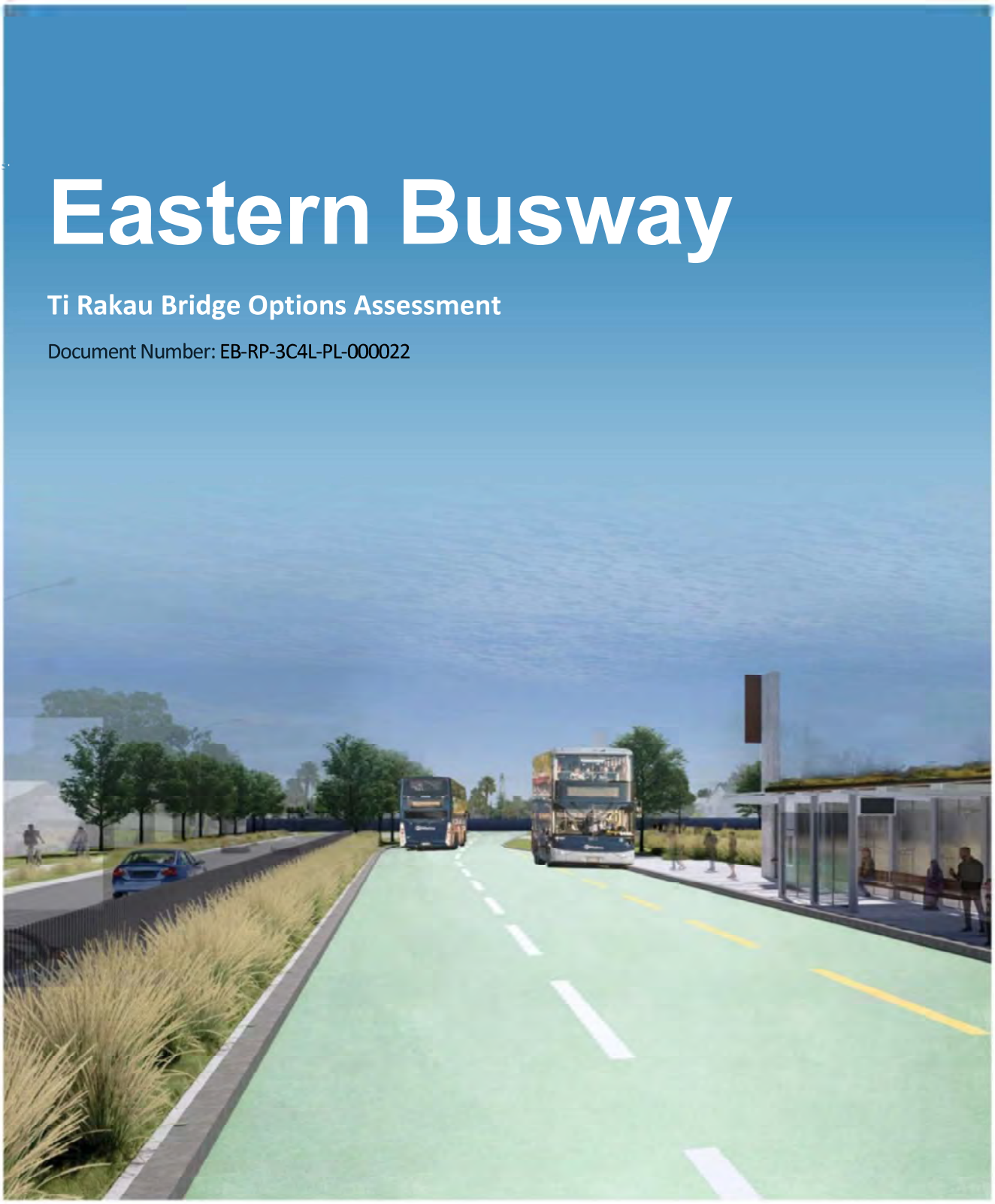
Appendix 34

Tī Rākau Drive Bridge Options Assessment

Eastern Busway

Ti Rakau Bridge Options Assessment

Document Number: EB-RP-3C4L-PL-000022



Eastern Busway

1 Contents

1. Introduction

This report outlines the option assessment work undertaken for Eastern Busway Ti Rakau Bridge in 2022 by the Eastern Busway Alliance (EBA). Several options have been developed and assessed against a range of factors to help determine the preferred option.

The Eastern Busway Project is part of the AMETI programme of initiatives to improve performance of the transport system in the East Auckland/Manukau area and to provide increased transport choices to support the existing and forecast growth in transport demand. A key initiative of the AMETI programme included a busway linking Panmure to Botany. Key initiatives completed to date include the Panmure Bus Rail Interchange and Eastern Busway 1 which connects Panmure Station to Pakuranga Town Centre.

d the wider Eastern Busway
ted to the east of Pakuranga
n Centre (connecting to EB4
on Drive).

Figure 1 provides a map of the Project and the surrounding area.

Figure 1 Project extent, including EB1, EB2, EB3 and EB4

For the assessment of alternatives for EB3, the Ti Rakau Drive corridor has been split into two, using Pakuranga Creek as the breakpoint. The section to the west of Pakuranga Creek is identified as EB3

Residential, and to the east of Pakuranga Creek as EB3 Commercial. With Ti Rakau Bridge considered separately.

To accommodate the busway, the crossing will be widened to allow for four general traffic lanes (two in each direction) and two lanes for the busway.

This report details the options assessment for Ti Rakau Bridge. The options assessment was undertaken using a multi-criteria assessment (MCA), with a range of technical specialists providing input into the process. The methodology used is consistent with previous MCAs undertaken for the Eastern Busway project, including EB1. Figure 2 shows the location of Ti Rakau Bridge.

Figure 2 – location of Ti Rakau Bridge (Source Map: AUP)

This report provides:

- A summary of the previous option assessments undertaken;
- A summary of the options considered for EB3;
- Details the option evaluation and MCA process; and
- The process undertaken by the Alliance Leadership Team (ALT) and Project Alliance Board (PAB) to select the preferred option.

2. Programme and Project Objectives

2.1. Programme Objectives

The overall AMETI Programme (which Eastern Busway is derived from) has overarching objectives that were agreed in a Memorandum of Understanding (MoU) by the former legacy programme partners on 1 February 2016. The overarching Programme Objectives identified were:

To secure the ability to implement and, in due course, to develop integrated multi-modal transport infrastructure within the Auckland-Manukau Eastern Transport Initiative which:

- Provides for sustainable movement of people, goods and services in a modern, planned and integrated manner;
- Provides connectivity between communities and businesses;
- Promotes economic development and the economic and social well-being of communities;
- Provides for Auckland's growth needs;
- Has a good urban design, a sense of place, physical safety, and environmental sensitivity; and
- Addresses travel demand requirements.

2.2. Project Objectives

The Eastern Busway Project has a set of clear objectives, which are integral when assessing alternative options for EB3. These Project Objectives are set out below and apply to EB3.

1. Provide a multimodal transport corridor that connects Pakuranga and Botany to the wider network and increases choice of transport options.
2. Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form.
3. Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centres.
4. Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network.
5. Provide transport infrastructure that is safe for everyone.
6. Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.

The following section provides background and overview of the processes, outcomes and assessment criteria used to undertaken previous option assessments for the Project.

2.3. Background and previous option assessments

Numerous investigations have been undertaken in the development of the Project. **Error! Reference source not found.**3 provides an overview of the investigations undertaken since 2014 whist Table 1 provides a summary of the identified outcomes.

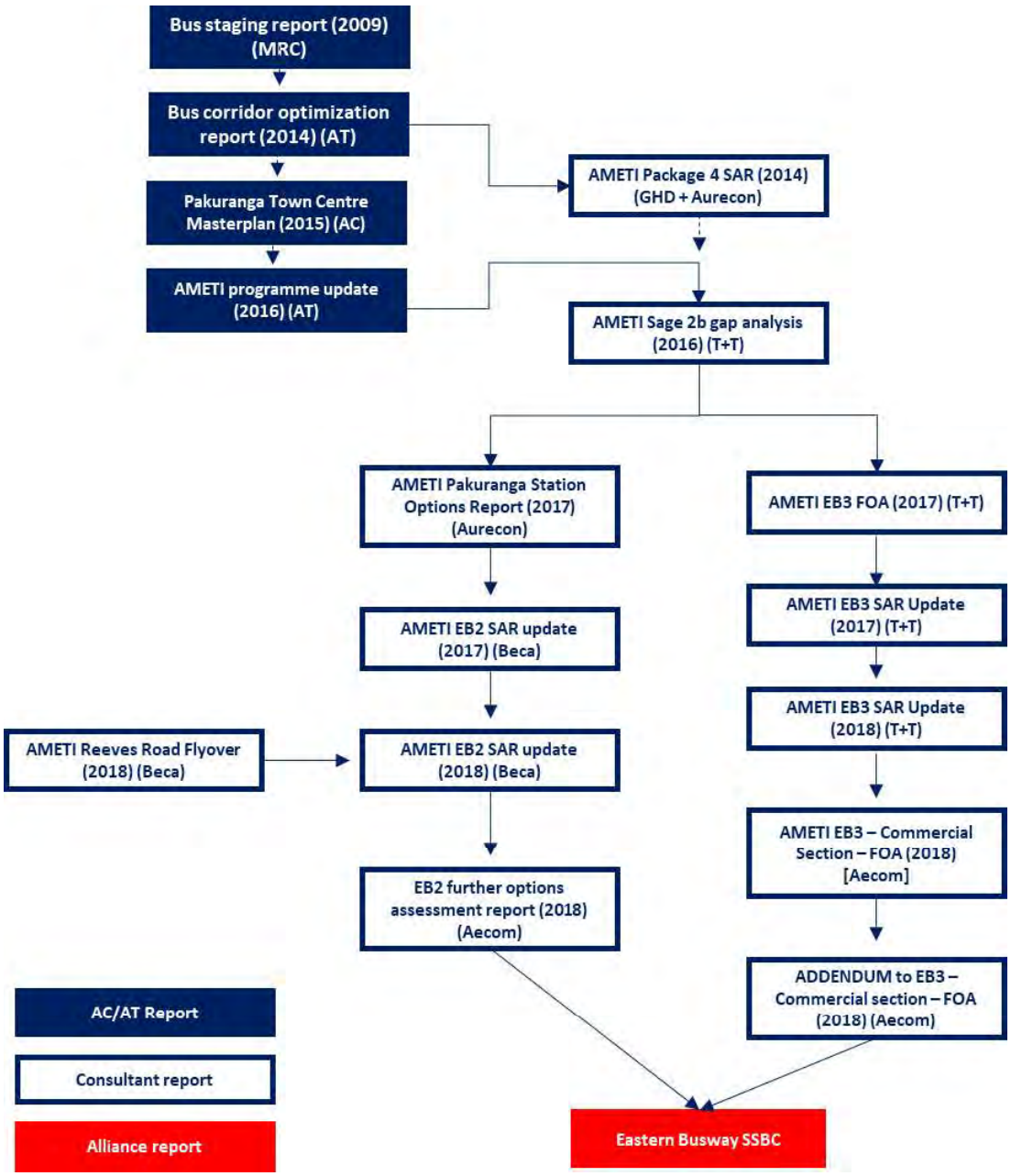


Figure 3 – Overview of Options undertaken since 2014.)

Table 1 Summary of previous investigations

Investigation	Outcome
Bus Staging Report (2009)	Identification of the form and function of the wider Auckland Rapid Transit Network.
AMETI Bus Corridor Optimisation Report (2014)	Development of the AMETI programme (including development of the 'do minimum' scenario) and initial programme cost estimate.
AMETI Package 4 Scheme Assessment Report (2014)	Developed the original scheme design and updated cost estimate.
Pakuranga Town Centre Masterplan (2015)	Auckland Masterplan outlining the vision for the development of Pakuranga Town Centre
AMETI Programme Update (2016)	Update to the AMETI project including development of programme problem and benefit statements and project objectives
AMETI Stage 2b GAP Analysis Report (2016)	Review of previous SAR and identification of aspects requiring further investigation
AMETI Pakuranga Bus Station Options Report (July 2017)	Development of 4 options for the development of the Pakuranga Bus Station. The Technical Preferred Option is Option 2 (lollipop design)
AMETI Eastern Busway 2 (Pakuranga Town Centre) - Scheme Assessment Update 2017	SAR update to reflect further option development and assessment undertaken.
***AMETI Eastern Busway 3 - Further Options Assessment (March 2017)**	**Development and assessment of 28 shortlist options for EB3. Identification of a Technical Preferred Option for each section** **This assessment included the consideration of different options for Ti Rakau Bridge.**
AMETI Eastern Busway 3 - Scheme Assessment Update Report (May 2018)	Updated SAR based on 2017 FOA. SAR documents construction considerations and specialist assessments
AMETI Eastern Busway 2 (Pakuranga Town Centre) - Scheme Assessment Update (May 2018)	SAR update included the identification and assessment of 21 longlist and 6 shortlist options. Identification of an emerging option
AMETI Reeves Road Flyover - Specimen Design Value Engineering Report (Feb 2018)	Identification and assessment 6 options for the design and construction of the Reeves Road Flyover. Identification an emerging option
AMETI Eastern Busway 2 - Further Options Assessment (Aug 2018)	Additional analysis and MCA assessment of EB2 options identified in May 2018 FOA. Options undergone minor alterations. Separate MCA on bus station location based on locations proposed in the 3 shortlist options. Technical preferred option is Option 3
Eastern Busway 3 Commercial Section - Further Options Assessment (Aug 2018)	Development and assessment of 3 shortlist options for the commercial section of EB3 to reduce impact on adjoining commercial properties. Option 1 is a refinement of the Technical preferred option in the 2018 EB3 SAR whilst options 2 and 3 are elevated structures. Option 1 identified as the emerging option.
ADDENDUM to Eastern Busway 3 Commercial Section - Further Options Assessment (2018)	Updates project risks, costs and consenting requirements

*Ameti Eastern Busway 3 Further Options Assessment (March 2017) – outcomes in respect of Ti Rakau Bridge MCA described in the next section.

2.4. AMETI Eastern Busway 3 - Further Options Assessment (March 2017)

The AMETI Further Options Assessment Report 2017 established that the northern side of the existing bridge is the preferred location for the extension of Ti Rakau Drive Bridge. The AMETI Further Options Assessment Report 2017 considered two options for the duplication of Pakuranga Creek Bridge:

- Northern bridge duplication (SLT11); and
- Southern bridge duplication (SLT12).

When considering the Pakuranga Creek bridge options, the MCA process undertaken for the AMETI Further Options Assessment Report 2017 resulted in very similar outcomes for both the northern and southern duplication options. Following the MCA workshop in December 2016, further work was undertaken in relation to property requirements for each of option. As a consequence of the greater property acquisition requirements for the southern bridge option, the AMETI Further Options Assessment Report 2017 identified the northern as being the preferred option.

The total number of properties affected for the southern option is eight with three partial acquisitions and five full acquisitions required. This is much higher than the northern option where a smaller number of properties are required, with two partial acquisitions and three full acquisitions required.

Consequently, the northern bridge duplication was identified as the preferred option, incorporating mitigation where required to minimise any adverse effects.

3. Eastern Busway Ti Rakau Bridge Further Options Assessment

3.1. Ti Rakau Drive Bridge Reference Design

The AMETI Further Options Assessment Report 2017 established that the northern side of the existing bridge is the preferred location for the extension of Ti Rakau Drive Bridge. The EB3C options assessment resulted in the technically preferred alignment (March 2021) which connected the Burswood Alignment across the CMA at Trugood Drive and is shown at figure 4.

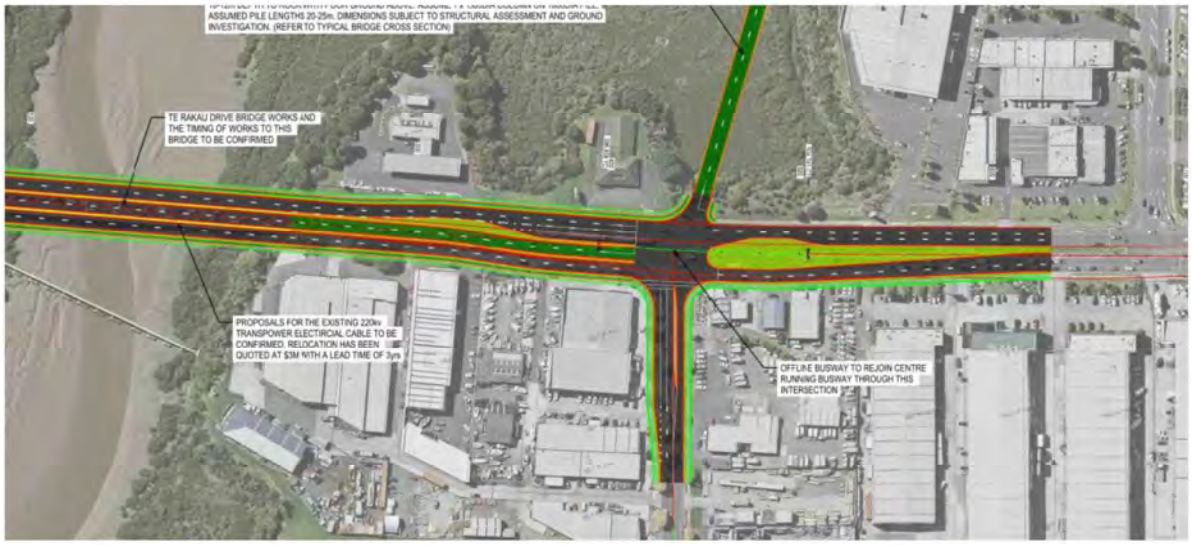


Figure 4: Technically Preferred Scheme

Following a review of the technically preferred scheme in October 2021 the EBA identified that the proposed alignment required significant works along Ti Rakau Drive including substantial works to Ti Rakau Drive Bridge, road alignment works east of Trugood Drive and along Trugood Drive as well as property acquisition from several properties on the southern side of Ti Rakau Drive.

The high cost of the works, the extent of the property acquisition and the disruption to businesses and general traffic (particularly during construction) prompted a review to identify an alternative that reduced the costs and disruption while minimising reduction of project benefits.

This review resulted in an alternative EB3 Commercial Alignment for Ti Rakau Bridge, shown in Figure 5, and documented through Potential Scope Adjustment 49 which was carried forward by the EBA into the Reference Design.

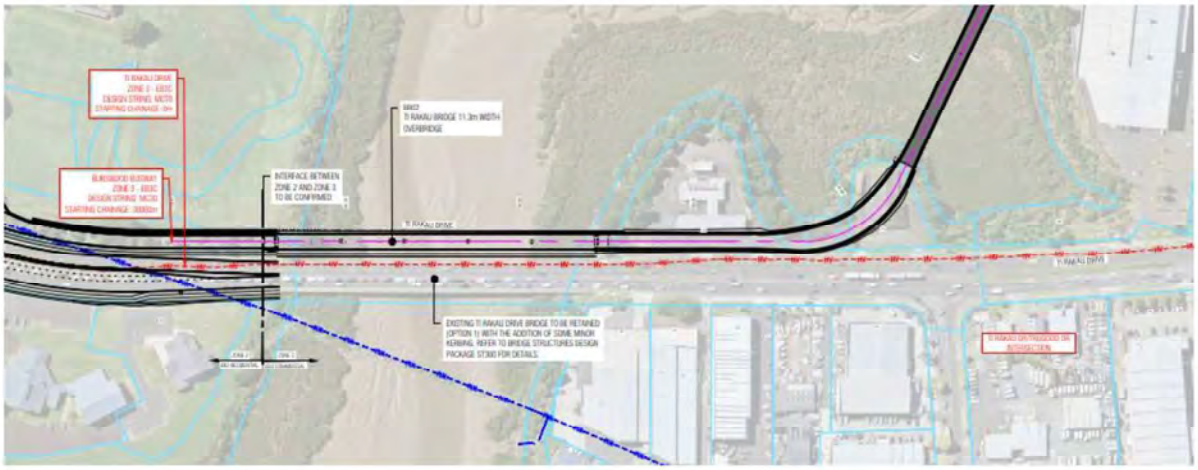


Figure 5 : Reference Design (October 2021).

The Reference Design was identified as having the following benefits:

- More cost effective reducing the estimated cost by approximately $30M.
- Requires a fewer number of property acquisitions with less complexity.
- Improved travel time for buses by removing the need for buses to pass through the Trugood Drive / Ti Rakau Drive intersection and providing a dedicated separated busway.
- Improved reliability for buses by removing the need for buses to pass through the Trugood Drive / Ti Rakau Drive intersection.
- Improved travel time for general traffic by removing buses from the Trugood Drive / Ti Rakau Drive intersection.
- Improved active transport facilities by providing a bi-directional cycleway and footpath on the new busway and active transport bridge across Pakuranga Creek.
- Allows the provision of a bi-directional cycleway from Pakuranga to Botany which is not achievable with the technically preferred alignment.
- Improved safety for vulnerable users by providing off road cycle facilities in preference to on road facilities.
- Less disruption to businesses along Ti Rakau Drive compared with the technically preferred alignment originally selected.
- Improved water quality outcomes with the incorporation of stormwater treatment measures using the land to be acquired at the Mobil petrol station.
- Reduced construction impacts to the travelling public with most of the construction of the northern alignment off-line.

The EBA Reference Design includes the duplication of the Ti Rakau Drive Bridge on the northern side of the existing bridge. The proposed alignment of the Busway is located on the duplicated bridge which runs along the northern side of Ti Rakau Drive before crossing the coastal marine area (CMA) at 254 Ti Rakau Drive.

The Reference Design severs the access to the site at 242 Ti Rakau Drive, the Mobil Service Station, and requires the full acquisition of this property.

EBA engaged with Mobil on the 05 November 2021. Mobil informed the EBA that their preference is to maintain the petrol station activity on the site and requested the EBA to undertaken further Options Assessment of alternative designs which do not require the full acquisition of the property.

This report details the further options assessment undertaken by the EBA and the conclusions reached.

Broadly this process was aligned with other options evaluations processes undertaken for EBA, including considering the options using a multi criteria analysis tool, considering cost, construction, programme and stakeholder considerations, and making a recommendation accordingly.

3.2. Further Options Assessment

Based on feedback from Mobil the EBA developed three alternative designs in January 2022 which would not require the acquisition of the property at 242 Ti Rakau Drive or would only require partial acquisition through the back of the site (including within the esplanade reserve).

EBA initially developed 3 options for consideration as shown in figure 6 below and Attachment 1.

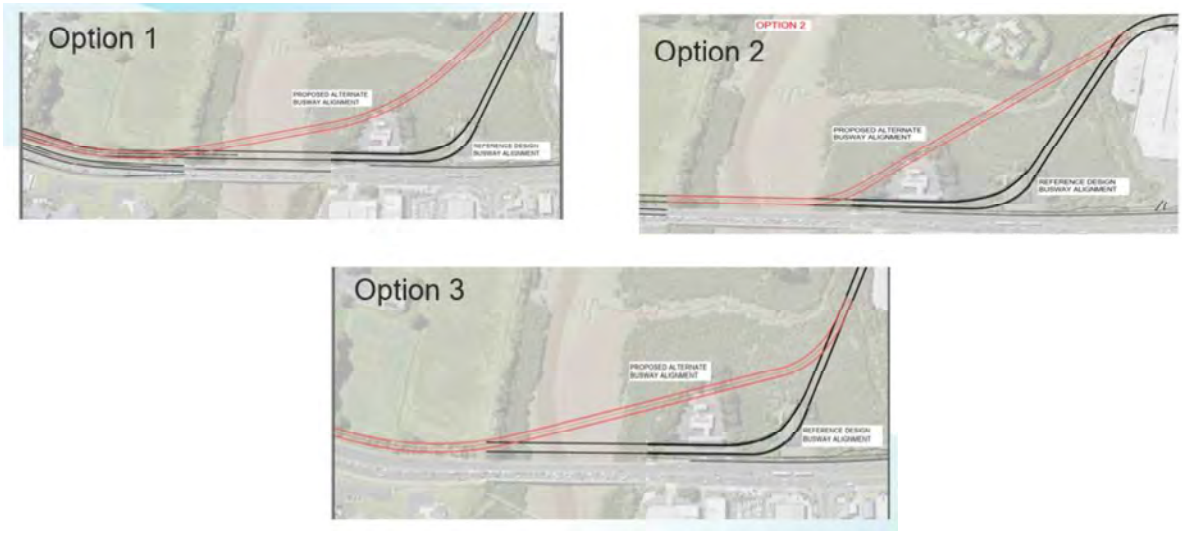


Figure 6: Further Options.

These further options would require partial acquisition of the rear of the site at 242 Ti Rakau Drive and or the esplanade reserve. The land would be required to enable the construction of the proposed bridge. During construction there would be temporary occupation for construction activities on land to the east of the Mobil site to connect the foot path and cycleway (subject to further design work the land for the footpaths and cycleways could be located within esplanade reserve).

The further options were presented to and discussed with mana whenua at a hui on the 27th January 2022 to determine if the Mana whenua partners had any concerns that would discount the options from further assessment. Mana Whenua's combined view was that retention of the Reference Design is preferred as the environmental footprint of the bridge is smaller, however the group understood the rational for the options but stipulated the need to see the detail of mitigation through the design process if any of the options were to be progressed.

At this stage of the assessment the EBA did not engage with AC parks or the Local Board with respect to acquiring/occupation of the esplanade reserve given the conceptual nature of the designs.

Following the mana whenua hui three options were progressed to Multi Criteria Assessment. The EBA met with Mobil on the 04 March 2022 to present and discuss Options 1 – 3.

4. Options Evaluation

4.1. MCA Overview

The purpose of an MCA is to provide a structured, consistent and systematic process for assessing each option. This tool is aligned to Project objectives and RMA requirements, providing evidence of structured option analysis, and maintaining consistency with other option assessment processes previously undertaken for the project. The outputs of the MCA assist the decision maker to understand relevant considerations when making a decision on the preferred option.

4.2. MCA Framework and Scoring Adopted

The MCA Framework for this assessment was adopted from previous MCAs undertaken for EB3 and the AMETI Further Options Assessment 2017, to ensure consistency in approach. The criteria were carried over from the previous assessments from the AMETI Further Options Assessment 2017. The completed MCA framework (in the form of an excel spreadsheet) identifying criteria, measures and information sources are provided in Attachment 2.

The performance of the options against the MCA criteria was scored, without weighting, using a 11-point scale as outlined in Table22 below. A workshop was held with all evaluators to fully explore the options to ensure that evaluators assessments were based on consistent and commonly understood information. The scoring was confirmed after the MCA workshop, ensuring scores were based on a common understanding of the options.

The assessments were not comparative to the previous and preferred options, rather the effects of the options were considered against the existing environment. In this case the existing environment also assumed that Eastern Busway 1 (EB1) has been implemented.

Table2 Scoring criteria

Score	Description/ indicators for assessment
-5 Very High Adverse Effect	**National or Greater**: Will have adverse effect on a nationally significant resource/ or may be experienced by a national scale audience; *and/or* May have a substantial/ complete effect (destruction) on the feature/ resource/ community identified; *and/or* **Long Term/ Permanent =** 20+ years.
-4 High Adverse Effect	**Regional**: Will have adverse effects on a regionally significant resource or may be experienced by a regional or wider audience; *and/or* May have a high extent of impact on features/ resource/ community identified; *and/or* **Long Term/ Permanent** = 10 -20+ years.
-3 Moderate Adverse Effect	**Local Area Level Impact**: Will have adverse effects on a locally significant resource (e.g. significant within an ecological district or within a catchment) or may impact on a local board community/ geographic scale; *and/or* May have a moderate extent of impact on the feature/ resource/ community identified; *and/or* **Medium term** = 5 -10 years
-2 Low Adverse Effect	**Local Area/ or Individual Level Impact**: Will have adverse effects on a locally prevalent resource (e.g. site specific significant within an ecological district but only local effect or within a catchment) or may impact on a local board community/ geographic scale; *and/or*

	May have some extent of impact on the feature/ resource/ community identified; *and/or* **Short term** = 1 -5 years
-1 **Very Low Adverse Effect**	**Individual level impact**: Will have adverse effects on resources not otherwise identified for their values or with otherwise innominate value or may impact a limited number of households (i.e. 20 households/ 50 people); *and/or* May have a low extent of impact on the feature/ resource/ community identified; *and/or* **Very Short Term =** <1 year.
0 **Neutral Effect**	Negligible effects from current situation/ natural
+1 **Very Low Positive Effect**	**Individual level benefit**: Benefits will be experienced for resources not otherwise identified for their values or with otherwise innominate value. Benefits may be experienced by a limited number of households (i.e. 20 households/ 50 people); *and/or* May have a very limited and confined extent of benefits on the feature/ resource/ community identified; *and/or* **Very Short Term** = < 1 year.
+2 **Low Positive Effect**	**Local level Benefits (2):** Benefits will be experienced by defined local environment or sub-catchment. Benefits may be on Census Area Unit or experienced by a limited number of households (i.e. 20-50 people); *and/or* May have a low extent of benefits on the feature/ resource/ community identified; *and/or* **Short Term** = 1-5 years.
+3 **Moderate Positive Effect**	**Local Level Benefits (1)**: Benefits will be experienced for values of an ecological district or within a catchment, or at a local board community/ geographic scale; And/or May have some extent of benefits on the feature/ resource/ community identified; And/or **Medium Term** = 5-10 years.
+4 **High Positive Effect**	**Regional Benefits**: Benefits will be experienced for a sub-regionally significant resource/ experienced by a sub-regional audience; *and/or* May have a high extent of benefits on the feature/ resource/ community identified (and confident of benefits being realised); *and/or* **Long Term Permanent** = 10-20+ years
+5 **Very High Positive Effect**	**Regional or Greater Benefit**: Benefits will be experienced by a whole region or across regions (including national) or may be to a regionally or nationally significant resource; *and/or* May have substantial benefits on features/ resources/ community identified. High degree of confidence of benefits being realised; *and/ or* **Long Term/ Permanent =** 20+ years.

A positive score indicated an opportunity for improvement to the existing environment, and a negative score indicated a worsening of the existing environment. Any 'very high adverse effect' (-5) in relation to key considerations was considered a fatal flaw, in which case the option would not progress as an alternative option. None of the options were considered to have a fatal flaw.

The technical specialists were provided a spread sheet ensuring their rationale and assumptions made ensuring the assessment were captured. This was to ensure transparency and consistency of scoring. The spread sheet with each specialist's score is provided in Attachment 3 of this report.

4.3. Briefing technical specialists

A workshop was held on 15 February 2022 for technical specialists to brief the specialists and to discuss the alternative options and the MCA process.

4.4. MCA Workshop

The workshop was held on15 February 2015. The purpose of the workshop was to:

- Allow specialists to ask questions of the project team about the alternative options;
- Allow for specialists to be asked questions by the wider team, test assumptions and issues discussed and clarified; and
- Provide an open and transparent discussion for specialists to base their scores on.

A list of workshop attendees is shown below at table 3 and their assessments have been included in Attachment 3.

Table 3 – workshop attendees

Name	Role/Area of Expertise
Shane Doran	Transportation
Chris Bentley	Urban Design, Landscape and Visual
Constructability	Alex Taefu / Stephen Power
Property	Fenella Fisher
Legislative	Jarrod Snowsill
Social impact	John Daly
Noise and Vibration	Shivam Jakhu
Stormwater	Paul May
Coastal Marine Ecology	Sharon De Luca
Coastal Process	Derek Todd
Archaeology	Arden Cruickshank
Contamination	Shannon Holroyd
Climate Change	Sarah Lindberg

The technical Specialist provided their feedback and scoring following this workshop. Table 4 and the Attachment 2 details the assessment criteria considered by the Technical Specialists

Table 4 Assessment Criteria

	Key Result Area / Criteria	Measures	Information Sources	Owned by
Objectives	Provide a multimodal transport corridor that connects Pakuranga and Botany to the wider network and increases choice of transport options.	Provide for all modes (walking, cycling, bus, freight, general traffic). Connect Pakuranga and Botany together and to the wider network, with adequate linkages and connectivity between modes.	Option descriptions and drawings. Background reviews of option reports.	Shane Doran
	Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network	Demonstrates improvements in transport network reliability of connection, journey time and frequency of service. Length of corridor, Journey time (approx), linkages etc.	Qualitative knowledge of the people carrying capacity of the network. Option descriptions and drawings. Models and qualitative assessment. Background reviews.	Shane Doran
	Provide transport infrastructure that is safe for everyone.	Provides transport infrastructure that is safe.	Option descriptions and drawings. Background reviews of option reports.	Shane Doran
	Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centers	Supports future amenity and public realm improvements to the town centre and along the corridor. Provides legible and desirable connections to the town centre and land uses along the corridor. Provides a continuous corridor connection for all modes to the town centre and along the corridor.	Land use and development opportunities-stakeholder consultation. AUP land use zonings. Background reviews including previous Scheme Assessments.	Chris Bentley

		Minimises impact on existing place.		
	Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form.	The proposed option integrates well (in terms of form and access) with land uses anticipated under the AUP. Option provides for good accessibility to and supports a high quality, compact urban form in Pakuranga and along the busway corridor to Botany. Accounts for number of residential and commercial properties affected by the corridor. Overlay of future proposed land use under the AUP. Colocation with existing infrastructure (e.g. utilises existing Arterial routes).	AUP land use zonings. Option descriptions and drawings. Background review including previous Scheme Assessment and Specimen Design.	Chris Bentley
	Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.	n/a	n/a	n/a
Legislative Considerations	Assessment against critical legislative requirements	Qualitative assessment of the consistency of the proposal with the Resource Management Act (1991), especially Part 2 matters, and high level policy framework relevant to the Project e.g. NZCPS, NPS's, RPS, NES.	Knowledge and review of the critical elements. Background review including previous (2014) Scheme Assessment and any updates since 2014 SAR Archsite, regional and district planning maps, MVAs	Planners (Jarrod Snowsill)
Con stru ctab				

	Can the option be constructed within reasonable and known construction constraints?	Constructability incl. volume/balance of earthworks, construction risks and general degree of difficulty: -	Option drawings and descriptions	Construction - Andy Gibbard / Tommy Temple / Stephen Power
		Disruption to existing services and utilities		
		traffic Management		
		programme		
Traffic and Transport	Traffic and Transport	Operational Effects:		Shane Doran
		Journey time improvement / Congestion/queue length within corridor / congestion and		
		queue lengths outside of corridor / PT reliability		
		Effects on existing network - positive and adverse		
		Levels of service of key intersections		
		Operational performance of busway		
		Effects on surrounding network		
		Mode shift - busway patronage et		
		Construction Effects:		
		Temporary intersection layout, acceptable level of delay, property access, pedestrian and cyclist facilities, detours etc. PT reliability during the construction phase.		
Natural Environment/ Ecological	Water Environment	Construction Effects: Extent of effects and ability to manage erosion and sediment effects on	Option drawings. AUP.	Paul May

		water quality from construction activities. Extent of effects on (and ability to manage) surface water, including direct physical effects during construction.		
		Operational Effects: Impact of operational stormwater (and ability to manage effects) in regards to quantity and quality (including life supporting capacity). Impact of project on overland flow paths and flooding.	Option drawings/AUP/ flood maps.	Paul May
		Coastal Processes - effects on coastal processes (currents, tides, sediment transport)	identify coastal resources (AUP/Coastal Charts/aerial photos/drawings)	Derek Todd.
		Coastal Ecology - extent of effects on significant marine areas (i.e. significant ecological areas) and physical footprint within the coastal marine area. Consideration of how the options may present more or less opportunities to enhance the natural environment/Ecology and open space.	AUP CMA boundaries and SEA's. Previous ecological assessments prepared for the project	Sharon De Luca
	Terrestrial Environment/Trees	Loss of scheduled trees and indirect effects on scheduled trees as identified in AUP. Ability to avoid effects on scheduled trees	Plans of scheduled trees. Specimen design arboricultural assessment.	Jarrod Snowsill /
		Extent of effects (and ability to manage effects) on indigenous vegetation	Specimen Design Ecological Report	Sharon De Luca,
		Extent of effects on significant habitats of		

		indigenous fauna (terrestrial).		
	Landscapes and Natural Features and Character	Extent of effects on natural character areas (particularly outstanding and high natural character areas).	Land use and Topo maps / aerial photo data. AUP and Overlays. Option drawings.	Chris Bentley/ Tom Lines
		Extent of effects on landscapes and natural features including geological features, landform vegetation (including trees), watercourses etc.	Land use and Topo maps / aerial photo data. AUP and Overlays. Option drawings.	
Heritage	Effects - Archaeology	Extent of effects on sites and places of archaeological value	Specimen design reports. AUP including overlays. Archaeological data bases	Arden Cruickshank
	Effects - Built heritage	Extent of effects on heritage buildings and place	Specimen design reports. AUP including overlays. Archaeological data bases	
Built Elements	Property Implications	Qualitative assessment of the scale of likely / anticipated effects from land take. Reasonable necessity and requirement for operation and construction. Considering extent to which additional land required has already been acquired for the project and risk of acquiring land still needed.	Option drawings and descriptions. Land ownership details along corridor and details of land already acquired/owned.	Fenella Fisher
		Number of properties to be acquired. Degree of difficulty of property acquisition (includes nature of land use, consideration of common land acquisition i.e. land		

		owned by multiple parties).		
		Type of property e.g. commercial versus residential versus parks/heritage.		
	Impacts on utilities and significant infrastructure	Requirements for relocation / design of alternative major infrastructure, including consideration of safety impacts of such requirements and risk of continuity of service over construction - e.g. Transpower National Grid, Watercare, Telecomms etc - account for cost of relocations if necessary Disruption - effects on networks and continuity of service.	Design footprint of options. Estimated durations for construction works. Previous consultation with utility owners.	Simon Jones/ Sikander Malik
	Permanent effects - connectivity (circulation)	The extent of effects on connectivity including disruption to the street network and walkability	Land Use mapping, aerial photographs, topographic mapping. Option Drawings.	Chris Bentley /Tom Lines
	Permanent effects - Built Form	The extent of effects on urban form including lot pattern, street frontages, significant buildings and other structures	Land Use mapping, aerial photographs, topographic mapping. Option Drawings. Historical areas identified on planning maps.	
	Permanent Effects - Activities/Use	The extent of effects on (or compatibility with) surrounding activities, with particular regard to public activities (such as town centres), land use, and character.	Use knowledge of the project area, urban structure and form. Identify activities (land use and topographic map	

			/ aerial photo data). Option Drawings	
	Permanent Effects - Visual Amenity	The extent of effects on visual amenity taking into account the character and visibility (prominence) of the proposal the materiality and proposed built form, the character of the existing environment, the sensitivity of audiences, duration of view, magnitude of visual change and the experience of future road users.	Project extent knowledge and Option Drawings. Aesthetics including visibility, prominence, effects on public views, 'fit' with context. Specimen Design landscape and visual assessment.	
	Permanent Effects - Associative Elements	The extent of effects on elements of townscape amenity with historical or cultural associations or which otherwise contribute to townscape amenity.	Use land use and topographic map / aerial photo data to identify associative elements including recreational areas and historical /cultural areas identified on plan maps	
Social Effects including Public Health	Noise and Vibration	Construction noise and vibration effects on residents and sensitive receivers. Extent of effects and Ability to avoid/manage noise and vibration effects during construction.	Design footprint of options. Specimen Design Acoustic assessment. Estimated durations for construction works. Noise management.	Shivam Jahku
		Impact of operational noise and vibration on sensitive receivers.	Land use and topo map / aerial photo data. Specimen design Acoustic	

			assessment. Option Drawings.	
	Contamination	Potential impact of contaminants from historical land uses on environmental discharges (to air, surface water and groundwater): Potential impact of contaminants from historical land uses on human health (construction workers and future users/general public); Ability to avoid/manage effects during construction, including cost considerations.	Plans of identified / known contaminated land. Specimen Design Reports, Option Drawings, Design footprint of options, estimated durations for construction works.	Shannon Holroyd
	Community facilities	The extent to which effects on community facilities in the study area (including educational, health and leisure facilities, but excluding public open space will impact on the existing and planned uses of these by the community. During construction and permanently.	Zoning maps, aerial photographs and option plans. Specimen Design reports. Physical impact of new structures. Extent of land take/physical impact. Proximity effects/change in quality. Removal of heavy / freight vehicles from nominated streets of social service / facilities .	John Daly
	Viability/Productivity of business land areas	The extent of effects on industrial and business land areas, including land take, severance and access impacts that affect the viability/productivity of these activities, such that people's material wellbeing (e.g. employees)	Zoning maps, aerial photographs and option plans. Physical impact of new structures. Extent of land take/physical impact.	

		or access to services (way of life) will be impacted.	Proximity effects/change in quality/ease of access. We note that this needs to recognise project cost if site directly affected.	
	Public Open Space	Extent to which people's use and enjoyment of (1) public open space and (2) access to and along the coast is provided for or impacted The assessment of people's use and enjoyment (quality and way of life) are affected with give considering to the proximity effects of works/change in quality/ease or change of access.	Land use and topographic map / aerial photo data. Option Drawings.	
	Social Cohesion	Discussion on the potential impacts on patterns of movement or communities of interest that might be affected by the construction/operation works, such that there may be a loss of social cohesion or fragmentation of existing community structures (e.g. disruption or severance of school zones, electoral catchments, etc).	Catchment maps for school zones, political boundaries etc.	
Climate Change	Climate Change Response	Impact on Materials consumption including embodied carbon (This represents the largest change between the options with respect to resource efficiency. Assuming an electric bus fleet, operational GHG emissions will be similar	Difference in materials impacts as measured by the IS materials calculator. Information source= quantities of key materials for each options (provided by QS	Sarah Lindberg

		between options). Climate risk and adaptation.	team or design team). Increase or decrease to either the EBA climate risk ratings or exposure to climate change hazards. Information sources: EBA climate change risk register and AC coastal hazards map.	

5. Multi Criteria Assessment

The further options were assessed using the MCA framework modelled on the AMETI Further Options Assessment Report 2017.

As detailed in section 4.0 of this report the EBA held a workshop to discuss the options on the 15 February 2022. This workshop was also attended by AT Subject matter Experts (SME's). Following the workshop, the EBA experts considered the options against a number of criteria detailed at Attachment 2 and shown in the MCA table at Attachment 3.

Initially the EBA considered the options in relation to the existing environment to determine if there was a preferred option to compare with the Reference Design. Options 1 and 3 were taken forward to compare with the refence design as the best performing of the options. Subsequent to this option 1A was developed and was considered by the Technical Specialists to be comparable to Option 1.

Option 1A (Figure 7) was developed as the options process was developed and is shown as an alternative that would not require any property acquisition from 242 Ti Rakau Drive. This is represented by the orange line in figure 4 with the blue line indicating the potential location of the walking and cycling connection.

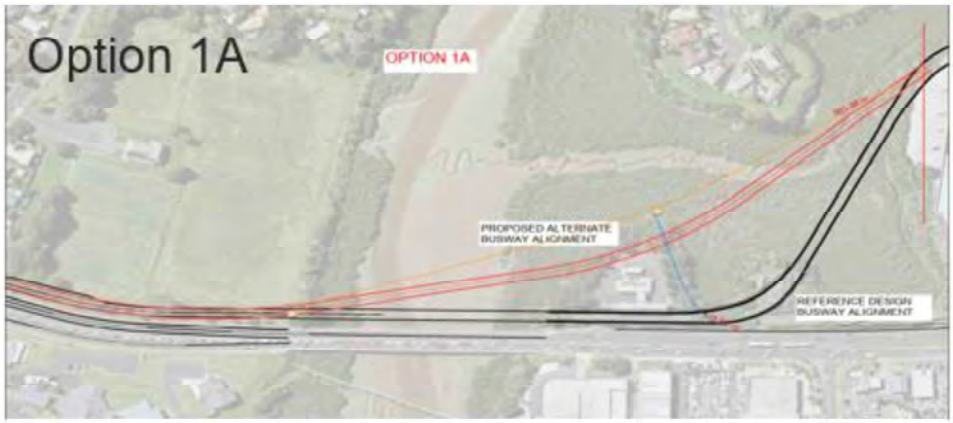


Figure7: Option 1A.

5.1. Assessment Outcomes and Recommendations

This section of the report outlines the key considerations from the MCA. Generally, the alternatives considered through the MCA process were similar with many criteria having no or similar differentiation across the criteria.

The key differences were in construction and property criteria which indicated a preference for Option 1.

The Transport criteria indicated a preference for the Reference Design as this option provides for better cycling connectivity.

The construction considerations (being measured by construction efficiency) favoured Option 1.

Project costs were heavily influenced by the length of structure.

The Reference Design was strongly preferred in relation to urban design and landscape and visual criteria.

The environmental criteria favoured the Reference Design but this was influenced by the differential in scoring from the urban design and landscape and visual outcomes with other criteria scoring similarly.

In summary, the options are comparable with most criteria scoring similarly. No option was considered to be fatally flawed.

Differences in the assessment in favour of Options 1 (and 1A) and 3 were in the following criteria:

- Construction methodology.
- Project costs, in particular the costs associated with property acquisition.
- Effects on McCullum's Wharf (Heritage) are less as the proposed bridge is located further away from the feature.
- It was also identified that Option 1 and 3 would not require temporary reclamations (as is required in the Reference Design) to construct.

Key considerations in favour of the Reference Design are as follows:

- Transport, particularly cycleway connectivity.
- Urban Design, Landscape and Visual, particularly views and amenity.
- Coastal Processes, less impact on the CMA and opportunities for environmental mitigation in favour of the Reference Design.

Differences in the assessment are expanded upon in the following sections of this report in relation to: Construction Methodology; Property Acquisition; Transport; Urban Design and Landscape and Visual impacts.

5.2. Construction Methodology:

The Reference Design requires the construction of 2 bridges with 4 abutments and requires on grade works between the abutments. The Reference Design doesn't need to be built concurrently with other project elements which will benefit the construction programme. The works will however be stop / start as the construction team will need to move equipment between the 2 bridges to be constructed. The Reference Design also requires temporary occupation of the CMA to construct the bridges.

Option 3 has a tighter curvature than Option 1 and will result in more permanent piles and beams. Option 3 will require wider temporary staging due to the curved spans which will need to be installed with a crane. Option 2 was assessed as having an excessive curve making it difficult to launch a gantry.

Option 1 was preferred by the construction team as this option has a gentler curvature in the bridge which allows for easier construction with the preferred launching gantry methodology. Option 1 was assessed as being the quicker option to build (circa 18 months vs circa 23 months when compared to the Reference Design) given it would be built using a single construction methodology. Temporary reclamation within the CMA is also not required for Option 1 and Option 3.

Temporary occupation of the service station site would be required for construction access for Option 1 and Option 3. Relocation of gas cylinders would be necessary for excavation and formation of the cycle path. It was also assumed that the temporary occupation area required in Riverhills Park would be slightly larger than shown on the current Land Requirement Plans to allow for assembly of gantry. Option 1a was assessed as being the same as option 1 from a construction perspective.

The project cost estimate is shown at Attachment 4 and is summarised below in Table 5.

Table 5 Project costs estimate

	Reference Design	Option 1A	Option 1	Option 2	Option 3
Construction cost	$34, 930,953	$40,447,044	40,606,022	$37, 867,448	$39.717,722
Variance to Reference Design (increase)	-	$5,516,091	$5,675, 069	$2,936, 495	4, 786,769
Property cost	$14,125, 000		$1,300,250.00	$1,599,750.00	$1,499,500.00
Total	$49,055,953	$40,447,044	$41,956,271	$39,517,198	$41,267,222
Variance to Reference Design		-$8,608,909	-$7,099,681	-$9,538,755	-$7,788,731

As can be seen from table 5 the construction costs of the Options are $2.9M – to $5.7m more expensive than the Reference Design. When the property costs are included in the estimate the project costs of the Options are approx. $7m - $8.6m cheaper than the Reference Design. This saving was considered by the EBA to be an important consideration in the affordability challenge for the project and is discussed further at section 5.4 of this report.

5.3. Property Acquisition

Table 6, Property Costs, below, identifies the estimated property costs for the proposed options and the Reference Design:

Table6 Project Acquisition estimate

		Property Cost	IA	Costs	
Reference Design	Full freehold	$8,760,000.00		$190,000.00	$8,950,000.00
	Leasehold	$5,000,000.00		$175,000.00	$5,175,000.00
	Total				**$14,125,000.00**
Option 1	Partial 550sqm	$990,000.00	$99,000.00	$190,000.00	$1,279,000.00
	TOA 850sqm				$21,250.00
					$1,300,250.00
Option 2	Partial 700sqm	$1,260,000.00	$126,000.00	$190,000.00	$1,576,000.00
	TOA 950sqm				$23,750.00
					$1,599,750.00
Option 3	Partial 650 sqm	$1,170,000.00	$117,000.00	$190,000.00	$1,477,000.00
	TOA 900sqm				$22,500.00
					$1,499,500.00

The technical specialist for property scored the Reference Design more negatively compared to the options given the likely costs to acquire the Mobil site.

5.4. Transport Summary

The transport assessment considered that the Reference Design and all options perform similarly for buses and general traffic, however there are some differences for pedestrians and cyclists. The Transport Assessment considered that the Reference Design provides a very good alignment with good connections to the "Trugood" cycle path (located on the southern side of Ti Rakau drive) with the only downside being the connection along Burswood Drive west and the potential safety concerns for vehicles turning into and out of driveways across the cycleway. With the cycleway immediately adjacent to Ti Rakau Drive there is good passive surveillance is provided from to the users of the cycleway from motorists.

The Transport assessment further stated that Option 1 provides a "good to very good" alignment with a reasonable connection with the "Trugood" cycle path using an alignment for the cycleway connection as shown in yellow shown at Figure 8. The Transport assessor stated that this option could be improved by bringing the cycleway on the western side of the Mobil Service Station (purple alignment). The movement of the cycleway away from Ti Rakau Drive marginally reduces the passive surveillance. There would be similar downsides to the Reference Design along Burswood Drive west.

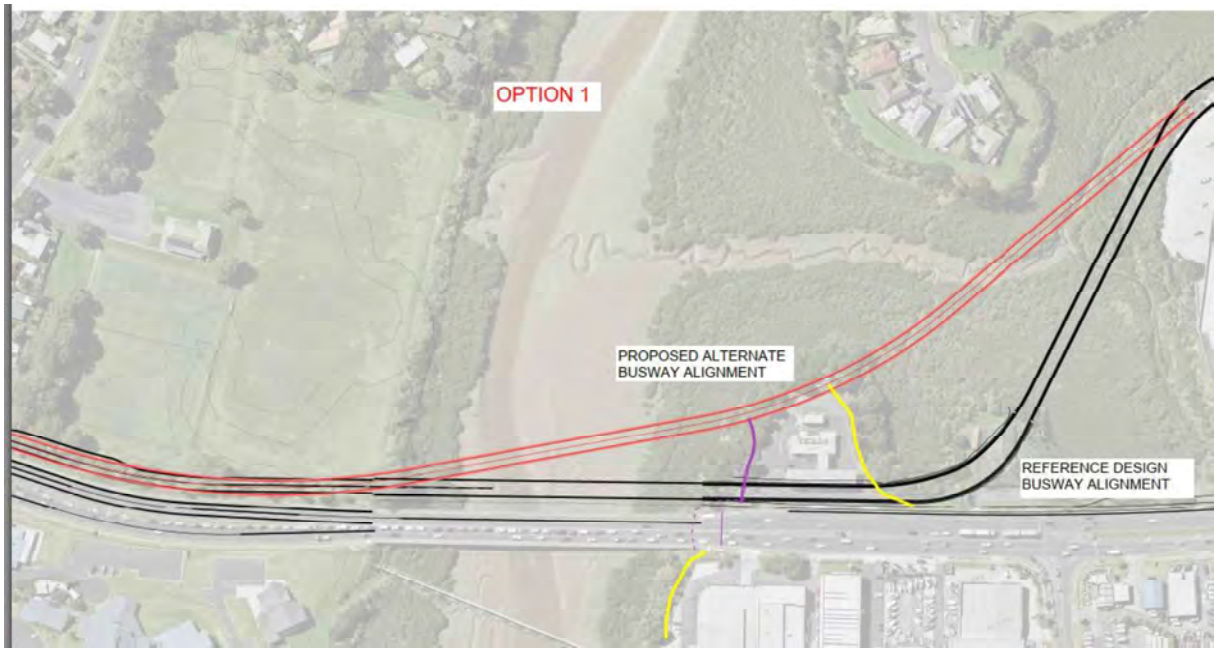


Figure 8 – Option 1 Cycling Connections

The Transport Assessment stated that Option 1A provides a good alignment but has a poor connection with the "Trugood" cycle path using an alignment for the cycleway connection as shown in yellow in the above. The Transport Assessor stated that this option could be improved by moving the cycleway on the western side of the Mobil Service Station (purple alignment Figure 9). There would be similar downsides as those that arose from the Reference Design along Burswood Drive west. The distance of the cycleway to Ti Rakau Drive would introduce Crime Prevention Through Environmental Design (CPTED) issues as passive surveillance from Ti Rakau Drive would be limited.

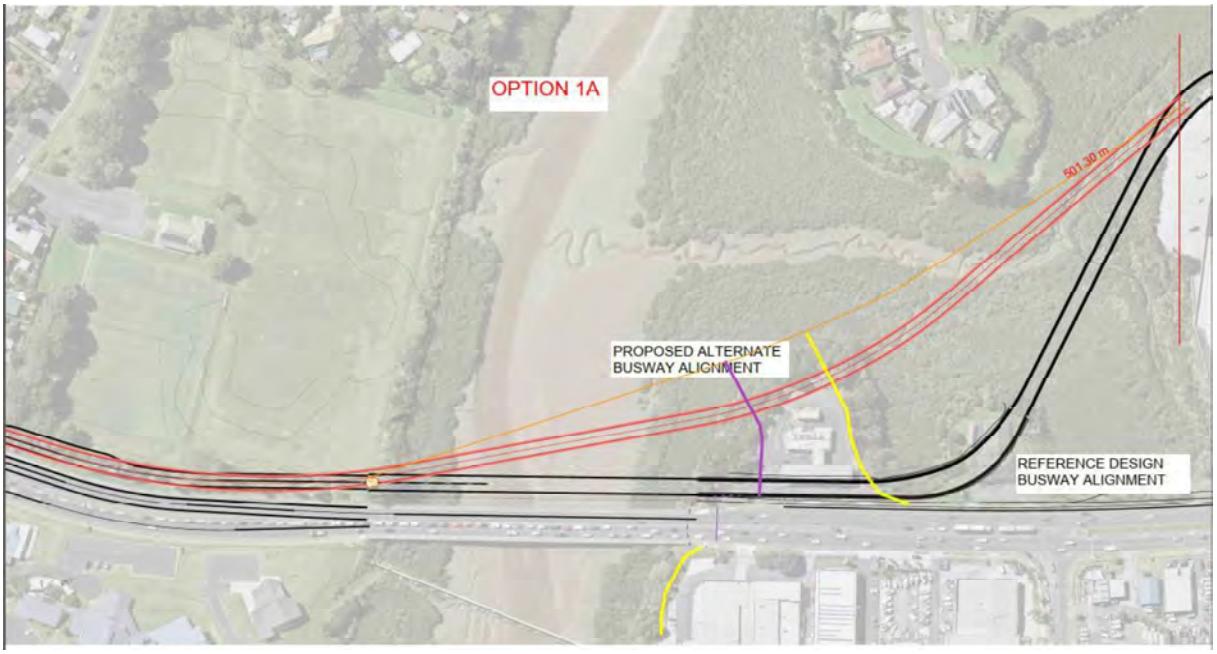


Figure 9 Option 1A Cycling Connections

Option 3 (Figure 10) was considered by the Transport Assessment to provides a good to very good alignment with a reasonable connection with the "Trugood" cycle path using an alignment for the cycleway connection as shown in yellow below. This option could be improved by moving the cycleway on the western side of the Mobil Service Station (purple alignment). The movement of the cycleway away from Ti Rakau Drive marginally reduces the passive surveillance. There would be similar downsides as those that arose from the Reference Design along Burswood Drive west.

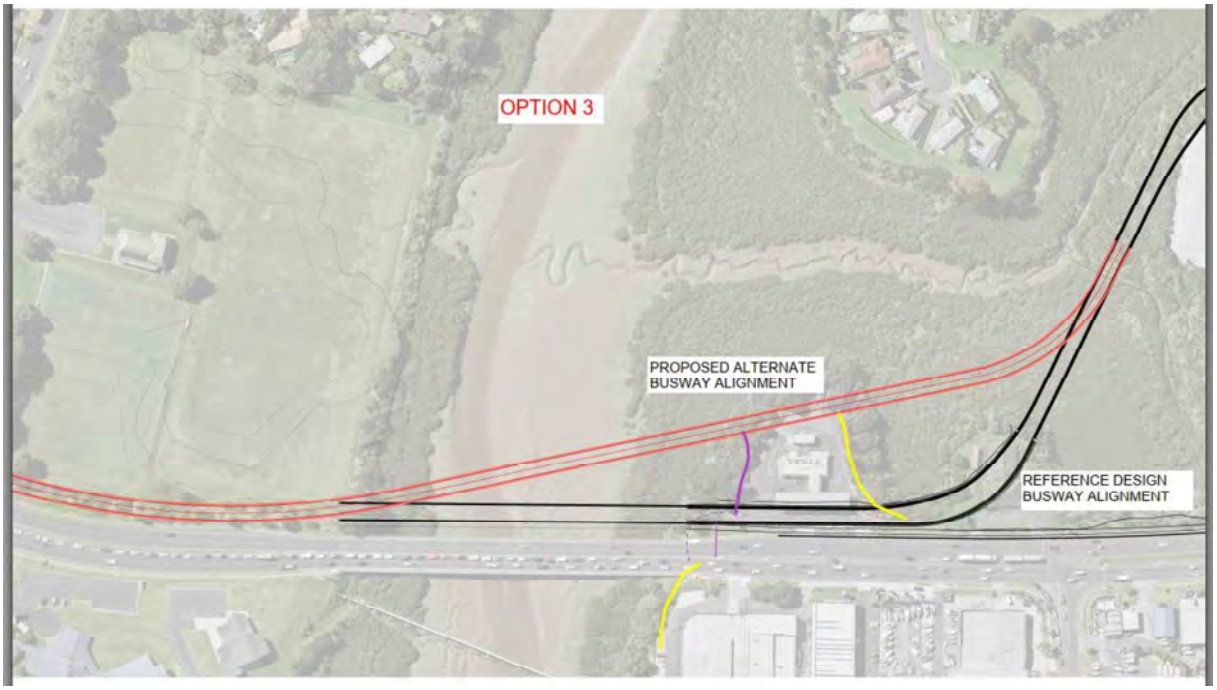


Figure 10 – Option 3 Cycling Connections

In relation to the Transport criteria the Reference Design was considered to perform best with Option 1a performing the worst based on the differences in the alternatives relating to cycling.

5.5. Urban Design and Landscape and Visual Assessment

The Urban Design and Landscape Assessment considered that Options 1 and 3 provide a bridge across the Pakuranga Creek Estuary that is askew with Ti Rakau Drive and the existing bridge, where as the alignment of the Reference Design is adjacent and parallel to the alignment of the existing bridge and Ti Rakau Drive. The Urban Design, Landscape and Visual Assessor considered that Options 1-3 do not align with Ti Rakau Drive or the cul de sac layout of the Burswood peninsular. In this respect the options would bring the bridge closer to residential properties and it was assessed that that all of the options that diverge from Ti Rakau Drive would detract from the character of local area as the new bridge options would extend across and dominates this section of Pakuranga creek.

The Urban Design Assessment considered that in this regard the options do not perform well against the project objective to "*provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form*" however the overall project and EB3C commercial can be seen as meeting this objective.

Accessibility for cyclists and pedestrians is restricted by having to travel around over the bridge to the north and then around the back of the Service Station to get back onto Ti Rakau Drive. There are also potential CPTED issues with cyclists and pedestrians using a shared user path (cycle way and footpath) that extends across the estuary and behind the Service Station. Users will then be hidden behind the buildings currently located on the site with very little option for an escape route.

The Reference Design was considered to supports future amenity and public realm improvements along the corridor as well as providing a legible and well connected cycleway. The Reference Design was also seen as minimising the impact on place, being the Pakuranga Creek estuary. The Reference Design was also considered to builds on the existing character of the area and fits in with the form of the China Town development. The removal of the Mobil and Pet Depot activities also enables these sites to be revegetated reinforcing the natural qualities of the wider estuary.

5.6. Outcomes of the MCA

The MCA was discussed at EBA key decisions meetings through April and was presented to the AT Subject matter Experts at the EBA Design Interface meeting on the 10 May 2022.

At its meeting of the 09 May 2022 the Alliance Leadership Team (ALT) key participants in the Options Assessment presented the findings to the ALT of the Ti Rakau Bridge options for consideration. After careful consideration of the Options Assessment, the ALT's position was to retain the Reference Design as it provides a better response in relation to Transport (walking and cycling) and Urban Design criteria

However, the ALT also recognised that the Options 1/1a and Option 3 had merits when considering affordability and the construction programme.

Following this meeting the initial views of the Project Alliance Board were sought in terms of the options assessment to discuss the merits of affordability and programme and the outcomes of the MCA. The PAB directed that a briefing session be held with Murray Burt (as representing the PAB) to discuss the issues. This meeting was held on the 20th of May 2022.

Feedback from the meeting with Murray Burt was that the Further Options present the following benefits:

- The options do not land lock the service station and PetStop sites.
- Project Cost savings.
- De-risks environmental clean up (of the service station and the temporary reclamation required by the Reference Design).

Issues associated with the Further Options were identified as:

- Programme
- Whether option 1 or 1a is too close to the residential peninsula in design.
- Geotech is unknown and may be a piling issue (however recognised that the Reference Design has similar issues for the part of the bridge between the Pet Store and Chinatown).
- Could the options be refined to provide a better consideration of cycling alternatives.

5.7. Other considerations

Additional consideration of the options was undertaken to address the matters raised by Murray Burt. These additional matters were considered outside of the MCA but the response to the matters raised are summarised below. These additional matters were not subject to the MCA criteria or scoring of the options but were additional matters which assisted the ALT in its decision making.

5.7.1. Other benefits of the Alternative Options (Options 1-3):

- The following additional cost estimates to the Reference Design were not considered in the MCA:
    - mitigation of the site (planting/reserve area) following removal of the service station of approximately $1.15M (To be priced under TOC2 scope).
    - $268,000 estimate for the demolition of the service station building and removal of the existing fuel storage tanks.
- The additional options do not require the PetStop site for operation of the Busway. The "PetStop" site would no longer be required following construction and could be reused.
- Similarly, the Service Station site would not be land locked and would allow the continuation of the business.
- Programme and Risk considerations:
    - Options 1-3 present a risk of delay to critical path due to redesign, circa 6-8 weeks to undertake a Reference Design, noting that this can be undertaken in parallel or early to mitigate any potential impact to the TOC2 programme. Any risk to consenting and construction programme is probably negligible given that only partial property acquisition is required, and construction programme is 5 months less than the Reference Design.
    - Reduced risk to property programme for high-risk stakeholder in particular the Service Station Option 1 or 3 reduces the potential for RMA/PWA appeal risk and risk to the programme (as these are options which are potentially more acceptable to the landowner, although partial acquisition and working within or adjacent to the site may still be required).
    - Risk to critical path, as the EBA have noted a significant programme savings for Option 1A i.e., 18months vs 23 months. The key programme consideration advantage of Option 1A is the property acquisition timeframe for the Service Station in Option 1A which is significant. Potentially marine staging for option 1A could commence 6 months earlier from the western abutment than the Reference Design. However, completing access would be dependent on obtaining residential properties in Burswood Drive.
- Options 1-3 are further away from the existing Ti Rakau Drive Bridge alignment and abutments. Consideration has been given to how this may impact future upgrades to the existing Ti Rakau Drive Bridge. Given that the abutment in both designs (reference and options) is immediately north of the existing Ti Rakau Drive Bridge, both designs have available width for replacement of the bridge on the northern side of the existing bridge. The Reference Design may be more practical for the purposes of a diversion route during construction, including relocation of the existing Transpower

cables. In addition, any future upgrades to the Hunua 2 Watercare Services Ltd (WSL) pipeline currently located to the south of Ti Rakau Drive bridge could consider realignment of the existing pipe bridge on to the duplicated Ti Rakau Drive Bridge to accommodate future upgrades of the existing WSL asset.

5.7.2. Further Consideration in favour of the Reference Design:

- The Stakeholder and Engagement lead for the EBA raised the issue of a potential reputation risk as there could be a public perception of the EBA avoiding commercial land take where the project is acquiring residential land elsewhere. This was considered to be a key Alliance reputational risk that would need to be carefully addressed in future engagement with the community, especially given the proposal to acquire private residential land through the back of Burswood.

5.7.3. Risk

An unweighted qualitative high level risk assessment of all the options was carried out to provide guidance on programme and is summarised in the table below.

Table 5. Relative difference in qualitative risk level between the Reference Design and the further options.

Option Selection Risk Assessment

Risk Area:	Ref. Design		Option 1		Option 1a		Option 2		Option 3		Comment:
Constuction Methodology:											
Geotech/Ground Conditions	High	3	Medium	2	Medium	2	Medium	2	Medium	2	There is little to no geotech info on the alternative options.
Construction Access	Low	1	Medium	2	Medium	2	Medium	2	High	3	Significant additional staging (Option 3 Beam launching), access
Programme Risk	Low	1	Medium	2	Medium	2	Medium	2	Medium	2	23 months vs 18 months, de-couple Chinatown from the main Ti Rakau bridge.
Ecological/Environmental:											
Coastal Realm	Medium	2	High	3	High	3	High	3	High	3	Less impact in the Ref design
Tributary crossing	Low	1	High	3	High	3	High	3	Low	1	Options 1 and 2 cross the tributary, the others don't.
Stakeholder/Consents:											
Property Impacts	High	3	Medium	2	Low	1	Medium	2	Medium	2	Impacts on the Petrol Station reduced, however, 1 and 2 impact other properties.
Reputation	Low	1	Medium	2	Medium	2	Medium	2	Low	1	Visual impact on residential properties, loss of urban realm design.
Consents											Non-differntiating
Cost Risk:											
Procurement	Low	1	Medium	2	Medium	2	Medium	2	Medium	2	Amount of marine staging that would need to be procured.
Design Maturity (cost uncertainty based on design maturity)	Low	1	High	3	High	3	High	3	High	3	Options other than the Ref design have significantly less detail and maturity.
	Score:	14		21		20		21		19	

The Reference Design presents a lower relative risk compared to the further options assessed. This is driven largely by the fact that a Reference Design already exists, has been consulted on, and presents the lowest overall construction risk (I.e more detailed design would need to be undertaken on the options that could identify further design constraints unknown at this time).

The risk profile for the options came out relatively similar. Option 3 has a slightly lower overall risk profile compared to the other options despite having a greater construction complexity due to access. Overall, none of the options have a risk profile that cannot be mitigated, however there is an as yet unquantified uncertainty that exists in terms of how any of these options would be received by the community. This would only become clearer once consultation with the public had occurred.

It is anticipated that a detailed quantitative risk assessment for any of the further options would ultimately result in a higher cost risk exposure as compared to the Reference Design; this is due to the construction staging and methodology required to deliver any of those options.

In considering risks to the construction programme, it was identified that progressing the Reference Design carried more certainty and was preferred by the ALT from a risk perspective.

5.8. ALT Consideration

The ALT met to consider the outcomes of the MCA, the meeting with Murray Burt and further work undertaken in respect of construction activities, programme and risk on the 23rd of May 2022.

The further assessment undertaken by the construction team noted the following:

- The construction team's preference continued to be for Option 1/1A as potentially early construction can start (subject to resource consents being obtained) as property isn't required if Option 1A is selected (Property acquisition risk reduced).
- The cycleway could be further refined (use of timber structurers).
- The rehabilitation work for the Service Station site in the Refence Design has been roughly estimated at a further $1.2m which would need to be confirmed in future budgeting.

The risk team noted that the Options 1 - 3 have a higher risk profile than the Refence Design when considering the following factors: construction; geotech; access; programme; environment; stakeholders; cost and procurement. However, these factors didn't consider mitigation.

The ALT further considered the landscape and visual factors of Options 1- 3 and their impact on Urban design issues, walking and cycling connections and wider issues. ALT also considered the views expressed by mana whenua.

The ALT noted the outcomes of the MCA, the views of Murray Burt and the additional matters considered, and the views of the ALT were shared in discussion. The conclusion reached by the ALT was to recommend to the IPAB to progress Option 1A as it presents the best option for a busway in terms of constructability and affordability however there were strong concerns expressed through the ALT regarding urban design outcomes, connectivity, impact on the CMA, landscape, and visual issues.

The ALT noted that detailed design of the recommended option will need to address crossing the tributary of the creek, proximity to the residential peninsula, cycling and walking connectivity, and mitigation of landscape impacts.

The ALT also noted that whilst a majority was reached the recommendation was a difficult decision as the issues considered were finely balanced between the affordability outcome and the connectivity, urban design, landscape, and visual outcomes.

5.9. Project Alliance Board.

The ALT presented a preliminary Ti Rakau Drive Bridge options assessment paper to the PAB on 26 May 2022 who agreed 'in principle' to further investigate other options which do not require any acquisition of the site, and sought detail on:

- walking and cycling connections
- feedback from partners including mana whenua and Auckland Council – Regulatory teams
- construction and cost
- future proofing and risks.

These matters are detailed in section 6 of this report.

The EBA updated Mobil on the 07 June 2022 with the results of MCA and shared the direction of PAB to look at options that didn't require land, to look more closely at walking and cycling, to discuss the bridge options with Auckland Council and to further engage with mana whenua.

6. Further Options for Assessment

6.1. Further Options for Assessment

Additional options to those previously shared with the PAB were developed to address walking and cycling and connectivity issues. Options 1A to 1H are shown below and included in attachment 5.

Figure 11 - Option 1a (revised)

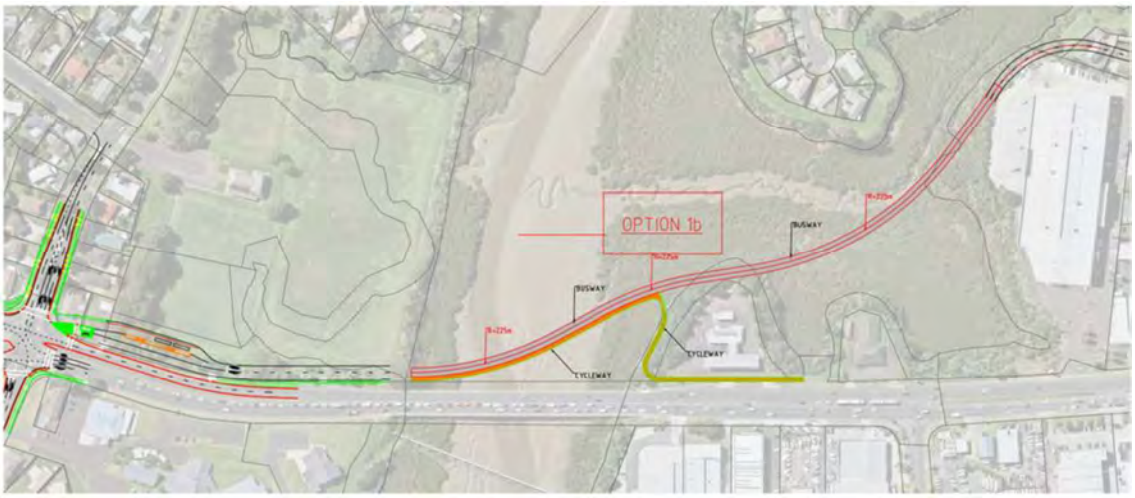


Figure 12 -Option 1b

Figure 13 - Option 1c

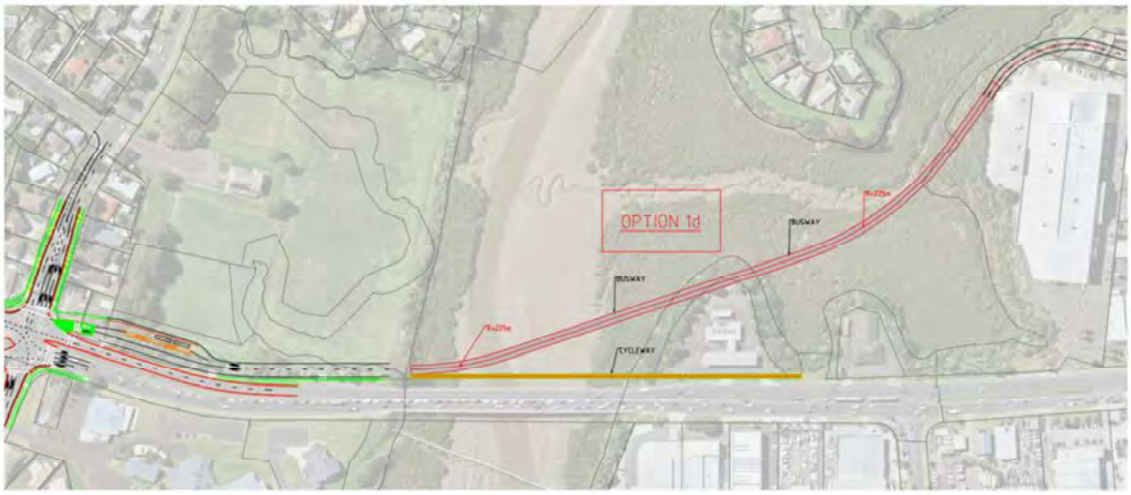


Figure 14 - Option 1d

Figure 15 - Option 1e

Figure 16 - Option 1f

Figure 17 - Option 1g

Figure 18 - Option 1h

Options 1b, 1c, and 1e and 1f were discounted because of an indirect cycle connection which would require pedestrians and cyclists to experience a tight turn from the proposed bridge on to the Mobil site and then again onto Ti Rakau Drive. ……

Option 1 d was seen as being similar to Option 1a and option 1h was seen as a refinement of option 1a which could be investigated through the design process. Option 1d and 1h were discounted by the Alliance for these reasons.

Options 1A and 1G were shortlisted for further assessment under the MCA by the technical specialists and were also discussed with Auckland Council and Mana whenua.

6.2. Feedback from partners - Auckland Council Regulatory

The Alliance met with the Auckland Council Regulatory team (including their Coastal specialists) on 30/06/2022 to discuss the Refence Design and the Bridge Options.

The Auckland Council team did not identify fatal flaws in the options during their 'first pass review', commenting that bridges get built over many coastal areas in the Auckland region. Auckland Council noted that the design of any bridge option would need to carefully consider the following matters:

- temporary reclamation,
- sea level rise,
- ecological values including mangrove environments and soft soils (noting that these may be very deep creating issues for bridge foundations),
- urban design and visual impacts of new bridge structures.

Auckland Council also considered it important to cover mana whenua views that all infrastructure should, in principle, be in close proximity to each other.

It was also identified that that any future geotechnical testing in the Coastal Marine Area may require resource consent depending on the methodology, and that this may be a time-consuming exercise if one of the alternative designs is chosen given the additional bridge length and depth of soft soils.

6.3. Feedback from partners - Mana whenua

The Alliance discussed the cycleway and bridge options 1a, 1g and the Reference Design with Mana Whenua at hui on 30 June 2022. Mana Whenua requested more time to consider the options and requested to hear from specialists. The Alliance met with mana whenua on the 28 July 2022where the Reference Design and Options 1a and 1g were presented and a detailed discussion about the options with Technical Specialists held.

Mana whenua expressed strong feedback during the discussion citing the principles and values of kaitiakitanga (guardianship the environment), manaakitanga (protection of people) and tikanga (doing the right thing) to guide our decision making.

In this context, mana whenua stated that these principles are best achieved by retaining the Reference Design, which minimises the impacts to the estuary and the neighbouring community.

6.4. MCA Analysis options 1A and 1G

The consideration of revised options 1A and 1G are shown in the MCA table at Attachment 3.

The further Options 1a and 1g were scored similarly to Options 1 (and the original Option 1A). Given the comments from the PAB the transport assessor gave a more detailed assessment of the walking and cycling connections as part of the MCA. The walking and cycling assessment is detailed below at section 6.4.1.

Overall revised Options 1a and Option 1g considered through the second round of the MCA process were considered to be similar with many criteria having no or similar differentiation across the criteria.

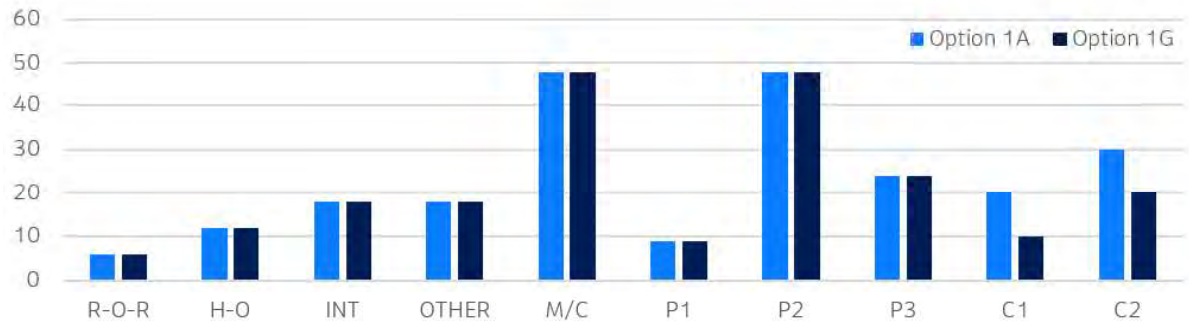
Whilst these options addressed issues raised by the PAB in respect of walking and cycling connections the Reference Design was still strongly preferred in relation to urban design and landscape and visual criteria with Options 1a and 1G scoring negatively for similar reasons as to that detailed at section 5 of this report.

6.4.1. Walking and Cycling Connections

The Transport Assessment considered the following in respect of walking and cycling for Options 1a and 1g:

- the accessibility of the commercial area to the south of Ti Rakau Drive and connectivity to the cycleway. There has been significant interest from the community, at consultation events held by the EBA, in active modes with a desire to include connections to the southern side of Ti Rakau Drive, serving Highbrook. Specific feedback from Fisher & Paykel (a large employer in the area) sees this as an opportunity to encourage their staff to walk or cycle to work, which is a key priority for their workplace.
- Crime Prevention Through Environmental Design (CPTED) suggests that the design of buildings, landscaping and outdoor environments can either encourage or discourage crime. CPTED principals favour the options which utilise Ti Rakau Drive for walking and cycling as there is significantly better passive surveillance and alternative options of 'escape' if required.
- Likely desire lines indicate the sharp turns in several of the options would see cyclists avoiding the bridge or introduce safety concerns.

The graph below shows the change in Safe System Assessment (SSA) product scores for Options 1a and 1g. In summary, only the cyclist crash risk differs between options, with option 1G having a lower crash risk than option 1A for side swipe / rear end crashes (C1 = 50% reduction) and intersection crashes (C2 = 33% reduction).



SSA Scoring commentary

There is no physical change to the busway alignment or road layout for general traffic between Option 1a and Option 1g. As a result, the SSA scores for general traffic (run-off-road head-on and intersection crashes), motorcyclist crashes, or pedestrian's crashes, remained the same across Option 1a and Option 1g.

The SSA has also assumed that the changes to the cycleway alignment will not significantly impact the volume of cyclists using the cycleway (exposure score remains constant), the speed of cyclists using the facility and the speed of conflicting traffic movements (severity scores remains constant).

The proposed changes will have an impact the likelihood scores for C1 (cycle rear-end and side swipe) and C2 (cyclists crossing intersection) type crashes as follows:

- The likelihood of sideswipe/rear-end crashes (C1) for Option 1a was considered unlikely (2) with a separated cycleway adjacent to the busway/road carriageway.
- The likelihood of sideswipe/rear-end crashes (C1) for Option 1g was considered very unlikely (1) with a separated cycleway along the busway alignment with barrier protection (further removed from the general traffic carriageways) and likely to attract a higher proportion of cyclists.
- The likelihood of intersection crashes (C2) for Option 1a was considered likely (3) due to the nine commercial driveways (uncontrolled intersection) the cycleway would cross on Ti Rakau Drive and Burswood Drive. Option 1a also involves two signalised crossings of the busway which may have low compliance.
- The likelihood of intersection crashes (C2) for Option 1g was considered unlikely (2). While the separated cycleway has no conflict points between cyclists and vehicles between Gossamer Station and Burswood Station and would result in a likelihood score of 0, this was offset by the increased risk due to the lack of provision/connection for cyclists travelling to/from Trugood Drive. This may result in cyclists using the footpath or Ti Rakau Dr as noted below.

Other SSA considerations

- Option 1g provides a better level of service than option 1a and is expected to be more attractive to all types of cyclists. It is more direct (150m shorter) than Option 1a which would make this route more attractive to commuter cyclists wanting to reach their destination faster. Option 1g also provides a more appealing environment for recreational cyclists with views across estuary and much less traffic on the busway compared with Ti Rakau Drive.
- Option 1a provides better connectivity for cyclists travelling to/from the Trugood Drive commercial area, as cyclists will be able to cross at the signalised intersection of Trugood Drive to access the cycleway. Option 1g creates a potential risk of riders choosing to either cycle on the footpath to reach the nearest crossings at Gossamer Drive or Burswood Drive or riding on Ti Rakau Drive with narrow kerbside traffic lanes and no dedicated cycle facilities or shoulder.

Overall, the Transport assessment found that the Reference Design and Option 1a provides the safest and most connected option for walking and cycling. Option 1g was considered to introduce safety concerns and reduce opportunity to provide wider connections.

The Reference Design and Option 1a were assessed similarly as they both provide a very good alignment with good connections to the “Trugood” cycle path with the only downside being the connection along Burswood Drive west and the potential safety concerns for vehicles turning into and out of driveways across the cycleway. With the cycleway immediately adjacent Ti Rakau Drive there is good passive surveillance

The alignment of the cycleway in option 1g which is adjacent to the Busway and from Gossamer Drive to behind China Town potentially introduces CPTED issues as the cycleway is removed from passive surveillance from Ti Rakau Drive and there are no opportunities for escape. This was a difference between option 1G and the Reference Design/Option 1A.

6.5. ALT consideration

The ALT met on the 12 August to where the outcomes of the MCA, discussions with Auckland Council and further engagement with Mana Whenua were presented by the project team. Other matters considered by the ALT to those outlined in Sections 6.1 to 6.4 above included: Construction and costs, future proofing for the East Tamaki 3 (Watercare) pipe and risks. These other matters are detailed below.

6.5.1. Construction and cost

As shown in attachment 7 the further options considered with the addition of cycleway connectivity and additional length to avoid the CMA are significantly more costly ranging from $17.125M to $43.7M more than the Reference Design. With the savings of the Mobil land acquisition (circa $14.125M) none of the further options provide any overall saving to the project compared to the Reference Design.

6.5.2. Future proofing - East Tamaki 3 pipe (Watercare)

Ongoing discussions with Watercare have identified an opportunity to upgrade the future East Tamaki 3 pipe. This work is betterment, which the Reference Design currently does not provide for. However, this requirement could be incorporated into an alignment that followed Ti Rakau Drive and/or Fremantle connection points.

Option 1A and 1H allow for the required support to be included on the new structure, though likely to see an increase in structural costs to allow for the additional mass of the large pipe. Option 1G does not support the future pipe requirements, with the bridge being a reasonable distance from Ti Rakau Drive. It could be incorporated but urban design and maintenance requirements would need to be considered to allow this.

6.5.3. Risks

The following matters were identified by the ALT as risks associated with the Options which were separate to the MCA evaluation but were additional matters to assist the ALT in endorsing an option:

- Programme – the indicative construction methodology of options 1A and 1G involves using the Reeves Road flyover gantry, potentially adding programme risk. The Reference Design allows reasonable access from Ti Rakau Drive and China Town for crane erection of the bridge beams with the gantry as an alternative, if available.
- Geotechnical – there is no geotechnical data available for the CMA area, beyond the existing structure. There is a significant risk there would be soft soils and, with consenting and accessibility issues, there is a risk this could delay the detailed design and delivery. The Reference Design allows for the existing geotechnical investigations at Ti Rakau Drive Bridge and China Town to be used.
- Mobil Service Centre feedback and consents – should the Reference Design be endorsed Mobil is likely to challenge the EB3C Notice of Requirement. This risk has been recognized at earlier stages of the project and the programme reflects the potential for this event.
- Costs –costs for the options are concept level costs based on the limited information available. There is a risk that the costs from the alternative options could increase as the options are developed.

- Community feedback – through engagement with the community by the EBA there has been significant concern regarding the impact of the project on the coastal marine area, flora and fauna and green space. With options 1a and 1g, there is a risk that it will be perceived as increased impact in this area.
- Road safety audits – the options with the cycleway away from Ti Rakau Drive are likely to be seen as a high safety risk with the lack of passive surveillance and reduced options for potential escape. Solutions for these issues are not simple and likely to increase costs.

The outcome of the ALT consideration and selection of the preferred option is detailed at section 7.0 below.

7. Outcomes

The Alliance has completed a detailed assessment process for further options of the Ti Rakau Drive Bridge alignment and recommends progressing with the Reference Design.

When assessing the options, the Alliance undertook a scored multi-criteria analysis which considered sustainability, costs, connectivity opportunities, risks, and feedback from partners.

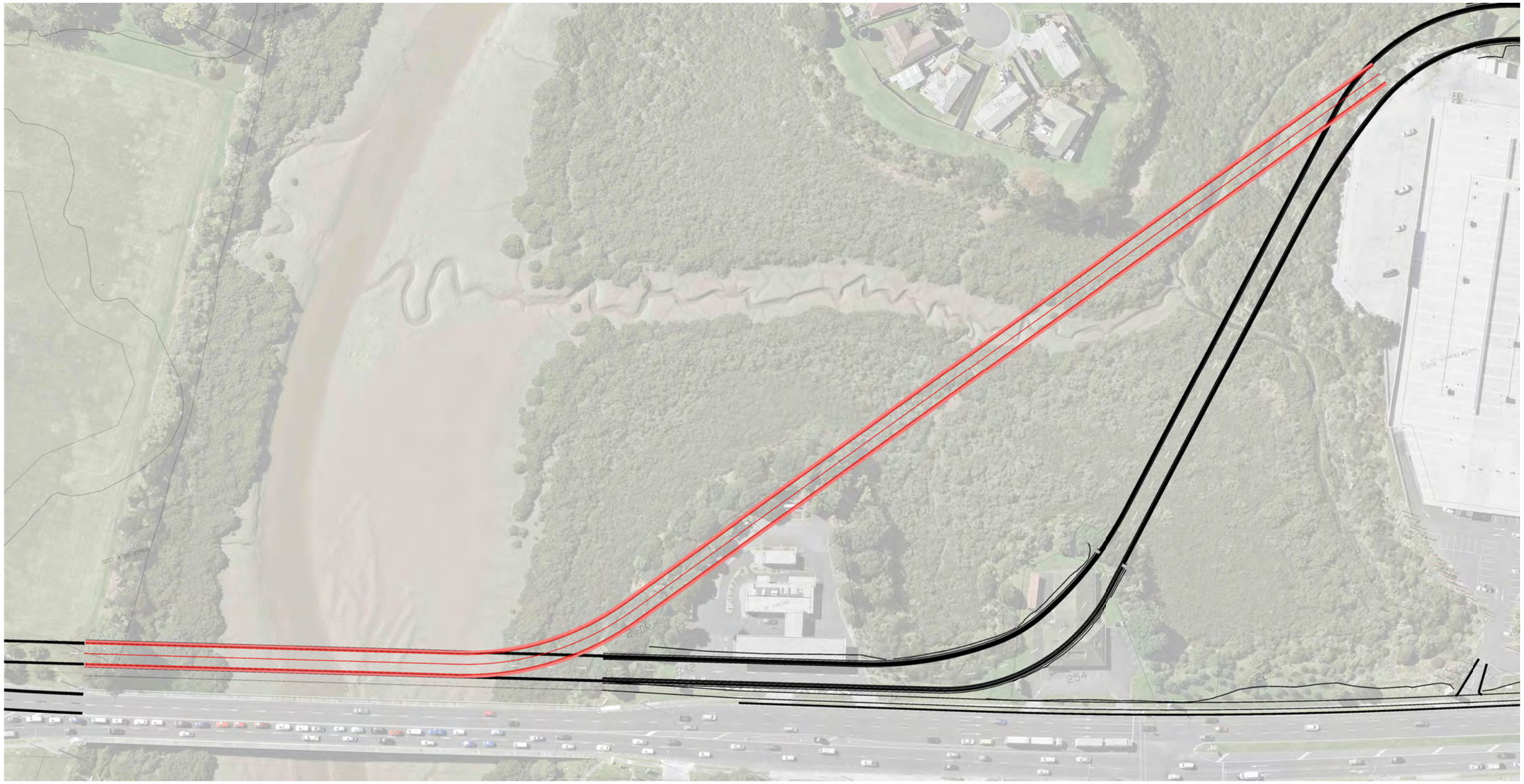
In summary, further investigation found the following:

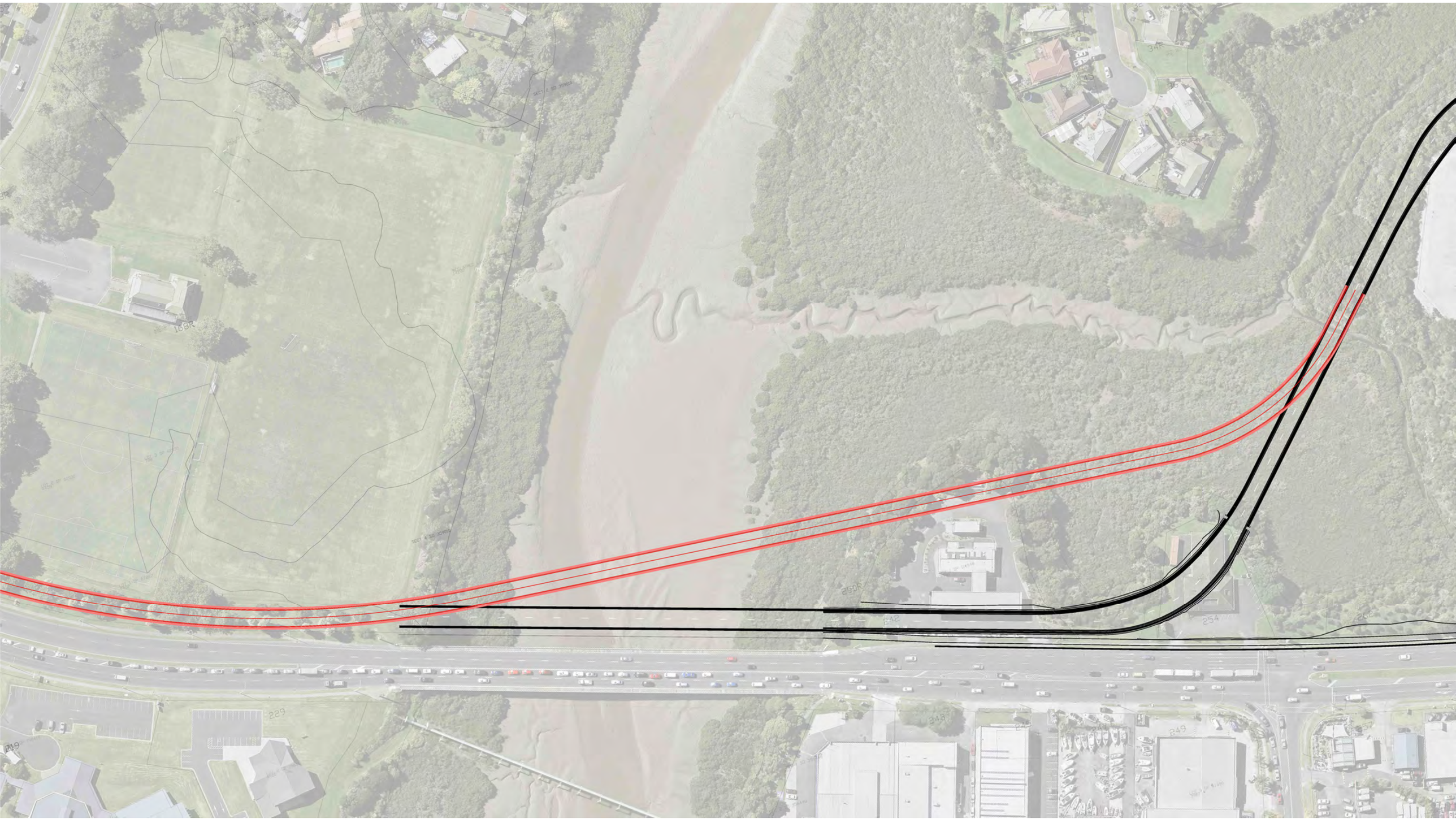
- Mana whenua shared principles and values which strongly support the Reference Design.
- The Reference Design was strongly preferred in the MCA in relation to urban design and landscape and visual criteria.
- The Reference Design and option 1a provides a safe and connected option for walking and cycling. Option 1g introduce safety concerns and reduce opportunity to provide wider connections.
- The Reference Design performs the best on our sustainability measures (embodied carbon).
- The other options considered are likely to raise community concern regarding increase in coastal marine area impact, visual impacts, and noise.
- The other options considered create additional risk to programme and likely extension of contract timeframes.
- The Reference Design is the most cost effective when compared to other options

Based on the further investigation and findings outlined above, the Alliance recommended in a paper to the PAB on the 12/08 /2022 to retain the Reference Design. This recommendation was endorsed by the PAB at the Board meeting held on the 18/08/2022.

On the 23 august 2022 the EBA met with Mobil to update them on the results of the further options investigated, the response from Auckland Council, further engagement with mana whenua and the decision of the EBA to retain the Reference Design

- **Attachment 1: Options 1 -3.**





- **Attachment 2: MCA Criteria**

	Key Result Area / Criteria	Measures	Information Sources	Owned by
Objectives	Provide a multimodal transport corridor that connects Pakuranga and Botany to the wider network and increases choice of transport options.	Provide for all modes (walking, cycling, bus, freight, general traffic). Connect Pakuranga and Botany together and to the the wider network, with adequate linkages and connectivity between modes.	Option descriptions and drawings. Background reviews of option reports.	Shane Doran
	Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network	Demonstrates improvements in transport network reliability of connection, journey time and frequency of service. Length of corridor, Journey time (approx), linkages etc.	Qualitative knowledge of the people carrying capacity of the network. Option descriptions and drawings. Models and qualitative assessment. Background reviews.	Shane Doran
	Provide transport infrastructure that is safe for everyone.	Provides transport infrastructure that is safe.	Option descriptions and drawings. Background reviews of option reports.	Shane Doran
	Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centres	Supports future amenity and public realm improvements to the town centre and along the corridor. Provides legible and desirable connections to the town centre and land uses along the corridor. Provides a continuous corridor connection for all modes to the town centre and along the corridor. Minimises impact on existing place.	Land use and development opportunities-stakeholder consultation. AUP land use zonings. Background reviews including previous Scheme Assessments.	Chris Bentley
	Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form.	The proposed option integrates well (in terms of form and access) with land uses anticipated under the AUP. Option provides for good accessibility to and supports a high quality, compact urban form in Pakuranga and along the busway corridor to Botany. Accounts for number of residential and commercial properties affected by the corridor. Overlay of future proposed landuse under the AUP. Colocation with existing infrastructure (e.g. utilises existing Arterial routes).	AUP land use zonings. Option descriptions and drawings. Background review including previous Scheme Assessment and Specimen Design.	Chris Bentley
	Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.	n/a	n/a	n/a
Legislative Considerations	Asssessment against critical legislative requirements	Qualitative assessment of the consistency of the proposal with the Resource Management Act (1991), especially Part 2 matters, and high level policy framework relevant to the Project eg. NZCPS, NPS's, RPS, NES.	Knowledge and review of the critical elements. Background review including previous (2014) Scheme Assessment and any updates since 2014 SAR Archsite, regional and district planning maps, MVAs	Planners (Jarrod Snowsill)
Constructability	Can the option be constructed within reasonable and known construction constraints?	Constructability incl. volume/balance of earthworks, construction risks and general degree of difficulty: - Disruption to existing services and utilities traffic Management programme	Option drawings and descriptions	Construction - Andy Gibbard / Tommy Temple / Stephen Power
Traffic and Transport	Traffic and Transport	Operational Effects: Journey time improvement / Congestion/queue length within corridor / congestion and queue lengths outside of corridor / PT reliability Effects on existing network - positive and adverse Levels of service of key intersections Operational performance of busway Effects on surrounding network Mode shift - busway patronage et		Shane Doran
		Construction Effects: Temporary intersection layout, accepible level of delay, property access, pedestrianand cyclst facilities, detours etc. PT reliability during the construction phase.		
Natural Environment/Ecological Effects	Water Environment	Construction Effects:Extent of effects and ability to manage erosion and sediment effects on water quality from construction activities. Extent of effects on (and ability to manage) surface water, inculding direct physical efects durring construction.	Option drawings. AUP.	Paul May
		Opertaional Effects: Impact of opertaional stormwater (and ability to manage effects) in regards to quantity and quality (including life supporting capaity). Impact of project on overland flow paths and flooding.	Option drawings/AUP/ flood maps.	Paul May
		Coatal Processes - effects on coastal processes (currents, tides, sediment transport)	identify coatal resources (AUP/Coastal Cahrts/aerial photos/drawings)	Derek Todd.
		Coastal Ecology - extent of effects on significant marine areas (i.e. significant ecological areas) and physical footprint within the coastal marine area.Consideration of how the options may present more or less opportunities to enhance the natural environment/Ecology and open space.	AUP CMA boundaries and SEA's. Previous ecological assessments prepareed for the project	Sharon De Luca
	Terrestrial Environment/Trees	Loss of scheduled trees and indirect effecfts on scheduled trees. Ability to avoid effects on scheduled trees	Plans of scheduled trees. Speciemn design arboricultural assessment.	Jarrod/Tim
		Extent of effects (and ability to manage effects) on indigenous vegetation	Specimen Design Ecological Repo	Sharon De Luca, Jarrod and Tim H
		Extent of effects on significant habitats of indigenous fauna (terrestrial).		
	Landscapes and Natural Features and Character	Extent of effects on natural character areas (particularly outstanding and high natural charater areas).	Land use and Topo maps / aerial photo data. AUP and Overlays. Option drawings.	Chris Bentley/Tom Lines
		Extent of effects on landscapes and natural features including geological features, landform vegetation (including trees), watercourses etc.	Land use and Topo maps / aerial photo data. AUP and Overlays. Option drawings.	
Heritage	Effects - Archaeology	Extent of effects on sites and places of archaeological value	Specimen design reports. AUP including overlays. Archaeological data bases	Arden Cruickshank
	Effects - Built heritage	Extent of effects on heritage buildings and place	Specimen design reports. AUP including overlays. Archaeological data bases	
	Property Implications	Qualitative assessment of the scale of likely / anticipated effects from land take. Reasonable necessity and requirement for operation and construction. Considering extent to which additional land required has already been acquired for the project and risk of acquiring land still needed.	Option drawings and descriptions. Land ownership details along corridor and details of land already acquired/owned.	Fenella Fisher
		Number of properties to be acquired. Degree of difficulty of property acquisition (includes nature of land use, consideration of common land acquisition i.e. land owned by multiple parties).		
		Type of property e.g. commercial versus residential versus parks/heritage.		

Built Elements	Impacts on utilities and significant infrastucture	Requirements for relocation / design of alternative major infrastructure, including consideration of safety impacts of such requirements and risk of continuity of service over construction - e.g. Transpower National Grid, Watercare, Telecomms etc - account for cost of relocations if necessary Disruption - effects on networks and continuity of service.	Design footprint of options. Estimated durations for construction works. Previous consultation with utility owners.	Simon Jones/ Sikander Malik
	Permnanet effects -connectivity (circulation)	The extent of effects on connectivity including disruption to the street network and walkability	Land Use mapping, aerial photographs, topographic mapping. Option Drawings.	Chris Bentley /Tom Lines
	Permanent effects - Built Form	The extent of effects on urban form including lot pattern, street frontages, significant buildings and other structures	Land Use mapping, aerial photographs, topographic mapping. Option Drawings. Historical areas identified on planning maps.	
	Permanent Effects - Activities/Use	The extent of effects on (or compatibility with) surrounding activities, with particular regard to public activities (such as town centres), land use, and character.	Use knowledge of the project area, urban structure and form. Identify activities (land use and topographic map / aerial photo data). Option Drawings	
	Permanent Effects - Visual Amenity	The extent of effects on visual amenity taking into account the character and visibility (prominence) of the proposal the materiality and proposed built form, the character of the existing environment, the sensitivity of audiences, duration of view, magnitude of visual change and the experience of future road users.	Project extent knowledge and Option Drawings. Aesthetics including visibility, prominence, effects on public views, 'fit' with context. Specimen Design landscape and visual assessment.	
	Permanent Effects -Assocaitive Elements	The extent of effects on elements of townscape amenity with historical or cultural assocaitions or which otherwise contribute to townscape amenity.	Use land use and topographic map / aerial photo data to identify associative elements including recreational areas and historical /cultural areas identified on plan maps	
Social Effects including Public Health	Noise and Vibration	Construction noise and vibration effects on residents and sensitive receivers. Extent of effects and Ability to avoid/manage noise and vibration effects during construction.	Design footprint of options. Specimen Design Acoustic assessment. Estimated durations for construction works. Noise management.	Shivam Jahku
		Impact of operational noise and vibration on sensitive receivers.	Land use and topo map / aerial photo data. Speciemn design Acoustic assessment. Option Drawings.	
	Contamination	Potential impact of contaminants from historical land uses on environmental discharges (to air, surface water and groundwater): Potential impact of contaminants from historical land uses on human health (construction workers and future users/general public); Ability to avoid/manage effects during construction, including cost considerations.	Plans of identified / known contaminated land. Specimen Design Reports, Option Drawings, Design footprint of options, estimated durations for construction works.	Shannon Holroyd
	Community facilities	The extent to which effects on community facilities in the study area (including educational, health and leisure facilities, but excluding public open space will impact on the existing and planned uses of these by the community. During construction and permanently.	Zoning maps, aerial photographs and option plans. Specimen Design reports. Physical impact of new structures. Extent of land take/physical impact. Proximity effects/change in quality. Removal of heavy / freight vehicles from nominated streets of social service / facilities .	John Daly
	Viability/Productivity of business land areas	The extent of effects on industrial and business land areas, including land take, severance and access impacts that affect the viability/productivity of these activities, such that people's material wellbeing (e.g. employees) or access to services (way of life) will be impacted.	Zoning maps, aerial photographs and option plans. Physical impact of new structures. Extent of land take/physical impact. Proximity effects/change in quality/ease of access. We note that this needs to recognise project cost if site directly affected.	
	Public Open Space	Extent to which people's use and enjoyment of (1) public open space and (2) access to and along the coast is provided for or impacted The assessment of people's use and enjoyment (quality and way of life) are affected with give considering to the proximity effects of works/change in quality/ease or change of access.	Land use and topographic map / aerial photo data. Option Drawings.	
	Social Cohesion	Discussion on the potential impacts on patterns of movement or communities of interest that might be affected by the construction/operation works, such that there may be a loss of social cohesion or fragmentation of existing community structures (e.g. disruption or severance of school zones, electoral catchments, etc).	Catchment maps for school zones, political boundaries etc.	
Climate Change	Climate Change Response	Impact on Materials consumption including embodied carbon (This represent the largest change between the options with respect to resource efficiency. Assuming an electric bus fleet, operational GHG emissions will be similar between options). Climate risk and adaptation.	Difference in materials impacts as measured by the IS materials calculator. Information source= quantities of key materials for each options (provided by QS team or design team). Increase or decrease to either the EBA cliamte risk ratings or exposure to climate change hazards. Infomration sources: EBA climate chenge risk register and AC coastal hazards map.	Sarah Lindberg

- **Attachment 3: MCA Table**

	A	B	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1		Key Result Area / Criteria	Option 1		Option 2		Option 3			Reference Design	Notes	Option 1A	Revised Option 1a		Option 1g		
2			score	Reasons/Assumptions/Mitigations	score	Reasons/Assumptions/Mitigations	score	Reasons/Assumptions/Mitigations	Score	Reasons/Assumptions/Mitigations			score	Reasons/Assumptions/Mitigations	score	Reasons/Assumptions/Mitigations	
3	Objectives	Provide a multimodal transport corridor that connects Pakuranga and Botany to the wider network and increases choice of transport options.	4	Provides for all modes of transport	4	Provides for all modes of transport	4	Provides for all modes of transport	4	Provides for all modes of transport		Same as option 1	4	Provides for all modes of transport, however curving alignment has potential to provide an uncomfortable ride for bus passengers as the buses navigate the alignment	4	Provides for all modes of transport, however curving alignment has potential to provide an uncomfortable ride for bus passengers as the buses navigate the alignment	
4		Provide transport infrastructure that improves linkages, journey time and reliability of the public transport network	4	Provides a dedicated separated busway with walking and cycling facilities improving reliability and travel time for bus services	4	Provides a dedicated separated busway with walking and cycling facilities improving reliability and travel time for bus services	4	Provides a dedicated separated busway with walking and cycling facilities improving reliability and travel time for bus services	4	Provides a dedicated separated busway with walking and cycling facilities improving reliability and travel time for bus services		Same as aoption 1	4	Provides a dedicated separated busway with walking and cycling facilities improving reliability and travel time for bus services	4	Provides a dedicated separated busway with walking and cycling facilities improving reliability and travel time for bus services	
5		Provide transport infrastructure that is safe for everyone.	3	Provision of offline busway and cycling facilities removes vulnerable users from potential accidents with motor vehicles	3	Provision of offline busway and cycling facilities removes vulnerable users from potential accidents with motor vehicles	3	Provision of offline busway and cycling facilities removes vulnerable users from potential accidents with motor vehicles	3	Provision of offline busway and cycling facilities removes vulnerable users from potential accidents with motor vehicles		Same as option 1	3	Provision of offline busway and cycling facilities removes vulnerable users from potential accidents with motor vehicles	2	Provision of offline busway and cycleway removes vulnerable users from potential accidents, however alignment of cycleway adjacent to Busway from Gossamer to behind China Town potentially introduces CPTED issues as the cycleway is removed from passive surveillance from Ti Rakau Drive and there are no opportunities for escape.	
6		Contribute to accessibility and place shaping by providing better transport connections between, within and to the town centres	-3	Does not contribute to accessibility and place shaping and detracts from amenity and public realm outomes.	-3	Does not contribute to accessibility and place shaping and detracts from amenity and public realm outomes.	-3	Does not contribute to accessibility and place shaping and detracts from amenity and public realm outomes.	2	Supports future amenity and public realm improvements along the corridor. Provides legible and well connected cycleway. Minimises impact on place, ie the Pakuranga Creek estuary. Builds on the existing character of the area. Fits in with the form of China Town. The removal of the Mobil and Pet Depot enables these sites to be revegetated reinforcing the natural qualities of the wider estuary. The connection to the China Town Bridge impacts on a compact urban form and placeshaping.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as option 1	-2	Improves connectivity and accessibility but does not contribute to place shaping and detracts from amenity and public realm outomes.	-3	Improves accessibility to Burswood but redcues connectivity to Ti Rakau Drive businesses. Does not contribute to place shaping and detracts from amenity and public realm outomes.	
7		Provide transport infrastructure that integrates with existing land use and supports a quality, compact urban form.	-3	Does not provide a compact urban form or integrate with existing land uses,	-3	Does not provide a compact urban form or integrate with existing land uses,	-3	Does not provide a compact urban form or integrate with existing land uses,	3	Provides a compact urban form and intgrates well with exsting landuses, ie is built beside and parallel to the existing Ti Rakau Bridge.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	Same as option 1	-3	Does not provide a compact urban form or integrate with existing land uses,	-3	Does not provide a compact urban form or integrate with existing land uses,	
8		Safeguard future transport infrastructure required at (or in vicinity of) Botany Town Centre to support the development of a strategic public transport connection to Auckland Airport.		n/a		n/a		n/a		n/a	n/a	n/a		n/a		n/a	
9	Legislative Considerations	Asssessment against critical legislative requirements	-2	None of the alternative options are considered to be fatally flawed from and legislative and consenting perspective as works required for specified infrastructure (AMETI). All options require a higher level of environmental mitigation to enable the option to gain consent. This option interacts with the Coastal Marine Area (CMA), Open Space that is identified within the Auckland Unitary Plan and wetlands/watercourses that are recognised and afforded a level of protection in the National Policy Statement for Freshwater Management. Effects related to urban design and extent of bridge and impacts on views. Effects on built heritage seen as slightly better than ref design.	-1	None of the alternative options are considered to be fatally flawed from and legislative and consenting perspective as works required for specified infrastructure (AMETI). All options require a higher level of environmental mitigation to enable the option to gain consent. This option interacts with the Coastal Marine Area (CMA), Open Space that is identified within the Auckland Unitary Plan and wetlands/watercourses that are recognised and afforded a level of protection in the National Policy Statement for Freshwater Management	-2	None of the alternative options are considered to be fatally flawed from and legislative and consenting perspective as works required for specified infrastructure (AMETI). All options require a higher level of environmental mitigation to enable the option to gain consent. This option interacts with the Coastal Marine Area (CMA), Open Space that is identified within the Auckland Unitary Plan and wetlands/watercourses that are recognised and afforded a level of protection in the National Policy Statement for Freshwater Management. Effects related to urban design and extent of bridge and impacts on views - most similar to ref design with respect to views at the China town end.	-2	None of the alternative options are considered to be fatally flawed from and legislative and consenting perspective as works required for specified infrastructure (AMETI). All options require a higher level of environmental mitigation to enable the option to gain consent. This option interacts with the Coastal Marine Area (CMA), Open Space that is identified within the Auckland Unitary Plan and wetlands/watercourses that are recognised and afforded a level of protection in the National Policy Statement for Freshwater Management. Given scores for marine area this options scored. Could be seen to have more efficient use of the CMA (minimum area), but has large temporary reclamation and has larger effects on adjacent land.	Scoed the sme but for different reasons. Options 1 and 3 have design/viusal issues. Ref design less occupation of CMA, but has large temporary reclamation and greater impact on adjacent land. For the purposes of the MCA it is assumed that all options would be publically notifed with the EB3C application. I have not scored the difficulty of obtaining consent with respect to objection from the directly affected land owner and consultation with community as unknown at this point in time.	Option 1a same as option1.	-2	None of the alternative options are considered to be fatally flawed from and legislative and consenting perspective as works required for specified infrastructure (AMETI). All options require a higher level of environmental mitigation to enable the option to gain consent. This option interacts with the Coastal Marine Area (CMA), Open Space that is identified within the Auckland Unitary Plan and wetlands/watercourses that are recognised and afforded a level of protection in the National Policy Statement for Freshwater Management. Effects related to urban design and extent of bridge and impacts on views. Effects on built heritage seen as slightly better than ref design.	-2	None of the alternative options are considered to be fatally flawed from and legislative and consenting perspective as works required for specified infrastructure (AMETI). All options require a higher level of environmental mitigation to enable the option to gain consent. This option interacts with the Coastal Marine Area (CMA), Open Space that is identified within the Auckland Unitary Plan and wetlands/watercourses that are recognised and afforded a level of protection in the National Policy Statement for Freshwater Management. Effects related to urban design and extent of bridge and impacts on views. Effects on built heritage seen as slightly better than ref design.	
10 11 15 16 17	Constructability	Can the option be constructed within reasonable and known construction constraints?	-1	More gentle curvature in the bridge allows for easier construction with preferred methodology ie. Launching Gantry Will be the quicker and cheaper option given it is adopting a construction single methodology	-3	Tighter curvature will result in more permanent works piles and beams. Also it will require wider temporary staging due to the curved spans needing to be installed with a crane.	-3	Tighter curvature will result in more permanent works piles and beams. Also it will require wider temporary staging due to the curved spans needing to be installed with a crane.	-3	Need to build 2No. Bridges with 4No. Abutments and on grade works between (seems like more work). Don't need to build concurrently so can assist programme and methodology / resourcing etc. Will be stop / start as we need to move equipment between the 2 bridges. Require temporary occupation in CMA to construct.		Scores a -2	-1	More gentle curvature in the bridge allows for easier construction with preferred methodology ie. Launching Gantry Will be the quicker and cheaper option given it is adopting a construction single methodology	#VALUE!	More gentle curvature in the bridge allows for easier construction with preferred methodology ie. Launching Gantry Will be the quicker and cheaper option given it is adopting a construction single methodology	
18 19 20 21 22 23 24 25	Traffic and Transport	Traffic and Transport	3	The provision of a dedicated and separated busway improves travel time and reliability. Option 1 provides a good to very good alignment with a reasonable connection with the "Trugood" cycle path using an alignment for the cycleway connection as shown in yellow in the attached PDF. This option could be improved by bringing the cycleway on the western side of the Mobil Service Station (purple alignment). The movement of the cycleway away from Ti Rakau Drive	4	The provision of a dedicated and separated busway improves travel time and reliability	3	The provision of a dedicated and separated busway improves travel time and reliability. Option 3 provides a good to very good alignment with a reasonable connection with the "Trugood" cycle path using an alignment for the cycleway connection as shown in yellow in the attached PDF. This option could be improved by bringing the cycleway on the western side of the Mobil Service Station (purple alignment). The movement of the cycleway away from Ti Rakau Drive	4	The provision of a dedicated and separated busway improves travel time and reliability. The reference design provides a very good alignment with good connections to the "Trugood" cycle path with the only downside being the connection along Burswood Drive west and the potential safety concerns for vehicles turning into and out of driveways across the cycleway. With the cycleway immediately adjacent Ti Rakau Drive there is good passive surveillance.		Option 1A provides a good alignment with a poor connection with the "Trugood" cycle path using an alignment for the cycleway connection as shown in yellow in the attached PDF. This option could be improved by bringing the cycleway on the western side of the Mobil Service Station (purple alignment). There would be similar downsides as the Reference Design along Burswood Drive west. The distance of the cycleway to Ti Rakau Drive would introduce CPTED issues as passive surveillance from Ti Rakau Drive would be limited. I would give this option a score of 2.	4	The provision of a dedicated and separated busway improves bus travel time and reliability. Option 1a provides a very good alignment with good connections to the "Trugood" cycle path with the only downside being the connection along Burswood Drive west and the potential safety concerns for vehicles turning into and out of driveways across the cycleway. With the cycleway immediately adjacent Ti Rakau Drive there is good passive surveillance.	2	Option 1g provides a good alignment for the busway with a poor cycle connection with the "Trugood" cycle path. There would be similar downsides as the Reference Design along Burswood Drive west. The distance of the cycleway to Ti Rakau Drive would introduce CPTED issues as passive surveillance from Ti Rakau Drive would be limited. I would give this option a score of 2.	
26 27			0	The construction traffic effects are neutral as there is no interaction with existing infrastructure with the proposed option	0	The construction traffic effects are neutral as there is no interaction with existing infrastructure with the proposed option	0	The construction traffic effects are neutral as there is no interaction with existing infrastructure with the proposed option	0	The construction traffic effects are neutral as there is no interaction with existing infrastructure with the proposed option		Same as Option 1.	0	The construction traffic effects are neutral as there is no interaction with existing infrastructure with the proposed option	0	The construction traffic effects are neutral as there is no interaction with existing infrastructure with the proposed option	
28	Natural Environment/Ecological Effects	Water Environment	-2	All three options are predominantly about works in the CMA and erosion and sediment control will be more about minimising disturbance. I don't see any differentiators between the options and score them -2 assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed. The construction methodology says no occupation of CMA (ie no reclamation) which minimises impacts	-2	All three options are predominantly about works in the CMA and erosion and sediment control will be more about minimising disturbance. I don't see any differentiators between the options and score them -2 assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed. The construction methodology says no occupation of CMA (ie no reclamation) which minimises impacts	-2	All three options are predominantly about works in the CMA and erosion and sediment control will be more about minimising disturbance. I don't see any differentiators between the options and score them -2 assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed. The construction methodology says no occupation of CMA (ie no reclamation) which minimises impacts	-2	Less works in the CMA and erosion and sediment control will be more about minimising disturbance. Assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed. However, becasue the construction methodology says there is a occupation of CMA (ie reclamation) I score this option the same.		All three options are predominantly about works in the CMA and erosion and sediment control will be more about minimising disturbance. I don't see any differentiators between the options and score them -2 assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed. The construction methodology says no occupation of CMA (ie no reclamation) which minimises impacts. -2	-2	Similar to the first three option except a cycleway adjacent to Ti Rakau Drive as a second area of potential impact. The option, like the others, is predominantly about works in the CMA and erosion and sediment control will be more about minimising disturbance. This option has two areas of work so has a larger area of potential impact although not significantly different and I score it -2 assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed.	-2	Similar to the first three options. The option, like the others, is predominantly about works in the CMA and erosion and sediment control will be more about minimising disturbance. I score it -2 assuming best practice erosion and sediment control with sheet piling to keep water out while piles and piers are constructed.	
29			-1	I have assumed the bridge would have a single high point somewhere along the bridge. For all three bridges the section that drains to the northeast will have similar drainage systems with equal opportunity for a raingarden type device to treat the stormwater on the northern side of China Town building. All three options have no feasible options for green infrastructure to treatment stormwater as there is no room of a device at the end of the bridge and are likely to be treated by a GPT off the bridge near the abutment. The three options therefore score the same which is a -1 as the busway is a low contaminant generating road and half will be treated by best practice with the other half receiving similar treatment to other sections of busway.	-1	I have assumed the bridge would have a single high point somewhere along the bridge. For all three bridges the section that drains to the northeast will have similar drainage systems with equal opportunity for a raingarden type device to treat the stormwater on the northern side of China Town building. All three options have no feasible options for green infrastructure to treatment stormwater as there is no room of a device at the end of the bridge and are likely to be treated by a GPT off the bridge near the abutment. The three options therefore score the same which is a -1 as the busway is a low contaminant generating road and half will be treated by best practice with the other half receiving similar treatment to other sections of busway.	-1	I have assumed the bridge would have a single high point somewhere along the bridge. For all three bridges the section that drains to the northeast will have similar drainage systems with equal opportunity for a raingarden type device to treat the stormwater on the northern side of China Town building. All three options have no feasible options for green infrastructure to treatment stormwater as there is no room of a device at the end of the bridge and are likely to be treated by a GPT off the bridge near the abutment. The three options therefore score the same which is a -1 as the busway is a low contaminant generating road and half will be treated by best practice with the other half receiving similar treatment to other sections of busway.	0	This option allows green infrastructure for stormwater treatment although its only for the busway so its not a major benefit.		I have assumed the bridge would have a single high point somewhere along the bridge. For all three bridges the section that drains to the northeast will have similar drainage systems with equal opportunity for a raingarden type device to treat the stormwater on the northern side of China Town building. All three options have no feasible options for green infrastructure to treatment stormwater as there is no room of a device at the end of the bridge and are likely to be treated by a GPT off the bridge near the abutment. The three options therefore score the same which is a -1 as the busway is a low contaminant generating road and half will be treated by best practice with the other half receiving similar treatment to other sections of busway. -1	-1	I have assumed the bridge would have a single high point somewhere along the bridge. For all options (excluding Reference Design) the section that drains to the northeast will have similar drainage systems with equal opportunity for a raingarden type device to treat the stormwater on the northern side of China Town building. All options (excluding reference design) have no feasible options for green infrastructure to treatment stormwater as there is no room of a device at the end of the bridge and are likely to be treated by a GPT off the bridge near the abutment. THe cycleway doesn't require treatment and can free discharge to creek. The three options therefore score the same which is a -1 as the busway is a low contaminant generating road and half will be treated by best practice with the other half receiving similar treatment to other sections of busway.	-1	I have assumed the bridge would have a single high point somewhere along the bridge. For all options (excluding Reference Design) the section that drains to the northeast will have similar drainage systems with equal opportunity for a raingarden type device to treat the stormwater on the northern side of China Town building. All options (excluding reference design) have no feasible options for green infrastructure to treatment stormwater as there is no room of a device at the end of the bridge and are likely to be treated by a GPT off the bridge near the abutment. The three options therefore score the same which is a -1 as the busway is a low contaminant generating road and half will be treated by best practice with the other half receiving similar treatment to other sections of busway.	
30			-2	Crosses tributary of Pakuranga Creek twice, therefore increasing potential for adverse effect on tidal processes increases, but these potential effects would be low	-2	Crosses tributary of Pakuranga Creek twice, therefore increasing potential for adverse effect on tidal processes increases, but these potential effects would be low	2	Low positive effect compared to options 1 & 2 as doesn't cross any tributaries of the Pakuranga Cree, therefore less potential to imapct of water and sediment movements	2	From a coastal processes presceptive, is very similar to Option 3, as doesn't cross any tributaries of the Pakuranga Creek, therefore less potential to impact water and sediment movements		I have reviewed option 1A and the same as Chris & Sharon, in terms of coastal processes and potential hazards it is not vastly different from Option 1, but not as good as the reference design). Therefore I score it the same as Option 1, being -2.					
31			-3	Crosses over low tide channel twice. Assumed no structures/piers in channel. Assumed piers/piles in new bridge across Tamaki River are aligned with existing bridge piers/piles. Mangrove habitat will be removed with construction of piers (consider NES FW coastal wetlands in assessment), disturbance to foraging habitat of some coastal bird species (not breeding habitat). Scoring dependant on how to deal with NES FW re coastal wetlands (mangroves).	-3	Crosses over low tide channel twice. Assumed no structures/piers in channel.Mangrove habitat will be removed with construction of piers (consider NES FW coastal wetlands in assessment), disturbance to foraging habitat of some coastal bird species (not breeding habitat). Scoring dependant on how to deal with NES FW re coastal wetlands (mangroves).	-2	Not crossing the low tide channel as options 1 and 2 do, less disturbance and less permanent occupation. Assumed that crossing the low tide channel does not involve structures in the channel. Less disturbance of mangrove habitat than Options 1 and 2. Assumed piers/piles in new bridge across Tamaki River are aligned with existing bridge piers/piles. Mangrove habitat will be removed with construction of piers (consider NES FW coastal wetlands in assessment), disturbance to foraging habitat of some coastal bird species (not breeding habitat). Scoring dependant on how to deal with NES FW re coastal wetlands (mangroves).	-2	The reference deisgn crosses one low tide channel (by way of a bridge structure, piers out of low tide channel), and hugs the north eastern side of China Town. No reclamation of the CMA is included as part of the design, avoiding the loss of mangrove habitat (coastal wetlands under NES FW). Coastal foraging avifauna will be distrubed during construction (but extensive habitat undisturbed available elsewhere in Tamaki Estuary), with the ultimate structure being a bridge limiting the occupation of the CMA to piers. Post construction, avifauna will be able to forage within the construction area. Could be reduced to -1 effect with appropriate mitigation/offset and careful construction.		I have reviewed option 1A. It is not vastly different to Option 1, but not as good as the reference design (with the reference design hugging the CMA boundary next to Ti Rakau Drive and involving less crossing of low tide channels). I score it the same as Option 1 being -3.	-2	This design hugs the main low tide channel and crosses one smaller low tide channel (by way of a bridge structure, piers out of low tide channel), and hugs the north eastern side of China Town. There will be permanent loss of mangrove habitat for the bridge piers (coastal wetlands under NES FW). Coastal foraging avifauna will be distrubed during construction (but extensive habitat undisturbed available elsewhere in Tamaki Estuary), with the ultimate structure being a bridge limiting the occupation of the CMA to piers. Post construction, avifauna will be able to forage within the construction area.	-2	This design hugs the main low tide channel and crosses one smaller low tide channel (by way of a bridge structure, piers out of low tide channel), and hugs the north eastern side of China Town. The busway is located very close to the maain ow tide channel. There will be permanent loss of mangrove habitat for the bridge piers (coastal wetlands under NES FW). Coastal foraging avifauna will be distrubed during construction (but extensive habitat undisturbed available elsewhere in Tamaki Estuary), with the ultimate structure being a bridge limiting the occupation of the CMA to piers. Post construction, avifauna will be able to forage within the construction area.	
32		Terrestrial Environment/Trees	-3	No scheduled trees. SEA. Score reflects specilaist input	-3	No scheduled trees. SEA. Score reflects specilaist input	-2	No scheduled trees. SEA. Score reflects specilaist input	-2	No scheduled trees. SEA. Score reflects specilaist input.		same as 1					
33			-3	Greaterm impact on mangrove habitat than option 3 - scoring depends on how the NES FW will deal with coastal wetlands (mangroves).	-3	Greater impact on mangrove habitat than option 3 (similar to option 1) - scoring depends on how the NES FW will deal with coastal wetlands (mangroves).	-2	Less impact on mangrove habitat than options 1 and 2 - scoring depends on how the NES FW will deal with coastal wetlands (mangroves).	-2	Less impact on mangrove habitat than options 1 and 2 - scoring depends on how the NES FW will deal with coastal wetlands (mangroves).		same as 1					
34				n/a		n/a		n/a				n/a					
35		Landscapes and Natural Features and Character	-2	Crosses Pakuranga creek at an angle from the existing bridge and extends across the widest part of the CMA. Crosses a tributory of the Pakuranga Creek.	-2	Crosses Pakuranga Creek beside the existing bridge so less impact on the Natural Character of Pakuranga Creek, however extends across the widest part of the CMA. Crosses a tributory of the Pakuranga Creek.	-2	Crosses Pakuranga creek at an angle from the existing bridge and extends across the widest part of the CMA	-1	Crosses Pakuranga Creek but is built beside the existing Ti Rakau Bridge minimising the effects on Natural Character.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	increases to -3 given the extent that the structure dominates the estuary.	-3	Natural Character Crosses Pakuranga creek at an angle from the existing bridge and extends across the widest part of the CMA. Although the bridge avoids the channel of a tributary it introduces a large structure into the coastal environment.	-3	Natural Character Crosses Pakuranga creek at an angle from the existing bridge and extends across the widest part of the CMA. Although the bridge avoids the channel of a tributary it introduces a large structure into the coastal environment.	
36			-3	Impact on CMA and loss of trees from esplande reserve around Mobil site. Further impacts/ bisects natural features and water course patterns of Pakuranga Creek.	-3	Impact on CMA and loss of trees from esplande reserve around Mobil site. Further impacts/ bisects natural features and water course patterns of Pakuranga Creek.	-3	Impact on CMA and loss of trees from esplande reserve around Mobil site. Further impacts/ bisects natural features and water course patterns of Pakuranga Creek.	-1	Impact on CMA is limited to the area besdie the existing Ti Rakau Bridge and the piers can align with the existing bridge.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as 1	-3	Landscape Impact on CMA and loss of coastal vegetation including trees from the northern end of the esplande reserve around Mobil site.	-3	Landscape Combined active modes and BRT bridge results in a wider structure within the CMA. Loss of coastal vegetation including trees from the northern end of the esplande reserve around Mobil site.	
37	Heritage	Effects - Archaeology	-1	assuming that this will avoid the extent of the stone jetties and quarry area, still a possibility of encountering previosly unrecorded archaeological sites witihn the proposed works area, especially behind the petrol station	-1	assuming that this will avoid the extent of the stone jetties and quarry area, still a possibility of encountering previosly unrecorded archaeological sites witihn the proposed works area, especially behind the petrol station	-3	it is assumed that the stone jetties will be destroyed for the placement of piles	-3	it is assumed that the stone jetties will be destroyed for the placement of piles	The assumption of affecting the stone jetties would be changed once we get into that area and can accurately map the features associated with the quarry (AC note).	same as 1	-2	the main bridge/busway will avoid most of the known quarry items and also the promentary behind the petshop which lowers the risk of encountering any previously unrecorded archaeological sites that may exist. The cycleway however will impact the promentary and is closer to the elements of the historic quarry and may impact them, especially during construction	-1	assuming that this will avoid the extent of the stone jetties and quarry area, still a possibility of encountering previosly unrecorded archaeological sites witihn the proposed works area, especially behind the petrol station	
38		Effects - Built heritage	-1	assuming that the extent of works will encroach into the Historic Heritage Extent of Place for the Quarry (Item 2114)	-1	assuming that the extent of works will encroach into the Historic Heritage Extent of Place for the Quarry (Item 2114)	-2	works will be within the HHEP for item 2114, not sure how Council Heritage team will view it once assessed for the AEE.	-2	works will be within the HHEP for item 2114, not sure how Council Heritage team will view it once assessed for the AEE.		same	-2	Extent of works will encroach into the Historic Heritage Extent of Place for the Quarry (Item 2114) with the potential of impacting known elements through the placement of the Cycleway.	-1	Extent of works will encroach into the Historic Heritage Extent of Place for the Quarry (Item 2114), but may miss the known elements.	

	A	B	F	G	H	I	J	K
1		Key Result Area / Criteria	Option 1		Option 2		Option 3	
2			score	Reasons/Assumptions/Mitigations	score	Reasons/Assumptions/Mitigations	score	Reasons/Assumptions/Mitigations
39 40 41	Built Elements	Property Implications	-1	Back of Mobil, assume carwash impacted. Has a larger impact on the Riverhills have assumed impact on field 2 is more than option 2. Assumed impact on 262 is substanitally less, same impact as Option 2 however still not substantial No impact on 254 can still operate	-1	Back of Mobil, follows same alignment for Bridge as reference desgin. Assume similar impact on Mobil similar to Option 1, however closer to properties on the pensinula. Assumed impact on 262 is the same as Option 1, reduced from reference design. No impact on 254 can still operate	-2	Back of Mobil, assume more land impacted than Option 1 and Option 2. Assume no reduction in land impact to the reference desgin for 262. Assume Riverhills impact is greater, however does not impact sports field No Impact on 254 can still operate
42		Impacts on utilities and significant infrastucture	-1	All options would have same impacts on utilities (protect/relocate) and its due to cycle way alignment more than bridge alignmen	-3	All options would have same impacts on utilities (protect/relocate) and its due to cycle way alignment more than bridge alignmen	-3	All options would have same impacts on utilities (protect/relocate) and its due to cycle way alignment more than bridge alignmen
43		Permnanet effects -connectivity (circulation)	-1	Pedestrians and cyclysts have to cross on the bridge and then join Ti Rakau Drive from the back of the Mobil site.	-1	Pedestrians and cyclysts have to cross on the bridge and then join Ti Rakau Drive from the back of the Mobil site.	-1	Pedestrians and cyclysts have to cross on the bridge and then join Ti Rakau Drive from the back of the Mobil site.
44		Permanent effects - Built Form	-3	Juxtaposition to the residential properties on the Burswood peninsular. Urban form, busway diverging away from Ti Rakau Drive	-3	Juxtaposition to the residential properties on the Burswood peninsular. Urban form, busway diverging away from Ti Rakau Drive	-2	Urban form, busway diverging away from Ti Rakau bridge and Ti Rakau Drive but further away from Burswood peninsula
45		Permanent Effects - Activities/Use	-3	Detracts from character of local area as it extends across and dominates the estuary.	-3	Detracts from character of local area as it extends across and dominates the estuary.	-2	Detracts from character of local area as it extends across and dominates the estuary. Score lower due to bridges being parallel.
46		Permanent Effects - Visual Amenity	-3	Significant adverse visual effects on Burswood residential dwellings and people using the coastal SUP.	-3	Significant adverse visual effects on Burswood residential dwellings and people using the coastal SUP.	-2	High adverse visual effects on Burswood residential dwellings and people using the coastal SUP.
47		Permanent Effects -Assocaitive Elements	-3	High associative values in relation to Pakuranga Creek. Consider the legibility of Pakuranga Creek and peoples association with its legibility will be impacted. Historical/ cultural values considered by others.	-3	High associative vakues in relation to Pakuranga Creek. Consider the legibility of Pakuranga Creek and peoples association with its ledgibility will be impacted. Historical/ cultural values considered by others.	-2	High associative vakues in relation to Pakuranga Creek. Consider the legibility of Pakuranga Creek and peoples association with its ledgibility will be impacted. Historical/ cultural values considered by others.
48	Social Effects including Public Health	Noise and Vibration	-1	Works are ~40m away at the closest point to the closest residential receiver at 30 Davington Way. Works may be within 3 dB of the daytime noise criterion at this address during worst-case activities. Construction noise may be noticeable at closest residential receivers. Limited impact of construction noise at China Town due to the commercial use of the building and its construction. No vibration effects predicted.	-1	Works are ~40m away at the closest point to the closest residential receiver at 30 Davington Way. Works may be within 3 dB of the daytime noise criterion at this address during worst-case activities. Construction noise may be noticeable at closest residential receivers. Limited impact of construction noise at China Town due to the commercial use of the building and its construction. No vibration effects predicted.	-1	Works are ~70m away at the closest point to the closest residential receiver at 30 Davington Way. Works will likely be below the daytime noise criterion at this address even while taking place at closest point along the route. Construction noise may be noticeable at closest residential receivers. Limited impact of construction noise at China Town since due to the commercial use of the building and its construction. No vibration effects predicted.
49			-1	The option will introduce a new noise source to the area, however there will be very low adverse noise effects from the busway	-1	The option will introduce a new noise source to the area, however there will be very low adverse noise effects from the busway	-1	The option will introduce a new noise source to the area, however there will be very low adverse noise effects from the busway
50		Contamination	0	No known environmental investigation reports available for the Mobil site and so cannot comment on the status / level of potential contamination at the site.	0	No known environmental investigation reports available for the Mobil site and so cannot comment on the status / level of potential contamination at the site.	0	No known environmental investigation reports available for the Mobil site and so cannot comment on the status / level of potential contamination at the site.
51		Community facilities	0	Community facilities within vicinity of Project are unaffected by the proposed design change	0	Community facilities within vicinity of Project are unaffected by the proposed design change	0	Community facilities within vicinity of Project are unaffected by the proposed design change
52		Viability/Productivity of business land areas	0	Full acquisition of Mobil site is no longer required. Partial acquisition would not result in displacement of this business. However, each option will impact the rear of the Mobil site however it appears the site can remain open and operational.	0	Full acquisition of Mobil site is no longer required. Partial acquisition would not result in displacement of this business. However, each option will impact the rear of the Mobil site however it appears the site can remain open and operational. Slightly preference for this option as the footprint appears to be the smallest	0	Full acquisition of Mobil site is no longer required. Partial acquisition would not result in displacement of this business. However, each option will impact the rear of the Mobil site however it appears the site can remain open and operational.
53		Public Open Space	-2	Larger temporary occupation area of Riverhills Park which would result in a short-term adverse impact for users of sporting pitches and recreational activities. This option will result in parallel transport corridors which may change the perceptions of the place i.e. less visibility of mangroves to a more transport focused corridor.	-2	Larger temporary occupation area of Riverhills Park which would result in a short-term adverse impact for users of sporting pitches and recreational activities. This option will be screened by petrol station and warehouse which may allow for more enjoyment of the mangroves. Slight preference for this option.	-2	Larger temporary occupation area of Riverhills Park which would result in a short-term adverse impact for users of sporting pitches and recreational activities. This option will result in parallel transport corridors which may change the perceptions of the place i.e. less visibility fo mangroves to a more trnasport focused corridor
54		Social Cohesion	-2	Longer construction time, however as most of this construction is offline limited additional impacts to communities. This option will have construction closer to residential properties on Davington Way and Ilfield Ct.	-2	Longer construction time, however as most of this construction is offline limited additional impacts to communities. This option will have construction closer to residential properties on Davington Way and Ilfield Ct.	-2	Longer construction time, however as most of this construction is offline limited additional impacts to communities. Construction is further from residential properties on Davington Way and Ilfield Ct. Slight preference for this option based on separation from residential receivers.
55	Climate Change	Climate Change Response	-1	Shotest route/ assumed less materials required. Equal exposure to coastal inudation.	-2	Next shortest route but has streams to cross which will likely require wider spans/more strengthening. Equal exposure to coastal inundation	-2	longest route, curves will add piers but avoids stream crossing. Equal exposure to inundation.
56								
57								
58								
59								
60								
61		**Scoring.**						
62								

	B	L	M	N	O	P	Q	R	S	T
1	Key Result Area / Criteria	Reference Design		Notes	Option 1A	Revised Option 1a		Option 1g		
2		Score	Reasons/Assumptions/Mitigations			score	Reasons/Assumptions/Mitigations	score	Reasons/Assumptions/Mitigations	
39 40 41	Property Implications	-4	Busway severs access to the property and requires the property to be acquired. High property cots		No property acquisition assumed. Score would be neutral.	0	No property acquisition assumed. Score would be neutral.	0	No property acquisition assumed. Score would be neutral.	
42	Impacts on utilities and significant infrastucture	-3	All options would have same impacts on utilities (protect/relocate) and its due to cycle way alignment more than bridge alignmen		Same as 1	-1	All options would have same impacts on utilities (protect/relocate) and its due to cycle way alignment more than bridge alignmen	-1	All options would have same impacts on utilities (protect/relocate) and its due to cycle way alignment more than bridge alignmen	
43	Permnanet effects -connectivity (circulation)	3	A new shared use path will provide direct access across Pakuranga Creek to connect with the proposed cycleway along Ti Rakau Drive. Significant improvement on the existing footpath over the Ti Rakau Bridge.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as 1	2	A new cycleway bridge beside the existing Ti Rakau bridge will provide direct access across Pakuranga Creek to connect with the proposed cycleway along Ti Rakau Drive. Would be better to provide for cyclists and pedestrians, seperated from the traffic on Ti Rakau bridge.	-3	Pedestrians and cyclysts have to cross Pakuranga Creek on the bridge and then join Ti Rakau Drive from the Burswood Station. Whilst the bridge connection provides a faster travel time for cyclists coming from Burswood it provides poor connectivety to local roads and work place, retail outlets on Ti rakau Drive. Very long bridge with no way to escape resulting CEPTED issues	
44	Permanent effects - Built Form	2	Reinforces the established urban form.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as 1	-3	Juxtaposition to the residential properties on the Burswood peninsular. Urban form, busway diverging away from Ti Rakau Drive	-3	Juxtaposition to the residential properties on the Burswood peninsular. Urban form, busway diverging away from Ti Rakau Drive	
45	Permanent Effects - Activities/Use	1	Increases the extent of built form but because the new bridge is beside the existing bridge it does not detract from local character.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as 1	-3	Detracts from character of local area as it extends across and dominates the estuary.	-3	Detracts from character of local area as it extends across and dominates the estuary.	
46	Permanent Effects - Visual Amenity	-1	Low visual effects because the bridge is to be built beside and parallel with the existing Ti Rakau Bridge. The bridge does not have a close viewing audience.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as 1	-3	Significant adverse visual effects on Burswood residential dwellings and people using the coastal SUP.	-3	Significant adverse visual effects on Burswood residential dwellings and people using the coastal SUP.	
47	Permanent Effects -Assocaitive Elements	-1	Low -moderate associative values in relation to Pakuranga Creek given the bridge is located beside and parallel with the existing bridge. Historical/ cultural values considered by others.	I only scored between -3 and +3 as the effects are only local, ie not regional or national.	same as 1	-3	High associative values in relation to Pakuranga Creek. Consider the legibility of Pakuranga Creek and peoples association with its legibility will be impacted. Mana whenua have stated concerns about cultural values being compromised by this option.	-3	High associative values in relation to Pakuranga Creek. Consider the legibility of Pakuranga Creek and peoples association with its legibility will be impacted. Mana whenua have stated concerns about cultural values being compromised by this option.	
48	Noise and Vibration	-1	Works are ~70m away at the closest point to the closest residential receiver at 30 Davington Way. Works will likely be below the daytime noise criterion at this address even while taking place at closest point along the route. Construction noise may be noticeable at closest residential receivers. Limited impact of construction noise at China Town since due to the commercial use of the building and its construction. No vibration effects predicted.	Same impact as Option 3.	In terms of acoustics, I would score this option -1 for both construction and operation (as per the other options). Similar to the other options assessed, the busway will only impact a limited number of people in the area when operational, and it is sufficiently far from residents such that construction can still be considered low-impact.	-1	Works are ~50m away at the closest point to the closest residential receiver at 30 Davington Way. Works may be within 3 dB of the daytime noise criterion at this address during worst-case activities. Construction noise may be noticeable at closest residential receivers. Limited impact of construction noise at China Town due to the commercial use of the building and its construction. No vibration effects predicted.	-1	Works are ~50m away at the closest point to the closest residential receiver at 30 Davington Way. Works may be within 3 dB of the daytime noise criterion at this address during worst-case activities. Construction noise may be noticeable at closest residential receivers. Limited impact of construction noise at China Town due to the commercial use of the building and its construction. No vibration effects predicted.	
49		-1	The option will introduce a new noise source to the area, however there will be very low adverse noise effects from the busway.	Same impact as Option 3.		-1	The option will introduce a new noise source to the area, however there will be very low adverse noise effects from the busway.	-1	The option will introduce a new noise source to the area, however there will be very low adverse noise effects from the busway.	
50	Contamination	0	No known environmental investigation reports available for the Mobil site and so cannot comment on the status / level of potential contamination at the site.	same	Same as 1	0	same as other options considered	0	same as other options considered	
51	Community facilities	0	Community facilities within vicinity of Project are unaffected by the proposed design change	same						
52	Viability/Productivity of business land areas	-1	Full acquisition of Mobil site would result in displacement of this business.	Option 1 Difference of -1						
53	Public Open Space	-1	Smaller temporary occupation area in Riverhills Park which would reduce the short-term adverse impact for users of sporting picthes and recreational activities.	diffeence of -1						
54	Social Cohesion	-1	Shorter construction time and greater separation between construction activities (and associtaed effects) and residential receivers on Davington Way and Ilfield Ct.							
55	Climate Change Response	0	least bridge materials and slightly les exposure to coastal inundation	Reference option, best option scored as 0 and others relative to ref design. Bridge deck areas used as proxy for high embodied carbon materials required	Requires largest bridge deck areas, coastal inundation exposure similar to 1 and 3. Would score -2	-2	Requires largest bridge deck areas, coastal inundation exposure similar to 1 and 3. Would score -2	-2	Requires largest bridge deck areas, coastal inundation exposure similar to 1 and 3. Would score -2	
56										
57										
58										
59										
60										
61	**Scoring.**									
62										

- **Attachment 4: Cost Estimate**

Ti Rakau Drive & China Town Bridge Optioneering

			REF DESIGN		PREFERRED OPTION 1A	OPTION 1	OPTION 2	OPTION 3	COMMENT
		Unit	Amount		Amount	Amount	Amount	Amount	
1	Ti Rakau Bridge	m2	$ 16,368,352.00						
2	China Town Bridge	m2	$ 16,069,893.00						
3	Realigned Bridge/s	m2	$ -		$ 39,763,744	$ 39,698,122	$ 36,394,004	$ 38,504,066	
4	Road on fill	m2	$ 1,438,400.00		$ -	$ -	$ 409,944	$ 309,256	
5	Abutment Saving		$ -		-$ 300,000	$ -	$ -	$ -	
			$ -		$ -	$ -	$ -	$ -	
6	Ret Wall-RW01	m2	$ 77,400.00		$ -	$ -	$ -	$ -	Estimate from TOC Estimate
7	Ret Wall-RW02	m2	$ 77,196.00		$ -	$ -	$ -	$ -	Estimate from TOC Estimate
8	Ret Wall-RW04	m2	$ 474,912.00		$ -	$ -	$ -	$ -	Estimate from TOC Estimate
			$ -		$ -	$ -	$ -	$ -	
9	SUP	m2	$ 199,800.00		$ -	$ -	$ -	$ -	
10	SUP - Boardwalk off bridge	m2	$ -		$ 83,300	$ 60,900	$ 66,500	$ 57,400	
11	Demolition-P.Station	Sum	$ 200,000.00		$ -	$ -	$ -	$ -	
12	Relocation of gas tank	Sum	$ 25,000.00		$ -	$ 25,000	$ 25,000	$ 25,000	
13	Mobil land occupation during construction	mth	$ -		$ -	$ 72,000	$ 72,000	$ 72,000	
14	Mid Point Access from Petstore -Staging	m	$ -		$ 900,000	$ 750,000	$ 900,000	$ 750,000	
			$ -		$ -	$ -	$ -	$ -	
			$ -		$ -	$ -	$ -	$ -	
			$ -		$ -	$ -	$ -	$ -	
	TOTAL		$ 34,930,953		$ 40,447,044	$ 40,606,022	$ 37,867,448	$ 39,717,722	
	Variance; Compared to Ref Design excluding Property				$ 5,516,091	$ 5,675,069	$ 2,936,495	$ 4,786,769	*Red is cost increase
	*Cost to Acquire P.Station (AT Cost)	Sum	$ 14,125,000.00						
	*Cost to Acquire P.Station (AT Cost)-Part	Sum	$ -		$ -	$ 1,279,000.00	$ 1,576,000.00	$ 1,477,000.00	
	TOA				$ -	$ 21,250.00	$ 23,750.00	$ 22,500.00	
	Adjustment for TOA				$ -	$ 50,000.00	$ 50,000.00	$ 50,000.00	
	TOTAL		$ 49,055,953.00		$ 40,447,044.02	$ 41,956,271.70	$ 39,517,198.00	$ 41,267,222.06	
					-18%	-14%	-19%	-16%	
	Variance; Compared to Ref Design including Property				-$ 8,608,909	-$ 7,099,681	-$ 9,538,755	-$ 7,788,731	*Green is cost saving

Notes:

a Rates extrapolated from the Ref design TOC pricing done by the team.

b All options priced based on Super T placing by Crawler and not Launcher. Launcher may not be all that feasible since we still require the staging to install the piles be it only single bay. Some further analysis needs to be put to this however on a very rough estimate deem it to almost be a cost neutral scenario. Availability and the capital cost needs to be better understood. If we can re-use Launcher from Reeves Rd this will make it viable and $1.5m saving(Not considering overall programme associated Indirect Cost).

c Temporary access assumed to be constructed at the Petrol station, except in option 1A where no access via mobil is required. However, option 1A must be considered in the MCA.

d General note that pavements are expensive. Noting the 20Mpa Concrete layers. Is this to mitigate any undercut and SIL? Has this undercut been priced over and above and can it be removed?

e Potential interface with contaminated excavated material at Mobil.

f No Traffic Management costs considered. These would be marginally mitigated with less interface on Ti Rakau Drive

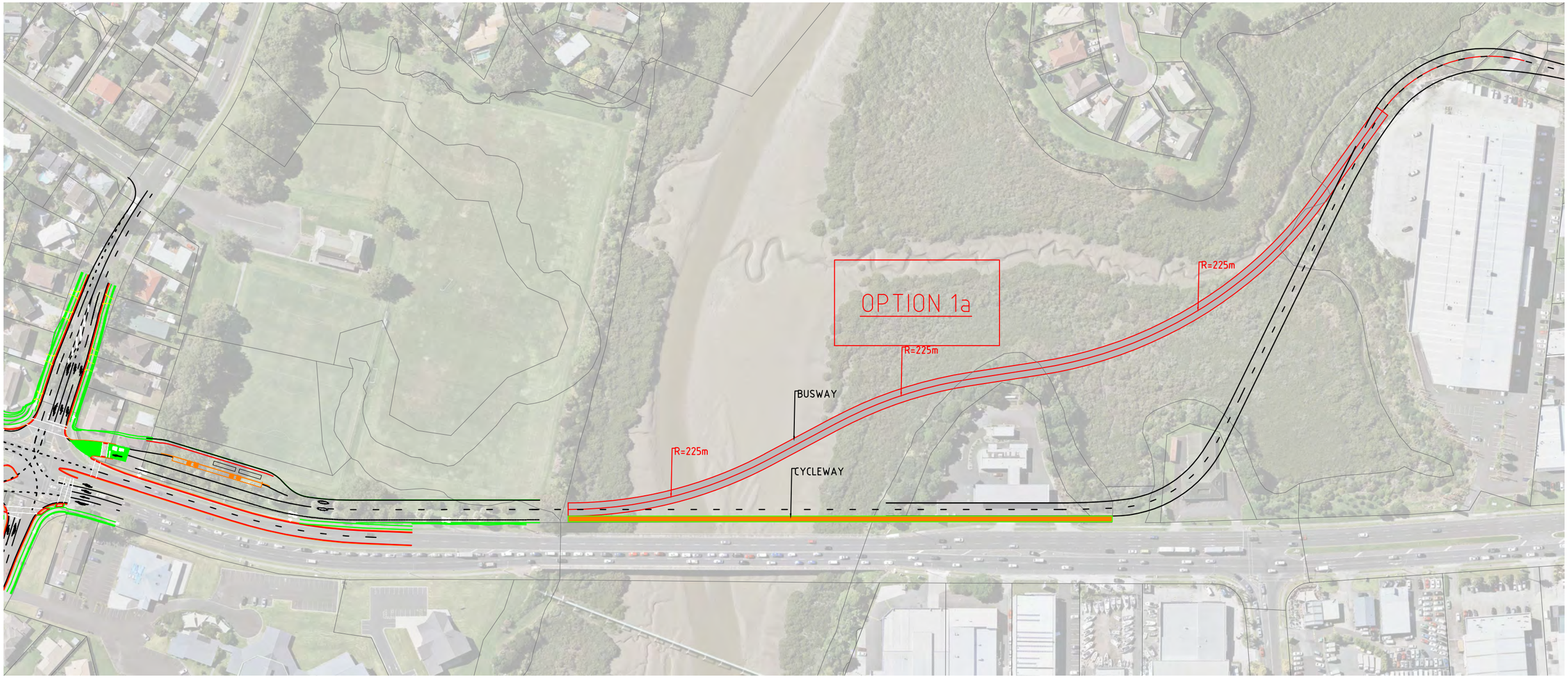
g Would consider there to be a big value to community and to AT(Cost to Acquire) for P.Station to remain.

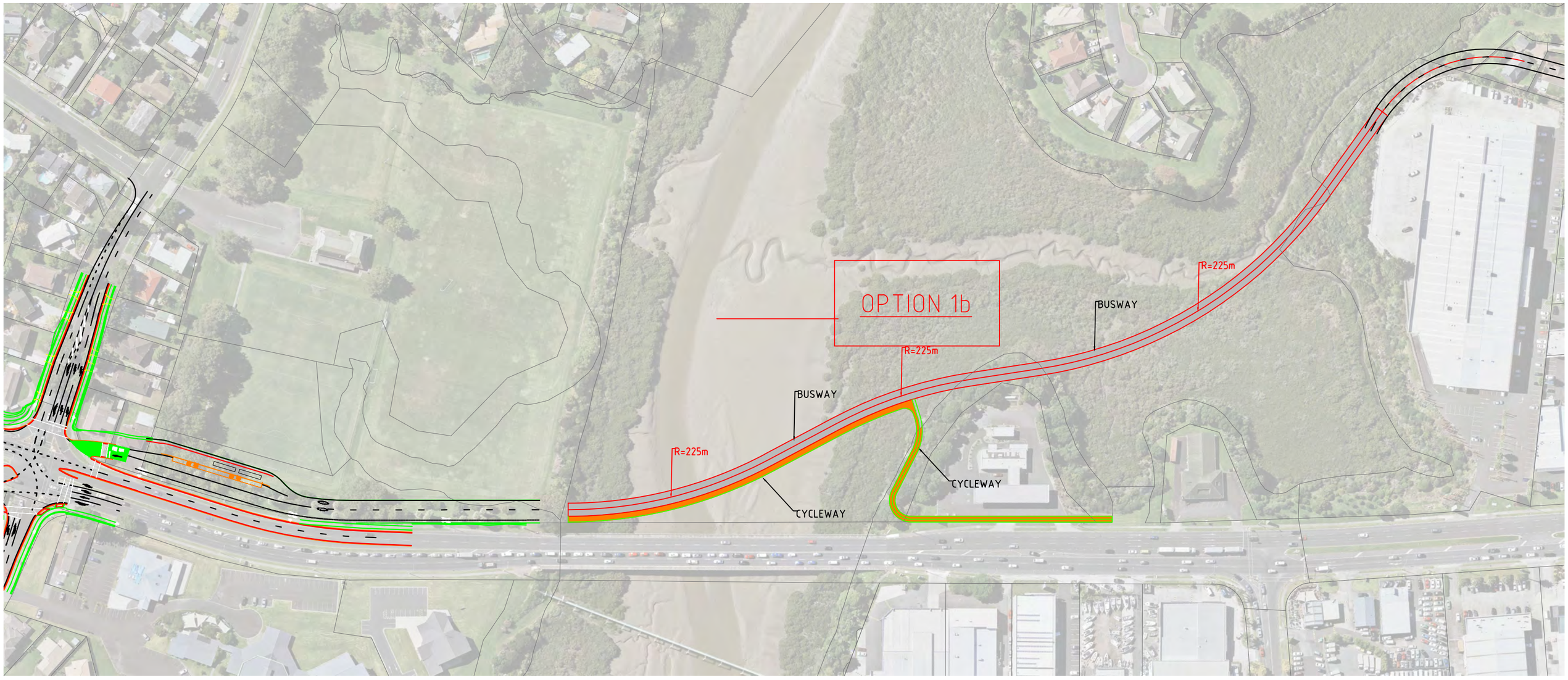
h

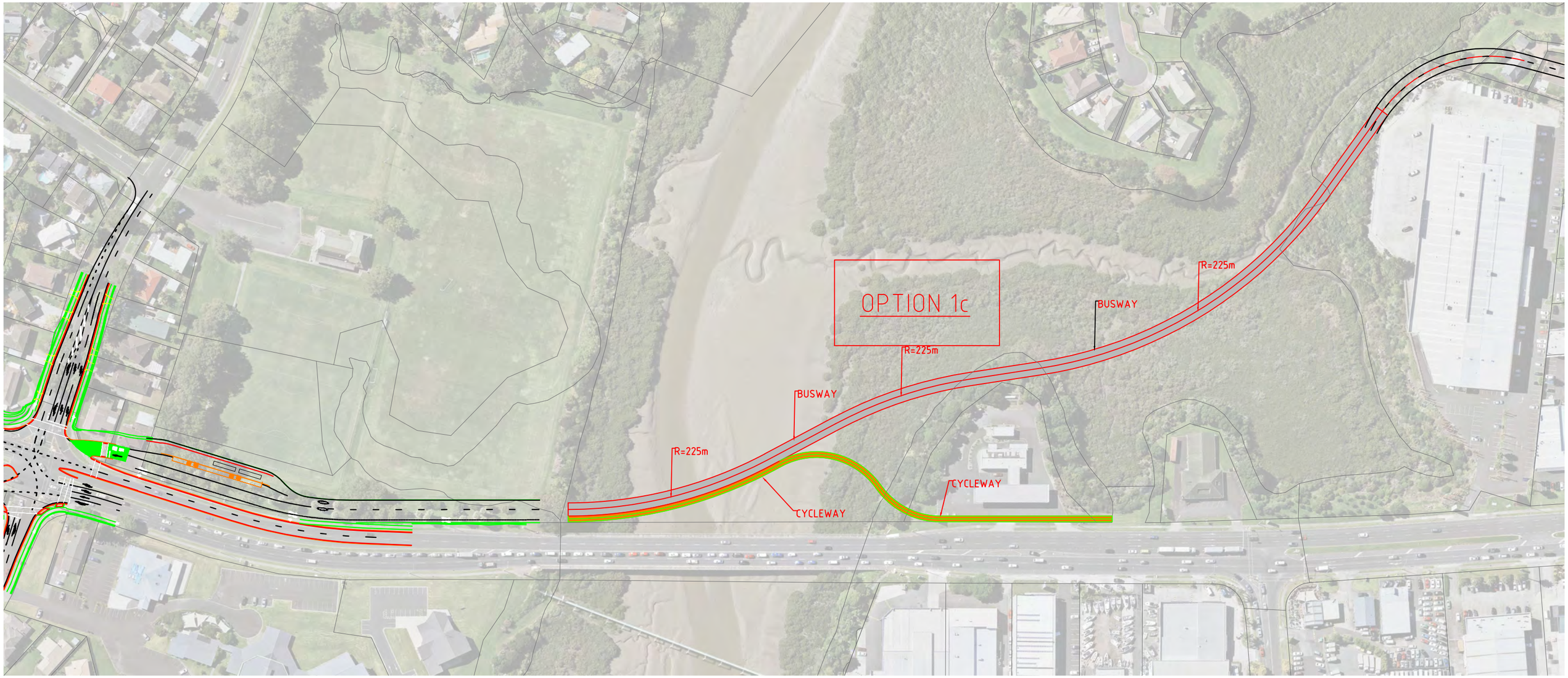
i $10mill could be saved on ref design if China Town Bridge section was constructed as a causeway. Alternatively potential to be shortened by half and section behind China town to be on fill.

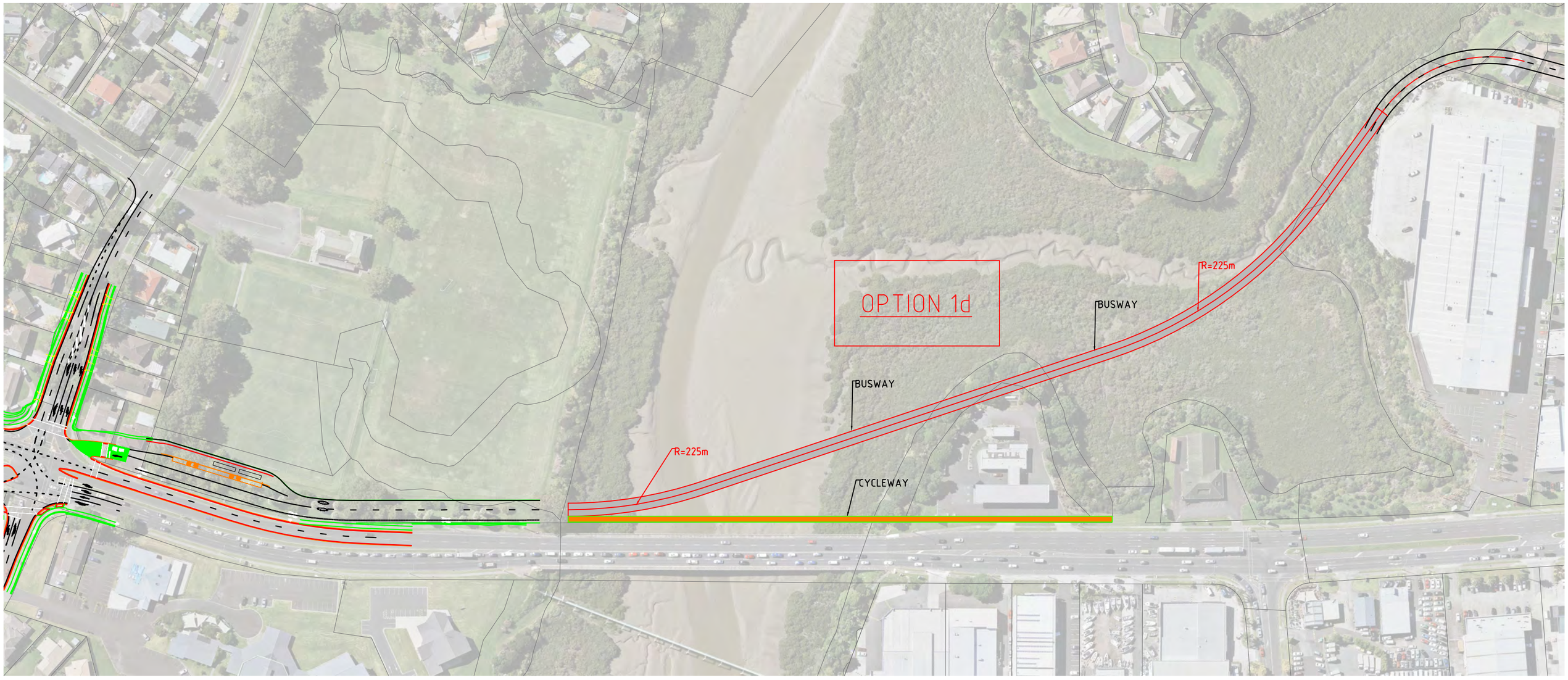
j If AT cost for Mobil is ignored the Ref design will always come out the most cost effective. Regardless of how efficient we are in the programme and methodology in bridge construction.

- **Attachment 5 – Additional Options 1A – 1H**


OPTION 1a
R=225m
R=225m
BUSWAY
R=225m
CYCLEWAY


OPTION 1b
R=225m
BUSWAY
R=225m
BUSWAY
R=225m
CYCLEWAY
CYCLEWAY


OPTION 1c
R=225m
BUSWAY
R=225m
BUSWAY
R=225m
CYCLEWAY
CYCLEWAY


OPTION 1d
R=225m
BUSWAY
BUSWAY
BUSWAY
R=225m
CYCLEWAY

OPTION 1e

R=225m

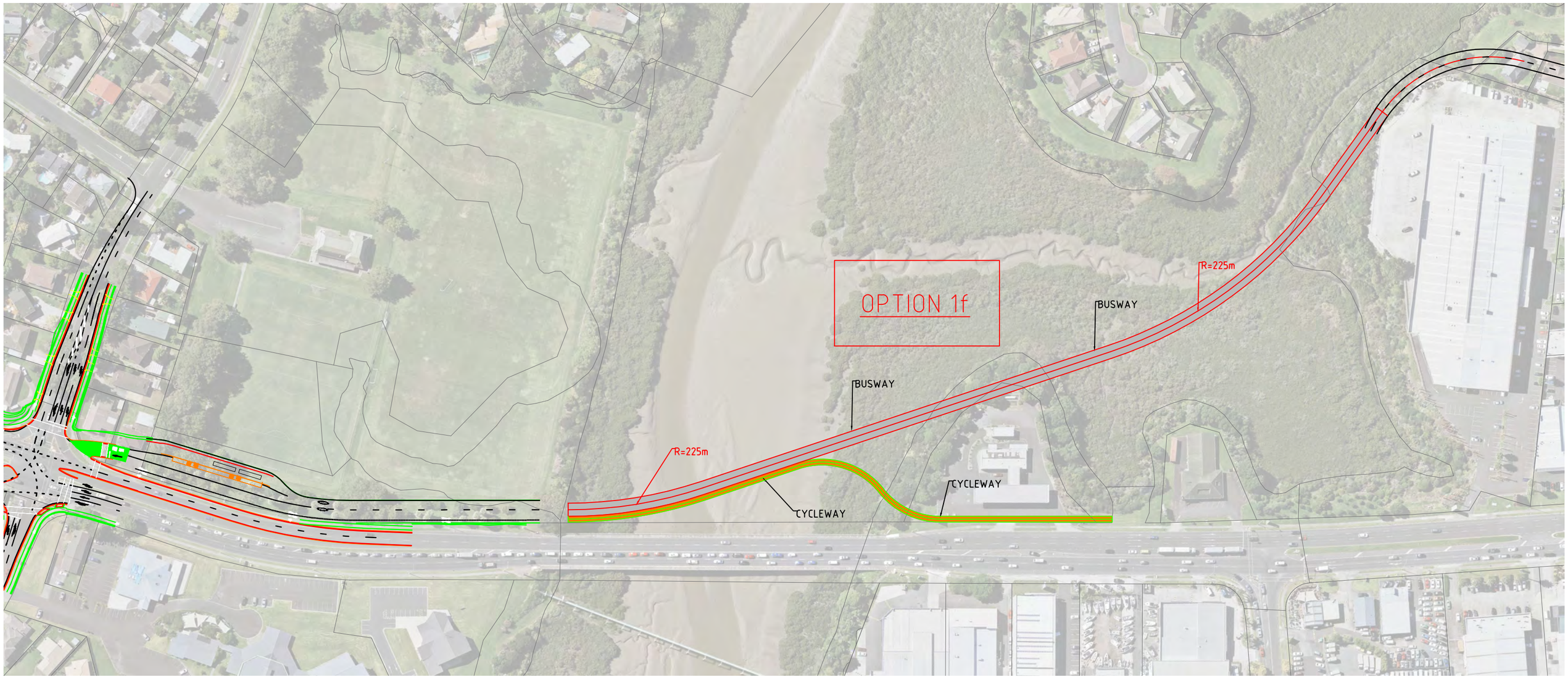
BUSWAY

BUSWAY

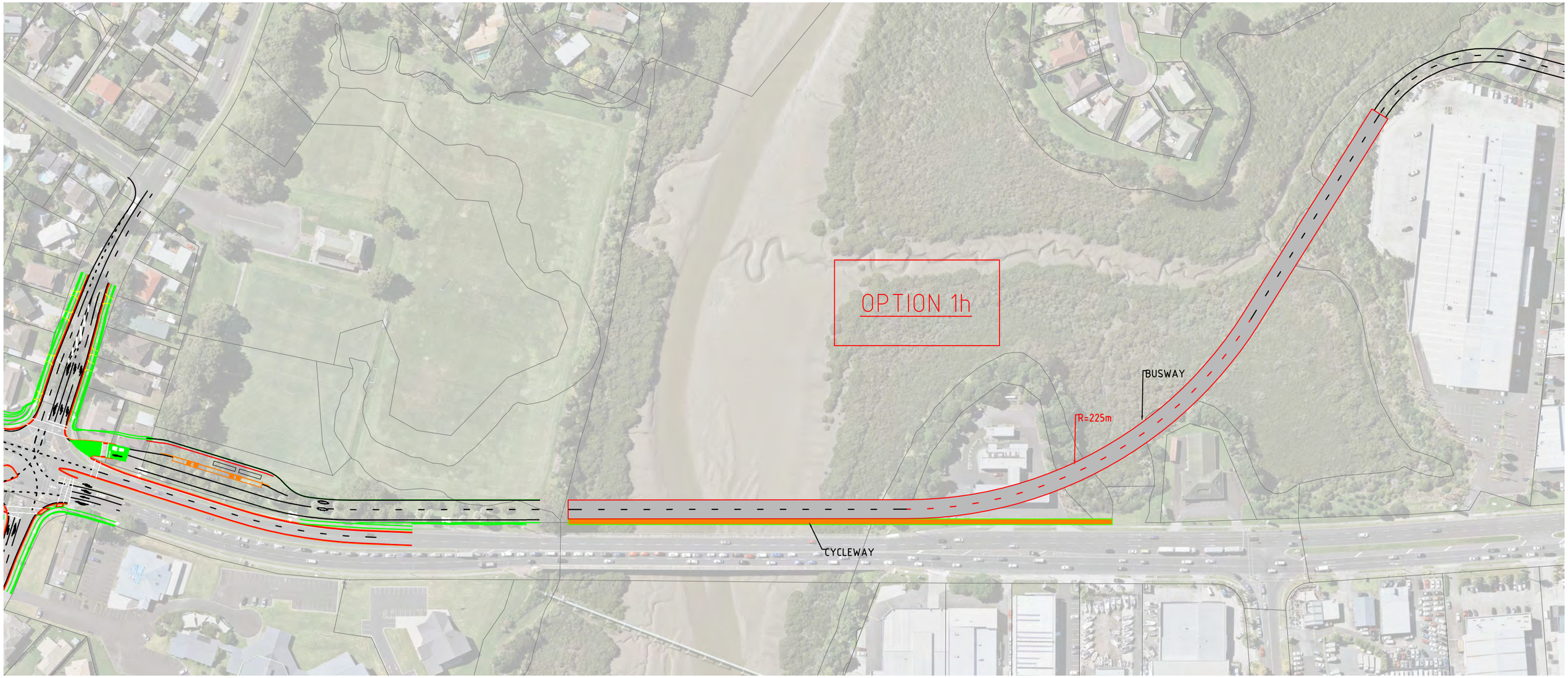
R=225m

CYCLEWAY

CYCLEWAY


OPTION 1f
R=225m
BUSWAY
BUSWAY
R=225m
CYCLEWAY
CYCLEWAY

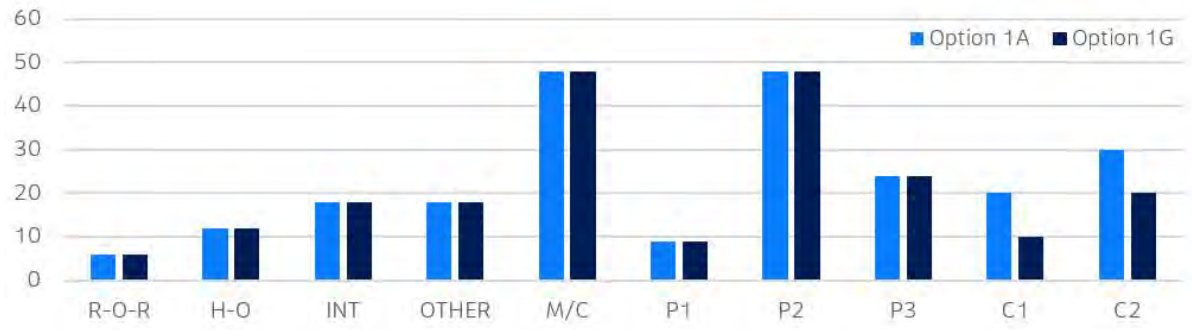

OPTION 1g
R=225m
CYCLEWAY
R=225m
BUSWAY
R=225m


OPTION 1h
BUSWAY
R=225m
CYCLEWAY

- **Attachment 6: Safe Systems Assessment**

Attachment 6: SSFA Assessment

In summary, only the cyclist crash risk differs between options, with option 1G having a lower crash risk than option 1A for side swipe / rear end crashes (C1 = 50% reduction) and intersection crashes (C2 = 33% reduction). The graph below shows the change in SSA product scores for the two options.



SSA Scoring commentary

There is no physical change to the busway alignment or road layout for general traffic between Option 1a and Option 1g. As a result, the SSA scores for general traffic (run-off-road head-on and intersection crashes), motorcyclist crashes, or pedestrians crashes, remained the same across Option 1a and Option 1g.

The SSA has also assumed that the changes to the cycleway alignment will not significantly impact the volume of cyclists using the cycleway (exposure score remains constant), the speed of cyclists using the facility and the speed of conflicting traffic movements (severity scores remains constant).

The proposed changes will have an impact the **likelihood** scores for C1 (cycle rear-end and side swipe) and C2 (cyclists crossing intersection) type crashes as follows:

- The likelihood of sideswipe/rear-end crashes (C1) for Option 1a was considered **unlikely** (2) with a separated cycleway adjacent to the busway/road carriageway.
- The likelihood of sideswipe/rear-end crashes (C1) for Option 1g was considered **very unlikely** (1) with a separated cycleway along then busway alignment with barrier protection? (further removed from the general traffic carriageways) and likely to attract a higher proportion of cyclists.

- The likelihood of intersection crashes (C2) for Option 1a was considered **likely** (3) due to the nine commercial driveways (uncontrolled intersection) the cycleway would cross on Ti Rakau Drive and Burswood Drive. Option 1a also involves two signalised crossings of the busway which may have low compliance.
- The likelihood of intersection crashes (C2) for Option 1g was considered **unlikely** (2). While the separated cycleway has no conflict points between cyclists and vehicles between Gossamer Station and Burswood Station and would result in a likelihood score of 0, this was offset by the increased risk due to the lack of provision/connection for cyclists travelling to/from Trugood Drive. This may result in cyclists using the footpath or Ti Rakau Dr as noted below.

Other considerations

- Option 1g provides a better level of service than option 1a and is expected to be more attractive to all types of cyclists. It is more direct (150m shorter) than Option 1a which would make this route more attractive to commuter cyclists wanting to reach their destination faster. Option 1g also provides a more appealing environment for recreational cyclists with views across estuary and much less traffic on the busway compared with Ti Rakau Drive.
- Option 1a provides better connectivity for cyclists travelling to/from the Trugood Drive commercial area, as cyclists will be able to cross at the signalised intersection of Trugood Drive to access the cycleway. Option 1g creates a potential risk of riders choosing to either cycle on the footpath to reach the nearest crossings at Gossamer Drive or Burswood Drive, or riding on Ti Rakau Drive with narrow kerbside traffic lanes and no dedicated cycle facilities or shoulder.

- **Attachment 7 - Concept level costs compared to Reference Design**

Attachment 7: Concept Level costs compared to reference design

Bridge Options		Option 1a	Option 1b	Option 1g	Option 1h
Net Construction Direct Cost		$ 8,895,058	$ 8,619,397	$ 22,872,694	$ 8,264,522
Mark Ups Based on Final PAA Shares					
Bridge Structures were 60,578,585 @20.5% of Direct Costs		0.15	0.14	0.38	0.14
Design	20.50%	$ 1,351,011	$ 1,309,313	$ 3,473,980	$ 1,255,243
P&G	20.50%	$ 3,755,777	$ 3,640,043	$ 9,657,581	$ 3,489,545
Risk	20.50%	$ 909,064	$ 882,372	$ 2,337,562	$ 844,624
Escalation	20.50%	$ 1,254,109	$ 1,217,467	$ 3,224,807	$ 1,165,210
Limb 1 Total		$ 16,165,019	$ 15,674,791	$ 41,566,624	$ 15,019,143
Limb 2					
Design	23.20%	$ 313,435	$ 303,807	$ 313,435	$ 313,435
Constructor	12.10%	$ 1,792,495	$ 1,738,199	$ 1,792,495	$ 1,792,495
Sell TOC Adjustment		$ 18,270,949	$ 17,716,797	$ 43,672,554	$ 17,125,073

All costs above are relative to the reference design and are additional to the value of the reference design concept estimate.

Costs of property are not included in the above