MWH

BUILDING A BETTER WORLD

**ADDENDUM TO SCOPING REPORT**

# Ōtaki to North of Levin Expressway

Prepared for the NZ Transport Agency

JULY 2012

# QUALITY STATEMENT

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# NZ Transport Agency

## Ōtaki to North of Levin Expressway

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# 1 Introduction

## 1.1 Purpose of Study

The purpose of the study is to identify a preferred alignment for an expressway between north of Ōtaki and north of Levin and prepare applications for the required designation and resource consents.

The method being used to identify and secure the most suitable route for the expressway is the ACRE model: the acronym standing for Area, Corridor, Route, Easement. This is a systematic process utilising a range of "best practice" methods of identifying a preferred route option followed by refinement of that route, all in accordance with NZTA processes, consultation stages and reporting[1].

The Scoping Report was the first major deliverable for this study. It presented the methodology and outcomes to date in terms of identifying the preferred corridors with indicative routes.

The next stage is the scheme assessment, which will take the short list of corridors from the scoping report and develop them to a level of detail that, along with consultation outcomes, enables a preferred route to be chosen and hence designations and consents to be lodged.

## 1.2 Purpose of Addendum Report

After submission of the Scoping Report, the NZTA requested that investigation be undertaken into what possible staging opportunities would be available if a full four-lane expressway was unable to be implemented directly. Staging investigation was originally intended to form part of the Scheme Assessment phase; however, it was considered that some initial work was needed to assist in the upcoming public consultation process.

This report presents:

- the options being considered;
- the estimated cost of those options; and
- the economic evaluation of those options based on transportation modelling and crash analysis.

## 1.3 Project Objectives

At the time of preparing this report, the following project objectives apply to the Ōtaki to north of Levin expressway project:

- to provide a value for money proposal which will achieve the RoNS goals for this corridor of building a high quality expressway route between north of Ōtaki and north of Levin;
- to provide a better journey time Level of Service between north of Ōtaki and north of Levin;
- to reduce and progressively eliminate at-grade intersections between north of Ōtaki and north of Levin;
- to engage effectively with key stakeholders;
- to lodge Notices of Requirement and key resource consents with the appropriate consent authority by the 2012/13 financial year; and
- to improve safety on the route.

These project objectives will be refined as part of the on-going process of investigations.

[1] The ACRE process adopted for this study is explained in full in Section 7 of the Scoping Report

# 2 Staging Options

## 2.1 Contiguous Corridor 66

This report has not sought to determine which of the contiguous corridors recommended at the end of the scoping report should be developed further in the Scheme Assessment phase. However, one contiguous corridor has been picked to enable the analysis of staging options to be undertaken quickly and efficiently. Contiguous Corridor 66 has been chosen for two reasons:

- it facilitates staging opportunities to the south of Levin by remaining on one side of the existing railway lines (making it easier and cheaper to tie back into the existing SH1); and
- it facilities staging opportunities to the north of Levin by meeting the existing SH1 corridor in two separate locations (near Heatherlea East Road and near Oturoa Road).

## 2.2 Staging Options

During a meeting (25 October 2011) with NZTA and MWH representatives, it was determined that the following staging options would be considered as part of the addendum report.

- A two-lane access controlled route following the Contiguous Corridor 66 alignment (which could be upgraded to a full expressway at some point in the future)
- A 2+1 option comprising a median divided route with alternate passing lanes for a reduced length of the Contiguous Corridor 66 alignment (which could be upgraded to a full expressway at some point in the future)
- A three-stage option which progressively develops the full expressway.

In addition to the staging options above, it was requested that an expanded Do Minimum be developed which would resolve some of the significant safety issues on the existing state highway network.

These options are discussed in more detail below. Plans of the options are provided in Appendix A.

It is noted that each option has been evaluated separately. No attempt at this stage has been made to determine the benefits of implementing different scenarios at different time periods; e.g. Staging Option 3B is purely implementing all aspects of 3A and 3B in 2016 and leaving this in place until the end of the analysis period. The overall benefits of implementing 3A in 2016, 3B in 2026 and Contiguous Corridor 66 in 2036 has not been investigated.

### 2.2.1 Expanded Do Minimum

The Do Minimum presented in the original scoping report was essentially a Do Nothing as far as capital projects are concerned. If consideration is being given to staging or deferring the expressway then further consideration needs to be given to what projects would need to be undertaken.

Accordingly, this expanded Do Minimum comprises projects to address the safety issues that are present on the existing state highway network within the study area. It includes, from south to north:

- SH1 Forest Lakes Improvements. The preferred option (Option 2A) from the Forest Lakes Scoping Report (Contract 410PN, Beca, April 2010) comprises a wire rope median barrier within a 1.5 m median and widening to provide 2.0 m shoulders on either side of the carriageway between the Waitohu Stream Bridge and the Pukehou Rail Overbridge.
- SH1 Manukau Rail Overbridge. Replacement of this substandard rail overbridge to provide a safer alignment for state highway traffic.
- SH1 Ohau Rail Overbridge and River Bridge. Replacement of the substandard rail overbridge and a new crossing of the Ohau River to provide a safer alignment for state highway traffic.
- SH1 / SH57 Intersection Improvement. Upgrade the intersection to provide for the safe and efficient movement of all traffic. For example, install a rural roundabout.

- SH57 Kimberly Road / Arapaepae Road Intersection Improvement. Realignment of the highway to bypass the 90 degree turn at the current intersection.
- SH57 / Queen Street Intersection Improvement. Upgrade the intersection to provide for the safe and efficient movement of all traffic. For example, install a rural roundabout.
- SH1 in the vicinity of Waitarere Beach Road. Realign the highway through the three existing curves and three intersections to improve the safety of this stretch of highway.

The above improvements would address the top six blackspots as identified within the scoping report.

### 2.2.2 Option 2: Two Lane Route

This option comprises a two lane access controlled route on the alignment of Contiguous Corridor 66 from Taylors Road to the Manawatu River.

It would be a two lane, two way road with wire rope median barrier and at-grade intersections. Whilst the exact location and form of intersections has not been decided, they would be more regular than that for the full expressway. The route would be fully access controlled; however, there will be some locations where connectivity would be required across the new route. In these situations, access would be provided via local road intersections (cross or staggered T) rather than by overbridges or underpasses. Movements to and from Levin via Queen Street East would be provided for by a roundabout or other form of at-grade intersection.

This option allows for further stages in the upgrade to full expressway standard by constructing grade separated intersections and lengths of 4 lane expressway.

### 2.2.3 Option 3: Three Stage Option

Whilst the other options give two-stage approaches to developing the full expressway, this option involves three distinct phases.

#### *2.2.3.1 Stage A – New 2 lane route south of Levin*

This stage comprises:

- Forest Lakes Improvements (as per the Expanded Do Minimum)
- New 2 lane route from immediately south of the Pukehou Rail Overbridge to SH57 near the intersection of Kimberly Road and Arapaepae Road.
- Retaining the existing SH57 from Kimberly Road to north of Queen Street East but with a new roundabout at Queen Street East
- New 2 lane route from north of Queen Street to Heatherlea East Road on SH1.
- Retaining the existing SH1 from Heatherlea East Road to the Manawatu River.

The new sections of the highway would be access controlled. Intersections would be at-grade.

#### *2.2.3.2 Stage B – 4 lane route south of Levin*

This stage involves provision of the full expressway standard route from Taylors Road to Queen Street East. The expressway would rejoin the existing network at the Queen Street roundabout.

The section upgraded to four lanes would have all access removed and any local road crossings would be grade separated.

No changes would be implemented north of Queen Street East.

#### *2.2.3.3 Stage C – Full expressway*

The final stage would be to construct the four lane expressway north of Queen Street East so that the entire route is grade separated expressway from Taylors Road to the Manawatu River.

### 2.2.4 Option 4: 2+1 Option

A 2+1 road is a three lane road consisting of two lanes in one direction and one lane in the other, alternating every few kilometres. The opposing traffic flows are separated by a median with a wire rope safety barrier.

This option involves creating a 2+1 route from Taylors Road to Queen Street East and a new 2 lane link back to SH1 near Heatherlea East Road. This would result in a 2+1 facility south of Levin and a 2 lane plus passing lane facility north of Levin.

Safety improvements in the vicinity of Waitarere Beach Road would also be included to address the existing safety issue.

This route would be access controlled on all sections of new build. There will be some locations where connectivity would be required across the new route. In these situations, access via overbridges or underpasses would be considered so as to not interfere with safety or efficiency of the 2+1 operation.

Movements to and from Levin via Queen Street East would be provided for by a roundabout or other form of at-grade intersection.

This option allows for further stages in the upgrade to full expressway standard by constructing grade separated intersections and lengths of 4 lane expressway.

# 3 Cost Estimates

Estimates have been prepared in accordance with the NZTA Cost Estimation Manual for the expanded Do Minimum and the three staging options. As with the options in the scoping report, it is stressed that the information and data available is such that there is still a high level of uncertainty, and this is reflected in the 95%ile totals.

A summary of the costs is presented in Table 3-1 below. More detailed estimate information is found in Appendix B.

**Table 3-1 : Cost Estimates**

| Do Min and Staging Option | Expected Estimate ($M) | 95%ile Estimate ($M) |
|---|---|---|
| Expanded Do Minimum | 56.4 | 80.8 |
| 2 Lane | 380.3 | 545.5 |
| Three Stage – Stage A | 290.5 | 416.6 |
| Three Stage – Stage B | 101.2 | 145.2 |
| Three Stage – Stage C | 146.1 | 209.6 |
| 2+1 Option | 338.2 | 485.0 |
| Option 66 – Full Expressway | 453.0 | 649.0 |

The costs are undiscounted and exclude escalation and GST.

The estimates have been undertaken as feasibility level estimates to provide costs for comparison purposes. Significant further work is necessary to refine these broad estimates during the Scheme Assessment stage of the project. Note that the 2 Lane and 2+1 lane option estimates do not include the costs of further upgrades to full expressway standards.

These cost estimates have been prepared on the same basis as the options in the Scoping Report. Accordingly, the estimates should be used in the knowledge of the assumptions, exclusions and methodologies outlined in Sections 13.1.2 to 13.1.6 of the Scoping Report.

# 4 Modelling

The same SATURN model was used for this staging network testing as was used for the earlier Otaki-Levin Scoping Study modelling. Thus the same basic road network and level of network detail has been used as the basis of the network coding for Option 66 staging options. The modelling for the base network and Option 66 has also been drawn upon for comparison purposes in the reporting of this additional modelling, but no further modelling of those options has been undertaken.

As with the options analysed in the Scoping Report, traffic modelling was undertaken for the current/do-minimum road network and the staging options, assessing the morning peak (8.00-9.00 hrs), evening peak (16.30-17.30 hrs) and inter-peak (11.00-12.00 hrs) periods for the years 2016, 2026 and 2041.

The options have been appointed the following names for the modelling exercise:

- 2 lane option: S2
- 1st stage of the 3 Stage option: S3A
- 2nd stage of the 3 Stage option: S3B
- 2+1 option: S4

For each of the model runs for this testing (four networks for 2016, 2026 and 2041, all three periods), the following results are derived from the outputs and reported in this section:

- the summary statistics for Vehicle Kilometres Travelled and Total Travel Time; and
- Level of Service diagrams for 2016 and 2041, AM and PM peaks only

The numbers of vehicle trips in the modelled network for each period and year are shown in the table below. The trips are shown for both light vehicles and heavy vehicles, demonstrating the different growth rates between these classes. Perhaps mostly notable is the very low growth rate in trips, which is a result of the very low local growth rates in population and employment along with low and consistent slow growing state highway volumes as a proportion of the overall trip totals. The state highway light vehicle volumes are projected to grow at 1.5% per annum and heavy vehicles at 2.0% per annum.

**Table 4-1 : Number of Vehicle Trips**

| Year | Number of Trips | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | AM Peak | | | Inter Peak | | | PM Peak | | |
| | LV | HV | Total | LV | HV | Total | LV | HV | Total |
| **2011** | 6321 | 653 | **6973** | 5733 | 658 | **6391** | 7004 | 481 | **7485** |
| **2016** | 6390 | 661 | **7050** | 5786 | 669 | **6455** | 7076 | 489 | **7565** |
| **2026** | 6544 | 685 | **7230** | 5911 | 693 | **6604** | 7265 | 506 | **7771** |
| **2041** | 6776 | 729 | **7504** | 6086 | 729 | **6815** | 7525 | 533 | **8059** |

The outputs of modelling can be put to a range of purposes including evaluating the performance of the network, assessment of environmental effects (e.g. noise assessments), information for economic evaluations and data for road safety assessments. Results from this work have been key inputs to Benefit/Cost analysis of the staging options elsewhere in this report.

The global results (vehicle kilometres travelled and total travel time) of the network runs are presented in the tables and figures below. More extensive diagrams are provided in the appendices showing more detail on individual runs. Additionally the 2041 morning and evening peak hour runs Level of Service diagrams which indicate the levels of service for links and junctions are provided in Appendix C.

**Table 4-2 : Model Results**

| Option | Output | 2016 | | | 2041 | | |
|---|---|---|---|---|---|---|---|
| | | AM | IP | PM | AM | IP | PM |
| Base network | Total Travel Time | 332.3 | 307.6 | 372.0 | 402.6 | 364.0 | 458.0 |
| | Total Distance Travelled | 25517 | 23660 | 28455 | 31424 | 28525 | 35300 |
| 66 | Total Travel Time | 352.8 | 349.4 | 376.3 | 424.0 | 385.4 | 453.2 |
| | Total Distance Travelled | 28120 | 26176 | 30388 | 34241 | 31279 | 37353 |
| S2 | Total Travel Time | 329.4 | 309.7 | 364.2 | 394 | 362 | 441.8 |
| | Total Distance Travelled | 26386 | 24749 | 29523 | 32359 | 29678 | 36374 |
| S3A | Total Travel Time | 339.8 | 318.6 | 380.5 | 409.4 | 376.5 | 464.2 |
| | Total Distance Travelled | 26919 | 25276 | 30360 | 33398 | 30480 | 37823 |
| S3B | Total Travel Time | 326.4 | 305.9 | 359.6 | 389.0 | 357.4 | 432.2 |
| | Total Distance Travelled | 26292 | 24612 | 29439 | 32290 | 29575 | 36379 |
| S4 | Total Travel Time | 325.2 | 304.6 | 358.8 | 388.3 | 356.2 | 432.8 |
| | Total Distance Travelled | 26127 | 24365 | 29170 | 32091 | 29322 | 36083 |

Table 4-2 above shows the overall statistics, with Table 4-3 below providing a summary of the evening peak hour travel time and total distance travelled for each of the staging options. This also shows the relative percentage of the option result compared to the base network. Further the colour coding of the cells indicates whether the staging option result shows a better or worse performance compared to Option 66.

**Table 4-3 : Relativity to Base Network – PM Peak period**

| | | Base | 66 | S2 | S3A | S3B | S4 |
|---|---|---|---|---|---|---|---|
| **Total Travel Time (Veh.hr/hr)** | 2016 | 372.0 | 376.3 | 364.0 | 381.0 | 359.6 | 325.2 |
| | % of Base | | 101.2% | 97.9% | 102.3% | 96.7% | 87.4% |
| | 2041 | 458.0 | 453.2 | 442 | 464 | 432.2 | 432.8 |
| | % of Base | | 98.9% | 96.5% | 101.4% | 94.4% | 94.5% |
| **Total Distance Travelled (Veh.km/hr)** | 2016 | 28,455 | 30,388 | 29,523 | 30,360 | 29,439 | 29,170 |
| | % of Base | | 106.8% | 103.8% | 106.7% | 103.5% | 102.5% |
| | 2041 | 35,300 | 37,353 | 36,374 | 37,823 | 36,379 | 36,083 |
| | % of Base | | 105.8% | 103.0% | 107.2% | 103.1% | 102.2% |

Key: Green shading = better performance than Option 66
Red shading = worse performance than Option 66

The following four figures demonstrate graphically the vehicle kilometres travelled and the total travel time for the base network, Option 66 and the four staging options tested, for the 2016 and 2041 runs, grouped by period (morning, evening and inter-peak) to allow more direct comparison

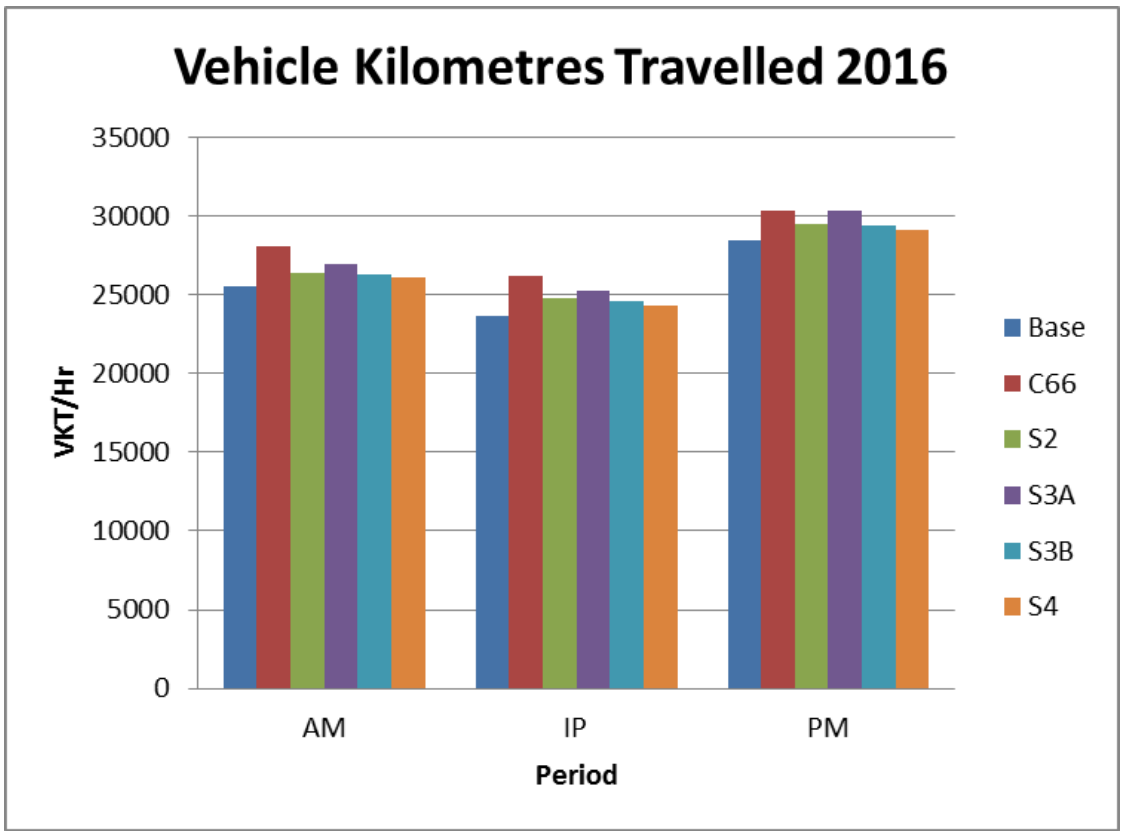



**Figure 4-1: Vehicle Kilometres travelled in Model Area in Year 2016 runs**

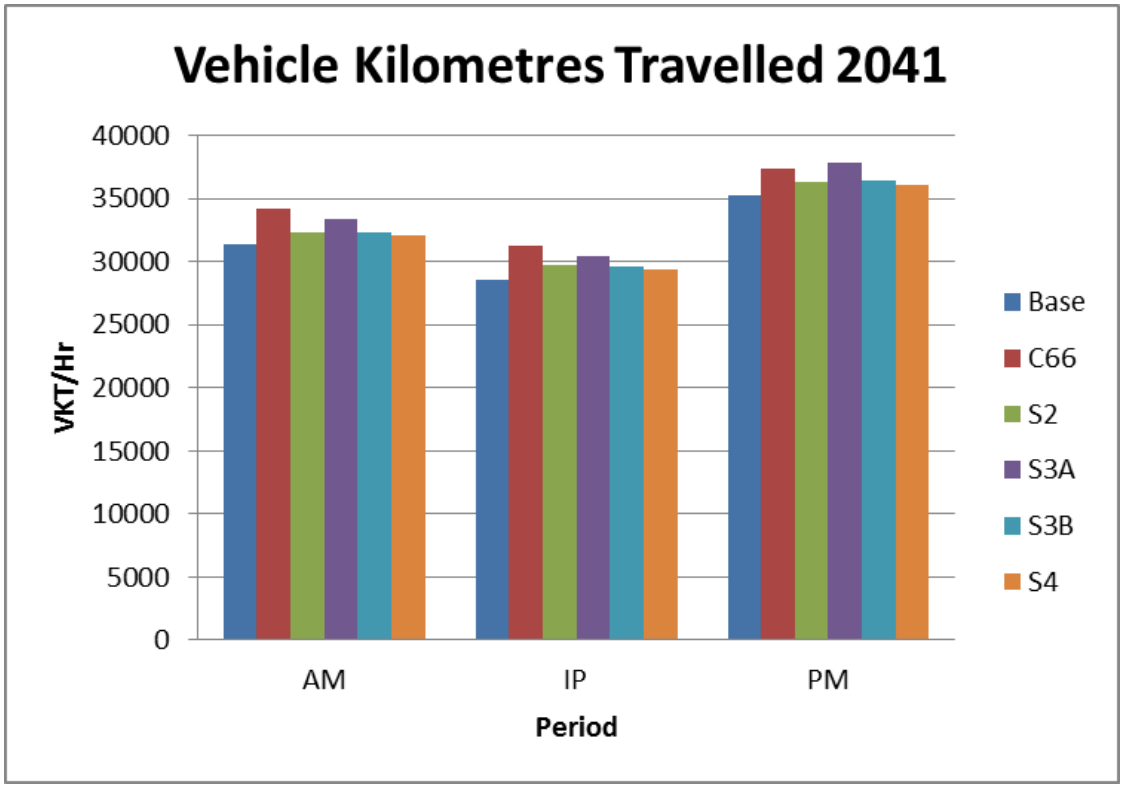



**Figure 4-2: Vehicle Kilometres travelled in Model Area in Year 2041 runs**

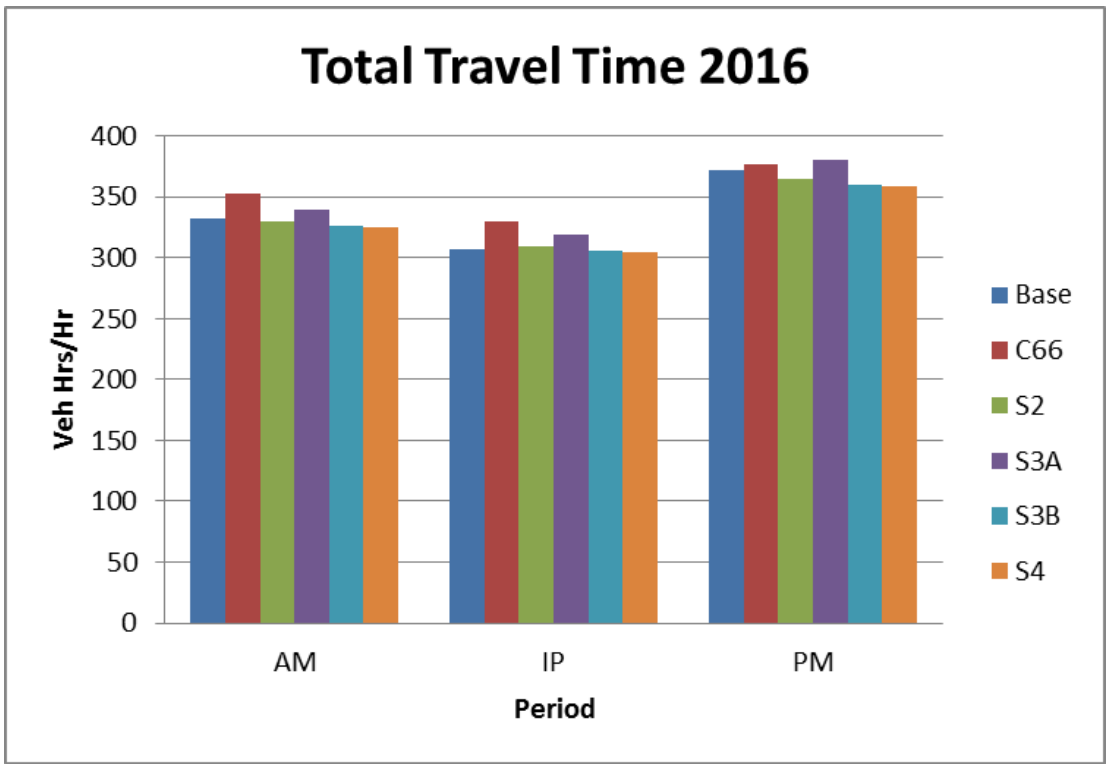



**Figure 4-3: Total travel time in Model Area in Year 2016 runs**

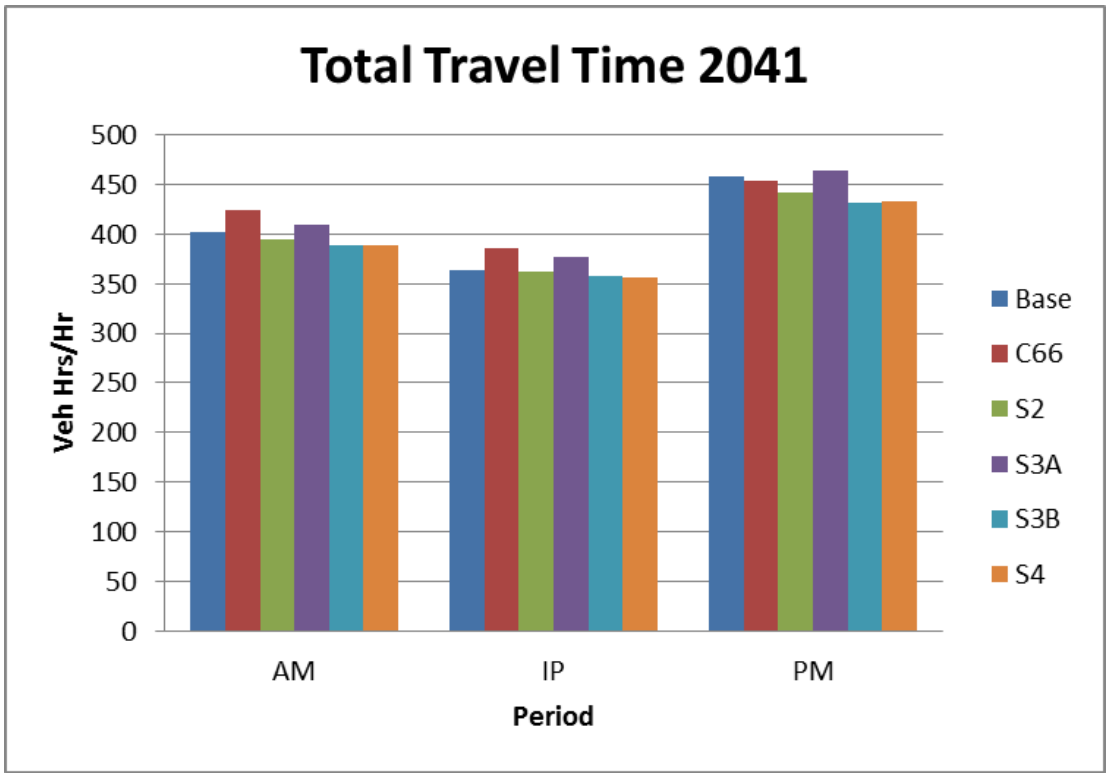



**Figure 4-4: Total travel time in Model Area in Year 2041 runs**

Table 4-4 below summarises the locations from the staging network models where the level of service was D or worse. Only intersections showed up in these categories, with no links operating below level of service C.

**Table 4-4 : Locations of poor Levels of Service – 2041**

| Option | Level of Service | AM Peak | PM Peak |
|---|---|---|---|
| S2 | D | • Expressway/South Manakau Rd (north end)<br>• Expressway/ next junction north of Sth Manakau | • Expressway/Muhunoa East (both sides) |
| | E | • South Manakau Rd (south end)/SH1 | • Expressway/ next junction north of Sth Manakau<br>• South Manakau Rd (south end)/SH1 |
| | F | | • South Manakau Rd (north end)/SH1 |
| S3A | D | • SH1/Bath St<br>• SH1/Forest Lakes Rd | • SH1/Queen St<br>• Kimberley/Arapaepae Rd |
| | E | • South Manakau Rd (south end)/SH1 | • South Manakau Rd (south end)/SH1<br>• SH1/Kimberley<br>• SH1/Bath |
| | F | | • SH1/Forest Lakes Rd |
| S3B | D | | • SH1/Queen St |
| | E | • South Manakau Rd (south end)/SH1 | • South Manakau Rd (south end)/SH1 |
| | F | | |
| S4 | D | • SH1/Bath<br>• South Manakau Rd (north end)/SH1<br>• SH1/Forest Lakes Rd | |
| | E | • South Manakau Rd (south end)/SH1 | • South Manakau Rd (south end)/SH1 |
| | F | | • South Manakau Rd (north end)/SH1<br>• SH1/Forest Lakes Rd |

Select link analysis was undertaken to determine the percentage of traffic that would be attracted to the new road / expressway in 2026. The table below outlines the traffic volumes estimated by the model for the staging options for a screenline at the Ohau River.

**Table 4-5 : 2026 Traffic Volumes across Ohau River**

| Staging Option | Current SH1 | New Road / Expressway |
|---|---|---|
| Base Network | 22,097 | 0 |
| Option 66 | 11,982 | 10,420 |
| 2 Lane | 10,186 | 12,216 |
| Three Stage – Stage A | 5,081 | 17,317 |
| Three Stage – Stage B | 10,530 | 11,872 |
| 2+1 Option | 11,149 | 11,253 |

## 4.1 Discussion

The results presented of the staging network modelling runs have focussed on the 2016 and 2041 runs; the results of the 2026 runs are in between the results presented.

As with the original options modelling presented in the Scoping Report, there is an increase in network speed over the 30 year time period (2011-2041), which is a result of most of the growth in traffic in the model using the state highways, and thus pushing up the relative proportion of vehicles using higher speed roads which remain relatively uncongested.

The vehicle kilometres travelled modelling results of the four staging networks, as can be seen in the previous figures, are generally similar and almost all lie between the results for the base network and Option 66. The total travel time results for the staging options again are similar (although option S3A is consistently higher), and are consistently lower than the base network and Option 66.

As would be expected, the evening peak results are the overall highest values and inter-peak hour the lowest throughout the years modelled. The gap in result values grows between the periods over the years (e.g. the gaps between inter-peak and evening peak values are larger in 2041 than in 2016).

Option 66 performs worst of the sets of results presented here in all cases except for option S3A in travel time in 2016 and 2041, and VKT for year 2041 evening peak.

In all cases for Vehicle Kilometres Travelled, the base network results are the best over the years. For the same measure, Option 3A is consistently the worst performing of the 4 staging options, and in the evening peaks performs similarly to Option 66. For total travel time options S2, S3B and S4 start close to the base network results (and better for the evening peak period), and by 2041, these three options are showing growing travel time benefits over the base network (despite the longer distances of the new corridor/expressway). Option S3A is the worst performing of the 6 options presented for total travel time in both 2016 and 2041.

Overall from the perspective of both vehicle kilometres travelled and total travel time throughout the 2016-41 period, Option S4 could be considered the best alternative to the base network with Options S3B and S2 the second and third best options respectively.

The Level of Service analysis has been presented graphically in Appendix C for the 2041 morning and evening peak periods which are considered to represent the worst case situations for each network.[2]

As with the base network, the various staging options are shown to largely operate at acceptable levels of service with a small number of specific locations where further refinements and improvements of intersections may be required.

The figures in Appendix C show that all the mid-block road sections are operating at good levels of service. However, there are a number of intersections in the networks where the level of service has been assessed as D or worse (as noted in Table 4-4 above).

In all bar three cases, the poorly performing intersections are priority controlled junctions intersecting either with SH1 (current) or the new expressway (with at-grade intersections), and are in or south of Levin. At these locations, the poor performance is due to side road traffic seeking access to the main through route. Given the stage of development of the study, no iterative modelling has been done to seek to resolve these situations.

[2] Note: There is a graphical error in the diagrams for the Option S4 Level of Service, where the nodes for the proposed new links between Levin and Ohau have been incorrectly coded for their location (placing them to the west of SH1. However, the other characteristics of the associated nodes and links are correct, so this is a cosmetic error and does not affect the statistical results reported.

Two of the remaining locations that indicate poor future performance are the two signalised junctions in Levin, although neither is shown to be operating at LoS F. It is expected (from other assessments) that solutions could be found for these during option refinement.

In terms of the traffic attracted by the expressway, the model is estimating that Option 66 attracts less than half of the 2026 traffic that currently uses SH1 between Manakau and SH57. This is likely to be due to two reasons – the lack of connectivity to townships and local roads and the increased distance via the expressway to central Levin. As mentioned in the scoping report, further work will be done during the scheme assessment stage to increase the attractiveness of the expressway through consideration of interchange locations and alterations that are likely to happen to the existing state highway once it is bypassed. It is noted that with the increasing traffic volumes in future years, a much higher percentage of traffic is predicted to use the expressway in 2041.

Of the staging options, all have higher flows on the expressway than Contiguous Corridor 66. The most attractive option is Option 3A, likely due to its high level of connectivity to the local road network. However, the model results also show this option to be one with the highest number of vehicle kilometres travelled and total travel time.

## 4.2 Conclusion

The modelling undertaken of four staging network options has provided results related to vehicle kilometres travelled, total travel time and Levels of Service across the network.

This has shown that these networks on the whole perform better than Option 66, which was the starting point for developing these staging networks. This is principally due to the network not being congested to any notable degree in the base network option, in conjunction with the greater network connectivity of the staging options in contrast to the modelled network severance effects of the primary options such as Option 66.

In contrast to the full expressway options, the networks generally perform acceptably well and similar to or a little better than the base network.

Whilst the staging networks generally performed less well than the base network for vehicle kilometres travelled but better for total travel time, it is noteworthy that the total travel time results were showing a trend where the options were performing increasingly well in contrast to the base network and by 2041 three options had better total travel time statistics than the base network which may balance the increasing total distance travelled on the network. This infers a case for improvements with time, even if not being a strong case on modelling statistics in the early days.

Of the staging options tested, overall Option S4 (2+1 with limited new links, at-grade junctions) appears to perform the best with Options S3B (partial 4 lane motorway with other 2 lane new links) and S2 (2 lane expressway version of C66, at grade junctions) following in order, but it must be stressed that these options results are all close – within 1-2% generally of each other.

# 5 Economic Evaluation

Economic analysis was carried out in accordance with NZTA's Economic Evaluation Manual (EEM) using the outcomes of the SATURN transportation model.

The following assumptions have been made in the calculation of the Benefit Cost Ratio. They are:

1. The base year is 2011, time zero is 2012, start of construction 2016, start of (28 years) benefits 2018.

2. The travel time and vehicle operating costs have been calculated from the SATURN transportation modelling. The travel time benefits were determined by using the queuing delays and link cruise times, and the vehicle operating cost benefits determined from the fuel use output.

3. As presented earlier in this report, the model was run for the years 2011, 2016, 2026 and 2041 and for the AM, Interpeak and PM periods. The daily benefits were calculated by using an assessed number of hours per day for each time period. Annual costs were linearly interpolated between modelled years.

4. The accident costs have been calculated for the Do-Minimum network and each corridor option by splitting the network into multiple sections (and key intersections) to enable detailed analysis of crashes for the principal routes (SH1, SH57, Queen St and the option expressway).

   Based on the Opus Peka Peka to Otaki model, the AADTs used in the accident analysis were estimated by applying factors of 2, 11.4 and 2 to the AM Peak, Inter-peak and PM Peak hour movement volumes, respectively.

   The methods adopted for calculating the accident costs are summarised in the table below:

   Method A: Accident by accident
   Method B: Accident rate analysis
   Method C: Weighted accident procedure

| Section | Do min | Option |
|---|---|---|
| | Method | |
| Existing Highway | A | A, C |
| Proposed Expressway | - | B |

5. No benefits associated with walking and cycling facilities, congestion reduction or driver frustration has been claimed. Furthermore, no wider economic benefits have been considered as these are being evaluated on the entire RoNS corridor.

6. Travel time benefits have been based on the Urban Arterial congested value of time applied to the total queuing delay, and a composite uncongested value of time applied to the link cruise times based on the urban/rural approximate split of 40/60 in travel demand from examination of the model link flows.

7. The VOC costs have been derived by applying the ratio of fuel to operating costs as given in the EEM for Rural Strategic. The $CO_2$ costs have been assessed as 4% of the VOC based on 10% heavy vehicles overall for the equations for light and heavy vehicles.

8. For the staging options, each has been evaluated separately for the entire period. No attempt at this stage has been made to determine the benefits of implementing different scenarios at different time periods; e.g. Staging Option 3B is purely implementing all aspects of 3A and 3B in 2016 and

leaving this in place until the end of the analysis period; the overall benefits of implementing 3A in 2016, 3B in 2026 and Contiguous Corridor 66 in 2036 has not been investigated.

A summary of the economic analysis is detailed in the following sections.

### 5.1.1 Travel Time Savings

The SATURN model outputs were used to determine the overall travel time values for each of the staging options. The travel time benefits and dis-benefits for each option, when compared to the Do-Minimum are shown below.

Note that this table compares to the Scoping Report Do Minimum not the Expanded Do Minimum.

**Table 5-1: Travel Time Benefits**

| Option Description | Travel Time Savings ($million) |
|---|---|
| Contiguous Corridor 66* | -19 |
| Staging Option S2 | 1 |
| Staging Option S3A | -6 |
| Staging Option S3B | 6 |
| Staging Option S4 (2+1) | 7 |
| Expanded Do-Minimum | 0 |

*Modelling updated compared to original option 66 in the Scoping Report

As with the model results presented earlier, the analysis shows that many of the staging options result in small travel time benefits due to the increase travel speed and connectivity with the local road network.

### 5.1.2 Vehicle Operating Cost Savings

The vehicle operating cost savings for each option, when compared to the Do-Minimum, are shown below. Carbon dioxide emission benefits are included in the numbers reported in the table.

**Table 5-2: Vehicle Operating Cost Savings and $CO_2$ Benefits**

| Option Description | Vehicle Operating Cost and $CO_2$ Savings ($million) |
|---|---|
| Contiguous Corridor 66* | -20 |
| Staging Option S2 | -8 |
| Staging Option S3A | -14 |
| Staging Option S3B | -7 |
| Staging Option S4 (2+1) | -5 |
| Expanded Do-Minimum | 0 |

*Modelling updated compared to original option 66 in the Scoping Report

Analysis of vehicle operating costs, based on fuel usage, shows that these are still negative which relates to the longer distance of the routes and the higher travel speeds.

### 5.1.3 Crash Cost Savings

The crash cost savings for each option, when compared to the Do-Minimum, are shown below.

**Table 5-3: Crash Cost Benefits**

| Option Description | Crash Cost Savings ($million) |
|---|---|
| Contiguous Corridor 66 | 61 |
| Staging Option S2 | 87 |
| Staging Option S3A | 55 |
| Staging Option S3B | 56 |
| Staging Option S4 (2+1) | 31 |
| Expanded Do-Minimum | 14 |

The crash analysis shows that Staging Option S2 provides higher crash cost benefits than the full expressway. This is primarily because the increased connectivity of the route attracts more traffic away from the old state highways onto the new safer road for the entire length of the corridor. The 2+1 option results in relatively poor crash cost savings because a high proportion of traffic stays on the old highways and it only provides the safer route for a proportion of the study length.

### 5.1.4 Option Costs

The pre-construction costs were estimated from the project feasibility estimates (December 2011). These project costs were discounted into the years at which the costs would occur. The project costs were discounted into the years that the element costs occurred. It was assumed that there would be an approximate 40 percent reduction in current maintenance costs for the existing SH1 and SH57 sections bypassed by the options. A uniform maintenance cost per km for the new route option was based on the annual maintenance costs in the latest Forward Works Program for SH1 and SH57 within the study area.

### 5.1.5 Benefit Cost Ratio Results

The benefit cost ratios for each option are shown below. The net present value (NPV) costs and benefits are also reported.

**Table 5-4: Economic Analysis Summary**

| Option Description | NPV Costs ($mill) | NPV Benefits ($mill) | Benefit Cost Ratio |
|---|---|---|---|
| Contiguous Corridor 66* | 294 | 21 | 0.07 |
| Staging Option S2 | 244 | 80 | 0.33 |
| Staging Option S3A | 190 | 35 | 0.18 |
| Staging Option S3B (includes S3A costs) | 252 | 55 | 0.22 |
| Staging Option S4 (2+1) | 218 | 33 | 0.15 |
| Expanded Do-Minimum | 42 | 14 | 0.34 |

*Modelling updated compared to original Option 66 in the Scoping Report

The analysis shows that all options perform better than the full expressway.

As noted earlier in this section, each staging option has been evaluated separately for the entire analysis period. No attempt at this stage has been made to determine the benefits of implementing different

scenarios at different time periods; e.g. Staging Option 3B is purely implementing all aspects of 3A and 3B in 2016 and leaving this in place until the end of the analysis period; the overall benefits of implementing 3A in 2016, 3B in 2026 and Contiguous Corridor 66 in 2036 has not been investigated.

Benefit cost ratios are provided for comparative purposes and form an important part of the options assessment process. At this stage costs and benefits are uncertain and are likely to change significantly as the project develops and the scale and form of improvements are selected and refined.

It is noted that the assessment profile for the overall Wellington Northern Corridor RoNS is HHL.

This economic analysis has been subject to an external peer review with agreement reached between the analyst and the reviewer.

The economic analysis is detailed in Appendix D.

# 6 Conclusions and Recommendations

## 6.1 Discussion and Conclusions

Three staging options were considered as part of this addendum report.

- A two-lane access controlled route following the Contiguous Corridor 66 alignment (which could be upgraded to a full expressway at some point in the future)
- A 2+1 option comprising a median divided route with alternate passing lanes for a reduced length of the Contiguous Corridor 66 alignment (which could be upgraded to a full expressway at some point in the future)
- A three-stage option which progressively develops the full expressway.

In addition to the staging options identified above, an Expanded Do Minimum option was also developed as a potential staging option. This option essentially involves addressing some of the significant safety issues on the existing state highway network.

Each of the staging options assessed generally perform better than the four lane expressway for both vehicle kilometres travelled and total travel time due to the fact that the staging options have a larger number of connections with the local road network.

When comparing staging options to the existing road network, each still results in increased travel distances, but many of them have better network travel time with travel time benefits improving further in future years. However, due to the relatively high speeds already present on the existing state highway, the travel time benefits from the staging options are not considered to be materially significant. This reflects that fact that the Level of Service provided by the existing road network is considered to be adequate.

In terms of crash cost savings, many of the staging options capture the majority of the benefits that would be obtained by the full expressway. This is because the staging options will attract traffic away from the existing state highway network which suffers from various safety deficiencies.

In conclusion, staging is considered to be attractive when compared to constructing a full four lane expressway. This is particularly because each of the three options considered have lower capital costs and higher transport benefits compared to a full expressway.

However, given the capacity of the existing state highway is considered to be satisfactory for current and medium term demand, and as none of the options provide large travel time and/or vehicle operating benefits, improving the existing state highway route (i.e. the Expanded Do Minimum or similar) appears to be an attractive option. Further work would be needed to ensure the best treatments are being progressed and to determine whether other improvements such as passing lanes and wire rope barriers should be included. This Expanded Do Minimum approach should be considered as the first stage of a long term strategy for the upgrade of the state highway between Otaki and north of Levin. This option could realise cost effective safety benefits in the short to medium term prior to implementing any staged or full four lane option in the longer term.

## 6.2 Recommendations

There are two different approaches that the NZTA could adopt in order to progress its RoNS programme for the state highway network between north of Otaki and north of Levin.

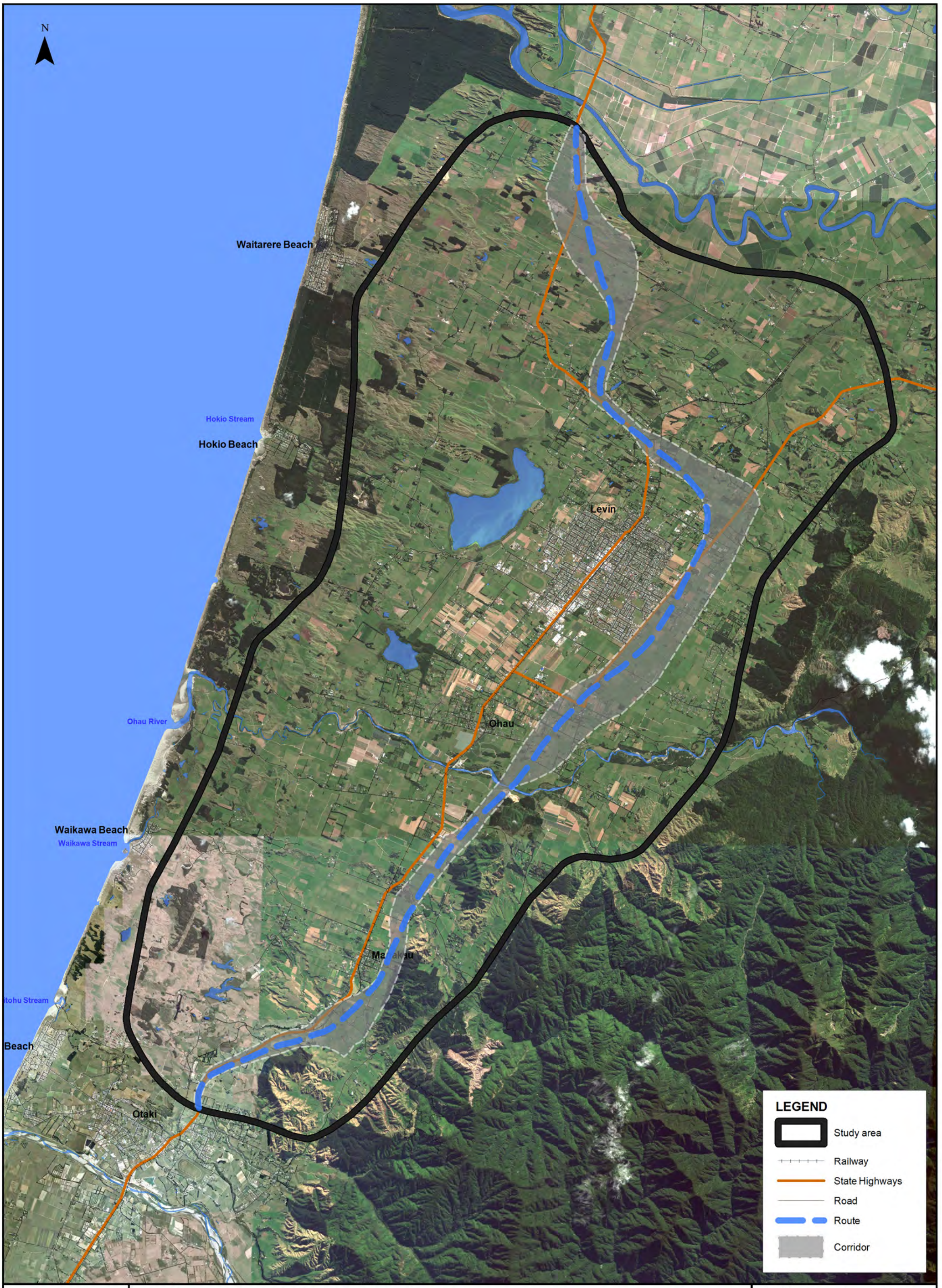
If the desire is to construct a full four lane road in the short to medium term, it is recommended that further consideration and identification of layouts is undertaken to provide a range of opportunities for connection to existing settlements. This would involve iterative modelling to determine the most

beneficial staging methodology and final layout; i.e. consideration of 2+1 with local road connections as a staging option leading to a full four lane solution with a number of interchanges as an ultimate outcome.

If the desire is to proceed with the best value for money solution, it is recommended that further consideration be given to upgrading the existing state highway network along similar lines to the proposals included in the Expanded Do Minimum. If such an approach is pursued, it is recommended that it is considered to be the first stage of a long term strategy that may ultimately result in the section of highway between Otaki and Levin becoming a four lane road. Such an approach would allow the NZTA to realise important safety benefits in the short to medium term whilst deferring the need to construct four lanes for the time being.

Finally, it is recommended that further analysis be undertaken into the wider economic benefits of this project to enable the full range of benefits to be understood.

# Appendix A Staging Option Plans




NZ TRANSPORT AGENCY
WAKA KOTAHI

# Otaki to North of Levin Expressway Corridors
# Scoping Report: Addendum
## Staging Options - 4 Lane Expressway Route

0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH

N

Waitarere Beach

Hokio Stream

Hokio Beach

Levin

Ohau River

Ohau

Waikawa Beach

Waikawa Stream

Otaki

LEGEND

- Study Area
- Railway
- State highways
- Road
- Route
- Corridor

NZ TRANSPORT AGENCY
WAKA KOTAHI

# Otaki to North of Levin Expressway
# Scoping Report: Addendum
## Staging Options - Two Lane

0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH

N

Waitarere Beach

Retain Existing
(Two-Lane Highway
with Passing Lanes)

Hokio Stream

Hokio Beach

New Two-Lane
Highway

Levin

Retain Existing Highway
but Rationalise Intersections

Ohau River

Ohau

Waikawa Beach

Waikawa Stream

New Two Lane
Highway

tohu Stream

Beach

Forest Lakes
Improvement

Otaki

LEGEND

- Study Area
- Railway
- State highways
- Road
- Route
- Corridor

NZ TRANSPORT AGENCY
WAKA KOTAHI

# Otaki to North of Levin Expressway
# Scoping Report: Addendum
## Staging Options - Stage 1 of 3

0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH

N

Waitarere Beach

Retain Existing
(Two-Lane Highway
with Passing Lanes)

Hokio Stream

Hokio Beach

Two-Lane
Highway

Levin

Ohau River

Ohau

New Four Lane
Expressway

Waikawa Beach

Waikawa Stream

itohu Stream

Beach

Otaki

LEGEND

- Study Area
- Railway
- State highways
- Road
- Route
- Corridor

NZ TRANSPORT AGENCY
WAKA KOTAHI

# Otaki to North of Levin Expressway
# Scoping Report: Addendum
## Staging Options - Stage 2 of 3

0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH

N

Waitarere Beach

Retain Existing
(Two-Lane Highway
with Passing Lanes)

Hokio Stream

Hokio Beach

Two-Lane
Highway

Levin

Ohau River

Ohau

New Four Lane
Expressway

Waikawa Beach

Waikawa Stream

itohu Stream

Beach

Otaki

LEGEND

- Study Area
- Railway
- State highways
- Road
- Route
- Corridor

NZ TRANSPORT AGENCY
WAKA KOTAHI

# Otaki to North of Levin Expressway
# Scoping Report: Addendum
## Staging Options - Stage 2 of 3

0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH

N

Waitarere Beach

Retain Existing
(Two-Lane Highway
with Passing Lanes)

Hokio Stream

Hokio Beach

New Two-Lane
Highway

Levin

Retain Existing Highway
but Rationalise Intersections
and Widen to 2 + 1

Ohau River

Ohau

Waikawa Beach

Waikawa Stream

New 2 + 1
Alignment

itohu Stream

Beach

Otaki

LEGEND

- Study Area
- Railway
- State highways
- Road
- Route
- Corridor

NZ TRANSPORT AGENCY
WAKA KOTAHI

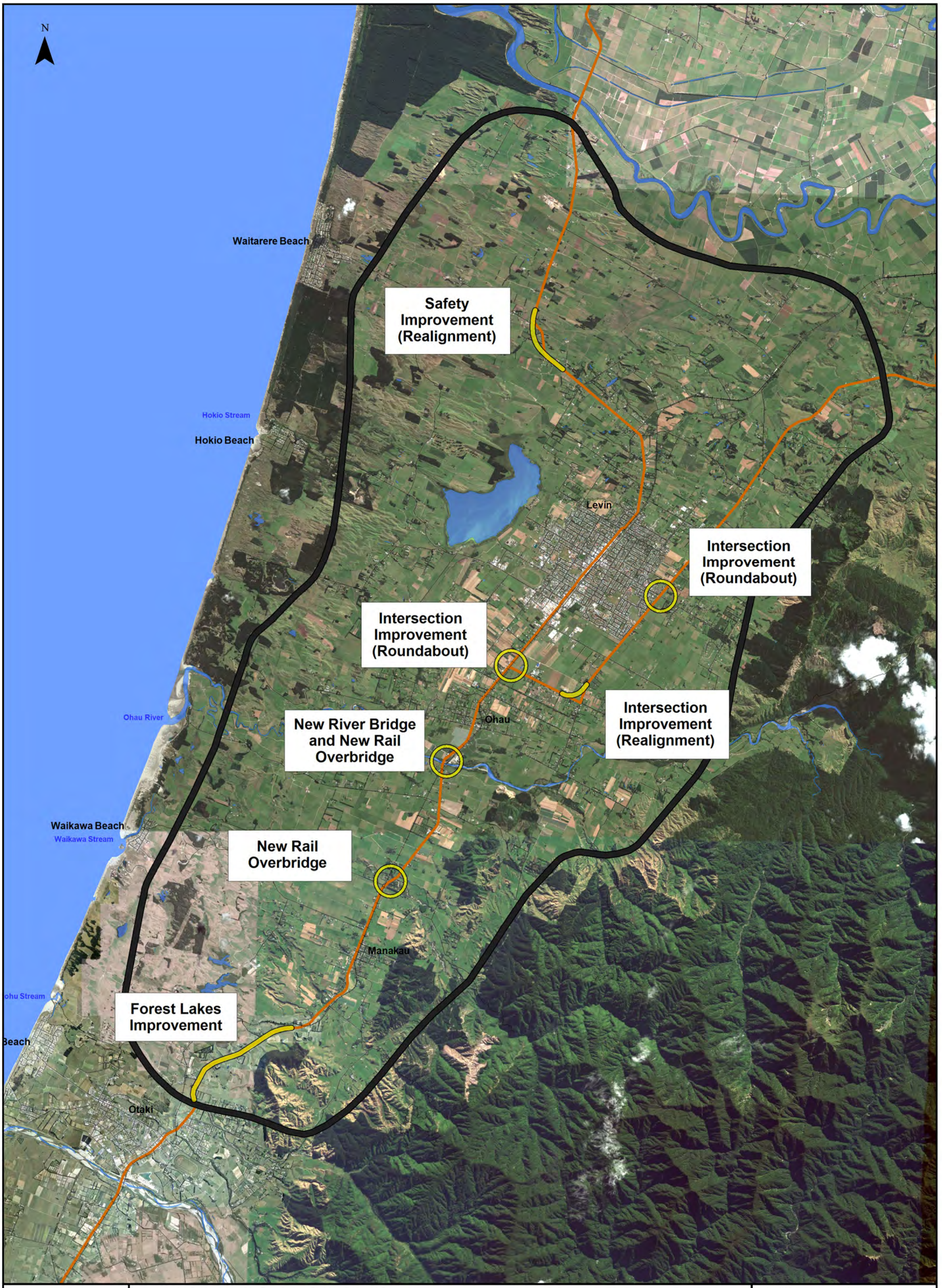
# Otaki to North of Levin Expressway
# Scoping Report: Addendum
## Staging Options - 2+1 Alignment



0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH




NZ TRANSPORT AGENCY
WAKA KOTAHI

# Otaki to North of Levin Expressway
# Scoping Report: Addendum
## Appendix A: Staging Options - Do Minimum



0 0.5 1 2 3 4
Kilometers
Scale: 1:90,000

Origonal Map Size: A3
Date: December 2011
Appendix A

MWH

# Appendix B Cost Estimates

# Project Estimate

## Form A

Project Name: Otaki to Levin Expressway RoNS Summary Base estimate 66 NE2:SE3

Feasibility estimate

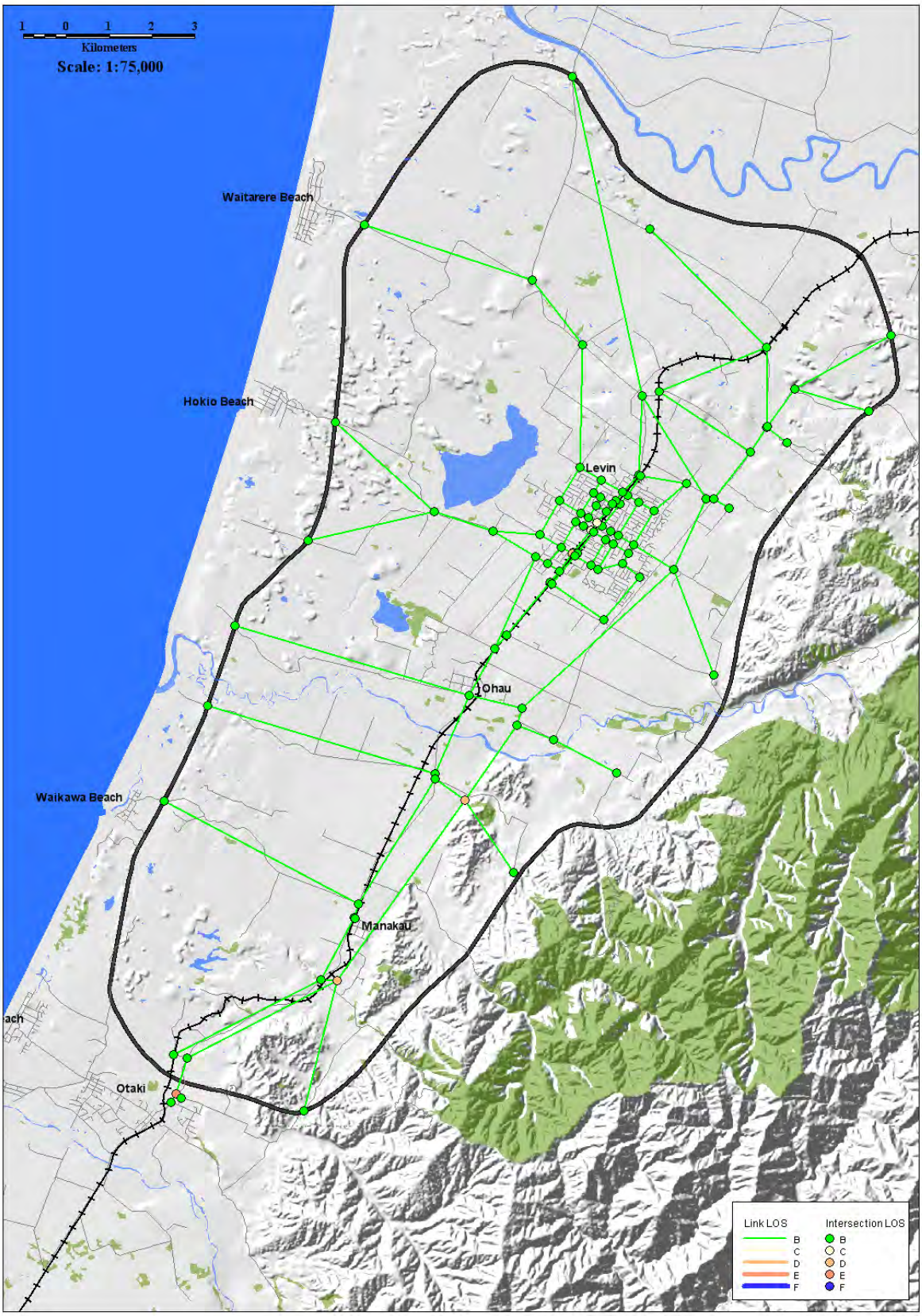
| Item | Description | Base Estimate 66 NE2:SE3 | Staged Sum Options 3A 3B 3C | Expanded Do Minimum Option 1 | 2 lane Option 2 | 4 lane Stage 1 Option 3A | 4 lane Stage 1 Option 3B | 4 lane Stage 1 Option 3C | 2+1 lane Option 4 |
|---|---|---|---|---|---|---|---|---|---|
| A | **Nett project property cost** | 61,748,000.00 | 66,948,000.00 | 4,980,000.00 | 61,748,000.00 | 61,748,000.00 | 2,600,000.00 | 2,600,000.00 | 59,348,000.00 |
| | Investigation and reporting: | | | | | | | | |
| | - consultancy fees | | | | | | | | |
| | - the NZTA-managed costs | | | | | | | | |
| B | **Total investigation and reporting** | 5,553,750.00 | 13,084,375.00 | 4,553,750.00 | 5,553,750.00 | 5,553,750.00 | 3,765,312.50 | 3,765,312.50 | 5,553,750.00 |
| | Design and project documentation: | | | | | | | | |
| | - consultancy fees | | | | | | | | |
| | - the NZTA-managed costs | | | | | | | | |
| C | **Total design and project documentation** | 26,100,000.00 | 36,900,000.00 | 2,760,000.00 | 22,800,000.00 | 17,400,000.00 | 7,200,000.00 | 12,300,000.00 | 20,400,000.00 |
| | Construction | | | | | | | | |
| | *MSQA* | | | | | | | | |
| | - consultancy fees | | | | | | | | |
| | - the NZTA-managed costs | | | | | | | | |
| | - consent monitoring fees | | | | | | | | |
| | *Sub-total base MSQA* | | | | | | | | |
| | *Physical works* | | | | | | | | |
| 1 | Environmental compliance | 5,140,333.28 | 6,353,541.55 | 280,606.80 | 5,140,333.28 | 3,709,984.07 | 1,220,299.37 | 1,423,258.11 | 4,505,437.24 |
| 2 | Earthworks | 26,656,546.12 | 36,818,771.99 | 345,549.51 | 21,470,075.66 | 19,340,638.53 | 6,100,885.33 | 11,377,248.13 | 23,611,731.47 |
| 3 | Ground improvements | 1,879,000.00 | 1,879,000.00 | 33,840.00 | 1,127,400.00 | 751,600.00 | 751600.00 | 375,800.00 | 751,600.00 |
| 4 | Drainage | 6,829,648.88 | 7,596,616.58 | 0 | 6,662,869.30 | 5,124,601.00 | 509,747.65 | 1,962,267.93 | 5,051,819.64 |
| 5 | Pavement and surfacing | 100,181,863.00 | 100,181,863.00 | 3,868,099.20 | 77,353,875.00 | 45,724,735.00 | 23,928,132.00 | 30,528,996.00 | 57,933,133.00 |
| 6 | Bridges ori | 29,755,315.24 | 36,059,369.04 | 10,879,658.40 | 10,948,346.20 | 10,058,400.00 | 8,164,200.00 | 17,836,769.04 | 13,726,067.12 |
| 7 | Retaining walls | 44,550.00 | 44,550.00 | 44,550.00 | 44,500.00 | | | 44,550.00 | 44,550.00 |
| 8 | Traffic services | 12,628,159.47 | 17,913,421.69 | 2,383,667.16 | 18,265,347.46 | 10,705,853.60 | 2,884,585.14 | 4,322,982.95 | 13,142,480.07 |
| 9 | Service relocations | 550000.00 | 990,000.00 | 55,000.00 | 330,000.00 | 330,000.00 | 330,000.00 | 330,000.00 | 440,000.00 |
| 10 | Landscaping | 7,814,646.78 | 6,598,864.00 | 303,533.00 | 7,814,646.78 | 4,826,700.00 | 566,262.00 | 1,205,902.00 | 5,701,186.44 |
| 11 | Traffic management and temporary works | 565,400.00 | 1,379,400.00 | 434,500.00 | 565,400.00 | 565,400.00 | 407,000.00 | 407,000.00 | 565,400.00 |
| 12 | Preliminary and general | 31,350,000.00 | 44,550,000.00 | 3,938,000.00 | 28,875,000.00 | 21,450,000.00 | 9,900,000.00 | 13,200,000.00 | 26,400,000.00 |
| 13 | Extraordinary construction costs | 13,405,972.69 | 18,161,487.07 | 817,339.60 | 10,968,602.43 | 6,290,388.86 | 6,111,483.03 | 5,759,615.18 | 11,476,773.17 |
| | *Sub-total base physical works* | | | | | | | | |
| D | **Total construction** | 236,801,435.46 | 278,526,884.92 | 23,384,343.67 | 189,566,396.11 | 128,878,301.06 | 60,874,194.52 | 88,774,389.34 | 163,350,178.15 |
| E | **Project base estimate** (A+B+C+ | 330,203,185.46 | 395,459,259.92 | 35,678,093.67 | 279,668,146.11 | 213,580,051.06 | 74,439,507.02 | 107,439,701.84 | 248,651,928.15 |
| F | **Contingency (Assessed/Analysed)** (A+B+C+D) | 120,120,077 | 142,365,334 | 20,673,692 | 100,680,533 | 76,888,818 | 26,798,223 | 38,678,293 | 89,514,694 |
| G | **Project expected estimate** (E+F) | 450,323,263 | 537,824,593 | 56,351,785 | 380,348,679 | 290,468,869 | 101,237,730 | 146,117,995 | 338,166,622 |
| | Project property cost expected estimate | | | | | | | | |
| | Investigation and reporting expected estimate | | | | | | | | |
| | Design and project documentation expected estimate | | | | | | | | |
| | Construction expected estimate | | | | | | | | |
| H | **Funding risk** (Assessed/Analysed) | 195,527,348 | 233,519,841 | 24,467,568 | 165,144,852 | 126,119,640 | 43,956,745 | 63,443,456 | 146,829,685 |
| I | **95th percentile project estimate** | 645,850,611 | 771,344,434 | 80,819,354 | 545,493,531 | 416,588,510 | 145,194,475 | 209,561,450 | 484,996,308 |
| | Project property cost 95th percentile estimate | | | | | | | | |
| | Investigation and reporting 95th percentile estimate | | | | | | | | |
| | Design and project documentation 95th percentile estimate | | | | | | | | |
| | Construction 95th percentile estimate | | | | | | | | |

| | |
|---|---|
| **Date of estimate** | **Cost index (Qtr/Year)** |
| **Estimate prepared by Chris Bremner** | **Signed** |
| **Estimate internal peer review by Bob Barraclough** | **Signed** |
| **Estimate external peer review by** | **Signed** |
| **Estimate accepted by the NZTA** | **Signed** |

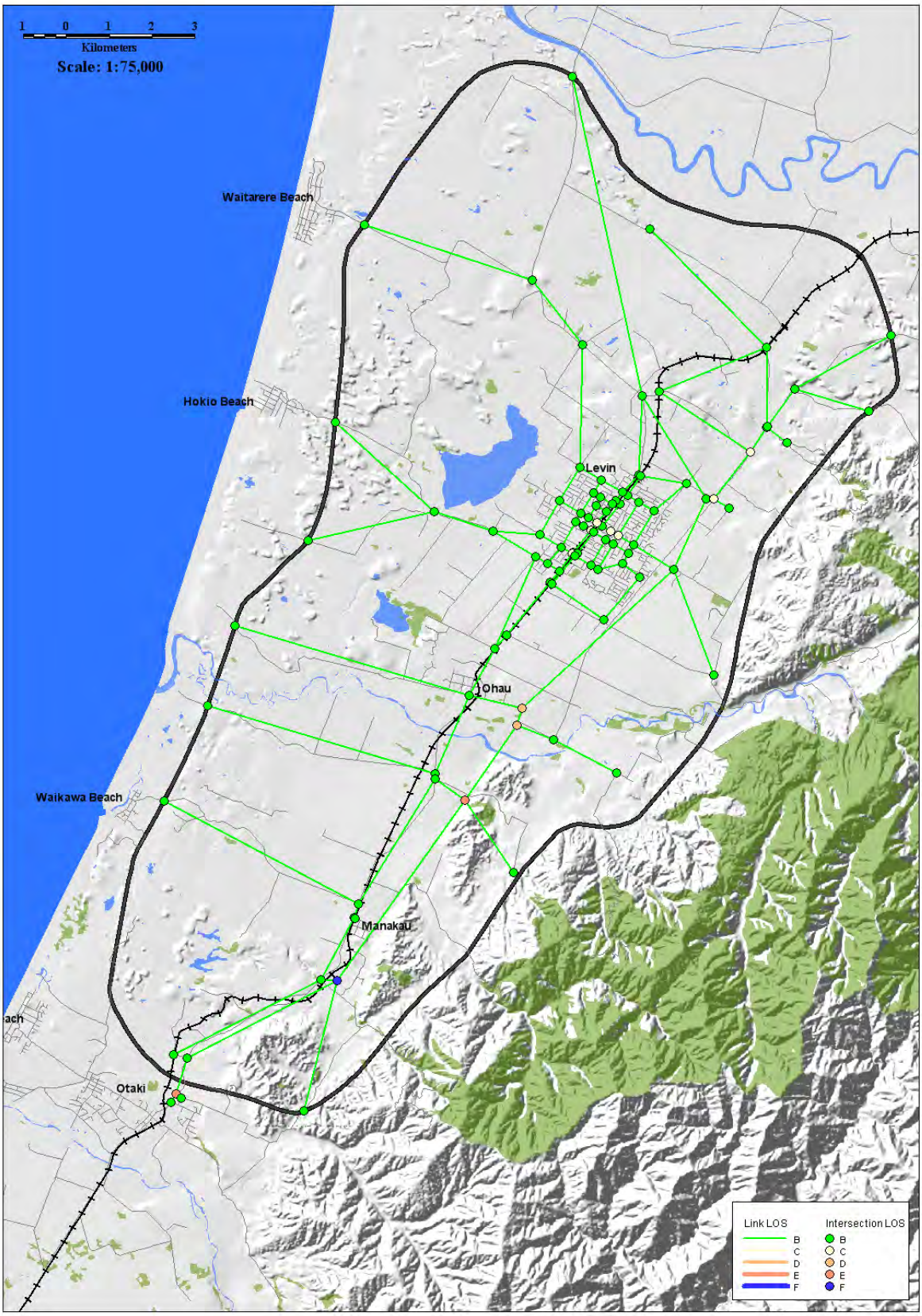
*Note:* (1) These estimates are exclusive of escalation and GST.

# Appendix C SATURN Level of Service Diagrams

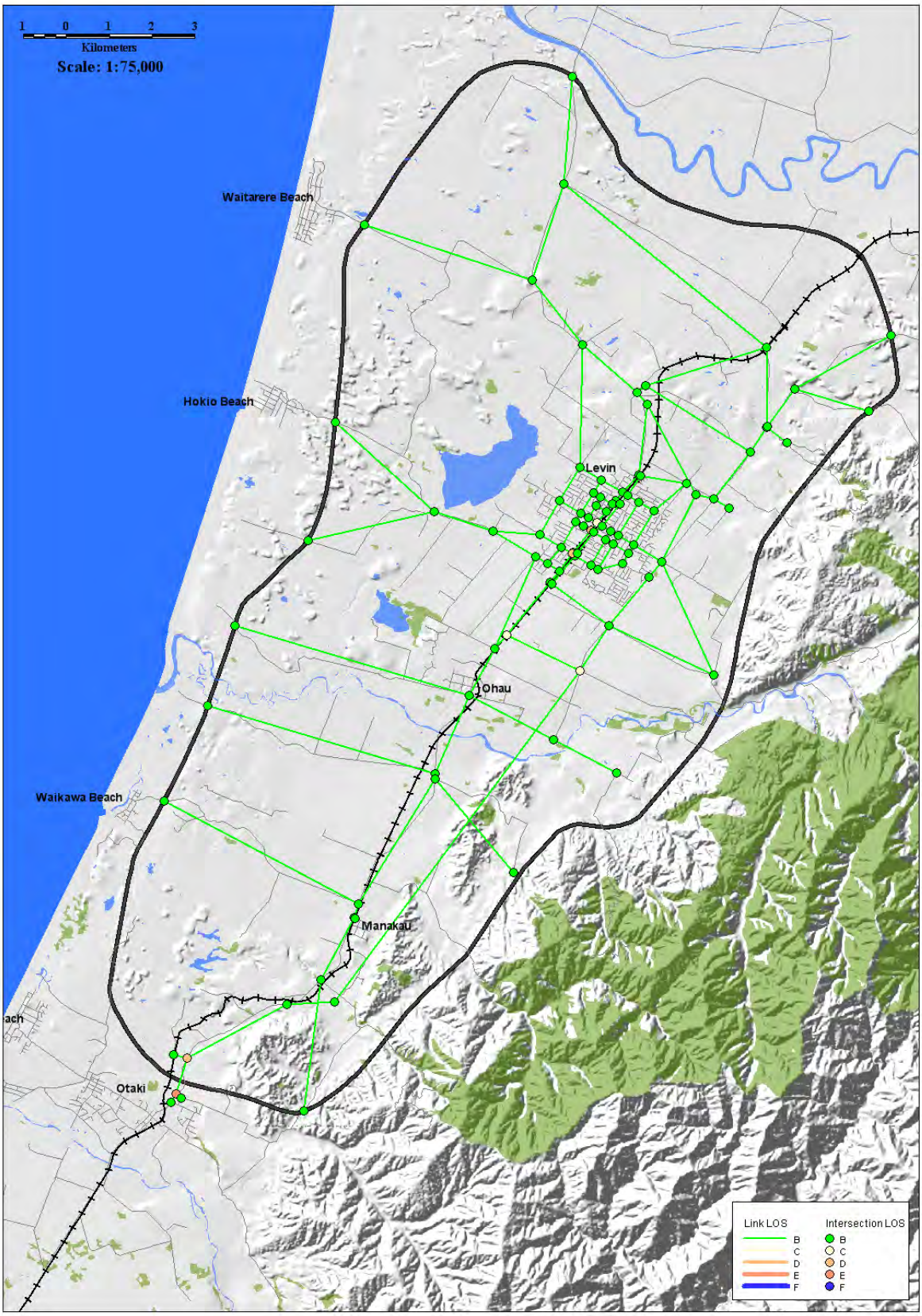
S2 2041 AM Peak



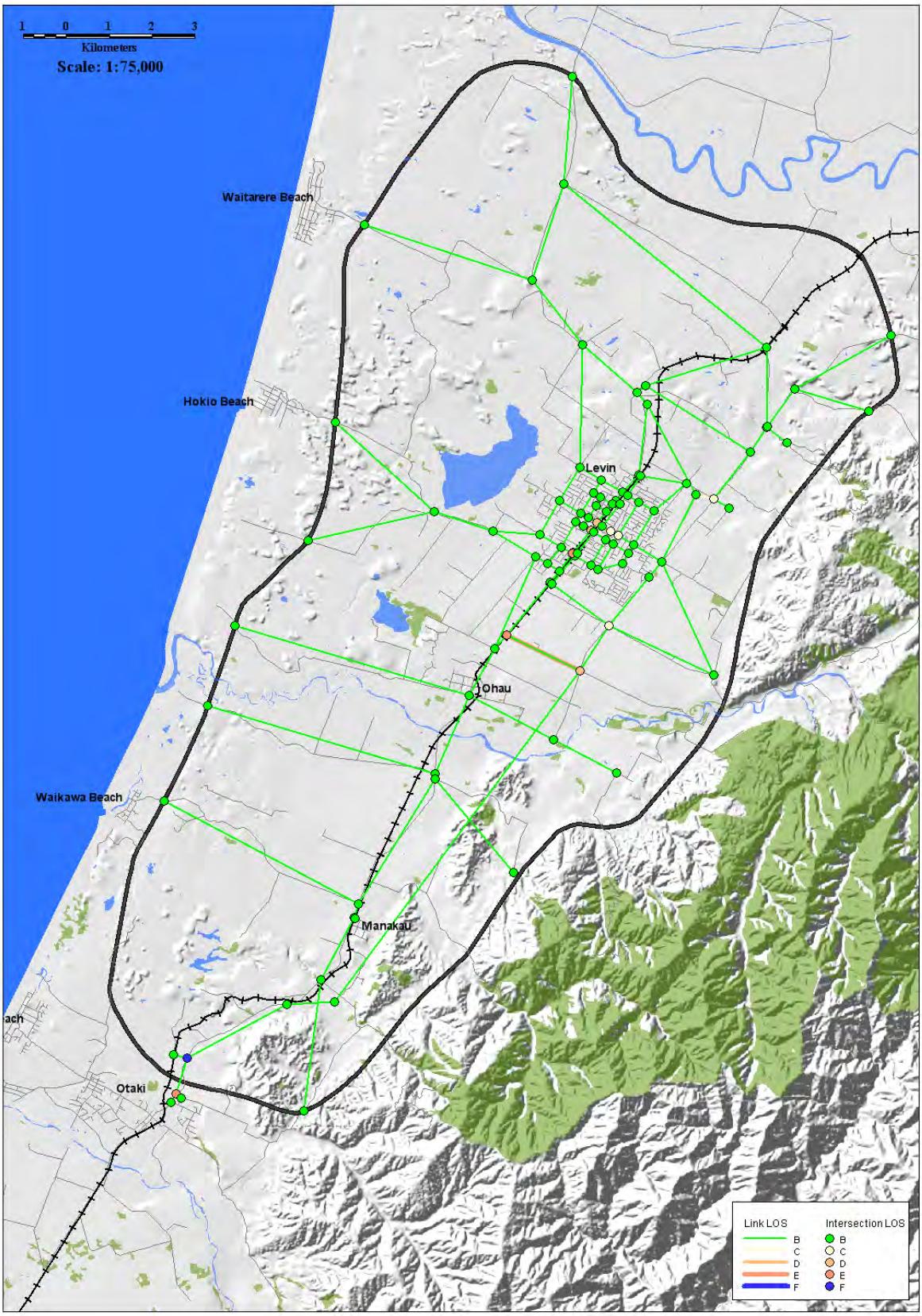
S2 2041 PM Peak



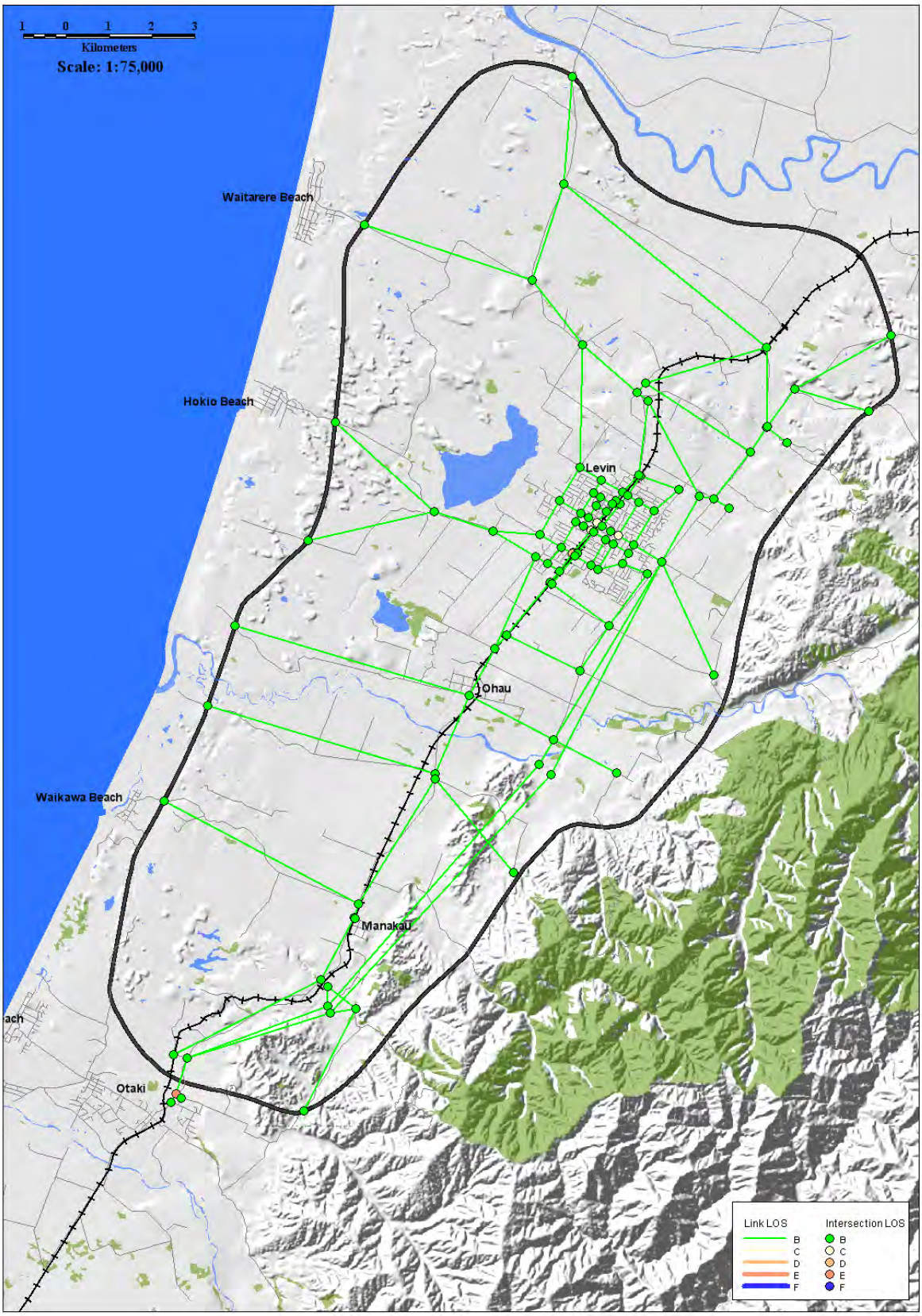
S3A 2041 AM Peak



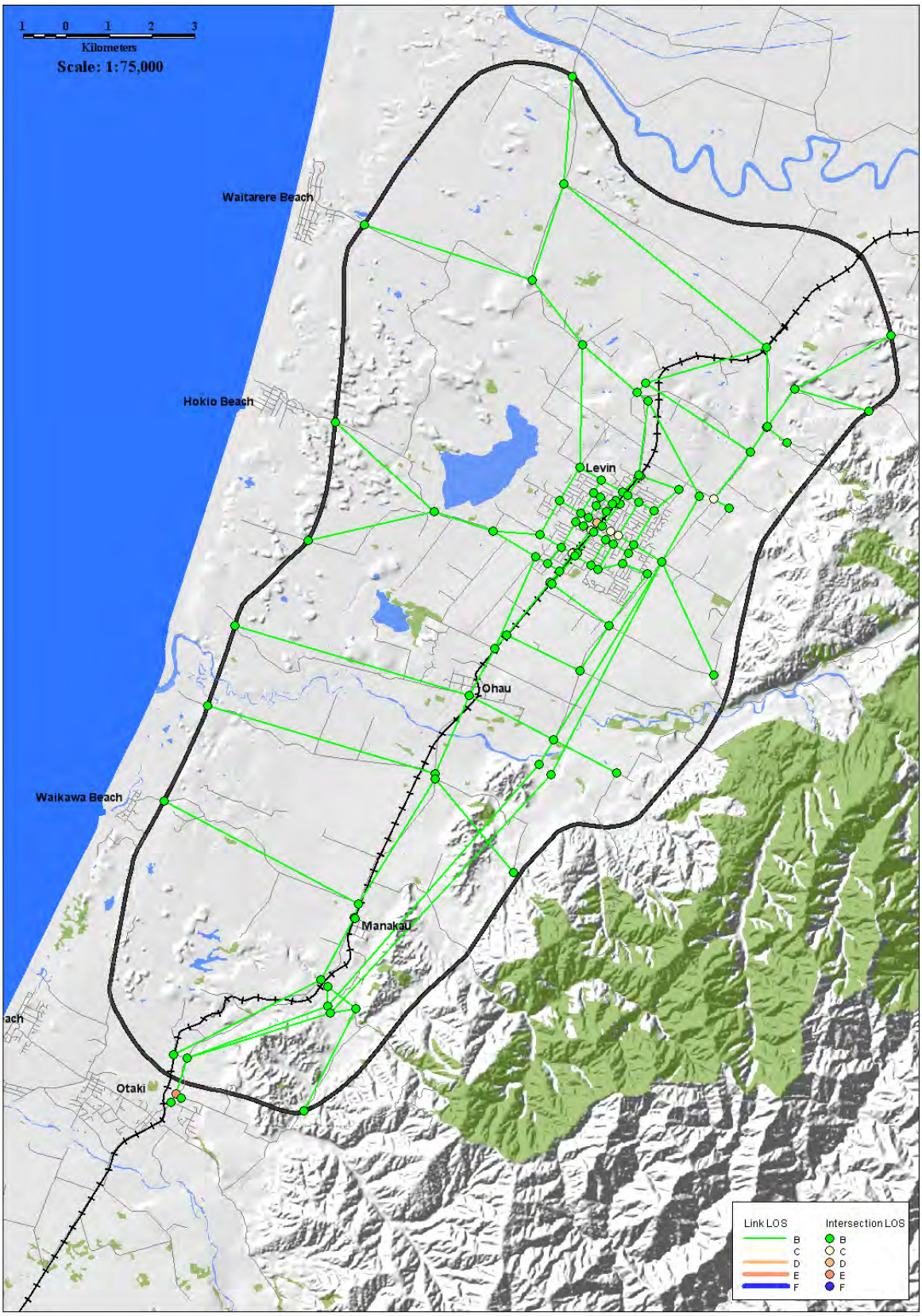
S3A 2041 PM Peak



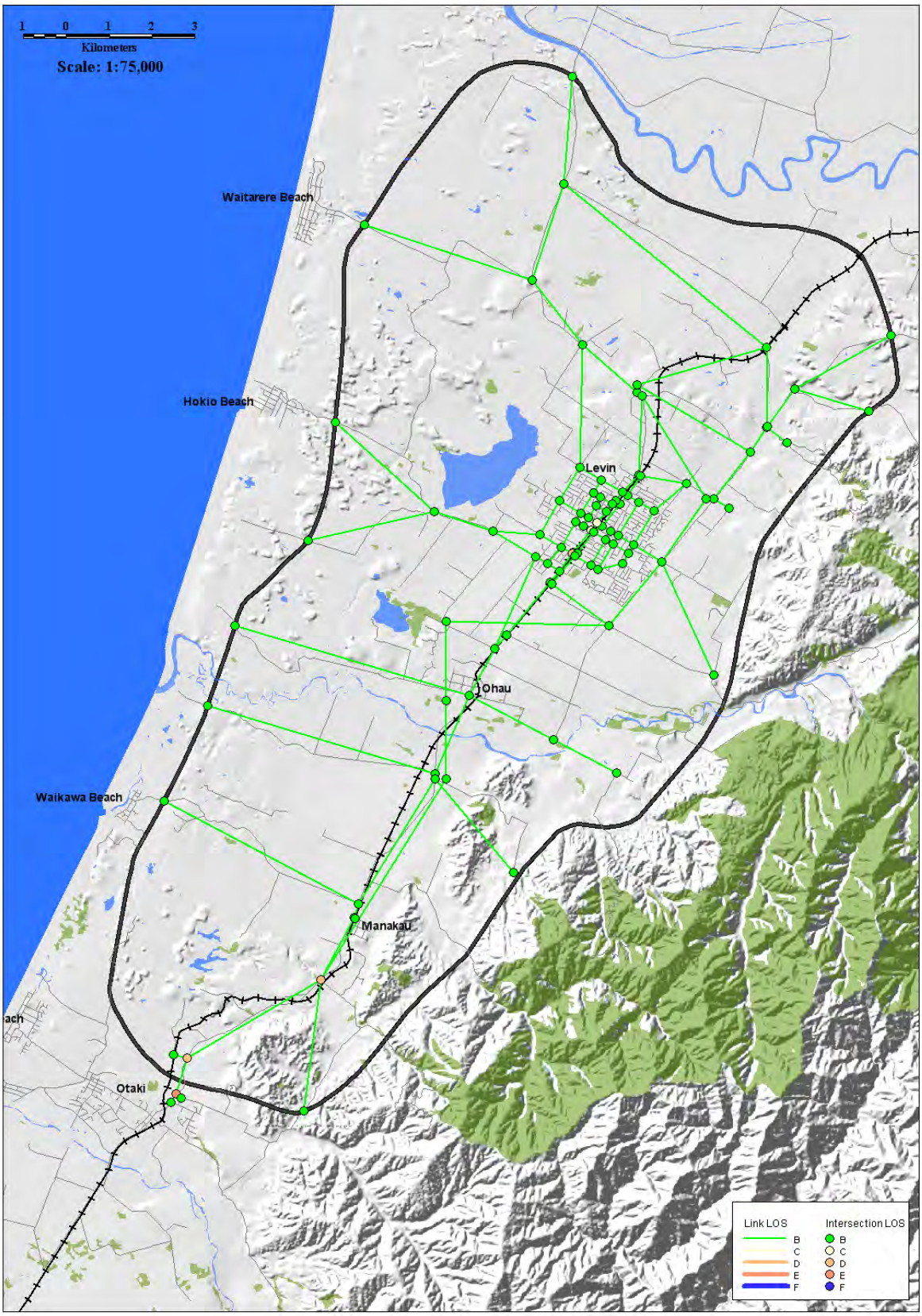
S3B 2041 AM Peak



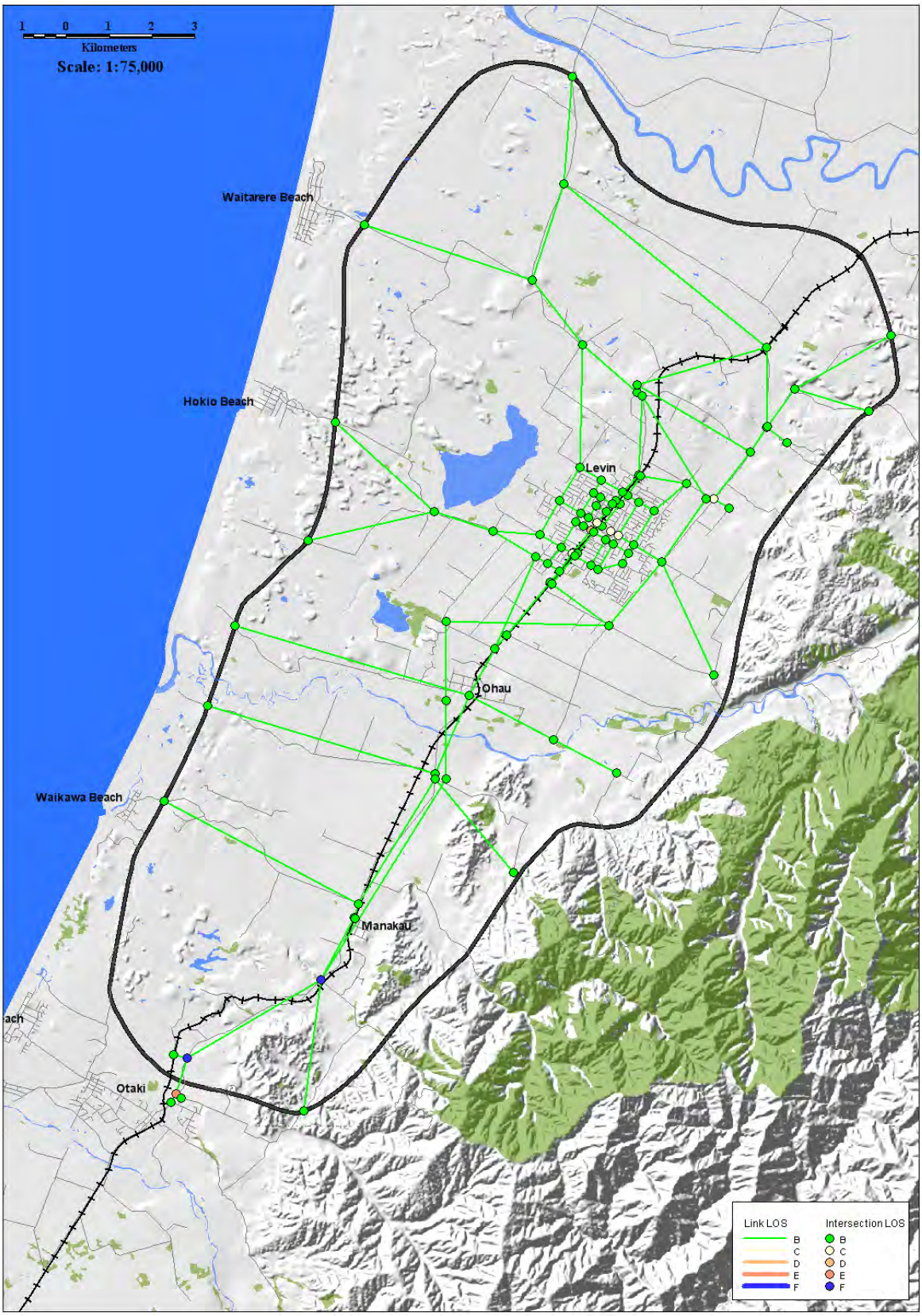
S3B 2041 PM Peak



S4 2041 AM Peak



S4 2041 PM Peak



# Appendix D Economic Evaluation Worksheets

MWH

Simplified Procedure 3 - General Road Improvements

# GENERAL ROADING IMPROVEMENT WORKS:
## EVALUATION SUMMARY

**WORKSHEET 1**

1 **Evaluator(s)** Dhimantha Ranatunga
**Reviewer(s)** David Wanty

2 **Project / Package Details**

| | |
|---|---|
| Approved Organisation Name | MWH (NZ) Ltd |
| Project / Package Name | Otaki to Levin RoNS |
| Your Reference | |
| Project Description | Otaki to Levin RoNS |
| Describe the problem to be addressed | Levin Bypass |

3 **Location**

Brief description of location: SH1 and SH57 north of Otaki to north of Levin

4 **Alternatives and Options**

| | |
|---|---|
| Describe the Do Minimum | Retain existing state highway |
| Summarise the options assessed | Levin Bypass Option 66 |

5 **Timing**

| | |
|---|---|
| Time Zero | 1 July 2012 |
| Assumed construction start date) | 1 July 2018 |
| Expected duration of construction (Months) | 24 months |

6 **Economic Efficiency**

| | |
|---|---|
| Date economic evaluation completed (mm/yyyy) | 27 September 2011 |
| Base date for costs | 1 July 2012 |
| AADT at Time Zero (SH1 Taylors Rd) | 9,000 |
| Traffic Growth Rate at Time Zero (%) | 1.5% |

| | | | | | |
|---|---|---|---|---|---|
| Existing Roughness | 3.20 | IRI or NAASRA | Existing Traffic Speed | 50-100 | km/hr |
| Predicted Roughness | 3.20 | IRI or NAASRA | Predicted Traffic Speed | 50-100 | km/hr |
| Affected SH1 before improvements | 30.600 | km | Posted Speed Limit | 50-100 | km/hr |
| Affected SH57 and Queen St (W / E ) | 17.500 | km | Road Type | | |
| Bypass total sectional length: | 32.650 | km | Gradient Before Improvements | 0% | |
| | | | Gradient After Improvements | 0% | |

7 **PV Cost of Do Minimum** **Cost $** $5,851,150 **A**

8 **PV Cost of the preferred Option** **Cost $** $299,797,694 **B**

9 **Benefit values from Worksheet 4, 5 or 6**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PV Travel Time Cost savings: | $ | -$14,530,135 | **C** | x Update Factor$^{TT}$ | 1.33 | = $ | -$19,325,079 | **W** |
| PV VOC & CO2 savings: | $ | -$19,437,913 | **D** | x Update Factor$^{VOC}$ | 1.04 | = $ | -$20,215,429 | **Y** |
| PV Accident Cost savings: | $ | $51,901,878 | **E** | x Update Factor$^{AC}$ | 1.17 | = $ | $60,725,197 | **Z** |

10 **B/C Ratio =** $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{-19325079 + -20215429 + 60725197}{299797694 - 5851150}$ = **0.07**

11 **FYRR =** $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{4376905.94}{299797694 - 5851150}$ = **1.5%**

| | | |
|---|---|---|
| TTC year 1 benefits (Mid Year | $ | -$1,120,122 |
| (Mid Year 6.5 discounted) | | |
| VOC & CO2 year 1 savings: | $ | -$1,391,648 |
| (Mid Year 6.5 discounted) | | |
| 2011 annunal AXS | $ | $6,888,676 |

MWH

Simplified Procedure 3 - General Road Improvements

# GENERAL ROADING IMPROVEMENT WORKS:
## EVALUATION SUMMARY

**WORKSHEET 1**

**1 Evaluator(s)** Dhimantha Ranatunga, Ian Robertson
**Reviewer(s)** David Wanty

**2 Project / Package Details**

| | |
|---|---|
| Project / Package Name | Otaki to Levin RoNS |
| Your Reference | |
| Project Description | Otaki to Levin RoNS |
| Describe the problem to be addressed | Levin Bypass |

**3 Location**

Brief description of location: SH1 and SH57 north of Otaki to north of Levin

**4 Alternatives and Options**

| | |
|---|---|
| Describe the Do Minimum | Retain existing state highway |
| Summarise the options assessed | Staging Option S2 |

**5 Timing**

| | |
|---|---|
| Time Zero | 1 July 2012 |
| Assumed construction start date) | 1 July 2018 |
| Expected duration of construction (Months) | 24 months |

**6 Economic Efficiency**

| | |
|---|---|
| Date economic evaluation completed (mm/yyyy) | 27 September 2011 |
| Base date for costs | 1 July 2012 |
| AADT at Time Zero (SH1 Taylors Rd) | 9,000 |
| Traffic Growth Rate at Time Zero (%) | 1.5% |

| | | | | | |
|---|---|---|---|---|---|
| Existing Roughness | 3.20 | IRI or NAASRA | Existing Traffic Speed | 50-100 | km/hr |
| Predicted Roughness | 3.20 | IRI or NAASRA | Predicted Traffic Speed | 50-100 | km/hr |
| Affected SH1 before improvements | 25.075 | km | Posted Speed Limit | 50-100 | km/hr |
| Affected SH57 and Queen St (W / E ) | 16.700 | km | Road Type | | |
| Bypass total sectional length: | 28.516 | km | Gradient Before Improvements | 0% | |
| | | | Gradient After Improvements | 0% | |

**7 PV Cost of Do Minimum** — **Cost $** $5,851,150 **A**

**8 PV Cost of the preferred Option** — **Cost $** $249,932,184 **B**

**9 Benefit values from Worksheet 4, 5 or 6**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PV Travel Time Cost savings: | $ $1,086,642 | C | x Update Factor$^{TT}$ | 1.33 | = $ | $1,445,234 | W |
| PV VOC & CO2 savings: | $ -$7,693,560 | D | x Update Factor$^{VOC}$ | 1.04 | = $ | -$8,001,302 | Y |
| PV Accident Cost savings: | $ $73,985,855 | E | x Update Factor$^{AC}$ | 1.17 | = $ | $86,563,451 | Z |

**10 B/C Ratio =** $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{1445234 + -8001302 + 86563451}{249932184 - 5851150}$ = **0.33**

**11 FYRR =** $\frac{1^{st} \text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{2903296.63}{249932184 - 5851150}$ = **1.19%**

MWH

Simplified Procedure 3 - General Road Improvements

# GENERAL ROADING IMPROVEMENT WORKS:
## EVALUATION SUMMARY

**WORKSHEET 1**

**1 Evaluator(s)** Dhimantha Ranatunga
**Reviewer(s)** David Wanty

**2 Project / Package Details**

| | |
|---|---|
| Project / Package Name | Otaki to Levin RoNS |
| Your Reference | |
| Project Description | Otaki to Levin RoNS |
| Describe the problem to be addressed | Levin Bypass |

**3 Location**

Brief description of location: SH1 and SH57 north of Otaki to north of Levin

**4 Alternatives and Options**

| | |
|---|---|
| Describe the Do Minimum | Retain existing state highway |
| Summarise the options assessed | Staging Option S3A |

**5 Timing**

| | |
|---|---|
| Time Zero | 1 July 2012 |
| Assumed construction start date | 1 July 2018 |
| Expected duration of construction (Months) | 24 months |

**6 Economic Efficiency**

| | |
|---|---|
| Date economic evaluation completed (mm/yyyy) | 27 September 2011 |
| Base date for costs | 1 July 2012 |
| AADT at Time Zero (SH1 Taylors Rd) | 9,000 |
| Traffic Growth Rate at Time Zero (%) | 1.5% |

| | | | | | |
|---|---|---|---|---|---|
| Existing Roughness | 3.20 | IRI or NAASRA | Existing Traffic Speed | 50-100 | km/hr |
| Predicted Roughness | 3.20 | IRI or NAASRA | Predicted Traffic Speed | 50-100 | km/hr |
| Affected SH1 before improvements | 25.075 | km | Posted Speed Limit | 50-100 | km/hr |
| Affected SH57 and Queen St (W / E ) | 16.700 | km | Road Type | | |
| Bypass total sectional length: | 20.043 | km | Gradient Before Improvements | 0% | |
| | | | Gradient After Improvements | 0% | |

**7 PV Cost of Do Minimum** — **Cost $** $5,851,150 **A**

**8 PV Cost of the preferred Option** — **Cost $** $196,224,313 **B**

**9 Benefit values from Worksheet 4, 5 or 6**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PV Travel Time Cost savings: | $ | -$4,644,712 | C | x Update Factor$^{TT}$ | 1.33 | = $ | -$6,177,467 | W |
| PV VOC & CO2 savings: | $ | -$13,106,179 | D | x Update Factor$^{VOC}$ | 1.04 | = $ | -$13,630,426 | Y |
| PV Accident Cost savings: | $ | $46,736,363 | E | x Update Factor$^{AC}$ | 1.17 | = $ | $54,681,545 | Z |

**10 B/C Ratio =** $\frac{W + Y + Z}{B - A} = \frac{\text{BENEFITS}}{\text{COSTS}} = \frac{-6177467 + -13630426 + 54681545}{196224313 - 5851150} =$ **0.18**

**11 FYRR =** $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}} = \frac{-2719879.61}{196224313 - 5851150} =$ **-1.43%**

MWH

Simplified Procedure 3 - General Road Improvements

# GENERAL ROADING IMPROVEMENT WORKS:
## EVALUATION SUMMARY

**WORKSHEET 1**

**1 Evaluator(s)** Dhimantha Ranatunga, Ian Robertson
**Reviewer(s)** David Wanty

**2 Project / Package Details**

| | |
|---|---|
| Project / Package Name | Otaki to Levin RoNS |
| Your Reference | |
| Project Description | Otaki to Levin RoNS |
| Describe the problem to be addressed | Levin Bypass |

**3 Location**

Brief description of location: SH1 and SH57 north of Otaki to north of Levin

**4 Alternatives and Options**

| | |
|---|---|
| Describe the Do Minimum | Retain existing state highway |
| Summarise the options assessed | Staging Option S3B |

**5 Timing**

| | |
|---|---|
| Time Zero | 1 July 2012 |
| Assumed construction start date) | 1 July 2018 |
| Expected duration of construction (Months) | 24 months |

**6 Economic Efficiency**

| | |
|---|---|
| Date economic evaluation completed (mm/yyyy) | 27 September 2011 |
| Base date for costs | 1 July 2012 |
| AADT at Time Zero (SH1 Taylors Rd) | 9,000 |
| Traffic Growth Rate at Time Zero (%) | 1.5% |

| | | | | | |
|---|---|---|---|---|---|
| Existing Roughness | 3.20 | IRI or NAASRA | Existing Traffic Speed | 50-100 | km/hr |
| Predicted Roughness | 3.20 | IRI or NAASRA | Predicted Traffic Speed | 50-100 | km/hr |
| Affected SH1 before improvements | 25.075 | km | Posted Speed Limit | 50-100 | km/hr |
| Affected SH57 and Queen St (W / E ) | 16.700 | km | Road Type | | |
| Bypass total sectional length: | 20.043 | km | Gradient Before Improvements | 0% | |
| | | | Gradient After Improvements | 0% | |

**7 PV Cost of Do Minimum** — **Cost $** $5,851,150 **A**

**8 PV Cost of the preferred Option** — **Cost $** $257,974,313 **B**

**9 Benefit values from Worksheet 4, 5 or 6**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PV Travel Time Cost savings: | $ | $4,255,734 | **C** | x Update Factor$^{TT}$ | 1.33 | = $ | $5,660,126 | **W** |
| PV VOC & CO2 savings: | $ | -$6,894,088 | **D** | x Update Factor$^{VOC}$ | 1.04 | = $ | -$7,169,852 | **Y** |
| PV Accident Cost savings: | $ | $48,098,994 | **E** | x Update Factor$^{AC}$ | 1.17 | = $ | $56,275,823 | **Z** |

**10 B/C Ratio =** $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{5660126 + -7169852 + 56275823}{257974313 - 5851150}$ = **0.22**

**11 FYRR =** $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{818703.73}{257974313 - 5851150}$ = **0.32%**

MWH

Simplified Procedure 3 - General Road Improvements

# GENERAL ROADING IMPROVEMENT WORKS:
## EVALUATION SUMMARY

**WORKSHEET 1**

**1 Evaluator(s)** Dhimantha Ranatunga
**Reviewer(s)** David Wanty

**2 Project / Package Details**

| | |
|---|---|
| Project / Package Name | Otaki to Levin RoNS |
| Your Reference | |
| Project Description | Otaki to Levin RoNS |
| Describe the problem to be addressed | Levin Bypass |

**3 Location**

Brief description of location: SH1 and SH57 north of Otaki to north of Levin

**4 Alternatives and Options**

| | |
|---|---|
| Describe the Do Minimum | Retain existing state highway |
| Summarise the options assessed | Levin Bypass Option S4 2+1 |

**5 Timing**

| | |
|---|---|
| Time Zero | 1 July 2012 |
| Assumed construction start date) | 1 July 2018 |
| Expected duration of construction (Months) | 24 months |

**6 Economic Efficiency**

| | |
|---|---|
| Date economic evaluation completed (mm/yyyy) | 27 September 2011 |
| Base date for costs | 1 July 2012 |
| AADT at Time Zero (SH1 Taylors Rd) | 9,000 |
| Traffic Growth Rate at Time Zero (%) | 1.5% |

| | | | | | |
|---|---|---|---|---|---|
| Existing Roughness | 3.20 | IRI or NAASRA | Existing Traffic Speed | 50-100 | km/hr |
| Predicted Roughness | 3.20 | IRI or NAASRA | Predicted Traffic Speed | 50-100 | km/hr |
| Affected SH1 before improvements | 25.075 | km | Posted Speed Limit | 50-100 | km/hr |
| Affected SH57 and Queen St (W / E ) | 16.700 | km | Road Type | | |
| Bypass total sectional length: | 17.087 | km | Gradient Before Improvements | 0% | |
| | | | Gradient After Improvements | 0% | |

**7 PV Cost of Do Minimum** — **Cost $** $5,851,150 **A**

**8 PV Cost of the preferred Option** — **Cost $** $223,353,790 **B**

**9 Benefit values from Worksheet 4, 5 or 6**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PV Travel Time Cost savings: | $ | $5,177,928 | C | x Update Factor$^{TT}$ | 1.33 | = $ | $6,886,644 | W |
| PV VOC & CO2 savings: | $ | -$5,264,914 | D | x Update Factor$^{VOC}$ | 1.04 | = $ | -$5,475,511 | Y |
| PV Accident Cost savings: | $ | $26,710,297 | E | x Update Factor$^{AC}$ | 1.17 | = $ | $31,251,048 | Z |

**10 B/C Ratio =** $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{6886644 + -5475511 + 31251048}{223353790 - 5851150}$ = **0.15**

**11 FYRR =** $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{-509038.34}{223353790 - 5851150}$ = **-0.23%**

MWH

Simplified Procedure 3 - General Road Improvements

# GENERAL ROADING IMPROVEMENT WORKS:
## EVALUATION SUMMARY

**WORKSHEET 1**

**1 Evaluator(s)** Dhimantha Ranatunga
**Reviewer(s)** David Wanty

**2 Project / Package Details**

| | |
|---|---|
| Project / Package Name | Otaki to Levin RoNS |
| Your Reference | |
| Project Description | Otaki to Levin RoNS |
| Describe the problem to be addressed | Levin Bypass |

**3 Location**

Brief description of location: SH1 and SH57 north of Otaki to north of Levin

**4 Alternatives and Options**

| | |
|---|---|
| Describe the Do Minimum | Retain existing state highway |
| Summarise the options assessed | Crash improvements on Existing do-min |

**5 Timing**

| | |
|---|---|
| Time Zero | 1 July 2012 |
| Assumed construction start date) | 1 July 2018 |
| Expected duration of construction (Months) | 24 months |

**6 Economic Efficiency**

| | |
|---|---|
| Date economic evaluation completed (mm/yyyy) | 27 September 2011 |
| Base date for costs | 1 July 2012 |
| AADT at Time Zero (SH1 Taylors Rd) | 9,000 |
| Traffic Growth Rate at Time Zero (%) | 1.5% |

| | | | | | |
|---|---|---|---|---|---|
| Existing Roughness | 3.20 | IRI or NAASRA | Existing Traffic Speed | 50-100 | km/hr |
| Predicted Roughness | 3.20 | IRI or NAASRA | Predicted Traffic Speed | 50-100 | km/hr |
| Affected SH1 before improvements | 25.075 | km | Posted Speed Limit | 50-100 | km/hr |
| Affected SH57 and Queen St (W / E ) | 16.700 | km | Road Type | | |
| Bypass total sectional length: | 0.000 | km | Gradient Before Improvements | 0% | |
| | | | Gradient After Improvements | 0% | |

**7 PV Cost of Do Minimum** — **Cost $** $0 — **A**

**8 PV Cost of the preferred Option** — **Cost $** $41,919,900 — **B**

**9 Benefit values from Worksheet 4, 5 or 6**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PV Travel Time Cost savings: | $ | $0 | C | x Update Factor$^{TT}$ | 1.33 | = $ | NIL | W |
| PV VOC & CO2 savings: | $ | $0 | D | x Update Factor$^{VOC}$ | 1.04 | = $ | NIL | Y |
| PV Accident Cost savings: | $ | $12,128,063 | E | x Update Factor$^{AC}$ | 1.17 | = $ | $14,189,833 | Z |

**10 B/C Ratio =** $\frac{W + Y + Z}{B - A}$ = $\frac{\text{BENEFITS}}{\text{COSTS}}$ = $\frac{0 + 0 + 14189833}{41919900 - 0}$ = **0.34**

**11 FYRR =** $\frac{1^{st}\text{ Year BENEFITS}}{\text{COSTS}}$ = $\frac{3335647.44}{41919900 - 0}$ = **7.96%**