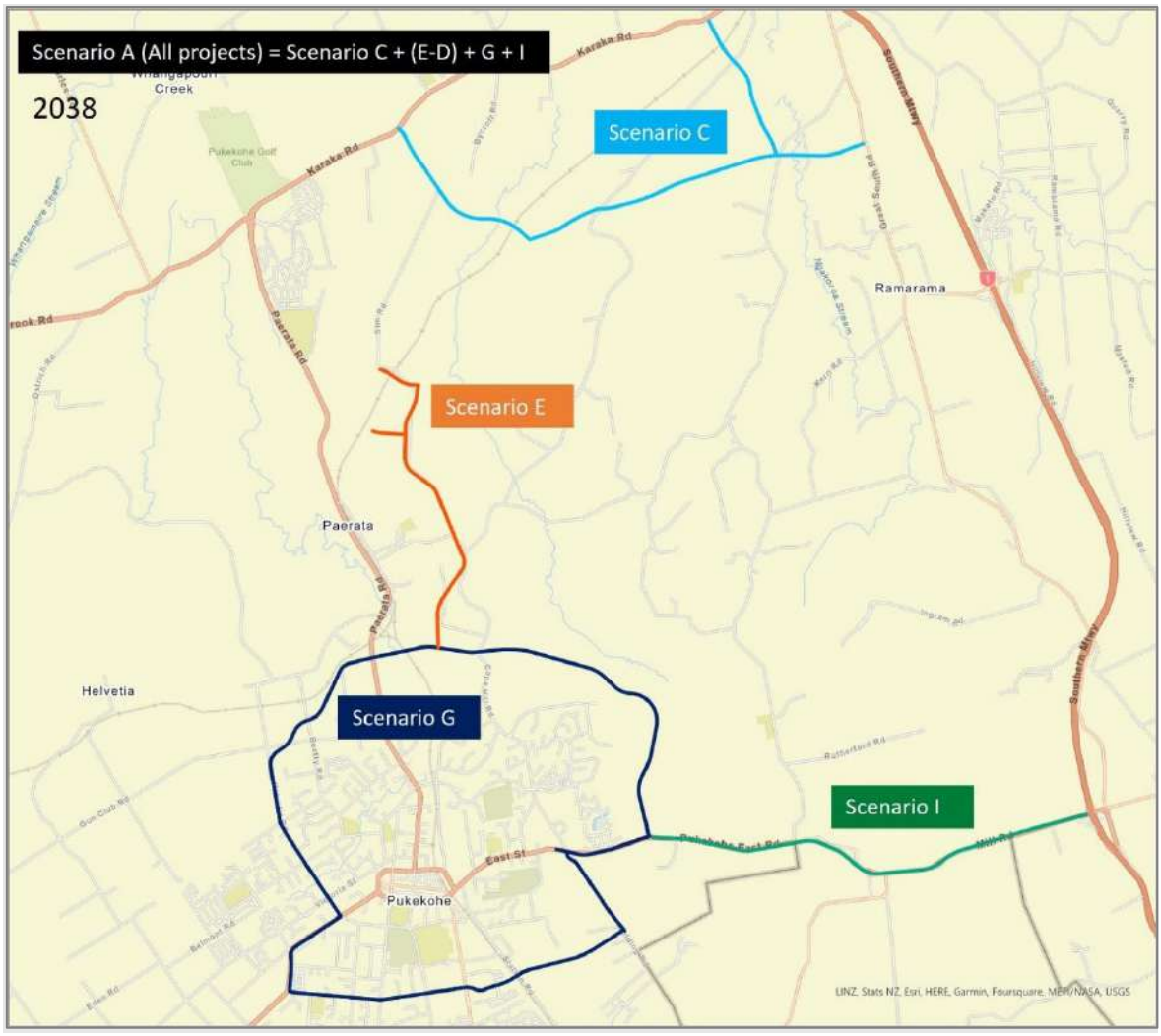

Figure 17 : Project segmentation that comprise the 2038 Reference Network

Public transport benefits and operating cost contribution

Project segmentation for the PT benefits and operating costs from MSM was calculated on a pro rata basis by assessing the 2048+ patronage uplift along the project corridors.

Crash benefits contribution

Project segmentation for crash benefits from MSM was calculated proportionally by assessing the 2048+ daily VKT along the project corridors.

For project segmentation in 2048+, each of the scenarios were assumed to contribute to a proportion of the Crash benefit reduction. This was calculated proportionally, as a percentage of the total Vehicle Kilometres Travelled (VKT) from the SATURN model, as shown in **Table 12**.

Table 12: Crash Benefit Reduction for project segmentation

Scenario	% Crash Benefit
Scenario B	10%
Scenario C	26%
Scenario D	10%
Scenario E	22%
Scenario F	23%
Scenario G	22%
Scenario H	14%
Scenario I	30%
Scenario J	30%

Active mode benefits contribution

Project segmentation for cycle benefits was calculated proportionally by assessing the 2048+ SAMM cycle-km uplift on each project corridor. Project segmentation for walk benefits was calculated proportionally by assessing the 2048+ population of SAMM zones adjacent to project corridors with pedestrian uplift.

2 Benefits Analysis and Discussion

The benefits analysed for the Pukekohe DBC economic assessment are discussed below and the outcome is enumerated in **Section 5**.

1.8 Traffic Travel Time and Congestion Savings

The travel time costs have been calculated based on the matrix-based SATURN outputs. The travel time components include:

- Base travel time; and
- Congested travel time (defined as 'CRV' in the MBCM).

The base travel time applies to the total travel times, whereas the CRV has been applied to the mean delay time from the transport model outputs. In theory, CRV should be applied to where the CRV value has been applied to sections of road deemed congested, such as:

- Urban roads in the model which use the methodology for urban roads, whereby CRV only applies to links with a volume to capacity (V/C) ratio greater than 70%; and
- All bottleneck delay, such as intersections.

However, due to the nature of the matrix-based outputs, the CRV has been applied to all the mean delay time calculated by the transport models, due to the inability to distinguish individual V/C on each section of road for each origin-destination pair. This is deemed to be acceptable given minimal delays at V/C ratios lower than 70%.

1.9 Traffic Reliability Benefits

Travel time reliability can generally be improved by upgrading the road network, improving connectivity and improving PT services. Travel reliability was assumed to be 8% of the travel time benefits for light and heavy vehicles, as per the standard approach with other South Te Tupu Ngātahi business cases. However, it is acknowledged that with increased levels of congestion this may underestimate the full reliability benefits.

1.10 Vehicle Operating Costs

Vehicle operating costs for private travel were estimated based on applying running costs (from the MBCM) to the SATURN model outputs. PT operating costs were included as a system cost item (rather than user cost).

1.11 Active Mode Benefits

The active modes benefits were calculated from SAMM based on the change in demand and generalised costs (the same method used for PT benefits from MSM). The road sections where cycling facilities are upgraded and designated as protected cycle lanes in the Reference Network scenario are shown in the cycle facility map in **Figure 18** below and are measured against the Do minimum scenario where the new cycle facilities are excluded (i.e. except those present in the base year) as in **Figure 19**.

The key difference in cycling facilities between the Reference Network and Do minimum is that the Reference Network includes protected cycle lanes along all Pukekohe DBC schemes. Generally, as per Te Tupu Ngātahi, all new DBC arterial roads will have a safe and separated cycle facilities. But, depending on the land use and adjoining road category the cycle facility type will vary. For example, Pukekohe East Road and Mill Road (Bombay) which have primarily rural land use, is a strategic road network and is expected to have regional cycling trips connecting to SH1. Therefore, the cycle facility is assumed to be “Off-Road cycleway”. Similarly, the South Drury Arterial which runs through the Drury West and Paerata FUZ boundary is proposed to have “Bi-directional cycleway”.

The high-quality Regional Active mode corridor (AMC) assumed to be in the Reference Network and Do Minimum scenarios and is expected to undertake most of the cycling trips in future. This will have some impacts on the Pukekohe cycling network which is primarily provided to connect local centres and collector roads. The Pukekohe cycling network will act as feeder networks to the regional cycleways.

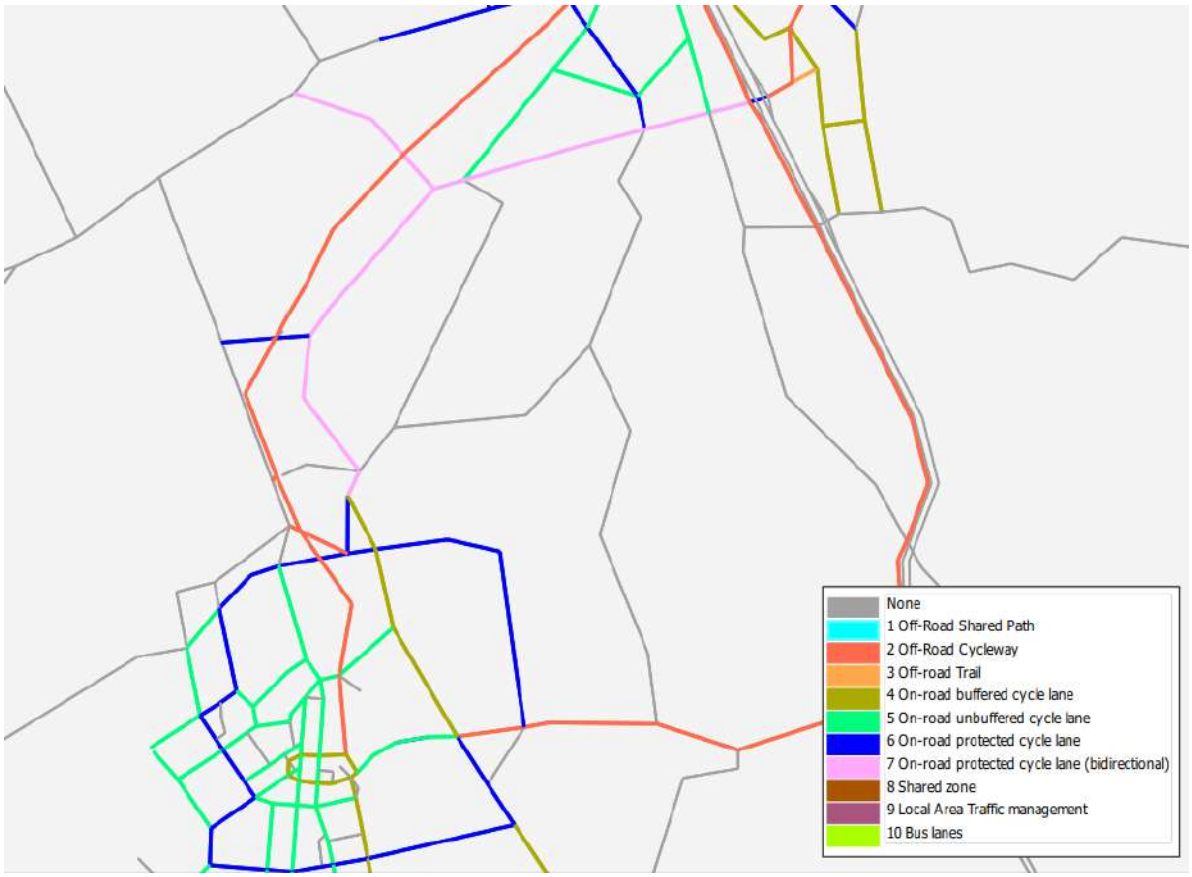

Figure 18 : Cycle Facilities for Reference Network in 2048+

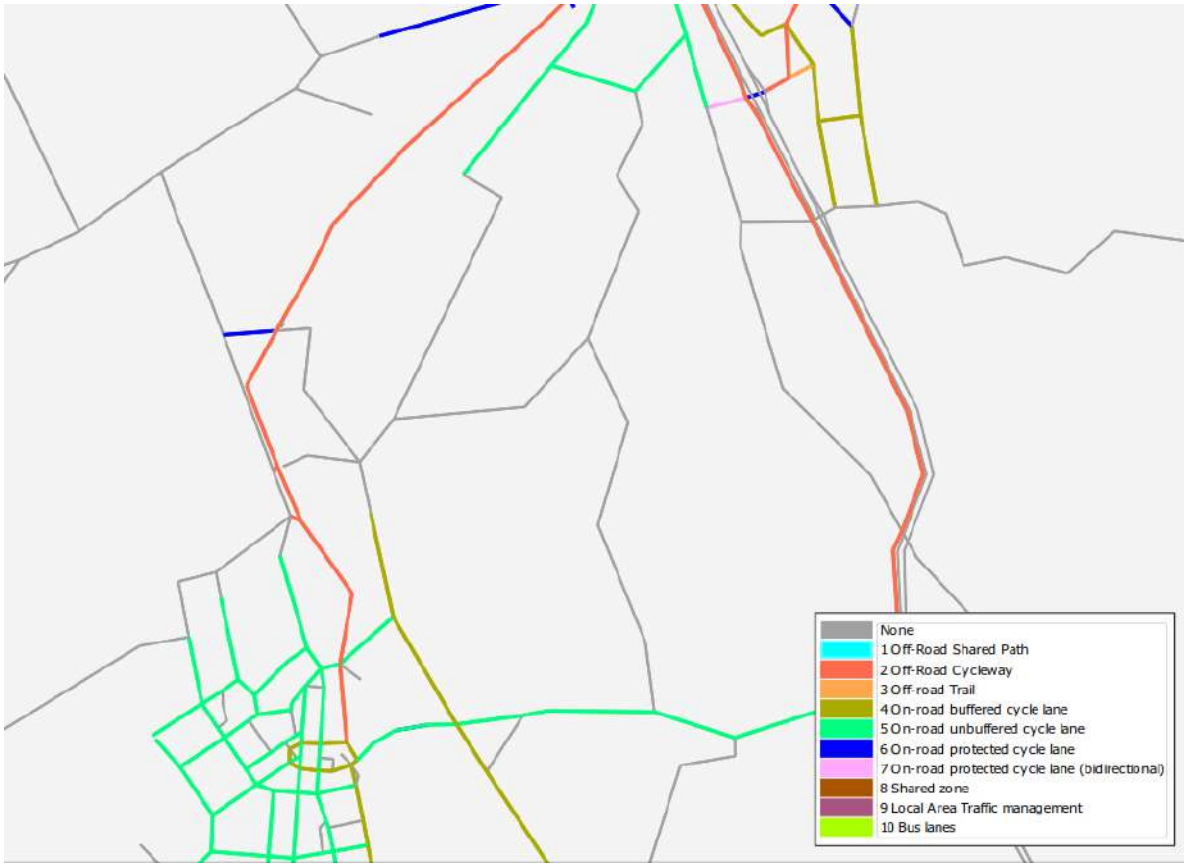

Figure 19 : Cycle Facilities for Do Minimum Scenario in 2048+

There are various components to the active modes benefits as shown below:

1.11.1 Travel Time Benefits

The user travel cost benefits were assessed using the demand and perceived cost matrices in SAMM. They are split into two purposes: home-based work (HBW) and other (including home-based education (HBE), home-based other (HBO), and non-home-based). The value of time used for the HBW purpose is $7.80 per hour and for non-work travel purpose is $6.90 per hour, which are then multiplied with the update factor of 1.59 (year 2021).

The provision of upgraded active mode facilities on the Pukekohe DBC corridors and their exclusivity to active modes leads to travel time savings for the cyclists and pedestrians. It is expected to obtain reasonable travel time savings for the active mode users in South Auckland, provided the better active mode connectivity. The active modes travel time benefits are shown in **Table 13**. Differences in the quality of routes are reflected in the attributes incorporated in SAMM which are similar to those included in the MBCM.

Table 13: Active Modes Travel Time Benefit – Year 2048+

Mode	Base	Option	Benefits (generalised minutes)		VoT ($/hr)		Update Factor	Annual Factor	Annual TT Benefit ($million)		
			HBW	Other	HBW	Other			HBW	Other	TOTAL
Cycle	DM	Reference	748	1,330	7.80	6.90	1.59	365	56,415	88,775	0.1
Walk	DM	Reference	4,151	80,653	7.80	4.49	1.59	365	313,185	3.5	3.8

Note: The value of time for the Walk Other trips has been reduced by 35% of the MBCM Reference to account for the travel demand management (TDM) effect in MSM (conversion of a proportion of mechanised short trips (shorter than 3 km) to active mode trips in MSM turned off for HBO trips. This has been agreed during the Drury local peer review process as the reviewer considered Walk Other purpose benefits to be potentially overstated relative to HBW purpose. Additionally, for evaluation purposes the walk trips beyond 6 km and cycle trips beyond 30 km were removed to avoid particularly long trips.

1.11.2 Health, Safety and Decongestion Benefits

Road traffic reduction and health benefits were estimated from the change in the amount of walk- and cycle-km as obtained from SAMM. The walk- and cycle-km were calculated in SAMM by multiplying the walk and cycle trips with the walk and cycle distance travelled, respectively. The change in predicted walk- and cycle-km is multiplied with the cyclist ($2.20 per cyclist per km) and pedestrian ($4.40 per pedestrian per km) composite benefit factors, as obtained from the MBCM. These are updated to year 2021 by applying the update factor of 1.06.

The decongestion benefits obtained due to cycling are calculated by multiplying the change in cycle-km by the road reduction factor and the number of car users who experience mode shift. It is calculated as the ratio of car diversion rate for cycle (65%) and car occupancy (1.2 persons). The road traffic reduction factor of $1.54 per vehicle per km was obtained from the MBCM, but because SAMM only provides daily demand this was reduced by 50% to make allowance for lower decongestion outside the peak periods. The safety benefits for cyclists are obtained by multiplying the cycle-km with the safety factor of $0.05 as obtained from MBCM SP11, year 2021[1]. The Pukekohe DBC active modes health, safety and decongestion benefits are shown in **Table 14**.

Table 14: Active Modes Health, Safety and Decongestion Benefit – Year 2048+

Mode	Base	Option	Km Increase	Health factor	Safety Factor	Update Factor	Benefits ($m)		
							Health	Safety	Decongestion
Cycle	DM	Reference	245	2.2	0.05	1.06	0.2	0.01	0.05
Walk	DM	Reference	7,421	4.4	-	1.06	12.6	-	-

The active modes benefits were assessed from SAMM for year 2048+, with benefits of earlier years being assessed as a proportion of the 2048+ benefits, based on the population data of zones (using land use scenario i11.6) affected by the active modes network. The assumed proportions for the interim years are as follows:

- 2038: 65%
- 2048: 75%
- 2048+: 100%

[1] The safety factor has no reference in recent MBCM but is present in the SP11 calculation worksheet. It has reference in Economics Evaluation Manual (EEM) 2018 with value dated year 2008. Hence it was updated with update factor 1.28.

1.12 Crash Cost Savings

Crash reduction benefits were estimated using average crash costs per vehicle kilometres travelled (VKT) for different road categories, as used in the IBC. This captures both reduction in the total VKT (e.g., from mode shift) and from shifting traffic to safer road environments i.e., road category upgrades. The crash rates used were calculated based on the total recorded crashes in the Auckland region over the last 5 years and the VKT by road type and speed from the 2016 MSM regional model which are outlined below in **Table 15**.

Table 15: Crash Costs by Road Type and Speed

Road Type	Speed	Veh Km (millions/year)	Crash Cost (million NZ$/year)	Cents/Veh km
Motorway	All speeds	4,687	126	2.69
Arterial	<80	4,659	526	11.28
	>=80	68.97	10	14.56
Local	All speeds	1,698	140	8.22
Rural	<80	486	22	4.43
	>=80	1,390	243	17.46
All categories		12,991	1,066	8.20

The standard method assumes that the new roads proposed would perform only as well as the 'average' arterial roads in Auckland. This would not capture the higher standard of road proposed, which could be expected to have a better crash performance due to fully separated walking and cycling facilities, wider berms and medians, reduced vehicle access and less turning conflicts etc.

To reflect this, the standard road crash rates were reduced by 20% for travel on new arterial roads and by 30% for travel by new strategic roads, see below **Figure 20**. The network-wide crash cost savings are obtained by multiplying the veh-km savings from the MSM models with the crash rate and then updated to year 2021 by applying the update factor of 1.10. It is expected to have substantial crash cost saving due to reduced VKT with mode shifts from private vehicles and more direct connections in the reference option. The veh-km savings are translated to crash cost savings as shown in **Table 16**.

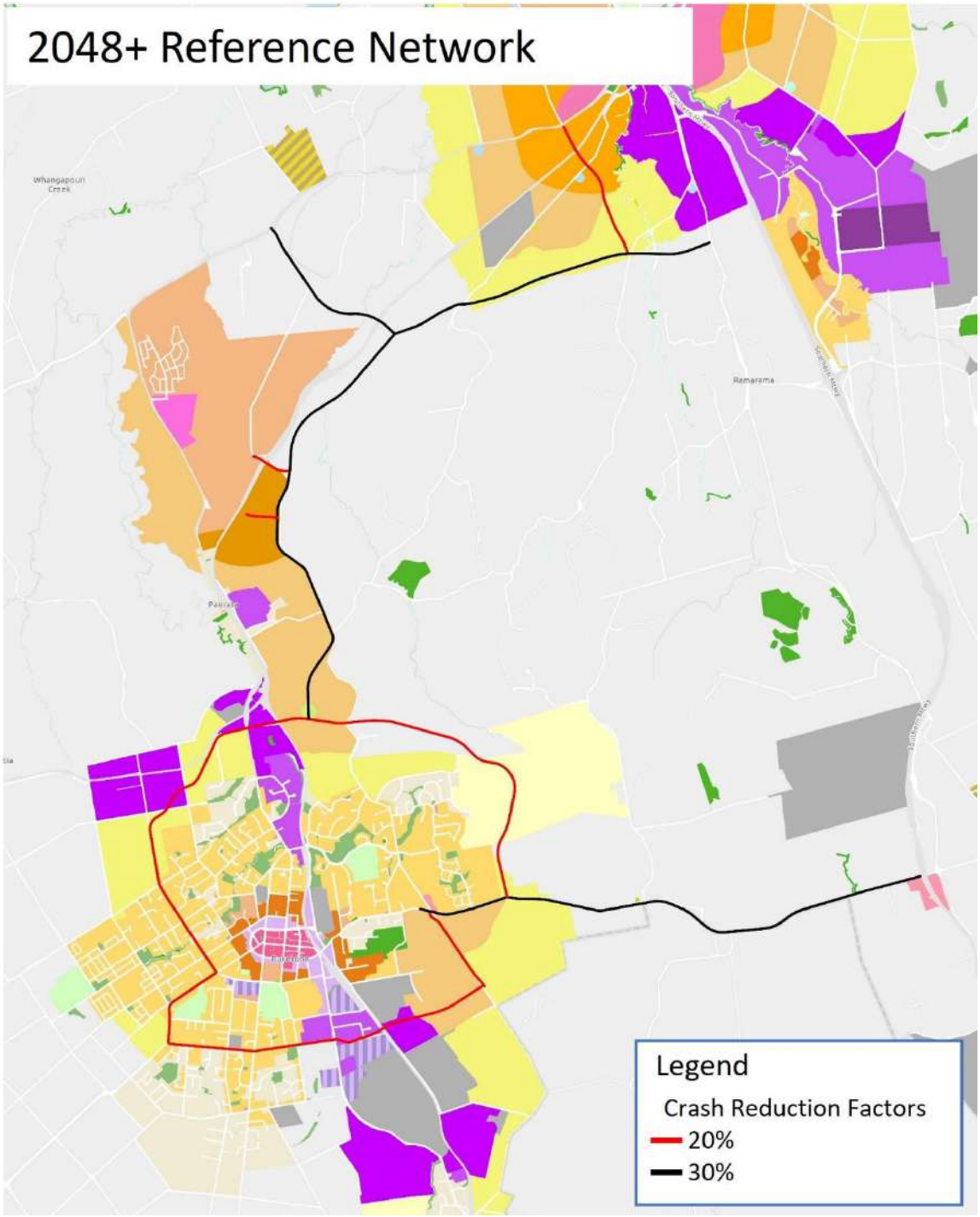

Figure 20: Crash Reduction Factors

Table 16: Crash Cost Savings for the Modelled Years

Year	Crash Cost Savings ($M)
2038	2.3
2048	2.5

Year	Crash Cost Savings ($M)
2048+	2.5

1.13 Public Transport Users Benefits

The PT benefits from the Reference Network is limited to Drury West arterials where new alignment connecting to Drury West Station is planned. For rest of the project areas, the Do minimum and Reference PT network will be very similar. It is assumed that in Do minimum where new arterials are not in place the PT services will re-route using existing networks.

Since no specific PT intervention is considered as part of the Pukekohe DBC, the primary roading improvements will result in a mode shift i.e., reduction of PT Benefits (mostly health benefits). However, the Reference transport networks provided will support growth and employment opportunities and enable safer commute to the future urban growth areas.

The PT user benefits are estimated by multiplying the VoT (as obtained from the MBCM) of each trip purpose to the passenger hours obtained from MSM. The VoT used for HBW purpose is $7.80 per hour, for work travel purpose is $23.85 per hour, and for other non-work travel purpose is $6.90 per hour; these were then updated to year 2021 by applying the update factor of 1.59.

1.14 Public Transport Reliability Benefits

The provision of bus lanes in the Drury arterial section along with the road upgrades is expected to provide better reliability for the Public transport users. The PT reliability of 20% of PT user benefits is assumed for commuter peaks and 10% for other peaks.

1.15 Public Transport Health Benefits

For the Reference network compared to the Do Minimum Closure case, a certain amount of health benefits was also obtained from the PT walk trips (trips that walk to the stops or stations to access PT services) predicted from MSM. The mode shift to private vehicles caused by the roading upgrades results in negative health benefits, refer to below **Table 17**

Table 17: PT Stop/Station Walk Trips Health Benefits from MSM – Year 2048+

Health Factor	Update Factor	Daily km Increase	Annual Health Benefits ($M)
4.4	1.06	-675	-1.1

1.16 Carbon Dioxide Emissions

The CO_2-equivalent emissions are calculated from SATURN models using the VEPM 6.3 emission rates. The difference between the Reference Network and Do minimum gives the emission impact due to the project.

Compared to the Do minimum, the Pukekohe DBC schemes provide high-quality and direct corridors in the Drury-West, Paerata and Pukekohe areas. It is expected to obtain CO_2 savings due to shorter connectivity to key destination such as rail stations and reduced congestion in the network.

The Pukekohe DBC project reduces the emissions as seen in **Table 18**. The economic benefit of the emissions is calculated by multiplying the social cost per CO_2 tonne emitted as per the higher values in the range provided in the MBCM[2].

Table 18: Annual Emission Benefits for the Modelled Years – Pukekohe DBC

Year	Social Cost of CO_2 ($/tonne)	Annual CO_2-equivalent Emission Savings (tonnes)	Annual Emission Cost Savings ($M)
2038	178	3,938	0.7
2048	222	2,603	0.6
2048+	246	2,772	0.7

Other emissions like volatile organic compounds, NO_x and particulates were assessed and it was found that the emission savings were comparatively insignificant.

1.17 Wider Economic Benefits

Given the scale of the proposed improvements and its impact in the future urban mobility in the area, it was deemed likely that there would be significant WEBs. The WEBs were initially assessed using the MBCM procedures from the 2048+ MSM models. After consideration of the results, a method was adopted that involved a fixed uplift in the conventional transport benefits.

The analysis is done for three principal types of WEBs:

- Agglomeration impact;
- Imperfect competition impact; and
- Labour supply impact and more productive jobs impact.

The total WEBs evaluated for the Pukekohe DBC are shown in **Table 19**.

Table 19: WEBs by Type Determined from MSM Models 2048+

Item	Benefits ($M)
Agglomeration impact	$10.6
Imperfect competition impact	$5.8
Labour market impact	$0.09
Total WEBs	$16.6

[2] The social cost of CO_2 used for 2048+ is the upper bound value for year 2053, extrapolated from the values provided in the MBCM.

Item	Benefits ($M)
WEBs percentage	17%

As shown above, the WEBs was estimated as 17% uplift on conventional benefits. A range of methods were tested in applying WEBS to the analysis period. This included a fixed 15%, variable rates growing from 0% or 10% to 17%. From the assessment a fixed 15% uplift on conventional benefits was adopted as a reasonable value, albeit possibly conservative for the Pukekohe economics analysis.

For simplicity, same WEBs% was considered for the individual projects, this will mean that some of the projects will have higher WEBs benefits and some lower than expected, but this is covered in the sensitivity test reported in **Section4.2**.

3 Project Costs

1.18 Capital Cost

For the BCR calculations the expected cost (P50) is used as a base estimate. The following **Table 20** summarises the cost estimate for each individual project.



1.19 Operation and Maintenance Costs



[redacted]

1.19.3 Bridge Maintenance

The bridge maintenance cost is ignored because the bridge construction cost is not available in isolated form from the total construction cost for each of the individual projects.

[redacted]



The important thing to note in the process of cost calculation is that all the individual packages have the same start date of 2036. Whereas in practice, the project will progress cumulatively over the years and the NPV (Net present value) derived from them will increase proportionally. Since it is rather difficult to estimate the phasing of the individual schemes that will commence 20-30 years later, the start date has been assumed constant, but the construction periods have been varied as per an estimate of priority.

Similarly, the NPV (Net present value) for the full package scenario is assumed wholly rather than in stages. This methodology will reflect some differences when comparing the discounted costs, as opposed to undiscounted project costs which are fairly consistent.

It is also noted that the due to the inherent uncertainties associated with each projects the benefits and costs will lie somewhere within a range of the proposed BCR as discussed in Section 5

4 Benefits-Cost ratio (BCR)

1.21 National BCR Outputs

Based on the methodology described above, the net present values of benefits were evaluated and summarised in **Table 23**.The core results for the Pukekohe DBC package components were generated from a set of 'core' assumptions. The **Figure 21** below shows the summary of scenarios B to J.

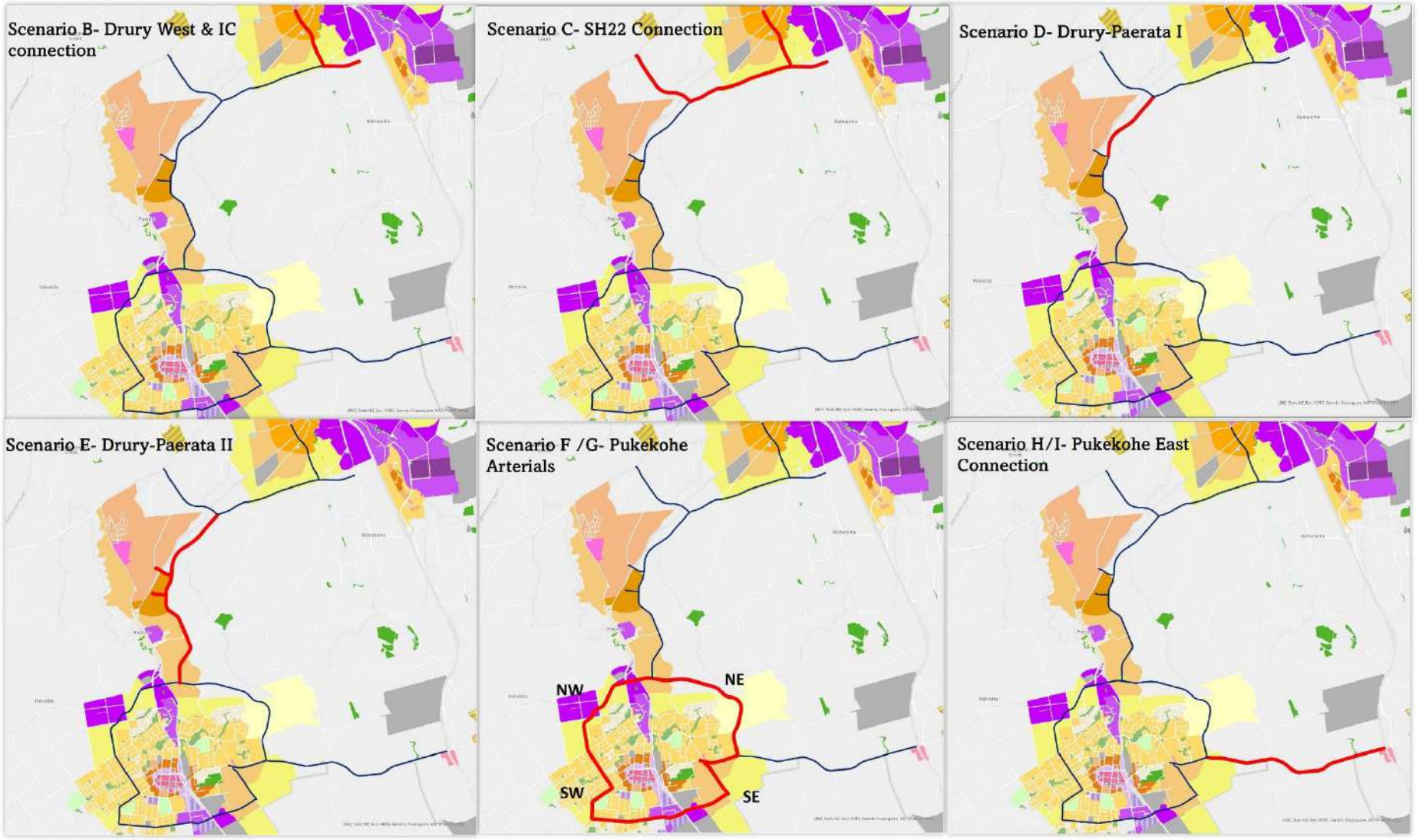

Figure 21: Economic Assessment Scenarios B to J

Table 23: Summary of Core Benefits of Individual projects in Pukekohe DBC ($ million PV)

Items	NPV Benefits ($m)									
	Scenario A- All Projects	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F	Scenario G	Scenario H	Scenario I	Scenario J
Traffic - Travel Time Benefits	485	75	219	57	146	107	187	27	107	105
Traffic - Congestion Benefits	86	10	33	10	24	20	33	5	23	22
Traffic - Trip Reliability	39	6	18	5	12	9	15	2	9	8
Traffic - Vehicle Operating Costs	77	13	44	10	33	19	29	6	14	14
Active Modes	151	6	7	0	46	119	98	79	0	0
Crash savings	23	3	6	3	5	5	5	3	7	7
PT - Travel Time Benefits	13	13	13	0	0	1	1	1	0	0
PT - Reliability	2	2	2	0	0	0	0	0	0	0
PT - Health benefits	-10	-10	-10	0	0	0	0	-1	0	0
CO2	6	1	3	0	2	1	2	0	1	2
PV total net benefits excluding WEBs	873	118	336	85	267	281	370	124	162	159
PV of total net costs	1,134	233	554	72	213	417	417	216	63	62
National BCR Excluding WEBs	**0.8**	**0.5**	**0.6**	**1.2**	**1.3**	**0.7**	**0.9**	**0.6**	**2.6**	**2.6**
WEBs %	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
WEBs Benefits	131	18	50	13	40	42	55	19	24	24
PV Benefits Including WEBs	1,004	136	386	97	308	323	425	142	186	183
National BCR Including WEBs[3]	**0.9**	**0.6**	**0.7**	**1.4**	**1.4**	**0.8**	**1.0**	**0.7**	**3.0**	**3.0**

[3] The National BCR including Webs is considered as sensitivity test as per MBCM

1.21.1 Key Observations

1 The results are sensitive to the definition of the “do minimum”, as demonstrated by the range of BCRs with respect to the project segmentation and staging assumptions, higher for Scenarios F and G, and to a much smaller extent for Scenarios I and J.
2 The traffic benefits comprise a major portion of the benefits which appears reasonable since majority of the networks are new intra and inter-regional connections servicing future urban areas. The new arterials provide direct connections, reduce significant delays and congestion on the existing network, see **Figure 22**.
3 The regional active mode corridor adjacent to the study area inhibits the overall active mode benefits of the Pukekohe cycling network, thereby giving most of the benefits from local connections to walking.
4 The bulk of PT benefits from this region has been quantified in the separate DBC. The Pukekohe DBC does not significantly improve the bus networks with respect to the Do Minimum scenario. The Drury West arterials (Scenario B) would slightly improve PT access to station and reduce travel times for users. But the serviced PT area is small-scale compared to the project area and therefore the benefits presented would be conservative.

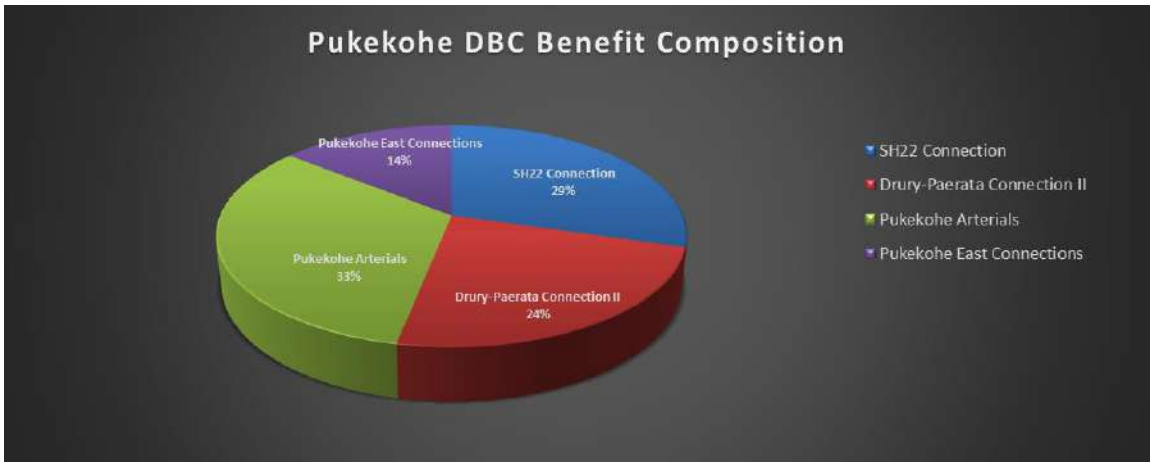

Figure 22 : Pukekohe DBC Benefits Composition

1.22 Sensitivity Tests

The key purpose of the sensitivity tests is to understand the relative impact of key assumptions on the BCR. The sensitivity tests were carried out as per the MBCM.

The sensitivity tests are split into analysis framework and parameter sensitivity tests. The analysis framework includes discount rate and analysis period, whilst parameter sensitivity includes WEBs, cost, and active modes and traffic benefits variability. Additional sensitivity tests were performed, as agreed with the peer reviewer.

1.22.1 Analysis Framework Sensitivity Tests

The analysis framework includes discount rate and analysis year:

Discount Rate and Analysis Period

The discount rate Reference in the current MBCM is 4% with sensitivity tests for 3% and 6%. A range of discount rates was tested, being 3%, 4%, 6%. The analysis period used for testing is 40 years and 60 years. The longer analysis period is relevant for long-lived strategic infrastructure projects such as South Drury Arterials and Mill Road (Bombay) in the Pukekohe DBC.

The **Table 24** shows the BCR range for the above analysis parameters

Table 24: BCR range – Different Discount rate and Analysis Period excluding Webs

Discount Rate	BCR excluding WEBs					
	Analysis Period 40 years			Analysis Period 60 years		
	3%	4%	6%	3%	4%	6%
Scenario A	0.9	0.8	0.6	1.2	0.9	0.6
Scenario B	0.6	0.5	0.4	0.8	0.6	0.4
Scenario C	0.7	0.6	0.4	0.9	0.7	0.5
Scenario D	0.8	1.2	0.8	1.9	1.5	0.9
Scenario E	1.4	1.3	0.9	2.0	1.6	1.0
Scenario F	1.5	0.7	0.5	1.0	0.8	0.5
Scenario G	0.8	0.9	0.6	1.4	1.1	0.7
Scenario H	1.1	0.6	0.4	0.9	0.7	0.5
Scenario I	0.7	2.6	1.9	3.9	3.1	2.1
Scenario J	3.1	2.6	1.9	3.9	3.1	2.1

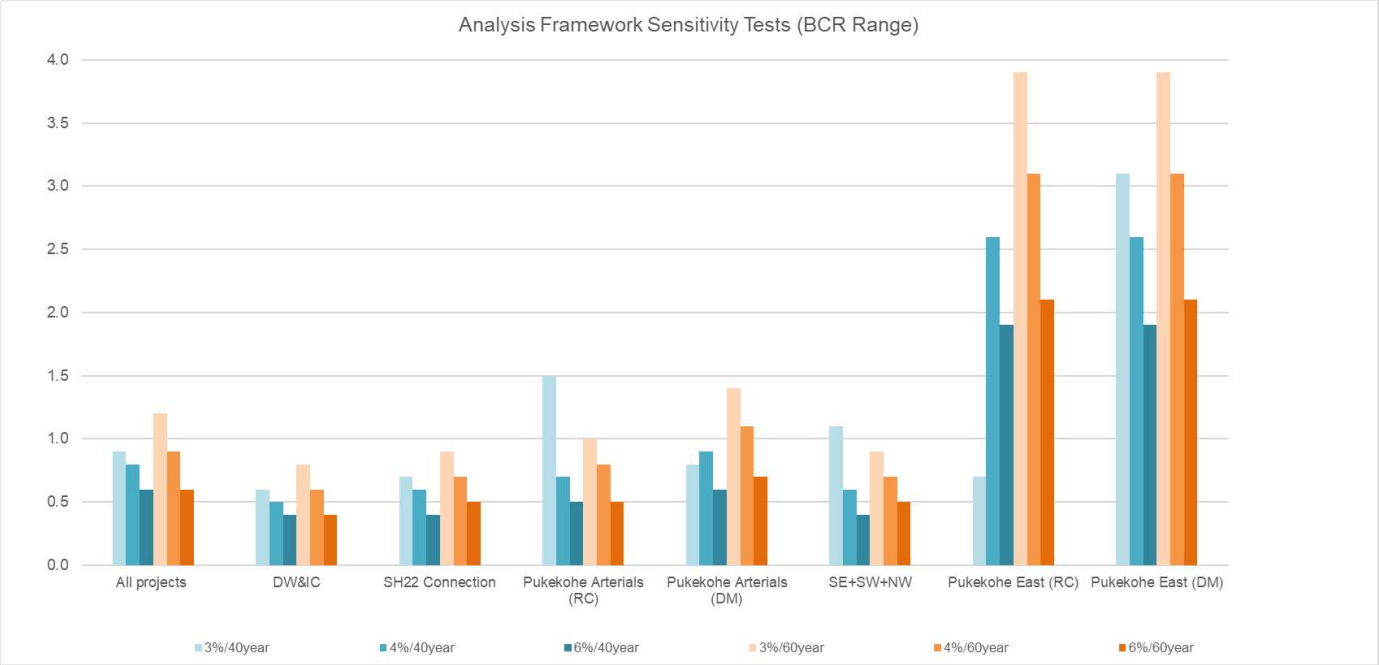

Figure 23 : Analysis Framework - BCR range for the Pukekohe DBC Project

The above analysis shows that:

- The BCR for All projects full package lies between 0.6-1.2.
- Using the recommendation in the MBCM (4%/40years), the BCR ratio is 0.8 (excluding WEBs) and 0.9 (including WEBs) for the Reference network against the Do Minimum.
- Since most of Pukekohe projects are long-lived infrastructure, a sensitivity test for a 60year analysis period was carried out which further uplifts the BCR to 1.2 for the Reference network against the Do Minimum.

1.22.2 Parameter Sensitivity Tests

These sensitivity tests are performed by altering one parameter at a time while maintaining the rest of the core assumptions, including the 4% discount rate and 40-year analysis period. The following parameter sensitivity tests were carried out:

- Including WEBs: ±10%
- Active modes benefits variability: ±25%
- Traffic benefits variability: ±25%

Wider Economic Benefit Percentage

The WEB % was sensitivity tested at +/-10% of the central estimate i.e. 25% and 5% tested for all Pukekohe projects. The base BCR without including WEBs is also presented in the **Table 25**. It is observed that the adopted 15% Webs raises the BCR from 0.8 to 0.9 for the Reference Network against the Do minimum, and further increases to 1.0 if the WEBs is doubled to 30%. However, the relative impact of WEBs on varying it +/-10% have insignificant impact.

Table 25: WEBs Percentage sensitivity tests

WEBs%	BCR				
	0% (Base)	5%	15% (adopted WEBs)	25%	30%
Scenario A	0.8	0.8	0.9	1.0	1.0
Scenario B	0.5	0.5	0.6	0.6	0.7
Scenario C	0.6	0.6	0.7	0.8	0.8
Scenario D	1.2	1.2	1.4	1.5	1.5
Scenario E	1.3	1.3	1.4	1.6	1.6
Scenario F	0.7	0.7	0.8	0.8	0.9
Scenario G	0.9	0.9	1.0	1.1	1.2
Scenario H	0.6	0.6	0.7	0.7	0.7
Scenario I	2.6	2.7	3	3.2	3.4
Scenario J	2.6	2.7	3	3.2	3.4

Active Mode benefits Sensitivity test

During the Drury Local peer review, extensive modelling methodology checks were carried out to understand better the Walk benefits predicted by the model, especially for the “Other’ trip purpose. These were found to align with expected daily travel by each mode and purpose. However, the greenfield nature of the location and the extensive future population growth make it more difficult to independently check the scale of benefits. It was therefore agreed to test with +/-25% active mode benefits. The same tests have been carried out for the Pukekohe DBC Economics, **Table 26**. The variation in active mode benefits cause no significant variance to the overall BCRs.

Table 26: BCR variation with Active Mode benefits change

Active Mode benefit %	BCR		
	-25%	0% (core)	25%
Scenario A	0.7	0.8	0.8
Scenario B	0.5	0.5	0.5
Scenario C	0.6	0.6	0.6
Scenario D	1.2	1.2	1.2
Scenario E	1.2	1.3	1.3
Scenario F	0.6	0.7	0.7
Scenario G	0.8	0.9	0.9

Active Mode benefit %	BCR		
	-25%	0% (core)	25%
Scenario H	0.5	0.6	0.7
Scenario I	2.6	2.6	2.6
Scenario J	2.6	2.6	2.6

Traffic benefits Sensitivity test

The traffic benefits variability is tested for robustness since the traffic benefits exhibited highly sensitive with the projects and they comprise of bulk of the total benefits. The travel time, congestion, vehicle operating cost and trip reliability was tested for ±25%. The results in **Table 27** show that the BCR is relatively sensitive to changes in traffic benefits, which is expected given that they form the bulk of the benefits in the present appraisal.

Table 27: BCR variation with Traffic benefits change

	BCR		
Traffic benefit %	-25%	0% (core)	25%
Scenario A	0.6	0.8	0.9
Scenario B	0.4	0.5	0.6
Scenario C	0.5	0.6	0.7
Scenario D	0.9	1.2	1.5
Scenario E	1.0	1.3	1.5
Scenario F	0.6	0.7	0.8
Scenario G	0.7	0.9	1.0
Scenario H	0.5	0.6	0.6
Scenario I	2.0	2.6	3.2
Scenario J	2.0	2.6	3.2

1.22.3 Landuse sensitivity

There is particular uncertainty around the extent and timing of the land-use development in the Pukekohe growth area. To examine the possible effects of alternative landuse forecasts, two tests have been carried out to test the effects of delayed growth or accelerated growth termed as landuse decelerated growth (LU_Dec) and landuse accelerated growth (LU_Acc) respectively. The tests have been undertaken by ascribing the benefits estimated for the base case to different years that reflect faster or slower rates of land-use development. For each of these it is assumed that until 2028 nothing will change, and the long-term effects will also remain the same but the timing of growth between these points will differ. For examining the longer term effects, it is considered that the

analysis period for all projects will be 60 years. In case of the land use deceleration scenario the long-term effects will be achieved at a delayed date than base case and for landuse acceleration it will be achieved earlier as exhibited in **Figure 24**. The specific assumptions for land use sensitivity tests are:

- Land use decelerated growth – It is assumed that 2038 benefits will remain same as base case and will remain flat till 2048, and 2048+ benefits occur after 2055.
- Land use accelerated growth –Year 2038 have about 60% benefits of year 2048. Year 2048+ growth occurs in 2048 and as a result Year 2048+ experiences 20% additional benefits as the effect of landuse acceleration

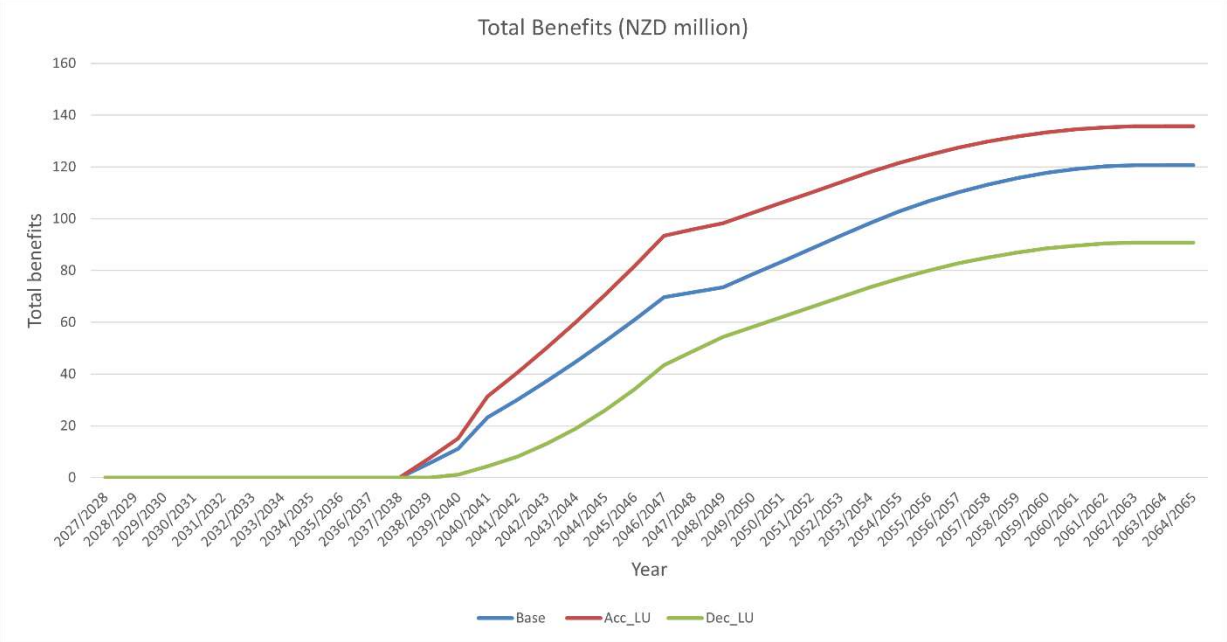

Figure 24: Landuse deceleration or acceleration effects on Total Benefits ($ million)

Below **Table 28** shows BCRs with different landuse growth scenario.

Table 28: Landuse Sensitivity tests

BCR	Landuse Scenario					
	Excluding WEBs			Including WEBs		
	Base	LU_Dec	LU_Acc	Base	LU_Dec	LU_Acc
Scenario A	0.8	0.5	0.9	0.9	0.6	1.1
Scenario B	0.5	0.3	0.6	0.6	0.4	0.7
Scenario C	0.6	0.4	0.8	0.7	0.5	0.9
Scenario D	1.2	0.9	1.6	1.4	1.0	1.9
Scenario E	1.3	0.9	1.5	1.4	1.0	1.8
Scenario F	0.7	0.5	0.8	0.8	0.5	0.9
Scenario G	0.9	0.6	1.1	1	0.7	1.2
Scenario H	0.6	0.4	0.7	0.7	0.5	0.8

BCR	Landuse Scenario					
	Excluding WEBs			Including WEBs		
	Base	LU_Dec	LU_Acc	Base	LU_Dec	LU_Acc
Scenario I	2.6	1.7	3.1	3	2.0	3.6
Scenario J	2.6	1.7	3.1	3	2.0	3.6

From the above table it is inferred that the project are reasonably sensitive to growth and therefore project implementation to match the growth is important.

Route protection at an early stage will be required to help ensure that changes in the timing of development either accelerated or delayed can be easily accommodated. The 'decelerated growth' sensitivity test could be taken as a conservative scenario where the growth in the Pukekohe-Paerata future urban zones do not eventuate or are delayed, considering that these are expected to occur in 2048.

Landuse sensitivity test shifting 2048+

The core BCR has been calculated with the assumption of 2048+ landuse allocated to 2053 for the purpose of economics assessment. However, this have been sensitivity tested by considering the 2048+ as 2058.

This was done to reflect the alterative assumption to when the 2048+ benefits will commence Considering the long-term benefits from this project this is a valid sensitivity that needs to be addressed. The overall BCR is 0.7 (excluding WEBs) , which does not significantly change from this test. See **Figure 25** for the 40-year benefits profile staggering the benefits to year 2058.

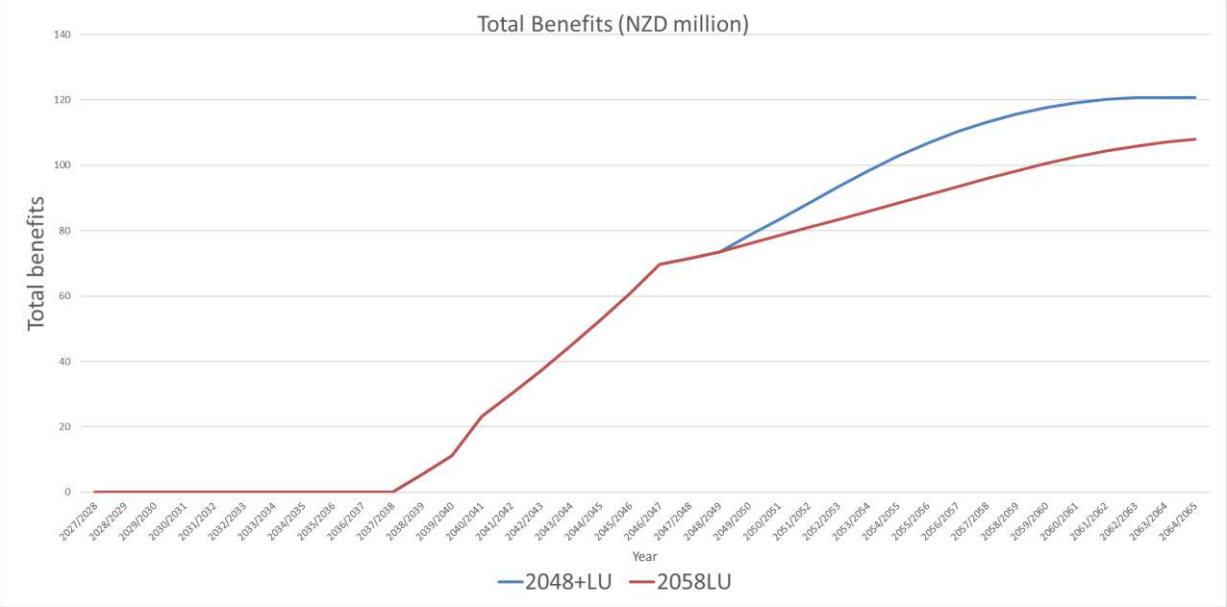

Figure 25: 40-year benefits profile considering 2048+ and 2058 LU assumptions

Table 29: BCR Comparison for 2058 Land use

BCR	Landuse Scenario	
	Excluding WEBs	
	Base	LU_2058
Scenario A	0.8	0.7
Scenario B	0.5	0.5
Scenario C	0.6	0.6
Scenario D	1.2	1.1
Scenario E	1.3	1.1
Scenario F	0.7	0.6
Scenario G	0.9	0.8
Scenario H	0.6	0.5
Scenario I	2.6	2.6
Scenario J	2.6	2.4

The **Table 29** above gives the overall and package BCR resulting from the land use sensitivity.

1.22.3.1 Covid Scenario

The Land use growth might slow down due to Covid or any other unknown reasons in long term and hence the project start date might need to be delayed to meet the changed transport needs. We recognise such situation to arise but believe it will not have any significant impact on the economic returns from the project as the costs and benefits timestreams will be shifted with the project start.

5 Summary

The core results for the economic evaluation of the components of the Pukekohe DBC package are set out in the table below, **Table 30**. The **Figure 21** shows the summary of the scenarios.

Table 30: BCRs per Project – with and without WEBs

Projects	PV total benefits, $M PV	PV total net costs, $M PV	BCR excluding WEBs	WEBs	BCR including WEBs
Scenario A	1,004	1,134	0.8	131	0.9
Scenario B	136	233	0.5	18	0.6
Scenario C	386	554	0.6	50	0.7
Scenario D	97	72	1.2	13	1.4
Scenario E	308	213	1.3	40	1.4
Scenario F	323	417	0.7	42	0.8
Scenario G	425	417	0.9	55	1
Scenario H	142	216	0.6	19	0.7
Scenario I	186	63	2.6	24	3
Scenario J	183	62	2.6	24	3

Key conclusions were noted as follows:

- It is noted that the due to the inherent uncertainties associated with individual projects the benefits and costs will lie somewhere within a range of the “proposed” package BCR, but the overall combined BCR can be considered robust.
- The BCR of the “All project” package i.e., Reference Network with respect to Do Minimum is 0.8 without WEBs and slightly increases to 0.9 if WEBs are included.
- The BCR of the individual project segments range from 0.6-3 including WEBs depending on the project prioritisation and staging.
- Sensitivity testing of many of the assumptions or parameters used in the analysis indicated that the BCR of scenarios B, C and H can lower up to 0.4. The BCR for Scenarios D and E can increase up to 1.9 and 2.0 respectively. The BCRs are relatively insensitive to changes in these assumptions and parameters, and the results can therefore be considered robust. The results of these sensitivity tests are summarised in **Table 31** .
- The Pukekohe East connection which is one of the strategic connections to SH1 reliving regional traffic on SH22 and local roads, has the highest individual BCR of up to 3.9 with 3% discount rate, 60 years analysis period.
- The PT and active mode benefits of the Pukekohe study area is covered in a separate Rail/AMC business case, this DBC assessment therefore shows low PT and active mode benefits.

Table 31: Summary of BCR Range for the Pukekohe DBC Projects

Projects	Analysis Framework	Parameter sensitivity
Scenario A	0.6-1.2	0.6-1.0
Scenario B	0.4-0.8	0.4-0.7
Scenario C	0.4-0.9	0.5-0.9
Scenario D	0.8-1.9	1.0-1.7
Scenario E	0.9-2.0	1.0-1.6
Scenario F	0.5-1.5	0.5-0.8
Scenario G	0.6-1.4	0.7-1.1
Scenario H	0.4-1.1	0.5-0.7
Scenario I	0.7-3.9	2.0-3.3
Scenario J	1.9-3.9	2.0-3.3

1 Appendix 1 - Model Extents

The sector system considered for the benefit analysis is shown below; it comprises of all the regions in Auckland as in MSM. **Figure 26** shows the internal sectors from MSM.

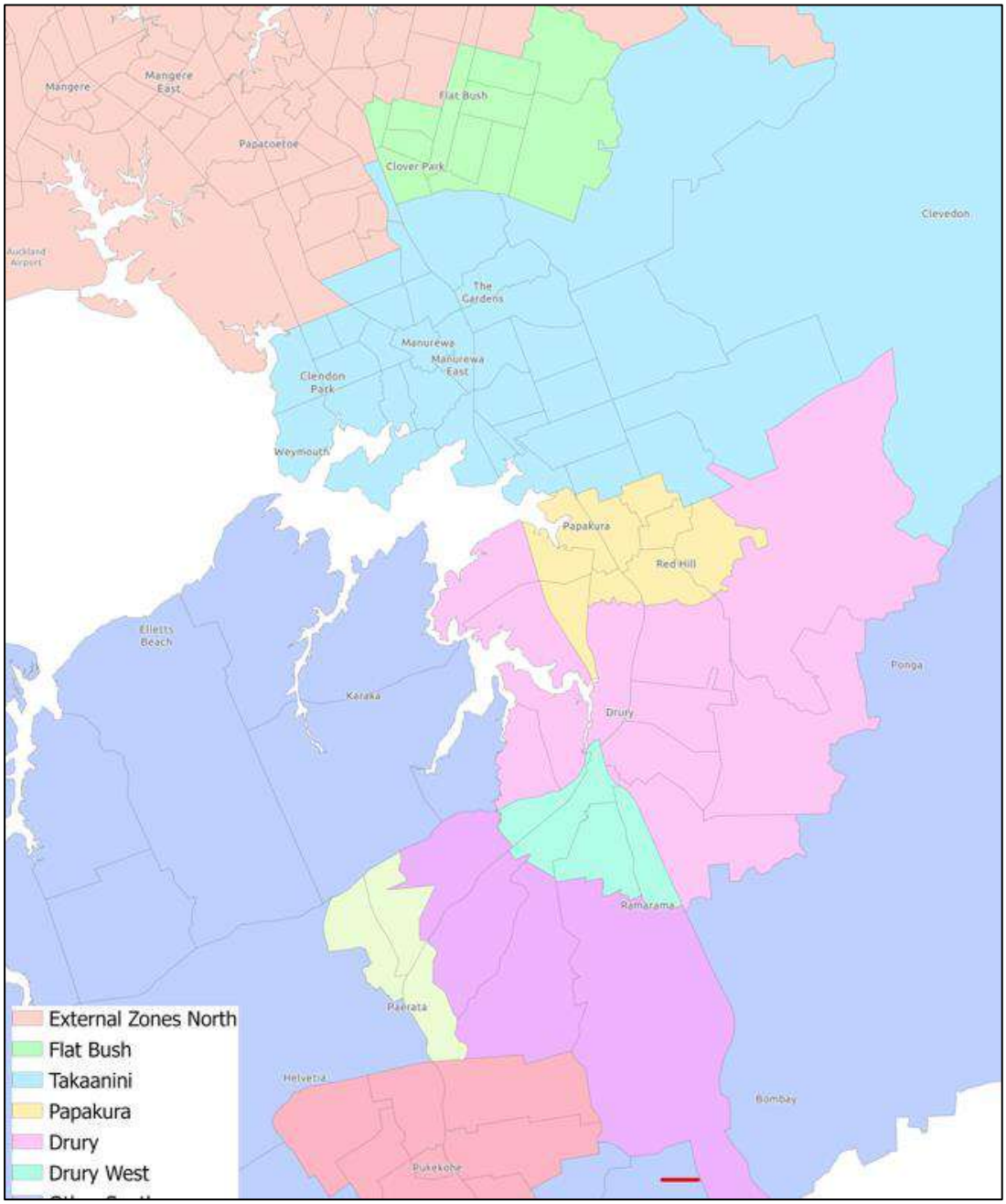

Figure 26 : Economics Sector Map (Internal Sectors Only)

1.1 Sector-to-Sector Traffic Benefits

The SATURN traffic model comprises of region from Manukau to the Pukekohe. The cordon volume from MSM is transferred into SATURN and all the zones north of Flat Bush and Takaanini as external North Zone. **Figure 27** shows the SATURN network with the blue triangles indicating the traffic model

boundary. The sector-to-sector analysis of traffic benefits derived from SATURN is shown in **Table 32**.

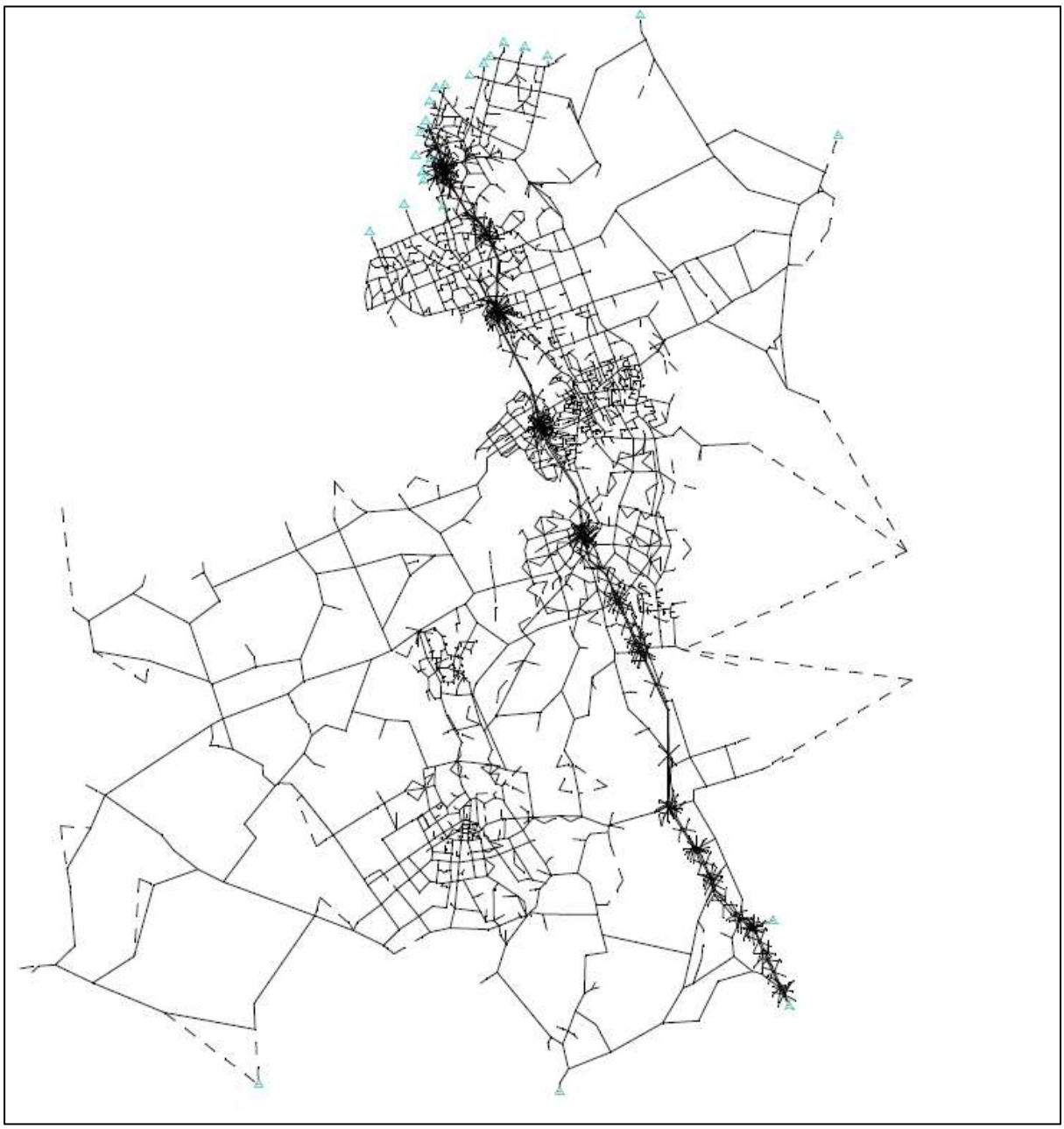

Figure 27 : Saturn Network

Table 32: SATURN Sector-sector Traffic Benefit (veh/hr) Analysis – Year 2048+ AM Peak

	External Zones North	Flat Bush	Takaanini	Papakura	Drury	Drury West	Other South	Paerata	Paerata Rural	Pukekohe	External South	Total
External Zones North	-6	-2	-1	0	-3	0	3	3	1	9	-3	**1**
Flat Bush	-1	0	0	0	0	0	0	0	0	0	0	**-1**
Takaanini	11	-1	-9	0	-1	0	1	1	0	4	0	**5**
Papakura	1	0	2	0	1	0	0	0	0	2	0	**7**
Drury	6	1	4	0	-7	0	5	6	3	10	1	**29**
Drury West	2	0	0	-1	5	-6	3	4	1	7	0	**17**
Other South	0	0	6	7	28	20	1	5	4	12	0	**84**
Paerata	41	2	27	7	55	17	33	37	14	109	8	**351**
Paerata Rural	3	0	1	1	6	10	3	3	1	5	1	**33**
Pukekohe	14	-1	6	5	23	15	18	26	11	56	8	**182**
External South	-27	0	-3	-1	-1	0	0	1	0	7	0	**-23**
Total	**45**	**-1**	**33**	**19**	**106**	**56**	**68**	**86**	**35**	**221**	**15**	**683**

There are small benefits between external zone trips. Around 90% of the benefits is accounted to come from urban arterial road type.

Transport Outcomes Report

Date Prepared: 14/04/2023

Appendix D - Pukekohe Transport Outcomes Report

Document Status

Responsibility	Name
Author	[redacted]
Reviewer	[redacted]
Approver	[redacted]

Revision Status

Version	Date	Reason for Issue
0.1	14 April 2023	Draft for Review
0.2	24 April 2023	Final Report
0.3		

Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand .Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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1 Introduction

1.1 Purpose and Scope of the Report

This Transport Outcomes report has been prepared by Te Tupu Ngātahi (the Supporting Growth Alliance) for the Pukekohe Detailed Business Case (Pukekohe DBC). Te Tupu Ngātahi is a collaboration between Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) to carry out the planning phase of the Te Tupu Ngātahi Programme (the Programme) (formerly known as the Transport for Future Urban Growth (TfUG) Programme).

Like the rest of the DBC, this report is targeted at informing a decision to proceed to Route Protection. This means it has a greater focus on flexibility and concepts rather than the more detailed analysis that could be expected for a project being prepared for imminent implementation.

This Transport Outcomes report:

- Provides an overview of the recommended network including the corridor form and function and intersection form and function.
- Details the transport outcomes including Key Performance Indicators (KPIs) of the recommended network for Pukekohe.
- Provides an overview of the key transport assessments undertaken to support the optioneering process for the Pukekohe recommended network including:
    - Land use assumptions
    - Transport network assumptions; and
    - Transport network analysis.

As identified, the focus of this report is the transportation outcomes of the recommended package, with a more detailed description of the option development and assessment process provided within **Appendix C** of the Pukekohe DBC in the Options Assessment Report.

1.2 Report Structure

The report has been split into several sections, covering the following:

Section 2 summarises the recommended network for the Pukekohe corridors.

Section 3 summarises the investment objectives identified for the Pukekohe corridors and the associated Key Performance Indicators (KPIs) set for each of these objectives. These KPIs subsequently measure how well the recommended network performs against the investment objectives.

Section 4 summarises the transport assessment undertaken to reach the recommended network.

2 Recommended Network

The following section outlines the recommended network for the Pukekohe DBC. The recommended transport network for the Pukekohe DBC consists of a system of interventions including local corridors and strategic network components. These components include upgrades to existing rural corridors and new urban corridors.

These interventions are in response to the planned growth within Pukekohe, Paerata and South Drury, where more than 55,000 people are expected to be living, along with 21,000 new homes and 9,000 new jobs. Further detail on the specific features of these interventions are provided in the following section.

Overall, it is considered that the Pukekohe recommended network provides a safe, reliable transport system that supports growth, offers sustainable travel choice and access to employment and social amenities.

2.1 South Wide Recommended Network

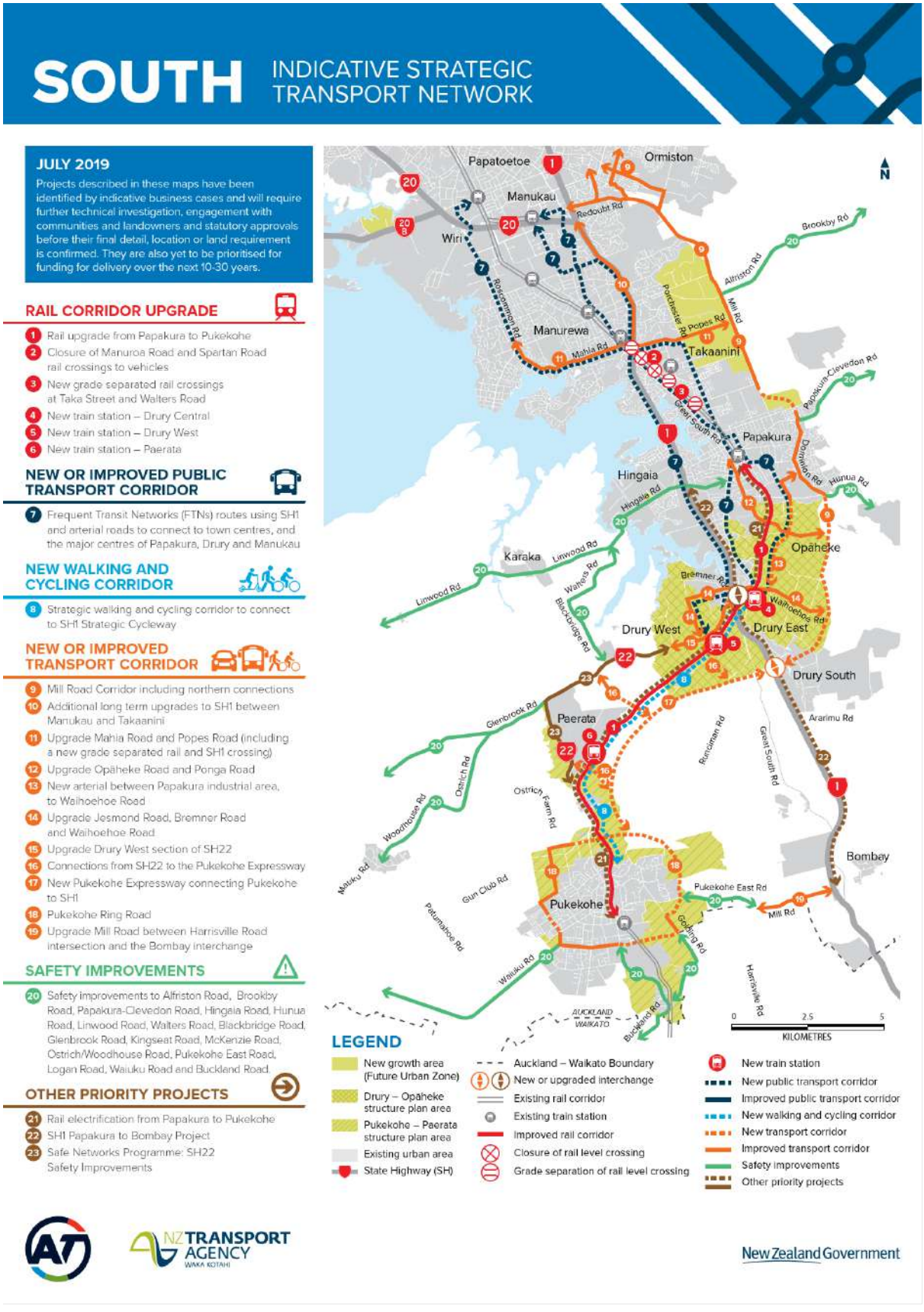
A series of Business Cases and public engagement (including corridors in Drury Package) have been undertaken over the past four years as part of a wider programme of transport initiatives needed to support the growth in this southern part of Auckland. These include:

- Transport for Future Urban Growth Programme Business Case (TfUG) (2016)
- South Indicative Business Case (IBC) (2018)
- Integrated Transport Assessment Report (2019)

The previous work identified these transport corridors for more detail analysis, which then lead to this assessment process and transportation evidence to reach the recommended network suitable for route protection.

The Pukekohe Package was developed as part of a wider programme of transport initiatives needed to support the growth in the southern part of Auckland. Those other projects have been designed to be complementary to the Pukekohe Package and operate as an integrated network as shown in Figure 2-1 below.

Figure 2-1 - South Auckland Indicative Strategic Transport Network

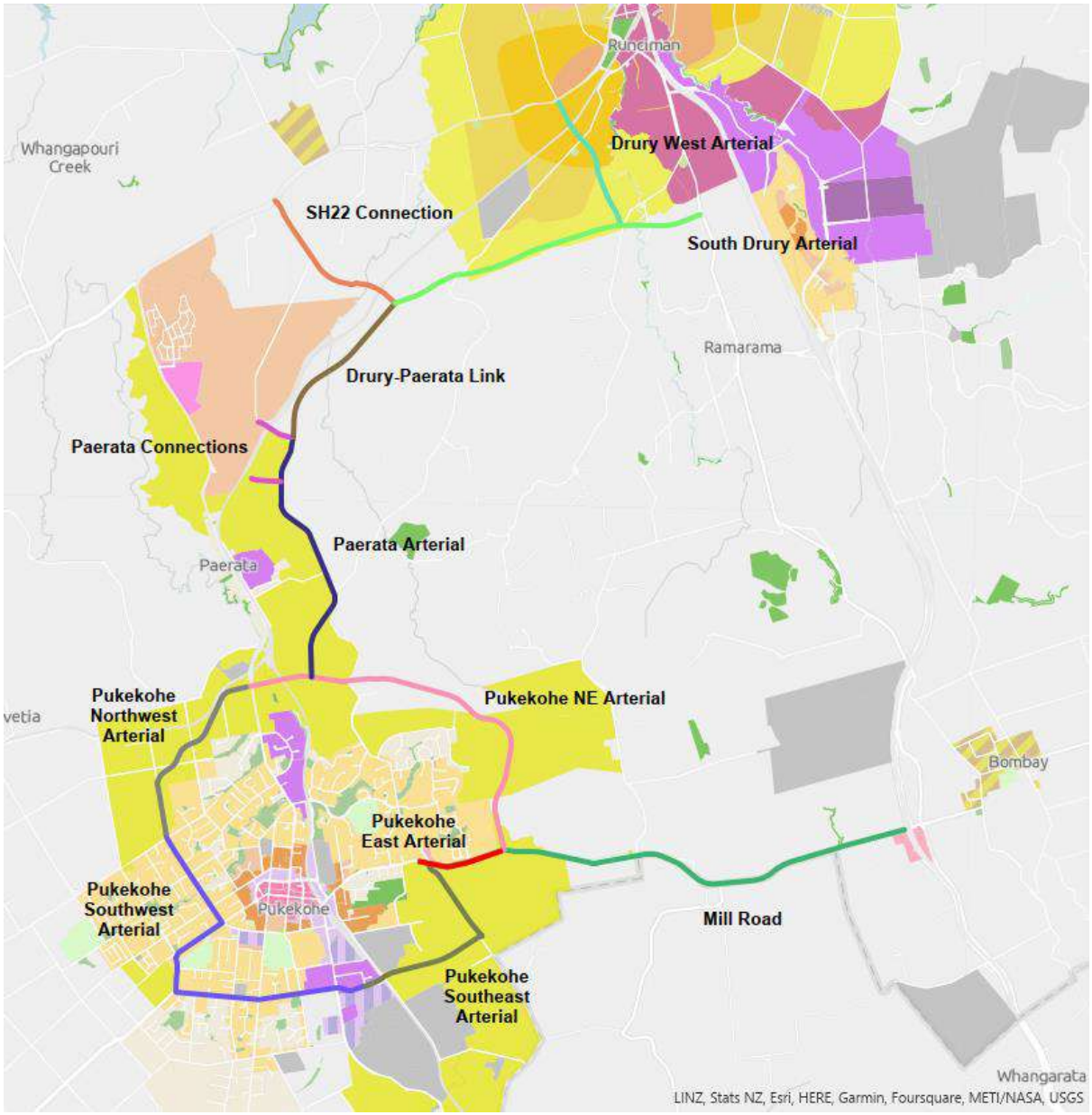


2.2 Pukekohe Transport Corridors

The recommended network was derived as an outcome of this network planning process and provides a safe, reliable network that supports growth, offers sustainable travel choice and access to employment and social amenities. The network and corridor planning have been based on the Objectives and desired outcomes, rather than a modelling-driven 'deficiency' analysis. With the focus on long-term route protection, the analysis has assumed and/or sought some flexibility tin the exact final form of the implemented project.

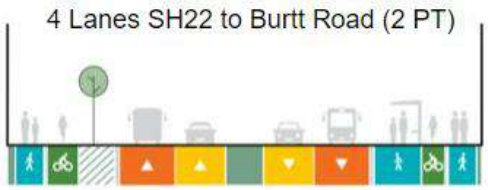
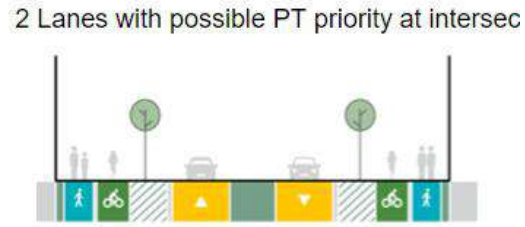
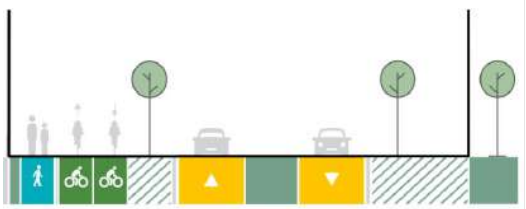
The corridors considered in the Pukekohe DBC are shown below in Figure 2-2.

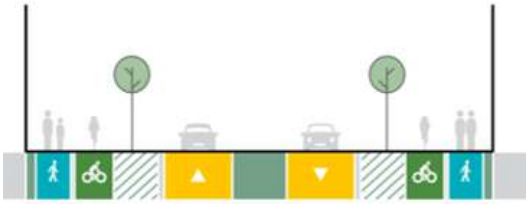
Figure 2-2 - Pukekohe DBC Corridors

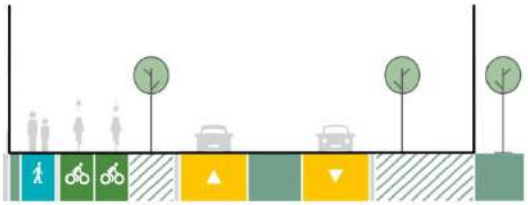
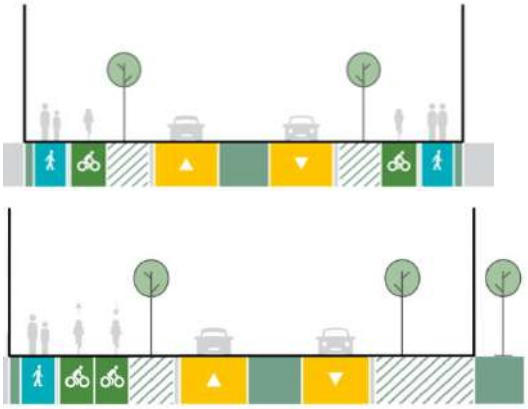


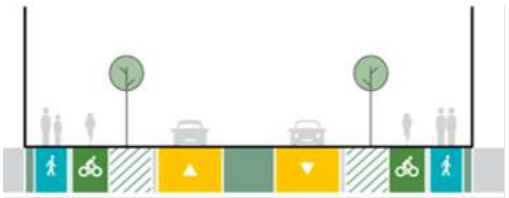
The detailed network elements for the recommended corridors including the corridor form and function are summarised as shown in Table 1 below, with a summary map illustrating this in Figure 2-3.

Table 1 – Network Features

Road Section	Network Features	
Drury West Arterial	• Drury West Arterial provides an arterial connection from SH22/Jesmond Road to the edge of FUZ, connecting to Drury West Town Centre, Drury West Rail Station and provide access to the strategic corridors (SH1, SH22) • **Section 1:** SH22 – Burtt Rd: 30m cross section, 2 lane general traffic, two lane PT, walking and cycling facilities on both sides • **Section 2:** South of Burtt Rd: 24m cross section, 2 lane general traffic, walking and cycling facilities on both sides • 50kph speed limit • 27 buses per hour (Jesmond Rd to rail line) and 9-11 buses per hour (from rail line to Runciman Road)	  **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
South Drury Arterial	• South Drury Arterial provides an arterial connection in Drury West. It is an east-west connection on the edge of the FUZ providing a strategic connection to Drury South Interchange and connecting Drury West with Paerata. • 24m cross section, 2 lane general traffic, walking and cycling on one side • 60 kph speed limit • 8-12 buses per hour (east of Drury West arterial), no buses planned west of Runciman Road • Level 2 freight route, connects to the regional freight corridor on SH1	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P1 -** Predominantly local function with a small catchment of users.
SH22 Connection	• SH22 Connection is a new north-south corridor connecting the future South Drury Arterial and Drury-Paerata Link. It crosses the rail line and provides a key connection between Drury West and Paerata. This connection also provides better travel options, with access to the	

Road Section	Network Features	
	strategic active mode corridor, improved local access between Drury West and Paerata and diverts strategic traffic away from SH22 and provides direct connectivity to Drury South Interchange and SH1. • 24m cross section, 2 lane general traffic, walking and cycling on one side with integration with SH22 • No buses planned on this corridor • 80 kph speed limit • Level 2 freight route	**Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P1 -** Predominantly local function with a small catchment of users.
Drury-Paerata Link	• Drury-Paerata Link is a new east-west corridor connecting the future South Drury Arterial, SH22 Connection and Paerata Arterials. • It improves the wider network connectivity, safety and resilience between Drury West and Pukekohe with a primary general traffic and freight function. • 24m cross section, 2 lane general traffic, walking and cycling on one side • 60-80 kph speed limit • Level 3 freight route	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P1 -** Predominantly local function with a small catchment of users.
Paerata Connection	• The Paerata Connections provides key connection to SH22, Sim Rd, Paerata station, Paerata Rise Development and Centres. It is also the primary east-west connection for all modes and crosses over the railway (NIMT). • 24m cross section, 2 lane general traffic, walking and cycling. • 50 kph speed limit • 8-12 buses per hour (priority at intersections)	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Paerata Arterial	• Paerata Arterial is the primary north-south corridor in Paerata. It connects Paerata Connections, Drury-Paerata Link, Pukekohe Northeast Arterial. It also provides a connection to SH22	

Road Section	Network Features	
	and the proposed new Paerata train station. • 24m cross section, 2 lane general traffic, walking and cycling. • 10-12 buses per hour, no priority at intersections • 50 kph speed limit • Level 3 freight route	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Pukekohe Northeast Arterial	• The Pukekohe Northeast Arterial is a ring road and arterial corridor from Pukekohe East Road to SH22. Its primary function is for general traffic, freight, an active mode links between neighbourhoods and alleviating traffic on Cape Hill and Valley Rd. • 24m cross section, 2 lane general traffic, walking and cycling. • No PT • 50-70 kph speed limit in urban areas (close to SH22), higher speed in rural sections • Level 3 freight route	 **Future Typology (North):** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area. **Future Typology (South):** • **M2 -** Medium strategic network significance with increasing volume of users. • **P1 -** Predominantly local function with a small catchment of users.
Pukekohe East Arterial	• Pukekohe East Arterial is an existing corridor from the north-eastern ring road to Belgium Road. It has a high east-west function for general traffic and freight but also needs to accommodate buses and active modes in future. • 24m cross section, 2 lane general traffic, walking and cycling on both sides • 10 buses per hour	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.

Road Section	Network Features	
	• 50 kph speed limit • Level 1B, strategic freight route	
Pukekohe Southeast Arterial	• Pukekohe Southeast Arterial is a and new and upgraded corridor connecting Pukekohe East Road to Nelson Street. It is also the primary east-west connection for all modes and crosses over the railway (NIMT). It has a moderate to high function for general traffic and freight but also needs to accommodate buses and active modes • 24m cross section, 2 lane general traffic, walking and cycling. • 10 buses per hour • 50 kph speed limit • Level 1B, strategic freight route connecting Pukekohe east Road to SW industrial areas. Level 2 freight route through the industrial areas.	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Pukekohe Southwest Arterial	• Pukekohe Southwest Arterial is a primary east-west and north-south road which helps in detracting general traffic and freight away from the town centre. Its primary function is for general traffic, freight, active modes and with buses in some sections. • Reduced 20m cross section, 2 lane general traffic, walking and cycling on both sides • 8-10 buses per hour on some sections • 50 kph speed limit • Level 3 freight route	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.
Pukekohe Northwest Arterial	• Pukekohe Northwest Arterial links SH22 and wider Pukekohe Northeast Arterial to the Pukekohe Southwest Arterial. It is also the primary northwest route for all modes in Pukekohe West. • 24m cross section, 2 lane general traffic, walking and cycling on both sides • 10-12 buses per hour • 50 kph speed limit • Level 3 freight route through FUZ areas. Level 2 freight route through the NW industrial areas.	 **Future Typology:** • **M2 -** Medium strategic network significance with increasing volume of users. • **P2 -** Attracts activity from across a subregion or neighbouring local board area.

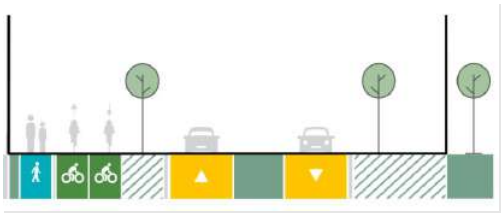
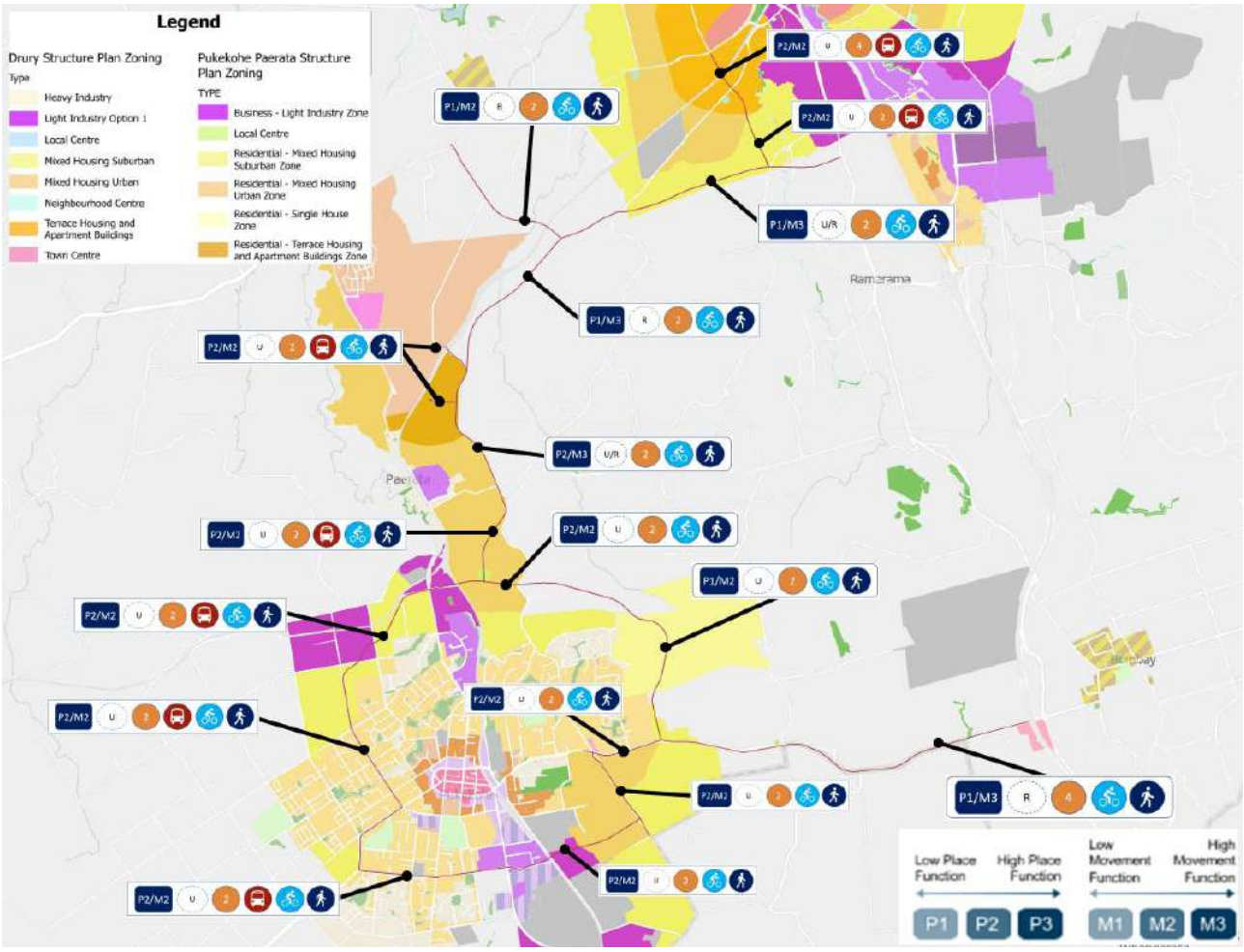
Road Section	Network Features	
Mill Road	• Mill Road (Pukekohe) forms a primary east-west connection from SH1 to Pukekohe future urban areas. This corridor is a strategic connection for traffic and freight, with an active mode connection. • 30m cross section, 4 General Traffic, walking and cycling on one side • 80 kph speed limit • Level 1B, strategic freight route connecting Pukekohe east Road to SH1 regional freight corridor.	 **Future Typology:** • **M3 -** High strategic significance with a high volume of users. • **P1 -** Predominantly local function with a small catchment of users.

Figure 2-3 RASF



2.3 Transport Intersections

The intersections on the proposed corridors are proposed to be upgraded to provide adequate capacity to accommodate the expected growth in transport demand and provide safe crossing facilities for all users. The proposed intersections are illustrated in Figure 2-4 below, along with the form and function and intersection performance summarised in

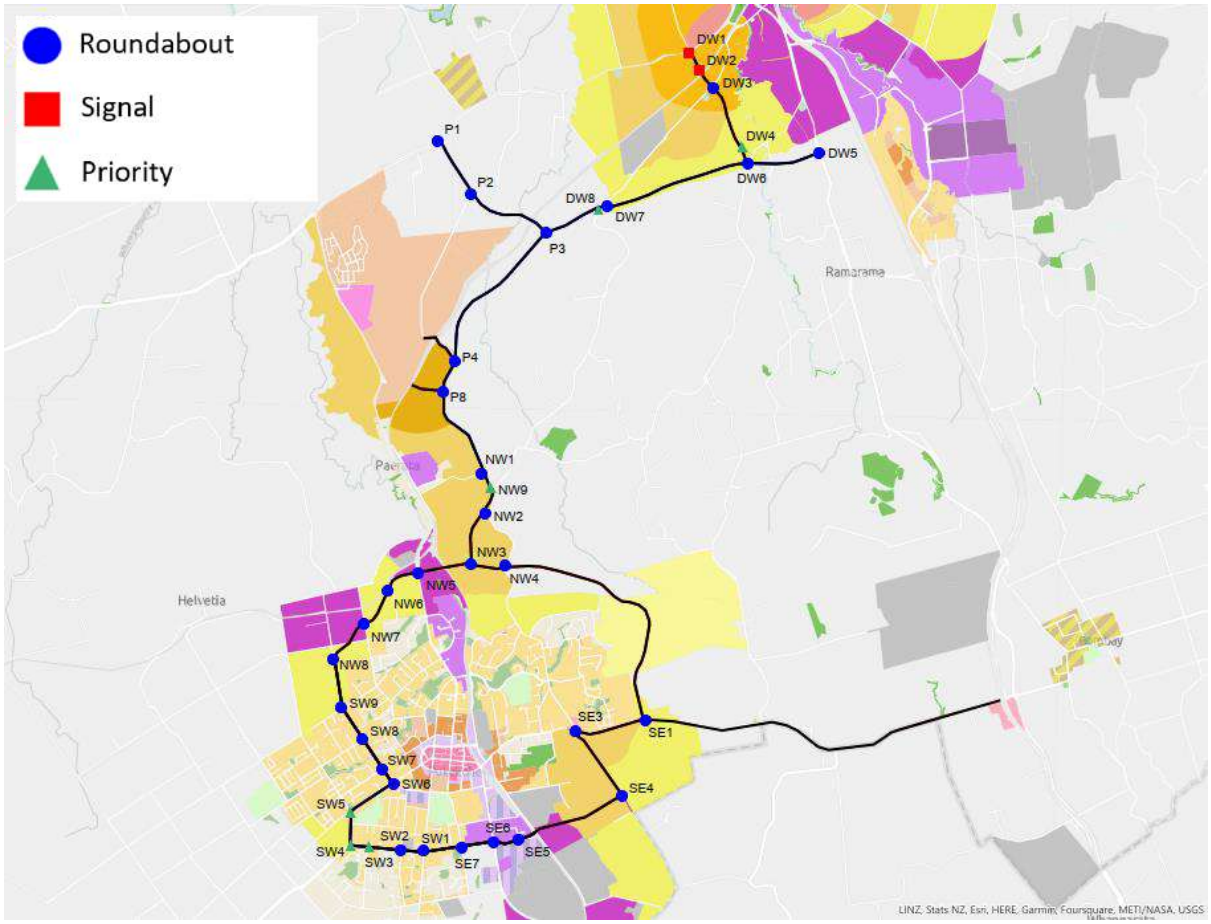


Table 2.

Figure 2-4 Pukekohe Package Intersections

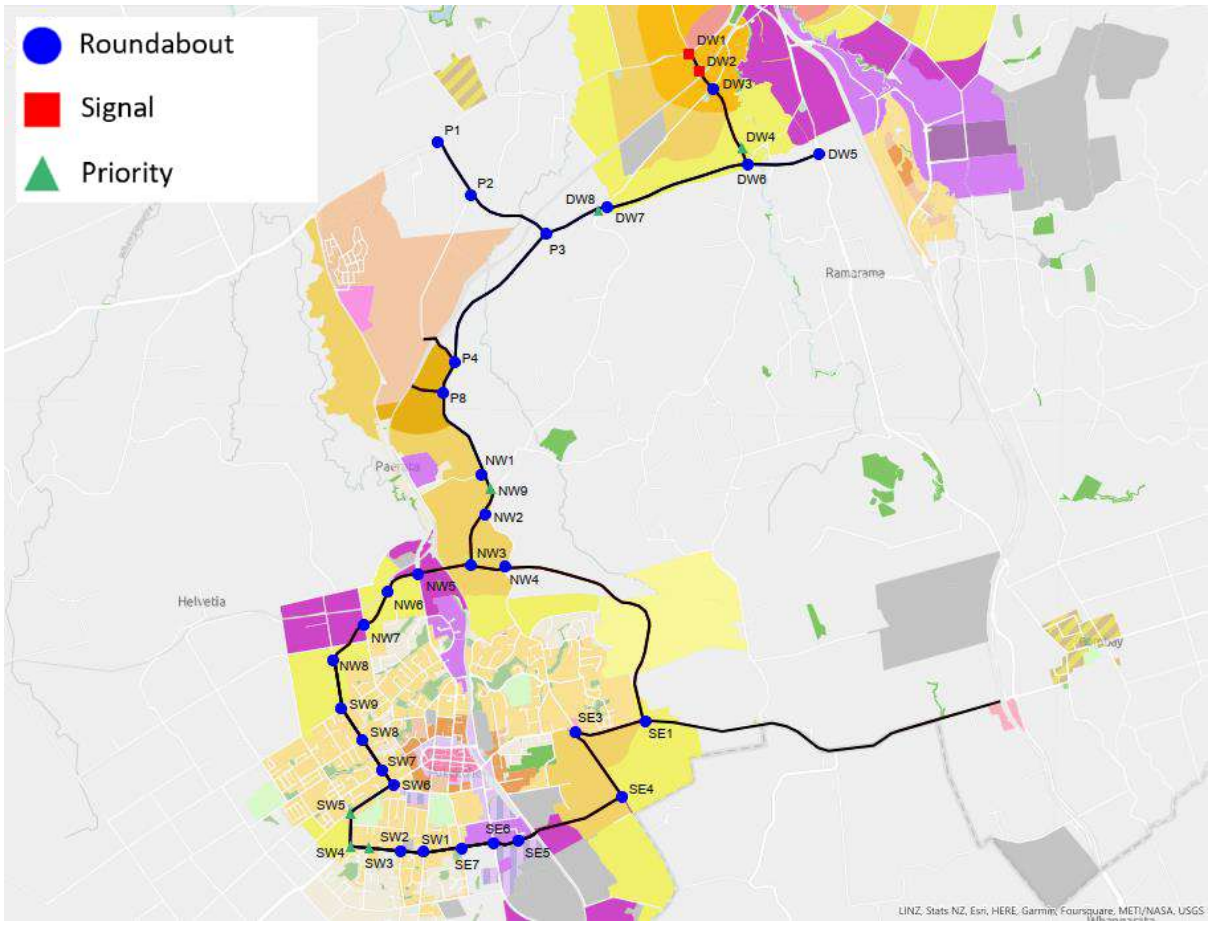


Table 2 - Intersection Forms

Intersection	ID	Current Form	Proposed Form	AM Peak Sidra Performance	PM Peak Sidra Performance
Southwest Pukekohe					
Queen St / Ward St / Nelson St	SW1	Roundabout	Roundabout	A	B
Wellington St / Ward St	SW2	Roundabout	Roundabout	A	A
Ward St / Green Lane	SW3	Priority	Priority	A	A
Puni Rd / Ward St	SW4	Priority	Priority	B	B
Pun Rd / West St / Jutland Rd / McNally Rd	SW5	Roundabout	Priority	B	B
West St / Helvetia Rd / Harris St	SW6	Roundabout	Roundabout	A	A
Helvetia Rd / Victoria St	SW7	Roundabout	Roundabout	A	A
Helvetia Rd / Princes St	SW8	Priority	Roundabout	A	A

Intersection	ID	Current Form	Proposed Form	AM Peak Sidra Performance	PM Peak Sidra Performance
Helvetia Rd / Birdwood Rd / Kauri Rd	SW9	Priority	Roundabout	A	A
Southeast Pukekohe					
Pukekohe East Rd / NE Arterial	SE1	N/A	Roundabout	A	A
Pukekohe East Rd / East St / Golding Rd / Belgium Rd	SE3	Roundabout	Roundabout	C	C
Golding Rd / Railway Link Rd	SE4	N/A	Roundabout	A	A
Manakau Rd / Nelson St / Svendsen Rd	SE5	Roundabout	Roundabout	B	B
Nelson St / John St	SE6	Roundabout	Roundabout	A	A
Pukekohe East Rd / Mill Road / Harrisville Rd	SE7	Priority	Roundabout	B	A
Northwest Pukekohe					
Tuhimata Rd / Burtt Rd / Sim Rd	NW1	Priority	Roundabout	B	A
Cape Hill Rd / Paerata Arterial	NW2	N/A	Roundabout	A	A
NE Arterial / Paerata Arterial	NW3	N/A	Roundabout	A	A
NE Arterial / Cape Hill Road	NW4	N/A	Roundabout	A	A
NE Arterial / Paerata Arterial / Paerata Rd	NW5	Priority	Roundabout	A	B
Paerata Arterial / Butcher Rd	NW6	N/A	Roundabout	A	A
Pukekohe Arterial / Beatty Rd	NW7	N/A	Roundabout	A	A
Pukekohe Arterial / Helvetia Rd / Gun Club Rd	NW8	N/A	Roundabout	A	A
Paerata					
Karaka Rd / Sim Rd	P1	Priority	Roundabout	B	A
SH22 Connection / Sim Road	P2	N/A	Roundabout	A	A
Drury Paerata Link / SH22 Connection	P3	N/A	Roundabout	B	A
Drury Paerata Link / Sim Road	P4	N/A	Roundabout	A	A

Intersection	ID	Current Form	Proposed Form	AM Peak Sidra Performance	PM Peak Sidra Performance
Paerata Station Accesses	P8	N/A	Roundabout	A	A
Drury West					
Karaka Rd / Jesmond Rd / Drury West Arterial	DW1	Priority	Traffic Signal	D	C
Drury West Arterial / Drury Station Access	DW2	N/A	Traffic Signal	B	B
Drury West Arterial / Burtt Rd	DW3	N/A	Roundabout	A	A
Drury West Arterial / Runciman Rd	DW4	N/A	Roundabout	A	A
South Drury Arterial / Great South Rd	DW5	N/A	Roundabout	A	A
South Drury Arterial / Drury West Arterial	DW6	N/A	Roundabout	A	A
South Drury Arterial / Burtt Road (North)	DW7	N/A	Roundabout	A	A

3 Investment Objectives and KPI's

The following section provides a breakdown of the performance of the Pukekohe Recommended Network against the Investment Objectives and subsequent KPIs.

The KPI measures compare a 'Do-minimum' transport network against the proposed Te Tupu Ngātahi projects in the recommended Pukekohe DBC network, using a full build out 2048+ scenario. The DBC has followed the principles of the Te Tupu Ngātahi programme wide approach for the definition of the Do Minimum. The Do Minimum is defined as the least effort to maintain the existing system, including maintenance and operation of the existing system. The 2048+ land use scenario was agreed with Auckland Council to be the most appropriate scenario for route protection purposes. This is not a specified date but reflects the full build-out (post 2048) of the currently planned development, which then informs the long-term infrastructure needs.

The proposed Pukekohe DBC projects and improvements have been identified in order to support growth in Pukekohe and unlock the future land use. In addition to these projects, there are several key strategic projects that integrate with this network including:

- SH1 upgrades from Drury to Bombay
- All Drury Arterial Packages
- Drury South interchange connection up to Great South Road
- Drury West station and access connection
- Paerata station and access connection

It should be noted that these projects have been including in both the 'Do Minimum' and '2048+'

modelling scenarios. The inclusion of the key inter-dependent strategic projects in the Do-minimum network is to account for the fact that those projects are being developed by Waka Kotahi, so are not included as part of the Te Tupu Ngātahi improvements package.

It is the combination of these projects and the proposed Te Tupu Ngātahi projects that will enable the key transport and land use integration outcomes for the Pukekohe community.

The following changes between the Do-minimum (Do-min) and recommended transport network (Recommended Option) are noted below:

- **Road Network**: The Do-minimum network includes the existing arterial and local road connections within and surrounding Pukekohe.
- **Active Mode Connections**: The connections present in the Do-minimum network include all existing / planned facilities.

3.1 Overall Pukekohe Outcomes

As detailed above, the Pukekohe Recommended Network has been developed within the context of a wider network, the following table reports on the overall outcomes of the entire system. The measures reported on are based on the complete network, with the complete build out of projected growth in Pukekohe.

The key investment objectives for the Pukekohe DBC have been identified as the following:

- Safety – provide a transport network that is safe for all users within and between Pukekohe, Paerata and Drury
- Access – enable access to economic and social opportunities by providing multi-modal corridors
- Integration - provide a transport network that appropriate balance between movement and place, and contributes toward well-functioning future urban environments
- Resilience – enable resilient freight and people movement to, from and within Pukekohe, Paerata and Drury
- Travel Choice and Climate Change – enable travel choice in Pukekohe, Paerata and Drury West by enhancing access to the existing rail network and providing a safe and attractive walking / cycling network

Table 3 below details the overall Pukekohe outcomes.

Table 3 - KPIs

KPI	Measure	Outcome	Commentary
Investment Objective 1: Safety			
User safety	DSI's	65 DSIs were recorded in the last 5-year period (2018-2022). However, with the expected growth in the area, the number of vehicles travelling on the road network will increase which may result in an increase in DSIs. To accommodate for this increased safety risk, the pressure on the network will be alleviated by additional connections and improved facilities to keep congestion on the corridors within and surrounding Pukekohe to a minimum. The crash benefits of the Pukekohe Package are **$23m** over 40-year analysis period, compared to the Do Minimum.	Considering the study area covers all of Pukekohe town centre and the supporting network west of SH1, 65 DSIs in a 5-year, It is anticipated that these occurrences could increase significantly because of population growth if adequate mitigation is not put in place. This risk can be significantly reduced by implementing the Pukekohe Package, which significantly improve safety for all users.
Active mode user safety	Active mode DSI's	14 Active mode DSIs in the last 5-year period (2019-2023). However, with the expected growth in the area exposure to risks for active mode users is expected to increase. To accommodate for this increased safety risk, safe and connected walking and cycling facilities will be provided on the majority of corridors in Pukekohe. 5 Active mode DSIs estimated to be saved per year, based on 50% reduction of crashes after implementation of the Pukekohe package.	While the number of previous active mode DSIs are notable, the conflict risk for these users will increase significantly in the future as there are more vehicles and active mode users on the network. This risk can be significantly reduced by providing dedicated facilities separated from traffic.
Perceived safety	KMs of new and improved cycle network achieving required QoS (from AT Statement of Intent 2018-21)	**30.6km** of new cycle network. This is 100% of the arterial network proposed by the Alliance.	Additionally, this KPI was measured on a per corridor basis (one-way along the corridor) • Drury West Arterial: 1.6km • South Drury Arterial: 3.7km • Drury-Paerata Link: 2.2km • SH22: 1.9km • Paerata Arterial: 3.5km • North East Arterial: 4.5km • Mill Road: 2.2km • Pukekohe East Arterial: 3.6km • Pukekohe Southeast

<table>
<tr><th>KPI</th><th>Measure</th><th>Outcome</th><th>Commentary</th></tr>
<tr><td></td><td></td><td></td><td>Arterial: 2.5km
• Pukekohe Southwest Arterial: 4.4km
• Pukekohe Northwest Arterial: 2.1km</td></tr>
<tr><td colspan="4">Investment Objective 2: Access</td></tr>
<tr><td>Access to jobs</td><td>Proportion of population living within travel threshold (15 and 30 mins) of jobs by active modes</td><td>The journey time via active modes within Pukekohe would typically range between 15 and 30 minutes. Accordingly, there journey times have been used for this measure.

In the recommended option, the number of jobs that can be accessed within 15 mins by active modes are 77,000 jobs (compared to 74,000 in the do-min option).

In the recommended option, the number of jobs that can be accessible within 30 mins by active modes are 151,000 jobs (compared to 137,000 in the do-min option).</td><td>The proportion of employment accessible by active modes increases in each of the time intervals assessed.

Within 15 mins the proportion of employment increases by 4% and in 30 mins there is an 10% increase in the recommended option compared to the do-min.</td></tr>
<tr><td>Network Performance</td><td>Vehicle kilometres travelled in peak congestion (>90% v/c) in AM peak</td><td><table><tr><th></th><th>Do Min</th><th>Recomm.</th></tr><tr><td>AM</td><td>101,554 vkt (14%)</td><td>81,811 vkt (11%)</td></tr><tr><td>IP</td><td>58,742 vkt (9%)</td><td>52,076 vkt (8%)</td></tr><tr><td>PM</td><td>115,019 vkt (14%)</td><td>90,475 vkt (11%)</td></tr></table></td><td>There is a 19% reduction of vehicle kilometres travelled in peak congestion (>90% v/c) in the AM peak in the Recommended Option.

There is an 11% reduction of vehicle kilometres travelled in peak congestion (>90% v/c) in the INTER peak in the Recommended Option.

There is an 21% reduction of vehicle kilometres travelled in peak congestion (>90% v/c) in the PM peak in the Recommended Option.</td></tr>
<tr><td>Network performance</td><td>Average freight journey time to SH1 Drury South interchange from the Industrial areas in North-West Pukekohe during the AM peak</td><td>Do-min Option
- 21.7 mins (southbound)
- 29.9 mins (northbound)
Recommended Option
- 14.2 mins (southbound)
- 16.9 mins (northbound)</td><td>The average travel time to SH1 Drury South interchange from the Industrial areas in North-West Pukekohe reduces by 35% for southbound traffic and 43% for northbound traffic in the recommended option.

This improvement allows for efficient and effective means of freight vehicles accessing Pukekohe industrial areas.</td></tr>
<tr><td>Network performance</td><td>Average freight journey time to SH1 Bombay interchange from the Industrial areas in South-East</td><td>Do-min Option
- 10.3 mins (westbound)
- 12.5 mins (eastbound)
Recommended Option
- 8.8 mins (westbound)</td><td>The average travel time to SH1 Bombay interchange from the Industrial areas in South-East Pukekohe reduces by 15% for westbound traffic and 30% for</td></tr>
</table>

KPI	Measure	Outcome	Commentary
	Pukekohe during the AM peak	- 8.8 mins (eastbound)	eastbound traffic in the recommended option. This improvement allows for efficient and effective means of freight vehicles accessing Pukekohe industrial areas.
Investment Objective 3: Integration			
Proximity to active mode network	% of HH with access to high-quality walking and cycling facilities (within 400m of a dedicated, separated active mode facility)	**Do-min Option** **16%** of households within the Pukekohe area are located within 400m of a dedicated, separated active mode facility. **Recommended Option** **31%** of households within the Pukekohe area are located within 400m of a dedicated, separated active mode facility.	Proximity to high-quality active mode facility increases by 15% with implementation of Pukekohe package. This is a notable improvement from the do-min option which only provides for an active mode corridor along the railway line.
Amenity of the street	KMs of new and improved transport network with enough space for street furniture/lighting and tree planting appropriate to the known place function and built form	**26.2km** of new urban street scape space, which is 86% of the Pukekohe arterial network proposed by the Alliance.	Additionally, this KPI was measured on a per corridor basis (one-way along the corridor): • Drury West Arterial: 1.6km • South Drury Arterial: 3.7km • Drury-Paerata Link: 2.2km • SH22: 1.9km • Paerata Arterial: 3.5km • North East Arterial: 4.5km • Mill Road: 2.2km • Pukekohe East Arterial: 3.6km • Pukekohe Southeast Arterial: 2.5km • Pukekohe Northwest Arterial: 2.1km
Investment Objective 4: Resilience			
Susceptibility to inundation	Kilometres of infrastructure susceptible to Q100 flooding	**26.2km** of the road network within Pukekohe achieves Q100 Flood level immunity. This helps support the overall sustainability and resilience goals of the Pukekohe transport network.	Additionally, this KPI was measured on a per corridor basis: • Drury West Arterial: 1.6km • South Drury Arterial: 3.7km • Drury-Paerata Link: 2.2km • SH22: 1.9km • Paerata Arterial: 3.5km • North East Arterial: 4.5km • Mill Road: 2.2km • Pukekohe East Arterial:

<table>
<tr><th>KPI</th><th>Measure</th><th>Outcome</th><th>Commentary</th></tr>
<tr><td></td><td></td><td></td><td>3.6km
• Pukekohe Southeast Arterial: 2.5km
• Pukekohe Northwest Arterial: 2.1km</td></tr>
<tr><td colspan="4">Investment Objective 5: Travel Choice</td></tr>
<tr><td>Mode share</td><td>% active mode share am peak</td><td>14% (5,336 trips) - Recommended Option
12% (4,780 trips) - Do-min Option</td><td>There is a 2% point increase from 12% to 14% in active mode trips in the Recommended option compared to the Do-min option.</td></tr>
<tr><td>Mode share</td><td>% car mode share am peak</td><td>64% (25,524 trips) - Recommended Option
65% (25,059 trips) - Do-min Option</td><td>There is a 0-1% point decrease from 65% to 64% in private vehicle trips in the Recommended option compared to the Do-min option.</td></tr>
<tr><td colspan="4">Investment Objective 6: Climate Change</td></tr>
<tr><td>Emissions</td><td>Absolute and per capita and per household transport emissions as a result of the project as measured by the VEPM model</td><td><table><tr><th>Emission</th><th>CO_2 -eq/t</th></tr><tr><td>Do-min (yearly-2048+)</td><td>380,726</td></tr><tr><td>Recommended (yearly-2048+)</td><td>377,954</td></tr></table></td><td>According to the VEPM model, there is a 2,772-tonne yearly reduction in CO_2 -eq/t emissions for the Pukekohe Recommended transport network in 2048+.</td></tr>
<tr><td>Total vehicle usage</td><td>Vehicle Kilometres Travelled (VKT)</td><td>The Recommended Option records 3,707,937,922 VKT yearly, compared to Do Minimum which records 3,723,384,163 – a yearly reduction of 15,446,241 VKT.</td><td>This VKT reduction is due to the improved connectivity for general vehicles and freight both within and surrounding Pukekohe for traffic that would otherwise be diverted to longer routes.</td></tr>
</table>

3.2 Aotearoa's New Zealand's First Emissions Reduction Plan

In addition to the above metrics, one of the key priorities of the current government is to reduce emissions over the next 15 years. This will help achieve the initial commitment of getting to net-zero emissions by 2050. This is outlined in New Zealand's very first emissions reduction plan.

Transport is one of the largest sources of greenhouse gas emissions, the sector is responsible for approximately 17% of gross domestic emissions and 39% of total domestic carbon dioxide emissions. The emissions reduction plan suggests three focus areas for reducing transport emissions, these include:

- Reducing reliance on cars and supporting people to walk, cycle and use public transport
- Rapidly adopt low-emission vehicles
- Beginning work to decarbonise heavy transport and freight

The outcomes sought by the Te Tupu Ngātahi and the Pukekohe recommended network directly impact the first focus area. This is achieved by improving urban form, travel choice and accessibility to improve transport options which all play a role in reducing VKT emissions. Within this focus area there are two key action areas outlined in the emissions reduction plan. These include:

- **Action 10.1.1 –** Integrate land-use planning, urban development and transport planning and investments to reduce transport emissions.
- **Action 10.1.2 –** Support people to walk, cycle and use public transport.

Further details of how these outcomes directly impact the first focus area are detailed in Table 4 below.

Table 4 - Outcomes of Recommended Network that Achieve Focus Areas

Emissions Reduction Plan Focus Area	Achievement
Action 10.1.1	• 30.6km of new and improved cycling facilities • 24% of households in Pukekohe will be within 400m of a high-quality, dedicated active mode facility in the 2048+ option. This will include upgrading existing corridors on the network with high-quality walking and cycling facilities and the development of new corridors on the network enabling the provision of active mode facilities within new growth areas.
Action 10.1.2	• 30.6km of new and improved cycling facilities • Within 15 mins, the proportion of employment accessible by active modes increases by 4% and within 30 mins there is an 10% increase between the 2048+ and Do-min Option. These increases can be attributed to the improvements outlined in Action 10.1.1 for active modes as part of the recommended transport network. Accordingly, the use of active modes becomes a viable option for residents commuting to local jobs in the 2048+ option. • The provision of dedicated active mode facilities on both new and existing corridors results in a 2% increase in active modes trips in the 2048+ option compared to the Do-min option.

4 Transport Analysis

The following transport analysis sets out the transport network planning undertaken to determine the recommended corridors and intersections.

4.1 Land Use Scenarios

This summary provides an overview of the land use scenarios and assumptions used to assess the transport network.

4.1.1 Land Use Assumptions

Land use data was the main input used to inform the expected growth in transport demand, which then informed the network planning. For network planning purposes, a 2048+ (full build-out of planned development) land use scenario was used to develop the recommended network, which reflects the needs for long-term transport infrastructure.

It is acknowledged that land use forecasts have inherent uncertainty, particularly in terms of the specific rate of new growth in specific areas. Currently, there is additional uncertainty around the likely outcomes and rate and location of higher-density development sought through central Government policies such as the National Policy Statement on Urban Development (NPS-UD) and Auckland Council's Plan Change 78.

A key intent of those policies is to enable higher density development, especially around high-quality public transport systems. The specific planning response to those policies is currently being progressed by Auckland Council, and revised land use forecasts reflecting any expected changes were not available at the time of preparing this assessment. Generally, it is considered that this Project is not inconsistent with such policy direction, regarding supporting higher density urban development via more sustainable travel modes. Given this context, the use of a full build out scenario forecasts is considered acceptable for this assessment.

Land Use Scenarios

- Unitary Plan Zoning
- Precinct Plans
- Council Plan Changes
- Council Structure Plans, such as the Paerata-Pukekohe Structure Plan
- Outcomes identified in the Auckland Plan, including for Homes and Places; Transport and Access; and Opportunity and Prosperity
- Strategic Framework used in Transport for Urban Growth (TfUG) (only applicable for areas with no Structure Plan)
- Master Planning by landowners through Private Plan Changes

Assessment Years

The development of the land use scenarios includes different analytical years to inform staging, economic assessments and the development of the recommended network. The different assessment years and their intended use are summarised below in Table 5.

Table 5 - Assessment Years

Assessment Year	Network Planning and Staging	Economic Assessments	Recommended Network
2016, 2028	✓	✓	✓
2038, 2048 (interim years)	✓✓✓	✓✓✓	✓
2048+ (full build out)	✓✓✓	✓✓✓	✓✓✓

relative significance low (√), relative significance high (√√√) and base year reference (*)

The different analytical years and their intended use can be summarised as follows:

- The 2016 land-use scenarios were used as a baseline to represent the base year transport context
- The interim land-use scenarios (2028, 2038 & 2048) were mainly used for network planning, staging and economic assessments.
- The 2048+ land-use scenario was agreed with Auckland Council to be the most appropriate scenario to be used for route protection purposes. This is not a specified date but reflects the full build-out (post 2048) of planned development, which then informs the long-term infrastructure needs.

The I-11 land use forecast series was agreed by Waka Kotahi (NZTA), AT and AC as the most appropriate land use scenarios to use. This also includes the interpretation of the Future Urban Land Supply Strategy (FULSS). The inputs include Stats NZ Medium growth population forecasts and detailed demographic trends, via 64 person-categories, 8 household categories, 6 employment types and 3 educational role categories.

Based on the I-11 land use forecast series, the Auckland Forecasting Centre (AFC) created each forecast scenario used by SGA for the interim and full build-out scenarios.

AFC created the forecasts for the IBC and DBC. These include the 2046+ (used in the IBC) and 2048+ (used in the DBC) datasets that include the full build-out in growth areas.

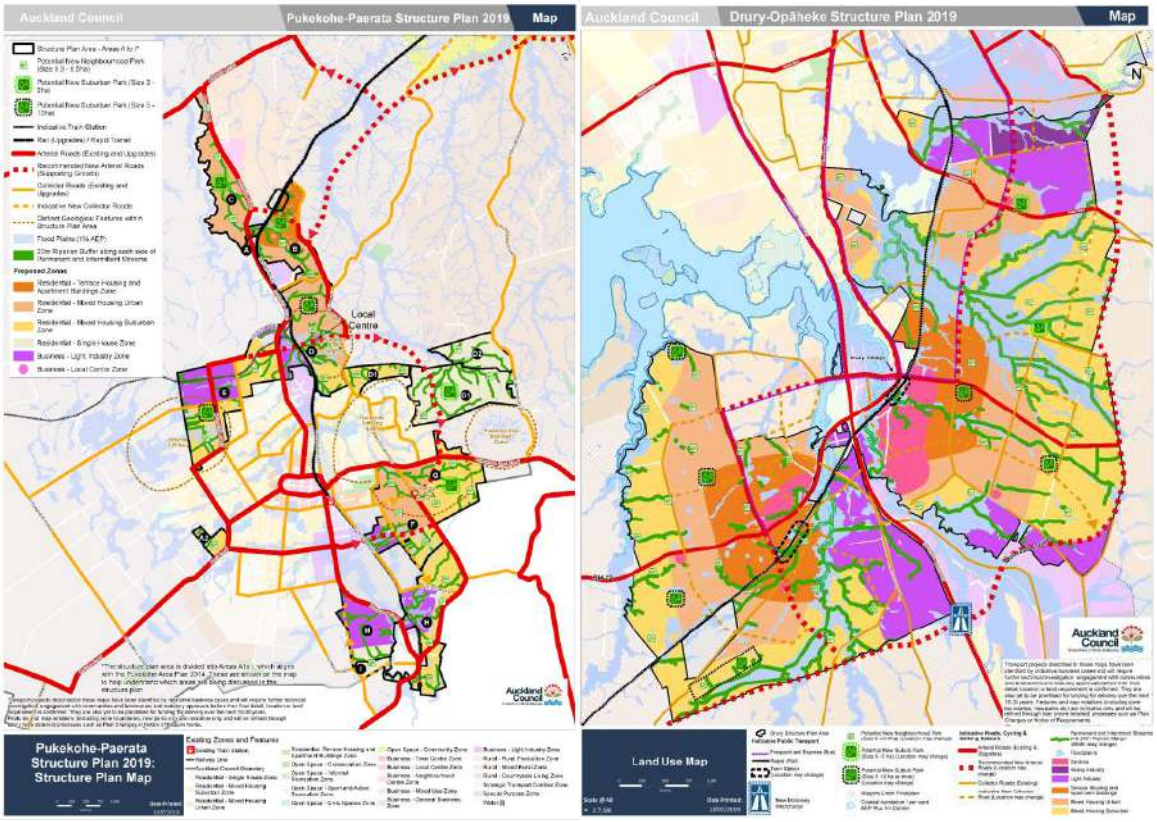
4.1.2 Transport Network Assumptions

The transport network assumptions detail the network planning inputs used to undertake the transport assessment. This includes a range of committed and planned transport projects expected to be built by 2048+ to reflect the cumulative effect of growth and wider transport infrastructure investment.

The Drury, Opaheke and Paerata areas in the south of Auckland have been signalled to undergo significant urban growth in the Auckland Unitary Plan (AUP) and Auckland Council have recently completed structure planning for this area, which includes planned transport projects.

The Pukekohe-Paerata Structure Plan and the Drury-Opaheke Structure Plan developed by Auckland Council in 2019 are shown in Figure 4-1, indicating both the expected pattern of urban development and the future transport projects (subject to planning and funding approvals) in the Pukekohe and Paerata area. Furthermore, there is also a range of regional projects either under construction or expect to be built by 2048+.

Figure 4-1 - Future Transport and Land Use in Pukekohe-Paerata and Drury Area



The future transport projects in southern growth areas are summarised in Table 6 below.

Table 6 Future Transport Projects within Southern Growth Areas

Package	Project
Rail DBC Package	Additional rail capacity between Pukekohe and Papakura (and associated grade separations at road/rail crossings)
	New rail stations at Drury Central, Drury West and Paerata
	Regional north-south cycle route between Drury and Pukekohe, with grade-separated active mode crossings of SH1 and NIMT
South Strategic DBC	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South
	FTN on Porchester / Mahia / Roscommon Roads and Great South Road from Drury to Manukau
SH1 Papakura-to-Bombay	Stage 1 of the P2B project includes an upgrade to the existing Drury interchange, which connects to and is interdependent with the SH22 upgrade project. The Interchange upgrade will also need to provide for proposed rail upgrades. There is also a direct inter-relationship with the Bremner Upgrade/FTN project, as P2B will necessitate an upgrade/replacement of the existing Bremner Road crossing of SH1.
SH22 Drury-to-Paerata (Safe Network Programme)	The Safe Network Programme is in the funding application process for short-term safety improvements in the SH22 area. Parts of this programme are being prioritised including a roundabout at the intersection of SH22 and Glenbrook

Package	Project
	Road, and the recently completed right-turn bay into Jesmond Road.
	Longer term upgrades on SH22 between SH1 and Oira Road are being looked at by SGA as part of this Drury Local package. These upgrades are proposed to improve safety, amenity and capacity along the route to enable urbanisation of the area and are envisaged to ultimately be supplemented by a new route in the long term (the proposed Pukekohe Arterials).
Drury Strategic Transport Network	State Highway 22 Arterial Upgrade (NoR D1)
	Jesmond to Waihoehoe East FTN Arterial upgrade (NoR D2)
	Waihoehoe Road East Arterial Upgrade (NoR D3)
	Opāheke North-South FTN Arterial (NoR D4)
	Ponga Road / Opāheke Road Arterial Upgrade (NoR D5)
Mill Road	Mill Road Corridor – a new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South (4 lanes with lower speeds)
Takaanini DBC Package	New FTN on GSR and other Takanini area road upgrades. This includes the grade-separation and/or closure of level crossing, urbanisation of Takanini Industrial areas, Takanini interchange upgrades.
Pukekohe General	Indicative New Collector Roads
	Crown Road closure
	Speed limit changes in Auckland

4.1.3 Transport Network Analysis

The following section describes the transport analysis undertaken to reach the recommended network for the Pukekohe DBC. This includes the network, corridor and intersection assessments undertaken, including:

- AT's Roads and Streets Framework (RASF)
- The Corridor Form Assessment Framework (CFAF)
- Cross-Section Design
- Intersection Form and Function.
- Intersection Design

Transport Modelling

Throughout the transport network analysis process, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system. These then inform decisions about planning transport network, corridors, and intersections.

The modelling methodology undertaken for the Pukekohe DBC options follows a typical hierarchical modelling structure and utilises a range of models as detailed below.

Strategic multi-modal model

- MSM is a regional multi-modal model for Auckland, which translates land use (such as population and employment) to travel patterns (which creates estimates of car, truck and public

transport movements) at a strategic and region-wide level.

SATURN model

- The SATURN model is a mesoscopic traffic model, which loads the forecasted vehicle trip patterns from MSM onto the road network to investigate the traffic effects at a more detailed level.

Active Modes model

- The AFC Strategic Active Modes Model (SAMM) provides strategic-level estimates of walking and cycling demands.
- Te Tupu Ngātahi active modes station access model, this tool is only used to provide estimates of walking and cycling to major stations.

Intersection modelling

- SIDRA modelling has been undertaken to assess the operational performance of key intersections along the project corridors. The demand was informed by the SATURN models.

Roads and Streets Framework (RASF)

The development of the corridor design has included the use of AT's Roads and Streets Framework (RASF), which qualitatively assesses the typology (movement and place value) and modal priority.

The intent of that framework is to classify the expected movement and place functions from a consistent regional context and identify the likely priority applied to each mode.

Each corridor within the Pukekohe DBC was assessed based on the following:

- **Place function** – for existing and long term 2048+
- **Movement function** – for existing and long term 2048+
- **Modal priority** – that reflects a 2048+ environment.

The framework itself does not directly dictate a specific corridor design but provides context and guidance regarding the intended function of the corridor. This in turn will be used to inform future development and operation of the corridor. A 'mandate' for each road corridor has been developed by Te Tupu Ngātahi and approved by the RASF Steering Group, comprising senior officers from Auckland Transport and Auckland Council.

RASF mandates were completed for corridors that fall under the jurisdiction of Auckland Transport.

Corridor Form Assessment Framework (CFAF)

The Corridor Form Assessment Framework (CFAF) has been designed by Te Tupu Ngātahi to provide a consistent methodology to define the desired corridor form and function requirements and ensure all modes are considered. The CFAF assessments were completed for all multi-modal corridors within the Pukekohe recommended network.

The CFAF output recommends traffic capacity, bus priority measures, walking and cycling facilities and other corridor elements which influence the corridor footprint. All modes are considered in the development of the cross-section, however facilities for all modes may not necessarily be provided. The resulting cross-section forms the basis for route protection for the corridor.

The form and function of a corridor is determined using a combination of 'place' and 'movement'

significance on the individual setting:

- **Place factors** consider the existing land use, future land use plans and trip generators present in the catchment area. It also includes an assessment of the future density of residential, industrial or mixed land use and local/regional trip attraction areas e.g. stations, schools, hospitals.
- **Movement factors** consider the hierarchy of the corridor in the regional road network (PT network, strategic freight network), modal priorities for the corridor and existing and future traffic volumes to determine the future typology and recommendations for a corridor function. Movement is considered at both local and network levels to ensure that duplication of facilities is avoided and the corridors have targeted modal functions.

Table 7 provides a summary of the inputs and outputs of the CFAF tool used during the assessment.

Table 7 - CFAF Inputs and Outputs

Inputs	Modelling Inputs Required	Parameters	Outputs	Impact on Modelling
Place and corridor function	No	Qualitative assessment based on the Roads and Streets Framework (RASF)	Determines the purpose of the route and feeds into wider modal priority assessment	N/A
Public transport	No	AT Remix File	Public transport priority	No
Walking and cycling	No	Te Tupu Ngātahi primary and secondary walking and cycling network used, based on urban design framework	Helps with geometric design, determining suitable paths and which sides to include the facility	Chosen facility type for different corridors coded into SAMM
General traffic	Yes	ADT volumes used, extracted from SATURN.	If PT priority needed, helps determine whether corridor is route protected for 2 or 4 lanes.	Number of lanes included in MSM, used for SATURN outputs
Freight	Yes	User Class 3 (heavy vehicles) divided by total of all user classes (all vehicles) to determine the percentage of freight. Data extracted from SATURN.	Informs role within wider freight network and whether specific freight measures are needed along corridor.	Yes
Speed Environment	No	Assumption based on RASF and future land use. Parameters for high and low speed based on the IBC design philosophy	High level assessment concludes a low speed of 50/60km/h or a high speed of 80km/h. These are the base assumptions for the speed, subject to vary through the DBC Optioneering process	Speed along each network included in MSM, used for SATURN outputs

Intersection Form and Function

In addition to the corridor form and function, an intersection form and function assessment has been undertaken to determine a suitable footprint required for route protection.

As part of network planning, decision-making for selecting the safest intersection controls is carefully

considered for each corridor on the Supporting Growth network.

The assessment of intersection form adopts a Safe System approach by recommending roundabouts as the first choice for intersections due to the safety benefits for road users resulting from slowing down through traffic and reducing the number of conflict points. Intersections are assessed against a range of site-specific factors and considers changes/ design features to meet the needs of different users safely and effectively.

The intersection form and function assessment undertaken was based on 2048+ network and land use assumptions to determine the following:

- Intersection type (roundabout or signalised) using SGA guidance to determine whether this would be a roundabout or a signal would be more appropriate route protection strategy
- Intersection size (determined by SiDRA modelling)
- Intersection design for route protection

For each intersection typology chosen, design features are also considered to ensure that the intersection meets the needs of different users safely and effectively and responds to the site-specific factors.

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Appendix E
Design Report
Pukekohe DBC

May 2023

Version 1.1

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

Document Status

Responsibility	Name
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Reviewer	[redacted]
Approver	[redacted]

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Acronym/Term	Description
AC	Auckland Council
AGRD	Austroads Guide to Road Design
AMC	Active Modes Corridor/Connection
ASD	Approach Sight Distance
AUP	Auckland Unitary Plan
AT	Auckland Transport
DBC	Detailed Business Case
LIDAR	Light Detection and Ranging
MSE	Mechanically Stabilised Earth
NIMT	Northern Island Main Trunk (Rail)
NZGD	New Zealand Geotechnical Database
NZTA / WK	Waka Kotahi New Zealand Transport Agency
NZTM	New Zealand Transverse Mercator
SGA	Te Tupu Ngātahi Supporting Growth Alliance
SMAF	Stormwater Management Area Flow
SSD	Stopping Sight Distance
TDM	Transport Design Manual

1 Introduction

This document has been prepared as Appendix H of the Pukekohe Detailed Business Case (DBC). It has been prepared to document the design development principles behind the concept designs within the Pukekohe transport network. The concept design is then used as a basis of designation setting as it provides the likely footprint of the new infrastructure.

The design report has been developed with technical inputs from a wide range of engineering design specialities including traffic, geometric, geotechnical, stormwater, urban design, road safety and structures.

The Pukekohe DBC identifies the construction of the transport network to support Pukekohe's forecast growth within the next 15 to 25 years. It is therefore anticipated the concept design contained in this document will be revised and reconfirmed at that time of implementation to reflect any changes in standards, planning conditions, network demands, and/or any other construction related matters.

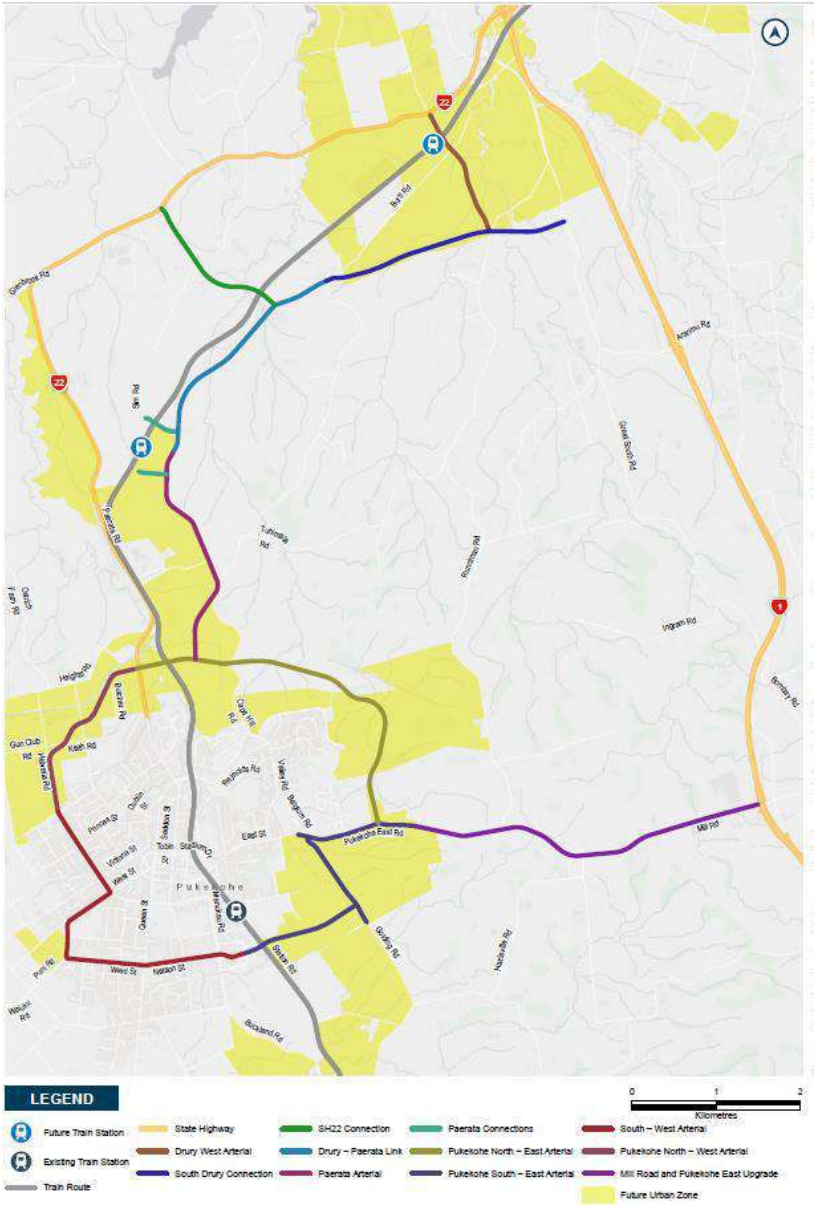


Figure 1-1: Pukekohe scope of works

2 Approach to design

Te Tupu Ngātahi Supporting Growth Alliance (the Alliance) has been established to provide route protection of strategic transport infrastructure to support the future growth of Auckland. As such, most of the projects within the Programme will not be constructed for several years, and it is anticipated that the preliminary design will need to be revised at that time to reflect the standards, transport demands, and requirements. Therefore, the design to support the option assessment process and the cost estimate will be limited to a level that supports the designation footprint, effects, and a number of generic assumptions will be made.

There are several design elements that will not be considered in the development of designs for both the concept and recommended option design development as they will not inform the assessment of effects. The design elements where there will be no specific design developed are as follows:

- Pavement design and road surfacing
- Street lighting
- Road safety barriers
- Utilities design
- Signs and line markings
- Traffic signal design
- Advanced Traffic Management Systems (ATMS) requirements
- Intelligent Traffic Systems (ITS)
- Landscape design, and
- Urban streetscape design features.

2.1 Interface with Other Projects

The Pukekohe programme of works have interfacing requirements imposed by the projects and developments listed in

Table 1 - Interfacing Projects

Project / Development Name	Interfacing Requirements
KiwiRail Drury West Railway Station Ngaakooroa – Transport Interchange and accessways Notice of Requirement	• Future connection with Drury West Ngaakooroa Rail Station
KiwiRail Paerata Station Designation	• Future connection with Paerata Rail Station
Kiwi Rail/ Auckland Transport NIMT 4 tracking and Active Modes Corridor (AMC)	• 4 tracking and AMC space allocation were taken into consideration when designing structures over the NIMT.
Paerata Rise – Grafton Downs development	• Interface with Sim to Sim Connection. The intent is for the new road to connect with Paerata Rise development

SH1 Papakura to Bombay Motorway Project	• Connection with Future Mill Road Bombay interchange improvements • Future connection with proposed Drury South Interchange at SH1 / Great South Road
SH22 Drury upgrade	• Tie in with Karaka Road (SH22) / Jesmond interchange and SH22 works near Sim Road

2.2 Topographical survey and aerial photography

2.2.1 Topographical survey

Light detection and ranging (LiDAR) is an optical remote-sensing technique that uses laser light to densely sample the surface of the earth, producing highly accurate x, y, z measurements. LiDAR data was provided by Land Information New Zealand (LINZ) and has been used to develop the preliminary design for the road corridors part of this package.

New Zealand Transverse Mercator (NZTM) projection is the coordinate system for the project. The vertical datum is named AUK46, obtained from Auckland Council.

2.2.2 Aerial photography

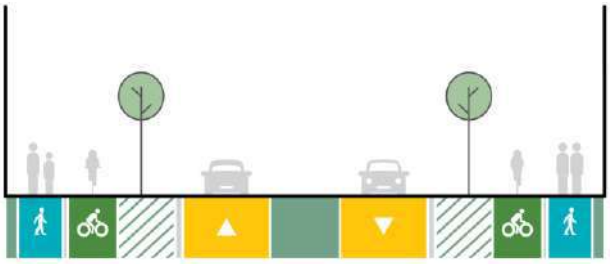
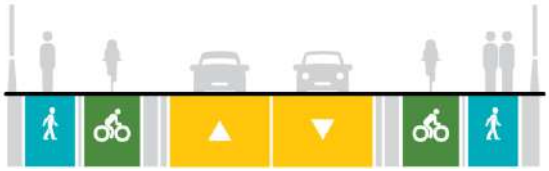
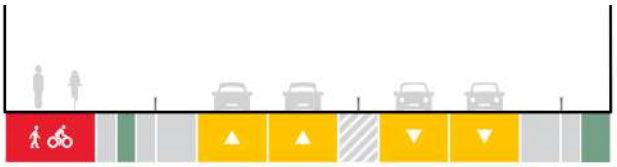
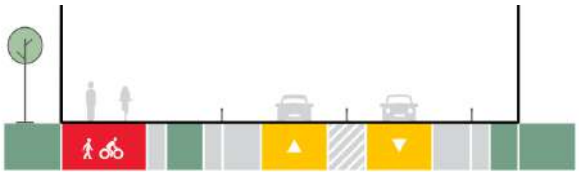
The aerial photography is provided by Nearmap Ltd at an image resolution of 6.0cm ground sampling distance (GSD). The orthophotography flown over the southern area twice yearly, imagery at present is from 2021 - 2022.

2.3 Corridor form and function

Table 2 provides a summary of the general form and function of the Pukekohe corridors. Alternative corridor cross sections used are outlined where relevant.

Table 2 Summary of the form and function

Road corridor	Typical cross section
Four lane arterial – 30m cross section	

Road corridor	Typical cross section
Two lane arterial – 24m cross section	
Two lane arterial bridge – 18m cross section	
Four lane high speed rural – 30m minimum cross section	
Two lane high speed rural – 24m minimum cross section	

2.4 Intersection Form and Function

Figure 2-1 provides a summary of the proposed intersection forms. Refer to the Appendix G Transport Outcomes Report within the Detailed Business Case for further details regarding intersection form and function of the corridor.

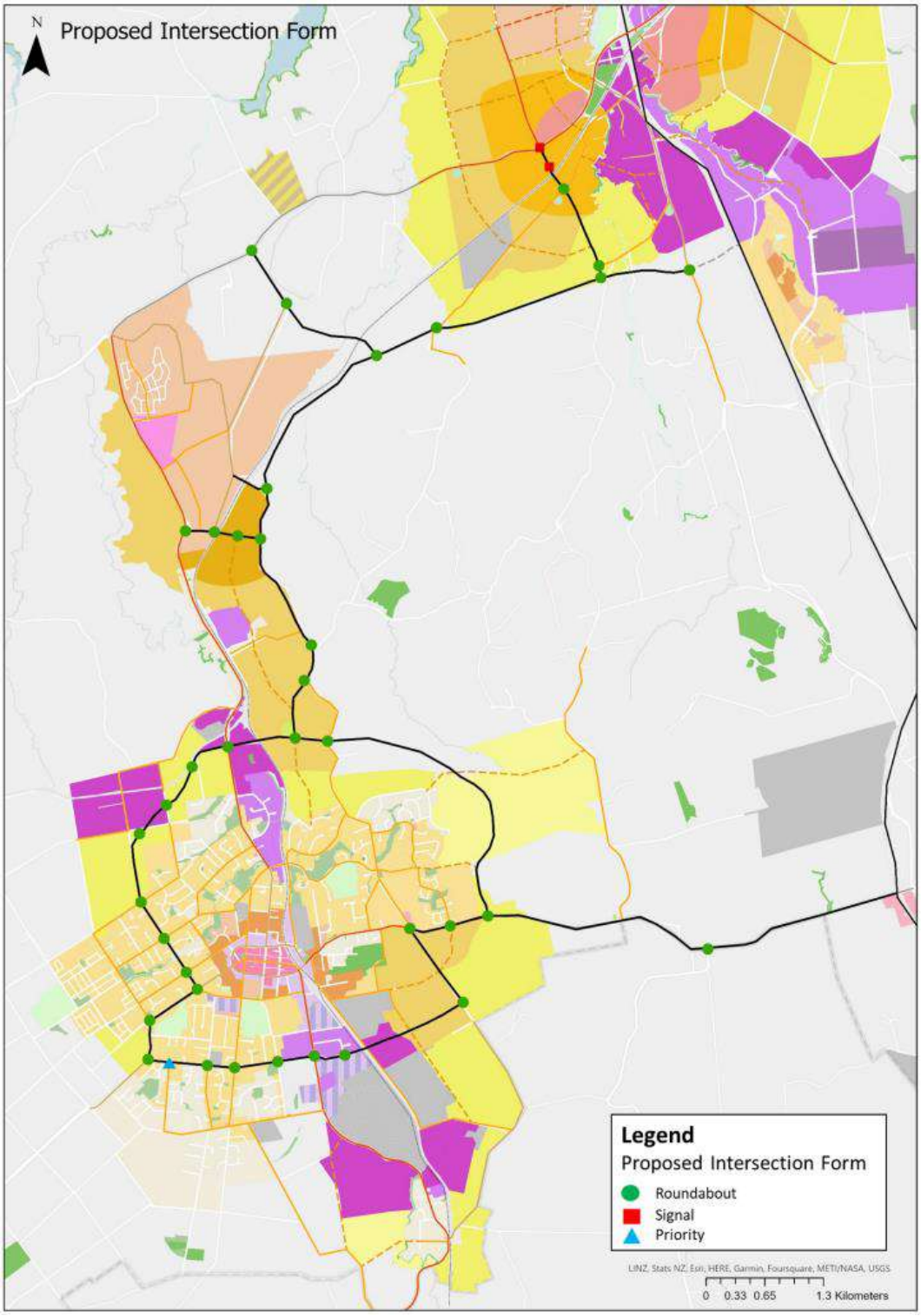


Figure 2-1: Pukekohe indicative intersection forms

2.5 Access and driveways

The need to restrict turn movements into accessways to left-in left-out varies and the design and designation allow flexibility for the exploration of different solutions as best suited for the location and land use, at a time when implementation is planned.

Specific design for regrading driveways has not been carried out for this preliminary level of design. However the effect on existing driveways has been assessed in conjunction with the proposed horizontal and vertical position of the road and road cross-sections. Adjustments to avoid significant impact to properties and driveways are accessed to comply with the TDM in the first instance. Where driveway compliance is not able to be achieved, this has generally resulted additional designation to provide required driveway grading.

2.6 Clearance Envelope

The following clearance envelopes have been taken into consideration when designing Pukekohe, as set out in Table 3.

Table 3 Clearance envelope

Items	Clearance envelope	Considerations
Road over Road	8m vertical clearance and horizontal clearance to accommodate existing road cross section	8m vertical clearance would accommodate an over dimension (OD) vehicle route
Road over stream	Bridge crossing – 3.0m vertical clearance (stream flood level to road surface)	Vertical clearance consisting of: • 1.2m freeboard to bridge structure soffit in accordance with bridge manual • 1.8m allowance for bridge structure
Road over rail	Absolute minimum horizontal clearance per Figure 2-2. 30m desirable minimum horizontal clearance 7.8m absolute minimum vertical clearance 8.0m desirable vertical clearance	Absolute minimum horizontal clearance varies to accommodate rail four tracking scenarios as shown below on Figure 2-2. Absolute minimum vertical clearance consisting of: • 5.5m rail vertical clearance, according to KiwiRail standards as shown below on Figure 2-2 • 0.2m rail height above sleepers/ballast • 2.1m for bridge superstructure (deck + beam) and surfacing

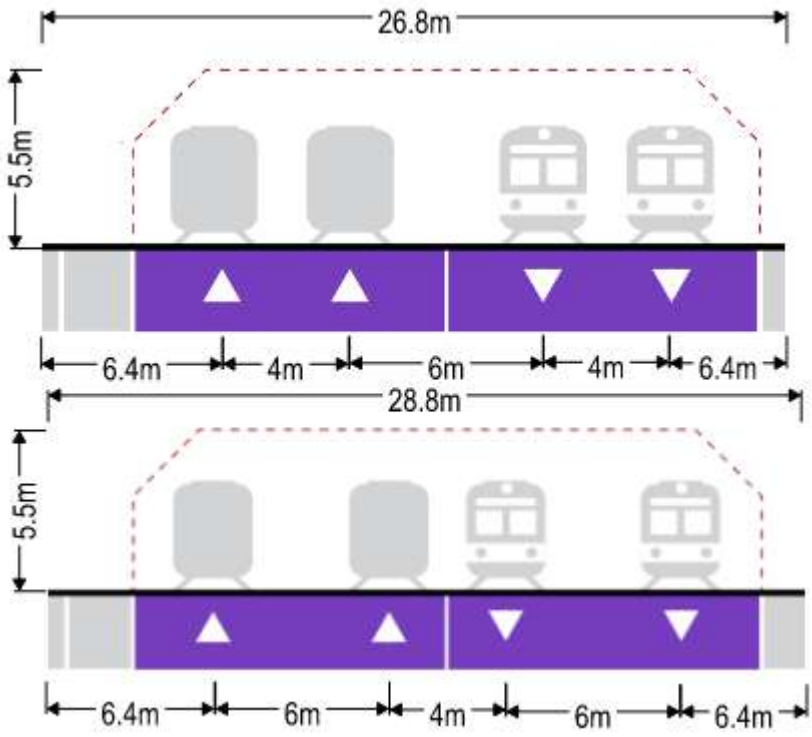


Figure 2-2 Absolute minimum clearance requirements for four-tracking, with two future tracks to one side of existing tracks (top) and a future track to either side of existing tracks (bottom).

2.6.1 Roading geometric design

Table 4 describes the general elements of the geometric design from a roading point of view.

Table 4 Approach to geometric design (general elements)

Design element	Approach to design	Comments
Cross section	As per section 2.3 of this report	
Clearance envelope	As per section 2.6 of this report	N/A
Accessway and driveways	As per section 2.5 of this report	N/A
Signalised intersections	Intersection form and stacking lanes details are as per Appendix C Transport Outcomes Report.	Splitter islands are to be added on the mainline corridor in a case by case scenario assessed by the designer.
Uncontrolled intersections	To utilise the existing geometry as much as possible.	N/A
Slope embankment and retaining walls	As per section 2.7 of this report.	• N/A

Table 5 describes the key elements of the geometric mid-block design at a 50km/hr posted speed.

Table 5 Approach to geometric design - 50kph

Design element	Approach to design	Comments
Posted Speed	50 km/hr	N/A
Design Speed	Horizontal – 50 km/hr Vertical – 60 km/hr*	As per TDM Geometric design *Excludes tie in with existing roads where Approach Sight Distance (ASD) minimum requirements for 50km/hr design speed
Horizontal alignment*	Minimum radius 120m for minimum curve length of 70m. This allows 3.0% adverse crossfall to be applied.	As per AGRD Part 3
Vertical alignment	Grade: • Desirable 5% • Maximum 8% Minimum crest curve: • K=11.8 Minimum sag curve: • K=6 Minimum length: • 40m	Maximum grade as per TDM without requiring specific treatment for pedestrian routes. Minimum crest curve and sag curve as per AGRD Part 3.
Single lane roundabout	ICD of 41m for single lane roundabout within existing urbanised area.	The typical section of an ICD of 41m consists of a 11m central island radius and 9.25m circulating carriageway width.
Multi lane roundabout	ICD of 55m for multilane lane roundabout within existing urbanised area.	The typical section of an ICD of 55m consists of a 13.2m central island radius and 14.3m circulating carriageway width.

Table 6 describes the key elements of the geometric mid-block design at a 60km/hr posted speed.

Table 6 Approach to geometric design (60kph)

Design element	Approach to design	Comments
Posted Speed	60 km/hr	N/A
Design Speed	Horizontal – 70 km/hr Vertical – 70 km/hr	As per TDM Geometric design
Horizontal alignment* *Excludes design specific to intersections and accessways	Minimum radius 200m for minimum curve length of 140m. This allows no greater than 5% superelevation to be applied and that a spiral is not required.	As per TDM Geometric design adverse crossfall not permitted on roads with design speed greater than 50 km/h. As per TDM Geometric design maximum super-elevation should be limited to 5% in areas where pedestrian movements are prevalent. As per SHGDM minimum radius of 280m for maximum superelevation application of 5%

Vertical alignment	Grade: • Desirable 5% • Maximum 8% Minimum crest curve: • K=19.1 Minimum sag curve: • K=13	Maximum grade as per TDM without requiring specific treatment for pedestrian routes. Minimum crest curve and sag curve as per AGRD Part 3.
Single lane roundabout	ICD of 55m for single lane roundabout within existing urbanised area / Future Urban Zone	The typical section of an ICD of 55m consists of a 18m central island radius and 9.25m circulating carriageway width.
Multi lane roundabout	ICD of 65m for multilane lane roundabout within existing urbanised area.	The typical section of an ICD of 65m consists of a 20m central island radius and 12.35m circulating carriageway width.

Table 7 describes the key elements of the geometric mid-block design at a 80km/hr posted speed.

Table 7 Approach to geometric design (80kph)

Design element	Approach to design	Comments
Posted Speed	80 km/hr	N/A
Design Speed	Horizontal – 90 km/hr Vertical – 90 km/hr	As per TDM Geometric design
Horizontal alignment* *Excludes design specific to intersections and accessways	Minimum radius 450m for minimum curve length of 230m. This allows no greater than 5% superelevation to be applied and that a spiral is not required. Exclusion is existing curves with radius <450m and superelevation > 5%.	As per TDM Geometric design adverse crossfall not permitted on roads with design speed greater than 50 km/h. As per TDM Geometric design maximum super-elevation should be limited to 5% in areas where pedestrian movements are prevalent. As per SHGDM minimum radius of 450m for maximum superelevation application of 5%
Vertical alignment	Grade: • Desirable 5% • Maximum 8% Minimum crest curve: • K=42.9 Minimum sag curve: • K=21	Maximum grade as per TDM without requiring specific treatment for pedestrian routes. Minimum crest curve and sag curve as per AGRD Part 3.
Single lane roundabout	ICD of 65m for single lane roundabout within existing rural area.	The typical section of an ICD of 65m consists of a 22m central island radius and 9.25m circulating carriageway width.

Multi lane roundabout	ICD of 73m for multilane lane roundabout within rural area.	The typical section of an ICD of 73m consists of a 24m central island radius and 12.35m circulating carriageway width.

2.7 Geotechnical design

2.7.1 Slope stability

No numerical analysis has been carried out in this phase of design, with assessment based on review of recent and historic investigation data. Stability of slopes has been assessed based on the mapped geomorphology, and the performance of similar geological areas.

1V:3H slopes have been adopted as the default batter for cut and fill slopes to meet maintenance requirements for most of the alignment. Within the Auckland region, similar slopes have been widely utilised successfully in soils that do not have known slope instability issues.

The exception to this is where the alignment crosses alluvial, or swamp deposits as shown on the geological map. In this scenario, embankment side slopes of 1V:4H have been adopted and not the general 1V:3H applicable for the remainder of the soils in the Pukekohe area. Alluvial deposits may be highly variable and incorporate soft layers, with a low bearing capacity and potential for toe failures; excess settlement is likely and liquefaction possible. The swamp deposits are expected to include peat and organic soils and their adverse characteristics are likely to be worse. Some soils with these adverse characteristics may be present in other associated deposits (eg fan deposits and, terrace deposits) but their extent is expected to be significantly less and persevering with 1v:3h embankment slopes is recommended.

2.7.2 Retaining walls

Vertical retaining walls have been placed where necessary to limit impact on properties and manage topographic constraints. Fill walls have been assumed to be constructed using generic mechanically stabilised earth techniques.

Given the limited geotechnical information available, the form of retaining walls has not been determined, with the most suitable wall types identified to inform the construction method statement and cost estimation.

Final decisions around wall type will be undertaken during subsequent design phases once further site investigation is carried out.

2.7.3 Bridge abutments

Vertical abutment walls have been adopted as the default approach to bridge abutments within the existing urbanised/industrial area. The vertical abutment walls have been assumed to be constructed using mechanically stabilised earth walls.

No specific design of abutment walls slope stability has been carried out during this phase of design.

2.8 Structures design

The following design standards have been referenced for this design:

- The NZTA: Bridge manual 3rd edition published, Revision 4
- The NZTA: Highway structures design guide 1st edition
- NZTA Research Report 364: Standard precast concrete bridge beams

Given the high-level nature of design input, the route protection philosophy is that no preliminary or detailed design is undertaken for the structures, but only concept form and function.

Bridge skew angles are limited to a maximum of 30 degrees relative to the service being crossed to maximise future design options. Typically, girder type and box type bridge decks are only suitable up to skews of 30 degrees.

Bridge Span Articulation definition is as follows:

- Single span bridges up to a maximum span of 35 m
- Multi-span bridges for spans in excess of 35 m, or as dictated by geometric constraints.

2.9 Stormwater Design and Flooding

Stormwater design includes four separate yet inter-related considerations:

- Stormwater runoff capture / conveyance system design,
- Treatment design (water quality mitigation),
- Water quantity design (hydrologic mitigation and attenuation) and
- Flood effect mitigation (peak flow increase and displacement effects).

Each of these stormwater design features are prescribed for management within Auckland Council Guidelines and/or required by the Unitary Plan - Operative in Part (AUP:OP).

The Auckland Design Manual, the Auckland Transport Design Manuals and the Unitary Plan are the key documents that govern the stormwater design approach. For road corridors under NZTA jurisdictions, relevant Waka Kotahi NZTA's design standards will be applied, including NZTA P46 Stormwater Specification.

In general, the key stormwater objectives are to provide stormwater treatment and retention/detention for new impervious surfaces, re-use and re-purpose existing infrastructure, enhance with green infrastructure and provide treatment of existing surfaces where possible, including where existing runoff mixes with new prioritising high loading areas such as intersections.

2.9.1 Stormwater runoff capture and conveyance

The Road Drainage chapter of the Auckland Transport Design Manual sets out the performance requirements for stormwater capture and conveyance systems for local roads in Auckland. The details of this system shall be developed and confirmed at the resource consent application phase of the project. The approach for each new road section will typically require a kerb and channel along the road edge with a concrete barrier at the bridge sections to intercept road runoff. The intercepted flow will be captured in catchpits and conveyed via a new piped network to a stormwater treatment,

detention, and attenuation system. Where swale conveyance is a suitable option, this approach has been taken instead of kerb and channel conveyance systems.

2.9.2 Stormwater treatment and hydrologic mitigation

Stormwater runoff is considered polluted when flowing from high vehicle use impervious areas. The Auckland Unitary Plan (AUP), chapter E9 considers the construction of roads, up to 5000m² of new impervious road area, as a permitted activity and treatment is required in accordance with Guidance Document 2017/001 Stormwater Management Devices in the Auckland Region (GD01). Raingardens/bioretention systems, planted or grassed swales, wetlands and proprietary cartridge treatment systems are common practice to meet this requirement.

In Pukekohe project, wetlands are the preferred stormwater treatment option. If wetland is not feasible due to space or flood plain constraint, treatment swales, proprietary SWMDs or linear SWMD (i.e. raingarden), will be used.

Hydrologic mitigation refers to the detention and slow release of stormwater runoff to prevent downstream erosion. The Auckland Unitary Plan E10 defines the approach detention as either SMAF1 or SMAF 2. SMAF is an acronym for Stormwater Management Area Flow and generally refers to control overlay in the unitary plan where the requirement is identified based on downstream environment sensitivity. However, AUP:OP chapter E8 contains a trigger for restricted discretionary activities that require SMAF 1 hydrologic mitigation regardless of being in the SMAF control overlay or not.

High-use road water quality treatment requirements and SMAF hydraulic mitigation requirements are considered when sizing wetlands for Pukekohe project.

2.9.3 Flood effect mitigation

Flood effects can arise by blocking overland flowpaths, adding new impervious area (reducing the soil storage capacity) and by displacing flood storage, typically by filling earth in the floodplain. Two approaches are available to assessing and mitigating flood effects:

1. Utilising the existing Auckland Council Flood model to calculate the effects and iterate a mitigation solution that could include, offset storage, culverts or both.
2. Providing a compensatory volume of 1m³ of fill in the floodplain equal to 1m³ of offset storage as compensation.

All earthworks in flooded regions are potential sources of flood effects and may require mitigation. Flood effects and mitigation is discussed in greater detail in the Flood Assessment of Environmental Effects (AEE).

3 Drury West Arterial

Table 8 describes the key elements of the Drury West Arterial design. Refer drawings SGA-DRG-STH-002-GE-1000 in Appendix E1 of this report for general arrangement plan.

Table 8 Drury West Road design

Design item	Comments
Posted speed	50kph
Cross section	Four lane arterial – 30m from SH22 / Jesmond Road intersection to Burtt Road Two lane arterial - 24m cross section from Burtt Road interchange
Horizontal alignment	• Minimum radius of 200m applied.
Vertical alignment	Grades: • 5% maximum • 0.5% minimum Transition curves: • Minimum Crest K-value of 12 • Minimum Sag K-value of 14
Intersections	• Karaka Road (SH22) / Jesmond Road • Tie in with NZUP SH22 Upgrade Intersection • Drury West Station • Tie in with Drury West Ngateoroa Station Rail Station Park N' Ride • Burtt Road • New roundabout to be provided
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. An exemption is 1V:4H embankment batters around the alluvial deposits (Ngakoroa stream) surrounding the 100m long bridge.
Bridge design	75m long new bridge over existing N.I.M.T rail line and future 4 tracking. 27m long new bridge over existing stream. 100m long new bridge over flood plain. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 3 wetlands are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

4 South Drury Arterial

Table 9 describes the key elements of the South Drury Arterial design. Refer drawings SGA-DRG-STH-002-GE-2200 and SGA-DRG-STH-002-GE-2300 in Appendix E1 of this report for general arrangement plan.

Table 9 South Drury Arterial Road design

Design item	Comments
Posted speed	50kph
Cross section	Two lane arterial - 24m two lane cross section as per Table 2.
Horizontal alignment	• Minimum radius of 300m applied.
Vertical alignment	Grades: • 5% maximum • 0.5% minimum Transition curves: • Crest K-value of 30 • Sag K-value of 25
Intersections	• New roundabout at Drury West / Runciman intersection • New Roundabout and T-intersection at South Drury / Burtt Road intersection
Embankment slope	Alluvial and swamp deposits predominantly underlie the alignment between the two new roundabouts. A 1V:4H embankment batter is recommended on these deposits and the surrounding area of the new 90 m bridge. The remainder of the soils in this region can follow the default design of 1V:3H.
Bridge design	65m long new bridge over existing stream. 90m long new bridge over existing stream. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 5 wetlands are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

5 SH22 Connection

Table 10 describes the key elements of the SH22 Connection design. Refer drawing SGA-DRG-STH-002-GE-2400 in Appendix E1 of this report for general arrangement plan.

Table 10 SH22 Connection design

Design item	Comments
Posted speed	80kph
Cross section	Two Lane high speed rural 24m cross section as per Table 2.
Horizontal alignment	Minimum radius of 450m applied.
Vertical alignment	Grades: • 5% maximum (except 50m length at 7.7% to match existing on Sim Road) • 0.5% minimum Transition curves: • Crest K-value of 42.9 • Sag K-value of 21
Intersections	• New roundabout at intersection with Sim Road • New roundabout at intersection with SH22 • New roundabout at intersection with Drury-Paerata Link Proposed Corridor
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The exemption is 1V:4H embankment batters around the alluvial deposits which surround the 80m long bridge.
Bridge design	80m long new bridge over existing stream. 35m long new bridge over existing N.I.M.T rail line and future 4 tracking. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater runoff capture and conveyance	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 2 wetlands and 3 treatment swales are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

6 Drury-Paerata Link

Table 11 describes the key elements of the Drury-Paerata Link design. Refer drawings SGA-DRG-STH-002-GE-2100 and SGA-DRG-STH-002-GE-2200 in Appendix E1 of this report for general arrangement plan.

Table 11 Drury-Paerata Link design

Design item	Comments
Posted speed	80kph
Cross section	Two Lane high speed rural 24m cross section as per Table 2.
Horizontal alignment	Minimum radius of 450m applied.
Vertical alignment	Grades: • 7.22% maximum • 1.25% minimum Transition curves: • Crest K-value of 25 (at approach to Burtt Road Intersection) • Sag K-value of 22
Intersections	• New roundabout at intersection with SH22 connection • New roundabout at intersection with Paerata Connections (Sim to Sim Connection corridor) and Sim Road (where Paerata Arterial commences)
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. 1V:4H embankment batters are suggested to the west of the roundabout at intersection with SH22, and some of the surrounding area to the 135m new bridge due to the alignment crossing over the Oira Creek which has alluvial deposits.
Bridge design	135m long new bridge over existing stream and flood plain. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 3 wetlands and 4 treatment swales are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

7 Paerata Arterial

Table 12 describes the key elements of the Drury-Paerata Link design. Refer drawings SGA-DRG-STH-002-GE-2000 and SGA-DRG-STH-002-GE-2100 in Appendix E1 of this report for general arrangement plan.

Table 12 Paerata Arterial Road design

Design item	Comments
Posted speed	50kph
Cross section	CH0 to CH650 (Intersection with Cape Hill Road) - Two Lane arterial 24m cross section as per Table 2. CH650 (Intersection with Cape Hill Road) to CH 3000 - Two Lane arterial 24m cross section with cross-section width re-allocated as shown below due to being located at the urban / rural edge 
Horizontal alignment	Minimum radius 120m.
Vertical alignment	Grades: • 5% maximum (excluding one 50m length 6-8%) • 0.9% minimum Transition curves: • Crest K-value of 8 • Sag K-value of 7
Intersections	• New roundabout at intersection with Paerata Connections (Sim to Sim Connection corridor) and start of Sim Road (where Drury-Paerata Link ends) • New roundabout at intersection with Paerata Connections (Paerata Rail Station Corridor) • Replace Tuhimata Road T-intersections with single four leg roundabout • New roundabout at intersection with Cape Hill Road
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. An exemption is 1V:4H embankment batters at the intersection with the Pukekohe North East Arterial due to the swamp deposits.
Bridge design	No bridges proposed for this corridor.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10.

Design item	Comments
	3 wetlands are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

8 Paerata Connections

Table 13 describes the key elements of the Paerata Connections design. Refer drawing SGA-DRG-STH-002-GE-3000 in Appendix E1 of this report for general arrangement plan.

Table 13 Paerata Connections Road design

Design item	Comments
Posted Speed	50kph
Cross section	Two lane arterial 24m cross section as per Table 2. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal alignment	Minimum radius of 120m.
Vertical alignment	Grades: • 8% maximum • 2% minimum Transition curves: • Crest K-value of 12 • Sag K-value of 6
Intersections	• New roundabout at intersection with Drury Paerata Link and start of Sim Road (where Paerata Arterial commences) • New roundabout at intersection with existing Sim Road (Paerata Arterial Corridor)
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H.
Bridge design	35m long new bridge over existing N.I.M.T rail line and future 4 tracking. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. Based on this, 2 wetlands are proposed and their design will be in accordance with AC GD01.

9 Pukekohe North-East Arterial

Table 14 describes the key elements of the Pukekohe North-East Arterial design. Refer drawings SGA-DRG-STH-002-GE-4000 and SGA-DRG-STH-002-GE-4100 in Appendix E1 of this report for general arrangement plan.

Table 14 Pukekohe North East Arterial design

Design item	Comments
Posted speed	50kph (CH0-1200) 6kph (CH1200-4400)
Cross section	Two lane arterial 24m cross section as per Table 2.
Horizontal alignment	Minimum radius of 225m.
Vertical alignment	Grades: • 7% maximum • 0.5% minimum Transition curves: • Crest K-value of 17 • Sag K-value of 16
Intersections	• New roundabout at intersection with Paerata Road (SH22) • New roundabout at intersection with Paerata Arterial • New roundabout at intersection with Cape Hill Road
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. 1V:4H embankment batters have been applied the area that ties in with Paerata Arterial due to the swamp deposits.
Bridge design	95m long new bridge over existing N.I.M.T rail line and future 4 tracking. 60m long new bridge over existing stream and flood plain. 47m long new bridge over existing stream and flood plain. 80m long new bridge over existing stream and flood plain. 60m long new bridge over existing stream and flood plain. 60m long new bridge over existing stream and flood plain. 95m long new bridge over existing stream and flood plain. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 2 wetlands are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the

Design item	Comments
	existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

10 Pukekohe South-East Arterial

Table 15 describes the key elements of the Pukekohe South-East Arterial design. Refer drawings SGA-DRG-STH-002-GE-5000 and SGA-DRG-STH-002-GE-5100 in Appendix E1 of this report for general arrangement plan.

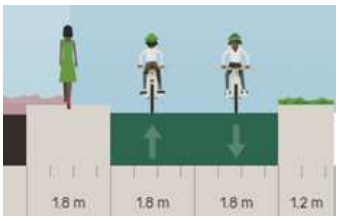
Table 15 Pukekohe South East Arterial design

Design item	Comments
Posted speed	50kph
Cross section	Two lane arterial 24m cross section as per Table 2.
Horizontal alignment	Minimum radius of 120m.
Vertical alignment	Grades: • 11% maximum (matching existing as agreed with AT) • 0.2% minimum (matching existing) Transition curves: • Crest K-value of 8 (matching existing as agreed with AT) • Sag K-value of 5 (matching existing as agreed with AT)
Intersections	• New roundabout at intersection with Svendsen Road / Crosbie Road / Wrightson Way • New roundabout at intersection with Golding Road • Upgraded roundabout at intersection of Golding Road / Pukekohe East Road • New roundabout at intersection of Pukekohe East Road and Pukekohe North-East Arterial
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The exemption is 1V:4H embankment batters around the channel of alluvial deposits which run parallel to the stream south of the Golding Road roundabout.
Bridge design	65m long new bridge over existing N.I.M.T rail line. Clearance envelope per Section 2.6 and structural design to comply with structural requirements Section 2.8.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 5 wetlands are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

11 Pukekohe South-West Arterial

Table 16 describes the key elements of the Pukekohe South-West design. Refer drawings SGA-DRG-STH-002-GE-6000 and SGA-DRG-STH-002-GE-6100 in Appendix E1 of this report for general arrangement plan.

Table 16 Pukekohe South-West Arterial Road design

Design item	Comments
Cross section	Cross-section as below to provide bi-directional cycleway and walking facility within existing urban environment.  As per Auckland Transport Technical Note Cycleway Delivery Scope and Design Standards (22/04/2022) • Berm can be reduced from 1.2m to absolute minimum of 0.6m • Cycling facility can be reduced from 3.6m to absolute minimum of 3m.
Horizontal alignment	Unchanged from existing
Vertical alignment	Unchanged from existing
Intersections	Unchanged from existing
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H.
Bridge design	No bridges proposed for this corridor.
Stormwater runoff capture and conveyance	The general solution for this design will be to intercept flow in the kerb and channel on either side of the road as it flows away from the road high point and into the existing stormwater pipe network. Where driveway grade away from the road, the new bi-directional cycleway and pedestrian footpath would also need to be graded away from the road (with a new stormwater collection system to tie into the existing stormwater pipe network). Refer image below.

Design item	Comments
Stormwater treatment	No route protection of stormwater wetlands for the new bi-directional cycleway and pedestrian footpath along the existing road corridors due to the uncertainty of the cycle facilities ever being built. From a stormwater perspective, looking at if only the intersections are upgraded / constructed to allow for change in form and safety upgrades. These areas are expected to have a hardstand area less than 5000m² and not located in a SMAF overlay, meaning hydrologic mitigation is not required. If hardstand are is greater than 5000m² it would be a restricted discretionary (RD) activity under the AUP:OP E8 (SMAF retention/detention will be required) and potentially need to comply with AUP:OP E36 (attenuate 1%AEP and 10% AEP).

12 Pukekohe North-West Arterial

Table 17 describes the key elements of the Pukekohe North-West Arterial design. Refer drawing SGA-DRG-STH-002-GE-7000 in Appendix E1 of this report for general arrangement plan.

Table 17 Pukekohe North-West Road design

Design item	Comments
Posted Speed	50kph
Cross section	Two lane arterial 24m cross section as per Table 2. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal alignment	Minimum radius of 150m.
Vertical alignment	Grades: • 5% maximum • 0.55% minimum Transition curves: • Crest K-value of 7 • Sag K-value of 7
Intersections	• New Heights Road / Gun Club Road T-intersection • New roundabout at intersection with Gun Club Road • New roundabout at intersection with Butcher Road
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The exception is 1V:4H embankment batter slopes on Helvetia Road which is underlain by alluvial deposits.
Bridge design	No bridges proposed for this corridor.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 3 wetlands are proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.
Flood effect mitigation	Flood mitigation will be assessed, and mitigation proposed at a more advanced design phase

13 Mill Road Upgrade

Table 18 describes the key elements of the Mill Road upgrade design. Refer drawings SGA-DRG-STH-002-GE-8000 and SGA-DRG-STH-002-GE-8100 in Appendix E1 of this report for general arrangement plan.

Table 18 Mill Road design

Design item	Comments
Posted speed	80kph
Cross section	Four lane high speed rural minimum 30m cross section as per Table 2. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal alignment	Minimum radius of 320m applied to match existing.
Vertical alignment	Grades: • 7% maximum • 0.5% minimum Transition curves: • Crest K-value of 20 (matching existing) • Sag K-value of 20 (matching existing)
Intersections	• New roundabout at intersection with Harrisville Road • Tie in with Bombay interchange
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The exception is 1V:4H embankment batter slopes at the eastern edge which is underlain by alluvial deposits of the Ngaakooroa Stream.
Bridge design	No bridges proposed for this corridor.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. Based on this, swales are proposed

14 Pukekohe East Road Upgrade

Table 19 describes the key elements of the Mill Road upgrade design. Refer drawings SGA-DRG-STH-002-GE-5100 and SGA-DRG-STH-002-GE-8000 in Appendix E1 of this report for general arrangement plan.

Table 19 Pukekohe East Road design

Design item	Comments
Posted speed	80kph
Cross section	The existing road will remain with wire rope provided and a new 4m wide shared path on the southern side separated by berm or stormwater swale
Horizontal alignment	Unchanged from existing
Vertical alignment	Unchanged from existing
Embankment slope	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H.
Bridge design	No bridges proposed for this corridor.
Stormwater	Water quality treatment, detention and SMAF hydrology mitigation is required by the Auckland Unitary Plan, Activity A7 of Chapter E9, Activity A5 of Chapter E8 and Activity A7 of Chapter E10. 1 swale is proposed and their design will be in accordance with Auckland Council GD01. The location of each wetland has been decided firstly by the geometric low points in the road longitudinal alignment. The wetlands are all placed on the downhill side of the road so the wetlands can outfall to a downstream point relative to the road location on the existing terrain slope. Each wetland is located such that floodplain, ecological features and important property features are avoided as much as possible.

Appendix E2 – Safety in Design (SiD)

Appendix E3 – Road Safety Audit Exemption

Road Safety Audit Exemption Form

NZ TRANSPORT AGENCY
WAKA KOTAHI

File reference	SGA-900-DBC-WPL-Road Safety Exemption Form
Project name	Supporting Growth Alliance (SGA)
Project stage	Detailed Business Case for Route Protection
RCA	Auckland Transport/ Waka Kotahi (NZ Transport Agency)

Brief project description and location:

The Supporting Growth Programme is a collaboration between Auckland Transport and Waka Kotahi NZ Transport Agency to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years. The programme includes numerous transport corridors proposed within the Auckland Region over a 30+ year timeframe

The scope of the SGA programme where Safety Audit Exemption is sought includes all transport corridors where construction funding is **not** being sought (i.e. a route protection designation only).

Exemption rationale:

The Supporting Growth Business Cases are being developed to enable a designation footprint to be identified for future projects, and the design effort has been limited to that which will inform the designation footprint and Assessment of Environmental Effects for designation (i.e. the deliverable is the designation boundary rather than the design itself). The footprint will include sufficient land requirement to allow for construction and this will provide flexibility for design development to be made in future. It is expected that the future design will achieve a safe system outcome which will align with AT's Vision Zero for Tamaki Makaurau, Unitary Plan and Road and Street Framework.

As pre-implementation and construction funding is not being sought from this business case, several typical design tasks (intersection tracking, drainage design, geotechnical investigation and topographical survey) are not being carried out at this stage. The primary objective of a road safety audit is to help ensure a project achieves an outcome consistent with Safer Journeys and the Safe System approach – that is, minimisation of death and serious injury. It is considered that there is insufficient development of the design to undertake a safety audit at this point in time. An 'Implementation Business Case' will subsequently be required at some time in the future when construction is imminent to identify and confirm funding. The design for this business case will incorporate the latest design principles and standards that are relevant at the time, and there is a high likelihood that these will differ from today's requirements. Therefore, a Concept (Stage 1) Safety Audit is not proposed for the current route protection process and will be deferred until the project is ready to progress to implementation. A Concept Safety Audit will be required at that time regardless of whether one is carried out now.

To adequately incorporate safety into our route protection business case, consultation with various AT's department to ensure adequate footprint is being secured. We will be applying the Safe System Assessment Framework to our programme and will also carry out a Safety in Design review during the pre-implementation design stage .

Declaration:

Having checked the above project with reference to the relevant procedures as laid down in Road Safety Audit Procedures for Projects - Guidelines, 2013, I consider that an independent road safety audit is not required for this stage subject to the following:

1. A Safety in Design Register is included in the Design Report
2. Safe System Principles to be applied to all design development and are documented in the design Report
3. A Concept (Stage 1) Safety Audit is undertaken for the subsequent Detailed Business Case required for implementation funding

Recommended by (Auckland Transport Owner Interface Manager):		**Endorsed by (Auckland Transport Safety Engineer):**	
Name	Alastair Lovell	Name	Irene Tse
Position	SGA Auckland Transport Owner Interface Manager	Position	Technical Lead Road Safety Engineering
Signature		Signature	
Date	28 August 2020	Date	28 August 2020
Recommended by (Waka Kotahi - NZ Transport Agency Owner Interface Manager):		**Endorsed by (Waka Kotahi -NZ Transport Agency Safety Engineer):**	
Name	Deepak Rama	Name	Shashi Lakshminarasimhaiah
Position	SGA Waka Kotahi Owner Interface Manager	Position	Senior Safety Engineer
Signature		Signature	
Date	28 August 2020	Date	17 August 2020

Appendix E4 - Geological map and historic geotechnical investigation logs (NZGD)

GEOLOGY OF THE PUKEKOHE AREA

DRAFT

Drury West
South Drury
SH22
Paerata Link
Paerata Connection
Paerata Arterial
Pukekohe North East Arterial
Pukekohe North West Arterial
Pukekohe South East Arterial
Pukekohe South West Arterial
Mill Rd Bombay Upgrade

0 0.5 1 2
Kilometers

LEGEND

RevA_Designs

RevA_Designations

LEGEND QMAP

Chenier shellbank deposits
Oyster mounds
Estuarine plain deposits
Beach deposits
Coastal terrace deposits
Swamp deposits
Landslide deposits
Alluvial deposits
Alluvial/colluvial fan deposits
Fluvial terrace deposits

TAKAANINI FORMATION (PQt) Poorly to moderately consolidated clastic fluvial, lacustrine, paralic, and shallow-marine deposits dominated by sand(stone) and mud(stone). Six lithofacies-based members are mapped locally at the surface:

The **Ardmore Member** (Qta) consists of organic matter-rich swamp deposits, including peat.

The **Curlew Member** consists predominantly of fine-grained sand, silt, and clay associated with estuarine plain and beach deposits (Htc) and coastal terrace deposits (Qtc).

The **Kepa Member** encompasses landslide deposits characterised by sheared and mixed masses of weathered rock, clay and soil, with highly variable grain-size, sorting and texture (Qtk). A Kepa Member landslide deposit occurring on a single underlying geological unit may be portrayed only with an overprint.

The **Ōtāhuhu Member** (Pto, Hto) consists of distinctly shelly, sand(stone) and mud(stone) deposited in estuarine to coastal settings.

The **Pahurehure Member** consists of gravel, silt, clay, and carbonaceous matter, in alluvial deposits (Htp) and alluvial fan and colluvial fan and fluvial terrace deposits (Qtp) with clast composition reflecting the local catchment geology.

The **Puketoka Gravel Member** (Ptg) is comprised of sandy or muddy gravel (conglomerate), with sand- and mud-dominated layers, minor organic material, and some shells. Gravel clasts include rock types not within present-day catchments.

Two lithofacies-based members are not mapped at the surface but have been identified in shallow drillholes in the area:

The **Hobsonville Member** encompasses undifferentiated silicic (pumiceous) ignimbrite, tephra, and deposits formed through their sedimentary reworking.

The **Runciman Member** consists of carbonaceous sand and mud including wood and leaf fragments deposited in fluvial, estuarine, lacustrine, and shallow-marine settings.

TAURANGA GROUP

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe
Appendix F: Urban Design Assessment

Memorandum

To:	Pukekohe Project Team
From:	[redacted]
Date:	January 2023
Subject	Pukekohe – Design Framework Review
File/Ref No.	Draft

This urban design evaluation has been prepared for the Pukekohe Detailed Business Case based on the guidance and principles established in the program wide document - Te Tupu Ngātahi Design Framework (Design Framework).

The Design Framework takes a systems-based approach as the basis on which urban areas are organised and understood and pulls these apart as a series of layers; environment, social, built form, movement and land use, and cultural and sustainability values underpinning and spanning across these. In this way transport networks are not seen in isolation rather in terms of how they can contribute to the urban system as a whole.

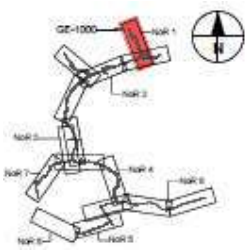
The Design Framework provides measurable guidance for outcomes-based decisions throughout each phase of the programme delivery including:

- Option development
- Option evaluation
- Detailed business case preparation, and
- The corridor protection and consenting process.

There are 20 design principles that have been established within these layers to provide high level guidance on the attributes of responsive, resilient, sustainable and high-quality urban environments. Each preferred option has been evaluated against these 20 programme wide design principles based on the current design detail (Rev A drawings). The record notes where an option is supportive of each of the design principles and where the option was assessed as being neutral or as an opportunity for development, this has been noted below as urban design recommendations that should be considered and developed in future design stages.

The intention of this evaluation is to provide a high-level urban design overview that considers the road and active mode alignments. The urban design commentary will also identify design opportunities and refinements that should be considered at subsequent stages of the design and help to form the basis of future urban design specific consent conditions.

1.1 Drury West Arterial



The proposed corridor is supportive of the following Design Framework principles:

Environment

- Support water conservation and enhance water quality in a watershed

Social

- Identity and place
- Adaptive corridors
- Social cohesion

Built Form

- Align corridors with density

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Prioritise active modes and public transport
- Support inter-regional connections and strategic infrastructure.
- Support legible function

Land Use

- Public transport directed and integrated into centres

Those principles that scored neutral in their support include:

Environment –

- **Support and enhance ecological bio corridors and biodiversity** – There are no SEAs near this corridor, and the design bridges over streams and riparian margins. Habitat has been identified by ecologist. Details of the ecological management strategy of the corridor is not fully resolved and should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.

- **Minimise land disturbance, conserve resources and materials**
  Earthworks are required to accommodate the corridor through the FUZ. Larger areas of earthworks are required to provide for the Runciman Road Intersection. These should be minimised where possible and provide for the ability for future development to respond to, and interface with, the corridor. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development.

- **Adapt to a changing climate and respond to the microclimatic factors of each area** – The corridor provides for active modes, and public transport where required. Space has been allocated for amenity measures and planting. Detailed design will need to provide for street

trees and planting. Need to provide further details and definition at future design stages of the proposed amenity planting and water sensitive design elements to demonstrate consideration of urban heat island effects in this future urbanized area.

- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater retention pond at a future design stage is recommended to provide an appropriate interface with the surrounding land uses. There are also opportunities to explore an integrated urban storm water strategy and stormwater treatment for the corridor to deliver an integrated water quality treatment system.

Social

- **Respect culturally significant sites and landscapes** – There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.

- **Safe Corridors -** The indicative cross section of the corridor has clear and legible zones for different modes. Detailed design will need to address CPTED and establish a positive interface with adjacent land use. Safe mid-block crossings that prioritise movements for pedestrians and cyclists will need to be identified and included as part of future detailed design.

Built Form

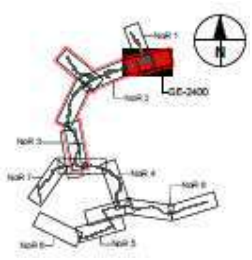
- **Corridor scaled to the surrounding context and urban structure –** The corridor width changes in response to anticipated demand. The corridor has space to provide for corridor amenity and integrate with future land use. An urban integration strategy should be developed to address interface issues with future land use as the area develops.

- **Facilitate an appropriate interface between place and movement –** An urban integration strategy should be developed to coordinate with landowners in future stages to address interface issues and areas of localized fill and cut batters. This will enable an appropriate interface with adjacent land uses that will provide for active edge permeability and enable local access and connectivity to be achieved, particularly any areas of higher density housing.

The following principles were identified as not relevant to the public transport interchange:

- Strategic corridors as urban edges

1.2 South Drury Arterial (Drury West – Great South Road Connection)



The proposed corridor is supportive of the following Design Framework principles:

Environment

- Support water conservation and enhance water quality in a watershed

Social

- Identity and place
- Adaptive corridors
- Social cohesion

Movement

- Connect nodes – the corridor provides a connection through to the DW station via Drury West Arterial from the rural hinterland to the south.
- Connect modes
- Support access to employment and industry
- Support inter-regional connections and strategic infrastructure.

Land Use

- Strategic corridors as urban edges

Those principles that scored neutral in their support include:

Environment –

- **Support and enhance ecological bio corridors and biodiversity** – There are no SEAs near this corridor, and the design bridges over streams and riparian margins. Habitat has been identified by ecologist. Details of the ecological management strategy of the corridor is not fully resolved and should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.
- **Minimise land disturbance, conserve resources and materials -** Earthworks are required to accommodate the corridor over flood plains, with larger area of fill required to bridge over the Ngakoroa Stream stream in this location. Explore opportunities as part of future refinement to reduce the size and scale of these earthworks to reduce land disturbance. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development on the northern side. This part of the corridor will define the urban edge of the FUZ before moving into the rural zone.
- **Adapt to a changing climate and respond to the microclimatic factors of each area** – The corridor provides for active modes. Space has been allocated for amenity measures and planting. Detailed design will need to provide for street trees and planting. Need to provide further details and definition at future design stages of the proposed amenity planting and water sensitive design elements to demonstrate consideration of urban heat island effects in this future urbanized area.

- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater retention pond at a future design stage is recommended to provide an appropriate interface with the surrounding land uses.

Social

- **Respect culturally significant sites and landscapes** – There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.
- **Safe Corridors -** The indicative cross section of the corridor has clear and legible zones for different modes. Given the lack of interface, there will be minimal opportunities to establish positive CPTED outcomes with relation to adjacent land use. The need for midblock crossings can be minimised by moving the active mode facilities to the northern side of the corridor adjacent to the FUZ.

Built Form

- **Corridor scaled to the surrounding context and urban structure –** The corridor width in this segment is two-lanes and scaled for the peri-urban context. The corridor has space to provide for corridor amenity this should be developed as part of detailed design.

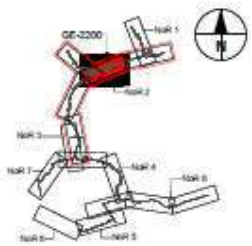
Movement

- **Support legible function –** The current cross section works in an urban environment, improved legibility for active modes could be provided by establishing bi-directional facilities on the northern side of the corridor.
- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections.

The following principles were identified as <u>not relevant</u> to the South Drury Arterial:

- **Facilitate an appropriate interface between place and movement –** The corridor will have a low place function as the majority of the corridor will be in the rural zone. The segment in the FUZ is located in a flood plain, therefore minimal interface is expected.
- **Align corridors with density –** The corridor is not aligned with density, with the majority of this segment of the corridor located in the rural zone.
- **Public transport directed and integrated into centres –** there is no public transport function provided on this corridor.

1.3 South Drury Arterial (SH22 Connection - Drury West)



The proposed corridor is supportive of the following Design Framework principles:

Social

- Adaptive corridors
- Social cohesion

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Support inter-regional connections and strategic infrastructure

Land Use

- Public transport directed and integrated into centres
- Strategic corridors as urban edges

Those principles that scored neutral in their support include:

Environment

- **Adapt to a changing climate and respond to the microclimatic factors of each area** – The corridor provides for active modes. Space has been allocated for amenity measures and planting. Detailed design will need to provide for street trees and planting amenity measures and planting. Detailed design will need to provide for street trees and planting and provide further details and definition at future design stages of the proposed amenity planting and water sensitive design elements to demonstrate consideration of urban heat island effects in this future urbanized area.

Social

- **Respect culturally significant sites and landscapes** – There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.

- **Safe Corridors -** The indicative cross section of the corridor has clear and legible zones for different modes. This segment of the corridor spans FUZ and Rural Zones. Within the FUZ, detailed design will need to address CPTED and establish a positive interface with adjacent land use. In the Rural Zone, given the lack of interface, there will be minimal opportunities to establish positive CPTED outcomes with relation to adjacent land use.

Built Form

- **Align corridors with density –** The corridor runs along the boundary of FUZ, which is anticipated to be Mixed Housing Urban Zone as per the Drury-Opāheke Structure Plan, and within the Rural Zone.
- **Corridor scaled to the surrounding context and urban structure –** The corridor width in this segment is two-lanes and scaled for the peri-urban context. The corridor has space to provide for corridor amenity this should be developed as part of detailed design.
- **Facilitate an appropriate interface between place and movement –** The corridor will have a low place function as the majority of the corridor will be in the rural zone. The segment in the FUZ is located in a flood plain, therefore minimal interface is expected.

Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections.
- **Support legible function –** The current cross section works in an urban environment, improved legibility for active modes could be provided by establishing bi-directional facilities on the northern side of the corridor.

Those principles were identified as Opportunities for development include:

Environment

- **Support and enhance ecological bio corridors and biodiversity –** There are no SEAs near this corridor, however there are large areas of stream and floodplain that are proposed to be filled. Further consideration of the response to these streams and flood plains is required. Details of the ecological management strategy of the corridor is not fully resolved and should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.

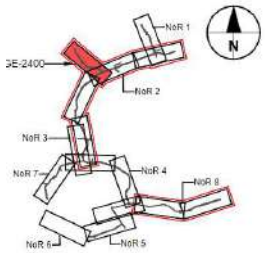
- **Support water conservation and enhance water quality in a watershed –** There are large areas of fill located across streams and within the flood plain. Water quality treatment areas are shown within flood plains and across streams. Further consideration of these streams and flood plains is required.

- **Minimise land disturbance, conserve resources and materials**
  Large areas of earthworks are required to accommodate the corridor over flood plains, working against the topography of the land. Look for opportunities as part of detailed design to refine the approach to better work with the character and topography of the corridor.

Social

- **Identity and place –** The corridor will fill large areas of flood plain and permanent streams further consideration of how the design could better respond to the natural characteristics of the area is required as part of detailed design.

1.4 SH22 Connection



The proposed corridor is supportive of the following Design Framework principles:

Environment

-

Social

- Adaptive corridors

Movement

- Connect modes
- Support access to employment and industry
- Support legible function

Those principles that scored neutral in their support include:

Environment

- **Support and enhance ecological bio corridors and biodiversity** – There are no SEAs near this corridor, and the design bridges over the Oira Creek and riparian margins. Habitat has been identified by ecologist. Details of the ecological management strategy of the corridor is not fully resolved and should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.
- **Minimise land disturbance, conserve resources and materials -** Large areas of earthworks are required to accommodate the eastern portion of the corridor in this location. Further refinement of design presents the opportunity to minimise this.
- **Adapt to a changing climate and respond to the microclimatic factors of each area** – The corridor provides for active modes. Space has been allocated for amenity measures and planting. Detailed design will need to provide for street trees and planting and provide further details and definition at future design stages of the proposed amenity planting and water sensitive design elements.

Social

- **Respect culturally significant sites and landscapes** – There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.
- **Social cohesion** – provides alternate connections between two main transport corridors, SH22 and the new Drury Arterials, through a rural area, with no activity nodes, or areas of density.
- **Safe Corridors -** The indicative cross section of the corridor has clear and legible zones for different modes. This corridor is in the Rural Zone. Given the lack of interface, there will be minimal opportunities to establish positive CPTED outcomes with relation to adjacent land use.

Built Form

- **Corridor scaled to the surrounding context and urban structure –** The rural corridor is two-lanes and requires large amounts of earthworks in the eastern portion. Detailed design should look to minimise the extent of earthworks and include a strategy to integrate the corridor into the context through contouring and landscaping.

Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections.

Those principles were identified as opportunities for development include:

Environment

- **Support water conservation and enhance water quality in a watershed –** there are large areas of earthworks and an artificial wetland located over a tributary of the Oira Creek. Detailed design should look for opportunities for refine the approach to stormwater management in this area.

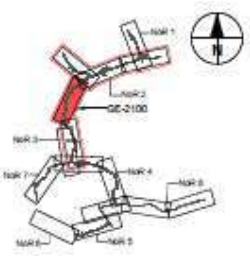
Social

- **Identity and place –** The corridor includes large area of fill in the eastern portion. Detailed design should look to minimise this and incorporate mitigation measures to integrate the corridor into the rural environment.

The following principles were identified as not relevant to the South Drury Arterial:

- **Align corridors with density –** the Corridor is located in the Rural Zone.
- **Facilitate an appropriate interface between place and movement –** The corridor will have a low place function as the corridor will be in the rural zone.
- **Connect nodes –** the corridor does not provide a connection between nodes.
- **Support inter-regional connections and strategic infrastructure**
- **Strategic corridors as urban edges**
- **Public transport directed and integrated into centres**

1.5 Drury-Paerata Link



The proposed transport corridor is supportive of the following Design Framework principles:

Social

- **Adaptive corridors**
- **Social Cohesion**

Movement

- **Connect modes**
- **Connect nodes**
- **Support access to employment and industry**
- **Support inter-regional connections and strategic infrastructure**
- **Support legible function**

Those principles that scored neutral in their support include:

Environment

- **Support and enhance ecological corridors and biodiversity**
  Details of the ecological management strategy of the corridor is not fully resolved and should be reviewed for landscape integration opportunities with the two stream crossings in this location.
- **Support and enhance ecological bio corridors and biodiversity** – There are no SEAs near this corridor, and the design bridges over one of two streams and riparian margins. Habitat has been identified by ecologist. Details of the ecological management strategy of the corridor is not fully resolved and should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.
- **Support water conservation and enhance water quality in a watershed –** This corridor includes a bridge over the Oira Creek, and a culvert through a tributary of the Creek adjacent to the NIMT, with large areas of fill across the stream and within the flood plain. There is a need to further refine the approach to stormwater management.
- **Minimise land disturbance, conserve resources and materials**
  Large areas of earthworks are required to accommodate the northern portion of the corridor in this location, particularly around the proposed wetlands. Further refinement of design presents the opportunity to minimise this. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development where it is located adjacent to the FUZ.
- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Provide further details and definition at future design stages of the proposed amenity planting and water sensitive design elements to demonstrate consideration of urban heat island effects in this future urbanized area.

Social

- **Identity and place –**
  The future design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as the landscape character drivers of the tributaries of the Oira Creek, cultural values and narratives and integrate the corridor into the rural context.

- **Respect culturally significant sites and landscapes** – There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.

- **Safe Corridors -** The indicative cross section of the corridor has clear and legible zones for different modes. This corridor is in the Rural Zone. Given the lack of interface, there will be minimal opportunities to establish positive CPTED outcomes with relation to adjacent land use.

Built Form

- **Corridor scaled to the surrounding context and urban structure –** The rural corridor is two-lanes. Detailed design should look to minimise the extent of earthworks and include a strategy to integrate the corridor into the context through contouring and landscaping.

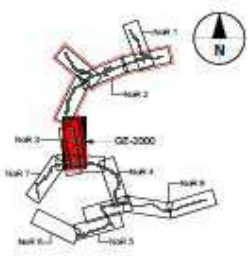
Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections.

The following principles were identified as not relevant to the South Drury Arterial:

- **Align corridors with density –** The corridor runs along the eastern side of the NIMT, and is outside the FUZ.
- **Facilitate an appropriate interface between place and movement –**
  The corridor will have a low place function as the majority of the corridor will be in the rural zone.
- **Strategic corridors as urban edges**
- **Public transport directed and integrated into centres**

1.6 Paerata Arterial



The proposed corridor is supportive of the following Design Framework principles:

Environment

- Support and enhance ecological corridors and biodiversity
- Support water conservation and enhance water quality in a watershed

Social

- Social cohesion

Built Form

- Align Corridors with density- *The corridor is located on the edge of, or within, the FUZ. The Pukekohe – Paerata Structure Plan anticipates that the area near the Paerata Station will be zoned THAB, providing for density, and the area to the south will be developed for Mixed Housing Urban Zoning, providing for medium density.*

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Prioritise active modes and public transport
- Support inter-regional connections and strategic infrastructure
- Support legible function

Land Use

- Public transport directed into centres.
- Strategic corridors as urban edges.

Those principles that scored neutral in their support include:

Environment

- **Minimise land disturbance, conserve resources and materials** – Large areas of earthworks are required to accommodate the southern portion of the corridor in this location, particularly around the proposed wetlands. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development.

- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Provide further details and definition at future design stages of the proposed amenity planting and water sensitive design elements to demonstrate consideration of urban heat island effects in this future urbanized area.

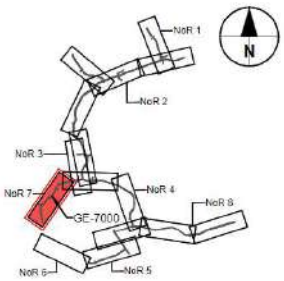
Social

- **Identity and place –** The future detailed design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as the landscape character drivers of the water courses, cultural values and narratives.
- **Respect culturally significant sites and landscapes –** There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.
- **Safe Corridors -** The indicative cross section of the corridor has clear and legible zones for different modes. There are opportunities to provide positive CPTED outcomes for urban integration within the FUZ area and this should be addressed as part of detailed design. Future design will also need to include the provision of safe crossing for active modes at intersections and mid-block crossing.

Built Form

- **Scaled to the surrounding context and urban structure** – The corridor is two-lanes. Detailed design should look to minimise the extent of earthworks and include a strategy to integrate the corridor into the context through contouring and landscaping, particularly in the southern portion of the corridor, where large areas of fill are proposed. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development where it interfaces with the FUZ.
- **Facilitate an appropriate interface between place and movement –**
  An urban integration strategy should be developed to coordinate with landowners in future stages to address interface issues and areas of localized fill and cut batters, particularly in the southern portion where large areas of fill are proposed. This will enable an appropriate interface with adjacent land uses that will provide for active edge permeability and enable local access and connectivity to be achieved.

1.7 Pukekohe North-West Arterial



The proposed corridor is supportive of the following Design Framework principles:

Environment

- Minimise land disturbance and conserve resources

Social

- Adaptive corridors

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Support legible function

Those principles that scored neutral in their support include:

Environment

- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater management at a future design stage is recommended to provide an appropriate interface with the surrounding land uses and management of impacts on floodplains.
- **Support and enhance ecological corridors and biodiversity –** the current alignment avoids identified SEAs. Details of the ecological management strategy of the corridor is not fully resolved and the corridor runs across two streams. The design should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.
- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater management at a future design stage is recommended to provide an appropriate interface with the surrounding land uses and management of impacts on floodplains.
- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Active modes are to be provided along the length of the corridor. Detailed design will need to accommodate amenity measures such as street trees and shading.

Social

- **Identity and place –** The future detailed design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as the landscape character drivers of the tributaries of the XXX Streams, cultural values and narratives.
- **Respect culturally significant sites and landscapes –** There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.
- **Social Cohesion –** the proposed corridor will provide connectivity in the north-west of Pukekohe, traversing anticipated future industrial and residential land use pattern as identified

in the Pukekohe- Paerata Structure Plan. There are opportunities for the corridor to include landscaping and buffer treatments to manage the interface and transition between industrial and residential landuse. The inclusion of protected cycling facilities will provide modal choice for users.

- **Safety –**
  Detailed design of the corridor will need to consider CPTED and how active interfaces can be established with the road corridor. Detailed design will need to consider design detail for safe active mode crossings and safe pedestrian environments, including mid-block crossings.

Built Form

- **Align corridors with density –** The location of the corridor is zoned FUZ, and is indicated to be, as per the Pukekohe Structure Plan, a mix of industrial and mixed housing suburban zone in the future, which provides for low – medium density development. The corridor is part of a circulatory route around Pukekohe, providing access to industrial employment areas.
- **Scaled to the surrounding context and urban structure** – The two-laned corridor is located in the FUZ and future development will be able to respond to the corridor and its scale. Nevertheless, the topography of the area will result in earthworks batters in some locations and these should be minimised as much as possible during more detailed design, with a strategy to integrate and interface with adjacent land use as the area develops.
- **Facilitate an appropriate interface between place and movement –**
  The scale of the earthworks required in some areas of the corridor required will likely create difficulties in facilitating an appropriate interface between public and private. Future detailed design should take the opportunity to maximise interface outcomes along the corridor. Providing for future connectivity to adjacent land development and future movement network will be important to provide permeability and connectivity in the area.

Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections.

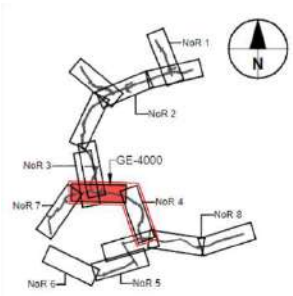
Landuse

- **Public transport directed and integrated into centres –**
  The corridor doesn't specifically direct public transport into 'centres', however it does provide access from the north-east to the Milldale Centre. Further understanding of the future public transport network is required.

The following principles were identified as <u>not relevant</u> to the North-West Corridor.

- Public transport directed and integrated into centres
- Support inter-regional connections and strategic infrastructure
- Strategic corridors as urban edges

1.8 Pukekohe North-East Arterial



The proposed corridor is supportive of the following Design Framework principles:

Social

- Adaptive corridors
- Social cohesion

Movement

- Connect modes
- Support access to employment and industry
- Support legible function

Those principles that scored neutral in their support include:

Environment

- **Support and enhance ecological corridors and biodiversity –** the current alignment is adjacent to an identified SEA, and the edge of indigenous vegetation identified as part of the wider ecological assessment. There are opportunities to minimise effects on these areas, as part of design refinement and these should be considered when developing the construction methodology.
- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater management at a future design stage is recommended to provide an appropriate interface with the surrounding land uses and management of impacts on floodplains.
- **Minimise land disturbance, conserve resources and materials –** The corridor includes large areas of earthworks in the southern portion due to the steep topography in this area. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development.
- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Active modes are to be provided along the length of the corridor, and part of the corridor provides for public transport lanes. Detailed design will need to accommodate amenity measures such as street trees and shading.

Social

- **Identity and place –** The future detailed design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as the landscape character drivers of the tributaries of the XXX Streams, cultural values and narratives.
- **Respect culturally significant sites and landscapes –** There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.
- **Safe corridors –** Detailed design of the corridor will need to consider CPTED and how active interfaces can be established with the road corridor. Detailed design will need to consider design detail for safe active mode crossings and safe pedestrian environments.

Movement

- **Connect nodes –** The North-East Corridor does not directly connects nodes, providing a route around Pukekohe. It does provide a more direct route from the north to wider connections such as Bombay.
- **Prioritise active modes and public transport –** The corridor provides for separated cycling facilities; however design detail needs to resolve access through intersections to provide for priority to active modes.

The following principles were identified as Opportunity for development for the North-East Corridor

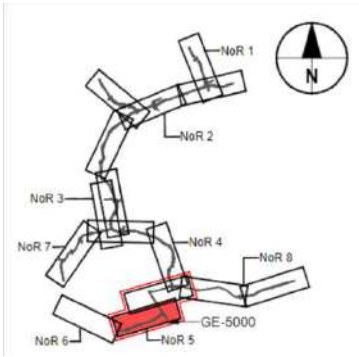
Built Form
Built Form

- **Scaled to the surrounding context and urban structure** – The two-laned corridor is located in the FUZ, with a portion in the Mixed Rural Zone. Future development in the FUZ will be able to respond to the corridor and its scale in some locations, however, the topography of the area will result in large earthworks batters in some locations and these should be minimised as much as possible during more detailed design, with a strategy to integrate and interface with adjacent land use as the area develops.
- **Facilitate an appropriate interface between place and movement –**
  The scale of the earthworks required in some areas of the corridor required will likely create difficulties in facilitating an appropriate interface between public and private. Future detailed design should take the opportunity to maximise interface outcomes along the corridor. Providing for future connectivity to adjacent land development and future movement network will be important to provide permeability and connectivity in the area; this will be difficult due to the topography, particularly in portion of the corridor that runs north/south.
- **Align corridors with density –** The corridor traverses a range of densities with FUZ (anticipated to be Mixed Housing Urban) in the north east, before moving through the Mixed Rural Zone back to FUZ (anticipated to be Single House Zone) in the south. With the exception of the small portion in the north, the corridor does not support density.

The following principles were identified as not relevant to the Pine Valley Road Upgrade.

- Support inter-regional connections and strategic infrastructure.
- **Public transport directed and integrated into centres –**
  The corridor doesn't specifically direct public transport into 'centres', creating a link around the north east of Pukekohe.
- Strategic corridors as urban edges.

1.9 Pukekohe South-East Arterial



The proposed corridor is supportive of the following Design Framework principles:

Social

- Adaptive corridors
- Social cohesion

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Support legible function

Those principles that scored neutral in their support include:

Environment

- **Support and enhance ecological corridors and biodiversity –** the current alignment avoids identified SEAs. Details of the ecological management strategy of the corridor is not fully resolved and the corridor runs across three streams, two on an existing road corridor (Golding Road) and one near the NIMT crossing point. The design should be reviewed for landscape integration opportunities with stream networks as part of detailed design and designation conditions.
- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater management at a future design stage is recommended to provide an appropriate interface with the surrounding land uses and management of impacts on floodplains.
- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Active modes are to be provided along the length of the corridor. Detailed design will need to accommodate amenity measures such as street trees and shading.

Social

- **Identity and place –** The future detailed design response of the corridor will need to consider the underlying identity drivers of the surrounding context such as the landscape character drivers of the tributaries of the Oira Creek, cultural values and narratives.
- **Respect culturally significant sites and landscapes –** There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.
- **Safety –** Detailed design of the corridor will need to consider CPTED and how active interfaces can be established with the road corridor. Detailed design will need to consider design detail for safe active mode crossings and safe pedestrian environments, including mid-block crossings.

Built Form

- **Align corridors with density –** The location of the corridor is zoned FUZ, and is indicated to be, as per the Pukekohe Structure Plan, a mix of industrial and mixed housing urban and suburban zone in the future, which provides for low – medium density development. The corridor is part of a circulatory route around Pukekohe, providing access to industrial employment areas.
- **Scaled to the surrounding context and urban structure** – The two-laned corridor is located in the FUZ and makes use of existing corridors for a portion of the corridor. Future development in the area will be able to respond to the corridor and its scale. Nevertheless, the topography of the area will result in earthworks batters in some locations and these should be minimised as much as possible during more detailed design, with a strategy to integrate and interface with adjacent land use as the area develops.

Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections.

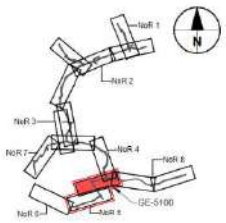
The following principles were identified as Opportunity for development for the South-East Corridor.

- **Minimise land disturbance and conserve resources -** The upgraded corridor uses the existing Golding Road corridor and establishes a new corridor between Svendsen Road and Golding Road. The new section requires large areas of earthworks to construct. Detailed design should look to refine this and include mitigation strategies to integrate the corridor within the landform and with future development.
- **Facilitate an appropriate interface between place and movement –**
  The scale of the earthworks required in some areas of the corridor required will likely create difficulties in facilitating an appropriate interface between public and private. Future detailed design should take the opportunity to maximise interface outcomes along the corridor. Providing for future connectivity to adjacent land development and future movement network will be important to provide permeability and connectivity in the area.

The following principles were identified as not relevant to the South-East Corridor.

- Public transport directed and integrated into centres
- Support inter-regional connections and strategic infrastructure
- Strategic corridors as urban edges

1.10 Pukekohe East Road Upgrade



The proposed corridor is supportive of the following Design Framework principles:

Environment

- Support and enhance ecological corridors and biodiversity
- Minimise land disturbance, conserve resources and materials

Social

- Identity and place
- Adaptive corridors
- Social cohesion

Built form

- Scaled to the surrounding context and urban structure

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Support interregional connections and strategic infrastructure
- Support legible function

Those principles that scored neutral in their support include:

Environment

- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater management at a future design stage is recommended to provide an appropriate interface with the surrounding land uses and management of impacts on floodplains.
- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Active modes are to be provided along the length of the corridor. Detailed design will need to accommodate amenity measures such as street trees and shading.

Social

- **Respect culturally significant sites and landscapes –** There are no known sites of cultural significance, but this should be confirmed with Mana Whenua in future design stages.

- **Safety –** Detailed design of the corridor will need to consider CPTED and how active interfaces can be established with the road corridor. Detailed design will need to consider design detail for safe active mode crossings and safe pedestrian environments, including mid-block crossings.

Built Form

- **Align corridors with density –** The location of the existing corridor is on the interface between existing development and FUZ, which is indicated to be, as per the Pukekohe Structure Plan, mixed housing suburban zone in the future, which provides for low – medium density development. The corridor is part of a circulatory route around Pukekohe, providing access to industrial employment areas.

- **Facilitate an appropriate interface between place and movement –** Providing for future connectivity to adjacent land development and future movement network will be important to provide permeability and connectivity in the area.

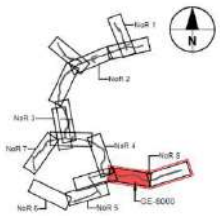
Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections and through mid-block crossings.

The following principles were identified as not relevant to the South-East Corridor.

- Public transport directed and integrated into centres
- Strategic corridors as urban edges

1.11 Mill Road (Bombay) Upgrade



The proposed corridor is supportive of the following Design Framework principles:

Environment

- Support and enhance ecological corridors and biodiversity
- Minimise land disturbance, conserve resources and materials

Social

- Adaptive corridors
- Social cohesion

Built form

- Scaled to the surrounding context and urban structure
- Facilitate an appropriate interface between place and movement

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Support interregional connections and strategic infrastructure
- Support legible function

Those principles that scored neutral in their support include:

Environment

- **Support water conservation and enhance water quality in a watershed –** Future development and definition of the proposed stormwater management at a future design stage is recommended to provide an appropriate interface with the surrounding land uses and management of impacts on floodplains and streams.
- **Adapt to a changing climate and respond to the microclimatic factors of each area –** Active modes are to be provided along the length of the corridor. Detailed design will need to accommodate amenity measures such as street trees and shading.

Social

- **Identity and place –** The widening of the Mill Road corridor in this location includes areas within the Tuff Crater ONF. Detailed design will need to respond to the identity and character of the place.
- **Respect culturally significant sites and landscapes -** The corridor widens near the tuff crater, detailed design needs to minimise impacts on this significant landscape and Outstanding Natural Feature.
- **Safety –** Detailed design of the corridor will need to consider CPTED and how active interfaces can be established with the road corridor where it is adjacent to developable land.

As the majority of the corridor is within the rural area, there will be limited opportunities for active interfaces. Detailed design will need to consider design detail for safe active mode crossings and safe pedestrian environments, including mid-block crossings where adjacent to developable land.

Built Form

- **Align corridors with density –** The majority of the existing corridor is within the rural zone, with a small area adjacent to the FUZ at the western end. This is indicated to be, as per the Pukekohe Structure Plan, mixed housing suburban zone in the future, which provides for low – medium density development.

Movement

- **Prioritise active modes and public transport -**The corridor provides for active modes. Detailed design will need to provide for prioritisation for active modes at intersections and through mid-block crossings.

The following principles were identified as not relevant to the Mill Road (Bombay) Corridor.

- Public transport directed and integrated into centres
- Strategic corridors as urban edges

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe DBC Appendix G: Engagement Summary Report

February 2023

Version 0.1

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

Document Status

Responsibility	Name
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0.2		
0.3		

Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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1 Executive Summary

1.1 Introduction

Te Tupu Ngātahi Supporting Growth is a collaboration between Auckland Transport and Waka Kotahi NZ Transport Agency ('Waka Kotahi'). Te Tupu Ngātahi was formed to investigate, plan, and secure route protection for transport projects in the Auckland region to support the region's growth over the next 30 years. As part of this work, Pukekohe Detailed Business Case local arterials and strategic transport projects. These projects are expected to provide future communities in Pukekohe, Paerata and south Drury safer and more sustainable transport options for future communities.

Engagement with partners, stakeholders, landowners, and the wider community is an integral part of the planning process. This report summarises engagement activities undertaken for Pukekohe, Paerata and south Drury future transport projects between 1 November and 20 December 2022. The primary purpose of this engagement was to gather feedback from stakeholders and the wider community on the emerging preferred options for the future network.

1.2 What we heard

Pukekohe Arterials

In general, there is support for the Pukekohe Arterials. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas. Feedback related to specific projects within the Pukekohe Arterials was varied. Some people were unsure if the presented alignment for the proposed South East and/or South West Arterials should be the preferred option. Sentiment was also mixed for the North West Arterial proposal. Feedback indicated that people clearly do want a solution for traffic congestion but disagree with the proposal's route connecting future urban areas, including housing developments. Feedback also raised concerns of heavy vehicle (freight) movements through what is perceived as an already congested route or through existing (or proposed) residential areas. Residents of Grace James Road and residents living in proximity, strongly oppose upgrading Grace James Road for the North East Arterial. They formed a residents group who Te Tupu Ngātahi engaged and met with. A large proportion of the total feedback received was made towards the North East Arterial. Some feedback queried the change from the route for the NE Arterial shown in the Pukekohe-Paerata Structure Plan 2019.

Mill Road (Bombay) – Pukekohe East Upgrade

Engagement feedback illustrates support for the proposed Mill Road (Bombay) – Pukekohe East Road Upgrade. Feedback acknowledged that this road is a key strategic route into Pukekohe, with some pieces of feedback directing that the four-lane upgrade should be applied to the entire route.

Strategic connections

Limited feedback was received for each of the Drury West Arterial and South Drury Connection proposals. The feedback raised concerns on potential property impacts, especially to working farms. Those that provided feedback on the State Highway 22 Connection, wanted further connections to support traffic to and from Karaka (to the north of the project area). Property impacts were also raised on the proposed upgrade of Sim Road (north) as part of a strategic connection.

Limited feedback was provided on the Paerata Arterial. However, from the feedback received, potential property impacts were a concern on Sim Road (south) and Cape Hill Road and the potential effect on farms. There were also some concerns raised that a four-lane road is no longer proposed.

Key themes

- Support from the wider community for improved connections for future generations.
- There is a high level of support for a ‘ring road’ around Pukekohe, with the community agreeing that it is needed sooner rather than later. There were suggestions that the 'ring road' be located further on the outskirts of Pukekohe.
- Strong opposition towards the upgrade of Grace James Road as part of the North East Arterial from Grace James residents and those living in proximity.
- Concerns around the impact to properties/land acquisition.
- Some pieces of feedback still think the former Pukekohe Expressway is being proposed, with some comments around a preference for a four-lane arterial.
- General comments around public transport in Pukekohe and how this could improve in the future.

1.3 Next steps

The feedback gathered during the engagement period has been analysed, and community responses will contribute to decision-making as the project progresses. We will share feedback with the community, in the form of a two-page engagement summary, in early 2023.

Stakeholder and public engagement will continue into 2023; in particular, we will be able to engage and communicate with landowners about potential property impacts with greater certainty and clarity.

Lodgement of Notices of Requirement to support route protection of the preferred options is planned to occur in late 2023.

2 Background

In 2016, a strategic transport network for future growth areas in Tāmaki Makaurau was identified as part of a Programme Business Case (PBC). Te Tupu Ngātahi investigated the South Auckland growth area through an Indicative Business Case (IBC) in 2018. This IBC included Pukekohe, Paerata and south Drury. At that time, we heard from the community that many supported an upgrade of existing roads before building new strategic transport corridors. We also heard that people wanted minimal impacts to agricultural land, the volcanic tuff ring and property. People were supportive of the idea of a 'ring road.' The IBC was endorsed by the Waka Kotahi and Auckland Transport Boards in 2019.

In 2020, public engagement occurred on recommended options to support a business case being prepared at Te Tupu Ngātahi for the Pukekohe Expressway, the North East Arterial and other strategic connections in South Auckland. At that time, we heard that there was mixed feedback towards the Pukekohe Expressway. Investigations into these projects were paused in 2020 due to the COVID-19 pandemic and associated funding issues.

The Pukekohe DBC continues to investigate the strategic and local arterials in south Drury, Pukekohe and Paerata. These have been integrated into the preferred strategic network as the following projects:

- Drury West Arterial
- South Drury Connection
- Drury-Paerata Link
- Paerata Arterial
- Pukekohe Arterials – North East Arterial, North West Arterial, South East Arterial, and the South West Arterial
- Pukekohe East Road Upgrade
- Mill Road (Bombay) Upgrade

In order to support the DBC and alternatives assessment process, engagement on the future transport network for Pukekohe, Paerata and south Drury was held to gather community feedback on the preferred options. The approach of Te Tupu Ngātahi for route protection is illustrated below in Figure 1.



Figure 1: Te Tupu Ngātahi Supporting Growth funnel diagram

This report summarises the engagement activities and the feedback received between 1 November to 20 December 2022.

2.1 Indicative Strategic Transport Network – Pukekohe

The Pukekohe DBC is one of several detailed business cases that form part of the wider 'Strategic South' transport network. It is anticipated to be delivered in the next 30 years, subject to growth and funding. There is currently no provision with local or central government funding this project, or the wider south network, to the next stage.

The Pukekohe DBC package includes the following projects:

- A new strategic connection between Drury South and Pukekohe with connections to State Highway 22 which includes:
  - **Drury West Arterial** and **South Drury Connection**
  - **Drury-Paerata Link** and **State Highway 22 Connection**
  - **Paerata Arterial**
- **Pukekohe Arterials Mill Road (Bombay) - Pukekohe East Road Upgrade** to four lanes between the State Highway 1 interchange and Harrisville Road.

A map of the emerging preferred options is shown in Figure 2.

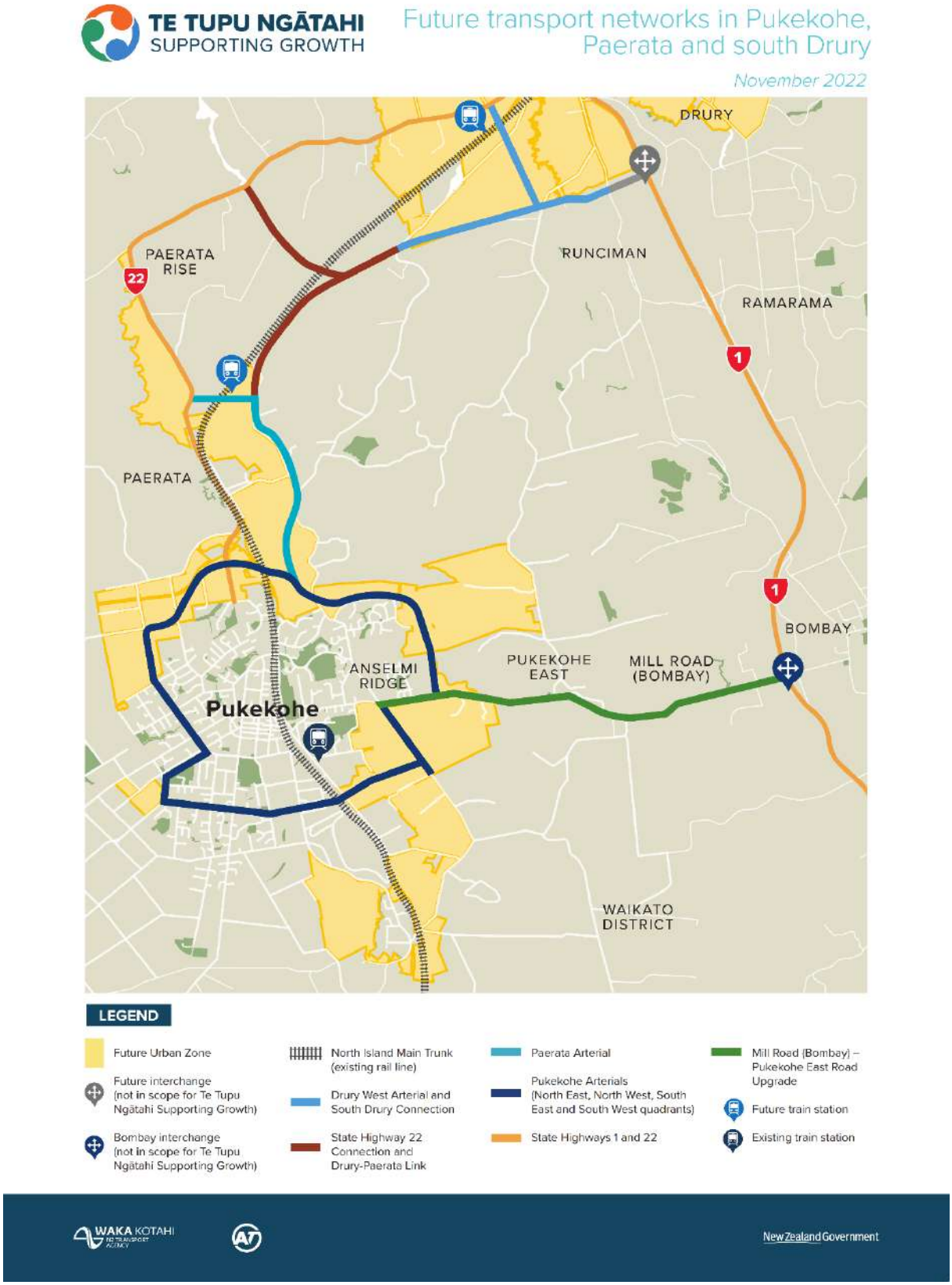

Figure 2: Map of the proposed network for Pukekohe, Paerata and south Drury

3 Engagement Activity and Feedback

3.1 Engagement activity

We engaged with partners, elected members, the community, and other key stakeholders. Table 1 summarises our engagement methods and the groups that we engaged with.

Table 1: Engagement activity by stakeholder group

Who we engaged	How we engaged
Partners	• **Southern manawhenua table** – ongoing twice monthly hui with manawhenua and the project team • **Auckland Council Partnership Forum** – twice monthly meetings to update Council on Te Tupu Ngātahi projects (including the Pukekohe project)
Elected Members	• **Memo** – two memos were distributed to elected members of Franklin Local Board, to update them on the project and community engagement • **Presentations –** project updates to the Franklin Local Board on 2 August and 22 November • **Email** – interactions with elected members with informal email updates as community engagement progressed
Key stakeholders	• **Direct communications** – informative emails to the Pukekohe Business Association, local education facilities, social/recreational clubs, and churches as advocacy stakeholders • **Presentations** – presentations to the Pukekohe Vegetable Growers Association (17 November) and Pukekohe Raceway (23 November) • **Focus group –** engagement with a dedicated resident's representative group of Grace James Road and surrounding area on 30 November to discuss the proposed North East Arterial, followed by regular communication • **1:1 session** – held with the Auckland Transport Freight Working Group on 1 December.
Community	• **Flyer** – two community flyer drops to 15,000 households across Franklin to socialise the project prior to formal consultation (see Appendix 1) and an invitation to the first of two open days held to keep the community informed of the proposed options (see Appendix 2) • **Media advertising –** invitations for the November and December 2022 open day events in the Papakura Courier and Franklin Courier (see Appendix 2), one full page advertorial in the Franklin Courier (see Appendix 3), and a digital media campaign between 31 October – 7 November 2022 • **Social media** – promotional adverts for the two open day events and online feedback through Auckland Council, Franklin Local Board, Pukekohe Business Association, Waka Kotahi, and Auckland Transport social media channels • **The Hive** – our online engagement platform that contained project information and a place for the public to place online feedback • **Email campaigns** – numerous email campaigns sent out to let subscribers know of key dates across the formal consultation period

Who we engaged	How we engaged
	• **Community open days –** we held two community open days on 12 November (Franklin: The Centre) and 3 December (Pukekohe Memorial Hall) and attended the Waka Kotahi Papakura ki Pukekura – Papakura to Bombay open day on 10 December • **One on one meetings with landowners.**
Developers	• **Meetings –** the project team met with several developers across 2022 and 2023 in respect to their proposed development and the Pukekohe proposals.
Utilities	• **Meetings** - Te Tupu Ngātahi met with Vector, First Gas, Transpower, and Watercare to discuss the interface between projects and utilities on a programme wide basis throughout 2022. Conversations will continue in 2023.

3.1.1 Manawhenua engagement summary

Te Tupu Ngātahi engaged with manawhenua on the Pukekohe project prior to and during wider community engagement. Collaborating with manawhenua as project partners, we actively sought their feedback and involvement as part of the DBC process.Southern hui with manawhenua representatives were held twice a month. The purpose of these hui was to collaborate with manawhenua on option development, update manawhenua on the progress of the project, present technical information, and findings to involve manawhenua as project partners. Table 2 below identifies manawhenua representative attendance at each hui. The section under the table summarises feedback manawhenua provided in hui across March to December 2022. At some hui, manwhenua did not provide specific feedback.

Table 2: Manawhenua representative attendance by hui

Date of hui	Manawhenua representative in attendance
March 3 2022	Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Maru, Te Patu Kirikiri, Ngai Tai Ki Tamaki
April 7 2022	Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Maru, Ngāti Paoa Trust Board
April 26 2022	Ngāti Tamaoho, Te Ākitai Waiohua, Ngāi Tai ki Tāmaki, Ngāti Tamaoho, Ngāti Whanaunga, Ngāti Tamaterā
May 5 2022	Ngāi Tai ki Tāmaki, Ngāti Maru, Ngāti Tamoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Tamaterā
June 2 2022	Ngāti Maru, Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitai Waiohua, Ngāti Tamaterā, Ngāti Te Ata
June 21 2022	Ngāti Tamaoho, Te Ākitai Waiohua, Ngāti Whanaunga, Ngāti Maru
July 7 2022	Ngāti Tamaoho, Ngāti Paoa Trust Board, Ngāti Tamaterā, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Whanaunga
July 8 2022	Ngāti Te Ata Waiohua, Ngāti Tamaoho
August 4 2022	Ngāti Tamaoho, Ngāti Tamaterā, Te Ākitai Waiohua, Ngāti Whanaunga

Date of hui	Manawhenua representative in attendance
August 23 2022	Ngāti Tamaoho, Te Ākitati Waiohua, Ngāti Whanaunga, Ngāti Maru, Ngāi Tai ki Tāmaki
September 27 2022	Te Ākitai Waiohua, Ngāti Whanaunga, Ngāti Tamaterā, Ngāti Paoa Trust Board
October 6 2022	Te Ākitai Waiohua, Ngāti Te Ata Waiohua, Ngāti Tamaoho, Ngāti Tamaterā
October 12 2022	Ngāti Te Ata Waiohua
October 25 2022	Te Ākitai Waiohua, Ngāti Tamaoho, Ngāti Tamaterā, Ngāti Whanaunga, Te Ahiwaru, Ngāti Maru, Ngā Tai Ki Tāmaki
December 1 2022	Te Ākitai Waiohua, Ngāti Tamaoho, Ngāti Whanaunga
December 15 2022	Te Ākitai Waiohua, Ngāti Tamaoho
December 19 2022	Ngāti Te Ata Waiohua

Manawhenua representatives in attendance at the April 7 hui expressed concern towards the potential for arterials in rural areas to encourage growth around the new roads rather than an 'expressway' (strategic connection between Drury and Pukekohe) which, in the representative's view, was a higher speed road with more limited access. It was noted by one representative that there are several water courses and cultural sites in the proposed network footprint, and that the project team needed to physically understand the environment rather than digitally. Another representative noted that the conversation around options needed to be about the environment and people instead of just the roads.

In the June 21 hui, a manawhenua representative expressed their appreciation for the project team's flexibility and engagement across multiple forums. The project team met with Ngāti Te Ata Waiohua out of their representative's preference to meet with Te Tupu Ngātahi separately to provide feedback. In a July 8 hui, the representative observed that the Whangapouri Stream is in poor condition and in need of rehabilitation. They acknowledged that option is proximity to or crossing streams presents an opportunity to enhance them.

At the August 23 hui, manawhenua representatives were presented with the draft community wide flyer for upcoming public engagement on the proposed Pukekohe DBC projects. It was agreed by manawhenua and Te Tupu Ngātahi that the draft flyer and online feedback platform would recognise the important partnership between manawhenua and Te Tupu Ngātahi. It was agreed that the below wording would be used:

> *"Manawhenua has a vital role as kaitiaki for Tāmaki Makaurau. We partner with Manawhenua to ensure Māori cultural values and perspectives are considered and integrated into our transport network plans".*

Route refinement options were presented to manawhenua representatives in the September 27 hui for feedback. It was acknowledged that more detailed route refinement assessment outcomes would be presented in an October hui. These were presented to manawhenua at the October 6 hui. In this hui, a manawhenua representative gave feedback on the preference for the proposed Drury West Arterial to limit crossings of the Ngakoroa (Ngaakooroa) Stream, due to iwi aspirations of leaving the stream in a better condition than it is currently. Feedback for a section of the Pukekohe North East Arterial that included bridging of the Whangapouri Creek was that water quality in the stream had degraded and its mauri has diminished; the whole catchment needs to be restored. A manawhenua

representative acknowledged that the turn by the BP station on Mill Road is very dangerous, with trucks dominating the roads.

A manawhenua representative also queried what feedback had been given by local boards. The project team responded that they have been unable to present to the recent local body elections; however, it was acknowledged that there was support from the Franklin Local Board towards the Pukekohe projects being pursued after being placed on hold in 2020.A representative from Ngāti Te Ata Waiohua gave general feedback to the project team on the emerging preferred options at a hui on October 12. Manawhenua in attendance at the October 25 hui were given an update on the approach to upcoming community engagement on the proposed Pukekohe DBC projects. An overview of the online engagement platform was provided, along with information about the community open day on Saturday 12 November. The project team explained that feedback would be collated and reported on once the formal consultation period had concluded.

In the December 1 hui, the project team gave an update on community engagement and a summary of feedback received so far. The project team advised manawhenua representatives that the first open day in November was well attended and that there was general support for improved transport but concern about freight and heavy vehicles. There is support for better transport options, but that the project team is not doing enough to future proof the area (for freight in particular).

The project team worked with manawhenua as project partners across the DBC process, have taken on board their issues, concerns and considerations into their decision making. Te Tupu Ngātahi will continue to engage with manawhenua as the Pukekohe project progresses.

3.1.2 Key stakeholder interactions

We spoke to several key stakeholders during and around the engagement period. Table 2 below summarises who we engaged and the feedback we received. Written feedback (where received) is noted.

Table 3: Key stakeholder interactions

Who we engaged	Feedback
Andrew Bayley (MP for Port Waikato)	• Provided a letter outlining that members of their electorate have expressed concerns towards Pukekohe Arterials proposal and that they do not support the proposal. • People felt as though the proposal does not consider the roading infrastructure required for the transport of produce, goods, and services, noting that this is important to the Franklin District's economy. • Noted the submission from the Rt Hon William Birch. • Mr Bayley encouraged the project team to consider an alternative proposal.
Birch Land Development Consultants	• Submitted by Birch Land Development Consultants and represents the views of several parties, including the Pukekohe Vegetable Growers Association. • Stated that the current proposal for the Pukekohe Arterial does not have community support. • Highlights concern with the proposed North East Arterial as it runs through Grace James Road, crosses challenging topography and encounters ecological areas of interest.

Who we engaged	Feedback
	• Opposed to the redirection of heavy traffic through major residential streets (Helvetia Road, West Street and Ward Street) and onto narrow streets due to a lack of infrastructure and space. Concentrating heavy vehicle movement to the Bombay hills and east Pukekohe makes no sense, as heavy vehicles negotiating tricky topography is contradictory to the project outcome to lower carbon emissions. • The proposal fails to consider the important role of the farming and vegetable sectors and their use of equipment to conduct business, fails to recognise the NPS-HPL (Highly Productive Land), and the importance of daily transit of milk from dairy farms in west Pukekohe. • Heavy traffic in Glenbrook (due to the NZ Steel plant) and heavy traffic in the Pukekohe urban area has not been considered. • The Waikato/Auckland boundary line has not been explored holistically. • Fails to mitigate congestion by not providing a four-lane expressway from the Drury – Ramarama zone of SH1 to Pukekohe. • The proposed active transport routes are illogical and create a risk with recreational travellers mixing with heavy vehicles. • An alternative proposal was provided in the feedback. Broad support for this alternative proposal is noted within the feedback from school principals and Boards of Trustees, residents groups, business groups, property owners, developers, the heavy transport sector, Federated Farmers, and the Pukekohe Vegetable Growers Association. Discussions were also held with manawhenua, members of the Franklin Local Board, and the Mayor of Waikato District Council. The alternative alignments include an outer NW Arterial in the rural area and a four-lane expressway from Drury to Pokeno (Waikato) including through the urban centres of Pukekohe, Tuakau and Pokeno.
Bus and Coach Association New Zealand	• Written feedback received during the consultation period. • Expressed the Association's view that public transport is the most efficient use of limited transport corridor space, and that Auckland Transport's position on upgrading State Highway 22 for future growth is incorrect. • The Pukekohe Arterials proposal alone would not improve traffic. Instead, the Association believes that the proposed public transport and active modes facilities will have the greatest impact towards improving traffic. • New urban development areas must allow for strong public and active transport links that are user friendly and of good service, • Pedestrianising main centres and slowing traffic in surrounding areas would improve safety and reduce traffic.
Federated Farmers of New Zealand	• Written feedback requested that the proposals are paused and re-evaluated. This was based on their view that the proposed ring route should be pushed out further away, and heavy vehicles need to be separated from residential areas. • Highlighted that the proposal presented a safety risk to children accessing school in the area, as well as safety for heavy vehicle drivers who already navigate major intersections and tight corners. • Noted that heavy vehicle movements restrict traffic flow at present in Pukekohe, and that the proposal should consider shifting to the existing area where heavy haulage businesses are located.

Who we engaged	Feedback
	• Support was expressed for the submission made by the Pukekohe Vegetable Growers Association (via Birch Surveyors). • Statement of support towards Notices of Requirement where they provide certainty but disagree with the current project outcomes.
Grace James (and surrounds) Residents Group	• Written feedback received after targeted engagement with a focus group of Grace James Road and the surrounding residents Group. • The group are strongly opposed to the proposed Pukekohe North East Arterial that includes an upgrade of Grace James Road. Residents believe that the alignment will heavily impact their community, level of amenity, and the value of their land and/or dwelling. They are also concerned at the level of engagement from the project team and their transparency of information and decision making. • Criticism was made towards the use of Grace James Road, as previous proposals were outside of the existing urban area. Background was provided to the extensive level of involvement residents had in the past, namely through the Pukekohe-Paerata Structure Plan 2019 and the Strategic South Indicative Business Case. • A preference was expressed towards a more northern alignment for the NE Arterial which was recommended in the South IBC and included in the Pukekohe-Paerata Structure Plan 2019. Several points were made in support of this position.
Karaka Residents and Ratepayers Association	• Written feedback was provided from the Association that the Karaka area (to the north of the project) should be included within the project scope. • Noted that whilst the proposal between Drury and Pukekohe will make travel more efficient, transport choice in Karaka is limited. • Presented a list of improvements in Karaka that the Association would like to see included within the project scope.
Pukekohe Business Association	• Written feedback from the Pukekohe Business Association outlined that they support the proposed 'ring road' in principle, expressing that they had concerns with the proposals. • Concerned about heavy vehicles in high traffic areas, impacts of road widening, impact on residential properties and land value, proximity to schools and children moving safely around. • Encouraged a plan to futureproof Pukekohe and future growth by moving the ring road away from residential areas. They are also concerned about the suitability of existing roads to accommodate heavy vehicles. • Question raised on whether conversations had been had with the relevant authorities in the Waikato region. • View that the proposal would not gain community support without the Business Association, Growers, Residents and Local Board being on side.
Waikato District Council – Mayor Jacqui Church	• Written feedback from Mayor Jacqui Church in respect to the project footprint crossing into the Waikato region in places. • Mayor Church states that the transport ecosystem of southern Auckland and northern Waikato need to be treated as one.

Who we engaged	Feedback
	• Farming communities in both regions rely on roads to shift heavy equipment, and that cross-region roads need to support this kind of movement; a similar comment is made around the transportation dairy farm products. • Requested that the Mill Road (Bombay) project be a four-lane upgrade. • Feedback also brought to the attention of the project team that Council is working on their own rail IBC, and that the electrification occurring in Pukekohe should extend to the Waikato (out of project scope).

3.1.3 Community engagement summary

Between 1 November and 20 December 2022, the wider community were invited to provide their feedback on the preferred options for the network. We used our online engagement tool 'The Hive' to collected feedback, using an interactive map and an online survey. Our survey questions were:

1. **It is good that land is being protected now for future transport options to support growth in Pukekohe, Paerata and south Drury**
2. **To what extent do you agree with the following statements?**
   a. **Providing new or upgraded transport corridors to help redirect heavy freight away from Pukekohe town centre in the future will make the town centre safer and more pleasant to walk, scooter, cycle or drive around**
   b. **I want future generations to have safer and more sustainable transport options in and around Pukekohe, Paerata, and south Drury**
3. **Is there any other feedback you would like to share about the proposed future transport options?**

We distributed a flyer to around **15,000** properties in the Pukekohe, Paerata and south Drury area (see Appendix 1). This was intended to inform the community about the project prior to the beginning of the formal consultation period.

Due to a high level of interest from Grace James Road residents, a focus group with residential representatives was held in November 2022. This was to ensure that the project team and residents had an opportunity to discuss the North East Arterial proposal in detail.

3.2 Feedback

Feedback was gathered on preferred options in the transport network from the wider community. There was a high level of feedback overall, with a large proportion of feedback placed on the North East Arterial proposal. This is a summary of this feedback and the key themes that we received.

3.2.1 Online engagement statistics

We received **187 pieces of feedback** via our online engagement platform. 158 (83.68%) came from the interactive social map, with 29 (16.32%) coming from the survey. We received 48 emailed pieces of feedback, and 11 post-it note comments at our first community open day. Overall, we received 246 pieces of feedback.

The project page received 3,284 views over the engagement period, with 1,849 visitors. Traffic on the page peaked between December 12 – December 14, 2022, with around 140 visitors each day. The page attracted 1,770 new visitors to our online engagement platform. Most of these visitors were direct traffic, with 1,311 directly accessing the page through its URL.

There were 614 file downloads overall. 136 downloads were of the project map, and 131 were of the community flyer drop from November 2022.

3.2.2 Overall feedback

Respondents were asked whether they agreed that it would be more pleasant to move around Pukekohe town centre, if new or upgraded transport corridors were provided to redirect heavy freight away. Most respondents strongly agreed (30%), whereas others (23.3%) were neutral towards this statement.

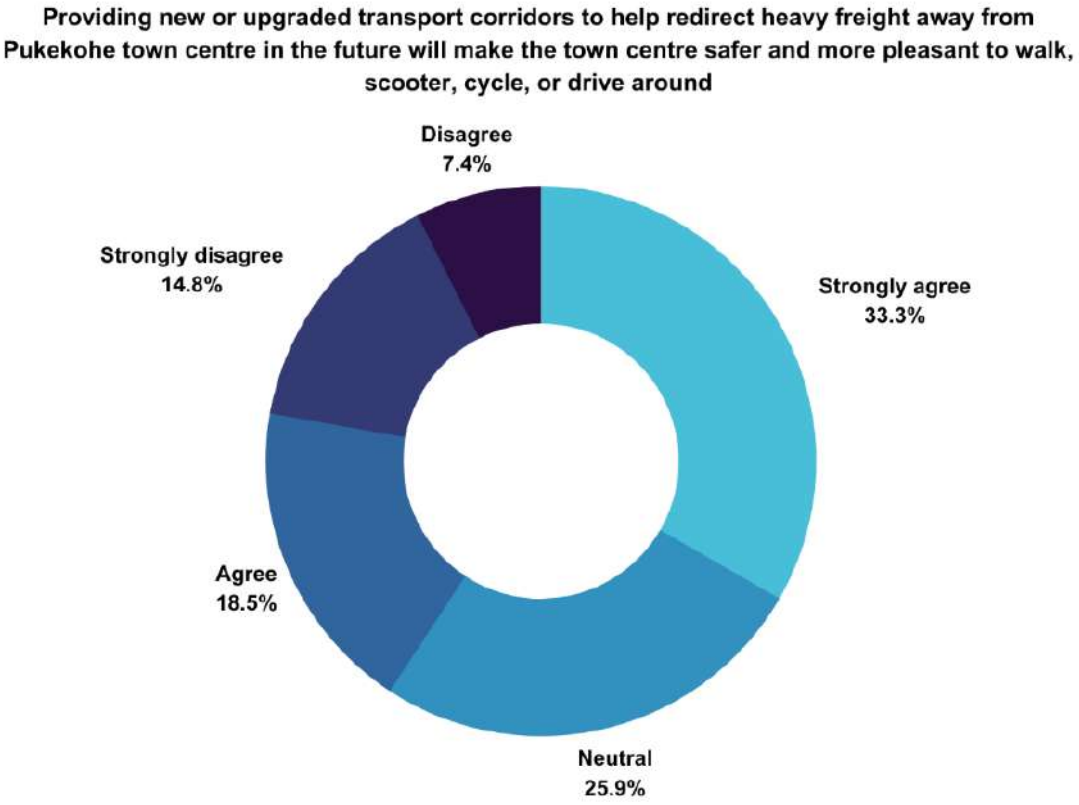

Figure 3: Sentiment towards new or upgraded transport corridors to help redirect heavy freight away from the town centre

The survey also asked respondents whether they want future generation to have safer and more sustainable transport options in and around Pukekohe, Paerata and south Drury. 63.33% of respondents either agree or strongly agree with this statement.

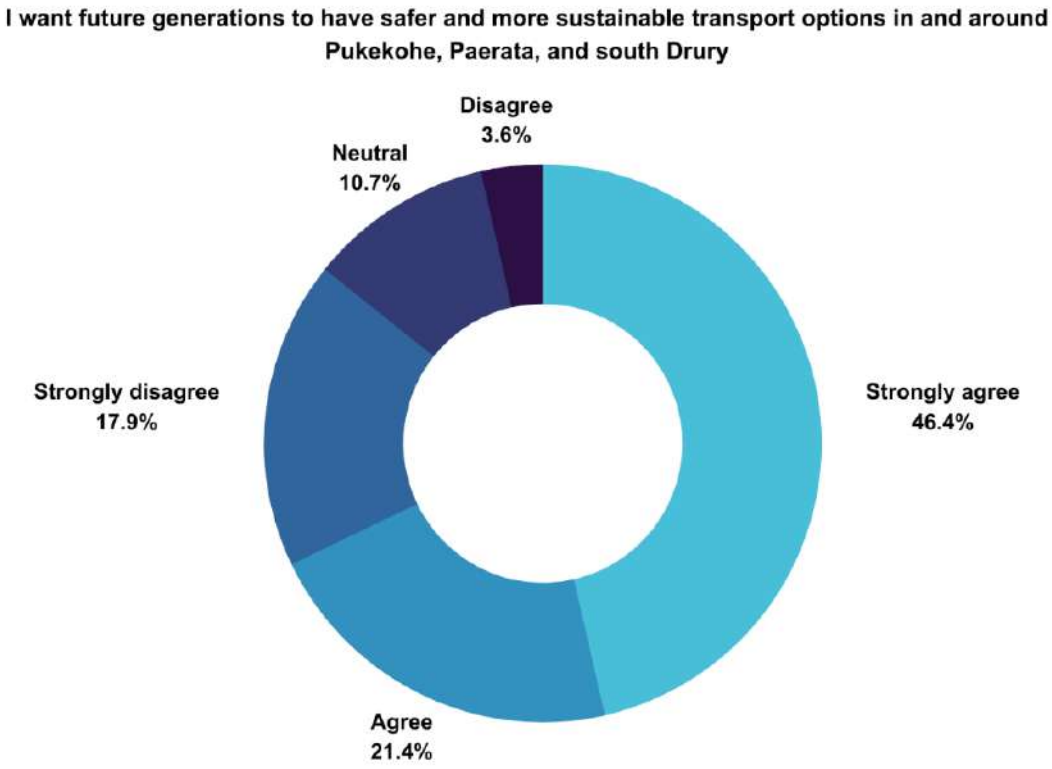

Figure 4: Sentiment towards the future generation having safer and more sustainable transport options

We asked survey respondents if they thought it was good that land is being protected now for future transport options to support growth in Pukekohe, Paerata and south Drury. 23 (79.3%) of respondents thought that it was, with 6 (20.7%) thinking it was not.

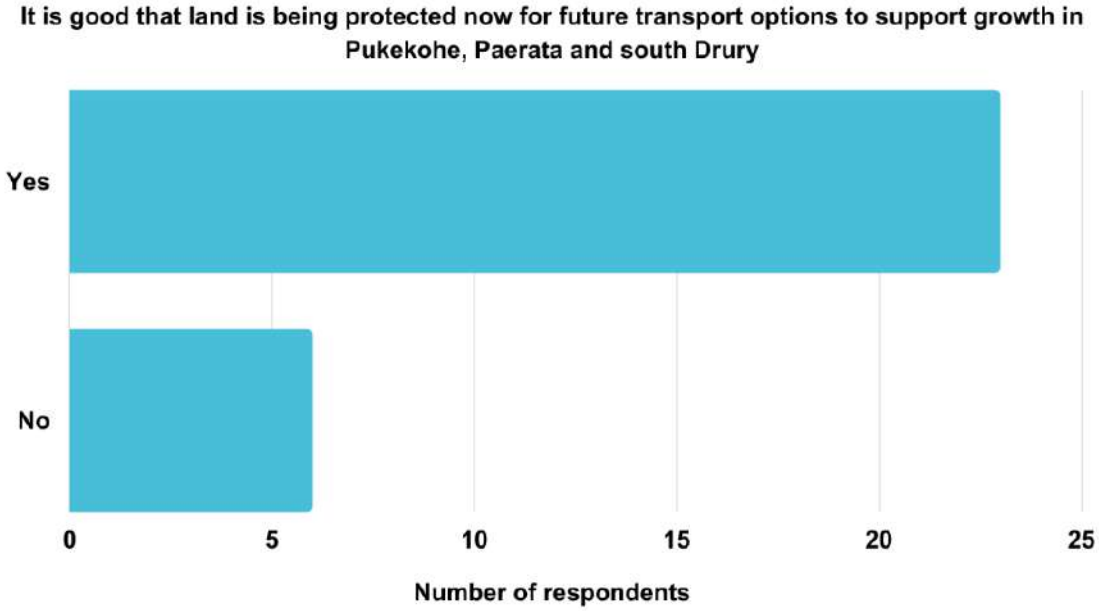

Figure 5: Support towards route protection for future transport options in Pukekohe, Paerata and south Drury

The survey also asked if there was any further feedback respondents wanted to place. People told us that they were concerned generally about potential property impacts. A low level of support was expressed towards the proposed network, due to people not agreeing with the location of different routes for the redirection of heavy vehicles from the town centre. Residents of Grace James Road and surrounding areas also told us that they do not support the North East Arterial proposal, applying the same key themes from across the other areas of feedback.

The project page also had an interactive 'social' map that allowed people to drop pins with comments at a location along the project footprint. The Pukekohe, Paerata and south Drury map received 171 comments from 103 contributors. Users were able to upvote comments they agreed with; 653 upvotes were made, averaging at 5.4 upvotes per comment. The majority of these comments were placed in the area of the North East Arterial proposal, specifically in the vicinity of Grace James Road.

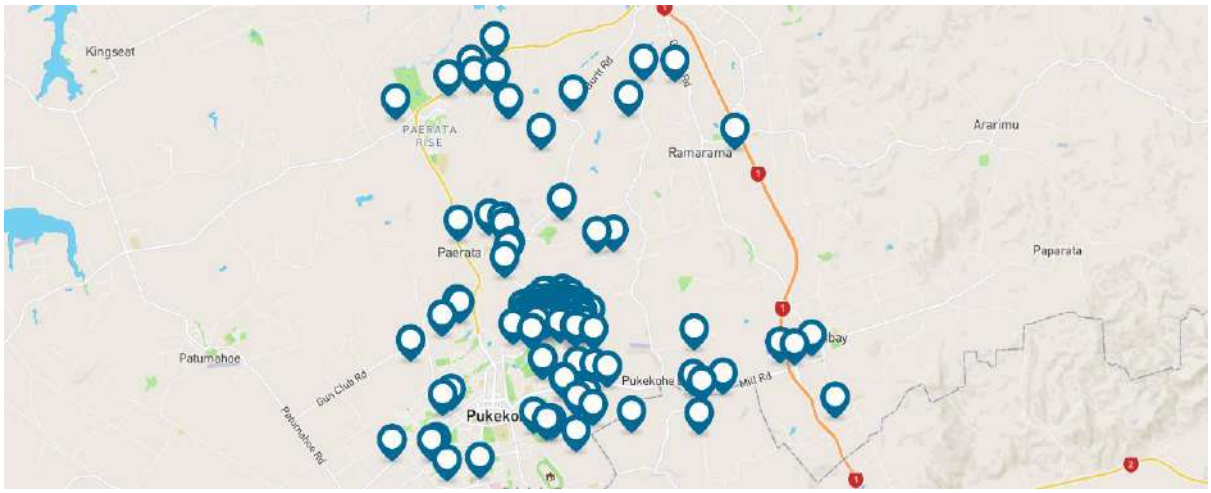

Figure 6: Hive social map with pin drops, by location

Key themes drawn from public feedback is summarised in Table below, alongside our responses to the feedback we received.

Table 4: Summary of key themes and responses

Key theme	Comments	What we have done
Opposition to the North East Arterial proposal	• A large proportion of the feedback received was against the proposed North East Arterial • Residents of Grace James Road and the surrounding area were heavily against the road being upgraded • Other members of the community were against the alignment out of concern for the impact on residents, safety for pedestrians and children, and for being too close to housing and the town centre • People told us that the proposal should be further north through greenfields, with many people agreeing with the original proposal in the Pukekohe-Paerata Structure Plan 2019	• We met with a community representative group (representing Grace James Road and surrounding streets residents), in November 2022. This was in response to a high level of engagement from several landowners to ensure that they were given an opportunity to directly speak with the project team about the North East Arterial proposal. • We acknowledged the strong opposition to the proposed NE Arterial option, specifically the section that runs along Grace James Road, and are taking the opportunity to test all options again. This work includes a northern rural route, similar to what was outlined in the Pukekohe--Paerata Structure Plan 2019. • We are considering if any changes should be made to the North-East Arterial proposal as a result of these additional investigations. We will complete this

Key theme	Comments	What we have done
		• investigation in early 2023 and advise the community and stakeholders of our findings.
Pukekohe Expressway	• Some pieces of feedback were unclear on whether the Pukekohe Expressway was being proposed • Other pieces of feedback disagreed with the Paerata Arterial and Drury-Paerata Link proposals, instead wanting a four-lane expressway.	• We are not proposing a four-lane expressway. We have selected a new emerging preferred option due to it having a smaller footprint, has reduced property impacts and integrated better with future urban areas providing better public transport, walking, and cycling facilities. Through the options assessment process, it also had a reduced effect on flooding, ecology, and visual amenity.
Rural areas	• People around Sim Road were concerned with the proposals that potentially impact the landowners should the arterial be constructed • Some landowners let us know that they were against proposals where they thought their properties were potentially impacted • A small level of feedback was concerned that Sim Road was being upgraded and made part of a strategic connection. People told us that this is an important route for rural business (farming, agriculture, and dairy.	• The Drury-Paerata Link and Paerata Arterial preferred options were selected as they integrated better with future urban areas providing better public transport, walking, and cycling facilities.. • We are not yet at the stage where we are able to discuss property impacts with potentially affected landowners. Further investigations and assessments are taking place to help the project team decide on the early detail of the proposals. • We will be in a better position to outline any potential property impacts with landowners in mid-2023, namely a draft designation boundary should their property be impacted.
'Ring route'	• People support a 'ring route' around Pukekohe town centre in principle. Several people told us that the community has been waiting for this to be constructed • However, most of the feedback disagreed with the route proposed as part of the Pukekohe Arterials, on the basis that the route was too close to the town centre, as well as current and future housing.	• We acknowledge that a ring route is an important local arterial for the community, and that people want it constructed much sooner. • We have considered all the feedback that we have received, and we will use this to decide whether any changes need to be made to each of the proposals. • Further investigations and technical assessments are taking place across early to mid-2023, to help the project team select their preferred option.
Heavy vehicle traffic	• We were told that heavy vehicle traffic is a contentious issue for the community. • People told us that they did not want heavy vehicle traffic so close to the Pukekohe town centre. Equally, we heard from different industries about the importance of heavy vehicles in their ability to conduct business in the Franklin district and beyond.	• The proposals aim to support the redirection of heavy vehicle traffic outside of Pukekohe town centre. This complements the vision of the Pukekohe Masterplan, which aims to make Pukekohe a better place to live, work and play. • We will review all feedback and people's suggestions towards how heavy vehicle traffic could be diverted safely from the Pukekohe town centre and use that to decide whether any changes should be made to the proposals.

3.3 Feedback by area

3.3.1 Drury West Arterial and South Drury Connection

Limited feedback was received for each of the Drury West Arterial and South Drury Connection proposal - fewer than five pieces overall. A general sense for the South Drury Connection from the few pieces of feedback received was that people would have preferred a four-lane connection instead.

3.3.2 Drury-Paerata Link and State Highway 22 Connection

Four pieces of feedback were received across these two proposals. From the limited pieces received, people told us that the Drury-Paerata Link proposal would impact several rural properties. Those who placed feedback were against the proposal where this would impact their property, as well as their working farms.

Limited feedback was received for the State Highway 22 Connection. From the people that gave feedback, the general sentiment was that they were unsupportive Comments were made around the need for this proposal to integrate with routes to and from Karaka (to the north of the project area), with feedback highlighting traffic issues in the area. Some felt it would not function correctly without supporting infrastructure between Blackbridge Road and the proposed strategic connection into Pukekohe. Additionally, the use of Sim Road as a connection was unsupported by 12 individual pieces of feedback.

3.3.3 Paerata Arterial

Less than ten people submitted feedback on the Paerata Arteria ll. From the people that gave feedback, the general sentiment was that they were unsupportive. Some were against it due to the potential property impacts the arterial would create, which would disrupt current resident's lifestyles. Others felt that a four-lane proposal was more suitable and that they did not like a departure from the earlier Pukekohe Expressway proposal in 2020. Feedback indicated that it would be better to use existing infrastructure along Sim Road and Cape Hill Road; however, a contrasting theme was that Sim Road is a rural road, and that the proposal would seriously impact the way that the road is used for agriculture and farming.

3.3.4 Pukekohe Arterials

The bulk of community feedback was made towards the Pukekohe Arterials, with over 150 pieces of feedback received. Despite support for the proposal in principle, there was mixed sentiment towards the proposed 'ring road'. People felt as though the proposal was too close to current and future residential areas and would prefer it to go outside of these areas. There was a mixed degree of understanding towards the context of climate change policies that were a consideration for the proposals. Some pieces of feedback were critical of a departure from the Pukekohe-Paerata Structure Plan 2019. Feedback for a proposed ring route has been divided into each of the four quadrants.

3.3.4.1 North West Arterial

Feedback was mixed towards the proposal. People commented that the current route is already congested, prompting that a solution is needed for this issue. Some pieces of feedback were critical of the proposal on the basis that it did not fully use existing infrastructure, and that it would place an

arterial through future housing developments. Other pieces of feedback were against this proposal due to the view that heavy vehicle traffic would create issues.

3.3.4.2 North East Arterial

More than 120 pieces of feedback were placed towards the proposal. Feedback towards the North East Arterial was mostly unsupportive. Some community members were against the proposal entirely. Other community members were supportive of a north east arterial in principle but disagreed with the proposal using the existing Grace James Road. Reasons for this sentiment were around safety, heavy vehicle movements, and a view that greenfields (the rural area) to the north are a better location for the arterial. Residents of Grace James Road and surrounding residential roads were strongly against the proposal. Residents did not want their street to become a local connection, fearing it would adversely impact amenities and the enjoyment of their properties. Other concerns were based around safety, land impact and property values, and that the proposed arterial departed from earlier options consulted on by Te Tupu Ngātahi, and Auckland Council for the Pukekohe-Paerata Structure Plan 2019. People felt that there should have been other options for consideration, a northern more rural route in line with that proposed in the Pukekohe-Paerata Structure Plan 2019 being one.

3.3.4.3 South West Arterial

Feedback was mixed towards the proposal. Out of the 15 pieces of feedback received, most did not support existing infrastructure being used, with some against residential streets being used as route by heavy vehicles. Some pieces of feedback recommended that the proposal shift southwards, to take traffic around Pukekohe town centre to the west. Other feedback placed touched on a lack of safety in the area (especially on Helvetia Road), with an already high volume of traffic and poor visibility. A small number of the pieces of feedback received wanted to see different alignments instead, with Jutland Road and the paper road through to Gunclub Road being suggested instead.

3.3.4.4 South East Arterial

There was mixed feedback overall for this proposal. Most pieces of feedback focused on the potential property impacts from landowners in the area. Other pieces of feedback did not agree with the proposed alignment, with some questions over why there was not a connection to Pukekohe East Road directly. People did not agree with the dog leg alignment from Golding Road. Some people understood that the proposal is trying to connect Golding Road to Svendsen Road (via Station Road), but people were against this out of concern for potential property impacts. Despite concerns towards the proposed alignment, most pieces of feedback generally understood that this would be an important local connection in the future.

3.3.5 Mill Road (Bombay) – Pukekohe East Road Upgrade

Pieces of feedback received for this proposal were mostly positive. People commented on the safety issues along the current route, particularly at the turn off near BP petrol station in Bombay. Feedback was supportive of an upgrade to Mill Road (Bombay) to four lanes but questioned why this did not carry down the entirety of the proposal into Pukekohe East Road. Some pieces of feedback highlighted that this a key route for users to travel to and from Pukekohe.

3.4 Media coverage

Media coverage was closely monitored during the engagement period. Table 5 below summarises the media coverage of the project.

Table 5: Media coverage of the project

Media Outlet	Date	Title	Key Points
Stuff	21/12/2022	*Pukekohe residents urge reconsideration of arterial road plans*	This article focused on the residents of Grace James and their opposition to the Pukekohe North East Arterial proposal.

4 Next Steps

Feedback gathered during the formal consultation period has been analysed. It will be used to help understand the issues and opportunities with the proposals for Pukekohe, Paerata and south Drury. This will also contribute to decision making on the project.

Engagement will continue with partners, key stakeholders, developers, landowners, and the wider community beyond the consultation period.

We will share feedback and our analysis with landowners and the community in early 2023. Further technical and specialist investigations will continue into 2023. We will be able to outline potential property impacts with affected landowners in mid-2023. Lodgement of the Pukekohe Notices of Requirement will occur in late 2023.

The project is currently without funding for detailed design and construction. It is not expected to be built for another 10- 20 years, in line with Auckland Council land release.

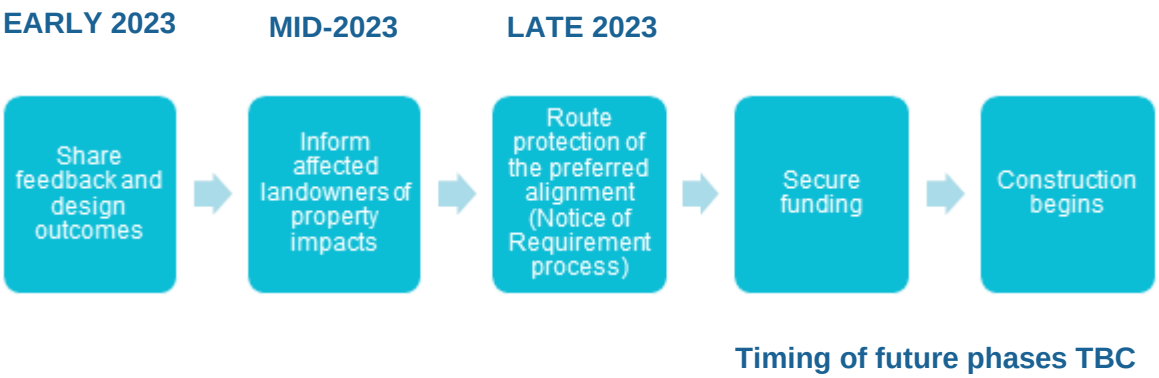

Figure 7: Indicative project timeline

Appendices

Appendix 1

This was the two-page community flyer distributed to 15,000 homes in the Franklin District.

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Planning future transport networks to support growth in Pukekohe, Paerata, and south Drury

August 2022

Te Tupu Ngātahi Supporting Growth is a collaboration between Auckland Transport and Waka Kotahi NZ Transport Agency.

We're responsible for investigating and planning more than 70 transport projects to support urban growth in Tāmaki Makaurau over the next 30 years. We're helping prepare for future expansion before new homes and communities are built.

Our transport projects will help connect new communities, help people travel in safe, low-carbon ways, and deliver infrastructure essential to future-proof our economy.

Previous engagement - Pukekohe, Paerata and south Drury

In 2020, engagement was undertaken with the community, Manawhenua, local businesses, and elected members on the Pukekohe Project as part of the Strategic South Detailed Business Case (DBC). This engagement focused on the emerging preferred corridor options for the Pukekohe, Paerata, and south Drury growth areas. Options we engaged on included:

- The Pukekohe Expressway
- State Highway 22 Connectors (across the rail line)
- The Northeast Urban Arterial
- The Mill Road Corridor (a transport connection from Redoubt Road to Drury).

In mid-2020, we paused work on the Strategic South projects as Aotearoa responded to the COVID-19 pandemic.



WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Next steps

We are now progressing the planning required for transport projects to support the future urban areas of Pukekohe, Paerata, and south Drury. Our first step is to assess the previously discussed options and balance them with new considerations, such as:

- A shift in the current climate change context, including Resource Management Act reforms and the Climate Change Response (Zero Carbon) Amendment Act.
- Increased developer activity in the area.
- The changing way Aucklanders want to travel – communities want more transport choices, including options for more sustainable transport modes.



There are already projects underway to support the expected growth in the area. These include:

- Improvements to State Highway 1 between Papakura and south Drury as part of the Waka Kotahi Papakura to Bombay project
- Waka Kotahi State Highway 22 Safe Network Programme safety improvements between Drury and Paerata
- KiwiRail electrification of 19km track between Papakura and Pukekohe and three new stations - Drury Central, Drury West, and Paerata.
- Drury Arterials - local roading infrastructure improvement projects

We'll be coming to talk more with the Pukekohe community in late 2022/early 2023. Keep an eye on our website https://supportinggrowth.govt.nz for more information about upcoming engagement and updates about our planning work in Pukekohe.

Where can I get more information?

If you have any questions, or if you'd like to speak to the Supporting Growth team, you can reach us by:

Visiting our website at supportinggrowth.govt.nz/growth-areas/south-auckland/

Calling us on the phone on 0800 GROW AKL (4769 255)

Emailing us at info@supportinggrowth.nz

Te Tupu Ngātahi Supporting Growth supportinggrowth.govt.nz

Appendix 2

This advert was displayed in both the Papakura Courier and Franklin Courier to advertise the community open day. It was also part of a second flyer drop to 15,000 homes in the community.



Appendix 3

This was a full-page advertorial in the Franklin Courier from December 2022. It intended to promote community engagement.



TE TUPU NGĀTAHI
SUPPORTING GROWTH

PLANNING AUCKLAND'S TRANSPORT FUTURE TOGETHER

WAKA KOTAHI NZ TRANSPORT AGENCY

Franklin residents are encouraged to come along to our second community information day on

Saturday 3 December 2022

Time: 12-2pm

Where: Pukekohe War Memorial Hall Concert Chamber, Massey Avenue, Pukekohe

Meet team members and find out more about the future network for Franklin.

Future Transport Projects Discussed at Pukekohe Open Day

Over the next 30 years, there will be more than 85,000 people living in Pukekohe, Paerata, and south Drury, with around 12,500 new homes and 5,000 new jobs expected because of this population increase. With areas of land across Pukekohe, Paerata, and south Drury being zoned for future urban growth, Te Tupu Ngātahi is in collaboration between Auckland Transport and Waka Kotahi NZ Transport Agency, is working to protect the land needed to deliver integrated, safe, and sustainable transport networks for future generations.

We're currently investigating the following:

- A new strategic connection between Drury South and Pukekohe with connections to State Highway 22 which includes:
  - Drury West Arterial and South Drury Connection
  - Drury-Paerata Link and State Highway 22 Connection
  - Paerata Arterial
- Pukekohe Arterials which will form a 'ring road' providing an alternative route to the current main road through the Pukekohe town centre and connections to the future urban zones in Pukekohe.
- Mill Road (Bombay) – Pukekohe East Road Upgrade to four lanes between the State Highway 1 interchange and Hamsville Road.

Around 150 members of the community, including residents of Pukekohe, Paerata and south Drury, visited the open day at Franklin. The Centre on Saturday 12 November. On the table and up for discussion were proposals for future transport routes in and around Franklin over the next 30 years.

All the information day, community members had the opportunity to meet the project team and see first-hand the proposed options for improved transport networks across the area.

Andy Baker, our new Franklin Ward Councillor, attended the open day and says that growth in the area is expected in Auckland, including in Franklin, to be significant to leave to chance.

"Around 1.66 million people currently live in Auckland," explains Mr Baker. "And over the next 30 years, this number could reach 2.4 million. That's massive growth. We need a clear understanding of what this growth looks like, and how it can be supported. That includes in Franklin. We can't just let growth happen without planning for it."

Alan Cole, Deputy Chair of the Franklin Local Board, agrees.

"You might be someone who doesn't mind change and growth, or you might be someone who doesn't want either," reflects Mr Cole. "But as we look to the future across Pukekohe, Paerata and south Drury has been a real opportunity to support business and residential growth, so we know things aren't going to stay the same. The Pukekohe of today is different to the Pukekohe of our grandparents, and it will be different again for our grandchildren and adults. I want better transport options, and to get them, we need to plan now. Designating now is all about futureproofing for what's to come in the future."

Congratulations to Brett Norris Angela Golding Linda Brown who attended our first open day and won an electric scooter and helmet.

People can also give feedback on the proposals for our future transport network. Go to https://haveyoursay.supportinggrowth.nz/pukekohe

Consultation for this round of engagement closes on 13 December 2022.



14 FRANKLIN COUNTY NEWS, NOVEMBER 24, 2022 neighbourly.co.nz

Woman's sore knees were bone cancer

SOPHIE HARRIS

When Amy Haigh's knees began to hurt, she thought nothing of it.

At 17, she had always been fit and healthy. The south Auckland local was training for a fitness competition and in the gym five days a week.

When she finally went to the doctor, she was told the pain, inconvenience – the pain, just would be a temporary thing.

However, doctors would eventually diagnose her with bone cancer.

Haigh is talking about her experience to remind young people to take their health seriously.

"It's so easy for life to get in the way, and you can chuck it all in and say you'll do those things for yourself," she said.

"It's about being in tune with your body, and knowing what's right and what isn't, and getting it looked at."

When Haigh first went to the doctor, she had no idea what everything looked normal.

However, the Bombay woman, just a little "normal" A later MRI and CT could find there was a mass on the knee, where osteosarcoma drilled into the bone to take a sample, which was sent away.

On a Thursday night in October her doctor called to tell her she had osteosarcoma, a

"It's about being in tune with your body, and knowing what's right and what isn't, and getting it looked at."
Amy Haigh

things would never be the same again.

She had hoped to undergo treatment to preserve her eggs, but her heart beats thereapy immediately.

The aggressive treatment meant her chance of having children was significantly reduced.

"I've worked with children my whole life, so it was devastating," she said.

She started chemotherapy at the end of October and has another three months to go, as well as radiation.

"I'm the youngest I have seen in the oncology ward by far."

In November, Haigh gave up her job.

She said it was the past 10 years that was an early childhood educator, but doctors told her she couldn't be around children as the treatment has compromised immune system.

She will be left without an income for about six months.

Her sister has set up a Givealittle page to help cover costs.

In October, Amy Haigh was diagnosed with osteosarcoma, a form of bone cancer.

Haigh has not yet been told what the cancer is like. She said it was better this way.

She said the diagnosis had changed her life and many

form of bone cancer.

Middlemore Hospital's Mayo Clinic, bone cancer is very rare, making up less than 1% of all cancers.

While many cancers are most likely to affect older people, osteosarcoma tends to occur mostly in teenagers and young adults.

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Pukekohe DBC

Appendix H – Cost Estimate Report

May 2023

Version 1.1

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

Document Status

Responsibility	Name
Author	[redacted]
Reviewer	[redacted]
Approver	[redacted]

Revision Status

Version	Date	Reason for Issue
0.1	14th April 2023	Draft for internal review
1.0	24st April 2023	For Waka Kotahi and Auckland Transport review
1.1	18th May 2023	Issued for IQA

Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

Cost Estimate Summary Table



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Table 3 Cost summary by project costing segment ($ Million) 1

Acronym/Term	Description
AT	Auckland Transport
AUP	Auckland Unitary Plan
CEM	SM014 Cost Evaluation Manual
CH	Chainage
DBC	Detailed Business Case
SM014	SM014 Cost Evaluation Manual
WK	Waka Kotahi

1 Introduction

This estimate has been prepared to provide an indication of costs for future budget forecasting and for inclusion in the economic analysis, part of the **Appendix C Economics assessment** within the Pukekohe Detailed Business Case (DBC).

This document should be read in conjunction with the **Appendix E Design report** within the Pukekohe (DBC) and appended general arrangement plan.

The costing of works has been based primarily on the revision A general arrangement drawing dated January 2023, the generic assumptions schedule outlined in Appendix H2 of this report, and indicative property cost outlined in the Appendix H3. The estimates have been prepared to reflect the projects highlighted on the Figure 1. Sub-segments of the grade separated corridors have been costed separately.

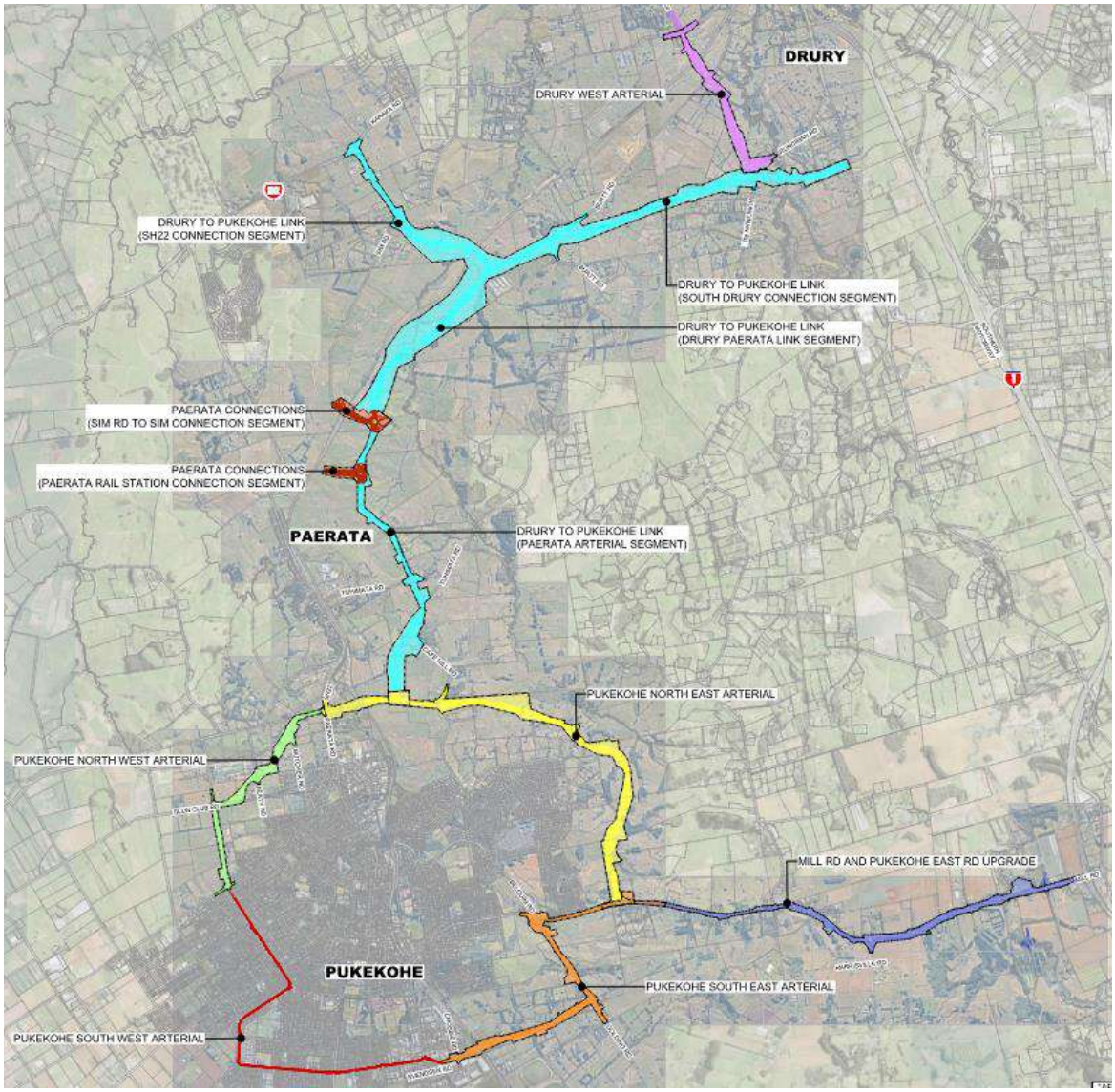


Figure 1 Pukekohe costing scope of works

2 Approach to cost estimation

The cost allowances formatting has been developed consistent with the Cost Estimation Manual (CME) for a Detailed Business Case (DBC). No risk analysis has been undertaken.

2.1 Property

The cost of land forms a significant part of the estimate. Property cost estimates have been prepared by the Auckland Transport team on behalf of Te Tupu Ngātahi. These cost estimates have been prepared based on the land requirement (full, permanent and temporary) represented by the proposed Designation boundary in the Revision A drawing set. The assumptions associated with the property cost estimates are attached in the Appendix H3 within this report.

The property costing approach is as follows:

- **Review the proposed alignment –** identify those properties where the proposed project alignment would have a significant impact requiring the acquisition of the full property. These full acquisitions are then costed at the current estimated market value using online resources.
- **Obtain independent valuation advice** – Gribble Churton Taylor Valuers were engaged to provide a report with land rates for the AUP zones applicable within the subject area.
- **Develop an acquisition cost for each property** – develop an acquisition cost (for business case purposes) for the identified property by applying the appropriate land rate to the permanent land requirement identified in the land requirement plans provided.
- **Benchmark** – Use the current pricing to inform the validity of the parcel pricing
- **Review** – Property pricing reviewed by senior experienced valuation experts

Where it was found that a property requirement was on the boundary between two costing segments (refer to Appendix H4), an assessment has been made as to which segment this cost should best be attributed to. It is for partly for this reason that the property cost estimates per “project corridor” in the property cost memorandums supplied do not necessarily align with those in Table 3.

[redacted]

Table 2 Assumed temporary occupation by project corridor

Project corridor	Expected construction duration (years)	Assumed duration for temporary occupation (years)	[redacted]
Drury West Arterial	3 to 4 years	4 years	
South Drury Connection	3 to 4 years	4 years	
SH22 Connection	3 to 4 years	3 years	

Project corridor	Expected construction duration (years)	Assumed duration for temporary occupation (years)	[redacted]
Drury-Paerata Link	3 to 4 years	4 years	
Paerata Arterial	3 to 4 years	4 years	
Sim to Sim Connection	1 to 2 years	2 years	
Paerata Rail Station Connection	1 to 2 years	2 years	
Pukekohe North-East Arterial	3 to 4 years	4 years	
Pukekohe South-East Arterial	3 to 4 years	4 years	
Pukekohe South-West Arterial	1 to 2 years	2 years	
Pukekohe North-West Arterial	3 to 4 years	4 years	
Mill Road Upgrade	3 to 4 years	4 years	
Pukekohe East Road Upgrade (WK)	3 to 4 years	4 years	
Pukekohe East Road Upgrade (AT)	3 to 4 years	4 years	

2.2 Project development phase

An allowance of 2% of the sub total base physical works has been applied for project development phase. This includes the following:

- Consultant fees, including preliminary design, implementation business case
- Client managed costs.

2.3 Pre-implementation phase

An allowance of 9% of the sub total base physical works has been applied for pre-implementation phase. This includes the following:

- Consenting 1%, including environmental court risk
- Design fees 7%, including geotechnical investigation
- Client managed costs 1%, including IWI consultation

2.4 Implementation phase

2.4.1 Implementation fees

An allowance of 6% of the sub total base physical works has been applied for implementation fees within the Implementation phase. This includes the following:

- Consultancy fees 2%
- Client managed cost 4%

2.4.2 Physical works

Costs allowances for the physical works costs have been undertaken by the quantity surveying team based on assumptions scheduled as per the Appendix H3 per each corridor described in the Appendix H4 of this report. Quantity measurements are from the concept design shown on the General Arrangement drawing as part of the Appendix E1 Design report of the Pukekohe DBC.

An allowance of the following physical works items has been made:

- Environmental Compliance
- Earthworks
- Ground Improvement
- Drainage
- Pavement and Surfacing
- Bridges
- Retaining Walls
- Traffic Services
- Utility Services
- Landscaping
- Traffic Management
- Preliminary and General
- Extraordinary construction cost

2.5 Risk and Contingencies

The physical works allowances include a 25% contingency (P50) and a funding risk contingency (P95) of 20%, reflecting the uncertainty in the final form of the projects. These contingencies are required for cost estimation in accordance with the CEM. Definitions for those are as follows:

Contingency (P50)

> A financial provision added to the base estimate to provide for uncertainty in relation to the estimate inputs and specific project threats and opportunities with a cost impact to derive the expected estimate. The ‘contingency’ represents the statistical mean.

Funding Risk Contingency (P95)

An additional financial provision for uncertainty in relation to the estimate inputs and project related threats and opportunities (funding risk contingency)

Advanced approach toward risk is to be undertaken on the Implementation Business Case in the future.

2.6 Escalation

The cost allowances provide an indication of infrastructure funding requirements at a base date and do not reflect programming over time. Therefore, escalation is not included directly in this report.

2.7 Verification

A Business Case of this scale would normally involve preparation of a parallel estimate by an independent estimator. However, as this Business Case is primarily focused on route protection and a subsequent stage will be undertaken to seek funding for implementation, the level of cost estimation accuracy is considered to be less than a typical DBC. Therefore, it has been agreed with both Auckland Transport and Waka Kotahi that the costs will be peer reviewed through 'cross verification' by a separate team within Te Tupu Ngātahi who were independent of the initial estimate preparation. .

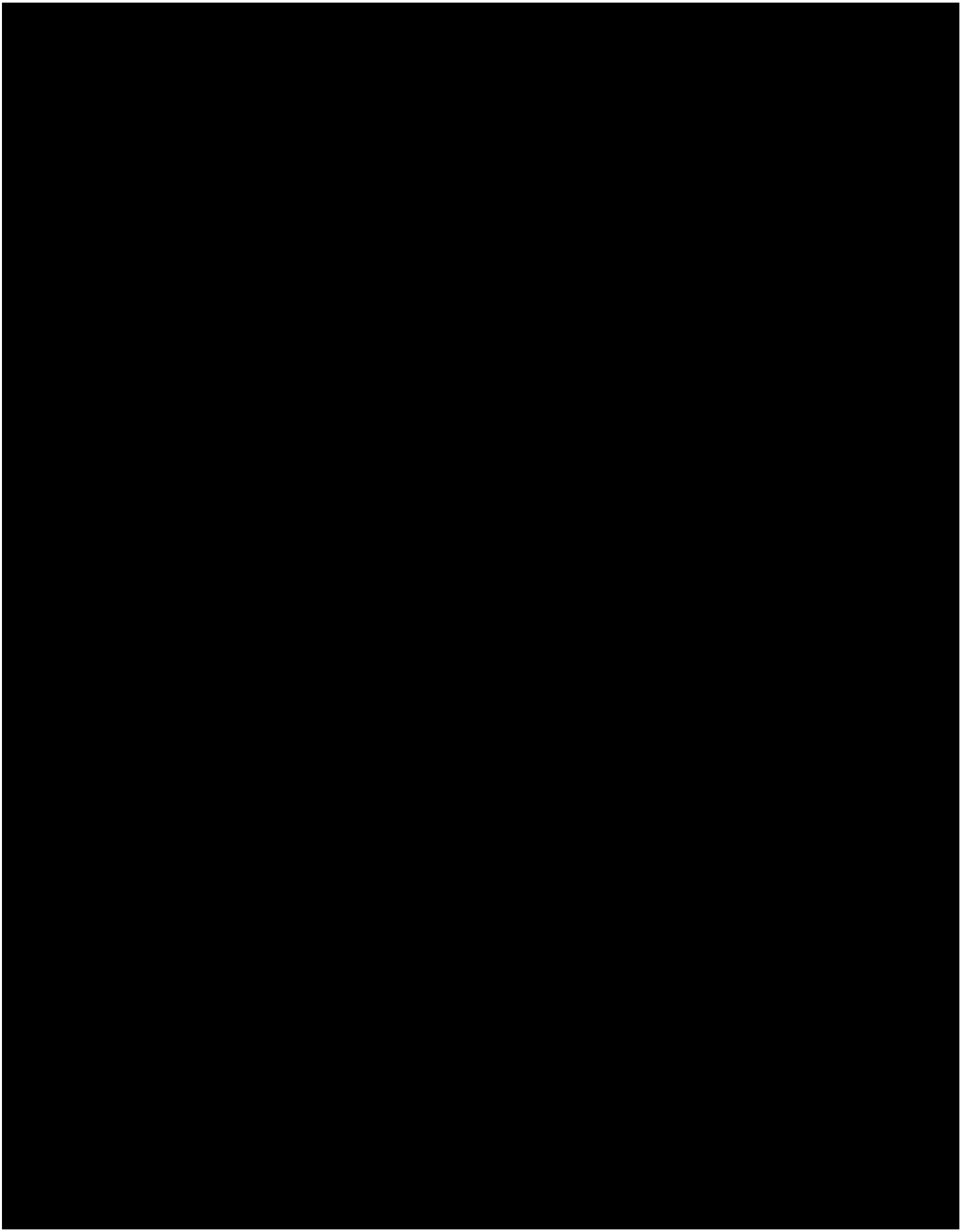
From a property point of view, verification is suited to a route protection business case to follow the approach outlined on the section 2.1 on this report involving the following:

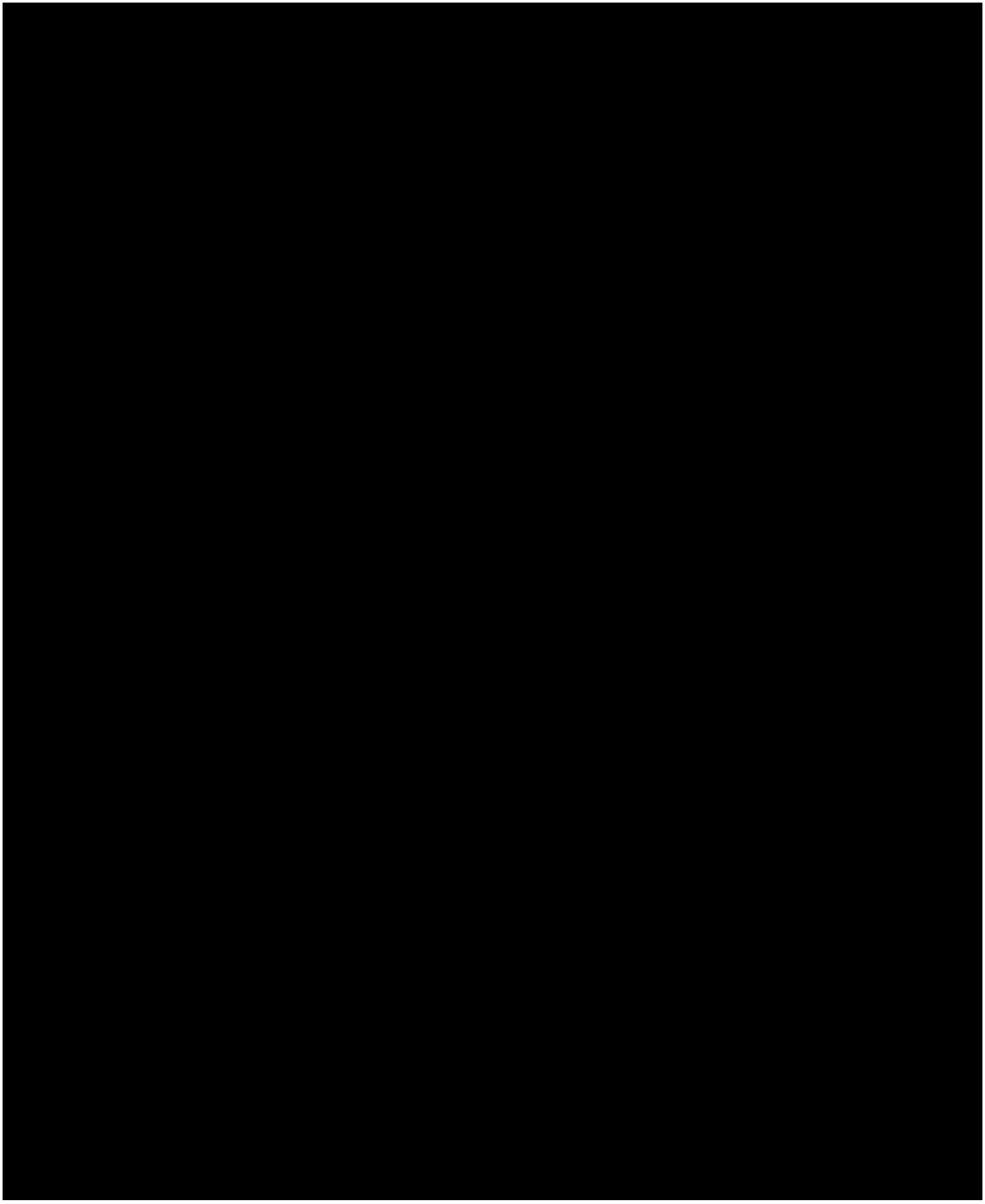
- Undertake a review of the methodology applied on the project
- Undertake a review of the rates/benchmarking used for different land uses and property types
- Internal review with AT and Waka Kotahi on property estimates

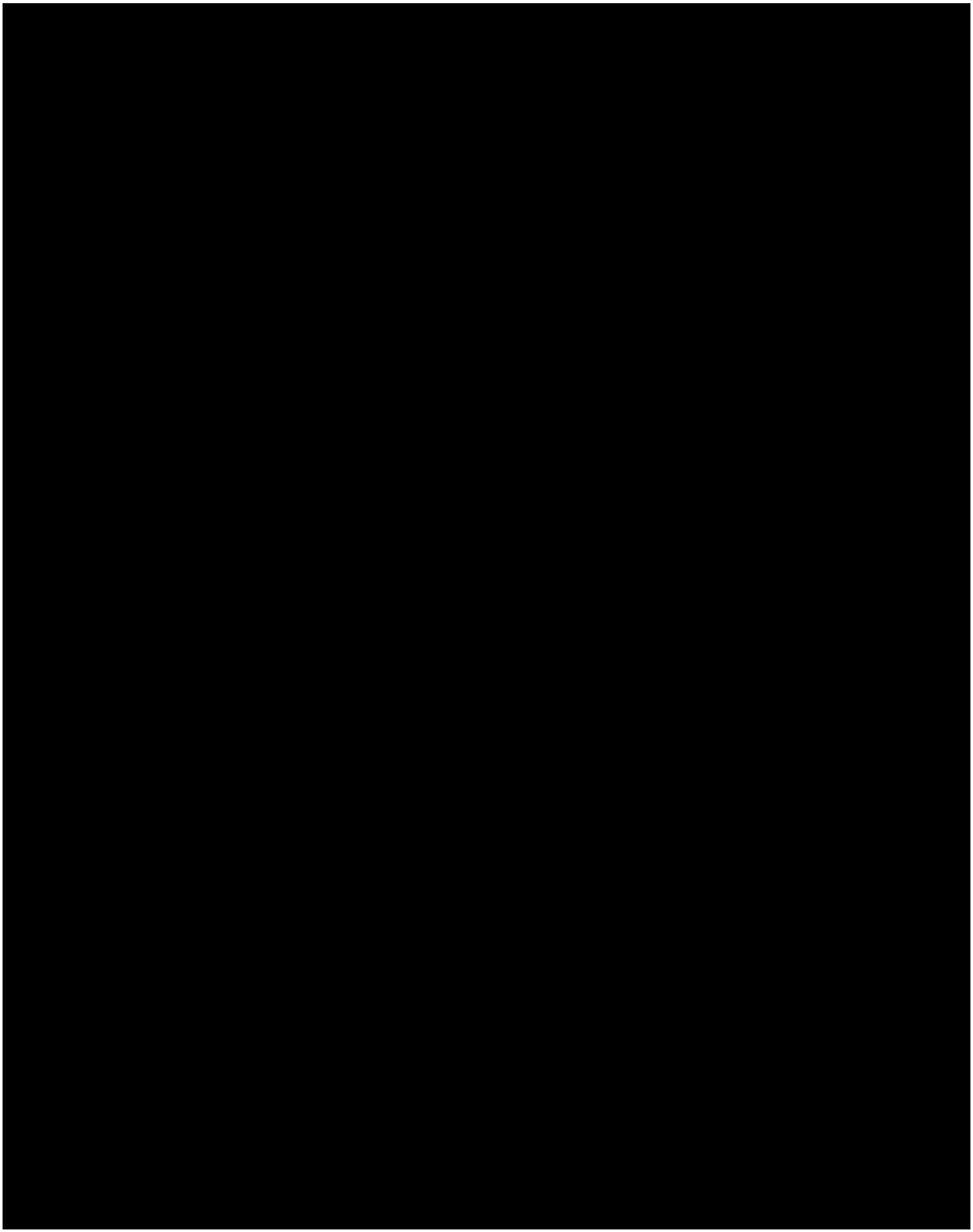
3 Cost summary

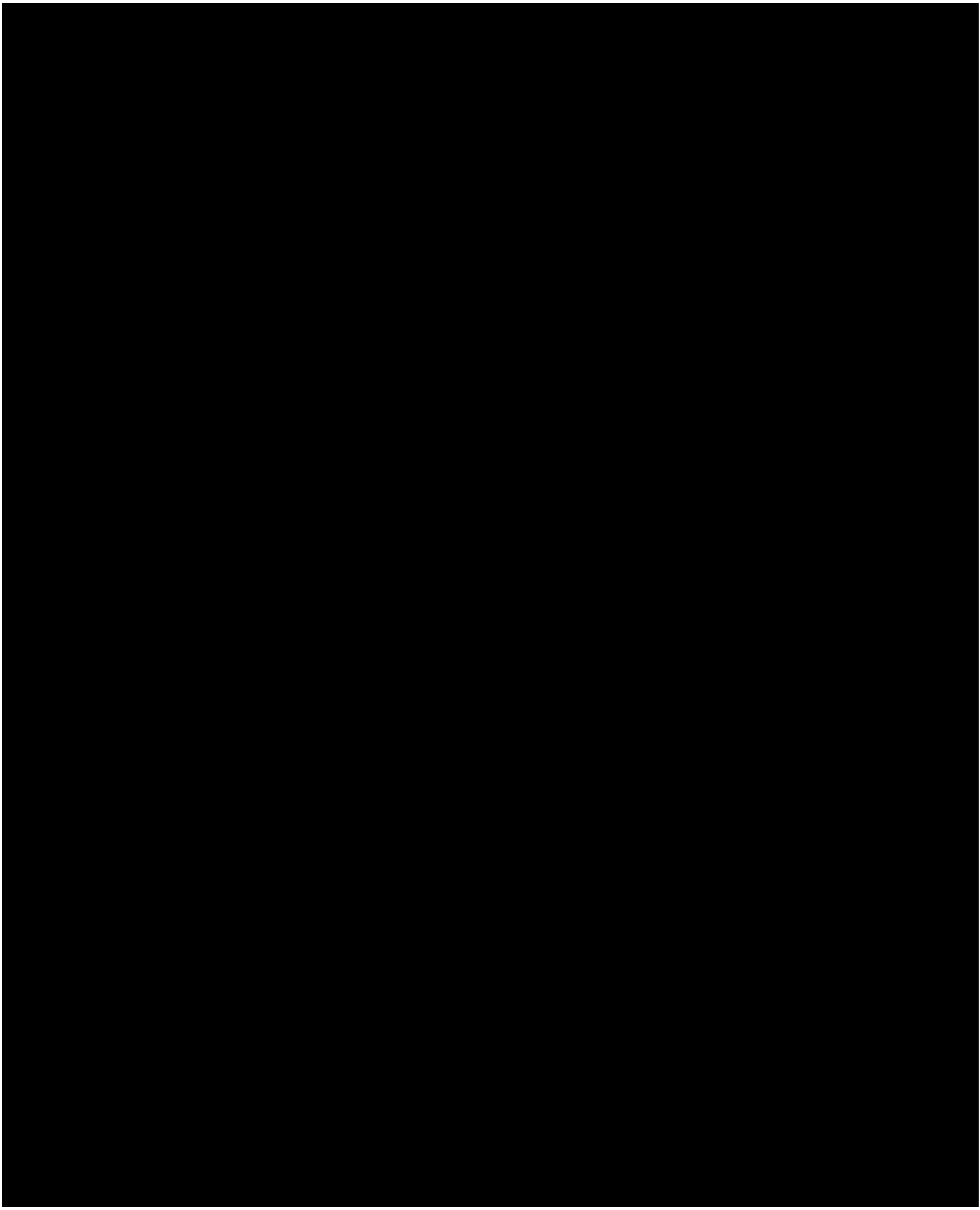


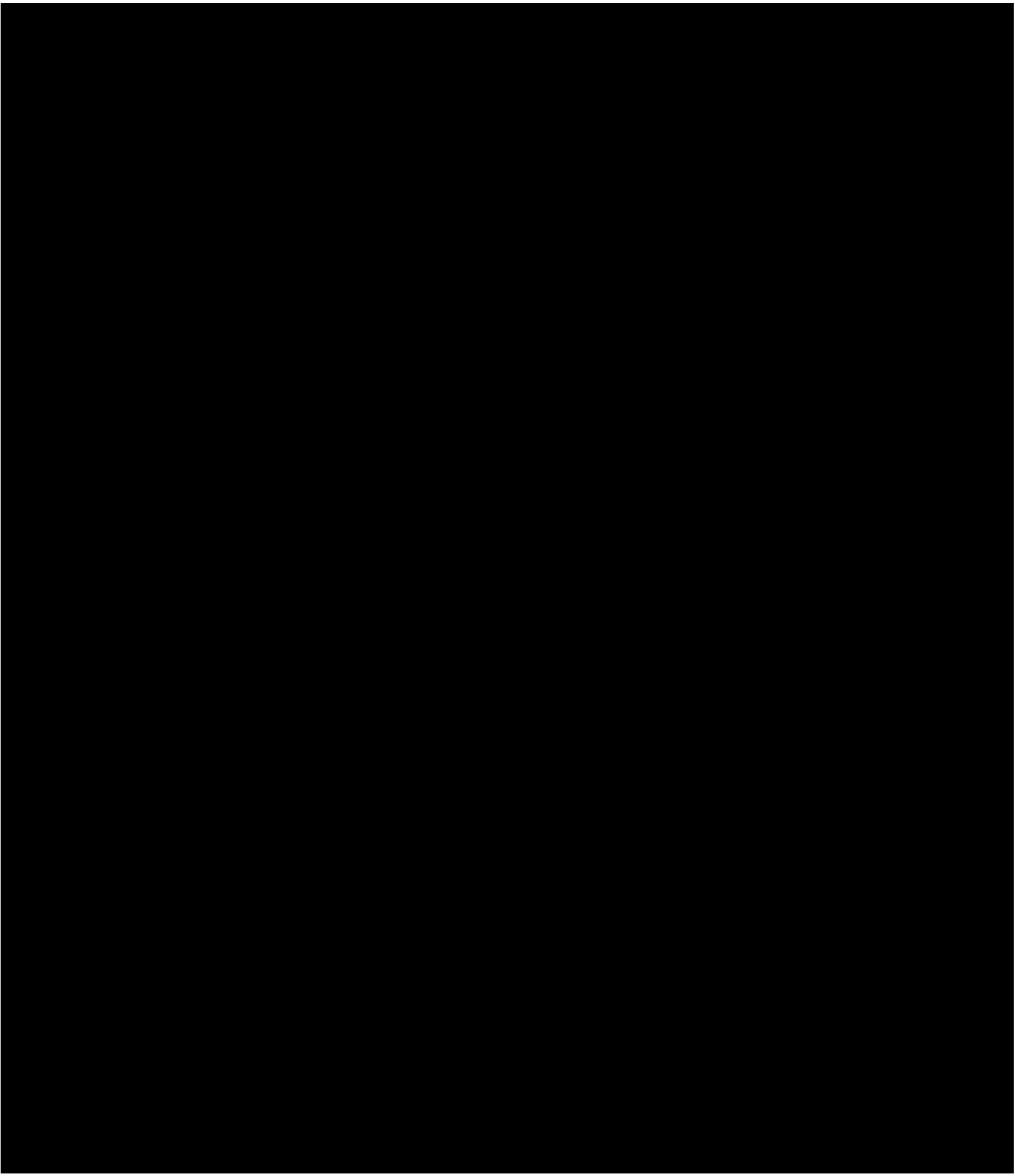
Appendix H1 - Cost estimate summary forms (DBE)

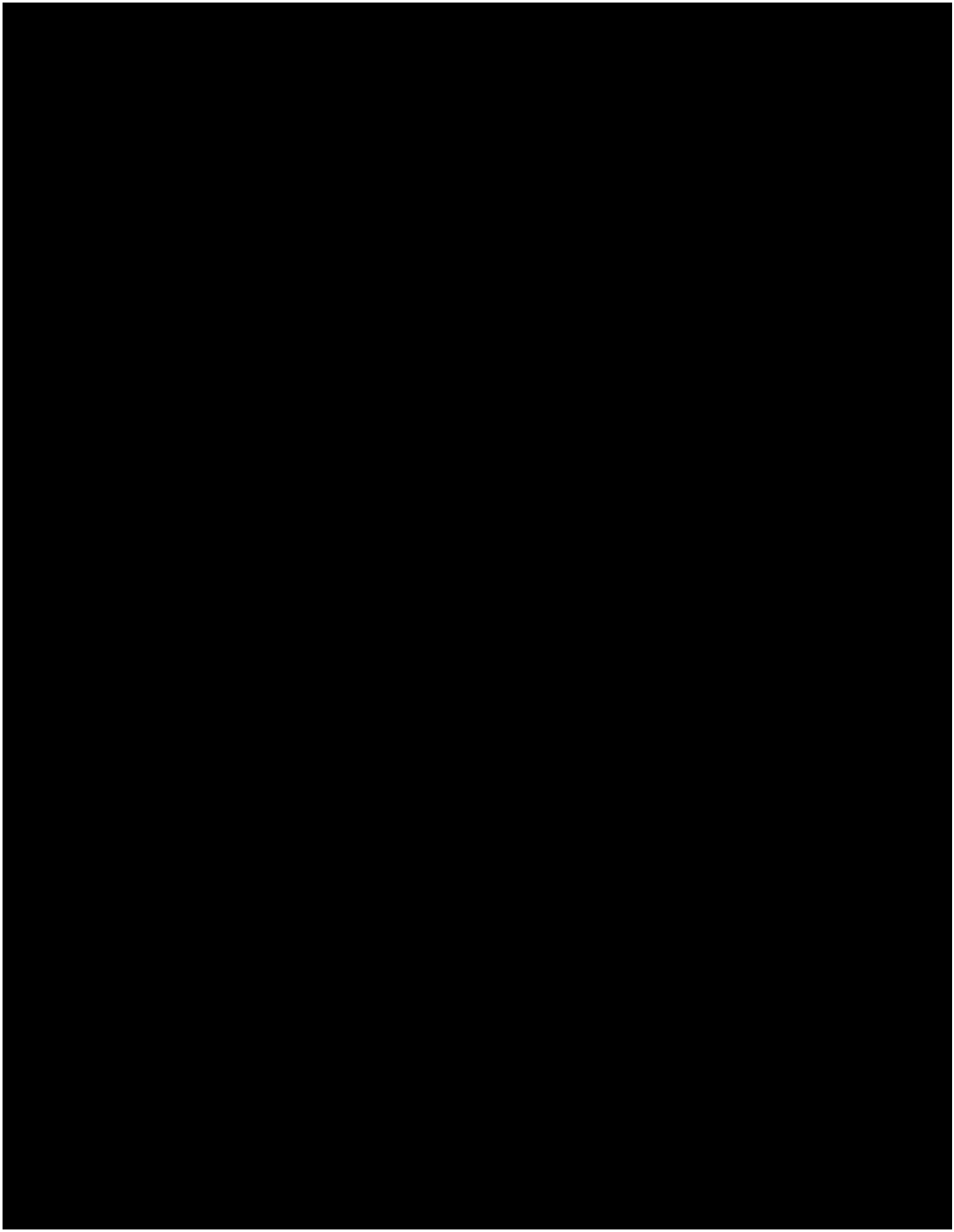


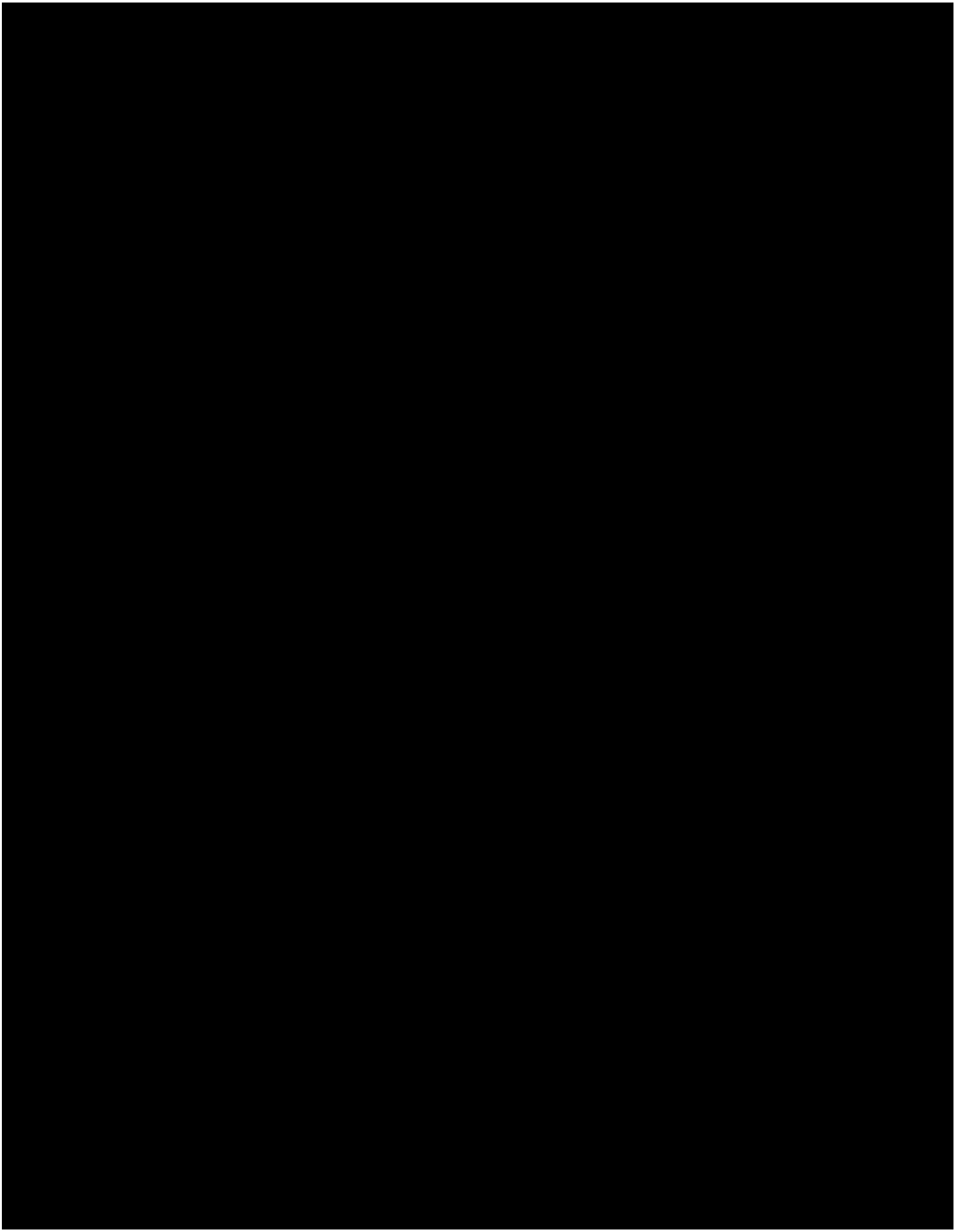


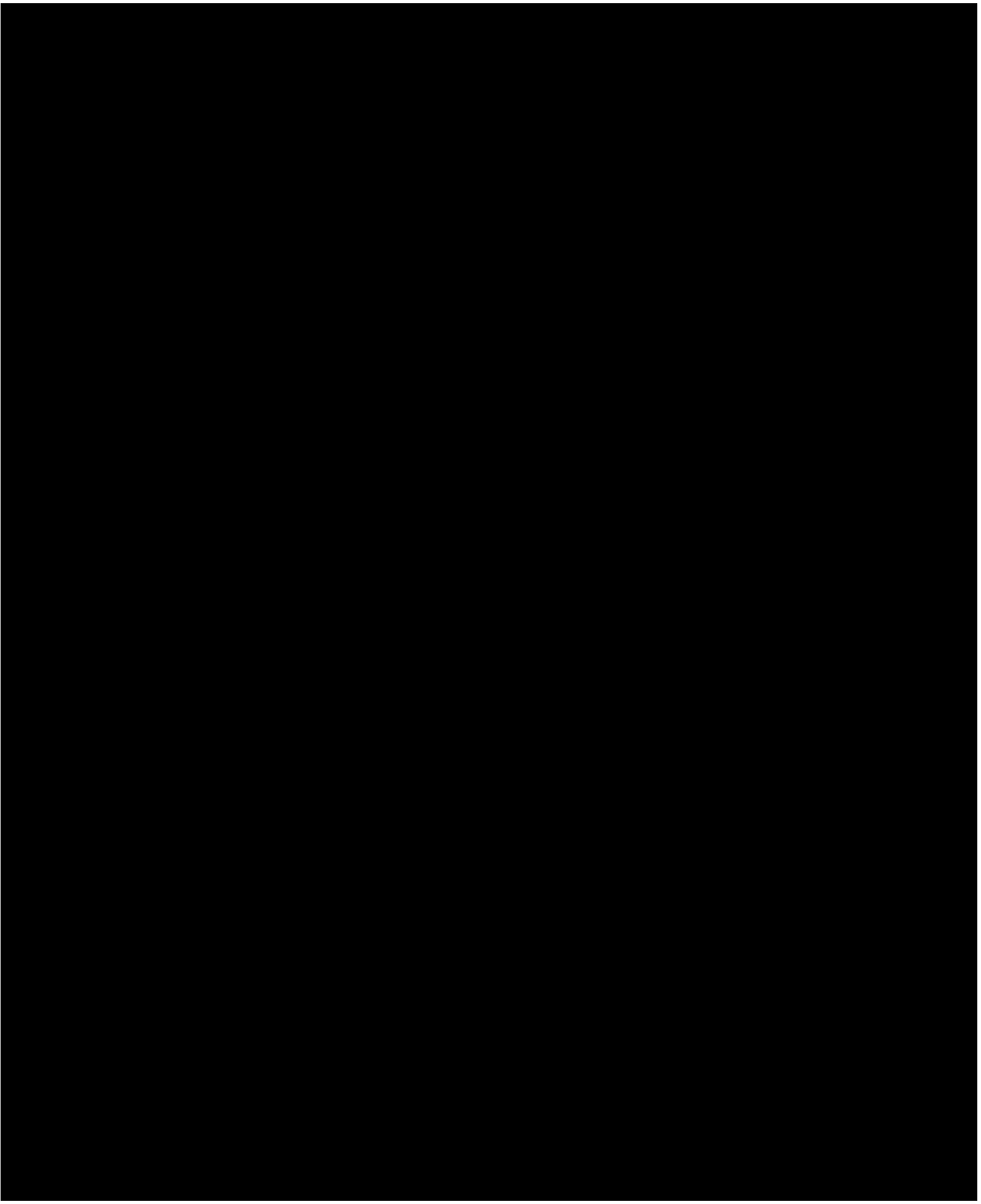


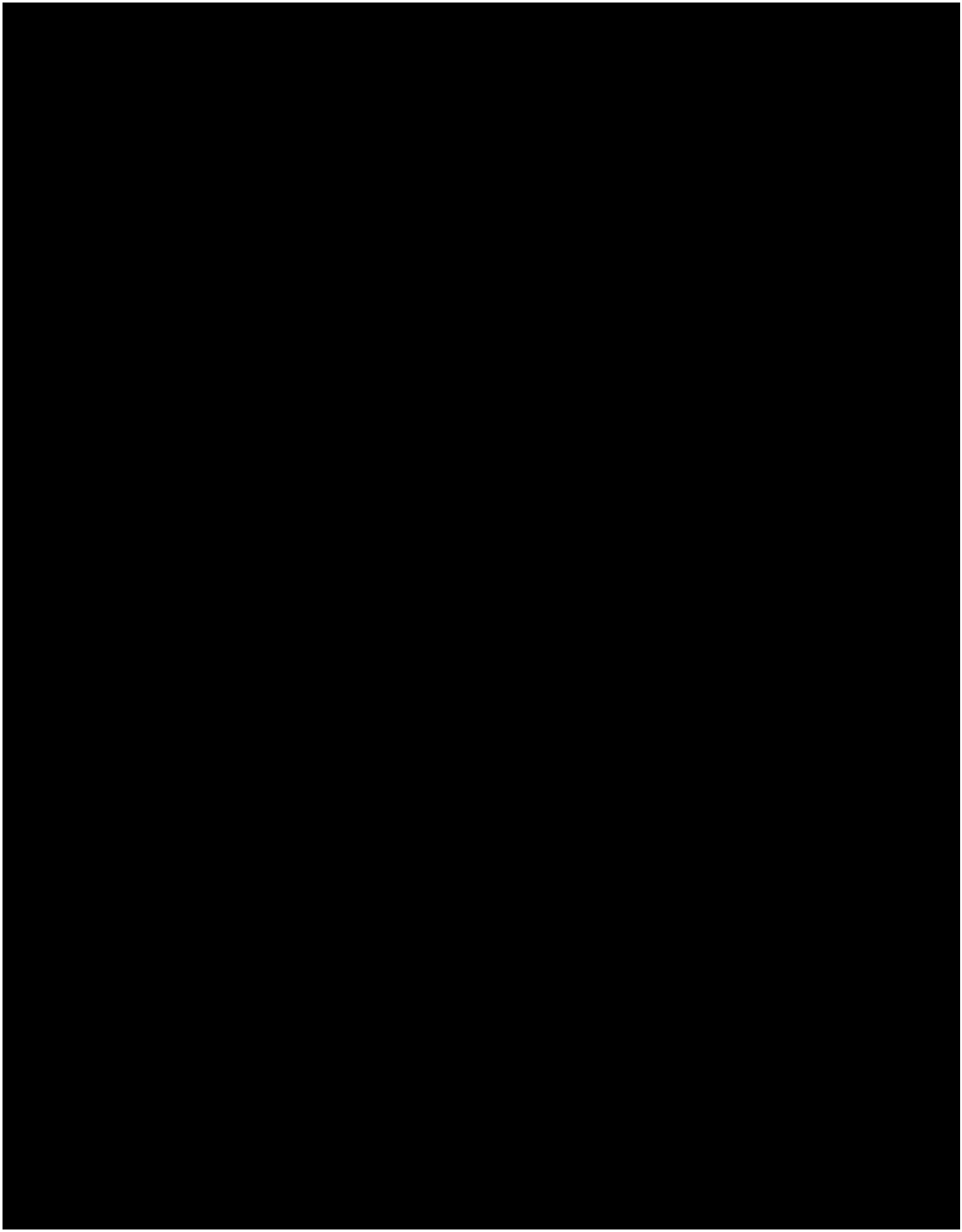


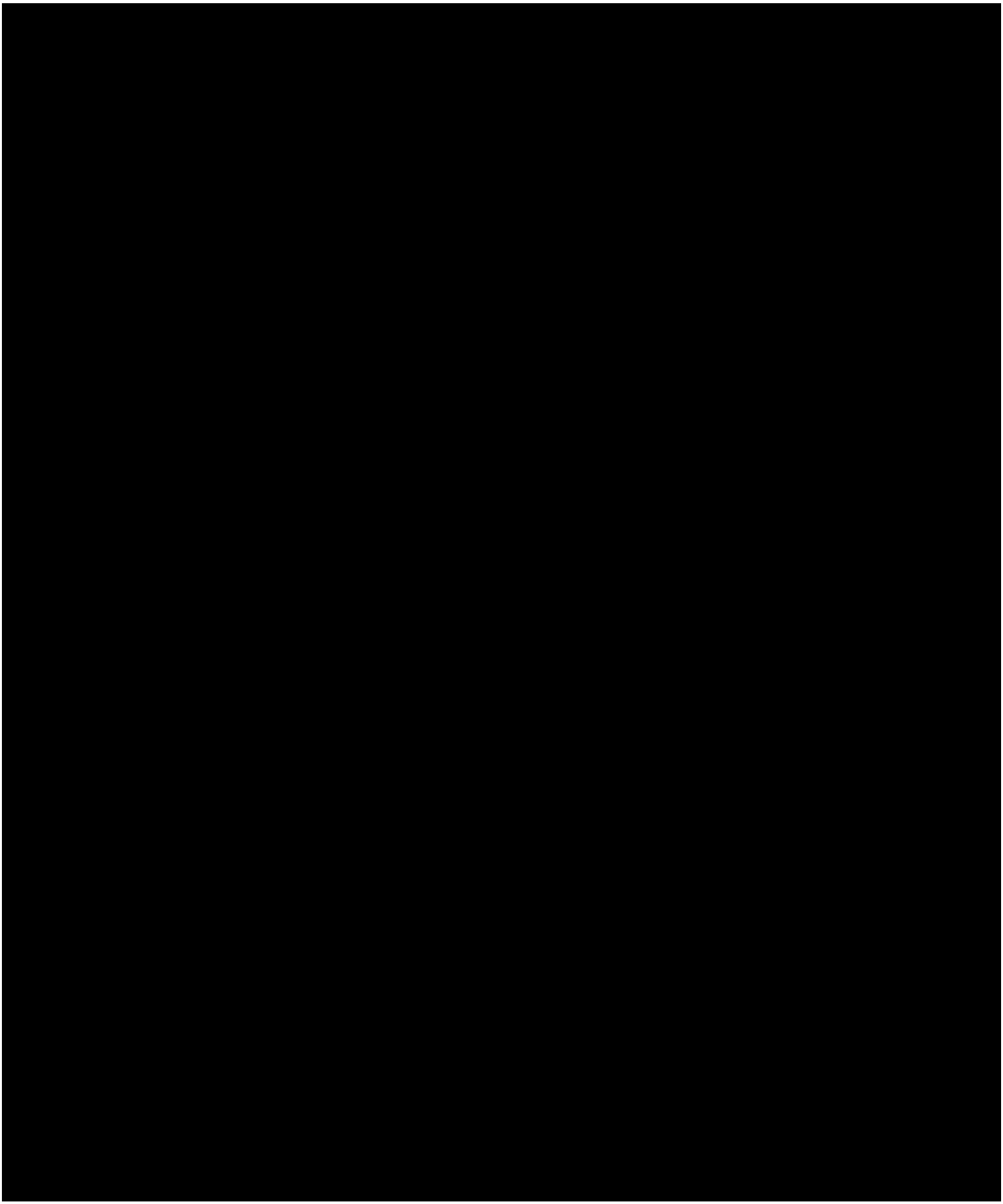


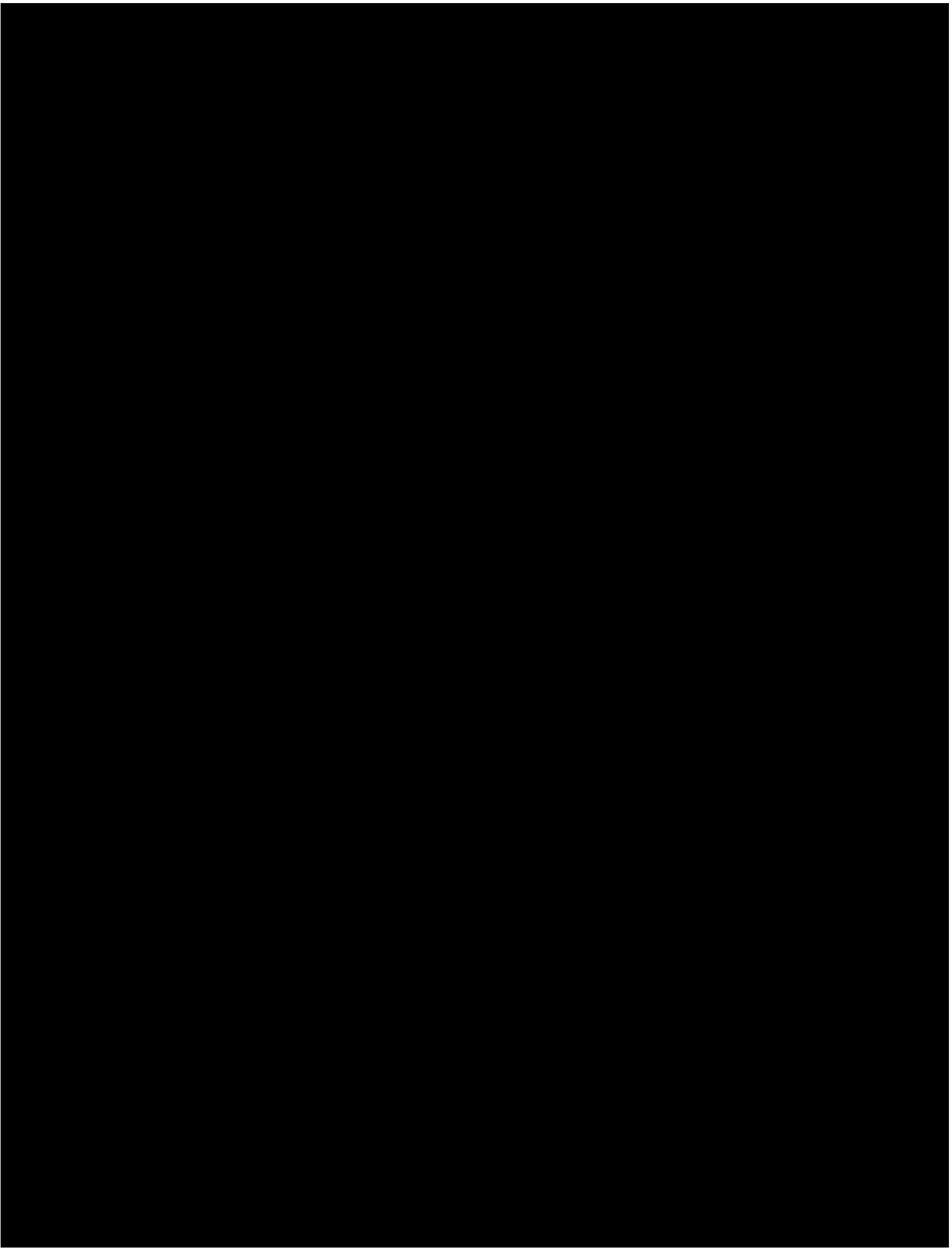


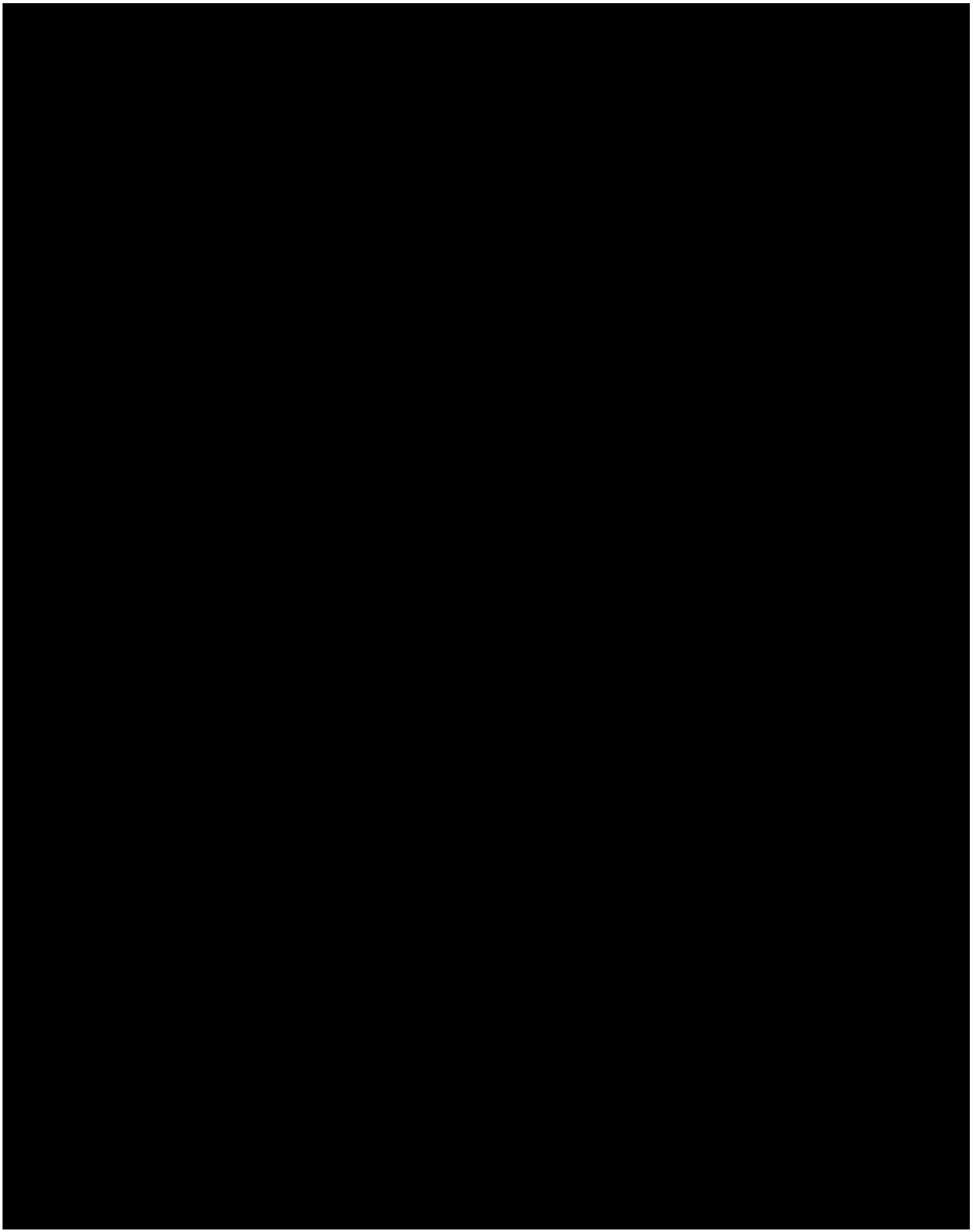


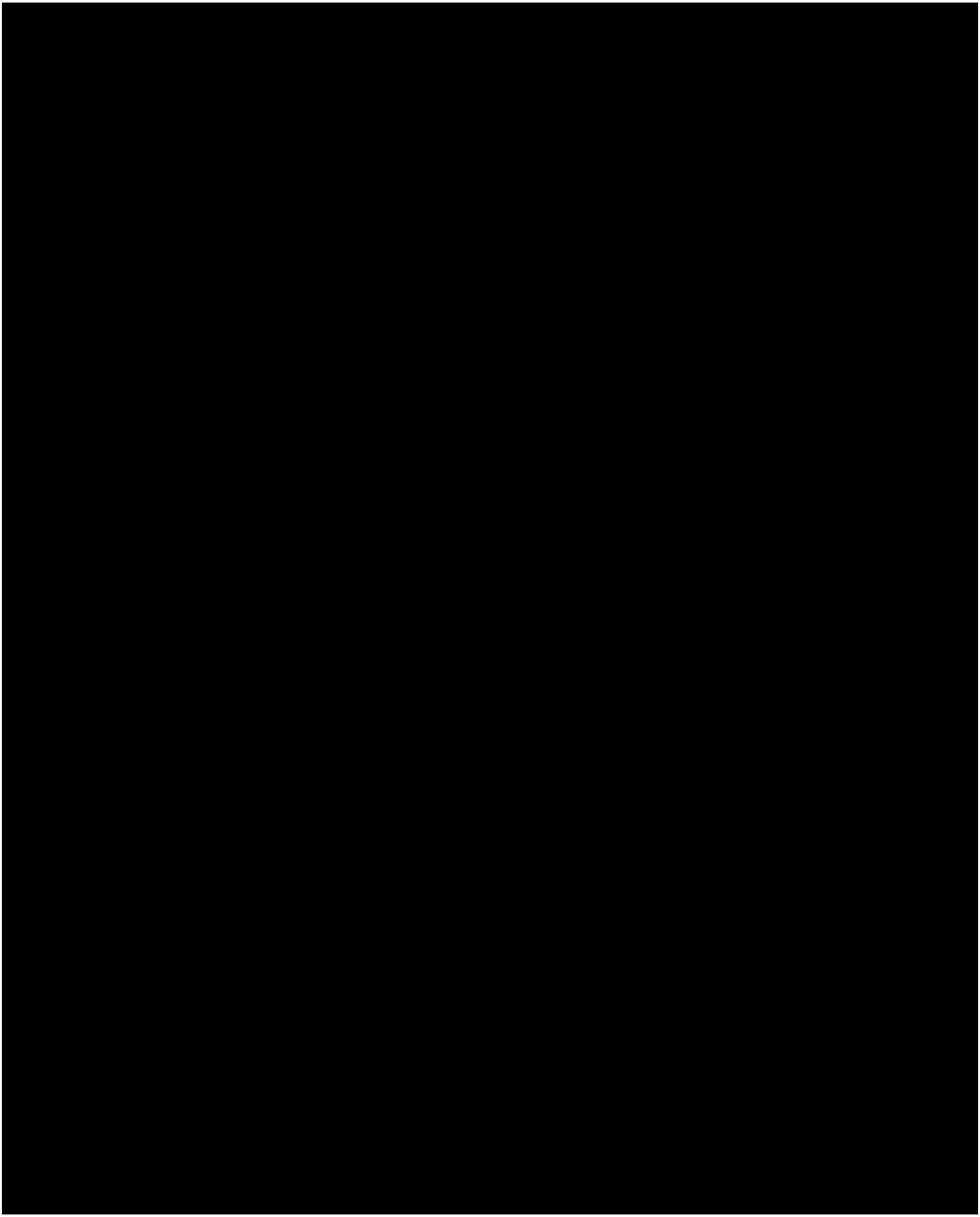












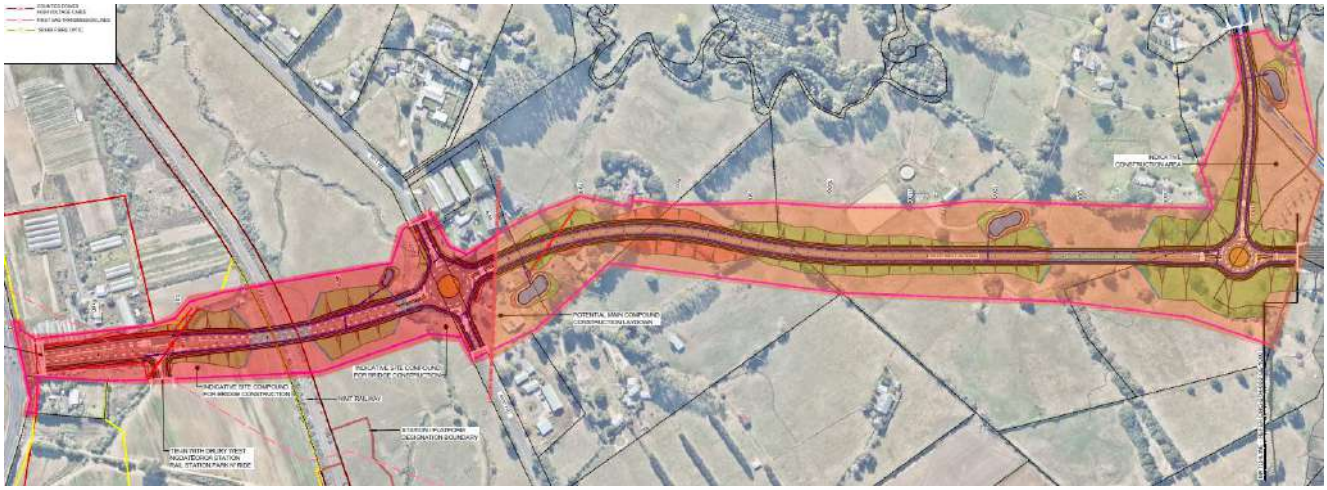
Appendix H2 - Property cost estimate memorandums

Appendix H3 - Generic physical works assumption schedule

Appendix H4 - Project costing segments

Drury West Arterial

Extent of scope for physical works cost estimation:

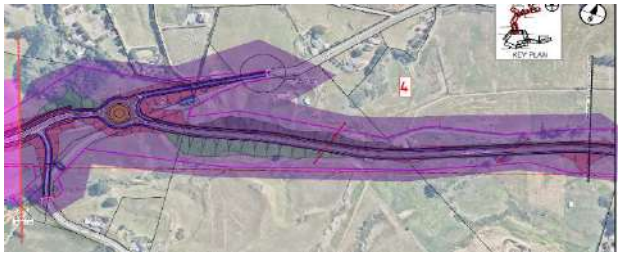


Segment	Description	CH Start	CH End
Segment 1	The scope of works include: • Tie-in with Drury West Ngoatēroa Station Rail Station Park 'N Ride • Two bridges • Pitt Rd/Burtt Rd roundabout • Mainline corridor Drury West Arterial section CH0-CH600	0	600
Segment 2	• Bridge • Runciman Rd Roundabout • Mainline corridor CH600-CH1550	600	1550

South Drury Arterial

Extent of scope for physical works cost estimation:



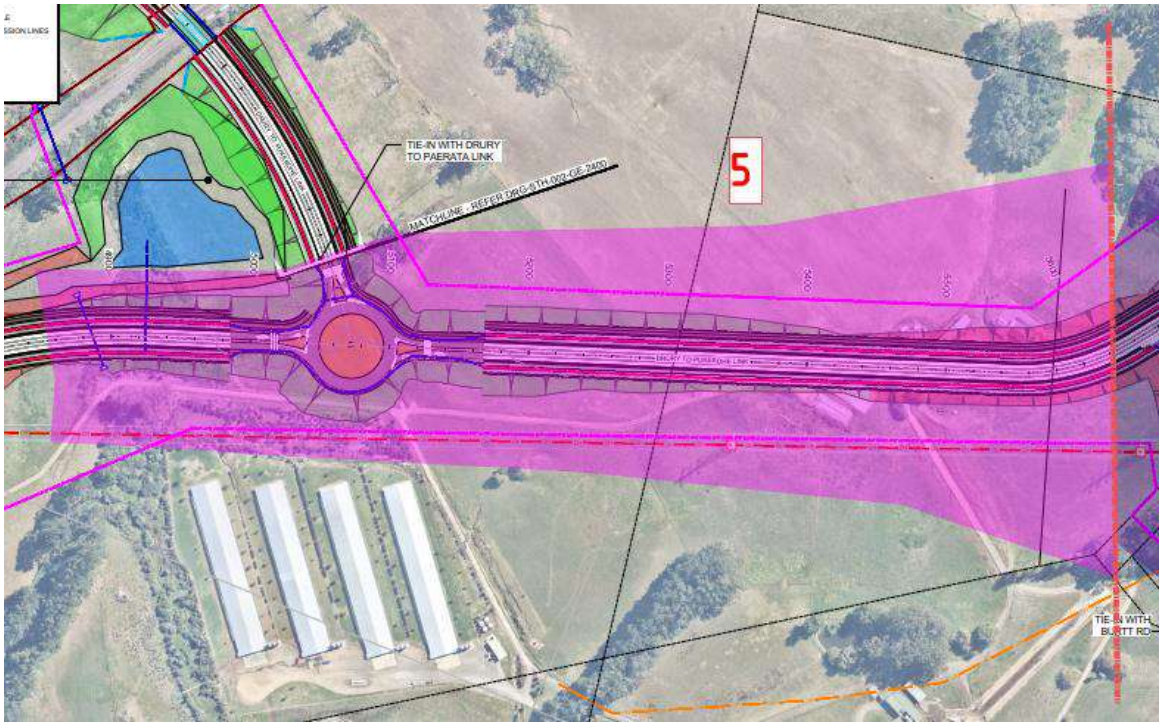


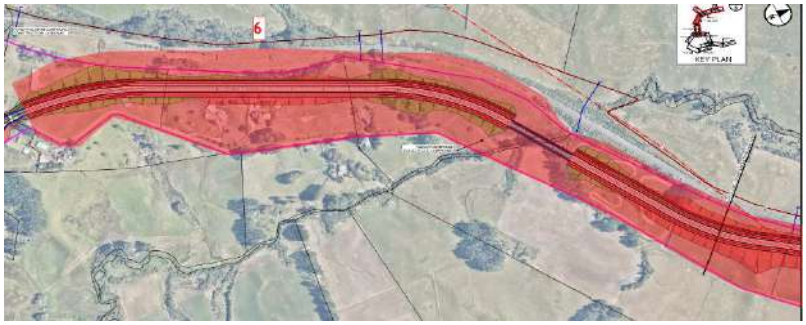


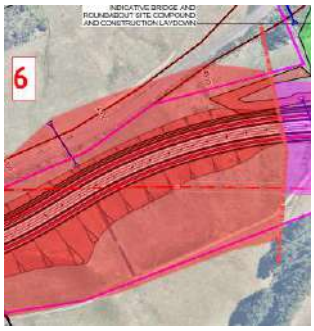
Segment	Description	CH Start	CH End
Segment 3	• Tie-in with Drury West Arterial • Two bridges • Runciman Rd Roundabout • Tie-in with Great South Road • Mainline corridor CH7750-CH8752	7750	8752
Segment 4	• Two tie-ins with Burtt Road • Burtt Rd/ Drury to Pukekohe link Roundabout • Mainline corridor CH5650-CH7750	5650	7750

Drury-Paerata Link

Extent of scope for physical works cost estimation:



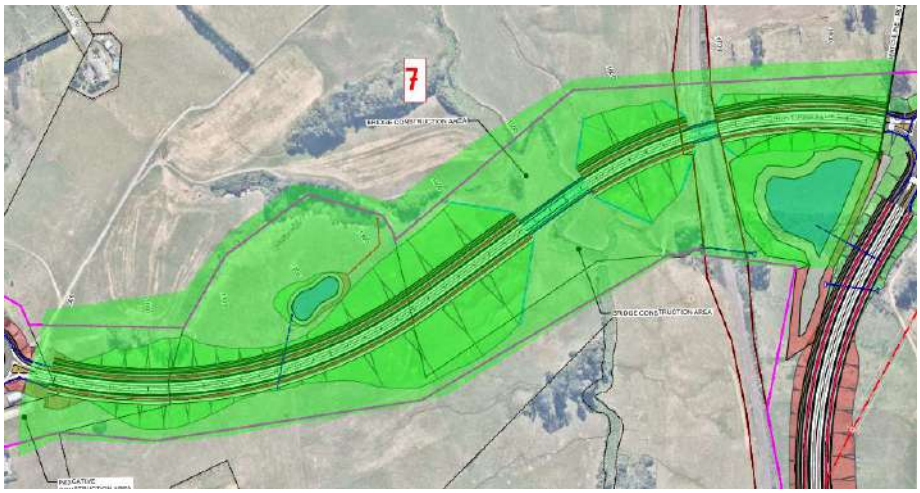


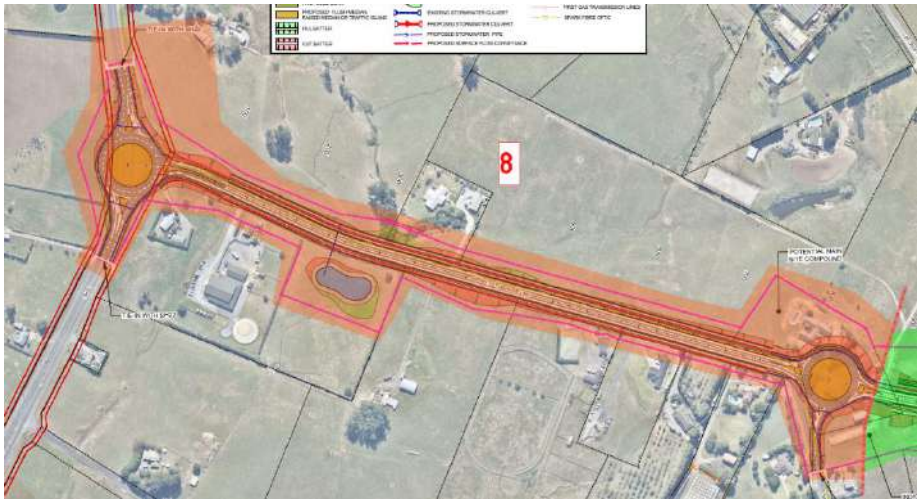


Segment	Description	CH Start	CH End
Segment 5	The scope of works include: • Tie-in with Drury Paerata Link • SH22 Connection Roundabout • Mainline corridor CH4850 – CH5650	4850	5650
Segment 6	The scope of works include: • One bridge • Mainline corridor CH3130-CH4850	3130	4850

SH22 Connection

Extent of scope for physical works cost estimation:

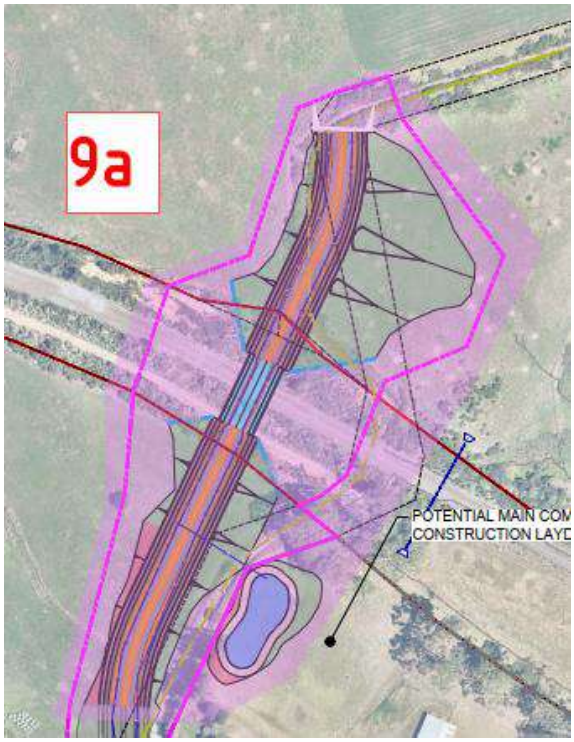


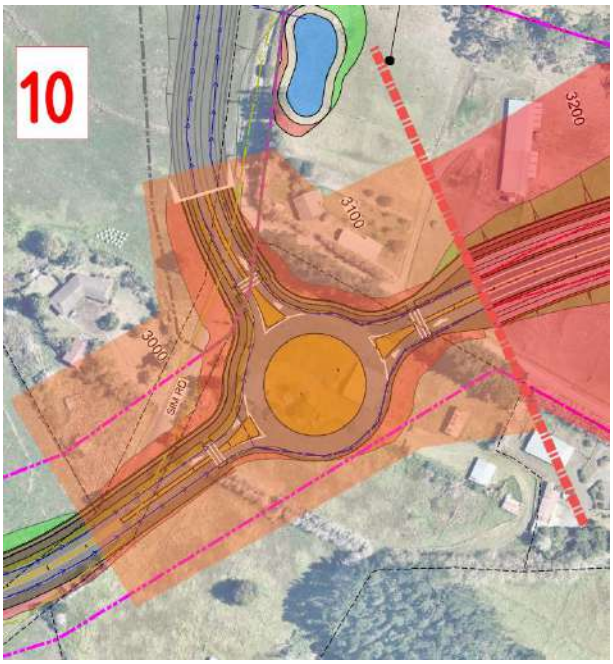


Segment	Description	CH Start	CH End
Segment 7	The scope of works include: • Two bridges • Tie in with Drury Paerata Link • Corridor CH880-CH1870	880	1870
Segment 8	The scope of works include: • Two roundabouts • Tie in with SH22 • Tie in with Sim Road • Corridor CH0-CH880	0	880

Sim to Sim Connection

Extent of scope for physical works cost estimation:

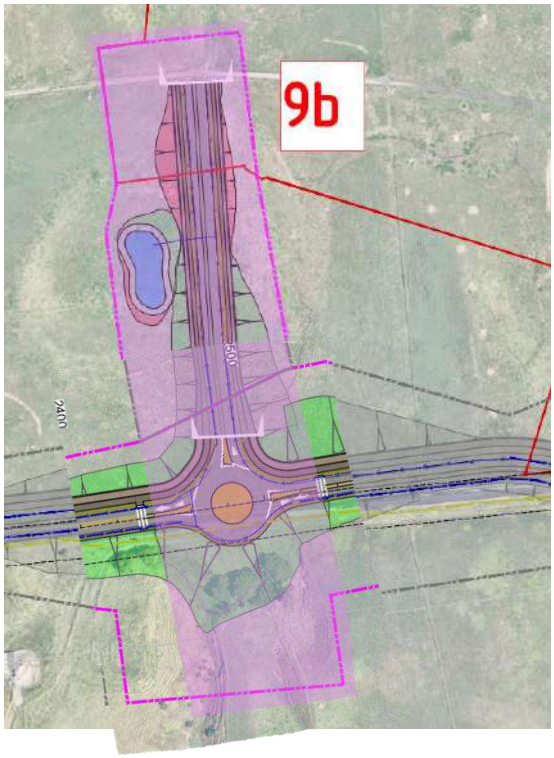




Segment	Description	CH Start	CH End
Segment 9a	The scope of works include: • One bridge • Perpendicular to mainline corridor CH3000-CH3100	3000	3100
Segment 10	The scope of works include: • Roundabout • Perpendicular to mainline corridor CH2925-CH3130	2925	3130

Paerata Rail Station Connection

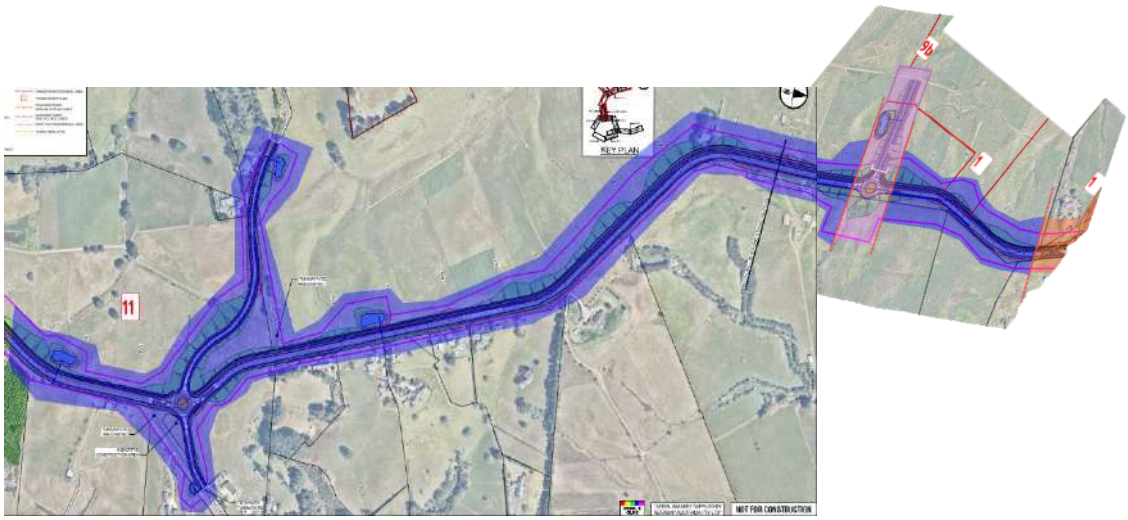
Extent of scope for physical works cost estimation:



Segment	Description	CH Start	CH End
Segment 9b	The scope of works include: • New roundabout at Sim Road • Perpendicular to mainline corridor CH2440-CH2530	2440	2530

Paerata Arterial

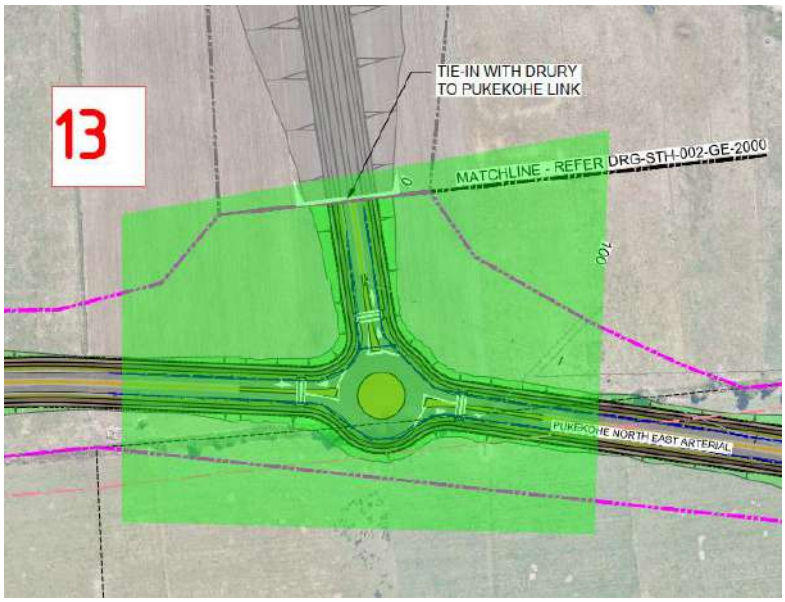
Extent of scope for physical works cost estimation:

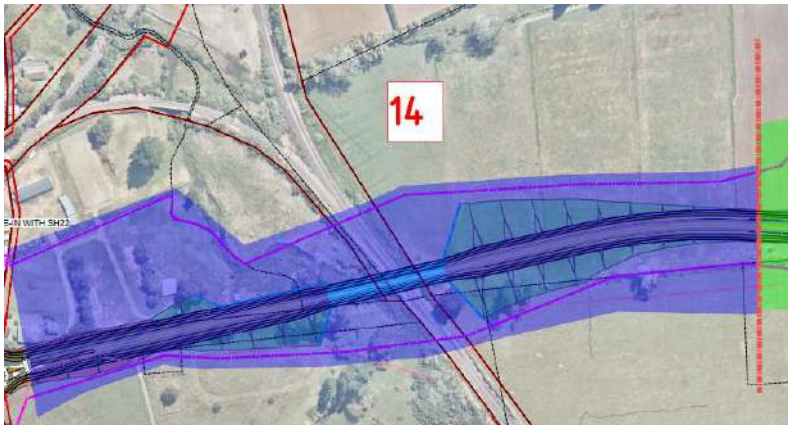


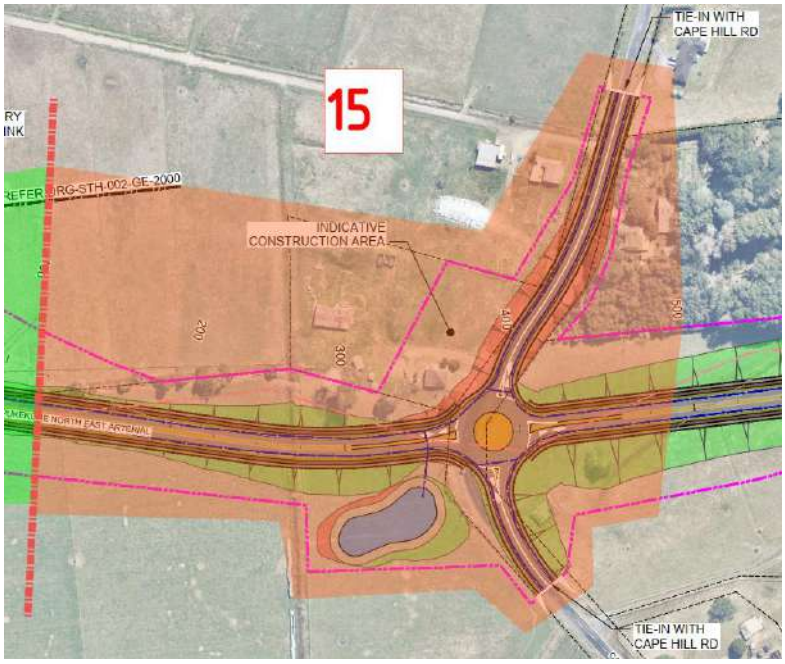
Segment	Description	CH Start	CH End
Segment 11	The scope of works include: • Upgrade of Sim Road • Tie-in with Tuhimata Road • One roundabout • Mainline Corridor CH720-2440, CH2530-CH2925	720 2530	2440 2925
Segment 12	The scope of works include: • Roundabout • Mainline corridor CH100 – CH720	100	720

Pukekohe North-East Arterial

Extent of scope for physical works cost estimation:








16
KEY PLAN


26
SH22
TIE-IN WITH SH22
TIE-I
NOR
TIE-I
MATCHI

Segment	Description	CH Start	CH End
Segment 13	The scope of works include: • Roundabout • Tie-in with Drury to Pukekohe Link • Drury to Pukekohe Link Corridor CH 0 – 100 and Pukekohe North East Arterial Corridor CH630-860	630	860
Segment 14	The scope of works include: • Bridge over N.I.M.T rail track and waterway • Mainline corridor CH30 – CH630	30	630
Segment 15	The scope of works include: • Roundabout at intersection with Cape Hill Road • Mainline Corridor CH630 – CH1230	630	1230
Segment 16	• Roundabout • Six bridges • Mainline corridor CH1200-CH4400	1230	4400
Segment 26	• Roundabout at intersection with Pukekohe North West Arterial / SH22 • Mainline corridor CH0-30	0	30

Pukekohe East Road Upgrade – WK and AT section

Extent of scope for physical works cost estimation:





Segment 16 is included as part of the Pukekohe North-East Arterial corridor.

Segment 17 belongs to Auckland Transport and Segment 18 to Waka Kotahi.

Segment	Description	CH Start	CH End
Segment 17	The scope of works include: • Mainline corridor extents noted CH 450 – 1050 and CH 1275 – CH1580 • Mainline corridor extents CH1050 – 1275 for active model costs only (on south side of Segment 16 roundabout)	450	1050
Segment 18	The scope of works include: • Tie in with Pukekohe South-East Arterial • Mainline corridor CH1580 – CH3575	1580	3575

Mill Road Upgrade

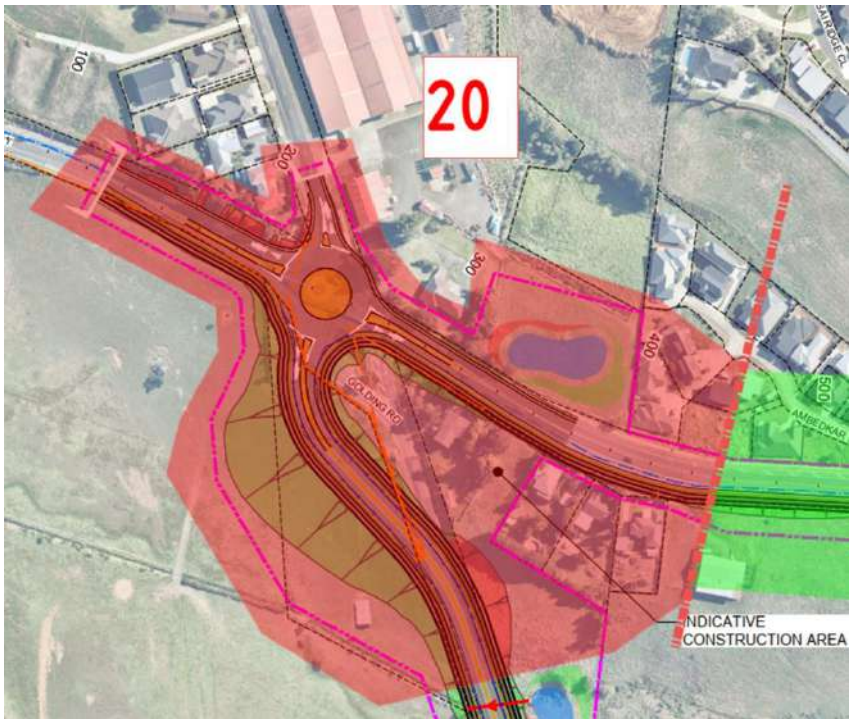
Extent of scope for physical works cost estimation:



Segment	Description	CH Start	CH End
Segment 19	The scope of works include: • Roundabout at Harrisville Road intersection • Mainline corridor extents noted	3575	5725

Pukekohe South-East Arterial

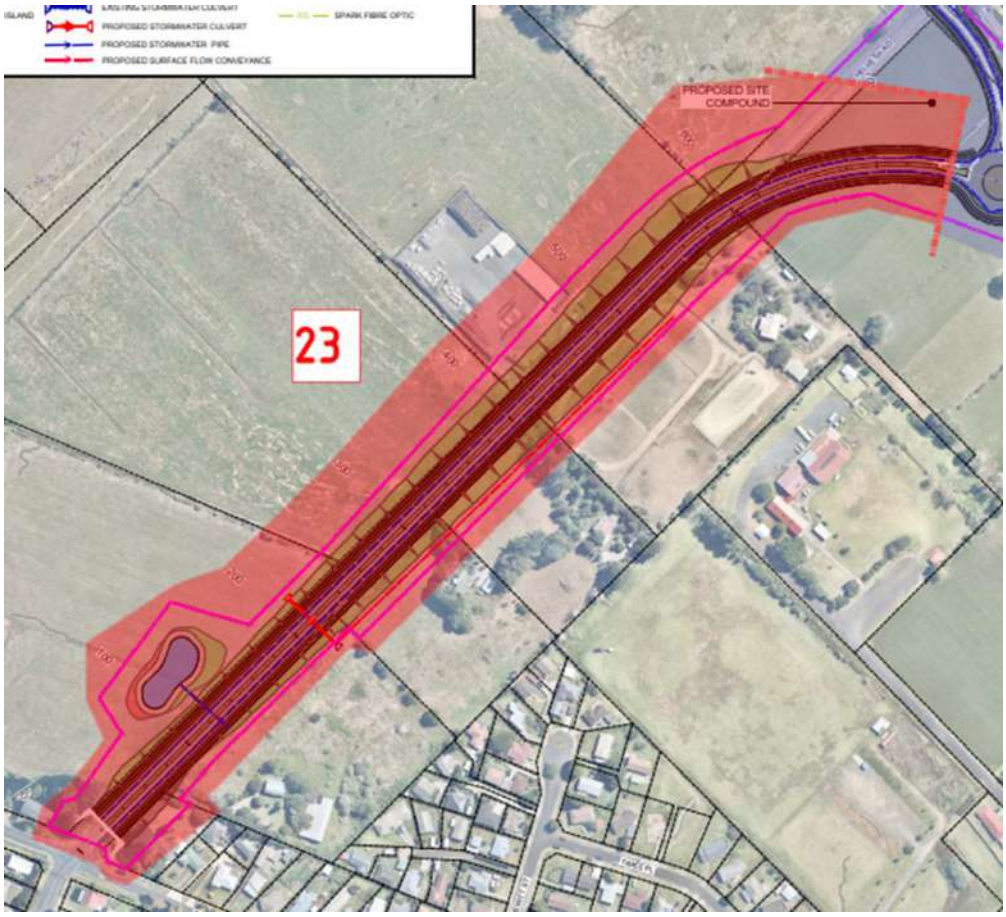
Extent of scope for physical works cost estimation:



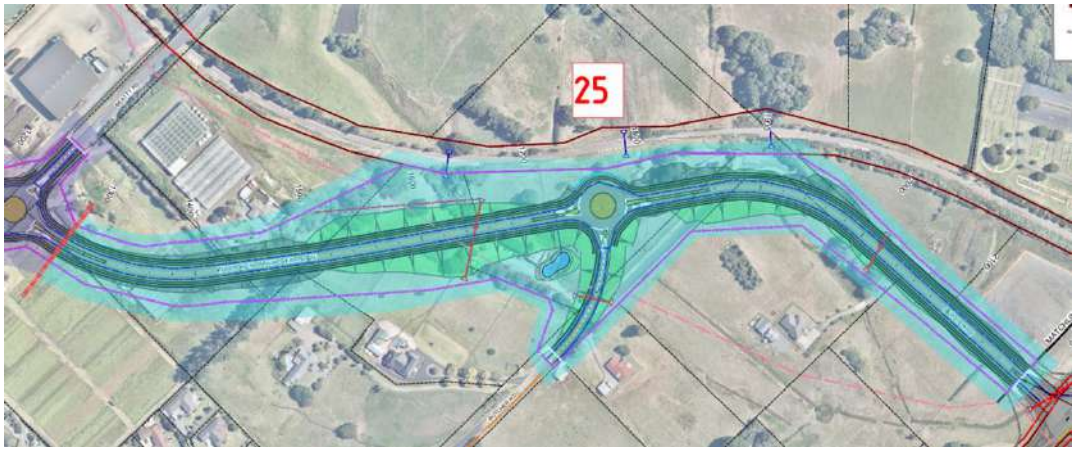
Segment	Description	CH Start	CH End
Segment 20	The scope of works include: • Upgraded roundabout at Golding Road / Pukekohe East Road intersection • Pukekohe East Road corridor CH130 – CH450	130	450
Segment 21	The scope of works include: • Upgraded roundabout at Golding Road / Pukekohe East Road intersection • Golding Road Corridor CH0-CH450	0	900
Segment 22	The scope of works include: • Golding Road Corridor CH900-1270 • New Roundabout on Golding Road to tie into Pukekohe South East Arterial mainline corridor CH 300-CH1800	900 300	1270 1800

Pukekohe North-West Arterial

Extent of scope for physical works cost estimation:







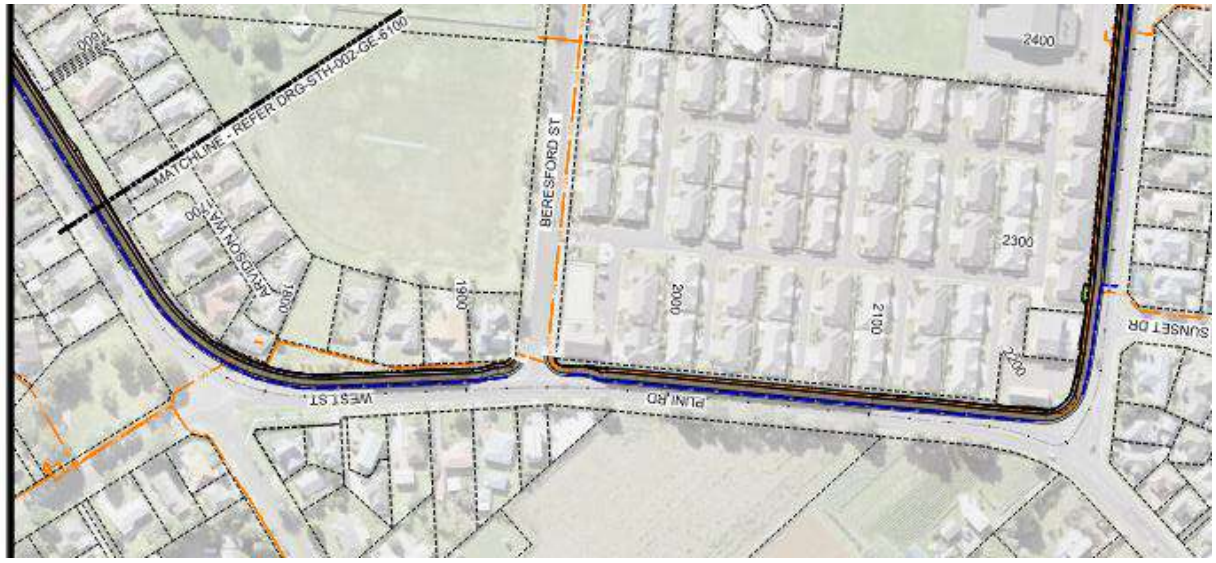
Segment	Description	CH Start	CH End
Segment 23	The scope of works include: • Mainline Corridor CH0 – CH750	0	750
Segment 24	The scope of works include: • Two roundabouts • Mainline Corridor CH750-CH1290	750	1290
Segment 25	The scope of works include: • One roundabout • Mainline Corridor CH1290 – CH2185 • Tie in with Pukekohe North-East Arterial	1290	2185

Pukekohe South-West Arterial

Extent of scope for physical works cost estimation:











Segment	Description	CH Start	CH End
Segment 27	The scope of works include: • Mainline Corridor CH0 – CH4350 comprising of active mode improvements (bi-directional cycleway and pedestrian walkway) on one side of the road • One roundabout	0	4355

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe Appendix I: Route Protection Strategy Report

May 2023

Version 1.0

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

Document Status

Responsibility	Name
Author	[redacted]
Reviewer	[redacted]
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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Glossary

Acronym/Term	Description
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
ATCOP	AT Code of Practice
AUP:OP	Auckland Unitary Plan: Operative in Part (2016)
Council	Auckland Council
CHI	Cultural Heritage Inventory
CIA	Cultural Impact Assessment
CPTED	Crime Prevention through Environmental Design
DBC	Detailed Business Case
FTN	Future Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
IBC	Indicative Business Case
MCA	Multi-Criteria Assessment
N/A	Not Applicable
NES	National Environmental Standard
NES:FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NES:Soil	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NPS	National Policy Statement
NPS:FM	National Policy Statement on Freshwater Management
NPS:UD	National Policy Statement on Urban Development
NIMT	North Island Main Trunk
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
NoRs	Notices of Requirement
NZ	New Zealand
NZUP	New Zealand Upgrade Programme
ONF	Outstanding Natural Feature
ONL	Outstanding Natural Landscape
P2B	SH1 Papakura to Bombay Project

Acronym/Term	Description
P2P	Papakura to Pukekohe rail electrification Project
Partner	Manawhenua, Auckland Council, Auckland Transport, and Waka Kotahi
PBC	Preliminary Business Case
RLT	Auckland Regional Land Transport Plan
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
SH1	State Highway 1
SH22	State Highway 22
SMAF	Stormwater Management Area: Flow
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
TDM	AT's Transport Design Manual
VKT	Vehicle Kilometres Travelled
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
Zero Carbon Act	Climate Change Response (Zero Carbon) Amendment Act 2018

1 Introduction

1.1 Purpose of this Report

This document provides analysis and recommendations for the route protection of the recommended transport network for the Pukekohe Detailed Business Case (DBC) as part of the Supporting Growth Programme. The agencies responsible for the programme are Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi).

This route protection strategy has been prepared in accordance with the methodology set out in the 'Programme Wide Technical Guidance Note – Route Protection Strategy' (PWTG – RPS).

The recommended transport network for the Pukekohe DBC includes the following components:

- Drury West Arterial
- South Drury Connection
- SH22 Connection
- Drury-Paerata Link
- Paerata Arterial
- Pukekohe North-East Arterial
- Pukekohe South-East Arterial
- Pukekohe South-West Upgrade
- Pukekohe North-West Arterial
- Mill Road and Pukekohe East Road Upgrade

1.2 Structure of this Report

Table 1-1 Structure of this report

Section	Heading	Description
1	Introduction	The purpose and structure of this report
2	Methodology	How the programme wide route protection methodology has been applied to the Pukekohe DBC.
3	Transport Corridors for Route Protection	An overview of each transport corridor including its planning context.
4	Route Protection Evaluation	Evaluation of the route protection mechanisms which are being considered taking into account the planning context, known risks and opportunities and other relevant considerations for each of the recommended options.
5	Grouping and packaging	Recommendations for grouping projects and, where appropriate, packaging considerations.

2 Methodology

The Pukekohe DBC team has developed a route protection strategy for the recommended transport network by applying the methodology in the PWTG – RPS. This route protection strategy should be read in conjunction with the PWTG – RPS. Where appropriate reference is made to the Auckland Unitary Plan Operative in Part (AUP OIP) as the relevant plan for the area under the Resource Management Act 1991 (RMA).

2.1 Route Protection Mechanisms

The integrated transport system to support Auckland's urban growth relies on a broad suite of interventions that will be delivered by different national and local agencies. One component of effective delivery of the system is the identification of physical corridors within future urban growth areas. Initial confirmation of these transport corridors is important for a number of reasons, including the contribution this can make to urban form and the certainty this can provide for infrastructure investment in the future.

As a summary, the different 'layers' or stages of corridor identification provide different levels and opportunities for 'route protection', ranging from the provision of transparency in the form of identified corridors, to the shaping of planning provisions that recognise these corridors and ultimately to acquisition or designation of corridors for construction purposes (Figure 2-1).

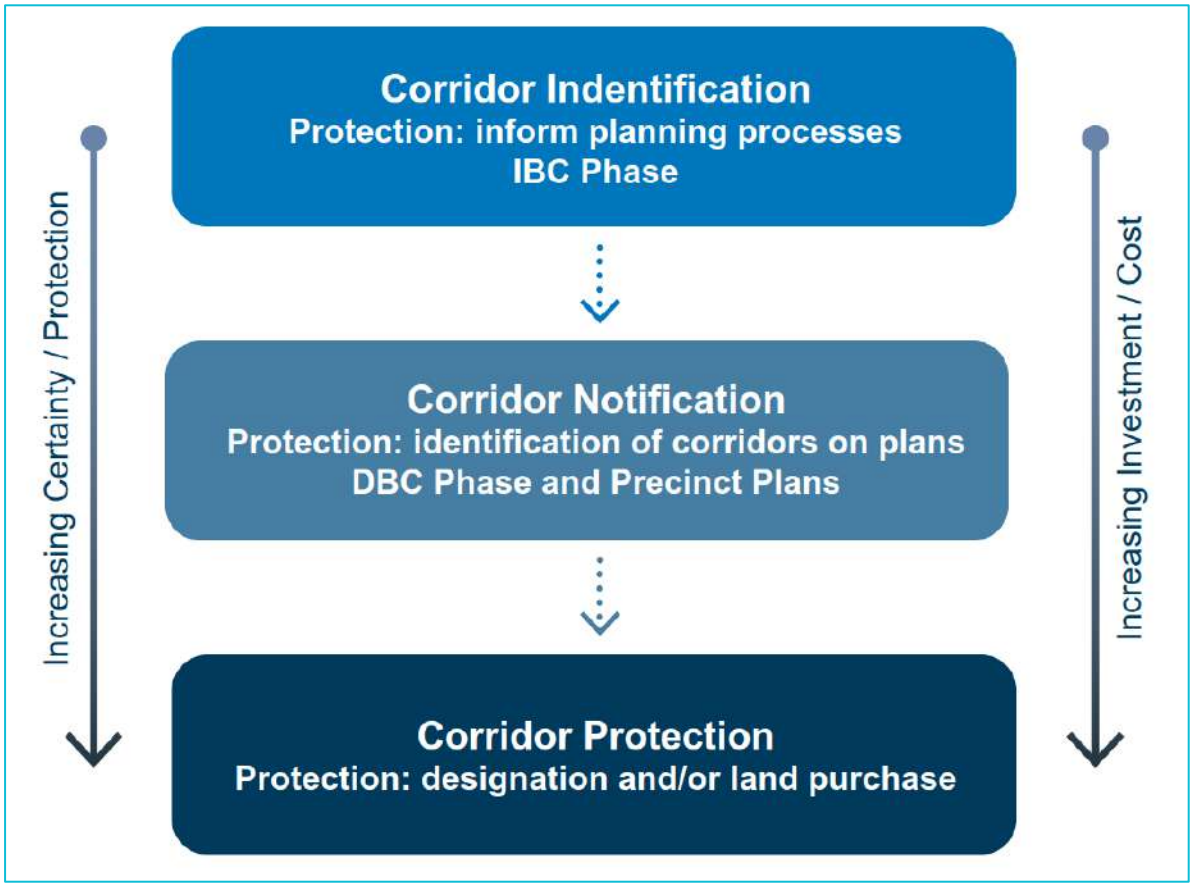

Figure 2-1 The stages of corridor identification and route protection

While all the phases of corridor development provide some level of 'route protection' it is important to recognise that the later stage (corridor protection) results in the highest form of statutory protection when a designation is confirmed. Without a designation, land purchase only secures the relevant part of the corridor that has been acquired. Furthermore, while some instruments such as Precinct or Zone provisions may provide a level of corridor identification (which can assist in the protection of corridors but is always vulnerable to adverse resource consent decisions), only a designation will enable potential construction and operation of the corridor.

The PWTG – RPS provides an overview of the route protection mechanisms which are being considered by the Supporting Growth Programme. Whilst route protection is a key next step for much of the recommended programme, not all components within the recommended network require route protection. Projects with no requirement for route protection will follow typical project development pathways and given the scope of the Supporting Growth Programme will likely be progressed by owner organisations. For projects requiring route protection, layers of protection (described above) may mean that some projects may derive significant benefit from the earlier indicative levels of corridor protection. As such, other delivery mechanisms may be appropriate to deliver a number of components in the recommended network.

Strengths and weaknesses of route protection mechanisms (identified in Figure 2-2) were assessed as part of the PWTG – RPS.

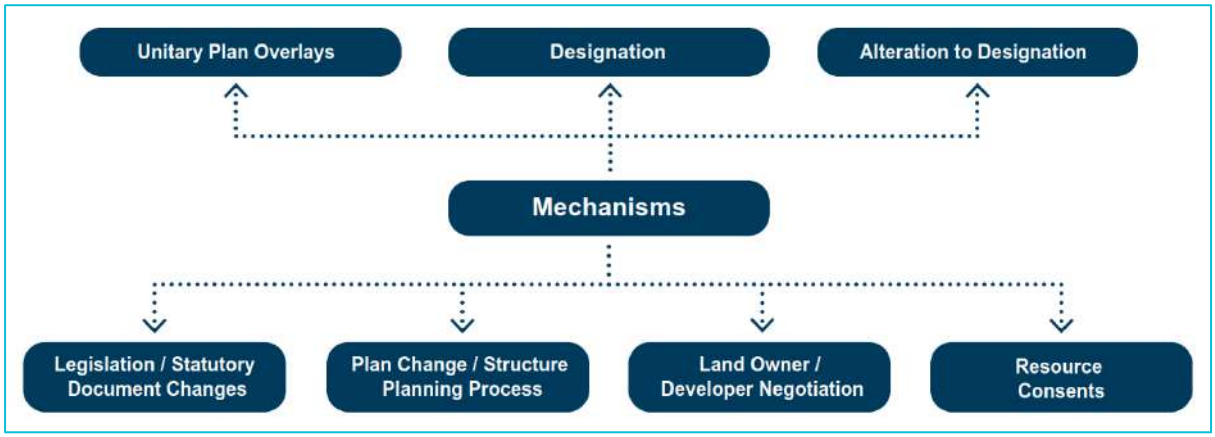

Figure 2-2 Route Protection Mechanisms

With specific reference to the Pukekohe DBC area context, the strengths and weaknesses are summarised below in Table 2-1.

Table 2-1 Possible route protection and consenting mechanisms

Mechanism	Summary of strengths and weaknesses within local context	Considered
Designation	A Notice of Requirement (NoR) to designate land for a public work under the RMA provides a strong level of route protection particularly where development pressure is anticipated along the corridor. A NoR has interim effect as soon as the notice is lodged with Council (s178 of the RMA). In accordance with s176 of the RMA, a designation, once confirmed in a district plan, controls activities which would prevent or hinder the purpose of the designation (without prior written consent of the requiring authority). A designation also provides the authorisation to undertake the works in accordance with the designated purpose as they relate to s9(3) of the RMA. A designation is appropriate to protect land for the designated purpose. The designation may result in the need to purchase properties earlier than anticipated (in advance of construction)	Yes

Mechanism	Summary of strengths and weaknesses within local context	Considered
	pursuant to section 185 of the RMA exposing Requiring Authorities to financial cost from lodgement. The proposed upgrades and new corridors for the Pukekohe transport network impacts a high number of properties and multiple developers are active in the area. For the purpose of this route protection strategy, a designation without a request for an outline plan waiver has been considered. A request for an outline plan waiver is sought when a higher level of assessment and design detail is provided as part of the NoR to enable a more streamlined approval process. This is however generally at the cost of less design flexibility following the NoR process. Regional resource consents would likely also be obtained in parallel to enable the construction of the project once the designation is confirmed and resource consents granted. Given the Pukekohe transport network are future projects and not anticipated to be constructed in the near future, flexibility in the design is preferred.	
Alteration to existing designations	Where existing transport designations are available these may be altered under the RMA to provide for the recommended network. Within the Pukekohe project area, KiwiRail designations include the NIMT (Designation 6302) and the Paerata Rail Station (Designation 6311) (and one NoR for Drury West Station). Waka Kotahi has two designations in the area for SH22 and SH1. The suitability of altering these designations is discussed later in this report. Auckland Transport has no existing designations in proximity to the Pukekohe DBC transport corridors.	Yes
Landowner/ developer negotiation	Infrastructure Funding Agreements (IFA) are the preferred form of landowner/ developer agreement to enable the delivery of transport infrastructure. IFAs can provide route protection where a developer is able to agree to design and implement of a project. Where there are numerous landowners and/or developers, IFAs may be problematic as a route protection mechanism due to the added complexity of negotiating with numerous parties, who may have differing timeframes, expectations and priorities. Additionally, it is also not compulsory for developers to enter into IFAs if sought by infrastructure providers. Developers in the Pukekohe DBC area are actively seeking plan changes in the future urban zone (FUZ). There is opportunity to enter IFAs with developers therefore, this mechanism is assessed further in this document. This opportunity only exists for some portions of the Pukekohe DBC transport network where developers are active. These areas are within the Pukekohe FUZ.	Yes
Plan Change/ Structure Planning Process	Large areas in proximity to the Pukekohe transport network are zoned for development in the AUPOIP including Drury West, Paerata and Pukekohe. Substantial areas are zoned Future Urban Zone (FUZ) which remains largely rural but signals it will be urbanised in the future subject to a structure plan and plan change process to rezone it with an appropriate urban zoning. The Pukekohe-Paerata and Drury-Ōpāheke Structure Plans were completed by Auckland Council in 2019. This covers the majority of the Pukekohe transport network. The Structure Plan shows the Indicative Strategic Transport Network from the South Indicative Business Case (IBC). The Pukekohe transport network generally aligns with the network shown in the Structure Plan. While this signals the intent of the transport network in Pukekohe, the Structure Plan has no formal statutory weight. The Structure Plan will inform private and Council initiated plan changes to change the zoning of the FUZ (and has been relied upon by decision	Yes – FUZ areas only

Mechanism	Summary of strengths and weaknesses within local context	Considered
	makers during recent plan change proceedings). If Council advances plan changes, there may be opportunities to work with Council to provide a level of protection of the corridors. Private plan changes are starting to be initiated by developers in Pukekohe and they have their own aspirations for transport infrastructure which may not align with those shown in the Structure Plan. However, there may be opportunities to negotiate with developers through the plan change process to identify corridors in those plan changes. Further to private plan changes that have been lodged, developers are actively looking to progress further private plan changes which provide opportunity for negotiations.	
Legislation/ Statutory document change	The local scale, level of complexity and uncertain timing of the Pukekohe recommended network is not likely to justify legislative intervention at this time. This mechanism has not been considered further in the strategy.	No
Unitary Plan 'Corridor Overlay'	The PWTG – RPS identified AUPOIP overlays as the least likely option to achieve route protection. Although it would provide certainty to the community, it would require a plan change to include the overlay and the Council may not accept the approach. Additionally, it would be inconsistent with the approach of the AUPOIP overlays which are focussed on RMA Section 6, 7 and some 5 matters. Therefore, progressing a new 'Corridor Overlay' within the AUPOIP has not been considered as a viable route protection mechanism for the Pukekohe network.	No
Resource Consents	A resource consent, if granted, is not shown in a district plan and does not provide a mechanism to protect the land not already under the ownership of Waka Kotahi NZ Transport Agency (Waka Kotahi) or Auckland Transport (AT). However, it can be advantageous to also seek resource consents (particularly for construction activities) under the RMA alongside other route protection mechanisms in instances where projects are likely to proceed to construction once route protection is secured. None of the Projects within the Pukekohe transport network are funded or planned to be implemented once route protection is secured, therefore resource consents have not been considered.	No

2.2 Route Protection Evaluation

Section 4 of this route protection strategy provides recommendations as to the most appropriate form of route protection for the recommended transport corridors. The methodology for undertaking this evaluation is:

1. Review the planning context to identify any constraints or opportunities for route protection.
2. Identify the key risks and considerations which may influence the preferred route protection mechanism.
3. Evaluate the available route protection mechanisms taking into account the planning environment and identified risks and considerations.
4. Provide recommendations for route protection.

Components of the recommended network have been assigned an urgency of route protection classification. The reasons for grouping components, and for assigning the relevant urgency of route protection to the packages, are discussed in Section 5.

3 Transport Corridors for Route Protection

The following section provides an overview of the transport corridors for route protection and their planning context.

3.1 Drury West Arterial

The Drury West Arterial is a new two-lane road connection extending south from the Drury West Rail Station at the intersection of SH22 and Jesmond Road, connecting with the south Drury Connection at the edge of the FUZ. The route provides local connectivity to future urban zones, the new train station at Drury West and connects with existing strategic roads. Primarily serves Drury West Station and urban areas with 7000-8000 vpd (All-class), low freight function, greater PT and active mode function.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-1.

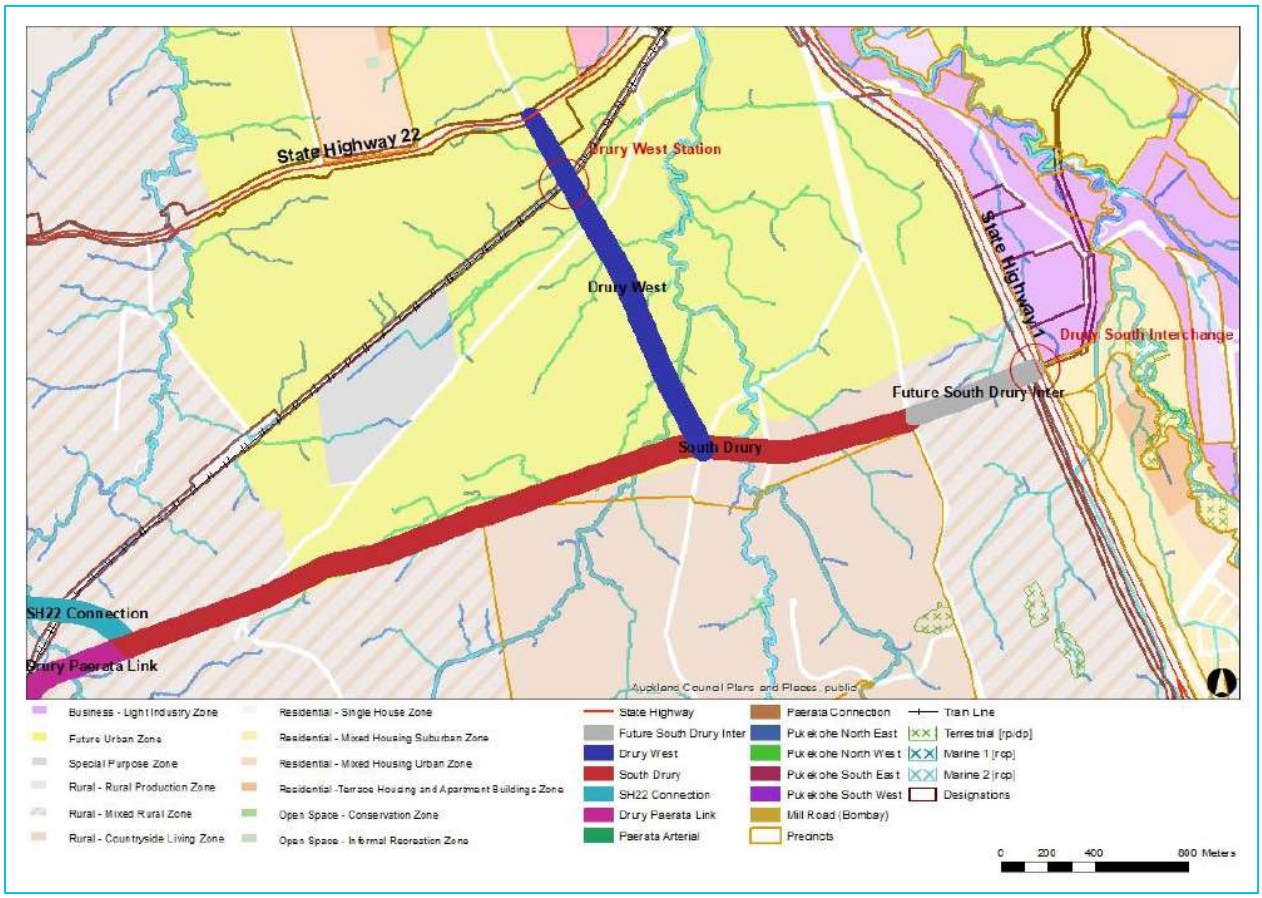

Figure 3-1 Drury West Arterial - Zoning and Other Features

Key elements of the planning context are as follows:

- Zoning adjacent to the project is 'Future Urban Zone' under the AUPOIP.
- The project intersects with the existing Waka Kotahi SH22 designation (Designation 6707) at the northern extent. This designation has recently been altered to provide for widening (through the Supporting Growth programme) and funding has recently been allocated for part of this upgrade through NZUP (including where the project intersects).

- There is an existing KiwiRail designation for North Island Main Trunk Railway Line (Designation 6302) and Notice of Requirement lodged for Drury West Station (KiwiRail).
- The Drury 2 precinct is located north of SH22 and the Runciman precinct is located to the south of the FUZ.
- The project crosses the Ngakoroa Stream, and the project area is covered by two natural resource overlays (high-use stream and aquifer management areas overlay).

3.2 South Drury Connection

This is a new two-lane road connection from Great South Road in the east which is the extent of the proposed Drury South interchange at SH1 (as part of the Waka Kotahi Papakura to Bombay project) and along the southern extent of the future urban zone in Drury. It connects with the Drury to Paerata Link at the western extent.

Primarily serves Drury West station and urban areas with 7000-8000 vpd (All-class), low freight function, greater PT and active mode function. This new connection will reduce traffic congestion and delays on SH22 through the future Drury West town centre area. It provides an alternate route for Glenbrook and Paerata developments to access strategic networks.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-2.

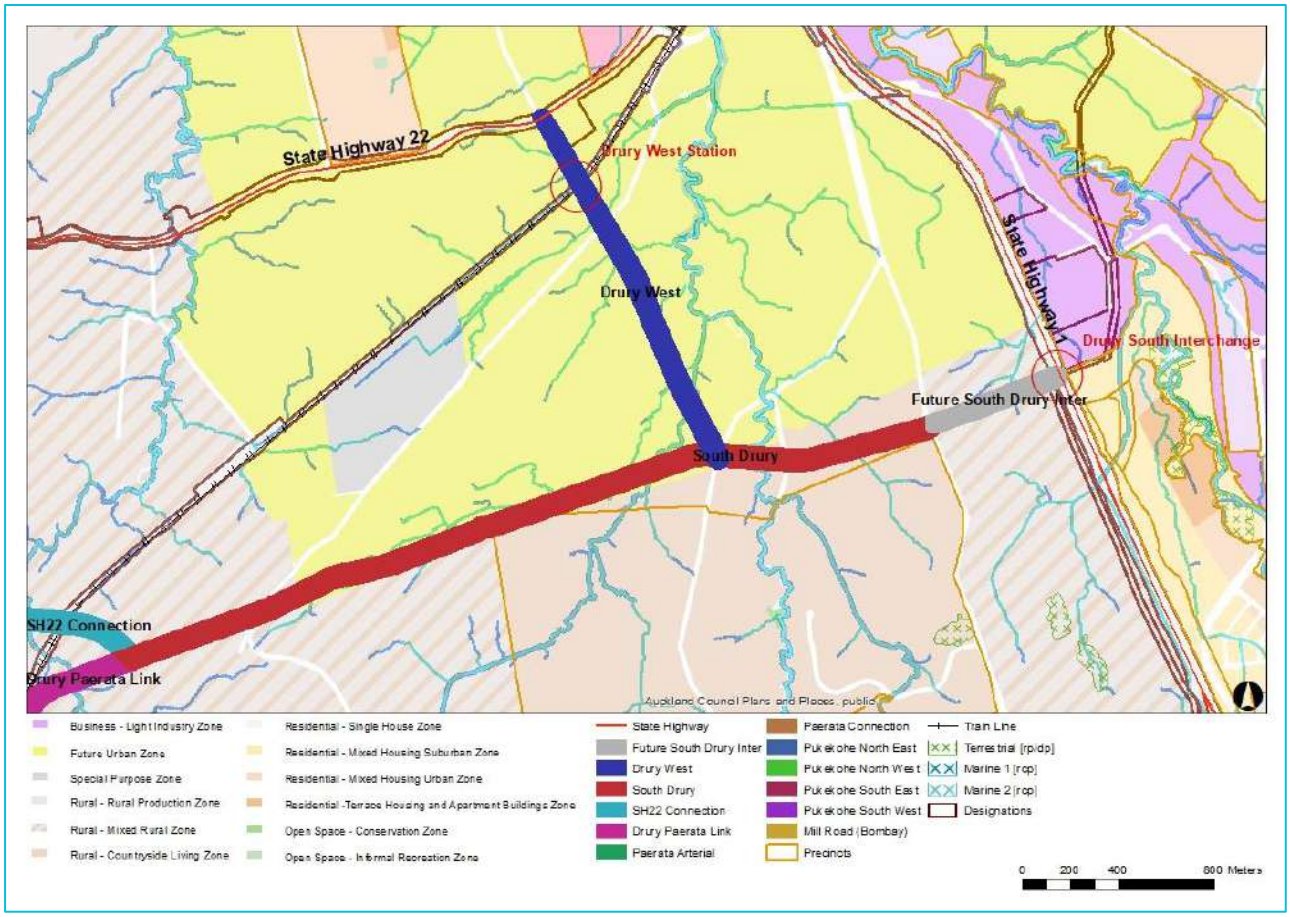

Figure 3-2 South Drury Arterial - Zoning and Other Features

Key elements of the planning context are as follows:

- Zoning adjacent to the project is 'Future Urban Zone' under the AUPOIP.
- There is no existing roading designation along the length of the road corridor.
- The Runciman precinct is located to the south on the other side of the South Drury project.
- The project crosses the Ngakoroa Stream, and the project area is covered by two natural resource overlays (high-use stream and aquifer management areas).

3.3 SH22 Connection

This new two lane corridor provides a connection with SH22 in the north and the Drury to Paerata Link project (see Section 3.4 below) at the southern extent. It includes a partial upgrade / widening of Sim Road and partial development of a new road.

Inter-district route connecting strategic corridors, when integrated with SH22 improves performance of the state highway, likely volumes are 8,000 – 10,000 vpd. The new SH22 Connection will enhance accessibility, particularly for freight to and from the rural areas of Paerata and Waiuku and improve access for trips north and south on SH1.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-3.

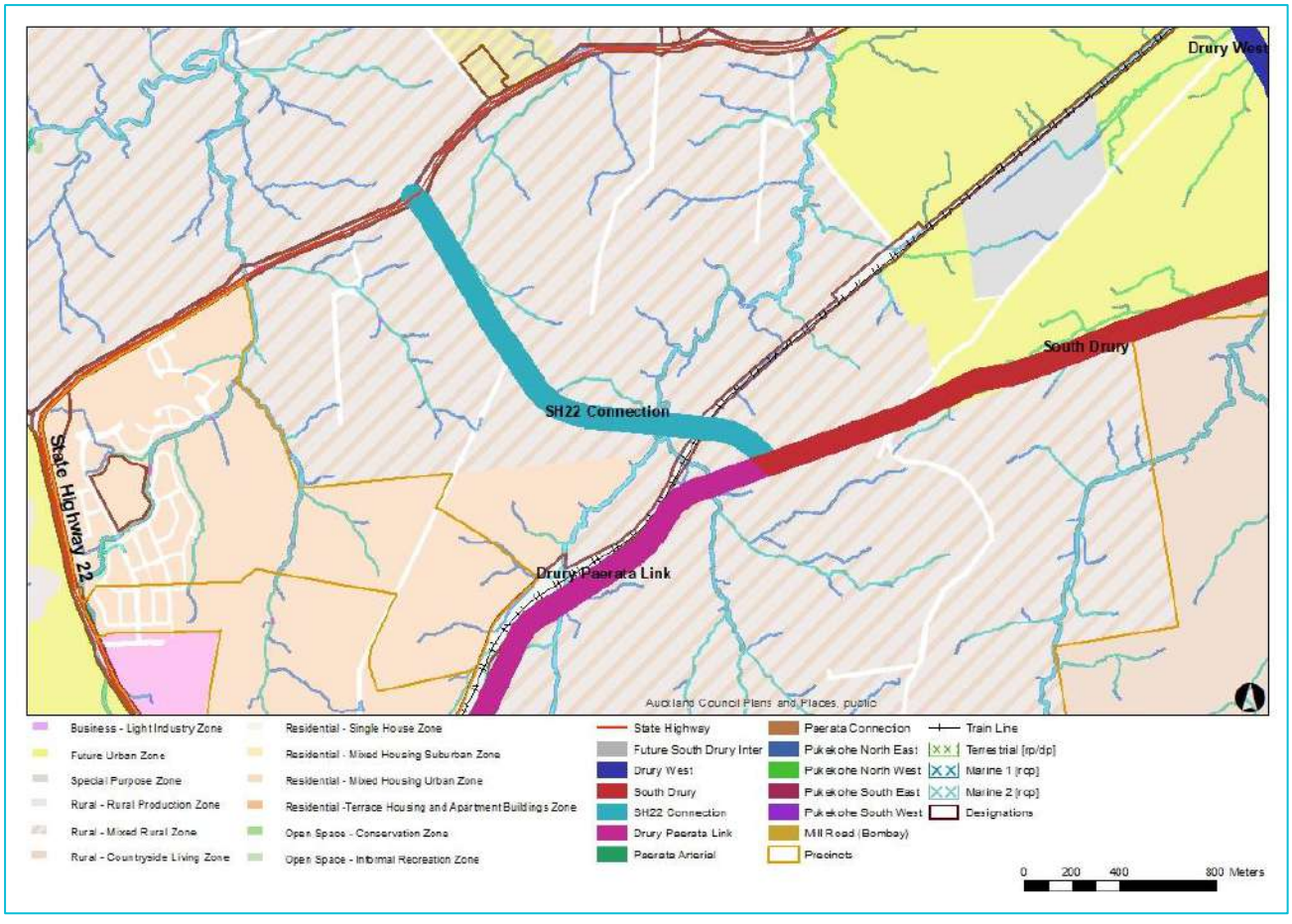

Figure 3-3 SH22 Connection - Zoning and Other Features

Key elements of the planning context are as follows:

- This corridor is completely within the 'Mixed Rural Zone' under the AUPOIP.

- The project intersects with the existing Waka Kotahi SH22 designations (Designation 6704 and 6705) at the northern extent.
- The SH22 Connection crosses over the KiwiRail North Island Main Trunk Railway designation (Designation 6302).
- The Franklin 2 precinct is located to the west.
- The project crosses the Oira Creek and the area is covered by a high use aquifer management area overlay.
- The Oira Creek is of cultural significance to mana whenua.
- The area is also identified as highly productive land under the NPS HPL.

3.4 Drury-Paerata Link

The Drury-Paerata Link is a new two-lane road connection providing a new link between the future communities in Drury and Paerata through the rural zone and connects with the Paerata train station (construction of the Paerata train station is expected to start in early 2023).

This route serves through strategic traffic (21,000 – 23,000 vpd) with minimum weight/dimensional constraints for heavy vehicles, inter-district route with higher freight function.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-4.

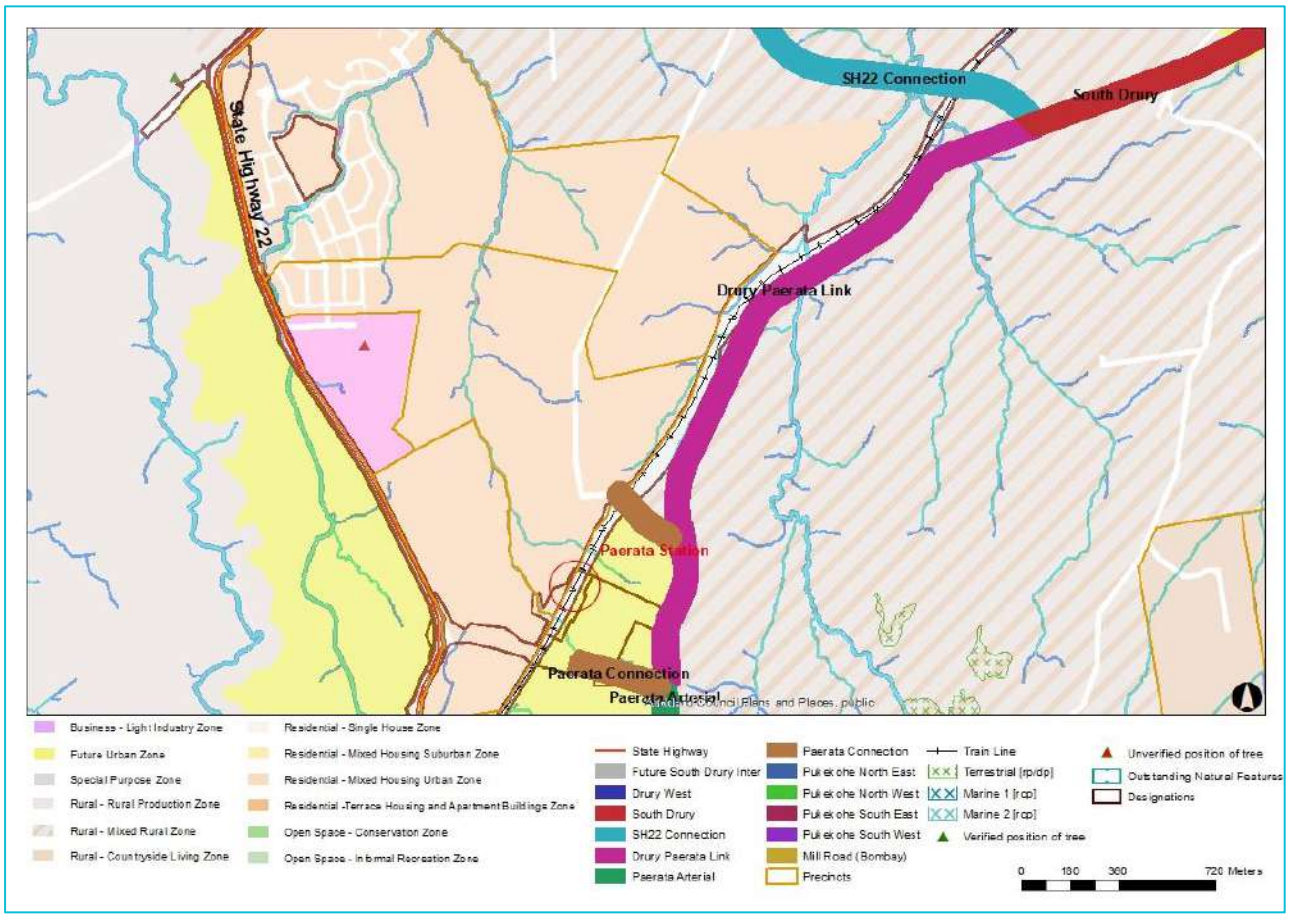

Figure 3-4 Drury Paerata Link - Zoning and Other Features

Key elements of the planning context are as follows:

- Zoning adjacent to the project is majority ‘Rural – Mixed Rural Zone’ under the AUPOIP.
- The Drury-Paerata Link is adjacent to the KiwiRail North Island Main Trunk Railway designation (Designation 6302), the KiwiRail Paerata Interchange and Accessway (Designation 6311). And Waka Kotahi SH22 designations (6704 and 6705).
- The Franklin 2 precinct is located to the east of the project and NIMT (Designation 6302).
- The project crosses the Oira Creek and the area is covered by a high use aquifer management area overlay.
- The area is also identified as highly productive land under the NPS HPL.

3.5 Paerata Arterial

The Paerata Arterial upgrades Sim Road and Cape Hill Road, creating an arterial road to improve local connectivity and access to the Paerata rail station and the Paerata and north Pukekohe future urban areas. This is an inter-district route serving Paerata urban areas and connecting with Pukekohe and strategic corridors. When integrated with SH22 improves performance of the state highway. The predicted ADT is 15,000 – 17,000 vpd.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-5.

Key elements of the planning context are as follows:

- Zoning adjacent to the project is ‘Future Urban Zone’ on the eastern side and ‘Mixed Rural Zone’ on the western side in the northern portion and fully contained within the ‘Future Urban Zone’ in the south.
- Existing KiwiRail Paerata Interchange and Accessway Designation (6311) and KiwiRail North Island Main Trunk Railway designation (Designation 6302) at the northern extent of the corridor.
- The project area is covered by a high use aquifer management area overlay.
- A SEA (SEA_T_4380) is located to the east of project area on Cape Hill Road (but the project does not intersect with it).

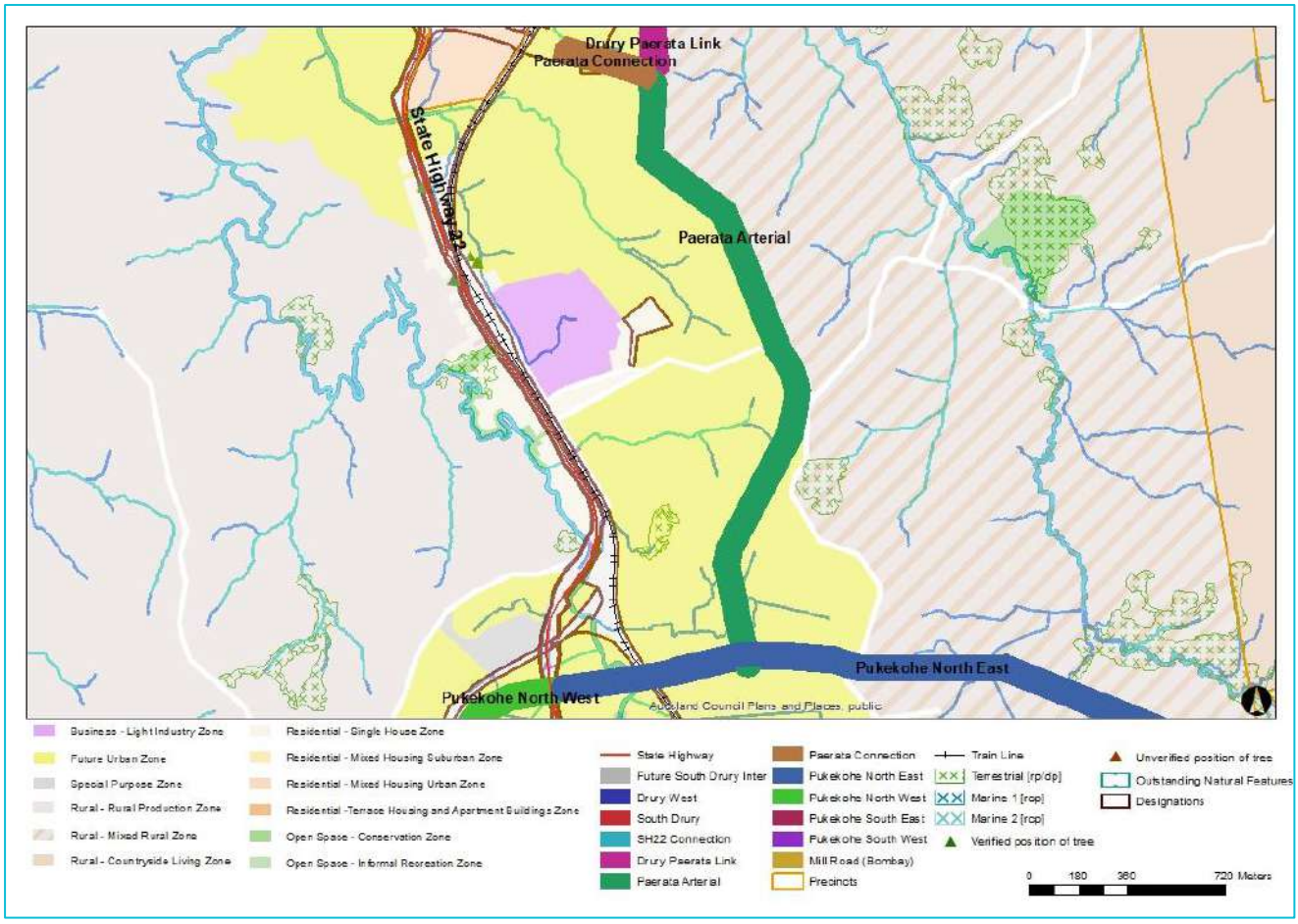

Figure 3-5 Paerata Arterial - Zoning and Other Features

3.6 Paerata Connections

The Paerata Connections includes two new connections to improve local connectivity and access to the Paerata rail station and the Paerata Rise and north Pukekohe future urban areas. The connections are:

- Sim to Sim Connection - an upgrade to Sim Road to provide a connection over the rail line
- Paerata Station Connection - a connection to Paerata Station which overlaps with the exisiting KiwiRail designation

This is an inter-district route serving Paerata urban areas and connecting with Pukekohe and strategic corridors. The predicted ADT is 10,000 – 16,000 vpd.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-6.

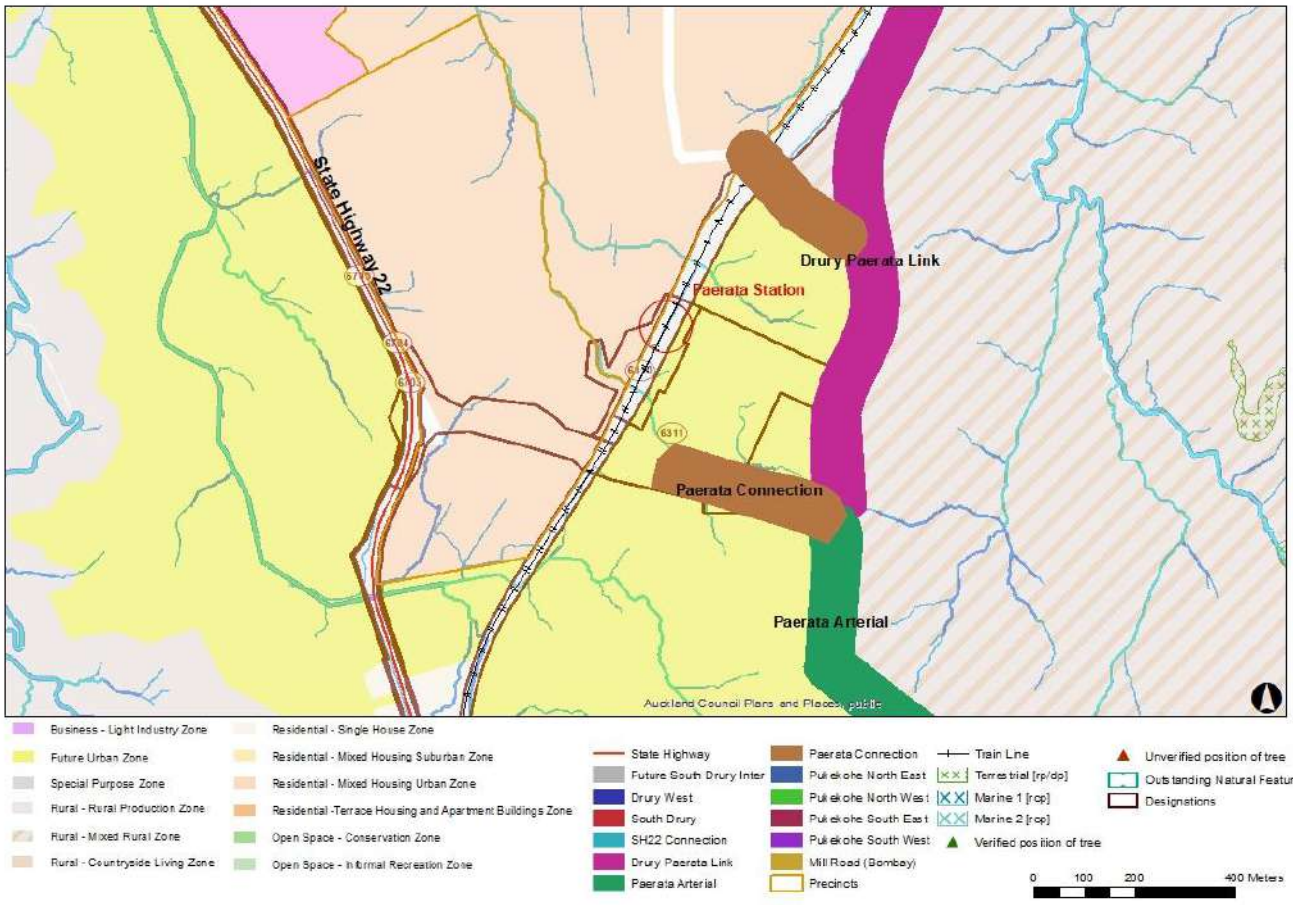

Figure 3-6 Paerata Connection - Zoning and Other Features

Key elements of the planning context are as follows:

- Zoning adjacent to the project is 'Future Urban Zone' on the eastern side and 'Mixed Rural Zone' on the western side in the northern portion and fully contained within the 'Future Urban Zone' in the south.
- Project tie sin with the existing KiwiRail Paerata Interchange and Accessway Designation (6311) and KiwiRail North Island Main Trunk Railway designation (Designation 6302).
- The Franklin 2 precinct is located to the east of the project and NIMT (Designation 6302).
- The project area is covered by a high use aquifer management area overlay.

3.7 Pukekohe North-East Arterial

The Pukekohe North-East Arterial is a two-lane arterial that connects with SH22 in the west, crosses the rail corridor at Butcher Road (paper road section), upgrades Grace James Road and forms a new connection with Pukekohe East Road at the southern extent.

The route provides traffic movement between points to the north and east of Pukekohe, to reduce vehicles travelling through Pukekohe town centre. It also provides new connections for public transport and walking and cycling. Serves through traffic to bypass the Pukekohe town centre, connects SH22 to Pukekohe East Road serving around 8000 vpd (All-class).

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-7.

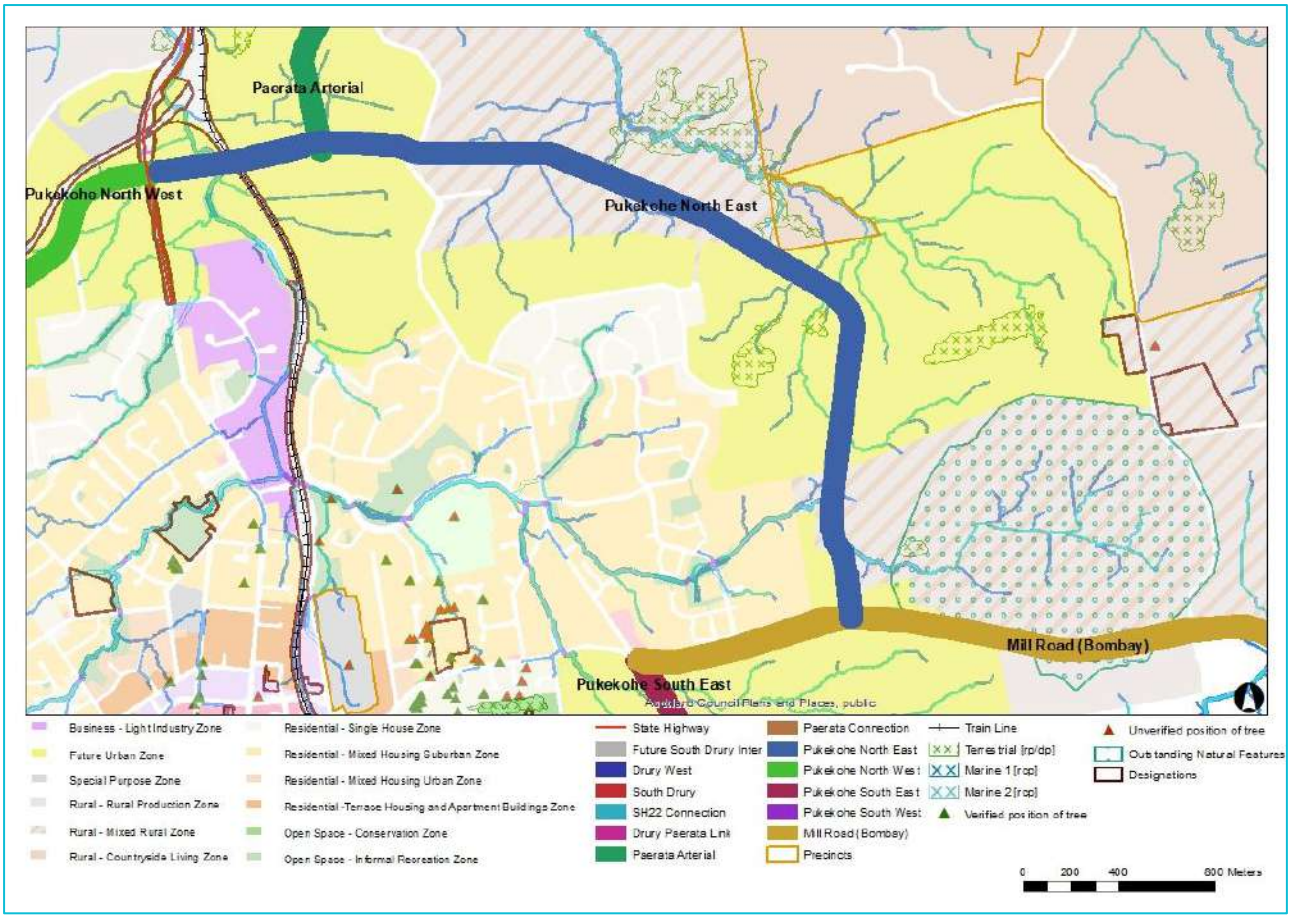

Figure 3-7 Pukekohe North-East Arterial - Zoning and Other Features

Key elements of the planning context are as follows:

- The transport corridor is for the majority located within the 'Future Urban Zone' although a small portion is located within the Mixed Rural Zone. The southern side of Grace James Road is zoned Residential – Single House Zone and at the southern extent on the west side of the proposed transport corridor, is zoned Residential - Mixed Housing Suburban Zone.
- The Runciman Precinct is located to the north of the corridor.
- There are no existing designations in proximity to the corridor.
- There is new development occurring and active developer interest adjacent to the south-west extent of the corridor.
- The project is adjacent to a Significant Ecological Area Overlay (SEA_T_4374) and crosses Whangapouri Stream.
- The project is located to the west of the Outstanding Natural Feature (Pukekohe East tuff ring) and does not intersect with this feature.
- The area is covered by two natural resource overlays (high-use aquifer management area, quality-sensitive aquifer management area).

3.8 Pukekohe South-East Arterial

The Pukekohe South-East Arterial includes an upgrade to Golding Road and a new connection within the future urban zone crossing the rail corridor to Svendsen Road in the west.

The route will redirect traffic and freight traffic away from Pukekohe town centre. It will provide increased network resilience with an additional rail crossing, increased connectivity to the existing Pukekohe rail station and to the strategic network through Pukekohe East Road. It also provides an additional transport corridor for public transport and walking and cycling.

Serves as bypass for freight vehicles and through traffic away from Pukekohe town centre, connects to Pukekohe East Road. The predicted ADT is around 8,000 vpd.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-8.

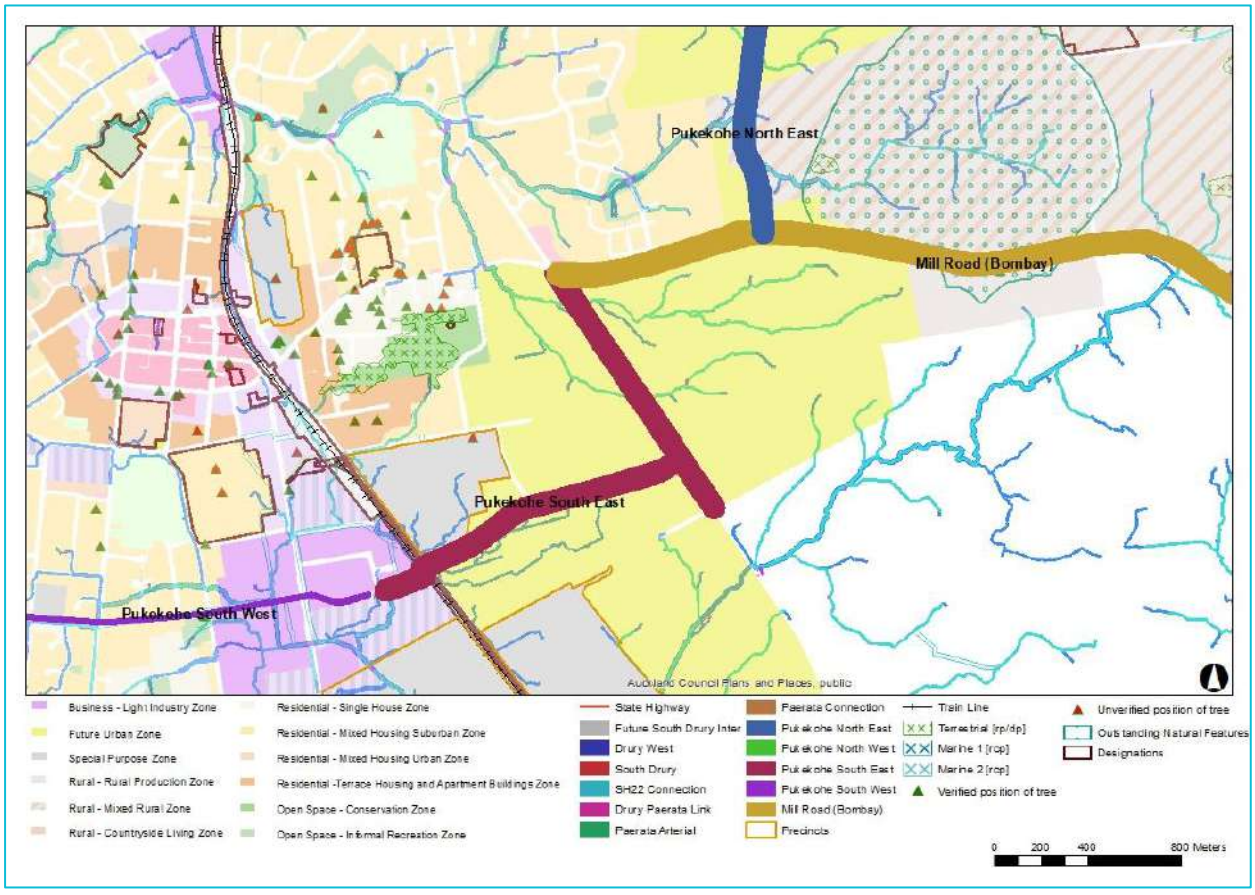

Figure 3-8 Pukekohe South-East Arterial - Zoning and Other Features

Key elements of the planning context are as follows:

- The transport corridor is located within the 'Future Urban Zone' and 'Business - Light Industry Zone'.
- The project is adjacent to the Pukekohe Showground (Special Purpose - Major Recreation Facility Zone).
- The project crosses NIMT (Designation 6302).
- Two plan changes have been lodged adjacent to the transport corridor: Plan Change 74 - Golding Meadows and Plan Change 76 - 53 Birch Road and 19 Golding Road.
- The project area is covered by two natural resource overlays (high-use aquifer management area, quality-sensitive aquifer management area).

3.9 Pukekohe South-West Upgrade

This transport corridor includes an upgrade to walking and cycling within the existing road reserve as much as possible. The route follows Nelson Street West from Manukau Road, Ward Street, Puni Road, West Street and Helvetia Road to connect to Pukekohe North-West Arterial. The project would serve around 8000-10,000 vpd (All-class) and improves active mode and PT connection to most SW Pukekohe areas.

Key elements of the planning context are as follows:

- The project is mostly 'Residential - Mixed Housing Suburban Zone'. Adjacent to the South-East Arterial project the Pukekohe South-West Upgrade project traverses 'Business - Light Industry Zone'. There are also some areas of 'Future Urban Zone' and Open Space.
- There are no existing designations along the length of the road corridor.
- There is one plan change lodged for the area of FUZ identified at 290 Victoria Street, Pukekohe which interacts with the project.
- The project area is covered by two natural resource overlays (high-use aquifer management area, quality-sensitive aquifer management area).
- Adjacent to Samuel Miller Reserve (42-54 Nelson Street), Pukekohe Cemetery (Ward Street), Buttercups Early Learning Centre (47a Ward Street), Pukekohe Indian Community Centre (59 Ward Street), Jutland Road South Park (West Street), Pukekohe Tennis Club (West Street), New Life Health Centre (West Street), Little Sparks Pukekohe (65 Helvetia Road).

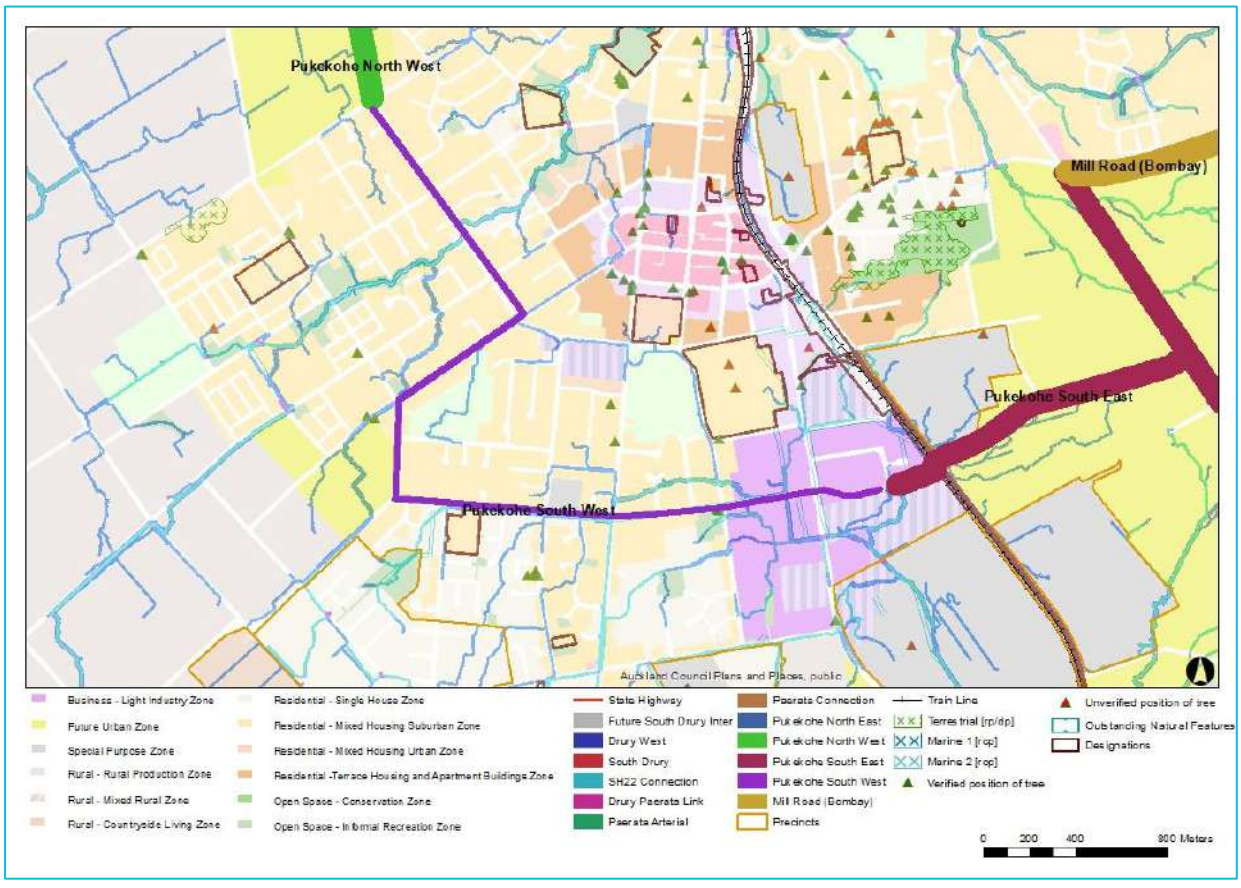

Figure 3-9 Pukekohe South-West Arterial - Zoning and Other Features

3.10 Pukekohe North-West Arterial

The Pukekohe North-West Arterial includes upgrades of existing roads at Helvetia Road, Gun Club Road (paper road) and Butcher Road. It also includes a new alignment within the future urban area located to the south of the Glenbrook Rail Line and connects to SH22. Serves around 8000-9,000 vpd (All-class). Connects industrial and residential areas to SH22 within NW Pukekohe areas.

The route will create a safe connection to the west of Pukekohe and will help redirect traffic away from the town centre, improving access for all modes, including public transport and walking and cycling.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-10.

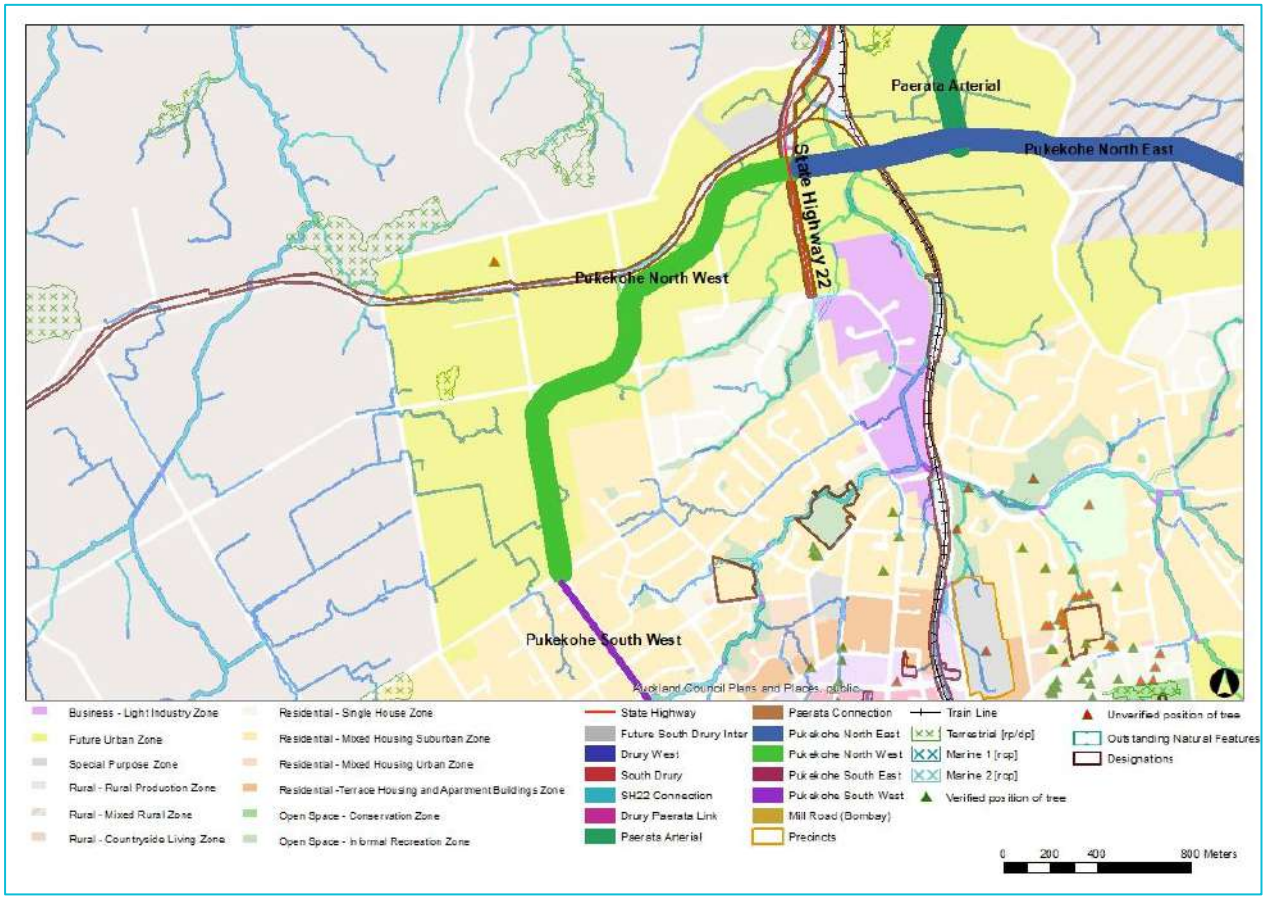

Figure 3-10 Pukekohe North-West Arterial - Zoning and Other Features

Key elements of the planning context are as follows:

- The proposed transport corridor is located within the 'Future Urban Zone'.
- The corridor at the western extent intersects with existing Waka Kotahi SH22 designation (Designation 6704).
- The corridor is south of the Mission Bush Railway Line designation (Designation 6306).
- There are no existing designations along the length of the road corridor.
- There is developer interest on both sides of Helvetia Road near Heights Road.
- The project crosses Whangapouri Stream and the project area is covered by two natural resource overlays (high-use aquifer management area, quality-sensitive aquifer management area).

3.11 Mill Road and Pukekohe East Road Upgrade

This includes widening of Mill Road (Bombay) to four lanes between the SH1 Bombay interchange and Harrisville Road. The upgrade will tie in with the proposed Waka Kotahi NZ Transport Agency upgrade to the Bombay Interchange. This corridor also includes an active mode upgrade, generally within the existing road reserve, from Harrisville Road along Mill Road and continues along Pukekohe East Road to the FUZ in Pukekohe (at the North-East Arterial).

Mill Road (Bombay) is a key freight route and traffic volumes are predicted to reach up to 32,000 vehicles per day by 2048. Mill Road (Bombay) and Pukekohe East Road provide an important connection between Auckland and Waikato.

The AUPOIP zoning, and selected overlays and controls are shown in Figure 3-11.

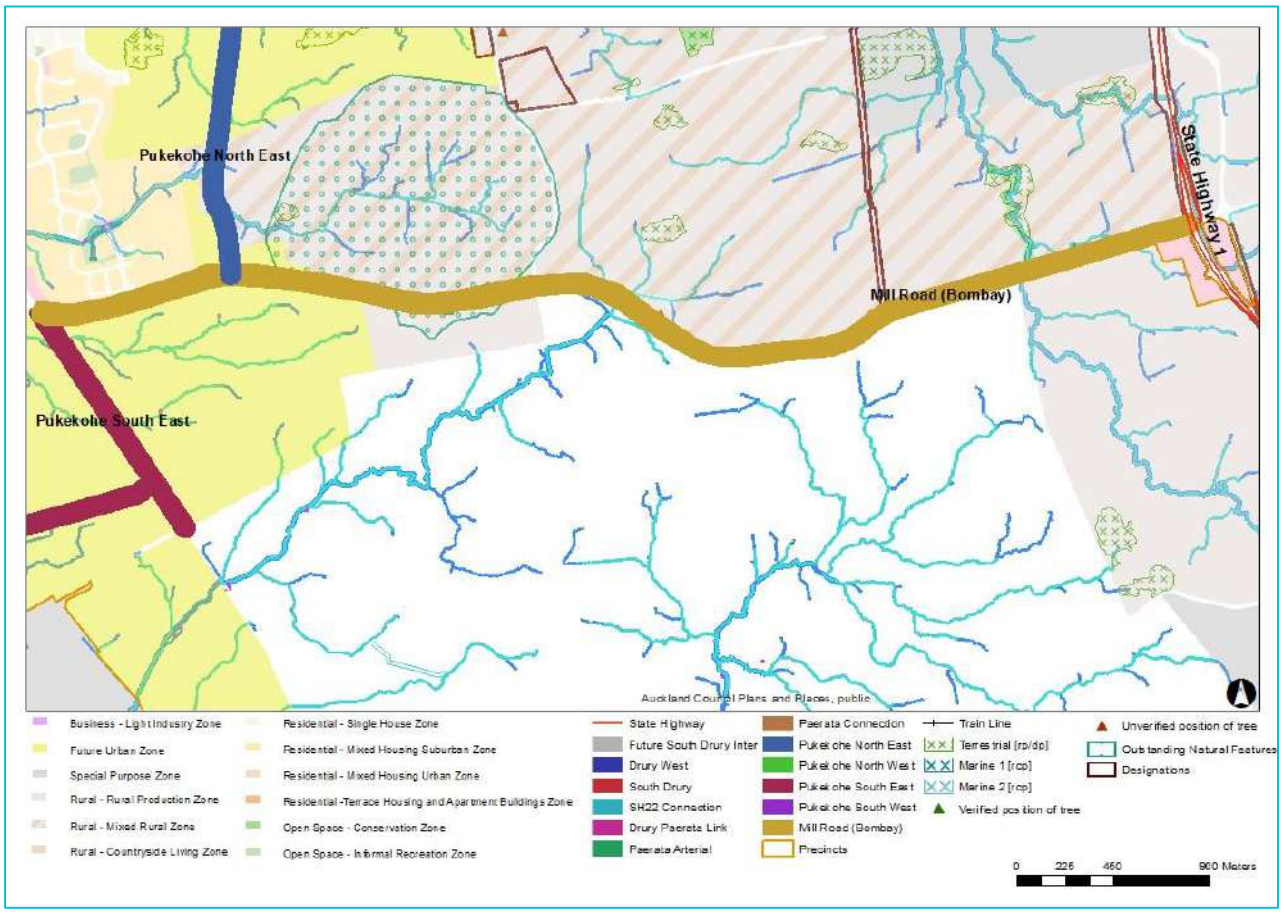

Figure 3-11 Mill Road and Pukekohe East Road Upgrade - Zoning and Other Features

Key elements of the planning context are as follows:

- Part of Mill Road borders the Waikato District area, for part of the corridor the Auckland/Waikato border is within the centreline of the existing Mill Road.
- In Auckland, the transport corridor is within the 'Rural Production Zone' and 'Mixed Rural Zone'. At the eastern extent is Business – Neighbourhood Centre Zone. In the Waikato District, the zoning is Rural (F) with a small pocket of Recreation (F) east of Jericho Road.
- The existing Waka Kotahi SH1 (Designation 6702) and Bombay 1 Precinct are located at the eastern extent of the corridor.

- Inter-district route of national significance close to Auckland-Waikato regional boundary.
- A Significant Ecological Area Overlay (SEA_T_4464) is located to the north of Mill Road (the upgrade does not intersect this).
- Part of Pukekohe East Road is located within the southern extent of an Outstanding Natural Feature (Pukekohe East tuff ring).
- The project area is covered by three natural resource overlays (high-use aquifer management area, quality-sensitive aquifer management area, high-use stream management area).

4 Route Protection Evaluation

4.1 Key Risks and Considerations

4.1.1 Overview

The following sections provide an overview of the key risks and considerations of each transport corridor when determining the preferred method of route protection.

4.1.2 Structure Plans and Private Plan Changes

Through the Supporting Growth Programme, AT and Waka Kotahi have a continuing programme of engagement with landowners and developers along and around the recommended alignments. In 2019, Council prepared and endorsed two structure plans within the Pukekohe DBC area and a number of private plan changes have been lodged or are proposed in the area.

4.1.2.1 Auckland Council Drury-Ōpāheke Structure Plan and Pukekohe-Paerata Structure Plan

Approval of the Drury-Ōpāheke and the Pukekohe-Paerata Structure Plans by Auckland Council outlines the Council's anticipated growth and land use patterns in the FUZ in these areas. The structure plans have informed a number of private plan changes in both Drury and Pukekohe as described in the next section. The South Indicative Strategic Transport Network is indicated on the structure plans (through the work undertaken for the South Indicative Business Case which has informed this DBC).

4.1.2.2 Private Plan Changes

Areas of land in Drury, Pukekohe and Paerata, are rapidly urbanizing including the Auranga Development (Drury 1 Precinct), Drury Crossing (Drury South Precinct), Paerata Rise (Franklin 2 Precinct) and areas within Anselmi Ridge in Pukekohe. Areas in Drury east and west have recently been live zoned through developer led plan changes bringing forward development ahead of expected land release under the Auckland Council FULSS. Under FULSS, FUZ land within Paerata is development ready 2018 – 2022 and in the FUZ in Pukekohe this is 2023-2027. Developers are actively looking to progress private plan changes in Pukekohe with a number lodged with Council or being prepared.

Recently approved, lodged or planned plan changes in the Pukekohe DBC area are listed below:

Recently approved plan changes:

- Plan Change 46 - Drury South Precinct (Fully Operative 29 October 2021)
- Plan Change 51 - Drury 2 Precinct (Operative in part on 12 August 2022)
- Plan Change 61 – Waipupuke (Drury) (Operative in part on 8 July 2022)
- Paerata Rise Franklin 2 Precinct (Special Housing Area)

Lodged Plan Changes:

- Plan Change 48 – Drury Centre Precinct (under appeal)
- Plan Change 49 – Drury East Precinct (under appeal)
- Plan Change 50 – Waihoehoe Precinct (under appeal)

- Plan Change 74 - Golding Meadows and Auckland Trotting Club Inc (Notified on 24 March 2022)
- Plan Change 76 - 53 Birch Road & 19 Golding Road (Notified on 26 May 2022)
- Plan Change 87 – 301 and 303 Buckland Road (Notified 27 October 2022)

Proposed plan changes not yet lodged:

- 50 Pukekohe East Road & 47 Golding Road, Pukekohe
- 70A and 70B Lisle Park Road, Pukekohe
- Helvetia Heights (Helvetia Road), Pukekohe
- Victoria Street/Puni Road, Pukekohe
- Fisher and Paykel – Karaka Road, Drury

It is noted that these proposed plan changes which have been lodged or are being prepared do not have any statutory weighting. They do however demonstrate the level of developer interest in the area.

4.1.3 New Zealand Upgrade Programme

In January 2020, the New Zealand Government announced the New Zealand Upgrade Programme (NZUP) which will invest in road, rail, public transport and walking and cycling infrastructure to get New Zealand cities moving, improve safety and boost productivity. A number of these projects are within South Auckland and Pukekohe DBC area and the projects have a direct interaction with many of them, these include:

- Mill Road (Manukau) safety improvements
- Transport roading upgrades in Drury to support growth (SH22 and Waihoehoe Road)
- SH1 Papakura to Drury improvements
- Papakura to Pukekohe rail line electrification - supporting urban and economic growth
- Drury and Paerata Rail Stations – three new rail stations (Drury Central, Drury West and Paerata), park and ride facilities as well as a bus and rail interchange supporting urban and economic growth.

4.1.4 National Policy Statement for Highly Productive Land

There are a range of National Policy Statements that are relevant to the Pukekohe DBC area. However, the National Policy Statement for Highly Productive Land (NPS HPL) has recently come into force (on 17 October 2022) and is of particular relevance to Pukekohe which is known for its highly productive soils. The NPS HPL applies to land identified as Land Use Capability Class 1, 2, or 3.

The NPS HPL sets out that land which is the subject of an approved plan change to rezone the land ceases to be highly productive land from the date the plan change becomes operative.

However, there remains large areas of highly productive soils in the Rural zoned areas around south Drury, Paerata and Pukekohe where some Pukekohe DBC transport corridors are recommended to be located to connect and support future communities.

The NPS HPL makes provision for activity by a requiring authority in relation to a designation or notice of requirement for the use or development of highly productive land. It is not considered inappropriate

as long as measures are taken to minimise or mitigate loss or potential loss of highly productive land and to avoid or mitigate reverse sensitivity effects on primary production activities (s3.9(3)).

The projects located on highly productive land would need to demonstrate that a robust assessment of alternatives has been carried out and considered impacts on the rural zone. Further refinement of the corridors during design will seek to minimise impacts to highly productive land where possible.

4.1.5 Construction Programme

The recommended options do not have secured funding for construction, therefore immediate implementation of the corridors is not a key driver of the route protection strategy.

4.2 Summary

Timing of land release in the FUZ according to the Auckland Council FULSS is 2028 - 2032 in Drury West south of the rail corridor, 2017 - 2022 in Paerata, and 2023 - 2028 in the Pukekohe. There are a number of private plan changes currently being progressed and multiple developers with an active interest in sites around Pukekohe DBC area. Over the next five years there will be significant change in the Pukekohe DBC area. The nature and scale of this change and the need to provide a transport network that meets the needs of these future communities makes it necessary to route protect the projects proposed within the Pukekohe transport network.

5 Consideration of Route Protection Mechanisms

As demonstrated by the analysis in Section 4.1, there are a number of common risks and considerations that apply across the corridors that make up the Pukekohe DBC recommended transport network. The following discussion provides a general assessment of the route protection mechanisms across the network identifying where specific mechanisms are suitable for route protection of the network or specific components of the network.

5.1 Designation

Lodging a NoR and designating specific corridors provides interim and permanent route protection as soon as the notice is lodged with Council, by protecting the land for the designated purpose and providing approval through its inclusion in the district plan (negating the need for additional land use consents under the rules of the plan). This effectively manages risk of development within the corridor that may otherwise hinder the proposed work. A designation, if confirmed, protects the proposed corridor from incompatible development, authorises the activity (in accordance with the designated purpose) and is included in the relevant district plan. This provides certainty and visibility to the public about the intended land use, enabling informed development decisions.

As the proposed cross section for the Pukekohe South-West Arterial (located within the existing urban area) fits largely within the existing road corridor, ‘route protection’, and therefore a designation, of the full corridor is not required. However, where the proposed upgrade requires additional land at certain locations along the proposed route (such as intersections and driveways), a designation will manage risk of incompatible development and intensification within these areas that may hinder the proposed work in the future and will provide certainty to landowners.

For the Mill Road upgrade, part of the existing road reserve is within the Waikato District. This means that the requiring authority must submit the NoR to the Waikato District Council as well as to the Auckland Council.

5.2 Landowner / Developer Negotiations

There are a number of developer-led plan changes and resource consents in Pukekohe. Particularly in the South East project area. A map of those plan changes or resource consents that have been lodged, notified or are operative are shown in Figure 5-1. This information is the best available at the time of preparing this strategy.

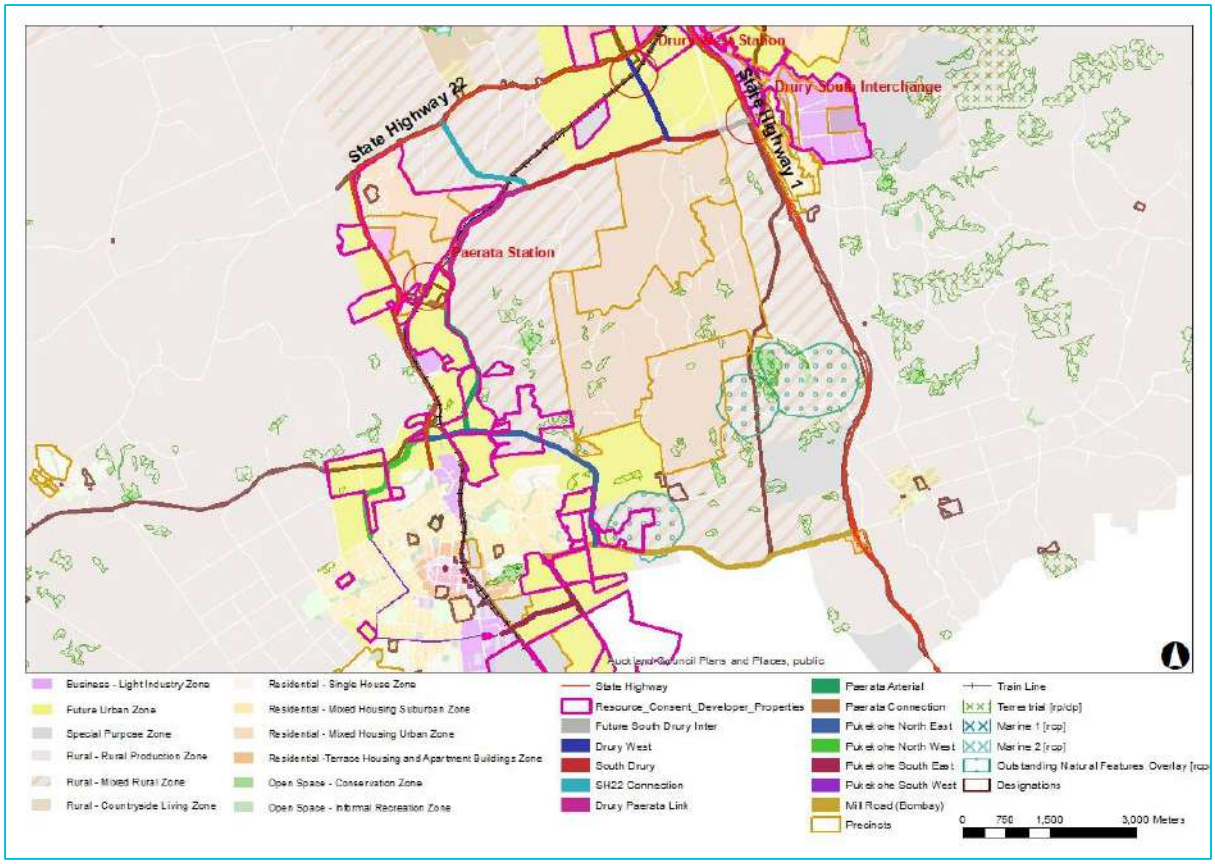

Figure 5-1 Developer interest in the Pukekohe package area

Timing is a key issue when looking to enter into developer and/or landowner agreements. Additionally, each of the recommended corridors traverse a large number of individual properties with individual landowners.

For landowner agreements to be undertaken efficiently, the plans and timing of plans of each party involved must be aligned. Although a number of developers are active in the wider Drury and Pukekohe area, in most cases they do not own all of the relevant land for a single corridor or the network, resulting in a reliance on individual property owners to enter into agreements. Private property owners with little or no development plans and that are not part of an agreement with a larger developer are unlikely to have an appetite to negotiate.

Furthermore, in reality, where a number of properties/developers are involved, the final solution is likely to be piecemeal due to the practicality and timeframes required to negotiate agreements with numerous affected landowners for each corridor. This may result in another form of route protection being required to ensure the entire corridor is protected. Additionally, it is not compulsory for landowners or developers to enter into agreements, significantly reducing the use of this mechanism for route protection purposes.

5.3 Plan Change / Structure Plan

The Structure Plans are not considered an appropriate mechanism to rely upon for route protection as they do not provide enough certainty in protection of privately-owned land and they have no formal statutory weighting. Some of the recommended alignments for the Pukekohe DBC transport corridors

have been altered through the DBC options assessment process to that shown indicatively in the structure plans and therefore cannot be relied on.

Similarly, a new plan change is not considered an appropriate mechanism to implement the network because the land surrounding portions of the network are already zoned for future development, are precincts or have established development. Also, a number of private plan changes have been lodged and/or accepted by Auckland Council across the network (see Section 4.1.2), so a single plan change solution across the network is not viable.

Given the upgrade for the Pukekohe South-West Arterial can generally be contained within the existing road reserve, a structure plan and plan change process would not provide any more certainty to the community than what is already shown in the AUPOIP.

5.4 Suitability of Route Protection Mechanisms and Recommendations

Based on the above considerations and assessments, the Table 5-1 presents the level of suitability of each route protection mechanism for each section of the network. The recommended route protection mechanism for each section of the network is outlined below. Some route protection mechanisms have not been assessed in detail since they were ruled out for further consideration (refer discussion in Section 2.1).

A designation is the recommended route protection mechanism for all projects. Although route protection of all of the Pukekohe South-West Arterial is not required as it can be generally provided for within the existing road corridor, a designation is recommended to protect the discrete areas of private land required for [driveway access, roundabouts, swales]. As previously identified, a designation is the most efficient and effective mechanism for providing route protection in a changing urban environment and providing certainty to the community and to affected landowners.

While some existing designations are in proximity to, or some transport corridors interact with, the Pukekohe DBC transport network components, altering these existing designations to incorporate the Pukekohe DBC components is not recommended as these designations are for different purposes.

Table 5-1 Strength of Route Protection Mechanisms for Recommended Pukekohe DBC Transport Network

Corridor	Designation	Landowner / developer negotiations	Plan Change / Structure Plan
Drury West Arterial			
South Drury Arterial			
SH22 Connection			
Drury-Paerata Link			
Paerata Arterial			

Pukekohe North-East Arterial				
Mill Road and Pukekohe East Road Upgrade				
Pukekohe South-East Arterial				
Pukekohe North-West Arterial				
Pukekohe South-West Upgrade				

KEY:	**STRONG**	**MEDIUM**	**WEAK**	**NOT APPLICABLE**

5.5 Urgency of Route Protection

Table 5-2 provides an assessment of the urgency of route protection for each of the corridors taking into account the considerations outlined in Section 4.2.

Table 5-2 Urgency of Route Protection Mechanisms for Recommended Pukekohe DBC Transport Network

Corridor	Urgency	Comment
Drury West Arterial	Medium	Active developers are located to the north of SH22 and not in the south Drury area immediately adjacent to the corridor. However, construction of Drury West Station is likely to increase interest in development around it. Drury West FUZ south of the rail line is timed for release 2028 -2032 in FULSS.
South Drury Connection	Medium	Increasing development in Drury will also increase pressure on connections in the Drury area, including SH22. An alternative connection to SH22 and a new connection to SH1 is likely to be needed sooner rather than later.
SH22 Connection	Medium	Together with the South Drury Connection, the SH22 connection provides an alternative to SH22 connecting to SH1 which may need to be brought forward to meet the needs of development in the Drury area. In addition to development in Drury the Paerata Rise (Franklin Precinct 2) is also being developed. The SH22 Connection is located in the rural zone which is not anticipated to change significantly in the future with reduced risk in terms of development pressure adjacent to the corridor.
Drury-Paerata Link	Medium - Low	This connection is likely to be the last project for delivery in the Pukekohe transport network. This project is located in the rural zone which is not anticipated to change significantly in the future.
Paerata Arterial	High	Apart from Paerata Rise, there are no active developers immediately adjacent to the corridor. However, construction of Paerata Station is likely to increase interest in development around it. The area around Paerata station is timed for release 2018-2022 in FULSS.
Pukekohe North-East Arterial	High	There is active development in proximity to this corridor and further plan changes proposed adjacent to this project. It is recommended this corridor be designated as soon as possible to protect the land required for the corridor and ancillary infrastructure, as well as providing certainty to landowners, stakeholders and developers.
Mill Road and Pukekohe East Road Upgrade	Medium	This project provides an important strategic connection between Pukekohe, Waikato and SH1. While there is no development pressure adjacent to the corridor at the eastern end, Waikato and Pukekohe are growing and there will be increasing pressure placed on this corridor connecting to the strategic network (SH1). At the western extent of the corridor, there is active interest by developers in the FUZ – so in this section the urgency of route protection is high.
Pukekohe South-East Arterial	High	There are a number of proposed plan changes adjacent to this project – both lodged and proposed. The timing in the FULSS is 2023-2027. It is recommended this corridor be designated as soon as possible to protect the land required for the corridor and ancillary infrastructure, as well as providing certainty to landowners, stakeholders and developers.
Pukekohe North-West Arterial	High	There is a proposed plan changes adjacent to this project. It is recommended this corridor be designated as soon as possible to protect the land required for the corridor and ancillary infrastructure, as well as providing certainty to landowners, stakeholders and developers.

Pukekohe South-West Upgrade	Medium-Low	This project is within the existing urban area but development is likely to intensify with Plan Change 78 and the Medium Density Residential Standards (MDRS)

6 NoR Grouping, Requiring Authority and Lapse

6.1 NoR Grouping Considerations

NoRs for new designations are the recommended route protection mechanisms for all of the recommended options. There are opportunities to group multiple recommended options into a single NoR (i.e. one NoR covering multiple corridors) and/or package multiple NoRs into a single application. The grouping and packaging of NoRs provides an opportunity to improve efficiencies in the NoR process, streamlining statutory timeframes and avoiding unnecessary duplication in supporting documentation. However, this must be balanced with the potential for increased planning risk and added complications of grouping issues/corridors together.

In determining whether it may be appropriate to group options and/or package NoRs, the following criteria have been considered:

- Project context – A contextual basis (such as similar business case foundations, investment objectives, requiring authority, geographic context and project drivers) allows for efficiencies in base information which will be provided to support the NoR package/bundle. The investment objectives are the same for all components of the network so haven't been considered further in NoR grouping considerations.
- Planning risk and project complexity – A similar level planning risk (such as notification risk, likelihood of appeal, complexity of planning approval requirements) limits the potential that projects are unnecessarily exposed to delays and added planning complexity, noting projects also need to be credible and be able to stand alone if required.
- Project timing – Similar programme timing (including design, assessment, project drivers) provides consistency in provision of information requirements, key deadlines and delivery targets. Also similar urgency for route protection.

Lapse period – The specific length of these lapse periods is determined largely by the proposed project timing according to FULSS, and IBC and DBC modelling.

Table 6-1provides commentary on how the above criteria relate to each of the recommended corridors and the appropriateness of option grouping based on these criteria.

In summary, it is recommended to group South Drury Arterial, Drury to Paerata Link and SH22 Connection as one NoR. Together these provide the strategic link between Drury and Paerata/Pukekohe and provide an alternative to State Highway 22 which will increasingly become urbanised. They have similar planning risk and are located in the rural zone (or future urban edge).

There was also consideration of grouping the Pukekohe Local Arterial projects in to one NoR. This was discounted as, although these projects are likely to have a similar lapse, each of these quadrants have different development pressures.

6.1.1 Recommended Requiring Authority

The recommended requiring authority for projects are set out in Table 6-1.

The local arterial roads are recommended to be designated by Auckland Transport. These are:

- Drury West Arterial (NoR 1)

- Connections from the Paerata Arterial to the Paerata Rail Station and to SH22 and a new connection across the rail corridor (Sim to Sim) (NoR 3)
- Pukekohe Arterials (North East, South East, North West and South West) (NoRs 5-7)

The transport corridors that provide more of the strategic through route and freight function, integrate into the existing state highway network and meet the Waka Kotahi State Highway criteria (2002) are recommended to be designated by Waka Kotahi. These are:

- South Drury Arterial, SH22 Connection, Drury-Paerata Link and Paerata Arterial (NoR 2)
- Mill Road and Pukekohe East Road Upgrade (NoR 8)

For NoR 2 the future environment in Drury will be a major urban area and the project(s) will provide new connections with the existing state highway network. When integrated into the state highway network it will significantly improve the overall performance and management of the state highway network1.

For NoR 8 the Mill Road and Pukekohe East Road are the main connection between Pukekohe and SH1. The project will provide a strategic inter-district route connecting locations of national economic significance where Pukekohe is considered a significant centre of population and a major industrial, forestry and agricultural area. The project will provide the most convenient, efficient and safe route for through traffic.

6.1.2 Lapse Periods

The recommended lapse for the projects is set out in Table 6-1 and are generally 15 – 20 years.

The purpose of Te Tupu Ngātahi is to route protect land for future implementation of the required strategic transport corridors and infrastructure. Therefore, there is a need for long term route protection to enable integration with land use as it changes, to provide certainty and access, and to protect the corridor from inappropriate development until such time as the transport corridors are required to support and facilitate planned urban growth. Funding for the construction of the Pukekohe projects is uncertain at this time and construction staging and timing still has a level of uncertainty however the proposed transport corridors need to be protected so that these projects can be implemented in the future when required.

The use of a long lapse period provides greater certainty on the following matters:

- Protects the corridor from inappropriate development and enables effective transport and land use integration as future urban land is urbanised and developed overtime;
- Provides certainty to everyone that the projects can be constructed and operated when required, responding to growth;
- Provides adequate time to undertake property negotiations and processes, including access negotiations and acquisitions as necessary;
- Provides adequate time to complete further site investigations and design (preliminary, detailed and construction) of all aspects of a project; and
- Provides adequate time to secure project funding and to complete construction procurement processes.

[1] State Highway Review Criteria 2002 Criteria b)

Table 6-1 provides an overview of the risk and timing implementation of the designations, for each of the corridors.

Table 6-1 Pukekohe NoR Grouping, Requiring Authority and Lapse Recommendations

Component	Project Context	Planning Risk	Project Timing (according to FULSS, DBC investigations, and developer interest)	NoR Grouping Recommendation	Recommended Requiring Authority	Recommended Lapse Period
Drury West Arterial	• Future Urban Zone in Drury West. • Two-lane arterial to connect to Drury West Station and SH1.	• Low to moderate planning risk • General interest of stakeholders. But likely to be significant interest from Drury West developers. • Environmental constraints include Ngakoroa Stream crossing and high value wetlands and critical species, impacts were considered and minimised where possible through the options assessment • Connects to Drury West station. Location of the station is currently subject to court processes.	• Active development at the north of the corridor on north side of SH22. However, no active development • FULSS planned release 2028 -2032	No grouping with other components. Has a different function than the other transport corridors in proximity.. Geographically different location than Paerata/Pukekohe arterials, and different timing under FULSS. **NoR 1**	AT	15 years
South Drury Arterial	• Future Urban Zone in south Drury (Drury west) and Rural Zone between Drury and Paerata.	• Low to moderate planning risk • General interest of stakeholders	• Active development in Drury South across SH1 to the East. No active development adjacent to corridor. • FULSS planned release 2028 -2032 in Drury west	Recommend to group with SH22 Connection, Drury to Paerata Link and Paerata Arterial which together form the strategic connection between Drury and Paerata-Pukekohe and	WK WK	20 years

Component	Project Context	Planning Risk	Project Timing (according to FULSS, DBC investigations, and developer interest)	NoR Grouping Recommendation	Recommended Requiring Authority	Recommended Lapse Period
	• New connection to reduce congestion on and improve safety SH22 as it urbanises in Paerata and Drury west	• Adjacent to Transpower pylons need to avoid overhead utilities • Environmental constraints include Ngakoroa Stream and Oira Creek crossings and high value wetlands and critical species, impacts were considered and minimised where possible through the options assessment		provide an alternative to SH22. **NoR 2**	AT	
SH22 Connection	• All within Rural Zone • New connection to reduce congestion on SH22 through Drury West connecting to south Drury Connection and Drury-Paerata Link		• Active development in Paerata Rise to the south west of the corridor. However, corridor is located within the rural zone so no active (or likely) development proposed in this area. • FUZ to the east and west: FULSS planned release 2028 -2032 in Drury west and in Paerata FUZ release 2018 - 2022			
Drury-Paerata Link	• All within Rural Zone • New alignment connects Drury and Paerata future growth areas	• Low to moderate planning risk • General interest of stakeholders • Developer interest (Paerata 5 Farms Limited and McCall Family Farms Ltd) • Potential opportunities with KiwiRail designation	• Active development in Paerata Rise to the west of the corridor. However, corridor is located within rural zone with no active (or likely) development proposed in this area. • FULSS planned release 2028 -2032 in Drury west and in Paerata FUZ release 2018 - 2022			

Component	Project Context	Planning Risk	Project Timing (according to FULSS, DBC investigations, and developer interest)	NoR Grouping Recommendation	Recommended Requiring Authority	Recommended Lapse Period
		• Environmental constraints include Oira Creek crossings, high value wetlands and critical species and productive soils, impacts were considered and minimised where possible through the options assessment				
Paerata Arterial	• Mostly Future Urban Zone in Paerata. Passes through the Paerata Rise development (station access) to connect to SH22. • Improve local connectivity and access to the Paerata rail station	• Moderate planning risk • General interest of stakeholders • Developer interest • Environmental constraints include Significant Ecological Area (SEA_T_4380), Whangapouri Creek and critical species, impacts were considered and minimised where possible through the options assessment. No impact on SEA.	• Developer interest in the area and with Paerata Rail Station due for construction in the near future, will likely increase the interest. • FULSS planned release 2018 - 2022	Paerata Arterial to be included with NoR 2 but connections over the rail corridor to be a separate AT NoR (see below).		
Paerata Connections (over rail corridor)				Paerata Connections NoR 3	AT	15 years
Pukekohe North-East Arterial	• Existing residential and rural zone as well as Future Urban Zone • New connection to reduce vehicles travelling through	• Moderate-high planning risk. • High interest from residents in existing urban area • Environmental constraints include Whangapouri Creek and	• Developer interest / plan changes lodged. • FULSS planned release 2023 - 2027	Discounted grouping Pukekohe arterials as each quadrant has different pressures, appeal risk and timing. **NoR 4**	AT	15 years

Component	Project Context	Planning Risk	Project Timing (according to FULSS, DBC investigations, and developer interest)	NoR Grouping Recommendation	Recommended Requiring Authority	Recommended Lapse Period
	Pukekohe town centre	critical species, impacts were considered and minimised where possible through the options assessment. However, still some impacts on ecological features including edge effects on SEA adjacent to corridor.				
Pukekohe South-East Arterial	• Future Urban Zone and also Business - General Business Zone and Light Industry Zone New connection to reduce vehicles travelling through Pukekohe town centre	• Moderate planning risk • General interest of stakeholders • Birch Land Development Consultants development interest • Environmental constraints include stream crossings and critical species	• Active development and plan changes High urgency to route protect and have designation approved. • Likely to be implemented sooner (acknowledging there is no funding confirmed) due to imminent development on Golding Road. • FULSS planned release 2023 - 2027	As above. **NoR 5**	AT	15 years
Pukekohe South-West Upgrade	• Existing urban area subject to intensification through MDRS	• Low - moderate planning risk • Limited areas being designated – proposed to only upgrade specific intersections. • General interest of stakeholders	• Existing urban area. • Timing of project likely in decade 3.	As above. **NoR 6**	AT	20 years

Component	Project Context	Planning Risk	Project Timing (according to FULSS, DBC investigations, and developer interest)	NoR Grouping Recommendation	Recommended Requiring Authority	Recommended Lapse Period
		• Often strong interest from community in an existing urban area				
Pukekohe North-West Arterial	• Future Urban Zone • New connection to reduce vehicles travelling through Pukekohe town centre	• Moderate planning risk • General interest of stakeholders • Active developer interest • Environmental constraints include stream crossings • Partially uses existing roads including paper roads	• Active development and plan changes • FULSS planned release 2023 - 2027	As above. **NoR 7**	AT	15 or 20 years
Mill Road and Pukekohe East Road Upgrade	• Rural zone and existing residential development • Upgrade and widening of Mill Road (Bombay) and upgrade of Pukekohe East Road within road corridor • Significant strategic connection between Pukekohe / Auckland and Waikato	• Moderate to high planning risk • General interest of stakeholders • Mana whenua interest in Pukekohe East Tuff Ring • Uses existing road • Interacts with SH1 upgrades • Waikato border • Environmental constraints include Significant Ecological Area (SEA_T_4464) and ONF Pukekohe	• Medium urgency. No development pressure either side of the corridor at eastern extent as in rural zone. However, imminent development pressure at the western extent in FUZ. Corridor likely to need to be implemented sooner rather than later with Pukekohe and Waikato growth and imminent development in FUZ.	Not suitable to group with other projects in the vicinity. Significant strategic function. **NoR 8**	WK	15 years

Component	Project Context	Planning Risk	Project Timing (according to FULSS, DBC investigations, and developer interest)	NoR Grouping Recommendation	Recommended Requiring Authority	Recommended Lapse Period
		East Tuff Ring, critical species and productive soils. Part of upgrade will occur withing the ONF.				

6.2 Packaging

As discussed in Section 4.3, for the majority of transport corridors route protection is of medium to high urgency in order to protect the land required for the proposed network, while providing certainty to landowners, businesses, stakeholders and the community. For those corridors that are of lower urgency to route protect, there are significant benefits to lodging the NoRs together to tell the overall transport network story and gain efficiencies in document preparation (to support the NoRs). The efficiencies of lodging a package of NoRs will continue into the post lodgement process as well (one round of public submission and Council hearing process).

It is proposed that NoRs 1 to 8 be lodged with the Council as one package. This package will be supported by, and share, one Assessment of Environmental Effects (AEE). It is anticipated that the technical assessments below will be required to support the NoRs to enable the nature and scale of effects of the construction and operation of the projects and any mitigation to be understood:

- Cultural Impact Assessment
- Transport Assessment
- Landscape and Visual Effects Assessment
- Historic Heritage Effects Assessment
- Noise and Vibration Effects Assessment
- Ecological Impact Assessment
- Flooding Effects Assessment
- Arboricultural Effects Assessment
- Urban Design Evaluation

Table 6-2 and Figure 6-1 provides a summary of the Pukekohe NoR grouping and packaging recommendations.

Table 6-2 Pukekohe Overall NoR Grouping Recommendations

Project		Notice (and requiring authority)	Lapse Period
Drury West Arterial		NoR 1 (AT)	15 years
Drury-Pukekohe Link	South Drury Arterial	NoR 2 (WK)	20 years
	SH22 Connection		
	Drury-Paerata Link		
	Paerata Arterial		
Paerata Connections		NoR 3 (AT)	15 years
Pukekohe North-East Arterial		NoR 4 (AT)	20 years
Pukekohe South-East Arterial		NoR 5 (AT)	15 years
Pukekohe South-West Upgrade		NoR 6 (AT)	20 years
Pukekohe North-West Arterial		NoR 7 (AT)	15 years
Mill Road and Pukekohe East Road Upgrade		NoR 8 (WK)	20 years

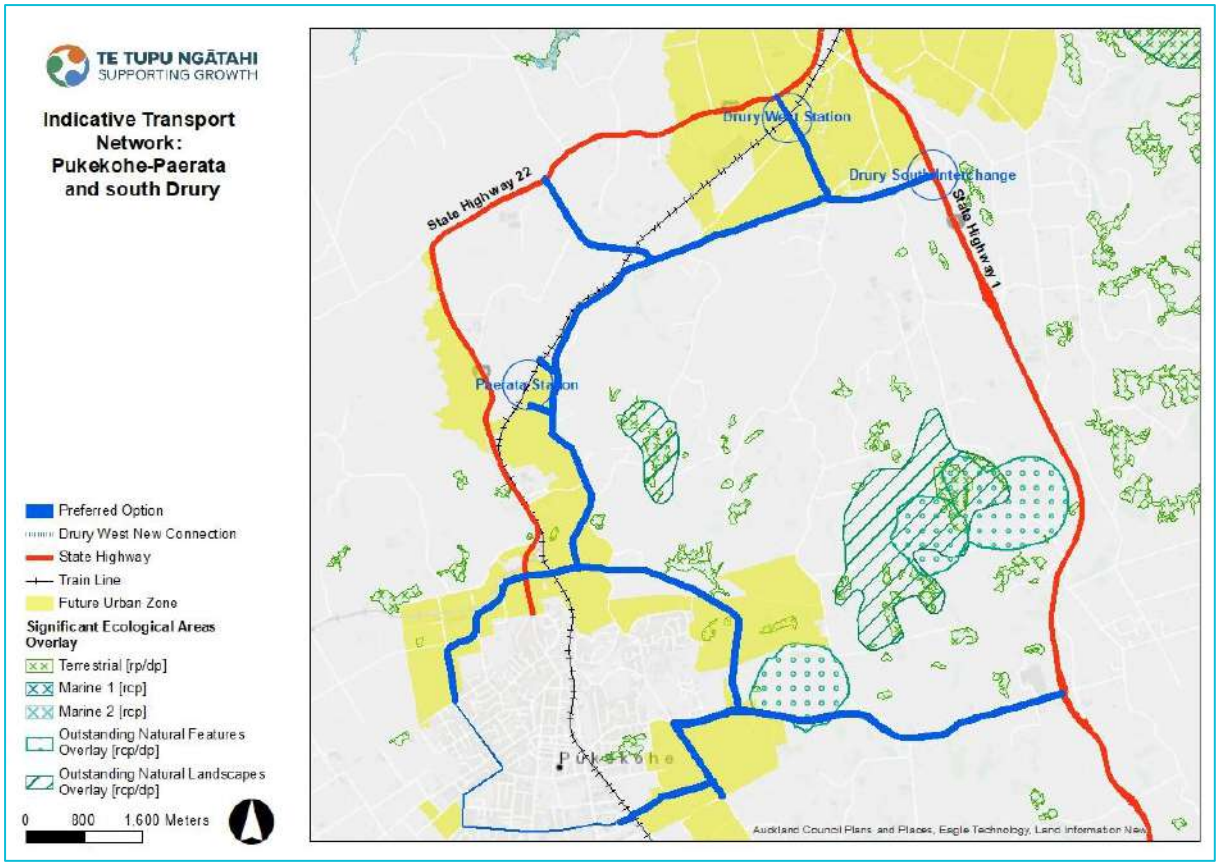

Figure 6-1 NoR Recommendations

1 Appendix 1 - Draft Strategy Selection Checklist

Key to table:	
Neutral	O
Positive / High	✓
Negative / Low	X
Not applicable / Not relevant	blank

	Liveability Outcomes				**Urgency**							**Complexity**											
	Strategic importance – anchor projects, area synergies	**Window of opportunity to shape urban form**	**Window of opportunity to coordinate with other infrastructure providers**	**Existing (e.g. zoning) environment and scope of any existing designations**	**General growth pressure in the focus area and risk of imminent build out**	**Status and timing of Council's structure planning/plan change process**	**Status and timing of proximate or related projects – completion linked projects**	**Likelihood of early funding OR availability of**	**Escalating land values**	**Developer timing and staging plans**	**High degree of interest from local and/or central**	**Alignment with strategic documents**	**Level of certainty regarding width of corridor and likely mode**	**Need for flexibility in relation to mode and progression of mode over time**	**Size, scale, and number of components that need to be bundled**	**Existence of sensitive receiving environment or**	**Significance of social, environmental or cultural effects[2]**	**Number of affected landowners**	**Extent of alignment with developer aspirations**	**Level of community engagement (support vs opposition)**	**Physical constructability issues**	**Future consenting risk for implementation phase (e.g. SEAs CMA)**	**Lack of certainty re future land use**
Route Protection Packages																							
Drury West Arterial	✓	✓	O	O	✓	O	✓	O	✓		O	✓	O	O		O	O	✓	O	✓	✓	O	O
South Drury Arterial	✓	✓	O	O	✓	O	✓	O	✓		O	✓	O	O	✓	O	O	✓	O	✓	✓	O	O

[2] Issues that are of such significance that they would influence consenting method(s) and/or approach.

SH22 Connection	✓	O	O	O	O	O	O	O	✓		O	✓	O	O	✓	O	O	✓	O	✓	✓	O	O
Drury-Paerata Link	✓	O	O	O	O	O	O	O	✓		O	✓	O	O	✓	O	O	✓	O	✓	✓	O	O
Paerata Arterial	✓	✓	O	O	O	O	O	O	✓		O	✓	O	O	✓	O	O	✓	O	✓	✓	O	O
Paerata Connection	✓	✓	O	O	O	O	✓	O	✓		O	✓	O	O		O	O	✓	O	✓	✓	O	O
Pukekohe North-East Arterial	✓	✓	O	O	O	O	O	O	✓	✓	O	✓	O	O		✓	✓	✓	✓	✓	✓	✓	O
Pukekohe South-East Arterial	✓	✓	O	O	✓	O	O	O	✓	✓	O	✓	O	O		O	O	✓	✓	✓	✓	O	O
Pukekohe North-West Arterial	✓	✓	O	O	O	O	O	O	✓	✓	O	✓	O	O		O	O	✓	✓	✓	✓	O	O
Mill Road and Pukekohe East Road Upgrade / East Road	✓	O	O	O	O	O	✓	✓	✓		O	✓	O	O		✓	✓	✓	O	✓	✓	✓	O
Pukekohe South-West Upgrade	O	X	O	O	X	O	X	X	✓		O	✓	O	O	X	✓	✓	✓	O	✓	O	O	O

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe
Appendix J: Property Overview

May 2023

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

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Approver	[redacted]

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Appendices

Appendix A: Property Acquisition Profiles

Acronym/Term	Description
AT	Auckland Transport
AUPOIP	Auckland Unitary Plan - Operative in Part
Council	Auckland Council
DA	Developer Agreement
DBC	Detailed Business Case
Development ready	Bulk infrastructure is in place to service development, including three waters, transport, and social infrastructure
FAR	Funding Assistance Rate
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
ha	hectare
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
OIM	Owner Interface Manager
Partners	Collectively refers to Auckland Transport, Waka Kotahi NZ Transport Agency, manawhenua, Auckland Council
RTC	Rapid Transit Corridor. Forms part of the overall Auckland Rapid Transit Network (RTN).
RTN	Rapid Transit Network which is comprised of multiple Rapid Transit Corridors (RTC's) around Auckland.
SGA	Supporting Growth Alliance (referred to as Te Tupu Ngātahi)
SH1	State Highway 1
SH22	State Highway 22
TCE	Target Cost Estimate
Te Tupu Ngātahi	Supporting Growth Alliance
The Council	Auckland Council
The Programme	The Supporting Growth Programme
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1 Executive Summary

1.1 Context

This Property Overview has been developed to outline the anticipated property requirements for the Pukekohe Detailed Business Case (DBC).

It is important to note that whilst this Property Overview has been developed for the Pukekohe DBC its primary purpose is for **route protection.** There will be a subsequent Implementation Business Case to seek approval for implementation funding of individual projects, which will include more detailed analysis of the property issues.

The Te Tupu Ngātahi programme has developed a Programme Wide Property Strategy that outlines the principles for property acquisition for the entire programme. These principles have guided the development of the property approach for Pukekohe with the key points being:

- The programme is about long-term affordability and property will be generally acquired closer to implementation.
- It is recognised there will potentially be an early property acquisition liability as soon as the NoR is lodged for each project.
- The Requiring Authority will take the lead on property negotiations for that specific project, utilising the current processes of that organisation (Auckland Transport (AT) or Waka Kotahi).
- AT's Early Acquisition Guideline and Waka Kotahi's Advance Purchase Policy processes will apply.
- Where there is opportunity for strategically important properties to be acquired, these should be taken.
- Opportunities for resultant value capture from residual land will be considered as part of the land use integration.

[redacted] This Property Overview outlines the analysis and approach to providing as much certainty as possible to what this early acquisition could be in the future.

This is a living document developed for the route protection detailed business case phase. Given the long-term timeframes envisaged for this route protection, the Property Overview will need to be revisited, reviewed and updated each decade and more frequently in the lead up to project implementation. The acquisition programme is dependent on detailed design and land requirement plans being completed.

All corridors in the Pukekohe DBC will proceed to route protection. A total of 245 property interests have been identified for acquisition as outlined in Figure 1-1.

Figure 1-1 : Property Acquisition Summary

No.	Package Projects	Total Property Interest	Full	Partial	Temporary	Partial & Temporary Occupation
1	Drury West Arterial	10	2	8	15	23
2	South Drury Arterial	26	11	15	15	30
3	SH22 Connection	14	1	13	15	28
4	Drury-Paerata Link	5	2	3	3	6
5	Sim-Sim Connection	5	0	5	5	10
6	Paerata Station Connection	3	0	3	4	7
7	Paerata Arterial	8	1	7	18	25
8	Pukekohe North-east arterial	24	3	21	43	64
9	Pukekohe South-east arterial	39	6	33	39	72
10	Pukekohe South-west arterial	31	2	29	31	60
11	Pukekohe North-west arterial	26	5	21	32	53
12	Pukekohe East Road Upgrade (AT)	8	0	8	10	18
13	Pukekohe East Road Upgrade (WK)	9	1	8	11	19
14	Mill Road Upgrade	37	1	36	39	75
	Total	**245**	**35**	**210**	**180**	**390**

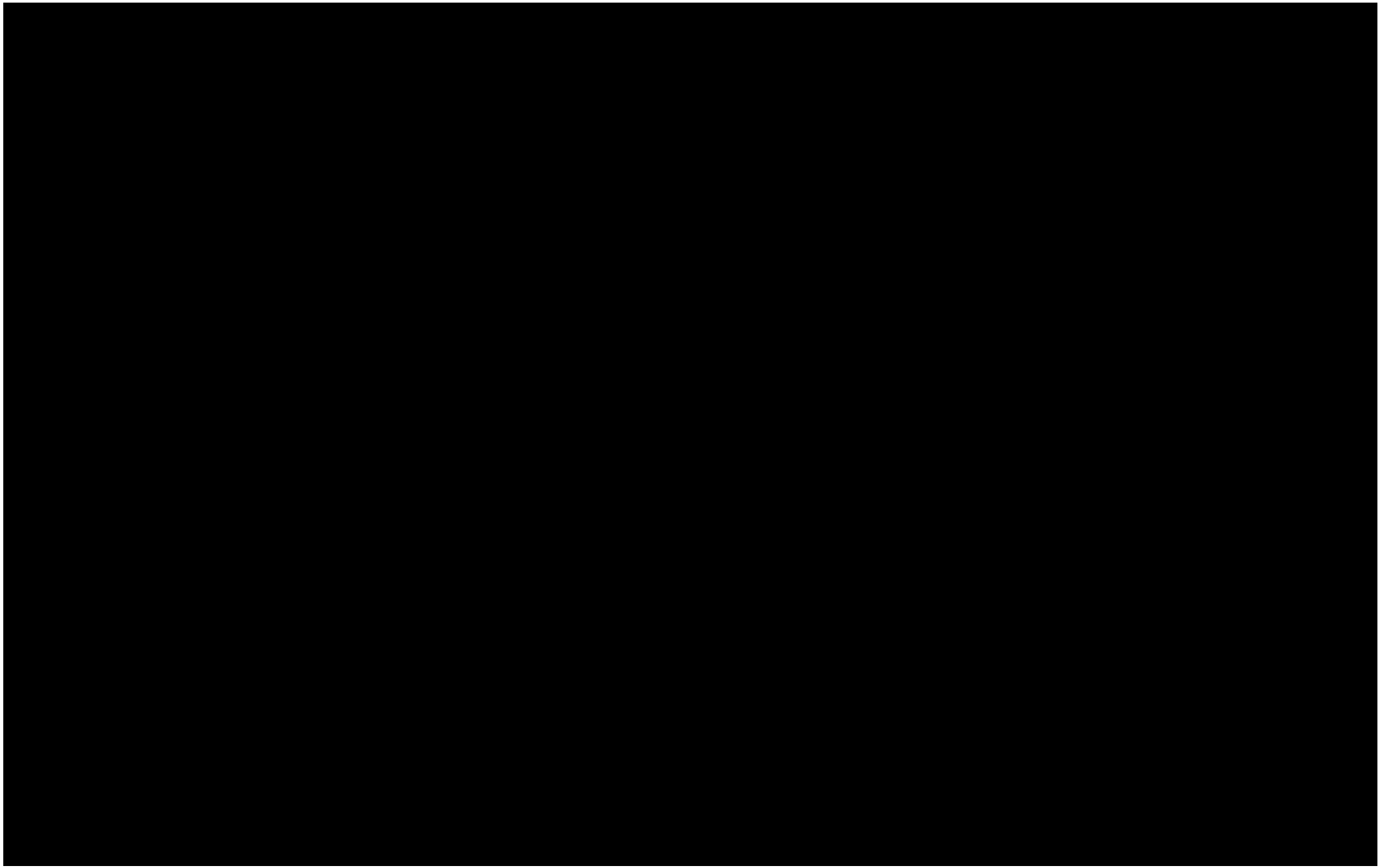
This shows that only 14% of property costs are full purchase.

1.2 Compensation

The likely compensation has been developed through consideration of:

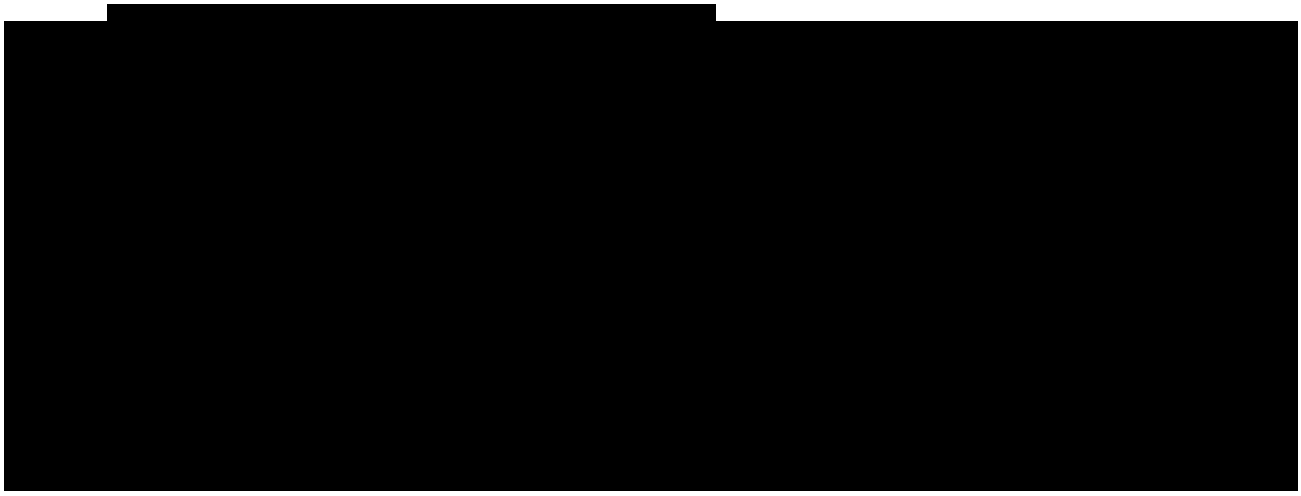
1. The base property estimate, refer Section 4.3.
2. Plus, an estimated allowance for Stage Two Public Works Act 1981 (PWA) compulsory acquisition processes and Land Valuation Tribunal (LVT) costs, refer Section 4.4.
3. Application of various risk profiles to identify expected P50 and P95 estimates, refer Section 4.5.

[redacted]



Given the long-term nature of the proposed route protection, a range of potential property appreciation rates have been used to recognise how values may change in the long term. Three annual compounding rates of appreciation have been used Low (5%), Likely (10%) and High (5%).

[redacted]

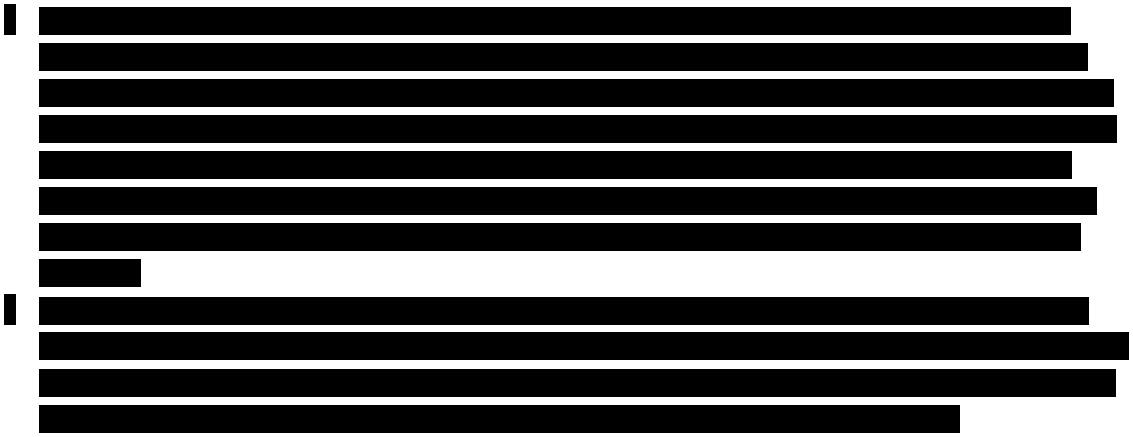


discussed in Section 10. The cost of mitigation on a property-by-property basis and temporary occupation during construction are examples of costs to the project and are included as part of the physical works construction cost.

1.3 Key Risks

1.3.1 Risks

There are a number of risks and uncertainties from a property perspective due to the long-term nature of the route protection approach proposed. These include:



These risks have been considered when developing this Property Overview.

1.4 Key Initiatives to Manage risks

1.4.1 General

There is considerable uncertainty around the property costs given the size of this programme (and the wider Te Tupu Ngātahi programme). Therefore, to best manage this uncertainty and minimise the early property acquisition expenditure as much as possible until projects are implemented the following is proposed:

- **Joint governance:** – It is recommended that a joint approach to property be taken at a governance level to ensure consistency of policies and priorities.
- **Appropriate resourcing** – This is a large programme of works over an extended period of time and appropriate resourcing will ensure best for programme outcomes are achieved.
- **Developer Agreement** – Focussing on getting alignment of various plan changes will assist in identifying infrastructure priorities. This will clarify the need for early and comprehensive developer agreements to assist an acquisition programme and cashflow phasing.

1.5 Wider Te Tupu Ngātahi Property Management

[redacted]

1.6 Property Overview Recommendations

This programme is focussed on route protection. There remains uncertainty as to the exact timing of the property acquisition needs of the projects until implementation is confirmed. There is therefore risk and uncertainty associated with the scale and timing of future property appreciation and the early acquisition property liability of this programme.

To manage this risk and uncertainty appropriately and proactively, it is recommended that during the projects development the following occurs:

- The Implementation DBC reconfirm the property cost and requirements as further design confidence is developed.
- Any changes in design avoid the need for minor land requirements.
- Value engineering is undertaken to minimise the land required for projects.
- Detailed property valuations are undertaken closer to implementation.
- Agreements with developers are progressed and 'locked in' as soon as possible to try and reduce the total property costs of the programme. This requires the commitment of funding to enable agreements to be advanced.

2 Introduction

The Pukekohe DBC identifies a transport system that will support Pukekohe's planned greenfield growth over the next 30 years and develops a case for route protecting corridors within the Pukekohe-Paerata-West Drury growth area. Route protection is important as it provides property owners, businesses and the community with increased certainty on where infrastructure will be in the future, so people can make informed decisions about their land.

The DBC area is located at the southern most extent of the Auckland region, approximately 30km south of the Auckland city centre.

2,233ha of currently rural land has been has been identified as Future Urban Zone in the Auckland Unitary Plan (AUP) to support significant business and residential growth. The growth is based on the Future Urban Land Supply Strategy (FULSS) and at full build out this growth is anticipated to reach[1]:

- 55,000 additional people
- 21,000 new houses
- 9,000 new jobs

2.1 Purpose of the Property Overview

This Property Overview has been developed to outline the anticipated property requirements for the Pukekohe Detailed Business Case (DBC).

It is important to note that this Property Overview has been developed for the Pukekohe DBC which has a primary purpose for **route protection.** There will be a subsequent Implementation Business

[1] This full build out is based on the Future Urban Land Supply Strategy modelled as per the 2048+ modelling scenario which uses Land use scenario i11.6.

Case to seek approval for implementation funding of individual projects, which will include more detailed analysis of the property issues.

The Te Tupu Ngātahi programme has developed a Programme Wide Property Strategy that outlines the principles for property acquisition for the entire programme. These principles have guided the development of the property approach for Pukekohe with the key points being:

- The programme is about long-term affordability and property will be generally acquired closer to implementation.
- It is recognised there will potentially be an early property acquisition liability as soon as the NoR is lodged for each project.
- The Requiring Authority will take the lead on property negotiations for that specific project, utilising the current processes of that organisation (Auckland Transport (AT) or Waka Kotahi).
- AT's Early Acquisition Guideline and Waka Kotahi's Advance Purchase Policy processes will apply.
- Where there is opportunity for strategically important properties to be acquired, these should be taken.
- Opportunities for resultant value capture from residual land will be considered as part of the land use integration.

Future property appreciation and early acquisition property liability are critical issues once the identified projects are route protected. This Property Overview outlines the analysis and approach to providing as much certainty as possible to what this early property acquisition liability could be into the future.

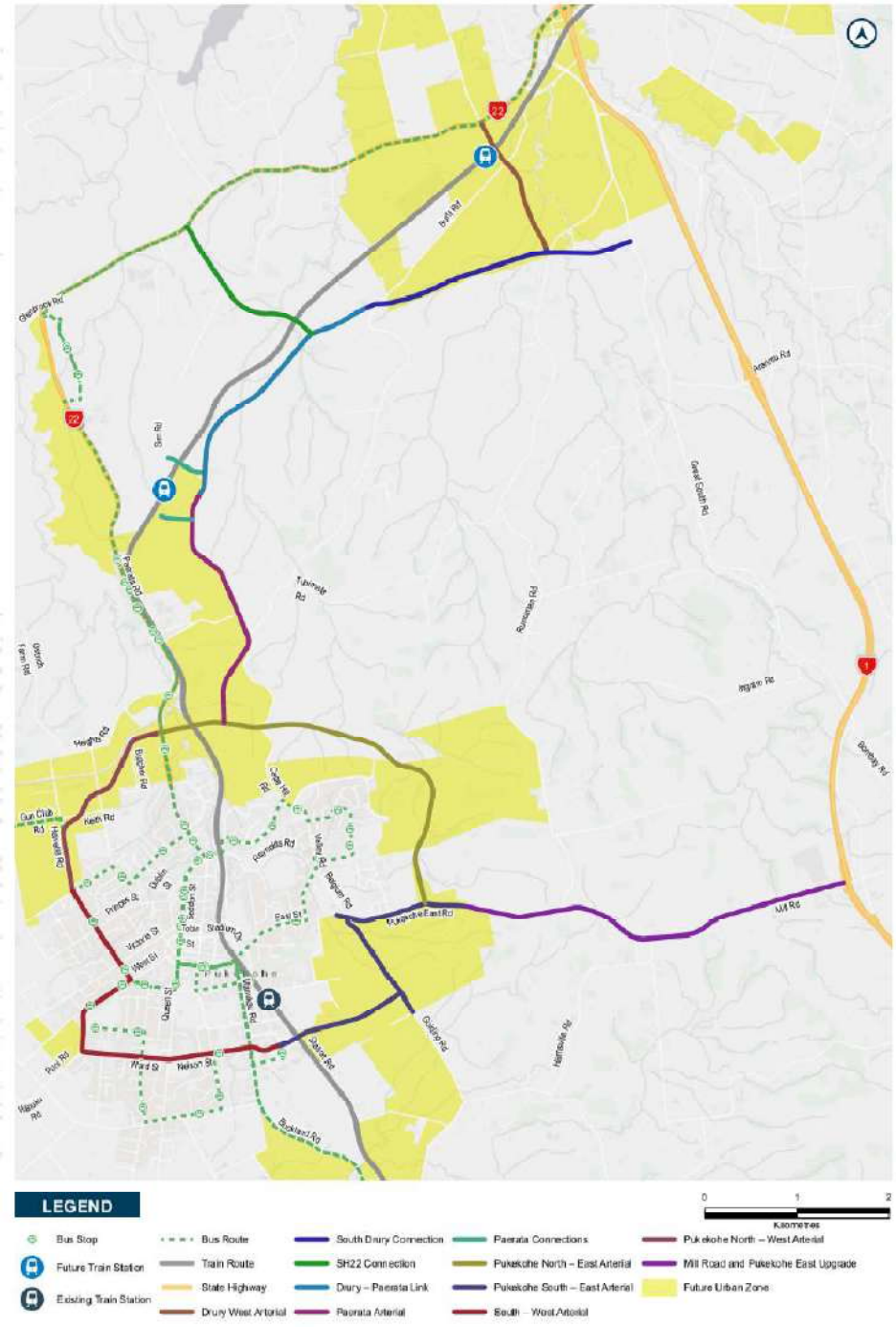
It is a living document developed for the route protection detailed business case phase. Given the long-term timeframes envisaged for this route protection, the Property Overview will need to be revisited, reviewed and updated each decade and more frequently in the lead up to project implementation. The acquisition programme is dependent on detailed design and land requirement plans being completed.

This Property Overview is intended to sit alongside the Route Protection Strategy and a strategy to commence a dialogue with developers at resource consent subdivision pre application stage to secure additional arterial road widths.

2.2 The Pukekohe Recommended Package

The Pukekohe Recommended Network is shown in Figure 2-1 and includes 14 projects.

Figure 2-1 Pukekohe recommended network.

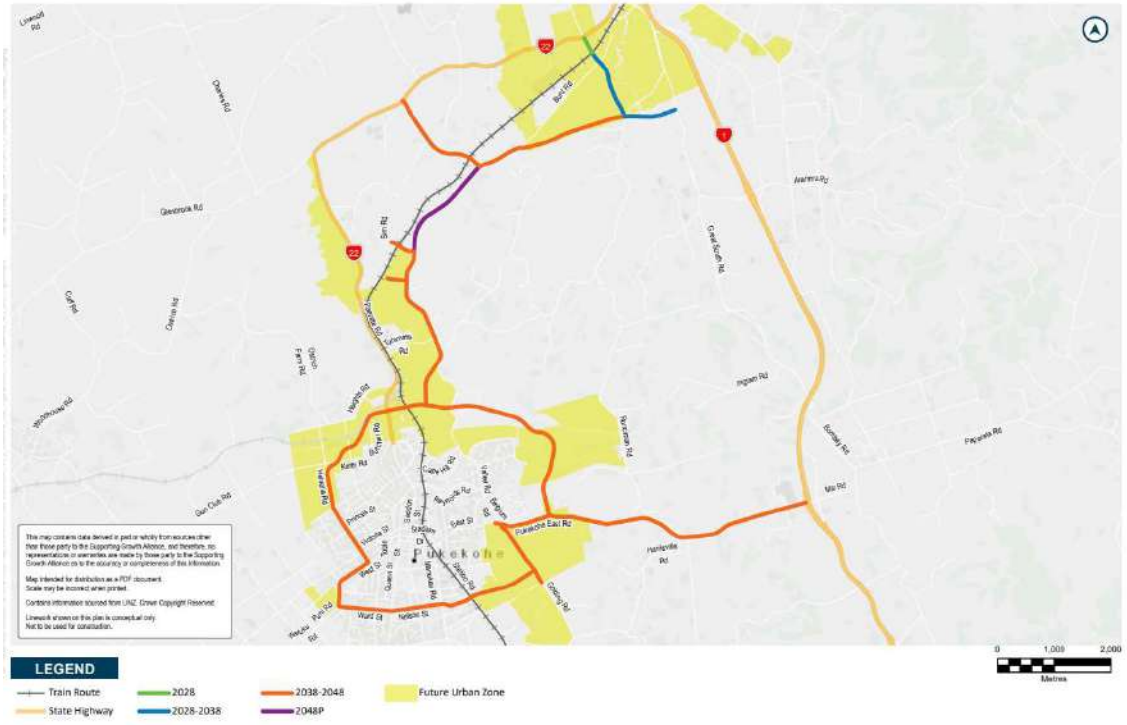


The Pukekohe Route Protection Strategy has identified all of these recommended projects (or sections of these projects) to be progressed for route protection. Refer to Appendix I: Route Protection Strategy for more information.

2.2.1 Package Timing

The projects in this package have different dates for planned implementation. These dates are heavily reliant on funding availability and development triggers. Importantly as this DBC has focussed on route protection, a further 'Implementation DBC' is to be completed prior to implementation to secure implementation funding. A much more detailed project specific property assessment will be undertaken at that time. Figure 2-2 sets out the current forecast programme.

Figure 2-2 Pukekohe Recommended Network assumed timeframes



3 Affected Properties

3.1 Indicative Land Requirements

A detailed analysis of the number of properties and what type of resultant property purchase is required (full, partial, partial and temporary or temporary) has been undertaken by Auckland Transport for the Pukekohe area.

A total of 245 property interests have been identified for acquisition as outlined in Figure 3-1.

Figure 3-1 : Property Acquisition Summary

No.	Package Projects	Total Property Interest	Full	Partial	Temporary	Partial & Temporary Occupation
1	Drury West Arterial	10	2	8	15	23
2	South Drury Arterial	26	11	15	15	30
3	SH22 Connection	14	1	13	15	28
4	Drury-Paerata Link	5	2	3	3	6
5	Sim-Sim Connection	5	0	5	5	10
6	Paerata Station Connection	3	0	3	4	7
7	Paerata Arterial	8	1	7	18	25
8	Pukekohe North-east arterial	24	3	21	43	64
9	Pukekohe South-east arterial	39	6	33	39	72
10	Pukekohe South-west arterial	31	2	29	31	60
11	Pukekohe North-west arterial	26	5	21	32	53
12	Pukekohe East Road Upgrade (AT)	8	0	8	10	18
13	Pukekohe East Road Upgrade (WK)	9	1	8	11	19
14	Mill Road Upgrade	37	1	36	39	75
	Total	**245**	**35**	**210**	**180**	**390**

This shows that only 14% of property costs are full purchase.

3.1.1 Development in Pukekohe

There are private plan changes being progressed in Pukekohe, with a number having been lodged:

- Plan Change 74 - Golding Meadows, Pukekohe

- Plan Change 76 – Kohe, Pukekohe
- Plan Change 87 – Buckland Road, Pukekohe

The DBC team are also aware of a number of private plan changes in development that may be brought forward for plan changes in due course. These examples serve to demonstrate that the development community is active around Pukekohe, Paerata and West Drury, presenting property acquisition risks as well as opportunities to the delivery of the recommended Pukekohe network.

3.2 Acquisition Issues and Risks

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

A recent example of the increasing land values in Auckland can be seen with the interventions planned for Redhills. These corridors are located within land zoned through the Auckland Unitary Plan (AUP) process. Auckland Council data on land value changes in 2017 confirms that the Redhills area has experienced an increase in land values of around 100% after the rezoning of the land to live zone and future urban zone. [redacted]

[redacted]

3.3 Access

All properties will retain access to the transport system. A number of properties will require their access to be modified during the acquisition process. The details of this will be worked through in the future detailed design phase of the project. The land identified for acquisition has taken this access principle into account and is reflected in the scale of land to be acquired. Where it is unlikely that access can be maintained then the property has been identified for full acquisition.

For some of the properties temporary access will be required for investigations during the project development phases in the future. These properties will be identified in the next phase of the project's development (design). It is recommended that this temporary investigative access be obtained as early as possible for any property identified for future acquisition.

3.4 Land Tenure Issues

This assessment has not been undertaken at this time due to the route protection nature of this DBC.

4 Compensation

4.1 Base Price Methodology

The AT property team have undertaken the base property cost estimate for Pukekohe on behalf of Te Tupu Ngātahi. This section of the Property Overview outlines the methodology adopted by the AT property team in developing the base property cost estimate.

The level of information provided by Te Tupu Ngātahi to AT to inform the base cost estimate is commensurate with the business case, which is for NoR route protection purposes. Unlike traditional detailed business cases, the implementation dates for the Pukekohe programme of works are within the next 10-30 years.

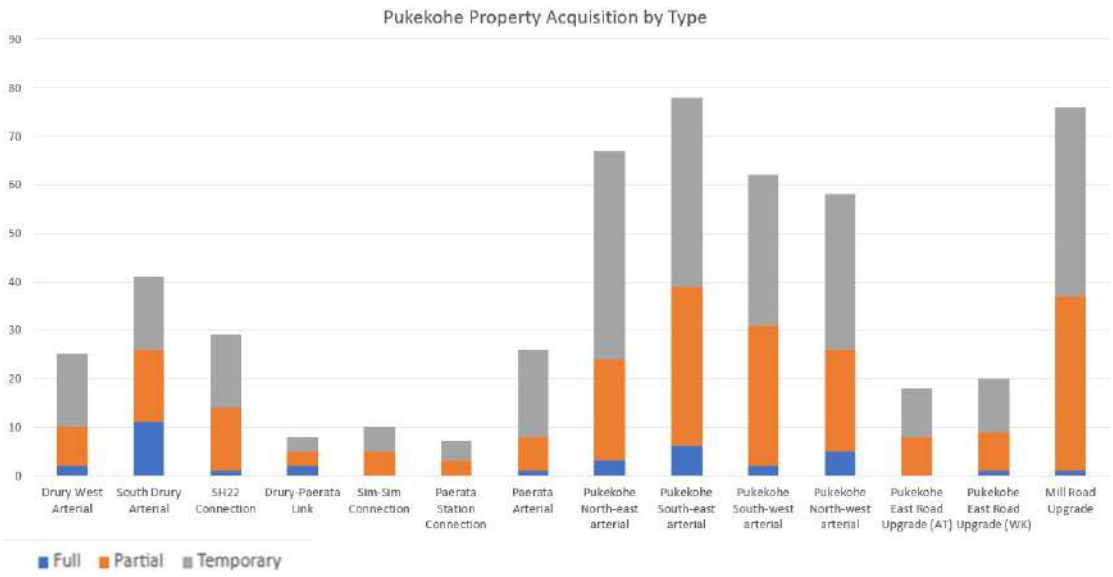
Auckland Transport assessed the 14 projects proceeding to route protection. The inputs provided by Te Tupu Ngātahi to AT consisted of GIS maps showing indicative permanent and temporary land requirements for the identified projects and supporting data identifying the affected properties on a property-by-property basis. The inputs provided by Te Tupu Ngātahi at this stage did not include detailed investigation of property impacts, for example, topographical and geotechnical impacts.

Informing the base cost estimate are the following assumptions:

- New arterial roads are planned as well as widening of existing roads to form arterial standard roads. For arterial road corridors, the full arterial road width has been included, notwithstanding the land acquisition programme may be developer led with developers providing the local corridor width at no cost. This reflects the need for the full arterial road corridor width to be within the proposed NoR boundary.
- It is assumed the land acquisition programme will be developer led within the Future Urban Zone (FUZ). Generally, given the long-term route protection, the majority of the earthwork batters have been included within the temporary occupation area rather than the permanent acquisition area, within the FUZ, as it is expected development will be built up to the road boundary.
- The prospect of zoning changes and specifically future urban land being subject to Plan Change and the timing of these processes relative to any route protection forms part of the additional analysis undertaken by Te Tupu Ngātahi.

Figure 4-1 shows the type of property acquisition by individual project. This confirms most acquisitions are either partial or temporary, with very few full acquisitions envisaged.

Figure 4-1 Property acquisition type by individual project



[redacted]

Table 4-1 Cost estimate process

Task	Additional information
AT instructed an independent registered valuer to provide a desktop assessment of land values expressed on a rate per square metre basis for raw (un-subdivided) Pukekohe block land (i.e., land requiring earthworks, roading and servicing prior to any development) for the classifications shown in figure 3-4 above.	• The desktop data included comparable FUZ block sales evidence. Based on the upper range a land rate of [redacted] FUZ zoned land has been adopted. • Adopted a Heavy Industrial rate of [redacted] based on comparable built heavy industry sales. • Adopted [redacted] for the MHU zone, based on the desktop assessment. • The adjacent land rate for FUZ zoned land was applied to properties zoned Mixed Rural. • In some cases, relative to Open Space zoned land and Hydro land, a higher land value rate has been adopted. • For properties in the Business Local Centre Zone, the rate adopted of [redacted] is based on comparable local centre sales, with an adjustment for location.
Each property and land requirement has been assessed on a property-by-property basis.	• For full acquisitions, an estimate of the current market value was obtained using online sources such as Property Guru and Trade Me Properties.
Land cost component contingency.	• An assessment has been undertaken to determine the appropriate contingency to apply to the land cost component of the base cost estimate. Considering the lack of investigation (e.g topographical and Geotech), high-

Task	Additional information
	level design and the depth of market and level of available sales evidence, the contingency applied to the base land cost estimate component has been assessed at 15%.
Each partial acquisition has been considered in terms of the level of potential injurious affection.	• Injurious affection has not been considered in this study but will be taken into account when the design is further refined.
PWA cost estimates have been assessed and included on a property-by-property basis.	• Section 72 PWA costs. • Section 66 PWA costs allowing for the issue of section 18 PWA Notices of Desire, if required. This is based upon analysis of previous s66 claim history of comparable claims over recent years. • Costs of acquisition including legal and valuation costs and staff time. This also allows for the issue of section 18 PWA Notices of Desire, if required. The base cost estimate does not include the cost of using external acquisition service providers. Costs are based upon the AT internal acquisition model. • The upper end of section 66 PWA and estimated costs of acquisition has been adopted for each acquisition type. Across the whole land acquisition programme, the methodology adopted is reasonable for the required level of input. • In addition to the base estimate costs associated with stage two of the PWA compulsory acquisition process and LVT proceedings are assessed on an aggregate basis across each tranche of acquisitions. This allowance is estimated based upon the historic aggregate number of acquisitions that progress to the s23, s26 and LVT Proceedings. The assumptions are outlined in the following section.
Stage 2 PWA compulsory acquisition and LVT proceeding costs.	An allowance has been made on an aggregate basis based on the following assumptions: [redacted]
PWA Cost contingency.	• An assessment has been undertaken to determine the appropriate contingency to apply to the PWA cost component of the base cost estimate. Considering historical averages overtime and potential variability, the contingency applied to the PWA cost components has been assessed at 15%.
Stage Two PWA and LVT cost component contingency	• At the request of the AT property team a contingency of 15% has been added to the Stage Two PWA and LVT cost component by Te Tupu Ngātahi. • The base cost estimate excludes existing legal road areas that are already in AT/Council ownership. • Where properties are included in more than one package project, this has been specifically noted and only counted once.

Task	Additional information
	• Various other cost elements, which are a cost to the physical works budget have also been identified. These form part of the early property acquisition project liability addressed in Section 10. The cost of mitigation on a property-by-property basis and temporary occupation during construction is an example of costs to the project, as part of the physical works construction cost. For temporary occupations, a rental rate of 7% of the land rate has been adopted on a per annum basis. This is informed by AT's current knowledge of temporary occupation rates.

4.2 Base Property Internal Quality Assurance

The base property cost estimate methodology has been reviewed by the property team at Align Property Consultants. They have reviewed the process and outlined above to come up with the base property estimates and have advised that they are comfortable with the process used to establish the base costs.

4.3 Base Property Estimate

[redacted]



The total base property estimate, using the methodology outlined above, as at present dollar value for the project packages provided by AT to Te Tupu Ngātahi is [redacted] excluding land cost contingency and PWA cost contingencies and annual temporary occupation rental. The temporary occupation costs are shown separately as annual costs.

4.4 Stage Two PWA and LVT Cost Estimate

To the base property estimate above, AT then added an allowance of [redacted] to the overall acquisition programme for the estimated section 23 and 26 PWA and LVT proceeding costs and prorated this figure between the projects, refer table 4.1.

4.5 Expected P50 and P95 Property Costs

To the resultant increase in the base estimate figure from [redacted] and [redacted] a contingency based on the assessed risk profile is added.

This is done in two parts, a contingency to identify the expected estimate, or P50 and then a further contingency to identify the P95 cost.

4.5.1 Expected (P50) Costs

An assessment was undertaken by the AT property team of the likely property risk. This resulted in a 15% contingency being added firstly, to the land cost component of the base estimate, and secondly, to the PWA cost component of the base estimates for all projects, as summarised in Figure 4-3. In addition to this, a 15% contingency has been added on the Stage Two PWA and LVT cost estimate.

Figure 4-3 Expected estimate (P50) risk breakdown

Risk	%	Rationale
Base land cost estimation	< 30%	Injurious affection assessment as per the risk matrix in Table 4.1
Land cost estimation contingency	15%	Makes allowance for the lack of investigations (e.g topographical and geotech), high-level design, and the depth of market and level of available sales evidence.

Risk	%	Rationale
PWA costs (S66 Disturbance, S72 and acquisition costs)	15%	Allowance above historical averages for individual and future variability.
Stage Two PWA and LVT cost estimate contingency	15%	Allowance above historical averages for individual and future variability.
Annual Temporary Occupation Rental	7%	Makes allowance for current level of analysis into the level of temporary occupation required.

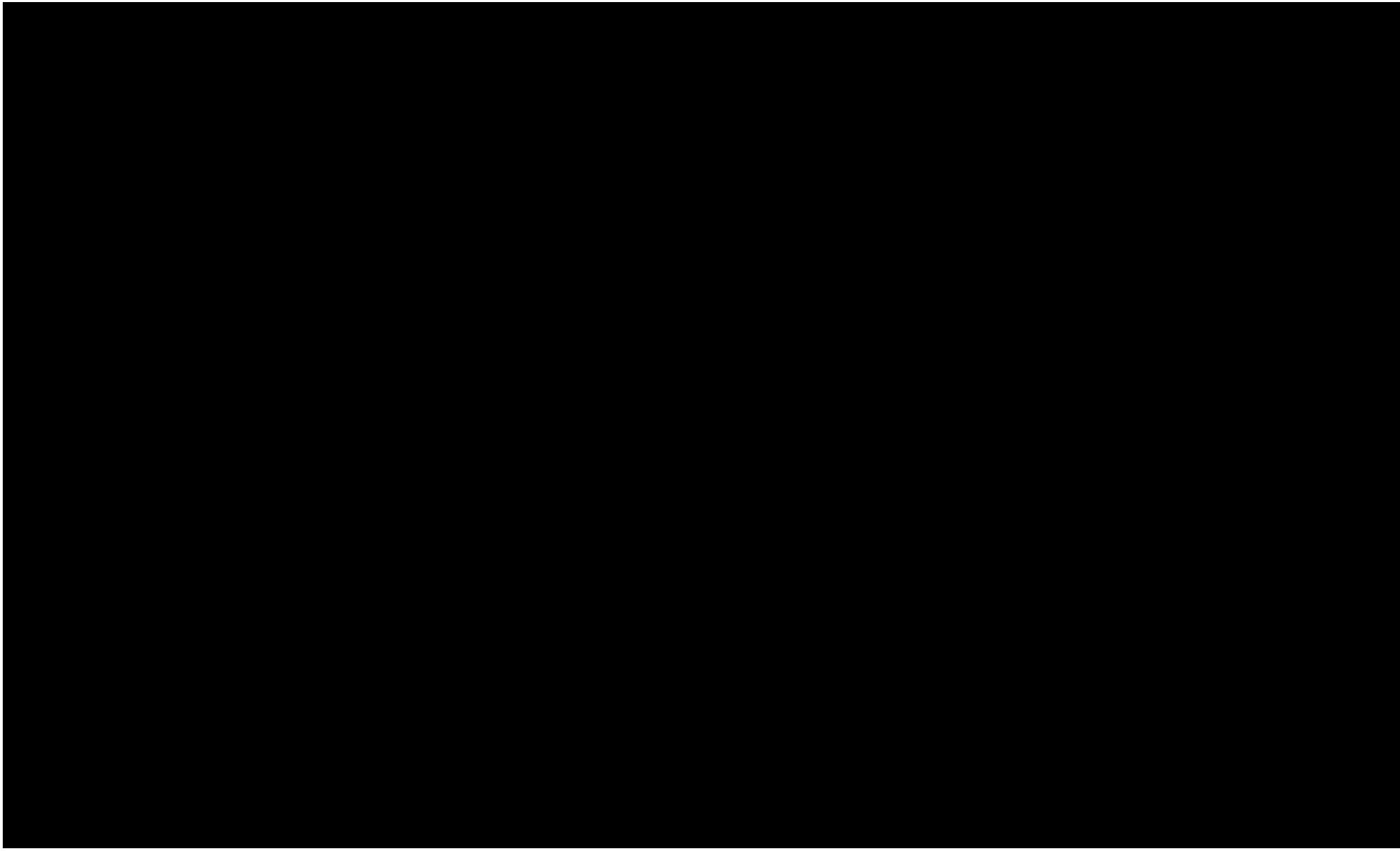
4.5.2 P95 Contingency

For the P95 contingency a further 20% has been added to the Expected Estimate (P50) contingency. This is based upon the detailed risk modelling (consistent with SM014) undertaken for the capital costs of each project in the programme and takes into account the risk profile accordingly. This approach is considered appropriate as it takes into account the increased risk profile of the projects to get to a P95 and is consistent with the CAPEX costs and approach.

4.5.3 Summary

[redacted]

Note the P50 figures used in the DBC reporting include the annual impacts of the temporary cost based on estimated construction timelines.



5 Package property acquisition approach

5.1 NoR with Contemporaneous Purchase

[redacted]

5.2 NoR with Future Purchase

[redacted]

- [redacted]
- [redacted].

6 Future Property Appreciation

6.1 Challenges of appreciation in long term growth areas

A designation prevents physical/capital development of the land in designated areas, and therefore any inflation arising from that, though it does not completely freeze the value uplift. From a PWA perspective, the value of compensation paid is assessed as at the date it is purchased and is evaluated with reference to surrounding comparable market values. When the expected time horizon of these projects is potentially several decades into the future, estimation of future costs is extremely unreliable. Property inflation can only sensibly be estimated three to five years into the future. Anything beyond this becomes problematic.

This risk is mitigated on a practical basis by regularly reviewing property estimates on a three yearly basis in line with the RLTP process.

6.2 Risk Profile

At a macro level the dynamism of the surrounding land-use changes will have an impact as this will result in land value appreciation. Route protection will occur over a range of land zonings, each with different potential for land value inflation. Areas that have the least potential for change to a more intensive zoning will have the least potential for land value inflation. For example, those with a current urban or rural zoning that will remain the same or similar over the project period will only be subject to inflation at the rate standard for that land-use class.

6.3 Risk Analysis

6.4 Property Appreciation Application

[redacted]

We acknowledge this approach is simplistic. We have therefore sense checked this approach by looking at individual property types and understanding from the AT property team, what their experience has been in similar situations. This consideration identified that the appreciation rates applied would be appropriate over time, however when land use zoning actually changes, there would be a noticeable spike in land prices in the 1-3 year period after this zoning change.

However, over the 30-year time horizon of this long-term route protection approach, the more simplistic approach is considered appropriate. This has given us confidence that the medium

[3] Note the base property estimate has included the temporary costs according to the modelled construction periods. This base estimate is therefore higher than those reported in earlier tables.

scenario gives an appropriate estimate of likely appreciation and the high scenario adequately catches a potential upper bound.

[redacted]

There is an opportunity to work with the developers in the area to reduce these costs (as has been done elsewhere in the Te Tupu Ngātahi programme) through property being provided as part of wider infrastructure agreements (such as funding agreement of actual infrastructure). To enable this opportunity to be maximised, having a designation in place facilitates these discussions occurring and increasing the chance of the opportunity being realised. No discussions have been undertaken with developers at this stage.

7 Early Acquisition Liability

In addition to the future property appreciation risk, implementing a route protection strategy that aligns implementation of the property acquisition programme with future project delivery that is programmed in future decades, creates:

- The need for the Requiring Authority to respond to demand for early property acquisition.
- An obligation to acquire the protected land in some instances under section 185 of the RMA.

[redacted]

7.1 Demand for Purchase of land with NoR in place

The timing of the demand for early purchase of land within the protected route will be driven by both the individual landowners' various land-use decisions and the anticipated construction date. This assumes the NoR is in place.

To a significant degree the proposed network is located within the RUB, either areas that already have a FUZ or an urban zoning.

The majority of the land that will be subject to any NoR protection is not expected to generate a high level of demand for early purchase acquisition (i.e., substantially prior to the normal purchase timeframes leading up to project implementation).

[redacted]

[redacted] or reap the benefit of property value uplift from the up-zoning and urbanisation of these areas.

Over the life of the route protection (NoR) at various points individual landowners will want to change the land use, or for business or lifestyle reasons, want to dispose of the land.

[redacted]

[redacted]

Again, we note the majority of properties in this programme are partial purchases.

7.2 Section 185 RMA Purchase Obligation

Requiring Authorities can be compelled to purchase route protected land pursuant to s185 RMA. Section 185 allows an owner to apply for an order obliging the Requiring Authority to purchase the land in certain circumstances. The Environment Court is empowered to make such orders, where the owner establishes that they have been unable to sell their property at the same value they could have if the property was not subject to the NoR. If the landowner was not the owner when the NoR was placed on the property, they also have to establish the NoR prevents their reasonable use of the land.

[redacted]

[redacted]

7.3 Risk Analysis

7.3.1 Acquisition approach

[redacted]

7.4 Early Acquisition Approach

Both Agencies have guidelines for managing early acquisition of property in advance of the project implementation phase, and in particular clarify the criteria and outline decision making processes for assessing each early acquisition on a case by case basis.

These guidelines anticipate the s185 process but are a less formal negotiated process. The process takes into account personal circumstances and recognises the NoR may have a blighting impact on property.

[redacted]

7.5 Early Acquisition Liability Application

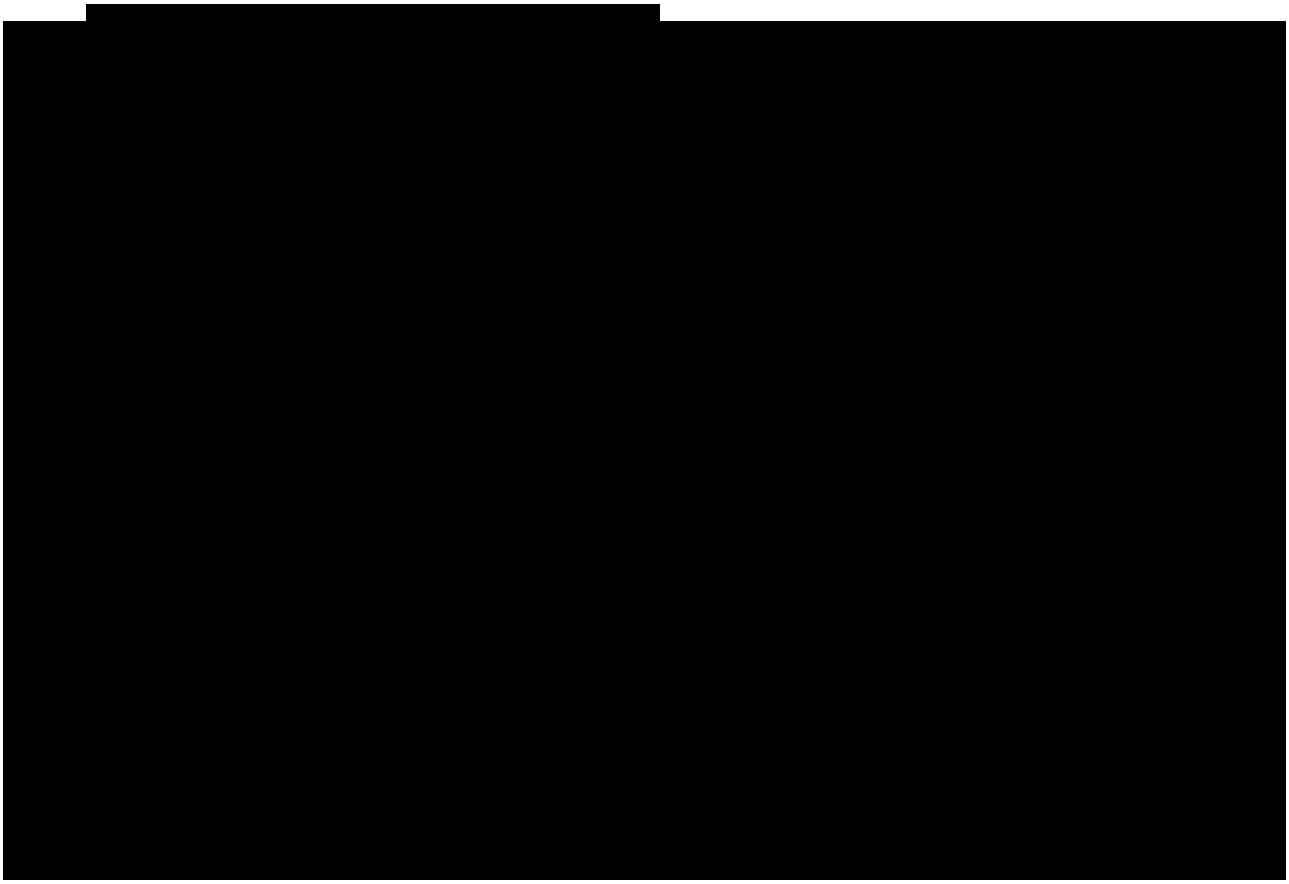
[redacted]

- [redacted].



9 Potential Implications on Acquisition Cashflow

This section outlines the estimated annual property cashflow forecast between commencing following the RMA designation processes and when the future project is programmed for delivery.



10 Ongoing management

10.1 Ongoing property management

Both Agencies have comprehensive processes and teams dedicated to the ongoing management of properties once purchased. It is assumed that these existing processes will be used to manage properties, where required. With only 5% of the total acquisition plan being full purchases the ongoing management is somewhat reduced.

[redacted]

As well as the above issues, where applicable, there are the standard issues that will require attention, including:

- **Healthy Homes** – There will likely be a need to comply with the latest legislative requirements for any rental properties, including insulation, heating and draft (windows) management.
- **Asbestos** – There maybe asbestos in some of the properties that will require removal.

The standard approach of the Agencies in the testing, implementation and ongoing management of these issues (and any others) would be used.

[redacted]

10.2 Disposal

As no significant acquisition plan is forecast in the short term, this has not been addressed in this document and will need to be addressed closer to implementation and as part of the Implementation DBC and resultant property approach.

11 Contingent Project Liability

Various other cost elements, that are a cost to the physical works budget have also been identified including:

- [redacted]
- An annual temporary occupation rental, subject to adjustment by the project team to reflect the assumed construction duration.
- The risk of potential business relocation and business loss PWA claims. [redacted].
- Cost of reinstatement works.
- [redacted]
- Demolition and relocation of improvements to enable the works construction. Where applicable, estimated QV Costbuilder rates have been provided.
- Mitigation, where possible, of the potential effects of road construction, noise, dust and privacy issues etc.

12 Key Initiatives

12.1 General

There is considerable uncertainty around the property costs given the size of this programme (and the wider Te Tupu Ngātahi programme) and therefore to best manage this uncertainty and minimise the early property acquisition expenditure as much as possible until projects are implemented the following is proposed:

- Joint governance.
- Appropriate resourcing.
- Developer Agreement.

12.2 Governance

It is recommended that a joint property focussed decision making group be set up with a representative from each partner organisation. The purpose of this is that whilst individual property acquisitions will be managed on a day-to-day basis by the appropriate road controlling authority, overall joint governance is required to ensure that consistency of approach and priorities is maintained.

This joined up approach will provide increased certainty of outcome for all and a consistent approach across the programme.

12.3 Resourcing

There needs to be a dedicated resource of at least one person from each partner organisation who are focussed on the identification, acquisition and enhancement of strategic properties. There is a real risk that without this dedicated resourcing that a property specific approach in isolation is taken rather than an all of programme view. This will ensure that there is consistency in approach and issues will be addressed early and hopefully this will result in acquisitions only occurring when absolutely necessary.

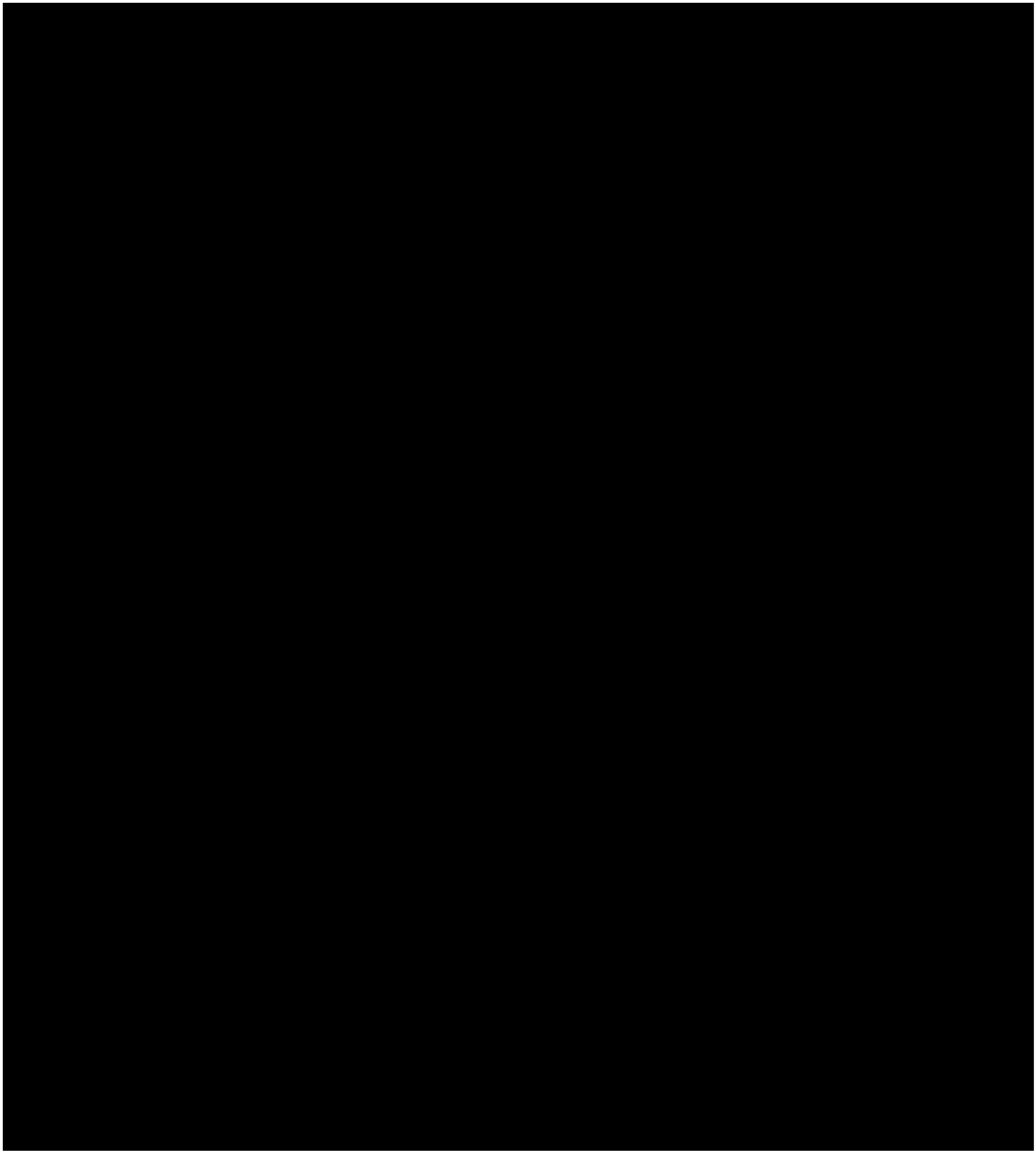
The wider Te Tupu Ngātahi programme is also seeking a dedicated resource from each organisation and the Pukekohe role would be part of this overall programme resourcing rather than additional resourcing.

12.4 Developer Agreements

Focussing on getting alignment of various plan changes will assist in identifying infrastructure priorities. This will clarify the need for early and comprehensive developer agreements, particularly with the significant developers in the area, to assist an acquisition programme and cashflow phasing.

12.5 Wider Te Tupu Ngātahi Property Management

It is also important to outline that the Te Tupu Ngātahi Programme Wide Property Strategy sets out a number of initiatives to effectively manage the significant acquisition programme of the route protection approach. These are currently being considered and this Property Strategy is consistent with the aspirations of these wider approaches if successful.



13 Resource Consent and Public Consultation

13.1 Engagement

As part of this DBC's development, engagement on options (and the recommended option) has been undertaken with the community so there is an awareness of the scale of projects. A summary of the outcomes of the engagement undertaken so far can be found in the engagement section of the DBC.

The next stage is for the designation to be sought for these projects. This will require further community engagement, and in particular, discussion and engagement with affected property owners. The NoR development of documentation is ongoing and due to be lodged in October 2023.

13.2 Consents

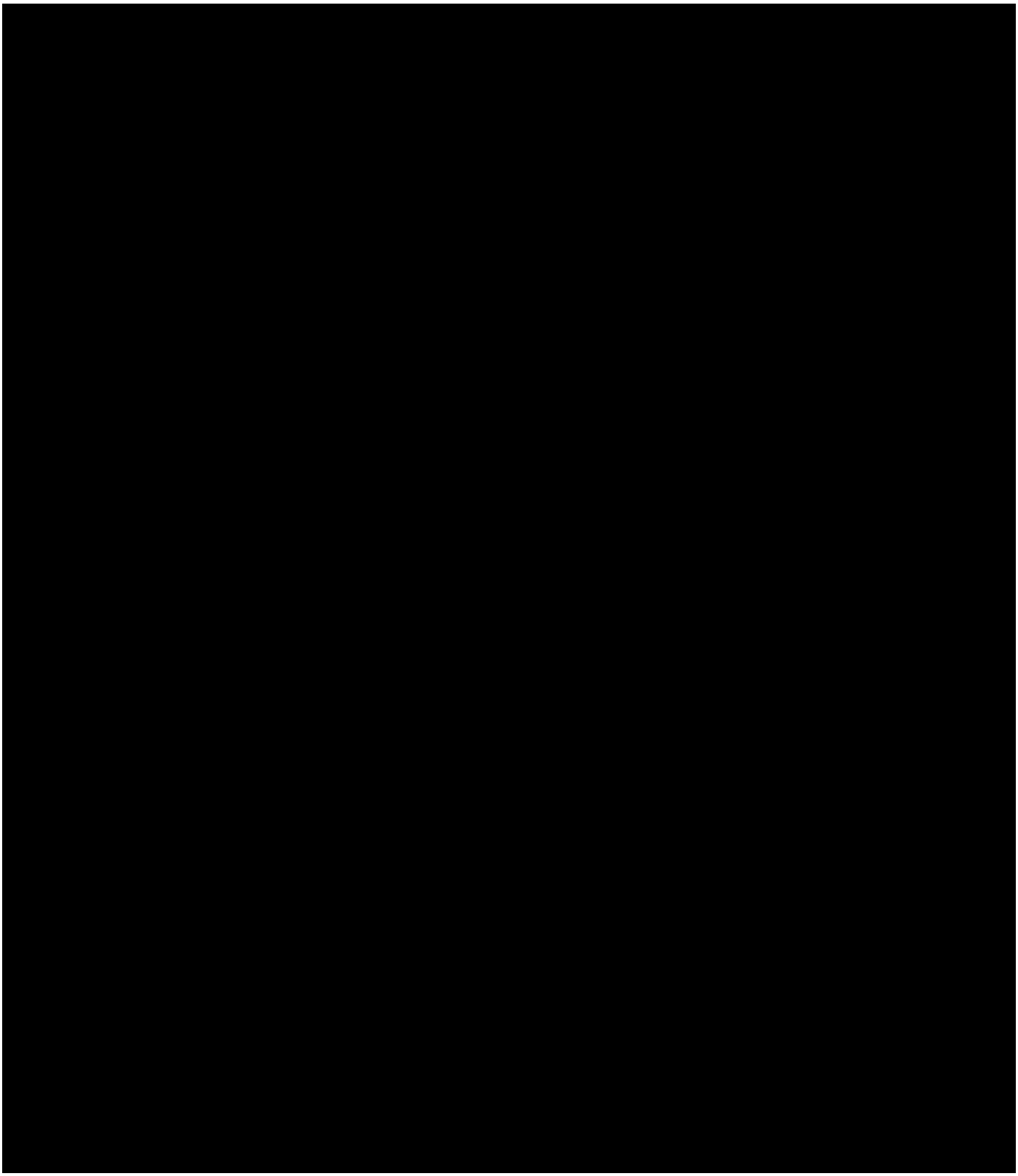
Route protection for this package will be sought through the application of a designation for the new roads and widening identified. Resource consents will not be sought at this time, with these currently proposed to be obtained on an individual project basis closer to the time of implementation.

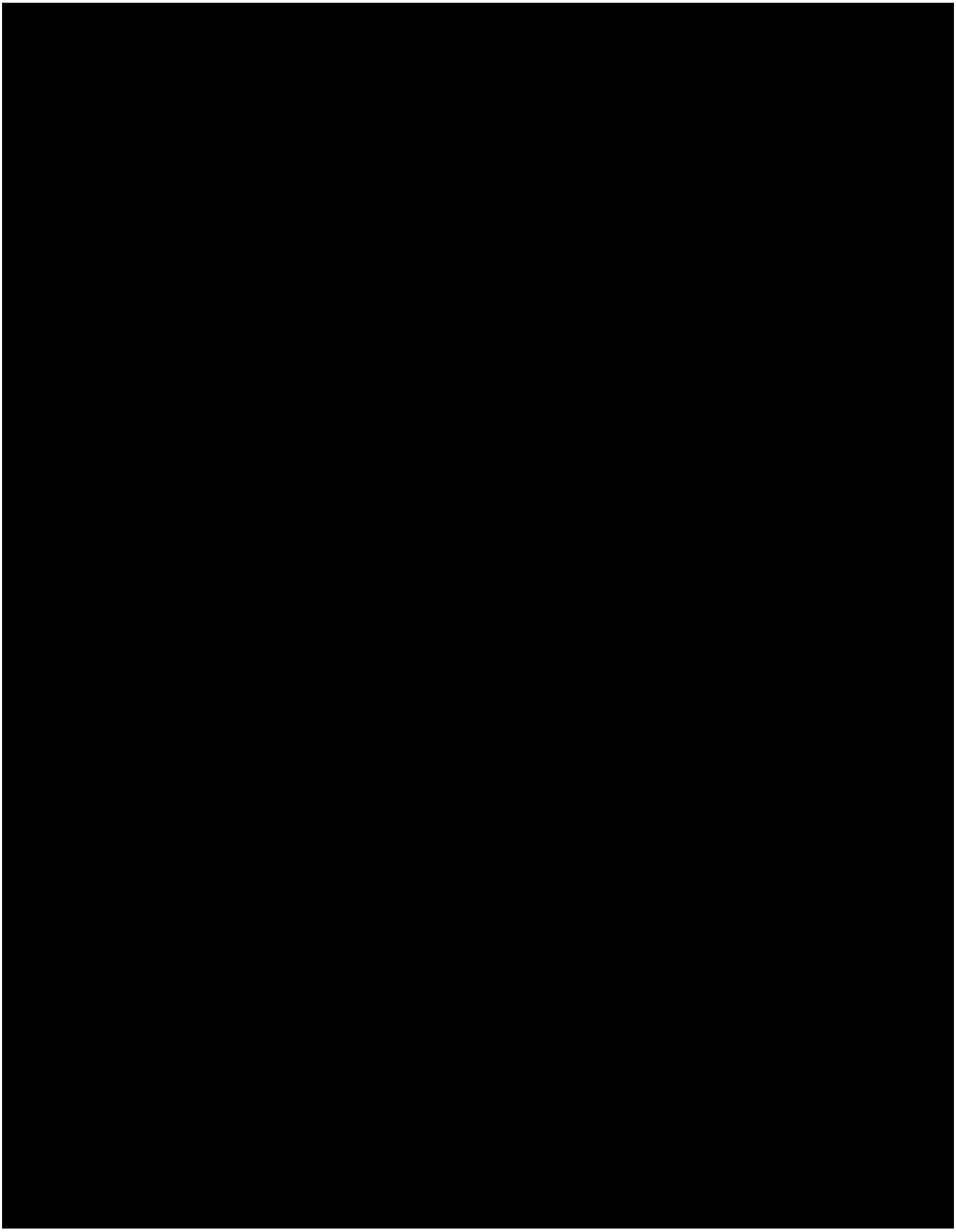
14 Recommendations

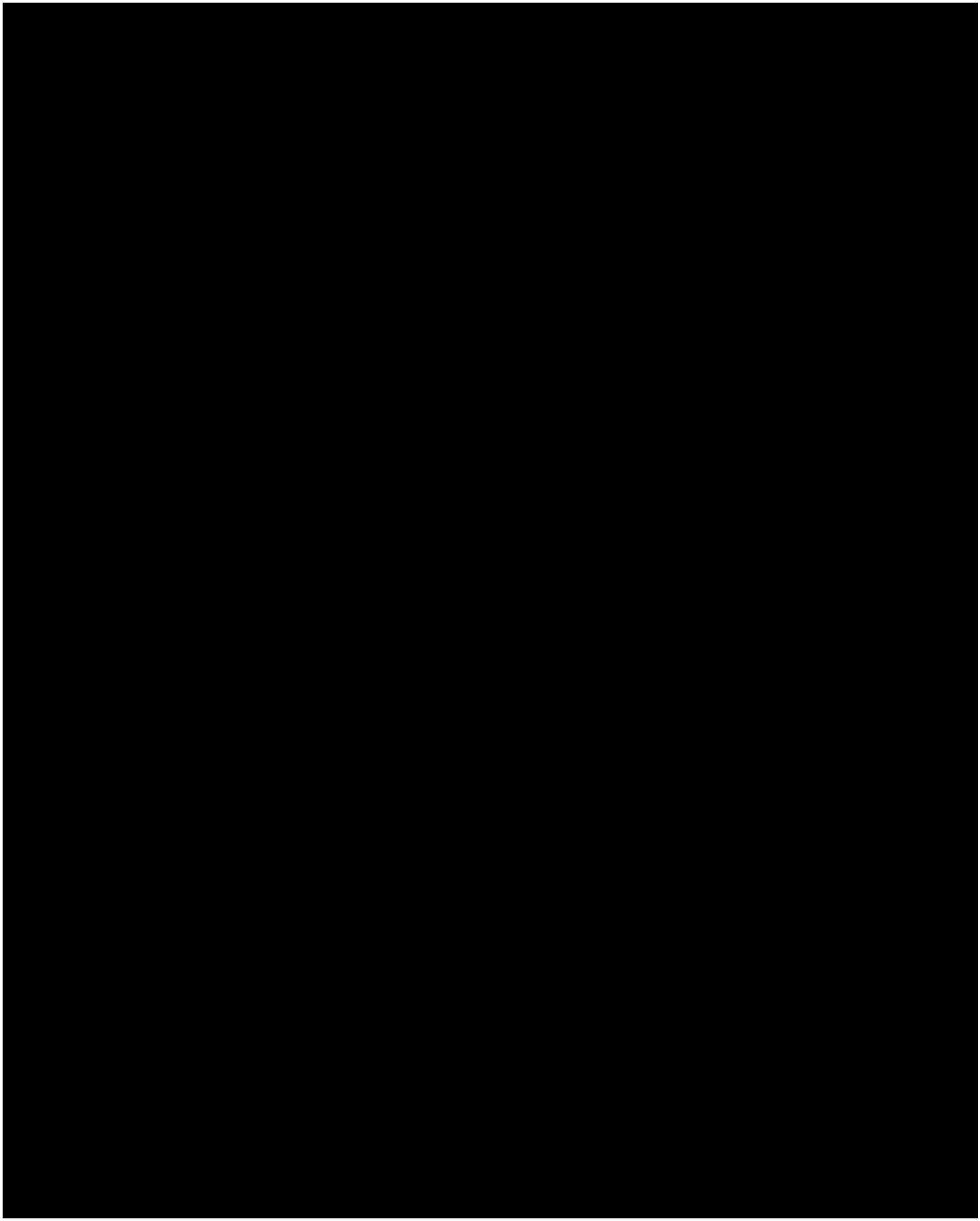
This programme is focussed on route protection. There remains uncertainty as to the exact timing of the property acquisition needs of the projects until implementation is confirmed. There is therefore risk and uncertainty associated with the scale and timing of future property appreciation and the early acquisition property liability of this programme.

To appropriately and proactively manage this risk and uncertainty it is recommended that during the projects development the following occurs:

- The Implementation DBC reconfirm the property cost and requirements as design confidence is further developed.
- Any changes in design avoid the need for minor land requirements.
- Value engineering is undertaken to minimise the land required for projects.
- Detailed property valuations are undertaken closer to implementation.
- Agreements with developers are progressed and 'locked in' as soon as possible to try and reduce the total property costs of the programme. This requires the commitment of funding to enable agreements to be advanced.









TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe Appendix K: Risk Register

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY
AT
New Zealand Government

Document Status

Responsibility	Name
Author	[redacted]
Reviewer	[redacted]
Approver	[redacted]

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Acronym/Term	Description
AC	Auckland Council
AT	Auckland Transport
BCR	Benefit-cost Ratio
Class A, B, C & D	Risk score class after evaluation of likelihood x consequence. Refer to Tables 3 & 4 below for further detail.
DBC	Detailed Business Case
GPS	Government Policy Statement on Land Transport 2021
IBC	Indicative Business Case
IQA	Internal Quality Audit
MCA	Multi Criteria Analysis
NoR	Notice of Requirement
OAG	Office of the Auditor General of New Zealand
OIM	Owner Interface Manager
PAB	Programme Alliance Board
Partners	AT, Waka Kotahi NZ Transport Agency, Auckland Council and Manawhenua
RC	Resource Consents
Risk	An uncertain event that may have a positive or negative influence on the ability to achieve objectives
RMA	Resource Management Act
RTN	Rapid Transit Network
SME	Subject Matter Expert
SGA	Te Tupu Ngātahi Supporting Growth Alliance
SM014	Waka Kotahi's Cost Estimation Manual SM014
SSBC	Single Stage Business Case
WK	Waka Kotahi NZ Transport Agency

1 Risk Management Process

1.1 Introduction

Risk management has been undertaken throughout the development of this Pukekohe Detailed Business Case (DBC) in accordance with the Te Tupu Ngātahi Supporting Growth Alliance's (SGA's) 'Risk and Opportunity Management Plan' which comprises of the following stages:

- Risk (threat and opportunity) identification – relative to context.
- Risk analysis – likelihood and consequences based upon current control measures.
- Risk evaluation – scoring of the risk to determine it's relative magnitude.
- Risk treatment – to elimate or reduce the consequences or likelihood of the risk occuring.

Section 1 of this Risk Register outlines the process that has been followed in each of these stages. Section 2 summarises the key Programme-wide risks and Section 3 identifies Project-specific risks to be considered during future work.

1.2 Identification

Threat and opportunity identification has been a continuing process throughout the development of the DBC and has included the following:

- Initial risk workshops to identify threat and opportunities at the start of the DBC.
- Regular identification (and update) at Pukekohe team meetings based upon the DBC's development and subsequent feedback from the team and partners/stakeholders.
- Ad-hoc emails/conversations with team members.

Identified programme risks were captured within the Pukekohe DBC SharePoint risk register, Risk Owner assigned and subsequent analysis undertaken (as detailed below).

1.3 Analysis

The likelihood of occurrence and consequence of the risks have been analysed using the criteria identified in Tables 1 and 2 below based upon the current control measures.

Table 1: Likelihood Risk or Opportunity Rating

Likelihood Risk or Opportunity Rating		Likelihood of Risk or Opportunity Occurring	%
5	HIGHLY LIKELY	May occur in next 12 Months	> 85
4	LIKELY	May occur in the next >1 to 2 years	55 – 85
3	POSSIBLE	May occur in next >2 to 6 years	30 – 55
2	UNLIKELY	May occur once in >6 to 10 years	5 – 30
1	RARE	May occur once in 10 years	< 5

Table 2: Semi-Quantitative Threat Criteria

Semi-Quantitative Threat Criteria

Rating Scale	Reputation			Performance			
	Stakeholders	**Public / Media**	**Legal / Compliance**	**Project Delivery**	**Project Cost**	**Health & Safety**	**Environmental**
Severe	Disruption to stakeholder relationship slowing progression of nationally strategic activity, and/or Loss of route availability of a national strategic high-volume highway	Sustained national and/or international media coverage AT/Waka Kotahi NZ Transport Agency and the PAB do not envisage any exposure in reputational risks at this level	High profile prosecution(s) with potential for custodial sentence	Programme slippage resulting in late delivery by more than 180 days	Negative financial impact of more than $25M	Loss of life, permanent disability or injury, or multiple serious injuries	Permanent pollution damage or other environmental damage
Major	Disruption to stakeholder relationship slowing progression of regionally strategic activity, and/or Loss of route availability of a national strategic highway	Sustained media coverage (weeks) Possible Ministerial inquiry leading to loss of Ministerial confidence/formal enquiry by OAG or statutory agency Widespread and significant community concern and/or high-profile community concerns raised	Individual prosecution Potential prosecution with maximum fine / imprisonment High profile legal challenge or prosecution with heavy fines	Programme slippage resulting in late delivery by between 90 and 180 days	Negative financial impact between $10M to $25M	Serious injury (injuries) requiring specialist medical treatment or lost time greater than three weeks	Significant and widespread pollution or other environmental damage, with long term effects
Moderate	Disruption to stakeholder relationship slowing progression of regional activity, and/or Loss of route availability of a regional strategic highway	Short term (days) media coverage Parliamentary/Ministerial questions or 3rd party investigation Community complaints	Breach with legal rebuke / abatement notice/restrictions Some legal constraints imposed, minimal fines	Programme slippage resulting in late delivery by between 30 and 90 days	Negative financial impact between $2M to $10M	Injury requiring medical treatment or lost time of one day to three weeks	Pollution or other environmental damage at a localised level, with medium term effects
Minor	Disruption to stakeholder relationship slowing progression of site-specific activity, and/or Loss of route availability of a regional connector highway	Local media coverage for 1-5 days Official information request. Negative feedback from Minister Reputation within industry is damaged Some community complaints Marginal impact on stakeholder confidence	Breach with letter from authority requesting action	Programme slippage resulting in late delivery by between 7 and 30 days	Negative financial impact between $0.5M to $2M	Injury requiring short term medical treatment and workplace absence less than one day	Minimum pollution or other environmental damage. Short term effects only
Insignificant	Disruption to stakeholder relationship, and/or Loss of route availability of a regional distributor highway	Local media coverage for 1-day Reputation intact Internal knowledge only Minimal impact on stakeholder confidence	Breach managed at a regional level	Programme slippage resulting in late delivery by less than 7 days	Negative financial impact of less than $0.5M	Injury requiring short-term first-aid care and no absence from the workplace	Small scale pollution or other environmental damage is localised with no resultant effects. Contained locally

1.4 Evaluation

Based upon the likelihood and consequence outcomes from the risk analysis, the risks have been evaluated using the Tables 3 & 4 below to identify their Class from A to E. The significance of a Class A threat is 'very high' compared to Class E which is considered 'very low'. Likewise, for opportunities.

Table 3: Threat Rating Matrix

RISK RATINGS LIKELIHOOD x CONSEQUENCE						
Likelihood	**5 Highly Likely** (May occur this year) >85%	Class B (5)	Class B (10)	Class A (15)	Class A (20)	Class A (25)
	4 Likely (May occur once in the next 2 years) 55-85%	Class C (4)	Class C (8)	Class B (12)	Class A (16)	Class A (20)
	3 Possible (May occur once in the next 2-5 years) 30-55%	Class D (3)	Class C (6)	Class C (9)	Class B (12)	Class A (15)
	2 Unlikely (May occur once in 5-20 years) 5-30%	Class D (2)	Class D (4)	Class D (6)	Class C (8)	Class C (10)
	1 Rare (May occur once in 20 years) <5%	Class E (1)	Class E (2)	Class E (3)	Class D (4)	Class C (5)
		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Severe
		Consequence				

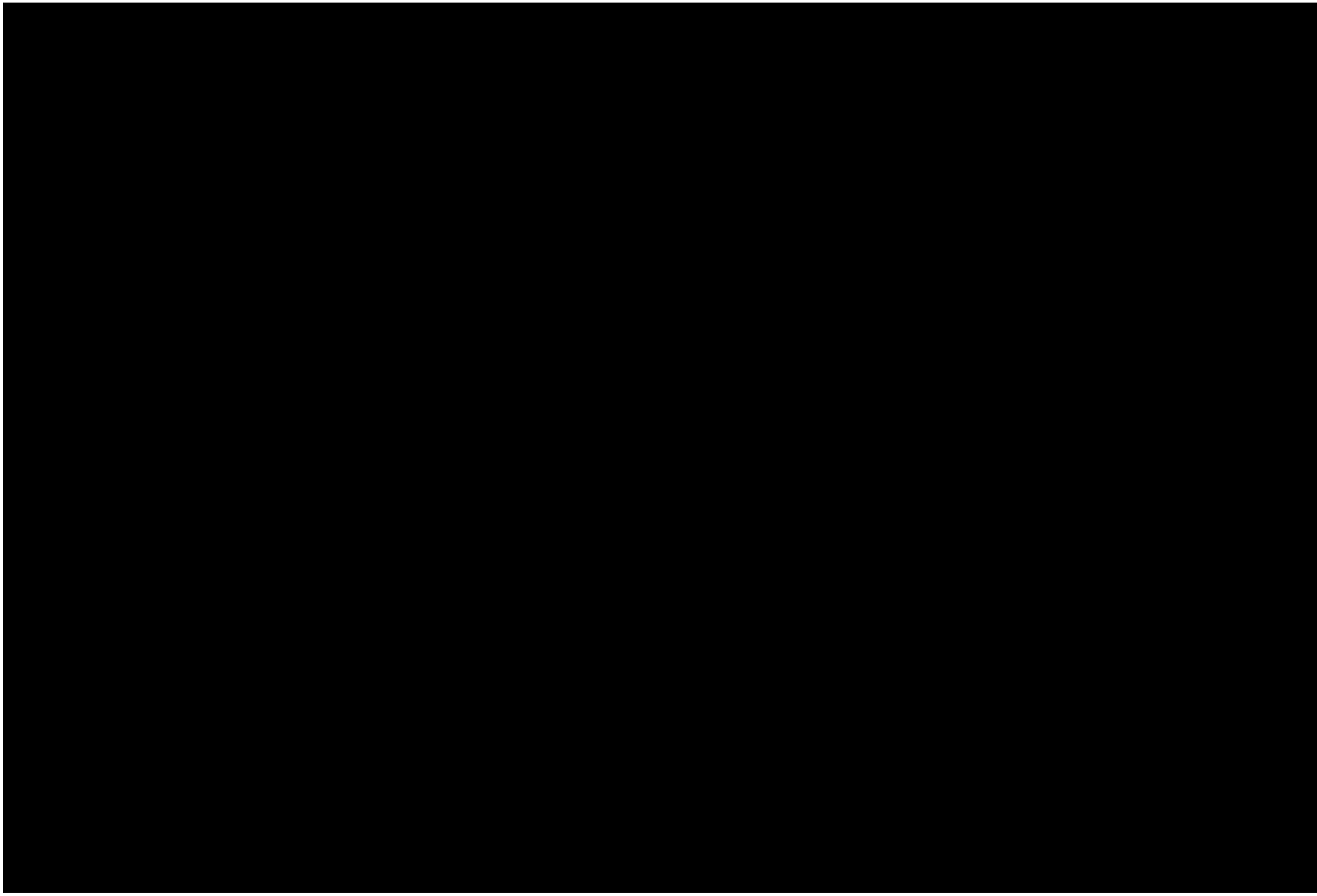
Table 4: Opportunity Rating Matrix

Likelihood						
	5 Highly Likely (May occur this year) >85%	Critical Opportunity (25)	Critical Opportunity (20)	High Opportunity (15)	Medium Opportunity (10)	Low Opportunity (5)
	4 Likely (May occur once in the next 2 years) 55-85%	Critical Opportunity (20)	Critical Opportunity (16)	High Opportunity (12)	Medium Opportunity (8)	Low Opportunity (4)
	3 Possible (May occur once in the next 2-5 years) 30-55%	Critical Opportunity (15)	High Opportunity (12)	Medium Opportunity (9)	Medium Opportunity (6)	Low Opportunity (3)
	2 Unlikely (May occur once in 5-20 years) 5-30%	High Opportunity (10)	Medium Opportunity (8)	Medium Opportunity (6)	Low Opportunity (4)	Low Opportunity (2)
	1 Rare (May occur once in 20 years) <5%	High Opportunity (5)	Low Opportunity (4)	Low Opportunity (3)	Low Opportunity (2)	Low Opportunity (1)
		5 Severe	4 Major	3 Moderate	2 Minor	1 Insignificant
		Consequence				

1.5 Treatment

Risk Owners were responsible for identifying and then undertaking 'planned risk treatment' actions appropriate to the risk score identified during the evaluation. These actions were reviewed by the project team and risks were also closed once further investigation into the risk found that the initial threat or opportunity was no longer a consideration.







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TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe
Appendix L: Climate Change Response

May 2023

Version 1.0

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and Waka Kotahi NZ Transport Agency (Waka Kotahi). This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and Waka Kotahi. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Acronym/Term	Description
ASI	Avoid – Shift – Improve (ASI) methodology
DBC	Detailed Business Case
ERP	Emissions Reduction Plan
GHG	Greenhouse gases
IBC	Indicative Business Case
NoR	Notice of Requirement
PEET	Project Emissions Estimation Tool
VKT	Vehicle Kilometres travelled

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1 Introduction

The Climate Change Response Act 2002, and in particular the amendments under the Climate Change Response (Zero Carbon) Amendment Act 2019, directly respond to the international commitments New Zealand has made to reduce GHG emissions. Transport emissions are a key focus of New Zealand's climate response and the legislation and policy on Greenhouse Gas (GHG) emissions and targets are continuing to evolve.

Te Tupu Ngātahi is delivering a route protection programme to enable a future transport system that can respond to the planned growth in a way that supports the reduction of emissions and reshapes the transport network to provide for low carbon transport solutions. As such, Te Tupu Ngātahi is seeking to further integrate climate change thinking into each stage of the development process.

1.1 Purpose

This report is <u>not</u> an assessment of the climate change merits or challenges of greenfield growth itself. It instead considers that should this greenfield growth occur then what could be done to respond to greenfield growth in a sustainable manner e.g., enable urban residents to make travel behaviour decisions that support better climate change outcomes.

This report documents the climate change considerations made as a part of the preparation and optioneering sections of the Pukekohe Detailed Business Case (DBC). It details where specific GHG reduction interventions or considerations have been made following the approach and methodology developed by Te Tupu Ngātahi. This includes:

- How the Intervention framework and methodology has been applied;
- Actions and recommendations identified from the initial climate change assessment;
- How the recommendations have been addressed by the DBC; and
- Identification of considerations for future phases of the projects.

Note this assessment is primarily focused on mitigation measures, however during the development of the DBC high level consideration has also been given to climate adaptation measures, in particular infrastructure response to future flooding scenarios. All new infrastructure has been designed to respond to the 1 in 100-year floods and where bridges are being replaced as part of corridor widening, then if needed the height of the bridge is being lifted as part of the project. During future detailed design, further design measures should be considered to optimise resilience to flooding.

1.2 Scope of assessment

The corridors considered in the Pukekohe DBC include and are shown in **Error! Reference source not found.** :

- Drury West Arterial
- State Highway 22 Connection
- Paerata Connection
- South Drury Connection
- Drury-Pukekohe Link
- Paerata Arterial

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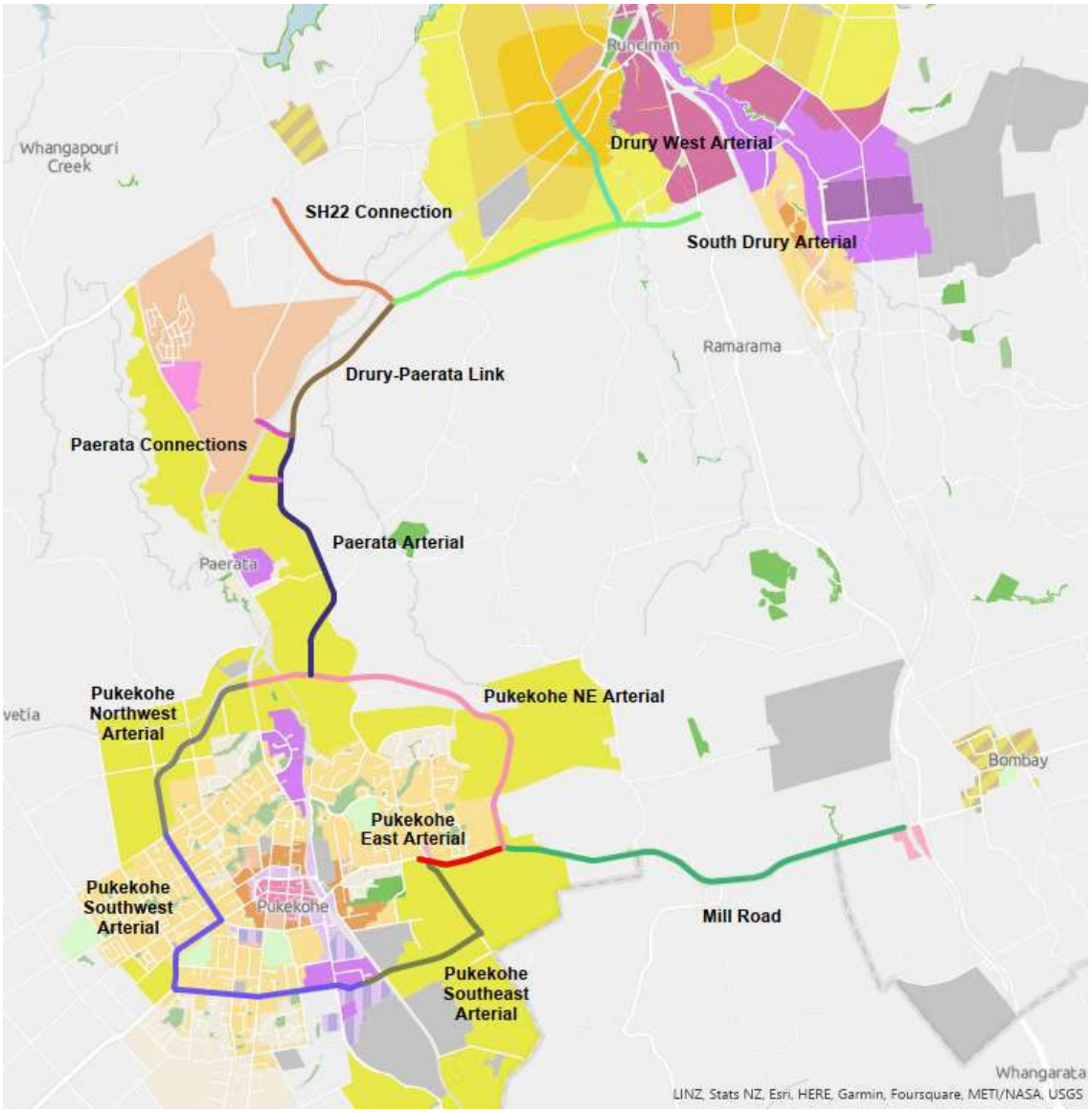
- Pukekohe Northeast Arterial
- Pukekohe East Arterial
- Pukekohe Southeast Arterial
- Pukekohe Southwest Arterial
- Pukekohe Northwest Arterial
- Mill Road

Figure 1-1 - Pukekohe DBC Map



2 Intervention Framework Methodology

It is acknowledged that the transformation of New Zealand to a low-emissions, climate-resilient country includes a number of pathways such as emission reduction as well as adaptive measures to allow the country to adapt, live and thrive in a different and changing climate. Transport is one of New Zealand's largest sources of GHG and as such the focus for the climate change response for the Pukekohe DBC is on decarbonising the transport system. This aligns with the Government targets as outlined in the Aotearoa New Zealand Emissions Reduction Plan.

Three broad categorisations of GHG emissions ("carbon") are being considered in this assessment:

1. **Embodied carbon:** The quantum of carbon from the creation, movement and installation of construction materials. Construction carbon emissions can be measured using emissions factors which translate material quantities into tCO2e, e.g., tonnes of concrete used into tonnes of carbon dioxide equivalent.
2. **Vehicle emissions** (referred to in this report as enabled emissions): The emissions released from the vehicles (buses and trucks) using the asset which in this case the use of the local and strategic transport network. Te Tupu Ngātahi uses the Vehicle Emissions Prediction Model (VEPM) modelling to consider enabled emissions through Vehicle Kilometres Travelled (VKT).
3. **Land use changes**: The GHG emissions arising from land use changes that impact the ability to sequester carbon which is the long-term storage of carbon in oceans, soils and vegetations. Te Tupu Ngātahi can influence better land use through compact urban form and minimising impacts on soils and vegetation.

2.1 Te Tupu Ngātahi Intervention Framework

Te Tupu Ngātahi has developed an intervention framework (mechanisms & tools) for considering climate change at different stages of the route protection process. The intervention framework forms the basis to interrogate and evaluate the planned networks to identify opportunities for emissions reduction – primarily at the route protection stage that is the focus of the Te Tupu Ngātahi programme. It is a best practice approach to develop confidence that opportunities have been maximised to reduce GHG emissions for whole of life emissions (which include emissions associated with the construction of the infrastructure, and with its use, and eventual disposal).

Our intervention approach for considering and responding to climate change at different stages of the business case and route protection process is focused on an ***Eliminate – Reduce – Optimise*** intervention framework as shown in Figure 2.

This framework is a hierarchical approach that increases in detail and focus as the programme progresses. It aligns with the Avoid – Shift – Improve (ASI) methodology regularly used in transportation planning[1] and in global carbon management specifications such as PAS 2080:2016[2].

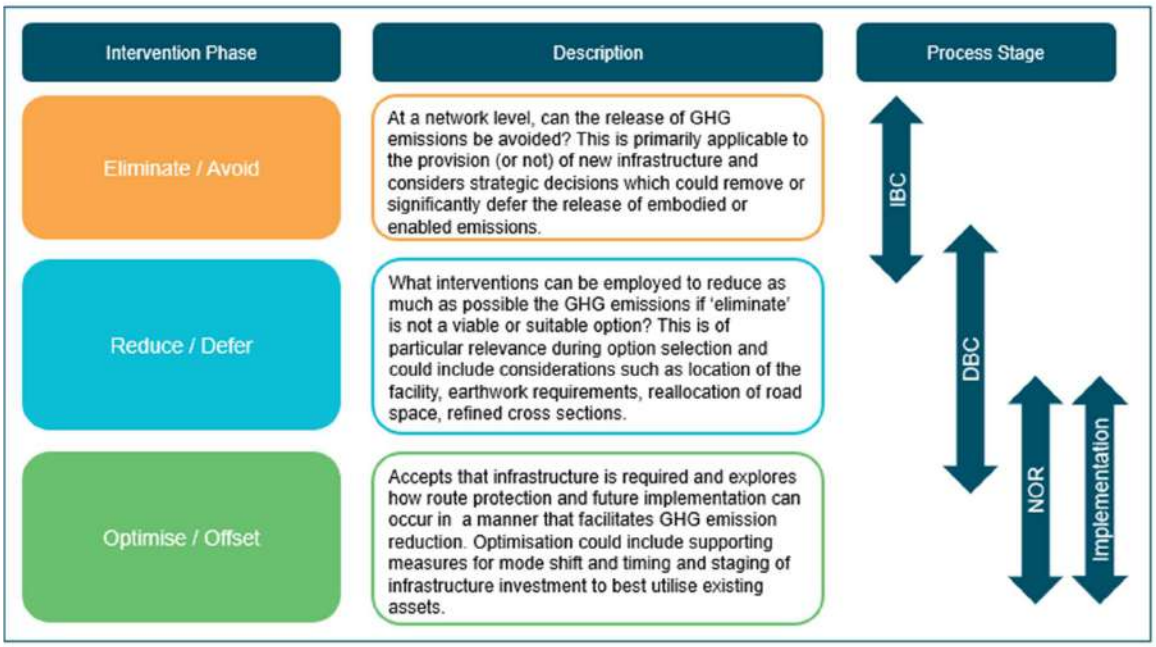
The ability to influence carbon emissions changes as projects move from Indicative Business Case (IBC) to Detailed Business Case (DBC) and Notice of Requirement (NoR) or Implementation design. The main area of influence for the DBC is in the "Reduce" intervention, although it is noted that through

[1] Example: Waka Kotahi's Whakarāpopoto a Aotearoa (national summary), page 10.

[2] PAS 2080:2016 Carbon Management in Infrastructure (UK).

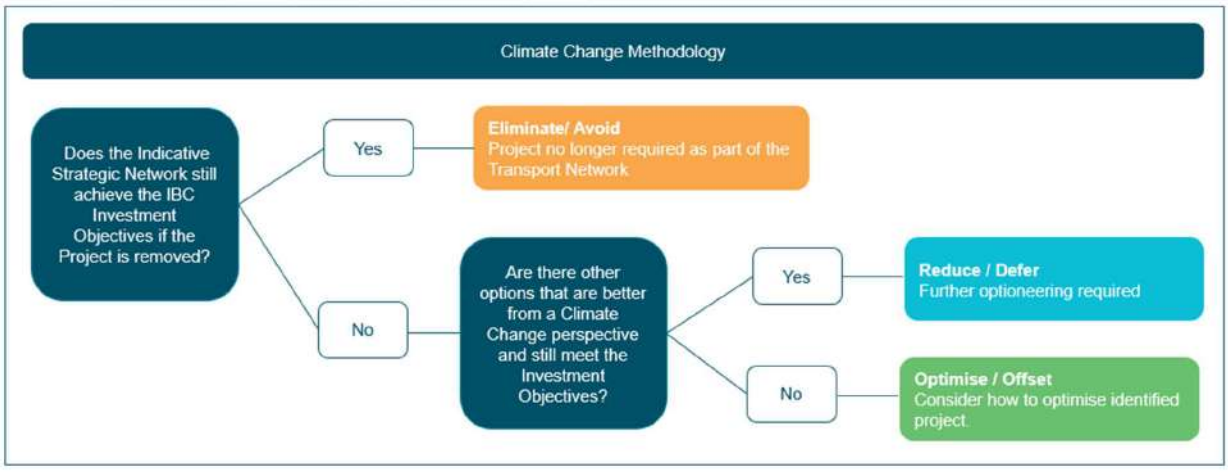
the gap analysis and policy changes some corridors may need to be reconsidered for elimination. The DBC will also identify possible climate optimisation interventions to be considered at the later date.

Figure 2-1 Eliminate - Reduce - Optimise Intervention Framework



The intervention framework requires considering embodied and enabled carbon in both an integrated and sequential way. The assessment explores the practical interventions as they apply to the whole of life emissions at each stage of infrastructure development decisions from both a network and project view. The decision-making process is shown in Figure 2-2 below.

Figure 2-2 Decision making process



The following steps have been taken to consider climate change in this DBC:

- Workshop held with Project team to consider and document potential climate change interventions and identify opportunities and risks.
- DBC addressed the outcomes of the climate change assessment in the development of the recommended transport network.
- Identification of climate change interventions to be considered further during future implementation stages.

As part of the initial MCA process, construction emissions were scored and ranked for each of the strategic south corridors using the Waka Kotahi Project Emissions Estimation Tool (PEET). This involved completing a first order PEET estimation. The primary assessment involved reviewing the lane kilometres for each option, given that the length and width of the corridor will significantly affect the quantum of consultation emissions generated from materials required, transport to site, and fuel/energy used in construction. The secondary assessment reviewed major structures and major earthworks as these are likely to be emissions intensive from a materials and construction fuel/energy perspective.

It should be noted that a Second Order PEET estimation (which may be used when there is a specific need for further differentiation between options rather than a comparison by corridor length) has not been completed.

The climate change analysis centred on three broad categorisations of greenhouse gas (GHG) emissions:

- **Enabled emissions**: The emissions from individuals and organisations that are enabled through the use of national systems over time, like Auckland's transport network.
- **Construction emissions**: The emissions from project construction, including embodied emissions from the creation, movement, and installation of construction materials; and other emissions from project construction (e.g. earthworks). Construction carbon emissions can be measured using emissions factors, which translate material quantities into tonnes of carbon dioxide equivalents (tCO2-e), e.g., tonnes of concrete used, into tonnes of carbon dioxide equivalent. Te Tupu Ngātahi can influence manufacturers/suppliers and right-size infrastructure projects. Waka Kotahi's Beta Preliminary Emissions Estimation Tool (PEET) is being used to consider construction emissions through the DBC and Notices of Requirement (NoRs) processes.
- **Land use changes:** The GHG emissions arising from land use changes (e.g. the loss of emissions sequestration from removing forestry which if left undisturbed would continue to remove carbon dioxide from the atmosphere over the long term).

3 Summary of Response

Each project was considered individually against all three elements of the Eliminate – Reduce – Optimise framework and a summary of the resulting applicable investigations for Pukekohe are shown in **Error! Reference source not found.**. A full summary of climate change considerations for each project is included in the following sections. It is noted that:

- All projects had opportunities to use the optioneering process to consider reduction of GHG emissions.
- All options identified opportunities to consider further climate change optimisation of the project.

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- If a decision is made to build new infrastructure, then the asset owners will make the design and the construction process as resource and emissions efficient as possible.

Table 3-Error! No text of specified style in document.**1 Pukekohe Climate Change Gateways**

Project	Consider Elimination?	Opportunity for Reduction?	Opportunity for Optimisation?
Drury West Arterial		✓	✓
State Highway 22 Connection		✓	✓
Paerata Connection		✓	✓
South Drury Connection		✓	✓
Drury-Pukekohe Link		✓	✓
Paerata Arterial		✓	✓
Pukekohe Northeast Arterial		✓	✓
Pukekohe East Road Upgrade	✓	✓	✓
Pukekohe Southeast Arterial		✓	✓
Pukekohe Southwest Arterial	✓	✓	✓
Pukekohe Northwest Arterial		✓	✓
Mill Road		✓	✓

4 Pukekohe Interventions, Recommendations and Actions

The Pukekohe Climate Change workshops were held on 30th March 2023 and used the Eliminate-Reduce-Optimise framework to identify the climate change opportunities for each project element. The DBC then used the outputs from the workshops to shape the optioneering process and results for each project are documented in the following sections.

Refer to Pukekohe DBC Appendix C for more information about the detailed optioneering process.

4.1 Drury West Arterial

The new Drury West Arterial combines the northern SH22 connection and the eastern / northern most section of the former Pukekohe Expressway, both identified in the IBC. The link provides relief to the current Drury interchange and SH22 through Drury West as the Future Urban Zone land is developed. This will enable greater urbanisation of the SH22 corridor through Drury West, with improved safety, access and transport-land use integration with multi-modal facilities for travel along and across the SH22 corridor.



4.1.1 Can this project be eliminated?

This link will provide relief to the current Drury interchange and SH22 through Drury West as the Future Urban Zone land is developed. If this connection was eliminated, it would hinder the urbanisation of the SH22 corridor through Drury West, reducing safety, access, and transport-land use integration with multi-modal facilities for travel along and across the SH22 corridor.

Additionally, without this new arterial link, there would be no direct access for all modes from Drury West to the proposed new train station. There are existing and compounding severance issues experienced by residents and businesses in these areas as a result of SH1, and with the anticipated growth, it is likely that the existing road network would become severely over capacity. Without the additional link, heavy industrial traffic would be required to remain on SH22 or be displaced to use local roads such as Burtt Road for access and would bring an increase of heavy traffic through the planned residential and local centre land uses.

The indirect nature of these trips would result in increased VKT and likely increased enabled emissions. Without the certainty of a through route between SH22 and the South Drury connection people would be inclined to continue travelling on SH22 to reach key destinations such as Pukekohe, resulting in increased congestion. Similarly, it would not support good active mode catchment to the proposed southern local centre.

Therefore, these elements are all critical to the overall Pukekohe mode shift and climate change response and cannot be eliminated.

4.1.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 .

Table Error! No text of specified style in document.**-1 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• There are no existing roads which provide the desired north south connection between SH22 and the proposed South Drury connection that supports the future residential growth and planned local centre. This link will also be the sole means of accessing Drury West station. Therefore, this needs to be a new connection.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form	• While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process. • The recommended corridor option is partially comprised of option DW1, which was identified as the preferred option in relation to embodied carbon emissions as it has low lane kilometres (likely lower materials and construction emissions) and no addition features which might adversely differentiate option based on earthworks or major structures.
Staging	• The requirement for this infrastructure is strongly linked to the release of land in Drury West. It is important the upgrade is in place when Drury West Rail Station and Park and Ride is operational to ensure early mode shift, reduced travel length and reduced emissions. • This should be implemented in line with surrounding development as the early implementation supports emissions reduction by enabling efficient PT network and mode shift from outset of development.

4.1.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities are detailed in Table 4-222.

Table 4-22 Optimisation actions identified

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide

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Optimisation action	Matters for further consideration
	opportunities for individual developments to proactively connect to this active mode spine in their designs.
Carbon and resource efficiency during bridge construction	• Consider a carbon and resource efficiency assessment of the design of the three bridges to weight embodied and construction emissions through choice of material and design.
Intersection efficiency	• Consider during detailed/implementation design how to maximise safety and active mode connections across SH22 and at the Drury West station access.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
PT Priority	• At the implementation of this corridor, consideration should be given to priority measures for PT along the corridor. This will reduce trip time and improve reliability for PT while deterring use by private vehicles. This is expected to reduce enabled carbon.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

4.2 South Drury Connection

The South Drury connection connects at its eastern extent to the above-mentioned Drury West Arterial project and at its western extent to the proposed SH22 Connection and the Drury-Pukekohe Link. Combined with the Drury West Arterial, the Drury-Pukekohe Link and the Paerata Arterial, this project provides multi-modal connectivity between Pukekohe, Paerata, Drury West and SH1.

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4.2.1 Can this project be eliminated?

Without this connection, the travel demands resulting from future urban growth in north Pukekohe and Paerata that needs to access Drury and beyond will be limited to using SH22. Eliminating this project would result in increased congestion and delay on SH22, causing an overspill of traffic onto the parallel rural road network, including on Cape Hill Road, Burtt Road and Runciman Road. The indirect nature of these trips would result in increased VKT and likely increased enabled emissions.

In addition, this has the strong potential to result in a dramatic increase in death and serious injury crashes on these links due to their rural character and geometry. It should be noted that these roads are not suitable for upgrade to an arterial function due to the extensive costs and impacts resulting from the need to fundamentally alter vertical and horizontal alignments, as well as bring the cross-section up to a modern arterial standard.

Therefore, this project cannot be eliminated as these elements are all critical to the overall Pukekohe climate change response and achieving the associated safety objectives.

4.2.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 .

Table Error! No text of specified style in document.**-3 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• This connection is an intrinsic part of the wider planned network for the growth of Pukekohe, and without it there would be no connection to the SH22 connection. At the IBC phase, several options were investigated to test multiple locations and alignments for a Pukekohe Expressway providing a direct link to SH1 from Pukekohe.
Route refinement An opportunity was identified to consider incorporating a climate lens	• As key transport and environmental policy direction changed between the IBC and DBC, a carbon emissions assessment methodology was formed to further test the alignment of the

Reduction opportunity	DBC Response
into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form	preferred network with this new policy direction. This included further alternatives being considered which may provide more of a contribution to decarbonisation as set out in government direction. • The DBC confirmed through the form and function that this connection will remain a two-lane road. This is beneficial to avoiding additional embodied and construction carbon investment to support private vehicles.
Staging	• The requirement for this infrastructure is strongly linked to the release of land in Drury West. It is important to integrate with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects. • This should be implemented in line with surrounding development as this link is only viable if the wider road network and associated growth is in place. • By staging this project in line with development there is an opportunity to reduce emissions through the provision of high-quality active mode facilities which will encourage mode shift.

4.2.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation are detailed in Table 4-224.

Table Error! No text of specified style in document.**-4 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development begins. • It will be important that the active mode facilities are in place along the northern edge (at FUZ boundary) at the beginning of development to support early mode shift.
Carbon and resource efficiency during bridge construction	• Consider a carbon and resource efficiency assessment of the two new bridges to reduce embodied and construction emissions through choice of material and design.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

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4.3 State Highway 22 Connection

The SH22 Connection will enable inter-regional strategic travel demand to be taken from SH22 through Drury West, enabling improved functioning of the urban environment there. The project also enhances accessibility, particularly for freight to and from the rural hinterland of north and west Pukekohe onto SH1, which will experience improved access for trips north and south on the state highway.



4.3.1 Can this project be eliminated?

Without the certainty of this through route between SH22 and the South Drury connection, vehicles would be inclined to continue travelling on SH22, meaning those who wish to access Paerata and Drury West would have increased journey time leading to increased VKT and likely increased enabled emissions.

In addition, this route holds strategic importance as it provides additional access across rail line, a key to increasing resilience in the network.

Therefore, these elements are all critical to the overall Pukekohe network resilience and climate change response and cannot be eliminated.

4.3.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 5.

Table Error! No text of specified style in document.**-5 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• There are no existing roads which provide the desired north south connection between SH22 and the proposed South Drury connection. With the planned growth in the area, it is anticipated that pressure will be significantly increased on the road network, with this connection playing a strategic role in reducing

Reduction opportunity	DBC Response
	connection in and around Pukekohe. Therefore, this needs to be a new connection.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form	• The DBC confirmed through the form and function that this connection will remain a two-lane road. This is beneficial to avoiding additional embodied and construction carbon investment to support private vehicles. • While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process, however the short list options had minimal differences when it came to lane km and large structures.
Staging	• The requirement for this infrastructure is strongly linked to the release of land in Drury West. It is important to integrate with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects. • This should be implemented in line with surrounding development to relieves urbanised areas from strategic traffic, enhancing resilience and freight reliability and allowing alternative mode facilities to be enhanced and safety improved.

4.3.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-226.

Table Error! No text of specified style in document.**-6 Optimisation actions identified**

Optimisation action	Matters for further consideration
Carbon and resource efficiency during bridge construction	• Consider a carbon and resource efficiency assessment of the design of the bridge to weight embodied and construction emissions through choice of material and design.
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development begins. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.

Optimisation action	Matters for further consideration
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

4.4 Paerata Connections

The new Paerata connections includes an arterial connection from SH22 to Sim Rd, connecting to Paerata station, Paerata Rise Development and Centres as well as a new connector between the two extents of Sim Road (Sim Road to Sim Road) across the NIMT. These connections will form the primary east-west connections for all modes in Paerata.



4.4.1 Can this project be eliminated?

The connection between Sim Road and Sim Road across the NIMT will increase connectivity over the railway line, provide an additional crossing and relieve future vehicle through movements past the Paerata Rail Station and connect directly to the Paerata Rise development. The Paerata connection links SH22 to Sim Rd, connecting to Paerata station, Paerata Rise Development, and local centres.

These connections play an integral role in relieving urbanised areas from strategic traffic, enhancing resilience and allowing alternative mode facilities to be enhanced and safety to be improved. In addition, improved access to the rail stations will encourage a mode shift away from private vehicles form the onset of development. Without such connections, trips would be displaced onto the wider network, journey times would increase, and congestion would worsen. The indirect nature of these trips would result in increased VKT and likely increased enabled emissions. Similarly, it would not support good active mode catchment to the proposed station and the surrounding FUZ area.

Therefore, these elements are all critical to the overall Pukekohe mode shift and climate change response and cannot be eliminated.

4.4.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 7.

Table Error! No text of specified style in document.**-7 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• There are no existing roads which provide the desired east-west connection between SH22 and the upgraded Paerata arterial that supports the future residential growth and planned local centre. This link will also be the sole means of accessing Paerata station. Therefore, this needs to be a new connection.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process. • Through the Paerata Arterial route refinement assessment, an opportunity was identified to connect the two extents of the paper road (Sim Road to Sim Road) across the NIMT to increase connectivity over the NIMT, provide an additional crossing and relieve future vehicle through movements past the Paerata Rail Station and connect directly to the Paerata Rise development. No alternatives were investigated as this connection connects two points in short proximity using a paper road. It connects to the paper Sim Road (planned to be a local road within the Paerata Rise development) on the west side of the NIMT to the paper road on the east side if the NIMT and on to the Paerata Arterial.
Staging	• It is important the upgrade is in place when Paerata Rail Station is operational to ensure early mode shift, reduced travel length and reduced emissions. • By staging this project in line with surrounding development, there will be improved across the NIMT to increase connectivity and relieve future vehicle through movements past the Paerata Rail Station and connect directly to the Paerata Rise development, reducing VKT and associated emissions.

4.4.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-228.

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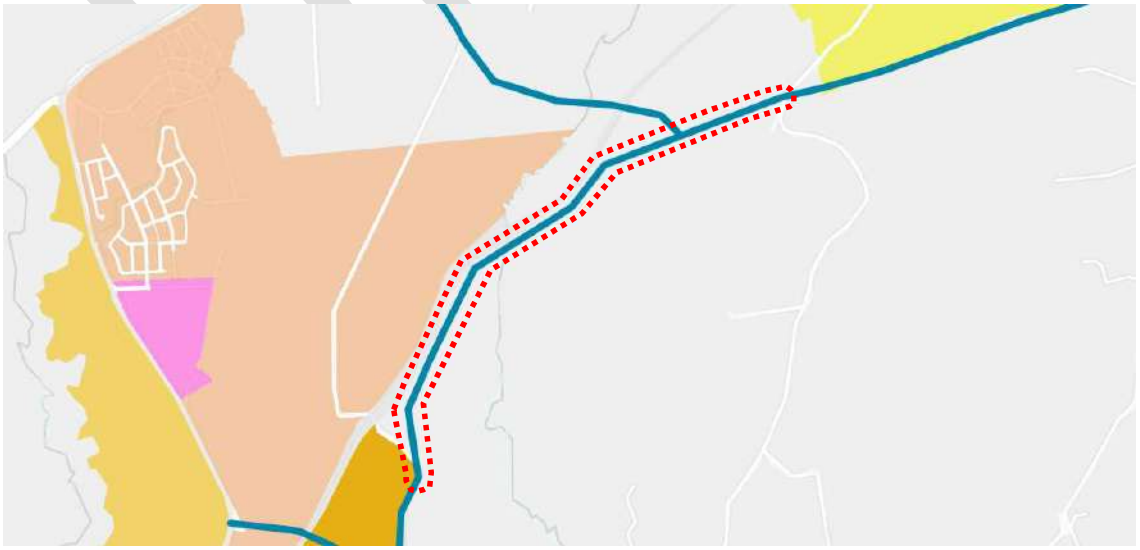
Table Error! No text of specified style in document.**-8 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Intersection efficiency	• Consider during detailed/implementation design how to maximise safety and active mode connections to / from the Paerata station access.
PT Priority	• At the implementation of this corridor, consideration should be given to priority measures for PT along the corridor. This will reduce trip time and improve reliability for PT while deterring use by private vehicles. This is expected to reduce enabled carbon.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

4.5 Drury-Pukekohe Link

The Drury-Pukekohe connection links the SH22 connection and South Drury connection to the north with the Paerata Arterial to the south.



4.5.1 Can this project be eliminated?

The functional intent of this project is to accommodate the growth in travel demand between Pukekohe, Paerata, Drury and beyond, avoiding excess travel demands on SH22 and allowing the Drury locality to urbanise and cater for multiple modes safely and to a greater extent than is present today.

If this project was to be eliminated, the consequence of not providing for these trip patterns would be increased congestion and poor safety outcomes on SH22 and the parallel rural road network, as well as an impediment to future urban zones realising their full development potential as the transport system struggles to accommodate growth and meet expected levels of service commensurate with an attractive, liveable urban environment. Such impacts are likely to having negative climate change impacts, with increased journey time leading to increased VKT and the associated increased enabled emissions.

Therefore, these elements are all critical to the overall Pukekohe mode shift and climate change response and cannot be eliminated.

4.5.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 9.

Table Error! No text of specified style in document.**-9 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• While SH22 provides an existing connection between Drury and Pukekohe, the new Drury Pukekohe link plays a key role in connecting planned future growth, acting as the spine that ties the future road network together. • The anticipated growth in Pukekohe and Drury is expected to result in a significant increase in general vehicle trips, and without this connection it is very likely that SH22 would become quickly congested and overwhelmed.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process. • Through the route refinement process, various options were identified for this connection, however it was determined that all options were considered likely to have similar embodied emissions profile.
Staging	• The requirement of this project is highly reliant on the provision of the supporting road network and anticipated growth, and therefore should be staged accordingly to ensure its purpose is to relieve pressure off of SH22, reducing congestion and VKT, as there is a risk if it is implemented too early that it would simply

Reduction opportunity	DBC Response
	encourage private vehicle use and negatively impact carbon emissions.

4.5.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-2210.

Table Error! No text of specified style in document.**-10 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Carbon and resource efficiency during bridge construction	• Consider a carbon and resource efficiency assessment of the design of the bridge to weight embodied and construction emissions through choice of material and design.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

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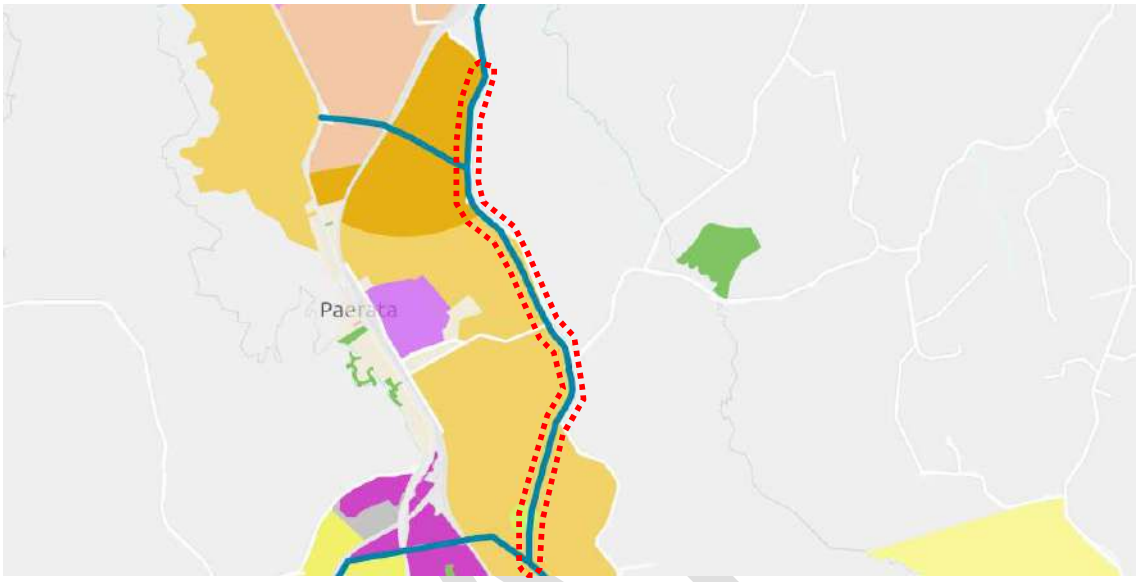
4.6 Paerata Arterial

The Paerata Arterial completes the connection between Pukekohe and SH1. At Paerata it also provides a connection to SH22 and the proposed new Paerata train station, due to be completed in 2025, along with electrification of the Papakura to Pukekohe rail line.



4.6.1 Can this project be eliminated?

If this project was to be eliminated, there would be a negative impact on congestion, delay and safety along SH22 as it struggles to cope with the increased pressure on the network from the associated local growth. There would also be a negative impact on the safety of Cape Hill Road, which is not designed to safely accommodate the predicted growth in its current state. This link provides good strategic access, connectivity and resilience, particularly for general traffic and freight.

This link will also provide multi-modal access to Pukekohe from the FUZ area located west, therefore, if it was to be eliminated it would not support a good active mode catchment, reducing integration with multi-modal facilities.

Therefore, these elements are all critical to the overall Pukekohe mode shift and climate change response and cannot be eliminated.

4.6.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 .

Table Error! No text of specified style in document.**-13 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• While SH22 provides an existing connection between Drury and Pukekohe, the new Paerata Arterial link plays a key role in connecting planned future growth, acting as the spine that ties the future road network together.

Reduction opportunity	DBC Response
	• The anticipated growth in Pukekohe and Drury is expected to result in a significant increase in general vehicle trips, and without this connection it is very likely that SH22 would become quickly congested and overwhelmed.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process. • Two alignment options were considered for this connection, both of which were considered against embodied carbon emissions. While one option included an opportunity to reduce emissions through reusable material, the alternative option, which has since been identified as the preferred option, has shorter lane km of road, resulting in reduced VKT.
Staging	• This project should be staged according to the surrounding development, as early implementation will be highly beneficial to alleviating pressure off the road network and supporting planned communities in travelling sustainably. There is an opportunity for integration with Paerata station to improve accessibility and integration while encouraging mode shift from private vehicles

4.6.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-22.

Table Error! No text of specified style in document.**-14 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible, and cohesive network which will encourage mode shift.

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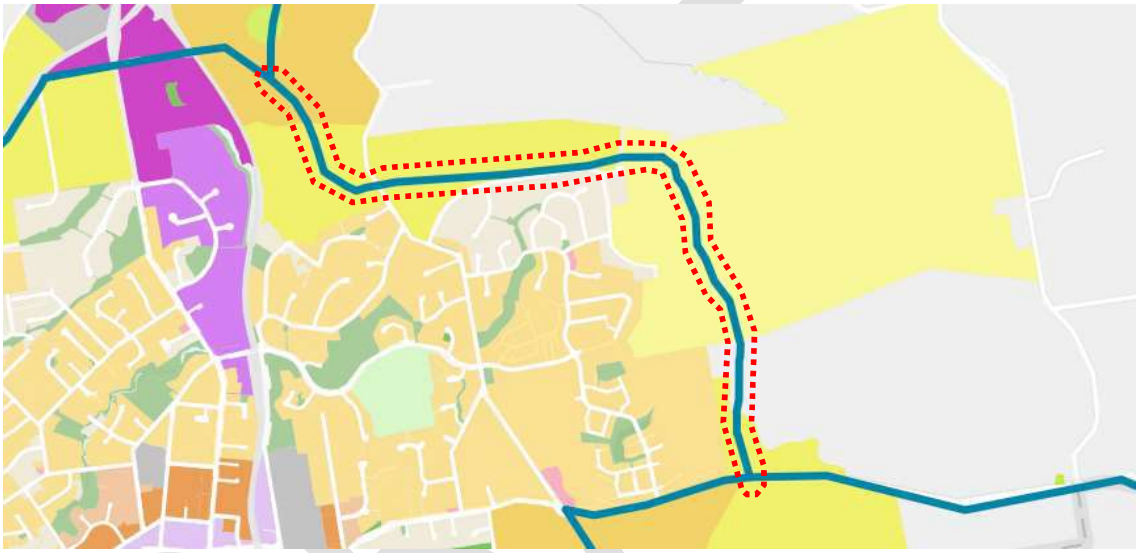
Optimisation action	Matters for further consideration
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

4.7 Pukekohe Northeast Arterial

The Pukekohe northeast arterial links SH22 to Pukekohe East Road. Its primary function is for general traffic, freight, an active mode links between neighbourhoods and alleviating traffic on Cape Hill and Valley Road.



4.7.1 Can this project be eliminated?

This connection is vital in reducing severance, enhancing access to new growth areas as well as separating local and town centre traffic from regional and through traffic.

If this link was to be eliminated, traffic would increase within the town centre and on local residential streets. In addition to an increase in congestion from localised trips, regional traffic including freight would be forced to use this local network, with a less reliable and less efficient means of accessing the strategic transport network.

Inefficient journeys for freight and increased congestion and delay will have a negative impact on climate change, with increased VKT and associated carbon emissions.

Therefore, these elements are all critical to the overall Pukekohe climate change response and cannot be eliminated.

4.7.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 3.

Table Error! No text of specified style in document.**-13 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• Under the existing road network, vehicles wishing to access the strategic road network and travel inter-regionally from SH22 to the east must route through Pukekohe town centre. With the anticipated growth expected in the area, without the northeast arterial, it is likely the town centre would become overwhelmed with vehicle traffic resulting in excessive congestion, increased emissions, and a poor environment for residents. • As this connection is vital in providing such relief, it has been determined that there is no alternative solution.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process. • While the options which has the lowest impact on enabled carbon emissions were not chosen due to other constraints, the preferred option provides the best integration for existing urban areas and the provides better network integration from Paerata Arterial and Pukekohe NW Arterial, which in turn will result in reduced congestion, emissions and VKT. The alignment also improves resilience and access for all modes and has less of earthworks than other options.
Staging	• The requirement of this project is highly reliant on the provision of the supporting road network and anticipated growth, and therefore should be staged accordingly to ensure its purpose is to reduce traffic travelling through Pukekohe town centre resulting in reduced congestion and VKT, as there is a risk if it is implemented too early that it would simply encourage private vehicle use and negatively impact carbon emissions.

4.7.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-2214.

Table Error! No text of specified style in document.**-14 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.

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Optimisation action	Matters for further consideration
Carbon and resource efficiency during bridge construction	• Consider a carbon and resource efficiency assessment of the design of the seven bridges to weight embodied and construction emissions through choice of material and design.
Intersection efficiency	• Consider during detailed/implementation design how to maximise safety and active mode connections across Pukekohe East Road.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Freight Priority	• At the implementation of this corridor, consideration should be given to priority measures for freight. This will reduce trip time and improve reliability for freight while deterring use by private vehicles. This is expected to reduce enabled carbon.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

4.8 Pukekohe East Arterial

The Pukekohe East arterial is an existing arterial section from the north-eastern ring road to Belgium Road. It has a high east-west function for general traffic and freight but also needs to accommodate buses and active modes.



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4.8.1 Can this project be eliminated?

As an existing corridor, careful consideration was given to whether the upgrade of this link is necessary for the overall future Pukekohe transport network. The corridor itself is expected to carry >15,000 ADT and is considered a strategic link between the proposed Pukekohe southeast arterial and Mill Road, providing for local and regional traffic (both general and freight).

As this link plays a key role in better accommodating future volumes of traffic that are anticipated as a result of urban growth in the south of Pukekohe and its hinterland, as well as from the north-east residential growth area which will connect with Pukekohe East Road at the southernmost extent of the north-east arterial, it was determined that this project should not be eliminated.

Without upgrading this link, the existing arterial section would not be suitable to accommodate the increased traffic, resulting in increased delay, congestion and safety issues. This is likely to impact journeys, displacing them to more local roads. As a result of increased congestion and detours, it is believed that eliminating this link would result in increased carbon emissions and VKT.

Therefore, these elements are all critical to the overall Pukekohe climate change response and cannot be eliminated.

4.8.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 5.

Table Error! No text of specified style in document.**-55 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• As this is an existing connection between Pukekohe East Road and Golding Road, there is no alternative means of linking this connection that would be considered more efficient in relation to climate change. While it was considered that this link may not need to be upgraded as it is existing, through providing active mode connections and increasing capacity, mode shift and reduced congestion/VKT will be facilitated.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• All options were considered in terms of embodied carbon emissions; however it was concluded that there was no difference between the options.
Staging	• Staging this project early on supports emissions reduction by enabling efficient PT network and mode shift from the outset of development.

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4.8.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-2216.

Table Error! No text of specified style in document.**-16 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Intersection efficiency	• Consider during detailed/implementation design how to maximise safety and active mode connections at the Pukekohe Northeast arterial intersection.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Freight Priority	• At the implementation of this corridor, consideration should be given to priority measures for freight. This will reduce trip time and improve reliability for freight while deterring use by private vehicles. This is expected to reduce enabled carbon.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.

4.9 Pukekohe Southeast Arterial

The Pukekohe southeast arterial is a section from the north-eastern ring road to Belgium Road. It has a high east-west function for general traffic and freight but also needs to accommodate buses and active modes.

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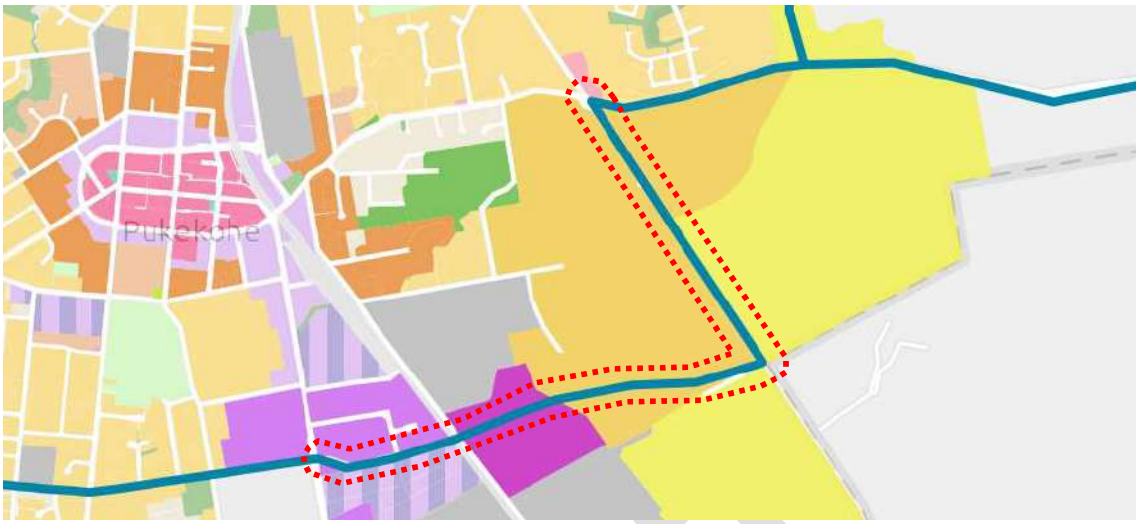

4.9.1 Can this project be eliminated?

The south-east arterial will play an important role in connecting current and future light industry zones around south Pukekohe, as well as freight through traffic, to SH1 at Bombay. As noted, this plays a key role for freight traffic crossing south-east Pukekohe to access Pukekohe East Road and Mill Road. This connection will provide a vital crossing over the NIMT, which will result in improved connectivity and reduced severance, supplementing the existing height constraint and poor geometry at the Subway Road rail underpass. If this project were to be eliminated, freight trips and general traffic would be displaced onto town centre roads including Manukau Road and East Street, which is largely residential and has existing engine breaking restrictions. In turn, this would increase congestion and VKT resulting in enabled emissions.

Therefore, these elements are all critical to the overall Pukekohe climate change response and cannot be eliminated.

4.9.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 7.

Table Error! No text of specified style in document.**-67 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• As mentioned above, it was determined that if this project were to be eliminated, freight trips and general traffic would be displaced onto town centre roads including Manukau Road and East Street. While various options were investigated, it was determined that it was essential to provide an additional crossing over the railway line to sufficiently provide for anticipated growth. Due to spatial constraints and existing development, it was determined that an additional crossing was the only solution to alleviating pressure on the road network.

Reduction opportunity	DBC Response
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• All options were considered in terms of embodied carbon emissions; however it was concluded that there was no difference between the options.
Staging	• This project should be strategically staged to ensure an effective connection to future light industry zones is in place, leading to reduced congestion and freight journey times.

4.9.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-2218.

Table Error! No text of specified style in document.**-18 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Carbon and resource efficiency during bridge construction	• Consider a carbon and resource efficiency assessment of the design of the bridge to weight embodied and construction emissions through choice of material and design.
Intersection efficiency	• Consider during detailed/implementation design how to maximise safety and active mode connections where this link connects to Svendsen Road.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Freight Priority	• At the implementation of this corridor, consideration should be given to priority measures for freight. This will reduce trip time and improve reliability for freight while deterring use by private vehicles. This is expected to reduce enabled carbon.

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Optimisation action	Matters for further consideration
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible, and cohesive network which will encourage mode shift.
Departures in design standards	• As the project corridor is constrained with property constraints present, departures from design standards are expected to lead to significant reductions in cost and complexity of the project.

4.10 Pukekohe Southwest Arterial

The Pukekohe southwest arterial links Golding Road to Puni Road in Pukekohe. It is a primary east-west road which helps in detracting general traffic and freight away from the town centre. Its primary function is for general traffic, freight, active modes and with buses in some sections.



4.10.1 Can this project be eliminated?

As an existing corridor, the scope of upgrading the Southwest Arterial has been investigated in detail, and it has been concluded that works will include provision of new, high-quality walking and cycling facilities, while maintaining a carriageway cross-section width that continues to sufficiently provide for both generally traffic, public transport and freight.

Careful consideration was given to whether the upgrade of this link is necessary for the overall future Pukekohe transport network. The corridor itself is expected to carry >10,000 ADT and is considered a strategic route for local and regional traffic, including freight, due to the industrial areas located at the eastern and northern end of the corridor.

Being one of the few project areas that comprises of an existing road, it was questioned whether the outcomes of upgrading this route would sufficiently benefit both Pukekohe and the wider network.

Whilst it is considered possible for the network to function without an upgrade of the Southwest Arterial, there is merit in continuing to route protect it. Without the link, the future network would have:

- Less resilience to increased pressure on Nelson St, Ward St, Puni Rd, West St and Helvitia Rd. This route plays a strategic role in the wider network for local and regional access. Not upgrading the route will result in increased congestion due to the presence of new residential developments west of Puni Road, the new industrial areas north of Helvitia Road and the new railway bridge west of Golding Road.
- Reduced attractiveness for the cycle network. It was questioned as to why this network was being upgraded to have cycle facilities along the length of it due to it not being part of the primary cycle network; however, this connection links to key routes such as Queen Street and Manukau Road and will overall improve active mode accessibility between residential areas and Pukekohe town centre. Implementation of this upgrade will support emissions reduction by enabling efficient walking and cycling mode shift.
- Reduced safety for pedestrians and cyclists as they would be required to travel in proximity and / or share the carriageway with high volumes of traffic and heavy vehicles.

Whilst it is an option to eliminate the upgrade of the Pukekohe Southeast corridor to reduce the enabled construction emissions associated with the required works, it has been concluded that the value to the transport system from improving this link outweighs the climate and emissions impact.

Therefore, it was concluded that whilst the upgrade will require an embodied and construction emission investment to support the planned growth, the project retains an important role in the network supporting mode shift and resilience and should be retained.

4.10.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 9.

Table Error! No text of specified style in document.**-79 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• This project forms an existing corridor through an already urbanised area, which provides the most direct and effective means of connecting to Pukekohe town centre and the surrounding residential and industrial areas, therefore there is no alternative solution.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• Due to the spatial constraints along this corridor, as it is completely within the existing built-up urban area of Pukekohe, options were developed to utilise the existing road reserve and had a bespoke options assessment process. The comparative assessment involved rating each of the scenarios against the key indicators: walking safety, cycling safety, property impact and cost. • While the key motive of this process was to minimise land-acquisition, through choosing an option (bi-directional cycleway) which only requires land to be acquired at intersections and retains the existing road crown also results in reduced embodied carbon emissions through reduced construction requirements.

Reduction opportunity	DBC Response
Staging	• Project should be implemented in line with supporting residential and industrial development as it provides an alternative link for general traffic and freight, reducing traffic within Pukekohe town centre as well as reducing VKT and journey times.

4.10.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-220.

Table Error! No text of specified style in document.**-80 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Intersection efficiency	• Consider appropriate upgrades of existing intersections to provide safe and efficient crossing points for active modes to encourage mode shift.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Freight Priority	• At the implementation of this corridor, consideration should be given to priority measures for freight. This will reduce trip time and improve reliability for freight while deterring use by private vehicles. This is expected to reduce enabled carbon.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible, and cohesive network which will encourage mode shift.

4.11 Pukekohe Northwest Arterial

Pukekohe Northwest Arterial links SH22 and wider Pukekohe Northeast Arterial to the Pukekohe Southwest Arterial. It is also the primary northwest route for all modes in Pukekohe West.



4.11.1 Can this project be eliminated?

This connection links to both key residential and industrial areas in northwest Pukekohe, and is vital in reducing severance, enhancing access to new growth areas as well as separating local and town centre traffic from regional and through traffic. This will provide improved access from the FUZ to the rest of the urban area and to the strategic transport system.

If this link were to be eliminated, the absence of the arterial would force new local and collector roads within new developments to connect onto the existing network, compounding existing safety and congestion issues. This link forms part of the strategic network providing an arterial route avoiding Pukekohe town centre, therefore without this arterial there will remain a lack of clear differentiation between roads with traffic growth continuing to congest existing roads and constrain access for all modes and severely impacting access, making FUZ areas reliant on an internal collector road network accessing existing roads.

Such inefficient journeys for freight and increased congestion and delay will have a negative impact on climate change, with increased VKT and associated carbon emissions.

Therefore, these elements are all critical to the overall Pukekohe climate change response and cannot be eliminated.

4.11.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 .

Table Error! No text of specified style in document.**-29 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• While it would be possible to link traffic between southwest Pukekohe and SH22 via the existing road network (Helvetia Rd, Gun Club Rd, Beatty Rd and Heights Rd)

Reduction opportunity	DBC Response
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• While it was not possible to retain existing carriageway as there is no existing connection in place, embodied carbon emissions were considered as part of the option assessment process.
Staging	• Project should be phased in line with development of industrial area in order to remove freight traffic from Pukekohe town centre, reducing congestion and VKT for heavy vehicles.

4.11.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-22.

Table Error! No text of specified style in document.**-102 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Intersection efficiency	• Consider during detailed/implementation design how to maximise safety and active mode connections in all existing and proposed intersections – particularly in ensuring intersections cater for heavy vehicles while keeping active modes at a safe distance to promote mode shift.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Freight Priority	• At the implementation of this corridor, consideration should be given to priority measures for freight. This will reduce trip time and improve reliability for freight while deterring use by private vehicles. This is expected to reduce enabled carbon.

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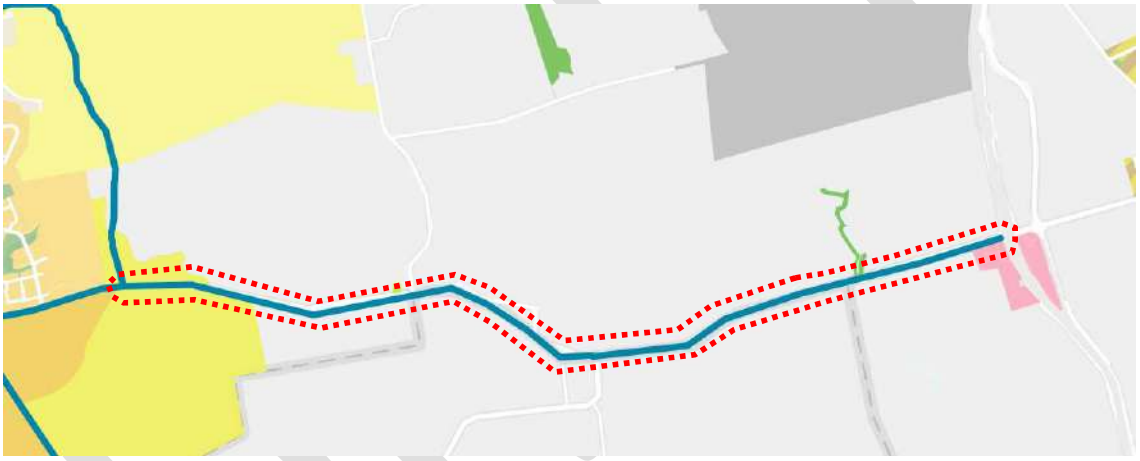
Optimisation action	Matters for further consideration
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible and cohesive network which will encourage mode shift.
Flooding optimisation	• Design should consider expected flood levels and adjust the vertical alignment in key locations to ensure the facility is available during flooding events.

4.12 Mill Road

Mill Road forms a primary east-west connection from SH1 to Pukekohe urban areas. This corridor is a strategic connection for traffic and freight, with a major rural active mode connection and has the potential to take on a State Highway function.



4.12.1 Can this project be eliminated?

The main intent of this project is to enhance safety and access to SH1 Bombay for strategic traffic, including freight, whilst also improving travel choice with active mode facilities where currently there are none. Upgrading this link will provide a strategic connection to SH1 as an alternative to the Drury-Pukekohe link and SH22 at Drury, especially from the Waikato and southern and eastern areas of Pukekohe. Existing form and function of Pukekohe East Road and Mill Road is not appropriate for the level of future growth anticipated, therefore without this improvement, traffic from the Waikato will be delayed accessing SH1 at Bombay or seek alternative routes, increasing pressure on other parts of the network and increasing VKT.

Therefore, these elements are all critical to the overall Pukekohe climate change response and cannot be eliminated.

4.12.2 Can GHG emissions be reduced?

The workshop explored a number of opportunities to reduce GHG emissions for the project which are detailed in Table **Error! No text of specified style in document.**-1 23.

Table Error! No text of specified style in document.**-23 Identified GHG Reduction Opportunities**

Reduction opportunity	DBC Response
Is there an alternative solution?	• Mill Road forms a primary east-west connection from SH1 to Pukekohe urban areas, playing an integral role in connecting freight and general traffic to the strategic road network and facilitating inter-regional trips. As this is the only direct east-west connection from Pukekohe town centre, any alternative solutions would either involve the construction of a new arterial route, the diversion of traffic north via Drury to access SH1 or a heavy displacement of traffic onto supporting regional roads which would quickly become overwhelmed. Due to its directness and existing capacity, it has been determined that there are no alternative solutions for increasing capacity for east-west movements.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement option assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied carbon and consideration of active mode facility form.	• All options were considered in terms of embodied carbon emissions as part of the route refinement process; however, it was concluded that there was no difference between the options.
Staging	• Project should be integrated with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects at western end, as well as with the proposed SH1 upgrade to create a cohesive and resilient local and regional road network. Strategic staging will relieve urbanised areas from strategic traffic, enhancing resilience and freight reliability and allowing alternative mode facilities to be enhanced.

4.12.3 Can these projects be optimised?

The main opportunities identified in the workshop for further optimisation of these facilities in future stages are detailed in Table 4-224.

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Table Error! No text of specified style in document.**-114 Optimisation actions identified**

Optimisation action	Matters for further consideration
Optimise timing	• The timing of this corridor is linked with the release of land and will only be required once development commences. • It will be important that the active mode facilities are in place at the beginning of development to support early mode shift and provide opportunities for individual developments to proactively connect to this active mode spine in their designs.
Reduction of embodied carbon through the detailed design process	• Through the detailed design process, consideration should be given to the projects embodied carbon including review of structures, materials used, and consideration given to reducing the project footprint.
Freight Priority	• At the implementation of this corridor, consideration should be given to priority measures for freight. This will reduce trip time and improve reliability for freight while deterring use by private vehicles. This is expected to reduce enabled carbon.
Active mode connections across the corridor	• Provision of high-quality active mode facilities along the length of the corridor to provide a safe, accessible, and cohesive network which will encourage mode shift.

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TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe
Appendix M: Staging Considerations

May 2023

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

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Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

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Acronym/Term	Description
AT	Auckland Transport
AUP	Auckland Unitary Plan
DBC	Pukekohe Detailed Business Case
Do-min	Do-Minimum Option
FUZ	Future Urban Zone
FULSS	Future Urban Land Supply Strategy
IBC	Pukekohe Indicative Business Case
MSM	Macro Strategic Model
SATURN	Meso-simulation modelling software package used for transport assessment – Simulation and Assignment of Traffic to Urban Road Network
Te Tupu Ngātahi	Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1 Introduction

1.1 Purpose

This report has been prepared to support the Pukekohe Detailed Business Case (DBC) and sets out considerations relating to the potential phasing of the transport projects identified in the Pukekohe DBC. This report will inform the development of the Financial Case for the Pukekohe DBC.

The implementation of projects within the Pukekohe area is highly dependent on the development of FUZ land and availability of funding to deliver the transport infrastructure. Critically, this assessment looks to identify interdependencies between projects and relationships between transport projects and land use as opposed to providing an accurate implementation timeframe.

1.2 Background

The IBC and DBC have identified the need for significant transport infrastructure to support the next 30+ years of growth in South Auckland and wider regional growth. The scale of growth is significant, and projects will have extended delivery timeframes staged over three decades.

The growth in the relevant Structure Plan areas (specifically Pukekohe-Paerata, and more broadly Drury-Opāheke) 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 the Southern growth areas is highly influenced by the proposed release of FUZ areas by Council through Plan Changes. The Council's proposed sequencing of land release is identified in the FULSS. There are known growth pressures from landowners 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.

While the considerations relating to the implementation of the Pukekohe DBC transport projects are heavily driven by assumptions around the land use roll-out, there are various other factors that may impact the staging of such projects. Specific triggers include legislation surrounding greenhouse gas emission reduction and adaptation to climate change, shift in investment priorities, cash-flow availability and protection and restoration of the natural environment. Due to the strategic nature of the Pukekohe arterial network, triggers might range from local to regional, with the development of the Pukekohe network acting as a trigger for development in some cases.

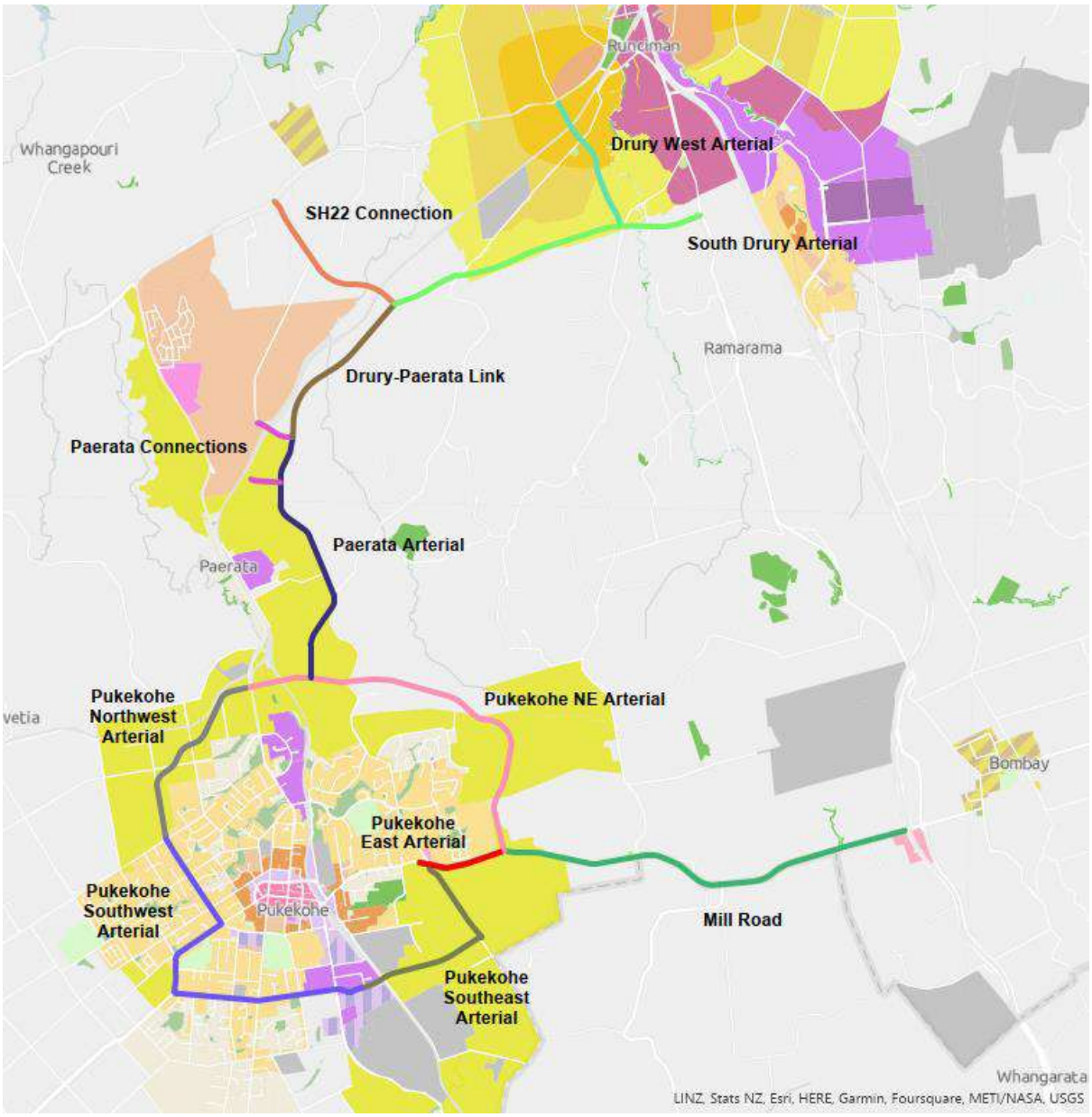
The expected timeframes for the future land use roll-out in the Pukekohe growth areas have initially been guided by Auckland Council's Future Urban Supply Strategy, released in July 2017 (FULSS), and the Pukekohe Structure Plan, adopted in 2019.

It should be noted that at the time of preparing this document, Auckland Council are developing an updated Future Development Strategy which is currently under consultation. While this document is yet to be approved, it has been reviewed internally and confirmed that any amendments to development timing will not have a negative impact on the Pukekohe DBC, and in some situations will align better. Therefore, it is not expected that the future release of this document will introduce a material change on Pukekohe DBC outcomes.

1.3 Scope of Projects

The corridors considered in the Pukekohe DBC are shown in Figure 1-1:

Figure 1-1 Pukekohe DBC Map



2 Land Use Sequencing

2.1 Future Urban Land Supply Strategy and Pukekohe Structure Plan

The Future Urban Land Supply was prepared by Council in 2017 and its primary purpose is to identify the sequencing and timing of future urban land for development readiness over 30 years. For the Pukekohe growth area this staging is shown in Figure 2-1.

Figure 2-1: Future Urban Land Supply Strategy (2017)

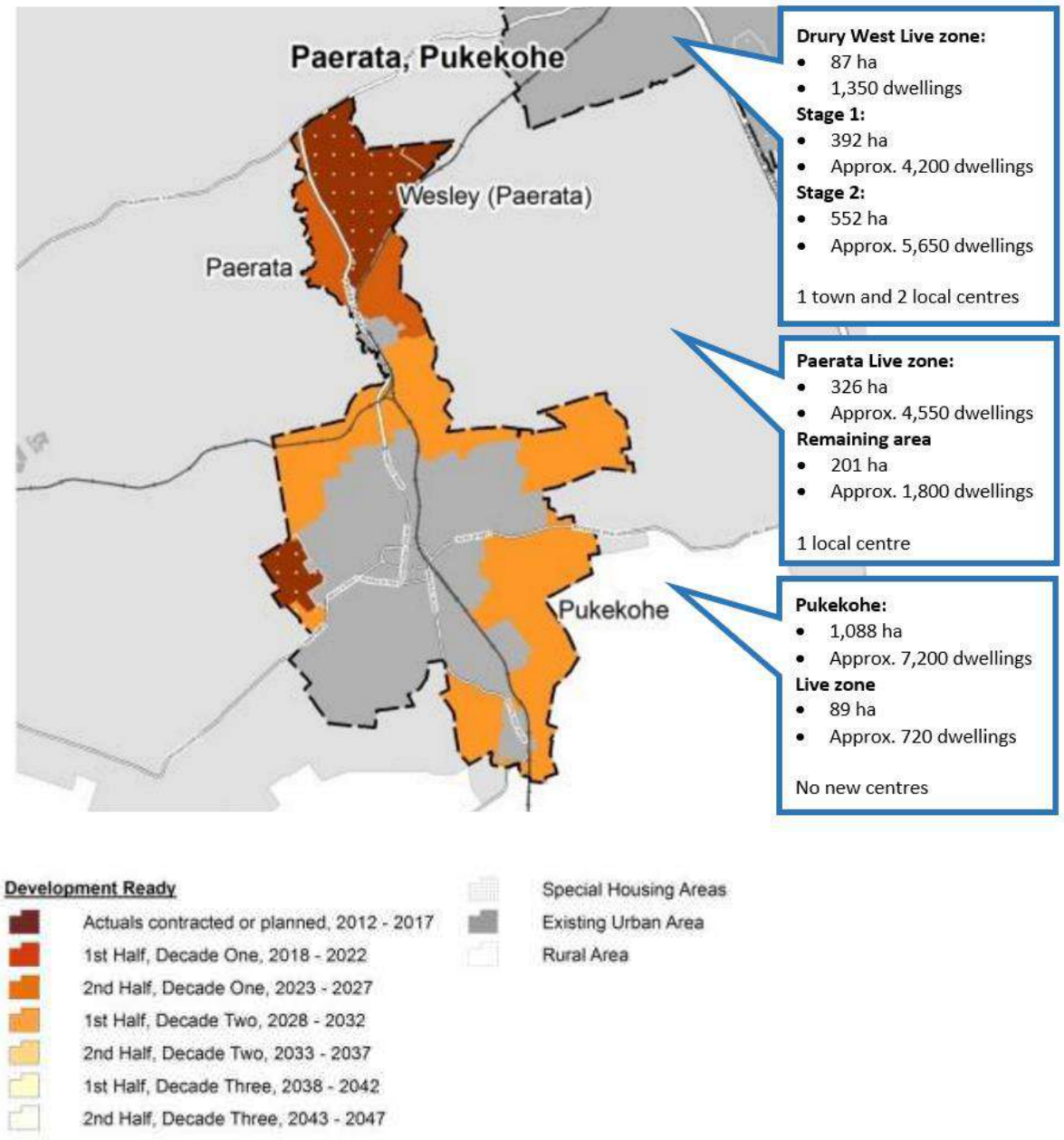


Table 2-1 compares the assumed staging of transport infrastructure for the Pukekohe growth areas based on the FULSS with the staging assumptions used to inform the transport modelling for the Pukekohe.

Table 2-1: Anticipated yield Comparison between Future Urban Land Supply Strategy and the Pukekohe-Paerata Structure Plan

Development Ready Date	Future Urban Land Supply Strategy (2017)	Pukekohe-Paerata Structure Plan (2019)
2017	5,270 dwellings	5,270 dwellings
From 2022	1,800 dwellings 1 local centre	Yields slightly lower than FULSS 2017 as a result of detailed assessments for structure plan 2019
From 2028	7,200 dwellings	Yields slightly lower than FULSS 2017 as a result of detailed assessments for structure plan 2019
Total	14,270 dwellings	12,522 dwellings

As part of the Structure Plan process a review of development staging was undertaken. In particular, Council gave consideration to land release timing for each area. Overall, no areas were identified to be bought forward. This was due to significant infrastructure funding issues combined with the wider Auckland compact city focus on redevelopment of brownfield areas and the higher priority greenfield areas in Auckland that would take any additional greenfield infrastructure funding before Pukekohe. These forecasted release periods are the same as that proposed in the Pukekohe Indicative Business Case.

2.2 Auckland Future Development Strategy

As mentioned above, Auckland Council are developing an updated Future Development Strategy which is currently under consultation. This document will supersede the existing Auckland Plan 2050 Development Strategy (2018) and the FULSS (2017). This document reviews Auckland's Development Strategy in relation to zoning and expected timeframes for development, resulting in associated amendments and impacts on programme.

There are five key strategic principles being considered as part of the strategy:

- Support greenhouse gas reduction
- Adapt to the impacts of climate change
- Make efficient and equitable infrastructure investments
- Protect and restore the natural environment
- Ensure sufficient capacity for growth in the right place and at the right time

The scope of development and associated programme have been reviewed and changed in accordance with one of the below:

- **Removal:** rezoning of areas to an appropriate non-urban zoning

- **Further investigation**: Areas with moderate exposure to hazards, infrastructure capacity issues, unlikely to support VKT reduction. Further analysis is needed to confirm the appropriate land use response
- **Delay**: to timing of anticipated development (compared to the previous Future Urban Land Supply Strategy)

This document has been reviewed internally in relation to the Pukekohe DBC package and confirmed that any amendments to development zoning and/or timing will not have a negative impact on the Pukekohe DBC, and in some situations will align better with the proposed staging principles. Therefore, it is not expected that the future release of this document will introduce a material change on Pukekohe DBC outcomes.

2.3 Modelled Land Use Forecasts

The transport modelling for the Pukekohe DBC has been informed by the i11 version 6 land use forecasts agreed with Auckland Council. These have informed the transport modelling using the regional transport model (the Macro Strategic Model (MSM)), as well as the Strategic Active Modes Model (SAMM) used for the assessment of the active modes demands. The outputs from the MSM have then been used as inputs to the SATURN based traffic models, which have more specifically considered the traffic effects.

A key input to the models is regional land use forecasts, which influence the future quantum and location of travel. Regionally agreed land use forecasts are prepared by Auckland Council via the Auckland Forecasting Centre (AFC), with the most recent available forecasts (at the time of this assessment), referred to as Scenario I11.6. Those forecasts are based on regional population forecasts from Statistics NZ, with spatial allocation to individual spatial areas based on the AFC's land use model and known detail around specific land use planning processes.

Error! Reference source not found. and **Error! Reference source not found.** summarise the assummed residential population and employment forecasts for the Pukekohe growth areas from i11v6. This included a 2048+ forecast year, which represents the 'full' build out of the growth areas sometime beyond 2048, depending on the longer term rate of growth.

Table 2-2: i11v6 Population Forecasts - Pukekohe Growth Areas

Population	2018	2028	2038	2048	2048+
Drury West	566	538	5,457	10,890	13,717
Paerata	449	7,063	12,821	14,065	22,525
Pukekohe	23,554	30,250	34,785	36,626	45,147
Other South	1,840	2,783	3,736	4,177	4,617
Total	26,409	40,634	56,798	65,757	86,006
% of 2048+	31%	47%	66%	76%	100%

Table 2-3: i11v6 Employment Forecasts - Pukekohe Growth Areas

Employment	2018	2028	2038	2048	2048+
Drury West	372	452	1,234	2,145	2,613
Paerata	285	770	1,269	1,337	2,113
Pukekohe	8,778	10,180	11,996	12,942	14,484
Other South	901	991	1,187	1,292	1,384
Total	10,336	12,393	15,685	17,715	20,594
% of 2048+	50%	60%	76%	86%	100%

It is acknowledged that land use forecasts have inherent uncertainty, in terms of the rate of new growth in specific areas. Currently, there is additional uncertainty around the likely outcomes and rate and location of higher-density development sought through central Government policies such as the National Policy Statement on Urban Development (NPS-UD) and Auckland Council's Plan Change 78. A key intent of those policies is to enable higher density development, especially around high-quality public transport systems. The specific planning response to those policies is currently being progressed by Auckland Council, and revised land use forecasts reflecting any expected changes were not available at the time of preparing this assessment. Generally, it is considered that this Project is not inconsistent with such policy direction, regarding supporting higher density urban development via more sustainable travel modes. Given this context, the use of those available I11.6 forecasts is considered acceptable for this assessment. Also, it is noted that the forecast sequencing is generally consistent with that of the Future Urban Land Supply Strategy and the Pukekohe Structure Plan.

Overall, the proposed transport infrastructure identified in the recommended network is expected to be sufficient to accommodate the projected growth and is flexible enough to respond to changes in land use projections including increased density and changes in timing. It is noted that increased housing density will further support the viability of bus and train services across Pukekohe-Paerata.

2.4 Auckland Regional Land Transport Plan (RLTP)

The Regional Land Transport Plan (RLTP) is a parallel workstream, with a 10-year investment programme for transport in Auckland, developed by Auckland Transport (AT) together with the New Zealand Transport Agency (NZTA) and KiwiRail to respond to growth and challenges facing Auckland over the next decade.

The RLTP acknowledges Auckland's challenges linked to accommodate rapid population growth that requires accelerating the construction of housing and business development including the Drury/ Pukekohe/Paerata areas. The RLTP includes an investment programme staged between 2018– 2028.

2.5 New Zealand Upgrade Programme (NZUP)

The New Zealand Upgrade Programme is a parallel workstream that reflects the Government's balanced transport policy with $6.8 billion being invested across road, rail, public transport and walking and cycling infrastructure across New Zealand. The upgrade programme includes transport

infrastructure in six main growth areas – Auckland, Waikato, Bay of Plenty, Wellington, Canterbury, and Queenstown.

The package provides for more frequent and better public transport and building safe, new walking and cycling paths. The committed planned transport networks relevant to Pukekohe DBC can be summarised as follows:

- Proposed rail stations in Drury West and Paerata. These rail stations are included in the New Zealand Upgrade Programme (NZUP) and construction is planned to start in 2023 and be completed by late 2024/25.
- SH1 Papakura-to-Bombay Upgrade providing more north-south regional capacity.The South Auckland Package includes upgrades on Waihoehoe Road and SH22 to support the urbanisation in Drury West and Drury East.

The New Zealand Upgrade Programme will trigger a range of different considerations linked to growth. More notable, accelerating the 'development ready' status of the future planned urban zones.

3 Transport Staging Considerations

3.1 Principles

Due to the uncertainty regarding the timing and form of specific land use activities, a principle-based approach is regarded as the best way to manage and deliver the desired transport and land use outcomes consistently. This recognises that staging in many cases will either be determined by regional, inter-regional and local priorities, which rely on the scale and rate of growth.

A set of key principles has therefore been applied, which links staging to broader strategic goals regarding travel demand management and modal shift. These principles will ultimately deliver the following desired transport and land use outcomes for Pukekohe:

- Immediate shift to more sustainable travel choices by integrating with and prioritising public transport (new stations and PT routes) and active mode interventions early.
- Manage adverse impacts of development on the wider system.
- Support the desired urban form, in particular higher density, quality urban environments.
- Recognise the need to support both place and movement function.
- Provide affordable staging plans that match expected land development.
- Protects space for longer terms needs.

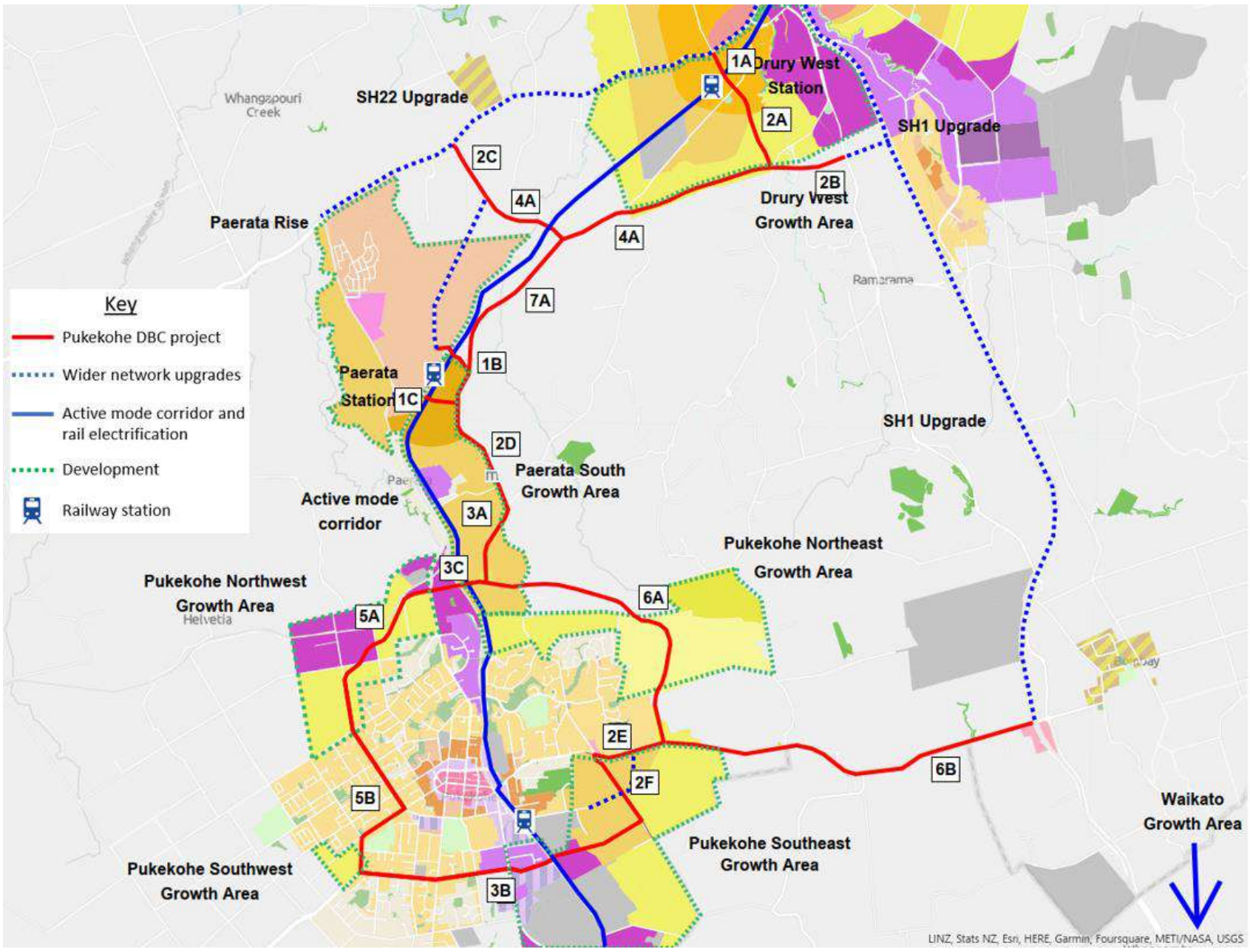
The suggested principles for staging are:

- Prioritise facilities that are on existing, brownfield corridors to enable the network to immediately receive and connect with the new greenfield developments.
- Programme public transport and active mode facilities and services from the start of urban development to support a shift to more sustainable travel.
- Consider potential interrelationships between transport projects to achieve overall outcomes.
- Consider potential interrelationships with surrounding growth areas.
- Consider staging of elements of a project to match likely development stages and system needs, whilst also considering pathways to achieve the full built elements.
- Consider the needs to support place function, not solely movement function.
- Provide safe travel by all modes.
- Staging that can respond to the timing, scale and form of urban development.

3.2 Proposed Staging

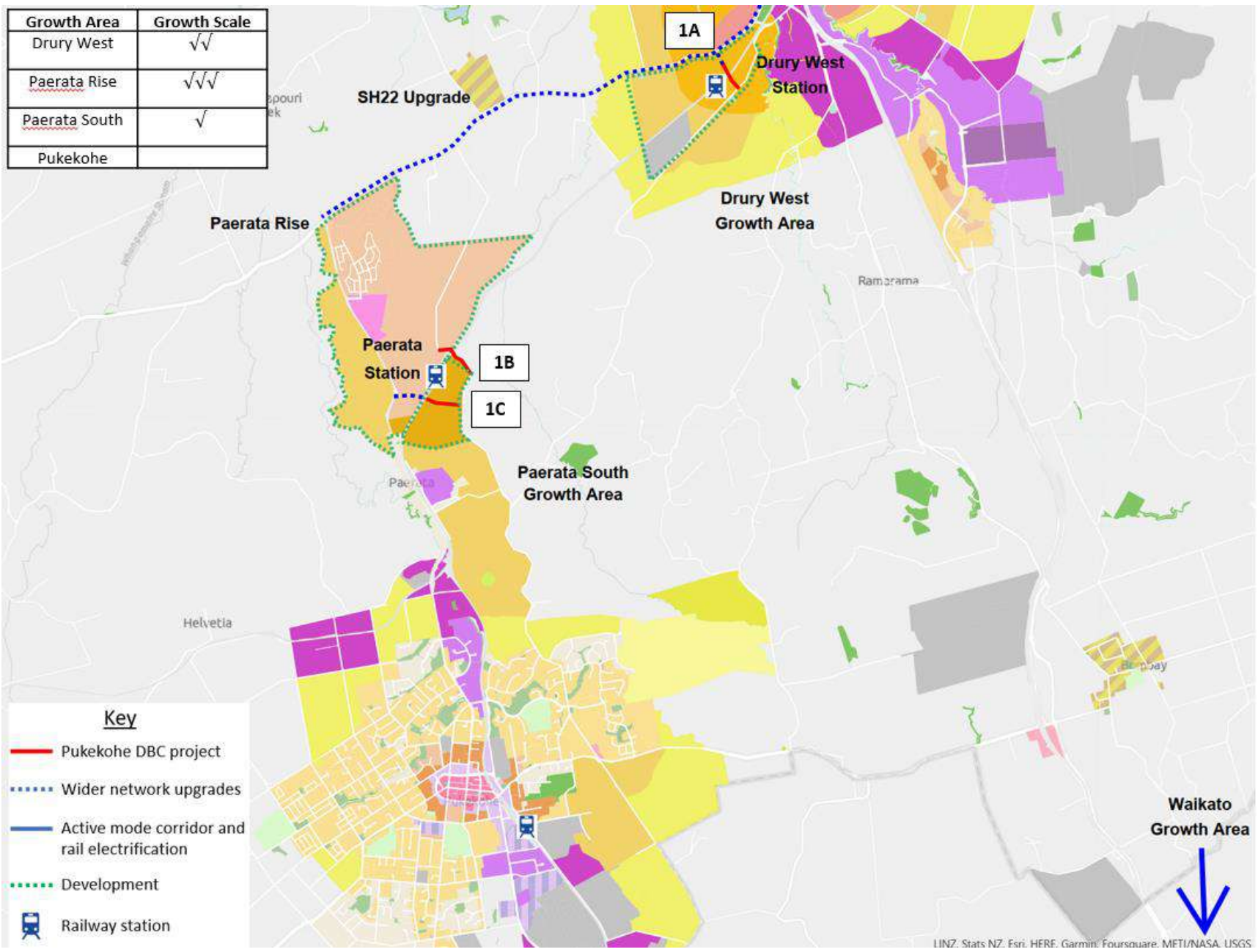
The proposed staging is illustrated in the following plans and followed by Table 3-1 which details the intended implementation timeframe, rationale and associated risks and opportunities The proposed staging has been reflected in the transport modelling undertaken to inform the economics analysis and will also be used within the financial case of the Pukekohe DBC. The staging was considered with Auckland Transport and Waka Kotahi team members to ensure that any identified wider organisational considerations were accommodated. Overall, the land use staging is generally consistent with earlier work completed as part of the Future Urban Land Supply Strategy and the Pukekohe Structure Plan. The implementation and staging of transport projects within these forecasted timeframes have been adjusted to take advantage of opportunities to support desired outcomes.

Overview

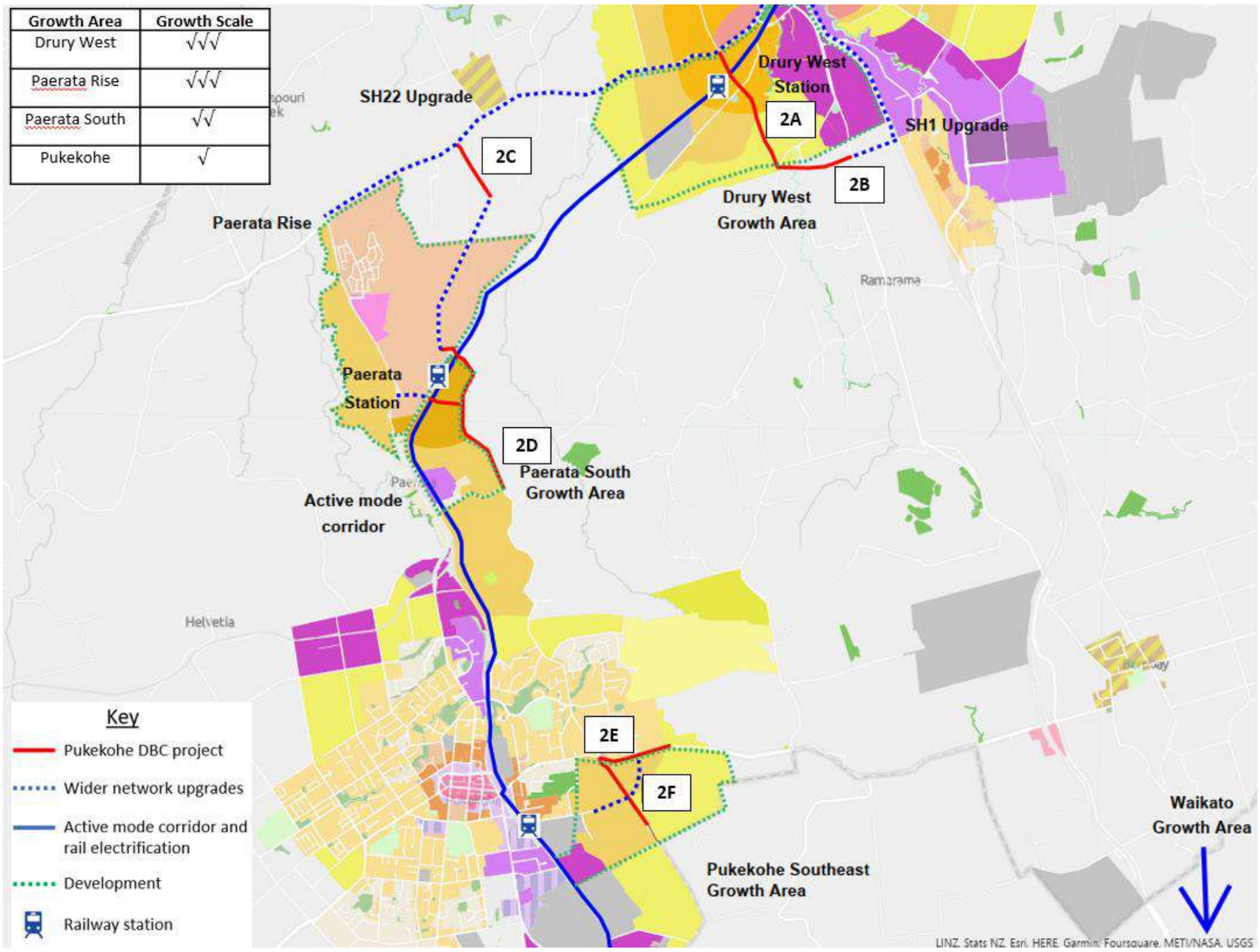


Stage 1

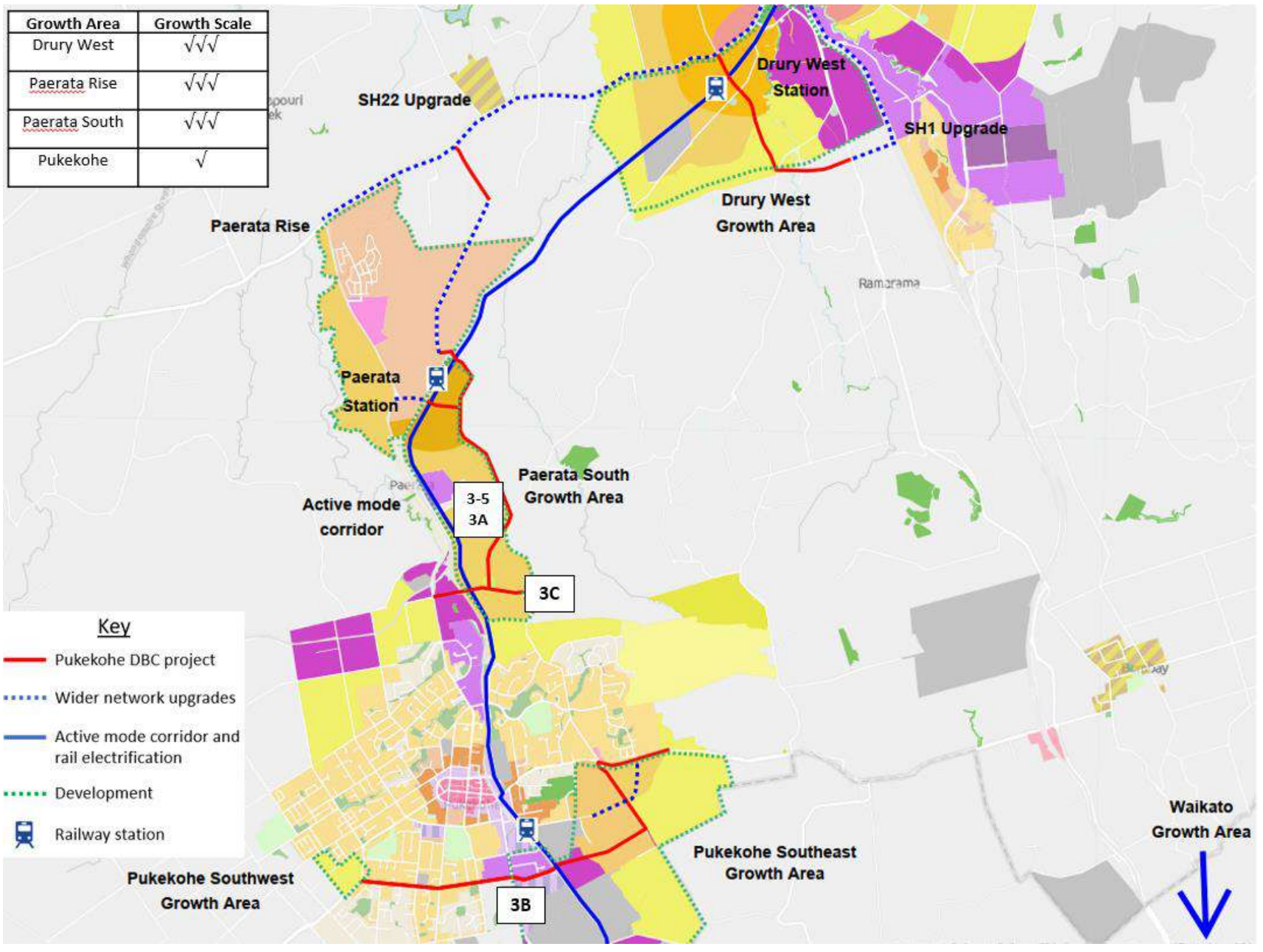
Growth Area	Growth Scale
Drury West	√√
Paerata Rise	√√√
Paerata South	√
Pukekohe	



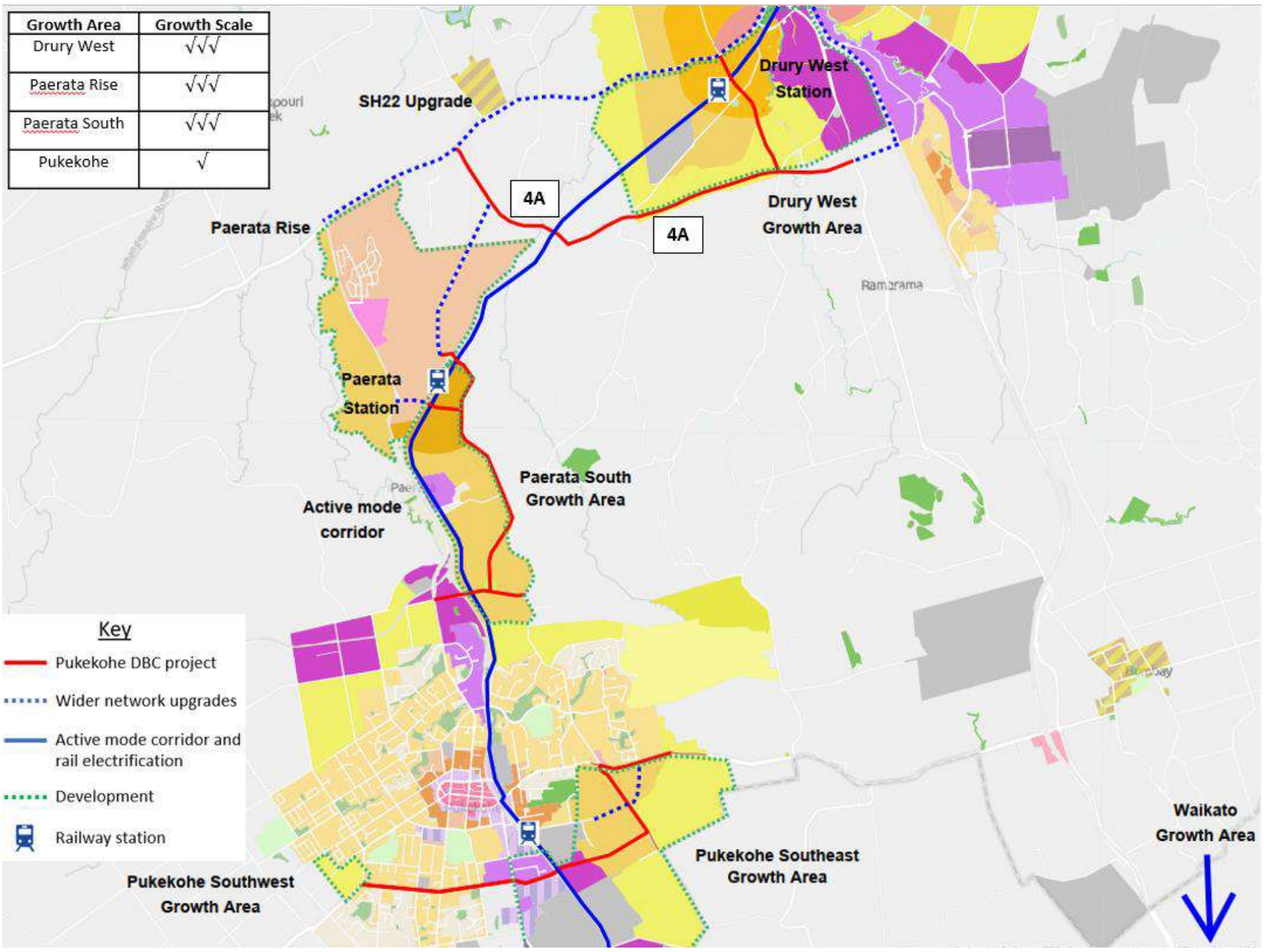
Stage 2



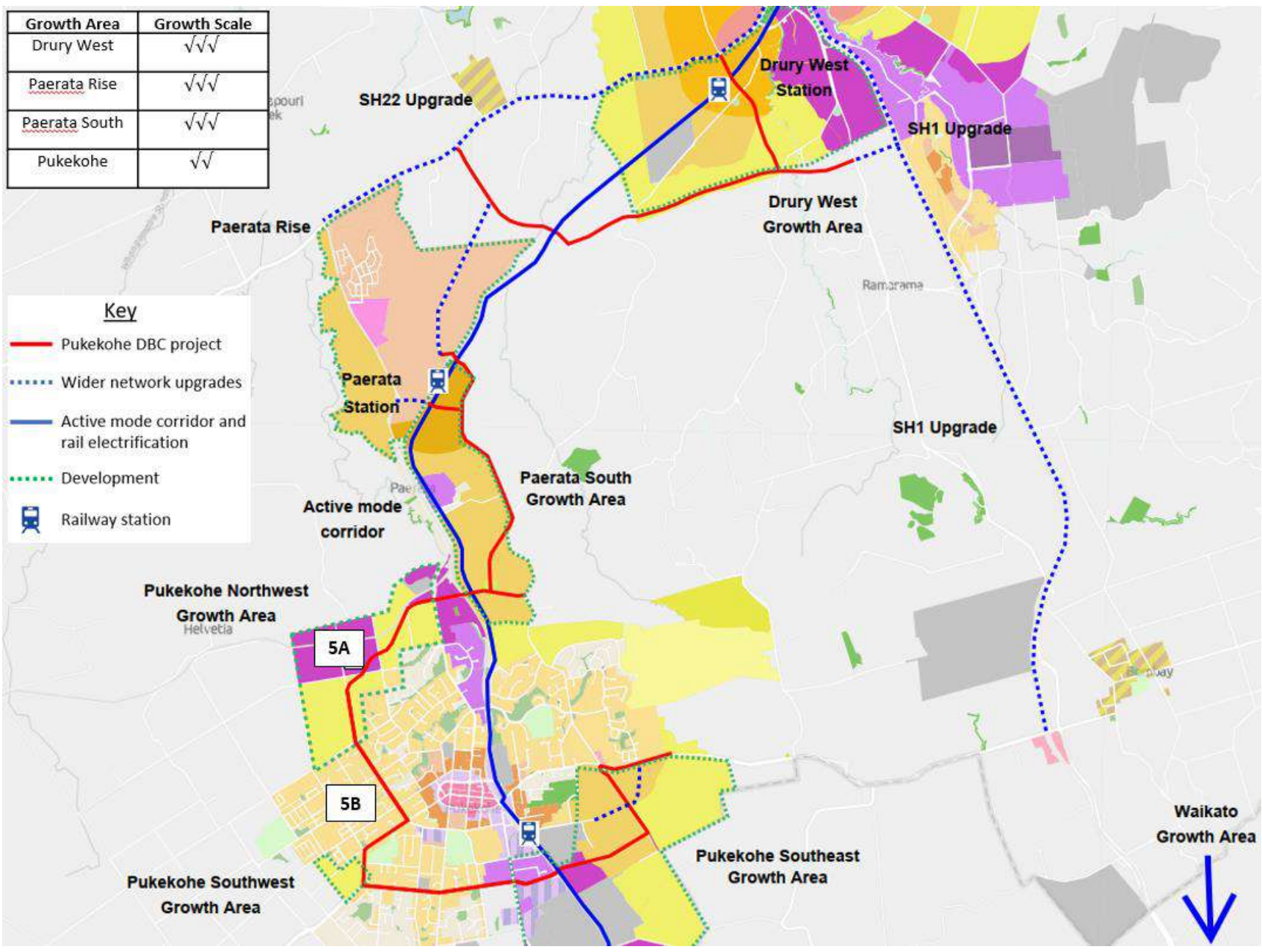
Stage 3



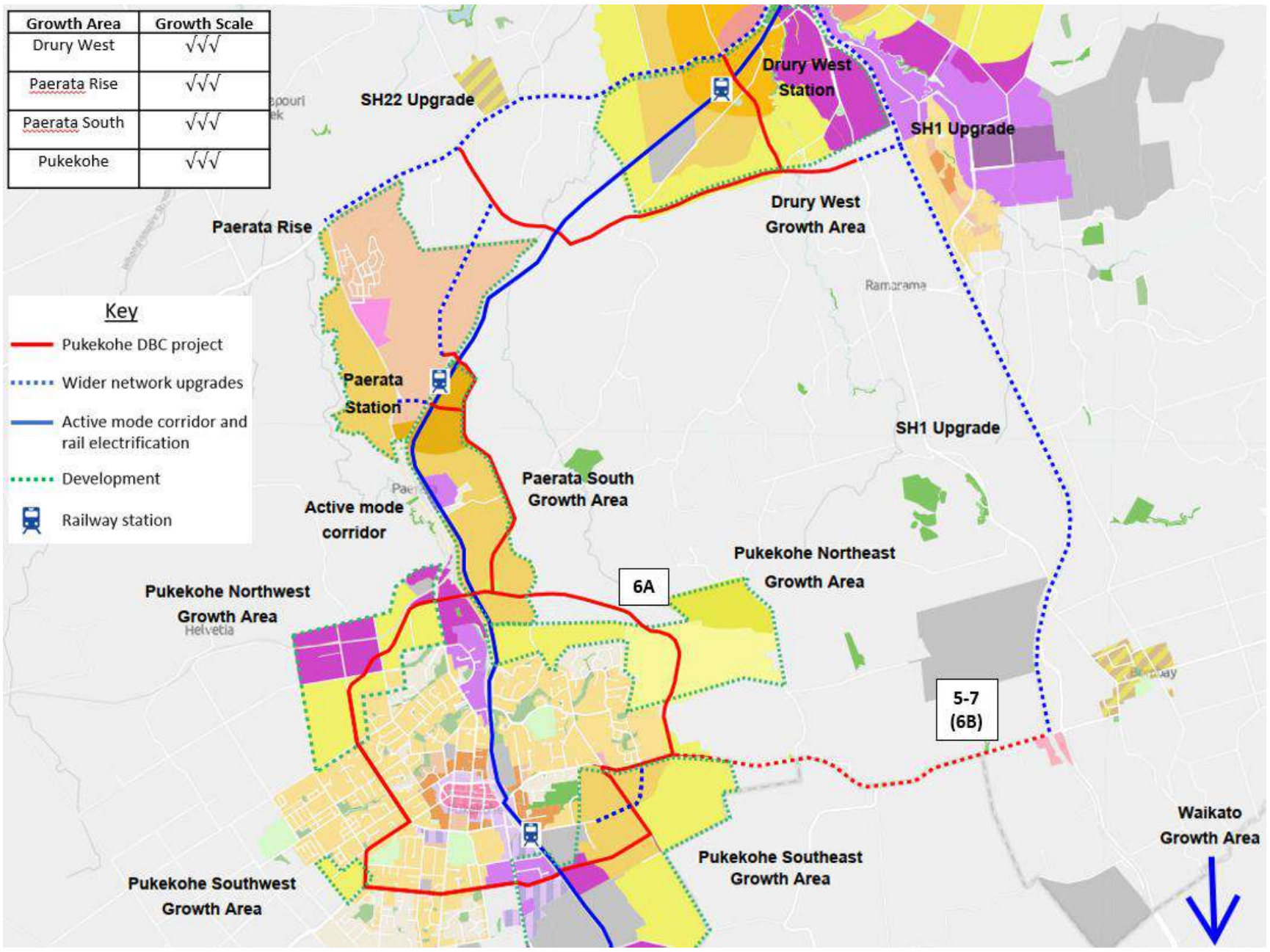
Stage 4



Stage 5



Stage 6



Stage 7

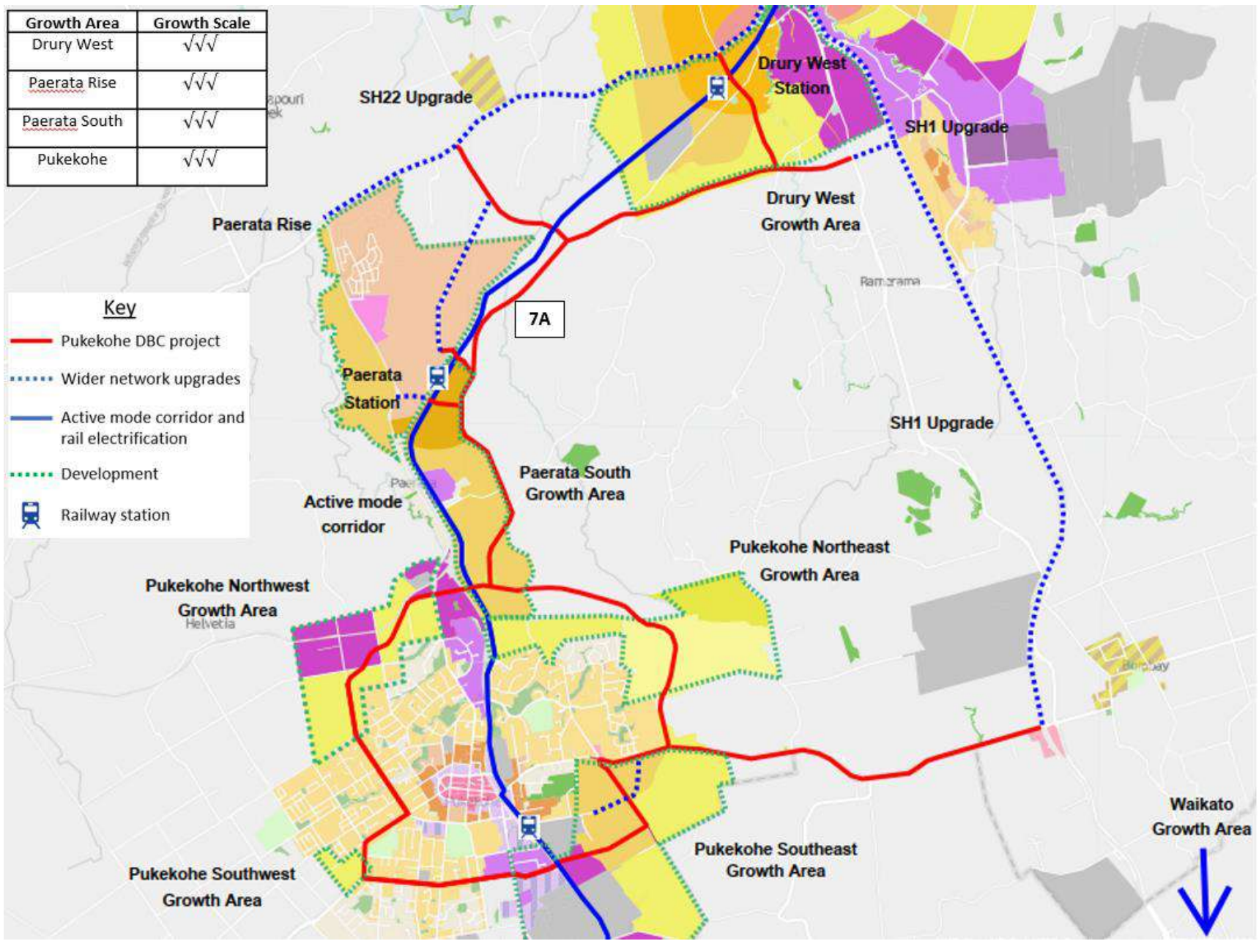


Table 3-1 summarises the staging of the Pukekohe projects as well as the intended implementation timeframe, rationale and associated risks and opportunities, with each ID corresponding to Figure 3-1 below.

Table 3-1 Proposed staging for Pukekohe DBC

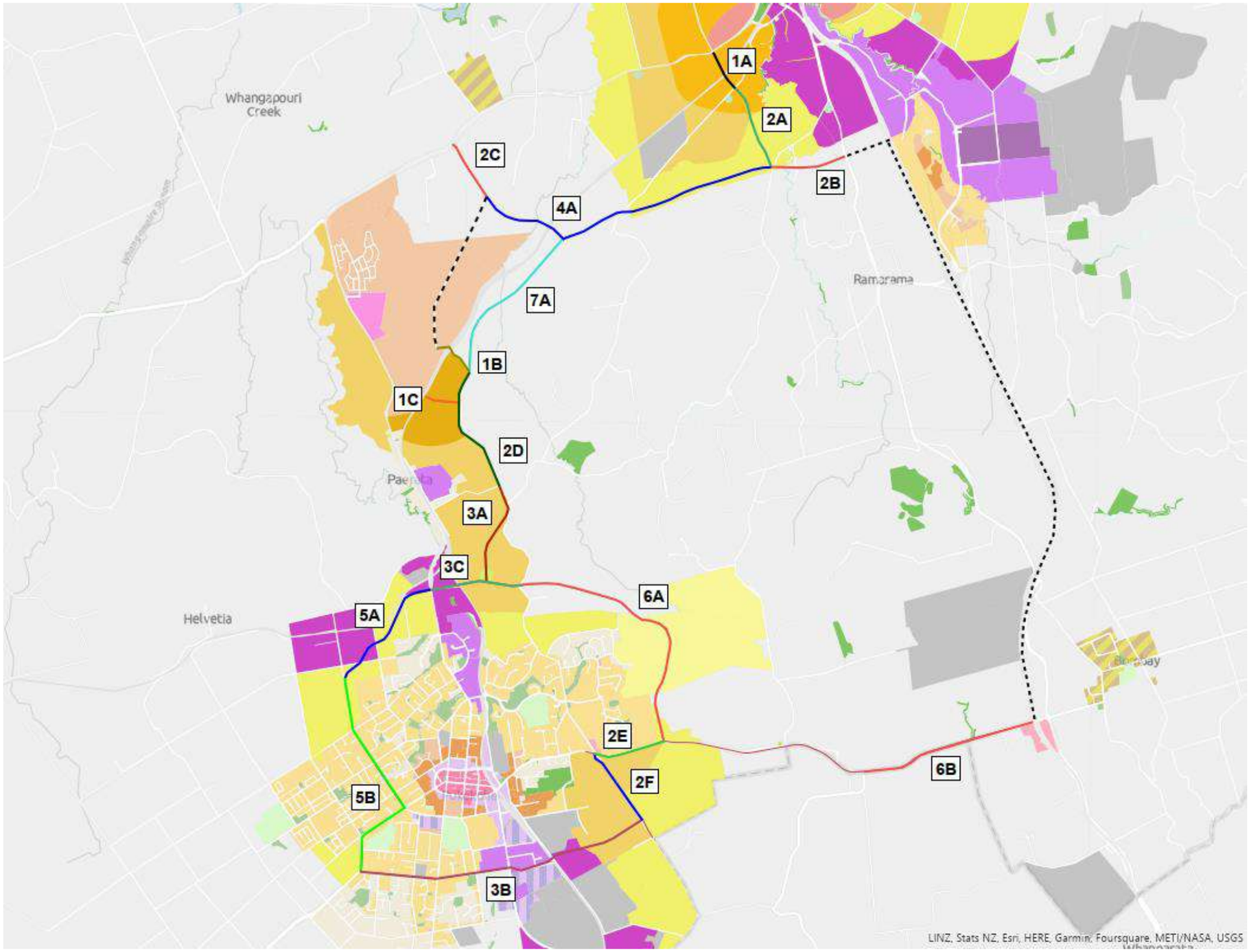
Transport Project	ID	FULSS / Pukekohe Structure Plan Staging	Pukekohe DBC Model Scenario	Implementation	Rationale	Risks/Opportunities
Stage 1						
Drury West Arterial (from Jesmond Road intersection to Burtt Road incl. Drury West park n' ride intersection and Burtt Road roundabout)	1A	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the release of land in Drury West. • Follows implementation of the Drury West Rail Station and park and ride. • The early implementation supports emissions reduction by enabling efficient PT network and mode shift from outset of development. • Support a shift to more sustainable travel.	• Delayed or early land release would influence staging of the Drury West Arterial and affect access to the proposed Drury West station • Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Project completion subject to NZUP funding • Station Access Benefits
Sim Road to Sim Road connection / bridge	1B	2018 - 2022	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the completion of Paerata Rise and the release of some land in Paerata South. • Follows implementation of the Paerata Rail Station. • Support a shift to more sustainable travel by improved station access. • Completes a Sim Road to Sim Road across the NIMT to increase connectivity over the NIMT to improve station access, provide an additional crossing and relieve future vehicle through movements past the Paerata Rail Station and connect directly to the Paerata Rise development. • Relieves urbanised areas from strategic traffic, enhancing resilience and allows alternative mode facilities to be enhanced and safety improved.	• Early implementation will be highly beneficial to the road network and supporting planned communities, particularly active transport connections. • Delay in implementation could have significant impacts on access to Public Transport and local centres as well as additional congestion on SH22.
Paerata Station Road to Sim Road (including roundabout at Sim Road)	1C	2023 - 2027	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the completion of Paerata Rise and the release of some land in Paerata South. • Follows implementation of the Paerata Rail Station. • Support a shift to more sustainable travel by improved station access. • Completes a connection from SH22 to Sim Rd, connecting to Paerata station, Paerata Rise Development and local centres. • Relieves urbanised areas from strategic traffic, enhancing resilience and allows alternative mode facilities to be enhanced and safety improved.	• Delayed or early land release would influence staging of the Drury-Pukekohe Link and affect access to the proposed Paerata station and the planned Paerata Rise development • Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Project completion subject to NZUP funding
Stage 2						
Drury West Arterial (from Burtt Road roundabout to Runciman Road)	2A	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the completion more development in Drury West. • Follows implementation of the Drury West Rail Station and park and ride. • The early implementation supports emissions reduction by enabling efficient PT network and mode shift from outset of development.	• Delayed or early land release would influence staging of the South Drury Arterial (from Great South Road to Runciman Road) • Early implementation subject to completion of the Waka Kotahi project linking SH22 to Great South Road

Transport Project	ID	FULSS / Pukekohe Structure Plan Staging	Pukekohe DBC Model Scenario	Implementation	Rationale	Risks/Opportunities
South Drury Arterial (from Great South Road, excluding GSR roundabout, to Runciman Road)	2B	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the completion of development in Drury West. • Follows implementation of the Drury West Rail Station and park and ride. • The early implementation supports emissions reduction by enabling efficient PT network and mode shift from outset of development. • Completes SH22 Connection / South Drury Arterial link to great South Road and future SH1 interchange at Drury South delivered through P2B Stage 2.	• Subject to implementation of both Drury West Arterial and the Waka Kotahi project linking SH22 to Great South Road • Delayed or early land release would influence staging of the South Drury Arterial (from Runciman Road to Burtt Road)
SH22 Connection (from Sim Road to Drury Paerata Link)	2C	rural	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to Paerata Rise and the release of land in Paerata South. • Follows implementation of the Paerata Rail Station. • Enhance resilience and improved safety.	• Rely on Paerata Rise development, creating an opportunity for integration with developer to require infrastructure as part of the suite of mitigation effects • Opportunity to alleviate congestion off SH22 by improving connectivity for local trips, however it is interdependent on the provision of a link between the Sim Roads.
Paerata Arterial (from roundabout at Sim Road to roundabout at Cape Hill Road)	2D	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the completion of Paerata Rise and the release of land in Paerata South. • Follows implementation of the Paerata Rail Station. • Completes north-south link between Sim Road and Cape Hill Road • Support adjacent urbanisation	• Early implementation will be highly beneficial to the road network and supporting planned communities • Delay in implementation could have significant impacts on the planned development surrounding Paerata • Opportunity for integration with Paerata station to improve accessibility and integration while encouraging mode shift from private vehicles • Opportunity for integration with developer or Plan Change plans to require infrastructure along western edge as part of the suite of mitigation effects
Pukekohe East Road upgrade (Golding Road to NE arterial)	2E	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to development in Southeast Pukekohe. • Existing arterial section from the north-eastern ring road to Belgium Road. • High east-west function for general traffic and freight and will accommodate buses and active modes. • The early implementation supports emissions reduction by enabling efficient PT network and mode shift from outset of development. • Support adjacent urbanisation and improved access to Pukekohe Station	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Implementation supports emissions reduction by enabling efficient PT network and active mode network causing mode shift from outset of development. • Opportunity to enhance freight resilience and connectivity
South-east arterial (Golding Road)	2F	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to development in Southeast Pukekohe. • Creates link between the new connection over the rail bridge and Pukekohe East Road via Golding Road • Plays an important role in connecting current and future light industry zones around south Pukekohe, as well as freight through traffic, to SH1 at Bombay • Support adjacent urbanisation and improved access to Pukekohe Station	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Implementation supports emissions reduction by enabling efficient PT network and mode shift from outset of development. • Provision of this link will enhance freight resilience and connectivity
Stage 3						

Transport Project	ID	FULSS / Pukekohe Structure Plan Staging	Pukekohe DBC Model Scenario	Implementation	Rationale	Risks/Opportunities
Paerata Arterial (from Cape Hill Road roundabout to roundabout at north-east arterial)	3A	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to development in Paerata South. • Completes north-south link between Sim Road and Cape Hill Road, providing access for all modes. • This link provides good strategic access, connectivity and resilience, particularly for general traffic and freight.	• Early implementation will be highly beneficial to the road network and supporting planned communities • Delay in implementation could have significant impacts on the planned development surrounding Paerata • Opportunity for integration with developer or Plan Change plans to require infrastructure along western edge as part of the suite of mitigation effects • Rely on project 3C below to provide continous access to Pukekohe East and West.
South-west arterial (Puni Road to Golding Road, including new railway bridge)	3B	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to more development in Southeast Pukekohe. • Links Golding Road to Puni Road in Pukekohe. It is a primary east-west road which helps in detracting general traffic and freight away from the town centre. • Allows alternative mode facilities to be enhanced and safety improved. • Provides a new bridge across the railway line, improving connectivity and resilience	• Implementation supports emissions reduction by enabling efficient active mode and PT network and mode shift. • Provision of this link will enhance freight resilience and connectivity • Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects in proximity to the southwest growth area
North-east Arterial (from SH22 to Cape Hill Rd)	3C	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to 3A and development in South Paerata, Pukekohe East Growth areas. • Completes a link between SH22 and Cape Hill Road, allowing for improved access to Drury-Pukekohe link and the surrounding growth. • Provides a new bridge across the railway line, improving connectivity and resilience for all modes.	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Implementation will be highly beneficial to the road network and supporting planned communities • Provision of this link will enhance freight resilience and connectivity for all modes • Delay in implementation could have negative impacts relating to climate change • Rely on project 3A below to provide continuous access to Pukekohe East and Paerata.
Stage 4						
South Drury Arterial (from Runciman Road to (and including) SH22 Connection up to Sim Road.	4A	2028 - 2032	2038	2028 - 2038	• The requirement for this infrastructure is strongly linked to the release of land in Drury West, Paerata Rise and Paerata South. • Eases demand along SH22 through Drury West, along with enhanced safety and greater promotion of active modes. • Completes SH22 Connection / South Drury Arterial link to Great South Road and future SH1 interchange at Drury South delivered through P2B Stage 2. • Improve connectivity and resilience for general traffic and freight.	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Subject to implementation of both Drury West Arterial and the Waka Kotahi project linking SH22 to Great South Road • This link is only viable if the wider road network and associated growth is in place • Opportunity to alleviate congestion off SH22, however if it is implemented too early it may encourage car usage and increase VKT • Opportunity to alleviate congestion off SH22 and improve connectivity to the Paerata rise developments
Stage 5						
North-west arterial (Gun Club Road to SH22)	5A	2028 - 2032	2038	2038 - 2048	• The requirement for this infrastructure is strongly linked to development in Northwest Pukekohe growth area and the need to provide better connectivity with existing and planned growth areas. • Completes east-west link between SH22 and Gun Club Road, providing direct access to the proposed north-western industrial area	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Implementation will be highly beneficial to the road network and supporting planned communities • Provision of this link will enhance freight resilience and connectivity • Delay in implementation could have negative impacts relating to climate change

Transport Project	ID	FULSS / Pukekohe Structure Plan Staging	Pukekohe DBC Model Scenario	Implementation	Rationale	Risks/Opportunities
					• Improve access for all modes to access the strategic network and reducing congestion and VKT for general traffic and heavy vehicles.	• Risk with connection being implemented too early (where there is not significant enough population or pressure on the road network) resulting in increased private vehicle mode share and VKT
North-west arterial (Gun Club Road to Ward St)	5B	2028 - 2032	2038	2038 - 2048	• The requirement for this infrastructure is strongly linked to development in Northwest Pukekohe and the need for a more connected multimodal transport network. • Completes the north-western arterial link between Gun Club Road and Ward St • Provides an alternative link for general traffic and freight to access SH22 but is also an essential active mode and public transport corridor.	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Implementation will be highly beneficial to the road network and supporting planned communities, particularly the active mode networks • Provision of this link will enhance freight resilience and connectivity • Delay in implementation could have negative impacts relating to climate change
Stage 6						
North-east arterial (from Cape Hill Rd to Pukekohe East Rd)	6A	2028 - 2032	2038	2038 - 2048	• The requirement for this infrastructure is strongly linked to development in Northeast Pukekohe, as well as in Northwest Pukekohe and the need for better local access and more efficient general traffic and freight journeys. • Completes a link between SH22 to Pukekohe East Road • Relieves urbanised areas from strategic traffic, enhancing resilience and freight reliability and allowing alternative mode facilities to be enhanced and safety improved.	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects • Implementation will be highly beneficial to the road network and supporting planned communities • Provision of this link will enhance freight resilience and connectivity • Risk with connection being implemented too early (where there is not significant enough population or pressure on the road network) resulting in increased private vehicle mode share and VKT
Mill Road upgrade	6B	2028 - 2032	2038	2038 - 2048	• Strongly linked to wider growth in Pukekohe northeast, Pukekohe northwest, Pukekohe southeast, Pukekohe southwest and Waikato). Reliant on the completion of the SH1 upgrade being complete. • Upgrades link between Pukekohe town centre and SH1 • Integrates with the proposed SH1 upgrade to create a cohesive and resilient local and regional road network • Relieves safety pressure on rural roads	• Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects at western end • Implementation will be highly beneficial to the road network and supporting planned communities • Provision of this link will enhance freight resilience and connectivity • Risk with connection being implemented too early (where there is not significant enough population or pressure on the road network) resulting in increased private vehicle mode share and VKT
Stage 7						
Drury Paerata Link (SH22 Connection roundabout to Sim Road roundabout)	7A	rural	2048	2048+	• Follows the completion of all associated development and highway upgrades in Pukekohe, Drury West and Paerata. • Completes north-south link between Pukekohe, Paerata, Drury West, SH1 and Drury-Opaheke. • Final connection staged to drive early mode shift and optimised use of existing infrastructure. • Relieves significant safety pressure on rural roads	• Implementation reliant on all other projects being in place • This link is only viable if the wider road network and associated growth is in place • Opportunity to alleviate congestion off SH22 and the wider network • Risk with connection being implemented too early (where there is not significant enough population or pressure on the road network) resulting in increased private vehicle mode share and VKT

Figure 3-1 Transport Projects



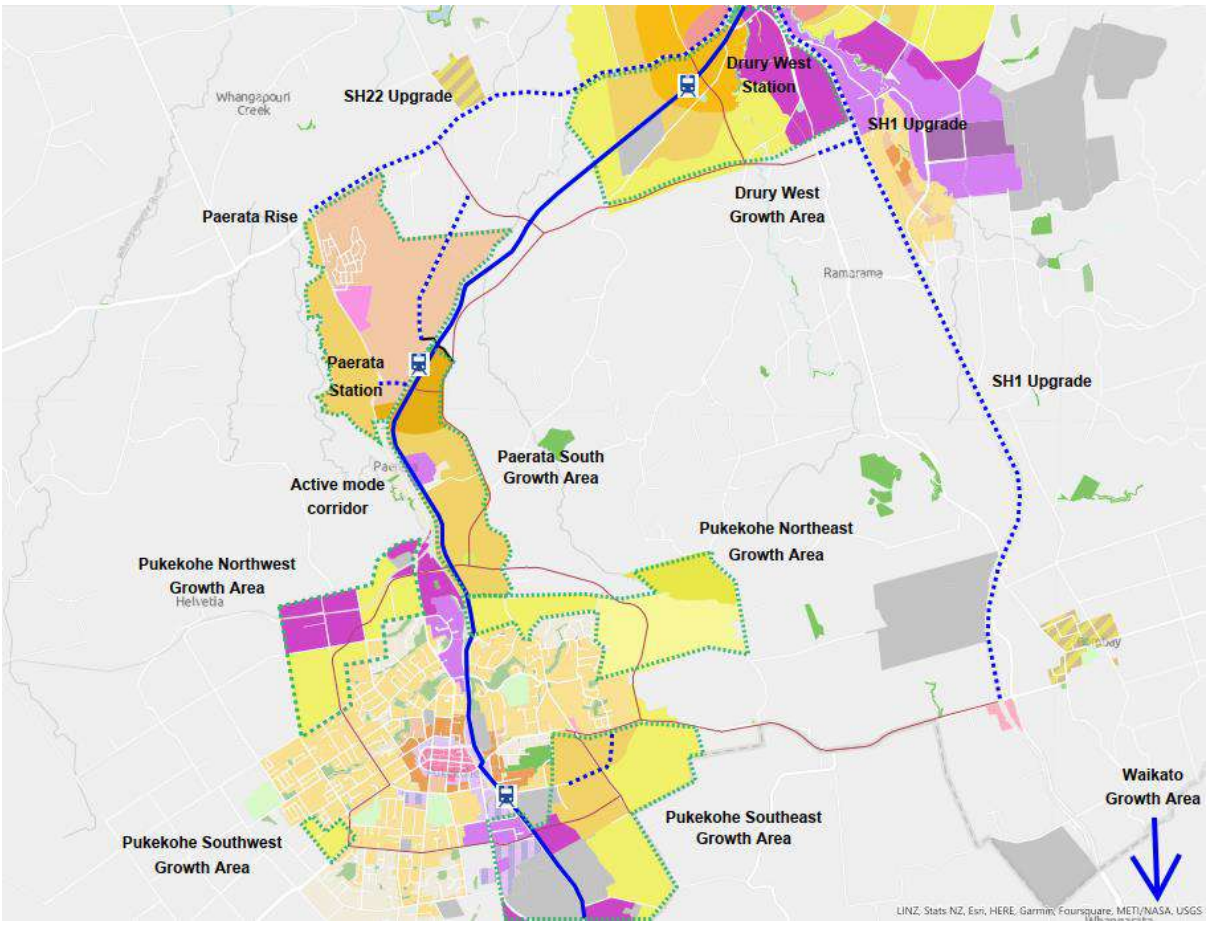
3.3 Staging Implications and Interdependencies with other projects

Given the scale transport infrastructure to be delivered in the next 30+ years of growth in South Auckland and wider regional growth, Pukekohe DBC has several interdependencies with other projects, particularly functional overlaps and staging considerations that influence effectiveness of transport and land use integration.

The sections below provide an overview of the interdependencies and relationships between Pukekohe projects and other Te Tupu Ngātahi and AT / Waka Kotahi Projects to provide clarity about short- and long-term integrated project planning.

The primary transport projects impacting Pukekohe DBC are shown in Figure 3-2 below.

Figure 3-2 Transport Projects Impacting Pukekohe DBC



3.3.1 Upgrades to Existing Corridors

There are several Waka Kotahi upgrades planned for the Paerata and Pukekohe area. These corridors will form key links to the proposed network and have the potential to shift travel patterns and have an impact of mode share. It is important that the Pukekohe DBC staging considers these projects, integrating their interdependencies into the overall strategy. These corridors include:

- SH1 Upgrade (SH22 South Interchange to Great South Road)

- SH1 Upgrade (Great South Road to Bombay Mill Road)
- SH1 to Great South Road link
- SH22 Upgrade

This investment is also less exposed to land use staging uncertainties as any investment in these corridors will provide significant benefit to existing communities, regardless of the timing of wider growth.

3.3.2 New Transport Interchanges at Paerata and Drury West

KiwiRail is working with partner agencies Auckland Transport and Waka Kotahi on creating a cohesive transport network in Southern Auckland for the anticipated population growth. Combined with KiwiRail's project to extend of electrification from Drury to Pukekohe, the three new stations are proposed between Paerata and Pukekohe. Two of these stations are located within the Pukekohe DBC project area:

- Paerata Station; and
- Drury West Station.

These stations will play an important role in improving public transport accessibility for the existing and future residents of Pukekohe, helping drive a mode shift away from private vehicles. It is vital that any projects which connect with these stations (mainly Paerata Connections and Drury West Arterial) and prioritised within the staging strategy to allow for improved accessibility and integration.

3.3.3 Proposed Future Urban Zone Areas

Future Urban Zones surround a large portion of the proposed network for Pukekohe DBC, primarily comprising of residential developments, some of which are already live zoned. These growth areas have been grouped as following:

- Drury West Growth Area
- Paerata Rise
- Paerata South Growth Area
- Pukekohe Northeast Growth Area
- Pukekohe Northwest Growth Area
- Pukekohe Southwest Growth Area
- Pukekohe Southeast Growth Area

It is important that the staging of the Pukekohe transport projects are linked to the release of available land to ensure maximum integration of transport facilities with the planned development. This will provide an opportunity to benefit from developer contributions to facilities and ensure mode shift from the onset.

3.3.4 Waikato Growth Areas

Along with the planned growth within Pukekohe, there will also be significant growth in existing urban communities in North Waikato. As a number of the projects within the Pukekohe DBC play a strategic, inter-regional role, it is likely that growth occurring in North Waikato will have an impact on these and therefore should be staged accordingly to provide for the additional inter-regional trips.

3.3.5 Regional Active Mode Corridor (AMC)

The South Auckland DBC recommended a strategic active mode corridor to achieve a high level of integration with existing and future land use and provide connectivity between new railway stations and the wider reginal cycle network.

The preferred alignment of this corridor runs from Pukekohe to Drury East, including interfaces with existing and proposed railway stations along the alignment.

The functional intent of this project is to provide a safe, direct, attractive and viable AMC which connects the future urban areas of Pukekohe, Paerata and Drury, as well as integrate with the wider walk and cycle network.

It is important that the staging of the Pukekohe transport projects, particularly the active mode elements are aligned with the provision of the AMC to ensure a cohesive and attractive facilitity that encourages mode shift. Active mode catchment and connectivity will be greatly enhanced by this corridor being implimented as early as possible, further justifying the rationale for the intented active mode upgrades on Pukekohe DBC corridors. Therefore, it should be a priority to have this corridor in place prior to development rollout.

3.3.6 Rail Electrification

Funding as part of NZUP has been allocated for an additional 15 electric trains to enable electric rail services to be extended to Pukekohe and to provide additional capacity on the rail network. Additionally, this will include outlining space for concrete platforms, forming the basis for the South Stations implemented through NZUP.

Rail electrification will remove the need for passengers to change trains at Papakura, increasing the attractiveness of public transport in the South. This has a direct interrelationship with station upgrades and four tracking and will imminently improve connectivity and transport choices imminently within the Pukekohe growth area.

It is important that the staging of the Pukekohe transport projects is staged in accordance with the rail electrification in order to provide for the increased train patronage associated with improved connectivity and travel time.

3.3.7 Pukekohe DBC Interdependencies

As shown above, the scale transport infrastructure to be delivered in the next 30+ years of growth in South Auckland and wider regional growth results in Pukekohe DBC having several interdependencies with other projects, particularly functional overlaps and staging considerations that influence effectiveness of transport and land use integration.

Table 3-2 provides an overview of the interdependencies and relationships between the Pukekohe DBC projects.

Table 3-2 Pukekohe DBC Project Interdependencies

Transport Projects	1A	2A	2B	4A	2C	7A	1B	1C	2D	3A	5A	5B	3B	2F	2E	6A	6B	3C
Location	Drury West Arterial	Drury West Arterial	South Drury Arterial	South Drury Arterial	SH22 Connection	Drury Paerata Link	Sim Road Connection	Paerata Connection	Paerata Arterial	Paerata Arterial	North-west Arterial	North-west Arterial	South-west Arterial	South-east Arterial	Pukekohe East Road	North-east Arterial	Mill Road	North-east Arterial
[1A] Drury West Arterial (from Jesmond Road intersection to Burtt Road incl. Drury West park n' ride intersection and Burtt Road roundabout)		√	√															
[2A] Drury West Arterial (from Burtt Road roundabout to Runciman Road)	√		√															
[2B] South Drury Arterial (from Great South Road, excluding GSR roundabout, to Runciman Road)	√	√																
[4A] South Drury Arterial (from Runciman Road to (and including) SH22 Connection up to Sim Road.	√	√	√		√													
[2C] SH22 Connection (from SH22 to Sim Road)				√			√											
[7A] Drury Paerata Link (SH22 Connection roundabout to Sim Road roundabout)	√	√	√	√	√		√	√	√	√	√	√				√	√	√
[1C] Sim Road to Sim Road connection / bridge					√	√			√									
[1C] Paerata Station Road to Sim Road (including roundabout at Sim Road)									√									
[2D] Paerata Arterial (from roundabout at Sim Road to rbt at Cape Hill Road)							√	√										
[3A] Paerata Arterial (from Cape Hill Road roundabout to roundabout at north-east arterial)							√	√	√									√
[5A] North-west arterial (Gun Club Road to SH22)												√	√					
[5B] North-west arterial (Gun Club Road to Ward St)											√		√					
[3B] South-west arterial (Puni Road to Golding Road, including new railway bridge)												√		√	√			
[2F] South-east arterial (Golding Road)													√		√			

Transport Projects	1A	2A	2B	4A	2C	7A	1B	1C	2D	3A	5A	5B	3B	2F	2E	6A	6B	3C
[2E] Pukekohe East Road upgrade (Golding Road to NE arterial)														√	√	√		
[3C] North-east arterial								√	√	√	√	√				√	√	
[6B] Mill Road upgrade													√	√	√	√		√
[3C] North-east Arterial (from SH22 to Cape Hill Rd)								√	√	√	√					√		

4 Alternative Staging Considerations

Careful consideration has been given to the development of an alternative staging scenario for the Pukekohe growth area.

The development of an alternative staging scenario is typically created in response to known funding constraints and to inform the feasibility and deliverability of land use release projections. The greatest benefit of testing alternative staging scenarios exists where large, strategic infrastructure has the ability to create significant liabilities to asset owners. This could include implications on property liability or peak cashflow demands for capital expenses. These have large consequences for planning and policy documents such as the Regional Land Transport Plan, Regional Public Transport Plan and the National Land Transport Plan.

While there are wider known funding constraints in the Auckland context, no alternative staging has been proposed for Pukekohe for the following reasons:

- Growth in Pukekohe has been sequentially staged and there appears to be a reasonable distribution of land use release across the projected growth periods to 2048, therefore no significantly critical funding pinch points have been identified.
- The staging principles discussed previously have enabled proposed staging to be congnisant of climate change principles, land use release implications and project interdependicies.

Overall, it is considered that the proposed staging scenario provides a realistic assumption of likely staging outcomes, and as such has been used to inform transport modelling, transport economics and financial forecasting within the Pukekohe DBC.

5 Summary

In reality there are a range of different drivers, parallel workstreams and triggers that will influence how the network staging will be delivered.

Due to the uncertainty regarding timing and form of specific and use activities, it is not feasible to develop a detailed stage by stage implementation plan. Further, this is not required for this Business Case, given its focus on identifiying preferred long term corridors, which will be subject to separate implementation decisions and project specific implementation business cases in the future.

Therefore, a principle based approach is regarded as the best way to manage and deliver the desired transport and land use outcomes consistently. There are ongoing land use development pressures in Pukekohe, which may in turn influence land use staging. As such, this report provides a summary of potential staging considerations, and reflects our limited current knowledge of land use activities. Therefore, the inherent nuances linked to interdependencies with other projects, longitudinal staging and land use activities should be frequently evaluated (with every modified Structure Plan, Plan Change etc) to ensure that optimum transport and land use integration is being achieved in the short, medium and long term. To assist in this process, an overview of key project interdepencies has been provided.

In summary, while the overall land use staging is consistent with earlier work completed as part of the Future Urban Land Supply Strategy and the Pukekohe Structure Plan, the implementation and staging of transport projects within these forecasted timeframes have been adjusted to take advantage of opportunities to support desired outcomes. In particular this assessment demonstrates that:

- There are opportunities to reinforce wider climate change and mode shift outcomes. In particular, a later implementation of Drury Paerata Link, combined with earlier delivery of active mode and walking and cycling focused projects can assist in driving change while managing for potential increases in private vehicle demands.
- There are a number of projects such as the links to both the Drury West and Paerata stations and the Sim-Sim link over the NIMT that are considered to be required earlier due to current live zoned land adjacent to the projects and imminent increased density provisions (Paerata Rise). As such planning to secure funding for these projects is considered a practical next step.