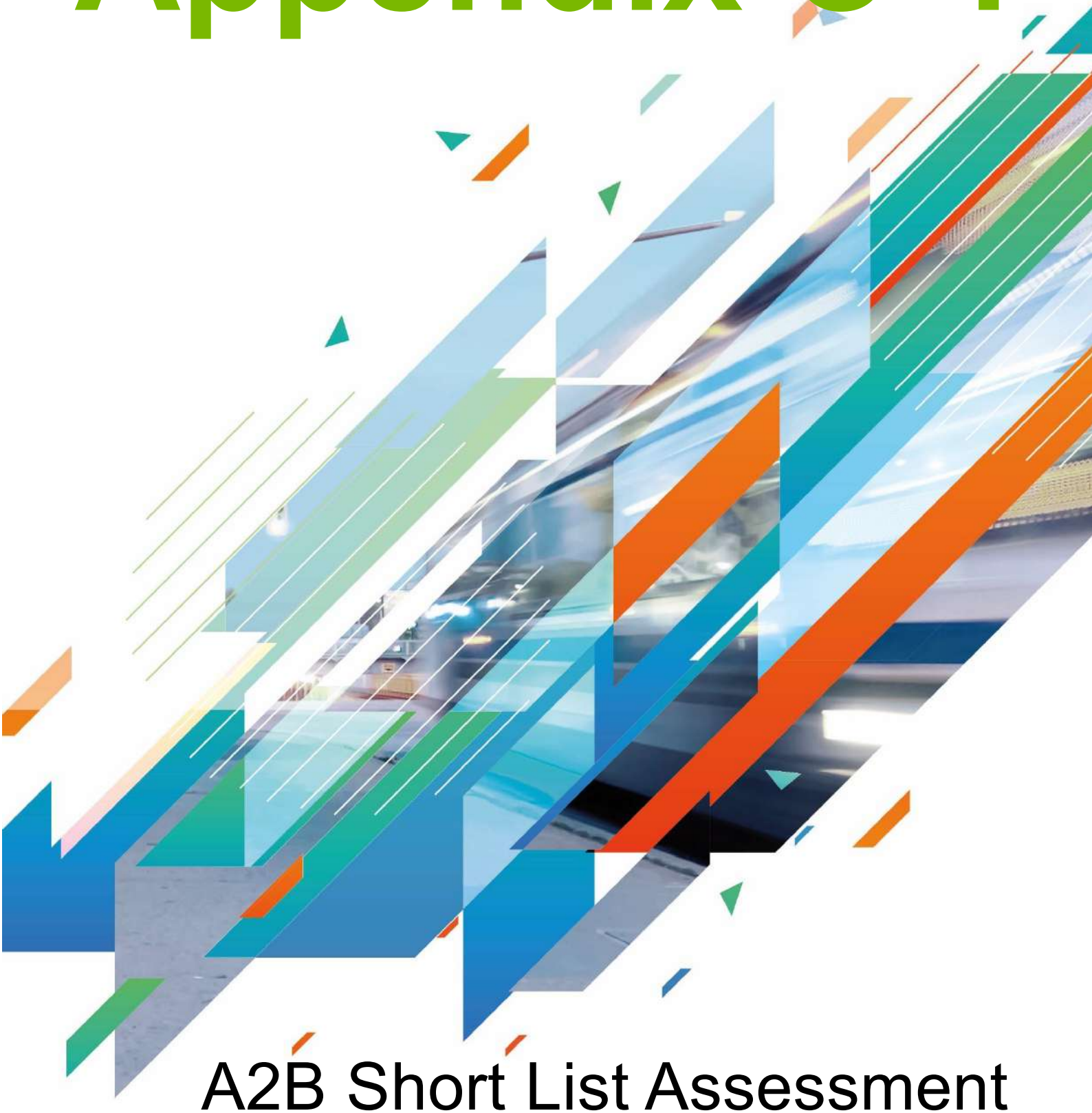
Appendix C-1



A2B Short List Assessment

Appendix C-1
A2B Short List Assessment

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Technical Note

To	**Auckland Transport**	From	[redacted]
Copy		Reference No.:	**502334-6000-TEC-JJ-0003**
Date	**2019-04-10**	Pages (including this page)	**19**
Subject	**Short List Options Assessment and Preferred Option**		

This note describes the process followed to execute the multi-criteria analysis (MCA) for the short list options for the Airport to Botany (A2B) Mass Rapid Transit (MRT) project. The MCA used problems, benefits and investment objectives established during the investment logic mapping (ILM) exercise carried out prior to the long list assessment. Key performance indicators (KPIs) were also carried forward from the ILM, with minor refinement to fit within the limits of available data sources and analysis methods.

The assessment of the A2B short list was integrated with the parallel assessment of the 20Connect project, which proposes upgrades of State Highways 20, 20A and 20B and motorway interchanges between them. 20Connect and A2B are closely related as they both aim to provide additional transport capacity for different modes along similar corridors. It is anticipated that the demands and preferred solutions for each project will affect the other project, and as such, each short list option includes components from both A2B and 20Connect options.

The short list assessment for A2B is comprised of three groups of assessment: transport planning, planning and environmental effects, and engineering feasibility.

The rest of this technical note describes the options that were assessed, what assessment was conducted, how scoring was applied, and how the short list MCA leads to the emerging preferred option.

1 Short list options

The short list options are based on the results of the long list assessments for both A2B MRT and 20Connect. Two primary options for the A2B MRT were identified, along with three options for 20Connect. Six formal short list options were assessed, with each A2B MRT option paired with each 20Connect option.

1.1 Base case option

The base case option for the short list assessment is largely the existing 2018 transit network and road infrastructure, with the following variations included from the preferred option for the short-term intervention package:

- A new short-term “pre-rapid transit” bus route supported by targeted infrastructure upgrades:
  - An A2B MRT bus service between the Airport and Manukau Station, via Puhinui Station with 5/10-minute headways and long service hours.
  - Puhinui Station upgraded to a high-quality bus-rail interchange.
  - The addition of bus priority lanes between the Airport and Manukau Station, on SH20B and Puhinui Road.
- Some corresponding changes to the surrounding public transport network in the modelling:

- Bus route 380 truncated from the Airport-Papatoetoe-Manukau corridor (replaced by the A2B MRT service), remaining in operation only on the northern section between Onehunga and the Airport.
- Additional *Frequent Service* crosstown bus route ("Route 36") on a more direct alignment between Onehunga, Māngere, Papatoetoe and Manukau (replacing part of the former route 380).
- Additional *Connector Service* bus route ("New Lynn Express") between New Lynn Interchange Station and the Airport.
- Increased frequencies and small route adjustments to some Māngere area bus routes.

- Upgraded road network and bus routing within the airport precinct.
- No further road, highway or bridge improvements.

1.2 Transit options

Following the long list assessment, two segments of the alignment for the A2B MRT were unresolved: the alignment through Manukau, and the routing between the Airport and Puhinui. The alignment through Manukau was not formally considered in the short list options, however it was assessed separately. Therefore, the A2B MRT options differed only in the routing between the Airport and Puhinui. The two options were:

A. Airport to Puhinui via SH20B, and

B. Airport to Puhinui via SH20A and SH20.

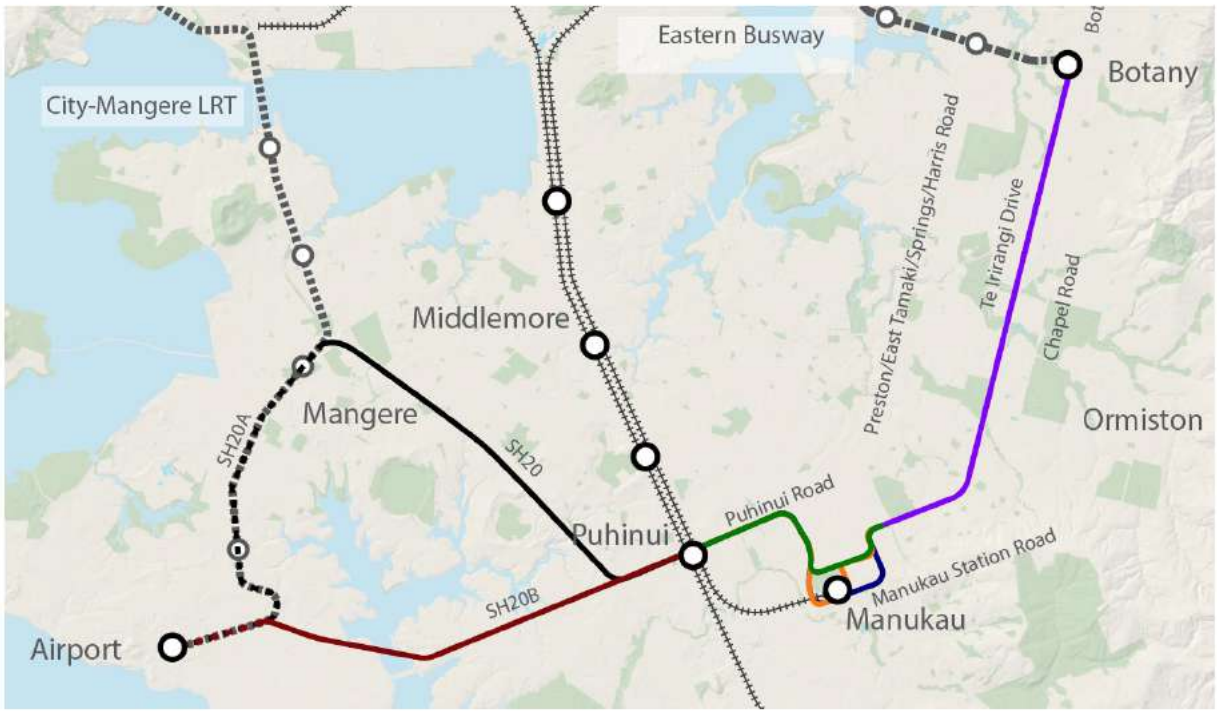
These two alignments are shown in Figure 1. The Manukau options were assessed separately to the full corridor using out-of-model assessments. It is noted that the MSM model has limited utility for discriminating between sub-options at a local scale with town centres such as Manukau. The Manukau options are:

B3. Ronwood Avenue,

B5. Manukau Station Road, and

B6. Hybrid: Manukau Station Road, Davies Avenue, Ronwood Avenue.

Figure 1: A2B short list options



1.3 20Connect options

The 20Connect short list comprised of three options, each with a different set of investments to the SH20, SH20A and SH20B corridors. The 20Connect short list options, and their key attributes are as described in Table 1-1.

Table 1-1: 20Connect short-list option key attributes

Components	Option 1	Option 2	Option 3
SH20B widening	Offline	Online	Online
SH20B south-facing ramps onto SH20	Yes	No	No
SH20A south-facing ramps onto SH20	No	Yes	Yes
SH20 widening (Māngere Bridge to interchange with…)	SH20A	SH20B	SH20B
Pukaki Creek Bridge lanes	4	4	2

1.4 Combined options for assessment

Each of the 20Connect short list options was combined with the A2B short list options, resulting in six short list options: 1A, 1B, 2A, 2B, 3A, 3B.

The A2B MRT Manukau alignment was assessed separately.

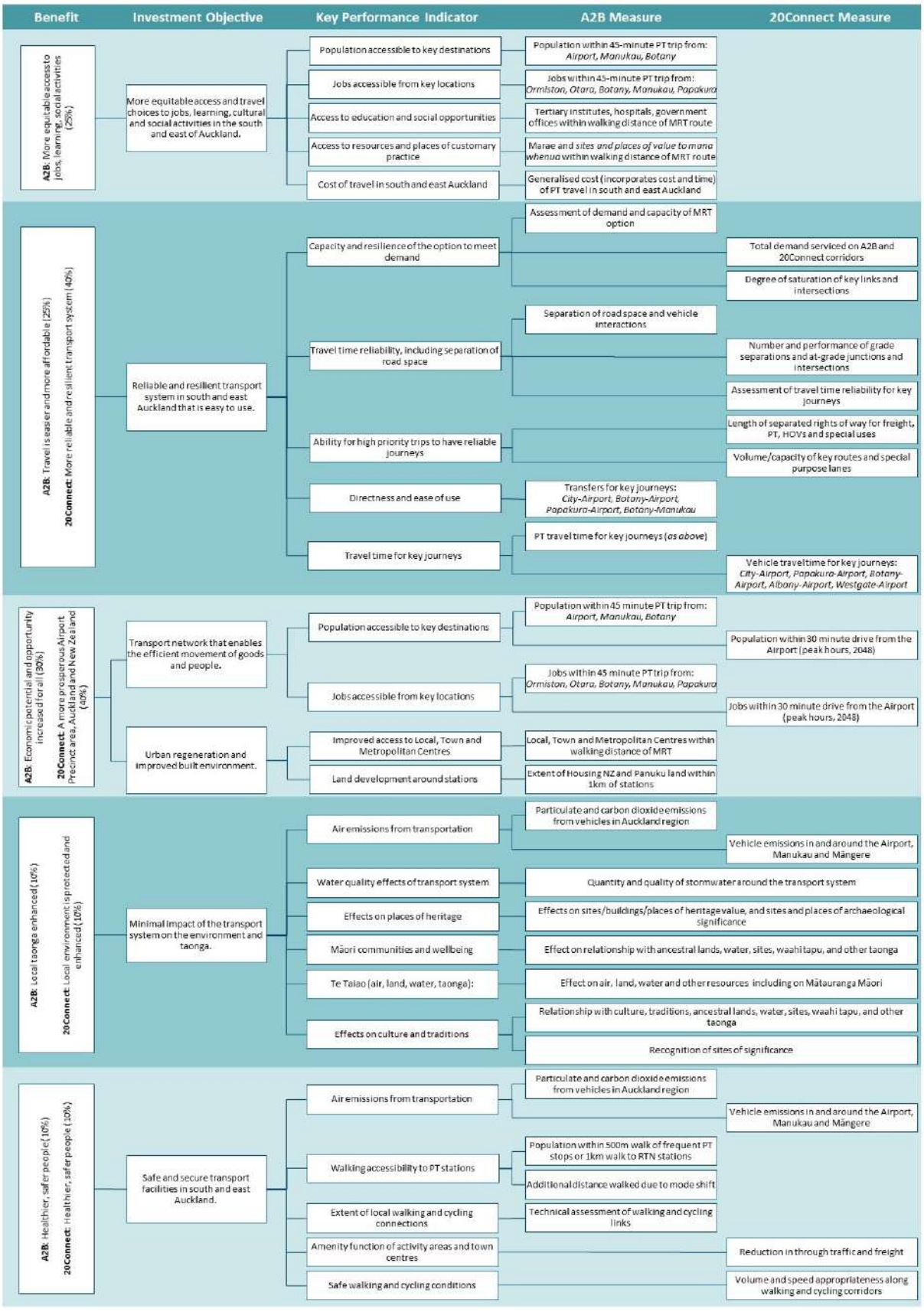
2 Analysis methodology

The MCA process is a way of distinguishing how each option performs against the investment objectives of the project by assessing the options against a set of key performance indicators related to the investment objectives and benefits. The benefits of the A2B and 20Connect projects are included in Figure 2. The benefits for the A2B MRT project are:

1. More equitable access to jobs, learning, social activities (25%)
2. Travel is easier and more affordable (25%)
3. Economic potential and opportunity increased for all (30%)
4. Local taonga enhanced (10%)
5. Healthier, safer people (10%)

Whilst some metrics can be assessed quantitatively through calculations, others must be assessed qualitatively by experts in the field. The section describes the metrics that were considered in the long list assessment for A2B.

Figure 2: A2B and 20Connect benefits, investment objectives and MCA indicators



2.1 Transport planning

The transport planning metrics aim to assess the effect of each option on public transport users and the accessibility to key destinations and opportunities using public transport. The assessment of the transport planning KPIs included both the quantitative and qualitative assessment of various metrics.

A seven-point scale (-3 to 3) was used to assess the transport planning metrics. Negative scores indicate worse performance than the base case, whilst positive scores indicate better performance and a score of zero represents similar performance to the base case option.

2.2 Planning and environmental effects

The potential effects of each option on the environment were also assessed. Specialist assessments were undertaken in the topic areas including ecology, arboriculture, stormwater, landscape, visual and urban design, social, noise and vibration, archaeology, contaminated land and air quality.

Each of the specialists assigned each option a score ranging between -3 (unmitigable adverse effect) to 3 (significant positive benefit).

Table 2-1: Scoring scale for planning metrics

3 (Significant positive)
2 (Moderate positive)
1 (Minor positive)
0 (Neutral)
-1 (Minor/moderate adverse)
-2 (Significant adverse)
-3 (Unmitigable adverse)

2.3 Engineering feasibility

The feasibility of implementation was assessed according to the criteria in Table 2-2.

Table 2-2: Criteria for assessing feasibility

Criterion	Description
Constructability	The level of complexity of implementing the solution, with consideration of construction methodology and staging, and constraints
Safety in design	General assessment of hazards and level of complexity in risk management during construction
Operation and maintenance	Assessment of maintenance and operational implications over the projected life
Construction disruption	Impacts of construction on people and businesses
Property	The extent of impacts on properties; primarily the necessary acquisition of properties

Criterion	Description
Construction cost and risk	Estimated construction costs, including complexity and risk in construction

The rating scale for the feasibility of implementation of options uses a five-point scale with no negative values (1 to 5). Unlike other categories, the feasibility is not measured against a do minimum or base case approach. A descriptive rating for each criterion was specified against the five-point scale for clarity and transparency; the descriptions of the scores are included in Table 2-3.

Table 2-3: Feasibility rating scale

	Implementability					
Rating	Constructability	Safety in design	Operation and maintenance	Construction Disruption	Property	Construction Cost and Risk
1	Construction of this kind has not been done before or often in NZ. The work is highly specialised. There are significant and/ or multiple physical constraints.	Significant / extreme H&S design and construction risks. Significant level of risk management through safety in design. Significant hazards associated with the option which pose a significant H&S risk in design, build and final product. Safety highly difficult to be developed into the design process to control H&S and operational risks.	Significant maintenance and operation costs. Significant level of maintenance activities required and ability/ capacity to carry out maintenance activities. Significant factors that affect the ability to operate or maintain the option over its projected life with major additional costs.	Significant amounts of construction impact on people and businesses.	Impacts significant land holdings, whole or parts of communities and large, well established businesses. 100+ parcels. Extreme level of anticipated risk for property acquisition (e.g. significant risk of appeals, objections). Difficult to meet project programme timeframes. Significant constraints on property titles impacting acquisition under PWA e.g. reservation land / covenants.	Significant costs for construction of option.
2	The work has been done before in NZ but is not common. Resource to carry out the work is scarce but available. There is at least one significant constraint.	High level of H&S design and construction risks. High level of risk management through safety in design. Hazards associated with the option which pose a high H&S risk in design, build and final product. Safety is challenging to be developed into the design process to control H&S and operational risks. However, is achievable.	Moderate to high maintenance and operation costs. Moderate to high level of maintenance activities required and ability/ capacity to carry out maintenance activities. Some factors that affect the ability to operate or maintain the option over its projected life with moderate to high additional costs.	High amounts of construction impact on people and businesses.	Impacting a large number of residential and business properties. 40-100 parcels. High level of anticipated risk for property acquisition (e.g. high risk of appeals, objections). May be able to meet project programme timeframes with active management of risk. High level of constraints on property titles impacting acquisition under PWA.	High costs for construction of option.
3	Major construction works but nothing unusual. May involve some traffic and local management issues.	Moderate to high level of H&S design and construction risks but nothing unusual. High level of risk management through safety in design. Hazards associated with the option which pose a H&S risk in design, build and final product. Safety can be developed into the design process to control H&S and operational risks.	Moderate maintenance and operation costs. Moderate level of maintenance activities required and ability/ capacity to carry out maintenance activities. Some factors that affect the ability to operate or maintain the option over its projected life with moderate additional costs.	Moderate construction impact on people and businesses.	Impacting a moderate number of residential and business properties. 10-40 parcels. Moderate level of anticipated risk for property acquisition (e.g. moderate risk of appeals, objections). May be able to meet project programme timeframes with active management of risk. Moderate level of constraints on property titles impacting acquisition under PWA.	Moderate costs for construction of option.
4	Moderate works.	Low to moderate level of H&S design and construction risks but nothing unusual. Low to moderate level of risk management through safety in design. Low to moderate hazards associated with the option which pose a H&S risk in design, build and final product. Safety can be developed into the design process to control H&S and operational risks.	Minor to moderate level of maintenance and operation costs.	Minor amounts of construction impact on people and businesses.	Minimal land requirement. <10 parcels. Minor level of anticipated risk for property acquisition (e.g. minor risk of appeals, objections). Likely to meet project programme timeframes. Minor constraints on property titles impacting acquisition under PWA.	Minor costs for construction of option.
5	Straightforward and minor works.	Low level of H&S design and construction risks but nothing unusual. Low level of risk management through safety in design. Low level hazards associated with the option which pose a H&S risk in design, build and final product. Safety can be developed with ease into the design process to control H&S and operational risks.	Neglig ble/ minor level of maintenance and operation costs.	Negligible amounts of construction impact on people and businesses.	No land requirement. No property acquisition required. Minimal level of anticipated risk for property acquisition (e.g. minimal or no risk of appeals, objections). Likely to meet project programme timeframes. No constraints on titles.	Minimal costs for construction of option.

3 Short list MCA results

Table 3-1 contains the investment objectives for both the A2B MRT and 20Connect projects, and the relevant KPIs from each project. Refer to tech note 501094-4401-TEC-KK-019 for more information.

Table 3-1: MCA results for assessment against investment objectives

Investment objective	Key Performance Indicator	Measure	A2B or 20Connect metric?	1A	1B	2A	2B	3A	3B
A2B: To provide more equitable access and travel choices to jobs, learning, cultural and social activities in the south and east of Auckland	Population accessible to key destinations	Population within 45-minute PT trip from: Airport, Manukau, Botany	A2B	3	1	3	1	3	1
	Jobs accessible from key locations	Jobs within 45-minute PT trip from: Ormiston, Otara, Botany, Manukau, Papakura	A2B	3	2	3	2	3	2
	Access to education and social opportunities	Tertiary institutes, hospitals, government offices within walking distance of MRT route	A2B	1	2	1	2	1	2
	Access to resources and places of customary practice	Marae and sites and places of value to mana whenua within walking distance of MRT route	A2B	0	1	0	1	0	1
	Cost of travel in south and east Auckland	Generalised cost (incorporates cost and time) of PT travel in south and east Auckland	A2B	2	1	3	2	3	2
A2B: To provide public transport for south and east Auckland that is easy to use, reliable, fast, resilient and affordable 20Connect: To improve the reliability and resilience of the transport system	Capacity and resilience of the option to meet demand	Assessment of demand and capacity of MRT option	A2B	2	2	2	2	2	2
		Total demand serviced on A2B and 20Connect corridors	20Connect	1	2	2	2	3	1
		Degree of saturation of key vehicle links and intersections	20Connect	1	1	2	2	2	2
	Travel time reliability, including separation of road space	Separation of road space and vehicle interactions	20Connect	3	3	1	1	1	1
		Number and performance of grade separations and at-grade junctions and intersections	20Connect	2	2	2	2	1	1
		Assessment of vehicle travel time reliability for key journeys	A2B	3	3	3	3	3	3
	Ability for high priority trips to have reliable journeys	Length of separated rights of way for freights, PT, HOVs and special uses.	20Connect	1	1	3	3	2	2
		Volume/capacity of key routes and special purpose lanes	20Connect	2	2	2	2	1	1
	Directness and ease of use	Transfers for key journeys: City-Airport, Botany-Airport, Papakura-Airport, Botany-Manukau	A2B	2	2	2	2	2	2
	Travel time for key journeys	PT travel time for key journeys (as above)	A2B	3	1	3	1	3	1
		Vehicle travel time for key journeys: City-Airport, Papakura-Airport, Botany-Airport, Albany-Airport, Westgate-Airport	20Connect	2	2	3	3	1	1

Investment objective	Key Performance Indicator	Measure	A2B or 20Connect metric?	1A	1B	2A	2B	3A	3B
A2B: To promote urban regeneration, improved built environment, and economic opportunities 20Connect: To improve economic performance of the airport area, Auckland and New Zealand	Population accessible to key destinations	Population within 45-minute PT trip from: Airport, Manukau, Botany	A2B	3	1	3	1	3	1
		Population within 30-minute drive from the Airport (peak hours, 2048)	20Connect	1	1	3	3	1	1
	Jobs accessible from key locations	Jobs within 45-minute PT trip from: Ormiston, Otara, Botany, Manukau, Papakura	A2B	3	2	3	2	3	2
		Jobs within 30-minute drive from the Airport (peak hours, 2048)	20Connect	1	1	3	3	1	1
	Improved access to Local, Town and Metropolitan Centres	Local, Town and Metropolitan Centres within walking distance of MRT	A2B	2	3	2	3	2	3
	Land development around stations	Extent of Housing NZ and Panuku land within 1km of stations	A2B	1	2	1	2	1	2
A2B: To reduce the effects of the transport system on the environment and taonga 20Connect: Reduce the effects of the transport system on the environment and taonga.	Air emissions from transportation	Particulate and carbon dioxide emissions from vehicles in Auckland region	A2B	-1	-1	-2	-2	-2	-2
		Vehicle emissions in and around the Airport, Manukau and Māngere	20Connect	2	2	3	3	2	2
	Water quality effects of transport system	Quantity and quality of stormwater around the transport system	Both	-1	-1	-1	-1	-1	-1
	Effects on places of heritage	Effects on sites/buildings/places of heritage value, and sites and places of archaeological significance	Both	-2	-2	-2	-2	-2	-2
	Māori communities and wellbeing[1]	Effect on relationship with ancestral lands, water, sites, waahi tapu, and other taonga	Both	-2	-2	-2	-2	-2	-2
	Te Taiao (air, land, water, taonga)[1]	Effect on air, land, water and other resources including on Mātautanga Māori	Both	-2	-2	-3	-3	-3	-3
	Effects on culture and traditions[1]	Relationship with culture, traditions, ancestral lands, water, sites, waahi tapu, and other taonga	Both	-2	-2	-2	-2	-2	-2
		Recognition of sites of significance	Both	1	1	1	1	1	1
A2B & 20Connect: To improve health, safety, and security of people	Air emissions from transportation	Particulate and carbon dioxide emissions from vehicles in Auckland region	A2B	-1	-1	-2	-2	-2	-2
		Vehicle emissions in and around the Airport, Manukau and Māngere	20Connect	2	2	3	3	2	2

[1] Note that at the time of issue, mana whenua had not validated these scores.

Investment objective	Key Performance Indicator	Measure	A2B or 20Connect metric?	1A	1B	2A	2B	3A	3B
	Walking accessibility to PT stations	Population within 500m walk of frequent PT stops or 1km walk to RTN stations	A2B	1	2	1	2	1	2
		Additional distance walked due to mode shift	A2B	2	2	1	1	1	1
	Extent of local walking and cycling connections	Technical assessment of walking and cycling links	Both	2	2	2	2	2	2
	Amenity function of activity areas and town centres	Reduction in through traffic and freight	20Connect	0	0	3	3	2	2
	Safe walking and cycling connections	Volume and speed appropriateness along walking and cycling corridors	20Connect	-1	-1	2	2	1	1

Table 3-2 contains the planning and environment considerations scoring for both the A2B MRT and 20Connect projects. Refer to tech note 501094-4401-TEC-NN-0022 for more information.

Table 3-2: Scores for each option against planning and environmental considerations

Environmental indicator	Measure	1A	1B	2A	2B	3A	3B
Ecology	Aquatic ecology	-1	-1	-1	-1	-1	-1
	Terrestrial ecology	-1	-1	-1	-1	-1	-1
	Marine ecology	-1	-1	-1	-1	-1	-1
	Arboriculture	The arboriculture measure was not scored in detail for the short list assessment, due to the initial screening indicating that there would be no differentiation between the options.					
Coastal processes	Construction effects on Coastal Marine Area (CMA)	-2	-2	-2	-2	-2	-2
	Geomorphology/ sedimentation and tidal flows	-1	-1	-1	-1	-1	-1
	Sea-level rise and costal climate change	-1	-1	-1	-1	-1	-1
Stormwater	Stormwater quality	-1	-1	-1	-1	-1	-1
	Stormwater quantity	-1	-1	-1	-1	-1	-1
Landscape, visual and urban design	Natural character and landscape	-2	-2	-2	-2	-2	-2
	Visual	-1	-1	-1	-1	-1	-1
	Extent, nature and degree of effects on urban design, including open space	2	2	1	1	1	1
Social/ community impact	Accessibility	2	3	2	3	2	3

Environmental indicator	Measure	1A	1B	2A	2B	3A	3B
	Community	-2	-2	-2	-2	-2	-2
	Health and safety	-1	-1	-1	-1	-1	-1
Noise and vibration	Operational noise and vibration	0	-1	-1	-1	-1	-1
	Construction noise and vibration	-1	-1	-1	-1	-1	-1
Archaeology and built heritage	Archaeology and built heritage	-2	-2	-2	-2	-2	-2
Contaminated land	Construction management (contaminated soils)	-2	-3	-1	-2	-1	-2
	Construction management (groundwater)	-1	-1	-1	-1	-1	-1
	Passive discharge	-1	-1	0	0	0	0
	Potential for new or cross contamination	-2	-2	-2	-2	-2	-2
	Built environment risk	-1	-1	-1	-1	-1	-1
	Health and safety of construction workers	-2	-2	-1	-1	-1	-1
	Acid sulphate soil	-3	-3	-3	-3	-3	-2
Air quality	Operational air quality	0	0	0	0	0	0
	Construction air quality	-1	-1	-1	-1	-1	-1

Table 3-3 contains the engineering feasibility scoring for both the A2B MRT and 20Connect projects. Refer to tech note 501094-4401-TEC-CC-0016 for more information.

Table 3-3: Scores for each option against engineering feasibility indicators

Feasibility indicator	1A	1B	2A	2B	3A	3B
Constructability	4	2	2	2	2	2
Construction disruption	3	3	2	2	2	2
Construction cost and risk	2	2	3	2	3	2
Safety in design and construction	3	3	3	3	3	3
Operation and maintenance	3	3	3	3	3	3
Property	2	2	2	2	2	2
Consentability	2	2	2	2	2	2

4 Manukau options MCA results

Table 4-1 details the MCA scores for the assessment of the Manukau options. This assessment is not affected by the 20Connect project; therefore, it excludes the 20Connect investment objectives and metrics. Refer to 502334-6000-TEC-KK-0012 for more information.

Table 4-1: MCA results for assessment against investment objectives

Investment objective	KPI	Measure	B3 (Ronwood Avenue)	B5 (Manukau Station Road)	B6 (Hybrid of B3 & B5)
To provide more equitable access and travel choices to jobs, learning, cultural and social activities in the south and east of Auckland	Population accessible to key destinations	Population within 45-minute PT trip from: Airport, Manukau, Botany	2	3	3
	Jobs accessible from key locations	Jobs within 45-minute PT trip from: Ormiston, Otara, Botany, Manukau, Papakura	2	2	2
	Access to education and social opportunities	Tertiary institutes, hospitals, government offices within walking distance of MRT route	1	1	1
	Access to resources and places of customary practice	Marae and sites and places of value to mana whenua within walking distance of MRT route	0	0	0
	Cost of travel in south and east Auckland	Generalised cost (incorporates cost and time) of PT travel in south and east Auckland	Not formally assessed due to no models for Manukau, however there would be negligible differences between the options.		
To provide public transport for south and east Auckland that is easy to use, reliable, fast, resilient and affordable	Capacity and resilience of the option to meet demand	Assessment of demand and capacity of MRT option	2	1	2
	Travel time reliability, including separation of road space	Assessment of vehicle travel time reliability for key journeys	2	2	2
	Directness and ease of use	Transfers for key journeys: City-Airport, Botany-Airport, Papakura-Airport, Botany-Manukau	2	2	2
	Travel time for key journeys	PT travel time for key journeys (as above)	3	1	2
To promote urban regeneration, improved built environment, and economic opportunities	Population accessible to key destinations	Population within 45-minute PT trip from: Airport, Manukau, Botany	2	3	3
	Jobs accessible from key locations	Jobs within 45-minute PT trip from: Ormiston, Otara, Botany, Manukau, Papakura	2	2	2
	Improved access to Local, Town and Metropolitan Centres	Local, Town and Metropolitan Centres within walking distance of MRT	3	2	3
	Land development around stations	Extent of Housing NZ and Panuku land within 1km of stations	0	1	1
To reduce the effects of the transport system on the environment and taonga	Air emissions from transportation	Particulate and carbon dioxide emissions from vehicles in Auckland region	Not formally assessed due to no models for Manukau, however there would be negligible differences between the options.		
	Water quality effects of transport system	Quantity and quality of stormwater around the transport system	-1	-1	-1

Investment objective	KPI	Measure	B3 (Ronwood Avenue)	B5 (Manukau Station Road)	B6 (Hybrid of B3 & B5)
	Effects on places of heritage	Effects on sites/buildings/places of heritage value, and sites and places of archaeological significance	-1	-1	-1
	Māori communities and wellbeing[2]	Effect on relationship with ancestral lands, water, sites, waahi tapu, and other taonga	-1	-1	-1
	Te Taiao (air, land, water, taonga)[1]	Effect on air, land, water and other resources including on Mātautanga Māori	-1	-1	-1
	Effects on culture and traditions[1]	Relationship with culture, traditions, ancestral lands, water, sites, waahi tapu, and other taonga	0	0	0
		Recognition of sites of significance	0	0	0
To improve health, safety, and security of people	Air emissions from transportation	Particulate and carbon dioxide emissions from vehicles in Auckland region	Not formally assessed due to no models for Manukau, however there would be negligible differences between the options.		
	Walking accessibility to PT stations	Population within 500m walk of frequent PT stops or 1km walk to RTN stations	1	1	1
		Additional distance walked due to mode shift	Not formally assessed due to no models for Manukau, however there would be negligible differences between the options.		
	Extent of local walking and cycling connections	Technical assessment of walking and cycling links	2	2	2

Table 4-2 contains the planning and environment considerations scoring for the assessment of the Manukau options. Refer to tech note 502334-6000-TEC-NN-0013 for more information.

Table 4-2: Scores for each option against planning and environmental considerations

Environmental indicator	Measure	B3 (Ronwood Avenue)	B5 (Manukau Station Road)	B6 (Hybrid of B3 & B5)
Ecology	Aquatic ecology	0	0	0
	Terrestrial ecology	0	0	0
	Marine ecology	The options are not located near the coastal marine area or any marine ecology.		
	Arboriculture	-2	-2	-2
Stormwater	Stormwater quality	-1	-1	-1
	Stormwater quantity	-3	-2	-3

[2] Note that at the time of issue, mana whenua had not validated these scores.

Environmental indicator	Measure	B3 (Ronwood Avenue)	B5 (Manukau Station Road)	B6 (Hybrid of B3 & B5)
Landscape, visual and urban design	Natural character and landscape	-1	-1	-1
	Visual	-1	-1	-1
	Urban design	1	2	1
Social/ community impact	Accessibility	1	1	1
	Community	-1	-1	-1
	Health and safety	-1	-1	-1
Noise and vibration	Operational noise and vibration	0	-1	-1
	Construction noise and vibration	-1	-1	-1
Archaeology and built heritage	Archaeology and built heritage	-1	-1	-1
Contaminated land	Waste management	-1	-1	-1
	Health and safety during construction works	-1	-1	-1
Air quality	Operational air quality	Not assessed because the information required to differentiate between options is unavailable.		
	Construction air quality	Not assessed because the information required to differentiate between options is unavailable.		

Table 4-3 contains the engineering feasibility scoring for the assessment of the Manukau options. Refer to tech note 502334-6000-TEC-NN-0001 for more information.

Table 4-3: Scores for each option against engineering feasibility indicators

Feasibility indicator	B3 (Ronwood Avenue)	B5 (Manukau Station Road)	B6 (Hybrid of B3 & B5)
Constructability	3	3	3
Construction disruption	3	2	2
Construction cost and risk	3	3	3
Safety in design and construction	3	3	3
Operation and maintenance	3	3	3
Property	1	3	1
Consentability	3	3	3

5 Preferred option

The output of the short list assessment is the identification of the preferred option that will be progressed in detail to inform the recommended option. This section defines the preferred option for the A2B project. The MCA assessment of the two projects was conducted in a single assessment, however it was found that the preferred option for the A2B project was the same for each of the 20Connect short list options.

The preferred option selection for the A2B MRT alignment is discussed in two components: the connection between the Airport and Puhinui, and the alignment through Manukau. (The preferred option for the third component between Manukau and Botany was already confirmed in the previous long list assessment). Figure 3 shows the preferred alignment for the A2B MRT service.

5.1.1 Alignment between the Airport and Puhinui

The short list assessment for the A2B and 20Connect options indicated very strongly that option A was preferable to option B. Within each 20Connect option, option A (MRT alignment via SH20B) scored significantly higher than option B (MRT alignment via SH20A and SH20). There were some individual metrics where option B did score higher, however upon reviewing the assessment overall, option A was preferred.

The primary strength of option A compared to option B is the more direct link between Puhinui and the Airport, reducing travel times for all journeys between the Airport and east and south Auckland. These shorter travel times result in faster passenger trips, better regional network connectivity with greater catchment area, and lower operating and fleet costs.

The strength of option B, in comparison, results from the diversion from the Airport north to Māngere and then south to Puhinui. This connects more local residents *directly* to the A2B MRT route, however it comes at the expense of longer overall travel times between the Airport and regional demands across east and south Auckland. Additionally, as Māngere will be served by the City Centre to Māngere (and the Airport) light rail service, Māngere will already have good access to the RTN with easy transfers to the A2B MRT line at the Airport.

The faster travel times between Puhinui and the Airport will benefit all travellers to the Airport from east and south Auckland, for which there are no other existing or planned rapid transit options. Improving those connections is therefore deemed more beneficial than providing a slower direct-access service that also connects to Māngere, which already has better (existing and proposed) service connections.

The preferred option for the A2B MRT alignment is therefore option A (routing via SH20B); this conclusion holds true for all short-listed 20Connect options.

5.1.2 Alignment through Manukau

The sub-option for the alignment of the A2B MRT service through Manukau was also assessed in detail. Two primary options (B3 Ronwood Avenue, and B5 Manukau Station Road) were considered from the long list assessment, and a third option (B6) was introduced.

The Ronwood Avenue option (B3) is a more direct alignment that serves the north side of the Manukau Metropolitan Centre well but does not directly connect to the existing Manukau rail and bus station. Conversely, the Manukau Station Road option (B5) provides a direct connection to the existing rail and bus interchange but bypasses the north side of the Metropolitan Centre.

Option B6 was developed as a hybrid of B3 and B5, with an alignment (west-east) along Manukau Station Road but continuing along Davies Avenue to Ronwood Avenue. This hybrid option was

developed during the assessment process with the aim of combining the primary benefits of the two initial options, with a slightly longer route that serves both the rail-bus interchange and the northern side of the Metropolitan Centre.

Options B3 and B6 via Ronwood Ave also avoid routing the MRT through the congested and constrained intersection of Great South Road, Manukau Station Road and the adjacent SH1 Southern Motorway ramps.

The two initial sub-options of B3 and B5 scored similarly across many of the metrics, however there were several metrics where one scored higher than the other. The hybrid option B6 mostly scored similarly to B3 and B5, however on the metrics where there was a difference between B3 and B5, B6 generally scored the same as the higher of the other two options. The metrics where B3 or B5 scored higher than B6 was the travel time metric, whereby B3 scored highest as it would be slightly more direct than the B6 hybrid option. Nonetheless, the slightly slower travel times through Manukau with option B6 is considered to be a reasonable trade off compared to the benefits of providing a more connected service through Manukau, connecting to both Manukau Station and the Metropolitan Centre.

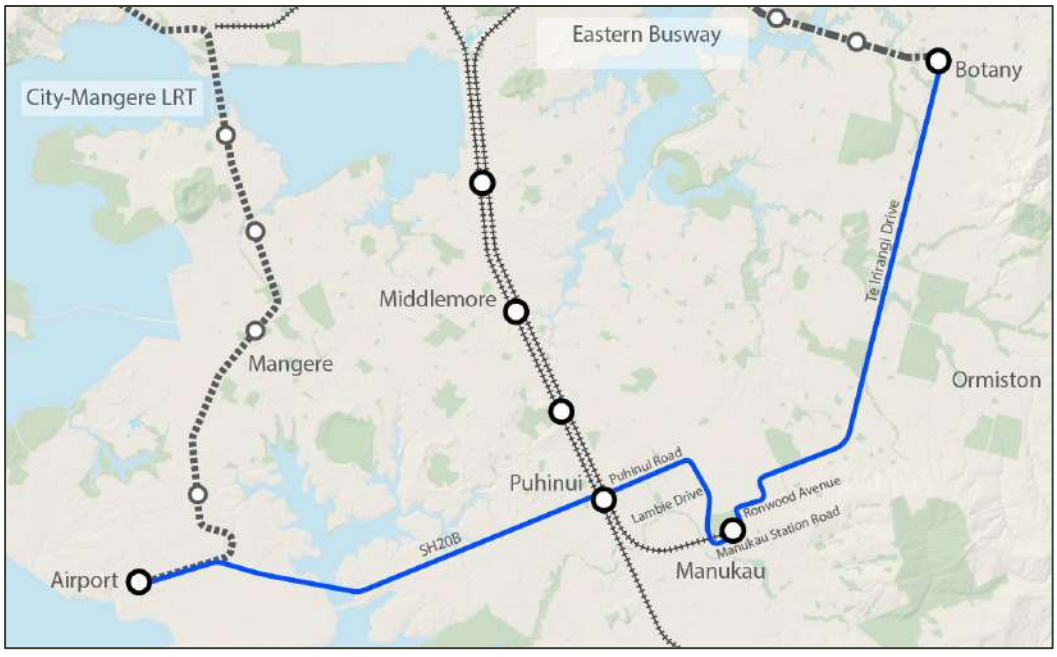
Therefore, option B6, using Manukau Station Road, Davies Avenue and Ronwood Avenue is the preferred option for the Manukau alignment of the A2B MRT service.

Although option B6 came out as the preferred option, it did score poorly on three metrics being stormwater quality, arboriculture and property for the following reasons:

- There is very limited space along Ronwood Avenue to provide any peak flow attenuation which may result in the increased flooding of the immediate downstream receiving environment.
- A substantial number of mature street trees would be required to be removed, however out of the options, option B6 has more opportunity for the relocation of trees and replacement planting.
- There are likely to be direct property impacts to commercial properties that are considered to be high risk.

Opportunities to mitigate these impacts will be focused on as the preferred option is developed.

Figure 3: A2B MRT preferred option



6 Summary

This note has described the process followed to execute the MCA for the short list options for the A2B MRT project, noting that this assessment was joint with 20Connect, however more detail related to the 20Connect project can be found in a separate technical note. Each of the options consisted of components from each project, to generate six options for comparison. Additionally, three sub-options were considered for the Manukau alignment of the A2B MRT.

The results of the MCA process are included, as well as a discussion on how those results transpired into the preferred option, to be developed in more detail.

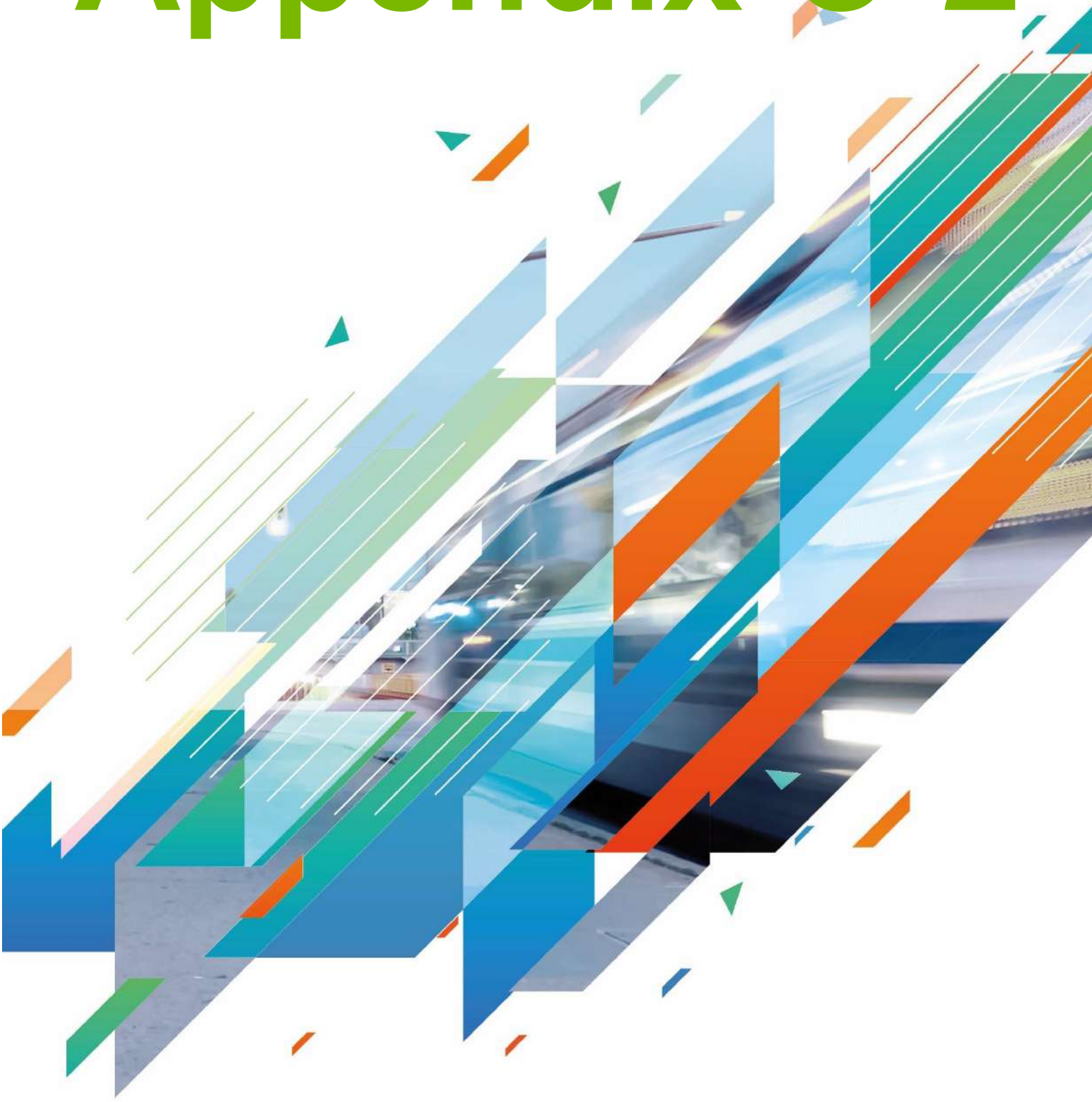
The preferred option for the A2B MRT project involves an alignment of the MRT service via SH20B between the Airport and Puhinui, and through the Manukau Metropolitan Centre and the Manukau bus and rail interchange using (west to east) Lambie Drive, Manukau Station Road, Davies Avenue and Ronwood Avenue. This is shown in Figure 3.

The preferred option for the A2B MRT project is the same regardless of the preferred option for the 20Connect project. More detail on the preferred option for 20Connect is available in a separate technical note.

Approved by:

Title	Name	Position	Signature	Date
Author	[redacted]	Transport Planner	[redacted]	10/04/2019
Reviewer	[redacted]	Associate		10/04/2019

Appendix C-2



20Connect Short List Assessment

Appendix C-2
20Connect Short List Assessment

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Technical Note

To	**NZ Transport Agency**	From	**20Connect Project Team**
Copy		Reference No:	**501094-4401-TEC-KK-0019**
Date	**2020-05-08**	Pages (including this page)	**35**
Subject	**Transport Planning Shortlist Assessment**		

1 Introduction

The purpose of this technical note is to provide a summary of the transport planning assessment carried out during the shortlist assessment stage of the 20Connect single stage business case project. The note will outline key performance indicators (KPIs) used in the assessment. It also includes discussion of the tools and the analysis used in evaluating the KPIs through associated measures. The evaluation of options has been undertaken through a mixture of qualitative and quantitative assessments.

For context the overall option assessment process for the project is summarised in the figure below, with the task for the shortlist assessment phase highlighted.

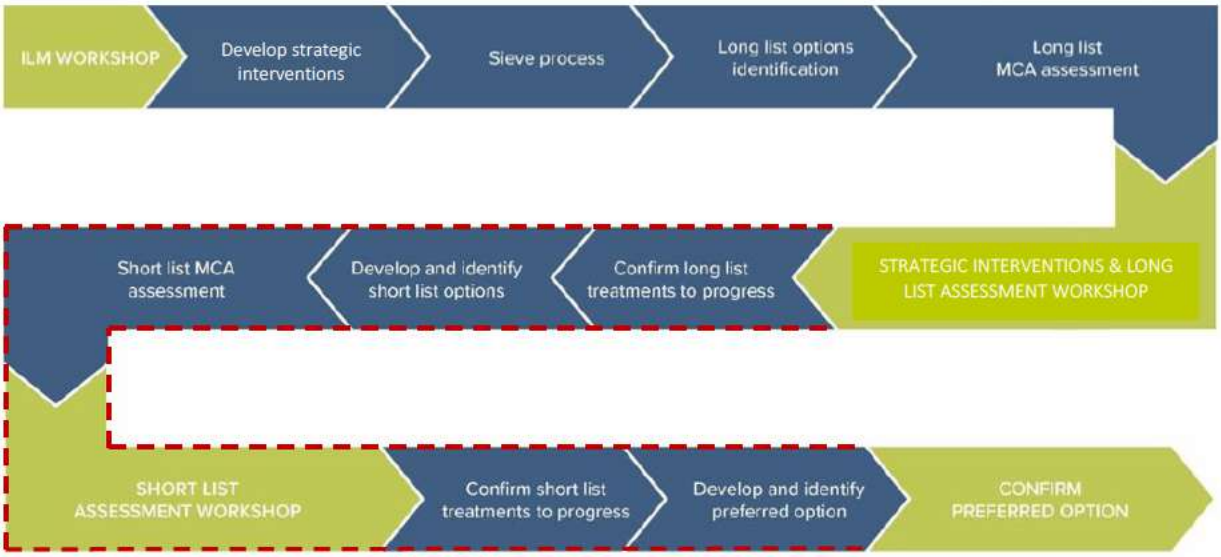


Figure 1: Options assessment overview

The shortlist assessment followed the longlist assessment stage. At the end of the long list stage, a workshop was held on 31st August 2018. Based on the workshop discussions and post-workshop consultations with project partners, a shortlist of options (including various treatments) that need to be progressed further was determined as follows:

- Option 1 – SH20B upgraded to a four-lane freeway standard and new south-facing ramps at SH20B/SH20 highway Interchange.
- Option 2 – SH20B upgraded to a four-lane urban expressway, with a southbound ramp from SH20A to SH20.

- Option 3 – SH20B upgraded to a four-lane expressway, but narrowing to two lanes at Pukaki Creek Bridge, and SH20A / SH20 southbound ramp.

The key reasons for the remaining long list options to be discarded include the following:

- High impact on commercial properties along SH20A corridor
- Significant competition between road and public transport investments along SH20A corridor
- Impact of SH20B / SH20 north-facing ramps on the Memorial Gardens Cemetery requires a Disinterment Licence.

The transport planning KPIs used during the short list assessment stage evolved from the long list stage. Options were assigned a rating (or a score), based on likely impact against each of the identified KPI measure. A summary of the impact rating is provided below, along with descriptions.

Table 1: KPI scoring

Rating	Description
	Significantly positive
	Moderately positive
	Minor positive
	Neutral
	Minor adverse
	Moderately adverse
	Significantly adverse

Further discussion of the transport assessment of the options is provided in the remainder of this document, which includes discussion of the transport assessment methodology, KPIs evaluation and multi-criteria analysis process.

2 Option assessment

The progressed 20Connect options were integrated with the Airport to Botany (A2B) public transport options. The options were assessed using two transport modelling tools.

- Macro strategic model (MSM) to test regional and strategic impacts / benefits across all modes
- SATURN traffic model for more detailed traffic analysis on the road network within the core study area.

The modelling tools and other option assessment tools used are discussed further in Section 3.

For the Macro-strategic modelling (MSM) assessment, the shortlisted 20Connect road treatments were combined into one road improvements test and integrated with the A2B RTN alignment options. A graphical representation of this integration is shown in Figure 2.

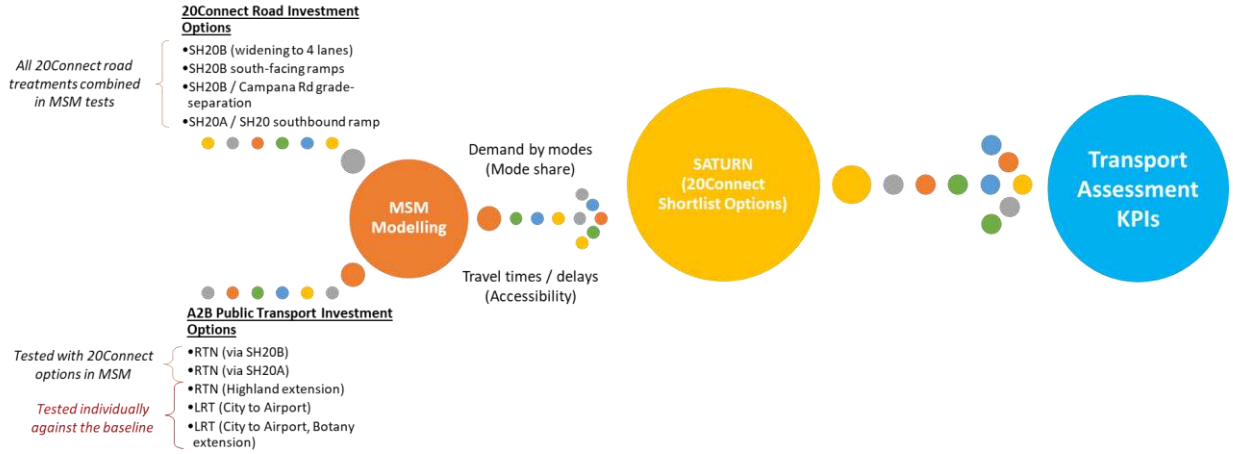


Figure 2: 20Connect and A2B options integration in MSM

A list of the MSM tests is provided below. The tests integrate the 20Connect and A2B shortlist options as discussed above.

- **MSM scenario 0**: 2048 baseline network and demand (reference scenario)
- **MSM scenario 1**: 2048 with RTN along SH20B without 20Connect road improvements
- **MSM scenario 2**: 2048 with RTN along SH20B *with 20Connect road improvements*
- **MSM scenario 3**: 2048 with RTN along SH20B, extended to Highlands, but without 20Connect road improvements
- **MSM scenario 4**: 2048 with RTN along SH20/SH20A without 20Connect road improvements
- **MSM scenario 5**: 2048 with RTN along SH20/SH20A *with 20Connect road improvements*
- **MSM scenario 6**: 2048 with City to Airport LRT, without 20Connect road improvements
- **MSM scenario 7**: 2048 with City to Airport LRT, extended to Botany, without 20Connect road improvements

The transport treatments included in each MSM scenario are shown in **Table 2**.

Table 2: Strategic model (MSM) scenario summary

Infrastructure elements	Scenarios							
	0	1	2	3	4	5	6	7
	2048 baseline	SH20B RTN No road imp	SH20B RTN With road imp	SH20B RTN Highlands ext	SH20A RTN No road imp	SH20A RTN With road imp	LRT C2A	LRT C2A, Botany Ext
BRT (Airport to Manukau to Botany, **via SH20B**)	✗	✓	✓	✓	✗	✗	✗	✗
BRT (Botany to Highlands Extension)	✗	✗	✗	✓	✗	✗	✗	✗
BRT (Airport to Manukau to Botany, **via SH20/20A**)	✗	✗	✗	✗	✓	✓	✓	✗
LRT (CBD to Airport)	✗	✗	✗	✗	✗	✗	✓	✓
LRT (Airport to Botany)	✗	✗	✗	✗	✗	✗	✗	✓
SH20 widening (Mangere Bridge to SH20A)	✗	✗	✓	✗	✗	✓	✗	✗
SH20 widening (SH20A to SH20B)	✗	✗	✓	✗	✗	✓	✗	✗
SH20 widening (SH20B to Cavendish Dr)	✗	✗	✓	✗	✗	✓	✗	✗
SH20A southbound ramp	✗	✗	✓	✗	✗	✓	✗	✗
SH20B at-grade widening	✗	✗	✓	✗	✗	✓	✗	✗
SH20B south-facing ramps	✗	✗	✓	✗	✗	✓	✗	✗
SH20B Price Rd grade-separation	✗	✗	✓	✗	✗	✓	✗	✗
SH20A to SH20B connection	✗	✗	✓	✗	✗	✓	✗	✗

Scenario 0, 1 and 4 are reference scenarios against which the impact of 20Connect road improvements and the LRT implementation were tested. Scenario 2 has been further expanded and tested in the localised traffic analysis to best align with the progressed shortlist options.

3 Transport assessment

3.1 Assessment Methodology and Tools

To evaluate impact of the options against the identified KPIs, two transport modelling tools were used, these modelling tools are “the Auckland Macro-Strategic Model (MSM)” and 20Connect SATURN traffic model. There was also an analysis carried out in Geographic Information Systems (GIS) platform, using modelling outputs to assess how the options impact the accessibility of the airport precinct to population catchments and employment opportunities.

MSM is a multi-modal strategic transportation model commonly used to assess transport system investments and demand scenarios in the Auckland region. The model is implemented in the EMME3 modelling suite. It is developed and maintained by the Auckland Forecasting Centre (AFC), an internal Auckland Transport (AT) modelling team. MSM is best used for assessing impact of transport investments and major developments at regional scale (or strategic level).

SATURN is a mesoscopic highway assignment modelling suite and is capable of analysing road network at a more detailed level than strategic models. This includes modelling of intersection delays, queue progression (spill back), bus lanes, traffic signal optimisation, multiple route choices and platoon assignment of vehicular traffic on congested road networks. SATURN does this without going into too much micro-simulation details than is necessary for a moderately large study area such as the 20Connect study area.

Figure 3 illustrates the extent of the SATURN study area and the relationship between the MSM and SATURN models. The purple, in Figure, is the road network of MSM and the SATURN as the boxed section.

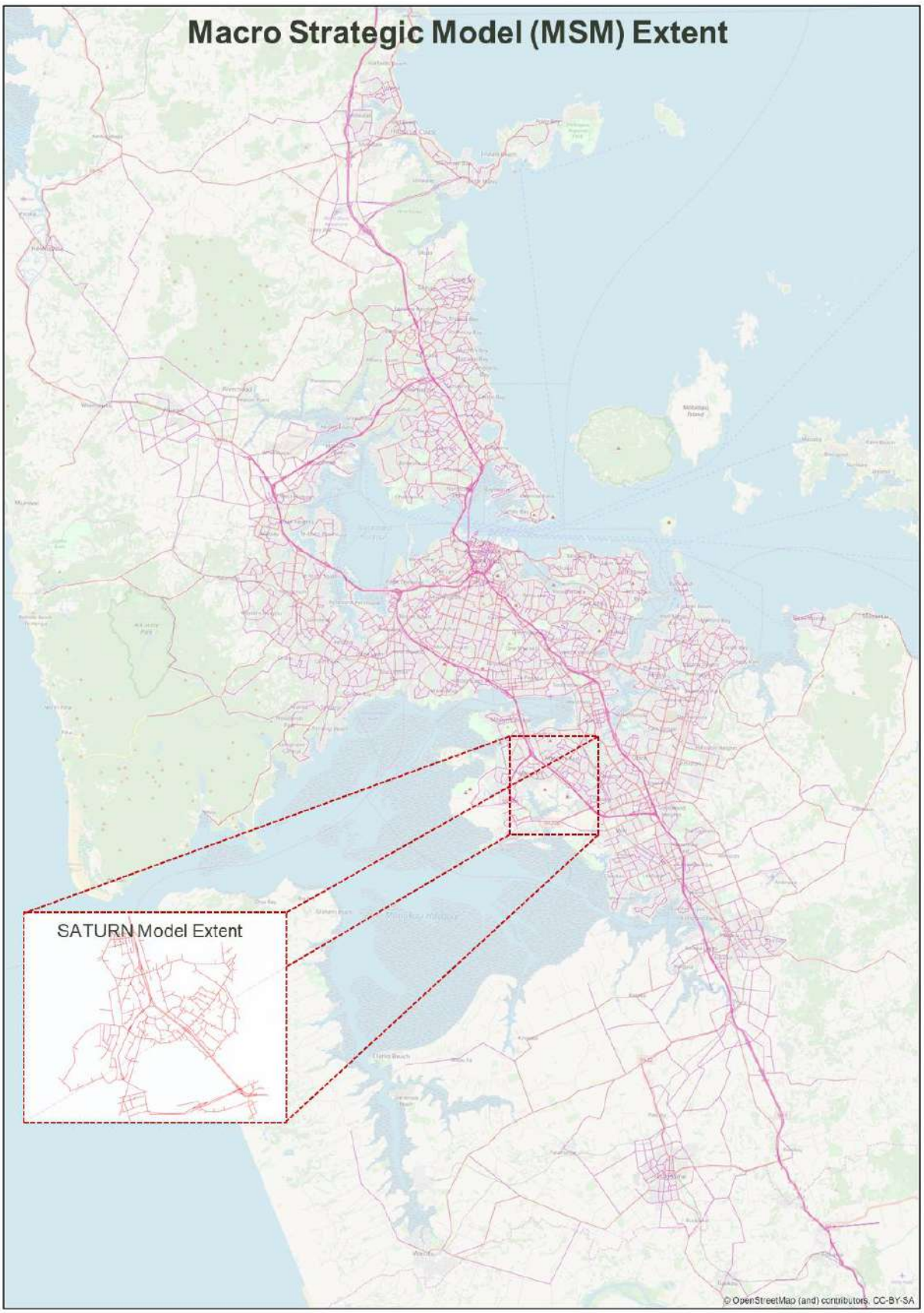


Figure 3: MSM and SATURN extent and relationship

3.1.1 Macro Strategic Model (MSM)

The transport investment scenarios, discussed in section 2, were assessed according to their performance in year 2048, which aligns with a 30-year assessment period as per the Transport Agency's requirements. The modelled network is therefore for year 2048 and uses the demand model developed for the Auckland Transport Alignment Project (ATAP).

The overall origin-destination (person trip) travel demand was kept constant for all scenarios. However, the demand assigned to each travel mode (e.g. assigned vehicle volumes on the road network) fluctuates between the scenarios due to different infrastructure and operational parameters that are assumed (i.e. the LRT scenario will have more people in public transport than road investment scenarios.)

The MSM provided insights into the following transport data:

- Airport precinct traffic volumes (general traffic and public transport)
- Airport precinct mode share rates
- Travel times on road and public transport network sections (used for GIS-based accessibility analysis)

One objective of the project is to increase accessibility to the airport, including nearby residential and commercial land use developments, whilst enabling a more balanced mode share. MSM analysis results enabled assessment of project impacts against the accessibility objective.

The traffic volumes and mode share results, as derived from MSM, are summarised in Figure 4**,** Figure 5 and Figure 6 for the AM, inter-peak (IP) and PM peak (2 hour) periods respectively.

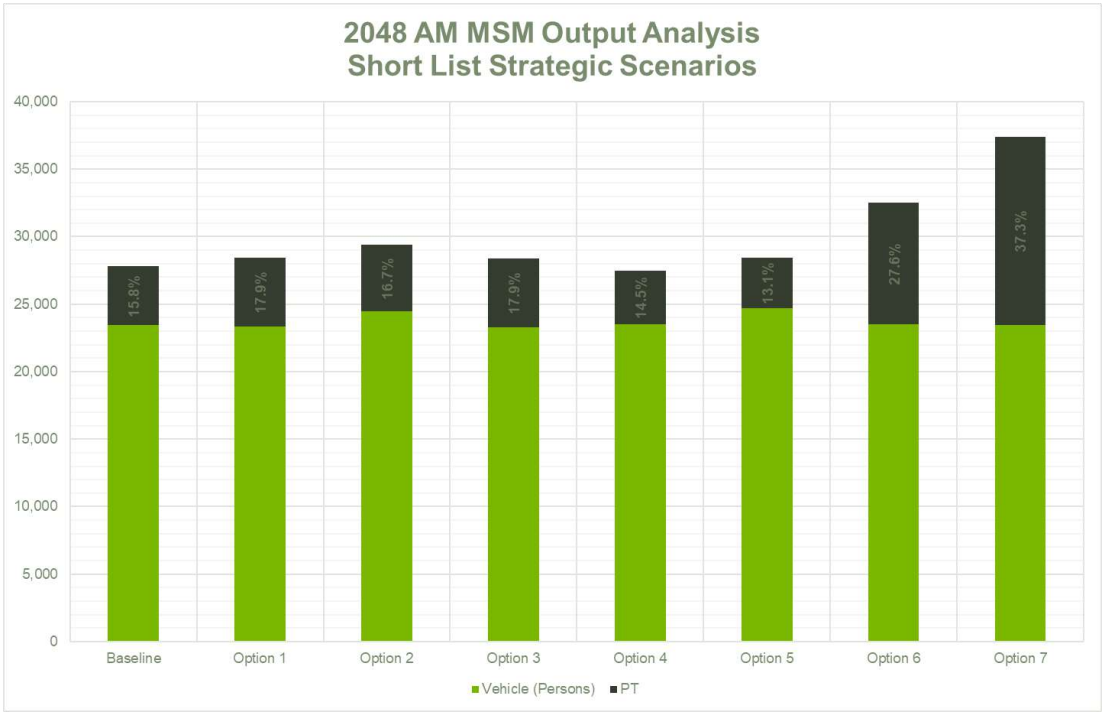


Figure 4: Airport precinct travel demand (person trips) – AM peak

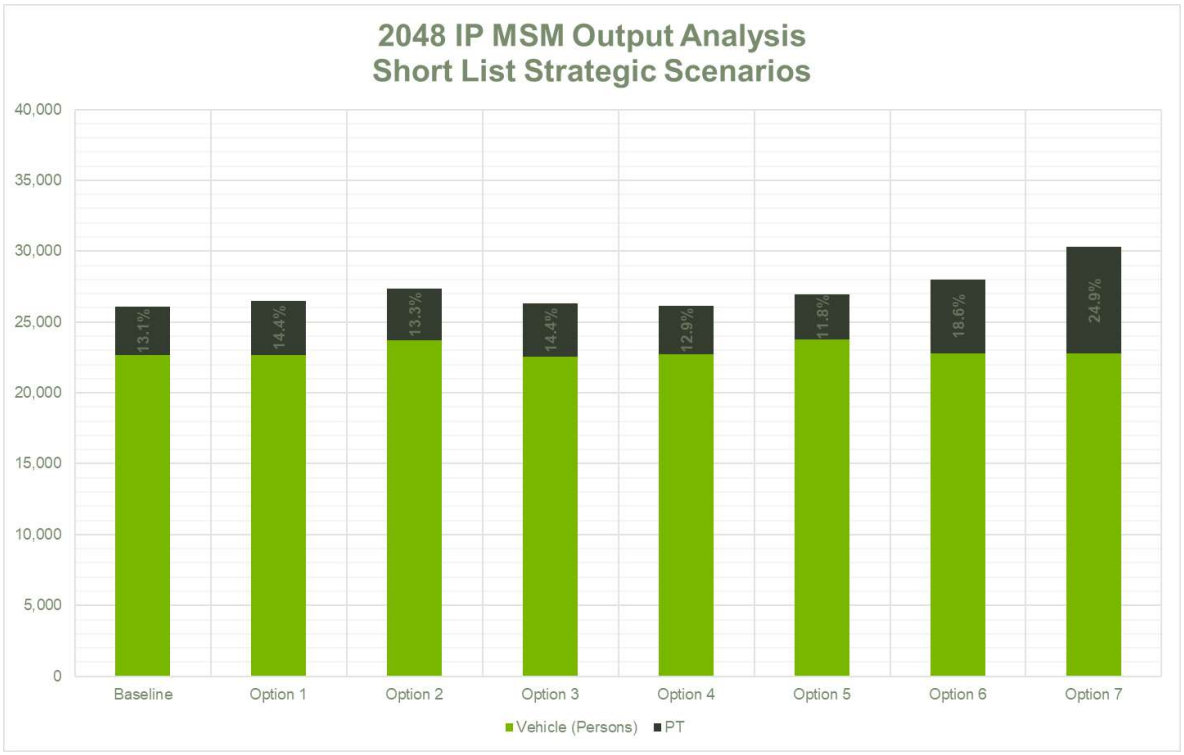


Figure 5: Airport precinct travel demand (person trips) - Inter-peak

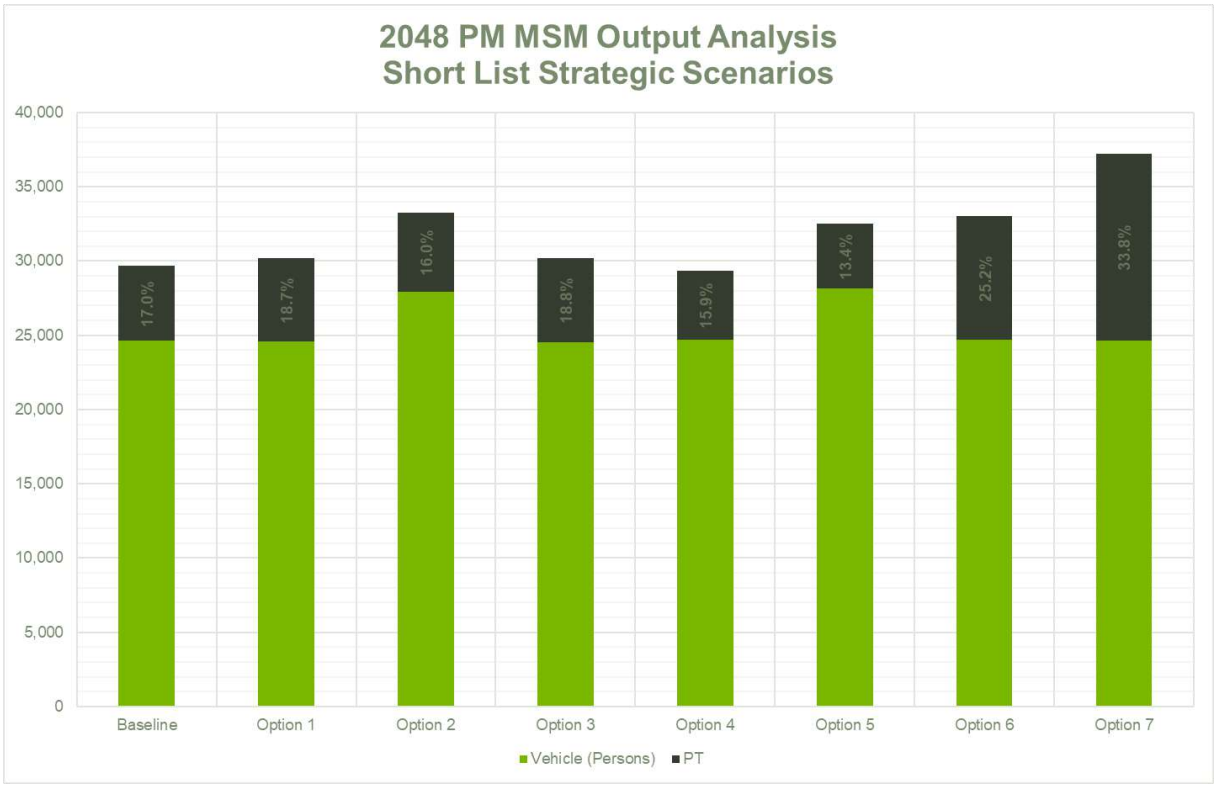


Figure 6: Airport precinct travel demand (person trips) - PM peak

The model results indicate that any of the available road network capacity within the airport precinct (about 25,000 people during 2-hour peak period) will be taken up in all the MSM modelling scenarios. With 20Connect road interventions (in Options 2 and 5), there will be an increase in person carrying capacity of the transport system (from 25,000 to 28,000 people during the peak 2 hours). This will result in additional number of people to the local network who will access the airport precinct by private vehicles. There will also be a minor decrease in number of public transport users within the airport precinct, as compared to the reference scenario (i.e. around 180 and 300 less public transport users in the AM and PM peak periods respectively). This will effectively reduce the percentage mode share of public transport by about 1 and 3 percent in the AM and PM peak periods respectively.

With the City Centre to Mangere (Airport) Light Rail Transit (LRT) options, a significant increase in public transport mode share can be expected. The extension of the LRT to Botany will have even greater mode share of people entering and leaving the airport precinct by public transport. It can, however, be reasonably concluded that some of those trips will not be primarily destined for the airport precinct but passing through to other destinations within the LRT catchment.

As illustrated by the modelling results, LRT is not expected to reduce volumes of road-based traffic (i.e. road capacity will still be fully taken up even with the LRT provided). But LRT will provide additional accessibility options to the airport and it surroundings, hence increasing the diversity and extent of the airport precinct catchment area within the Auckland region.

3.2 Option assessment and evaluation

Localised road network analysis was carried out in SATURN. Following the preliminary modelling results and project risk assessment process, options that included the RTN along SH20 / SH20A corridor (Options 1B, 2B, 3B) were not developed further. The initial modelling demonstrated that the traffic volumes did not vary significantly with the alignment of the RTN along either SH20B or SH20/SH20A corridor. The project risk assessment process, which included a risk workshop held on 5th November 2018, exposed major project risks associated with the options that provided for the RTN along SH20 / SH20A corridor. These risks included land take requirements, widening of over-bridges, and Crater Hill impact. The identified project risks could potentially delay the project implementation programme significantly and result in reputational damage to the project investment and implementation partners.

The options tested in SATURN were then only *based on MSM scenario 2 (RTN along SH20B with 20 connect interventions)*. A description of the options tested in SATURN are listed below and network treatments assessed with each option are summarised in **Table 3**.

- Do Minimum (2048 reference scenario)
- Option 1A – SH20B 4-lane freeway standard with SH20/SH20B south-facing ramps, Prices Rd grade separation, and RTN along SH20B
- Option 2A – SH20B 4-lane expressway standard without SH20/SH20B south-facing ramps, SH20A southbound ramp and RTN on SH20B
- Option 3A – SH20B 4-lane expressway between SH20 and Prices Rd (No second Pukaki Creek Crossing), SH20A southbound ramp and RTN on SH20B

Table 3: Local area (SATURN) modelling scenarios

Treatments		Options			
Corridor	Descriptions	Do Min	1A	2A	3A
SH20A	SH20A to SH20 southbound ramp	✗	✗	✓	✓
SH20B	SH20B 4 lane (SH20 to Pukaki Creek Bridge)	✗	✓	✓	✓
	SH20B 4 lane (Pukaki Creek Bridge)	✗	✓	✓	✓
	Price (Campana) Rd grade separation	✗	✓	✗	✗
	SH20 to SH20B (south-facing ramps only)	✗	✓	✗	✗
SH20	SH20 widening (Mangere Bridge to SH20A)	✗	✓	✓	✓
	SH20 widening (SH20A to SH20B)	✗	✗	✓	✓
	SH20 widening (SH20B to Cavendish Dr)	✗	✓	✗	✗
RTN	RTN along SH20B	✗	✓	✓	✓
	RTN along SH20 and SH20A	✗	✗	✗	✗

The local area modelling results, as derived from SATURN, provided the basis for evaluation of the project KPIs and are discussed further in Section 4 (multi-criteria analysis), in relation to the KPIs to which the model results were assessed against.

3.3 Accessibility assessment

The accessibility assessments were carried out using Geographic Information Systems (GIS), utilising the origin-destination (OD) travel time matrices as derived from MSM as the base for the analysis.

As stated earlier, the 20Connect road treatments were combined in MSM scenarios, with detailed analysis that match the shortlist options tested in SATURN. MSM has an advantage of covering a larger geographic area (beyond the SH20, SH20A and SH20B triangle), allowing for accessibility assessment across the Auckland Region.

SATURN, in addition to modelling the 20Connect options explicitly, is able to model intersection delays and queue progression within the local road network better than the strategic model. However, the SATURN model extent only covers the core 20Connect study area (SH20, 20A and 20B triangle and the immediate local road network). This model extent was not sufficient to cover the catchment area thresholds required for the accessibility assessment KPI. To ensure that the relative strengths of both modelling tools were used for a more holistic accessibility analysis, the MSM OD travel times were then adjusted with SH20A and SH20B travel times from SATURN localised modelling outputs. The accessibility assessment was then carried out in GIS, using the adjusted MSM Origin-Destination travel time matrices outputs.

The accessibility analysis considered the following categories:

- Population catchments
- Access to employment opportunities

For each of the scenarios, the following outputs for 2048 in both the AM and PM peak periods were estimated:

- 30-minute driving catchment areas from the Airport
- Population within this catchment
- Employment opportunities in the catchment

Each 30-minute catchment output is contained within the extent MSM model area.

The catchments were generated as follows:

- Adjusting the MSM origin-destination zone travel times with SATURN travel times for SH20A and SH20B, for each 20Connect shortlist option
- For each scenario, the following tasks were carried out to assess changes in accessibility of the airport precinct as a result of the proposed interventions:
  - Calculating a 30-minute driving catchment from and to the Airport
  - Relating each catchment with GIS information regarding population and job estimates
  - Estimating the population and number of employment opportunities that are accessible within the catchment.

The catchment of the PM peak period, in the outbound direction from the airport, is significantly smaller than the AM peak catchment, indicating high congestion in the evening. As the PM catchment is the smallest this indicates the worst-case scenario, and as such the PM peak is critical for accessibility assessment.

The results of the accessibility assessment are discussed in in Section 4.

4 Multi-criteria analysis (MCA) - transport planning

The KPIs evaluated as part of the transport planning component of the multi-criteria analysis are discussed below, along with the impact rating of the individual transport investment options.

4.1 KPI: Capacity and resilience of the transport system to meet forecast demand

4.1.1 KPI description

Table 4: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Economic, social and cultural	Inadequate transport system capacity, connections, and management to/from/within the Airport Precinct area risks economic growth and prosperity	More reliable and resilient transport system	Reliable and resilient transport system in south and east Auckland that is easy to use	Capacity and resilience of the option to meet forecast demand	Complementing PT and Road investments Degree of saturation of key links and intersections

KPI description: Complementing PT and Road Investments

The degree to which an option complements public transport and road investments is a measure of how well an intervention enables or aligns with other PT and/or roading investments. For this particular measure of the 20connect project, and in achieving the objectives set through the lifecycle of the wider airport access improvement project, this is a critical element within the assessment framework.

As highlighted through the Supplementary Programme Business Case and Strategic Case for 20Connect, to provide for, and support, the access requirements of the area in the future a balance of initiatives is needed across the full hierarchy of intervention being;

- Integrated planning,
- Demand management,
- Best use of existing network; and
- New infrastructure.

Options chosen to progress therefore must be in support of the wider project objectives. For example, 20Connect options should support the objective of encouraging more efficient travel choices through alternative modes to private vehicles. Thus, an option which may provide significant roading capacity could work against this objective in dissuading use of public transport and thus undermining the effectiveness of major public transport initiatives proposed through the wider project i.e. Mass Rapid Transit from the City (CC2M) and Botany (A2B).

KPI description: Degree of Saturation of key links and intersections

The degree of saturation (also known as volume over capacity rations or V/C) is a measure of how much of available transportation network capacity is used to accommodate traffic demand. The ability of the transport system to respond to system shocks is more limited with a network that has higher degree of saturation. At degree of saturation rates approaching 100%, the network is at high risk of reaching grid-locked conditions with even the slightest of increase in demand or an occurrence of a traffic incident. At over 100% V/C ratio, all available capacity is used up, with operational conditions typically characterised by slow speeds, delays and queue build-up on the network. So, the degree of saturation measure can be used as a proxy for network resilience.

The degree of saturation is used in this assessment, to measure the ability of each shortlist option to cater for future demand. The degree of saturation, for this assessment, is defined as the arrival flow volume on a road section divided by the capacity of that road section.

Road sections with a degree of saturation greater than 85% were considered and a summary of the assessment is presented in Figure 7 and Figure 9 below.

4.1.2 KPI evaluation

Complementing PT and Road Investments

Option 2A scored best against the measure “Complementing PT and Road investments” as it provides a balance of transport provision through the SH20B corridor for both road and PT (A2B).

By providing an upgrade of SH20B in the form of a 4-lane expressway for general vehicular traffic, and an at-grade intersection at Prices Road, capacity is sufficiently improved to cope with the future demands associated with the development of land to the south of SH20B. By not over-providing in roading capacity on SH20B (such as through grade-separated intersections and high flow ramps at SH20B/SH20 interchange, as in Option 1A) the integration with the future Auckland Airport network and SH20 to SH1 link, and interchange, is achieved. Furthermore, by not overproviding in roading capacity on SH20B prevents the undermining of MRT intervention through the A2B project, thus maximising the effectiveness of this key travel demand management intervention for transport demand to and from the east and south.

The inclusion of the SH20A to SH20 southbound ramp further supports Option 2A by providing an alternative for journeys, to/from the airport to/from the east and south, to remain on the State Highway network thus preventing through traffic from the airport network and allowing at-grade connections and interchanges to operate within a satisfactorily level of service.

Degree of Saturation of key links and intersections

Figure 7 and Figure 9 show the number of links within the study area that have degree of saturation rates above 85%, for each option during AM and PM peak hours respectively. Figure 10, Figure 11, Figure 12, and Figure 13 show the locations of saturated links for the Do Minimum, Options 1A, 2A, and 3A respectively, during the PM peak.

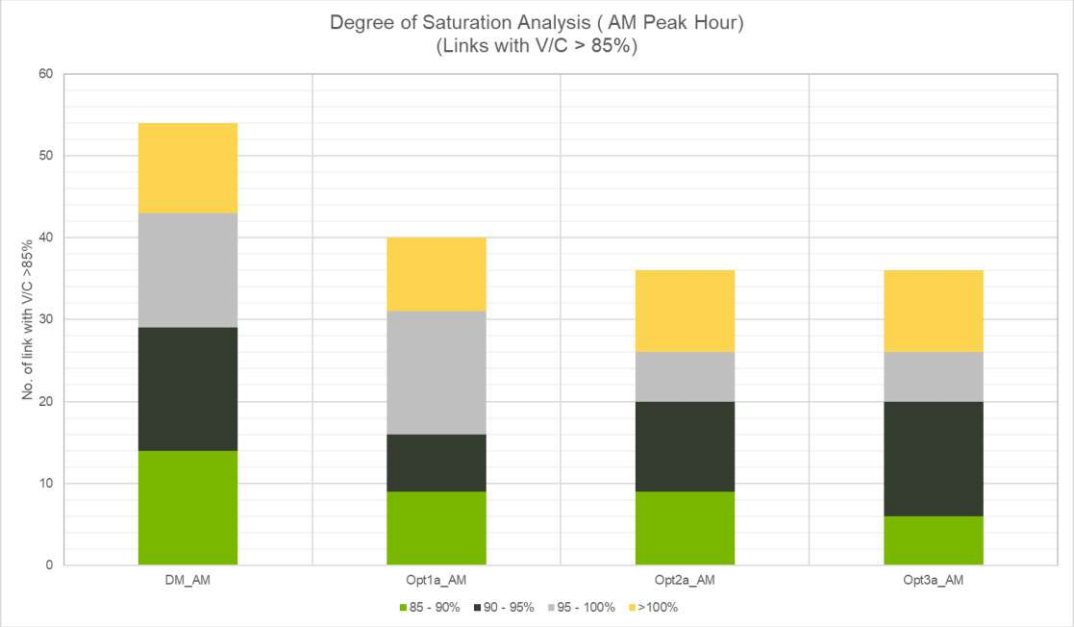


Figure 7: Degree of saturation assessment (AM peak)

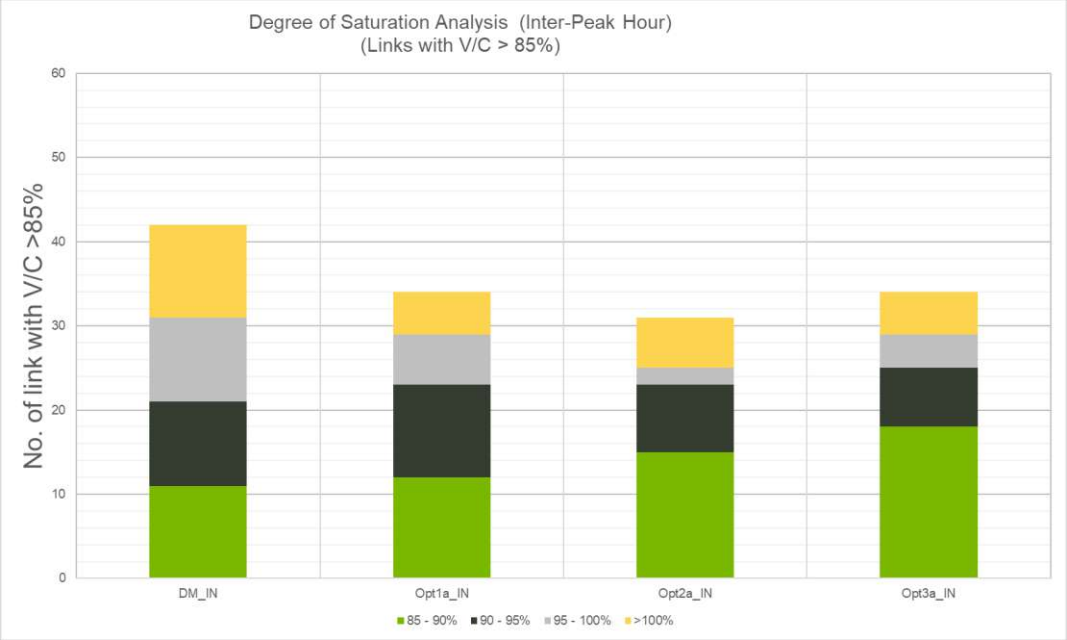


Figure 8: Degree of saturation assessment (inter-peak)

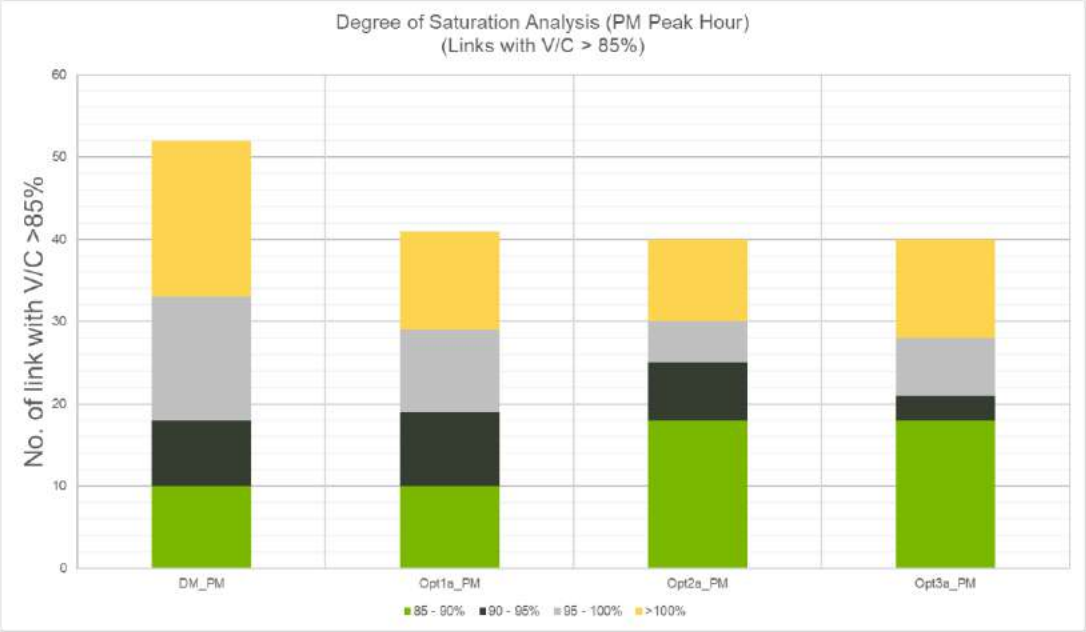


Figure 9: Degree of saturation assessment (PM peak)

The shortlist options will improve on the baseline, with the number of links with V/C greater than 85% reducing. The PM peak has more road sections with degree of saturations above the 85% threshold than the other peak periods. Options 2A and 3A are marginally better than Option 1A for this KPI, in the AM and PM peak hours. Table 5 shows the KPI scoring.

Table 5: Scoring overview of KPI

		Option 1A	Option 2A	Option 3A
KPI	KPI measures			
Capacity and resilience of the option to meet demand.	Complementing PT and Road investments	1	3	2
	Degree of saturation of key links and intersections	1	3	2

4.2 KPI: Travel time reliability, including separation of road space and vehicle interactions

4.2.1 KPI description

Table 6: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Economic, social and cultural	Inadequate transport system capacity, connections, and management to/from/within the Airport Precinct area risks economic growth and prosperity	More reliable and resilient transport system	Reliable and resilient transport system in south and east Auckland that is easy to use	Travel time reliability, including separation of road space and vehicle interactions	Number and performance of grade separations and at-grade junctions and intersections Assessment of travel time reliability for key journeys

KPI description: number and performance of grade separations and at-grade junctions and intersections:

To assess the separation of movements and the amount of conflict for each option the number of grade separations were counted, and the performance of the network qualitatively assessed. Factors that influenced the score for KPI include:

- The number of grade separated intersections
- The additional connections between state highways such as the one between SH20 and SH20A
- The network performance of each option when compared against the baseline in both AM and PM peaks, as measured in terms of degree of saturation.

To visualise the impact on the network performance, maps showing the degree of saturation for all road sections in the study area during the PM peak were prepared based on SATURN model results.

KPI Description: assessment of travel time reliability for key journeys

Travel time variations are important to understand the extent of the network's reliability. In a network where travel times can vary significantly during different times of the day, contingency travel time must be considered in one's trip planning. This results in additional time allocated for a trip than is necessary to ensure timely arrival at destination. This travel time variation, on key routes, was therefore assessed as a proxy to assess travel time reliability performance for each short list option.

4.2.2 KPI evaluation

KPI evaluation: number and performance of grade separations and at-grade junctions and intersections

Figure 10 to Figure 13 show the degree of saturation of road sections as determined by the SATURN model for the Do Min, Option 1A, 2A and 3A. Grade separations are circled and the road sections with a saturation above 85% are marked in shades of red.

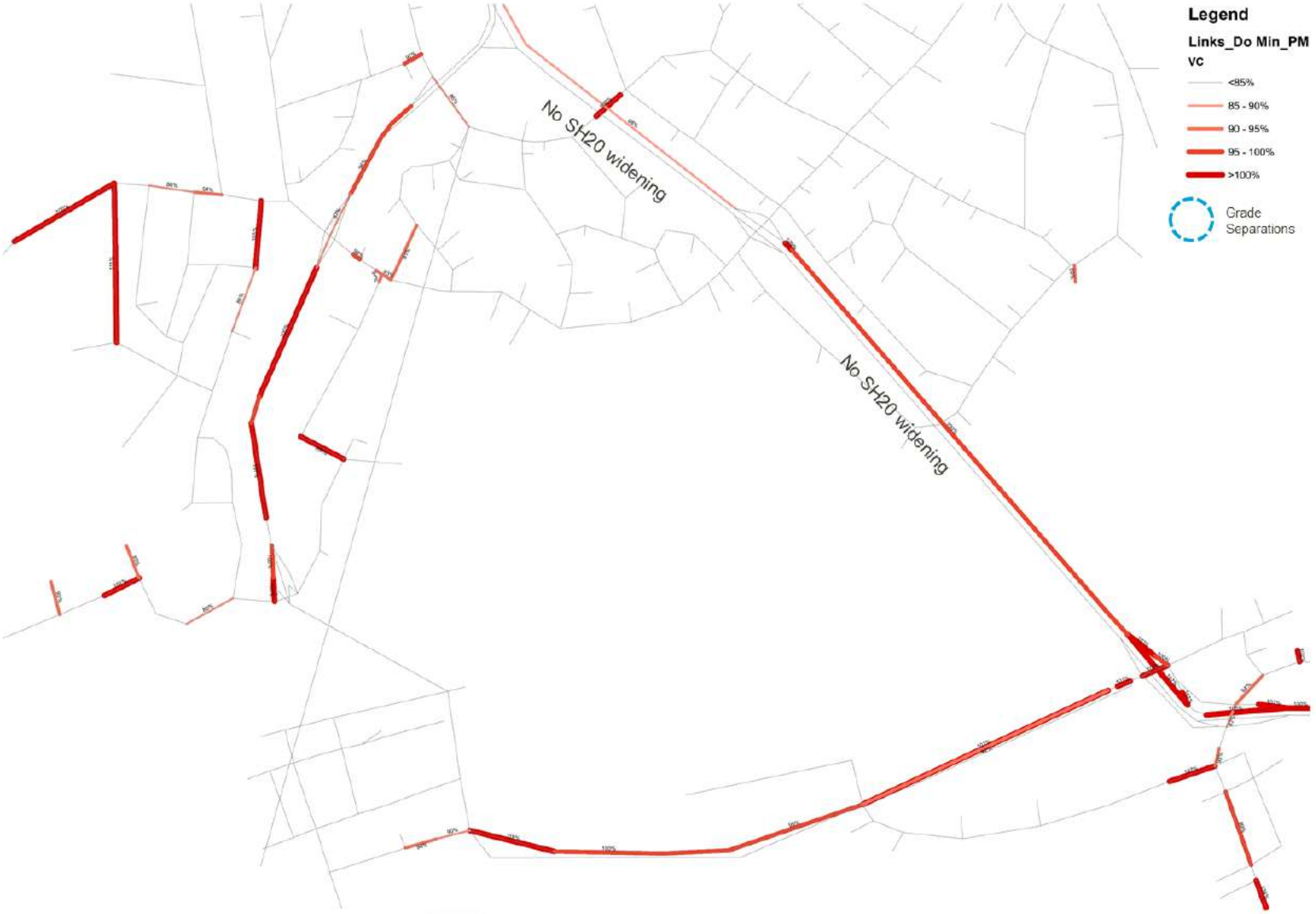


Figure 10: Degree of saturation – Do Minimum (PM peak)

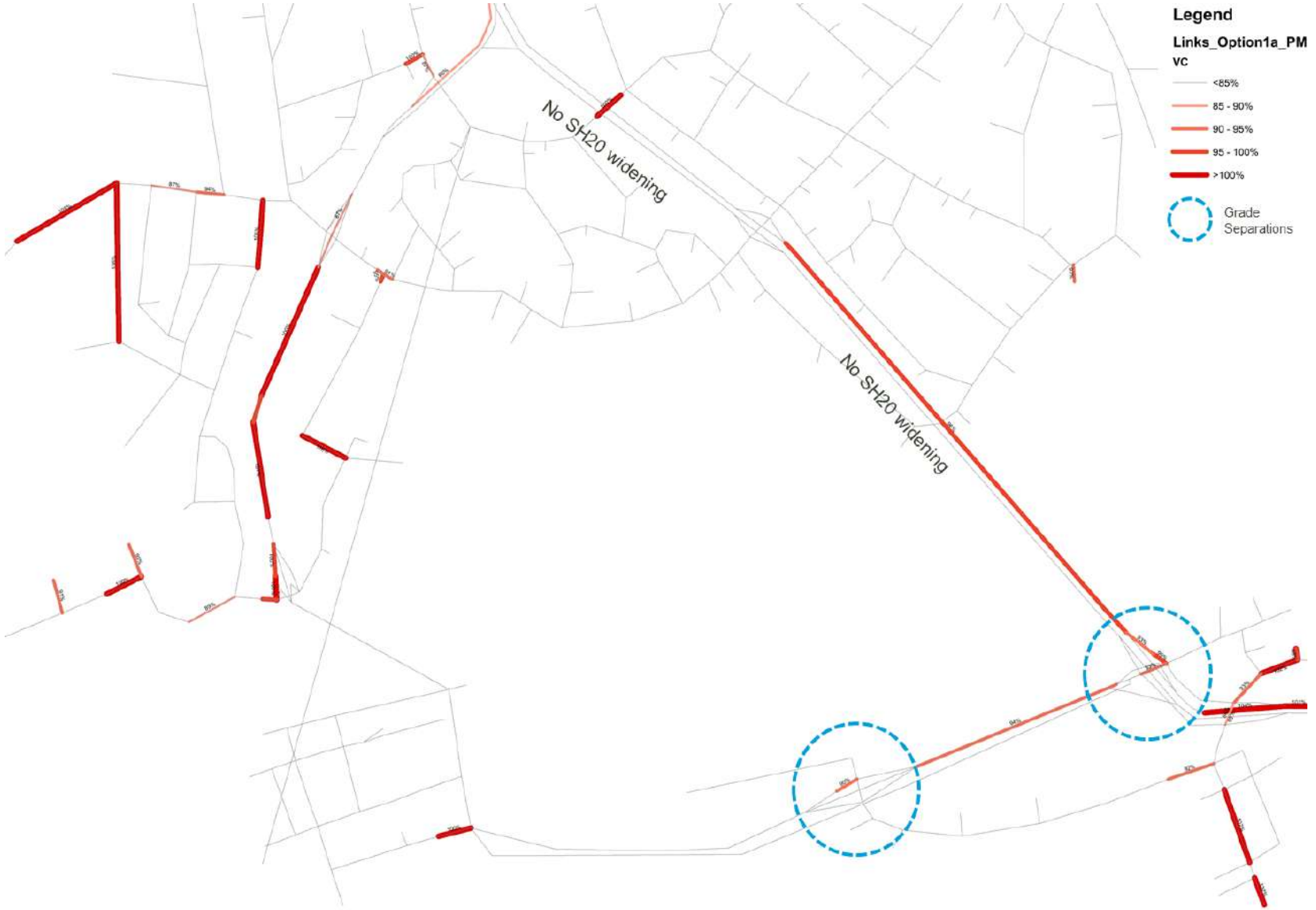


Figure 11: Degree of saturation - Option 1A (PM peak)

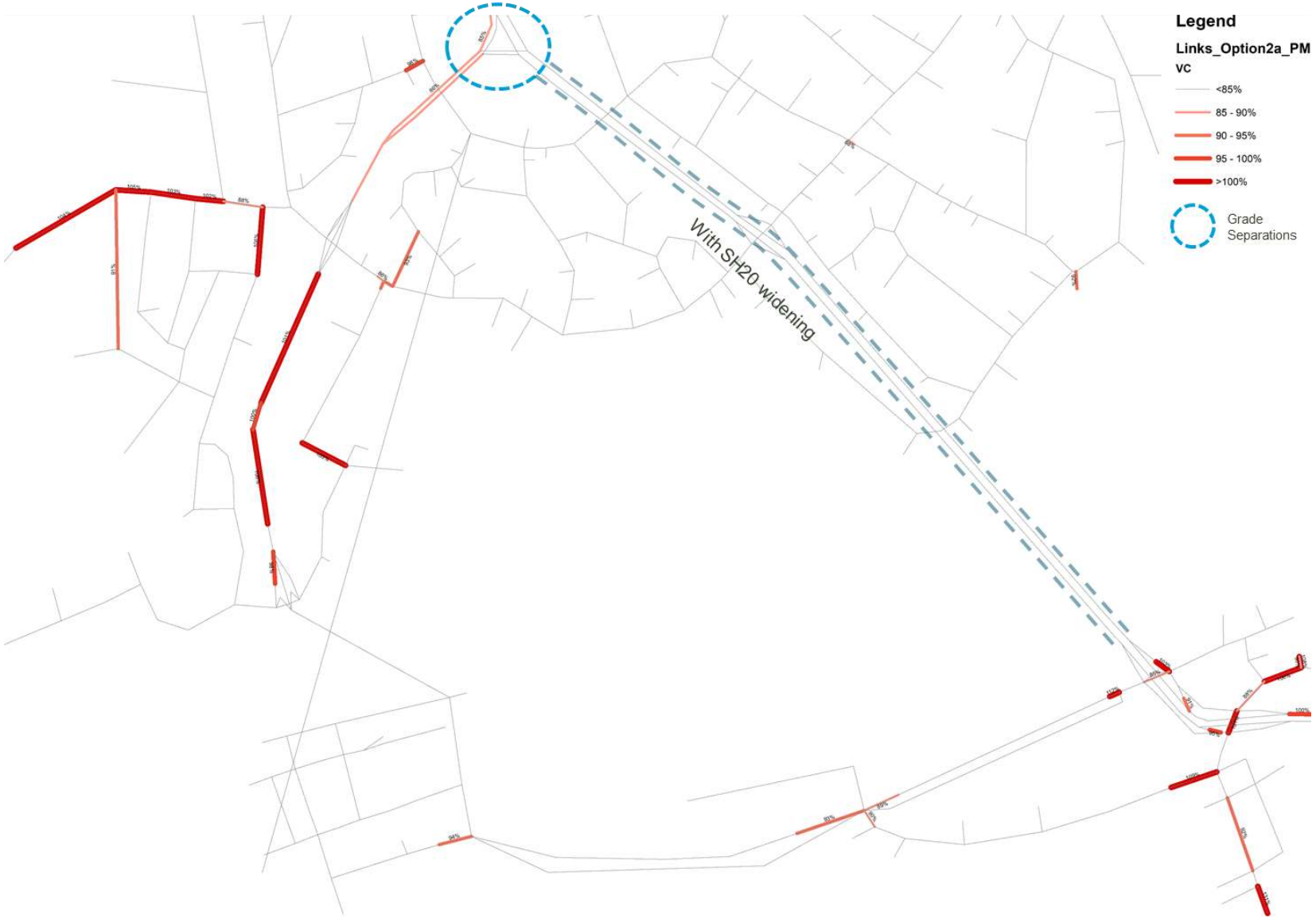


Figure 12: Degree of saturation - Option 2A (PM peak)

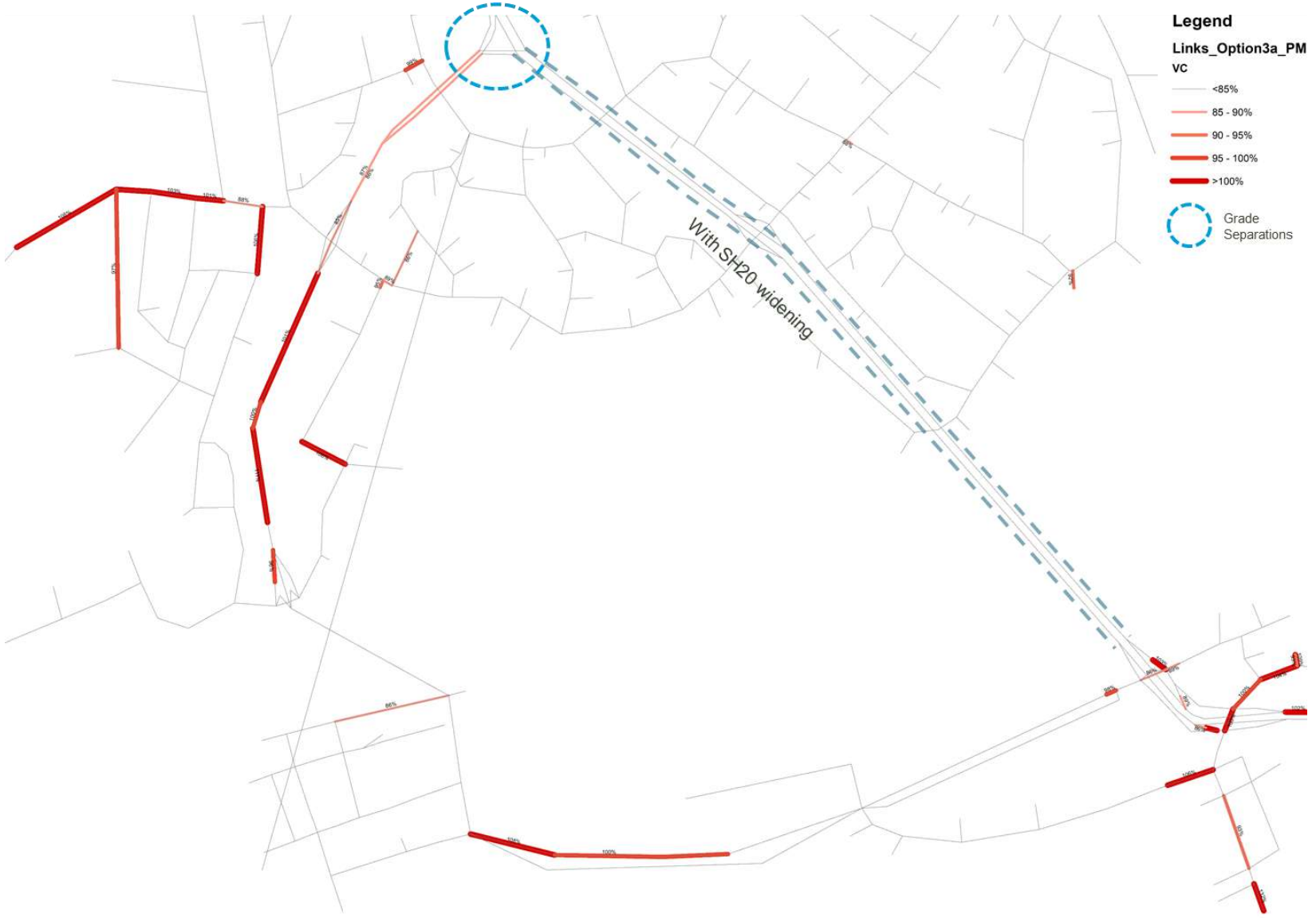


Figure 13: Degree of saturation - Option 3A (PM peak)

In terms of the performance of grade-separations and at-grade intersections, all the short list options achieved similar overall network performance. This is due to the interventions targeting different parts of the network. While Options 1A removes the most conflicts through inclusion of two grade separations (at Campana Road and SH20B / SH20 interchange), it does not include SH20 widening, resulting in V/C ratios remaining high along SH20.

In Option 2A, additional road capacity is provided along SH20B between the airport and the SH20 interchange. The SH20A southbound ramp and SH20 widening are also included in Option 2A, which provide additional routing alternatives to the southbound traffic.

In Option 3A, where general traffic capacity through Pukaki Creek bridge is constrained to the existing two lanes, V/C ratios on links west of the bridge increase, with queues building up towards the Airport terminal building and could possibly disrupt normal Airport operations. Based on the above, Option 2A was rated marginally better than the other two options considered against this KPI measure.

KPI evaluation: assessment of travel time reliability for key journeys

To assess the transport network's reliability, variability of travel times on key routes within the study area was assessed as summarised in Figure 14 below. The key routes included in the assessment included SH20, SH20A, SH20B and Massey Road.

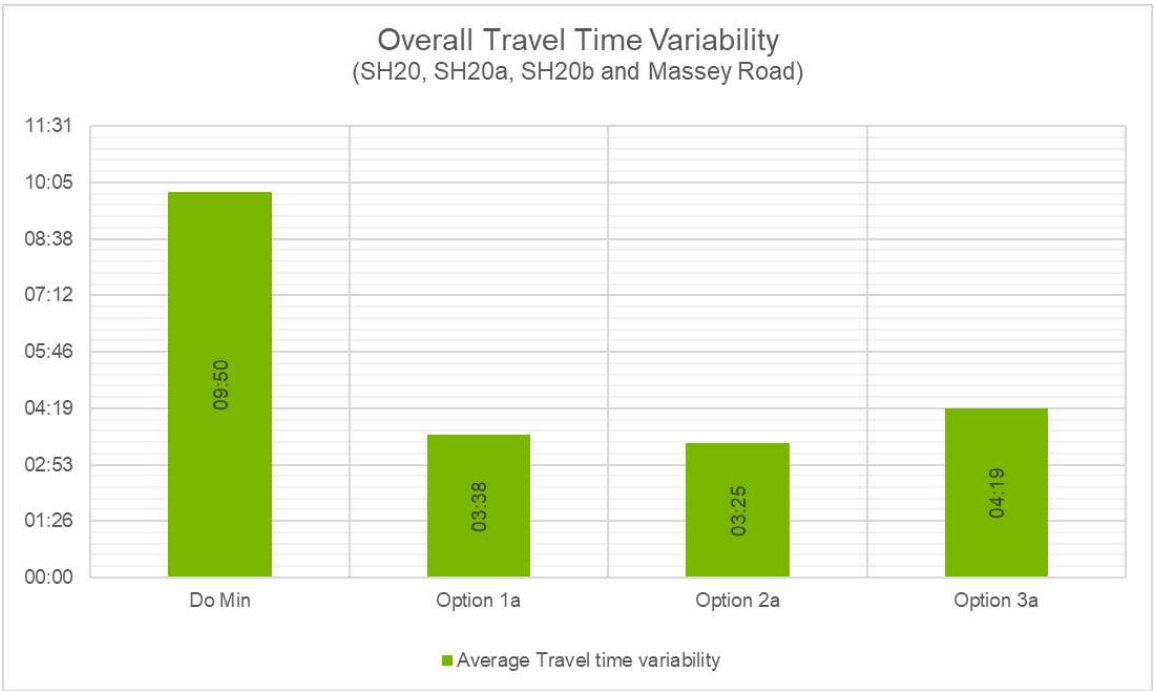


Figure 14: Average travel time variability of key routes for each option (SATURN)

From travel time reliability perspectives, Options 1A and 2A had lower variability in travel times between the peak periods. All options improved on the Do Minimum network travel time variability. The scoring against the above KPI measures are shown in Table 7 below.

Table 7: Scoring overview of KPI

		Option 1A	Option 2A	Option 3A
KPI	KPI measures			
Travel time reliability, including separation of road space and vehicle interactions	Number and performance of grade separations and at-grade junctions and intersections	2	3	2
	Assessment of travel time reliability for key journeys	3	3	2

4.3 KPI: Ability for high priority trips to have reliable journeys

4.3.1 KPI description

Table 8: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Economic, social and cultural	Inadequate transport system capacity, connections, and management to/from/within the Airport Precinct area risks economic growth and prosperity	More reliable and resilient transport system	Reliable and resilient transport system in south and east Auckland that is easy to use	Ability for high priority trips to have reliable journeys	Length of separated rights of way for freight, public transport, high-occupancy vehicles (HOVs) and special uses Volume / capacity of key routes and special purpose lanes

KPI description: separated right of way for special uses

All the shortlist options have special purpose lanes, in the form of bus lanes. Depending on operational priorities of the immediate road network, both general and bus lanes can be repurposed to prioritise specific user classes during certain times in a day, in accordance with provisions of the transport system's Network Operating Plan. To evaluate the transport system against this KPI, the opportunities of repurposing some of the vehicle lanes to special purpose lanes were evaluated qualitatively. This evaluation included considerations for the following:

- Route options for routing and prioritisation of public transport and freight traffic
- Number of continuous lanes available between the airport and strategic highways
- Potential for degree of saturation improvements due to special purpose lane user class reprioritisation.
- Potential travel time savings on special purpose vehicle lanes.

KPI description: volume / capacity ratios for key routes and special purpose lanes

The opportunities to route certain user groups through multiple routes will improve network resilience and will allow prioritisation of user groups by time of the day or to respond to some events. The number of alternative routes, that may be available for special purpose user groups were evaluated to assess this KPI measure.

4.3.2 KPI evaluation

KPI evaluation: separated right of way for special uses

Option 1A focuses investment on SH20B with limited opportunities to re-route or prioritise freight away from the airport terminal precinct and local roads. Option 2A has both SH20A improvements, with the provision of the SH20A to SH20 ramp connection, and SH20B improvements, with the SH20B improvements reaching the airport precinct. Option 3A has opportunities to re-route and prioritise public transport and freight along both SH20A and SH20B. However, with no Pukaki Creek crossing capacity upgrades, the benefit along SH20B does not accrue up to the airport terminals in Option 3A, affecting network resilience and thus reliability of journeys. Option 2A therefore performed better against this KPI.

KPI evaluation: volume / capacity ratios for key routes and special purpose lanes

Similar to the KPI measure assessment above, Option 2A is expected to have greater opportunities for prioritising special purpose transport user groups using multiple route alternatives. Option 1A does not have as many alternative routes as it does not include the proposed SH20A / SH20 southbound ramp. Option 3A has limited options for the airport traffic as capacity is limited at Pukaki Creek Bridge.

Table 9: Scoring overview of KPI

		Option 1A	Option 2A	Option 3A
KPI	KPI measures			
Ability for high priority trips to have reliable journeys	Length of separated rights of way for freight, public transport, high-occupancy vehicles (HOVs) and special uses	2	3	1
	Volume / capacity of key routes and special purpose lanes	2	3	1

4.4 KPI: Travel time for key journeys to the airport by public transport

4.4.1 KPI description

Table 10: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Economic, social and cultural	Inadequate transport system capacity, connections, and management to/from/within the Airport Precinct area risks economic growth and prosperity	More reliable and resilient transport system	Reliable and resilient transport system in south and east Auckland that is easy to use	Travel time for key journeys by PT	Overall network travel times (vehicle-hours)
					Vehicle travel time for key journeys

KPI description: overall network travel times

Overall network travel times (vehicle hours travelled or VKTs) provide a mean to compare options on their effectiveness to reduces travel time on the modelled network. Options that result in the most reduction in travel time, as compared to the Do Minimum (Base Case), will have fewer vehicle delays and have better operational performance overall.

KPI description: vehicle travel time for key journeys

SH20A and SH20B provide primary access to the airport precinct, including the surrounding industrial zones. Regional travel is facilitated through SH20. Travel time impact of the shortlist options from city centre, West Auckland, North Island, Auckland South and the Botany area can be assessed through measurement of travel times along the three state highway corridors above. To assess this KPI, travel time through these key corridors were used as a proxy of travel times for key journeys to the airport and its environs.

4.4.2 KPI evaluation

KPI evaluation: overall network travel times

A summary of the overall network travel times is provided in Figure 15.

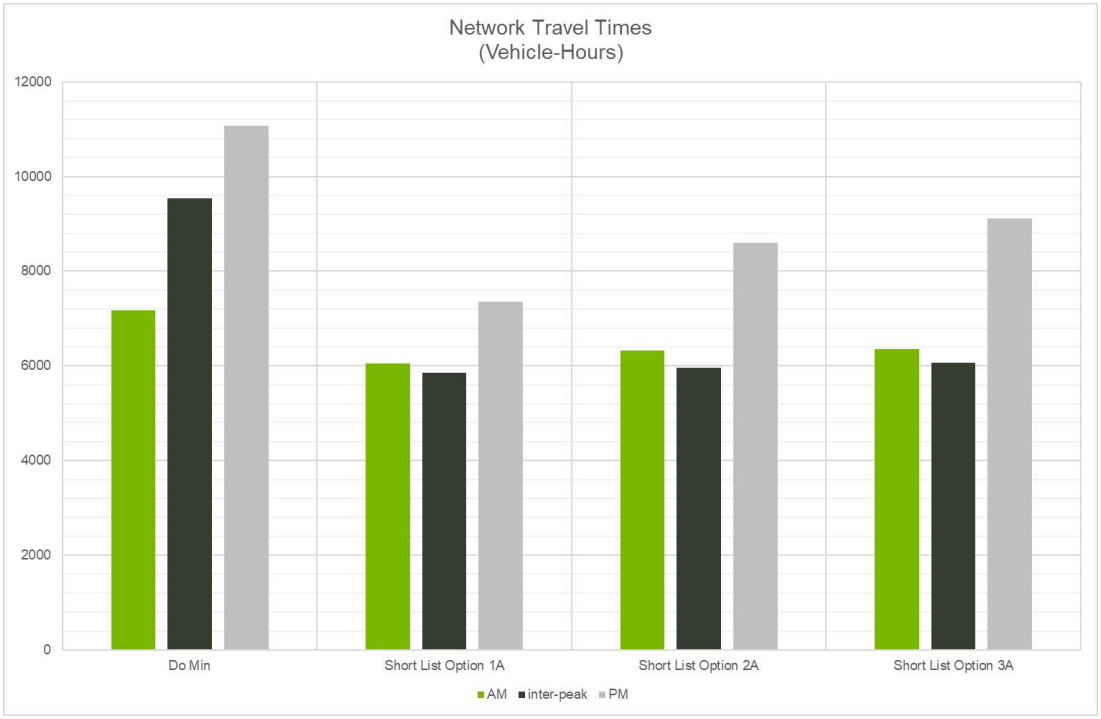


Figure 15: Overall network travel times (vehicle-hours)

The analysis illustrates the PM peak has the highest travel times than the AM peak and inter-peak. The PM peak has the most travel time savings for the options as compared to the Do Minimum (Base Case) scenario. The three shortlist options have similar travel times during the AM peak and inter-peak. However, Options 1a network is significantly faster (i.e. lowest travel times) than the other options during the PM peak, which is regarded a more critical peak for this KPI. Option 2A has the second lowest overall network travel times and Option 3A has the highest travel times.

KPI evaluation: travel time on key corridors

The travel times through SH20, SH20A, SH20B and Massey Road represent key journeys to and from the airport and their travel times are summarised in Figure 16, Figure 17 and Figure 18 below, for the AM, inter-peak and PM peak hours respectively as determined from the SATURN model outputs.

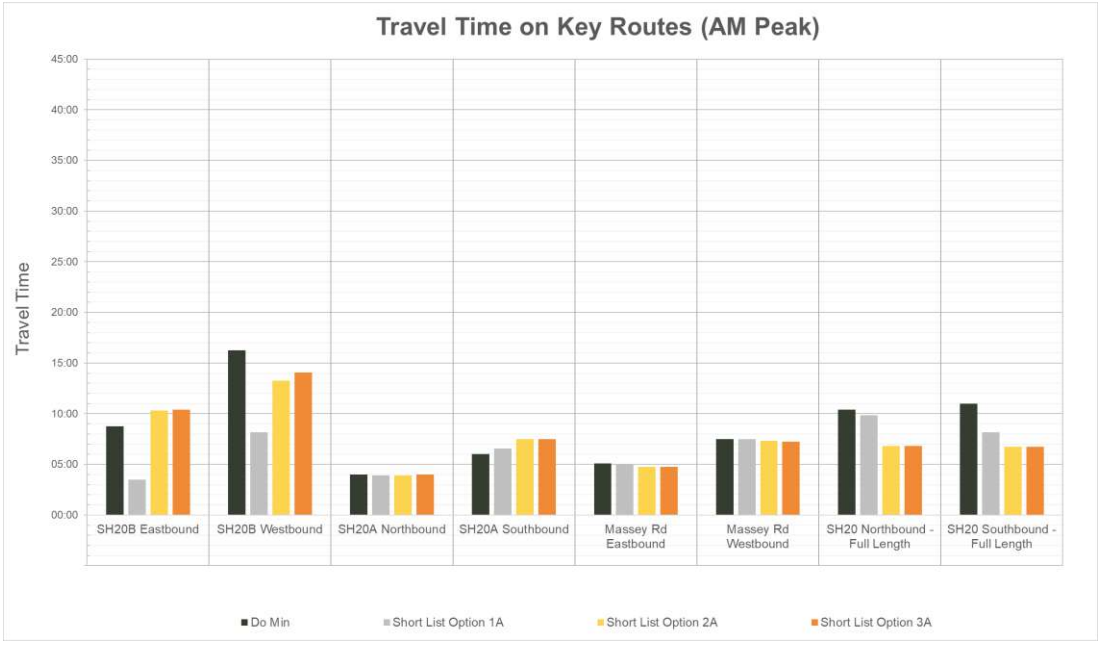


Figure 16: Travel times on key routes (AM Peak)

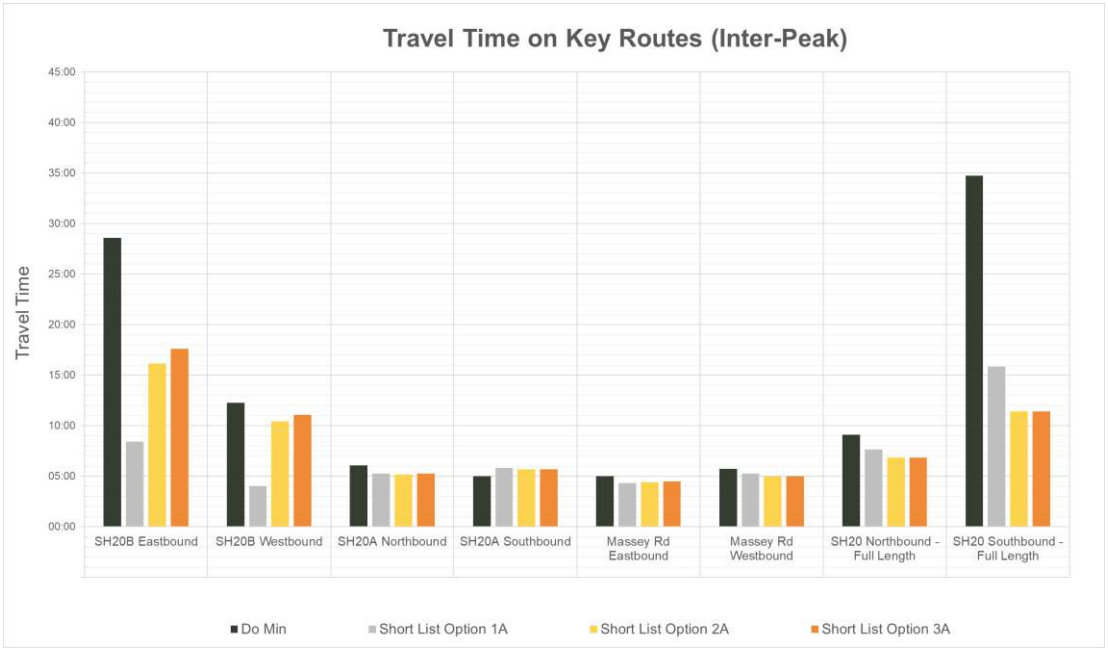


Figure 17: Travel times on key routes (inter-peak)

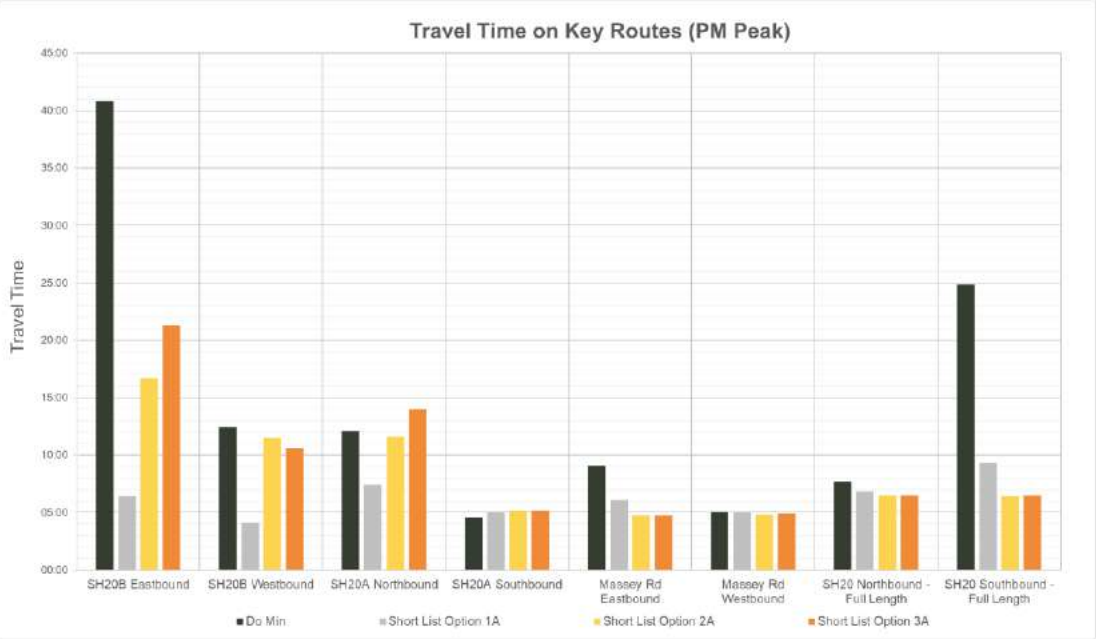


Figure 18: Travel times on key routes (PM Peak)

The analysis illustrates the impact that each option has on travel times on the individual corridors. Option 1A achieves more travel time savings along SH20B during all the peak hours, while having the lowest travel time savings along SH20. Options 2A and 3A have the highest travel time savings along SH20 and less so on SH20B. Options 2A and 3A have faster travel times along Massey Road eastbound direction. On aggregate, Option 1A achieves the most travel time savings than the other options, especially during the PM peak. Option 3A achieves similar travel time savings as Option 2A for most of the corridors, except for SH20B (east and westbound) and SH20A (northbound). This results in Option 3A having the lowest overall travel time savings than the other options.

Table 11: Scoring overview of KPI

		Option 1A	Option 2A	Option 3A
KPI	KPI measures			
Travel time for key journeys by PT	Overall network travel times (vehicle-hours)	3	2	1
	Vehicle travel times for key journeys (SH20, SH20A, SH20B and Massey Road travel times)	3	1	1

4.5 KPI: Population and job accessibility

4.5.1 KPI description

Table 12: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Transport Planning	Lack of reliable and readily accessible travel choices limits access to the airport, and surrounding area, for both customers and the reliable movement of people and goods	A more prosperous Airport Precinct area, Auckland and New Zealand.	To improve economic performance of the airport area, Auckland and New Zealand	Population with Access to Airport	Population within 30-minute from Auckland Airport (peak hours, 2048)
				Job Accessibility	Jobs within 30-minute from Auckland Airport (peak hours, 2048)

KPI description: population catchment from Auckland Airport

Auckland Airport precinct, including surrounding industrial zones and logistics hub, is a major employment centre in the area. Improving access options to the precinct is expected to result in more people able to access the existing and future employment opportunities in the precinct. As discussed earlier, an accessibility assessment was carried out to understand how each option impact the population catchment within 30 minutes driving time from the airport.

KPI description: Employment opportunities accessibility

The Airport Oaks industrial zone, which is part of the Airport Precinct, is adjacent to the Mangere residential area and a short crow-fly distance to the Mangere Town Centre. The residents in the Mangere area will benefit from transport interventions that increase the number of employment opportunities that can be accessed from the area within 30 minutes driving time. Transport interventions that improve the accessibility employment existing and future employment opportunities will have many social and economic benefits for the area.

4.5.2 KPI evaluation

KPI evaluation: population and employment accessibility from the airport precinct

Travel time outputs from both the MSM and SATURN model were used to assess the accessibility of each option as discussed earlier in Section 3.3. This analysis resulted in the estimate of the catchment area within 30 minutes driving time from the airport in the PM peak. Estimates of the population and employment opportunities that are accessible within this catchment were then determined for each option. The catchment areas for each option, during PM peak hours, are summarised in Figure 19. Comparing the size of the catchments provides insight into which areas will fall within half-hour driving catchment of the airport and its immediate surroundings in 2048. The estimated population and employment opportunities that may be accessible within the catchments are graphically represented in Figure 20 and Figure 21.

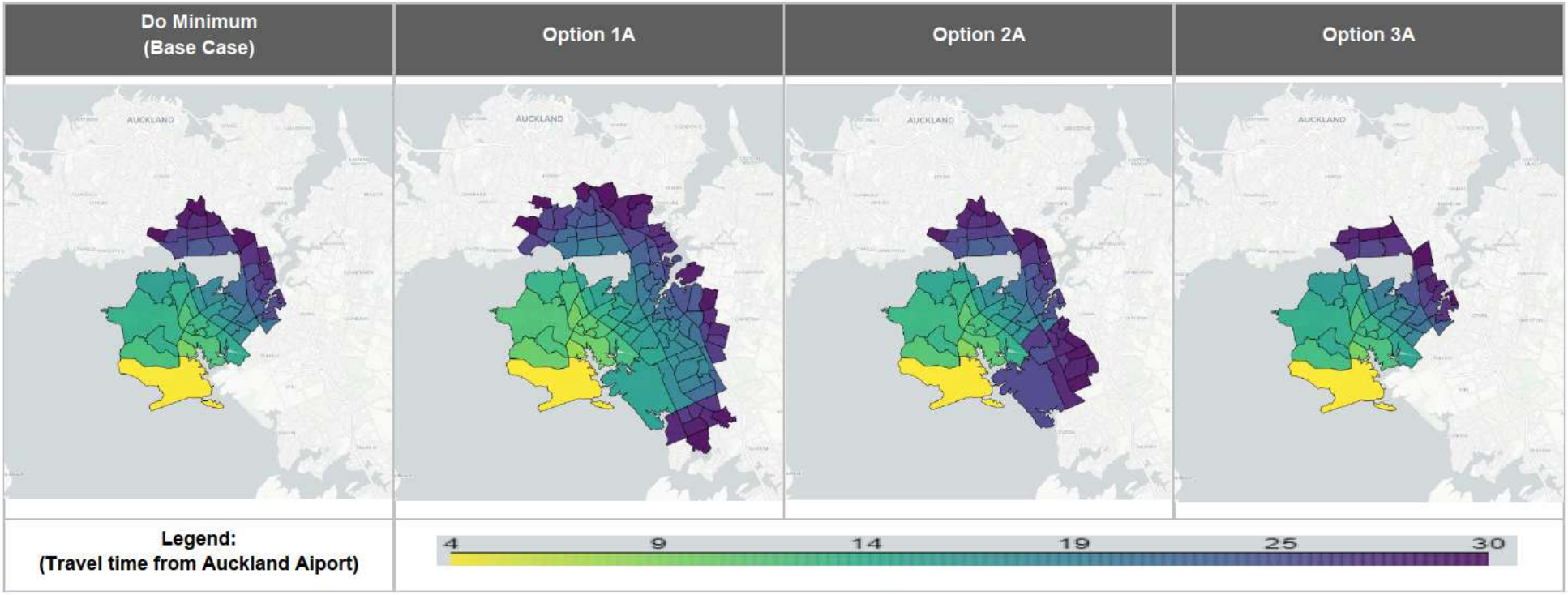


Figure 19: 30-minute driving catchments for each scenario (scenario Do Min, Option 1A, 2A and 3A) (PM peak)

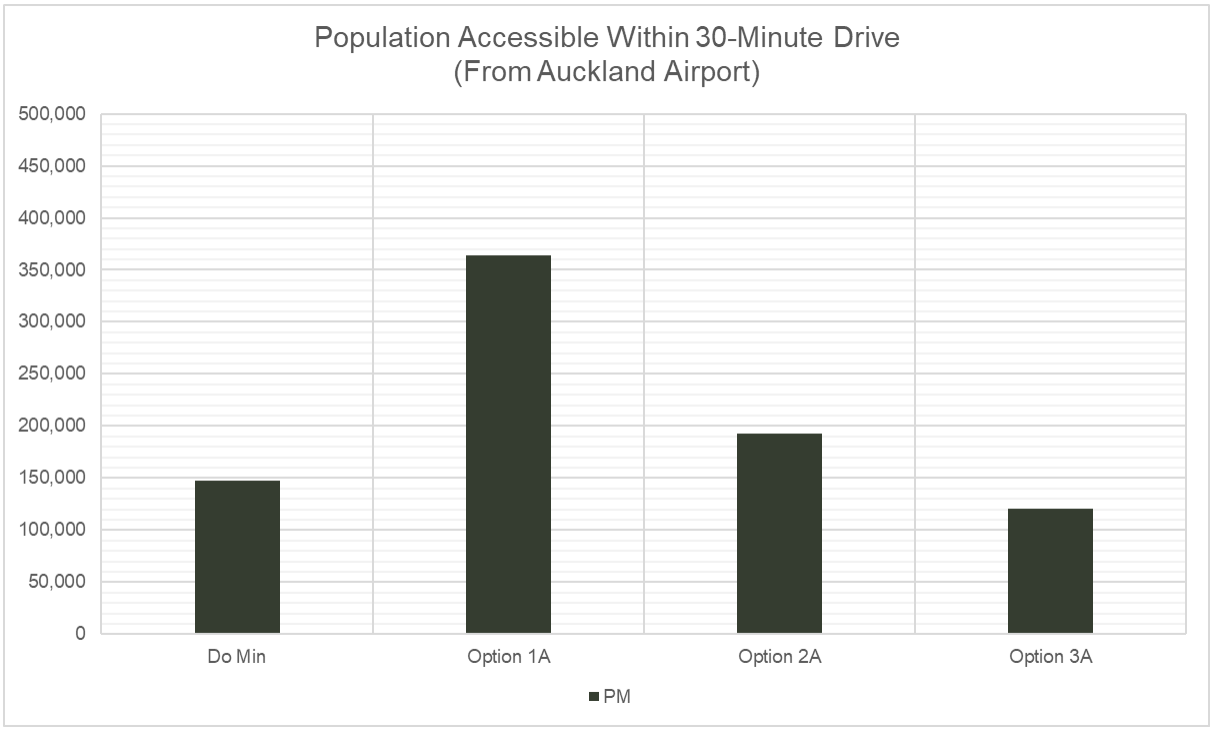


Figure 20: Population within 30-minute catchment of the Airport for each scenario (PM peak)

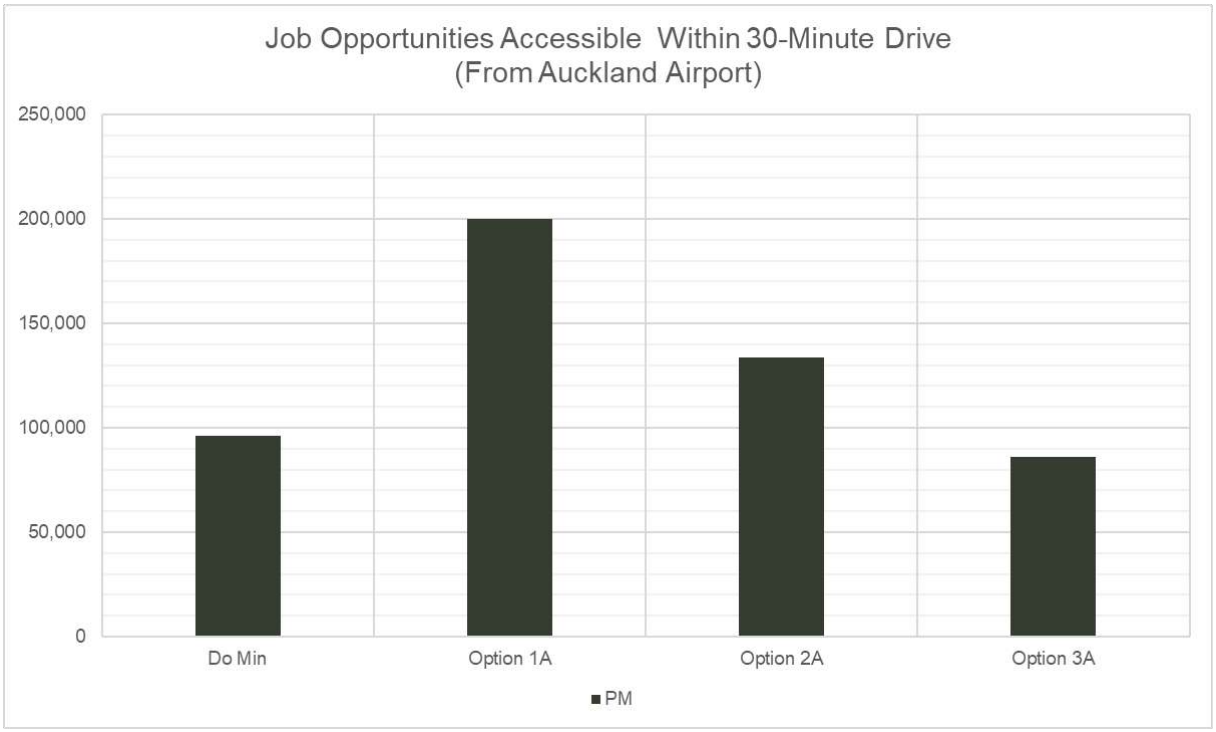


Figure 21: Job opportunities within 30-minute catchment of the Airport for each scenario (PM peak)

The catchment analysis illustrates that the airport will be more accessible under Option 1A, where the most people will be able to access opportunities in the Airport precinct compared to Options 2A and 3A investment scenarios. Under Option 3A, there could be about 50 percent less people able to drive to their destination within 30 minutes from the airport during the PM peak. Travel times along SH20B between the airport and SH20 interchange, by car, are expected to take longer than 30 minutes under Option 3A and could impact normal airport operations.

Table 13: Scoring overview of KPIs

		Option 1A	Option 2A	Option 3A
KPI	KPI measures			
Population access to Airport	Population within 30-minute trip during peak hours 2048	3	2	-1
Job accessibility	Jobs within 30-minute trip during peak hours 2048.	3	2	-1

4.6 KPI: Air quality/emissions from the transport system

4.6.1 KPI description

Table 14: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measure
Environmental Cultural Social	Current transport system has adverse environmental effects and does not recognise cultural identity and taonga	Local environment is protected and enhanced	Minimal impact of the transport system on the environment and taonga	Air quality/ emissions from the transport system	Vehicle emissions in and around Auckland Airport, Manukau and Mangere

Vehicle emissions contribute to deterioration of noise, air quality, greenhouse emissions in the local environment. Congested network is associated with longer idle time where emissions are released for a lot longer time than is necessary to complete a trip. In order to assess the impact of the proposed 20Connect short list options on vehicle emissions and air quality, the options were compared against the Do Minimum (Base Case). SATURN model outputs were used to assess this KPI as discussed below.

4.6.2 KPI evaluation

The SATURN model outputs provide insights regarding overall network vehicle emission cost in each option such as total vehicle hours travelled (VKT) and average network speeds. These factors can be used to estimate vehicles emission cost in dollar terms, using factors of vehicle user cost as proxy for environmental cost of the transport system. For the purposes of this options assessment, model-derived vehicle emission costs have only been used to compare each option to the Base Case (i.e. Do Minimum). Calibration of emission cost factors was not included in scope for transport modelling, however given the emissions parameters are consistent across the options, a comparative assessment of the options (using model outputs) was considered appropriate for evaluating this KPI. The comparison of overall vehicle emission cost of each option is shown in Figure 22. The emission cost of the options should be compared against the Do Minimum to assess the potential impact of the options against this KPI.

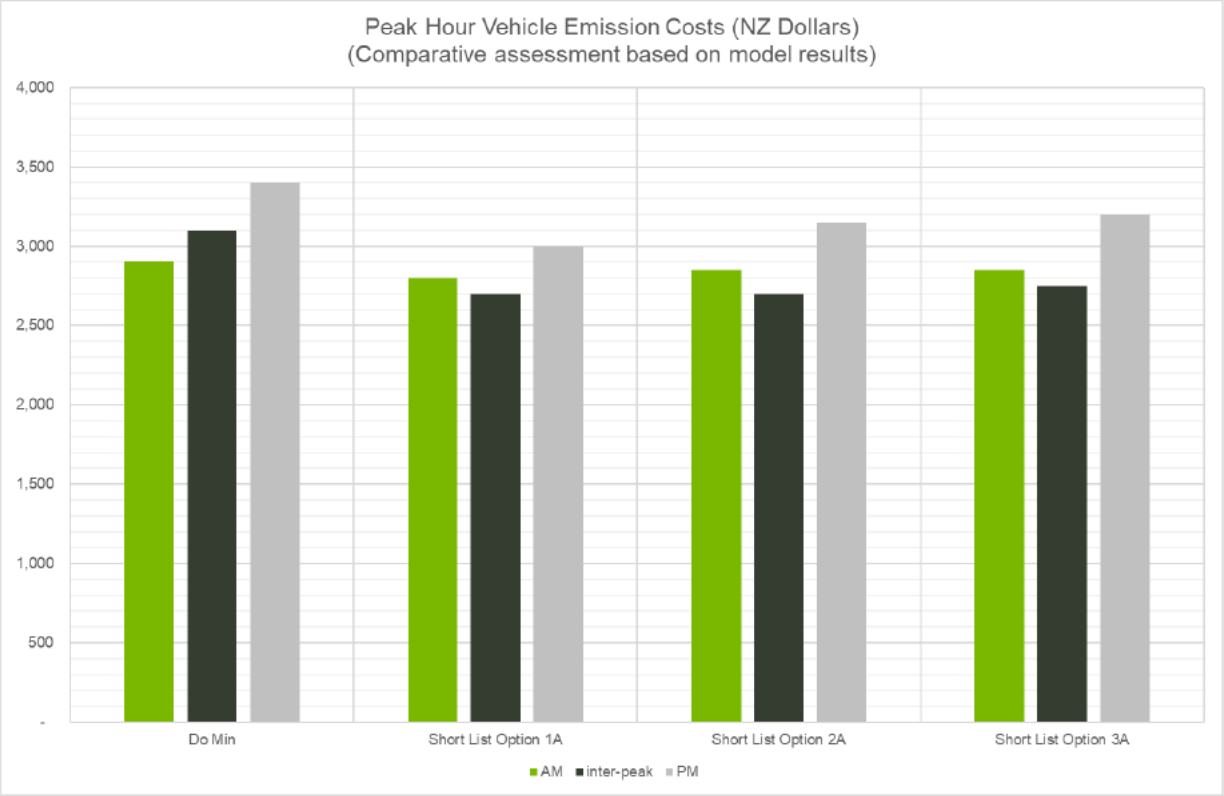


Figure 22: Overall network vehicle emission (SATURN)

The analysis indicates that the shortlist options can achieve between two and three percent peak hour vehicle emission cost savings during the AM peak, compared to the Base Case. During the inter-peak, the shortlist options could have between 11 and 13 percent peak hour vehicle emission cost savings. Option 1A could achieve the highest emission cost reduction during the PM peak, at 12 percent and Options 2A and 3A could achieve seven and six percent emission cost savings respectively.

Considering all the peak hours, Option 1A performs better against this KPI, followed by Option 2A and Option 3A. Option 1A could achieve the least aggregate peak hour vehicle emission cost savings, as compared to the Do Min (Base Case).

Table 15: Scoring overview of KPI

		Option 1A	Option 2A	Option 3A
KPI	KPI measure			
Air quality/emissions from the transport system	Vehicle emissions in and around Auckland Airport, Manukau and Mangere	3	2	1

4.7 KPI: Amenity function of activity areas and safe walking/cycling conditions

4.7.1 KPI description

Table 16: KPI framework

Discipline	Problem	Benefit	Investment Objectives	KPI	KPI measures
Environmental Cultural Social	Perceptions of poor personal safety limit uptake of public transport & active modes	Healthier and safer people	Safe and secure transport facilities in South and East Auckland	Amenity function of activity areas and town centres Safe wa king and cycling conditions	Reduction in through traffic and freight thus reducing conflicts on local roads Volume and speed appropriateness along walking and cycling corridors.

KPI description: reduction in through traffic and freight thus reducing conflicts on local roads

Local roads, and town centre arterials serve a variety of function and facilitate interactions between people on foot, public transport and in vehicles. Local roads and arterials are also characterised by on-street parking for residents and businesses. There is a natural desire for through traffic to want to traverse an area as quickly as possible given long journeys such trips take. When long distance and freight traffic is routed through local roads and areas with high place function, active mode / vehicle traffic conflicts are increased. Public transport efficiencies and safety are also impacted by this conflict. This has a negative impact on people's perception of safety in the area.

There is a need to ensure that different types of vehicles use routes that are appropriate for their type (e.g. long-distance freight on state-highways and regional arterials). There are currently limited opportunities for southbound traffic in the Airport Oaks area, as such long-distance traffic, including heavy commercial vehicles, tend to use local roads to access the state highway network. Options that provide alternative through traffic to avoid activity centre will support the local amenity function of these areas and the transport network that serves them.

KPI description: Volume and speed appropriateness along walking and cycling corridors.

Where traffic volumes and speeds are high, a greater need arises to protect vulnerable road users to improve both actual and perceived safety of walking and cycling facilities. The level of protection (and separation from vehicular traffic streams) for cyclist and pedestrians needs to be appropriate for the traffic volume and speed environment along the walking and cycling corridors.

4.7.2 KPI evaluation

KPI evaluation: amenity function of activity areas and town centres

To assess the impact of the shortlist options against this KPI, Massey Road is assumed to be a proxy for local arterial roads within the study area. Traffic volumes along a section of Massey Road (between Thomas Road and Mascot Avenue) are therefore evaluated as shown in Figure 23, Figure 24 and Figure 25 for the AM, inter-peak and PM peak hours respectively.

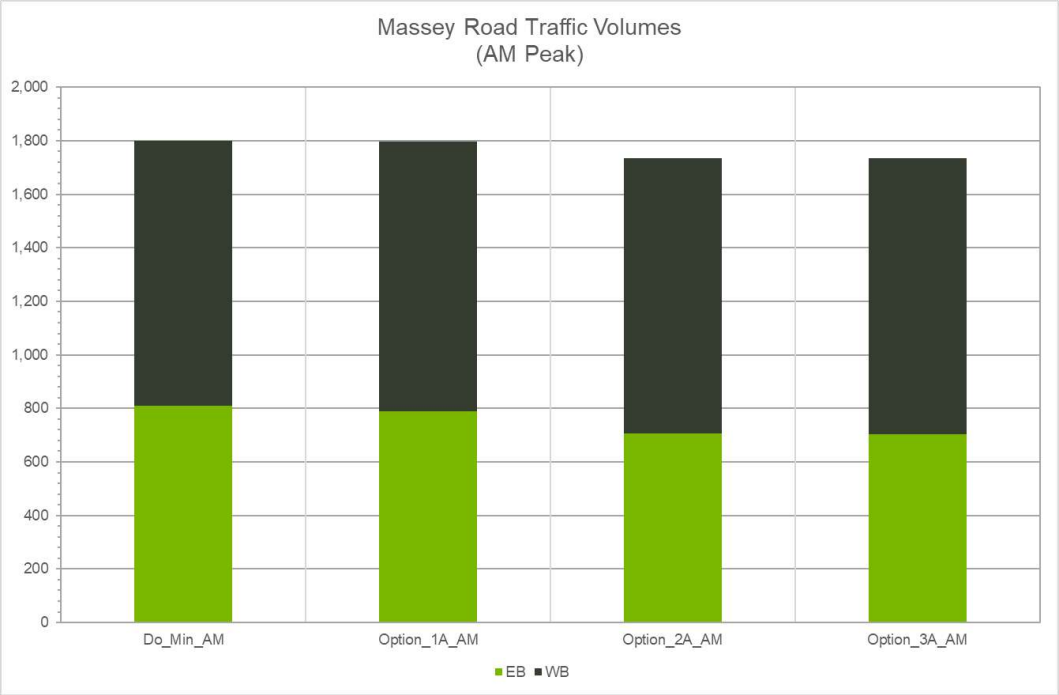


Figure 23: Massey Road traffic volumes (AM peak, 2048)

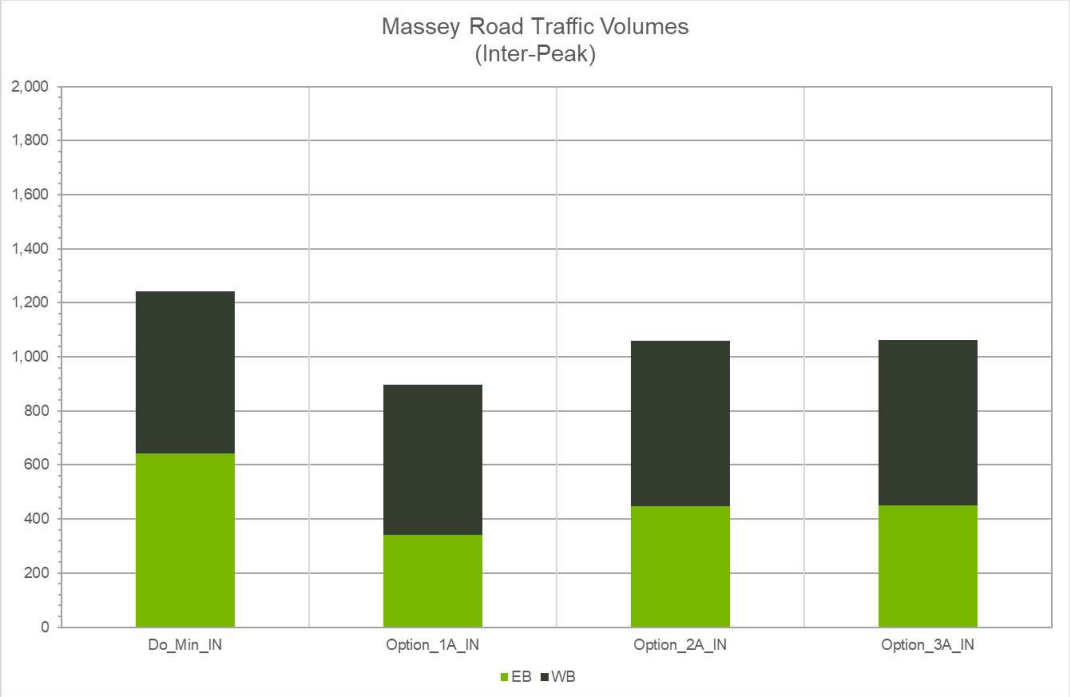


Figure 24: Massey Road traffic volumes (Inter-peak, 2048)

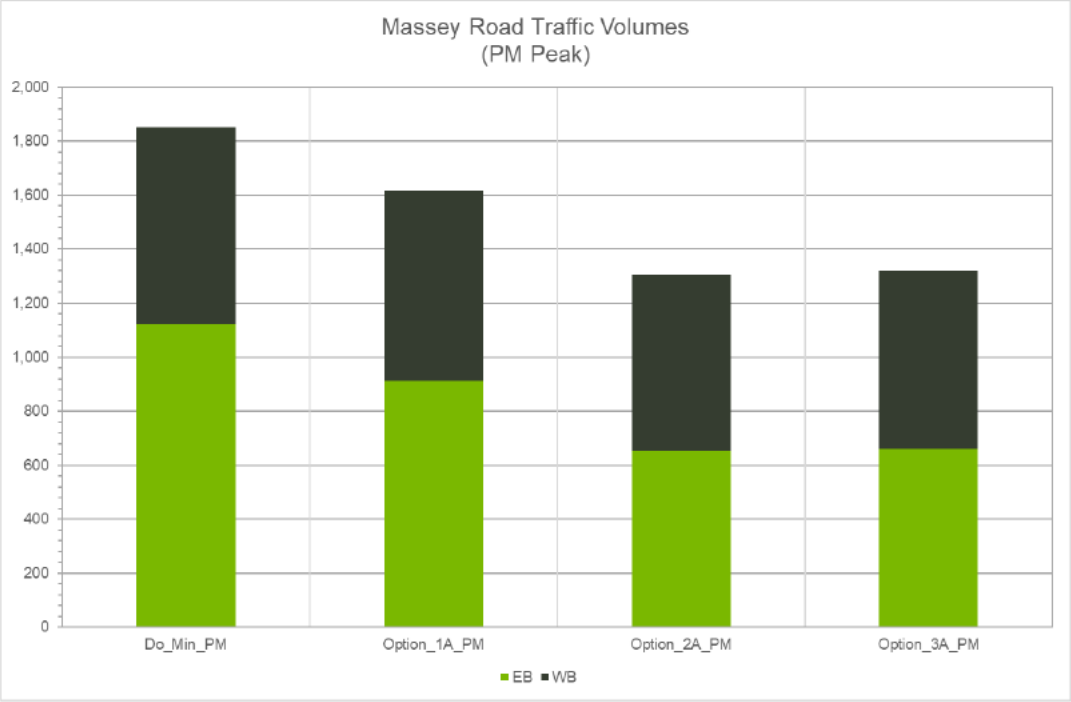


Figure 25: Massey Road traffic volumes (PM peak, 2048)

The analysis indicates that the largest reduction in traffic volumes on Massey Road will be realised during the PM peak, where Option 1A is expected to result in a 13 percent reduction in traffic volume, while Options 2A and 3A could reduce traffic by up to 30 percent .

KPI evaluation: walking and cycling safety

The impact of the shortlisted options against this KPI was assessed qualitatively. The following factors were considered in the assessment:

- Level of walking and cycling network separation from vehicular traffic
- Traffic speeds along the corridor
- Walking and cycling crossing facilities

All the options consist of a segregated shared use path for cyclists and pedestrians, which will be an improvement on the Do Minimum (Base Case) scenario. To a smaller degree, Option 1A may be perceived to be less safe than the other options as the option includes freeway standard highway along SH20B, possibly with higher traffic speeds, wider roadway and limited active modes' crossing opportunities.

Table 17: Scoring overview of KPI

		Option 1A	Option 2A	Option 3A
KPI	KPI measures			
Amenity function of activity areas and town centres	Reduction in through traffic and freight thus reducing conflicts on local roads	1	3	2
Improve walking and cycling safety	Volume and speed appropriateness along walking and cycling corridors.	1	2	2

5 Transport KPI assessment summary

A summary of the KPI assessment, as detailed above, is provided in bullet points below:

- Options 1B, 2B and 3B removed from further consideration in the selection of the preferred option as MRT alignment with SH20B was shown to be preferable to MRT alignment via SH20 and SH20A.
- Options 1A and 2A achieve similar benefits across the MCA, and both perform better than Option 3A overall.
- Option 1A has the most travel time savings, resulting in wider population catchment and higher vehicle emission cost savings.
- The travel time savings for Option 1A can mostly be attributed to the south-facing ramps at SH20B / SH20 interchange, and to a lesser extent the Campana Road grade-separation
- Option 2A has the least number of links operating over capacity, owing to SH20 widening, in addition to the SH20A / SH20 southbound ramp
- Option 2A achieves higher reductions in traffic using local roads such as Massey Road.

6 Short list to preferred option

Following the MCA analysis short list workshop and risk assessment, Option 2A was identified as the emerging preferred option.

The strength of Option 1A results from the south facing SH20B/SH20 ramp, which allows the interchange to operate in a manner that reduces traffic conflicts and can better accommodate public transport. It also has the most travel time savings, resulting in a wider population catchment and higher vehicle emission cost savings. However, this can mostly be attributed to the south facing ramps at the SH20B/SH20 interchange, and to a lesser extent the Campana Road grade-separation. Overall, Option 1A did not perform as well as Option 2A for the key criteria on ‘complementing PT and road investments’ and ‘reducing through traffic and freight, thus reducing conflicts on local roads’.

Option 1A was also expected to result in larger delays and additional land take due to the proposed SH20B/Campana Road grade separated interchange, resulting in higher costs.

While it performed well in terms of construction cost and risk, Option 3A was discarded as it was out-performed by Options 1A and 2A for the majority of KPIs. The exclusion of 4 lane widening over the Pukaki Creek crossing results in higher delays and resilience deficiencies due to the reduced general traffic capacity across the Pukaki Creek crossing and at-grade SH20B/Campana Road intersection. These delays will reduce the accessibility of the Airport for those travelling from the east and south.

7 Option refinement

Upon further testing of Option 2A, a number of inefficiencies were discovered relating to travel times along SH20B, which were underperforming compared to Option 1A. These inefficiencies related specifically to the operational requirements of the SH20/SH20B interchange and the need to provide for MRT and general traffic through this busy interchange.

To address these inefficiencies, the southbound SH20B to SH20 interchange ramp treatment from Option 1A was added to Option 2A, allowing the interchange to operate in a manner that could better accommodate public transport, by removing a major demand and conflict element from the interchange. In doing so, this refinement achieved the highest travel time savings of all the options. Option 2A was therefore repackaged to include this additional treatment, creating a refined preferred option - Option 2V.

Initial model test results demonstrate that Option 2V achieves:

- Greater travel time savings than Option 2A
- More reliable travel times by all modes
- Higher population catchments
- More resilient transport system as multiple route opportunities for PT, freight and airport traffic will be provided.

Approvals:

	Name	Title	Signature	Date
Authored by:	[redacted]	Traffic Engineer	[redacted]	2020-12-21
Reviewed by:	[redacted]	Associate, Transport Planner		2020-12-21

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094-4401-TEC-NN-0022**
Date	**2020-12-14**	Pages (including this page)	**267**
Subject	**20Connect and A2B – Environment Multi Criteria Analysis Scoring of Short List Options (Updated)**		

A preliminary assessment of the potential effects on the environment was carried out for the 20Connect Multi Criteria Analysis (MCA) of the short list options, the purpose of which is to inform the Single Stage Business Case (SSBC) for 20Connect and Airport to Botany to assist in the selection of a preferred option for further consideration and analysis.

This cover note provides a summary of the method and assumptions used, a summary of the scores, and a summary of the main points raised by the environmental specialists.

Attachments to this cover note include:

- Attachment A: Environmental Context Map
- Attachment B: Technical notes issued by environmental specialists
- Attachment C: Short List Options

In addition, commentary is provided below at section in support of the Consentability Key Performance Indicator (KPI).

1 Methodology and assumptions

Specialist assessments were undertaken in the topic areas including ecology (marine, terrestrial and freshwater), coastal processes, landscape, visual and urban design, heritage and archaeology, cultural values, land contamination, noise and vibration, stormwater, social, air quality and geology.

The assessments are based on the descriptions and schematics of the short list options provided as well as the general arrangement plans of each option. Overall, six options were assessed.

Each of the specialists assigned each option a score rating between -3 (significant adverse effect) to 3 (significant positive effect) (**Table 1**). The focus was on the assessment of the option, as opposed to the focus on the score itself. Weighting has not been applied to the scores.

Table 1 Scoring scale

Scoring scale
3 (Significant positive)
2 (Moderate positive)
1 (Minor positive)
0 (Neutral)
-1 (Minor/moderate adverse)
-2 (Significant adverse)
-3 (Significant Adverse/Un-mitigatable)

2 Description of the short list options

There are six short list options for 20Connect which focussed on variations of investment along the SH20 and SH20B corridors (See **Attachment C**). The options are summarised in **Table 2** below.

Due to the shared geographical location and aspirations of two separate projects being undertaken concurrently by the New Zealand Transport Agency (NZ Transport Agency) and Auckland Transport (AT) it was decided that the projects (and their cumulative effects) needed to be assessed holistically rather than in isolation from one another. As such, the extent of the Rapid Transit Corridor (RTC) of AT's Airport to Botany project (A2B) west of the Puhinui Interchange were considered as part of the 20Connect short list assessment.

Table 2 20connect short list options summary

Option	High-level description
Option 1A	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1B	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2A	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2B	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3A	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3B	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The following assumptions apply to all short list options:

- The approximate design footprint extent is north of Kirkbride Road on SH20A and east of the western abutment of Pukaki Bridge. Note, the long list phase extent was from the west of Orrs Road on SH20B and therefore the specialists were asked to assess the effects of the new extended area separately in conjunction with the overall option (see schematics for extent of assessment).
- Auckland International Airport Limited (AIAL) will develop their own network response (road and public transport), outside of the assumed design footprint and within the Auckland Airport precinct. As such, this does not form part of the 20Connect SSBC scope.
- A Detailed Business Case for the Airport to Botany (A2B) Project is being progressed separately for the extent of the RTC from the Puhinui interchange to Botany Town Centre. The portion of the RTC

west of the Puhinui Interchange has been assessed within the scope of the 20Connect SSBC. The technical specialists were asked to assess this component separately as well as in conjunction with the overall option.

- A separate scope is being investigated for the surrounding Light Rail Transit (LRT) for connection between Mangere and the City Centre (SH20 north of SH20A interchange) and Mangere and the Airport (along SH20A). The indicative alignments of these are shown on the schematics for context only. This is not to be assessed as part of the 20Connect SSBC short list assessment.
- The options that show the RTC alignment on SH20 also show the RTC connecting into Mangere Town Centre (as a connection point with assumed LRT). The portion of RTC from Bader Drive to Mangere Town Centre is a new addition at short list phase. The technical specialists were asked to assess this component separately as well as in conjunction with the overall option.
- All short-list options allow for a walking and cycling / shared use path (SUP) component (see schematics for proposed routes). These facilities were included within the scope of specialist assessment for the short list options.
- All existing and proposed interchange on/off-ramps would be realigned to connect to new lane arrangement. Notes and assumptions regarding interchange arrangement/alignment and proposed design were included on the schematics provided.
- Assessments considered the proposed height (of proposed grade separations and ramp connections), width (of various components) and bulk (such as bridge replacements) of the components as shown on the schematic notations.
- Base case for the 20Connect options is the existing environment as it stands today with the exception of SH20B which assumes that the NZTA short term improvements project has been implemented (detail of which was included on the schematics).

3 Summary of the MCA scores for the environmental workstream

The short list options received scores ranging from between -3 (Significant Adverse) and 3 (Significant Positive) (**Table 3**). While for the majority of the assessment topics there was very little variation among the options, there were a few key areas where differentiation was identified, these included: landscape and urban design (landscape and visual), cultural values, accessibility (social impact), geology, operational noise and vibration, and contaminated land. These assessments are high level and the preferred option will require further investigation with the preparation of Preliminary Environmental Assessment (PEA) reports. It is acknowledged that a number of potential adverse effects associated with the options can be managed through design iterations and the construction methodology, which will be considered in the PEA.

Table 3 Summary of environmental workstream MCA scores for short list options

Discipline	Sub-topic	Criteria	Option 1A	Option 1B	Option 2A	Option 2B	Option 3A	Option 3B
Ecology	Aquatic ecology	Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1	-1	-1	-1	-1	-1
	Terrestrial ecology	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1	-1	-1	-1	-1	-1
	Marine ecology	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1	-1	-1	-1	-1	-1
Coastal Processes	Construction effects on CMA	Extent of temporary effects on coastal physical processes.	-2	-2	-2	-2	-2	-2
	Geomorphology/sedimentation & tidal flows	Extent of permanent effects on coastal physical processes, including effects of geomorphology, exacerbating sedimentation and changes in tidal and storm-tide flows in the upper creeks.	-1	-1	-1	-1	-1	-1
	Sea-level rise and coastal climate change	Extent of increasing impacts on coastal physical processes from sea-level rise and climate change, including vulnerability of the works (present and proposed) and opportunities to improve resilience.	-1	-1	-1	-1	-1	-1
Stormwater	Stormwater quality	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.	-1	-1	-1	-1	-1	-1
	Stormwater quantity	Impact of operational stormwater discharges on flooding within the catchment, including vulnerability to impacts of climate change such as increased storm events, and opportunities to increase resilience.	-1	-1	-1	-1	-1	-1
Landscape, visual and urban design	Natural character and landscape	Extent, nature and degree of effects on natural character, features, and landscape.	-2	-2	-2	-2	-2	-2
	Visual	Extent, nature and degree of effects on visual amenity.	-1	-1	-1	-1	-1	-1

Discipline	Sub-topic	Criteria	Option 1A	Option 1B	Option 2A	Option 2B	Option 3A	Option 3B
	Urban design	Extent, nature and degree of effects on urban design, including open space.	2	2	1	1	1	1
Social/community impact	Accessibility	Extent and degree of effects on the community concerning accessibility to/from facilities, services, properties and businesses.	2	3	2	3	2	3
	Community	Extent and degree of change to groups and activities, including sense of community and to know aspirations and plans.	-2	-2	-2	-2	-2	-2
	Health and safety	Extent and degree of effects on human health and safety.	-1	-1	-1	-1	-1	-1
Geology		Preservation of nationally and regionally significant volcanic features	0	-1	-2	-2	-2	-2
Noise and vibration	Operational noise and vibration	Impact of operational noise and vibration on sensitive receivers. Ability to mitigate adverse impact.	0	-1	-1	-1	-1	-1
	Construction noise and vibration	Impact of operational noise and vibration on sensitive receivers. Ability to mitigate adverse impact.	-1	-1	-1	-1	-1	-1
Archaeology and built heritage		Extent of effects on sites and places of archaeological value and on heritage buildings and places.	-2	-2	-2	-2	-2	-2
Cultural Values		Extent of effects on Mana Whenua and cultural values	-2	-2	-3	-1	-2	0
Contaminated land	Construction management	Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1	-2	-1	-2	-1	-2
	Construction management	Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1	-1	-1	-1	-1	-1

Discipline	Sub-topic	Criteria	Option 1A	Option 1B	Option 2A	Option 2B	Option 3A	Option 3B
	Passive discharge	Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	-1	-1	0	0	0	0
	Potential for new or cross contamination	Potential for the works to mobilise or place contamination within the project area	-2	-2	-2	-2	-2	-2
	Built Environment Risk	Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1	-1	-1	-1	-1	-1
	H&S of construction workers	Risk to construction workers from soil or groundwater	-2	-2	-1	-1	-1	-1
	Acid sulphate soil	Risk to the environment from the discharge of acid generating soils	-2	-2	-2	-2	-2	-2
Air quality	Operational air quality	Extent and degree of effects on human health arising from operational air pollution.	0	0	0	0	0	0
	Construction air quality	Extent and degree of effects on human health arising from discharges to air from construction activities.	-1	-1	-1	-1	-1	-1

4 Summary of main points raised by each environmental specialist

This section provides an overview of any potential environmental effects of the short list options raised by the relevant specialist that will need to be taken into consideration as the project progresses towards a preferred option.

The full assessments are attached at **Attachment B**.

4.1 Ecology

The assessment of ecology considered three criteria and there was no notable differentiation between the options, with all options under each criterion assessed as having minor/moderate adverse effects. The key points of each of the ecological topic assessments is summarised below.

Freshwater ecology: Each option will likely involve streamworks or works within wetland environments with the need for culvert extensions or bridge widening. Opportunities exist for restoration and/or enhancement of fish passage and riparian planting.

Terrestrial ecology: It is noted that banded rail and other coastal birds are likely to be present within areas of the marine environment particularly at Mangere Bridge. Other areas within the Project extent are also likely to support herpetofauna.

Marine ecology: Each option requires one or more crossings of the coastal marine area (CMA), many of which are identified as Significant Ecological Areas (SEA). The interactions with the CMA mostly consist of upper intertidal habitats with the exception of the Pukaki Creek Bridge which spans the Pukaki Creek inlet (from the Manukau Harbour). The effects of the options on marine ecology are mitigatable.

4.2 Coastal Processes

The assessment of coastal processes considered three criteria. There was no differentiation identified between options, however, the construction effects of each option on the CMA were identified as being significantly adverse while the other criterion were assessed as having minor/moderate adverse effects. The key points associated with each criterion is summarised below.

Construction effects on the CMA: All options require a new crossing of Pukaki Creek. Minimisation (through use of erosion sediment controls) of disturbance in the seabed is required to minimise the generation of turbid sediment plumes and risk to the main tidal channel.

Geomorphology/sedimentation & tidal flows: No substantial effects on geomorphology of the tidal inlets and tidal flows are anticipated over the operational life for any of the potential CMA crossings. The only proviso is that the piers/piles associated with the new Pukaki Creek Bridge match both the diameter and size of those supporting the existing Pukaki Creek Bridge and that they are aligned where possible to minimise general scour in the channel and turbulent wakes.

Sea level rise and coastal climate change: It is considered that sea-level rise and climate change aspects can be managed via the design of the new bridges and culverts.

4.3 Stormwater

The assessment of stormwater considered two criteria – quality and quantity. There was no differentiation identified among the options and each option was assessed as having minor/moderate adverse effects. Key points to note from the assessment are summarised below.

Quality: There is currently little to no stormwater treatment in place. New treatment will need to be added to cater for new and existing impervious areas.

Quantity: Each option requires stormwater management as all lie within a Stormwater Management Area Flow (SMAF) control area. As a consequence of the proposed south facing ramp from SH20A to SH20, options 2A, 2B, 3A and 3B require the relocation of an existing stormwater pond.

4.4 Landscape, visual and urban design

This assessment considered three criteria. Differentiation among the options relates to urban design with the offline SH20B motorway options (Options 1A and 1B) scored slightly more favourably (moderately positively) as opposed to the online widening options (Options 2A, 2B, 3A and 3B). All options were assessed as having significant adverse effects on natural character and landscape and minor/moderate adverse visual effects. Key points to note from the assessment are summarised below.

Natural character and landscape: Each option results in the loss of vegetation, particularly along SH20 as well changes to the Pukaki Creek environment as a result of an additional/extended structure (bridge). Options 2A, 2B, 3A and 3B result in increased infrastructure on Puhinui Road/SH20B whereas Options 1A and 1B result in the isolation of Puhinui Road/SH20B. Due to the westerly widening of SH20, Options 2A, 2B, 3A and 3B result in greater effects on Nga Kapua Kohu Ora /Crater Hill which is subject to an Outstanding Natural Feature Overlay.

Visual: Loss of vegetation and removal of houses will increase the visibility of the motorway to receivers that may not currently have a visual effect. Options 2A, 2B, 3A and 3B may also have a potential effect on the Mount Mangere viewshaft (Viewshaft M4) in relation to the south-facing ramps between SH20A and SH20 proposed in these options.

Urban design: The differentiation described above is as a result of the online widening options (Options 2A, 2B, 3A and 3B) reducing the local road connections with the existing SH20B.

4.5 Social/community impact

This assessment considered three criteria. Differentiation among the options is in regard to accessibility; the options (the B options) that include the RTC connection to Mangere Town Centre scored slightly more favourably (significantly positively) as opposed to the direct airport connection (the A options). All options were assessed as having significant adverse effects on community and minor/moderate adverse effects on health and safety. Key points to note from the assessment are summarised below.

Accessibility: The inclusion of additional state highway lanes, the RTC and SUP will provide substantial social benefits as additional accessibility to a range of transport modes will arise. The inclusion of an RTC that provides direct connections to Mangere Town Centre will have more substantial benefits for the community than those options where town centre connectivity is not provided.

Community: The project components cannot all fit within the extent of the existing designation(s), and therefore, a number of properties are expected to be directly impacted. The loss of residential properties, parks and businesses could adversely change a community's sense of place as well as the loss or reduced functionality of community services and facilities. The adverse effect has the potential to be quite significant.

Health and safety: There will be some impacts on health and safety as a result of construction e.g. noise, dust, vibration, change to routes. It is considered that these could be managed through Construction Management Plans.

4.6 Geology

This assessment considered a single criterion being the extent and degree of effects on nationally and regionally significant volcanic features. Differentiation in the options relates to the potential effects on Nga Kapua Kohu Ora /Crater Hill as a result of SH20 widening. Option 1A was considered to have a neutral effect as it only proposes a SUP on the eastern side of SH20. Option 1B was assessed as having minor/moderate adverse effects as it proposes both an SUP and RTC on the eastern side of SH20. All other options (Options 2A, 2B, 3A and 3B) all result in significant adverse effects due to proposed widening to the west of SH20, toward the more significant volcanic features (eastern tuff ring) of Nga Kapua Kohu Ora /Crater Hill.

4.7 Noise and vibration

The assessment of noise and vibration considered two criteria – construction and operation and a single differentiation only was identified. Option 1A is considered to have a neutral operational noise and vibration effect whereas all other options were assessed as having minor/moderate adverse effects in regard to both construction and operation. Key points to note from the assessment are summarised below.

Operation: Option 1A results in most protected premises and facilities (PPF) being either demolished or experiencing negligible effects/ability for mitigation. All other options result in PPFs next to SH20 being affected either from the removal of the existing bund (in part) and/or the demolition of blocks of existing houses which immediately abut SH20. The widening of SH20B and the provision of the service road will have some effects on existing PPFs. It is also noted that for the applicable options (1B, 2B and 3B), the RTC lanes are proposed close to dwellings in Ilford Crescent.

Construction: Some exceedance of construction noise criteria is anticipated. However, mitigation measures can be utilised including allowing for a buffer between works and PPFs and/or standard Construction Noise and Vibration Management Plan (CNVMP) methods.

4.8 Archaeology and built heritage

Archaeology and built heritage was assessed as a single criterion. No differentiation was identified between the options. All options were assessed as having a significant adverse effect as they would result in probable impact on archaeological sites, namely Papahinau and Nga Kapua Kohu Ora /Crater Hill.

4.9 Cultural values

The South West Gateway area is of cultural significance to Te Ākitai Waiohua and they have provided an assessment against the options.

Cultural values were assessed as a single criterion. Option 1A, 1B and 3A are considered to have significant adverse effects due to the impact on areas including Pukaki Creek and the former settlements at Papahinau and Mimiti Te Arero. Option 2A was identified as having significant effects due to the impacts on Pukaki Creek, Te Hopua a Rangi, Te Ararata Creek and other sites of significance.

Option 3B is considered to have a neutral effect as it reduces the impact on the Pukaki corridor, although the effects on SH20 and Nga Kapua Kohu Ora /Crater Hill remain.

All options were identified as severing the relationship with Te Ākitai Waiohua from traditional sites and waterways of significance. It was noted that this makes it more difficult to appreciate and protect these sites over time with each successive development and modification. However, there is an opportunity for the installation of appropriate signage along the shared use corridor to help to mitigate the adverse effects.

4.10 Contaminated land

The assessment of contaminated land considered seven criteria resulting in a number of differentiations. The assessed effects ranged from neutral to significant adverse effects. Key points to note from the assessment are summarised below.

Construction management: Options 1B, 2B and 3B are likely to result in the demolition of residential properties along SH20 for the RTC and therefore, the consideration of asbestos containing material in residence construction and waste disposal to gardens will be required.

Passive discharge: With Options 1A and 1B, construction within quarry/landfill near Cavendish Road would occur which may create new pathways, worsening existing passive discharge arrangements in this area.

Potential for new or cross contamination: Contaminated land is likely to be disturbed across most of SH20, other areas are less affected. Cut to fill exercises may result in contamination of currently clean areas. Construction activities in close proximity to the jet fuel pipeline (owned by Wiri Oil Services Limited) and/or liquid fuel pipeline (NZ Refining Company Limited) have the potential to result in significant environmental impacts (contaminant discharge) if managed incorrectly.

Health and safety of construction workers: A significant adverse effect was applied to the new offline motorway options (Options 1A and 1B) due to the presence of the underground pipeline between Campana Road and Pukaki Bridge which may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.

Acid sulphate soils: Acid soils may be present, particularly along the western end of the SH20B corridor. Exposure of this soil type to air during earthworks (including bridge construction/improvements and piling activities) may trigger acidic earth discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater. If present, there is also the risk of acid soils weakening concrete structures.

5 Consentability

Consentability is assessed as one of the KPIs used to score the options in regard to implementability. Below is a discussion on the methodology used to score this KPI, the scores given and the reasoning.

5.1 Methodology

The rating scale for the Consentability KPI for each of the options uses a five-point scale (one to five). Unlike the environmental criteria, consentability is not measured against the do-minimum approach and therefore negative scores cannot be used. A descriptive rating for each criterion has been specified against the five-point scale for clarity and transparency and is provided at **Table 4** below.

Table 4 Consentability rating scale

Rating	Descriptor
1	Highly complex approvals process with significant risk of not obtaining approval due to some or all of the following: - No / or unacceptable mitigation available to reduce to the scale of a significant adverse effect. - Public notification guaranteed with potential for number of submissions in opposition to be high - Unable to obtain stakeholder buy-in and agreements - Prohibited activity status - Strongly conflicts with strategic policy direction of relevant RMA plans.
2	Complex approvals process. Associated risks due to: - Suite of consents required across a number of technical disciplines. - Potential for significant adverse effects. - Inconsistencies with strategic policy direction of relevant RMA plans. - Publicly notification high likely with potential for a number of submissions to be in opposition. - Multiple stakeholders require buy-in and approvals
3	Moderately complex approvals process with a suite of consents required: - Potential for consents to be limited notified or publicly notified - Limited stakeholder buy-in and approvals - Actual and potential adverse effects are not unusual for major construction works and mitigation options are likely to be available to mitigate adverse effects. - Not inconsistent with strategic policy direction of relevant RMA plans.
4	Suite of basic consents / approvals required, likely to be progressed non-notified and requiring limited stakeholder engagement.

5	Limited number of basic consents / approvals required for standard construction works and would be non-notified.

5.2 Summary

Table 5 Consentability KPI scoring

Criteria	Option 1A	Option 1B	Option 2A	Option 2B	Option 3A	Option 3B
Level of complexity of gaining approvals (e.g. activity status, risk of appeal, accordance with policy direction). Level of compliance with regulatory plans e.g. could the option include activities which are prohibited/ non-complying under the policies and rules of the district or regional plan?	2	2	2	2	2	2

All options scored 2 for consentability as seen in Table 5. This is due to the highly complex approvals pathway that would be required to authorise the Project. The information provided by the technical specialists (as summarised in Section 4 above) confirms that the existing environment contains urban, coastal and cultural elements and that the potential adverse effects of any of the short list options could be significant and require significant mitigation (noting, however, that none of the effects were identified as being un-mitigatable). This suggests that a suite of consents/approvals would be required, likely triggering non-complying activities which require an extra level of analysis. The options will affect multiple stakeholders and will likely require public notification with a high likelihood of submissions in opposition (and potentially appeals).

Yours sincerely,



Attachment A
Environmental Context Map

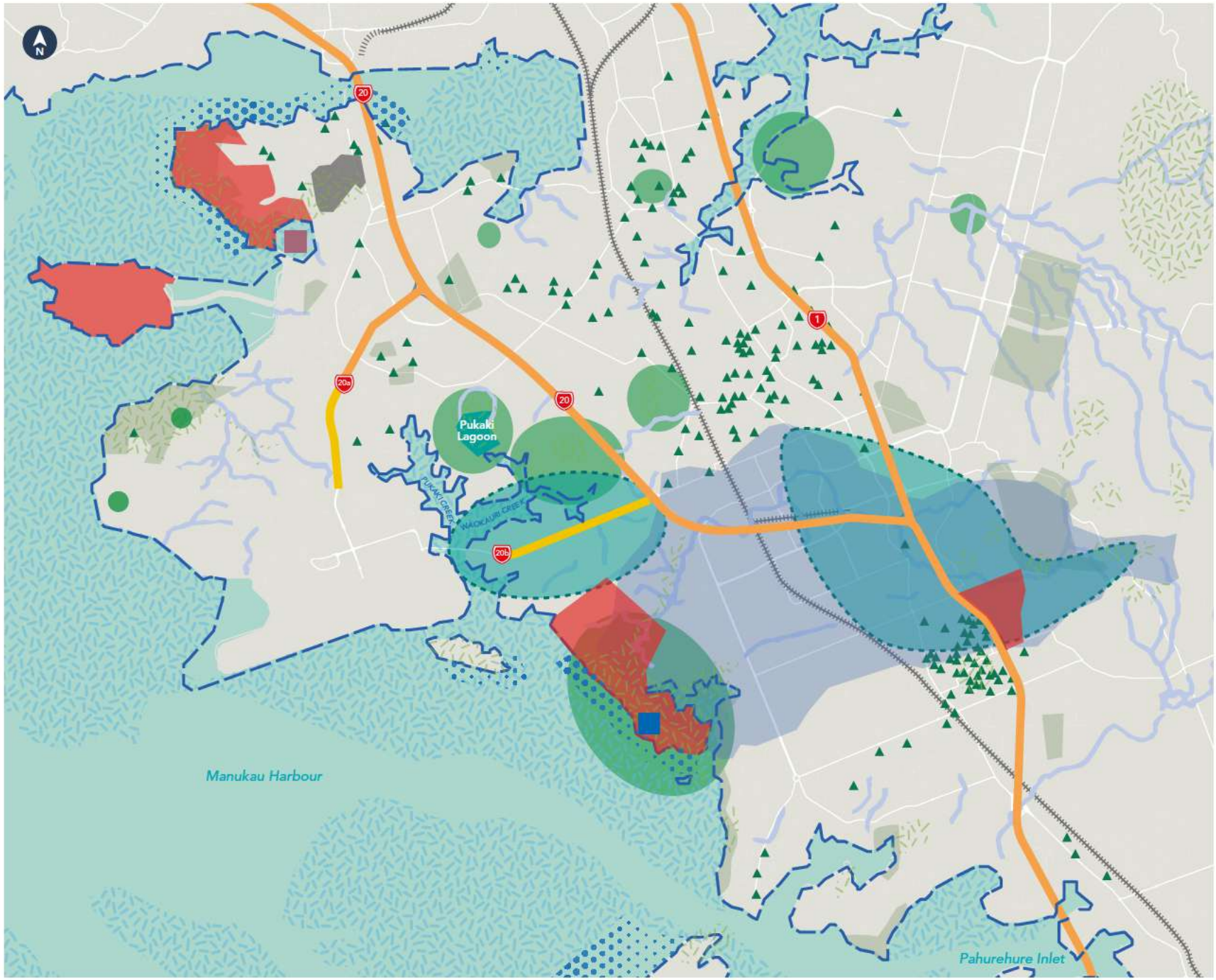


ENVIRONMENTAL FEATURES OVERVIEW

LEGEND

- Auckland Airport
- Auckland Airport area
- Motorway
- Major road
- Railway
- Train station
- Future Urban Zone
- Auckland Airport area
- Commercial
- Residential
- Regional & major parks
- Marae
- Volcanic cones
- Watercare area
- Lagoons
- Hospital
- Key environmental areas of interest
- Closed landfill
- Trees

Auckland Transport
NZ TRANSPORT AGENCY WAKA KOTAHI
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ENVIRONMENTAL CONTEXT MAP

NATURAL FEATURES

LEGEND

- Motorway
- Major road
- Railway
- Stormwater management areas (Flow 1 & 2)
- Regional parks
- Parks
- Indicative coastline
- Mangere Mountain
- Waterways
- High-use stream management areas
- Outstanding natural features
- Notable trees
- Wetland management areas
- Mangere lagoon

Significant Ecological Areas:

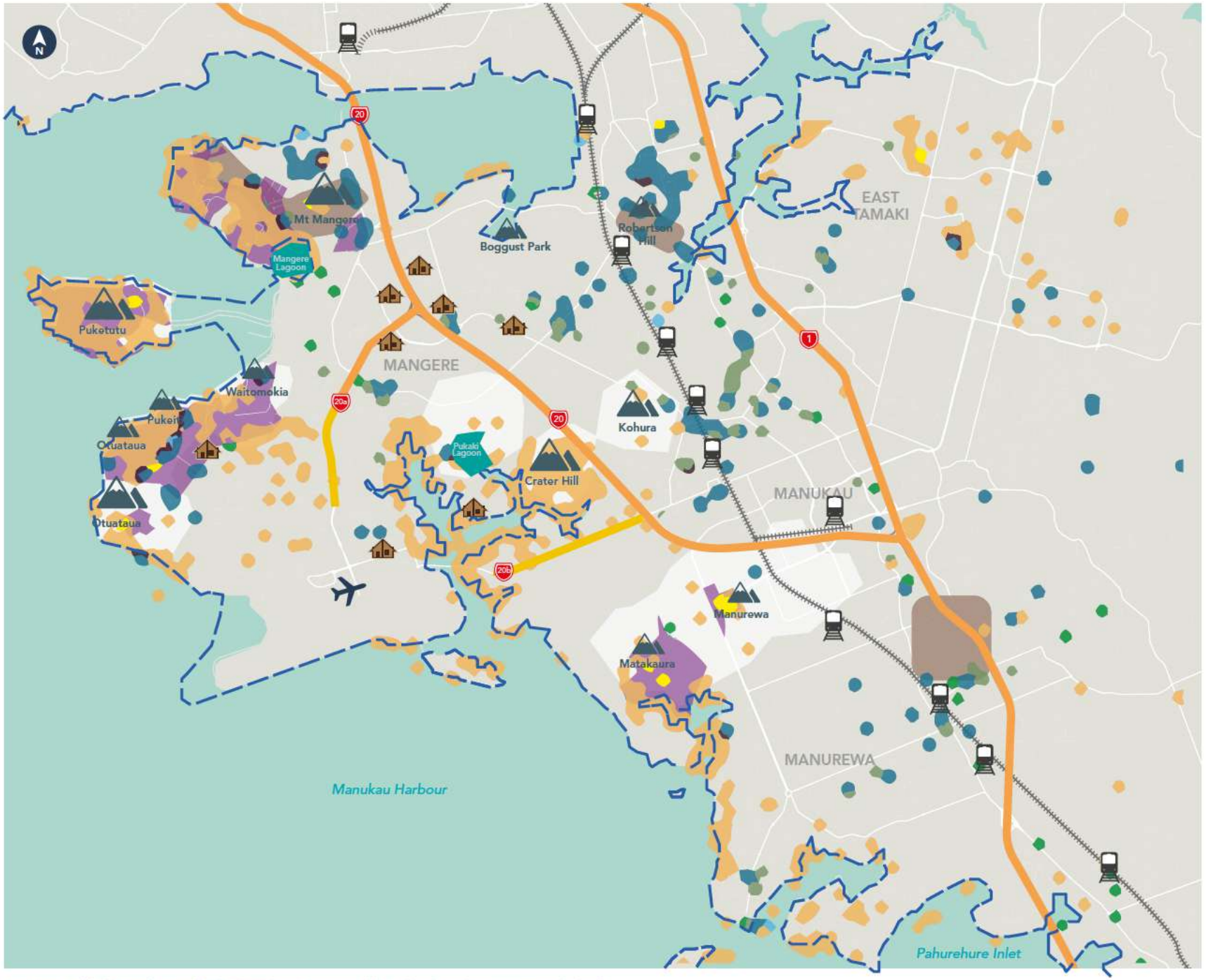
- Terrestrial
- Marine 1
- Marine 2

GeoMaps, Auckland Council (sourced 12/02/2018) https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html
GeoMaps Auckland Unitary Plan Operative in part (16 Nov 2016), Auckland Council (sourced 12/02/2016) https://unitaryplanmaps.aucklandcouncil.govt.nz/upviewer/ and http://unitaryplan.aucklandcouncil.govt.nz/Pages/Plan/Book.aspx?exhibit=AucklandUnitaryPlan_Print

Auckland Transport
An Auckland Council Organisation

NZ TRANSPORT AGENCY
WAKA KOTAHI

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ENVIRONMENTAL CONTEXT MAP

HERITAGE & CULTURE & GEOLOGICAL FEATURES

LEGEND

- Marae
- Motorway
- Major Road
- Indicative Coastline
- Railway
- Train Stations
- Built Heritage & Character
- Sites and Places of Significance to Mana Whenua (Auckland Unitary Plan)
- Volcanic cones
- Lagoons
- Auckland Airport
- Volcanic geological features (includes stone and lava fields)

Cultural Heritage Inventory (Public):

- Archaeological Site
- Historical Botanical Site
- Historic Structure
- Maori Heritage Area
- Maritime Site
- Reported Historic Site

GeoMaps, Auckland Council (sourced 12/02/2018) https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html
GeoMaps Auckland Unitary Plan Operative in part (16 Nov 2016), Auckland Council (sourced 12/02/2016) https://unitaryplanmaps.aucklandcouncil.govt.nz/upviewer/ and http://unitaryplan.aucklandcouncil.govt.nz/Pages/Plan/Book.aspx?exhibit=AucklandUnitaryPlan_Print

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ENVIRONMENTAL CONTEXT MAP

SOCIAL FEATURES & INFRASTRUCTURE

LEGEND

- Auckland Airport
- Auckland Airport area
- Motorway
- Major road
- Railway
- Train station
- Regional/Major park
- Community centre
- Library
- School
- Hospital
- Rainbows End
- Cemetery
- South Auckland Corrections Centret
- Arts centre
- Recreational centre
- Watercare area
- Volcanic cones

NZ Schools, Koordinates (source 12/02/2016) https://koordinates.com/layer/243-nz-schools/data/
NZ Cemetery Points, Koordinates (source 12/02/2017) https://koordinates.com/layer/130-nz-cemetery-points-topo-150k/
Google Maps (sourced 12/02/2016) https://www.google.com.au/maps/place/Mangere,+Auckland+2022,+New+Zealand/@-36.9779085,174.7130624,12z/data=!3m1!4b1!4m5!3m4!1s0x6d0d4f854f521a07:0x500ef6143a2ded08!8m2!3d-36.9686277!4d174.7936872

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Appendix B
Technical Environmental Specialist Notes

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094**
Date	**2018-10-25**	Pages (including this page)	**27**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Archaeology and Built Heritage**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The Archaeology and Built Heritage assessments were based on:

- The 20Connect long-list technical assessment undertaken by Arden Cruickshank dated 24/08/2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018).
- New Zealand Archaeological Association (NZAA) site recording forms within 200m of the proposed works (This distance is used due to the possible inaccuracy of archaeological sites recorded prior to 1990, which could exist within the proposed designation).
- Auckland Council Cultural Heritage Inventory (CHI).
- Auckland Council Unitary Plan - Operative in Part (AUP(OiP)).
- Self Family Trust v Auckland Council [2018] NZEnvC 49.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	Arden Cruickshank MA (Hons) CFG Heritage Ltd
Area of assessment	Archaeology and Built Heritage

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) **20Connect Road + RTC SH20B** Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. **-2** Reasons / Comments ■ **Puhinui Interchange to Orrs Road** – There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed

<table>
<tr>
<td></td>
<td>offline motorway route. The Campana Road interchange does not change any of the values.
– The interchange is near to several archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified near this interchange but it is unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).
■ RTC SH20B (Papahinau)
– There are 17 recorded archaeological sites in the vicinity of this option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Extent of effects on sites and places of archaeological value and on heritage buildings and places.</td><td>-2</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ SH20B including RTC
– There are 17 recorded archaeological sites in the vicinity of this section of the option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values.
</td>
</tr>
</table>

	■ **SH20 Southbound SUP** – The portion of the SUP on SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and It is likely that archaeological material exists on both sides of the motorway that would be affected by works. – Although most of the recorded sites are on the western side of the motorway, it is likely that these sites extend onto the eastern side of the motorway and that archaeological material associated with this would be uncovered. Works to the east of the motorway are considered mitigatable.	

Notes:

Assumptions

- All roading and bridging from Orrs Road to Pukaki Creek would be done at ground level, requiring extensive modification to the ground surface.
- All works regarding road widening through SH20 between Portage road and Puhinui Road will be done eastwards, avoiding the highly significant Nga Kapua Kohu Ora / Crater Hill sites to the west of the road.
- NZAA site records, the CHI and AUP(OiP) are up to date.

Other Information relied upon

- As listed on Page 1.

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted] MA (Hons) CFG Heritage Ltd
Area of assessment	Archaeology and Built Heritage

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. : -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> ■ **Mangere town centre** – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that

<table>
<tr><td></td><td>unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre.</td></tr>
<tr><td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td><td>
<table>
<tr><td>Extent of effects on sites and places of archaeological value and on heritage buildings and places.</td><td>-2</td></tr>
</table>

My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>

■ Puhinui Interchange to Orrs Road
– There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route. The Campana road interchange does not change the scoring of this section.
– The interchange is near to several archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified near this interchange but it is unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).
■ Rapid transport corridor
– The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and</td></tr>
</table>

	heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. – Although most of the recorded sites are on the western side of the motorway, it is likely that these sites extend onto the eastern side of the motorway and that archaeological material associated with this would be uncovered. Works to the east of the motorway are considered mitigatable. ■ **Mangere town centre** – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre.
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. : -2 My reasoning/justification for this is as follows: Reasons / Comments ■ **Orrs Roads to Pukaki Bridge** – There are 17 recorded archaeological sites in the vicinity of this option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values. ■ **Puhinui Interchange to Orrs Road**

	– There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route. – The interchange is near to several archaeological sites indicating that unrecorded archaeological material may be uncovered within the vicinity of the proposed interchange. CHI item 17015 (Cambria Park Camp) is also identified near this interchange but it is unlikely that any material related to this WWII camp is present. This item is not listed as a Significant Historic Heritage Place in the Unitary Plan (Operative in Part).

Notes:

Assumptions

- All roading and bridging from Orrs Road to Pukaki Creek would be done at ground level, requiring extensive modification to the ground surface.
- All works regarding road widening through SH20 between Portage road and Puhinui Road will be done eastwards, avoiding the highly significant Nga Kapua Kohu Ora / Crater Hill sites to the west of the road.
- NZAA site records, the CHI and AUP(OiP) are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted] MA (Hons) CFG Heritage Ltd
Area of assessment	Archaeology and Built Heritage

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. : -2 My reasoning/justification for this is as follows: Reasons / Comments ■ **Puhinui Interchange to Orrs Road** – There are five recorded archaeological sites recorded within 200m of the current road reserve between the interchange and Orrs Road. Although all these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering

<table>
<tr>
<td></td>
<td>archaeological material along the proposed route.
■ New Service Lane
– The new service lane north of SH20B is scored alongside the rest of the SH20B works and does not change the score.
■ Rapid Transport Corridor
– This scores the same as the other works between Puhinui Road Interchange and Orrs Road.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Extent of effects on sites and places of archaeological value and on heritage buildings and places.</td><td>-2</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ 20a to 20 southern link:
– Item 2625 in the Unitary Plan (Operative in Part) ‘Homestead at Mangere Centre Park’ has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens.
■ 20 south of Portage Road:
– The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and It is likely that archaeological material exists on both sides of the motorway that would be affected by works.
</td>
</tr>
</table>

	– Although there is a high chance of encountering archaeological material related to Nga Kapua Kohu Ora / Crater Hill on both sides of the road, works to the west should be viewed as significantly adverse and should be avoided, whereas works to the east, would be able to be mitigated. – Any proposed replacement of the Portage Road over bridge and Hunua No. 4 waterpipe bridge should be mitigatable as the ground has likely been heavily disturbed. ▪ ***Orrs Roads to Pukaki Bridge*** – There are 17 recorded archaeological sites in the vicinity of this option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values. ▪ ***Puhinui Interchange to Orrs Road*** – There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.

Notes:

Assumptions

- The Puhinui interchange works would be within the current designation, which has already been heavily modified and no archaeological or heritage material would remain.
- All roading and bridging from Orrs Road to Pukaki Creek would be done at ground level, requiring extensive modification to the ground surface.

- All works regarding road widening through SH20 between Portage road and Puhinui Road will be done eastwards, avoiding the highly significant Nga Kapua Kohu Ora / Crater Hill sites to the west of the road.
- Portage Road and Hunua NO. 4 pipe bridge replacement works would be undertaken within previously disturbed ground and is mitigatable.
- NZAA site records, the CHI and AUP(OiP) are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted] MA (Hons) CFG Heritage Ltd
Area of assessment	Archaeology and Built Heritage

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. : -1 My reasoning/justification for this is as follows: Reasons / Comments ■ **Mangere town centre** – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre.

4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Extent of effects on sites and places of archaeological value and on heritage buildings and places.	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- **Puhinui Interchange to Orrs Road**
  - There are five recorded archaeological sites recorded within 200m of the current road reserve between the interchange and Orrs Road. Although all these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.
- **Rapid Transport Corridor**
  - This rates the same as the other works between Puhinui Road Interchange and Orrs Road.
- **Mangere town centre**
  - There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre.

5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Extent of effects on sites and places of archaeological value and on heritage buildings and places.	-2

My reasoning/justification for this is as follows:

Reasons / Comments

	■ **20a to 20 southern link:** – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. ■ **Mangere town centre** – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre. ■ **20 south of Portage Road:** – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and It is likely that archaeological material exists on both sides of the motorway that would be affected by works. – Although there is a high chance of encountering archaeological material related to Nga Kapua Kohu Ora / Crater Hill on both sides of the road, works to the west would be unmitigable, whereas works to the east, would be able to be mitigated. – Any proposed replacement of the Portage Road over bridge and Hunua No. 4 waterpipe bridge should be mitigatable as the ground has likely been heavily disturbed. ■ **Orrs Roads to Pukaki Bridge**

	– There are 17 recorded archaeological sites in the vicinity of this option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values. ■ **Puhinui Interchange to Orrs Road** – There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.	

Notes:

Assumptions

- The Puhinui interchange works would be within the current designation, which has already been heavily modified and no archaeological or heritage material would remain.
- All roading and bridging from Orrs Road to Pukaki Creek would be done at ground level, requiring extensive modification to the ground surface.
- All works regarding road widening through SH20 between Portage road and Puhinui Road will be done eastwards, avoiding the highly significant Nga Kapua Kohu Ora / Crater Hill sites to the west of the road.
- Portage Road and Hunua NO. 4 pipe bridge replacement works would be undertaken within previously disturbed ground and is mitigatable.
- NZAA site records, the CHI and AUP(OiP) are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted] MA (Hons) CFG Heritage Ltd
Area of assessment	Archaeology and Built Heritage

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. : -2 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> ■ ***Puhinui Interchange to Orrs Road*** – There are five recorded archaeological sites recorded within 200m of the current road reserve between the interchange and Orrs Road. Although all these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering

<table>
<tr>
<td></td>
<td>archaeological material along the proposed offline motorway route.
– The service lane north of SH20B has been scored with the rest of this section and does not change the score.
■ Rapid Transport Corridor
– This rates the same as the other works between Puhinui Road Interchange and Orrs Road.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Extent of effects on sites and places of archaeological value and on heritage buildings and places.</td><td>-2</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ 20a to 20 southern link:
– Item 2625 in the Unitary Plan (Operative in Part) ‘Homestead at Mangere Centre Park’ has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens.
■ 20 south of Portage Road:
– The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within200m of the road reserve which are associated with this landscape and It is likely that archaeological material exists on both sides of the motorway that would be affected by works.
</td>
</tr>
</table>

	– Although there is a high chance of encountering archaeological material related to Nga Kapua Kohu Ora / Crater Hill on both sides of the road, works to the west would be unmitigable, whereas works to the east, would be able to be mitigated. – Any proposed replacement of the Portage Road over bridge and Hunua No. 4 waterpipe bridge should be mitigatable as the ground has likely been heavily disturbed. ▪ ***Orrs Roads to Pukaki Bridge*** – There are 17 recorded archaeological sites in the vicinity of this option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values. ▪ ***Puhinui Interchange to Orrs Road*** – There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.

Notes:

Assumptions

- The Puhinui interchange works would be within the current designation, which has already been heavily modified and no archaeological or heritage material would remain.
- All roading and bridging from Orrs Road to Pukaki Creek would be done at ground level, requiring extensive modification to the ground surface.

- All works regarding road widening through SH20 between Portage road and Puhinui Road will be done eastwards, avoiding the highly significant Nga Kapua Kohu Ora / Crater Hill sites to the west of the road.
- Portage Road and Hunua NO. 4 pipe bridge replacement works would be undertaken within previously disturbed ground and is mitigatable.
- NZAA site records, the CHI and AUP(OiP) are up to date.

Other Information relied upon

- As listed on Page 1.
- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	[redacted] MA (Hons) CFG Heritage Ltd
Area of assessment	Archaeology and Built Heritage

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent of effects on sites and places of archaeological value and on heritage buildings and places. : -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> ▪ ***Mangere town centre*** – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre.

4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Extent of effects on sites and places of archaeological value and on heritage buildings and places.	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- **Puhinui Interchange to Orrs Road**
  - There are five recorded archaeological sites recorded within 200m of the current road reserve between the interchange and Orrs Road. Although all these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. there is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.
  - The service lane north of SH20B has been scored with the rest of this section and does not change the score.
- **Rapid Transport Corridor**
  - This rates the same as the other works between Puhinui Road Interchange and Orrs Road.
- **Mangere town centre**
  - There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre.

5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	Extent of effects on sites and places of archaeological value and on heritage buildings and places.	-2

	My reasoning/justification for this is as follows: Reasons / Comments ■ **20a to 20 southern link:** – Item 2625 in the Unitary Plan (Operative in Part) 'Homestead at Mangere Centre Park' has an extent of place which is within the proposed 50m designation outside the current road reserves. Although the building itself is outside of the proposed 50m designation, this would affect the associated gardens. ■ **Mangere town centre** – There have been both pre-European and historic sites identified near to SH20A, and it cannot be completely ruled out that unrecorded archaeological material will be uncovered within the road reserves in Mangere town centre. ■ **20 south of Portage Road:** – The portion of SH20 between Puhinui Road and Massey Road runs through the extent of Nga Kapua Kohu Ora / Crater Hill. Nga Kapua Kohu Ora / Crater Hill is a heritage landscape of outstanding archaeological and heritage value and significance at a local, regional and national level and is part of the volcanic cones (tupuna maunga) landscape which is of international significance. There are 14 recorded archaeological sites within 200m of the road reserve which are associated with this landscape and It is likely that archaeological material exists on both sides of the motorway that would be affected by works. – Although there is a high chance of encountering archaeological material related to Nga Kapua Kohu Ora / Crater Hill on both sides of the road, works to the west would be unmitigable, whereas works to the east, would be able to be mitigated. – Any proposed replacement of the Portage Road over bridge and Hunua No. 4 waterpipe bridge should be mitigatable as the ground has likely been heavily disturbed.

	■ **Orrs Roads to Pukaki Bridge** – There are 17 recorded archaeological sites near this part of the option, mainly to the west of Orrs Road. This area is part of a larger settlement complex (papakainga) known as Papahinau, centred on the eastern bank of the Pukaki Creek. It is likely that archaeological material will be encountered during works through this section of the option. Papahinau can be considered to have significant heritage values. ■ ***Puhinui Interchange to Orrs Road*** – There are five recorded archaeological sites recorded within 200m of the current road reserve. Although all of these sites are located on the northern side of Puhinui Road, it is indicative of the density of archaeological sites in the area. Recent archaeological survey including test pitting by Clough and Associates (Baquie et al 2018) on the southern side of Puhinui Road did not reveal any archaeological features. There is a low, yet possible chance of encountering archaeological material along the proposed offline motorway route.

Notes:

Assumptions

- The Puhinui interchange works would be within the current designation, which has already been heavily modified and no archaeological or heritage material would remain.
- All roading and bridging from Orrs Road to Pukaki Creek would be done at ground level, requiring extensive modification to the ground surface.
- All works regarding road widening through SH20 between Portage road and Puhinui Road will be done eastwards, avoiding the highly significant Nga Kapua Kohu Ora / Crater Hill sites to the west of the road.
- Portage Road and Hunua NO. 4 pipe bridge replacement works would be undertaken within previously disturbed ground and is mitigatable.
- NZAA site records, the CHI and AUP(OiP) are up to date.

Other Information relied upon

- As listed on Page 1.

- Baquie, B., Z. Burnett, S. Macready and R. Clough. 2018. Park and Ride South, 454 Puhinui Road, Wiri, Auckland: Archaeological Assessment. Unpublished Clough and Associates Ltd report to Auckland International Airport Ltd.

Approved by: Matthew Campbell

Title	Name	Qualification	Signature	Date
Author	[redacted]	MA (Hons) Auckland	[redacted]	30-10-2018
Reviewer	[redacted]	MA (Otago) PhD (Sydney)		30-10-2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094**
Date	**2018-11-29**	Pages (including this page)	**20**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Contaminated Land**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The contaminated land assessments were based on:

- The 20Connect long-list technical assessment undertaken by Aurecon dated 23 August 2018.
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018).
- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

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Technical Note

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a: New offline SH20B, RTC on SH20B	
Name of assessor (incl. qualifications and organisation)	Stanley Howell – Aurecon. BSc, CEnvP(SC)
Area of assessment	Contaminated Land

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Risk to construction workers from soil or groundwater: **-2** My reasoning/justification for this is as follows: – There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills . – The presence of the underground pipeline between Campana Road and Pukaki Bridge, and pipeline bends at Campana Road may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport)

Option 1a: New offline SH20B, RTC on SH20B

3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	-1
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-2
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Construction within quarry/landfill near Cavendish road may create new pathways, worsening existing passive discharge arrangements in this area
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills.
  - The presence of the underground pipeline between Campana Road and Pukaki Bridge, and pipeline bends at Campana Road may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Option 1a: New offline SH20B, RTC on SH20B

4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	-1
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-2
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Construction within quarry/landfill near Cavendish road may create new pathways, worsening existing passive discharge arrangements in this area
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills
  - The presence of the underground pipeline between Campana Road and Pukaki Bridge, and pipeline bends at Campana Road may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Additional Pukaki Bridge construction and associated piling. Bridge improvements and piling along SH20B corridor
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Notes:

Assumptions

- Excavations may extend in some locations to 1.5m below ground surface
- Bridge piles will require soil disturbance deeper than 1.5 m below ground surface
- Per- and poly-fluoroalkyl substances (PFAS) are assumed to not be present in soil between Orrs Road and Pukaki Bridge; however, PFAS was identified as a contaminant of potential concern in the Preliminary Site Investigation, so should be analysed for prior to bulk earthworks. The ***Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment*** criteria above will require revision, should PFAS be detected.
- Groundwater may be present in some locations at 2 m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b: New offline SH20B, RTC on SH20 with spur to Mangere Town Centre	
Name of assessor (incl. qualifications and organisation)	[redacted] – Aurecon. BSc, CEnvP(SC)
Area of assessment	Contaminated Land

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Risk to construction workers from soil or groundwater: -2 My reasoning/justification for this is as follows: – There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills – The presence of the underground pipeline between Campana Road and Pukaki Bridge, and pipeline bends at Campana Road may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20 should be: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.: -2 My reasoning/justification for this is as follows: – Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens

Option 1b: New offline SH20B, RTC on SH20 with spur to Mangere Town Centre

3) **Rapid Transit Corridor Mangere Town Centre**
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-1
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	0
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	0

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land may be encountered across parts of the Mangere Town Centre
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land may be encountered across parts of the Mangere Town Centre
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, minimal cut to fill anticipated
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils unlikely to be present
- *Criteria: Risk to construction workers from soil or groundwater.*
  - Contaminated land is likely to be disturbed across most of SH20
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils unlikely to be present

Option 1b: New offline SH20B, RTC on SH20 with spur to Mangere Town Centre

4) 20Connect Road + RTC SH20
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	-1
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-2
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
  - Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens.
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Construction within quarry/landfill near Cavendish road may create new pathways, worsening existing passive discharge arrangements in this area
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills.
  - The presence of the underground pipeline between Campana Road and Pukaki Bridge, and pipeline bends at Campana Road may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Option 1b: New offline SH20B, RTC on SH20 with spur to Mangere Town Centre

5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	-1
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-2
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
  - Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Construction within quarry/landfill near Cavendish road may create new pathways, worsening existing passive discharge arrangements in this area
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills
  - The presence of the underground pipeline between Campana Road and Pukaki Bridge, and pipeline bends at Campana Road may be a source of deeper hydrocarbon contamination in these areas. Impacts to deeper soils and groundwater may be realised during excavations associated with the proposed fly-over at Campana Road.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Additional Pukaki Bridge construction and associated piling. Bridge improvements and piling along SH20B corridor
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Notes:

Assumptions

- Excavations may extend in some locations to 1.5m below ground surface
- Bridge piles will require soil disturbance deeper than 1.5 m below ground surface
- PFAS are assumed to not be present in soil between Orrs Road and Pukaki Bridge; however, PFAS was identified as a contaminant of potential concern in the Preliminary Site Investigation, so should be analysed for prior to bulk earthworks. The *Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment* criteria above will require revision, should PFAS be detected.
- Groundwater may be present in some locations at 2 m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a: SH20 widening, SH20B widening to west of Pukaki Bridge, RTC on SH20B	
Name of assessor (incl. qualifications and organisation)	[redacted] – Aurecon. BSc, CEnvP(SC)
Area of assessment	Contaminated Land

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent)
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport)
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	See table below

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Option 2a: SH20 widening, SH20B widening to west of Pukaki Bridge, RTC on SH20B

4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Additional Pukaki Bridge construction and associated piling. Bridge improvements and piling along SH20B corridor
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Notes:

Assumptions

- Excavations may extend in some locations to 1.5m below ground surface
- Bridge piles will require soil disturbance deeper than 1.5 m below ground surface
- PFAS are assumed to not be present in soil between Orrs Road and Pukaki Bridge; however, PFAS was identified as a contaminant of potential concern in the Preliminary Site Investigation, so should be analysed for prior to bulk earthworks. The *Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment* criteria above will require revision, should PFAS be detected.
- Groundwater may be present in some locations at 2 m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b: SH20 widening, SH20B widening to west of Pukaki Bridge, RTC on SH20 with spur to Mangere Town Centre	
Name of assessor (incl. qualifications and organisation)	Stanley Howell – Aurecon. BSc, CEnvP(SC)
Area of assessment	Contaminated Land

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent)
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment. **-2** My reasoning/justification for this is as follows: – Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens
3) Rapid Transit Corridor Mangere Town Centre Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment. **-1** Potential to encounter and ability to manage the effects of groundwater on human health and the environment. **-1** Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water. **0** Potential for the works to mobilise or place contamination within the project area **-1** Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions **0** Risk to construction workers from soil or groundwater **-1** Risk to the environment from the discharge of acid generating soils **0** My reasoning/justification for this is as follows: Reasons / Comments ■ *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.* – Contaminated land may be encountered across parts of the Mangere Town Centre ■ *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.* – Contaminated land may be encountered across parts of the Mangere Town Centre ■ *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.* – Unlikely to affect passive discharge ■ *Criteria: Potential for the works to mobilise or place contamination within the project area.* – Contaminated land is likely to be disturbed across most of SH20, minimal cut to fill anticipated ■ *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.* – Acid soils unlikely to be present ■ *Criteria: Risk to construction workers from soil or groundwater.* – Contaminated land is likely to be disturbed across most of SH20 ■ *Criteria: Risk to the environment from the discharge of acid generating soils.* – Acid soils unlikely to be present

Option 2b: SH20 widening, SH20B widening to west of Pukaki Bridge, RTC on SH20 with spur to Mangere Town Centre

4) 20Connect Road + RTC SH20
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
  - Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Option 2b: SH20 widening, SH20B widening to west of Pukaki Bridge, RTC on SH20 with spur to Mangere Town Centre

5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
  - Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Additional Pukaki Bridge construction and associated piling. Bridge improvements and piling along SH20B corridor
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Notes:

Assumptions

- Excavations may extend in some locations to 1.5m below ground surface
- Bridge piles will require soil disturbance deeper than 1.5 m below ground surface
- PFAS are assumed to not be present in soil between Orrs Road and Pukaki Bridge; however, PFAS was identified as a contaminant of potential concern in the Preliminary Site Investigation, so should be analysed for prior to bulk earthworks. The *Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment* criteria above will require revision, should PFAS be detected.
- Groundwater may be present in some locations at 2 m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a: SH20 widening, SH20B widening to Orrs Rd, RTC on SH20B	
Name of assessor (incl. qualifications and organisation)	[redacted] – Aurecon. BSc, CEnvP(SC)
Area of assessment	Contaminated Land

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent)
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport)
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Option 3a: SH20 widening, SH20B widening to Orrs Rd, RTC on SH20B

4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Additional Pukaki Bridge construction and associated piling. Bridge improvements and piling along SH20B corridor
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Notes:

Assumptions

- Excavations may extend in some locations to 1.5m below ground surface
- Bridge piles will require soil disturbance deeper than 1.5 m below ground surface
- PFAS are assumed to not be present in soil between Orrs Road and Pukaki Bridge; however, PFAS was identified as a contaminant of potential concern in the Preliminary Site Investigation, so should be analysed for prior to bulk earthworks. The *Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment* criteria above will require revision, should PFAS be detected.
- Groundwater may be present in some locations at 2 m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b: SH20 widening, SH20B widening to Orrs Rd, RTC on SH20 with spur to Mangere Town Centre	
Name of assessor (incl. qualifications and organisation)	[redacted] – Aurecon. BSc, CEnvP(SC)
Area of assessment	Contaminated Land

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road
Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)

I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent)

2) Rapid Transit Corridor
Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.

No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2

My reasoning/justification for this is as follows:

Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens

3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-1
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-1
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	0
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	0

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land may be encountered across parts of the Mangere Town Centre
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land may be encountered across parts of the Mangere Town Centre
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, minimal cut to fill anticipated
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils unlikely to be present
- *Criteria: Risk to construction workers from soil or groundwater.*
  - Contaminated land is likely to be disturbed across most of SH20
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils unlikely to be present

Option 3b: SH20 widening, SH20B widening to Orrs Rd, RTC on SH20 with spur to Mangere Town Centre

4) 20Connect Road + RTC SH20
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
  - Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills.
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Option 3b: SH20 widening, SH20B widening to Orrs Rd, RTC on SH20 with spur to Mangere Town Centre

5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.	-2
Potential to encounter and ability to manage the effects of groundwater on human health and the environment.	-1
Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.	0
Potential for the works to mobilise or place contamination within the project area	-2
Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions	-1
Risk to construction workers from soil or groundwater	-1
Risk to the environment from the discharge of acid generating soils	-2

My reasoning/justification for this is as follows:

Reasons / Comments

- *Criteria: Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area.
  - Acquired residential properties along SH20 for RTC will require consideration of asbestos containing material in residence construction and waste disposal to gardens
- *Criteria: Potential to encounter and ability to manage the effects of groundwater on human health and the environment.*
  - Contaminated land is likely to be disturbed across most of the 20Connect project area
- *Criteria: Potential to influence ongoing passive discharge of contaminants from soil or groundwater to groundwater or surface water.*
  - Unlikely to affect passive discharge
- *Criteria: Potential for the works to mobilise or place contamination within the project area.*
  - Contaminated land is likely to be disturbed across most of SH20, other areas are less affected and cut to fill exercises may result in contamination of currently clean areas
  - Construction activities in close proximity to the jet fuel pipeline (WOSL) and/or liquid fuel pipeline (NZRCL) have potential to realise significant environmental impacts if managed incorrectly. Works near these pipelines are likely to require engagement of asset owners, and a potential obligation to undertake works consistent with 3rd party requirements.
- *Criteria: Risk to concrete and plastic below ground from aggressive ground conditions such as solvents and acid conditions.*
  - Acid soils may present which could weaken concrete structures
- *Criteria: Risk to construction workers from soil or groundwater.*
  - There is a likelihood shallow soil contamination will be encountered across the entire route due to the potential presence of historical farm dumps and gully fills
- *Criteria: Risk to the environment from the discharge of acid generating soils.*
  - Additional Pukaki Bridge construction and associated piling. Bridge improvements and piling along SH20B corridor
  - Acid soils may be present, exposure of these to air during earthworks may result in acidic earthworks discharge and acidification of groundwater resulting in longer term acid discharges to and from groundwater.

Notes:

Assumptions

- Excavations may extend in some locations to 1.5m below ground surface
- Bridge piles will require soil disturbance deeper than 1.5 m below ground surface
- PFAS are assumed to not be present in soil between Orrs Road and Pukaki Bridge; however, PFAS was identified as a contaminant of potential concern in the Preliminary Site Investigation, so should be analysed for prior to bulk earthworks. The *Potential to encounter and ability to manage the effects of contaminated soils on human health and the environment* criteria above will require revision, should PFAS be detected.
- Groundwater may be present in some locations at 2 m below ground surface.

Other Information relied upon

- A review of historical and current aerial photography available on Auckland Council Geomaps
- Roberts R. and McConchie J. November 2017. *Preliminary assessment of the acid sulphate soils hazard in the Auckland region*. New Zealand Geotechnical Society
- Our previous project experience in this area

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Technical Note

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	BSc, CEnvP(SC)	[redacted]	29/11/2018
Reviewer	[redacted]	BSc, MSc (Hons), CChem, MRSC, MNZIC		29/11/2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094 / BRS61946**
Date	**2018-12-04**	Pages (including this page)	**23**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Freshwater Ecology**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The **Freshwater Ecology** assessments were based on:

- The 20Connect long-list technical assessment undertaken by [redacted], Bioresearches dated 19 September 2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 15 Oct 2018).
- The 20 Connect short list baseline envelope plan, sheets 1 -10 (dated 23 Oct 2018).
- Auckland Council GeoMaps with Natural Resources and Catchment and Hydrology overlays; Google Maps; Google Earth; Auckland Unitary Plan E3, Lakes, rivers, streams and wetlands.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Freshwater Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) **Yes** ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~

	~~Criteria~~	~~[insert score]~~

~~My reasoning/justification for this is as follows:~~

3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)

Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Streamworks***
  No change from long list comments
  Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.

4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

	My reasoning/justification for this is as follows: Reasons / Comments ■ ***Criteria: Streamworks*** ***Streamworks and culvert extensions*** *Numerous sites with potential streamworks from culvert extensions or bridge widening. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.* *No change from long list comments, plus* ■ ***Criteria: West of Orrs Road- Works in wetlands and culvert extensions.*** *Potentially five wetlands in impact boundary. Works in wetlands have the potential to trigger E3; culvert extensions also come under AUP E3. The wetland in this area are impacted intermittent wetlands with likely low quality aquatic habitats. They are unlikely to support birds and highly unlikely to support fish. Impacts include loss of habitat (wetland and riparian) and loss of connectively. Adverse effects on the habitats can be removal of crossings which created the upstream wetlands, restoration of downstream habitat either as a wetland or the more probable intermittent stream. Riparian planting of the adjacent downstream habitats.*	

Notes:

Assumptions

- Under the AUP streamworks are usually non-complying or discretionary activity

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted] M.Sc.(Hons) Bioresearches
Area of assessment	Freshwater Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~
3) Rapid Transit Corridor Mangere Town Centre Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular* | -1

	on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Streamworks:***

  Crossing in/over Tararata Creek. The creek is over 5m wide at the crossing point with a band of riparian vegetation on both banks. Either a culvert or a bridge crossing will be required resulting in the loss of riparian vegetation, and disturbance or loss of aquatic habitat. None of the habitats have SEA overlays, and the quality will need to be assessed during a site visit. Effects can be mitigated with fish recovery, and weed removal, restoration and enhancement of the adjacent riparian zone.

4) 20Connect Road + RTC SH20B

Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Streamworks***

  No change from long list comments

  Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated

	through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement* : -1 My reasoning/justification for this is as follows: Reasons / Comments ■ ***Criteria: Streamworks*** *Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage,* *No change from long list comments, plus* ■ ***West of Orrs Road- Works in wetlands and culvert extensions.*** *Potentially five wetlands in impact boundary. Works in wetlands have the potential to trigger E3; culvert extensions also come under AUP E3. The wetland in this area are impacted intermittent wetlands with likely low quality aquatic habitats. They are unlikely to support birds and highly unlikely to support fish. Impacts include loss of habitat (wetland and riparian) and loss of connectively. Adverse effects on the habitats can be removal of crossings which created the upstream wetlands, restoration of downstream habitat either as a*

	wetland or the more probable intermittent stream. Riparian planting of the adjacent downstream habitats

Notes:

Assumptions

- Under the AUP streamworks are usually non-complying or discretionary activity

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Freshwater Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~

3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement*	-1	

<table>
<tr>
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<td>My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Criteria: Streamworks
No change from long list comments

Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement</td><td>-1</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Criteria: Streamworks
Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk</td>
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	top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage, No change from long list comments, plus: ■ ***Criteria: West of Orrs Road- Works in wetlands and culvert extensions.*** *Potentially five wetlands in impact boundary. Works in wetlands have the potential to trigger E3; culvert extensions also come under AUP E3. The wetland in this area are impacted intermittent wetlands with likely low quality aquatic habitats. They are unlikely to support birds and highly unlikely to support fish. Impacts include loss of habitat (wetland and riparian) and loss of connectively. Adverse effects on the habitats can be removal of crossings which created the upstream wetlands, restoration of downstream habitat either as a wetland or the more probable intermittent stream. Riparian planting of the adjacent downstream habitats*	

Notes:

Assumptions

- Under the AUP streamworks are usually non-complying or discretionary activity

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Freshwater Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows~~:
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for* | -1

<table>
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<tr><td>ecological restoration and enhancement</td><td></td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

■ Criteria:

Crossing in/over Tararata Creek. The creek is over 5m wide at the crossing point with a band of riparian vegetation on both banks. Either a culvert or a bridge crossing will be required resulting in the loss of riparian vegetation, and disturbance or loss of aquatic habitat. None of the habitats have SEA overlays, and the quality will need to be assessed during a site visit. Effects can be mitigated with fish recovery, and weed removal, restoration and enhancement of the adjacent riparian zone.
</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement</td><td>-1</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

■ Criteria: Streamworks
No change from long list comments
Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.
</td>
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</table>

5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement*	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Streamworks***
- *Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.*
- *No change from long list comments, plus*
- ***Criteria: West of Orrs Road- Works in wetlands and culvert extensions.***

  Potentially five wetlands in impact boundary. Works in wetlands have the potential to trigger E3; culvert extensions also come under AUP E3. The wetland in this area are impacted intermittent wetlands with likely low quality aquatic habitats. They are unlikely to support birds and highly unlikely to support fish. Impacts include loss of habitat (wetland and riparian) and loss of connectively. Adverse effects on the habitats can be removal of crossings which created the upstream wetlands, restoration of downstream habitat either as a wetland or the more probable intermittent stream. Riparian planting of the adjacent downstream habitats.

Notes:

Assumptions

- Under the AUP streamworks are usually non-complying or discretionary activity

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Freshwater Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for* | -1

	ecological restoration and enhancement	

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria:***

  Culvert extensions, bridge widening, stream crossings

  Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.

4) Pukaki Creek

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Streamworks***

  Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish

	and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage, No change from long list comments, plus ■ ***Criteria: West of Orrs Road- Works in wetlands and culvert extensions.*** *Potentially five wetlands in impact boundary. Works in wetlands have the potential to trigger E3; culvert extensions also come under AUP E3. The wetland in this area are impacted intermittent wetlands with likely low quality aquatic habitats. They are unlikely to support birds and highly unlikely to support fish. Impacts include loss of habitat (wetland and riparian) and loss of connectively. Adverse effects on the habitats can be removal of crossings which created the upstream wetlands, restoration of downstream habitat either as a wetland or the more probable intermittent stream. Riparian planting of the adjacent downstream habitats.*	

Notes:

Assumptions

- Under the AUP streamworks are usually non-complying or discretionary activity

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	Treffery Barnett, M.Sc.(Hons) Bioresearches
Area of assessment	Freshwater Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for* | -1

	ecological restoration and enhancement	

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria:***

  Crossing in/over Tararata Creek. The creek is over 5m wide at the crossing point with a band of riparian vegetation on both banks. Either a culvert or a bridge crossing will be required resulting in the loss of riparian vegetation, and disturbance or loss of aquatic habitat. None of the habitats have SEA overlays, and the quality will need to be assessed during a site visit. Effects can be mitigated with fish recovery, and weed removal, restoration and enhancement of the adjacent riparian zone.

4) 20Connect Road + RTC SH20B

Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Streamworks***

  No change from long list comments

Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage.

5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	*Streamworks. The Extent, nature and degree of effects on freshwater aquatic ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement*	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Streamworks***

  Culvert extensions and stream crossings. Unless the culvert extension is less than 30m, including the length of the existing culvert, then the culvert extension will be a discretionary activity. Each culvert extension will need to be individually assessed on site to determine the values of the habitats impacted, the extent of the habitat loss and impacts on habitats. Impacts include loss of habitat (aquatic and riparian), loss of native fish and other fauna, sedimentation of the downstream watercourse, loss of continuity between upstream and downstream habitats. The matters of discretion are listed in AUP E3.8. From the desk top analysis impacts will be able to be mitigated through minimizing the works area in aquatic habitats, sediment control measures and clean water diversions, replacement plantings of riparian vegetation lost, fish recovery and/or passage, No change from long list comments, plus

- ***Criteria: West of Orrs Road- Works in wetlands and culvert extensions.***

  Potentially five wetlands in impact boundary. Works in wetlands have the potential to trigger E3; culvert extensions also come under AUP E3. The wetland in this area are impacted intermittent wetlands with likely low quality aquatic habitats. They are unlikely to support birds and highly unlikely to support fish. Impacts include loss of habitat (wetland and riparian) and loss of connectively. Adverse effects on the habitats can be removal of crossings which created the upstream wetlands, restoration of downstream habitat either as a wetland or the more probable intermittent stream. Riparian planting of the adjacent downstream habitats.

Notes:

Assumptions

- Under the AUP streamworks are usually non-complying or discretionary activity

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	M.Sc.(Hons)	[redacted]	5/12/2018
Reviewer	[redacted]	M.Sc.(Hons)		5/12/2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094 / BRS61946**
Date	**2018-10-31**	Pages (including this page)	**25**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Marine Ecology**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The Marine Ecology assessments were based on:

- The 20Connect long-list technical assessment undertaken by [redacted], Bioresearches dated 19 September 2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 15 Oct 2018).
- The 20 Connect short list baseline envelope plan, sheets 1 -10 (dated 23 Oct 2018).

  Auckland Council GeoMaps with Natural Resources overlay; Google Maps; Google Earth.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Marine Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~

	~~Criteria~~	~~[insert score]~~

~~My reasoning/justification for this is as follows:~~

~~[insert text]~~

3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)

Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Potential for works in the CMA or SEA Marine***

  SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.

4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	

Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Works in the CMA & SEA Marine***

  SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.

  SEA-M2 New structure over Pukaki Creek; plus potential impact in CMA south-east of eastern abutment of Pukaki Bridge.

	SEA in reference to high quality and complex habitats for a variety of plant and animal communities, included dense populations of intertidal sand flat organisms, feeding grounds for migratory and NZ endemic wading birds, including threatened species. Mangrove habitats, coastal salt marsh and coastal riparian area. Construction effects have the potential for loss of habitat, both within the CMA and in the coastal riparian area, disturbance of at risk bird species, and increase in sedimentation. The area will need to be assessed on site to establish the quality of the habitat, Effects can be mitigated with timing of works, management, relocation of species, planting and enhancement (weed, rubbish removal).	

Notes:

Assumptions

Other Information relied upon

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Marine Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of | 0

	indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria:***
  - **Route not in or near CMA**

4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Potential for works in the CMA or SEA Marine***

  SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site

<table>
<tr><td></td><td>assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement</td><td>-1</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

■ Criteria: Works in the CMA & SEA Marine

SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.</td></tr>
</table>

	SEA-M2 New structure over Pukaki Creek; plus potential impact in CMA south-east of eastern abutment of Pukaki Bridge. *SEA in reference to high quality and complex habitats for a variety of plant and animal communities, included dense populations of intertidal sand flat organisms, feeding grounds for migratory and NZ endemic wading birds, including threatened species. Mangrove habitats, coastal salt marsh and coastal riparian area. Construction effects have the potential for loss of habitat, both within the CMA and in the coastal riparian area, disturbance of at risk bird species, and increase in sedimentation. The area will need to be assessed on site to establish the quality of the habitat, Effects can be mitigated with timing of works, management, relocation of species, planting and enhancement (weed, rubbish removal).*	

Notes:

Assumptions

Other Information relied upon

■

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Marine Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement | -1

	My reasoning/justification for this is as follows: Reasons / Comments ■ ***Criteria: Potential for works in the CMA or SEA Marine*** *SEA-M1 at Mangere Inlet, works in the vicinity SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.* *SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.* *SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.*
4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement: -1 My reasoning/justification for this is as follows: Reasons / Comments

	▪ ***Criteria: Works in the CMA & SEA Marine*** *SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.* *SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance* *SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.* *SEA-M2 New structure over Pukaki Creek; plus potential impact in CMA south-east of eastern abutment of Pukaki Bridge.* *SEA in reference to high quality and complex habitats for a variety of plant and animal communities, included dense populations of intertidal sand flat organisms, feeding grounds for migratory and NZ endemic wading birds, including threatened species. Mangrove habitats, coastal salt marsh and coastal riparian area. Construction effects have the potential for loss of habitat, both within the CMA and in the coastal riparian area, disturbance of at risk bird species, and increase in sedimentation. The area will need to be assessed on site to establish the quality of the habitat, Effects can be mitigated with timing of works, management, relocation of species, planting and enhancement (weed, rubbish removal).*	

Notes:

Assumptions

Other Information relied upon

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Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Marine Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Route not in / near CMA | 0 My reasoning/justification for this is as follows: Reasons / Comments ▪ ***Criteria:*** ***Route not in or near CMA***

4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Potential for works in the CMA or SEA Marine***

  SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.

5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs	Extent, nature and degree of effects on marine ecology, in particular on	-1

Road to the western abutment of Pukaki Bridge)	significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement		

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria: Works in the CMA & SEA Marine***

  SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

  SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work..

  SEA-M2 New structure over Pukaki Creek; plus potential impact in CMA south-east of eastern abutment of Pukaki Bridge.

  SEA in reference to high quality and complex habitats for a variety of plant and animal communities, included dense populations of intertidal sand flat organisms, feeding grounds for migratory and NZ endemic wading birds, including threatened species. Mangrove habitats, coastal salt marsh and coastal riparian area. Construction effects have the potential for loss of habitat, both within the CMA and in the coastal riparian area,

	disturbance of at risk bird species, and increase in sedimentation. The area will need to be assessed on site to establish the quality of the habitat, Effects can be mitigated with timing of works, management, relocation of species, planting and enhancement (weed, rubbish removal).	

Notes:

Assumptions

Other Information relied upon

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted] M.Sc.(Hons) Bioresearches
Area of assessment	Marine Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement: -1

<table>
<tr>
<td></td>
<td>My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Criteria: Potential for works in the CMA or SEA Marine
SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.
SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.
SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement</td><td>-1</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
</td>
</tr>
</table>

	▪ ***Criteria: Works in the CMA & SEA Marine*** *SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.* *SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.* *SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.* *SEA-M2 New structure over Pukaki Creek; plus potential impact in CMA south-east of eastern abutment of Pukaki Bridge.*	

Notes:

Assumptions

Other Information relied upon

▪

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	[redacted], M.Sc.(Hons) Bioresearches
Area of assessment	Marine Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) Rapid Transit Corridor Mangere Town Centre Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Route not in / near CMA | 0 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> ***Criteria:*** ▪ ***Route not in or near CMA***

<table>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement</td><td>-1</td></tr>
</table>

My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>

Criteria: Potential for works in the CMA or SEA Marine

SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance

SEA-M2 works in Waokauri Creek east of Campana Road. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.

</td>
</tr>
<tr>
<td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Extent, nature and degree of effects on marine ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement</td><td>-1</td></tr>
</table>

My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>

Criteria: Works in the CMA & SEA Marine

</td>
</tr>
</table>

	SEA-M1 at Mangere Inlet, works in the vicinity. SEA adjacent to bridge towards Mangere Inlet is identified as a feeding ground for thousands of international migratory and New Zealand endemic wading birds and a variety of other coastal bird species, including a number of threatened species. Impacts of works will be general disturbance to wading birds. Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance. *SEA-M2 near Walmsley Road offramp (Tararata Creek), works in the vicinity. . Potential for loss of intertidal habitat, mangroves and organisms with works. Will require on site assessment of significance.* *SEA-M2 works in Waokauri Creek east of Campana Road. SEA is in reference to high quality and complex habitats for plant and animal communities, including in the upper reaches significant area of mangroves with batchelor's button meadows on the fringe in places. Banded rail, fernbird and marsh crake. The quality of habitats and presence/absence of threatened bird species will need to be determined by on site assessment. Impacts will dominantly be construction impacts rather than operational and include loss of habitat, disturbance of rare or endangered birds, with the highest impacts specifically during the breeding season, which can be mitigated by the timing of the work.* *SEA-M2 New structure over Pukaki Creek; plus potential impact in CMA south-east of eastern abutment of Pukaki Bridge.* *SEA in reference to high quality and complex habitats for a variety of plant and animal communities, included dense populations of intertidal sand flat organisms, feeding grounds for migratory and NZ endemic wading birds, including threatened species. Mangrove habitats, coastal salt marsh and coastal riparian area. Construction effects have the potential for loss of habitat, both within the CMA and in the coastal riparian area, disturbance of at risk bird species, and increase in sedimentation. The area will need to be assessed on site to establish the quality of the habitat, Effects can be mitigated with timing of works, management, relocation of species, planting and enhancement (weed, rubbish removal).*

Notes:

Assumptions

Other Information relied upon

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	M.Sc.(Hons)	[redacted]	5/12/2018
Reviewer	[redacted]	M.Sc.(Hons)		5/12/2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094 / BRS61946**
Date	**2018-10-31**	Pages (including this page)	**20**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Terrestrial Ecology**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The Marine Ecology assessments were based on:

- The 20Connect long-list technical assessment undertaken by [redacted], Bioresearches dated 19 September 2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 15 Oct 2018).
- The 20 Connect short list baseline envelope plan, sheets 1 -10 (dated 23 Oct 2018).
- Auckland Council GeoMaps with Natural Resources overlays; Google Maps; Google Earth.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted] M.Sc.(Hons)
Area of assessment	Terrestrial Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by the reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~

<table>
<tr><td></td><td><table><tr><td>~~Criteria~~</td><td>~~[insert score]~~</td></tr></table>
~~My reasoning/justification for this is as follows:~~</td></tr>
<tr><td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td><td><table><tr><td>Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.</td><td>-1</td></tr></table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Criteria:
Upper tributaries of Waokauri Creek with contiguous vegetation linking with extensive riparian vegetation of SEA Marine 2 areas.ie. contiguous habitat that would be severed and reduced. Could be mitigated, however, by post-construction replanting, pre-construction mitigation – refer below.
SEA terrestrial in vicinity and south of Cavendish Drive ramps. Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna - will need to be assessed at detailed design & works in an SEA via field survey.
■ Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna will need to be assessed at detailed design via field survey. e.g. at Memorial Gardens and Tararata Creek.
■ Banded rail and other coastal birds use the terrestrial / marine interface – known presence of banded rail in Mangere Inlet, potential in the other areas of the CMA. Mitigated by timing to avoid breeding season for banded rail and other at-risk birds to protect eggs and juveniles, pre-construction survey and lizard management plan to ensure adverse effects on any protected herpetofauna are minimised; replacement planting for loss of indigenous vegetation for habitat loss.
■ Notable tree
■</td></tr>
<tr><td>4) Pukaki Creek</td><td><table><tr><td>Extent, nature and degree of effects on</td><td>-1</td></tr></table></td></tr>
</table>

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria:***

  No change from No.3 above as the new extent from Orrs Road to the western abutment of Pukaki Bridge has no no significant terrestrial habitats and/or values – heavily modified farmland.

Notes:

Assumptions

Other Information relied upon

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted] M.Sc.(Hons)
Area of assessment	Terrestrial Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1)	**Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2)	**Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~
3)	**Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and / -1

	vegetation, and opportunities for ecological restoration and enhancement.	

Reasons / Comments

Areas of continuous established vegetation that may support protected herpetofauna in the crossing at Tarata Creek - will need to be assessed at detailed design via field survey. Mitigated by a lizard management plant to ensure adverse effects on any protected herpetofauna are minimised, replacement planting for loss of any indigenous vegetation.

4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1

My reasoning/justification for this is as follows:

My reasoning/justification for this is as follows:

Reasons / Comments

Criteria:

Upper tributaries of Waokauri Creek with contiguous vegetation linking with extensive riparian vegetation of SEA Marine 2 areas.ie. contiguous habitat that would be severed and reduced. Could be mitigated, however, by post-construction replanting, pre-construction mitigation – refer below.

SEA terrestrial in vicinity and south of Cavendish Drive ramps. Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna - will need to be assessed at detailed design & works in an SEA via field survey.

Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna will need to be assessed at detailed design via field survey. e.g. at Memorial Gardens and Tararata Creek.

Banded rail and other coastal birds use the terrestrial / marine interface – known presence of banded rail in Mangere Inlet, potential in the other areas of the CMA. Mitigated by timing to avoid breeding season for banded rail and other at-risk birds to protect eggs and juveniles, pre-construction survey and lizard

<table>
<tr><td></td><td>management plan to ensure adverse effects on any protected herpetofauna are minimised; replacement planting for loss of indigenous vegetation for habitat loss.

Notable tree

.</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td><table><tr><td>Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.</td><td>-1</td></tr></table>
My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

■ Criteria:

No change from No. 4 above as the new extent from Orrs Road to the western abutment of Pukaki Bridge has no no significant terrestrial habitats and/or values – heavily modified farmland.</td></tr>
</table>

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	Graham Don M.Sc.(Hons)
Area of assessment	Terrestrial Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **20Connect Road + RTC SH20B** Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. | -1

My reasoning/justification for this is as follows:

Reasons / Comments

Reasons / Comments

Criteria:

Upper tributaries of Waokauri Creek with contiguous vegetation linking with extensive riparian vegetation of SEA Marine 2 areas.ie. contiguous habitat that would be severed and reduced. Could be mitigated, however, by post-construction replanting, pre-construction mitigation – refer below.

SEA terrestrial in vicinity and south of Cavendish Drive ramps. Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna - will need to be assessed at detailed design & works in an SEA via field survey.

Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna will need to be assessed at detailed design via field survey. e.g. at Memorial Gardens and Tararata Creek.

Banded rail and other coastal birds use the terrestrial / marine interface – known presence of banded rail in Mangere Inlet, potential in the other areas of the CMA. Mitigated by timing to avoid breeding season for banded rail and other at-risk birds to protect eggs and juveniles, pre-construction survey and lizard management plan to ensure adverse effects on any protected herpetofauna are minimised; replacement planting for loss of indigenous vegetation for habitat loss.

4) Pukaki Creek

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.	-1

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Criteria:***

No change from No.3 above as the new extent from Orrs Road to the western abutment of Pukaki Bridge has no no

	significant terrestrial habitats and/or values – heavily modified farmland.

Notes:

Assumptions

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted] M.Sc.(Hons)
Area of assessment	Terrestrial Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. | -1

	My reasoning/justification for this is as follows: Reasons / Comments *Areas of continuous established vegetation that may support protected herpetofauna in the crossing at Tarata Creek - will need to be assessed at detailed design via field survey. Mitigated by a lizard management plant to ensure adverse effects on any protected herpetofauna are minimised, replacement planting for loss of any indigenous vegetation.*
4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. — -1 My reasoning/justification for this is as follows: Reasons / Comments ▪ ***Criteria:*** ▪ *Upper tributaries of Waokauri Creek with contiguous vegetation linking with extensive riparian vegetation of SEA Marine 2 areas.ie. contiguous habitat that would be severed and reduced. Could be mitigated, however, by post-construction replanting, pre-construction mitigation – refer below.* *SEA terrestrial in vicinity and south of Cavendish Drive ramps. Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna - will need to be assessed at detailed design & works in an SEA via field survey.* *Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna will need to be assessed at detailed design via field survey. e.g. at Memorial Gardens and Tararata Creek.* *Banded rail and other coastal birds use the terrestrial / marine interface – known presence of banded rail in Mangere Inlet, potential in the other areas of the CMA. Mitigated by timing to avoid breeding season for banded rail and other at-risk birds to protect eggs and juveniles, pre-construction survey and lizard management plan to ensure adverse effects on any protected herpetofauna are minimised; replacement*

<table>
<tr><td></td><td>planting for loss of indigenous vegetation for habitat loss.</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.</td><td>-1</td></tr>
</table>

My reasoning/justification for this is as follows:

Reasons / Comments

■ Criteria:

No change from No.4 above as the new extent from Orrs Road to the western abutment of Pukaki Bridge has no no significant terrestrial habitats and/or values – heavily modified farmland.</td></tr>
</table>

Notes:

Assumptions

Other Information relied upon

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted] M.Sc.(Hons)
Area of assessment	Terrestrial Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ / ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. / -1

<table>
<tr>
<td></td>
<td>My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
<u>Reasons / Comments</u>
Criteria:
Upper tributaries of Waokauri Creek with contiguous vegetation linking with extensive riparian vegetation of SEA Marine 2 areas.ie. contiguous habitat that would be severed and reduced. Could be mitigated, however, by post-construction replanting, pre-construction mitigation – refer below.
SEA terrestrial in vicinity and south of Cavendish Drive ramps. Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna - will need to be assessed at detailed design & works in an SEA via field survey.
Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna will need to be assessed at detailed design via field survey. e.g. at Memorial Gardens and Tararata Creek.
Banded rail and other coastal birds use the terrestrial / marine interface – known presence of banded rail in Mangere Inlet, potential in the other areas of the CMA. Mitigated by timing to avoid breeding season for banded rail and other at-risk birds to protect eggs and juveniles, pre-construction survey and lizard management plan to ensure adverse effects on any protected herpetofauna are minimised; replacement planting for loss of indigenous vegetation for habitat loss.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement.</td><td>-1</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Criteria:
</td>
</tr>
</table>

	No change from No.3 above as the new extent from Orrs Road to the western abutment of Pukaki Bridge has no no significant terrestrial habitats and/or values – heavily modified farmland.

Notes:

Assumptions

Other Information relied upon

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	[redacted] Sc.(Hons)
Area of assessment	Terrestrial Ecology

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ ~~Criteria~~ | ~~[insert score]~~ ~~My reasoning/justification for this is as follows:~~ ~~[insert text]~~
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. | -1

	My reasoning/justification for this is as follows: Reasons / Comments *Areas of continuous established vegetation that may support protected herpetofauna in the crossing at Tarata Creek - will need to be assessed at detailed design via field survey. Mitigated by a lizard management plant to ensure adverse effects on any protected herpetofauna are minimised, replacement planting for loss of any indigenous vegetation..*
4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. — -1 My reasoning/justification for this is as follows: Reasons / Comments ▪ ***Criteria:*** Reasons / Comments ***Criteria:*** *Upper tributaries of Waokauri Creek with contiguous vegetation linking with extensive riparian vegetation of SEA Marine 2 areas.ie. contiguous habitat that would be severed and reduced. Could be mitigated, however, by post-construction replanting, pre-construction mitigation – refer below.* *SEA terrestrial in vicinity and south of Cavendish Drive ramps. Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna - will need to be assessed at detailed design & works in an SEA via field survey.* *Areas of established vegetation and/or weedy scrub and /or debris that may support protected herpetofauna will need to be assessed at detailed design via field survey. e.g. at Memorial Gardens and Tararata Creek.* *Banded rail and other coastal birds use the terrestrial / marine interface – known presence of banded rail in Mangere Inlet, potential in the other areas of the CMA. Mitigated by timing to avoid breeding season for banded rail and other at-risk birds to protect eggs and juveniles, pre-construction survey and lizard management plan to ensure adverse effects on any protected herpetofauna are minimised; replacement*

	planting for loss of indigenous vegetation for habitat loss.
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	Extent, nature and degree of effects on terrestrial ecology, in particular on significant habitats of indigenous fauna and vegetation, and opportunities for ecological restoration and enhancement. : -1 My reasoning/justification for this is as follows: Reasons / Comments ▪ ***Criteria:*** *No change from No.4 above as the new extent from Orrs Road to the western abutment of Pukaki Bridge has no no significant terrestrial habitats and/or values – heavily modified farmland.*

Notes:

Assumptions

Other Information relied upon

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	M.Sc.(Hons)	[redacted]	5/12/2018
Reviewer	[redacted]	M.Sc.(Hons)		5/12/2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**20181171 / 501094**
Date	**2018-10-28**	Pages (including this page)	**20**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Acoustics**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The noise and vibration assessments were based on:

- The 20Connect long-list technical assessment undertaken by [redacted] (Aurecon) dated 3 September 2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018).
- New Zealand Standard 6806:2010 Acoustics – Road-traffic noise – New and altered roads
- New Zealand Standard 6803:1999 Acoustics – Construction Noise
- Auckland Unitary Plan – Operative in Part (updated 26 October 2018) (AUP)
- MDA noise level measurements for trams and light rail, and assumed noise levels for electric buses

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:		
Name of assessor (incl. qualifications and organisation)	[redacted] (Marshall Day Acoustics)	MEnvEng MASNZ
Area of assessment	Acoustics	

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I consider the reasoning and scoring of the long list criteria (for the applicable extent) suitable and have no alternative response Yes Operational noise and vibration: -1 – Minor Adverse Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows: Operation of a new offline road next to Puhinui Road provides opportunity to implement mitigation. The road will be elevated; therefore road edge barriers will be effective. As the Future Urban land is not currently developed, mitigation is only required by the road noise standard in a limited form, if at all, for PPFs that remain. Most existing dwellings would be demolished to allow the construction of the new road. Mitigation should be considered for the Memorial Gardens. Construction noise and vibration would need to be assessed at the time of construction. Either the designation area makes allowance for a construction buffer to avoid any non-compliance, or there will likely be some exceedance of noise criteria at times. However, vibration should comply with the choice of appropriate construction methodologies.

<table>
<tr>
<td>2) Rapid Transit Corridor
Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment</td>
<td>I confirm that I consider the reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) suitable and have no alternative response

Yes

<table>
<tr><td>Operational noise and vibration</td><td>0 – Neutral</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor Adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

The RTC would be implemented in the Light Industry Zone. This zone does not contain PPFs (unless hotels or similar may be operated). For that reason, I would class the RTC as 0 – Neutral for operation.
Construction noise and vibration would need to be assessed at the time of construction. Either, the designation makes allowance for a construction buffer to avoid any non-compliance, or, since the land is likely to be developed by the time of project construction, it is likely that noise criteria will be exceeded at times, however, vibration criteria should comply with appropriate choice of methodology.</td>
</tr>
<tr>
<td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criterion for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>0 – Neutral</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor Adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

■ Operational noise and vibration:
– Operational vibration will be negligible
– Operational noise effects will only affect PPFs that existing (or have building consent). Most will be demolished for the construction, or if they still exist, can be mitigated. Elevated road means barriers will be effective. Only limited PPFs in the area. RTC in industrial zone.
– Overall, effects will be neutral due to lack of PPFs or, if PPFs are in the area, the opportunity to mitigate appropriately
■ Construction noise and vibration:
– Construction effects need to be assessed against what exists at the time of construction. Since this is unknown, it is likely that noise limits would be exceeded at times (common for such large infrastructure projects).
</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>

Option is to include a buffer in the designation to ensure that no building can be built too close to the actual alignment. – Risk reduction, but more land will be taken.
Construction vibration should be able to be managed to comply with relevant limits. Again, a buffer would ensure that there are no issues, however, choice of methodology would generally enable compliance.

</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>0 – Neutral</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor Adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>

Operational noise and vibration:

No additional PPFs or sensitive environments, reasons as per above

Construction noise and vibration:

Works in the CMA – additional assessment and potentially having to deal with piling in the CMA – assessment of underwater noise of marine fauna – however, still considered to be -1 only
No additional receivers apart from CMA – reasons as per above

</td>
</tr>
</table>

Notes:

<u>Assumptions</u>

- Strict application of NZS6806 – only existing or building consented PPFs are considered, no allowance for future zoning

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:		
Name of assessor (incl. qualifications and organisation)	[redacted] (Marshall Day Acoustics)	MEnvEng MASNZ
Area of assessment	Acoustics	

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I consider the reasoning and scoring of the long list criteria (for the applicable extent) suitable and have no alternative response Yes Operational noise and vibration: -1 – Minor Adverse Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows: Operation of a new offline road next to Puhinui Road provides opportunity to implement mitigation. The road will be elevated; therefore road edge barriers will be effective. As the Future Urban land is not currently developed, mitigation is only required by the road noise standard in a limited form, if at all, for PPFs that remain. Most existing dwellings would be demolished to allow the construction of the new road. Mitigation should be considered for the Memorial Gardens. Construction noise and vibration will need to be assessed at the time of construction. Either the designation area makes allowance for a construction buffer to avoid any non-compliance, or there would likely be some exceedance of noise criteria at times. However, vibration should comply with the choice of appropriate construction methodologies.
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only	I confirm that I consider the reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) suitable and have no alternative response No No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:

<table>
<tr>
<td>refers to the segments of RTC directly adjacent SH20 and SH20A.</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>-2 – Moderate/significant adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

No change to construction noise and vibration.

Operational noise: Large number of PPFs. These are currently protected by a bund along SH20. Both the bund and the first row of houses would be demolished according to the plans. Robertson Road School affected also. Barriers of significant height would likely be required along SH20. Separation distance will be less, and any double storey dwellings that are currently well removed and somewhat shielded, would lose that benefit (likely even with a barrier). Even more pronounced with a SUP.
</td>
</tr>
<tr>
<td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>0 – Neutral</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

Operational noise and vibration:

No details on where RTC will go, but assumed in middle of road. Traffic lanes may push out slightly – unlikely to result in noticeable effects, and therefore mitigation also unlikely to be required.

Construction noise and vibration:

Construction methodology likely to be as for normal road (or light rail) – unlikely to cause unusual construction effects. Likely to have some exceedances of noise criteria, and potentially some night time works to avoid disruption to traffic.

</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criterion for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Moderate adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

Operational noise and vibration:

Significant effects adjacent to SH20, but lesser or no effects adjacent to other parts of the project.

</td>
</tr>
</table>

<table>
<tr><td></td><td>
– Can be mitigated, but may require extensive barriers
– Not all effects can be fully mitigated
■ Construction noise and vibration:
– Normal construction effects, some exceedance likely but not unusual and can be dealt with through CNVMP and similar mechanisms
</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Moderate adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Operational noise and vibration:
– No additional PPFs or sensitive environments, reasons as per above
■ Construction noise and vibration:
– Works in the CMA – additional assessment and potentially having to deal with piling in the CMA – assessment of underwater noise of marine fauna – however, still considered to be -1 only
– No additional receivers apart from CMA – reasons as per above
</td></tr>
</table>

Notes:

<u>Assumptions</u>

- Strict application of NZS6806 – only existing or building consented PPFs are considered, no allowance for future zoning

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:		
Name of assessor (incl. qualifications and organisation)	[redacted] (Marshall Day Acoustics)	MEnvEng MASNZ
Area of assessment	Acoustics	

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I consider the reasoning and scoring of the long list criteria (for the applicable extent) suitable and have no alternative response Yes Operational noise and vibration: -1 – Minor Adverse Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows: Widening of Puhinui Road provides opportunity to implement mitigation if required. Some mitigation may be compromised to due access to properties, use barrier between widened road and service road. As the Future Urban land is not currently developed, mitigation is only required by the road noise standard in a limited form, if at all, for PPFs that remain. Some existing dwellings would be demolished to allow the construction of the widening. Mitigation should be considered for the Memorial Gardens. Construction noise and vibration will need to be assessed at the time of construction. Either, the designation area makes allowance for a construction buffer to avoid any non-compliance, or there would likely be some exceedance of noise criteria at times. However, vibration should comply with the choice of appropriate construction methodologies.
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I consider the reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) suitable and have no alternative response Yes Operational noise and vibration: 0 – Neutral Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows:

<table>
<tr><td></td><td>The RTC would be implemented in the Light Industry Zone. This zone does not contain PPFs (unless hotels or similar may be operated). For that reason, I would class the RTC as 0 – Neutral for operation. In addition, the SUP provides further buffer to any potential PPF in the Light Industrial zone.
Construction noise and vibration would need to be assessed at the time of construction. Either the designation makes allowance for a construction buffer to avoid any non-compliance, or, since the land is likely to be developed by the time of project construction, it is likely that noise criteria would be exceeded at times, however, vibration criteria should comply with appropriate choice of methodology.</td></tr>
<tr><td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criterion for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Minor Adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor Adverse</td></tr>
</table>

My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>

Operational noise and vibration:

Operational vibration will be negligible
Operational noise effects will only affect PPFs that are existing (or have building consent). Some will be demolished for the construction. Those that remain can generally be mitigated by locating a barrier between the widened road and the service road. Some effects on existing PPFs.

Construction noise and vibration:

Construction effects need to be assessed against what exists at the time of construction. Since this is unknown, it is likely that noise limits would be exceeded at times (common for such large infrastructure projects).
Option is to include a buffer in the designation to ensure that no building can be built too close to the actual alignment. – Risk reduction, but more land will be taken.
Construction vibration should be able to be managed to comply with relevant limits. Again, a buffer would ensure that there are no issues, however, choice of methodology will generally enable compliance.

</td></tr>
<tr><td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Minor adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
</td></tr>
</table>

Road to the western abutment of Pukaki Bridge)	My reasoning/justification for this is as follows: Reasons / Comments ■ ***Operational noise and vibration:*** – No additional PPFs or sensitive environments, reasons as per above ■ ***Construction noise and vibration:*** – Works in the CMA – additional assessment and potentially having to deal with piling in the CMA – assessment of underwater noise of marine fauna – however, still considered to be -1 only No additional receivers apart from CMA – reasons as per above

Notes:

Assumptions

- Strict application of NZS6806 – only existing or building consented PPFs are considered, no allowance for future zoning

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:		
Name of assessor (incl. qualifications and organisation)	[redacted] (Marshall Day Acoustics)	MEnvEng MASNZ
Area of assessment	Acoustics	

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I consider the reasoning and scoring of the long list criteria (for the applicable extent) suitable and have no alternative response Yes Operational noise and vibration: -1 – Minor Adverse Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows: Widening of Puhinui Road provides opportunity to implement mitigation if required. Some mitigation may be compromised to due access to properties, use barrier between widened road and service road. As the Future Urban land is not currently developed, mitigation is only required by the road noise standard in a limited form, if at all, for PPFs that remain. Some existing dwellings would be demolished to allow the construction of the widening. Mitigation should be considered for the Memorial Gardens. The SUP will not generate operational noise. Construction noise and vibration will need to be assessed at the time of construction. Either the designation area makes allowance for a construction buffer to avoid any non-compliance, or there would likely be some exceedance of noise criteria at times. However, vibration should comply with the choice of appropriate construction methodologies.
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I consider the reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) suitable and have no alternative response No No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be: Operational noise and vibration: -2 – Moderate/significant adverse Construction noise and vibration: -1 – Minor adverse

<table>
<tr>
<td></td>
<td>My reasoning/justification for this is as follows:

No change to construction noise and vibration.

Operational noise: Large number of PPFs. These are currently protected by a bund along SH20. Both the bund and the first row of houses would be demolished according to the plans. Robertson Road School affected also. Barriers of significant height would likely be required along SH20. Separation distance will be less, and any double storey dwellings that are currently well removed and somewhat shielded, would lose that benefit (likely even with a barrier). Even more pronounced with a SUP.</td>
</tr>
<tr>
<td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>0 – Neutral</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Operational noise and vibration:
– No details on where RTC will go, but assumed in middle of road. Traffic lanes may push out slightly – unlikely to result in noticeable effects and therefore mitigation also unlikely to be required.
■ Construction noise and vibration:
– Construction methodology likely to be as for normal road (or light rail) – unlikely to cause unusual construction effects. Likely to have some exceedances of noise criteria, and potentially some night time works to avoid disruption to traffic.
</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criterion for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Moderate adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Operational noise and vibration:
– Significant effects adjacent to SH20, but lesser or no effects adjacent to other parts of the project.
– Can be mitigated, but may require extensive barriers
– Not all effects can be fully mitigated
■ Construction noise and vibration:
</td>
</tr>
</table>

<table>
<tr><td></td><td>
Normal construction effects, some exceedance likely but not unusual and can be dealt with through CNVMP and similar mechanisms
</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Moderate adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

Operational noise and vibration:
No additional PPFs or sensitive environments, reasons as per above
Construction noise and vibration:
Works in the CMA – additional assessment and potentially having to deal with piling in the CMA – assessment of underwater noise of marine fauna – however, still considered to be -1 only

No additional receivers apart from CMA – reasons as per above
</td></tr>
</table>

Notes:

<u>Assumptions</u>

- Strict application of NZS6806 – only existing or building consented PPFs are considered, no allowance for future zoning

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:		
Name of assessor (incl. qualifications and organisation)	[redacted] (Marshall Day Acoustics)	MEnvEng MASNZ
Area of assessment	Acoustics	

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I consider the reasoning and scoring of the long list criteria (for the applicable extent) suitable and have no alternative response Yes Operational noise and vibration: -1 – Minor Adverse Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows: Widening of Puhinui Road provides opportunity to implement mitigation if required. Some mitigation may be compromised to due access to properties, use barrier between widened road and service road. As the Future Urban land is not currently developed, mitigation is only required by the road noise standard in a limited form, if at all, for PPFs that remain. Some existing dwellings would be demolished to allow the construction of the widening. Mitigation should be considered for the Memorial Gardens. Construction noise and vibration would need to be assessed at the time of construction. Either, the designation area makes allowance for a construction buffer to avoid any non-compliance, or there would likely be some exceedance of noise criteria at times. However, vibration should comply with the choice of appropriate construction methodologies.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I consider the reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) suitable and have no alternative response Yes Operational noise and vibration: 0 – Neutral Construction noise and vibration: -1 – Minor Adverse My reasoning/justification for this is as follows:

<table>
<tr><td></td><td>The RTC would be implemented in the Light Industry Zone. This zone does not contain PPFs (unless hotels or similar may be operated). For that reason, I would class the RTC as 0 – Neutral for operation. In addition, the SUP provides further buffer to any potential PPF in the Light Industrial zone.
Construction noise and vibration will need to be assessed at the time of construction. Either, the designation makes allowance for a construction buffer to avoid any non-compliance, or, since the land is likely to be developed by the time of project construction, it is likely that noise criteria would be exceeded at times, however, vibration criteria should comply with appropriate choice of methodology.</td></tr>
<tr><td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Minor Adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor Adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Operational noise and vibration:
– Operational vibration will be negligible
– Operational noise effects will only affect PPFs that are existing (or have building consent). Some will be demolished for the construction. Those that remain can generally be mitigated by locating a barrier between the widened road and the service road. Some effects on existing PPFs.
■ Construction noise and vibration:
– Construction effects need to be assessed against what exists at the time of construction. Since this is unknown, it is likely that noise limits would be exceeded at times (common for such large infrastructure projects).
– Option is to include a buffer in the designation to ensure that no building can be built too close to the actual alignment. – Risk reduction, but more land will be taken.
– Construction vibration should be able to be managed to comply with relevant limits. Again, a buffer will ensure that there are no issues, however, choice of methodology will generally enable compliance.
</td></tr>
<tr><td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Minor adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
</td></tr>
</table>

Road to the western abutment of Pukaki Bridge)	My reasoning/justification for this is as follows: Reasons / Comments ■ ***Operational noise and vibration:*** – No additional PPFs or sensitive environments, reasons as per above ■ ***Construction noise and vibration:*** – Works in the CMA – additional assessment and potentially having to deal with piling in the CMA – assessment of underwater noise of marine fauna – however, still considered to be -1 only No additional receivers apart from CMA – reasons as per above

Notes:

Assumptions

- Strict application of NZS6806 – only existing or building consented PPFs are considered, no allowance for future zoning

Table 6 Multi Criteria Analysis Scoring Sheet

<table>
<tr><th colspan="3">Option 3b:</th></tr>
<tr><td>Name of assessor (incl. qualifications and organisation)</td><td>[redacted] (Marshall Day Acoustics)</td><td>MEnvEng MASNZ</td></tr>
<tr><td>Area of assessment</td><td colspan="2">Acoustics</td></tr>
<tr><td colspan="3">Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:</td></tr>
<tr><td>1) Puhinui Interchange to Orrs Road
Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)</td><td colspan="2">I confirm that I consider the reasoning and scoring of the long list criteria (for the applicable extent) suitable and have no alternative response

Yes

<table><tr><td>Operational noise and vibration</td><td>-1 – Minor Adverse</td></tr><tr><td>Construction noise and vibration</td><td>-1 – Minor Adverse</td></tr></table>
My reasoning/justification for this is as follows:

Widening of Puhinui Road provides opportunity to implement mitigation if required. Some mitigation may be compromised to due access to properties, use barrier between widened road and service road. As the Future Urban land is not currently developed, mitigation is only required by the road noise standard in a limited form, if at all, for PPFs that remain. Some existing dwellings would be demolished to allow the construction of the widening. Mitigation should be considered for the Memorial Gardens.
The SUP will not generate operational noise.
Construction noise and vibration will need to be assessed at the time of construction. Either, the designation area makes allowance for a construction buffer to avoid any non-compliance, or there would likely be some exceedance of noise criteria at times. However, vibration should comply with the choice of appropriate construction methodologies.</td></tr>
<tr><td>2) Rapid Transit Corridor
Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.</td><td colspan="2">I confirm that I consider the reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) suitable and have no alternative response

No

No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:

<table><tr><td>Operational noise and vibration</td><td>-2 – Moderate/significant adverse</td></tr><tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr></table></td></tr>
</table>

<table>
<tr>
<td></td>
<td>My reasoning/justification for this is as follows:

No change to construction noise and vibration.

Operational noise: Large number of PPFs. These are currently protected by a bund along SH20. Both the bund and the first row of houses would be demolished according to the plans. Robertson Road School affected also. Barriers of significant height would likely be required along SH20. Separation distance will be less, and any double storey dwellings that are currently well removed and somewhat shielded, would lose that benefit (likely even with a barrier). Even more pronounced with a SUP.</td>
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<td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>0 – Neutral</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Operational noise and vibration:
– No details on where RTC will go, but assumed in middle of road. Traffic lanes may push out slightly – unlikely to result in noticeable effects and therefore mitigation also unlikely to be required.
■ Construction noise and vibration:
– Construction methodology likely to be as for normal road (or light rail) – unlikely to cause unusual construction effects. Likely to have some exceedances of noise criteria, and potentially some night time works to avoid disruption to traffic.
</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Moderate adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Operational noise and vibration:
– Significant effects adjacent to SH20, but lesser or no effects adjacent to other parts of the project.
– Can be mitigated, but may require extensive barriers
– Not all effects can be fully mitigated
■ Construction noise and vibration:
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<tr><td></td><td>
Normal construction effects, some exceedance likely but not unusual and can be dealt with through CNVMP and similar mechanisms
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<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Operational noise and vibration</td><td>-1 – Moderate adverse</td></tr>
<tr><td>Construction noise and vibration</td><td>-1 – Minor adverse</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

Operational noise and vibration:
No additional PPFs or sensitive environments, reasons as per above
Construction noise and vibration:
Works in the CMA – additional assessment and potentially having to deal with piling in the CMA – assessment of underwater noise of marine fauna – however, still considered to be -1 only

No additional receivers apart from CMA – reasons as per above
</td></tr>
</table>

Notes:

<u>Assumptions</u>

- Strict application of NZS6806 – only existing or building consented PPFs are considered, no allowance for future zoning

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	MEnvEng MASNZ	[redacted]	28/10/21018
Reviewer	[redacted]	Bsc (Hons) MASNZ MIOA		29/10/2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094**
Date	**2018-11-28**	Pages (including this page)	**18**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Social**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The social assessments were based on:

- The 20Connect long-list technical assessment undertaken by [redacted] and [redacted] dated 27 August 2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018).
- Environmental Context Maps (20Connect Single-Stage Business Case Part A: Strategic Context dated 13 August 2018).
- Auckland Plan 2050 (accessed August 2018).
- Southern Initiative (accessed August 2018).

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted] BPlan (Hons) Consultant, Environment and Planning, Aurecon.
Area of assessment	Social

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes My reasoning/justification for this is as follows: ▪ The removal of the additional motorway lanes and RTC along SH20 between the interchanges with SH20A and SH20B does reduce the number of properties/communities impacted but the potential impacts along the other sections of SH20 and SH20B still warrant the same scoring of -2 for Community impact.		
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes My reasoning/justification for this is as follows: ▪ The RTC will not have any additional adverse or positive effects above what has been scored as part of the long list options for A2B (where it scored a 1 for Accessibility, -2 for Community, and -1 for Health and Safety).		
3) 20Connect Road + RTC SH20B	Accessibility	2 (Moderate positive)	

Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	<table><tr><td>Community</td><td>-2 (Significant adverse)</td></tr><tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr></table> My reasoning/justification for this is as follows: <u>Reasons / Comments</u> ■ Criteria: Accessibility – Cumulatively, there would be more substantial benefits for those lacking access to a private vehicle with more opportunities to access businesses, social infrastructure and the Airport precinct. ■ Criteria: Community – Given the road corridor and RTC alignments are adjacent to each other, there will not be any more significant or unmitigatable adverse effects above what was scored for the long list assessment. ■ Criteria: Health and safety – No change to long list scoring. It is not expected that there be any significant additional adverse effects as a result of the two projects occurring adjacent to each other.	
4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Accessibility</td><td>2 (Moderate positive)</td></tr><tr><td>Community</td><td>-2 (Significant adverse)</td></tr><tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr></table> My reasoning/justification for this is as follows: ■ No changes are proposed to the scoring as a result of the inclusion of the section between Orrs Rd and the Pukaki Creek bridge. This area lies within the Airport complex is not widely accessed or use for any known formal recreational or commercial purposes by the general public. The Pukaki-Waiokauri Creek is reserved for the exclusive use by Te Akitai and Te Ahiwaru o Waiohua and is not known for recreational fishing or boating access by the wider community.	

Notes:

Assumptions

- The SUP along SH20 can largely be accommodated completely within the existing designation (including construction footprint).
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this short list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property impacts are being assessed separated by NZTA and AT appointed property advisors. This technical note assesses social impacts only with high level commentary on potential economic and property impacts with relation to social effects. Where the same land parcels are required for the State highway works and the RTC, the land would be acquired for both components to avoid further property acquisition from the same property owners.
- Community profiling or social baseline has not been carried out for this short list assessment.

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted] BPlan (Hons) Consultant, Environment and Planning, Aurecon.
Area of assessment	Social

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes My reasoning/justification for this is as follows: ▪ The removal of the additional motorway lanes along SH20 between the interchanges with SH20A and SH20B does reduce the number of properties/communities impacted but the potential impacts along other sections of SH20 and SH20B still warrant the same scoring of -2 for Community impact.
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) No In light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be: Accessibility: 1 (Minor positive) Community: -1 (Minor adverse) Health and safety: -1 (Minor adverse) My reasoning/justification for this is as follows: ▪ The number of properties impacted (and potential communities) by the RTC is likely to be significantly less than in the long list assessment as a result of the additional motorway lanes not being included in this

<table>
<tr><td></td><td>option which leaves more space within the extent of the designation for the RTC and SUP. This is likely to have a reduced impact on the community which borders SH20 and therefore the scoring for Community has been lowered to -1.</td></tr>
<tr><td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td><td>
<table>
<tr><td>Accessibility</td><td>2 (Moderate positive)</td></tr>
<tr><td>Community</td><td>-2 (Significant adverse)</td></tr>
<tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Criteria: Accessibility
– There is currently only one motorway off-ramp near the area to access the Mangere Town Centre (from northbound lanes at Bader Drive off SH20A). This RTC connection would provide a key public transport link to the Mangere Town Centre which does not currently exist which could provide substantial benefits in terms of accessibility for the Mangere community.
■ Criteria: Community
– Potential for direct property impacts along Bader Drive and within the Mangere Town Centre which would have adverse impacts on the community. The potential impact relates to community severance or sense of community following property acquisition, the loss of services and businesses, including potential alteration to the operation and functionality of the Sir Douglas Intermediate School.
■ Criteria: Health and safety
– Sensitive receivers along Bader Drive (including residential and educational properties) may experience adverse amenity (e.g. air quality, noise and vibration) impacts during construction which could be managed through Stakeholder and Communication Plans and Construction Management Plans.
</td></tr>
<tr><td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td><td>
<table>
<tr><td>Accessibility</td><td>3 (Significant positive)</td></tr>
<tr><td>Community</td><td>-2 (Significant adverse)</td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr>
</table>

My reasoning/justification for this is as follows:
■ The addition of the link to Mangere Town Centre provides additional benefits in relation to accessibility and connections to the City Centre LRT which is greater than solely the RTC along SH20 where it does provide a direct connection to a local town centre.
■ Likely to be additional property impacts including sensitive receivers and local businesses at the Mangere Town Centre which would see the Community impact scored as -2.
</td>
</tr>
<tr>
<td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Accessibility</td><td>3 (Significant positive)</td></tr>
<tr><td>Community</td><td>-2 (Significant adverse)</td></tr>
<tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr>
</table>

My reasoning/justification for this is as follows:
■ No changes are proposed to the scoring as a result of the inclusion of the section between Orrs Rd and the Pukaki Creek bridge. This area lies within the Airport complex is not widely accessed or use for any known formal recreational or commercial purposes by the general public. The Pukaki-Waiokauri Creek is reserved for the exclusive use by Te Akitai and Te Ahiwaru o Waiohua and is not known for recreational fishing or boating access by the wider community.
</td>
</tr>
</table>

Notes:

Assumptions

- The RTC and SUP along SH20 cannot be accommodated completely within the existing designation (including construction footprint).
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this short list assessment.
- The assumed ‘study area’ for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property impacts are being assessed separated by NZTA and AT appointed property advisors. This technical note assesses social impacts only with high level commentary on potential economic and property impacts with relation to social effects. Where the same land parcels are required for the State highway works and the RTC, the land would be acquired for both components to avoid further property acquisition from the same property owners.
- Community profiling or social baseline has not been carried out for this short list assessment.

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted] BPlan (Hons) Consultant, Environment and Planning, Aurecon.
Area of assessment	Social

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) No In light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Community: -2 (Significant adverse) My reasoning/justification for this is as follows: ▪ Inclusion of motorway lanes along SH20 would require property acquisition above that anticipated as part of the long list assessment. This may have more substantial adverse impacts on communities along the SH20 corridor, in addition to the property impacts along SH20B.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes My reasoning/justification for this is as follows: ▪ The RTC will not have any additional adverse or positive effects above what has been scored as part of the long list options for A2B (where it scored a 1 for Accessibility, -2 for Community, and -1 for Health and Safety).
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Accessibility: 2 (Moderate positive) Community: -2 (Significant adverse) Health and safety: -1 (Minor adverse)

<table>
<tr><td></td><td>My reasoning/justification for this is as follows:
Would score similarly to Option 1A. Connections to properties along SH20B would still be provided but there would be property impacts that may adversely impact community aspirations and way of life.</td></tr>
<tr><td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td><table>
<tr><td>Accessibility</td><td>2 (Moderate positive)</td></tr>
<tr><td>Community</td><td>-2 (significant adverse)</td></tr>
<tr><td>Health and safety</td><td>-1 (minor adverse)</td></tr>
</table>
My reasoning/justification for this is as follows:
No changes are proposed to the scoring as a result of the inclusion of the section between Orrs Rd and the Pukaki Creek bridge. This area lies within the Airport complex is not widely accessed or use for any known formal recreational or commercial purposes by the general public. The Pukaki-Waiokauri Creek is reserved for the exclusive use by Te Akitai and Te Ahiwaru o Waiohua and is not known for recreational fishing or boating access by the wider community.</td></tr>
</table>

Notes:

Assumptions

- The motorway lanes and SUP along SH20 cannot be accommodated completely within the existing designation (including construction footprint).
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this short list assessment.
- The assumed ‘study area’ for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property impacts are being assessed separated by NZTA and AT appointed property advisors. This technical note assesses social impacts only with high level commentary on potential economic and property impacts with relation to social effects. Where the same land parcels are required for the State highway works and the RTC, the land would be acquired for both components to avoid further property acquisition from the same property owners.
- Community profiling or social baseline has not been carried out for this short list assessment.

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted] BPlan (Hons) Consultant, Environment and Planning, Aurecon.
Area of assessment	Social

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) No In light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Community: -2 (Significant adverse) My reasoning/justification for this is as follows: ▪ Inclusion of motorway lanes along SH20 would require property acquisition above that anticipated as part of the long list assessment. This may have more substantial adverse impacts on communities along the SH20 corridor, in addition to the property impacts along SH20B.
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes My reasoning/justification for this is as follows: ▪ The RTC will not have any additional adverse or positive effects above what has been scored as part of the long list options for A2B (where it scored a 1 for Accessibility, -2 for Community, and -1 for Health and Safety).
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Accessibility: 2 (Moderate positive) Community: -2 (Significant adverse) Health and safety: -1 (Minor adverse)

My reasoning/justification for this is as follows:

Reasons / Comments

- Criteria: Accessibility
  - There is currently only one motorway off-ramp near the area to access the Mangere Town Centre (from northbound lanes at Bader Drive off SH20A). This RTC connection would provide a key public transport link to the Mangere Town Centre which does not currently exist which could provide substantial benefits in terms of accessibility for the Mangere community.
- Criteria: Community
  - Potential for direct property impacts along Bader Drive and within the Mangere Town Centre which would have adverse impacts on the community. The potential impact relates to community severance or sense of community following property acquisition, the loss of services and businesses, including potential alteration to the operation and functionality of the Sir Douglas Intermediate School.
- Criteria: Health and safety
  - Sensitive receivers along Bader Drive (including residential and educational properties) may experience adverse amenity (e.g. air quality, noise and vibration) impacts during construction which could be managed through Stakeholder and Communication Plans and Construction Management Plans.

4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Accessibility	3 (Significant positive)
Community	-2 (Significant adverse)
Health and safety	-1 (Minor adverse)

My reasoning/justification for this is as follows:

Reasons / Comments

- The addition of the link to Mangere Town Centre provides additional benefits in relation to accessibility and connections to the City Centre LRT which is greater than solely the RTC along SH20 where it does provide a direct connection to a local town centre.

5) Pukaki Creek

Accessibility	3 (Significant positive)

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	Community	-2 (Significant adverse)
	Health and safety	-1 (Minor adverse)

My reasoning/justification for this is as follows:

- No changes are proposed to the scoring as a result of the inclusion of the section between Orrs Rd and the Pukaki Creek bridge. This area lies within the Airport complex is not widely accessed or use for any known formal recreational or commercial purposes by the general public. The Pukaki-Waiokauri Creek is reserved for the exclusive use by Te Akitai and Te Ahiwaru o Waiohua and is not known for recreational fishing or boating access by the wider community.

Notes:

Assumptions

- The motorway lanes, RTC and SUP along SH20 cannot be accommodated completely within the existing designation (including construction footprint).
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this short list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property impacts are being assessed separated by NZTA and AT appointed property advisors. This technical note assesses social impacts only with high level commentary on potential economic and property impacts with relation to social effects. Where the same land parcels are required for the State highway works and the RTC, the land would be acquired for both components to avoid further property acquisition from the same property owners.
- Community profiling or social baseline has not been carried out for this short list assessment.

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted] BPlan (Hons) Consultant, Environment and Planning, Aurecon.
Area of assessment	Social

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) No In light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Community: -2 (Significant adverse) My reasoning/justification for this is as follows: ▪ Inclusion of motorway lanes along SH20 between SH20A and SH20B would require property acquisition above that anticipated as part of the long list assessment. This may have more substantial adverse impacts on communities along the SH20 corridor, in addition to the property impacts along SH20B.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes ▪ The RTC will not have any additional adverse or positive effects above what has been scored as part of the long list options for A2B (where it scored a 1 for Accessibility, -2 for Community, and -1 for Health and Safety).
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Accessibility: 2 (Moderate positive) Community: -2 (Significant adverse) Health and safety: -1 (Minor adverse) My reasoning/justification for this is as follows:

<table>
<tr><td></td><td>

- Would score similarly to Option 1A. Connections to properties along SH20B would still be provided but there would be property impacts that may adversely impact community aspirations and way of life

</td></tr>
<tr><td>

4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

</td><td>

<table>
<tr><td>Accessibility</td><td>2 (Moderate positive)</td></tr>
<tr><td>Community</td><td>-2 (significant adverse)</td></tr>
<tr><td>Health and safety</td><td>-1 (minor adverse)</td></tr>
</table>

My reasoning/justification for this is as follows:

- No changes are proposed to the scoring as a result of the inclusion of the section between Orrs Rd and the Pukaki Creek bridge. This area lies within the Airport complex is not widely accessed or use for any known formal recreational or commercial purposes by the general public. The Pukaki-Waiokauri Creek is reserved for the exclusive use by Te Akitai and Te Ahiwaru o Waiohua and is not known for recreational fishing or boating access by the wider community

</td></tr>
</table>

Notes:

Assumptions

- The motorway lanes and SUP along SH20 and SH20B cannot be accommodated completely within the existing designation (including construction footprint).
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this short list assessment.
- The assumed 'study area' for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property impacts are being assessed separated by NZTA and AT appointed property advisors. This technical note assesses social impacts only with high level commentary on potential economic and property impacts with relation to social effects. Where the same land parcels are required for the State highway works and the RTC, the land would be acquired for both components to avoid further property acquisition from the same property owners.
- Community profiling or social baseline has not been carried out for this short list assessment.

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	[redacted] BPlan (Hons) Consultant, Environment and Planning, Aurecon.
Area of assessment	Social

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) <u>No</u> In light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Community: -2 (Significant adverse) My reasoning/justification for this is as follows: ▪ Inclusion of motorway lanes along SH20 would require property acquisition above that anticipated as part of the long list assessment. This may have more substantial adverse impacts on communities along the SH20 corridor, in addition to the property impacts along SH20B.
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) <u>Yes</u> ▪ The RTC will not have any additional adverse or positive effects above what has been scored as part of the long list options for A2B (where it scored a 1 for Accessibility, -2 for Community, and -1 for Health and Safety).
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Accessibility: 2 (Moderate positive) Community: -2 (Significant adverse) Health and safety: -1 (Minor adverse) My reasoning/justification for this is as follows:

<table>
<tr>
<td></td>
<td>Reasons / Comments

Criteria: Accessibility

There is currently only one motorway off-ramp near the area to access the Mangere Town Centre (from northbound lanes at Bader Drive off SH20A). This RTC connection would provide a key link to the Mangere Town Centre which does not currently exist which could provide substantial benefits in terms of accessibility for the Mangere community.

Criteria: Community

Potential for direct property impacts along Bader Drive and within the Mangere Town Centre which would have adverse impacts on the community. The potential impact relates to community severance or sense of community following property acquisition, the loss of services and businesses, including potential alteration to the operation and functionality of the Sir Douglas Intermediate School.

Criteria: Health and safety

Sensitive receivers along Bader Drive (including residential and educational properties) may experience adverse amenity (e.g. air quality, noise and vibration) impacts during construction which could be managed through Stakeholder and Communication Plans and Construction Management Plans.

</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Accessibility</td><td>3 (Significant positive)</td></tr>
<tr><td>Community</td><td>-2 (Significant adverse)</td></tr>
<tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr>
</table>

My reasoning/justification for this is as follows:
Reasons / Comments

The addition of the link to Mangere Town Centre provides additional benefits in relation to accessibility and connections to the City Centre LRT which is greater than solely the RTC along SH20 where it does provide a direct connection to a local town centre.
</td>
</tr>
<tr>
<td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs</td>
<td>
<table>
<tr><td>Accessibility</td><td>3 (Significant positive)</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr>
<td>Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Community</td><td>-2 (Significant adverse)</td></tr>
<tr><td>Health and safety</td><td>-1 (Minor adverse)</td></tr>
</table>
My reasoning/justification for this is as follows:

No changes are proposed to the scoring as a result of the inclusion of the section between Orrs Rd and the Pukaki Creek bridge. This area lies within the Airport complex is not widely accessed or use for any known formal recreational or commercial purposes by the general public. The Pukaki-Waiokauri Creek is reserved for the exclusive use by Te Akitai and Te Ahiwaru o Waiohua and is not known for recreational fishing or boating access by the wider community.

</td>
</tr>
</table>

Notes:

Assumptions

- The motorway lanes, RTC and SUP along SH20 and SH20B cannot be accommodated completely within the existing designation (including construction footprint).
- No community consultation information is available at the time of writing (which would help inform the community aspirations and plans).
- No specific surveys of the community have been undertaken to inform this short list assessment.
- The assumed ‘study area’ for social effects is the area surrounding the SH20, SH20A and SH20B corridors.
- Property impacts are being assessed separated by NZTA and AT appointed property advisors. This technical note assesses social impacts only with high level commentary on potential economic and property impacts with relation to social effects. Where the same land parcels are required for the State highway works and the RTC, the land would be acquired for both components to avoid further property acquisition from the same property owners
- Community profiling or social baseline has not been carried out for this short list assessment.

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	BPlan (Hons) Int.NZPI	[redacted]	29.10.2018
Reviewer	[redacted]	MSc City and Regional Planning		12.11.2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094**
Date	**2018-11-29**	Pages (including this page)	**25**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Stormwater**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The **Stormwater** assessments were based on:

- The 20Connect long-list technical assessment undertaken by Aurecon dated 7 September 2018.
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018).
- Auckland Council GIS (dated October 2018) with associated street view records.
- Stormwater Management Devices in the Auckland Region – Guideline Document GD01.
- Airport Access – Gap Analysis Report (Stormwater Section), 501094-4401-REP-JJ-0001, by Aurecon (February 2018).
- Google Earth Street View.
- Schematic mark-ups of the options as received on the 05/10/2018, and continuously updated GA's received until the 05/11/2017.

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes

Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted], BEng (Civil), CPEng
Area of assessment	Stormwater and Treatment

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a	Stormwater Quality: -1

score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	

Stormwater Quantity	-1

My reasoning/justification for this is as follows:

Reasons / Comments

WATER QUALITY CRITERIA

- *Stormwater treatment score -1, based on the following commentary:*
  - AMA noted during the meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment:
    - SH20B;
    - Section of SH20 between SH20A and SH20B; and
    - SH20 / SH20A interchange.
  - The proposed option replaces the existing SH20B and provides new lanes on SH20 (between SH20A and SH20B, and south of Puhinui interchange where no treatment is currently provided. Therefore, with appropriate mitigation, there could potentially be an improvement to water quality for the new SH20B and existing SH20. However, considering the option, water quality is rated minor -1, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage.
  - The shared use path and RTC do not trigger requirements for treatment, as number of vehicle movements are less than 5000 vehicles per day.

WATER QUANTITY CRITERIA

- *SMAF: Score -1*
  - The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1 and southern portions of SH20 are within Flow 2. Stormwater management area control – Flow 1 and Flow 2 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for adverse impacts to stream health.
  - Space requirements for detention swales within SMAF areas have been included in the General Arrangement Plans.
- *Overland Flow path: Score -1*

	– There are locations within the project extents where channels adjacent to existing motorway act as overland flow paths for external Auckland Council catchments. – As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate. ■ *Flood plain interaction / Detention for larger storm events: Score -1* – There are numerous locations where the proposed option crosses flood plains. This is seen as a minor adverse effect as the extents of the flood plains are small and there is minimal interaction with the proposed option. – Designing for larger storm events may be required for various reasons, including but not limited: ■ Mitigation of flood effects caused by an increase in impervious surfaces ■ Reduction of existing flooding ■ Insufficient network capacity – As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.
4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Stormwater Quality</td><td>-1</td></tr><tr><td>Stormwater Quantity</td><td>-1</td></tr></table> My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score -1* – Per (3) above, there is still a requirement for treatment across the entire option, as well as treatment required for the lane extensions on the Pukaki Bridge. Hence a scoring of -1. – Scoring is per number 3 above. *WATER QUANTITY CRITERIA* Like discussion within (3) above, the following is additional commentary.

	■ *SMAF: Score -1* – Per (3) above, there is still a requirement to do retention per the SMAF 1 and SMAF 2 areas. The addition of the Pukaki bridge would require retention as this falls under a SMAF zone. – Detention swales within SMAF areas have been considered as plausible option. ■ *Overland Flow path: Score -1* As per discussion in (3) above, the same scoring applies. Additional commentary is as follows: – Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered at detailed design. ■ *Flood plain interaction / Detention for larger storm events: Score -1* – Per discussion in (3) above.

Notes:

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment, with the exception of Rapid Traffic Corridors and Shared Use Paths
- Existing Culverts do not form part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- All Stormwater tie-ins for the newly proposed infrastructure (swales etc) on the General Arrangement drawings are to be connected to the existing infrastructure within the NZTA extents. Capacity checks of the existing networks would need further investigation.
- All SMAF 2 along SH20, south of SH20B are assumed to be accommodated within the existing ponds for this assessment, however there is concern that these ponds are currently undersized. Potentially this could require pond enlargement, which would need investigation at detail design.

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	Jonathan Worsley, BEng (Civil), CPEng
Area of assessment	Stormwater

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) Rapid Transit Corridor Mangere Town Centre Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Stormwater Quality: 0 Stormwater Quantity: -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score 0* – The proposed option incorporates an additional segment of RTC lane connecting SH20 with Mangere Town Centre, which will be under the 5000 vehicles per day threshold. Therefore, from a quality perspective, there is no contribution to the need for Stormwater quality management. This is to be confirmed with the AMA at detailed design.

<table>
<tr>
<td></td>
<td>
WATER QUANTITY CRITERIA
■ Overland Flow path: Score -1
– There are overland flow paths that run along Bader Drive and connect into a flood prone area adjacent to the KFC, additional RTC will increase impervious area hence increase runoff within a possibly capacity constrained network.
– As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate.
■ Flood plain interaction / Detention for larger storm events: Score -1
– There is one location where the proposed option crosses a flood plain. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option, hence a score of -1.
– Designing for larger storm events may be required for various reasons, including but not limited:
■ Mitigation of flood effects caused by an increase in impervious surfaces
■ Reduction of existing flooding
■ Insufficient network capacity
– As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.
</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td>
<td>
<table>
<tr><td>Stormwater Quality</td><td>-1</td></tr>
<tr><td>Stormwater Quantity</td><td>-1</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
WATER QUALITY CRITERIA
■ Stormwater treatment: Score -1
– Per Option 1a, the addition of lanes on the Pukaki bridge to Orrs Road, in addition to number (4), would still require treatment. Hence a score of -1.
– The AMA noted during a meeting on 5 December 2017 with Aurecon that the following sections of state highway within the project extent do not currently receive stormwater treatment:
■ SH20B;
</td>
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</table>

	▪ Section of SH20 between SH20A and SH20B; and ▪ SH20 / SH20A interchange. – The proposed option replaces existing SH20B and provides new lanes on SH20 (between SH20A and SH20B, where no treatment is currently provided. Therefore, with appropriate mitigation per recommendation in GD01, there could potentially be an improvement to water quality for the new SH20B and existing SH20. However, considering the option, water quality is rated minor -1, as the level of treatment achievable cannot be confirmed at this stage. *WATER QUANTITY CRITERIA* ▪ *SMAF: Score -1* – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1, and southern portions of SH20 after Puhinui Road are Flow 2 Stormwater management area control Flow 1 and Flow 2 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for adverse impacts to stream health. – Space has been made for detention swales within SMAF areas during the detail design. – The existing ponds capacity within SMAF Flow 2 are to be investigated at detail design. For this purpose, a -1 score applies. ▪ *Overland Flow path: Score -1* – There are locations within the project extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development. – Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible and need to be considered during the detailed design.

	– As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate. ■ *Flood plain interaction / Detention for larger storm events: Score -1* – There are numerous locations where the proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option. – Designing for larger storm events may be required for various reasons, including but not limited: ■ Mitigation of flood effects caused by an increase in impervious surfaces ■ Reduction of existing flooding ■ Insufficient network capacity – As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate adverse.
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Stormwater Quality</td><td>-1</td></tr><tr><td>Stormwater Quantity</td><td>-1</td></tr></table> My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score -1* – Per (4) above, the addition of the Pukaki Bridge does not negate the need for treatment, nor does it add on additional treatment requirements. Hence a score of -1. *WATER QUANTITY CRITERIA* ■ *SMAF: Score -1* – Per number (4) above, the addition of Pukaki Bridge does not negate the need for SMAF practice, and therefore the score remains a -1. ■ *Overland Flow path: Score -1* – Per number (4) above, the addition of Pukaki Bridge does not negate the need for redesign of the overland flowpaths, and therefore the score remains a -1.

	■ *Flood plain interaction / Detention for larger storm events: Score -1* – Per number (4) above, the addition of Pukaki Bridge does not negate the need for redesign of the flood plain interaction, and therefore the score remains a -1.

Notes:

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- No area take-off has been carried out as part of the MCA.
- Existing Culverts do not perform part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment, with the exception of Rapid Traffic Corridors and Shared Use Paths
- **All Stormwater tie-ins for the newly proposed infrastructure (swales etc) on the General Arrangement drawings are to be connected to the existing infrastructure within the NZTA extents and/or council network. Capacity checks of the existing networks would need further investigation at detailed design.**
- All SMAF 2 along SH20, south of SH20B are assumed to be accommodated within the existing ponds for this assessment, however there is concern that these ponds are currently undersized. Potentially this could require pond enlargement, which would need investigation at detailed design.

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted], BEng (Civil), CPEng
Area of assessment	Stormwater

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Stormwater Quality: -1 Stormwater Quantity: -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score -1* Per Option 1 above, there is no treatment on SH20, SH20A and SH20B. – The proposed option provides new lanes on, SH20B, as well as manipulation to the existing SH20B, where no treatment is currently provided. Therefore, with appropriate mitigation, such as swales etc., there could potentially be an improvement to water quality for the existing SH20B and existing SH20. However, water quality is rated minor -1, as the level of treatment achievable on other parts of the network cannot be confirmed at this stage.

	– Package treatment devices will need to be investigated for SH20A. *WATER QUANTITY CRITERIA* ■ *SMAF: Score -1* – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for impacts to stream health. – Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. Airports do not typically support the use of wetlands or other open bodies of water due to issues such as bird strike, therefore the intention at this stage is to opt for bioretention swales. Further investigation will be required at detailed design. – Unknown as to the soil permeability, which pends geotechnical investigation, and so the level of treatment achievable is unknown. ■ *Overland Flow path: Score -1* – There are locations within the SH20B extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. At some of these locations, the state highway corridor is constrained and is adjacent to urban development. – Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimise impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible – As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate. ■ *Flood plain interaction / Detention for larger storm events: Score -1* – There are numerous locations where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option.	

	– Designing for larger storm events may be required for various reasons, including but not limited: ▪ Mitigation of flood effects caused by an increase in impervious surfaces ▪ Reduction of existing flooding ▪ Insufficient network capacity – As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate. ■ *Highway footprint clash with existing streams: Score -1* – There are locations within the extents where extension to existing culverts or new culverting will be required to accommodate the proposed option.
4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Stormwater Quality</td><td>-1</td></tr><tr><td>Stormwater Quantity</td><td>-1</td></tr></table> My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score -1* – Per number (3) above, the addition of the western abutment of Pukaki bridge will not impact the scoring. – Package treatment devices will need to be investigated for SH20A. *WATER QUANTITY CRITERIA* Like discussion within (3) above, the following is additional commentary. ■ *SMAF: Score -1* per (3) above, the proposed option is within SMAF 1 area. SMAF areas score -1 as this would require retention. Also, airports do not typically support the use of wetlands or other open bodies of water due to issues such as bird strike, therefore the intention at this stage is to opt for bioretention swales. – The addition of the Pukaki abutment does not impact the scoring. ■ *Overland Flow path: Score -1* As per discussion in (3) above.

	■ *Flood plain interaction / Detention for larger storm events: Score -1* As per discussion in (3) above. ■ *Highway footprint clash with existing streams: Score -1* – As per discussion in (3) above. – The road alignments should avoid going longitudinally along existing stream alignments as this would require the need for extensive reclamation, stream diversion and/or new culverting. ■ *Highway footprint clash with existing wetland/detention pond: Score -1* – The SH20 flyovers will be constructed over an existing pond at the Bader drive Northbound onramp on SH20A. This will require reconstruction of the pond further north, and considerable re-routing of networks discharging within the pond. Without further analysis, this would be considered a -1 score.

Notes:

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment, with the exception of Rapid Traffic Corridors and Shared Use Paths
- Existing Culverts do not form part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- All Stormwater tie-ins for the newly proposed infrastructure (swales etc) on the General Arrangement drawings, are to be to the existing infrastructure within the NZTA extents. Capacity checks of the existing networks would need further investigation.
- All SMAF 2 along SH20, south of SH20B are assumed to be accommodated within the existing ponds for this assessment, however there is concern that these ponds are currently undersized. Potentially this could require pond enlargement, which would need investigation at detail design.
- All bioretention swales along the SH20B corridor are dependent upon geotechnical investigations, which have not been carried out at this stage.

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted], BEng (Civil), CPEng
Area of assessment	Stormwater

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) **Rapid Transit Corridor Mangere Town Centre** Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Stormwater Quality: 0 Stormwater Quantity: -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> ■ *Stormwater Quality: Score 0* – None required due to number of vehicles per day being less than 5000, however not a positive score due as there is no improvement to the water quality because of the RTC. *WATER QUANTITY CRITERIA* ■ *Overland Flow path: Score -1* – There are overland flow paths that run along Bader Drive and connect into a flood prone area adjacent to the KFC, additional RTC will increase

	impervious area hence increase runoff within a possibly capacity constrained network. – As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate. ■ *Flood plain interaction / Detention for larger storm events: Score -1* – There is one location where the proposed option crosses a flood plain. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option, hence a score of -1. – Designing for larger storm events may be required for various reasons, including but not limited: ■ Mitigation of flood effects caused by an increase in impervious surfaces ■ Reduction of existing flooding ■ Insufficient network capacity – As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.
4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Stormwater Quality: -1 Stormwater Quantity: -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ Stormwater treatment: Score -1 – Per Option 2a – The proposed option provides new lanes on SH20B where no treatment is currently provided. Therefore, with appropriate mitigation such as bioretention swales, there could potentially be an improvement to water quality for the existing SH20B and existing SH20. Hence a scoring of -1 *WATER QUANTITY CRITERIA* ■ *SMAF: Score -1* – Per Option 2a. – The proposed option is to be constructed in a Stormwater Management Area Control - Flow 1. Stormwater management area control – Flow 1 are those catchments which discharge to sensitive or

	high value streams that have relatively low levels of existing impervious area. Depending on the level of mitigation achievable, there may be potential for minor adverse impacts to stream health. – Consider space requirements for detention swales and/or wetlands within SMAF areas during the short list design. Airports are against the proposal of wetlands due to issues such as bird strike, therefore the intention at this stage is to opt for bioretention swales. Further investigation will be required at detailed design. – Unknown as to the soil permeability, which depends on geotechnical investigation, and so the level of treatment achievable is unknown. ■ *Overland Flow path: Score -1* – Per Option 2a. – There are locations within the SH20B extents where the existing shoulder and/or channels adjacent to existing state highways act as overland flow paths for external Auckland Council catchments. – Options for widening the motorway over these channels need to consider the management of existing overland flow paths to avoid / minimize impacts to other properties. Depending on the space constraints, the provision to manage existing overland flow paths may be expensive or may not be practically feasible – As no analysis has been taken to determine the impact of the proposed option on flow paths this criterion has been scored Minor/Moderate. ■ *Flood plain interaction / Detention for larger storm events: Score -1* – Per Option 2a – There are numerous location where proposed option crosses flood plains. This is seen as minor as the extents of the flood plains are small and there is minimal interaction with the proposed option. – Designing for larger storm events may be required for various reasons, including but not limited: ▪ Mitigation of flood effects caused by an increase in impervious surfaces ▪ Reduction of existing flooding ▪ Insufficient network capacity	

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As no analysis has been taken to determine the impact of the proposed option on flood plains this criterion has been scored Minor/Moderate.
Highway footprint clash with existing streams: Score -1
Per Option 2a.

</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Stormwater Quality</td><td>-1</td></tr>
<tr><td>Stormwater Quantity</td><td>-1</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
WATER QUALITY CRITERIA

Stormwater treatment: Score -1

Per option 1, no treatment currently available along the SH20, SH20a and SH20b, and treatment to be provided for this entire option. Hence a score of -1.
Package treatment devices will need to be investigated for SH20A.

WATER QUANTITY CRITERIA

SMAF: Score -1

Per 4 above, the proposed option is within SMAF 1 area. SMAF area score -1 as this would require retention. Also, Airports do not typically support the use of wetlands or other open bodies of water due to issues such as bird strike, therefore the intention at this stage is to opt for bioretention swales.

Overland Flow path: Score -1

As per discussion in (4) above.

Flood plain interaction / Detention for larger storm events: Score -1

As per discussion in (4) above.

Highway footprint clash with existing streams: Score -1

There are locations within the project extents where extension to existing culverts or new culverting will be required to accommodate the proposed option.
The road alignments should avoid going longitudinally along existing stream alignments as

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	this would require the need for extensive reclamation, stream diversion and/or new culverting. ■ *Highway footprint clash with existing wetland/detention pond: Score -1* – Per Option 2a

Notes:

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment, with the exception of Rapid Traffic Corridors and Shared Use Paths
- Existing Culverts do not form part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- All Stormwater tie-ins for the newly proposed infrastructure (swales etc) on the General Arrangement drawings, are to be to the existing infrastructure within the NZTA extents. Capacity checks of the existing networks would need further investigation.
- All SMAF 2 along SH20, south of SH20B are assumed to be accommodated within the existing ponds for this assessment, however there is concern that these ponds are currently undersized. Potentially this could require pond enlargement, which would need investigation at detail design.
- All bioretention swales along the SH20B corridor are dependent upon geotechnical investigations, which have not been carried out at this stage.

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted], BEng (Civil), CPEng
Area of assessment	Stormwater

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	Stormwater Quality: -1 Stormwater Quantity: -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score -1* – Per Option 2a with the omission of treatment required on the Pukaki Bridge. This does not impact improve the overall scoring. *WATER QUANTITY CRITERIA* ■ *SMAF: Score -1* – Per Option 2a. The omission of works on Pukaki Bridge does not mitigate the requirement for SMAF. ■ *Overland Flow path: Score -1* – Per Option 2a.

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- *Flood plain interaction / Detention for larger storm events: Score -1*
  - Per Option 2a.
- *Highway footprint clash with existing streams: Score -1*
  - Per Option 2a.

</td></tr>
<tr><td>

4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

</td><td>

<table>
<tr><td>Stormwater Quality</td><td>-1</td></tr>
<tr><td>Stormwater Quantity</td><td>-1</td></tr>
</table>

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

Option 3a is consistent fundamentally the same as Option 2a, with the omission of additional lanes between Pukaki Bridge and Orrs Road.

There are no additional stormwater considerations within this extent.

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Notes:

<u>Assumptions</u>

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment, with the exception of Rapid Traffic Corridors and Shared Use Paths
- Existing Culverts do not form part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- All Stormwater tie-ins for the newly proposed infrastructure (swales etc) on the General Arrangement drawings, are to be to the existing infrastructure within the NZTA extents. Capacity checks of the existing networks would need further investigation.
- All SMAF 2 along SH20, south of SH20B are assumed to be accommodated within the existing ponds for this assessment, however there is concern that these ponds are currently undersized. Potentially this could require pond enlargement, which would need investigation at detail design.
- All bioretention swales along the SH20B corridor are dependent upon geotechnical investigations, which have not been carried out at this stage.

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	Jonathan Worsley, BEng (Civil), CPEng
Area of assessment	Stormwater

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) Yes/No
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes/No
3) Rapid Transit Corridor Mangere Town Centre Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Stormwater Quality: -1 Stormwater Quantity: -1 My reasoning/justification for this is as follows: <u>Reasons / Comments</u> *WATER QUALITY CRITERIA* ■ *Stormwater treatment: Score -1* – Per Option 2b. *WATER QUANTITY CRITERIA* ■ *SMAF: Score -1* – Per Option 2b. ■ *Overland Flow path: Score -1* – Per Option 2b.

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- *Highway footprint clash with existing streams: Score -1*
  - Per Option 2b.

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4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

</td><td>

Stormwater Quality	-1
Stormwater Quantity	-1

My reasoning/justification for this is as follows:

Reasons / Comments

WATER QUALITY CRITERIA

- *Stormwater treatment: Score -1*
  - Per Option 2b.

WATER QUANTITY CRITERIA

- *SMAF: Score -1*
  - Per Option 2b.
- *Overland Flow path: Score -1*
  - Per Option 2b.
- *Flood plain interaction / Detention for larger storm events: Score -1*
  - Per Option 2b.
- *Highway footprint clash with existing streams: Score -1*
  - Per Option 2b.

</td></tr>
<tr><td>

5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

</td><td>

Stormwater Quality	-1
Stormwater Quantity	-1

My reasoning/justification for this is as follows:

Reasons / Comments

Option 3a is consistent fundamentally the same as Option 2a, with the omission of additional lanes between Pukaki Bridge and Orrs Road.

There are no additional stormwater considerations within this extent.

</td></tr>
</table>

Notes:

Assumptions

- This assessment is based on a desktop study. No surveys, investigations or detailed site visits have been undertaken as part of this assessment.
- All roads are assumed to have over >5000 vehicles per day Annual Daily Traffic volume, triggering AUP Section E9 high contaminant generating zones requirements for water quality treatment, with the exception of Rapid Traffic Corridors and Shared Use Paths
- Existing Culverts do not form part of this assessment as no information is held on them within the Auckland Council Geo Maps.
- A number of sub-criteria has been considered under Water Quantity. The overall Water Quantity score is based on the sub-criterion with the worst score.
- All Stormwater tie-ins for the newly proposed infrastructure (swales etc) on the General Arrangement drawings, are to be to the existing infrastructure within the NZTA extents. Capacity checks of the existing networks would need further investigation.
- All SMAF 2 along SH20, south of SH20B are assumed to be accommodated within the existing ponds for this assessment, however there is concern that these ponds are currently undersized. Potentially this could require pond enlargement, which would need investigation at detail design.
- All bioretention swales along the sH20B corridor are dependent upon geotechnical investigations, which have not been carried out at this stage.

Approved by: [please complete]

Title	Name	Qualification	Signature	Date
Author	[redacted]	BE	[redacted]	28/11/2018
Reviewer	[redacted]	ME	[redacted]	29/11/2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094**
Date	**2018-12-14**	Pages (including this page)	**38**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Coastal Processes & Sea-Level Rise**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The **Coastal Processes** assessments were based on:

- The 20Connect long-list technical assessment on Coastal Processes undertaken by NIWA dated 18-Sept-2018 – also Figures 1 & 2 showing areas where crossings occur over the Coastal Marine Area (CMA)
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018) and GA Plans (dated 19-Nov-2018) for assessment purposes
- Maps of land elevation from the Parliamentary Commissioner for the Environment report Preparing New Zealand for rising seas: Certainty and Uncertainty (2015): https://www.pce.parliament.nz/publications/regional-land-elevation-maps
- Ministry for the Environment Coastal Hazards and Climate Change: Guidance for Local Government (December 2017): http://www.mfe.govt.nz/publications/climate-change/coastal-hazards-and-climate-change-guidance-local-government
- Auckland Council GeoMaps including Coastal Storm Inundation Layer (Auckland Unitary Plan (operative in part) as at September 2018) and 1959 historical aerial photography: https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html
- Auckland Unitary Plan (operative in part) as at September 2018 (AUP): Section E36: Natural hazards and flooding: http://unitaryplan.aucklandcouncil.govt.nz/Images/Auckland%20Unitary%20Plan%20Operative/Chapter%20E%20Auckland-wide/5.%20Environmental%20Risk/E36%20Natural%20hazards%20and%20flooding.pdf
- Stephens, S., Wadhwa, S and Tuckey, B (2016). Coastal inundation by storm-tides and waves in the Auckland region. Prepared by the National Institute for Water and Atmospheric Research, NIWA and DHI Ltd for Auckland Council. Auckland Council Technical Report, TR2016/017: https://www.aucklandcouncil.govt.nz/environment/what-we-do-to-help-environment/Documents/coastal-inundation-in-auckland.pdf

The options are outlined in the following table and scores and assessments are outlined in the tables.

Acronyms: RTC = possible Rapid Transit Connection (Airport to Botany); SUP = Shared Use Pathway; SLR = sea-level rise; AEP = annual exceedance probability (probability of a storm tide level); CMA = coastal marine area (defined in RMA); AUP = Auckland Unitary Plan; CSI = coastal storm inundation (related to a coastal-flooding and SLR overlay in the AUP).

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes
Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

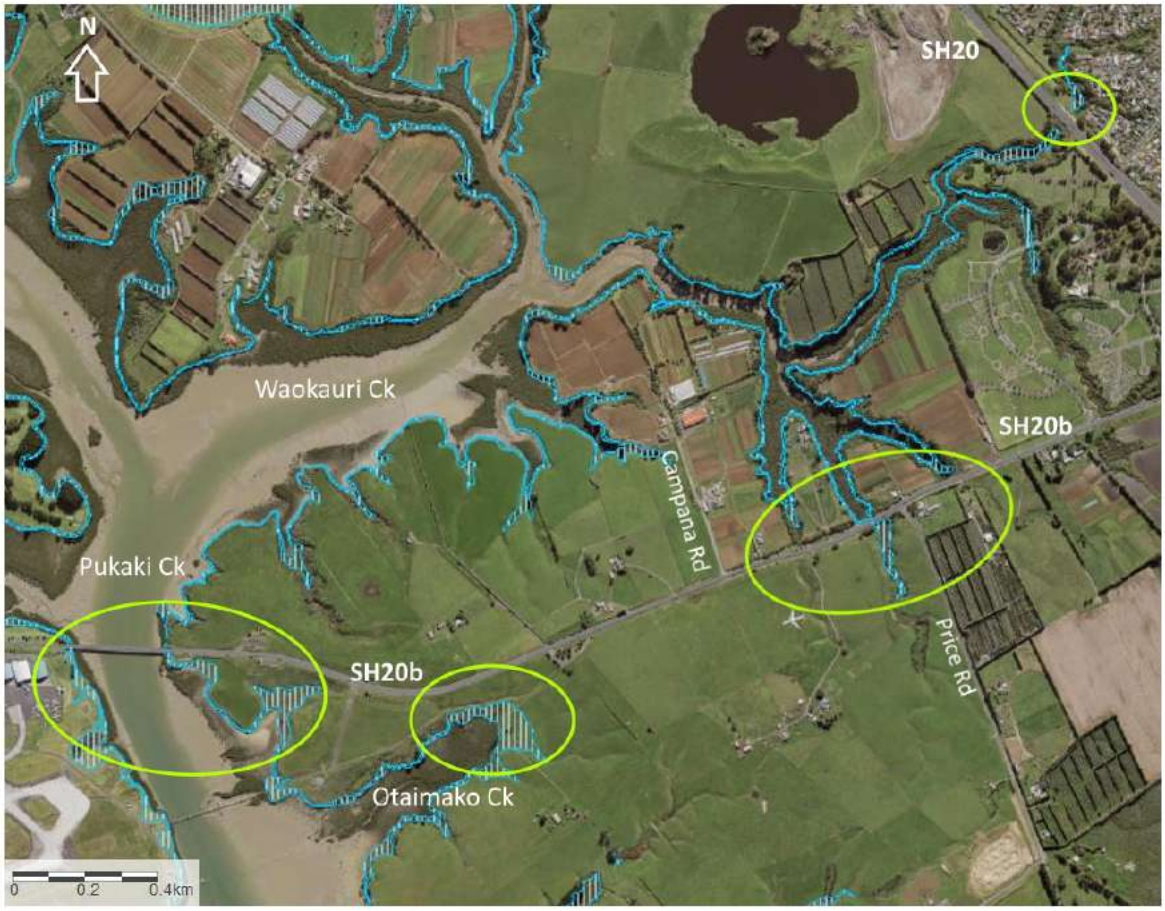


Figure 1: Areas in Waokauri Creek, Otaimako Creek and Pukaki Creek where the proposed short-list project options for SH20 and SH20B may impinge on the coastal environment and CMA. *Basemap:* Auckland Council GeoMaps plus hatched areas cover the Coastal Storm Inundation (CSI) Layer in the AUP (1% AEP coastal flooding plus 1 m sea-level rise).



Figure 2: Area in Tararata Creek (Mangere Inlet) where the proposed short-list project options for the SH20 may impinge on the coastal environment and CMA. *Basemap:* Auckland Council GeoMaps plus hatched areas cover the CSI Layer in the AUP) 1% AEP coastal flooding plus 1 m sea-level rise). *Note: section of SH20 under the CSI hatched zone – especially on the western side, which means potential for coastal flooding with sea-level rise.*

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted], PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton
Area of assessment	Coastal processes and coastal climate change and sea-level rise

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) of the nearest equivalent long-list option C2a. Yes/~~No~~ ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ – – ~~My reasoning/justification for this is as follows:~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes/~~No~~

<table>
<tr>
<td>the Airport to Botany (A2B) Long List assessment</td>
<td><s>No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:</s>
<table>
<tr><td><s>–</s></td><td><s>–</s></td></tr>
</table>
<s>My reasoning/justification for this is as follows:</s></td>
</tr>
<tr>
<td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td>
<td>
<table>
<tr><td>Construction effects on CMA</td><td>-1</td></tr>
<tr><td>Geomorphology, sedimentation & tidal flows</td><td>-1</td></tr>
<tr><td>Sea-level rise and coastal climate change</td><td>-1*</td></tr>
</table>
* See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.

My reasoning/justification for this is as follows:

<u>Reasons / Comments</u>

Construction effects on CMA:

<u>Reasons/comments:</u> While there would be additional upper tidal-arm crossings to the south of SH20B and SH20 (including the SUP) - construction runoff of sediment and creek-bed disturbances should still be quite manageable. Main reason is direct (flowing) tidal connection to these upper arms only occurs at high spring tides (other than catchment runoff during rainfall events). More encroachment of the CMA will also be required for the RTC and SUP across the small eastern side arm of Pukaki Creek (Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm.

The extra southbound and northbound lanes on SH20 over Tararata Creek (Mangere Inlet) are widened bridged sections on both sides SH20 [Sheet 3 in GA Plans] and are common to all short-list options. Provided there is minimal disturbance of the CMA and avoidance of piers in the main tidal channel, the effects on coastal processes and turbidity should be manageable through effective sediment & erosion control measures.

</td>
</tr>
</table>

- ***Geomorphology/sedimentation & tidal flows:***
  - Reasons/comments: No substantial change for this option on the effects on geomorphology of the upper tidal inlets and tidal flows over the operational life for any of CMA crossings (excluding Pukaki Creek bridges considered separately).
- ***Sea-level rise and coastal climate change:***
  - Reasons/comments: Sea-level rise and climate change aspects can be managed via the design of the new bridges and proposed culvert upgrades (Waokauri Creek crossings south of the existing SH20B). Sea-level rise and storm-tide aspects will need to be considered in designing the levels of the SUP and RTC across Otaimako Creek (Fig. 1) – but again can be mitigated through the design.

    For the SH20 Tararata Creek crossing, especially for the northbound lane, note the assumption below (2nd bullet) given the area to the west and south of Tararata Creek bridge is within the CSI layer in the Auckland Unitary Plan. If an adaptable design is problematic, then a score -2 would be appropriate (with respect to the Tararata Creek crossing).

4) Pukaki Creek

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Construction effects on CMA	-2
Geomorphology, sedimentation & tidal flows	-1
Sea-level rise and coastal climate change	-1*

** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.*

My additional reasoning/justification for this is as follows:

Reasons / Comments

- ***Construction effects on CMA:***
  - Reasons/comments: The additional wide new bridge crossings over Pukaki Creek for the westbound double lanes, RTC and SUP will require tight construction and erosion/sediment control measures to minimize seabed disturbances

	in the CMA and the generation of turbid sediment plumes during construction, including any temporary staging used. Therefore, this increased risk in a main tidal channel has been scored at -2. Further, another potential encroachment on the CMA may be required for the RTC and SUP alongside the small eastern side arm of Pukaki Creek (Ch. 400-500 of GA Plan Sheet 20, situated 300 m northeast of Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm. ■ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this combined option on the effects on geomorphology of the tidal inlets and tidal flows over the operational life for any of CMA crossings, provided the piers/piles of the new Pukaki Creek bridge(s) match the diameter/size supporting the existing bridge and they are aligned where possible with the average peak tidal flow directions (ebb and flood) under the structures and with the existing piles/piers to minimize general scour in the channel and turbulent wakes. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be accommodated in the new bridge structures, even if they are designed to the same deck level as the existing Pukaki Bridge. Stress-testing the new bridge options, using the 4 sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance out to 2120 (ranging from 0.55 to 1.36 m), would mean the future 1% Annual Exceedance Probability (AEP) storm-tide level could be in the range 3.47–4.28 m (Auckland Vertical Datum-1946 or AVD-46). The highest 2120 storm-tide scenario, is still well below the existing deck level of 7.25 m (AVD-46), but slightly higher (by ~20 cm) than the lowest soffit level of the existing bridge of ~4.05 m. It is assumed that the soffit level of the new bridge(s) across the Pukaki Creek could accommodate a slightly higher soffit level. – Consequently, the score for this criterion remains at -1, given sufficient capacity for SLR to be accommodated for the Pukaki Creek crossings.

Notes:

Assumptions

- Potential direct or indirect effects on the coastal environment or in the CMA would only occur (due to proximity) in four areas associated with the Pukaki Creek and its tributaries**: i)** Extra crossing in upper eastern Waokauri Creek (opposite end of Daphne Road) for the SUP on eastern side of SH20 (between Portage Road and Puhinui I/C); **ii)** RTC corridor and SUP south of SH20B (Puhinui Road) around Price Road up to Campana Road – crossing three arms of upper southern Waokauri Creek; **iii)** the RTC corridor and SUP south of Puhinui Road (SH20B), to the west of Orrs Road at the boundary with the Airport precinct including upper Otaimako Creek and the small eastern side arm of Pukaki Creek (Ch. 400-500, situated 300 northeast of Otaimako Creek – Fig.1); and, **iv)** The additional Pukaki Creek bridge(s) (west bound double lanes for SH20B, RTC and SUP).
- *Tararata Creek crossings for SH20 (Fig. 2): All short-list options retain both a southbound and northbound additional lane on the east and west sides respectively with a widening of the bridges either side [Sheet 3 of GA Plans]. However, it is noted from Fig. 2, the area to the west and south of the existing Tararata Creek bridge is within the CSI layer in the AUP. This means it would be subject to coastal flooding for a 1% AEP event with a 1 m sea-level rise, but it is unclear how deep that flooding would be for a 1m SLR, or indeed whether flooding could occur at the lesser SLR (would need more detailed modelling). It is assumed for scoring purposes that the additional northbound and southbound lanes can be designed to be adaptable in future to sufficiently accommodate SLR to minimise future coastal flooding, in conjunction with a more detailed assessment of the future adaptation needed for the hatched area covering the existing section of SH20 in Fig. 2.
- No direct or indirect effects on the coastal environment or in the CMA will occur for SH20A (George Bolt Memorial Drive), therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these creeks over time on the back of SLR.
- The present 1% AEP storm-tide level of 2.92 m (AVD-46) was used for the Pukaki Creek and Waokauri Creek areas and 3.02 m (AVD-46) for Tararata Creek (off Mangere Inlet). These are values for sites #47 and #18 respectively from Table 3-6 of Stephens et al. (2016) in the Reference list on p. 1.
- Existing crossings over the creek tributaries of Waokauri Creek (present SH20B), are planned to be upgraded or retained: **i)** culverts increased or replaced to accommodate SLR and associated storm-tide flows and water levels; **ii)** existing bridge (>9 m AVD-46) over the larger middle tributary (Fig. 1) is to be retained for the proposed service road (for all options). The new bridge(s) across the creek tributaries of Waokauri Creek to the south of the present SH20B should, where possible, bridge the waterway via a single span or piers/piles should be located out of the main tidal channel and similarly new culverts should follow the existing watercourse alignment. Therefore, the Multi-Criteria Decision Analysis (MCDA) scores assume these aspects can be built into the design.
- New bridges across Pukaki Creek are assumed to be the same height as the existing bridge (which has a minimum deck level of 7.25 m (AVD-46) and soffit level of ~4.05 m (AVD-46). This lowest soffit level would accommodate ~1 m SLR for a 1% AEP storm-tide event. Piers or piles should align with the average peak tidal flow (ebb and flood) directions and existing piles/piers where possible.
- This assessment is subject to findings from field surveys during later assessments and any overlaps with freshwater stream processes.

Other Information relied upon

- See list of references and maps (Figures 1–2).

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted], PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton
Area of assessment	Coastal processes and coastal climate change and sea-level rise

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) **Puhinui Interchange to Orrs Road** Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) of option C2a. Yes/~~No~~ ~~No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be:~~ _ _ ~~My reasoning/justification for this is as follows:~~
2) **Rapid Transit Corridor** Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the Airport to Botany long list criteria (for the RTC between Puhinui and the Airport) Yes/~~No~~ ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ _ _ ~~My reasoning/justification for this is as follows:~~

3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Drive (on SH20) and SH20A (via Mangere Town Centre)

Criteria	N/A

My reasoning/justification for this is as follows:

Reasons / Comments

- No coastal CMA impingement

4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.

Construction effects on CMA	-1
Geomorphology, sedimentation & tidal flows	-1
Sea-level rise and coastal climate change	-1*

** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.*

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Construction effects on CMA:***
  - Reasons/comments: While there would be additional upper tidal-arm crossings to the south of SH20B and to east of SH20 (in upper eastern Waokauri Creek opposite end of Daphne Road) for both the SUP and RTC for Option 1b - construction runoff of sediment and creek-bed disturbances should still be quite manageable. Main reason is direct (flowing) tidal connection to these upper arms only occurs at high spring tides (other than catchment runoff during rainfall events). Another encroachment of the CMA will also be required for the SUP alongside the small eastern side arm of Pukaki Creek (Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm.

    The extra southbound and northbound lanes on SH20 over Tararata Creek (Mangere Inlet) are widened bridged sections on both sides SH20 [Sheet 3 in GA Plans] and are common to all short-list options. Provided there is minimal disturbance of the CMA and avoidance of piers in the main tidal channel, the effects on coastal processes and turbidity should be manageable through effective sediment & erosion control measures.

	▪ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this option on the effects on geomorphology of the upper tidal inlets and tidal flows over the operational life for any of CMA crossings (excluding Pukaki Creek bridges considered separately), even with the addition of the RTC alongside SH20 at the upper eastern end of Waokauri Creek. ▪ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be managed via the design of the new bridges and proposed culvert upgrades (Waokauri Creek crossings south of the existing SH20B). Sea-level rise and storm-tide aspects will need to be considered in designing the levels of the SUP across Otaimako Creek (Fig. 1) – but again can be mitigated through the design. For the SH20 Tararata Creek crossing, especially for the northbound lane, note the assumption below (2nd bullet) given the area to the west and south of Tararata Creek bridge is within the Coastal Storm Inundation (CSI) layer in the Auckland Unitary Plan. If an adaptable design is problematic, then the score may need to go down to -2 (with respect to Tararata Creek crossing).
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Construction effects on CMA</td><td>-2</td></tr><tr><td>Geomorphology, sedimentation & tidal flows</td><td>-1</td></tr><tr><td>Sea-level rise and coastal climate change</td><td>-1*</td></tr></table> ** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.* My additional reasoning/justification for this is as follows: Reasons / Comments ▪ ***Construction effects on CMA:*** – Reasons/comments: The additional new bridge crossings over Pukaki Creek for the westbound double lanes and the SUP (even without the RTC bridge for this option) will require tight construction and erosion/sediment control measures to minimize seabed disturbances in the CMA and

	generation of turbid sediment plumes during construction, including any temporary staging used. Therefore, this increased risk in a main tidal channel has been scored at -2. Further, another potential encroachment on the CMA may be required for the SUP across the small eastern side arm of Pukaki Creek (Ch. 400-500 of GA Plan Sheet 20, situated 200 m west of Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm (and less risk compared to Option 1a with the RTC also present). ■ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this combined option on the effects on geomorphology of the tidal inlets and tidal flows over the operational life for any of CMA crossings, provided the piers/piles of the new Pukaki Creek bridges match the diameter/size supporting the existing bridge and they are aligned where possible with the average peak tidal flow directions (ebb and flood) under the structures and with the existing piles/piers to minimize general scour in the channel and turbulent wakes. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be accommodated in the new bridge structures, even if they are designed to the same deck level as the existing Pukaki Bridge. Stress-testing the new bridge options, using the 4 SLR scenarios in the 2017 MfE Coastal Guidance out to 2120 (ranging from 0.55 to 1.36 m), would mean the future 1% AEP storm-tide level could be in the range 3.47–4.28 m (AVD-46). The highest 2120 storm-tide scenario, is still well below the existing deck level of 7.25 m (AVD-46), but slightly higher (by ~20 cm) than the lowest soffit level of the existing bridge of ~4.05 m. It is assumed that the soffit level of the new bridges could accommodate a slightly higher soffit level. – Consequently, the score for this criterion remains at -1, given sufficient capacity for SLR to be accommodated for the Pukaki Creek crossings.

Notes:

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in four areas associated with the Pukaki Creek and its tributaries: i) Extra crossing in upper eastern Waokauri Creek (opposite end of Daphne Road) for both the SUP and the RTC on eastern side of SH20 (between Portage Road and Puhinui I/C); ii) SUP south of SH20B (Puhinui Road) around Price Road up to Campana Road – crossing 3 arms of upper southern Waokauri Creek; iii) SUP south of Puhinui Road (SH20B), to the west of Orrs Road at the boundary with the Airport precinct including upper Otaimako Creek and the small eastern side arm of Pukaki Creek (Ch. 400-500, situated 300 northeast of Otaimako Creek – Fig.1); and, iv) The additional Pukaki Creek bridge(s) (west bound double lanes for SH20B and SUP).
- *Tararata Creek crossings for SH20 (Fig. 2): All short-list options retain both a southbound and northbound additional lane on the east and west sides respectively with a widening of the bridges either side [Sheet 3 of GA Plans]. However, it is noted from Fig. 2, the area to the west and south of the existing Tararata Creek bridge is within the Coastal Storm Inundation (CSI) layer in the Auckland Unitary Plan. This means it would be subject to coastal flooding for a 1% AEP event with a 1 metre sea-level rise, but it is unclear how deep that flooding would be for a 1m SLR, or indeed whether flooding could occur at the lesser SLR (would need more detailed modelling). It is assumed for scoring purposes that the additional northbound and southbound lanes can be designed to be adaptable in future to sufficiently accommodate SLR to minimise future coastal flooding, in conjunction with a more detailed assessment of the future adaptation needed for the hatched area covering the existing section of SH20 in Fig. 2.
- No direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) will occur for SH20A (George Bolt Memorial Drive), therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these creeks over time on the back of SLR.
- The present 1% AEP storm-tide level of 2.92 m (AVD-46) was used for the Pukaki Creek and Waokauri Creek areas and 3.02 m (AVD-46) for Tararata Creek (off Mangere Inlet). These are values for sites #47 and #18 respectively from Table 3-6 of Stephens et al. (2016) in the Reference list on p. 1.
- Existing crossings over the creek tributaries of Waokauri Creek (present SH20B), are planned to be upgraded or retained: **i)** culverts increased or replaced to accommodate SLR and associated storm-tide flows and water levels; **ii)** existing bridge (>9 m AVD-46) over the larger middle tributary (Fig. 1) is to be retained for the proposed service road (for all options). The new bridge(s) across the creek tributaries of Waokauri Creek to the south of the present SH20B should, where possible, bridge the waterway via a single span or piers/piles should be located out of the main tidal channel and similarly new culverts should follow the existing watercourse alignment. Therefore, the MCDA scores assume these aspects can be built into the design.
- New bridges across Pukaki Creek are assumed to be the same height as the existing bridge (which has a minimum deck level of 7.25 m (AVD-46) and soffit level of ~4.05 m (AVD-46). This lowest soffit level would accommodate ~1 m SLR for a 1% AEP storm-tide event. Piers or piles should align with the average peak tidal flow (ebb and flood) directions and existing piles/piers where possible.
- This assessment is subject to findings from field surveys during later assessments and any overlaps with freshwater stream processes.

Other Information relied upon

- See list of references and maps (Figures 1–2).

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted], PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton
Area of assessment	Coastal processes and coastal climate change and sea-level rise

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) of nearest option C4. ~~Yes/~~No No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Sea-level rise and coastal climate change: -1 My reasoning/justification for this is as follows: The present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore, the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios).
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment (Option C4)	I confirm that I still stand by my reasoning and scoring of the Airport to Botany long list criteria (for the RTC between Puhinui and the Airport) Yes/~~No~~ ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ – : –

	~~My reasoning/justification for this is as follows:~~
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	

Construction effects on CMA	-1
Geomorphology, sedimentation & tidal flows	-1
Sea-level rise and coastal climate change	-1*

** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.*

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Construction effects on CMA:***
  - Reasons/comments: While there would be an additional upper tidal-arm crossing to the south of SH20B and to east of SH20 (in upper eastern Waokauri Creek opposite end of Daphne Rd) for the SUP only for Option 2a - construction runoff of sediment and creek-bed disturbances should still be quite manageable. Main reason is direct (flowing) tidal connection to these upper arms only occurs at high spring tides (other than catchment runoff during rainfall events). Only minor construction effects will arise in modifying the existing SH20B between Orrs Road, east to Memorial Gardens [GA Plan Sheet 22] to convert it to a local service road and upgrade culverts, so the effect will be minor on the more active seaward side of the tidal creek system at spring high tides in the three tributaries of the Waokauri Creek (compared to widening SH20B by 1 lane in the long-list option C4, without a service road). The score has been left at -1 as before (assuming erosion/sediment control measures can minimize sediment runoff and seabed disturbances on the upper tide range environment).

    A wider encroachment of the CMA will also be required for the SUP (besides only the RTC considered in long-list assessment) alongside the small eastern side arm of Pukaki Creek (Otaimako Creek – Fig.1) – but construction effects should

	still be quite manageable in the upper inter-tidal zone of this side arm. The extra southbound and northbound lanes on SH20 over Tararata Creek (Mangere Inlet) are widened bridged sections on both sides SH20 [Sheet 3 in GA Plans] and are common to all short-list options. Provided there is minimal disturbance of the CMA and avoidance of piers in the main tidal channel, the effects on coastal processes and turbidity should be manageable through effective sediment & erosion control measures. ■ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this option on the effects on geomorphology of the upper tidal inlets and tidal flows over the operational life for any of CMA crossings (excluding Pukaki Creek bridges considered separately), even with the addition of the SUP south of SH20B and alongside SH20 at the upper eastern end of Waokauri Creek. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be managed via the design of the new bridges and culverts across the Waokauri Creek crossings for the new carriageways south of the existing SH20B [GA Plan Sheet 22], while the present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. – Therefore, the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios). Sea-level rise and storm-tide aspects will need to be considered in designing the levels of the SUP ad RTC across Otaimako Creek (Fig. 1) – but again can be mitigated through the design. – For the SH20 Tararata Creek crossing, especially for the northbound lane, note the assumption below (2nd bullet) given the area to the west and south of Tararata Creek bridge is within the CSI layer in the AUP. If an adaptable design is problematic, then the score may need to go down to -2 (with respect to the Tararata Creek crossing).

4) Pukaki Creek

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Construction effects on CMA	-2
Geomorphology, sedimentation & tidal flows	-1
Sea-level rise and coastal climate change	-1*

** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.*

My additional reasoning/justification for this is as follows:

Reasons / Comments

- ***Construction effects on CMA:***
  - Reasons/comments: The additional new bridge crossings over Pukaki Creek for the westbound double lanes, RTC and the SUP will require tight construction and erosion/sediment control measures to minimize seabed disturbances in the CMA and generation of turbid sediment plumes during construction, including any temporary staging used. Therefore, this increased risk in a main tidal channel has been scored at -2.

    Further, another potential encroachment on the CMA may be required for the RTC and SUP across the small eastern side arm of Pukaki Creek (Ch. 400-500 of GA Plan Sheet 20, situated 200 m west of Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm.
- ***Geomorphology/sedimentation & tidal flows:***
  - Reasons/comments: No substantial change for this combined option on the effects on geomorphology of the tidal inlets and tidal flows over the operational life for any of CMA crossings, provided the piers/piles of the new Pukaki Creek bridges match the diameter/size supporting the existing bridge and they are aligned where possible with the average peak tidal flow directions (ebb and flood) under the structures and with the existing piles/piers to minimize general scour in the channel and turbulent wakes.
- ***Sea-level rise and coastal climate change:***
  - Reasons/comments: Sea-level rise and climate change aspects can be accommodated in the new bridge structures, even if they are designed to the

	same deck level as the existing Pukaki Bridge. Stress-testing the new bridge options, using the 4 SLR scenarios in the 2017 MfE Coastal Guidance out to 2120 (ranging from 0.55 to 1.36 m), would mean the future 1% AEP storm-tide level could be in the range 3.47–4.28 m (AVD-46). The highest 2120 storm-tide scenario, is still well below the existing deck level of 7.25 m (AVD-46), but slightly higher (by ~20 cm) than the lowest soffit level of the existing bridge of ~4.05 m. It is assumed that the soffit level of the new bridges could accommodate a slightly higher soffit level. Consequently, the score for this criterion remains at -1, given sufficient capacity for SLR to be accommodated for the Pukaki Creek crossings. ,	

Notes:

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in four areas associated with the Pukaki Creek and its tributaries: i) Extra crossing in upper eastern Waokauri Creek (opposite end of Daphne Road) for the SUP on eastern side of SH20 (between Portage Road and Puhinui I/C); ii) SUP south of SH20B (Puhinui Road) around Price Road up to Campana Road – crossing 3 arms of upper southern Waokauri Creek; iii) SUP and RTC south of Puhinui Road (SH20B), to the west of Orrs Road at the boundary with the Airport precinct including upper Otaimako Creek and the small eastern side arm of Pukaki Creek (Ch. 400-500, situated 300 northeast of Otaimako Creek – Fig.1); and, iv) The additional Pukaki Creek bridge(s) (for west bound double lanes for SH20B, RTC and SUP).
- *Tararata Creek crossings for SH20 (Fig. 2): All short-list options retain both a southbound and northbound additional lane on the east and west sides respectively with a widening of the bridges either side [Sheet 3 of GA Plans]. However, it is noted from Fig. 2, the area to the west and south of the existing Tararata Creek bridge is within the Coastal Storm Inundation (CSI) layer in the Auckland Unitary Plan. This means it would be subject to coastal flooding for a 1% AEP event with a 1 metre sea-level rise, but it is unclear how deep that flooding would be for a 1m SLR, or indeed whether flooding could occur at the lesser SLR (would need more detailed modelling). It is assumed for scoring purposes that the additional northbound and southbound lanes can be designed to be adaptable in future to sufficiently accommodate SLR to minimise future coastal flooding, in conjunction with a more detailed assessment of the future adaptation needed for the hatched area covering the existing section of SH20 in Fig. 2.
- No direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) will occur for SH20A (George Bolt Memorial Drive), therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these creeks over time on the back of SLR.
- The present 1% AEP storm-tide level of 2.92 m (AVD-46) was used for the Pukaki Creek and Waokauri Creek areas and 3.02 m (AVD-46) for Tararata Creek (off Mangere Inlet). These are values for sites #47 and #18 respectively from Table 3-6 of Stephens et al. (2016) in the Reference list on p. 1.
- Existing crossings over the creek tributaries of Waokauri Creek (present SH20B), are planned to be upgraded or retained: **i)** culverts increased or replaced to accommodate SLR and associated storm-tide flows and water levels; **ii)** existing bridge (>9 m AVD-46) over the larger middle tributary (Fig. 1) is to be

retained for the proposed service road (for all options). The new bridge(s) across the creek tributaries of Waokauri Creek to the south of the present SH20B should, where possible, bridge the waterway via a single span or piers/piles should be located out of the main tidal channel and similarly new culverts should follow the existing watercourse alignment. Therefore, the MCDA scores assume these aspects can be built into the design.

- New bridges across Pukaki Creek are assumed to be the same height as the existing bridge (which has a minimum deck level of 7.25 m (AVD-46) and soffit level of ~4.05 m (AVD-46). This lowest soffit level would accommodate ~1 m SLR for a 1% AEP storm-tide event. Piers or piles should align with the average peak tidal flow (ebb and flood) directions and existing piles/piers where possible.
- This assessment is subject to findings from field surveys during later assessments and any overlaps with freshwater stream processes.

Other Information relied upon

- See list of references and maps (Figures 1–2).

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted], PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton
Area of assessment	Coastal processes and coastal climate change and sea-level rise

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) for nearest option C4. ~~Yes/~~No No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Sea-level rise and coastal climate change: -1 My reasoning/justification for this is as follows: The present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore, the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios).
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes/~~No~~ ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ – : –

<table>
<tr><td></td><td>~~My reasoning/justification for this is as follows:~~</td></tr>
<tr><td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td><td>
<table>
<tr><td>Criteria</td><td>N/A</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ No crossings of coastal areas
</td></tr>
<tr><td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td><td>
<table>
<tr><td>Construction effects on CMA</td><td>-1</td></tr>
<tr><td>Geomorphology, sedimentation & tidal flows</td><td>-1</td></tr>
<tr><td>Sea-level rise and coastal climate change</td><td>-1*</td></tr>
</table>
* See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.

My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Construction effects on CMA:
– <u>Reasons/comments:</u> While there would be an additional upper tidal-arm crossing to east of SH20 (in upper eastern Waokauri Creek opposite end of Daphne Road) for <u>both the SUP and RTC</u> for Option 2b - construction runoff of sediment and creek-bed disturbances should still be quite manageable. Main reason is direct (flowing) tidal connection to these upper arms only occurs at high spring tides (other than catchment runoff during rainfall events). Only minor construction effects will arise in modifying the existing SH20B between Orrs Road, east to Memorial Gardens [GA Plan Sheet 22] to convert it to a local service road and upgrade culverts, so the effect will be minor on the more active seaward side of the tidal creek system at spring high tides in the three tributaries of the Waokauri Creek (compared to widening SH20B by 1 lane in the long-list option C4, without a service road).. The score has been left at -1 as before (assuming erosion/sediment control measures can minimize sediment runoff
</td></tr>
</table>

	and seabed disturbances on the upper tide range environment). Previously for long-list C4 option, the RTC alongside the small eastern side arm of Pukaki Creek (Otaimako Creek – Fig.1) was assessed, but this short-list Option 2b substitutes the SUP (so no further influences on the score from this area). In any case, construction effects should still be quite manageable in the upper inter-tidal zone of this side arm. The extra southbound and northbound lanes on SH20 over Tararata Creek (Mangere Inlet) are widened bridged sections on both sides SH20 [Sheet 3 in GA Plans] and are common to all short-list options. Provided there is minimal disturbance of the CMA and avoidance of piers in the main tidal channel, the effects on coastal processes and turbidity should be manageable through effective sediment & erosion control measures. ■ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this option on the effects on geomorphology of the upper tidal inlets and tidal flows over the operational life for any of CMA crossings (excluding Pukaki Creek bridges considered separately), even with the addition of the SUP south of SH20B and the RTC and SUP alongside SH20 at the far eastern end of Waokauri Creek. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be managed via the design of the new bridges and culverts across the Waokauri Creek crossings for the new carriageways south of the existing SH20B [GA Plan Sheet 22], while the present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios).Sea-level rise and storm-tide aspects will need to be considered in designing the levels of the addition of the SUP across Otaimako Creek (Fig. 1) – but again can be mitigated through the design.

	– For the SH20 Tararata Creek crossing, especially for the northbound lane, note the assumption below (2nd bullet) given the area to the west and south of Tararata Creek bridge is within the CSI layer in the AUP. If an adaptable design is problematic, then the score may need to go down to -2 (with respect to Tararata Creek crossing).
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Construction effects on CMA</td><td>-2</td></tr><tr><td>Geomorphology, sedimentation & tidal flows</td><td>-1</td></tr><tr><td>Sea-level rise and coastal climate change</td><td>-1*</td></tr></table> ** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.* My <u>additional</u> reasoning/justification for this is as follows: <u>Reasons / Comments</u> ■ ***Construction effects on CMA:*** – <u>Reasons/comments:</u> The additional new bridge crossings over Pukaki Creek for the westbound double lanes and the SUP (even without the RTC bridge for this option) will require tight construction and erosion/sediment control measures to minimize seabed disturbances in the CMA and generation of turbid sediment plumes during construction, including any temporary staging used. Therefore, this increased risk in a main tidal channel has been scored at -2. Further, another potential encroachment on the CMA may be required for the SUP alongside the small eastern side arm of Pukaki Creek (Ch. 400-500 of GA Plan Sheet 20, situated 200 m west of Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm (and less risk than Option 2a where the RTC is also included). ■ ***Geomorphology/sedimentation & tidal flows:*** – <u>Reasons/comments:</u> No substantial change for this combined option on the effects on geomorphology of the tidal inlets and tidal flows over the operational life for any of CMA crossings, provided the piers/piles of the new Pukaki Creek bridges match the diameter/size supporting the existing

	bridge and they are aligned where possible with the average peak tidal flow directions (ebb and flood) under the structures and with the existing piles/piers to minimize general scour in the channel and turbulent wakes. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be accommodated in the new bridge structures, even if they are designed to the same deck level as the existing Pukaki Bridge. Stress-testing the new bridge options, using the 4 SLR scenarios in the 2017 MfE Coastal Guidance out to 2120 (ranging from 0.55 to 1.36 m), would mean the future 1% AEP storm-tide level could be in the range 3.47–4.28 m (AVD-46). The highest 2120 storm-tide scenario, is still well below the existing deck level of 7.25 m (AVD-46), but slightly higher (by ~20 cm) than the lowest soffit level of the existing bridge of ~4.05 m. It is assumed that the soffit level of the new bridges could accommodate a slightly higher soffit level. – Consequently, the score for this criterion remains at -1, given sufficient capacity for SLR to be accommodated for the Pukaki Creek crossings.

Notes:

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in four areas associated with the Pukaki Creek and its tributaries: i) Extra crossings in upper eastern Waokauri Creek (opposite end of Daphne Road) for the SUP and RTC on eastern side of SH20 (between Portage Road and Puhinui I/C); ii) SUP south of SH20B (Puhinui Road) around Price Road up to Campana Road – crossing 3 arms of upper southern Waokauri Creek; iii) SUP south of Puhinui Road (SH20B), to the west of Orrs Road at the boundary with the Airport precinct including upper Otaimako Creek and the small eastern side arm of Pukaki Creek (Ch. 400-500, situated 300 northeast of Otaimako Creek – Fig.1); and, iv) The additional Pukaki Creek bridge(s) (for west bound double lanes for SH20B and the SUP).
- *Tararata Creek crossings for SH20 (Fig. 2): All short-list options retain both a southbound and northbound additional lane on the east and west sides respectively with a widening of the bridges either side [Sheet 3 of GA Plans]. However, it is noted from Fig. 2, the area to the west and south of the existing Tararata Creek bridge is within the Coastal Storm Inundation (CSI) layer in the Auckland Unitary Plan. This means it would be subject to coastal flooding for a 1% AEP event with a 1 metre sea-level rise, but it is unclear how deep that flooding would be for a 1m SLR, or indeed whether flooding could occur at the lesser SLR (would need more detailed modelling). It is assumed for scoring purposes that the additional northbound and southbound lanes can be designed to be adaptable in future to sufficiently accommodate SLR to minimise future coastal flooding, in conjunction with a more detailed assessment of the future adaptation needed for the hatched area covering the existing section of SH20 in Fig. 2.

- No direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) will occur for SH20A (George Bolt Memorial Drive), therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these creeks over time on the back of SLR.
- The present 1% AEP storm-tide level of 2.92 m (AVD-46) was used for the Pukaki Creek and Waokauri Creek areas and 3.02 m (AVD-46) for Tararata Creek (off Mangere Inlet). These are values for sites #47 and #18 respectively from Table 3-6 of Stephens et al. (2016) in the Reference list on p. 1.
- Existing crossings over the creek tributaries of Waokauri Creek (present SH20B), are planned to be upgraded or retained: **i)** culverts increased or replaced to accommodate SLR and associated storm-tide flows and water levels; **ii)** existing bridge (>9 m AVD-46) over the larger middle tributary (Fig. 1) is to be retained for the proposed service road (for all options). The new bridge(s) across the creek tributaries of Waokauri Creek to the south of the present SH20B should, where possible, bridge the waterway via a single span or piers/piles should be located out of the main tidal channel and similarly new culverts should follow the existing watercourse alignment. Therefore, the MCDA scores assume these aspects can be built into the design.
- New bridges across Pukaki Creek are assumed to be the same height as the existing bridge (which has a minimum deck level of 7.25 m (AVD-46) and soffit level of ~4.05 m (AVD-46). This lowest soffit level would accommodate ~1 m SLR for a 1% AEP storm-tide event. Piers or piles should align with the average peak tidal flow (ebb and flood) directions and existing piles/piers where possible.
- This assessment is subject to findings from field surveys during later assessments and any overlaps with freshwater stream processes.

Other Information relied upon

- See list of references and maps (Figures 1–2).

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted], PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton
Area of assessment	Coastal processes and coastal climate change and sea-level rise

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) for the nearest equivalent long-list option C4. ~~Yes/~~No No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Sea-level rise and coastal climate change: -1 My reasoning/justification for this is as follows: The present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore, the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios).
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes/~~No~~ ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ – : –

	~~My reasoning/justification for this is as follows:~~
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	

Construction effects on CMA	-1
Geomorphology, sedimentation & tidal flows	-1
Sea-level rise and coastal climate change	-1*

** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.*

My reasoning/justification for this is as follows:

Reasons / Comments

- ***Construction effects on CMA:***
  - Reasons/comments: While there would be an additional upper tidal-arm crossing to the south of SH20B and to east of SH20 (in upper eastern Waokauri Creek opposite end of Daphne Road) for the SUP only, for Option 3a - construction runoff of sediment and creek-bed disturbances should still be quite manageable. Main reason is direct (flowing) tidal connection to these upper arms only occurs at high spring tides (other than catchment runoff during rainfall events). Only minor construction effects will arise in modifying the existing SH20B between Orrs Road, east to Memorial Gardens [GA Plan Sheet 22] to convert it to a local service road and upgrade culverts, so the effect will be minor on the more active seaward side of the tidal creek system at spring high tides in the three tributaries of the Waokauri Creek (compared to widening SH20B by 1 lane in the long-list option C4, without a service road). The score has been left at -1 as before (assuming erosion/sediment control measures can minimize sediment runoff and seabed disturbances on the upper tide range environment).

    Another (or a widened) encroachment on the CMA may be required for the SUP (as well as for the RTC) alongside the small eastern side arm of Pukaki Creek (Otaimako Creek – Fig.1) – but construction effects should still be quite

	manageable in the upper inter-tidal zone of this side arm. ■ The extra southbound and northbound lanes on SH20 over Tararata Creek (Mangere Inlet) are widened bridged sections on both sides SH20 [Sheet 3 in GA Plans] and are common to all short-list options. Provided there is minimal disturbance of the CMA and avoidance of piers in the main tidal channel, the effects on coastal processes and turbidity should be manageable through effective sediment & erosion control measures. ■ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this option on the effects on geomorphology of the upper tidal inlets and tidal flows over the operational life for any of CMA crossings (excluding Pukaki Creek bridges considered separately), even with the addition of the SUP south of SH20B and alongside SH20 at the upper eastern end of Waokauri Creek. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be managed via the design of the new bridges and culverts across the Waokauri Creek crossings for the new carriageways south of the existing SH20B [GA Plan Sheet 22], while the present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore, the scoring has been altered to -1 (compared with the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios). Sea-level rise and storm-tide aspects will need to be considered in designing the levels of the SUP and RTC across Otaimako Creek (Fig. 1) – but again can be mitigated through the design. – For the SH20 Tararata Creek crossing, especially for the northbound lane, note the assumption below (2nd bullet) given the area to the west and south of Tararata Creek bridge is within the CSI layer in the AUP. If an adaptable design is problematic, then the score may need to go down to -2 (with respect to the Tararata Creek crossing).	

4) Pukaki Creek

Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)

Construction effects on CMA	-2
Geomorphology, sedimentation & tidal flows	-1
Sea-level rise and coastal climate change	-1*

** See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.*

My additional reasoning/justification for this is as follows:

Reasons / Comments

- ***Construction effects on CMA:***
  - Reasons/comments: The additional new bridge crossing over Pukaki Creek for the RTC and the SUP will require tight construction and erosion/sediment control measures to minimize seabed disturbances in the CMA and generation of turbid sediment plumes during construction, including any temporary staging used. Therefore, this increased risk in a main tidal channel has been scored at -2.

    Further, another potential encroachment on the CMA may be required for the RTC and SUP across the small eastern side arm of Pukaki Creek (Ch. 400-500 of GA Plan Sheet 20, situated 200 m west of Otaimako Creek – Fig.1) – but construction effects should still be quite manageable in the upper inter-tidal zone of this side arm.
- ***Geomorphology/sedimentation & tidal flows:***
  - Reasons/comments: No substantial change for this combined option on the effects on geomorphology of the tidal inlets and tidal flows over the operational life for any of CMA crossings, provided the piers/piles of the new Pukaki Creek bridge match the diameter/size supporting the existing bridge and they are aligned where possible with the average peak tidal flow directions (ebb and flood) under the structure and with the existing piles/piers to minimize general scour in the channel and turbulent wakes.
- ***Sea-level rise and coastal climate change:***
  - Reasons/comments: Sea-level rise and climate change aspects can be accommodated in the new bridge structures, even if they are designed to the

	same deck level as the existing Pukaki Bridge. Stress-testing the new bridge options, using the 4 SLR scenarios in the 2017 MfE Coastal Guidance out to 2120 (ranging from 0.55 to 1.36 m), would mean the future 1% AEP storm-tide level could be in the range 3.47–4.28 m (AVD-46). The highest 2120 storm-tide scenario, is still well below the existing deck level of 7.25 m (AVD-46), but slightly higher (by ~20 cm) than the lowest soffit level of the existing bridge of ~4.05 m. It is assumed that the soffit level of the new bridges could accommodate a slightly higher soffit level. – Consequently, the score for this criterion remains at -1, given sufficient capacity for SLR to be accommodated for the Pukaki Creek crossings. –	

Notes:

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in four areas associated with the Pukaki Creek and its tributaries: i) Extra crossing in upper eastern Waokauri Creek (opposite end of Daphne Road) for the SUP on eastern side of SH20 (between Portage Road and Puhinui I/C); ii) SUP and RTC south of SH20B (Puhinui Road) around Price Road up to Campana Road – crossing 3 arms of upper southern Waokauri Creek; iii) SUP and RTC south of Puhinui Road (SH20B), to the west of Orrs Road at the boundary with the Airport precinct including upper Otaimako Creek and the small eastern side arm of Pukaki Creek (Ch. 400-500, situated 300 northeast of Otaimako Creek – Fig.1); and, iv) The additional Pukaki Creek bridge(s) (for the RTC and SUP).
- *Tararata Creek crossings for SH20 (Fig. 2): All short-list options retain both a southbound and northbound additional lane on the east and west sides respectively with a widening of the bridges either side [Sheet 3 of GA Plans]. However, it is noted from Fig. 2, the area to the west and south of the existing Tararata Creek bridge is within the Coastal Storm Inundation (CSI) layer in the Auckland Unitary Plan. This means it would be subject to coastal flooding for a 1% AEP event with a 1 metre sea-level rise, but it is unclear how deep that flooding would be for a 1m SLR, or indeed whether flooding could occur at the lesser SLR (would need more detailed modelling). It is assumed for scoring purposes that the additional northbound and southbound lanes can be designed to be adaptable in future to sufficiently accommodate SLR to minimise future coastal flooding, in conjunction with a more detailed assessment of the future adaptation needed for the hatched area covering the existing section of SH20 in Fig. 2.
- No direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) will occur for SH20A (George Bolt Memorial Drive), therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these creeks over time on the back of SLR.
- The present 1% AEP storm-tide level of 2.92 m (AVD-46) was used for the Pukaki Creek and Waokauri Creek areas and 3.02 m (AVD-46) for Tararata Creek (off Mangere Inlet). These are values for sites #47 and #18 respectively from Table 3-6 of Stephens et al. (2016) in the Reference list on p. 1.
- Existing crossings over the creek tributaries of Waokauri Creek (present SH20B), are planned to be upgraded or retained: **i)** culverts increased or replaced to accommodate SLR and associated storm-tide

flows and water levels; **ii)** existing bridge (>9 m AVD-46) over the larger middle tributary (Fig. 1) is to be retained for the proposed service road (for all options). The new bridge(s) across the creek tributaries of Waokauri Creek to the south of the present SH20B should, where possible, bridge the waterway via a single span or piers/piles should be located out of the main tidal channel and similarly new culverts should follow the existing watercourse alignment. Therefore, the MCDA scores assume these aspects can be built into the design.

- New bridges across Pukaki Creek are assumed to be the same height as the existing bridge (which has a minimum deck level of 7.25 m (AVD-46) and soffit level of ~4.05 m (AVD-46). This lowest soffit level would accommodate ~1 m SLR for a 1% AEP storm-tide event. Piers or piles should align with the average peak tidal flow (ebb and flood) directions and existing piles/piers where possible.
- This assessment is subject to findings from field surveys during later assessments and any overlaps with freshwater stream processes.

Other Information relied upon

- See list of references and maps (Figures 1–2).

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	[redacted], PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ Programme Leader: Hazards & Risk, NIWA, Hamilton
Area of assessment	Coastal processes and coastal climate change and sea-level rise

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	I confirm that I still stand by my reasoning and scoring of the long list criteria (for the applicable extent) for the nearest long-list option C4. ~~Yes/~~No No, in light of the additional information, my scoring and reasoning from the long list assessment has changed. I now consider the score for the Puhinui Interchange to Orrs Road should be: Sea-level rise and coastal climate change: -1 My reasoning/justification for this is as follows: The present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore, the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios).
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I confirm that I still stand by my reasoning and scoring of the A2B long list criteria (for the RTC between Puhinui and the Airport) Yes~~/No~~ ~~No, in light of the additional information, my scoring and reasoning from the A2B long list assessment has changed. I now consider the score for the RTC along SH20B should be:~~ – : –

<table>
<tr><td></td><td>~~My reasoning/justification for this is as follows:~~</td></tr>
<tr><td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td><td>
<table>
<tr><td>Criteria</td><td>N/A</td></tr>
</table>
My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ No crossings of coastal areas
</td></tr>
<tr><td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td><td>
<table>
<tr><td>Construction effects on CMA</td><td>-1</td></tr>
<tr><td>Geomorphology, sedimentation & tidal flows</td><td>-1</td></tr>
<tr><td>Sea-level rise and coastal climate change</td><td>-1*</td></tr>
</table>
* See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.

My reasoning/justification for this is as follows:
<u>Reasons / Comments</u>
■ Construction effects on CMA:
– <u>Reasons/comments:</u> While there would be an additional upper tidal-arm crossing to east of SH20 (in upper eastern Waokauri Creek opposite end of Daphne Road) for <u>the SUP and RTC</u> for Short List Option 3b - construction runoff of sediment and creek-bed disturbances should still be quite manageable. Main reason is direct (flowing) tidal connection to these upper arms only occurs at high spring tides (other than catchment runoff during rainfall events).
– Only minor construction effects will arise in modifying the existing SH20B between Orrs Road, east to Memorial Gardens [GA Plan Sheet 22] to convert it to a local service road and upgrade culverts, so the effect will be minor on the more active seaward side of the tidal creek system at spring high tides in the three tributaries of the Waokauri Creek (compared to widening SH20B by 1 lane in the long-list option C4, without a service road).The score has been left at -1 as before (assuming erosion/sediment control measures can</td></tr>
</table>

	minimize sediment runoff and seabed disturbances on the upper tide range environment). Previously for Long-list option C4, the RTC alongside the small eastern side arm of Pukaki Creek (Otaimako Creek – Fig.1) was assessed but this Short-list Option 3b substitutes the SUP instead (so no further influence on the score for this area). In any case, construction effects should still be quite manageable in the upper inter-tidal zone of this side arm. The extra southbound and northbound lanes on SH20 over Tararata Creek (Mangere Inlet) are widened bridged sections on both sides SH20 [Sheet 3 in GA Plans] and are common to all short-list options. Provided there is minimal disturbance of the CMA and avoidance of piers in the main tidal channel, the effects on coastal processes and turbidity should be manageable through effective sediment & erosion control measures. ■ ***Geomorphology/sedimentation & tidal flows:*** – Reasons/comments: No substantial change for this option on the effects on geomorphology of the upper tidal inlets and tidal flows over the operational life for any of CMA crossings (excluding Pukaki Creek bridges considered separately), even with the addition of the SUP south of SH20Band the RTC and SUP alongside SH20 at the far eastern end of Waokauri Creek. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be managed via the design of the new bridges and culverts across the Waokauri Creek crossings for the new carriageways south of the existing SH20B [GA Plan Sheet 22], while the present SH20B section [GA Plan Sheet 22], traversing the three Waokauri Creek crossings, will become a local service road with only minor works and culvert upgrades proposed on the northern side of SH20B. Therefore, the scoring has been altered to -1 (compared with -2 for the equivalent long-list option C4) as the proposed works are minimal to the north of SH20B, where the direct tidal creek connections to the main estuary occur, provided the existing bridge and culvert sizes provide sufficient waterways for conveying the tidal flow for the higher SLR scenarios). – Sea-level rise and storm-tide aspects will need to be considered in designing the levels of the SUP alongside Otaimako Creek (Fig. 1) – but again can be mitigated through the design.

<table>
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For the SH20 Tararata Creek crossing, especially for the northbound lane, note the assumption below (2nd bullet) given the area to the west and south of Tararata Creek bridge is within the CSI layer in the AUP. If an adaptable design is problematic, then the score may need to go down to -2 (with respect to Tararata Creek crossing).

</td>
</tr>
<tr>
<td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Construction effects on CMA</td><td>-2</td></tr>
<tr><td>Geomorphology, sedimentation & tidal flows</td><td>-1</td></tr>
<tr><td>Sea-level rise and coastal climate change</td><td>-1*</td></tr>
</table>
* See assumption below regarding sea-level rise and coastal flooding south and west of Tararata Creek crossing.

My <u>additional</u> reasoning/justification for this is as follows:
<u>Reasons / Comments</u>

Construction effects on CMA:

<u>Reasons/comments:</u> The additional new bridge crossings over Pukaki Creek for the SUP (even without the RTC bridge for this option) will require tight construction and erosion/sediment control measures to minimize seabed disturbances in the CMA and generation of turbid sediment plumes during construction, including any temporary staging used. Therefore, this increased risk in a main tidal channel has still been scored at -2 (although slight reduction in risk than having the widened bridge including both the SUP and the RTC).

Further, another potential encroachment on the CMA may be required for the SUP alongside the small eastern side arm of Pukaki Creek (Ch. 400-500 of GA Plan Sheet 20, situated 300 m northeast of Otaimako Creek – Fig.1) – but the footprint is probably largely outside the CMA.

Geomorphology/sedimentation & tidal flows:

<u>Reasons/comments:</u> No substantial change for this combined option on the effects on geomorphology of the tidal inlets and tidal flows over the operational life for any of CMA crossings, provided the piers/piles of the new Pukaki Creek bridge supporting the SUP, match the diameter/size

</td>
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</table>

	supporting the existing bridge and they are aligned where possible with the average peak tidal flow directions (ebb and flood) under the structures and with the existing piles/piers to minimize general scour in the channel and turbulent wakes. ■ ***Sea-level rise and coastal climate change:*** – Reasons/comments: Sea-level rise and climate change aspects can be accommodated in the new bridge structures, even if they are designed to the same deck level as the existing Pukaki Bridge. Stress-testing the new bridge options, using the 4 SLR scenarios in the 2017 MfE Coastal Guidance out to 2120 (ranging from 0.55 to 1.36 m), would mean the future 1% AEP storm-tide level could be in the range 3.47–4.28 m (AVD-46). The highest 2120 storm-tide scenario, is still well below the existing deck level of 7.25 m (AVD-46), but slightly higher (by ~20 cm) than the lowest soffit level of the existing bridge of ~4.05 m. It is assumed that the soffit level of the new bridge supporting the SUP could accommodate a slightly higher soffit level. – Consequently, the score for this criterion remains at -1 for this Option, given sufficient capacity for SLR to be accommodated for the Pukaki Creek crossings.

Notes:

Assumptions

- Potential direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) would only occur (due to proximity) in four areas associated with the Pukaki Creek and its tributaries: i) Extra crossings in upper eastern Waokauri Creek (opposite end of Daphne Road) for the SUP and RTC on eastern side of SH20 (between Portage Road and Puhinui I/C); ii) SUP south of SH20b (Puhinui Road) around Price Road up to Campana Road – crossing 3 arms of upper southern Waokauri Creek; iii) SUP south of Puhinui Road (SH20B), to the west of Orrs Road at the boundary with the Airport precinct including upper Otaimako Creek and the small eastern side arm of Pukaki Creek (Ch. 400-500, situated 300 northeast of Otaimako Creek – Fig.1); and, iv) An additional Pukaki Creek bridge – to support the SUP.
- *Tararata Creek crossings for SH20 (Fig. 2): All short-list options retain both a southbound and northbound additional lane on the east and west sides respectively with a widening of the bridges either side [Sheet 3 of GA Plans]. However, it is noted from Fig. 2, the area to the west and south of the existing Tararata Creek bridge is within the Coastal Storm Inundation (CSI) layer in the Auckland Unitary Plan. This means it would be subject to coastal flooding for a 1% AEP event with a 1 metre sea-level rise, but it is unclear how deep that flooding would be for a 1m SLR, or indeed whether flooding could occur at the lesser SLR (would need more detailed modelling). It is assumed for scoring purposes that the additional northbound and southbound lanes can be designed to be adaptable in future to sufficiently accommodate SLR to minimise future coastal flooding, in conjunction with a more detailed assessment of the future adaptation needed for the hatched area covering the existing section of SH20 in Fig. 2.

- No direct or indirect effects on the coastal environment or in the Coastal Marine Area (CMA) will occur for SH20A (George Bolt Memorial Drive), therefore no further considerations for SH20A were undertaken for assessing coastal processes.
- Considered the four sea-level rise (SLR) scenarios in the 2017 MfE Coastal Guidance (Fig. 27, Tables 10-11) for a planning period of 100 years as required under the NZ Coastal Policy Statement (NZCPS). By 2120, SLR would be in the range from 0.55 m to 1.36 m. Tidal flows and potential for coastal flooding (without recourse to a field visit) will increase in these creeks over time on the back of SLR.
- The present 1% AEP storm-tide level of 2.92 m (AVD-46) was used for the Pukaki Creek and Waokauri Creek areas and 3.02 m (AVD-46) for Tararata Creek (off Mangere Inlet). These are values for sites #47 and #18 respectively from Table 3-6 of Stephens et al. (2016) in the Reference list on p. 1.
- Existing crossings over the creek tributaries of Waokauri Creek (present SH20B), are planned to be upgraded or retained: **i)** culverts increased or replaced to accommodate SLR and associated storm-tide flows and water levels; **ii)** existing bridge (>9 m AVD-46) over the larger middle tributary (Fig. 1) is to be retained for the proposed service road (for all options). The new bridge(s) across the creek tributaries of Waokauri Creek to the south of the present SH20B should, where possible, bridge the waterway via a single span or piers/piles should be located out of the main tidal channel and similarly new culverts should follow the existing watercourse alignment. Therefore, the MCDA scores assume these aspects can be built into the design.
- For the existing Pukaki Creek Bridge, the minimum deck level is 7.25 m (AVD-46) and soffit level is ~4.05 m (AVD-46). This lowest soffit level would accommodate ~1 m SLR for a 1% AEP storm-tide event.
- This assessment is subject to findings from field surveys during later assessments and any overlaps with freshwater stream processes.

Other Information relied upon

- See list of references and maps (Figures 1–2).

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	PhD (Civil Engineering), CPEng (Environmental Engineering), CMEngNZ	[redacted]	5-Dec-2018
Reviewer	[redacted]	PhD (Ocean Engineering), BE(Hons.) (Civil Engineering), MEngNZ		14-Dec-2018

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Technical Note

To	[redacted]	From	[redacted]
Copy	[redacted]	Reference	**501094**
Date	**2018-11-28**	Pages (including this page)	**27**
Subject	**20 Connect Short List Options: Multi-Criteria Analysis Scoring Sheet: Natural Character, Landscape, Visual and Urban Design**		

The following provides an assessment of the short-list options for the 20Connect Single Stage Business Case (20Connect SSBC). The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) assessment which is being undertaken for the short-list options.

The source information assessed was based on desktop analysis only. The **natural character, landscape, visual and urban design** assessments were based on:

- The 20Connect long-list technical assessment undertaken by [redacted] dated 22 August 2018
- The 20Connect short-list schematics (dated 12 Oct 2018) and the short-list options descriptions document (dated 17 Oct 2018).
- Google Earth, Google Maps and Google Street View
- Auckland Council Unitary Plan Geomaps System (https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html)
- NZ Topographic Maps Online (https://topomap.co.nz)
- Te Araroa Trail website and maps (https://www.teararoa.org.nz/)
- NZTA Landscape Guidelines (Final Draft) and NZTA Bridging the Gap (Urban Design Guidelines)
- Local knowledge of the site and locality, including some recent (unrelated) visits to the site area

The options are outlined in the following table. The scores and assessments are outlined in the below tables.

Option	High-level description
Option 1a	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 1b	SH20B Offline grade separated connections - Puhinui South-facing Ramps - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 2a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 4 lanes
Option 2b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 4 lanes
Option 3a	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20B - Pukaki Creek 2 lanes

Option 3b	SH20B Online widening at grade connections - SH20 Widening - RTC on SH20 and SH20A - Pukaki Creek 2 lanes

The **Scoring Scale to be applied to the assessment below is the same as the Long List and is as follows:**

-3 Significant Adverse/Un-mitigatable

-2 Significant Adverse

-1 Minor/Moderate Adverse

0 Neutral

1 Minor Positive

2 Moderate Positive

3 Significant Positive

Table 1 Multi Criteria Analysis Scoring Sheet

Option 1a:	
Name of assessor (incl. qualifications and organisation)	[redacted] Registered Landscape Architect
Area of assessment	Natural Character, Landscape, Visual and Urban Design

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	In light of the additional information, my ***reasoning*** from the long list has changed, but the scores stay the same. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +2 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - Although difficult to determine from schematic drawings, potentially the off-line options would be aligned in close proximity to the existing SH20B, resulting in a high density of infrastructure. Ideally there would be some separation between the motorway and the local road to allow for landscape mitigation. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:*** - The off-line provisions for SH20B and the SUP provide positive outcomes in terms of connectivity. - The isolating of Puhinui Road at each end, with access to this road by motorway only (which is not ideal for short-length local trips), is not a good UD outcome. This might potentially be mitigated in the future with other local roads being developed in the area south of SH20B, but options for this area are not yet understood.

<table>
<tr><td></td><td>- As for landscape effects, ideally there would be some separation between the new off-line motorway and the local road. Also need to consider pedestrian cross-connectivity over/under the motorway.
- Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
–</td></tr>
<tr><td>2) Rapid Transit Corridor
Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment</td><td>I did not provide an assessment for the A2B project. However, I did incorporate comments on the RTC between Puhinui Interchange and Orrs Road in my 20Connect assessment, and stand by these.

<table><tr><td>Natural Character and Landscape Effects</td><td>-1</td></tr><tr><td>Visual Effects</td><td>-1</td></tr><tr><td>Urban Design Outcomes</td><td>+1</td></tr></table>
<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- No substantial changes within this extent of the project.
Visual Effects:
- No substantial changes within this extent of the project
Urban Design Outcomes:
- The provision of an RTC from the airport to Puhinui is a positive UD outcome in terms of providing a variety of connections to/from the airport (in addition to potential future LRT to the north).
- This is offset by not having the RTC along SH20 which (even without the Mangere Town Centre Loop) which would provide increased local connectivity, as provided by other options.
- However, overall, the installation of any RTC elements is considered a good outcome (score would have been higher if both options were provided).</td></tr>
<tr><td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td><td><table><tr><td>Natural Character and Landscape Effects</td><td>-1</td></tr><tr><td>Visual Effects</td><td>-1</td></tr><tr><td>Urban Design Outcomes</td><td>+2</td></tr></table>
<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- SH20 is flanked by relatively mature vegetation on the eastern side resulting in this motorway being an established green corridor through the city. Installing a SUP along the corridor may result in the loss of some/all of this vegetation. Can be partially mitigated through further planting, if space allows.
- Shorter term landscape effects may be likely through open rural areas by Prices Road, however this is zoned</td></tr>
</table>

	business and future landscape changes in this area are provided for in the Auckland Unitary Plan. - Ideally there would be some separation between the motorway and Puhinui Road to allow for landscape mitigation. ***Visual Effects:*** - For an extended length SH20 is flanked by earth bunds, which may be affected by the installation of a SUP, increasing the visibility of the motorway corridor (and introducing visibility of the SUP) from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor, if space allows. - Limited residential properties near the SH20/SH20B interchange. - Visual effects likely in the rural open areas around Prices Road, however this area is zoned business and future visual changes are provided for in the Auckland Unitary Plan. ***Urban Design Outcomes:*** - Inclusion of the RTC through SH20B allows good connectivity between Puhinui and the airport. However, this is offset by no improvement of connectivity between local centres (including Mangere Town Centre), as provided by other options. - Inclusion of the SUPs throughout is positive for walking and cycling. - Inclusion of the SUP along SH20B is positive for completing a safe, walkable portion of Te Araroa Trail. - The offline development of SH20B could potentially allow for enhanced urban design and gateway outcomes. - Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project. - The isolating of Puhinui Road at each end, with access to this road by motorway only (which is not ideal for short-length local trips) is not an ideal UD outcome (and offsets the positives listed above). This might potentially be mitigated in the future with other local roads being developed in the area south of SH20B, but options for this area are not yet understood. Ideally some separation would be provided between the motorway and Puhinui Road. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr><tr><td>Visual Effects</td><td>-1</td></tr><tr><td>Urban Design Outcomes</td><td>+2</td></tr></table> **<u>My reasoning/justification for this is as follows:</u>** ***Natural Character and Landscape Effects:*** - Pukaki Creek has high natural character and landscape values. The construction of new bridge structures for the road, RTC and SUP will introduce built character, will likely result in coastal vegetation clearance, and urbanization of the coastal edge. Some

	mitigation may be possible through planting and artistic representations. ***Visual Effects:*** - As outlined in the reasoning above. ***Urban Design Outcomes:*** - As outlined in the reasoning above. –

Notes:

Assumptions

- Assumptions as per memorandum provided by [redacted] to 20Connect Environmental Specialists dated 17th October 2018.
- Auckland International Airport will provide appropriate links with their designated land area and as part of this will develop appropriate gateway landscape concepts in association with NZTA at a later time.

Other Information relied upon

- As outlined above.

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Technical Note

Table 2 Multi Criteria Analysis Scoring Sheet

Option 1b:	
Name of assessor (incl. qualifications and organisation)	[redacted] Registered Landscape Architect
Area of assessment	Natural Character, Landscape, Visual and Urban Design

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	In light of the additional information, my ***reasoning*** from the long list has changed, but the scores stay the same. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +2 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - Although difficult to determine from schematic drawings, potentially the off-line options would be aligned in close proximity to the existing SH20B, resulting in a high density of infrastructure. Ideally there would be some separation between the motorway and the local road to allow for landscape mitigation. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:*** - The off-line provisions for SH20B and the SUP provide positive outcomes in terms of connectivity. - The isolating of Puhinui Road at each end, with access to this road by motorway only (which is not ideal for short-length local trips), is not a good UD outcome. This might potentially be mitigated in the future with other local roads being developed in the area south of SH20B, but options for this area are not yet understood. - As for landscape effects, ideally there would be some separation between the new off-line motorway and the local road. Also need to consider pedestrian cross-connectivity over/under the motorway. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
2) Rapid Transit Corridor	I did not provide an assessment for the A2B project. However, I did incorporate comments on the RTC

<table>
<tr>
<td>Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.</td>
<td>between Puhinui Interchange and the airport in my 20Connect assessment, and stand by these.

<table>
<tr><td>Natural Character and Landscape Effects</td><td>-1</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+1</td></tr>
</table>

<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- No substantial changes within this extent of the project.
Visual Effects:
- No substantial changes within this extent of the project
Urban Design Outcomes:
- The provision of an RTC along SH20 is a positive UD outcome in terms of providing faster, more efficient local connections between town centres (even without the RTC loop through Mangere Town Centre). This is offset by not having the RTC between the airport and Puhinui.
- However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).</td>
</tr>
<tr>
<td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td>
<td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-1</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+2</td></tr>
</table>

<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Bader Drive through Mangere Town Centre has a relatively high degree of landscape amenity, created by a planted central median (in parts) and a large number of mature street trees. The installation of RTC lanes is likely to affect this amenity.
Visual Effects:
- Some parts of Bader Drive are flanked by residential properties. The installation of an RTC corridor would be visible to these properties, with limited opportunity for mitigation. However, this is considered in the context that Bader Drive is an existing busy arterial road.
Urban Design Outcomes:
- The provision of an RTC through Mangere Town Centre is a positive UD outcome in terms of providing faster, reliable, and more efficient local connections between town centres. This is offset by not having the RTC between the airport and Puhinui.
- However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).</td>
</tr>
<tr>
<td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a</td>
<td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-1</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
</table>
</td>
</tr>
</table>

score for each criteria for both the road and RTC components of this option for the whole option.	

Urban Design Outcomes	+2

My reasoning/justification for this is as follows:

Natural Character and Landscape Effects:

- SH20 is flanked by relatively mature vegetation on the eastern side resulting in this motorway being an established green corridor through the city. Installing a SUP along the corridor may result in the loss of some/all of this vegetation. Can be partially mitigated through further planting, if space allows.
- Shorter term landscape effects may be likely through open rural areas by Prices Road, however this is zoned business and future landscape changes in this area are provided for in the Auckland Unitary Plan
- Bader Drive through Mangere Town Centre has a relatively high degree of landscape amenity, created by a planted central median (in parts) and a large number of mature street trees. The installation of RTC lanes is likely to affect this amenity.

Visual Effects:

- For an extended length SH20 is flanked by earth bunds, which may be affected by the installation of a SUP, increasing the visibility of the motorway corridor (and introducing visibility of the SUP) from neighbouring properties. This could be mitigated through placement of noise walls and/or planting within the corridor, if space allows.
- Some parts of Bader Drive are flanked by residential properties. The installation of an RTC corridor would be visible to these properties, with limited opportunity for mitigation. However, this is considered in the context that Bader Drive is an existing busy arterial road.
- Limited residential properties near the SH20/SH20B interchange.
- Visual effects likely in the rural open areas around Prices Road, however this area is zoned business and future visual changes are provided for in the Auckland Unitary Plan.

Urban Design Outcomes:

- Inclusion of the RTC through Mangere Town Centre allows good connectivity between town centres. However, this is offset by lack of connectivity between the airport and Puhinui, as is provided by other options.
- Inclusion of the SUPs throughout is positive for walking and cycling.
- Inclusion of the SUP along SH20B is positive for completing a safe, walkable portion of Te Araroa Trail.
- The offline development of SH20B could potentially allow for enhanced urban design and gateway outcomes.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- The isolating of Puhinui Road at each end, with access to this road by motorway only (which is not ideal for short-length local trips) is not an ideal UD outcome (and offsets the positives listed above). This might potentially be mitigated in the future with other local roads being developed in the area south of SH20B, but options for

<table>
<tr><td></td><td>this area are not yet understood. Ideally some separation would be provided between the motorway and Puhinui Road.
- Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+2</td></tr>
</table>
<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Pukaki Creek has high natural character and landscape values. The construction of new bridge structures for the road and SUP will introduce built character, will likely result in coastal vegetation clearance, and urbanization of the coastal edge. Some mitigation may be possible through planting and artistic representations.
Visual Effects:
- As outlined in the reasoning above.
Urban Design Outcomes:
- As outlined in the reasoning above.
</td></tr>
</table>

Notes:

Assumptions

- Assumptions as per memorandum provided by [redacted] to 20Connect Environmental Specialists dated 17th October 2018.
- Auckland International Airport will provide appropriate links with their designated land area and as part of this will develop appropriate gateway landscape concepts in association with NZTA at a later time.

Other Information relied upon

- As outlined above.

Table 3 Multi Criteria Analysis Scoring Sheet

Option 2a:	
Name of assessor (incl. qualifications and organisation)	[redacted] Registered Landscape Architect
Area of assessment	Natural Character, Landscape, Visual and Urban Design

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	In light of the additional information, my ***reasoning*** from the long list has changed, but the scores stay the same. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - The new schematics indicate the likely extent of widening, which will increase the degree of landscape character change brought about by the road in the shorter term. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:*** - Previously I had noted that the on-line option of widening SH20B was likely to diminish UD outcomes for existing local residents and businesses. The additional changes including service lanes to provide for at-grade connections diminishes the outcomes further, especially in comparison to other options, hence the lower score versus Options 1a and 1b. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I did not provide an assessment for the A2B project. However, I did incorporate comments on the RTC between Puhinui Interchange and the airport in my 20Connect assessment, and stand by these. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - No substantial changes within this extent of the project. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:***

	- The provision of an RTC along SH20 is a positive UD outcome in terms of providing faster, more efficient local connections between town centres (even without the RTC loop through Mangere Town Centre). This is offset by not having the RTC between the airport and Puhinui. - However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).
3) 20Connect Road + RTC SH20B Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)	<table><tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr><tr><td>Visual Effects</td><td>-1</td></tr><tr><td>Urban Design Outcomes</td><td>+1</td></tr></table> **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, which has geological and cultural value, although noted that this ONF is already impacted by existing motorway and quarry activity. Mitigation may be necessary. - SH20 is flanked by relatively mature vegetation on the eastern side resulting in this motorway being an established green corridor through the city. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation along the eastern side. Together with an increase in the area of transportation corridor, this would diminish the existing landscape values, and reduce natural habitat that has been created along the corridor. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a), hence the lower score (-2) for this option. - Road widening and the introduction of the SUP could affect Historic Heritage in Mangere Centre Park, and the amenity of the park itself (east of Bader Drive). Could be mitigated with planting and a specific design response. - Road widening of SH20A to accommodate south-facing ramps could affect the amenity of Williams Park (north side of SH20A on Imrie Avenue). Could be mitigated with planting and specific design response. - Road widening of SH20 could affect the amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. - Shorter term landscape effects may be likely through open rural areas by Prices Road, however this is zoned business and future landscape changes in this area are provided for in the Auckland Unitary Plan ***Visual Effects:*** - The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the on-ramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. New

<table>
<tr>
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<td>south-facing ramps between SH20A and SH20 may impact this viewshaft.
- For an extended length SH20 is flanked by earth bunds and vegetation which screens the motorway from neighbouring residential properties. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation and bunds along the eastern side. The likely loss of houses will eliminate visual effects on these properties, however will potentially introduce visual effects to the ‘second tier’ of houses. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a), and mitigation might also be possible with noise walls.
- Limited residential properties near main interchanges.
- Visual effects likely in the rural open areas around Prices Road, however this area is zoned business and future visual changes are provided for in the Auckland Unitary Plan.
Urban Design Outcomes:
- Inclusion of the RTC through SH20B allows good connectivity between Puhinui and the airport. However, this is offset by no improvement of connectivity between local centres (including Mangere Town Centre), as provided by other options.
- Inclusion of the SUPs throughout is positive for walking and cycling.
- Inclusion of the SUP along SH20B is positive for completing a safe, walkable portion of Te Araroa Trail.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Additional changes including service lanes to provide for at-grade connections diminishes the UD outcomes achieved along Puhinui Road.
- Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.</td>
</tr>
<tr>
<td>4) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td>
<td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+1</td></tr>
</table>

<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Pukaki Creek has high natural character and landscape values. The widening and/or construction of bridge structures for the road, RTC and SUP will enhance built character, will likely result in coastal vegetation clearance, and increased urbanization of the coastal edge. Some mitigation may be possible through planting and artistic representations.
Visual Effects:
- As outlined in the reasoning above.
Urban Design Outcomes:
- As outlined in the reasoning above.</td>
</tr>
</table>

Notes:

Assumptions

- Assumptions as per memorandum provided by [redacted] to 20Connect Environmental Specialists dated 17th October 2018.
- Auckland International Airport will provide appropriate links with their designated land area and as part of this will develop appropriate gateway landscape concepts in association with NZTA at a later time.

Other Information relied upon

- As outlined above.

Table 4 Multi Criteria Analysis Scoring Sheet

Option 2b:	
Name of assessor (incl. qualifications and organisation)	[redacted] Registered Landscape Architect
Area of assessment	Natural Character, Landscape, Visual and Urban Design

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	In light of the additional information, my ***reasoning*** from the long list has changed, but the scores stay the same. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - The new schematics indicate the likely extent of widening, which will increase the degree of landscape character change brought about by the road in the shorter term. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:*** - Previously I had noted that the on-line option of widening SH20B was likely to diminish UD outcomes for existing local residents and businesses. The additional changes including service lanes to provide for at-grade connections diminishes the outcomes further, especially in comparison to other options, hence the lower score versus Options 1a and 1b. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I did not provide an assessment for the A2B project. However, I did incorporate comments on the RTC between Puhinui Interchange and the airport in my 20Connect assessment, and stand by these. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - No substantial changes within this extent of the project. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:***

	- The provision of an RTC along SH20 is a positive UD outcome in terms of providing faster, more efficient local connections between town centres (even without the RTC loop through Mangere Town Centre). This is offset by not having the RTC between the airport and Puhinui. - However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).
3) Rapid Transit Corridor Mangere Town Centre Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)	Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +2 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - Bader Drive through Mangere Town Centre has a relatively high degree of landscape amenity, created by a planted central median (in parts) and a large number of mature street trees. The installation of RTC lanes is likely to affect this amenity. ***Visual Effects:*** - Some parts of Bader Drive are flanked by residential properties. The installation of an RTC corridor would be visible to these properties, with limited opportunity for mitigation. However, this is considered in the context that Bader Drive is an existing busy arterial road. ***Urban Design Outcomes:*** - The provision of an RTC through Mangere Town Centre is a positive UD outcome in terms of providing faster, reliable, and more efficient local connections between town centres. This is offset by not having the RTC between the airport and Puhinui. - However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).
4) 20Connect Road + RTC SH20B Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.	Natural Character and Landscape Effects: -2 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, which has geological and cultural value, although noted that this ONF is already impacted by existing motorway and quarry activity. Mitigation may be necessary. - SH20 is flanked by relatively mature vegetation on the eastern side resulting in this motorway being an established green corridor through the city. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the

	loss of most/all vegetation along the eastern side. Together with an increase in the area of transportation corridor, this would diminish the existing landscape values, and reduce natural habitat that has been created along the corridor. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a) hence the lower score for this option (-2) – noting it will not be as much as Option 2a. - Road widening and the introduction of the SUP could affect Historic Heritage in Mangere Centre Park, and the amenity of the park itself (east of Bader Drive). Could be mitigated with planting and a specific design response. - Road widening of SH20A to accommodate south-facing ramps could affect the amenity of Williams Park (north side of SH20A on Imrie Avenue). Could be mitigated with planting and specific design response. - Road widening of SH20 could affect the amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. - Shorter term landscape effects may be likely through open rural areas by Prices Road, however this is zoned business and future landscape changes in this area are provided for in the Auckland Unitary Plan - Bader Drive through Mangere Town Centre has a relatively high degree of landscape amenity, created by a planted central median (in parts) and a large number of mature street trees. The installation of RTC lanes is likely to affect this amenity. ***Visual Effects:*** - The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the on-ramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. New south-facing ramps between SH20A and SH20 may impact this viewshaft. - For an extended length SH20 is flanked by earth bunds and vegetation which screens the motorway from neighbouring residential properties. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation and bunds along the eastern side. The likely loss of houses will eliminate visual effects on these properties, however will potentially introduce visual effects to the 'second tier' of houses. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a), and mitigation might also be possible with noise walls. - Some parts of Bader Drive are flanked by residential properties. The installation of an RTC corridor would be visible to these properties, with limited opportunity for mitigation. However, this is considered in the context that Bader Drive is an existing busy arterial road. - Limited residential properties near main interchanges. - Visual effects likely in the rural open areas around Prices Road, however this area is zoned business and future visual changes are provided for in the Auckland Unitary Plan.	

<table>
<tr><td></td><td>Urban Design Outcomes:
- Inclusion of the RTC through Mangere Town Centre allows good connectivity between town centres. However, this is offset by lack of connectivity between the airport and Puhinui, as is provided by other options.
- Inclusion of the SUPs throughout is positive for walking and cycling.
- Inclusion of the SUP along SH20B is positive for completing a safe, walkable portion of Te Araroa Trail.
- Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project.
- Additional changes including service lanes to provide for at-grade connections diminishes the UD outcomes achieved along Puhinui Road.
- Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.</td></tr>
<tr><td>5) Pukaki Creek
Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)</td><td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+1</td></tr>
</table>
<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Pukaki Creek has high natural character and landscape values. The widening and/or construction of bridge structures for the road, RTC and SUP will enhance built character, will likely result in coastal vegetation clearance, and increased urbanization of the coastal edge. Some mitigation may be possible through planting and artistic representations.
Visual Effects:
- As outlined in the reasoning above.
Urban Design Outcomes:
- As outlined in the reasoning above.</td></tr>
</table>

Notes:

<u>Assumptions</u>

- Assumptions as per memorandum provided by [redacted] to 20Connect Environmental Specialists dated 17th October 2018.
- Auckland International Airport will provide appropriate links with their designated land area and as part of this will develop appropriate gateway landscape concepts in association with NZTA at a later time.

<u>Other Information relied upon</u>

- As outlined above.

Table 5 Multi Criteria Analysis Scoring Sheet

Option 3a:	
Name of assessor (incl. qualifications and organisation)	[redacted] Registered Landscape Architect
Area of assessment	Natural Character, Landscape, Visual and Urban Design

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	In light of the additional information, my ***reasoning*** from the long list has changed, but the scores stay the same. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - The new schematics indicate the likely extent of widening, which will increase the degree of landscape character change brought about by the road in the shorter term. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:*** - Previously I had noted that the on-line option of widening SH20B was likely to diminish UD outcomes for existing local residents and businesses. The additional changes including service lanes to provide for at-grade connections diminishes the outcomes further, especially in comparison to other options, hence the lower score versus Options 1a and 1b. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport as part of the Airport to Botany (A2B) Long List assessment	I did not provide an assessment for the A2B project. However, I did incorporate comments on the RTC between Puhinui Interchange and Orrs Road in my 20Connect assessment, and stand by these. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - No substantial changes within this extent of the project. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:***

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<td>
- The provision of an RTC from the airport to Puhinui is a positive UD outcome in terms of providing a variety of connections to/from the airport (in addition to potential future LRT to the north).
- This is offset by not having the RTC along SH20 which (even without the Mangere Town Centre Loop) which would provide increased local connectivity, as provided by other options.
- However, overall, the installation of any RTC elements is considered a good outcome (score would have been higher if both options were provided).
</td>
<td></td>
</tr>
<tr>
<td>3) 20Connect Road + RTC SH20B
Please now consider the above two components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option (but only up to Orrs Road on SH20B)</td>
<td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+1</td></tr>
</table>
<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, which has geological and cultural value, although noted that this ONF is already impacted by existing motorway and quarry activity. Mitigation may be necessary.
- SH20 is flanked by relatively mature vegetation on the eastern side resulting in this motorway being an established green corridor through the city. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation along the eastern side. Together with an increase in the area of transportation corridor, this would diminish the existing landscape values, and reduce natural habitat that has been created along the corridor. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a), hence the lower score (-2) for this option.
- Road widening and the introduction of the SUP could affect Historic Heritage in Mangere Centre Park, and the amenity of the park itself (east of Bader Drive). Could be mitigated with planting and a specific design response.
- Road widening of SH20A to accommodate south-facing ramps could affect the amenity of Williams Park (north side of SH20A on Imrie Avenue). Could be mitigated with planting and specific design response.
- Road widening of SH20 could affect the amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response.
- Shorter term landscape effects may be likely through open rural areas by Prices Road, however this is zoned business and future landscape changes in this area are provided for in the Auckland Unitary Plan
Visual Effects:
- The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on
</td>
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</tr>
</table>

	the northbound side of SH20 near to the on-ramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. New south-facing ramps between SH20A and SH20 may impact this viewshaft. - For an extended length SH20 is flanked by earth bunds and vegetation which screens the motorway from neighbouring residential properties. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation and bunds along the eastern side. The likely loss of houses will eliminate visual effects on these properties, however will potentially introduce visual effects to the 'second tier' of houses. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a), and mitigation might also be possible with noise walls. - Limited residential properties near main interchanges. - Visual effects likely in the rural open areas around Prices Road, however this area is zoned business and future visual changes are provided for in the Auckland Unitary Plan. ***Urban Design Outcomes:*** - Inclusion of the RTC through SH20B allows good connectivity between Puhinui and the airport. However, this is offset by no improvement of connectivity between local centres (including Mangere Town Centre), as provided by other options. - Inclusion of the SUPs throughout is positive for walking and cycling. - Inclusion of the SUP along SH20B is positive for completing a safe, walkable portion of Te Araroa Trail. - Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project. - Additional changes including service lanes to provide for at-grade connections diminishes the UD outcomes achieved along Puhinui Road. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
4) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr><tr><td>Visual Effects</td><td>-1</td></tr><tr><td>Urban Design Outcomes</td><td>+1</td></tr></table> **<u>My reasoning/justification for this is as follows:</u>** ***Natural Character and Landscape Effects:*** - Pukaki Creek has high natural character and landscape values. The construction of bridge structures for the RTC and SUP will enhance built character, will likely result in coastal vegetation clearance, and increased urbanization of the coastal edge – although not as much as the options that involve road widening also. Some mitigation may be possible through planting and artistic representations. ***Visual Effects:*** - As outlined in the reasoning above.

	Urban Design Outcomes: - As outlined in the reasoning above.

Notes:

Assumptions

- Assumptions as per memorandum provided by [redacted] to 20Connect Environmental Specialists dated 17th October 2018.
- Auckland International Airport will provide appropriate links with their designated land area and as part of this will develop appropriate gateway landscape concepts in association with NZTA at a later time.

Other Information relied upon

- As outlined above.

Table 6 Multi Criteria Analysis Scoring Sheet

Option 3b:	
Name of assessor (incl. qualifications and organisation)	[redacted] Registered Landscape Architect
Area of assessment	Natural Character, Landscape, Visual and Urban Design

Given the advancement of options from Long List, we have asked you to consider the option in four stages as per the boxes below:

1) Puhinui Interchange to Orrs Road Please consider the additional detail provided and confirm (or otherwise) that your scoring and reasoning from the long list is still applicable to this option only for the extent of Puhinui Interchange to Orrs Road (as per long list extent)	In light of the additional information, my ***reasoning*** from the long list has changed, but the scores stay the same. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - The new schematics indicate the likely extent of widening, which will increase the degree of landscape character change brought about by the road in the shorter term. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:*** - Previously I had noted that the on-line option of widening SH20B was likely to diminish UD outcomes for existing local residents and businesses. The additional changes including service lanes to provide for at-grade connections diminishes the outcomes further, especially in comparison to other options, hence the lower score versus Options 1a and 1b. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
2) Rapid Transit Corridor Please consider and confirm the criteria and score that you gave to the RTC corridor between Puhinui Interchange and the Airport via SH20 as part of the Airport to Botany (A2B) Long List assessment. Note – the portion at Mangere Town Centre that is a new addition is assessed separately below. This line item only refers to the segments of RTC directly adjacent SH20 and SH20A.	I did not provide an assessment for the A2B project. However, I did incorporate comments on the RTC between Puhinui Interchange and the airport in my 20Connect assessment, and stand by these. Natural Character and Landscape Effects: -1 Visual Effects: -1 Urban Design Outcomes: +1 **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - No substantial changes within this extent of the project. ***Visual Effects:*** - No substantial changes within this extent of the project ***Urban Design Outcomes:***

<table>
<tr><td></td><td>
- The provision of an RTC along SH20 is a positive UD outcome in terms of providing faster, more efficient local connections between town centres (even without the RTC loop through Mangere Town Centre). This is offset by not having the RTC between the airport and Puhinui.
- However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).
</td></tr>
<tr><td>3) Rapid Transit Corridor Mangere Town Centre
Please consider the new portion of RTC not previously assessed between Bader Driver (on SH20) and SH20A (via Mangere Town Centre)</td><td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-1</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+2</td></tr>
</table>

<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Bader Drive through Mangere Town Centre has a relatively high degree of landscape amenity, created by a planted central median (in parts) and a large number of mature street trees. The installation of RTC lanes is likely to affect this amenity.
Visual Effects:
- Some parts of Bader Drive are flanked by residential properties. The installation of an RTC corridor would be visible to these properties, with limited opportunity for mitigation. However, this is considered in the context that Bader Drive is an existing busy arterial road.
Urban Design Outcomes:
- The provision of an RTC through Mangere Town Centre is a positive UD outcome in terms of providing faster, reliable, and more efficient local connections between town centres. This is offset by not having the RTC between the airport and Puhinui.
- However, overall, increasing speed and efficiency of Public Transport is considered a good outcome (score would have been higher if both options were provided).
</td></tr>
<tr><td>4) 20Connect Road + RTC SH20B
Please now consider the above three components cumulatively. Provide a score for each criteria for both the road and RTC components of this option for the whole option.</td><td>
<table>
<tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr>
<tr><td>Visual Effects</td><td>-1</td></tr>
<tr><td>Urban Design Outcomes</td><td>+1</td></tr>
</table>

<u>My reasoning/justification for this is as follows:</u>
Natural Character and Landscape Effects:
- Road widening of SH20 could affect ONF22 Crater Hill by Portage Road, which has geological and cultural value, although noted that this ONF is already impacted by existing motorway and quarry activity. Mitigation may be necessary.
- SH20 is flanked by relatively mature vegetation on the eastern side resulting in this motorway being an established green corridor through the city. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation along the eastern side.
</td></tr>
</table>

	Together with an increase in the area of transportation corridor, this would diminish the existing landscape values, and reduce natural habitat that has been created along the corridor. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a) hence the lower score for this option (-2) – noting it will not be as much as Option 3a. - Road widening and the introduction of the SUP could affect Historic Heritage in Mangere Centre Park, and the amenity of the park itself (east of Bader Drive). Could be mitigated with planting and a specific design response. - Road widening of SH20A to accommodate south-facing ramps could affect the amenity of Williams Park (north side of SH20A on Imrie Avenue). Could be mitigated with planting and specific design response. - Road widening of SH20 could affect the amenity of Imrie Avenue Reserve (west side of SH20 on Imrie Avenue). Could be mitigated with planting and specific design response. - Shorter term landscape effects may be likely through open rural areas by Prices Road, however this is zoned business and future landscape changes in this area are provided for in the Auckland Unitary Plan - Bader Drive through Mangere Town Centre has a relatively high degree of landscape amenity, created by a planted central median (in parts) and a large number of mature street trees. The installation of RTC lanes is likely to affect this amenity. ***Visual Effects:*** - The focal point of Regionally Significant Volcanic Viewshaft M4 towards Mangere Mountain is located on the northbound side of SH20 near to the on-ramp connection to SH20A, and the viewshaft extends over the southbound connection from SH20 to SH20A. New south-facing ramps between SH20A and SH20 may impact this viewshaft. - For an extended length SH20 is flanked by earth bunds and vegetation which screens the motorway from neighbouring residential properties. The short list plans provide more detail on the land-take requirements along SH20, which strongly suggests the loss of most/all vegetation and bunds along the eastern side. The likely loss of houses will eliminate visual effects on these properties, however will potentially introduce visual effects to the 'second tier' of houses. It is noted that the land-take is likely to result in additional land being available for planting mitigation, more than the SUP-only option (1a), and mitigation might also be possible with noise walls. - Some parts of Bader Drive are flanked by residential properties. The installation of an RTC corridor would be visible to these properties, with limited opportunity for mitigation. However, this is considered in the context that Bader Drive is an existing busy arterial road. - Limited residential properties near main interchanges. - Visual effects likely in the rural open areas around Prices Road, however this area is zoned business and future visual changes are provided for in the Auckland Unitary Plan. ***Urban Design Outcomes:***	

	- Inclusion of the RTC through Mangere Town Centre allows good connectivity between town centres. However, this is offset by lack of connectivity between the airport and Puhinui, as is provided by other options. - Inclusion of the SUPs throughout is positive for walking and cycling. - Inclusion of the SUP along SH20B is positive for completing a safe, walkable portion of Te Araroa Trail. - Pedestrian and cycling cross-connectivity over (or under) the motorway corridor can potentially be improved through the project. - Additional changes including service lanes to provide for at-grade connections diminishes the UD outcomes achieved along Puhinui Road. - Overall, the option provides for positive UD outcomes, but it is noted that there are some aspects which provide less than ideal outcomes.
5) Pukaki Creek Please now consider the entirety of the proposed option for the full extent (including the new extent from Orrs Road to the western abutment of Pukaki Bridge)	<table><tr><td>Natural Character and Landscape Effects</td><td>-2</td></tr><tr><td>Visual Effects</td><td>-1</td></tr><tr><td>Urban Design Outcomes</td><td>+1</td></tr></table> **My reasoning/justification for this is as follows:** ***Natural Character and Landscape Effects:*** - Pukaki Creek has high natural character and landscape values. The construction of bridge structures for the RTC and SUP will enhance built character, will likely result in coastal vegetation clearance, and increased urbanization of the coastal edge – although not as much as the options that involve road widening also. Some mitigation may be possible through planting and artistic representations. ***Visual Effects:*** - As outlined in the reasoning above. ***Urban Design Outcomes:*** - As outlined in the reasoning above.

Notes:

Assumptions

- Assumptions as per memorandum provided by [redacted] to 20Connect Environmental Specialists dated 17th October 2018.
- Auckland International Airport will provide appropriate links with their designated land area and as part of this will develop appropriate gateway landscape concepts in association with NZTA at a later time.

Other Information relied upon

- As outlined above.

Approved by:

Title	Name	Qualification	Signature	Date
Author	[redacted]	Registered Landscape Architect	[redacted]	28th November 2018
Reviewer				

Appendix C
Short List Options

NEW LANE
SHARED USE PATH
INDICATIVE AIRPORT TO BOTANY RTC
INDICATIVE NETWORK UPGRADE (NOT ASSESSED)
INDICATIVE AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)

Option 1A:

SH20B offline grade separated connections
Puhinui south-facing ramps
SH20 south widening
RTC on SH20B
Pukaki Creek four-lanes

SH20 WIDENING ON NORTHBOUND SIDE UNDER RIMU ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES UNDER HASTIE AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES OF TARARATA CREEK BRIDGE ON LEFT HAND SIDE

SH20 WALMSLEY ROAD OVERBRIDGE REPLACED

SH20 WIDENING ON BOTH SIDES UNDER HALL AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

RECENTLY BUILT SUP ON SH20A UNAFFECTED. LOCATED INSIDE NZTA DESIGNATION

SUP BETWEEN BADER DRIVE AND PORTAGE ROAD COULD BE PROVIDED GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR

LRT ALIGNMENT INDICATIVE AND SHOWN FOR INFORMATION ONLY. NO EFFECTS TO BE ASSESSED AS PART OF THE 20CONNECT PROJECT

EXISTING SH20B SEVERED AT THIS LOCATION. NO DIRECT CONNECTION TO THE SH20/SH20B INTERCHANGE

EXISTING SH20B RETAINED AS A LOCAL ROAD TO PROVIDE ACCESS TO PROPERTIES AND MEMORIAL GARDENS.

SUP BETWEEN PORTAGE ROAD AND PUHINUI SOUTHBOUND OFF-RAMP COULD BE PROVIDED GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR.

RTC ACCOMMODATED AT-GRADE UNDER EXISTING SH20 STRUCTURE AND LOCATED IN MEDIAN OF PUHINUI ROAD

POSSIBLE LRT CONNECTION (AIRPORT TO MANGERE AND CITY) (TWO-WAY)

SERVICE ROAD CONNECTING GRADE SEPARATED INTERCHANGE TO CAMPANA ROAD

NEW SOUTH FACING RAMPS +1 LEVEL ABOVE EXISTING SH20 LEVELS (+2 LEVEL ABOVE EXISTING SH20B)

EXISTING SH20B SEVERED AT THIS LOCATION. NO DIRECT CONNECTION TO THE NEW SH20B

SH20 WIDENING ON BOTH SIDES OF CAVENDISH ROAD BRIDGE IN MEDIAN

SH20 WIDENING ON SOUTHBOUND SIDE OF PUHINUI CREEK BRIDGE IN MEDIAN

EXTENT OF OPTION LANE DIAGRAM

EXISTING PUKAKI CREEK BRIDGE RETAINED FOR EASTBOUND CARRIAGEWAY

EXISTING MERGES FROM BRAIDED RAMPS BETWEEN PUHINUI ROAD AND CAVENDISH ROAD INTERCHANGES CLOSED. TRAFFIC REQUIRED TO CONTINUE TO NEXT SIGNALISED INTERSECTION TO JOIN SH20

SH20 WIDENING ON SOUTHBOUND SIDE OF RAIL BRIDGE IN MEDIAN

WIDENING ON SOUTHBOUND SIDE UNDER PLUNKET AVENUE BRIDGE IN MEDIAN. NO ALTERATION TO EXISTING STRUCTURE

EXTENT OF OPTION ASSESSMENT

NEW STRUCTURE REQUIRED OVER PUKAKI CREEK FOR WESTBOUND CARRIAGEWAY AND RTC LOCATED ON THE SOUTH SIDE OF THE EXISTING STRUCTURE

POSSIBLE RTC (AIRPORT TO BOTANY) (TWO-WAY)

NEW SH20B RAISED +1 LEVEL ABOVE EXISTING LEVELS TO ALLOW THE RAMPS TO PUHINUI ROAD TO CROSS UNDERNEATH

SH20 SOUTHBOUND WIDENING CONSTRUCTED IN EXISTING MEDIAN

NEW STRUCTURE OVER WAOKAURI CREEK

NEW GRADE SEPARATED INTERCHANGE LOCATED APPROXIMATELY 135M WEST OF CAMPANA ROAD.

INTERCHANGE LAYOUT ASSUMED TO BE A DIAMOND LAYOUT.

NEW SH20B ALIGNMENT ASSUMED TO BE AT SAME LEVELS AS EXISTING SH20B, WITH THE SIDE ROAD CROSSING OVER SH20B.

Rimu Rd
Walmsley Rd
Bader Dr
Kirkbride Rd
Massey Rd
Portage Rd
Puhinui Rd
Memorial Gardens
Price Rd
Campana Rd
Orrs Rd
Pukaki Bridge
Tom Pierce Dr
Cavendish Rd
Roscommon Rd
Plunket Ave
Manukau Station Rd
Great South Rd

NOTES:
"+1 LEVEL" AND "+2 LEVEL" MEANS THE PROPOSED INFRASTRUCTURE IS RAISED AT APPROXIMATELY 8m AND 16m RESPECTIVELY, ABOVE THE LEVEL OF THE EXISTING INFRASTRUCTURE

WORKING DRAFT

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SHORT LIST OPTION 1A LANE DIAGRAM

501094-4401-SKT-CC-0101 [A]
DRAWN: N. TAILOR
APPROVER: G. MOORE
12/10/2018

NEW LANE
SHARED USE PATH
INDICATIVE AIRPORT TO BOTANY RTC
INDICATIVE NETWORK UPGRADE (NOT ASSESSED)
INDICATIVE AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)
INDICATIVE AIRPORT TO BOTANY RTC + AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)

Option 1b:

SH20B offline grade separated connections
Puhinui south-facing ramps
SH20 south widening
RTC on SH20 and SH20A
Pukaki Creek four-lanes

SH20 WIDENING ON NORTHBOUND SIDE UNDER RIMU ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

Rimu Rd

SH20 WIDENING ON BOTH SIDES UNDER HASTIE AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WALMSLEY ROAD OVERBIRDGE REPLACED

POSSIBLE LRT CONNECTION (AIRPORT TO MANGERE AND CITY) (TWO-WAY)

RTC LOCATED ON NEW STRUCTURE OVER SH20 ADJACENT TO THE EXISTING BADER DRIVE OVERBRIDGE

SH20 WIDENING ON BOTH SIDES OF TARARATA CREEK BRIDGE ON LEFT HAND SIDE

Walmsley Rd

RTC FOOTPRINT OFFSET 25m BETWEEN BADER DRIVE BRIDGE TO PORTAGE ROAD BRIDGE.

RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

SH20 WIDENING ON BOTH SIDES UNDER HALL AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

RTC LOCATED AT SAME LEVEL AS SH20 AROUND EXISTING MASSEY ROAD RAMPS WITH NEW STRUCTURE UNDER MASSEY ROAD

RTC FOOTPRINT OFFSET 24m AT MASSEY ROAD SOUTHBOUND OFF-RAMP AND MASSEY ROAD SOUTHBOUND ON-RAMP

POSSIBLE RTC (AIRPORT TO BOTANY) (TWO-WAY)

RECENTLY BUILT SUP ON SH20A UNAFFECTED. LOCATED INSIDE NZTA DESIGNATION

Bader Dr

Bader Dr

Massey Rd

RTC LOCATED ADJACENT TO SH20 AT SAME LEVEL AS SH20

PORTAGE ROAD OVERBRIDGE REPLACED

HUNUA NO.4 PIPELINE BRIDGE REPLACED. NEW PIPELINE BRIDGE CONSTRUCTED ADJACENT TO EXISTING PIPELINE BRIDGE, WITH SWITCH OVER DURING OUTSIDE OF PEAK DEMAND (I.E. WINTER)

EXTENT OF OPTION ASSESSSMENT

Kirkbride Rd

RTC FOOTPRINT APPROXIMATELY 25m FROM EDGE OF EXISTING MARKING ON THE SH20 CARRIAGEWAY ASSUMING RETAINING WALLS USED IN CUT, BETWEEN PORTAGE ROAD BRIDGE RAMP TO PUHINUI SOUTHBOUND OFF-RAMP

RTC GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

EXISTING SH20B SEVERED AT THIS LOCATION. NO DIRECT CONNECTION TO THE SH20/SH20B INTERCHANGE

POSSIBLE LRT & RTC (TWO-WAY)

SHOWN FOR INFORMATION ONLY. NO EFFECTS TO BE ASSESSED AS PART OF THE 20CONNECT PROJECT

EXISTING SH20B RETAINED AS A LOCAL ROAD TO PROVIDE ACCESS TO PROPERTIES AND MEMORIAL GARDENS.

Portage Rd

RTC ON NEW BRIDGE OVER WATERCOURSE

RTC FOOTPRINT OFFSET 24m AT PUHINUI SOUTHBOUND OFF-RAMP

RTC ACCOMMODATED AT-GRADE UNDER EXISTING SH20 STRUCTURE AND LOCATED IN MEDIAN OF PUHINUI ROAD

SERVICE ROAD CONNECTING GRADE SEPARATED INTERCHANGE TO CAMPANA ROAD

NEW SOUTH FACING RAMPS +1 LEVEL ABOVE EXISTING SH20 LEVELS (+2 LEVEL ABOVE EXISTING SH20B)

SH20 WIDENING ON SOUTHBOUND SIDE OF PUHINUI CREEK BRIDGE IN MEDIAN

EXISTING PUKAKI CREEK BRIDGE RETAINED FOR EASTBOUND CARRIAGEWAY

EXISTING SH20B SEVERED AT THIS LOCATION. NO DIRECT CONNECTION TO THE NEW SH20B

Puhinui Rd

SH20 WIDENING ON BOTH SIDES OF CAVENDISH ROAD BRIDGE IN MEDIAN

Lambie Dr

Manukau Station Rd

Memorial Gardens

Price Rd

Campana Rd

Cavendish Rd

Plunket Ave

Great South Rd

EXTENT OF OPTION LANE DIAGRAM

Pukaki Bridge

Oms Rd

Tom Pierce Dr

Roscommon Rd

WIDENING ON SOUTHBOUND SIDE UNDER PLUNKET AVENUE BRIDGE IN MEDIAN. NO ALTERATION TO EXISTING STRUCTURE

EXISTING MERGES FROM BRAIDED RAMPS BETWEEN PUHINUI ROAD AND CAVENDISH ROAD INTERCHANGES CLOSED. TRAFFIC REQUIRED TO CONTINUE TO NEXT SIGNALISED INTERSECTION TO JOIN SH20

SH20 SOUTHBOUND WIDENING CONSTRUCTED IN EXISTING MEDIAN

EXTENT OF OPTION ASSESSMENT

NEW STRUCTURE REQUIRED OVER PUKAKI CREEK FOR WESTBOUND CARRIAGEWAY

NEW STRUCTURE OVER WAOKAURI CREEK

NEW SH20B RAISED +1 LEVEL ABOVE EXISTING LEVELS TO ALLOW THE RAMPS TO PUHINUI ROAD TO CROSS UNDERNEATH

SH20 WIDENING ON SOUTHBOUND SIDE OF RAIL BRIDGE IN MEDIAN

NEW GRADE SEPARATED INTERCHANGE LOCATED APPROXIMATELY 135M WEST OF CAMPANA ROAD.
INTERCHANGE LAYOUT ASSUMED TO BE A DIAMOND LAYOUT.
NEW SH20B ALIGNMENT ASSUMED TO BE AT SAME LEVELS AS EXISTING SH20B, WITH THE SIDE ROAD CROSSING OVER SH20B

NOTES:
"+1 LEVEL" AND "+2 LEVEL" MEANS THE PROPOSED INFRASTRUCTURE IS RAISED AT APPROXIMATELY 8m AND 16m RESPECTIVELY, ABOVE THE LEVEL OF THE EXISTING INFRASTRUCTURE

WORKING DRAFT

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SHORT LIST OPTION 1B LANE DIAGRAM

501094-4401-SKT-CC-0102 [A]
DRAWN: N. TAILOR
APPROVER: G. MOORE
12/10/2018

NEW LANE
SHARED USE PATH
INDICATIVE AIRPORT TO BOTANY RTC
INDICATIVE NETWORK UPGRADE (NOT ASSESSED)
INDICATIVE AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)

Option 2a:

SH20B online widening at-grade connections
SH20 widening
RTC on SH20B
Pukaki Creek four-lanes

SH20 WIDENING ON NORTHBOUND SIDE UNDER RIMU ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

Rimu Rd

SH20 WIDENING ON BOTH SIDES UNDER HASTIE AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES OF TARARATA CREEK BRIDGE ON LEFT HAND SIDE

SH20 WALMSLEY ROAD OVERBRIDGE REPLACED

Walmsley Rd

SH20 WIDENING ON BOTH SIDES UNDER HALL AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

NEW SOUTH FACING RAMP +1 LEVEL ABOVE EXISTING SH20 LEVELS (+2 LEVEL ABOVE EXISTING SH20A)

20

SH20A BADER DRIVE OVERBRIDGE REPLACED AND CLOSURE OF BADER DRIVE OFF-RAMP

SH20 BADER DRIVE OVERBRIDGE REPLACED

KILLINGTON CRESCENT FOOTBRIDGE REPLACED

Bader Dr

SUP BETWEEN BADER DRIVE AND MASSEY ROAD WOULD BE GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR

REPLACE RECENTLY BUILT SUP ON SH20A TO TIE INTO EXISTING SUP. LOCATED INSIDE NZTA DESIGNATION

20

Massey Rd

SH20 WIDENING ON SOUTHBOUND SIDE UNDER MASSEY ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

EXTENT OF OPTION ASSESSMENT

Kirkbride Rd

20a

SUP BETWEEN MASSEY ROAD AND PORTAGE ROAD COULD BE PROVIDED GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR.

PORTAGE ROAD OVERBRIDGE REPLACED.

SH20 WIDENING ON BOTH SIDES UNDER HUNUA NO.4 PIPELINE BRIDGE ON LEFT HAND SIDE. PROVISION OF SUP WOULD LIKELY REQUIRE REPLACEMENT OF HUNUA NO.4 PIPELINE BRIDGE

Portage Rd

POSSIBLE LRT CONNECTION (AIRPORT TO MANGERE AND CITY) (TWO-WAY)

SHOWN FOR INFORMATION ONLY. NO EFFECTS TO BE ASSESSED AS PART OF THE 20CONNECT PROJECT

SUP BETWEEN PORTAGE ROAD AND PUHINUI SOUTHBOUND OFF-RAMP COULD BE PROVIDED GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR

20

SH20 WIDENED ON LEFT HAND SIDE IN BOTH DIRECTIONS

SH20 STRUCTURE WIDENED OVER WATERCOURSE

EXISTING PUKAKI CREEK BRIDGE RETAINED FOR EASTBOUND CARRIAGEWAY

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT MEMORIAL GARDENS

Puhinui Rd

RTC ACCOMMODATED AT-GRADE UNDER EXISTING SH20 STRUCTURE AND LOCATED IN MEDIAN OF PUHINUI ROAD

EXTENT OF OPTION LANE DIAGRAM

SERVICE ROAD PARTIALLY LOCATED ON PRIVATE LAND, TO CONNECT DRIVEWAYS TO THE AT-GRADE SIGNALISED INTERSECTION AT AIAL PARK AND RIDE SOUTH

Memorial Gardens

Lambie Dr

Manukau Station Rd

Plunket Ave

Price Rd

Campana Rd

Cavendish Rd

20b

20

Orrs Rd

Great South Rd

Tom Pierce Dr

Pukaki Bridge

Roscommon Rd

SH20B WIDENED ON SOUTH SIDE TO KEEP WIDENING WITHIN 40M CORRIDOR ON PRECINCT PLAN. THIS WILL RESULT IN REMOVAL OF SUP CONSTRUCTED AS PART OF THE SHORT TERM WORKS

EXISTING WAOKAURI CREEK BRIDGE REPLACED

EXTENT OF OPTION ASSESSMENT

NEW STRUCTURE REQUIRED OVER PUKAKI CREEK FOR WESTBOUND CARRIAGEWAY AND RTC LOCATED ON THE SOUTH SIDE OF THE EXISTING STRUCTURE

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT AIAL PARK & RIDE SOUTH AT SAME LOCATION AS PROPOSED IN SH20B SHORT TERM IMPROVEMENTS

NOTES:
"+1 LEVEL" AND "+2 LEVEL" MEANS THE PROPOSED INFRASTRUCTURE IS RAISED AT APPROXIMATELY 8m AND 16m RESPECTIVELY, ABOVE THE LEVEL OF THE EXISTING INFRASTRUCTURE

WORKING DRAFT

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SHORT LIST OPTION 2A LANE DIAGRAM

501094-4401-SKT-CC-0103 [A]
DRAWN: N. TAILOR
APPROVER: G. MOORE
12/10/2018

NEW LANE
SHARED USE PATH
INDICATIVE AIRPORT TO BOTANY RTC
INDICATIVE NETWORK UPGRADE (NOT ASSESSED)
INDICATIVE AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)
INDICATIVE AIRPORT TO BOTANY RTC + AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)

Option 2b:

SH20B online widening at-grade connections
SH20 widening
RTC on SH20 and SH20A
Pukaki Creek four-lanes

SH20 WIDENING ON NORTHBOUND SIDE UNDER RIMU ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES UNDER HASTIE AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES OF TARARATA CREEK BRIDGE ON LEFT HAND SIDE

SH20 WALMSLEY ROAD OVERBRIDGE REPLACED.

SH20 WIDENING ON BOTH SIDES UNDER HALL AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

NEW SOUTH FACING RAMP +1 LEVEL ABOVE EXISTING SH20 LEVELS (+2 LEVEL ABOVE EXISTING SH20A)

SH20 BADER DRIVE OVERBRIDGE REPLACED

RTC LOCATED ON NEW STRUCTURE OVER SH20 ADJACENT TO THE EXISTING BADER DRIVE OVERBRIDGE

RTC FOOTPRINT OFFSET 28.5m BETWEEN BADER DRIVE BRIDGE TO PORTAGE ROAD BRIDGE. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

SH20A BADER DRIVE OVERBRIDGE REPLACED AND CLOSURE OF BADER DRIVE OFF-RAMP

SH20 WIDENING ON SOUTHBOUND SIDE UNDER MASSEY ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

REPLACE RECENTLY BUILT SUP ON SH20A TO TIE INTO EXISTING SUP. LOCATED INSIDE NZTA DESIGNATION

RTC FOOTPRINT OFFSET 27.5m AT MASSEY ROAD SOUTHBOUND OFF-RAMP AND ON-RAMP. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

KILLINGTON CRESCENT FOOTBRIDGE REPLACED

EXTENT OF OPTION ASSESSMENT

RTC FOOTPRINT OFFSET 28.5m BETWEEN MASSEY ROAD SOUTHBOUND ON-RAMP TO PUHINUI SOUTHBOUND OFF-RAMP. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

PORTAGE ROAD OVERBRIDGE REPLACED.

POSSIBLE LRT & RTC (TWO-WAY)

SHOWN FOR INFORMATION ONLY. NO EFFECTS TO BE ASSESSED AS PART OF THE 20CONNECT PROJECT

SH20 WIDENING ON BOTH SIDES UNDER HUNUA NO.4 PIPEBRIDGE ON LEFT HAND SIDE.

HUNUA NO.4 PIPELINE BRIDGE REPLACED. NEW PIPELINE BRIDGE CONSTRUCTED ADJACENT TO EXISTING PIPELINE BRIDGE, WITH SWITCH OVER DURING OUTSIDE OF PEAK DEMAND (I.E. WINTER)

SH20 WIDENED ON LEFT HAND SIDE IN BOTH DIRECTIONS

SH20 STRUCTURE WIDENED OVER WATERCOURSE

RTC ON NEW BRIDGE OVER WATERCOURSE

RTC FOOTPRINT OFFSET 24m AT PUHINUI SOUTHBOUND OFF-RAMP. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT MEMORIAL GARDENS

EXISTING PUKAKI CREEK BRIDGE RETAINED FOR EASTBOUND CARRIAGEWAY

SERVICE ROAD PARTIALLY LOCATED ON PRIVATE LAND, TO CONNECT DRIVEWAYS TO THE AT-GRADE SIGNALISED INTERSECTION AT AIAL PARK AND RIDE SOUTH

EXTENT OF OPTION LANE DIAGRAM

EXTENT OF OPTION ASSESSMENT

SH20B WIDENED ON SOUTH SIDE TO KEEP WIDENING WITHIN 40M CORRIDOR ON PRECINCT PLAN. THIS WILL RESULT IN REMOVAL OF SUP CONSTRUCTED AS PART OF THE SHORT TERM WORKS

EXISTING WAOKAURI CREEK BRIDGE REPLACED

NEW STRUCTURE REQUIRED OVER PUKAKI CREEK FOR WESTBOUND CARRIAGEWAY LOCATED ON THE SOUTH SIDE OF THE EXISTING STRUCTURE

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT AIAL PARK & RIDE SOUTH AT SAME LOCATION AS PROPOSED IN SH20B SHORT TERM IMPROVEMENTS

Rimu Rd
Walmsley Rd
Bader Dr
Massey Rd
Portage Rd
Puhinui Rd
Memorial Gardens
Price Rd
Campana Rd
Orrs Rd
Pukaki Bridge
Tom Pierce Dr
Kirkbride Rd
Lambie Dr
Manukau Station Rd
Plunket Ave
Cavendish Rd
Roscommon Rd
Great South Rd

NOTES:
"+1 LEVEL" AND "+2 LEVEL" MEANS THE PROPOSED INFRASTRUCTURE IS RAISED AT APPROXIMATELY 8m AND 16m RESPECTIVELY, ABOVE THE LEVEL OF THE EXISTING INFRASTRUCTURE

WORKING DRAFT

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SHORT LIST OPTION 2B LANE DIAGRAM

501094-4401-SKT-CC-0104 [A]
DRAWN: N. TAILOR
APPROVER: G. MOORE
12/10/2018

NEW LANE
SHARED USE PATH
INDICATIVE AIRPORT TO BOTANY RTC
INDICATIVE NETWORK UPGRADE (NOT ASSESSED)
INDICATIVE AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)

Option 3a:

SH20B online widening at-grade connections
SH20 widening
RTC on SH20B
Pukaki Creek two-lanes

SH20 WIDENING ON NORTHBOUND SIDE UNDER RIMU ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES UNDER HASTIE AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES OF TARARATA CREEK BRIDGE ON LEFT HAND SIDE

SH20 WALMSLEY ROAD OVERBRIDGE REPLACED.

SH20 WIDENING ON BOTH SIDES UNDER HALL AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

NEW SOUTH FACING RAMP +1 LEVEL ABOVE EXISTING SH20 LEVELS (+2 LEVEL ABOVE EXISTING SH20A)

SH20 BADER DRIVE OVERBRIDGE REPLACED

SUP BETWEEN BADER DRIVE AND MASSEY ROAD WOULD BE GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR

SH20A BADER DRIVE OVERBRIDGE REPLACED AND CLOSURE OF BADER DRIVE OFF-RAMP

KILLINGTON CRESCENT FOOTBRIDGE REPLACED

REPLACE RECENTLY BUILT SUP ON SH20A TO TIE INTO EXISTING SUP. LOCATED INSIDE NZTA DESIGNATION

SH20 WIDENING ON SOUTHBOUND SIDE UNDER MASSEY ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

SUP BETWEEN MASSEY ROAD AND PORTAGE ROAD COULD BE PROVIDED GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR.

EXTENT OF OPTION ASSESSMENT

PORTAGE ROAD OVERBRIDGE REPLACED.

SH20 WIDENING ON BOTH SIDES UNDER HUNUA NO.4 PIPELINE BRIDGE ON LEFT HAND SIDE. PROVISION OF SUP WOULD LIKELY REQUIRE REPLACEMENT OF HUNUA NO.4 PIPELINE BRIDGE

POSSIBLE LRT CONNECTION (AIRPORT TO MANGERE AND CITY) (TWO-WAY)

SHOWN FOR INFORMATION ONLY. NO EFFECTS TO BE ASSESSED AS PART OF THE 20CONNECT PROJECT

SUP BETWEEN PORTAGE ROAD AND PUHINUI SOUTHBOUND OFF-RAMP COULD BE PROVIDED GENERALLY INSIDE NZTA DESIGNATION RESULTING IN ONLY MINOR LAND REQUIREMENTS AT A FEW PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR

SH20 WIDENED ON LEFT HAND SIDE IN BOTH DIRECTIONS

SH20 STRUCTURE WIDENED OVER WATERCOURSE

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT MEMORIAL GARDENS

RTC ACCOMMODATED AT-GRADE UNDER EXISTING SH20 STRUCTURE AND LOCATED IN MEDIAN OF PUHINUI ROAD

EXTENT OF OPTION LANE DIAGRAM

SERVICE ROAD PARTIALLY LOCATED ON PRIVATE LAND, TO CONNECT DRIVEWAYS TO THE AT-GRADE SIGNALISED INTERSECTION AT AIAL PARK AND RIDE SOUTH

EXISTING PUKAKI CREEK BRIDGE RETAINED

SH20B WIDENED ON SOUTH SIDE TO KEEP WIDENING WITHIN 40M CORRIDOR ON PRECINCT PLAN. THIS WILL RESULT IN REMOVAL OF SUP CONSTRUCTED AS PART OF THE SHORT TERM WORKS

EXISTING WAOKAURI CREEK BRIDGE REPLACED

EXTENT OF OPTION ASSESSMENT

NEW STRUCTURE REQUIRED OVER PUKAKI CREEK FOR RTC

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT AIAL PARK & RIDE SOUTH AT SAME LOCATION AS PROPOSED IN SH20B SHORT TERM IMPROVEMENTS

Rimu Rd
Walmsley Rd
Bader Dr
Massey Rd
Portage Rd
Kirkbride Rd
Puhinui Rd
Memorial Gardens
Price Rd
Campana Rd
Orrs Rd
Pukaki Bridge
Tom Pierce Dr
Cavendish Rd
Roscommon Rd
Lambie Dr
Plunket Ave
Manukau Station Rd
Great South Rd
SH1

NOTES:
"+1 LEVEL" AND "+2 LEVEL" MEANS THE PROPOSED INFRASTRUCTURE IS RAISED AT APPROXIMATELY 8m AND 16m RESPECTIVELY, ABOVE THE LEVEL OF THE EXISTING INFRASTRUCTURE

WORKING DRAFT

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SHORT LIST OPTION 3A LANE DIAGRAM

501094-4401-SKT-CC-0105 [A]
DRAWN: N. TAILOR
APPROVER: G. MOORE
12/10/2018

NEW LANE
SHARED USE PATH
INDICATIVE AIRPORT TO BOTANY RTC
INDICATIVE NETWORK UPGRADE (NOT ASSESSED)
INDICATIVE AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)
INDICATIVE AIRPORT TO BOTANY RTC + AIRPORT TO MANGERE AND CITY LRT (NOT ASSESSED)

Option 3b:

SH20B online widening at-grade connections
SH20 widening
RTC on SH20 and SH20A
Pukaki Creek two-lanes

SH20 WIDENING ON NORTHBOUND SIDE UNDER RIMU ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES UNDER HASTIE AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

SH20 WIDENING ON BOTH SIDES OF TARARATA CREEK BRIDGE ON LEFT HAND SIDE

SH20 WALMSLEY ROAD OVERBRIDGE REPLACED.

SH20 WIDENING ON BOTH SIDES UNDER HALL AVENUE FOOTBRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE

NEW SOUTH FACING RAMP +1 LEVEL ABOVE EXISTING SH20 LEVELS (+2 LEVEL ABOVE EXISTING SH20A)

SH20 BADER DRIVE OVERBRIDGE REPLACED

RTC LOCATED ON NEW STRUCTURE OVER SH20 ADJACENT TO THE EXISTING BADER DRIVE OVERBRIDGE

RTC FOOTPRINT OFFSET 28.5m BETWEEN BADER DRIVE BRIDGE TO PORTAGE ROAD BRIDGE. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

SH20A BADER DRIVE OVERBRIDGE REPLACED AND CLOSURE OF BADER DRIVE OFF-RAMP

KILLINGTON CRESCENT FOOTBRIDGE REPLACED

REPLACE RECENTLY BUILT SUP ON SH20A TO TIE INTO EXISTING SUP. LOCATED INSIDE NZTA DESIGNATION

SH20 WIDENING ON SOUTHBOUND SIDE UNDER MASSEY ROAD BRIDGE ON LEFT HAND SIDE. NO ALTERATION TO EXISTING STRUCTURE.

RTC FOOTPRINT OFFSET 27.5m AT MASSEY ROAD SOUTHBOUND OFF-RAMP AND ON-RAMP. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

RTC FOOTPRINT OFFSET 28.5m BETWEEN MASSEY ROAD SOUTHBOUND ON-RAMP TO PUHINUI SOUTHBOUND OFF-RAMP. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

EXTENT OF OPTION ASSESSMENT

POSSIBLE LRT & RTC (TWO-WAY)

SHOWN FOR INFORMATION ONLY. NO EFFECTS TO BE ASSESSED AS PART OF THE 20CONNECT PROJECT.

PORTAGE ROAD OVERBRIDGE REPLACED.

SH20 WIDENING ON BOTH SIDES UNDER HUNUA NO.4 PIPEBRIDGE ON LEFT HAND SIDE.

HUNUA NO.4 PIPE BRIDGE REPLACED. NEW PIPELINE BRIDGE CONSTRUCTED ADJACENT TO EXISTING PIPELINE BRIDGE, WITH SWITCH OVER DURING OUTSIDE OF PEAK DEMAND (I.E. WINTER)

SH20 WIDENED ON LEFT HAND SIDE IN BOTH DIRECTIONS

SH20 STRUCTURE WIDENED OVER WATERCOURSE

RTC ON NEW BRIDGE OVER WATERCOURSE

RTC FOOTPRINT OFFSET 24m AT PUHINUI SOUTHBOUND OFF-RAMP. RTC GENERALLY OUTSIDE NZTA DESIGNATION RESULTING IN LAND REQUIREMENTS ALONG ROW OF PROPERTIES IMMEDIATELY ADJACENT TO THE SH20 CORRIDOR. PROVISION OF AN SUP WOULD INCREASE THE NUMBER OF PROPERTIES EFFECTED AND SEVERITY OF THE LAND REQUIREMENTS

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT MEMORIAL GARDENS

SERVICE ROAD PARTIALLY LOCATED ON PRIVATE LAND, TO CONNECT DRIVEWAYS TO THE AT-GRADE SIGNALISED INTERSECTION AT AIAL PARK AND RIDE SOUTH

EXTENT OF OPTION LANE DIAGRAM

SH20B WIDENED ON SOUTH SIDE TO KEEP WIDENING WITHIN 40M CORRIDOR ON PRECINCT PLAN. THIS WILL RESULT IN REMOVAL OF SUP CONSTRUCTED AS PART OF THE SHORT TERM WORKS

EXISTING WAOKAURI CREEK BRIDGE REPLACED

EXISTING PUKAKI CREEK BRIDGE RETAINED

AT-GRADE SIGNALISED INTERSECTION PROVIDED AT AIAL PARK & RIDE SOUTH AT SAME LOCATION AS PROPOSED IN SH20B SHORT TERM IMPROVEMENTS

Rimu Rd
Walmsley Rd
Bader Dr
Kirkbride Rd
Massey Rd
Portage Rd
Puhinui Rd
Memorial Gardens
Price Rd
Campana Rd
Orrs Rd
Pukaki Bridge
Tom Pierce Dr
Cavendish Rd
Roscommon Rd
Plunket Ave
Lambie Dr
Manukau Station Rd
Great South Rd
SH1

NOTES:
"+1 LEVEL" AND "+2 LEVEL" MEANS THE PROPOSED INFRASTRUCTURE IS RAISED AT APPROXIMATELY 8m AND 16m RESPECTIVELY, ABOVE THE LEVEL OF THE EXISTING INFRASTRUCTURE

WORKING DRAFT

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SHORT LIST OPTION 3B LANE DIAGRAM

501094-4401-SKT-CC-0106 [A]
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12/10/2018

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Technical Note

To	**NZ Transport Agency**	From	**20Connect Project Team**
Copy		Reference	**501094-4401-TEC-CC-0016**
Date	**2020-05-08**	Pages (including this page)	**10**
Subject	**Short List Assessment – Implementability Engineering Scoring**		

Name of assessor (incl. qualifications and organisation):	[redacted] CEng MICE MEng Civil Engineering Aurecon New Zealand Limited

1 Methodology

This assessment has taken into consideration the implementation feasibility in relation to the short-list options for the 20Connect SSBC and contributes to the short list multi-criteria analysis.

The following provides an assessment of the "short list" options for the 20Connect project. The assessment details the considerations which have been used to inform the assessment. This assessment is designed to contribute to the Multi-Criteria Analysis (MCA) which is being undertaken for the "short list" Options.

A high-level desktop assessment of the following criteria of the proposed short list options has been undertaken (Table 1):

Table 1 Assessment criteria

Constructability	Level of complexity: ▪ How straightforward is it to implement this option? ▪ Are there any challenges with construction methodology and staging or constraints? ▪ Consider topography, gradients, utilities, ground conditions, contaminated land, tie-ins to existing infrastructure etc.
Construction Disruption	Construction impacts on people and businesses regarding: ▪ Traffic ▪ Existing access levels ▪ Duration ▪ Any other impacts on businesses / community / town centres
Construction cost and risk	Assessed cost for construction of options including: ▪ Complexity and risk in construction (including consideration of constructability) ▪ Complexity in the programme

	▪ Cost and complexity of undertaking the works on contaminated land (including health and safety)
Safety in design and construction	Level of design and construction risks: ▪ Are there significant hazards associated with the option which pose a health and safety risk in design, build and final product? ▪ Can safety be developed into the design process to control it? ▪ Level of complexity in risk management through safety in design.
Operation and Maintenance	Any factors that may affect the ability to operate or maintain the option over its projected life: ▪ Any major ongoing or additional costs and/or whole of life costs? ▪ Level of maintenance activities required ▪ Capability to carry out maintenance activities.

2 Option Assessment

2.1 Common elements across all options

There are certain common elements across all options, which have been given equal importance during the assessment. Therefore, it is to be noted that the following elements are not considered to be major differentiators amongst all six options and thus, have not been focused on within the commentary in Section 2.2.

- The design between Mangere Bridge on SH20 and the SH20/SH20A interchange – This includes replacement of Walmsley Road bridge and Hall Avenue Footbridge.
- Construction of new Waokauri Creek Bridge on southern side SH20B (of varying bridge deck widths, depending on the individual option elements, i.e. online / offline widening, Rapid Transit Corridor (RTC) and Shared Use Path (SUP)).
- SH20B Campana Road interchange / intersection affects jetfuel pipelines - Although the works affecting the jetfuel pipeline are quite sensitive and have risks associated with it, every option involves some protection and/or relocation, so this has not been considered as a differentiator.

2.2 Assessment against implementability criteria

Base Case **Existing Environment (Do minimum)**	**Score**
n/a	n/a

Summary

The base case assumes no change to the existing roading network with no new construction impacts, except on-going maintenance and operations. The SH20B short term improvements project is assumed to be part of the existing environment. For this reason, we have not assessed the implementability feasibility of the Base Case.

Option 1a **SH20B offline grade separated connections; SH20/SH20B Puhinui south facing ramps; RTC on SH20B; Pukaki Creek four-lanes**	**Score**
Constructability One local bridge and one pedestrian footbridge, both over SH20 require replacement. In addition, construction of two new SUP underpasses are required. The majority of road, RTC and SUP construction is offline in the SH20B corridor. The SUP on the eastern side of SH20 is constructed offline and largely within designation, allowing for easier construction procedures with less disruption. However, the SH20B Campana Road interchange affects the jetfuel pipelines. Although the Puhinui south facing ramps involve major construction works, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before.	**4**
Construction Disruption Construction of two new SH20B/SH20 south facing system interchange ramps as well as the ramps connecting to Puhinui Road, would involve works over live traffic lanes and require lane closures, consequently increasing travel times. However, this can be mitigated by constructing them under night closures, which are considered to cause only a low level of disruption. Moderate long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing Walmsley Road on SH20, Hall Avenue footbridge on SH20 and the addition of two new SUP underpasses at Massey Road and Portage Road, respectively. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a significant period of time of reduced local access. This option has minimal impact on the existing users of SH20B as a majority of the works are undertaken offline.	**3**
Construction cost and risk [redacted]	**2**
Safety in design and construction A departure may be required for the proposed Puhinui south facing system interchange ramps, due to a steep upward gradient of 6%. This departure is common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20B/SH20 south facing system interchange ramps would ultimately likely provide a safer transition between SH20B and SH20, with the benefit of a consistent route to and from the airport without a staged reduction in speed and reduced travel times. Majority of the road, RTC and SUP construction is offline. However, the SH20B Campana Road interchange affects Jetfuel pipelines.	**3**

The Puhinui Road south-facing system interchange ramps and the Campana Road interchange are close to the runway vertical obstacle limitation surface. Furthermore, Pukaki Creek bridge involves works over water.	
Operation and Maintenance All options involve new pavement, stormwater, retaining walls and structures. Whilst the quantities between the options differ, they are all considered business as usual and therefore there are no differentiators.	**3**

Summary

A relatively minor amount of infrastructure is required that will have minor adverse impacts on journey reliability due to the proximity to the Airport precinct.

Moderate disruption is associated with works affecting bridges and construction of new underpasses. However, as most of the construction is undertaken offline and within designation, it allows for a less stringent construction methodology and is ultimately easier to construct.

Construction works of this style have been undertaken in NZ before on projects such as Southern Corridor Improvements (SCI) and Northern Corridor Improvements (NCI).

Option 1b **SH20B offline grade separated connections; SH20/SH20B Puhinui south facing ramps; RTC on SH20 and SH20A; Pukaki Creek four-lanes**	**Score**
Constructability A total of two local road bridges require replacement. One footbridge and one water main pipebridge also require replacement, and construction of one SUP underpass and two new system interchange ramps. The majority of road, and SUP construction is offline in the SH20B corridor. However, the SH20B Campana Road interchange affects the jetfuel pipelines. The RTC and SUP on the eastern side of SH20 is also constructed offline. However, the majority of the design lies outside designation requiring some large cuts and significant amount of retaining walls. Subsequently, there are a significant number of impacted properties on SH20 and the complications resulting from that interaction have been considered as a significant negative. Although the Puhinui south facing ramps involve major construction works, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before.	**2**
Construction Disruption Construction of two new SH20B/SH20 south facing system interchange ramps as well as the ramps connecting to Puhinui Road, will involve works over live traffic lanes and require lane closures, consequently increasing travel times. However, this can be mitigated by constructing them under night closures, which are considered to cause only a low level of disruption. Moderate long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing Walmsley Road and Portage Road on SH20, the	**3**

Hunua No. 4 water main pipebridge and Hall Avenue footbridge on SH20 and the addition of one new SUP underpass at Massey Road. Furthermore, the construction of the RTC along Bader Drive will add to the disruption within this area. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a significant period of time of reduced local access. This option has minimal impact on the existing users of SH20B as a majority of the works are offline.	
Construction cost and risk [redacted]	**2**
Safety in design and construction A departure may be required for the proposed Puhinui south facing system interchange ramps, due to a steep upward gradient of 6%. This departure is common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20B/SH20 south facing system interchange ramps would ultimately likely provide a safer transition between SH20B and SH20, with the benefit of a consistent route to and from the airport without a staged reduction in speed and reduced travel times. Majority of the road construction is offline on SH20B. However, the SH20B Campana Road interchange affects jetfuel pipelines. Furthermore, The Puhinui Road south-facing system interchange ramps and the Campana Road interchange are close to the runway vertical obstacle limitation surface. Pukaki Creek bridge involves works over water. Although the RTC and SUP on the eastern side of SH20 involves offline construction, it largely lies outside designation requiring some large cuts and significant amount of retaining walls, as well as the replacement of the Hunua No. 4 water main pipebridge.	**3**
Operation and Maintenance All options involve new pavement, stormwater, retaining walls and structures. Whilst the quantities between the options differ, they are all considered business as usual and therefore there are no differentiators.	**3**

Summary

A relatively moderate amount of infrastructure is required that will have moderate adverse impacts on journey reliability due to the proximity to the Airport precinct.

Moderate disruption is associated with works affecting bridges and construction of new underpasses. As most of the construction is undertaken offline, it allows for a slightly less stringent construction methodology.

However, construction challenges may still be present due to the works being outside designation within a constrained corridor and the large amount of interactions with adjacent properties. Therefore, requiring large earthworks and a significant amount of retaining walls, consequently triggering longer construction programmes.

Option 2a **SH20B online widening at-grade connections; RTC on SH20B; Pukaki Creek four-lanes**	**Score**
Constructability A total of five local road bridges require replacement. Two footbridges also require replacement and construction of one SUP underpass and one new system interchange ramp. The majority of road construction is online in the SH20B corridor with the intersections upgraded as part of the short-term works unaffected. The RTC and SUP construction is offline in the SH20B corridor. SH20A is shifted laterally to accommodate Light Rail Transit (LRT), with some eastbound widening. Minor online widening of SH20, whilst the SUP on the eastern side of SH20 is constructed offline and partially within designation. However, a significant number of impacted properties on SH20 and the complications resulting from that interaction have been considered as a significant negative. Although the SH20A/SH20 south facing system interchange ramp involves major construction works, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before.	**2**
Construction Disruption Construction of one new SH20A/SH20 south facing system interchange ramp and realignment of SH20A to accommodate LRT will involve works over and adjacent to live traffic lanes, requiring lane closures and consequently increasing travel times. However, this can be mitigated by constructing them under night closures, which are considered to cause only a low level of disruption. Significant long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing the following five local road bridges: Walmsley Road (SH20), Portage Road (SH20), Massey Road (SH20), Bader Drive (SH20 and SH20A). Waokauri Creek Bridge on SH20B is replaced offline. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a significant period of time of reduced local access. In conjunction, with the addition of one new SUP underpass at Massey Road, the replacement of the Hall Avenue footbridge on SH20 and the Killington Crescent Pedestrian Footbridge on SH20A, this is likely to cause major disruption as it is the only pedestrian footbridge which solely caters for pedestrian movements across SH20A. SH20B being classified as an overdimension vehicle route, currently has an above average movement of freight, including the high percentage of HCV's. Online widening would have a direct impact for the existing users of SH20B.	**2**
Construction cost and risk [redacted].	**3**

Safety in design and construction Introduction of the SH20A to SH20 system interchange ramp would result in sub-standard weave lengths, requiring four weaving departures. An additional departure is also required on the SH20A to SH20 system interchange ramps, due to a steep upward gradient of 6%. These departures are common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20A/SH20 system interchange ramp is ultimately likely to provide a safer southbound route between SH20A and SH20 with the benefit of reduced travel times. The majority of the road construction in the SH20B, SH20 and SH20A involves online widening, with the RTC and SUP being constructed offline on the southern side of SH20B. However, the SH20B widening affects jetfuel pipelines and the Pukaki Creek bridge involves works over water.	**3**
Operation and Maintenance All options involve new pavement, stormwater, retaining walls and structures. Whilst the quantities between the options differ, they are all considered business as usual and therefore there are no differentiators.	**3**

Summary

A relatively significant amount of infrastructure is required that will have significant adverse impacts on journey reliability, due to the close proximity to the airport precinct.

Significant disruption is associated with works affecting bridges and construction of new underpasses, as well as most of the construction being undertaken online.

Option 2b **SH20B online widening at-grade connections; RTC on SH20 and SH20A; Pukaki Creek four-lanes**	**Score**
Constructability A total of five local road bridges require replacement. Two footbridges and one water main pipebridge also require replacement. Construction of one SUP underpass and one new system interchange ramp. The majority of road construction is online in the SH20B corridor with the intersections upgraded as part of the short-term works unaffected. The SUP construction is offline in the SH20B corridor. SH20A is shifted laterally to accommodate Light Rail Transit (LRT), with some eastbound widening. Minor online widening of SH20, whilst the RTC and SUP is constructed offline on the eastern side of SH20, largely outside designation requiring some large cuts and significant amount of retaining walls. Subsequently, significant number of impacted properties on SH20 and the complications resulting from that interaction have been considered as a significant negative.	**2**

Although the SH20A/SH20 south facing system interchange ramp involves major construction works, the construction methodologies would follow a relatively standard process, with this work being undertaken in NZ before.	
Construction Disruption Construction of one new SH20A/SH20 south facing system interchange ramp, replacement of the Hunua No.4 water main pipebridge and realignment of SH20A to accommodate LRT will involve works over and adjacent to live traffic lanes, requiring lane closures and consequently increasing travel times. However, this can be mitigated by constructing them under night closures, which are considered to cause only a low level of disruption. Significant long-term disruption to local roads and neighbouring facilities due to the construction impacts from replacing the following five local road bridges: Walmsley Road (SH20), Portage Road (SH20), Massey Road (SH20), Bader Drive (SH20 and SH20A). Waokauri Creek Bridge on SH20B is replaced offline. All bridges requiring replacement are likely to have a construction period of greater than 9 months. A staged approach would be required, resulting in a significant period of time of reduced local access. In conjunction, with the addition of one new RTC/SUP underpass at Massey Road and the replacement of the Hall Avenue footbridge on SH20 and the Killington Crescent Pedestrian Footbridge on SH20A, this is likely to cause major disruption as it is the only pedestrian footbridge which solely caters for pedestrian movements across SH20A. Furthermore, the construction of the RTC along Bader Drive will add to the disruption within this area. SH20B being classified as an overdimension vehicle route, currently has an above average movement of freight, including the high percentage of HCV's. Online widening would have a direct impact for the existing users of SH20B.	**2**
Construction cost and risk [redacted]	**2**
Safety in design and construction Introduction of the SH20A to SH20 system interchange ramp would result in sub-standard weave lengths, requiring four weaving departures. An additional departure is also required on the SH20A to SH20 system interchange ramps, due to a steep upward gradient of 6%. These departures are common throughout the existing network and can be mitigated to provide an acceptable outcome. However, the SH20A/SH20 system interchange ramp is ultimately likely to provide a safer southbound route between SH20A and SH20 with the benefit of reduced travel times. The majority of the road construction in the SH20B, SH20 and SH20A involves online widening. Consequently, the SH20B online widening affects jetfuel pipelines and Pukaki Creek bridge involves works over water. Although the RTC and SUP on the eastern side of SH20 involves offline construction, it lies largely outside designation and requires some large cuts and significant amount of retaining walls, as well as the replacement of the Hunua No. 4 water main pipebridge.	**3**

Operation and Maintenance All options involve new pavement, stormwater, retaining walls and structures. Whilst the quantities between the options differ, they are all considered business as usual and therefore there are no differentiators.	**3**

Summary

A relatively significant amount of infrastructure will have significant adverse impacts on journey reliability, due to the close proximity to the airport precinct.

Significant disruption is associated with works affecting bridges and construction of new underpasses. As most of the construction is undertaken online, it presents a slightly more stringent construction methodology.

Furthermore, construction challenges may still be present due to major works being outside designation and within a constrained corridor. Therefore, requiring large earthworks and a significant amount of retaining walls, consequently triggering longer construction programmes.

Option 3a **SH20B online widening at-grade connections; RTC on SH20B; Pukaki Creek two-lanes**	**Score**
Constructability Same as Option 2a, except there are only two traffic lanes across Pukaki Creek Bridge to accommodate the eastbound and westbound movements, ultimately minimizing the overall structural bridge requirements compared to Option 2a.	**2**
Construction Disruption Same as Option 2a, except with slightly less disruption for commuters travelling across Pukaki Creek Bridge.	**2**
Construction cost and risk [redacted]	**3**
Safety in design and construction Same as Option 2a, except less time would be required whilst working over Pukaki Creek, due to smaller overall bridge deck width.	**3**
Operation and Maintenance All options involve new pavement, stormwater, retaining walls and structures. Whilst the quantities between the options differ, they are all considered business as usual and therefore there are no differentiators.	**3**

Summary

Same as Option 2a, except the constructability and safety in design risks are slightly reduced due to a smaller overall structure across Pukaki Creek (due to reduced bridge deck width). Therefore, to some extent reducing the time spent working over water and the overall cost. The construction disruption across Pukaki Creek is also slightly less in comparison to Option 2a.

Option 3b **SH20B online widening at-grade connections; RTC on SH20 and SH20A; Pukaki Creek two-lanes**	Score
Constructability Same as Option 2b, except there are only two traffic lanes across Pukaki Creek Bridge, to accommodate the eastbound and westbound movements, ultimately minimizing the overall structural bridge requirements compared to Option 2b.	2
Construction Disruption Same as Option 2b, except with slightly less disruption for commuters travelling across Pukaki Creek Bridge.	2
Construction cost and risk [redacted]	2
Safety in design and construction Same as Option 2b, except less time would be required whilst working over Pukaki Creek, due to smaller overall bridge deck width.	3
Operation and Maintenance All options involve new pavement, stormwater, retaining walls and structures. Whilst the quantities between the options differ, they are all considered business as usual and therefore there are no differentiators.	3

Summary

Same as Option 2b, except the constructability and safety in design risks are slightly reduced due to a smaller overall structure across Pukaki Creek (due to reduced bridge deck width). Therefore, to some extent reducing the time spent working over water and the overall cost. The construction disruption across Pukaki Creek is also slightly less in comparison to Option 2b.

Approvals:

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