



**MWH**

*BUILDING A BETTER WORLD*

# **Waikato Expressway: Rangiriri Section**

## **Assessment of Noise Effects**



Prepared for NZ Transport Agency

February 2011

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## REVISION SCHEDULE

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			Prepared By	Checked By	Reviewed By	Approved By
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1	May 10	Included comments on effects of new standard NZS 6806:2010	NH		DH	DH
2	July 10	Including Te Kauwhata residents	NH		DH	DH
3	Sept 10	Including assessment to new standard NZS 6806:2010	NH		DH	DH
4	Oct 10	Incorporating NZTA comments	NH		DH	DH
5	Nov 10	Incorporating further NZTA comments	NH		DH	DH
5	Feb 11	Correcting Noise criteria in Table 4	NH		DH	DH

# NZ Transport Agency

## Waikato Expressway: Rangiriri Section

### Assessment of Noise Effects

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# 1 Introduction

It is proposed to develop the 4.7km Rangiriri section of the Waikato Expressway as a dual two lane carriageway (State Highway 1) (Refer to Figure 4 - General Layout, in Appendix A which shows the extent of works). At the same time it is proposed to change the way traffic will access Rangiriri Township with the addition of access links and the closure of other roads. This report considers the traffic noise effects on the Township and those dwellings adjacent to the new alignment of the expressway.

# 2 The Proposal

Refer to Figures 1 - 3 in Appendix A. Figure 1 shows the existing and proposed road layout at Te Kauwhata, Figure 2 shows the existing road layout at Rangiriri and the proposed layout at Rangiriri is shown on Figure 3. The noise predictions discussed have been based on the information set out in these plans.

# 3 Traffic Noise Predictions

Noise predictions for both the existing conditions and the proposed changes were undertaken using the Traffic Noise Model (TNM) computer program. This software is a three dimensional modelling program that has been developed solely for the prediction of traffic noise by the U.S. Federal Highway Administration (FHWA). The program has been calibrated for New Zealand conditions and has proven to predict traffic noise levels generally within  $\pm 1$  dBA although occasionally it will be up to  $\pm 2$  dBA in very complex situations. The model has been fully calibrated to New Zealand conditions.

The accuracy of the noise predictions from the computer model is reliant on the accuracy of the base information. All data for the noise model, such as the road alignment, intersection layout, road surface, accelerating traffic, topographical features and receiver locations were down loaded directly into TNM from electronic files. As road information is three dimensional, TNM calculates road grades and applies the correct throttle setting for vehicles to maintain the design speed, that is, TNM recognises that vehicle engines operate differently on grades and this has been considered in the prediction of traffic noise.

A feature of TNM is that it allows accurate modelling of traffic signals, roundabouts and give way signs as well as for a steady flow of traffic.

The following design parameters have been adopted in the calculations:

Road speed	Posted speed
Road surface	Medium chip seal to all surfaces
Ground	Grass
Grades	As designed
Barriers	None
Traffic flows	As given on Figures 1, 2 & 3
Heavy commercial vehicles	As provided for each link
SH1 traffic	Existing and 2021 flows

The calculations have all been based on a receiver height of 1.2m above ground level and 1m from the facade of the building with a 2.5dBA reflection effect included in the analysis. For a number of the houses in Rangiriri the noise level has been calculated at the four facades as they are all potentially affected by a change to the traffic noise with the level either increasing or decreasing. The predictions have been

undertaken to 0.1dBA although it is important to realise that it takes a change of 3dBA to be noticed. The level of accuracy of the calculations is to enable the difference to be determined.

All calculations have been undertaken based on a 24 hour Leq, which is the value normally used to determine traffic noise effects as it reflects community reaction to traffic noise.

Based on the above the existing and future noise levels have been calculated at each of the houses in the area. The results of the calculations are shown in Table 1. Refer to Figures 5, 6 and 7 in Appendix A, which identify the site numbers referred to in the Tables.

**Table 1 – Predicted Noise Levels**

Site	Noise Level dBA L <sub>eq</sub> (24hr)		
	Existing conditions	With bypass in 2021	Change as a result of realignment
House 1 W	55.5	59.0	3.5
House 1 E	59.8	50.6	-9.2
House 2	50.0	57.9	7.9
House 3 W	51.0	60.7	9.7
House 3 E	60.1	45.7	-14.4
House 4 W	56.3	60.6	4.3
House 4 E	66.6	55.0	-11.6
House 5	65.3	53.4	-11.9
House 6	66.5	57.7	-8.8
House 7	63.7	56.9	-6.8
House 8	61.6	55.8	-5.8
School N	66.0	60.4	-5.6
School W	67.5	62.4	-5.1
School S	65.2	62.1	-3.1
School E	59.9	55.3	-4.6
House 9	58.5	55.6	-2.9
House 10	58.6	56.4	-2.2
House 11	54.8	54.8	0.0
House 12	55.0	55.8	0.8
House 13 E	52.5	53.8	1.3
House 13 W	58.1	56.1	-2.0
House 14 E	52.4	54.0	1.6
House 14 W	58.3	56.7	-1.6
House 15 E	52.0	53.4	1.4
House 15 W	58.5	57.2	-1.3
House 16 E	52.6	55.7	3.1
House 16 W	58.2	58.5	0.3
House 17 W	70.1	68.5	-1.6
House 17 N	64.8	58.5	-6.3
House 17 E	60.8	62.2	1.4
House 17 S	67.7	68.9	1.2

Site	Noise Level dBA L <sub>eq</sub> (24hr)		
	Existing conditions	With bypass in 2021	Change as a result of realignment
House 23	58.8	61.1	2.3
House 24	59.3	61.5	2.2
House 25	60.2	62.6	2.4
House 18 E	56.9	60.0	3.1
House 18 N	56.8	56.6	-0.2
House 18 W	61.8	64.0	2.2
House 18 S	62.5	65.5	3.0
House 20 E	62.7	67.1	4.4
House 20 N	59.4	61.1	1.7
House 20 W	68.0	71.1	3.1
House 20 S	67.5	71.4	3.9
House 19 E <sup>1</sup>	59.6	62.8	3.2
House 19 N <sup>1</sup>	61.6	62.3	0.7
House 19 W <sup>1</sup>	67.7	69.7	2.0
House 19 S <sup>1</sup>	66.8	70.0	3.2
House 21 <sup>2</sup>	69.6	73.3	3.7
House 22 <sup>2</sup>	68.7	74.2	5.5
House 26 W	56.9	58.6	1.7
House 26 S	58.8	60.3	1.5
Hotel	64.8	67.8	3.0
House 37	62.8	64.1	1.3
House 38	64.9	66.0	1.1
House 39	66	65.5	-0.5
House 40	62.7	61.3	-1.4
House 40A	54.3	53.0	-1.3
House 41	63.1	61.4	-1.7
House 42	61.2	57.6	-3.6
House 43	63.2	60.0	-3.2
House 44	53.9	56.0	2.1
House 44A	53.1	55.4	2.3
House 45	57.9	58.9	1
House 45A	61.2	62.1	0.9
House 46	62.4	63.0	0.6
House 47	68.4	60.7	-7.7
House 48	67.3	61.4	-5.9

1 NZTA house

2 House removed

Note:

All levels at 1m from building façade and include 2.5dBA reflection;

Levels at 1.2m above ground level

Although predicted to 0.1dBA this is to show the difference in levels only.

Houses 30 to 36 to the north along Wayside Road are beyond the extent of this project

## 4 Traffic Noise Design Requirements (TNZ Guidelines)

The New Zealand Transport Agency (NZTA) Planning Policy Manual, Appendix 6: *Transit New Zealand Guidelines for the Management of Road Traffic Noise – State Highway Improvements, 1999* (the NZTA Traffic Guidelines) were developed for the assessment of noise from state highways. Although NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads (NZS6806) has now been published, as this project is an alteration to an existing Notice of Requirement, the NZTA Traffic Guidelines has been retained as the assessment tool for this project to maintain compatibility with the existing NOR. However, an assessment based on the requirements of NZS6806 has also been undertaken and is also reported in Section 5.

The NZTA Guidelines are based on an assessment point that is 1m from the most exposed façade of residential dwellings and schools with the locations of each of these points considered in this assessment shown on Figures 5, 6 and 7 in Appendix A. The design is based on the traffic flow at 10 years after completion of the project.

The Guidelines use the 24 hour Leq measurement of sound which is a logarithmic average of the 24, one hour noise levels. Table 1 of the Guidelines, which is shown as Table 2 below, provides the design level against which traffic noise from the proposal is to be assessed and is based on the existing ambient noise at each receiver position. Essentially, the following Table sets the design criteria a margin above the existing ambient noise level with the margin depending on the current ambient noise level.

**Table 2 – Average Noise Levels for Residential Buildings**

Noise Area	Noise Descriptor	Ambient Noise Level (dBA)	Average Noise Design Level (dBA)
Low	L <sub>eq</sub> (24 hour)	Less than 43 43 – 50	55 Ambient + 12
Medium	“	50 – 59	62
High	“	59 – 67 67 – 70	Ambient + 3 70
	“	More than 70	Ambient

The Guidelines also provide protection from single event noise levels, and in particular passing trucks, as noise from short duration events can result in sleep disturbance at night time. The guidelines state:

*'The minimum distance to meet the single event noise design level is 12m from the nearside edge of the traffic lane to the nearest assessment point for residential buildings and educational facilities.'*

The guidelines go on to say:

*'Where the nearest assessment point is within 12m, a noise reduction of 3dBA is required at the assessment point.'*

The single event sound is not expected to be a controlling factor for this project.

The existing ambient sound that each receiver experiences is important as it forms the basis of the design criteria. The ambient sound has been determined based on the assumption that it will be controlled by traffic noise, which can be calculated in the same way as the levels from the proposed bypass and as set out in Table 1 for the existing conditions.

Refer to Figure 4 in Appendix A which shows the location of the sites assessed

Based on the above, the design criteria and the design levels are set out in Table 3.

**Table 3 – Compliance Requirements (TNZ Guidelines)**

Site	Noise Level dBA L <sub>eq</sub> (24hr)			
	Existing Ambient	Guidelines design Limit	Level with bypass, 2021	Treatment required for compliance
House 1 W	55.5	62	59.0	Nil
House 1 E	59.8	63	50.6	Nil
House 2	50.0	62	57.9	Nil
House 3 W	51.0	62	60.7	Nil
House 3 E	60.1	63	45.7	Nil
House 4 W	56.3	62	60.6	Nil
House 4 E	66.6	70	55.0	Nil
House 5	65.3	68	53.4	Nil
House 6	66.5	70	57.7	Nil
House 7	63.7	67	56.9	Nil
House 8	61.6	65	55.8	Nil
School N	66.0	69	60.4	Nil
School W	67.5	70	62.4	Nil
School S	65.2	68	62.1	Nil
School E	59.9	63	55.3	Nil
House 9	58.5	62	55.6	Nil
House 10	58.6	62	56.4	Nil
House 11	54.8	62	54.8	Nil
House 12	55.0	62	55.8	Nil
House 13 E	52.5	62	53.8	Nil
House 13 W	58.1	62	56.1	Nil
House 14 E	52.4	62	54.0	Nil
House 14 W	58.3	62	56.7	Nil
House 15 E	52.0	62	53.4	Nil
House 15 W	58.5	62	57.2	Nil
House 16 E	52.6	62	55.7	Nil
House 16 W	58.2	62	58.5	Nil
House 17 W	70.1	70	68.5	Nil
House 17 N	64.8	68	58.5	Nil
House 17 E	60.8	64	62.2	Nil
House 17 S	67.7	70	68.9	Nil
House 23	58.8	62	61.1	Nil
House 24	59.3	62	61.5	Nil
House 25	60.2	63	62.6	Nil
House 18 E	56.9	63	60.0	Nil
House 18 N	56.8	62	56.6	Nil



Site	Noise Level dBA L <sub>eq</sub> (24hr)			
	Existing Ambient	Guidelines design Limit	Level with bypass, 2021	Treatment required for compliance
House 18 W	61.8	65	64.0	Nil
House 18 S	62.5	66	65.5	Nil
House 20 E	62.7	66	67.1	1.1
House 20 N	59.4	63	61.1	Nil
House 20 W	68.0	70	71.1	1.1
House 20 S	67.5	70	71.4	1.4
House 19 E <sup>1</sup>	59.6	63	62.8	Nil
House 19 N <sup>1</sup>	61.6	65	62.3	Nil
House 19 W <sup>1</sup>	67.7	70	69.7	Nil
House 19 S <sup>1</sup>	66.8	70	70.0	Nil
House 21 <sup>2</sup>	69.6	70	73.3	NA
House 22 <sup>2</sup>	68.7	70	74.2	NA
House 26 W	56.9	63	58.6	Nil
House 26 S	58.8	62	60.3	Nil
Hotel	64.8	68	67.8	Nil
House 37	62.8	66	64.1	Nil
House 38	64.9	68	66.0	Nil
House 39	66	69	65.5	Nil
House 40	62.7	66	61.3	Nil
House 40A	54.3	62	53.0	Nil
House 41	63.1	66	61.4	Nil
House 42	61.2	64	57.6	Nil
House 43	63.2	66	60.0	Nil
House 44	53.9	62	56.0	Nil
House 44A	53.1	62	55.4	Nil
House 45	57.9	62	58.9	Nil
House 45A	62.1	65	62.1	Nil
House 46	62.4	65	63.0	Nil
House 47	68.4	70	60.7	Nil
House 48	67.3	70	61.4	Nil

1 NZTA house

2 House removed

Note: Houses 30 to 36 to the north along wayside road are beyond the extent of this project

Based on the above it is necessary to reduce the noise level at house 20 by 1dBA. This can be achieved using a two coat chip seal, which is understood to be adopted, or installing a short New Jersey barrier on the slip lane past this dwelling.

## 5 Traffic Noise Design Requirements (NZS 6806:2010)

An assessment of the project has also been undertaken in terms the requirements of NZS6806 (2010) Acoustics – Road Traffic Noise – New and altered roads. Each of the noise sensitive activities along the route has been assessed, these sites are termed “protected premises and facilities” (PPFs) in NZS6806.

Table 2 of NZS6806 sets the relevant criteria for noise from new roads and altered roads where the traffic flow is greater than 2,000vpd at:

Category	Altered Roads	New roads with a predicted traffic volume >75,000 AADT at the design year	New roads with a predicted traffic volume 2,000 to 75,000 AADT at the design year
	dB L <sub>Aeq(24hr)</sub>	dB L <sub>Aeq(24hr)</sub>	dB L <sub>Aeq(24hr)</sub>
A (primary free-field external noise criterion)	64	64	57
B (primary free-field external noise criterion)	67	67	64
C (internal noise criterion)	40	40	40

For this project there is both a new section of road (between the Te Kauwhata south facing ramps and where the alignment deviates from the existing road to the north of Rangiriri) and an alteration to existing roads (north of the Te Kauwhata interchange south facing ramps and south of where the alignment deviates from the existing road to the north of the Rangiriri interchange).

For a new road the requirements are set out in section 1.2 and clause 1.2.3(c) NZS6806, which state:

*Subject to 1.3.1(d) and 1.3.1(e), this Standard shall apply to all PPFs near a new road where the noise at any one or more PPFs is predicted to increase by 3dB LAeq (24h) or more at the design year when compared with the existing noise environment.*

For an altered road the design requirements are set out in section 1.2 and clause 1.2.3(d) of NZS6806, which state:

*Subject to 1.3.1(d) and 1.3.1(e), this Standard shall apply to all PPFs near an altered road where one or more PPF for that altered road exceeds one of the thresholds in 1.5.2;*

Clauses 1.3.1(d) and 1.3.1(e) state:

- (d) *PPFs located in urban areas and located more than 100 m from the edge of the closest traffic lane for the new or altered road;*
- (e) *PPFs located in rural areas and located more than 200 m from the edge of the closest traffic lane for the new or altered road; (as shown on the figures attached in Appendix A)*

Clause 1.5.2 states:

Subject to 1.5.4 [which is not relevant for this project], an altered road means an existing road that is subject to alterations of the horizontal or vertical alignment where at any assessment position at any one or more PPF:

- (a) The do-minimum noise environment would be greater than or equal to 64dB LAeq(24h) and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at that assessment position by 3 dB LAeq(24h) or more at the design year, when compared with the do-nothing noise environment; or
- (b) The do-minimum noise environment is greater than or equal to 68dB LAeq(24h) and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at that assessment position by 1 dB LAeq(24h) or more at the design year, when compared with the do-nothing noise environment.

In order to determine if the design criteria is being complied with the noise level for the existing conditions (that is the 2010 traffic flow on the existing road), the do-nothing conditions (which assumes the road alignment has not changed with the traffic flow as predicted in 10 years time) and the do-minimum option (which is the proposed alignment with no specific noise control treatment included with the traffic flow as predicted in 10 years after completion of the work).

The site for this project is zone rural. Refer to Figure 4 in Appendix A which shows the location of the PPF's assessed, the new and altered road sections and the 200m footprint applicable to this project.

Table 4 and Table 5 set out the free-field sound levels of the analysis undertaken when adopting these criteria.

**Table 4 – Analysis in Terms of NZS6806 for New Road**

PPF	Existing	Do-minimum	Threshold exceeded	New Road	
	External noise level (dB LAeq(24hr))			Noise criteria Category A	Noise criteria Category B
1W	53	54	N	57	64
1E	57	45	N	57	64
2	48	52	N	57	64
3W	49	55	N	57	64
3E	58	40	N	57	64
4W	54	55	N	57	64
4E	64	50	N	57	64
5	63	48	N	57	64
6	64	53	N	57	64
7	61	52	N	57	64
8	59	51	N	57	64
School N	64	56	N	57	64
School W	65	57	N	57	64
School S	63	57	N	57	64
School E	57	50	N	57	64
9	56	51	N	64	67
10	56	52	N	64	67
47	68	58	N	64	67
48	67	58	N	64	67

Note: Shaded PPF's within 200m of new road

**Table 5 – Analysis in Terms of NZS6806 for Altered Road**

PPF	Existing	Do-nothing	Do-minimum	Threshold exceeded	Altered Road	
	External noise level (dB L <sub>Aeq(24hr)</sub> )				Noise criteria Category A	Noise criteria Category B
11	52	54	49	N	64	67
12	53	54	50	N	64	67
13E	50	52	49	N	64	67
13W	56	57	51	N	64	67
14E	50	52	49	N	64	67
14W	56	58	52	N	64	67
15E	50	51	49	N	64	67
15W	56	58	52	N	64	67
16E	50	52	52	N	64	67
16W	56	57	54	N	64	67
17W	68	69	63	N	64	67
17N	62	64	52	N	64	67
17E	58	60	57	N	64	67
17S	65	67	64	N	64	67
18E	54	56	55	N	64	67
18N	54	56	53	N	64	67
18W	59	61	58	N	64	67
18S	60	62	60	N	64	67
20E	60	62	62	N	64	67
20N	57	59	56	N	64	67
20W	66	67	66	N	64	67
20S	65	67	66	N	64	67
19E <sup>1</sup>	57	59	58	N	64	67
19N <sup>1</sup>	59	61	58	N	64	67
19W <sup>1</sup>	65	67	64	N	64	67
19S <sup>1</sup>	64	66	64	N	64	67
21 <sup>2</sup>	67	69	68	N	64	67
22 <sup>2</sup>	66	68	69	N	64	67
23	56	58	57	N	64	67
24	57	59	57	N	64	67
25	58	59	58	N	64	67
26W	54	56	52	N	64	67
26S	56	58	54	N	64	67
Hotel	62	64	62	N	64	67
37	60	62	62	N	64	67
38	62	64	64	N	64	67
39	64	65	63	N	64	67
40	60	62	59	N	64	67
40A	54	55	53	N	64	67
41	61	62	59	N	64	67
42	59	60	55	N	64	67
43	61	62	58	N	64	67
44	51	53	54	N	64	67
44A	51	53	54	N	64	67
45	55	57	56	N	64	67
45A	59	60	60	N	64	67
46	60	62	61	N	64	67

1 NZTA house

2 House removed

Note: Shaded PPF's within 200m of altered road

Based on the above screening process, no further analysis or mitigation is required under NZS 6806. That is, the same result is achieved regardless of adopting the NZTA Traffic Guidelines or NZS 6806.

## 6 Conclusions

As the majority of the proposed location of State Highway 1 is significantly further from Rangiriri than the existing highway the noise levels will generally decrease in the area with the introduction of the bypass. The exception is for PPF's 1 to 4 in the area to the north of Rangiriri where the level will increase by up to 10dBA although this is due the existing level being relatively low at 51dBA.

The noise level in Morphy Street (which is currently a cul-de-sac) has increased slightly along the road frontage (up to 4dBA) due to the increased traffic flows on this street.

PPF's 21 and 22 (>67 dBA) are to be removed.

With either a two coat chip seal, which is understood to be adopted, or installing a short New Jersey barrier on the slip lane past dwelling 20, the noise requirements of both the NZTA Traffic Noise Guidelines and the requirements of NZS6806 will be complied with for the design year of 10 years after completion of the realignment. It is noted that this treatment will also satisfy section 16 of the Resource Management Act to adopt the best practicable option to minimise traffic noise.



Nevil Hegley  
November 2010

## Appendix A - Figures

**Figure 1:** Dwg No. C647 Existing and Proposed Roads at Te Kauwhata

**Figure 2:** Dwg No. C645 Existing Roads at Rangiriri

**Figure 3:** Dwg No. C643 Proposed Layout at Rangiriri

**Figure 4:** Waikato Expressway – Rangiriri Section General Arrangement Plan

**Figures 5, 6, 7:** Waikato Expressway – Rangiriri Section Noise Assessment



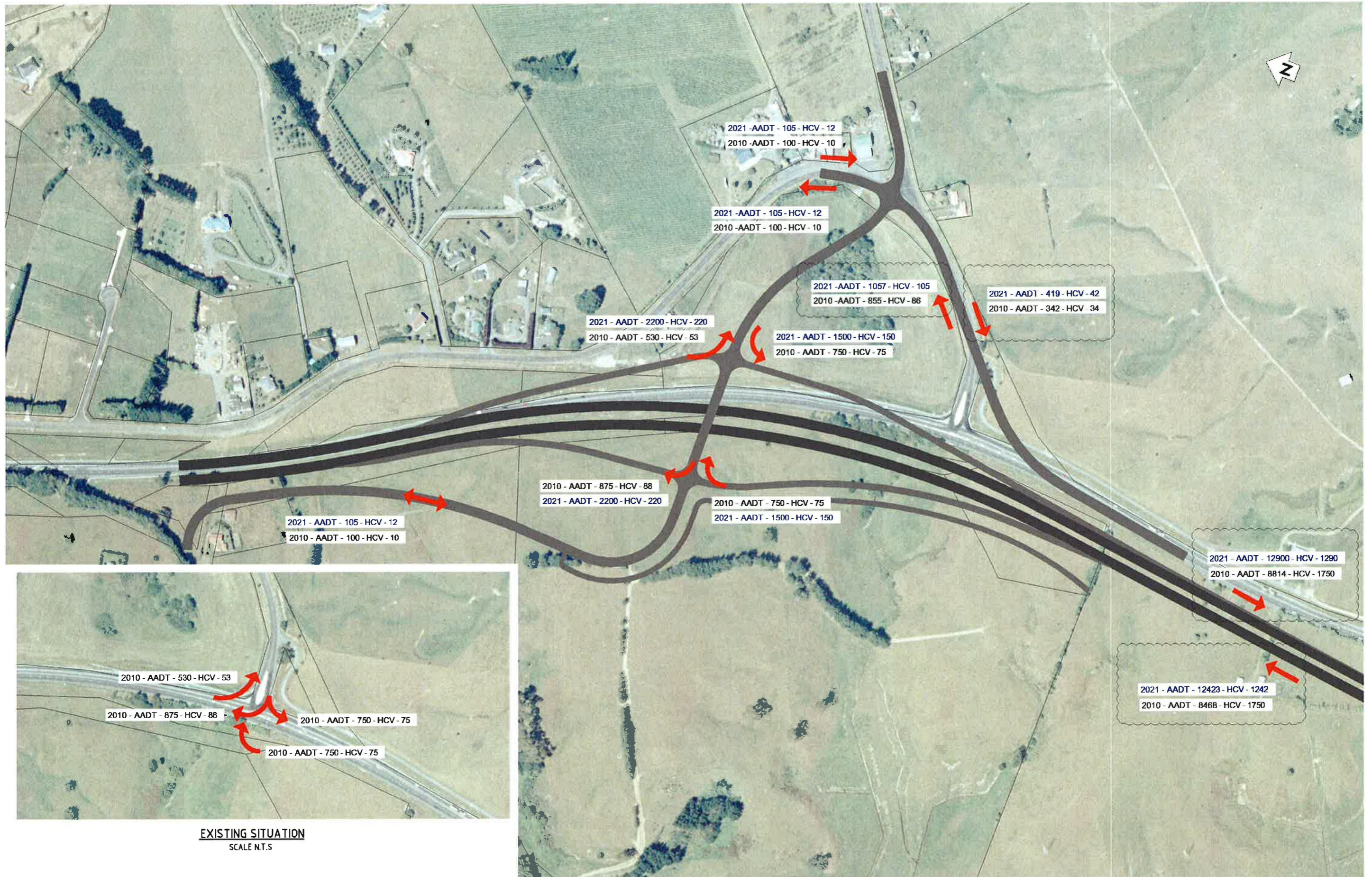


FIGURE 1 – Existing and Proposed Roads at Te Kauwhata





FIGURE 2 – Existing Roads at Rangiriri



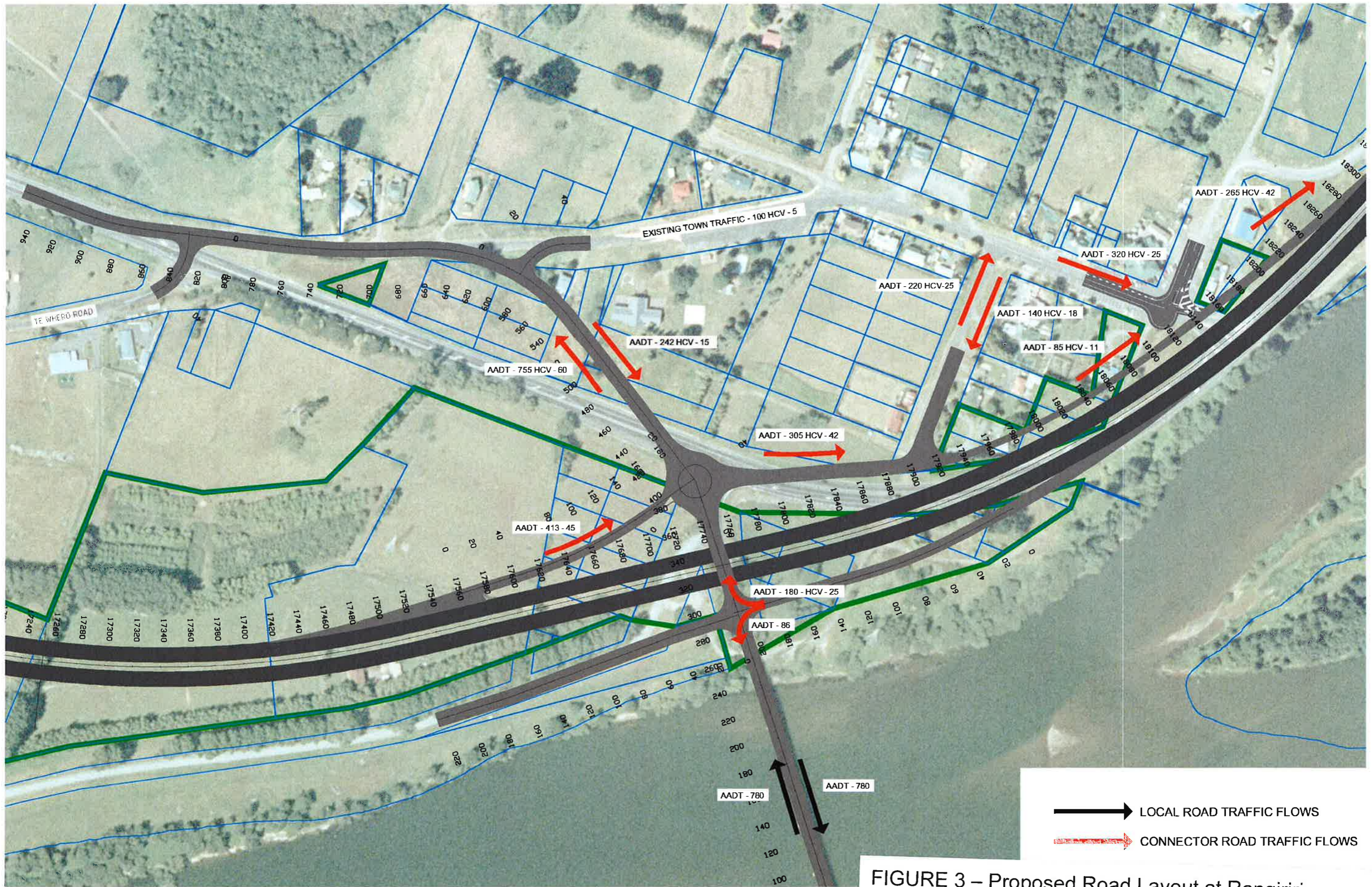


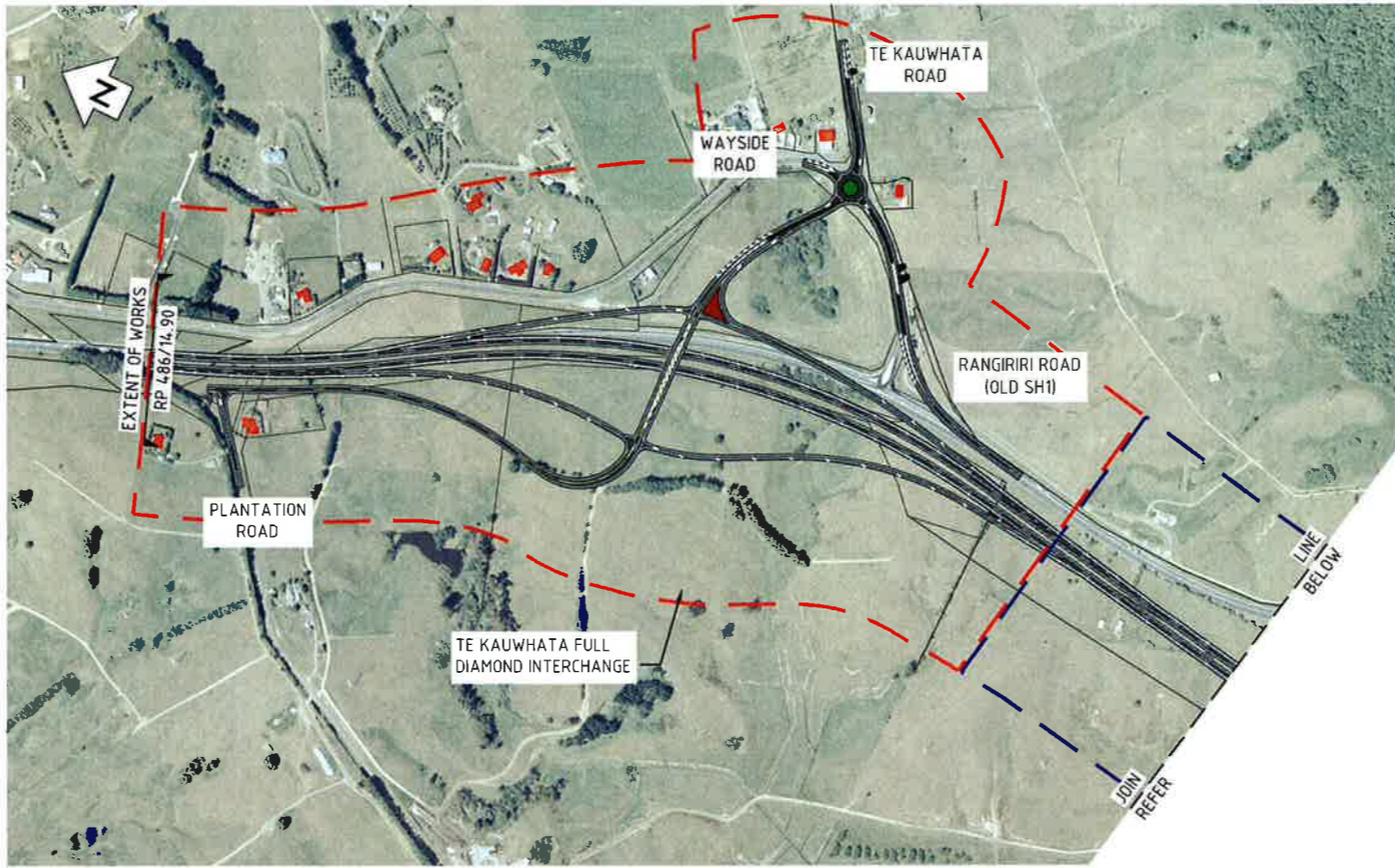
FIGURE 3 – Proposed Road Layout at Rangiriri



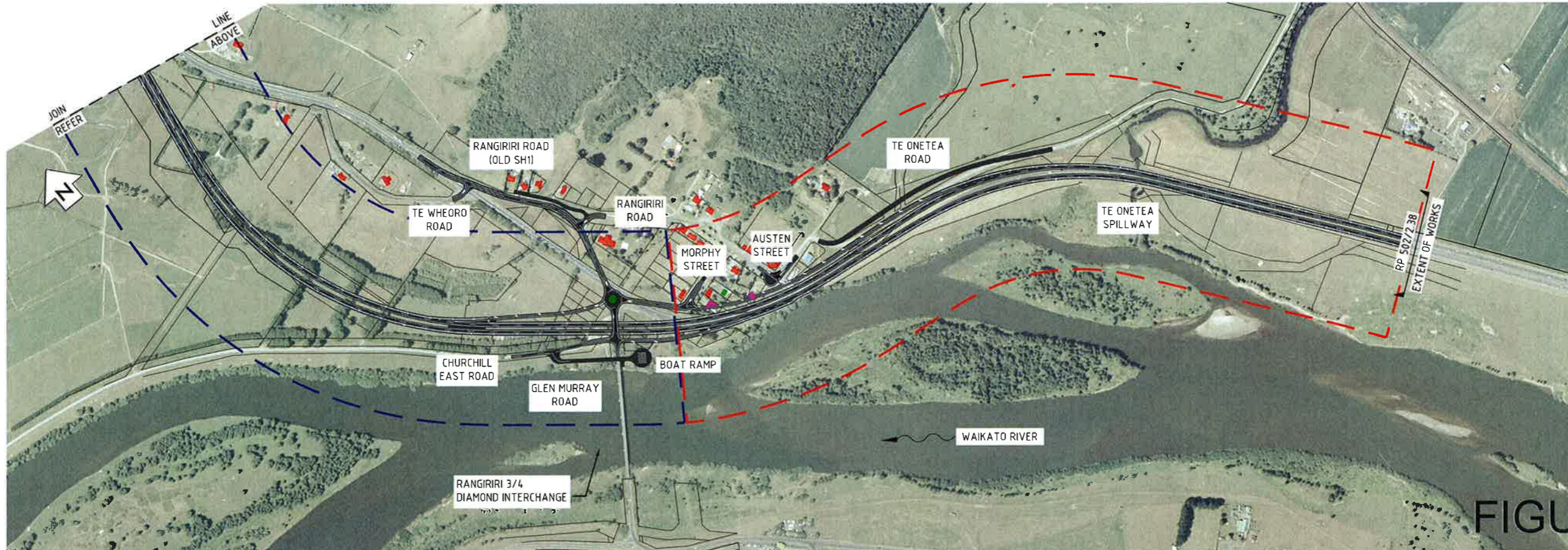
DO NOT SCALE - IF IN DOUBT, ASK

200m  
150  
100  
50  
0

ORIGINAL SIZE A1



**LEGEND:**  
 200m SOUND ENVELOPE  
 - - - - - ALTERED ROADS  
 - - - - - NEW ROADS  
 ———— PROPERTY BOUNDARIES



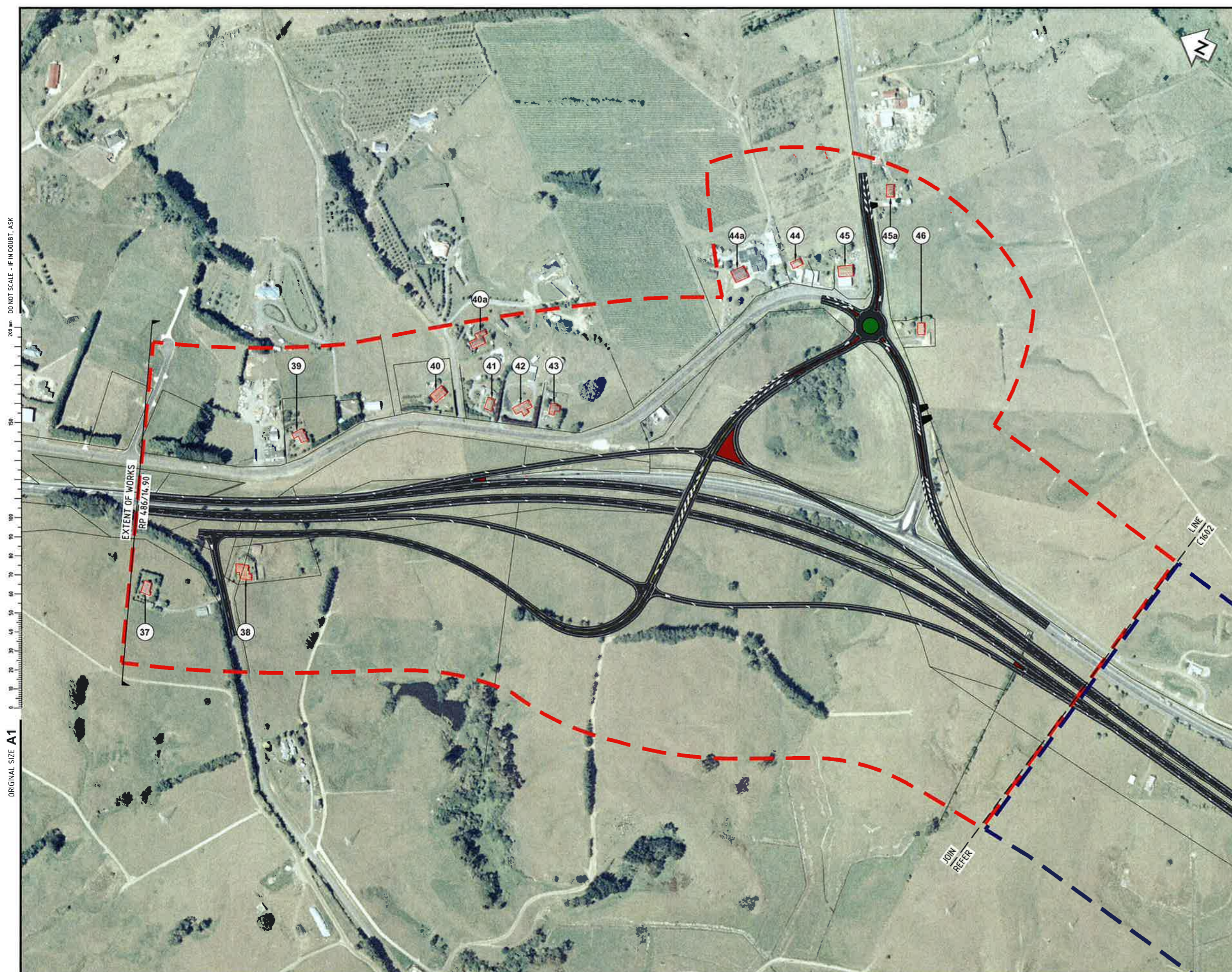
**FIGURE 4**

NOT FOR CONSTRUCTION

SURVEYED DESIGNED DRAWN CHECKED REVIEWED APPROVED		Name Blue Wallace	Date 10/08/2010		SH1 RD3 RS486 WAIKATO E'WAY - RANGIRIRI SECTION RP486 /14.90 - RP502/2.38 NOISE ASSESSMENT: NZS6806 - DO MINIMUM GENERAL LAYOUT	Status Stamp <b>WORKING PLOT</b>	Date Stamp
F AMMENDMENTS MADE TO LEGEND AND TITLE BLOCK INFORMATION E INCORPORATES RELEVANT CHIEF ENGINEERS OR SPECIALIST REVIEWERS COMMENTS D ISSUED FOR SAFETY AUDIT REV REVISIONS		DH DH JH	NO NO GO			07/02/2010 28/01/2010 20/10/2010	SCALES (A1) 1:5000 Drawing No. Z184-9504 Sheet No. C1600 Rev. F

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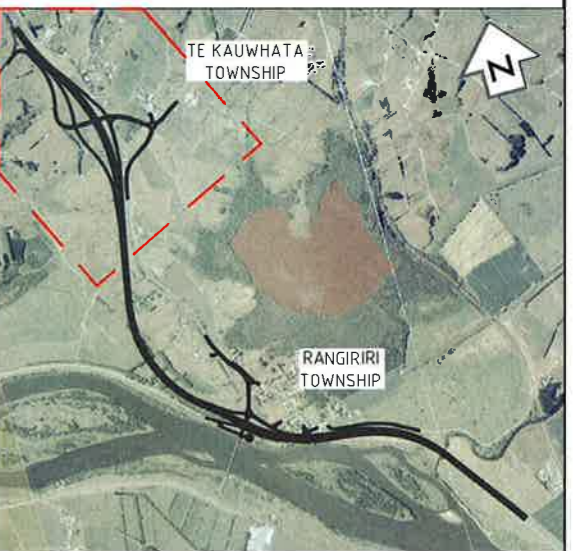
**LEGEND:**

200m SOUND ENVELOPE

- ALTERED ROADS
- NEW ROADS

NOISE LEVEL  
L<sub>Aeq</sub> 24 h IN DB

- <= CATEGORY A
- <= CATEGORY B
- HOUSE TO BE REMOVED
- PROPERTY BOUNDARIES



LOCATION PLAN  
SCALE : NTS

# FIGURE 5

NOT FOR CONSTRUCTION

ORIGINAL SIZE A1  
200mm  
100  
50  
0

REV	REVISIONS	DATE	APPROVED	DATE	APPROVED
F	AMMENDMENTS MADE TO LEGEND AND TITLE BLOCK INFORMATION	07/02/2011	DH	ND	
E	INCORPORATES RELEVANT CHIEF ENGINEERS OR SPECIALIST REVIEWERS COMMENTS	26/01/2011	DH	GS	ND
D	ISSUED FOR SAFETY AUDIT	26/10/2010	JH	GO	ND

Name	Date
SURVEYED Blue Wallace	10/08/2010
DESIGNED	
DRAWN	
CHECKED	
REVIEWED	
APPROVED	



SH1 RD3 RS486  
WAIKATO E'WAY - RANGIRIRI SECTION RP486 /14.90 - RP502/2.38

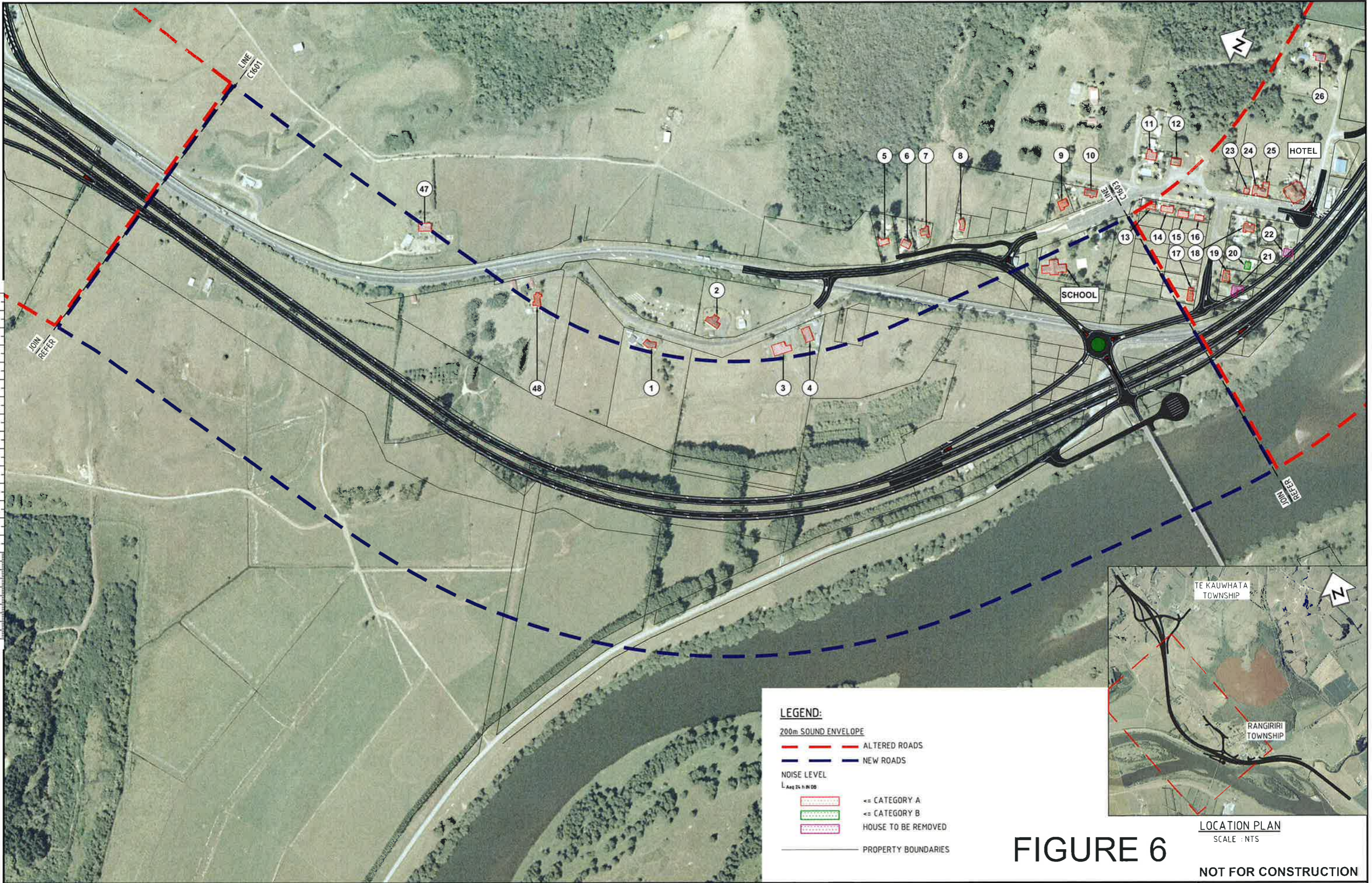
NOISE ASSESSMENT: NZS6806 - DO MINIMUM  
PROPOSED REALIGNMENT WITH NO SPECIFIC NOISE CONTROL TREATMENT - SHEET 1 OF 3

Status Stamp	<b>WORKING PLOT</b>		
Date Stamp			
SCALES (A1)	1:5000	Sheet No.	C1601
Drawing No.	Z1849504	Rev.	F

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ORIGINAL SIZE A1  
DO NOT SCALE - IF IN DOUBT, ASK



**LEGEND:**

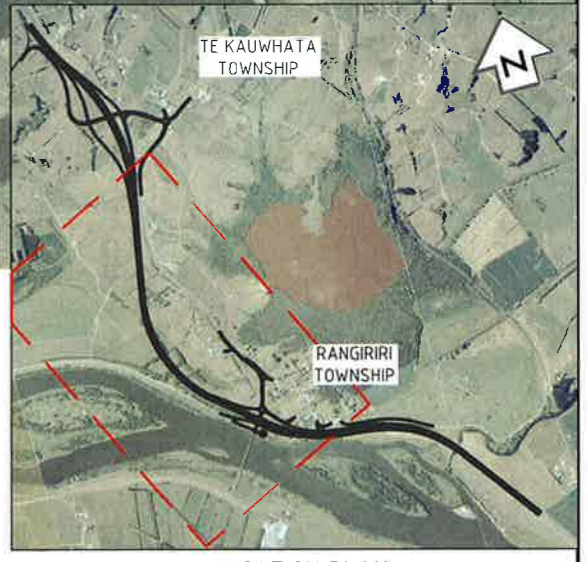
**200m SOUND ENVELOPE**

- ALTERED ROADS
- NEW ROADS

**NOISE LEVEL**  
L<sub>Aeq</sub> 24 h IN DB

- ≤ CATEGORY A
- ≤ CATEGORY B
- HOUSE TO BE REMOVED
- PROPERTY BOUNDARIES

**FIGURE 6**



**LOCATION PLAN**  
SCALE : NTS

**NOT FOR CONSTRUCTION**

REV	REVISIONS	DRAWN	CHECKED	APPROVED	DATE
F	AMMENDMENTS MADE TO LEGEND AND TITLE BLOCK INFORMATION	DH	DH	NO	07/02/2011
E	INCORPORATES RELEVANT CHIEF ENGINEERS OR SPECIALIST REVIEWERS COMMENTS	DH	GS	NO	28/01/2011
D	ISSUED FOR SAFETY AUDIT	JH	GO	NO	20/10/2010

Name	Date
SURVEYED Blue Wallace	10/08/2010
DESIGNED	
DRAWN	
CHECKED	
REVIEWED	
APPROVED	

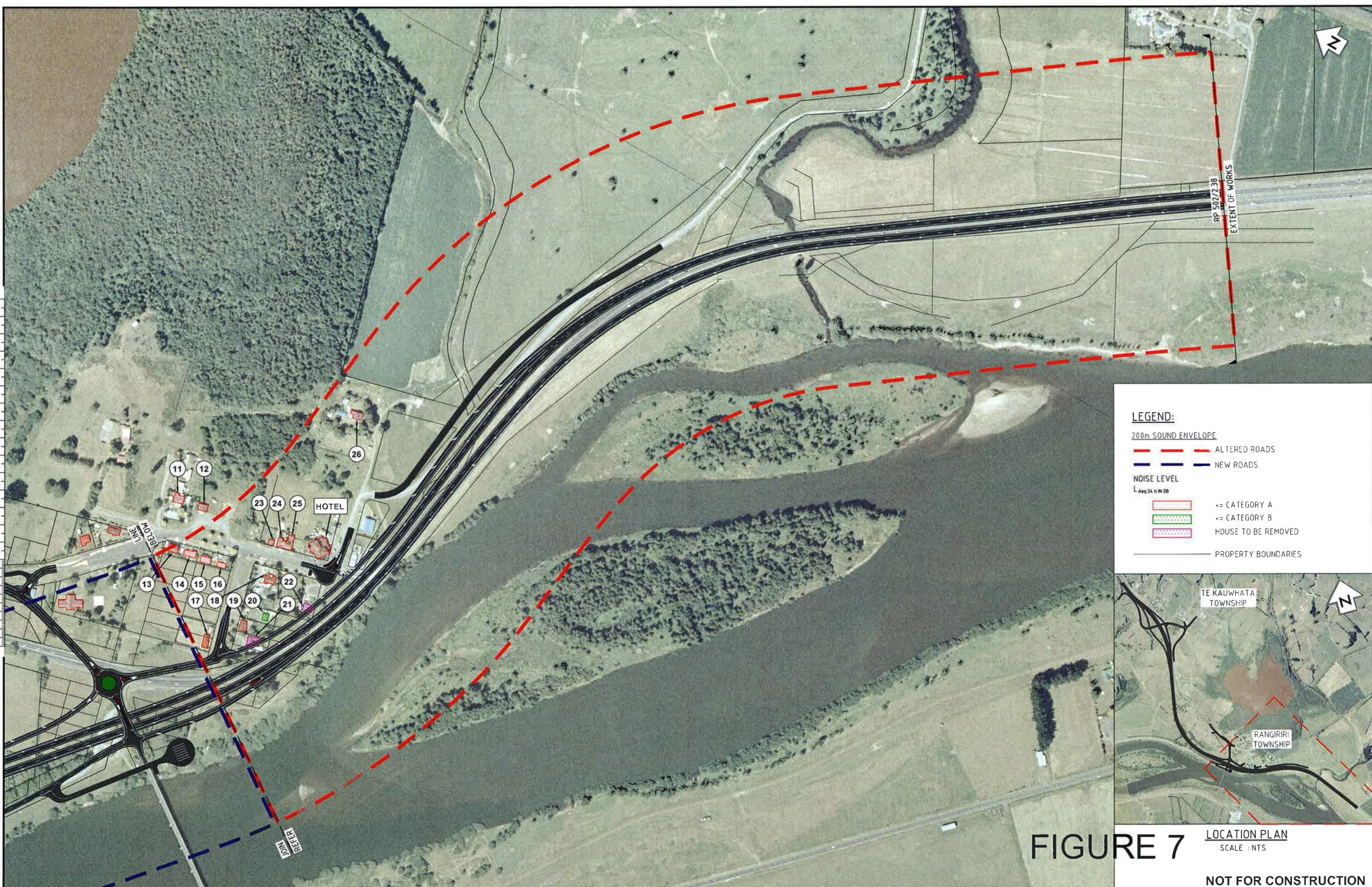


SH1 RD3 RS486  
 WAIKATO E'WAY - RANGIRIRI SECTION RP486 /14.90 - RP502/2.38  
 NOISE ASSESSMENT: NZS6806 - DO MINIMUM  
 PROPOSED REALIGNMENT WITH NO SPECIFIC NOISE CONTROL TREATMENT - SHEET 2 OF 3

Status Stamp	<b>WORKING PLOT</b>		
Date Impl.			
SCALES (A1)	1:5000	Sheet No.	C1602
Drawing No.	Z184.9504	Rev.	F



ORIGINAL SIZE A1



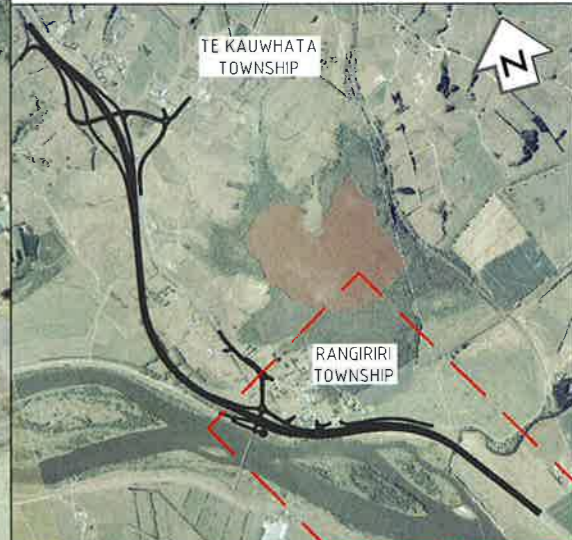
**LEGEND:**

**200m SOUND ENVELOPE**

- Red dashed line: ALTERED ROADS
- Blue dashed line: NEW ROADS

**NOISE LEVEL**  
L<sub>Aeq,24h</sub> IN DB

- Red hatched box: <= CATEGORY A
- Green hatched box: <= CATEGORY B
- Pink hatched box: HOUSE TO BE REMOVED
- Thin black line: PROPERTY BOUNDARIES



**FIGURE 7** LOCATION PLAN  
SCALE : NTS

REV	REVISIONS	DATE	APPROVED	DATE
F	AMMENDMENTS MADE TO LEGEND AND TITLE BLOCK INFORMATION	07/02/2011		
E	INCORPORATES RELEVANT CHIEF ENGINEERS OR SPECIALIST REVIEWERS COMMENTS	28/01/2011		
D	ISSUED FOR SAFETY AUDIT	28/08/2008		

Name	Date
SURVEYED Blue Wallace	10/08/2010
DESIGNED	
DRAWN	
CHECKED	
REVIEWED	
APPROVED	



SH1 RD3 RS486  
 WAIKATO E'WAY - RANGIRIRI SECTION RP486 /14.90 - RP502/2.38  
 NOISE ASSESSMENT: NZS6806 - DO MINIMUM  
 PROPOSED REALIGNMENT WITH NO SPECIFIC NOISE CONTROL TREATMENT - SHEET 3 OF 3

**NOT FOR CONSTRUCTION**

Status Stamp	<b>WORKING PLOT</b>		
Date Stamp			
SCALES (A1)	1:5000		
Drawing No.	Sheet No.	Rev.	
Z1849504	C1603	F	



## **Appendix B - Guide to Noise Terms**

## **Guide to Noise Terms**

The following sets out an explanation of the acoustic terms that will be referred to throughout this report. The aim is not to necessarily provide technical definitions, but to enable a basic understanding of what is meant.

The setting of specific noise levels to control any adverse effects does not necessarily mean that noise will not be heard. Audibility depends on the level of a sound, the loudness of the background sound and any special frequency composition or characteristics that a sound may have.

Research suggests that a small number of people (approximately 10%) will find any noise not of their own making unacceptable. Conversely, there are approximately 25% of the population that are essentially immune to any noise. Neither of these two extremes is normally designed for. In establishing the appropriate noise levels the aim is to try and represent the typical expected community reaction, this will generally be approximately 90% of the people.

In order to reflect community response to noise it is necessary to establish a measure that reflects our attitude to the sounds that we hear. Due to the variability of many sounds (level, tone, duration, intrusiveness above the existing sound, etc) no single descriptor will totally describe the potential community reaction to a sound. For this reason there are a number of terms that need to be understood.

### **dBA**

The basic unit to quantify a sound is the decibel. The A-weighted sound level, or dBA, is a good environmental noise descriptor because of the similarity between A-weighting and the frequency response of the human ear at moderate sound levels. It can also be measured easily. However, it provides no indication of tonal frequency components or unusual frequency distributions of sound that may be the cause of annoyance. Where appropriate, this must be assessed separately.

We can hear a change in sound pressure that varies from 1 (taken as the threshold of hearing) through to 1,000,000,000,000 (taken as the threshold of pain). In order to bring these numbers to a more manageable size a logarithmic scale is normally adopted. This reduces the above values to 0 and 12 respectively. The decibel is then described as 10 times the logarithm of the ratio of the pressure level of interest, to a reference pressure level. Thus the scale becomes 0 to 120dBA.

Some typical subjective changes in noise levels are:

A change of 3dBA is just perceptible

A change of 5dBA is clearly perceptible

A change of 10dBA is twice (or half) as loud

Because we use a logarithmic scale care must be taken when adding sound levels. Two equal noise sources raises the level of one source by 3dBA. It takes 10 equal noise sources to raise the level of one source by 10dBA. ie  $60\text{dBA} + 60\text{dBA} = 63\text{dBA}$  and  $60\text{dBA} \times 10 = 70\text{dBA}$ .

#### **Maximum Sound Level ( $L_{\text{max}}$ )**

This unit equates to the highest (maximum) sound level for a defined measurement period. It is adopted in NZS6802:1991 Assessment of Environmental Sound, mainly as a method of protecting sleep.

#### **$L_{10}$**

The sound level which is equaled or exceeded for 10% of the measurement time. This level is adopted in NZS6802:1991 Assessment of Environmental Sound to measure intrusive sound. This level may be considered as the average maximum sound level.

#### **Background Sound $L_{95}$**

The sound level which is equaled or exceeded for 95% of the measurement time. This level is adopted in NZS6802:1991 Assessment of Environmental Sound to measure the background sound. This level may be considered as the average minimum sound level and is the component of sound that subjectively is perceived as continuously present.



### **Equivalent Sound Level ( $L_{eq}$ )**

The  $L_{eq}$  may be considered as the continuous steady noise level that would have the same total A-weighted acoustic energy as a fluctuating noise over the same time period.

### **Day Night Level, $L_{dn}$**

The day/night level ( $L_{dn}$ ) is defined as the time-average sound level in decibels (re  $20\mu\text{Pa}$ ) over a 24 hour period from midnight to midnight) with the addition of 10dB to nighttime levels during the period from midnight to 07.00 hours and from 22.00 hours to midnight, to take account of the increased annoyance caused by noise at night.

### **Ambient Sound**

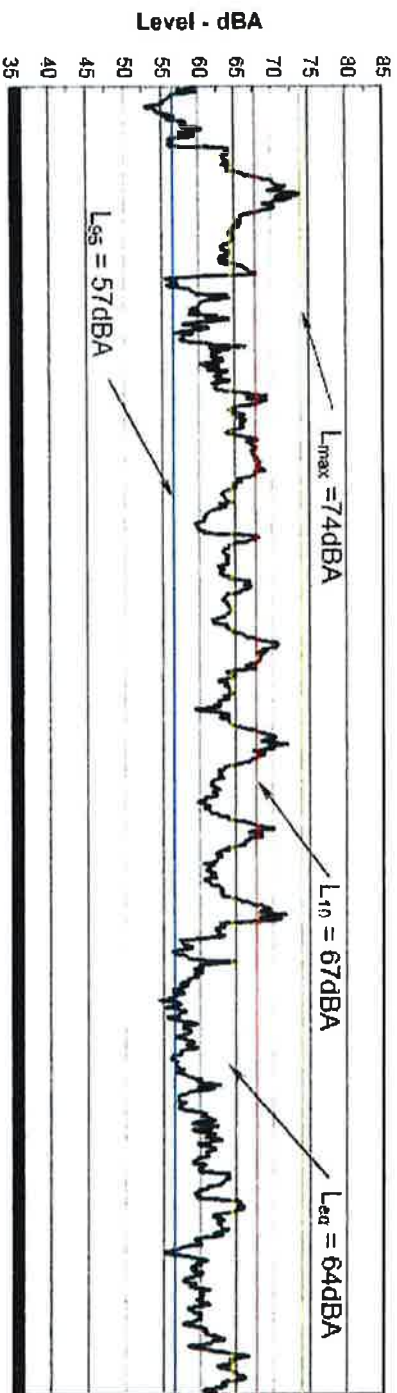
The ambient sound is normally used to describe the total noise environment. The ambient sound is often measured as the 24 hour  $L_{eq}$ , which is an average value over the 24 hour period. Shorter times are often used, such as the daytime period

### **Notional Boundary**

The notional boundary is defined as a line 20 metres from the facade of any rural dwelling or the legal boundary where this is closer to the dwelling.

Figure A1 shows a noise trace with the relationship of  $L_{max}$ ,  $L_{10}$ ,  $L_{95}$  and  $L_{eq}$  values when including all events over the 15 minute measurement period and Figure A2 some typical noise levels.

\* \* \*



$L_{max}$  is the maximum noise level  
 $L_{10}$  is the noise level that is equaled or exceeded for 10% of the measurement period  
 $L_{95}$  is the noise level that is equaled or exceeded for 95% of the measurement period  
 $L_{eq}$  is the noise level that contains the same energy as the time varying noise

Figure A1

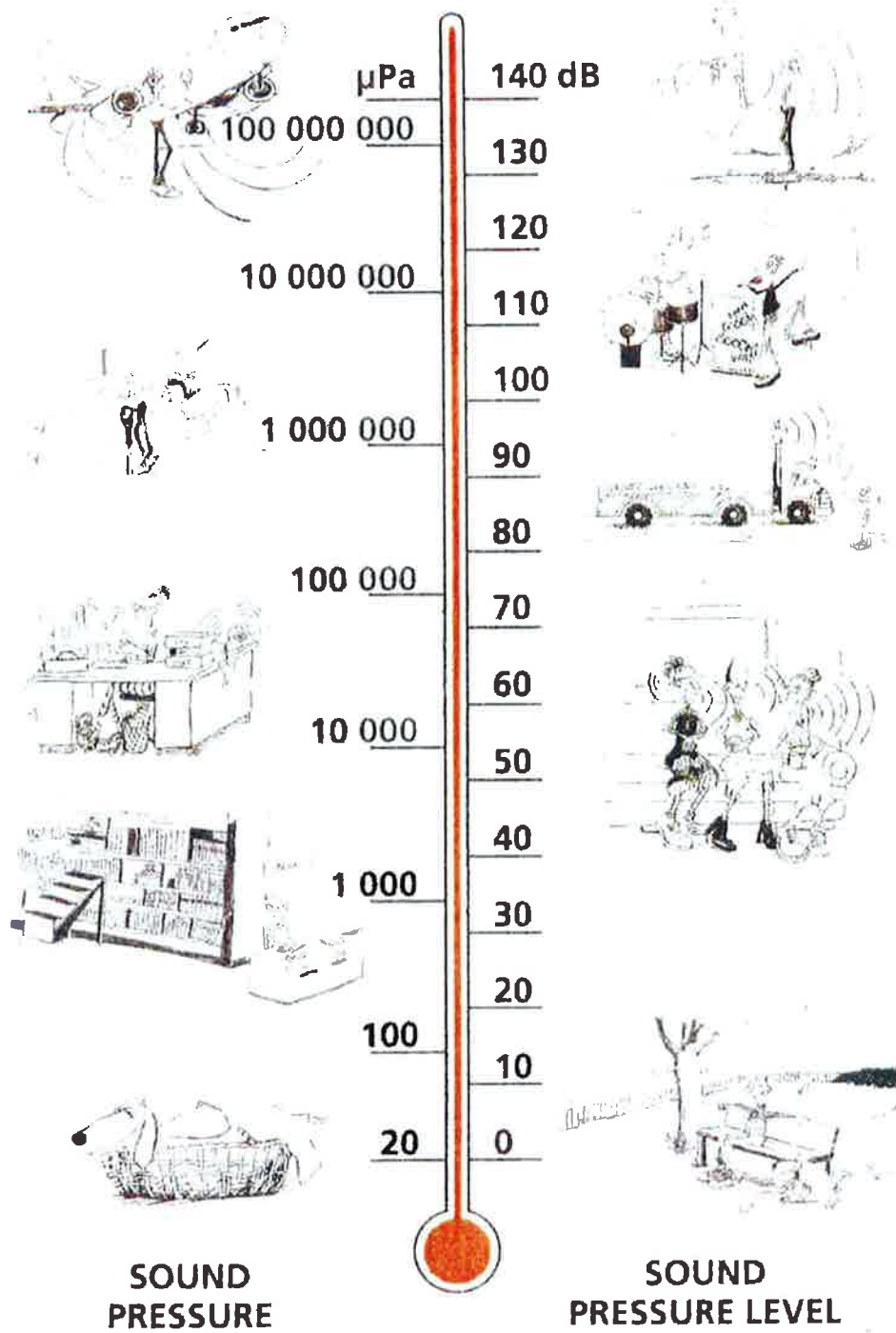


Figure A2