

6.2 Traffic Modelling

The 2016 and 2021 daily flows for the network surrounding the Whau River have been modelled using the existing SH16 Beca EMME/2 model with a four lane bridge and all traffic scenarios and a two lane bridge all traffic scenario. Three options were modeled including:

- McLeod Road to Rosebank Road (corresponds to evaluated options 1 and 2)
- Hepburn Road to Rosebank Road (corresponds to evaluated options 3, 4 and 5)

As it is a strategic model no differentiation has been made for the options relating to where the corridor “lands” on the Rosebank Peninsula. Therefore both McLeod Road options tested will have the same modeled numbers as will the Hepburn Road corridor options. The model was undertaken with two hourly flows for the AM, Inter and PM peaks. The options modeled were tested against a no Whau River Crossing option when assessing the performance of the options.

The following assumptions were made in the Beca model:

- Population growth to 2021 as forecast in the Auckland Regional Councils (ARC) ART2 model
- Regional transport priorities/policies as included in the 2005 Regional Land Transport Strategy (package 5) scenario, and as included in the ART2 model
- Travel behaviour in 2021 as predicted by the ART2 model
- Regional roading projects completed (especially the completion of the Western Ring Route), as included in the SH16 traffic model and used for previous modelling of the Whau project
- SH16 widening project is completed with priority lanes and grade priority gates at Lincoln Road and Rosebank Road. On SH16 the priority users are HCV's and HOV cars with more than three occupants.
- The SH16-20 Waterview project is completed.
- The two lane bridge has a 1500 vehicle per hour capacity constraint implemented.

The regional traffic demands are obtained from the Auckland Regional Transport model (ART2), as operated by Auckland Regional Council (ARC). The ART2 model uses population forecasts developed by the ARC as used in their 2005 regional Land Transport Strategy Study. The ART2 model covers the greater metropolitan area and as such the Whau River crossing model has been enhanced through additional validation on SH16 as well as the disaggregation of zones into smaller zones.

Indicative land take costs as well as the construction cost for the Whau River Crossing bridge and the road corridor form the costs for the BCR analysis. A total provisional sum of \$6.5 million has been included for the upgrading of the intersections at either end of the corridor and some work on the State Highway interchange at Rosebank and Patiki. This sum is provisional as it is not clear from NZTA what level of interchange upgrading NZTA would be prepared to incorporate as part of the Whau River Crossing.

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6.3 McLeod Road Crossing Options

This section summarises each of the McLeod Options, being Option 1 and Option 2, including an option description, characteristics and local and wider network traffic and property impacts.

6.3.1 Peak Traffic Impacts for Option 1 and 2

Two Hour Peak Traffic Impacts – SH16 (Four lane corridor & bridge):

The McLeod option results in the balancing of flows along SH16 with some of the larger re-distributions to the Rosebank Road and Patiki Road interchanges. However it is the option that in the inter-peak and PM peak puts more traffic on the city bound off ramps at Lincoln Road as vehicles take advantage of the spare capacity on the local network. With four lanes of general traffic it is likely that the Rosebank and Patiki Road interchanges will require more capacity to be added to the existing on and off ramps.

Two Hour Peak Traffic Impacts – Wider Network (Four lane corridor & bridge):

The McLeod options takes traffic from Te Atatu and Lincoln Roads and is a popular alternative route from Henderson however Great North Road is put under more pressure from further afield as vehicles attempt to reach the crossing point, the redistribution of traffic is less wide spread and the crossing carries the least amount of traffic at 29,600 vehicles per day.

Flows over Whau River Crossing

- Two Lanes

AM Peak = 3003 Inter Peak = 3270 PM Peak = 3742 ADT (Two lane option) = 24748 vpd

- Four Lanes

AM Peak = 4514 Inter Peak = 3663 PM Peak = 4537 ADT (Four lane option) = 29592 vpd

6.3.2 Alignment Description

Option 1: McLeod Road to the roundabout on Rosebank Road

- The corridor is 2050m long, 950m of which is in WCC and 320m in ACC.
- The bridge from McLeod Road to the Rosebank peninsula is 780m long. The span across the channel is approximately 100m long.
- McLeod Road would be widened on either side to provide a bus lane and cycle lane for both directions
- The intersection at McLeod Road and Te Atatu Road will need to be upgraded
- The roundabout intersection at Rosebank Road and Patiki Road will need to be upgraded. It is likely that this intersection will need to be changed to be a multi-lane signalised intersection to accommodate the expected traffic volumes.
- Two Lane Construction cost: \$ 73 million, Four Lane Construction cost: \$106 million
- Two Lane BCR = 3.1, Four Lane BCR = 3.8
- There are four priority intersections along the McLeod Road route which are likely to be affected by the high volume of through traffic.

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Option 2: McLeod Road to Timothy Place

- The corridor is 2100m long, 950m of which is in WCC and 400m in ACC.
- The bridge from McLeod Road to the Rosebank peninsula is 750m long. The span across the channel is approximately 100m long.
- McLeod Road would be widened on either side to provide a bus lane and cycle lane for both directions
- The intersection at McLeod Road and Te Atatu Road will need to be upgraded
- The existing priority intersection at Rosebank Road / Timothy Place would need to be upgraded.
- There would be a need to upgrade Rosebank Road from Timothy Place to the roundabout in a 4 lane arrangement to provide sufficient road capacity. This would involve upgrading and possibly signalling the Timothy Place intersection.
- Two Lane Construction cost: \$67 million , Four Lane Construction cost: \$96 million
- Two Lane BCR = 3.3, Four Lane BCR = 4.2

6.4 Hepburn Road Crossing Options

This section summarises each of the Hepburn Options, being Options 3, 4 and 5, including an option description, characteristics and local and wider network traffic and property impacts.

6.4.1 Peak Traffic Impacts

Two Hour Peak Traffic Impacts – SH16 (Four lane corridor & bridge)

The Hepburn options also have a positive effect in balancing of flows along SH16 with significant re-distributions of traffic from the Lincoln Road and Te Atatu Road interchanges to the Rosebank Road and Patiki Road interchanges. The balancing effect is consistent over all the ramps. With four lanes of general traffic on the bridge it is likely that the Rosebank and Patiki Road interchanges will require more capacity to be added to the existing on and off ramps.

Two Hour Peak Traffic Impacts – Wider Network (Four lane corridor & bridge)

The Hepburn options are the most popular corridor and crossing location with an AADT of 38000 vehicles per day. The approaches from the south have more vehicles as vehicles travel from further afield to reach the crossing. In comparison there is a reduction in traffic along Lincoln Road and Te Atatu Road, northbound towards the motorway in the AM peak.

Ash Street also experiences a reduction in traffic of 1000 vehicles northbound and 800 southbound in the AM peak which is more than the reduction experienced under the McLeod options.

Flows over Whau River Crossing

Two Lanes:

AM Peak = 3685 Inter Peak = 4046 PM Peak = 3885 ADT (Two lane option) = 29652 vpd

Four Lanes

AM Peak = 5250 Inter Peak = 4864 PM Peak = 5693 ADT (Four lane option) = 37950 vpd

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6.4.2 Alignment Description

Option 3: Hepburn Road to the Roundabout on Rosebank Road

- The corridor is 3400m long, 1900m of which is in WCC and 50m in ACC.
- The bridge from Hepburn Road to the Rosebank peninsula is 1350m long. The span across the channel is approximately 100m long.
- Hepburn Road will be widened on the northern side to provide a bus lane and cycle lane for both directions
- The intersection at Hepburn Road and Great North Road will need to be upgraded

The roundabout intersection at Rosebank Road and Patiki Road will need to be upgraded

- Two Lane Construction cost: \$114 million, Four Lane Construction cost: \$172 million
- Two Lane BCR = 3.0, Four Lane BCR = 1.8

Option 4: Hepburn Road to Timothy Place

- The corridor is 3150m long, 1940m of which is in WCC and 550m in ACC.
- The bridge from Hepburn Road to the Rosebank peninsula is 660m long. The span across the channel is approximately 100m long.
- Hepburn Road will be widened on the northern side to provide a bus lane and cycle lane for both directions
- The intersection at Hepburn Road and Great North Road will need to be upgraded
- The intersection at Rosebank Road and Timothy Place will need to be upgraded. There would be a need to upgrade Rosebank Road from Timothy Place to the roundabout in a 4 lane arrangement to provide sufficient road capacity. This would involve upgrading and possibly signalling the Timothy Place intersection.
- There are nine priority intersections along the Hepburn Road route which are likely to be affected by the high volume of through traffic
- Two Lane Construction cost: \$ 88 million, Four Lane Construction cost: \$127 million
- Two Lane BCR = 3.8, Four Lane BCR = 2.5

Option 5: Hepburn Road to New Intersection South of Timothy Place

- The corridor is 2900m long, 1900m of which is in WCC and 280m in ACC.
- The bridge from Hepburn Road to the Rosebank peninsula is 720m long. The span across the channel is approximately 100m long.
- Hepburn Road will be widened on the northern side to provide a bus lane and cycle lane for both directions
- The intersection at Hepburn Road and Great North Road will need to be upgraded
- A new intersection at Rosebank Road to the south of Timothy Place would need to be constructed. There would be a need to upgrade Rosebank Road from Timothy Place to the roundabout in a 4 lane arrangement to provide sufficient road capacity. This would involve upgrading and possibly signalling the Timothy Place intersection.

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- There are eight priority intersections along the Hepburn Road route which are likely to be affected by the high volume of through traffic.
- Two Lane Construction cost: \$90 million, Four Lane Construction cost: \$131 million
- Two Lane BCR = 3.7, Four Lane BCR = 2.4

7 Economic Assessment

7.1.1 Economic Assessment – General Traffic

As part of the Whau River Crossing Strategic study Beca has undertaken preliminary BCR analysis for the Whau River Crossing study.

Three options have been tested in the Beca sub-regional emme/2 model that was developed in 2007 for the purpose of testing the SH16 widening scheme. The emme/2 model is a traffic assignment model covering the wider Auckland Region for a representative weekday morning, inter-peak and evening peak periods.

Modelling was undertaken for two scenarios for each of these alignment options. Scenario one provides a four lane facility (two lanes in each direction), and scenario two provides for a two lane facility (one lane in each direction). For the purposes of this modelling, all lanes have been assumed to be available to general traffic and no allowance has been made for the inclusion of a bus priority lane. Likewise for the purposes of this assessment both options have no tolling constraint implemented as part of this economic analysis

Two forecast years have been modelled to enable the calculation of the BCR – 2016 & 2021. Construction costs have been provided by Opus for both scenarios. The economic assessment has been undertaken in accordance with the NZ Transport Agency's (NZTA) guidelines, and takes into account the recent updates including the 30 year modelled period and the 8% discount rate.

Indicative land take costs as well as the construction cost for the Whau River Crossing bridge and the road corridor form the costs for the BCR analysis. We have also included a total provisional sum of \$6.5 million for the upgrading of the intersections at either end of the corridor and some work on the State Highway interchange at Rosebank and Patiki. This sum is provisional as it is not clear from NZTA what level of interchange upgrading NZTA would be prepared to incorporate as part of the Whau River Crossing.

The following tables contain the BCR's calculated for each of the options.

Table 7-1 : BCR's for Four Lane Corridor and Crossing

| Beca Model | Road | Option | Capex Cost (\$million) | Total NPV (\$million) | NPV Benefits (\$million) | BCR |
|------------|-----------|--------|------------------------|-----------------------|--------------------------|-----|
| 1 | McLeod | 1 | \$108.80 | \$92.55 | \$345.79 | 3.7 |
| 1 | McLeod | 2 | \$98.75 | \$84.00 | \$345.79 | 4.1 |
| 4 | Hepburn | 3 | \$171.62 | \$147.13 | \$271.35 | 1.8 |
| 4 | Hepburn | 4 | \$127.20 | \$109.05 | \$271.35 | 2.5 |
| 4 | Hepburn | 5 | \$131.24 | \$112.51 | \$271.35 | 2.4 |
| 5 | Archibald | 6 | \$116.59 | \$99.80 | \$195.12 | 2.0 |

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Table 7-2 : BCR's for Two Lane Corridor and Crossing

| Beca Model | Road | Option | Capex Cost (\$million) | Total NPV (\$million) | NPV Benefits (\$million) | BCR |
|------------|-----------|--------|------------------------|-----------------------|--------------------------|-----|
| 1 | McLeod | 1 | \$75.04 | \$63.92 | \$191.44 | 3.0 |
| 1 | McLeod | 2 | \$69.46 | \$59.17 | \$191.44 | 3.2 |
| 4 | Hepburn | 3 | \$113.67 | \$97.53 | \$290.42 | 3.0 |
| 4 | Hepburn | 4 | \$88.11 | \$75.60 | \$290.42 | 3.8 |
| 4 | Hepburn | 5 | \$90.37 | \$77.54 | \$290.42 | 3.7 |
| 5 | Archibald | 6 | \$81.39 | \$69.65 | \$206.37 | 3.0 |

For a four lane Whau River Crossing and corridor the option with the highest benefit cost ratio (BCR) are the two McLeod Road options with a 3.7 BCR for Option 1 and 4.1 for Option 2. Not only do these two options have the highest benefits from the model they also are the two least costly options in terms of constructions. The Hepburn Road Option 3 has the least BCR due to being the most expensive option to construct because of the length of the bridge required.

In comparison under a two lane Whau River Crossing and corridor scenario the options with the highest benefit cost ratio (BCR) are two of the three Hepburn Road Options, Option 4 with a BCR of 3.8 and Option 5 with a BCR of 3.7. This is due to the benefits for the McLeod Road options experiencing a dramatic decrease of \$154 million while the Hepburn Road benefits increase by \$19 million. The McLeod Road options BCR's are being impacted by the interpeak periods which are experiencing increased VKT's and travel times under a 2 lane Whau River Crossing and Corridor.

7.2 Economic Risk Assessment

Rough order elemental cost estimates have been prepared following the guidelines outlined in NZTA SM014. It must be stressed that these are very preliminary estimates and is subject to the usual cost risk range uncertainties of a project feasibility estimate. It should not be regarded as any more accurate than, at best, 30-40 percent at this phase.

The very preliminary stage of investigation for this project dictates that it is not possible to be any more accurate than indicated above.

Major uncertainties within the estimate at this stage include the alignment and form of the link and the estuarine crossing, compensation and land costs. Other cost uncertainties will certainly arise but these can not be estimated at this phase.

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8 Statutory Consents

The purpose of this section is to provide a summary and comparison of the consenting requirements for each crossing option in order to identify the optimal means to firstly secure the footprint of the route required for the project (District Council designations), and secondly, to outline the necessary consents to construct the works (Regional Council consents) and Historic Places Trust authorisation.

The assumption is that the route will be secured with a Notice of Requirement (designation) in preference to other planning mechanisms (e.g. multiple District Council land use consents). Therefore, approvals under the Resource Management Act 1991 include:

- (a) Notice of Requirement (designation)
- (b) Auckland Regional Council Resource Consents (land use, coastal occupation and discharges)
- (c) Authorisation under the Historic Places Trust

A Notice of Requirement (designation) is the traditional method of securing land, subsoil or airspace necessary for a public work or efficient functioning or operation of a public work.

A designation allows a Requiring Authority to protect the corridor without initially owning the land and allows for design flexibility. For this project, all options will require boundary adjustments (or an alteration) to some existing Auckland City Council and Waitakere City Council road designations to allow for road widening to build additional lanes on the landward approaches to the bridge structure. In addition some options will require new designations to create new roads.

Regional Council consents are required for the proposed works, regardless of what method of route protection is chosen.

In addition, other approvals under the Historic Places Act 1993 may also be necessary.

Each crossing option has been assessed against the statutory requirements and relevant planning provisions as set out in the Waitakere City and Auckland City district plans as well as the various Auckland Regional Plans. Detailed discussion of the development requirements and the restrictions within the relevant plans and relative feasibility of each option is contained in previous reports including the Existing Situation Report; Issues and Constraints Report; and Option Evaluation Report.

The table in this section, together with its supporting explanatory notes, provides a summary of the consents and likely resource management issues that will arise from the proposed works for each option.

8.1 Consent Requirements

As noted above, the assumption is that the route will be secured with a Notice of Requirement (designation). Consents required for each crossing option are identified and explained in the table below. A 'tick' (✓) indicates a consent is required. A bold 'tick' (✓) indicates that there are more significant issues and/or constraints associated with that consent e.g. issues that may be harder to mitigate or require a higher level of community engagement.

The table is annotated to explain the particular resource management issues that are likely to arise from the proposed works in terms of each identified consent.

Table 9-1 and supporting explanations provide a summary on an option by option basis so to enable "ranking" of each option in terms of their relative ease in obtaining statutory approvals.

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Table 8-1 : Consent Requirements

| Option | Security Approval | | | | | | |
|--------------------------------------|-------------------------------|-------------------------------|--|---|--|---|---|
| | NOR WCC Securing the route | NOR ACC Securing the route | 5.12 RMA ARC Coastal Bridge, Occupation, Structures, Disturbance, Ecological Impact | 5.9 RMA ARC Earthworks Approaches (road widening) | 5.15 RMA ARC Stormwater Approaches (road widening) | 5.9 RMA Contaminated Sites Approaches (road widening) | Heritage ARC/HPT Approaches (road widening) |
| 1 McLeod Road to Rosebank roundabout | ✓ Note: 1 | ✓ 3 | ✓ 8 | ✓ 12 | ✓ 12 | ✓ 14 | ✓ 15 |
| 2 McLeod Road to Timothy Place | ✓ 1 | ✓ 4 | ✓ 8 | ✓ 12 | ✓ 12 | ✓ 14 | ✓ 16 |
| 3 Hepburn to Rosebank roundabout | ✓ 2 | ✓ 5 | ✓ 9 | ✓ 13 | ✓ 13 | ✓ 14 | ✓ 17 |
| 4 Hepburn to Timothy Place | ✓ 2 | ✓ 6 | ✓ 10 | ✓ 13 | ✓ 13 | ✓ 14 | ✓ 17 |
| 5 Hepburn to Rosebank Road | ✓ 2 | ✓ 7 | ✓ 11 | ✓ 13 | ✓ 13 | ✓ 14 | ✓ 17 |
| Summary | - All options require NOR | | | | | | |

Notes

- 1 Shortest land requirement of all options. Alteration to designation required for road widening through predominantly residential and open space land use.
- 2 Long section of alteration (road widening) through predominantly residential land as well as some commercial and industrial land.
- 3 Short section of new designation required to form new road for connection to the Rosebank Roundabout.
- 4 Short length of road widening along Timothy Place (alteration to designation) through predominantly commercial and industrial land use.
- 5 Short section of new designation required to form new road for connection to the Rosebank Roundabout. Potential to progress as an alteration to designation due to short length.
- 6 Short length of road widening along Timothy Place (alteration to designation) through predominantly commercial and industrial land use.
- 7 Short section of new designation required to form new road for connection to Rosebank Road.
- 8 Relatively short length of bridge, no significant ecological issues – can be mitigated.
- 9 Longest length of bridge within the Coastal Marine Area through mangrove marsh at the eastern end and possibly Patiki Road marginal strip (administered by Doc).
- 10 Relatively short length of bridge but the land edge supports Pohutukawa and native trees as well as a pied shag roost.
- 11 Relatively short length of bridge but crosses the land edge which supports natural resources of high potential ecological value. The alignment divides the reserve in two creating issues for bird feeding.
- 12 Shortest length of road widening and therefore smallest area of earthworks required and smallest subsequent increase in area of impervious surface (after resurfacing).
- 13 Long section of road widening on WCC side and therefore large area of earthworks required and large subsequent increase in area of impervious surface (after resurfacing). On the ACC side, very short section of earthworks required for new section of road, small resultant increase in impervious surface.
- 14 Potential for contamination due to historical industrial and agricultural land use.
- 15 Identified heritage site Pollen's Brickworks site, protected by ARC and HPT. Alignment directly affects site with significant negative impacts that are difficult to mitigate unless site is avoided.
- 16 Potential to uncover 'unknown' sites of cultural, archaeological or heritage significance.
- 17 High potential for effects on identified heritage sites along Hepburn Road.

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8.2 Consenting Requirement Summary

Table 8-1 provides a summary of the consents and likely resource management issues that will arise from the proposed works for each option. It details how all options require a full range of statutory approvals and that Option 2 has fewer consenting issues than the other options.

The options have been “ranked” in terms of their relative ease in obtaining statutory approvals (relative to the effects on the environment of each option and how these effects may be mitigated), as shown in Figure 8-1.

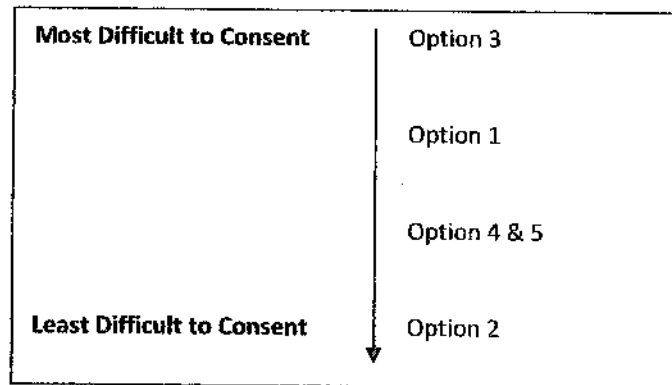


Figure 8-1 : Summary of Consenting Ranking

Option 2 is least contentious in terms of its potential effects and the majority of effects may be mitigated through sensitive design and direct off setting mitigation. This Option is similar to Option 1 in terms of consent requirements; the length of both road widening (alteration to designation on the WCC side) and the bridge structure over the river is comparatively short. However, Option 2 presents fewer issues than Option 1 because its alignment avoids the Pollens Brickworks site and there is existing road to accommodate the eastern landward connection (Timothy Place).

Options 4 and 5 are similar to Option 3 in terms of consent requirements and resource management issues, including a long length of road widening (alteration to designation) on the WCC side and a number of heritage sites located along Hepburn Road which may be affected by road widening. However, Options 4 and 5 present fewer issues / constraints than Option 3 because the footprint on the Whau River is significantly smaller for these two alignments compared to that proposed under Option 3.

Option 3 places the greatest footprint on the Whau River and therefore has a greater number of associated resource management issues requiring specialist mitigation (ecology). In addition there are a number of heritage sites along Hepburn Road which may be affected by road widening.

Option 1 has relatively few resource management issues because the length of both road widening (alteration to designation on the WCC side) and the bridge structure over the river is relatively short. However a new designation would be required on the ACC side because there is no existing road along the proposed alignment on this side. In addition, the alignment directly affects the Pollens Brickworks heritage site which is a prohibited activity under the Regional Coastal Plan.

Overall, Option 2 is considered to be the ‘easiest’ option in terms of obtaining statutory approvals.

9 Option Evaluation Process

Each option has been evaluated by the project team including Environmental, Social, Geotechnical and Transportation specialists and client representatives. The specialists undertook the evaluation process based on a four lane corridor in order to analyse the maximum footprint the crossing could create, and therefore consider the maximum effect on the local area, property/land take and their specialised areas.

The evaluation process was an extensive four stage exercise including:

- Specialists building upon the Issues, Constraints Risks and Opportunities study, reviewing the option descriptions and evaluation materials providing a preliminary rating for each option against relevant evaluation criteria (many of these specialists were involved in the original corridor identification process);
- An option evaluation workshop was held to present/discuss/agree the ratings from the specialists and to enable cross-specialists input;
- Following the workshop, specialists were asked to review and confirm the workshop outcomes; and
- Options were prioritised against 6 refined criteria.

A detailed discussion of the evaluation process is contained in the Option Identification and Evaluation Report, Opus, 2008 and the prioritisation process is detailed in the following section.

9.1 The Evaluation Outcomes

The key outcomes of the Option Evaluation Workshop include¹²:

- The outcomes of the issues & constraints process were confirmed during the evaluation;
- All options achieve the project goals and objectives, but to varying degrees (as shown in Table 9-1);
- Options 3, 4, and 5 facilitated the greatest redistribution of traffic and therefore performed best in alleviating traffic congested on the surrounding road network. These options also facilitate the greatest redistribution of freight movements;
- Matters of National and Regional Significance and identified as potential fatal flaws included the Pollens' Brickworks and the Cemetery at Orchard Road. These fatal flaw ratings can be downgraded provided that the sites are physically avoided;
- Matters of Regional Significance were identified as the ecological areas located along the Whau River, particularly the Rosebank Peninsula. It was agreed that most of these issues can be adequately mitigated through sensitive design and avoidance;
- The cumulative effects of high concentrations significant local land uses including schools, community facilities meant that collectively the effects were upgraded and rating to 'Regional Significance'; and
- Each option provided (to varying degrees) the ability to enhance the local bus network to provide better penetration to local areas.

¹² The minutes from the Evaluation Option workshop and the Option Matrix and description of outcomes are included in the Options and Evaluation Report, Opus, 2008.

Table 9-1 : Option Evaluation - Whau Crossing Project Goals

| Performance Indicator | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 |
|--|--|------------------------------|---|-------------------------------|--|
| | McLeod Road to the roundabout on Rosebank Road | McLeod Road to Timothy Place | Hepburn Road to the roundabout on Rosebank Road | Hepburn Road to Timothy Place | Hepburn Road to Rosebank Road (South of Timothy Place) |
| Achieve an integrated, safe, responsive and sustainable land transport solution which alleviates congestion on SH16 and its neighbouring State Highway, arterial and local road networks | +MINOR | +MINOR | +MODERATE POSITIVE | +MODERATE POSITIVE | +MODERATE POSITIVE |
| Assist regional economic growth | +MINOR | +MINOR | +MODERATE POSITIVE | +MODERATE POSITIVE | +MODERATE POSITIVE |
| Promote the purpose and objectives of the NZTS and the LTMA | +MODERATE POSITIVE | +MINOR | +MINOR | +MINOR | +MODERATE POSITIVE |

Option 5 scored moderate positive against all three performance indicators, this was due to the option having the highest redistribution of traffic and a direct short route across the river.

Options 3 and 4 scored moderate positive against the indicators of achieving a safe, responsive and sustainable land transport solution, and assisting regional economic growth. However when assessed against the purpose and objectives of the NZTS and the LTMA scored only minor positive.

Option 2 scored minor positive against all performance indicators, this was because the options achieved all of the project goals.

Option 1 scored minor positive against the indicators of achieving a safe, responsive and sustainable land transport solution, and assisting regional economic growth. However when assessed against the purpose and objectives of the NZTS and the LTMA scored moderate positive.

9.2 Option Prioritisation

Following the Specialist Evaluation Option workshop a Multi Variant Analysis was undertaken to directly compare the options in order to provide an emphasis rating to prioritise the options. As such, a "preferred" option or options priority has been derived.

The criteria for the analysis was developed with Waitakere City Council and NZTA and includes:

- Economic Growth;
- Network performance/ wider network effect;
- Environmental Impact;
- Impact on stakeholders;
- State Highway balancing; and
- Construction Costs.

No weightings were applied to the criteria.

The evaluation was undertaken considering impacts at a local and regional level.

The options were ranked against the criteria from 1-5, with 1 being the best performing and 5 being the worst, as shown in Table 9-1. Table 9-1 details the broad merits and demerits of each option.

The lowest scoring option is considered to be the best performing option overall.

Table 9-2 : Multi Variant Analysis Rating Key

| Ranking | Explanation |
|---------|-----------------------|
| 1 | Best Relative option |
| 2 | |
| 3 | Moderate |
| 4 | |
| 5 | Worst Relative Option |

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Table 9-2: Summary Option Prioritisation

| Summary Criteria | Option 1 McLeod Road to the roundabout on Rosebank Road | Option 2 McLeod Road to Timothy Place | Option 3 Hepburn Road to the roundabout on Rosebank Rd | Option 4 Hepburn Road to Timothy Place | Options Hepburn Road to Rosebank Rd (South of Timothy Place) |
|---|---|---|--|--|--|
| Economic Growth ¹³ | <ul style="list-style-type: none"> - Minimal land impact on existing landuse along Rosebank Road - Increased accessibility to new areas to allow for economic growth - Minor landuse development opportunity for WCC | <ul style="list-style-type: none"> - Minimal land impact on existing landuse - Minor landuse development opportunity for WCC | <ul style="list-style-type: none"> - Minimal land impact on Rosebank Road - Increased accessibility - Increased landuse development opportunity for WCC | <ul style="list-style-type: none"> - Significant land impact - Increased landuse development opportunity for WCC | <ul style="list-style-type: none"> - Land impact on Rosebank Rd and ACC industrial area - Increased landuse development opportunity for WCC |
| Network performance/ wider network effect | <ul style="list-style-type: none"> - Less network reassignment - Direct access to on-ramps | <ul style="list-style-type: none"> - Less network reassignment | <ul style="list-style-type: none"> - Traffic re-assignment for wider area - Highest reduction on wider network - Direct access to SH16 | <ul style="list-style-type: none"> - Traffic re-assignment for wider area - Highest reduction on wider network | <ul style="list-style-type: none"> - Traffic re-assignment for wider area - Highest reduction on wider network |
| Ranking: | 3 | 5 | 1 | 3 | 2 |
| Environmental Impact | <ul style="list-style-type: none"> - No prohibited activities - Bridge length is not extensive - No significant heritage/ ecological /w/ issues | <ul style="list-style-type: none"> - Longest bridge - High ecological impact on CMA - Heritage issues along Hepburn Road | <ul style="list-style-type: none"> - Longest bridge - High ecological impact on CMA - Heritage issues along Hepburn Road - Ecological issues /CMA | <ul style="list-style-type: none"> - Shortest bridge - Heritage issues along Hepburn Road - Ecological issues /CMA | <ul style="list-style-type: none"> - Shortest bridge - Heritage issues along Hepburn Road - Ecological issues /CMA |
| Ranking: | 2 | 2 | 1 | 1 | 3 |
| Impact on stakeholders | <ul style="list-style-type: none"> - Limited impact as connects directly to Rosebank Road roundabout | <ul style="list-style-type: none"> - Removal of industrial property on Rosebank Peninsula - Upgrade of infrastructure on Rosebank Peninsula | <ul style="list-style-type: none"> - Limited impact as connects directly to Rosebank Road roundabout - Increase in vehicles on Rosebank Road | <ul style="list-style-type: none"> - Increase in vehicles on Rosebank Road - Upgrade of infrastructure on Rosebank Peninsula - Removal of industrial property on Rosebank Peninsula | <ul style="list-style-type: none"> - Significant upgrade of infrastructure on Rosebank Peninsula - Removal of industrial property on Rosebank Peninsula |
| Ranking: | 5 | 1 | 3 | 2 | 2 |
| State Highway Balancing ¹⁴ | <ul style="list-style-type: none"> - Some of the highest figures for traffic re-distribution but also an unbalancing affect at Lincoln Road. Under a four lanes of general traffic option it is likely there will be a need to increase the capacity of these interchanges | <ul style="list-style-type: none"> - Some of the highest figures for traffic re-distribution but also an unbalancing affect at Lincoln Road. Under a four lanes of general traffic option it is likely there will be a need to increase the capacity of these interchanges | <ul style="list-style-type: none"> - Consistent balancing affect over all interchanges by moving traffic to Patiki and Rosebank Interchanges. Under a four lanes of general traffic option it is likely there will be a need to increase the capacity of these interchanges | <ul style="list-style-type: none"> - Consistent balancing affect over all interchanges by moving traffic to Patiki and Rosebank Interchanges. Under a four lanes of general traffic option it is likely there will be a need to increase the capacity of these interchanges | <ul style="list-style-type: none"> - Consistent balancing affect over all interchanges by moving traffic to Patiki and Rosebank Interchanges. Under a four lanes of general traffic option it is likely there will be a need to increase the capacity of these interchanges |
| Ranking: | 1 | 3 | 2 | 4 | 5 |
| Construction Costs | \$109 Million | \$99 Million | \$172 Million | \$128 Million | \$332 Million |
| Ranking: | 2 | 2 | 1 | 3 | 4 |
| Mean Ranking: | 2.5 | 2.3 | 2.2 | 2.3 | 2.8 |

¹³ Assessment of economic effects completed by Ascari illustrated crossing accessibility and development opportunities as equal for all crossing options (excluding option 6)
¹⁴ Due to strategic level modelling no comparative test can be applied in order to create a summary option prioritisation under the State Highway Balancing category.

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9.3 Option Prioritisation Outcomes

The results of the Multi Variant Analysis (unweighted), including the number of times each time a score is allocated, is shown in Table 9-2 and discussed below.

Table 9-3 : Multi Variant Analysis Option Results

| Option | Total Times # Occurs | | | | | Mean Ranking |
|--|----------------------|---|---|---|---|--------------|
| | 1 | 2 | 3 | 4 | 5 | |
| Option 1 : From McLeod Road to the roundabout on Rosebank Road | 1 | 3 | 1 | - | 1 | 2.5 |
| Option 2 : From McLeod Road to Timothy Place | 2 | 2 | 1 | - | 1 | 2.7 |
| Option 3 : From Hepburn Road to Rosebank Road | 3 | 1 | 1 | - | 1 | 2.2 |
| Option 4 : From Hepburn Road to Timothy Place | 2 | 1 | 2 | 1 | - | 2.7 |
| Option 5 : From Hepburn Road to Rosebank Road (south of Timothy Place) | 1 | 2 | 1 | 1 | 1 | 3.2 |

The results of the Multi Variant Analysis (unweighted) reveal the following priority of options (Table 9-3):

Table 9-4 : Multi Variant Analysis Option Ranking

| Option | Mean Ranking | Overall Ranking |
|---|--------------|-----------------|
| Option 3 : From Hepburn Road to the roundabout on Rosebank Road | 2.2 | 1 |
| Option 1 : From McLeod Road to the roundabout on Rosebank Road | 2.5 | 2 |
| Option 2 : From McLeod Road to Timothy Place | 2.7 | 3 |
| Option 4 : From Hepburn Road to Timothy Place | 2.7 | 4 |
| Option 5: From Hepburn Road to Rosebank Road (sth of Timothy Place) | 3.2 | 5 |

The outcomes of the Multi Variant Analysis show that Option 3 performs best primarily because of its ability to promote economic growth, balance the state highway traffic, provide for freight redistribution and accessibility to Rosebank Road, its limited physical impact on Rosebank Road and its ability to redistribute traffic. Whilst the environmental impacts are significant it is considered that these effects can be mitigated through sensitive design, direct and offsetting mitigation.

Option 1 also performs well because of its ability to balance the state highway traffic and its limited physical impact on Rosebank Road and its ability to redistribute traffic. The environmental issues are relatively lower than Option 3, provided that the Pollens brickworks can be avoided.

Option 2 was ranked third due to the requirement to upgrade infrastructure on Rosebank Peninsula, its significant land impact, the possible requirement for the SH ramps to be upgraded and the removal of industrial property on Rosebank Peninsula. Option 4 has similar land impact and requirements to upgrade Rosebank Peninsula. Option 2 preformed better than Option 4, even though they both have a mean ranking of 2.7, due to less heritage/ ecological /lwi issues along McLeod Road, shorter bridge and lower construction costs.

Option 5 performed the most poorly primarily due to its impact on Rosebank Road, requiring the road and intersections to be upgraded.

10 Project Funding

It is likely due to the projects location that a number of parties will need to be involved in funding this project. Project funding considerations include public private partnership arrangement and /or tolling.

10.1 Public Private Partnership (PPP) Assessment

This section analyses the possibility of funding the crossing with a Public Private Partnership. PPPs are long term contracts between the public and private sectors covering planning, construction, operation and / or financing of public infrastructure and services. PPP procurement involves ongoing payments over an agreed timeframe once an asset is built and open, as opposed to progress payments made during construction under conventional procurement.

A PPP procurement of the Whau River Crossing will allow Waitakere City Council and NZTA to secure earlier funding and completion of the project with the assistance of private finance and can provide increased value for money over the lifecycle of the project.

A PPP agreement can be entered into if the ownership of public road remains with the public sector and the Waitakere City Council and NZTA has obtained in principle approval of the Minister of Transport and satisfied any specified conditions. The term of an agreement must not exceed 35 years, unless there are exceptional circumstances justifying an extension of no more than 10 years.

Key benefits and drivers of a PPP include:

- The use of private finance, which provides stronger and more focused performance incentives;
- Innovation and cost savings across the life of the project inspired by the private sector partner;
- Risk transfer (more risk is transferred to the private sector partner under a PPP than is the case under conventional procurement).

Key risks that would best be managed by Waitakere City Council and NZTA, because of legislative requirements or because they are directly controlled by the public sector partner include:

- Obtaining a designation and resource consents;
- The development and approval of any tolling scheme;
- Land purchase; and
- Discriminatory law change directed specifically at the PPP.

PPP contracts are typically much more complicated than conventional procurement contracts. If a decision is taken to procure the Whau River Crossing as a PPP, further work is necessary to ensure a full and robust assessment of value for money. In the event that a decision is taken to proceed with a PPP the following factors are considered to be critical to ensure a successful outcome:

- Public sector commitment to the project in terms of funding, process and timeline;
- Clear project objectives to guide the development;
- Adequate public sector resources and clearly defined roles; and
- Confirmation that there is private sector interest to ensure adequate competition in bidding for the project.

10.2 Tolling Assessment

This section details the possibility of funding the crossing with a toll. The detailed analysis of the tolling options is included in the Options Identification and Evaluation Report.

Under the LTMA a road tolling scheme is able to be established to provide funds applied by or on behalf of a road controlling authority for the purposes of planning, design, supervision, construction, maintenance or the operation for a new road. Tolling can also be considered for an existing road where it is integral to the new road to be funded from tolls.

Preliminary toll analysis has been carried out in the Whau River Crossing strategic model by Beca, which tested the preliminary toll modelling on the Hepburn Road option with 4 lanes of general traffic. The toll model involves segmenting the traffic demands into different 'markets', each with a different 'Willingness-to-Pay' (WTP) response to tolls¹⁵.

The toll model testing assumed that a free-flow electronic toll collection facility would be in place in order to eliminate any delay related to the collection of the toll. In order to assess the impacts of a toll various toll rates between 75 cents and \$3 have been tested as well as a combination of 24/7 toll operation and differential peak and off peak tolls.

The modelling indicates that the Whau River Crossing attracts high tidal flows of commuter traffic. Future modelling shows that in 2021, the peak demand would exceed the capacity of a 2-lane bridge (1 lane each way) therefore tolling is a possible tool for Travel Demand management to regulate the volume of traffic using the Whau River Crossing.

The level of the toll set has an impact with regards to the traffic using the crossing. The level of traffic using the crossing if the toll is set at a level over \$1.50 in the AM or PM peaks or over \$1.00 in the inter-peak is very low with less than 20% of the total untolled volumes using the crossing. Under a 24/7 toll strategy, a \$1.50 toll applied creates the greatest revenue – a potential \$8,000 per day, however, there is a drop of 30,600 vehicles when compared to an un-tolled scenario. In comparison when a peak/off peak tolling is applied, the maximum revenue is gained under a tolling scenario with a \$2.00 toll applied in the AM & PM peaks, and a \$1.50 toll applied in the inter-peak¹⁶.

¹⁵ There is significant uncertainty in WTP data and each project requires extensive market research to determine appropriate parameters for modelling. This preliminary modelling has used existing data from the "SH16 Widening: Waterview to Royal" and other studies, and as such results can be considered as indicative only. Specific Whau River Crossing market research and more detailed traffic and toll modelling would be required to provide more robust forecasts.

¹⁶ The work undertaken for this report provides indicative results based on existing, available data and models. More detailed research into motorists likely response to tolls and more detailed traffic and toll models would be required to provide more robust forecasts.

By implementing tolling the traffic volumes reduce by 30,600 vehicles per day along the Crossing, resulting in:

- Reduced spare capacity created on surrounding arterial routes;
- Reduced balancing of the State Highway Network;
- A maximum predicted revenue of \$8,000 per day
- Increased risk that there will be unused capacity for the Whau Crossing and Corridor

Therefore tolling is not a recommended procurement option for the development of the Whau River Crossing and it is expected that the low income return would not attract the private sector for a PPP.

11 Recommendation

Development of the following recommendations has been derived from the previously reported options evaluation workshop and the subsequent Multi Variant Analysis of the options against a refined set of criteria¹⁷.

The development of a Whau River Crossing can facilitate economic, employment and land use opportunities on both sides of the river. The Crossing has the potential to also facilitate transportation opportunities including increasing traffic redistribution from beyond and within the study area; improving road safety; the development of a clear roading network assisting accessibility; increasing accessibility for cyclists and pedestrians, and increasing passenger transport routes and potential for express services.

By helping to balance the traffic flows at the State Highway interchanges the Whau River Crossing would assist in the operational performance and use of the State Highway as a strategic route which would benefit NZTA.

11.1 Crossing Form and Function

The recommended cross section for the crossing is a 4 lane multi modal corridor (1 lane of general traffic and 1 bus/cycle or HOV or Freight lane – each direction). This option will provide significant traffic redistribution, whilst future proofing for future demands, as well as meeting the objectives of a sustainable route, as promoted by the Government Policy Statement, 2008.

This could however require consideration of the upgrading of the State Highway on-ramps at the Rosebank and Patiki interchanges due to the increase in traffic flow, and this would be a key emphasis for the Project Feasibility Reporting stage.

It is recommended that the Whau River Crossing is a 30m multi-modal corridor comprising of:

- One General Traffic Lane Each Direction;
- 5m Shared Cycle Bus Lane Each Direction; and a
- 3m Median.

¹⁷ Outcomes of Evaluation Report, Opus 2008, Section 9.4

This lane arrangement is shown below and would link into a wider bridge option which would have two lanes in each direction as well as a combined cycle and footpath facility. The provision of bus priority lanes allows for the potential for new passenger transport and express services and an increased movement of people within the existing road space. The provision of a cycle lane will develop and expand on the existing and proposed regional cycle network and increase active modes of transport. While this corridor arrangement does not have a specific freight priority the arrangement can also assist in the movement of freight by developing a wide median lane to allow for freight movements from adjacent sites.

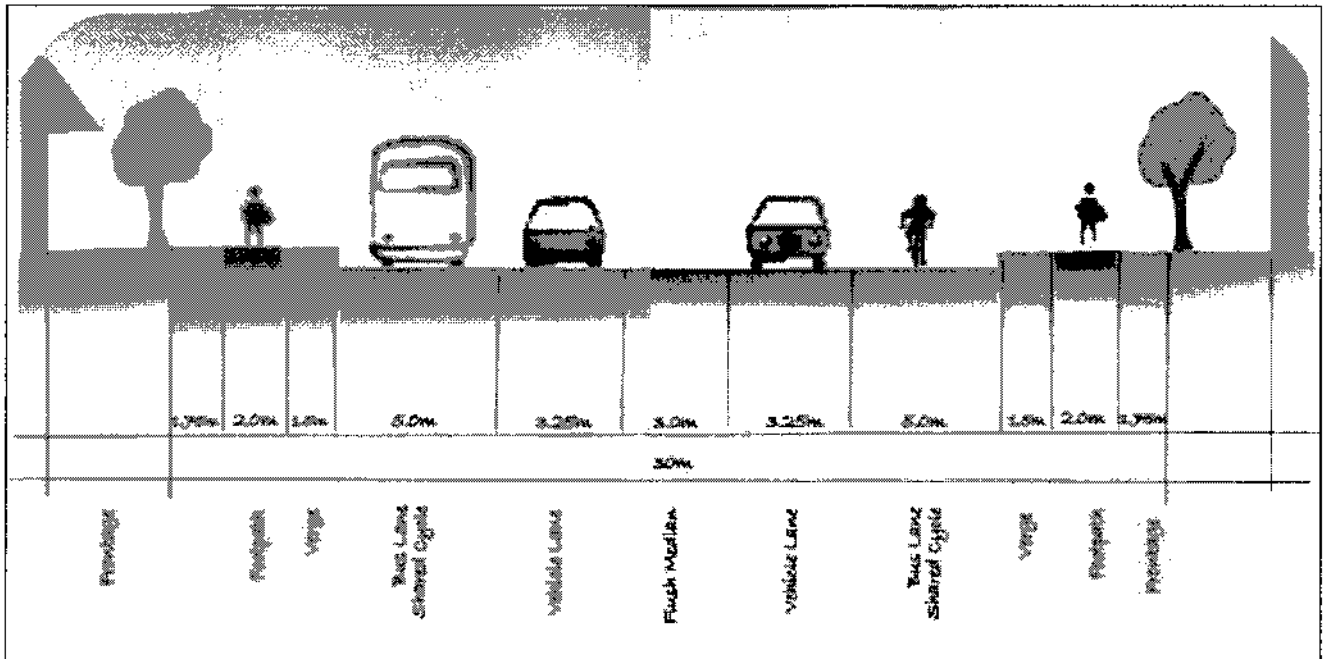


Figure 11-1 : Recommended Multi-Modal Corridor

For Notice of Requirement purposes it is important to investigate the maximum four lane corridor footprint required and to designate the land in order to future proof the route. At a later date when the corridor study is at its final stages a two lane corridor can still be designed and built if appropriate.

11.2 Crossing Option Alignment

The outcomes of the comparison illustrate that:

- Option 3 (Hepburn Road to the roundabout on Rosebank Road) performs best overall, primarily because of its ability to promote economic growth, balance the state highway traffic, provide for freight redistribution and accessibility to Rosebank Road, its limited physical impact on Rosebank Road and its ability to redistribute traffic. Option 3 also provides for the opportunity for new bus services and the promotion and development of cycle connections.

Option 3 provides the opportunity to develop a key bus public transport route between the residential areas and the key growth areas of Henderson and New Lynn in Waitakere City to the employment areas in Rosebank and the Auckland City CBD. The crossing provides an opportunity to develop a loop between Henderson, Rosebank Road and New Lynn to facilitate public transport connections between the major employment centres in the area.

Looking further afield, the corridor provides an opportunity to develop park and ride facilities for bus services and a dedicated public transport link with direct access to State Highway 16 to complement the existing local bus routes and longer distance rail journeys.

Whilst the environmental impacts are significant it is considered that these effects can be mitigated through sensitive design & direct and offsetting mitigation including land rehabilitation and possibly reclamation (with ARC support). Land reclamation offers the potential for significant landscaping and urban design opportunities along the coastal edge to create a scenic waterfront route which can offer connections for and encourage walking and cycling. An example of a coastal transportation corridor which promotes walking and cycling is along Tamaki Drive, as shown in Figure 11-2.



Figure 11-2: Tamaki Drive Land Reclamation (Screenshot from Google Maps)

- Option 1 also performs well overall against the criteria due to its ability to balance the state highway traffic and its limited physical impact on Rosebank Road and its ability to redistribute traffic. The environmental issues are comparatively low, provided that the Pollens brickworks site can be avoided through sensitive design. Further clarity of the design solutions would need to define the actual location of the proposed route option and the feasibility of avoiding the Pollens Brickworks site.
- Option 2 was ranked third due to the requirement to upgrade infrastructure on Rosebank Peninsula, its significant land impact, the possible requirement for the State Highway ramps to be upgraded and the removal of industrial property on Rosebank Peninsula.
- Option 4 has similar land impact and requirements to upgrade Rosebank Peninsula. Option 2 performed better than Option 4 due to less heritage/ ecological /iwi issues along McLeod Road, shorter bridge and lower construction costs.

- Option 5 performed the least primarily due to its impact on Rosebank Road, requiring the road and intersections to be upgraded.

It should be noted that these conclusions have been based upon an unweighted evaluation process. It is recommended that further consideration should be given to applying weighting to refined criteria at the Project Feasibility Reporting stage. This will provide direction for further prioritisation.

11.3 Timing of the Whau River Crossing

The modelling undertaken to date includes the Waterview Project and SH16 widening for the year 2016 & 2021. It therefore is considered that the Whau River Crossing will be constructed post Waterview and SH16 widening. The modelling would indicate that the best benefits for a multi modal corridor and crossing will eventuate if the necessary bus lane infrastructure is in place along the arterial network prior to the opening of the Whau River Crossing.

It is recommended that further study is undertaken on the modelling of a “no Waterview” and no “SH16 widening” option and the impacts on the traffic volumes, network and tolling outcomes.

Currently under the currently modelling outputs tolling is not a viable option to bring the implementation of the Crossing earlier than Waitakere City Council and NZTA funding sources will allow.

12 Next Steps

It is recommended that the Whau River Crossing study is taken forward to a Project Feasibility Reporting phase to further investigate the function, route and form of the recommended crossing Option 3 and Option 1.

The operation of the State Highway including the impact of ramp signalling and the inclusion of Waterview could be modelled in a micro-simulation model. This would provide a better indication of the effects of queuing vehicles and the effect of the balancing of State Highway flows at the interchanges. Detailed modelling of the intersections along the crossing route which require upgrading should also be undertaken either in a micro- simulation model or a demand / delay constrained model like SATURN.

As part of the Project Feasibility Reporting, the potential for new bus routes should also be modelled and assessed. It is also recommended that an addendum is done to the Whau River Crossing strategic study once the ATM3 model has been validated and released.

APPENDIX A

Table 1: Areas of the proposed 2009/2010 budget that currently support parts of the Housing Retrofit Project.

| Budget | Amount in draft 2009/2010 budget |
|--|----------------------------------|
| Environmental Strategy - Climate Change Projects 30,000 for solar hot water fee waiver 120,000 available for Housing Retrofit Project | \$150,000 |
| Water Demand Management | \$55,000 |
| Environmental Strategy The pilot project: Sustainable Living community engagement and individual home sustainability advice in Ranui, Swanson and Glen Eden now finishing is budgeted to continue through the period of the LTCCP 2009-2019 at 125,000 per year. | \$125,000 |
| External levies One more year of funding to Beacon: 200,000 Beacon is not budgeted beyond 2009/2010 in the LTCCP 2009-2019. | \$200,000 |
| Total | \$530,000 |

APPENDIX B

Beacon Pathway Ltd. (Beacon)

Beacon is a research consortium that seeks to fundamentally increase the effectiveness of the design, construction and renovation of New Zealand's homes. The shareholders are leaders in the development of the residential built environment – Fletcher Building, New Zealand Steel, Building Research Association of New Zealand, the Crown Research Institute, Scion, and Waitakere City Council.

2009/2010 is the last year for which Waitakere City Council has made budget allocation to Beacon: \$200,000

Since its inception in 2003, Beacon's shareholders' contribution has been matched dollar for dollar by the Foundation for Research, Science and Technology.

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