OTAKI TO NORTH OF LEVIN PFRs

Report No. 12: Four Lane Investigation

Prepared for NZ Transport Agency

February 2013

QUALITY STATEMENT

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Executive Summary

This report is one of a number of reports being undertaken to determine the package of improvements that should be implemented to improve the safety and efficiency of the highway between Otaki and north of Levin as part of the Wellington Northern Corridor Road of National Significance (RoNS). Whilst most of the reports are focussed on the short to medium term projects, this report initiates the consideration of the likely route for a future four lane highway.

The purpose of this report is to determine the probable alignment of a future four lane highway between Otaki and the SH1 / SH57 intersection to the south of Levin. This will help to determine both the scope and timing of the short and medium term projects, ensuring any work undertaken does not result in significant redundancy when four laning ultimately proceeds.

A number of potential alignments have been identified and mapped on aerial photographs. Other alignments were identified but have been discarded due to constraints or the fact that they would result in a longer state highway route.

The alignments that have been retained have not been subject to any evaluation, comparison or impact assessment. It is considered that this is best undertaken when more information is available; i.e. at the Scheme Assessment Stage.

The alignments identified here have helped inform the PFRs in terms of how the options identified in the PFRs would likely fit into the overall strategy for Otaki to north of Levin. There is a large amount of co-ordination between the short to medium and long term options, which potentially allows staging to be undertaken successfully.

No conclusions are being deduced for this report. However, it will be used to help NZTA in their decision making in regards to the short, medium and long term plan for SH1 between Otaki and Levin.

NZ Transport Agency

Report 12: Four Lane Investigation

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APPENDICES

1 Introduction

Using the outcomes of the Otaki to North of Levin Scoping Report and Addendum, the NZTA decided that the most appropriate strategy for the highway between Otaki and north of Levin is to upgrade the existing highways as the first stage of a long term strategy. This allows 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.

This report is one of a number of reports being undertaken to determine the package of improvements that should be implemented to improve the safety and efficiency of the highway between Otaki and north of Levin as part of the Wellington Northern Corridor Road of National Significance (RoNS). Whilst most of the reports are focussed on the short to medium term projects, this report initiates the consideration of the likely route for a future four lane highway.

The objectives of the Wellington Northern Corridor RoNS, which runs from Wellington Airport to north of Levin, are:

- To enhance inter regional and national economic growth and productivity;
- To improve access to Wellington's CBD, key industrial and employment centres, port, airport and hospital;
- To provide relief from severe congestion on the state highway and local road networks;
- To improve the journey time reliability of travel on the section of SH1 between Levin and the Wellington Airport; and
- To improve the safety of travel on state highways

For the Otaki to north of Levin section; the objectives are:

- To provide best value solutions which will progressively meet (via a staged approach) the long term RoNS goals for this corridor of achieving a high quality four lane route;
- To provide better Levels of Service, particularly for journey time and safety, between north of Otaki and north of Levin;
- To remove or improve at-grade intersections between north of Otaki and north of Levin;
- To engage effectively with key stakeholders; and
- To lodge Notices of Requirement and resource consents as appropriate with the relevant consent authorities for the first individual project by the 2013/14 financial year.

The projects that are being developed to help meet these objectives are presented in Section 2.

The purpose of this report is to determine the probable alignment of a future four lane highway between Otaki and the SH1 / SH57 intersection to the south of Levin. This will help to determine both the scope and timing of the short and medium term projects, ensuring any work undertaken does not result in significant redundancy when four laning ultimately proceeds.

The outcome of this report will be considered alongside the outcomes of the other investigations and used to determine the best package of works to progress as the first stage of the long term strategy.

2 Projects Currently Being Investigated

The projects that are currently being investigated to meet the short to medium term objectives of the Otaki to north of Levin RoNS project are presented in Figure 2-1 below.

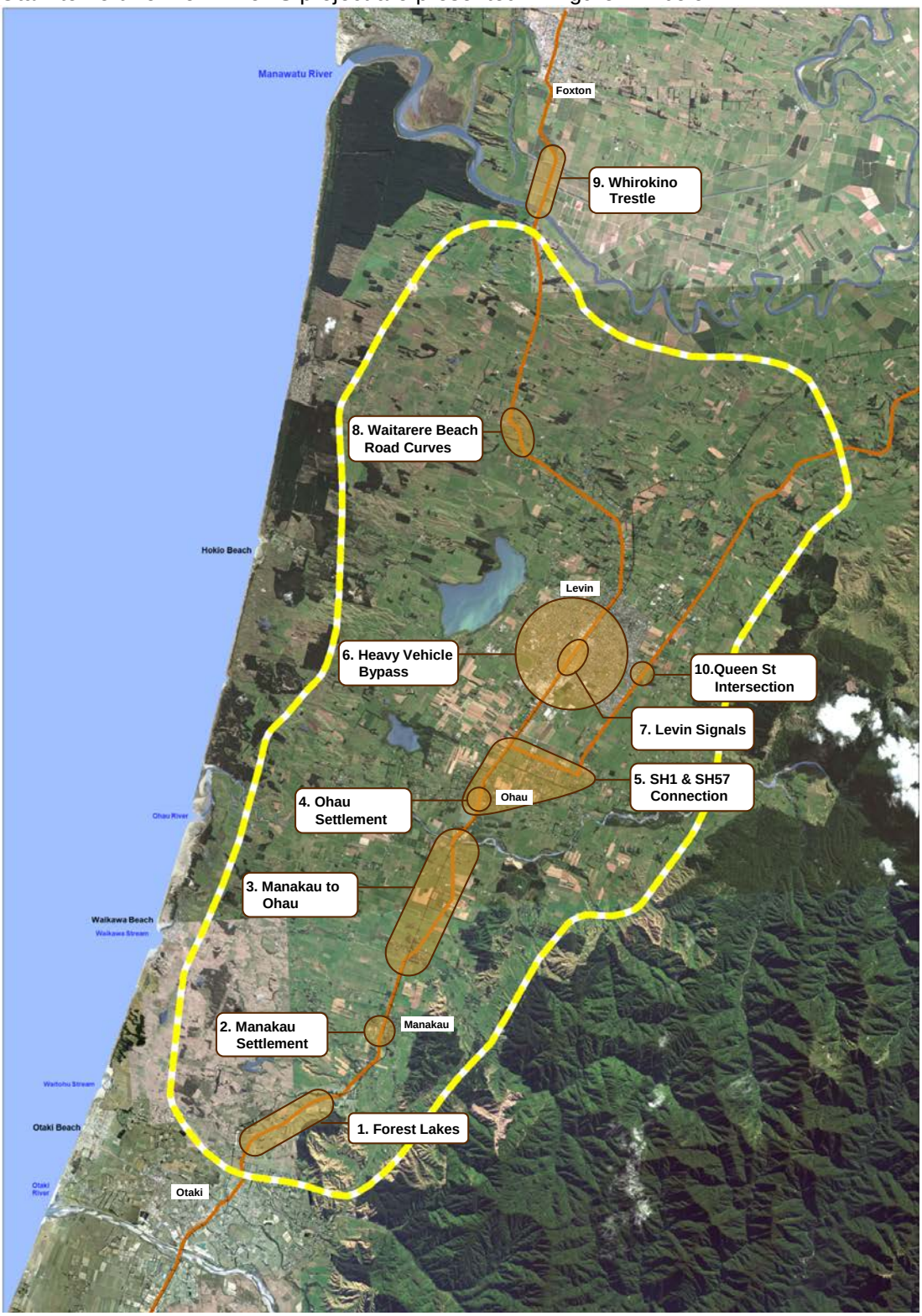


Figure 2-1: Projects Currently Being Investigated

In addition to the above PFRs, reports are also being undertaken on Route Improvements (i.e. passing lanes, walking and cycling, side friction etc; Report No. 11) and on a Four Lane Alignments (this report; Report No. 12).

3 Existing Highways

The existing highways in the study area include the section of SH1 from Taylors Road intersection, RP 1N/995/3.30, north through to the SH1 / SH57 intersection at RP 1N/985/0.0. This section of SH1 has a length of 14.4 km. Also included is the Kimberley Road section of SH57, from the beginning at RS 0/0 to the first curve north of the intersection of Kimberley Road and Arapaepae Road, a distance of approximately 2.6km.

3.1 Description and Function

3.1.1 State Highway 1

SH1 from Wellington to Levin is classified as 'National Strategic High Volume'.

SH1 through the study area is generally a two-lane two-way road with passing lanes. It follows the historic route established in the late 19th and early 20th centuries. As a consequence, it is constrained by a now substandard alignment, towns and settlements, narrow curved bridges and significant side friction caused by local roads, commercial frontages and property accesses for the entire stretch.

The topography of the route is generally flat. The speed limit is 100 km/h, except on the approach to the intersection with SH57 where an 80 km/h speed limit applies.

SH1 through the study area provides access between Wellington (and the South Island) and a major part of the remainder of the North Island. It connects locations of national economic significance in an area where there are no practicable alternative highway routes.

SH1 also provides access to numerous rural properties, rural selling places and acts as a collector road for many local roads.

3.1.2 State Highway 57

SH57 is classified as a 'National Strategic' route.

SH57 commences at its junction with SH1 at Kimberley Road, south of Levin. This major intersection is subject to priority control which results in many conflicting movements and is further complicated by the railway line.

From the intersection, SH57 proceeds east to Arapaepae Road, which it meets at a 90 degree angle. It then follows Arapaepae Road north, passing east of Levin and continuing on towards Shannon and Palmerston North; joining SH3 at Ashurst just prior to the Manawatu Gorge. The topography of the route within the study area is flat.

SH57 serves as the primary southern link between SH1 and Palmerston North. As such it carries a high proportion of commuter traffic between Palmerston North and the Horowhenua. Most of the freight movements between Wellington and Palmerston North and other regions to the east of the Manawatu Gorge use SH57 as an arterial route.

3.2 Traffic Statistics

The Average Annual Daily Traffic Volumes (AADTs), as determined by the NZTA, are shown below:

Table 3-1: 2010 AADTs on State Highways

State Highway	Route Station	Route Position	Location	AADT
1	985	3.48	Ohau (Telemetry)	15,000
1	967	17.27	South of Levin (north of SH57)	11,500
57	0	1.8	Near SH1	4,400

For comparison, traffic volumes north of Levin are around 7,700 on SH1 and 8,400 on SH57.

Traffic growth has been calculated at the Ohau telemetry site. For the period 1992 to 2010, the annual traffic growth has been approximately 1.2% per annum[1]. The numbers of heavy vehicles have increased by approximately 2% per annum.

4 Four Lane Strategy

The overall strategy for the Otaki to north of Levin project is to upgrade the state highway network to provide:

- a four lane highway to Levin;
- a bypass of Levin; and
- two lanes plus passing lanes on SH1 north of Levin

Based on the work undertaken in the scoping report, this has been further refined as the following:

- Initial investigations into short term safety improvements while future-proofing for a four lane highway to Levin.
- The four lane highway would be roughly along the line of the existing highway and only extend as far north as the SH57 split for this stage of investigation.
- Any SH1 bypass of Levin would utilise SH57 Arapaepae Road, but consideration will be given to short term heavy vehicle bypass options closer to the town centre.
- Two lanes plus passing lanes will be provided north of the SH1/57 split on both SH1 and SH57 on their existing alignments.

Accordingly, this report is focussed on the likely alignments for the future four lane highway between north of Otaki (adjoining the Peka Peka to Otaki RoNS project) and the SH57 intersection, noting that this will be roughly along the line of the existing highway to enable staging opportunities.

The four laning is only being investigated to where SH57 would begin as this is where there is a significant drop in through traffic volumes (see Table 3-1) and this is also the beginning of the Levin urban area.

5 Methodology

The methodology for identifying potential alignments was as follows. As this is only a brief initial investigation, no attempt has been made to identify every possible alignment.

- Identification of standards to be used
- Identification of deficiencies in current highway
- Identification of key constraints
- Desktop mapping exercise to identify potential alignments
- Site visit to check alignments and confirm constraints
- Desktop exercise to confirm alignments for consideration.

The identification aspects are discussed below with the options considered presented in the next section.

No quantification of costs or benefits is being undertaken as part of this report. Furthermore no effects assessment is being undertaken.

After the PFR stage, a multi-criteria analysis will be undertaken on the alignments contained in this report, utilising the knowledge gained during the production of the PFRs.

[1] Traffic volumes have been declining slightly over the last 5 years.

5.1 Identification of Standards

As this is currently only a two dimensional consideration of alignments, only cross section and horizontal geometry is being considered.

5.1.1 Cross Section

The cross sectional requirements for the four lane alignments have been based on the desirable RoNS standards and guidelines, modified as appropriate with regards to value for money and consistency with adjacent sections.

A 50m wide corridor has been assumed at this stage, which is represented in Figure 5-1 below.

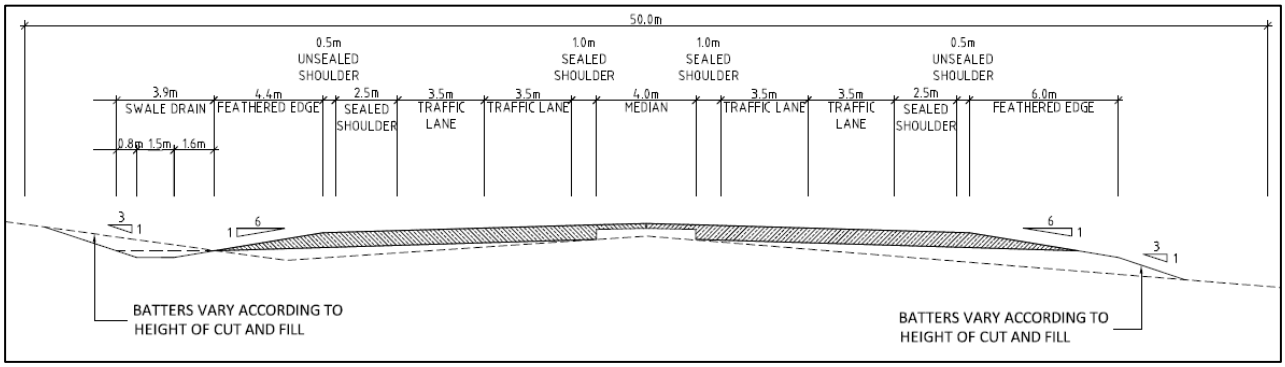


Figure 5-1: Assumed Cross Section

The only aspect which is not in accordance with RoNS guidelines is the central median width. Including the sealed shoulder, a 6 m width (with a median barrier) has been assumed, rather than the 9 m in the RoNS guidelines. This gives an offset from the traffic lane to the wire rope barrier of just under 2.5 m. This is not inconsistent with the other RoNS projects on the Wellington Northern Corridor, which have included median widths of between 4 and 6 m.

The 50 m cross section allows for clear zones rather than edge barrier and also includes an allowance for earthwork batters. It is acknowledged that edge barrier is the preferred edge treatment type, and whilst both will be considered in more detail during later stages of investigation, clear zones have currently been assumed as the conservative assumption in regards to width.

This cross section will need to be widened at interchanges and/or for embankments near structures. It does not specifically allow for parallel service roads, separate walking and cycling facilities and/or mitigation measures such as noise bunds. These aspects will need consideration in subsequent stages of investigation.

Any two lane facility (i.e. north of the SH1 / SH57 split) would only require a 20 – 25 m cross section.

5.1.2 Horizontal Geometry

For the purposes of this report, the RoNS geometric standards of 1100m desirable minimum radius curves have been adopted for the four lane alignment. It is noted that this can be reduced to 720 m as an absolute minimum, by agreement with NZTA. It is noted that the Peka Peka to Otaki project uses 800m minimum radius curves.

Vertical alignment has not been investigated but it is noted that apart from the Forest Lakes section the terrain is relatively flat. Approximate vertical profiles have been examined where grade separation is envisaged.

5.2 Identification of Deficiencies

None of the existing route meets the required RoNS cross section standard. There are passing lanes in a number of locations, but there are no four lane sections, there is no median barrier and few locations with clear zones or side protection.

There are also a number of curves with radii less than 1100 m. These are shown in the Table 5-1 below:

Table 5-1: Horizontal Curve Radii

Curve Location	Approximate Radius (m)
Between Taylors Road and Lawlors Road	435
Curve south of Lawlors Road	1000
Forest Lakes southbound rest area curve	600
Pukehou Rail Overbridge curve	450
South of Waiauti Stream Bridge	800
North of Waiauti Stream Bridge	550
South of Manakau	650
Southern end of Manakau Rail Overbridge	250
Northern end of Manakau Rail Overbridge	250
Waikawa River Bridge	300
North of Waikawa River Bridge	500
South of Tatum Park	750
Kuku	350
Ohau Rail and River Bridges	500
South of Ohau	400
North of Ohau	400

The above shows the minimum radius of each curve, estimated from the high speed data. Some of the curves have multiple radii (broken back curves) which make them harder to read by drivers and therefore are more of a crash risk.

5.3 Identification of Key Constraints

Constraints were identified as part of the Otaki to north of Levin Scoping Study. Those which are relevant to this study are presented on the plans in Appendix A.

Particular consideration has been paid to:

- landscape features;
- heritage areas;
- tangata whenua areas of significance;
- ecological areas of significance; and
- reserve or covenanted land;

In addition, whilst not specifically included on the constraints map, buildings and property boundaries were also taken into consideration in developing the alignments. This is an aspect that could result in fine tuning of the alignments during the next investigation stage.

It is expected that there are more constraints in the study area which will be progressively identified through more in-depth investigation and consultation.

6 Options Considered

For the purposes of this report, the SH1 corridor has been divided into three sections:

- Taylors Road to north of Manakau
- North of Manakau to Ohau River
- Ohau River to SH57 Kimberley Road

The northernmost section also includes alternative alignments to Kimberley Road to access SH57 Arapaepae Road.

It is noted that little or no investigation has been undertaken on how to provide access to properties or side roads under any alternative four lane alignment. This investigation will need to occur at a later date.

6.1 Taylors Road to north of Manakau

The two defining aspects of this section are the Pukehou Rail Overbridge and Manakau Settlement.

The Pukehou Rail Overbridge is a narrow two lane structure on a curve with a substandard radius (approximately 450m) and hence needs replacing. However, there are a number of constraints to the west including an historic building and several notable trees/patches of bush which would need to be avoided. Accordingly, any structure compatible with four laning would either need to be located immediately east or at least 500m west of the existing bridge.

The settlement of Manakau has a number of constraints including the railway line which runs immediately adjacent to the east of the highway and the historic Methodist Church (now a café) which is located on the west of the highway. Rail realignment to the east was considered but proved problematic due to a garden of remembrance and a war memorial. Accordingly, any four lane highway following the exisiting highway would require widening to the west and hence relocation of the church.

Three options have been developed for this section and are described below. Plans showing all the options are presented in Appendix A.

All of the options in this section require two structures, one to cross the railway at Pukehou and one to cross the Waiauti Stream (although Option 4L-A should only need a two lane bridge at Waiauti as the existing bridge could possibly be retained for one direction of traffic).

6.1.1 Option 4L-A

This option runs closest to the existing highway although realignments are necessary to meet the desirable minimum radii. From Taylors Road, the highway immediately needs realignment to replace the existing 425m radius curve, the option then follows the existing highway until approximately Forest Lakes Road where it diverts to the east in order to achieve a 1100m radius curve over the railway line east of the existing bridge. The existing highway matches the alignment until the Waiauti Stream Bridge where again realignment of a curve is needed, this time to the west. This option then follows the existing alignment through Manakau, with widening to the west which requires land from all properties which front the highway through this settlement.

6.1.2 Option 4L-B

This option follows the alignment of Option 4L-A until north of Pukehou Rail Overbridge where the alignment diverts to the west to avoid property impacts between South Manakau Road and Manakau Settlement. This option stays to the west of Manakau and joins the existing highway south of Waikawa Beach Road.

6.1.3 Option 4L-C

This option has been identified to obtain further travel time benefits as it is shorter than the existing highway route. North of Forest Lakes Road, where the existing highway turns east onto the existing Pukehou Rail Overbridge, this option instead continues straight ahead. It crosses the railway line

approximately 500m west of the existing bridge, travels west of Atkins Road before joining the alignment of Option 4L-B west of the existing Waiauti Stream Bridge to continue past Manakau.

6.1.4 Discarded Options

Options which divert from the highway further south of Forest Lakes Road have been discarded due to the additional cost of the new alignment and the extent of earthworks required.

Options which attempt to avoid property impacts by diverting behind Gleeson Road have also been removed from further consideration as they are longer than the options closer to Manakau.

6.2 North of Manakau to Ohau River

The defining aspects of the section are the two pairs of railway overbridges and river bridges, all of which are narrow and on poor alignments and need to be replaced on RoNS standard alignments to ensure future proofing. No alignment can precisely follow the existing highway at the Manakau end due to the location of residential properties, the Ngati Wehi Wehi Marae and the likely need to retain the existing structure for the local road network.

Two options are proposed here; one which follows the existing highway wherever viable and one that stays west of the railway line to avoid the need for railway overbridges along this section.

6.2.1 Option 4L-D

This alignment can closely follow the existing road network but still needs a few deviations due to the poor horizontal alignment and the position of key constraints. This option proposes to divert away from the existing highway near North Manakau Road to enable the desirable minimum radius curves to be used over the Waikawa River. A new railway overbridge would be required at the point at which the highway would leave the new alignment and a new river bridge would be located approximately 100m east of the existing structure. The option then follows the existing alignment to the curve at Kuku where realignment is needed to improve the curve radii but also to avoid the historic St Stephen Church.

As a new river bridge would be required and this option approaches from the east, it is logical to locate the new river bridge east of the existing. To avoid the existing concrete batching plant the new bridge would be approximately 350m to the east. Between Kuku and this new river bridge, there are the existing constraints of the historic Kuku Dairy Factory and the Ngati Tukorehe Marae. The current envisaged alignment follows the existing highway between these two sites; however this is likely to require a departure from the horizontal alignment standard adopted. A better option may be to realign the highway behind the Marae to give a better alignment and also potentially avoiding impacts on these properties.

6.2.2 Option 4L-E

This option also diverts away from the existing highway near North Manakau Road but to the west rather than the east. This is to stay on the western side of the railway line but avoiding adversely impacting Ngati Wehi Wehi marae. Once over the Waikawa River, the alignment runs immediately adjacent to the railway line and crosses the Ohau River immediately downstream of the existing river bridge.

6.2.3 Discarded Options

Options which run west of the existing Manakau bridges but then cross the existing highway and railway line to join the existing highway south of Kuku have been discarded as this would add additional length to the highway.

Likewise options that utilise the existing highway past Kuku but then cross the Ohau River west of the existing bridge have been discarded due to the longer route.

Options which cross the Ohau River more than 100m west of the existing bridge have also been discarded due to route lengthening.

6.3 Ohau River to SH57 Arapaepae Road

The defining aspects of this section are the Ohau Settlement and where to locate the SH1/SH57 intersection.

Ohau is a settlement with many urban features. There is a reasonable amount of property frontage along the highway as well as four intersections within a kilometre. There is pedestrian and vehicular movement between the residential community on the western side of the highway and the café, school, church and other community facilities on the east. Unfortunately, few options exist for bypassing this settlement due to the built up nature of the area and the fact that any deviation that avoids the majority of the built up areas would result in significant route lengthening.

Significant opportunity exists to improve both safety and travel time by replacing Kimberley Road with a new link further to the south which would also be the 4 lane to 2 lane transition and hence an opportunity to relax the standards to the north of the split from that required by the RoNS guidelines.

Locating this split between the Ohau River and Ohau would enable the safety and travel time benefits for SH57 traffic whilst also allowing the highway through Ohau to remain as two lanes in the medium to long term. This scenario is a possibility with both of the options below.

6.3.1 Option 4L-F

Option 4L-F is an extension of 4L-E; it begins at the river bridge proposed in 4L-E immediately north of the existing bridge. From this point it connects back into the highway to travel through Ohau. For this option there are three different possibilities for a SH57 intersection:

a) Bifurcation between Ohau River Bridge and Ohau with SH1 continuing on the existing route and SH57 splitting to join into SH57 Arapaepae Road.

b) Bifurcation between Ohau and Kimberley Road with SH1 continuing on the existing route and SH57 splitting to join onto Kimberley Road approximately half way along its length.

c) New intersection (roundabout or some form of interchange) at the SH1 / SH57 Kimberley Road intersection. Any new facility here would need to be centred to the west of the existing alignment due to the constraint of the railway line.

All options will have four lanes south of the split and two lanes each on SH1 and SH57 north of the split.

Adopting one of the latter two options could result in significant impacts on the community of Ohau with property purchase being required along one of the frontages and an increased severance effect due to the four lane highway.

6.3.2 Option 4L-G

Option 4L-G is an extension of 4L-D; it begins at the river bridge proposed in 4L-D approximately 350m east of the existing bridge. From this point it connects back into the highway to travel through Ohau. For this option there are two different possibilities for a SH57 intersection:

a) Bifurcation between Ohau River Bridge and Ohau with SH1 continuing on the existing route and SH57 splitting to join into SH57 Arapaepae Road.

b) New intersection (roundabout or some form of interchange) at the SH1 / SH57 Kimberley Road intersection. Any new facility here would need to be centred to the west of the existing alignment due to the constraint of the railway line.

As with 4L-F, the second option could result in significant impacts on Ohau (see above).

6.3.3 Discarded Options

The locations of the Ohau Bridge in Options 4L-D and 4L-E naturally constrain the number of options able to be progressed for this section.

As mentioned previously, options which involve a bypass for SH1 traffic of Ohau have been discarded due to the built up nature of the area and the fact that any deviation that avoids the majority of the built up areas would result in significant route lengthening for SH1 traffic.

7 Short to Medium Term Projects

Five PFRs have been undertaken to assess short to medium term improvement projects between Taylors Road and SH57. These are:

- Forest Lakes Safety Improvements (PFR No. 1)
- Manakau Settlement Improvements (PFR No. 2)
- Manakau to Ohau Bridges (PFR No. 3)
- Ohau Settlement Improvements (PFR No. 4)
- SH1/SH57 Intersection (PFR No. 5)

Further details on each of the options for these projects are available in the respective PFRs. However, the options have been mapped against the potential four lane routes and this is shown in the plans in Appendix B.

For the purposes of this exercise, two four lane options have been considered; one which follows the existing alignment as closely as possible, and another which includes the deviations to avoid constraints or provide route shortening.

The short to medium term projects do not encompass the full extent from Taylors Road to SH57, and the projects that have been identified do not propose four laning. Accordingly, there are a number of gaps that would need to be filled and future duplication works that would be required to transition to the full four laning.

Not least of the gaps is the Pukehou Bridge. This railway overbridge is narrow and on a curve with a radii below the absolute minimum RoNS standards. Nevertheless, the bridge is structurally acceptable, the side protection has recently been upgraded and no high severity crashes have occurred on or in the immediate vicinity of the bridge, hence it is not being considered for improvement or realignment in the short to medium term. It does remain a high risk site.

In summary if a four lane option closely aligned to the existing state highway were to be adopted as the long term strategy, the short to medium term projects should include:

- Option 1-1 through Forest Lakes. This is the higher standard route which more readily allows for future four laning on an appropriate alignment.
- Manakau Settlement Improvements, although it is noted that these would be redundant with the future four laning.
- Option 3-1 between Manakau and Ohau which follows the existing alignment as closely as possible although may have some adverse impacts with adjacent constraints.
- Ohau Settlement Improvements, although it is noted that these would be redundant with the future four laning.
- Option 5-1a for grade separation of the existing SH1/57 intersection, although in the future this would require four laning through Ohau. It is noted that a roundabout could be constructed instead of the grade separation at this location for a lower cost but results in significantly reduced benefits and a much lower BCR.

The total construction cost of the improvements above is estimated to be $103M yielding a combined BCR of 1.2. No estimate has been undertaken of the cost or BCR to transition from these projects to the full four laning or of economies of scale at this stage.

If a four lane option closely away from the existing state highway were to be adopted as the long term strategy, the short to medium term projects should include:

- Option 1-1 through Forest Lakes. This is the higher standard route which more readily allows for future four laning on an appropriate alignment.
- Manakau Settlement Improvements, although it is noted that these would be redundant with the future four laning.
- Option 3-2 between Manakau and Ohau which follows the rail alignment.
- Ohau Settlement Improvements, although it is noted that these would be redundant with the future four laning.
- Option 5-4a for bifurcation of SH1 and SH57 south of Ohau.

The total construction cost of the improvements above is estimated to be $106M yielding a combined BCR of 1.4. No estimate has been undertaken of the cost or BCR to transition from these projects to the full four laning or of economies of scale at this stage.

8 Peka Peka to Otaki project tie in

The Peka Peka to Otaki RoNS project is a four lane expressway immediately south of the Otaki to Levin RoNS that is expected to begin construction in around 2016.

Any short, medium and long term plans for Otaki to Levin need to consider the form of the highway to the south and how to provide a safe, efficient, consistent and readable environment for the road user travelling through both projects.

The current plans for the northern end of the Peka Peka to Otaki project involve the four lane highway reducing down to two lanes south of the Waitohu Stream Bridge. A two lane bridge would be provided over the Waitohu Stream (although this would be future proofed to allow two additional lanes to be added at a later date). A median would be provided to separate traffic past Taylors Road and turning bays provided for traffic using Taylors Road. It is also currently recommended that the southbound passing lane north of Taylors Road be removed due to the passing opportunities afforded by the four laning to the south.

Conceptually, the Forest Lakes options would tie in appropriately with the current proposals for Peka Peka to Otaki, particularly as they propose to improve the horizontal curve north of Taylors Road to provide a geometry which is consistent with the speed environment. The long term options of four laning between Otaki and Levin would require the additional lanes to be added to the Waitohu Stream bridge and the four laning made seemless between the projects.

The details of the tie-ins will need specific consideration during the later stages of design.

9 Summary and Conclusions

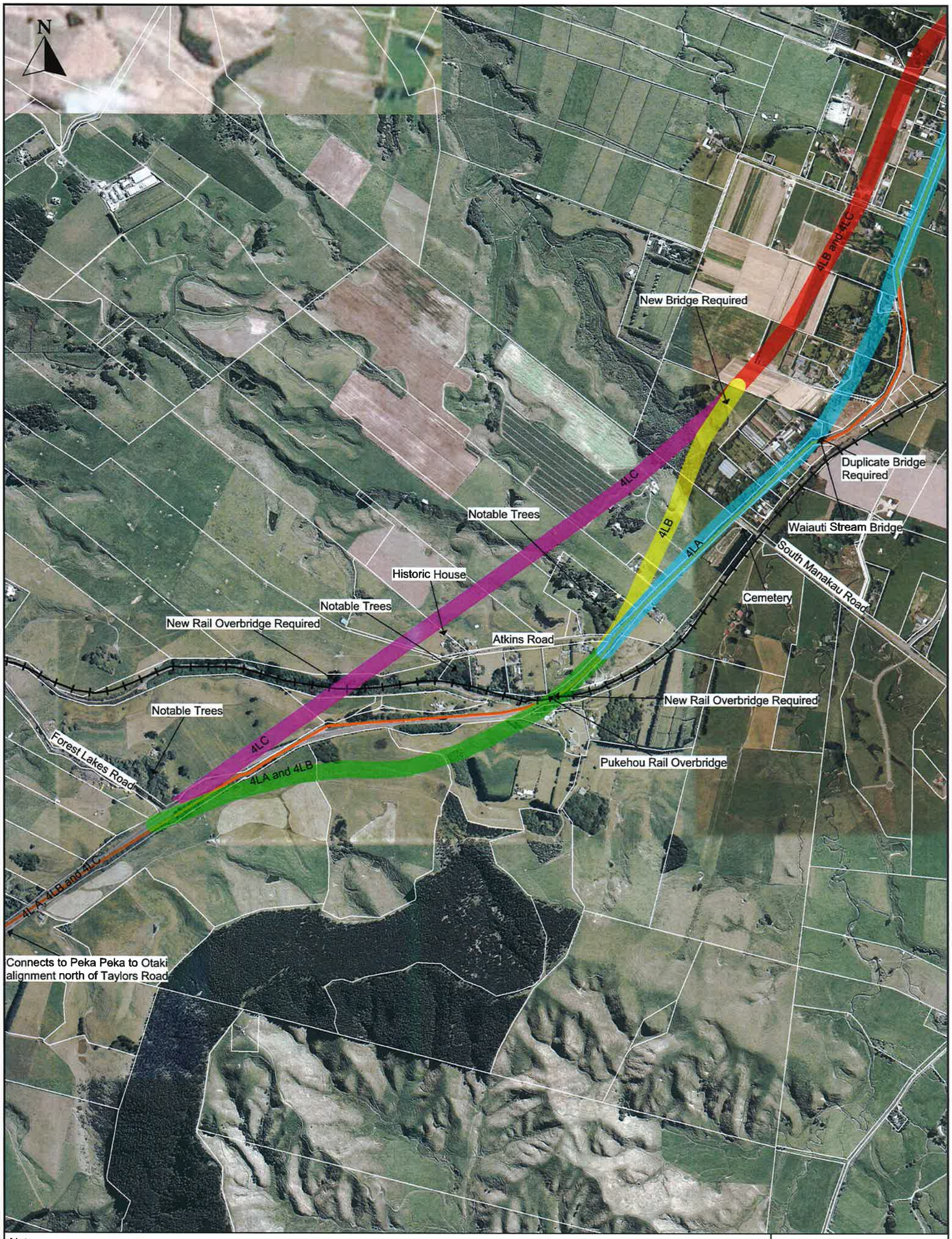
A number of potential alignments have been identified and mapped on aerial photographs. Other alignments were identified but have been discarded due to constraints or the fact that they would result in a longer state highway route.

The alignments that have been retained have not been subject to any evaluation, comparison or impact assessment. It is considered that this is best undertaken when more information is available; i.e. at the Scheme Assessment Stage.

The alignments identified here have helped inform the PFRs in terms of how the options identified in the PFRs would likely fit into the overall strategy for Otaki to north of Levin. There is a large amount of co-ordination between the short to medium and long term options, which potentially allows staging to be undertaken successfully.

No conclusions are being deduced for this report. However, it will be used to help NZTA in their decision making in regards to the short, medium and long term plan for SH1 between Otaki and Levin.

Appendix A Plan of Options



Notes:
1. All curves in four laning section are 1100m minimum radii.
2. Width shown as nominal 50m up to SH1 SH57 split.

Legend
- SH1
- NIMT Railway

MWH

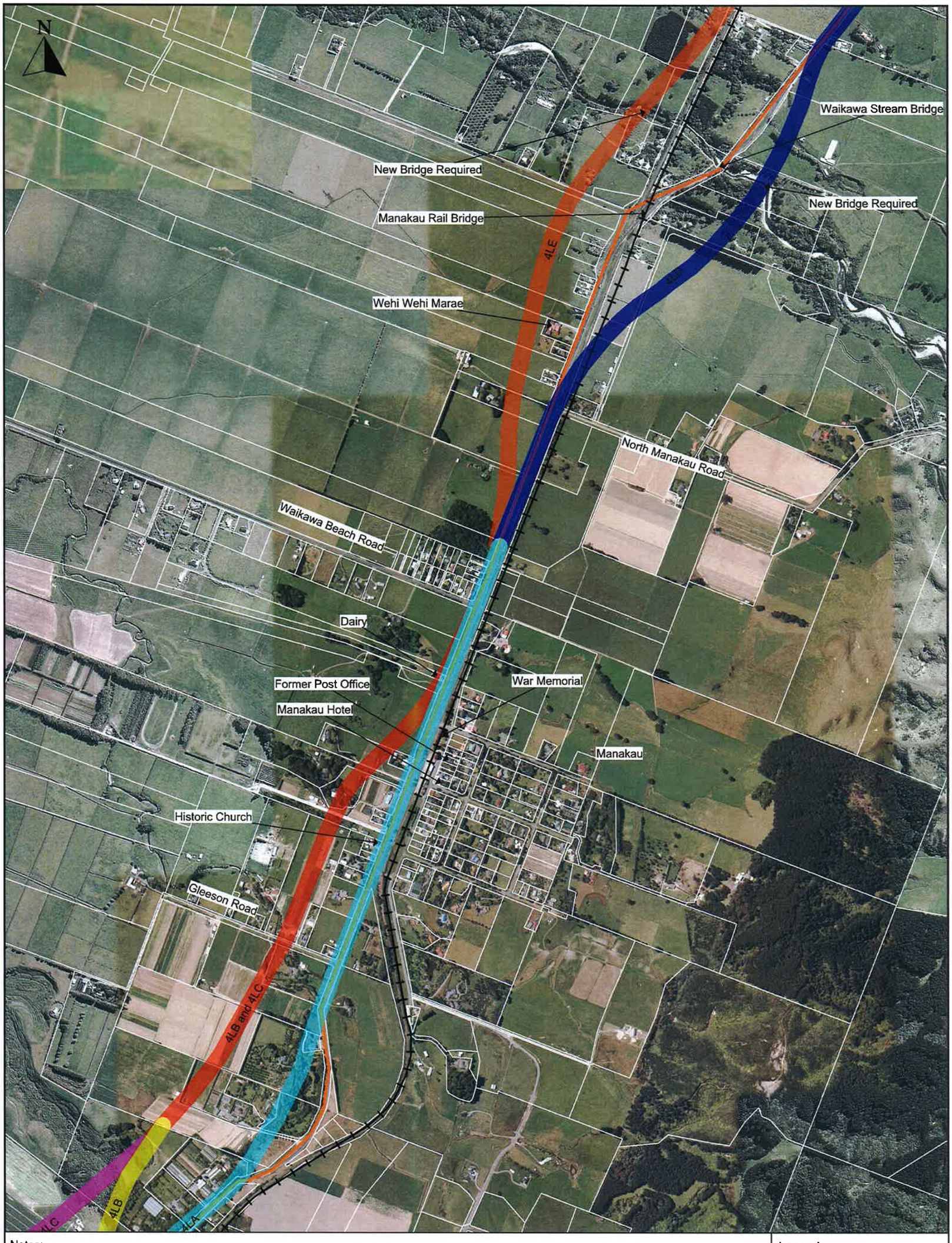
NZ TRANSPORT AGENCY
WAKA KOTAHI

Otaki to North of Levin - PFR Stage
Four Lane Options
Indicative Alignments

Map No. 1 of 5 Version: 1

Scale: 1:10,000

Original map size: A3 Date: Dec. 2012



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SH1
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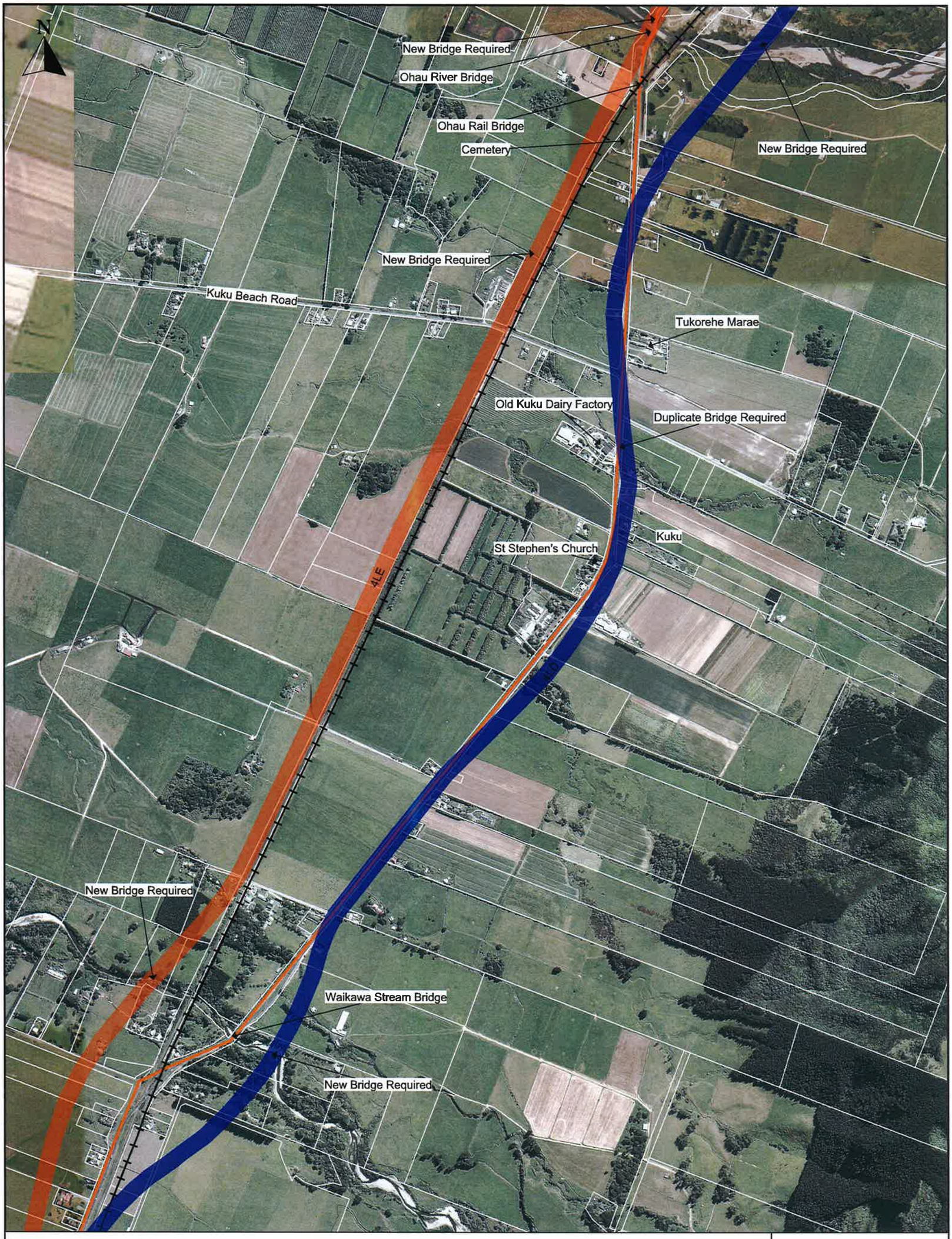
Otaki to North of Levin - PFR Stage
Four Lane Options
Indicative Alignments

Map No. 2 of 5 Version: 1

Scale: 1:10,000

Original map size: A3 Date: Dec. 2012



Notes:
1. All curves in four laning section are 1100m minimum radii.
2. Width shown as nominal 50m up to SH1 SH57 split.

Legend
SH1
NIMT Railway

MWH

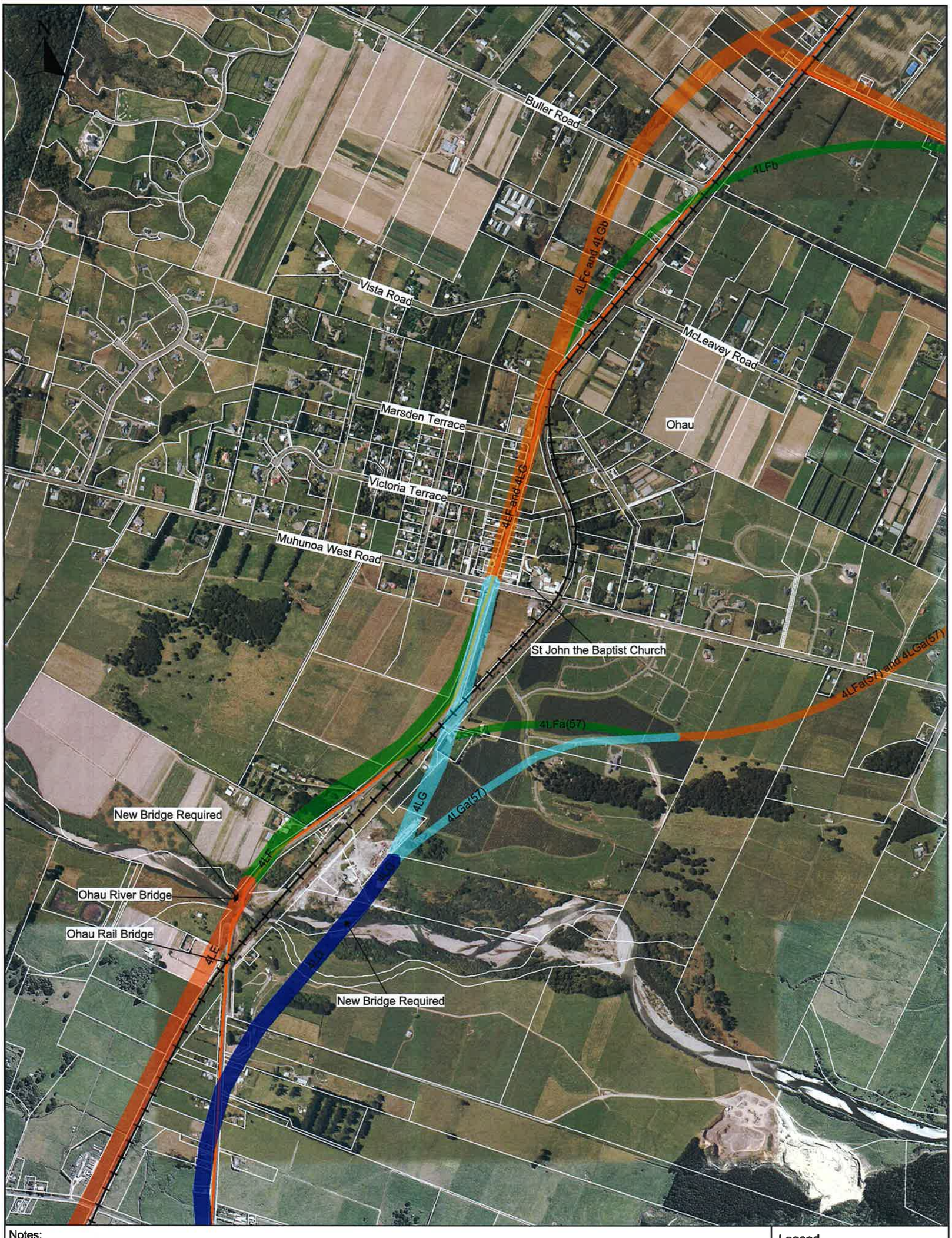
NZ TRANSPORT AGENCY
WAKA KOTAHI

Otaki to North of Levin - PFR Stage
Four Lane Options
Indicative Alignments

Map No. 3 of 5 Version: 1

Scale: 1:10,000

Original map size: A3 Date: Dec. 2012



Notes:
1. All curves in four laning section are 1100m minimum radii.
2. Width shown as nominal 50m up to SH1 SH57 split.
3. Once the SH57 alignment splits away from the main alignment, the SH1 alignment would continue as a 4 lane facility along the existing SH1 route.

Legend
- SH1
- NIMT Railway

MWH

NZ TRANSPORT AGENCY
WAKA KOTAHI

Otaki to North of Levin - PFR Stage
Four Lane Options
Indicative Alignments

Map No. 4 of 5 Version: 1

Scale: 1:10,000

Original map size: A3 Date: Dec. 2012

Notes:
1. All curves in four laning section are 1100m minimum radii.
2. Width shown as nominal 50m up to SH1 SH57 split.

Legend
- SH1
- NIMT Railway

MWH

NZ TRANSPORT AGENCY
WAKA KOTAHI

Otaki to North of Levin - PFR Stage
Four Lane Options
Indicative Alignments

Map No. 5 of 5 Version: 1

Scale: 1:10,000

Original map size: A3 Date: Dec. 2012

Appendix B Plan of Short to Medium Term Options

N

State Highway 1 & 57

Option 5-1a	Option 5-2
Grade Separation	Roundabout
Cost: $32.4m	Cost: $15.5m
BCR: 2.3	BCR: 1.0

Ohau Settlement Improvements

Cost: $3.9m
BCR: 1.0-1.3

Manakau / Ohau Bridges

Option 3-1

Cost: $50.3m
BCR: 0.4

Manakau Settlement Improvements

Cost: $1.95m
BCR: 0.9-2.7

Forest Lakes

Option 1-1

Cost: $14.0m
BCR: 1.2

Legend

- Potential 4-lane alignment
- Short to medium term 2-lane project
- Existing State Highway

MWH

NZ TRANSPORT AGENCY WAKA KOTAHI

Otaki to North of Levin – PFR Stage

Potential Four Lane Alignments

12-1 Close to Existing

0 500 1000 1500 Meters

Scale: 1:40,000

Original map size: A3 Date: Dec 2012

N

State Highway 1 & 57

Option 5-4a

Cost: $49.9m
BCR: 1.7

Ohau Settlement Improvements

Cost: $3.9m
BCR: 1.0-1.3

Manakau / Ohau Bridges

Option 3-2

Cost: $36.4m
BCR: 1.1

Manakau Settlement Improvements

Cost: $1.95m
BCR: 0.9-2.7

Forest Lakes

Option 1-1

Cost: $14.0m
BCR: 1.2

Legend

- Potential 4-lane alignment
- Short to medium term 2-lane project
- Existing State Highway

MWH

NZ TRANSPORT AGENCY
WAKA KOTAHI

Otaki to North of Levin – PFR Stage

Potential Four Lane Alignments

12-2 Away From Existing

0 500 1000 1500 Meters

Scale: 1:40,000

Original map size: A3 Date: Dec 2012