I hereby give notice that a hearing by commissioners will be held on:

Date:	**Mondays through Thursdays from 18 September until 12 October 2023**
Time:	**9:30am**
Meeting Room:	**Council Chambers**
Venue:	**Level 2, Henderson Civic, 3 Smythe Road, Henderson, Auckland 0612**

NOTIFICATION MATERIAL

VOLUME 03

NORTH-WEST STRATEGIC PROJECTS

TE TUPU NGĀTAHI SUPPORTING GROWTH

AUCKLAND TRANSPORT & WAKA KOTAHI NZ TRANSPORT AGENCY

COMMISSIONERS

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VOLUME 01 **TABLE OF CONTENTS** **PAGE NO.**
STR-PART 1
North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 1

NoR S1: Alternative State Highway

Attachment 01	S1 – Public Notice	5-8
Attachment 02	S1 – Form 18	9-100
Attachment 03	S1 – General Arrangement Plans – Alternative State Highway – Part 1 of 2	101-114
Attachment 04	S1 – General Arrangement Plans – Alternative State Highway – Part 2 of 2	115-128

NoR S2: State Highway 16 (SH16) Main Road (Huapai)

Attachment 05	S2 – Public Notice	129-132
Attachment 06	S2 – Form 18	133-194
Attachment 07	S2 – General Arrangement Plans – Highway 16 Main Road – Part 1 of 5	195-198
Attachment 08	S2 – General Arrangement Plans – Highway 16 Main Road – Part 2 of 5	199-202
Attachment 09	S2 – General Arrangement Plans – Highway 16 Main Road – Part 3 of 5	203-206
Attachment 10	S2 – General Arrangement Plans – Highway 16 Main Road – Part 4 of 5	207-210
Attachment 11	S2 – General Arrangement Plans – Highway 16 Main Road – Part 5 of 5	211-214

NoR S3: Rapid Transit Corridor (Kumeū)

Attachment 12	S3 – Public Notice	215-218
Attachment 13	S3 – Form 18	219-310
Attachment 14	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 1 of 10	311-314
Attachment 15	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 2 of 10	315-318
Attachment 16	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 3 of 10	319-322
Attachment 17	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 4 of 10	323-326
Attachment 18	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 5 of 10	327-330
Attachment 19	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 6 of 10	331-334
Attachment 20	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 7 of 10	335-338
Attachment 21	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 8 of 10	339-342

Attachment 22	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 9 of 10	343-346
Attachment 23	S3 – General Arrangement Plans – Rapid Transit Corridor – Part 10 of 10	347-350
NoR KS: Kumeū Rapid Transit Station		
Attachment 24	KS – Public Notice	351-354
Attachment 25	KS – Form 18	355-388
Attachment 26	KS – General Arrangement Plans – Kumeū Station	389-392
NoR HS: Huapai Rapid Transit Station		
Attachment 27	HS – Public Notice	393-396
Attachment 28	HS – Form 18	397-432
Attachment 29	HS – General Arrangement Plans – Huapai Station	433-438
NoR S4: Access Road (Kumeū)		
Attachment 30	S4 – Public Notice	439-442
Attachment 31	S4 – Form 18	443-490
Attachment 32	S4 – Access Road – Proposed Conditions	491-520
Attachment 33	S4 – General Arrangement Plans – Access Road – Part 1 of 2	521-526
Attachment 34	S4 – General Arrangement Plans – Access Road – Part 2 of 2	527-530
Attachment 35	North-West Strategic – Assessment of Effects on the Environment	531-760
VOLUME 02 STR-PART 2	**TABLE OF CONTENTS**	**PAGE NO.**
North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 2		
Attachment 36	North-West Strategic – Assessment of Alternatives	5-192
Attachment 37	North-West Strategic – Proposed Conditions – Part 1 of 3	193-240
Attachment 38	North-West Strategic – Proposed Conditions – Part 2 of 3	241-258
Attachment 39	North-West Strategic – Proposed Conditions – Part 3 of 3	259-276
Attachment 40	North-West Strategic – General Arrangement Plans - Strategic	277-280

Attachment 41	North-West Strategic – Assessment of Transport Effects	281-436
Attachment 42	North-West Strategic – Assessment of Construction Noise and Vibration Effects – Part 1 of 3	437-508
Attachment 43	North-West Strategic – Assessment of Construction Noise and Vibration Effects – Part 2 of 3	509-552
Attachment 44	North-West Strategic – Assessment of Construction Noise and Vibration Effects – Part 3 of 3	553-580

VOLUME 03 STR-PART 3	**TABLE OF CONTENTS**	**PAGE NO.**

North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 3

Attachment 45	North-West Strategic – Assessment of Operational Noise Effects	5-108
Attachment 46	North-West Strategic – Social Impact Assessment	109-186
Attachment 47	North-West Strategic – Assessment of Flooding Effects	187-270
Attachment 48	North-West Strategic – Assessment of Ecological Effects – Part 1 of 3	271-536

VOLUME 04 STR-PART 4	**TABLE OF CONTENTS**	**PAGE NO.**

North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 4

Attachment 49	North-West Strategic – Assessment of Ecological Effects – Part 2 of 3	5-178
Attachment 50	North-West Strategic – Assessment of Ecological Effects – Part 3 of 3	179-216
Attachment 51	North-West Strategic – Assessment of Landscape Effects – Part 1 of 4	217-372
Attachment 52	North-West Strategic – Assessment of Landscape Effects – Part 2 of 4	373-392
Attachment 53	North-West Strategic – Assessment of Landscape Effects – Part 3 of 4	393-414
Attachment 54	North-West Strategic – Assessment of Landscape Effects – Part 4 of 4	415-426
Attachment 55	North-West Strategic – Assessment of Historic (Built) Heritage / Effects	427-484
Attachment 56	North-West Strategic – Assessment of Heritage / Archaeology Effects	485-576
Attachment 57	North-West Strategic – Urban Design Framework Evaluation	577-660
Attachment 58	Cultural Impact Assessment	661-714

ATTACHMENT 45

NORTH-WEST STRATEGIC
ASSESSMENT OF OPERATIONAL NOISE EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Assessment of Operational Noise Effects

December 2022

Version 1

Document Status

Responsibility	Name
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Table of Contents

1 Executive Summary 1
2 Introduction 4
2.1 Purpose and Scope of this Report 4
2.2 Report Structure 5
2.3 Preparation for this Report 5
3 Performance standards 6
3.1 Noise 6
3.1.1 Guidelines and Standards reviewed 6
3.1.2 Road traffic noise 6
3.1.3 Station noise 8
3.1.4 Subjective perception of noise level changes 9
3.2 Vibration 10
3.2.1 Norwegian Standard NS 8176.E:2005 10
3.2.2 Road traffic 11
4 Existing Noise Environment 12
4.1 Surveys 12
4.2 Modelling 13
5 Assessment Methodology 14
5.1 Assumptions 14
5.2 Assessment basis 14
5.3 Computer noise modelling 15
5.3.1 Individual receiver noise levels 17
5.3.2 Noise contour plans 17
5.4 Assessment of operational vibration 17
6 Strategic Assessment Package Overview 18
7 Positive Effects 20
8 Recommended Measures to Avoid, Remedy or Mitigate Transport Noise Effects 21
8.1 Road traffic noise 21
8.2 RTC Station noise 22
8.3 Final measures 22
9 NoR S1: Alternative State Highway, including Brigham Creek Interchange 23
9.1 Project Corridor Features 23
9.2 Existing and Likely Future Environment 24
9.2.1 Planning context 24
9.2.2 Existing and Future Noise Environment 24
9.2.3 Buildings inside designation 25
9.3 Assessment of Road Traffic Noise Effects 25

9.3.1 NZS6806 26
9.3.2 Change in Noise Levels 29

9.4 Conclusions 31

10 NoR S2: SH16 Main Road Upgrade 32

10.1 Project Corridor Features 32
10.2 Existing and Likely Future Environment 33

10.2.1 Planning context 33
10.2.2 Existing and Future Noise Environment 34
10.2.3 Buildings inside designation 34

10.3 Assessment of Road Traffic Noise Effects 34

10.3.1 NZS6806 34
10.3.2 Change in Noise Levels 35

10.4 Conclusions 36

11 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station 37

11.1 Project Corridor Features 37
11.2 Existing and Likely Future Environment 39

11.2.1 Planning context 39
11.2.2 Existing and Future Noise Environment 41
11.2.3 Buildings inside designation 41

11.3 Assessment of Operational Noise Effects 41

11.3.1 Road Based Noise 42
11.3.2 Station Noise 43

11.4 Conclusions 43

12 NoR S4: Access Road Upgrade 44

12.1 Project Corridor Features 44
12.2 Existing and Likely Future Environment 45

12.2.1 Planning context 45
12.2.2 Existing and Future Noise Environment 45
12.2.3 Buildings inside designation 46

12.3 Assessment of Road Traffic Noise Effects 46

12.3.1 NZS6806 46
12.3.2 Change in Noise Levels 47

12.4 Conclusions 48

13 Conclusion 49

13.1.1 New Road 52

Appendices

Appendix A: Predicted Noise Levels at all PPFs
Appendix B: Noise Level Contours and NZS 6806 Categories

Table of Figures

Figure 3-1: Indicative Urban/Rural classification in accordance with Statistics NZ 7

Figure 4-1: Noise survey locations 13

Figure 6-1: North West Strategic Assessment Package – Overview of NoRs for Assessment 18

Figure 9-1: Overview of the Alternative State Highway, including Brigham Creek Interchange 23

Figure 9-2: New and Altered Road sections within NoR S1 26

Figure 9-34: Change in noise level 30

Figure 9-56: Change in noise level 31

Figure 10-1: Overview of the SH16 Main Road Upgrade 32

Figure 10-2: Change in noise level 36

Figure 11-1: Rapid Transit Corridor and Regional Active Mode Corridor Overview 38

Figure 11-2: New and Altered Road sections within NoR S3 (Bus RTC)...42

Figure 12-1: Overview of Access Road Upgrade 44

Figure 12-2: Change in noise level 48

Table of Tables

Table 2-1: North West Strategic Assessment Package – Notices of Requirement and Projects 4

Table 3-1: Traffic noise criteria categories 8

Table 3-2: AUP:OP noise limits for Station locations 9

Table 3-3: Noise level change compared with general subjective perception 10

Table 3-4: Human response criteria for transport sources in NS 8176.E:2005 10

Table 4-1: Noise level survey results...12

Table 4-2: Number of PPFs in each NoR 13

Table 5-1: Computer noise model verification 16

Table 6-1: Strategic Assessment Package Project Summary...18

Table 9-1: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment...24

Table 9-2: Buildings inside designation (not assessed) 25

Table 9-3: Summary of NZS 6806 assessment – Altered Road 27

Table 9-4: Summary of NZS 6806 assessment – New Road..29

Table 10-1: SH16 Main Road Upgrade Existing and Likely Future Environment 33

Table 10-2: Buildings inside designation (not assessed) 34

Table 10-3: Summary of NZS 6806 assessment – Altered Road 35
Table 11-1: RTC and RAMC Existing and Likely Future Environment...39
Table 11-2: Kumeū Rapid Transit Station Existing and Likely Future Environment 40
Table 11-3: Huapai Rapid Transit Station Existing and Likely Future Environment 40
Table 11-4: Buildings inside designation (not assessed) 41
Table 12-1: Access Road Upgrade Existing and Likely Future Environment 45
Table 12-2: Buildings inside designation (not assessed) 46
Table 12-3: Summary of NZS 6806 assessment – Altered Road 47

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
BPO	Best Practicable Option in accordance with Section 16 of the RMA
CC2W	City Centre to Westgate
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Strategic Assessment Package	Four Notices of Requirement (for ASH, RTC, Station Road and SH16) and one alteration to an existing designation (SH16 Main Road) for the Whenuapai Arterial Transport Network for Auckland Transport.
Projects	North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement for Waka Kotahi NZ Transport Agency and Auckland Transport

1 Executive Summary

This assessment assesses operational noise from road and station operations, and road vibration against relevant standards and guidelines. Where necessary, we have investigated and recommended mitigation.

Road traffic noise for any new or altered roads as well as bus rapid transit has been assessed against NZS6806 and other relevant guidance, including the Waka Kotahi "Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects". In addition, we have assessed the change in noise level due to the Projects. We have assessed potential noise levels and recommended mitigation to achieve compliance with the recommended limits.

Station noise has been assessed against the underlying zone noise limits of the AUP:OP.

Walking and cycling are not expected to generate noise levels high enough to affect the ambient noise environment, especially where the facilities are adjacent to busy roads.

The Strategic Assessment Package results in a redistribution of traffic across the wider area. It enables people to choose different transport modes (other than cars) and therefore results in a redistribution of traffic, including freight and inter-regional trips from SH16 Main Road to the Alternative State Highway.

NoR S1 Alternative State highway (ASH), including Brigham Creek Interchange (BCI)

Results of assessment and recommended measures

The ASH corridor, including the BCI, is within a largely rural area, with the exception of the connections to the existing SH16, where residential and business uses prevail. Intermittent rural dwellings are generally located 50 metres or more from the road.

We have assessed the traffic noise levels from the proposed ASH and BCI against NZS6806. The introduction of a new major road into a currently low noise mainly rural environment is predicted to result in significant noise level increases for some PPFs, especially in the area removed from other main roads. This section of the Project is assessed as a New road. Where the ASH connects with SH16 (where it is assessed as an Altered road), the change in traffic volume due to the suite of NoRs discussed in this report and the proposed mitigation measures will result in a reduction in noise level.

The ASH is assumed to be constructed using low noise road surface (Open Graded Porous Asphalt PA10 has been assumed in the modellingPA10). In addition, 2.4m high roadside barriers along the ASH and 2m high boundary fences at some PPFs will ensure that no PPFs would receive noise levels within Category C, and that more PPFs would receive noise levels within Category A than would be the case without the Project. While one third of PPFs are predicted to receive noticeable to significant noise level increases (generally adjacent to the New road) , with mitigation the resultant noise levels are acceptable for residential use.

Conclusion

Overall, with the barrier mitigation implemented as recommended, the effect of the Project is on average positive, with two thirds of PPFs receiving noise levels that are at or below the levels that would be experienced without the Project.

NoR S2 SH16 Main Road Upgrade

Results of assessment and recommended measures

The SH16 Main Road upgrade will alter an existing designation which already authorises the operation of the road. The proposed alteration will provide walking and cycling facilities, without the provision of additional traffic capacity.

The proposed establishment of walking and cycling facilities along SH16 is predicted to not cause any appreciable noise level change. The noise environment is currently, and will remain, controlled by traffic on SH16. No additional traffic capacity is created on SH16; rather, changes to lane configurations and intersections upgrades are introduced to make walking and cycling safer. These changes do not cause any noticeable effect on the overall noise environment.

We have not proposed any additional mitigation given the works involve walking and cycling upgrades and do not significantly affect traffic lanes

Without the North West Strategic Package implementation, noise levels in the future will continue to increase significantly and range from around 60 to 70 dB $L_{Aeq(24h)}$ at the walking and cycling paths.

Conclusion

Overall, we predict a noise level reduction in the vicinity of SH16, due to the redistribution of traffic across the area as a function of the suite of NoRs assessed in this report. Traffic volumes will reduce, with many using the proposed ASH. This effect is not due to the project, but the overall changes anticipated in the area.

NoR S3 Rapid Transit Corridor (RTC) and Regional Active Mode Corridor (RAMC); NoR KS Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

Results of assessment and recommended measures

The RTC and RAMC will straddle the Rural Urban Boundary and connect Kumeū-Huapai with Westgate and Auckland City. The alignment traverses two distinct sections. The rural section connects BCI with the existing SH16 via the North Auckland Line (NAL). In this area, existing noise levels are in the 50s dB L_{Aeq} with intermittent noise from trains passing. The urban section along SH16 Main Road, with elevated noise levels of mid-60 to low 70 dB L_{Aeq}. For sections the corridor will be co-located with other SGA North West Strategic Projects (i.e. NoR1 ASH and NoR 2 SH16 Main Road). Should the ASH already have been implemented, existing noise levels at time of implementation would be higher than currently, due to the increased traffic in a currently rural area. The RTC will accommodate electric bus transport.

The two stations are both located in the vicinity of the existing SH16. The Kumeū Station is located in a business area with ambient noise levels in the mid to high-60 dB L_{Aeq}, which is unlikely to change in the future. Huapai Station is located in the Future Urban Zone (FUZ) adjacent to SH16, with ambient noise levels affected by SH16 and in the low to mid-60 dB L_{Aeq}. The land is currently used for rural activities. Noise levels in the area will remain affected by traffic on SH16 even when the FUZ is developed.

NoR S3 is intended to facilitate electric bus transport. We predict minimal effects on the overall noise environment. The buses would be co-located with existing transport routes (rail and road) and, provided that the road surface is well maintained, buses would add only marginally to the overall noise level experienced by PPFs in the vicinity of the road.

Stations can be designed so that compliance with the relevant noise limits can be achieved. Closest sensitive receivers are at significant distances. Therefore, we do not anticipate that station noise will have any significant effect on the overall noise environment.

Conclusions

It is unlikely that specific mitigation will be required for the electric bus based RTC, provided that the road is maintained as a smooth and even surface. With appropriate design effects from the RTC and stations will be reasonable and may not be noticeable when adjacent to major roads.

NoR S4 Access Road

Results of assessment and recommended measures

Access Road is an existing road in a currently rural area. Existing noise levels are relatively low, given the distance from any major transport or commercial areas, except where Access Road connects with SH16. Should the ASH have been implemented already, ambient noise levels would be somewhat more elevated due to the new transport route.

It is proposed to widen the existing road and provide walking and cycling facilities. The proposed widening will bring traffic lanes closer to some dwellings. However, if the suite of NoRs discussed in this report are all implemented (as has been assumed for the design year 2048), an overall reduction in traffic volume is predicted on Access Road.

With the Project in place, including the proposed mitigation in the form of 2m boundary fences at two PPFs (59 and 76 Tawa Road), only one PPF (25 Tawa Road), which is a double storey dwelling, is predicted to receive noise levels in Category B. A barrier would need to be impracticably high to reduce the noise level at the upper floor.

Conclusions

With the Project in place and including other local roads in the area that are unaffected by the Project, the noise level is predicted to generally reduce by an average of 3 dB.

Overall Conclusion

Overall, the implementation of the suite of NoRs will have a positive effect on the traffic noise levels in the wider area as traffic is redistributed and more transport options are offered.

1 Introduction

This operational noise assessment has been prepared for the North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement (**NoRs**) for Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) (the "**Strategic Assessment Package**" and the "**Projects**").

The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

The Strategic Assessment Package will provide route protection for the strategic projects, which include:

- Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
- the Rapid Transit Corridor (RTC), including the Regional Active Mode Corridor (RAMC)
- Kumeū Rapid Transit Station
- Huapai Rapid Transit Station
- State Highway 16 (**SH16**) Main Road Upgrade

It also includes the upgrade of Access Road, a local arterial corridor within Kumeū-Huapai:

This report assesses the operational noise effects of the North West Strategic Assessment Package identified in Figure 5-1 and Table 1-1 below. Refer to the main AEE for a more detailed project description.

Table 1-1: North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR KS	Kumeū Rapid Transit Station
NoR HS	Huapai Rapid Transit Station
NoR S4	Access Road Upgrade

1.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Strategic Assessment Package. Its purpose is to inform the AEE that accompanies the Strategic Assessment Package sought by Waka Kotahi and AT.

This report considers the actual and potential effects of the Strategic Assessment Package on the existing and likely future environment as it relates to operational noise effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the ambient noise context of the Strategic Assessment Package area;
b) Identify and describe the actual and potential operational noise effects of each Project corridor within the Strategic Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential operational noise effects (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package; and
d) Present an overall conclusion of the level of actual and potential operational noise effects for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

Construction noise and vibration effects are assessed against different standards and criteria and are addressed in a different report.

1.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Strategic Assessment Package as it relates to operational noise;
c) Identification and description of the existing and likely future noise environment;
d) Description of the actual and potential operational noise effects of the Strategic Assessment Package;
e) Recommended measures to avoid, remedy or mitigate potential adverse operational noise effects; and
f) Overall conclusion of the level of potential operational noise effects of the Strategic Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Strategic Assessment Package. These have been reviewed by the author of this report and have been considered as part of this assessment of operational noise effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

1.3 Preparation for this Report

When preparing this report, we have relied on information from other experts, namely traffic, design and planning. We attended several team meetings where the information was discussed and undertook a site visit along all NoR alignments where this was publicly accessible.

We have reviewed relevant standards and guidance in relation to road-traffic noise and vibration.

Where information we rely on was provided by other experts, this is noted in the report.

2 Performance standards

New designations are sought for the Strategic Assessment Package, for all NoRs, except for NoR S1 (SH16 Main Road), which is an alteration to an existing designation. Therefore, we have reviewed a variety of criteria and standards and have recommended the operational performance standards that in our opinion should apply to all Projects irrespective of the requiring authority implementing it.

2.1 Noise

2.1.1 Guidelines and Standards reviewed

We reviewed the following guidelines and standards for the assessment traffic noise:

- AUP:OP, specifically rule E25.6.33 relating to transport noise and referencing NZ6806
- NZS6806:2010 Acoustics – Road-traffic Noise – New and altered roads
- Waka Kotahi's "Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects" (**Guide**), V1.1, August 2016

We recommend applying the requirements of NZS6806.

For NoR S1 and S2 (as appropriate), we recommend that the additional information provided in the Guide is applied to these projects. The Guide describes how NZS6806 should be implemented. It describes some Waka Kotahi specific processes, such as the use of a Waka Kotahi internal matrix of project discipline feedback when determining the BPO for noise mitigation. Overall, the Guide provides background on how to implement NZS6806, and is therefore a useful complimentary document to the Standard.

2.1.2 Road traffic noise

Road traffic noise is assessed in accordance with NZS6806. This Standard has been adopted by Waka Kotahi and is also required by the AUP:OP.

We consider the intent of NZS6806 is to provide a pragmatic approach to the use of noise mitigation. This approach includes the requirement that a roading project needs to have a noticeable noise effect before mitigation is considered, and that any mitigation needs to achieve a noticeable reduction in noise level.

NZS6806 applies to traffic noise assessments where a project falls within its thresholds, which are briefly explained below.

- **Assessment Positions** are described as "Protected Premises and Facilities" (**PPFs**). PPFs include dwellings (including those that have building consent but are not built yet), educational facilities and their playgrounds within 20m of any school building, boarding houses, retirement villages, Marae, hospitals with in-patient facilities and motels/hotels in residential zones.

  Note that:

  - Areas earmarked for future residential development are not PPFs as the location and specific type of the receiving buildings are not known. However, to provide information for the future developers, we have provided noise level predictions over vacant land also.

- o Businesses are not PPFs as they are not considered noise sensitive and are often noise generators in their own right.

- **Assessment Extent** is 100m from the edge of the new carriageway for urban areas and 200m for rural areas, in accordance with NZS6806. Urban areas are defined by Statistics NZ and are independent from the underlying zoning. Different parts of the projects are in Urban and Rural areas as indicted in Figure 2-1.

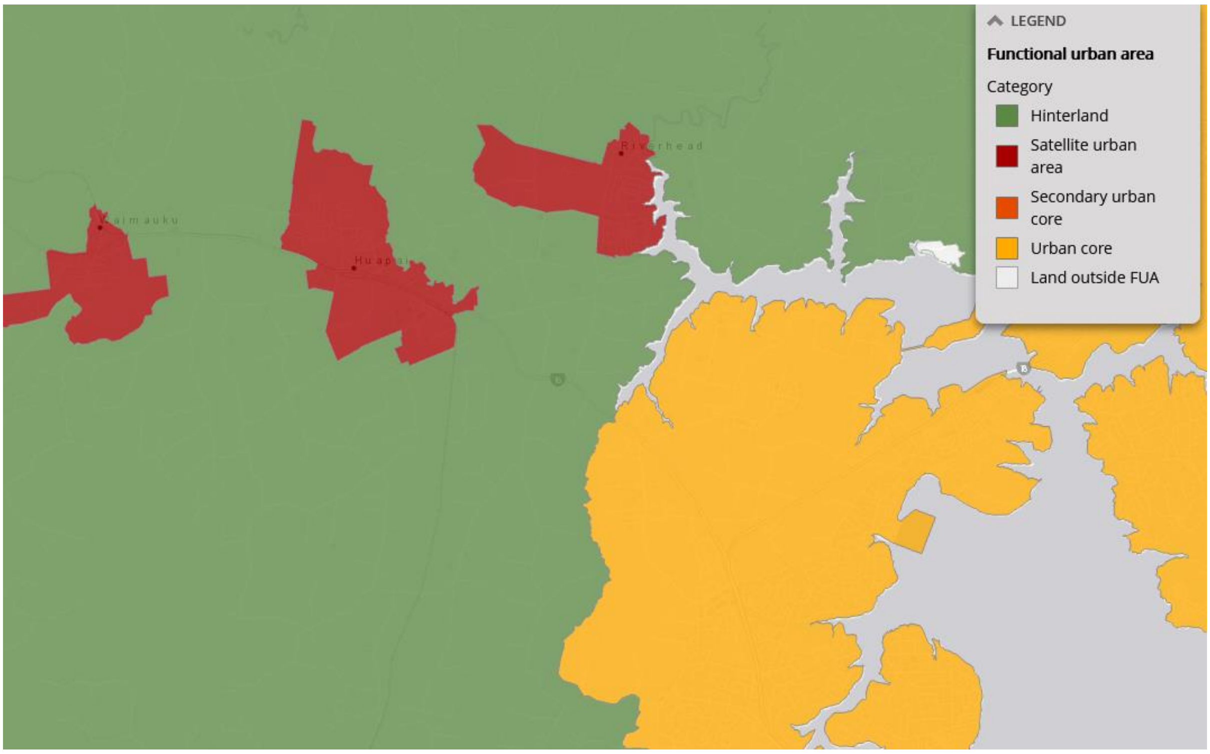


Figure 2-1: Indicative Urban/Rural classification in accordance with Statistics NZ

- **Assessment Areas** are areas which combine PPFs that would benefit from the same mitigation (e.g. barrier). For this Project, given the potential long implementation period, we have prepared an overview of proposed mitigation for each of the NoRs rather than dividing the areas further.

- **Design Year** is a year 10 to 20 years after opening of the Project. Since there are a number of NoRs assessed, without a defined implementation year, we chose a scenario where all NoRs are implemented, and the area is developed to its fullest potential. The design year for this scenario is 2048.

- **Noise Criteria** Categories are set out in the Standard for ‘new’ and ‘altered’ roads. This Project includes both new and altered roads, depending on the location of the project alignments. The Noise Criteria Categories are set out in Table 2-1 below.

Table 2-1: Traffic noise criteria categories

Category	New Road dB $L_{Aeq(24h)}$	Altered Road dB $L_{Aeq(24h)}$
A (primary external noise category)	≤ 57	≤ 64
B (secondary external noise category)	57 – 64	64 – 67
C (internal noise category)	40 (provided the external noise level is > 64)	40 (provided the external noise level is > 67)

The applicable category at any PPF depends on the BPO test, by progressively applying the noise criteria categories to determine which can practicably be achieved. NZS6806 is clear that preference is to be given to structural mitigation over building modification mitigation. NZS 6806 also requires achievement of the lowest external noise level with practicable structural mitigation, before considering building modification to mitigate internal noise levels.

- **Assessment Scenarios** are the various operational scenarios that we assess and compare. The Standard includes the following scenarios:
  - Existing noise environment: consists of the current road layout and traffic volume (for these Projects we sourced traffic data to be as current as practical while excluding data that was significantly affected by Covid restrictions, ranging from 2015 to 2021). (Note that a significant change in traffic volume is required to affect a noticeable change in traffic noise – refer Section 2.1.4)
  - Future Do-nothing scenario: This scenario only applies to Altered Roads, though we also predicted these noise levels for New Roads. It consists of the existing roads as for the existing noise environment, with traffic volume at the design year 2048. This scenario assumes that the full development of all surrounding areas has occurred, and traffic volumes have increased because of that development.
  - Future Do-minimum scenario: consists of all proposed transport corridors at the Design Year (2048), without any specific noise mitigation. This scenario means that the only barriers included are solid safety barriers, which are required for reasons other than noise mitigation. Where a low noise road surface such as PA10 30mm is proposed as the “base” road surface (as is the case for the alternative SH16 alignment NoR S1), this is also included in the Do-minimum scenario. Other roads that are not proposed to be altered by the Project (e.g. those crossing or connecting with the Projects) are not included in the assessment.
  - Future Project with mitigation: consists of the proposed Project roads at the Design Year, and includes mitigation that is designed specifically to reduce noise levels.
- **Mitigation Requirements** are set out in the Standard based on the BPO. Mitigation is split into structural (road surface, barriers, bunds) and building modification mitigation (improvement of building façades and ventilation, subsequent to the implementation of the structural mitigation, generally only considered for PPFs receiving noise levels within Category C). Any mitigation should achieve a noticeable noise level reduction of an average of 3 decibels within each assessment area or 5 decibels for standalone PPFs.

2.1.3 Station noise

There are two stations proposed to be operated as part of the RTC, within NoR HS and NoR KS. While the vehicle noise is covered by the assessment criteria set out in Section 2.1.2, other noise sources associated with the stations, such as from public address systems should be assessed against the relevant underlying zoning noise rules of the AUP:OP.

The stations are located in the Business – Town Centre zone (Kumeū Station between SH16 and the North Auckland rail line) and Future Urban zone (Huapai Station between Meryl Ave and the North Auckland rail line).

The noise limits applicable to these zones in relation to neighbouring zones are set out in Table 2-2 below.

Table 2-2: AUP:OP noise limits for Station locations

Station zone	Receiving zone	AUP:OP section	Assessment location	Noise limits	
Future Urban **(Huapai Station)**	Future Urban	E25.6.3.1	Notional boundary	Mon – Sat 7am – 10pm Sun 9am – 6pm All other times	55 dB L_{Aeq} 55 dB L_{Aeq} 45 dB L_{Aeq} 75 dB L_{AFmax}
Business – Town Centre **(Kumeū Station)**	Business – Town Centre	E25.6.8.1	Receiving building façade	7am – 11pm 11pm – 7am	65 dB L_{Aeq} 55 dB L_{Aeq} 65 dB L_{eq} at 63 Hz 60 dB L_{eq} at 125 Hz 75 dB L_{AFmax}
	Residential – Mixed Housing Suburban	E25.6.19.1	Receiving site boundary	Mon – Sat 7am – 10pm Sun 9am – 6pm All other times	55 dB L_{Aeq} 55 dB L_{Aeq} 45 dB L_{Aeq} 60 dB L_{eq} at 63 Hz 55 dB L_{eq} at 125 Hz 75 dB L_{AFmax}

2.1.4 Subjective perception of noise level changes

The subjective impression of changes in noise can generally be correlated with the numerical change in noise level. While every person reacts differently to noise level changes, research shows a general correlation between noise level changes and subjective responses.[1] Table 2-3 shows indicative subjective responses to explain the noise level changes discussed in this report. From experience, we have found that the subjective perception of a noise level change can be translated into an RMA effect. This effect is based on people's annoyance reaction to noise level changes.

The perception of these noise level changes generally applies to immediate changes in noise level, as would be the case for a new road, unlike for this Project where an existing road is modified in a minor way. However, people may subjectively have an annoyance reaction to a greater or lesser degree, depending on their perception of the Project.

1 For instance, LTNZ Research Report No. 292: Road traffic noise: determining the influence of New Zealand Road surfaces on noise levels and community annoyance, Table 18.

Table 2-3: Noise level change compared with general subjective perception

Noise level change	General subjective perception[2]
1–2 decibels	Insignificant/imperceptible change
3–4 decibels	Just perceptible change
5–8 decibels	Appreciable to clearly noticeable change
9–11 decibels	Halving/doubling of loudness
>11 decibels	More than halving/doubling of loudness

Noise is measured on a logarithmic scale, meaning that a doubling in traffic volume (e.g. from 10,000 vehicles per day (vpd) to 20,000 vpd) results in a noise level increase of 3 decibels, a just-perceptible change. A tenfold increase in traffic volume (e.g. from 10,000 to 100,000 vpd) would result in a noise level increase of 10 decibels, which would sound twice as loud.

2.2 Vibration

The AUP:OP does not contain applicable vibration criteria for transport infrastructure. However, Waka Kotahi does reference the Norwegian Standard NS 8176.E:2005 in its reverse sensitivity guidelines.

2.2.1 Norwegian Standard NS 8176.E:2005

The Norwegian Standard NS 8176.E:2005 specifically addresses transportation vibration. The Standard's criteria (shown in Table 2-4 below) are based on studies of vibration annoyance in residences, and it provides guideline values for four vibration "classes".

The appropriate class for new infrastructure is considered to be Class C, which is the *"recommended limit value … in connection with the planning and building of new transport infrastructures"*.[3] According to the Section B.3.3 of the Standard, at this level of vibration "about 15% of the affected persons in Class C dwellings can be expected to be disturbed by vibration" and this is deemed by the Standard to be acceptable.

Table 2-4: Human response criteria for transport sources in NS 8176.E:2005

Type of vibration value	Class A	Class B	Class C	Class D
Statistical maximum value for weighted velocity, $v_{w,95}$ (mm/s)*	0.1	0.15	0.3	0.6

* $v_{w,95}$ = value exceeded for 5% of events (equivalent to L_{05} centile level in noise terminology)

2 Based on research by Zwicker & Scharf (1965); and Stevens (1957, 1972).

3 From NS 8176.E:2005, Annex B.3.

2.2.2 Road traffic

Traffic vibration is usually only generated when heavy commercial vehicles (**HCV**) drive over bumps or dips in the road. We have determined the road traffic vibration risk by reviewing data of HCVs travelling on existing roads with a range of surface conditions. Assessing this data against the recommended traffic vibration criterion (Class C of the Norwegian Standard NS 8176.E:2005) indicates that compliance with the criteria can be achieved at 25 metres from the road edge, even for roads in a degraded state.

For a newly sealed pavement, the risk contour is less than 2 metres from the road edge. There will be no receivers this close to the traffic lane edge.

Therefore, we do not consider that traffic vibration needs to be assessed for the NoRs.

3 Existing Noise Environment

The existing noise environment provides a baseline for assessing noise effects. Effects can be assessed by quantifying the noise levels and noise level changes that people would experience due to the implementation of a project. The change in noise environment can be interpreted in relation to subjective responses of people and possible annoyance. In addition, measured noise levels are used to verify the computer noise model.

The existing noise environment for those NoRs close to the existing SH16 and major transport corridors (NoRs 2 and 4, and in small parts NoR 1) are controlled by traffic on those roads. The existing NAL currently only carries a limited number of trains (we understand two per day), so does not significantly affect the ambient sound environment.

3.1 Surveys

We undertook short duration attended noise level surveys on 21 June 2022 between 10 am and 4 pm, in the vicinity of the Projects. As traffic distribution over the day is known, the short duration survey results can be used to derive a 24-hour traffic noise level.

All noise level survey results are shown in Table 3-1 and the location shown on Figure 3-1.

Table 3-1: Noise level survey results

Survey id descriptor	Location	Measured noise level	Derived noise level
		dB $L_{Aeq(T)}$	dB $L_{Aeq(24h)}$
MP1	187 Access Road, Kumeū	71	69
MP2	15 Boord Crescent, Kumeū	57	55
MP3	354 Main Road, Huapai	73	71
MP4	30 Meryl Avenue, Kumeū	50	48
MP5	62 Foster Road, Kumeū	63	61
MP6	36 Puke Road, Kumeū	55	53
MP7	137 Tawa Road, Kumeū	63	61
MP8	703 Waitakere Road, Kumeū	70	68
MP9	156 Boord Crescent, Kumeū	46	44
MP10	374 Taupaki Road, Taupaki	71	69
MP11	173 State Highway 16, Whenuapai	76	74

Figure 3-1: Noise survey locations

3.2 Modelling

In addition to measuring the noise levels at a few locations along the projects, computer noise modelling enables the prediction of existing noise levels at all PPFs.

The PPFs for each project have been assessed separately. Where a PPF would be affected by more than one NoR, this is noted in the report. For each NoR, we have calculated the noise levels received by all PPFs.

The number of PPFs for each NoR are shown in Table 3-2.

Table 3-2: Number of PPFs in each NoR

NoR	Number of PPFs
S1	134
S2	323
S3 (incl. HS and KS)	227
S4	56

4 Assessment Methodology

We have assessed the operational noise effects on people based on:

- the noise criteria categories of NZS; and
- noise effects (both beneficial and adverse) through determination of noise level changes.

The reason for the two-pronged approach is that in some circumstances, compliance with a Standard does not necessarily mean that the effects of a project would be minor, and vice versa.

Potentially, the effects of a noise level increase can be small (e.g. a noise level increase of less than 3 decibels). At the same time, the resulting noise environment can be very high, particularly adjacent to existing state highways, and cause (potentially further) adverse effects for residential use.

These Projects are intended to unlock the development potential of land surrounding the transport corridors. The proposed extensive urban development of land in the vicinity is predicted to result in traffic volumes increasing, thus resulting in significant noise level increases for some areas when comparing current and future 2048 traffic volumes.

4.1 Assumptions

Assessment of operational noise and vibration effects is based on information provided by other experts, specifically the team's traffic specialists.

Since we have assessed six NoRs, without a defined implementation year, we chose a scenario where all NoRs are implemented, and the area is developed to its fullest potential. The design year for this scenario is 2048.

The assessment of the Do-nothing scenario (refer Section 2.1.2) is that the surrounding environment is fully developed, but without any changes to the transport corridors. We understand from the traffic specialists that a sensitivity factor is included in these traffic volumes that do not allow for impractically high traffic volumes on existing roads. The assumption is that peak traffic would occur for more hours of the day.

We have assumed that all existing buildings inside the designation areas will be removed or will not represent a PPF (e.g. buildings may be repurposed to contain non-noise sensitive uses). We have therefore not assessed these buildings as PPFs. Should they be retained and be used for any uses identifying them as a PPF, they will need to be assessed and mitigation will need to be determined where necessary.

Some of the buildings may be affected by more than one NoR. We have identified them in each of the NoRs that may affect them (either through removal or assessment of effects).

4.2 Assessment basis

The NoRs represent different transport modes and different extents of change. Therefore, each NoR must be assessed according to its relevant changes and associated effects:

- **Walking and Cycling**: One NoR (NoR S2) provides for mostly walking and cycling improvements, and does not propose significant changes to the road alignments. Changes to the traffic volumes are independent from the Project, and therefore the Project would not cause any change in noise effects. Walking and cycling facilities do not cause any significant noise levels that would be consistently noticeable adjacent to the integrated major transport corridors that they are located at. The proposed minor changes to the traffic lanes are predicted to not result in noticeable adverse changes to the noise level, so NoR S2 does not fall within the limitations of NZS6806 (refer Section 2.1.2). Nevertheless, an assessment in accordance with NZS6806 and in relation to the change in noise level has been undertaken for completeness.

- **Rapid transit** (and the regional active modes corridor – walking and cycling): NoR S3, HS and KS are intended to establish a rapid transit and active mode transport corridor. While walking and cycling does not generate elevated noise levels, electric bus rapid transit may generate noise. We have assessed the operational noise against the noise criteria of NZS6806. Stations are assessed based on their underlying AUP:OP zoning noise levels.
- **New and altered roads**: NoR S1 and NoR S4 represent a new road development and the widening of an existing road respectively. We have assessed these two NoRs against NZS6806 and in relation to the change in noise levels.

4.3 Computer noise modelling

The propagation of transport noise is affected by multiple factors, amongst them:

- Terrain elevations, including shielding from intervening terrain and exposure due to elevation
- Ground condition, including absorptive ground such as meadows or hard reflective ground
- Atmospheric conditions, including wind or temperature inversions
- Road parameters, including road surface, traffic speed, vehicle types and gradient

Because of the multiple factors and their interaction, computer noise modelling is a vital tool in predicting traffic noise impacts in the vicinity of major roads and for the determination of mitigation measures. Modelling enables a comprehensive and overall picture of noise impacts to be produced, taking into consideration all factors potentially affecting noise propagation.

We used the software SoundPLAN, which is an internationally recognised computer noise modelling programme. SoundPLAN uses a three-dimensional digital topographical terrain map of the area as its base. In addition, we entered data into the model for existing buildings, proposed earthworks edges and ground absorption within the assessment area. We digitised road traffic noise sources, with road lanes located on the terrain file, for the existing/Do-nothing scenarios and the Do-minimum scenario.

The SoundPLAN model implements the calculation algorithms of the "Calculation of Road Traffic Noise" methodology which is referenced in NZS6806 in Section 2.1.2.

The calculation algorithms take account of the factors set out above, including relevant atmospheric and ground conditions within appropriate parameters.

For road noise, we have used the adjustments for New Zealand road conditions, specifically road surface types, as set out in the Waka Kotahi "Guide to state highway road surface noise", V1.0, January 2014, Table 2.1. Therefore, modelling results can be compared with the relevant criteria without further adjustment.

The accuracy of the computer model needs to be verified. We used the measurement results set out in Section 3.1 to verify that the computer model operates within satisfactory tolerances.

Table 4-1: Computer noise model verification

Survey id	Location	Derived Level	Predicted Level	Difference	Comment
		dB $L_{Aeq(24h)}$	dB $L_{Aeq(24h)}$	decibels	
MP1	187 Access Road, Kumeū	69	63	-5	Model based on 1,200 vpd[4], but much higher traffic count during survey
MP2	15 Boord Cres, Kumeū	55	57	2	
MP3	354 Main Road, Huapai	71	69	-2	
MP4	30 Meryl Avenue, Kumeū	48	62	14	Model based on 1,200 vpd, but only one car passed during the survey
MP5	62 Foster Road, Kumeū	61	62	1	
MP6	36 Puke Road, Kumeū	53	53	1	
MP7	137 Tawa Road, Kumeū	61	59	-2	
MP8	703 Waitakere Rd, Kumeū	68	58	-10	Model based on 1,200 vpd, but much higher traffic count during survey
MP9	156 Boord Cres, Kumeū	44	58	14	Model based on 600 vpd, but only two cars passed during the survey
MP10	374 Taupaki Rd, Taupaki	69	70	1	
MP11	173 SH 16, Whenuapai	74	72	-2	

A comparison of the measured and predicted levels shows that there is generally good agreement between measured and predicted levels, with a difference of no more than 2 decibels, for those positions where traffic on existing roads is the controlling noise source. This accuracy fulfils the requirements of NZS 6806 which states in Section 5.3.4.2: *"The difference between measured and predicted levels should not exceed ± 2 dB."*

The larger discrepancies are due to measurements being undertaken for 15 minute periods only. The roads in the vicinity of MP1, 4, 8 and 9 are roads with low traffic volumes: Access Road, Meryl Ave and Waitakere Road all with 1,200 vehicles per day (vpd), and Boord Crescent with 600 vpd. During the surveys, where fewer cars passed than is assumed by the traffic data, then the measured noise level was significantly lower than the predicted (e.g. MP4 and MP9), and where more cars passed than the traffic model suggests, then the measured noise levels were significantly higher than the predicted (e.g. MP1 and MP8). For low flow roads, even a small change in traffic volume over a short survey period will make a significant difference to the measured levels.

[4] Vehicles per day

4.3.1 Individual receiver noise levels

We have assessed noise effects at all PPFs. We have included predicted noise levels for all PPFs, for all scenarios, in the tables in Appendix 1. The locations of these dwellings are shown in the drawings in Appendix 2.

For NoRs S1 and S4, noise criteria categories for the PPFs are shown as a graphic representation by colouring the buildings with a colour scale, showing NZS 6806 Category A buildings in green, Category B buildings in orange and Category C buildings in red. Any buildings not shown in these three colours on the figures are outside the assessment area, or are not PPFs, e.g. garages, sheds or business premises.

For NoR S3 (and NoRs HS and KS), for the electric bus transport most, noise criteria categories for the PPFs are shown in green, orange and red as for NoRs S1 and S4 (i.e. in accordance with NZS6806). The noise levels from the stations within NoR HS and KS are predicted in Section 10.3.2 against the AUP:OP underlying zone noise limits. They are not shown specifically on the figures but are included in the overall predictions for NoR S3 as they fall within the assessment radius of the rapid transit corridor.

For NoR S2, the works are focused on walking and cycling improvements. This means that the change in traffic volume is not due to the project works. The assessment indicates that no noticeable adverse effect is generated due to the project, and NZS6806 does not apply. Nevertheless, for completeness, we also show the PPFs in accordance with the NZS6806 categories as for NoRs S1 and S4 and assess the change in noise level.

4.3.2 Noise contour plans

Noise contour plans are a useful tool to obtain a graphical overview of a project area including currently vacant land that may be developed in the future. The contours are calculated by SoundPLAN by interpolating a large number of individual points. Therefore, noise contour maps should not be used to “read” noise levels for specific locations. For individual noise levels specific for each PPF, the receiver noise levels in the tables should be used (refer Appendix 1).

Noise contour plans are contained in drawings in Appendix 2. These plans show interpolated noise level bands at 5 decibel intervals from 55 dB to 70 dB $L_{Aeq(24h)}$.

4.4 Assessment of operational vibration

As noted in Section 2.2.2, vibration from well-constructed and maintained roads is not an issue that causes adverse effects. As such vibration effects are not anticipated on the two heritage buildings within the existing heritage overlay along SH16 Main Road once re-positioned along the corridor following works commencing on the RTC (NoR S3). The buildings are transported to their new site, which will involve high levels of vibration through the loading, transport and unloading. Since the buildings will be able to withstand such levels of vibration without damage, traffic vibration, which is magnitudes lower, is expected to not cause any issues. We have therefore not assessed road traffic vibration further.

5 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 5-1 below, with a brief summary of the Strategic Assessment Package projects provided in Table 5-1 below.

Figure 5-1: North West Strategic Assessment Package – Overview of NoRs for Assessment

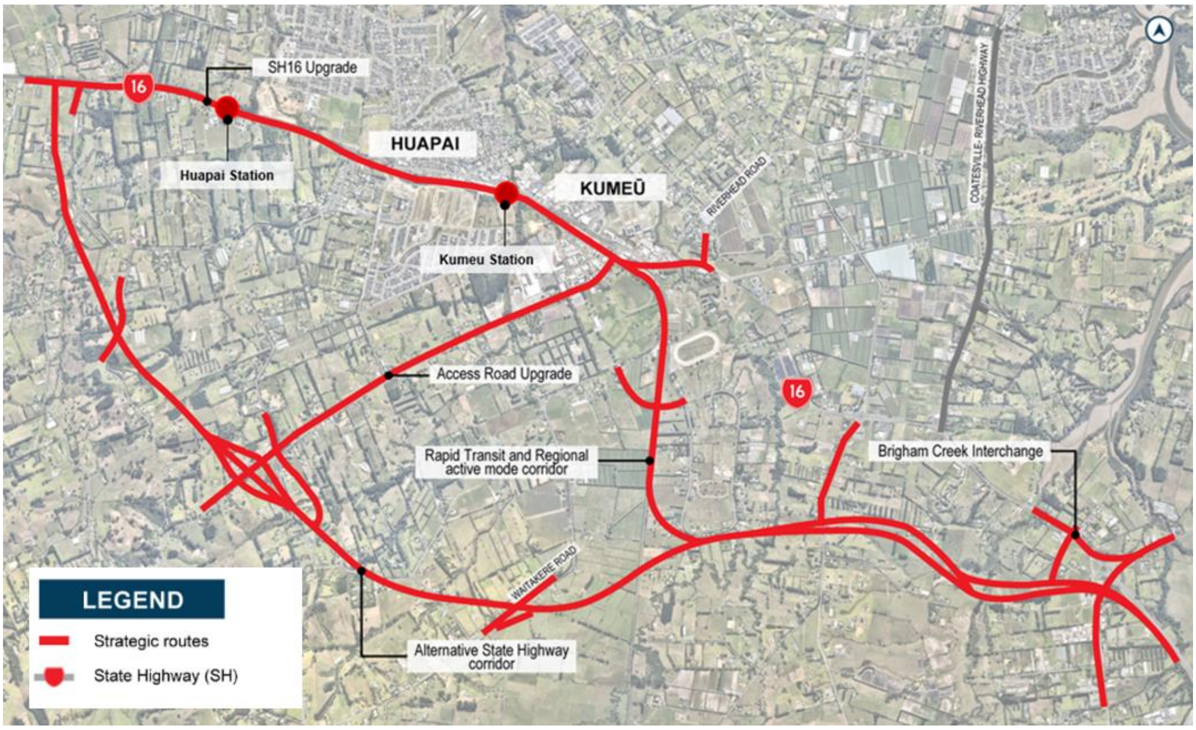


Table 5-1: Strategic Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Alternative State Highway	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange	Waka Kotahi
State Highway 16 Main Road Upgrade (alteration to existing designation 6766)	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New Rapid Transit Corridor and active mode corridor in one co-located corridor	Waka Kotahi
Kumeū RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road Upgrade	S4	Upgrade of Access Road to a four-lane cross-section with separated cycle lanes	Auckland Transport

Corridor	NOR	Description	Requiring Authority
		and footpaths on both sides of the corridor.	

Refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

6 Positive Effects

The Strategic Assessment Package results in a redistribution of traffic across the wider area. It enables people to choose different transport modes (other than cars) and therefore results in a reduction in traffic that would otherwise use the existing roading network.

All NoRs except NoR S1 enable multi modal transport along established transport routes, with options including walking and cycling and public transport, in addition to the existing traffic lanes.

NoR S1 establishes a new State highway in a currently rural area, but also includes walking and cycling facilities. The new road will result in an increase in noise level adjacent to the road.

Overall, however, the Strategic Assessment Package enables a choice of transport options, resulting in a reduction in traffic on existing roads, and therefore a reduction in noise level over the wider area.

7 Recommended Measures to Avoid, Remedy or Mitigate Transport Noise Effects

Traffic on roads and stations generate noise from different sources and has different characteristics. Therefore, mitigation measures need to reflect and address relevant effects depending on the source. The sections below discuss road and station noise. The sections below discuss road and station noise.

7.1 Road traffic noise

There are broadly three mitigation options that can be applied to manage road traffic noise, and are discussed in NZS6806:

- The choice of **road surface material**, a mitigation option that reduces noise at the source (especially for roads with speeds above 40-50 km/h where the road-tyre interaction is the controlling noise source rather than engine noise);
- The installation of **noise barriers** either on the roadside or on the property boundary; and
- The inclusion (for new builds) or retrofitting (for existing buildings) of **Building Modification Mitigation** (e.g., alternative ventilation to enable windows and doors to remain closed, improved joinery and/or glazing, or, in rare cases, the installation of additional wall and ceiling lining).

NZS6806 states:

> *The noise criteria are intended to address the adverse effects of road-traffic noise on people. Land-use planning is the preferred method of avoiding these effects. Where this is impracticable, the Standard sets out procedures and methods of the prediction, measurement and assessment, and guidelines for mitigation of road-traffic noise in accordance with the duty to adopt the best practicable option.*[5]

This indicates that NZS6806 deals with the residual noise effects after land-use planning has been implemented (or where it has been omitted in the planning stage).

Generally, mitigation is implemented from source to receiver. This means that the road surface is the first choice of mitigation measure as it protects the largest extent of receivers. Second are barriers placed either on the road edge or the property boundary. Barriers protect the area behind them, so are not suitable to shield upper floors of multi storey buildings, however, they are suitable to protect ground floors and outdoor living areas where these are facing a road. Barriers may also not be appropriate in suburban and urban environments for urban design reasons – this would be discussed when the BPO is confirmed. Lastly, building modification can be implemented to existing PPFs where these are not sufficiently designed to reduce internal noise levels. Building modification is the last choice as it only protects individual living areas and has no benefit to the wider community.

Where future developments are not yet implemented, the road controlling authorities and developers have a shared responsibility to implement reasonable and appropriate mitigation.

[5] NZS6806, Section 1.1.1

7.2 RTC Station noise

The main noise source at stations would be the PA system. These systems can be designed to comply with the relevant noise limits.

We would recommend that PA systems are turned down or off at night-time in the vicinity of residential use, or that highly directional speakers are used that avoid noise spill to neighbouring sites.

7.3 Final measures

The final measures to mitigate noise from the Project will be confirmed through a Construction Noise and Vibration Management Plan which is a condition of the proposed designations.

8 NoR S1: Alternative State Highway, including Brigham Creek Interchange

It is proposed to submit a Notice of Requirement (NoR S1) to designate the land required to implement a new four-laned dual carriageway motorway referred to as the Alternative State Highway (**ASH**) and the upgraded Brigham Creek Interchange (**BCI**).

8.1 Project Corridor Features

The ASH extends from the future State Highway 16 (**SH16**) / Brigham Creek Interchange (north of Massey) to a proposed new intersection with SH16 near/at Foster Road on the western edge of the FUZ, west of Huapai. This proposed state highway corridor will be approximately 11km long, travelling westward across rural farmlands to the southwestern side of Kumeū and Huapai, with an additional interchange proposed at Tawa Road.

An overview of the proposed design is provided in Figure 8-1 below.

Figure 8-1: Overview of the Alternative State Highway, including Brigham Creek Interchange

Key features of the proposed new corridor include the following:

- A new four-lane motorway corridor with a cross-section of approximately 50m to accommodate a four-lane dual carriageway and separated cycle lanes and footpaths. The typical cross section includes an active mode corridor with central and side barriers.
- Road surface material of Open Graded Porous Asphalt (PA10 assumed as the basis of prediction).

- An underpass at Taupaki Road and bridges over the NAL with further grade separations at Waitakere Road, Pomona Road, Tawa Road, Puke Road and Foster Road. Tawa Road is designed to future proof for a full diamond interchange.
- The western end of the alignment ties-in at a proposed three-legged roundabout with SH16 Main Road, immediately west of Foster Road.
- The re-alignment of the following local roads:
    - Pomona Road, approximately 1.5km (two sections);
    - Motu Road, approximately 200m; and
    - Puke Road, approximately 500m.
- Likely posted speed of 100km/h which was used for our predictions.

8.2 Existing and Likely Future Environment

8.2.1 Planning context

The Alternative State Highway (**ASH**) corridor, including the Brigham Creek Interchange (**BCI**), is largely rural and is proposed to traverse land zoned under the AUP:OP as Rural – Countryside Living Zone, Rural – Mixed Rural Zone and Rural – Rural Production Zones.

The ASH corridor will also traverse two separate areas of FUZ in Redhills North and Kumeū-Huapai with the BCI also currently sitting within FUZ land.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the ASH and BCI.

Table 8-1: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[6]	Likely Future Environment[7]
Rural	Rural - Mixed Rural Zone, Rural - Countryside Living Zone Rural - Production Zone	Low	Rural
Undeveloped greenfield areas	Future Urban	High	Urban

8.2.2 Existing and Future Noise Environment

The alignment traverses a range of areas with different ambient noise environments. These range from existing high noise levels in the mid-60 dB L_{Aeq} at the BCI, connecting with the existing SH16 near Foster Road, to mid-40 dB $L_{Aeq(24h)}$ away from any current major roads.

[6] Based on AUP:OP zoning/policy direction
[7] Based on AUP:OP zoning/policy direction

These noise levels are expected to remain largely unchanged in the vicinity of the alignment. Only small parts of the project are in the Future Urban zone, where the environment is expected to change significantly once developed and occupied. Once these areas are developed, ambient noise levels without the project would increase due to increase household noise.

8.2.3 Buildings inside designation

The following Table 8-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or not used for noise sensitive uses once the Project is operational. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

We assume that the relevant requiring authority will acquire the parcels of land that these buildings are located on. In addition, auxiliary buildings are not generally occupied, so would not be relevant receivers in relation to this assessment.

Table 8-2: Buildings inside designation (not assessed)

Address	Address
134, 138, 142, 146, 149, 152, 154, 156, 162, 171, 176, 178, 182, 176A Boord Cres, Kumeū	36, 37, 41, 47, 54, 69, 78 Puke Rd, Kumeū
5, 7, 18, 21 Brigham Creek Rd, Whenuapai	191, 272, 278, 280, 727 SH16, Kumeū
30, 40, 62, 80, 104, 113 Foster Rd, Kumeū	380, 388, 389, 400, 401 Taupaki Rd, Kumeū
148 – 155 (uneven nos. only), 155, 159, 186, 188, 192, 202, 204, 206, 212 Fred Taylor Dr, Whenuapai	87, 97, 122 Tawa Rd, Kumeū
87 Joseph Dunstan Dr, Taupaki	249 Trigg Rd, Kumeū
146 Motu Rd, Kumeū	656, 660, 670, 691, 703 Waitakere Rd, Kumeū
2, 9, 34, 37, 55, 73, 103, 107, 121, 130, 138, 142, 144, 170, 191 Pomona Rd, Kumeū	

8.3 Assessment of Road Traffic Noise Effects

The ASH traverses an area that is mostly rural in nature. A small part at the southern end is located within the FUZ, as well as another small section passing through the Redhills North and Kumeū-Huapai FUZ, all of which will be developed in the future. There is no structure plan for this area at present, which means that the future receiving environment is currently unknown. We have provided traffic noise contours across the entire assessment area, which can be used for the future planning of the FUZ. Where noise sensitive buildings are established, they should be designed appropriately to provide suitable internal noise levels for future residents or occupiers.

The ASH will be constructed using low noise roads surface PA10 30mm as the base road surface. This would generally be considered a mitigation measure, however, for this project it is already included in the Do-minimum scenario.

The assessment of road traffic noise takes account of both the noise criteria categories of NZS6806 and the change in noise level for the reasons set out in Section 2.1. Both are discussed below.

8.3.1 NZS6806

The ASH is generally a **New road** in accordance with NZS6806, i.e. will consist of a new road that is established where there is currently no road. It will cross several smaller local roads; however, these roads carry relatively low traffic volumes and therefore do not affect the noise levels significantly.

At either end where the ASH connects with the existing SH16, including the area around the BCI, the State highway controls the ambient noise environment as it is the highest noise generator in the area. Similarly, where the ASH affects PPFs that are close to major roads such as Brigham Creek Road or Fred Taylor Drive, these roads control the ambient noise environment. For those areas we have assessed the ASH against the **Altered road** criteria. Note that there is a cluster of PPFs at Access Road that have been assessed against the Altered road criteria. Access Road is predicted to experience a significant increase in traffic volume in the Do-nothing scenario, i.e. without the implementation of the Projects. This means that these PPFs will be strongly affected by traffic on Access Road. For that reason, we have assessed them against the Altered road criteria, given that the base noise level without the Project would already be elevated.

There are currently 134 PPFs in the vicinity of the ASH. As discussed above, each PPF has been assessed against relevant criteria relating to their location in relation to existing roads, specifically 63 PPFs have been assessed against Altered road criteria and 71 PPFs against New road criteria. The location of the PPF distribution is indicated in Figure 8-2 below. Those PPFs assessed against New road criteria are coloured yellow, those assessed against Altered road criteria turquoise.

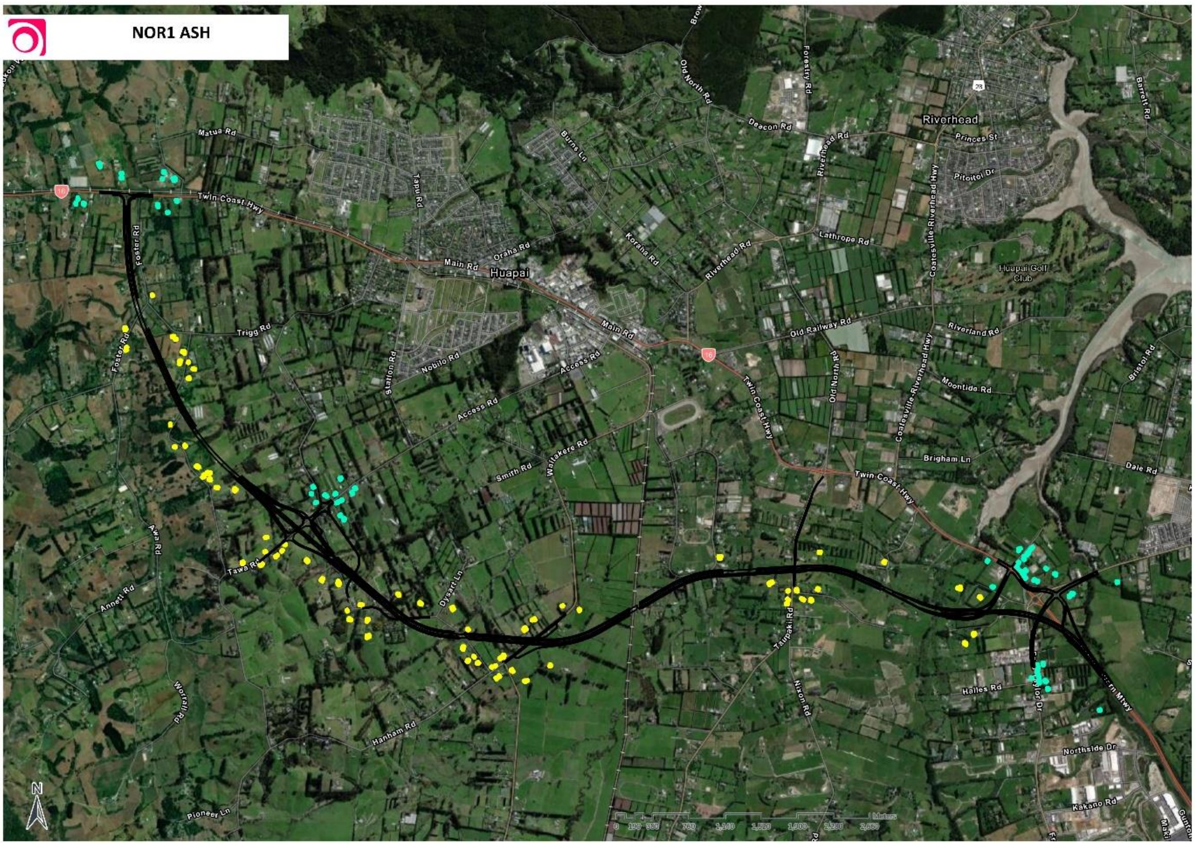


Figure 8-2: New and Altered Road sections within NoR S1

8.3.1.1 Altered Road

The future development in the area is also anticipated to increase the traffic volumes significantly.

This is reflected in the fact that the number of PPFs receiving noise levels in Category C is more than double in the Do-nothing scenario (i.e. where existing roads do not change but the traffic volumes change over time) compared with the existing situation.

The implementation of the ASH will result in a significant improvement for a number of PPFs, with no PPFs receiving noise levels in Category C from the ASH itself. For either Do-minimum scenario the number of PPFs in Category A increases or stay the same, even when compared with the existing scenario.

When local roads are included in the assessment (i.e. those already existing roads not altered by the Project, that have an effect on the ambient noise environment), the noise level at many PPFs would move into a higher noise level category. These roads are not affected by the Project, i.e. there is no change to their horizontal or vertical alignment. The requiring authority for the Project would not be required to upgrade these roads as they do not form part of the Project. For information (in grey), we have included noise levels with these roads, to ensure that the cumulative effect of all roads in the vicinity are taken into consideration when assessing the noise level changes (refer Section 8.3.2). This shows that these (unchanged) roads have an effect on the overall noise level received at some PPFs but are not subject to mitigation options as they are outside the responsibility of the requiring authority.

We tested the use of barriers along the ASH and, where more appropriate, along the property boundary. With a 2.4m barrier along parts of the ASH (as shown in the figures in Appendix 2.1) and 2m boundary fences for some limited properties, the noise level from the ASH as received at all PPFs can be reduced to be within Category A.

The number of PPFs assessed against the Altered road criteria is summarised in Table 8-3, and figures showing the location of the PPFs are included in Appendix 2.1.

Table 8-3: Summary of NZS 6806 assessment – Altered Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	44	12	7
Do-nothing	33	13	17
Do-minimum (ASH only)	59	4	0
Do-minimum (ASH and local roads)	44	16	4
Mitigation Option (ASH only) – 2.4m barrier on ASH or 2m barrier on property boundary	63	0	0

8.3.1.2 New Road

Those PPFs further removed from major roads generally receive lower noise levels in the existing situation. These PPFs are also those that would be more affected by the operation of a new State highway in a current green field environment.

At present, 58 of the 71 PPFs assessed against the New road criteria receive noise levels in Category A, and none receive noise levels in Category C. In the future, without and with the operation of the ASH (i.e. the Do-nothing and Do-minimum scenarios respectively), there is a shift to the higher noise levels, 31 PPFs for Do-nothing and 32 PPFs for Do-minimum scenarios predicted to receive noise levels in Category B (up from 13 for the existing situation).

When local roads are included in the assessment (i.e. those already existing roads not altered by the Project, that have an effect on the ambient noise environment), the noise level at many PPFs would move into a less stringent noise level category (e.g. 7 PPFs with noise levels in Category C compared with none where the noise level is based on the ASH only). These existing roads are not affected by the Project, i.e. there is no change to their horizontal or vertical alignment. The requiring authority for the Project would not be required to upgrade these roads as they do not form part of the Project. We have included noise levels with these roads for completeness, to ensure that the cumulative effect of all roads in the vicinity are taken into consideration when assessing the noise level changes (refer Section 8.3.2).

In addition to the assumed low noise road surface, we tested the use of 2.4m high barriers along the ASH and, where this was the more appropriate location, 2m high boundary fences along the property boundary.

Due to some of the surrounding sites being elevated above the ASH, barriers are not always effective. With barriers in place, the noise levels at the 32 PPFs predicted to receive noise levels within Category B can be reduced to Category A for 13 PPFs. For the remaining 20 PPFs, noise levels are predicted to remain in Category B irrespective of the barrier (where this has been found to be practicable).

For some of those PPFs, a barrier is recommended to reduce noise levels (and effects, refer 8.3.2.2 below), even though noise levels would remain within Category B. This is the case where noise levels can be reduced to a noticeable degree or where the noise barrier forms part of a larger barrier shielding several PPFs.

For others, barriers are not considered the BPO and not recommended. That is the case where the barriers would not achieve any noticeable noise level reduction at the PPFs, e.g. where the PPFs are elevated above the road, or where an existing road not related to the Project is the main noise source.

The number of PPFs assessed against the New road criteria is summarised in Table 8-4, and figures showing the location of the PPFs are included in Appendix 2.1.

Table 8-4: Summary of NZS 6806 assessment – New Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	58	13	0
Do-minimum (ASH only)	39	32	0
Do-minimum (ASH and local roads)	23	41	7
Mitigation Option (ASH only) – 2.4m barrier on ASH or 2m barrier on property boundary	52	19	0

8.3.2 Change in Noise Levels

Noise effects can be described based on the change in noise level with and without the Project. For PPFs assessed against the Altered road criteria, the Do-nothing and Do-minimum scenarios are compared, while for PPFs assessed against the New road criteria the existing and Do-minimum scenarios are compared. Where mitigation is recommended, the mitigation option is also included in the future assessment.

8.3.2.1 Altered Road

For the PPFs assessed against the Altered road criteria, we predict an average noise level increase from the existing to Do-nothing scenario of 3 dB across the 63 PPFs.

With the ASH in place (with low noise road surface assumed, as discussed above), and including local roads, noise levels are predicted to reduce on average 2 dB compared with the Do-nothing scenario. When predicting the noise levels from only the ASH, excluding local roads that are not being changed, then the average reduction is 7 dB.

With mitigation in the form of 2.4m barriers on the ASH and 2m boundary fences at selected properties, and including local roads, the noise levels are predicted to reduce on average by 3 dB, with many PPFs receiving noticeable to significant noise level reductions compared with the Project not being implemented.

shows the number of PPFs assessed against the Altered road criteria in each of the change in noise level bands discussed in Table 2-3. This shows clearly that noise levels will overall be lower, or similar to existing, as an effect of the redistribution of traffic away from the existing SH16. This comparison includes traffic on existing local roads as they will affect the noise environment and are therefore important when assessing potential noise level changes in the area.

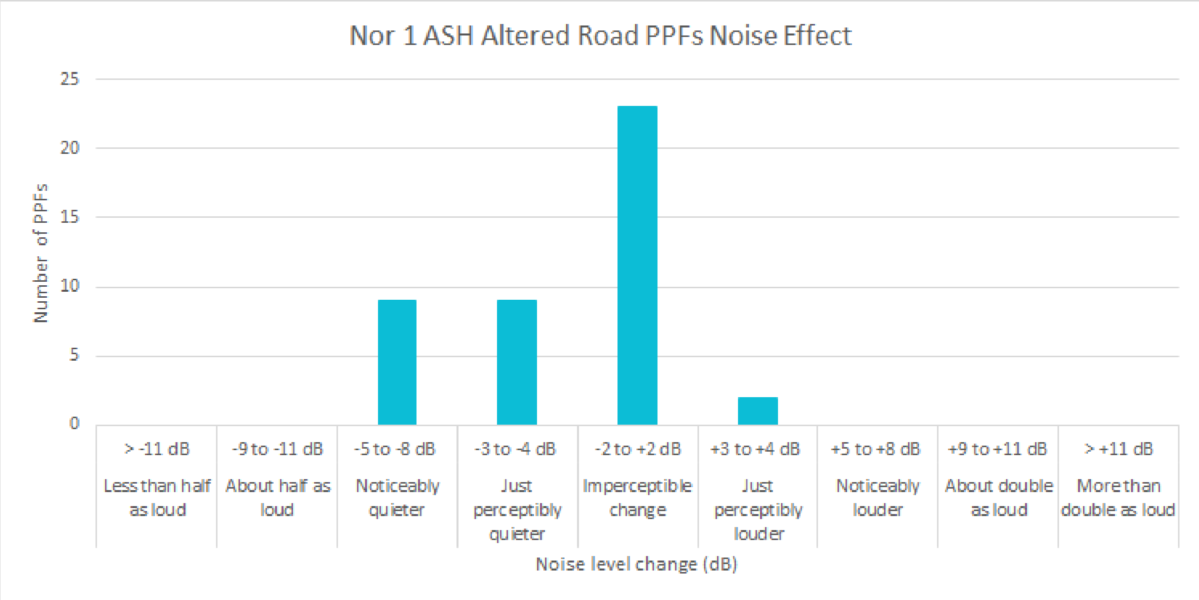


Figure 8-3 : Change in noise level

8.3.2.2 New Road

PPFs assessed against the New road criteria are generally in areas that are less affected by existing traffic noise on local roads. When comparing the existing and Do-minimum scenarios, the introduction of a new noise source, and the anticipated increase in traffic volume with the future development in the area, result in an average noise level increase of 2 dB. Some PPFs are predicted to receive noise level increases of up to 13 dB when compared with the existing situation.

When including other roads not affected by the Project (e.g. Tawa Road), noise levels increase further for a number of PPFs, which shows the effect of local roads on the overall noise level. The average increase would be 5 dB, which is a noticeable adverse change, which is largely unrelated to the Project and due to local roads.

With the recommended mitigation of 2.4m high noise barriers on the ASH and 2m high noise barriers at residential boundaries in place (refer to the figures in Appendix 2.1), in addition to the low noise road surface assumed, many PPFs will still experience noticeable noise level increases. This is the result of the introduction of a new noise source in a currently low noise environment with little man-made noise sources. The average noise level increase from the ASH only is predicted to be on average less than 2 dB. The highest noise level increases are predicted to be up to 13 dB, which would be perceived as more than a doubling in noise level. Nevertheless, the resultant traffic noise levels at all PPFs are generally within reasonable levels for residential use.

Figure 8-4 shows the number of PPFs assessed against the New road criteria in each of the change in noise level bands discussed in Table 2-3. As expected, noise levels are predicted to increase (as is generally the case for a new road in a greenfield situation). The comparison includes local roads in the area as the change in noise level experienced will be affected by traffic on those roads. The ASH itself is only one contributor to the overall change in noise level.

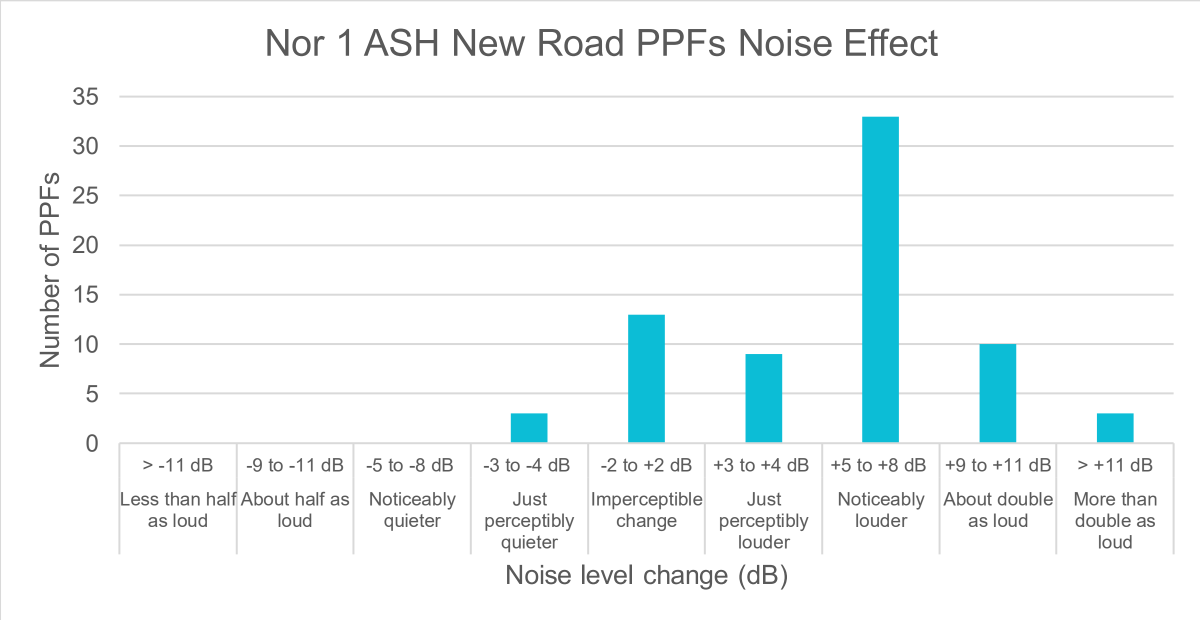


Figure 8-4: Change in noise level

8.4 Conclusions

We have assessed the traffic noise levels from the proposed ASH. The introduction of a new major road into a currently low noise mainly rural environment is predicted to result in significant noise level increases for some PPFs, especially in the area removed from other main roads. Where the ASH connects with SH16, the change in traffic volume due to the suite of NoRs discussed in this report and the proposed mitigation measures will result in an overall reduction in noise level.

The ASH is assumed to be constructed using low noise road surface (PA10). In addition, 2.4m high roadside barriers along the ASH and 2m high boundary fences at some PPFs will ensure that no PPFs would receive noise levels from the ASH within Category C, and that more PPFs would receive noise levels within Category A than would be the case without the Project.

Overall, while a small number of PPFs are predicted to receive noticeable to significant noise level increases (in the vicinity of the New road), the overall effect of the Project is positive.

9 NoR S2: SH16 Main Road Upgrade

It is proposed to submit a Notice of Requirement (NoR S2) to designate the land required to implement the upgrade of the existing State Highway 16 (**SH16**) to a two-lane corridor with walking and cycling facilities.

9.1 Project Corridor Features

The SH16 Main Road Upgrade extends approximately 4.5km between Old Railway Road, east of Kumeū to Foster Road, west of Huapai. The SH16 Main Road is currently a 20m wide two-lane urban arterial with no active mode facilities on either side of the corridor.

SH16 Main Road is proposed to be upgraded to a 24m urban corridor traversing through well-established retail, commercial and residential environs. The corridor generally follows the existing SH16 Main Road alignment and also includes a 600m section of active mode only upgrade between Oraha Road and Tapu Road. As part of this project, Station Road will be realigned to form a new signalised intersection with SH16 and Tapu Road.

An overview of the proposed design is provided in Figure 9-1 below.

Figure 9-1: Overview of the SH16 Main Road Upgrade

Key features of the proposed upgrade include the following:

- The widening of the existing 20m wide two-lane urban arterial to a 24m wide corridor with walking and cycling facilities on both sides of the corridor.

- Current existing road surface material is retained.
- The realignment of Station Road to form a new signalised intersection with SH16 and Tapu Road.
- Tie-ins with existing roads.
- Likely posted speed of 50km/h.

In terms of traffic noise, it is critical to consider that this project does not allow for any additional traffic lanes. Minor intersection upgrades are proposed to increase safety for the walking and cycling facilities that are the main feature of this project.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

SH16 Main Road is proposed to be upgraded to a 24m urban corridor along the urban extent of SH16 traversing through well-established retail, commercial and residential environs through Kumeū Huapai. This corridor contains a range of business, residential and open space and rural land uses under the AUP:OP (see zoning column in Table 9-1) between the eastern extent of the Kumeū-Huapai township and the western extent of the upgraded corridor (the intersection with the proposed ASH).

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the SH16 Main Road Upgrade.

Table 9-1: SH16 Main Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Rural	Rural Mixed Rural Zone, Rural Countryside Living Zone	Low	Rural
Business	Business (Industrial)	Low	(Business (Industrial)
	Business (Local Centre)	Low	Business (Local Centre)
	Business (Mixed Use)	Low	Business (Mixed Use)
Residential	Residential	Low	Residential
Open Space	Open Space – Sport and Active Recreation	Low	Open Space
Undeveloped greenfield areas	Future Urban	High	Urban

[8] Based on AUP:OP zoning/policy direction
[9] Based on AUP:OP zoning/policy direction

9.2.2 Existing and Future Noise Environment

Walking and cycling facilities are proposed to be established on either side of the existing SH16. The area is currently a high noise area, controlled by traffic on SH16. The suite of NoRs discussed in this report will change the traffic distribution across the area, with a large shift of traffic movements to the ASH (refer Section 8). This would lead to an overall reduction in noise levels experienced on the walking and cycling facilities.

Without the North West Strategic Package implementation, noise levels in the future will continue to increase significantly and range from around 60 to 70 dB $L_{Aeq(24h)}$ at the walking and cycling paths.

9.2.3 Buildings inside designation

The following Table 9-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or not used for noise sensitive uses once the Project is operational. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

Table 9-2: Buildings inside designation (not assessed)

Address	Address
21 Riverhead Rd, Kumeū	1 Trigg Road, Kumeū
619 SH16, Kumeū	

9.3 Assessment of Road Traffic Noise Effects

This project only involves minor intersection upgrades to the existing road. The main focus of this NoR is the establishment of walking and cycling facilities.

The establishment of walking and cycling facilities does not cause any appreciable noise levels and will not cause any change in noise level as the facilities are adjacent to a major road which controls the noise environment. Even with the redistribution of traffic across the area, the existing SH16 will remain a major road. Traffic noise from the road will be the controlling noise source and be well more than 10 dB louder than any noise from the walking and cycling facilities.

While this project does not involve a major road upgrade, the intersections will be slightly realigned, so we still have undertaken an assessment of traffic noise in accordance with NZS6806 and in relation to the change in noise level, both are discussed below.

9.3.1 NZS6806

The implementation of the suite of NoRs discussed in this report will result in a redistribution of traffic across the area, with a large number of vehicles using the ASH (refer Section 8). This is reflected in the Do-minimum scenario, where all PPFs would receive noise levels in Category A (if local roads are excluded from the predictions). Without the North West Strategic Package implementation, traffic volumes are predicted to increase (significantly for some extents of the existing roads).

There are 323 PPFs identified within the assessment area of this project. For all scenarios, the overwhelming majority (between 267 and 323 of the 323 PPFs) are receiving noise levels within Category A.

Looking at the future Do-minimum scenario, when assessing SH16 with its minor intersection alterations only, all PPFs are predicted to receive noise levels in Category A. If we include the local side roads, that are not part of the NoR and do not have a horizontal or vertical change, a small number of PPFs would receive noise levels in Category B (20 PPFs, compared with the 43 PPFs without the project) and Category C (four PPFs, compared with the 13 PPFs without the project). This means that all PPFs identified to receive noise levels in Categories B and C would not receive these noise levels from the upgraded SH16, but from local roads that are not being changed. None of these PPFs are predicted to receive noticeable noise level increases, and most are predicted to receive a noise level reduction of up to 2 dB. NZS6806 does not apply to this project as it does not trigger the relevant noise levels and changes (refer Section 2.1.2). Therefore, we have not identified additional mitigation as the project does not cause an adverse noise effect – which is the expected outcome for a walking and cycling upgrade.

Nevertheless, we have reported the number of PPFs (assessed against the Altered road criteria) for completeness, as summarised in Table 9-3, and figures showing the location of the PPFs are included in Appendix 2.2.

Table 9-3: Summary of NZS 6806 assessment – Altered Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	287	26	10
Do-nothing	267	43	13
Do-minimum (SH16 and intersections only)	323	0	0
Do-minimum (SH16 and local roads)	299	20	4

9.3.2 Change in Noise Levels

The provision of walking and cycling facilities does not have any effect on the overall noise environment, with traffic noise on SH16 remaining the controlling noise source. Nevertheless, we have assessed the noise level change from traffic on SH16 and its upgraded intersections to determine the potential effects of the change in traffic volume across the area, as a function of the North West Strategic Package overall).

As noted above, if the suite of NoRs is not implemented, traffic will increase, with noise level changes on average of 2 dB, with individual receivers potentially experiencing a noise level increase between 4 and 7 dB. These traffic noise changes would occur within the existing SH16 designation.

With the suite of NoRs in place, and with the SH16 intersection upgrades (and including other roads in the vicinity of the Project that are not affected by any works), noise levels are predicted to reduce on average 2 dB compared with the Do-nothing scenario, ranging from a no change to a more than 10 dB reduction. When predicting the noise levels from only SH16 including the intersection upgrades, excluding local roads that are not being changed, then the average reduction is 9 dB.

Figure 9-2 shows the number of PPFs in each of the change in noise level bands discussed in Table 2-3. Overall, noise level changes will be negligible or positive.

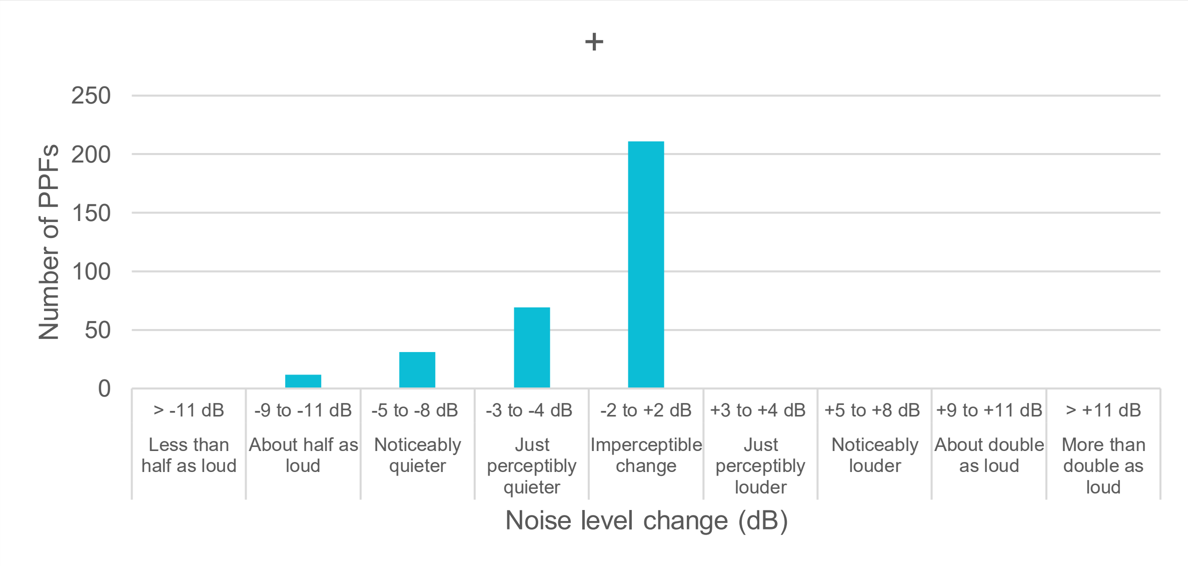


Figure 9-2: Change in noise level

9.4 Conclusions

The proposed establishment of walking and cycling facilities along SH16 is predicted to not cause any appreciable noise level change. The noise environment is currently, and will remain, controlled by traffic on SH16. No additional traffic capacity is created on SH16; rather, changes to lane configurations and intersections upgrades are introduced to make walking and cycling safer. These changes do not cause any noticeable effect on the overall noise environment.

Overall, we predict a noise level reduction in the vicinity of SH16, due to the redistribution of traffic across the area as a function of the suite of NoRs assessed in this report. Traffic volumes will reduce, with many using the proposed ASH. This effect is not due to the project, but the overall changes anticipated in the area.

All PPFs assessed will receive a noise level reduction because of the redistribution. When including local roads in the predictions, which are not affected by this project, all PPFs will experience either a noise level reduction or no noticeable change in noise level.

We have not proposed any additional mitigation given the works involve walking and cycling upgrades and do not significantly affect traffic lanes.

10 NoR S3: Rapid Transit Corridor; NoR KS: Kumeū RTC Station and NoR HS: Huapai RTC Station

It is proposed to submit a Notice of Requirement (NoR S3) to designate the land required to implement the new Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) in one co-located and integrated corridor.

10.1 Project Corridor Features

The proposed RTC is a new corridor which aims to complete a safe and frequent rapid transit system connecting Kumeū-Huapai with Westgate, Auckland City Centre and the North Shore. The RTC will extend the proposed City Centre to Westgate (**CC2W**) rapid transit corridor (a non-SG project) from the Brigham Creek Frequent Transit Network Station to the western edge of Kumeū-Huapai growth area near the Rural Urban Boundary (**RUB**).

The RTC will extend from the future SH16 / Brigham Creek Interchange to the west of Huapai. The RTC predominately traverses rural land outside of the FUZ at a total length of approximately 9.5km and is intended to operate in an uninterrupted free flowing manner with all road crossings grade separated.

The RTC is split into the following sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. Within the rural section, the RTC requires an extended width to accommodate both the RTC and RAMC.
- The **urbanised section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[10] along this section. Within this section, the RTC requires approximately 38m width to locate two FTN lanes, separated active mode facilities and the SH16 Main Road Upgrade.

It is proposed to route protect the RTC corridor for a future electric bus rapid transit system.

The RTC corridor will be at grade except at key sections to pass over local arterial roads or the Alternative State Highway, including Brigham Creek Road.

The RAMC is a segregated walking and cycling corridor that is located adjacent to the RTC alignment from the Brigham Creek Interchange to the western edge of Kumeū- Huapai, terminating at the signalised intersection of SH16 Main Road and Weza Lane. The corridor is co-located and integrated with the RTC and is proposed to be route-protected as a single NoR. The segregated corridor provides the opportunity for long-term amenity as a key cycling corridor, while connecting to the wider North Western Cycleway and ultimately to the Auckland city centre network.

[10] Refer Section 9 of this report

An overview of the proposed designs is provided in Figure 10-1.

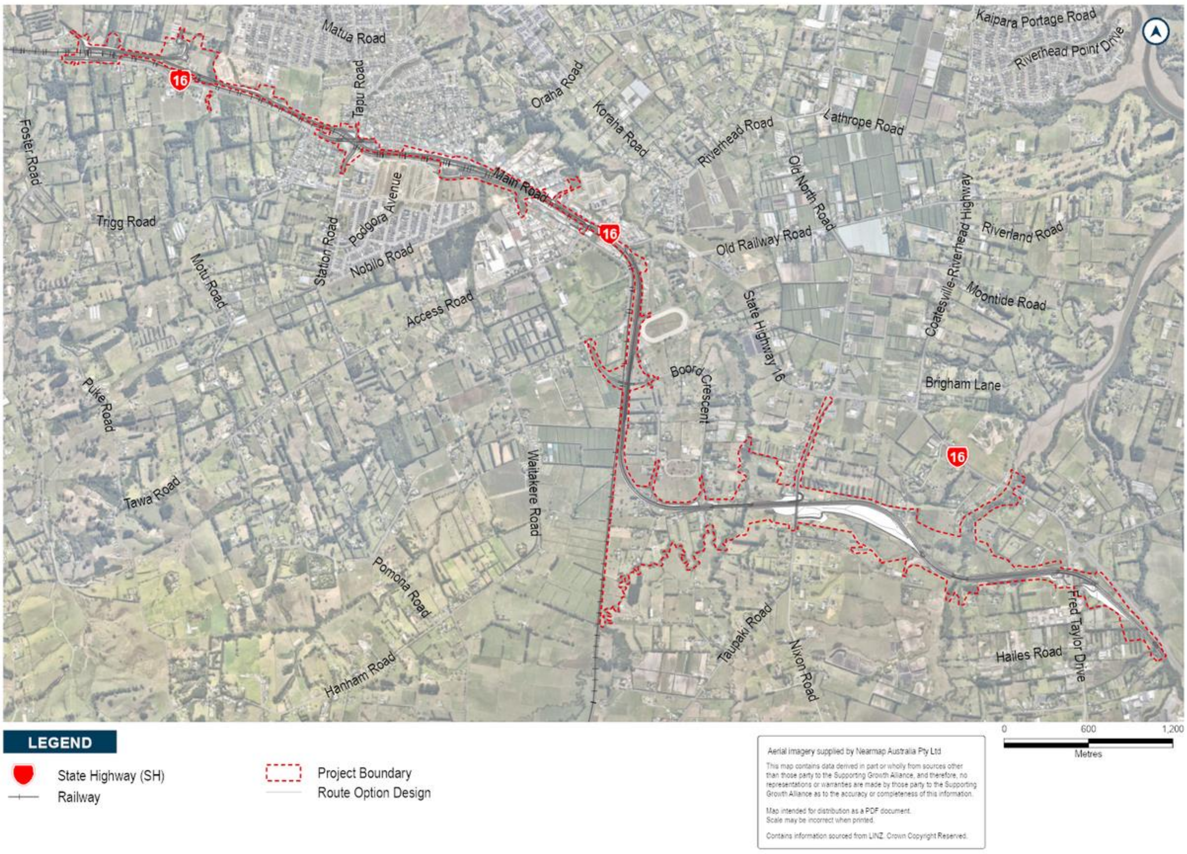


Figure 10-1: Rapid Transit Corridor and Regional Active Mode Corridor Overview

Key features of the proposed upgrade include the following:

- An approximately 9.5km long corridor intended to operate in an uninterrupted free flowing manner. The corridor has been designed to operate at 80km/h.
- The RTC will be at ground level except at key sections to pass over or under arterial roads (Fred Taylor Dr, Taupaki Rd, new Waitakere-Boord Cres Link Rd, Access Rd and Station Rd).
- The ASH (refer Section 8) goes over the RTC in the rural section.
- Grade separated road crossings at all intersections with adjoining roads.
- Within Kumeū-Huapai Township, upgrades of:
    - SH16 between Access Rd and John MacDonald Lane. At this section, the RTC abuts the KiwiRail boundary and the proposed SH16 upgrade which will need to be realigned north of its existing alignment.
    - Realignment of Station Road and Tapu Road to form a signalised cross-intersection. The RTC will pass under this proposed intersection to deviate to the north.

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

- Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary
- Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu Stream.

10.2 Existing and Likely Future Environment

10.2.1 Planning context

The Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) form a single, integrated corridor (Note the RAMC only extends to the eastern entrance to Kumeū). This corridor predominately traverses rural land outside of the FUZ (the rural section), however for assessment purposes it can be split into two sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. This rural section traverses land zoned under the AUP:OP as Rural – Countryside Living Zone, with an area zoned as FUZ in Redhills North.
- The **urban section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[11] along this section. This urban section contains a range of land uses zoned under the AUP:OP as a mix of business zonings between the eastern extent of the Kumeū-Huapai township and Station Road

Table 10-1 below provides a summary of the existing and likely future environment as it relates to the RTC and the RAMC.

Table 10-1: RTC and RAMC Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[12]	Likely Future Environment[13]
Rural	Rural	Low	Rural
Undeveloped greenfield areas	Future Urban	High	Urban
Business	Business (Industrial)	Low	Urban
	Business (Local Centre)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential	Low	Urban
Open Space	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

11 Another North West Strategic project – refer to Section **Error! Reference source not found.** of this report

12 Based on AUP:OP zoning/policy direction

13 Based on AUP:OP zoning/policy direction

Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL with active mode connections to:

- the Huapai Triangle crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and
- Wookey Lane crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and Business - Light Industry Zone.

Table 10-2: Kumeū Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]
Business	Business (Industrial)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential - Mixed Housing Suburban Zone	Low	Urban
Open Space (located to the north of the proposed station location)	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu Stream. The land is zoned under the AUP:OP as Future Urban Zone. An active modes overbridge is proposed across the NAL and SH16 to FUZ land. Future connections will be determined as part of structure plan process.

Table 10-3: Huapai Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[16]	Likely Future Environment[17]
Residential (located to the east of the proposed station location)	Residential – Single House Zone	Low	Urban
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

[14] Based on AUP:OP zoning/policy direction
[15] Based on AUP:OP zoning/policy direction
[16] Based on AUP:OP zoning/policy direction
[17] Based on AUP:OP zoning/policy direction

10.2.2 Existing and Future Noise Environment

The existing environment of the RTC ranges from relatively low (adjacent to the North Auckland Rail line, which currently carries approximately two trains a day) in the 40-50 dB $L_{Aeq(24h)}$ range, to elevated (mid-60 to 71 dB $L_{Aeq(24h)}$) where the RTC straddles the existing SH16.

With the redistribution of the traffic across each of the NoRs addressed in this report, we predict that noise levels will generally reduce, particularly in the vicinity of the existing SH16 (refer to Section 9). Increased use of the NAL, and additional activities in the developed FUZ may result in an increase in overall noise level, however, this will be dependent on the type of FUZ development and the potential future frequency of use of the rail line.

10.2.3 Buildings inside designation

The following Table 10-4 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or occupied by non-noise sensitive uses. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

Table 10-4: Buildings inside designation (not assessed)

Address	Address
42, 120, 122, 124, 130, 134, 138, 142, 146, 149, 152, 154, 156, 162, 176, 176A, 178, 182 Boord Cres, Kumeū	29, 30, 31 Meryl Ave, Kumeū
149 – 155 (uneven no. only), 186, 186, 188, 202, 204 Fred Taylor Dr, Whenuapai	191, 272, 278, 280, 609 SH16, Kumeū
51 Gilbransen Rd, Kumeū	2, 4, 6, 8 Tapu Rd, Huapai
87 Joseph Dunstan Dr, Taupaki	380, 388, 389, 400, 401 Taupaki Road, Taupaki
7 Main Road, Kumeū	9 Trotting Course Dr, Kumeū
335 – 347 (uneven no. only) Main Road, Huapai	903 Waitakere Road, Kumeū

10.3 Assessment of Operational Noise Effects

The use of the RAMC does not cause any appreciable noise levels compared with surrounding rail lines and roads. Therefore, we have not assessed it further. However, we note that the RAMC provides additional distance between the RTC and surrounding sites thus adding a small buffer.

For the RTC, we have assessed electric buses. There are a total of 227 sensitive receivers in the vicinity of the RTC.

10.3.1 Road Based Noise

We understand that only electric buses will be used on the RTC in line with the Auckland Transport "Low Emission Bus Roadmap"[18]. Electric buses emit significantly lower noise levels than diesel buses at lower speeds, but at speeds at and above 50 km/h noise levels are approximately the same as for diesel buses. Speeds of up to 80 km/h are proposed for the RTC.

No information is available as to the frequency of buses; however, we have assumed that at least 12 buses per hour will travel on the RTC, i.e. one every 10 min in each direction. We have predicted noise levels on a potential bus RTC using 100% heavy vehicles and a traffic volume of around 300 buses a day. Based on this assumption, we have predicted noise levels at each PPF adjacent to the RTC.

The bus transit lane will generally travel alongside existing roads or next to the NAL. However, as the NAL currently only carries a very limited number of trains, we have assumed that this part of the RTC would be assessed as a New road.

Of the total 227 PPFs, 37 have been assessed against the Altered road criteria, and 190 against the New road criteria. The location of the PPF distribution is indicated in Figure 10-2 below. Those PPFs assessed against New road criteria are coloured yellow, those assessed against Altered road criteria turquoise.

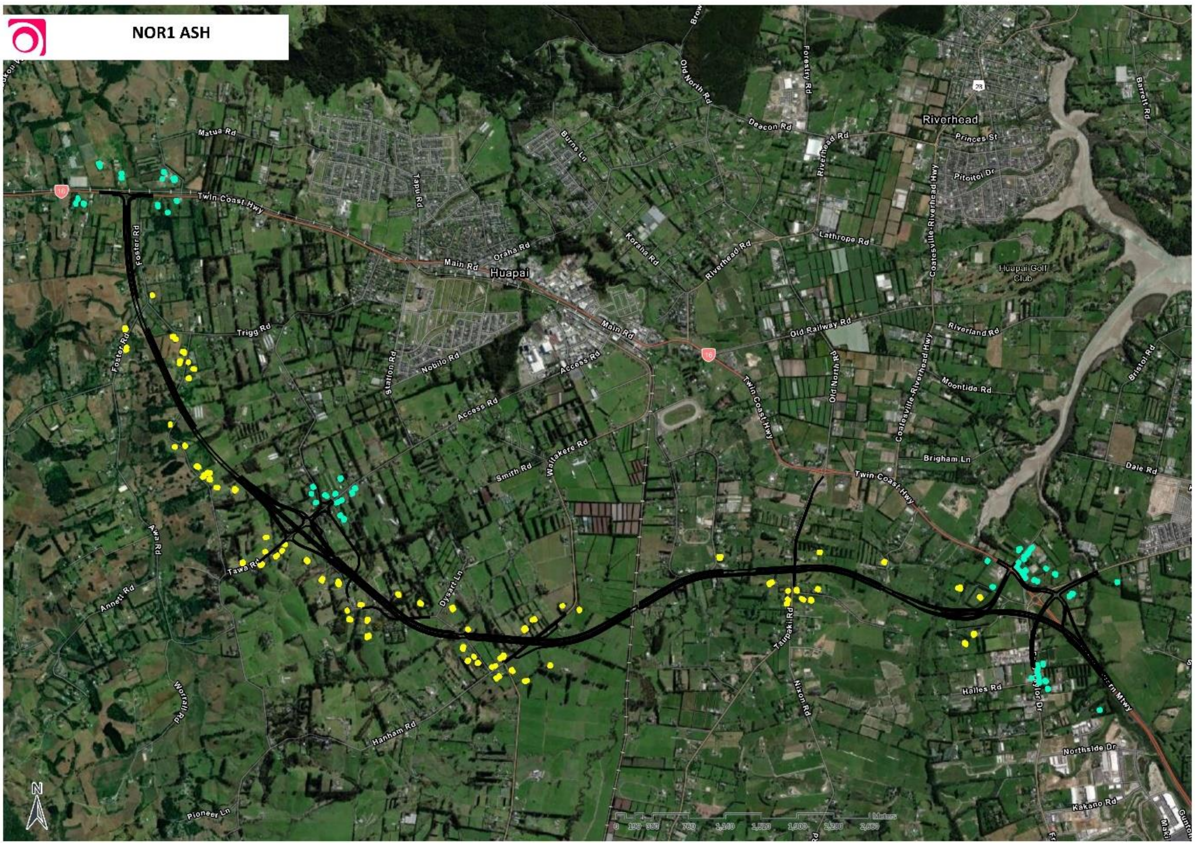


Figure 10-2: New and Altered Road sections within NoR S3 (Bus RTC)

[18] https://at.govt.nz/media/1985010/aucklands-low-emission-bus-roadmap-version-2-october-2020.pdf

For both New and Altered road sections, all PPFs are predicted to receive noise levels within Category A, with a highest predicted noise level of

- 56 dB $L_{Aeq(24h)}$ for the Altered road section and
- 48 dB $L_{Aeq(24h)}$ for the New road section.

We have predicted the noise environment from the future use of the roads in the design year. Noise levels from roads in the vicinity range from 43 dB $L_{Aeq(24h)}$ to 69 dB $L_{Aeq(24h)}$. The use of the RTC by electric buses may:

- add to the noise levels in low noise environments such as in the vicinity of the NAL), and
- not have any effect on the noise levels in high noise environments, e.g. where the RTC travels adjacent to SH16.

Should a significant increase in train numbers on the NAL occur, the establishment of the RTC with buses would be unlikely to contribute to the overall noise level, however, between trains, buses will still be audible and noticeable.

We have predicted noise levels of surrounding roads, with and without buses, and with the implementation of the suite of NoRs discussed in this report. The noise levels from the RTC only will be within Category A for all PPFs. Predicted noise levels for individual PPFs are included in Appendix 1.3. No noise level contours are included in Appendix 2 as the main noise source is traffic on neighbouring roads.

Overall, the effects will be negligible to unnoticeable.

10.3.2 Station Noise

As discussed in Section 2.1.3, station noise is generally defined by PA system noise. These can be easily designed to comply with the relevant AUP:OP zone noise limits. The closest sensitive receivers to both stations are at 105m at Huapai Station and 140m at Kumeū Station. At these distances, any common PA system will be able to comply with the most stringent night-time noise limit of 45 dB L_{Aeq} (refer Table 2-2).

10.4 Conclusions

The operational noise effects from electric buses are predicted to be minimal on the overall noise environment. The buses would be co-located with existing transport routes (rail and road) and, provided that the road surface is well maintained, buses would add only marginally to the overall noise level experienced by PPFs in the vicinity of the road.

Stations can be designed so that compliance with the relevant noise limits can be achieved. Closest sensitive receivers are at significant distances. Therefore, we do not anticipate that station noise will have any significant effect on the overall noise environment.

11 NoR S4: Access Road Upgrade

It is proposed to submit a Notice of Requirement (NoR S4) to designate the land required to implement the upgrade of Access Road to a four-lane corridor with separated walking and cycling facilities.

11.1 Project Corridor Features

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai. The proposed upgrade extends from the intersection of Access Road with SH16 (and entry to the Kumeū-Huapai township) in the east and continues into Tawa Road to its intersection with Puke Road in the west. Access Road plays a key role in connecting the existing and likely future business zones to both the RTC (refer Section 10) and ASH (refer Section 8). It is aligned along the south eastern boundary of the southern FUZ, providing for an enhanced collector network to connect to it.

It is proposed to widen the existing Access Road/Tawa Road corridor from its current width of 20m to accommodate a 30m wide four-lane cross-section. The cross-section of the corridor transitions from the rural edge cross-section to an urban cross-section west of Wookey Lane intersection. Along the western section of Access Road, which is a low-speed rural section, the corridor has a rural southern edge (swales, typically 9m wide top width) with walking and cycling facilities along its northern urban edge. Through the business and industrial area, a 30m urban corridor is provided, including walking and cycling infrastructure along both sides of this eastern section.

An overview of the proposed design is provided in Figure 11-1 below.

Figure 11-1: Overview of Access Road Upgrade

Key features of the proposed upgrade include the following:

- Upgrading the existing Access Road corridor to a 30m wide four-lane arterial road with walking and cycling provisions.
- Existing road surface is maintained, i.e. chip seal grade 3/5.
- A posted speed limit of 60km/h through the urban FUZ-rural edge area and 50km/h through the business and industrial area.
- Tie-ins with existing roads.

11.2 Existing and Likely Future Environment

11.2.1 Planning context

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai.

- The northern side of Access Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zoning at the north-eastern section of Access Road.
- The southern side of Access Road is predominantly zoned under the AUP:OP as Rural – Countryside Living, with exception to the Kumeū Showgrounds which are zoned as Rural – Mixed Rural Zone are identified as a precinct (I517 Kumeū Showgrounds Precinct) in the AUP:OP.

Table 11-1 below provides a summary of the existing and likely future environment as it relates to Access Road.

Table 11-1: Access Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[19]	Likely Future Environment[20]
Business	Business (Light Industrial) Zone	Low	Urban
Rural	Rural – Countryside Living Zone Rural – Mixed Rural Zone	Low	Rural
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

11.2.2 Existing and Future Noise Environment

Access Road straddles the boundary between an existing rural zone and the FUZ. This means that one side of the road will change significantly in the future, while the other is remaining largely similar to its current state.

[19] Based on AUP:OP zoning/policy direction
[20] Based on AUP:OP zoning/policy direction

Existing noise levels range from the 47 dB $L_{Aeq(24h)}$ to 66 dB $L_{Aeq(24h)}$ at neighbouring dwellings.

The potential future development in the area is predicted to generate a significant amount of extra traffic on local roads, which means that noise levels would increase significantly, around 7-8 decibels in the future, without the implementation of the suite of NoRs discussed in this report.

11.2.3 Buildings inside designation

The following Table 11-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or not occupied by noise sensitive uses when the project is complete. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

Table 11-2: Buildings inside designation (not assessed)

Address	Address
21, 123, 185, 187, 236 Access Road, Kumeū	166 Station Road, Kumeū

11.3 Assessment of Road Traffic Noise Effects

The upgrades proposed for this project involve the widening of the road, both to the north into the FUZ and to the south of the existing road, into the Rural Zone. This zone will not change significantly, while to the north urbanisation is planned in the FUZ. There is currently no structure plan or similar for the FUZ, which means we have no detail on potential future use. It may be developed as a THAB, Mixed Housing Urban, Town Centre or Business / Light Industry. In any event, we have provided traffic noise contours across the entire assessment area, which can be used for the future planning of the FUZ. Where noise sensitive buildings are established, they should be designed appropriately to provide suitable internal noise levels for future residents or occupiers.

11.3.1 NZS6806

The future development in the area is anticipated to increase the traffic volumes significantly. This is reflected in the fact that while currently all PPFs receive noise levels in Categories A, in the Do-nothing scenario there are 16 PPFs receiving noise levels in Category B, and 4 in Category C.

The implementation of the project will result in a significant improvement for a number of PPFs, with no PPFs receiving noise levels in Category C from the Project rather than other roads unrelated to the Project. When including noise from other surrounding roads (which are not altered by the Project), there are four PPFs with noise levels in Category C (150 and 164 Motu Road, 150 Station Road and 76 Tawa Road) controlled by traffic on Tawa and Motu Roads, which would occur irrespective of the Project. For either Do-minimum scenario (with and without local roads) the number of PPFs with noise levels in Category A increases, even when compared with the Do-nothing scenario.

When assessing traffic from Access Road only, only 76 Tawa Road is predicted to receive a slight (1 dB) noise level increase due to the Project, while also receiving noise levels in Category B. All other PPFs with predicted noise levels in Category B (25 and 59 Tawa Road) are predicted to receive noise level reductions. Nevertheless, we have assessed potential mitigation for these PPFs in the form of a barrier. With a 2m boundary fence, both 59 and 76 Tawa Road are predicted to receive noise levels in

Category A. 25 Tawa Road is a double storey dwelling. A boundary fence would not result in sufficient noise level reduction to reach noise levels in Category A unless such fence would be impractically high. Since this PPFs is predicted to receive a noise level reduction from the implementation of the Project, irrespective of mitigation, we have not recommended any further mitigation.

The number of PPFs in each noise criteria category is summarised in Table 11-3, and figures showing the location of the PPFs are included in Appendix 2.3

Table 11-3: Summary of NZS 6806 assessment – Altered Road

Scenario	Number of PPFs		
	NZS 6806 Categories		
	Category A	Category B	Category C
Existing	56	0	0
Do-nothing	36	16	4
Do-minimum (Access Road only)	53	3	0
Do-minimum (Access Road and local roads)	46	6	4
Mitigation Option (2m boundary fences)	55	1	0

11.3.2 Change in Noise Levels

For the 56 PPFs assessed, we predict noise level increases from the existing to Do-nothing scenario of up to 11 dB, and an average 7 dB.

With the project in place, and including local roads unaffected by the Project, noise levels are predicted to reduce on average 3 dB compared with the Do-nothing scenario.

Noise level increases of 4 dB are predicted for three PPFs (two buildings at 83 Tawa Road and 236 Access Road). All of these PPFs are predicted to receive noise levels within Category A, so no further mitigation would be required.

With localised mitigation at 59 and 76 Tawa Road (where noise levels are otherwise within Category B), the average noise level reduction remains 3 dB.

Figure 11-2 shows the number of PPFs assessed in each of the change in noise level bands discussed in Table 2-3. It shows clearly that noise levels will overall be lower, as an effect of the redistribution of traffic away from the existing SH16.

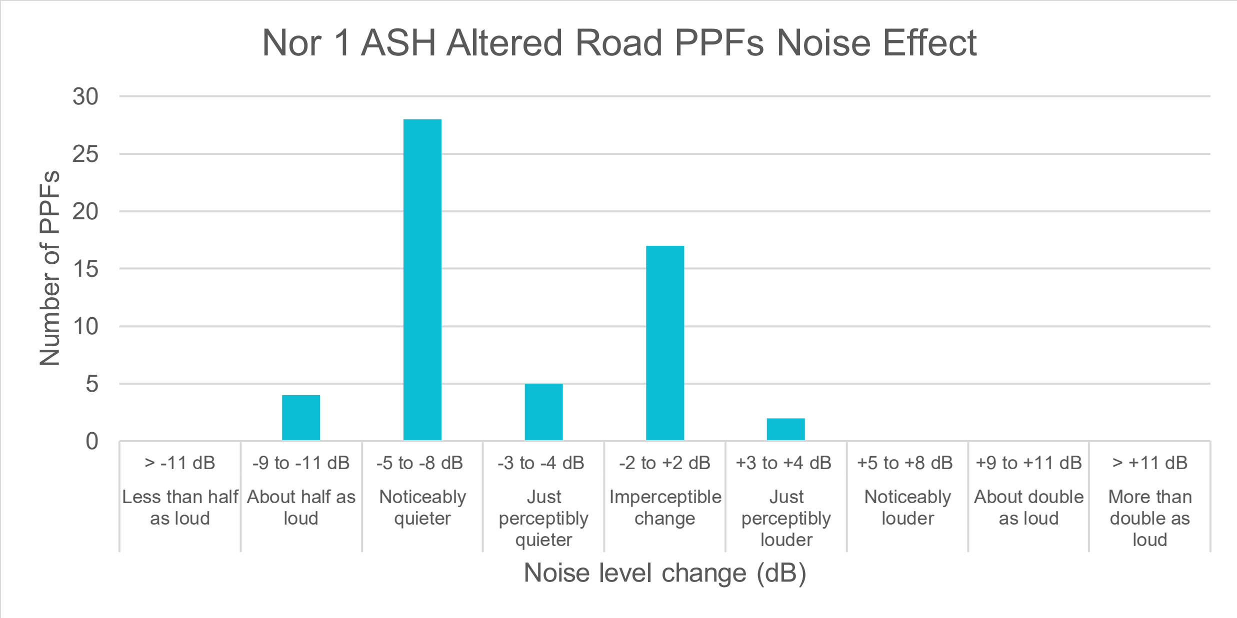


Figure 11-2: Change in noise level

11.4 Conclusions

NoR S4 involves the upgrade to an existing road by widening the road and providing walking and cycling facilities. The proposed widening will bring traffic lanes closer to some dwellings. However, with the implementation of the suite of NoRs discussed in this report, an overall reduction in traffic volume is predicted on Access Road.

With the Project in place, including the mitigation in the form of 2 m boundary fences at two PPFs, only one PPF (25 Tawa Road), which is a double storey dwelling, is predicted to receive noise levels in Category B. A barrier would need to be impracticably high to reduce the noise level at the upper floor. Therefore, no practicable mitigation was identified, and no further mitigation proposed.

With the Project in place and including other local roads in the area that are unaffected by the Project, the noise level is predicted to marginally reduce by an average of 3 dB.

Overall, while in some areas the noise levels will significantly increase (particularly in the vicinity of NoR S1 where a new major road is proposed in a current greenfield environment) the suite of NoRs will have an overall positive effect on the traffic noise levels in the wider area.

12 Conclusion

We have assessed operational noise for the Strategic Assessment Package. The package includes six NoRs: two new or altered roads (NoR S1 and NoR S4), one walking and cycling upgrade (NoR S2) and one rapid transit corridor (facilitating electric buses) and two stations (NoR S3, and NoRs HS and KS).

The road traffic noise of NoRs S1 and S4 has been assessed against NS6806 and in relation to the change in noise level. With limited mitigation in the form of roadside barriers or boundary fences, generally a noise level reduction can be achieved and noise levels within Category A or, for a small number of PPFs, Category B. NoR S1 will result in a noise level increase to a number of PPFs that are currently in a rural area with little major noise sources. Nevertheless, with mitigation, most are predicted to receive noise levels in Category A, with only 19 of the total 134 PPFs receiving noise levels within Category B, and no PPFs noise levels within Category C. For PPFs still predicted to receive noise levels in Category B, mitigation in the form of barriers is impracticable due to the location of the dwelling in relation to the road or because the dwelling is double storey. NoR S4 will result in a small noise level increase at three PPFs that are predicted to receive noise levels above Category A. With boundary fences, for two of these PPFs noise levels can be reduced to be within Category A, and there is no practicable mitigation to further reduce the noise level at the third PPF.

Walking and cycling (NoR S2) do not generate high noise levels and would not add to existing ambient noise levels, particularly where the walking and cycling facilities are located next to a busy road. No further mitigation has been proposed.

The rapid transit in NoR S3 is proposed to be via electric buses. We have assessed the noise against NZS6806, with all PPFs predicted to receive noise levels in Category A.

Road traffic vibration is not normally an issue, particularly for newly constructed and well-maintained roads. Therefore, we have not further assessed it here.

Station noise (NoRs HS and KS) has been assessed against the underlying AUP:OP zone limits. The main noise source from stations is the PA system, which can be designed to comply with the relevant limits. Sensitive receivers are at a significant distance, and we predict ready compliance including at night-time.

Overall, the implementation of the suite of NoRs assessed in this report is predicted to result in a reduction in noise level across all PPFs. While some PPFs are predicted to receive noise level increases (particularly in the vicinity of NoR S1), overall with mitigation in place, noise level will be lower than would have been the case without the suite of NoRs implemented.

1 Appendix A: Predicted Noise Levels at all PPFs

For all tables in this appendix, the following applies:

Situation	Description
Existing	current road layout and traffic volume
Do-nothing	current road layout and future traffic volume (2048+)
Do-minimum	future road layout of the Project of interest only, traffic volumes (2048+) assume that all Projects of the Nort Western Strategic Package have been implemented, but without specific noise mitigation
Mitigation Option	the same as for the Do-minimum Situation, but including noise mitigation in the form of barriers where considered to be BPO

1.1 NoR S1

1.1.1 Altered Road

PPF Address (NoR S1 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
2 Brigham Creek Road, Whenuapai, Auckland	GF	70.3	63.4	61.8	61.8
4 Brigham Creek Road, Whenuapai, Auckland	GF	72.8	64.2	62.6	62.6
6 Brigham Creek Road, Whenuapai, Auckland	GF	63.6	65.4	58.8	58.8
15 Brigham Creek Road, Whenuapai, Auckland (2)	GF	58.4	62.0	62.8	62.8
15 Brigham Creek Road, Whenuapai, Auckland (1)	GF	62.6	64.9	62.2	62.2
23-27 Brigham Creek Road, Whenuapai, Auckland	GF	58.4	60.5	51.5	51.5
107 Fred Taylor Drive, Whenuapai, Auckland	GF	51.9	56.5	53.2	53.2
121 Fred Taylor Drive, Whenuapai, Auckland	GF	55.7	59.4	53.4	53.4
125 Fred Taylor Drive, Whenuapai, Auckland	1.FL	55.7	59.1	55.6	55.6
127 Fred Taylor Drive, Whenuapai, Auckland	GF	65.3	69.0	52.7	52.2
129 Fred Taylor Drive, Whenuapai, Auckland	GF	63.5	67.2	51.8	51.2
131 Fred Taylor Drive, Whenuapai, Auckland	GF	62.4	66.2	51.6	51.6
133 Fred Taylor Drive, Whenuapai, Auckland	GF	64.6	68.4	51.6	51.6

PPF Address (NoR S1 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
135 Fred Taylor Drive, Whenuapai, Auckland	GF	65.5	69.2	56.8	55.8
137 Fred Taylor Drive, Whenuapai, Auckland	GF	64.6	68.3	57.7	56.8
139 Fred Taylor Drive, Whenuapai, Auckland	GF	57.6	61.3	57.9	54.6
141 Fred Taylor Drive, Whenuapai, Auckland	GF	65.3	69.0	63.7	61.1
143 Fred Taylor Drive, Whenuapai, Auckland	1.FL	57.0	60.7	58.8	58.8
172 Fred Taylor Drive, Whenuapai, Auckland	1.FL	66.7	70.4	57.9	58.0
1 Kennedys Road, Whenuapai, Auckland	1.FL	65.9	67.7	63.9	63.9
3 Kennedys Road, Whenuapai, Auckland	GF	58.5	60.2	54.1	53.9
5 Kennedys Road, Whenuapai, Auckland	GF	57.2	57.1	54.9	54.8
9 Kennedys Road, Whenuapai, Auckland	GF	56.9	58.4	55.2	55.2
11 Kennedys Road, Whenuapai, Auckland	GF	55.2	56.5	52.3	52.3
13 Kennedys Road, Whenuapai, Auckland	GF	54.5	55.7	52.1	52.1
15 Kennedys Road, Whenuapai, Auckland	1.FL	56.8	58.0	54.2	54.2
17 Kennedys Road, Whenuapai, Auckland	GF	54.2	55.6	51.6	51.6
19 Kennedys Road, Whenuapai, Auckland	1.FL	61.6	62.6	57.5	57.5
2-6 Kennedys Road, Whenuapai, Auckland	1.FL	57.1	59.0	54.8	54.7
17A Kennedys Road, Whenuapai, Auckland	GF	54.3	55.6	51.7	51.7
392 Matua Road, Kumeu	GF	59.1	59.7	51.7	51.6
402 Matua Road, Kumeu	1.FL	62.4	64.9	51.1	51.0
392B Matua Road, Kumeu	GF	59.7	60.0	52.0	52.0
150 Motu Road, Kumeu	1.FL	60.7	72.7	53.1	53.1
158 Motu Road, Kumeu	1.FL	55.6	65.9	58.0	58.0
164 Motu Road, Kumeu	1.FL	60.7	71.9	63.2	63.2
171 State Highway 16, Whenuapai, Auckland	GF	69.8	68.6	66.0	63.8
173 State Highway 16, Whenuapai, Auckland	GF	68.1	68.5	65.8	64.2
175 State Highway 16, Whenuapai, Auckland	GF	67.6	68.5	65.1	64.2
177 State Highway 16, Whenuapai, Auckland	GF	66.4	68.3	65.3	64.0
179 State Highway 16, Whenuapai, Auckland	GF	65.6	67.6	63.7	63.7
181 State Highway 16, Whenuapai, Auckland	GF	65.3	67.3	64.2	64.1

PPF Address (NoR S1 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
218 State Highway 16, Whenuapai, Auckland	GF	56.4	57.7	58.0	57.8
222 State Highway 16, Whenuapai, Auckland	GF	65.8	67.8	52.8	52.4
677 State Highway 16, Kumeu	GF	68.7	68.6	51.0	51.0
693 State Highway 16, Kumeu	1.FL	62.0	62.2	54.2	54.2
695 State Highway 16, Kumeu	GF	65.4	65.3	55.2	55.2
726 State Highway 16, Kumeu (2)	GF	57.7	58.4	48.9	48.9
726 State Highway 16, Kumeu (1)	1.FL	62.3	63.1	56.5	56.4
728 State Highway 16, Kumeu	1.FL	56.8	57.7	48.9	48.9
761 State Highway 16, Kumeu (2)	GF	67.7	68.6	41.9	41.9
761 State Highway 16, Kumeu (1)	GF	63.8	64.6	45.4	45.4
763 State Highway 16, Kumeu	GF	62.3	63.1	40.3	40.3
59 Tawa Road, Kumeu	GF	58.3	66.3	52.2	52.2
63 Tawa Road, Kumeu	GF	52.8	60.2	53.4	53.3
66 Tawa Road, Kumeu	GF	49.3	56.3	50.9	50.9
73 Tawa Road, Kumeu	GF	57.1	64.8	56.4	56.4
76 Tawa Road, Kumeu	GF	58.2	65.8	60.7	60.7
79 Tawa Road, Kumeu	GF	59.0	67.1	63.3	63.1
83 Tawa Road, Kumeu (2)	GF	51.0	57.6	61.1	61.1
83 Tawa Road, Kumeu (1)	GF	50.0	56.6	59.9	59.9
86 Tawa Road, Kumeu (2)	GF	54.6	62.3	61.7	61.7
86 Tawa Road, Kumeu (1)	GF	54.6	64.2	60.0	60.0

12.1.1 New Road

PPF Address (NoR S1 New Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
186 Boord Crescent, Kumeu	GF	57.3	55.8	60.0	59.1
4 Dysart Lane, Kumeu	GF	52.3	59.1	58.1	56.3
81 Foster Road, Kumeu	GF	56.6	62.9	55.5	54.6
116 Foster Road, Kumeu	GF	58.2	62.4	54.1	54.2
131 Foster Road, Kumeu	GF	57.2	61.5	53.8	53.8
196 Fred Taylor Drive, Whenuapai, Auckland	GF	50.2	51.9	55.1	55.1
198 Fred Taylor Drive, Whenuapai, Auckland	1.FL	49.3	51.3	54.1	54.1
208 Fred Taylor Drive, Whenuapai, Auckland	GF	54.2	55.7	58.3	57.3

PPF Address (NoR S1 New Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
210 Fred Taylor Drive, Whenuapai, Auckland	GF	53.9	55.8	55.4	55.0
2 Hanham Road, Kumeu	GF	55.3	62.7	59.3	56.6
6 Hanham Road, Kumeu	GF	53.0	59.9	54.6	53.9
8 Hanham Road, Kumeu	GF	57.4	64.3	55.7	53.6
9 Hanham Road, Kumeu	GF	53.0	60.6	54.6	54.1
14 Joseph Dunstan Drive, Taupaki	GF	51.1	53.4	55.6	54.8
28 Pomona Road, Kumeu	1.FL	52.3	58.9	61.2	59.8
48 Pomona Road, Kumeu	GF	53.4	60.1	58.2	56.1
66 Pomona Road, Kumeu	GF	60.5	67.5	59.6	57.6
90 Pomona Road, Kumeu	GF	59.5	67.1	60.0	57.7
94 Pomona Road, Kumeu	1.FL	56.0	62.8	57.7	57.1
95 Pomona Road, Kumeu	GF	61.4	68.6	62.3	59.3
96 Pomona Road, Kumeu	GF	54.9	61.7	59.3	59.2
114 Pomona Road, Kumeu	GF	50.4	56.8	56.0	56.0
123 Pomona Road, Kumeu (2)	GF	52.9	59.8	59.4	58.6
123 Pomona Road, Kumeu (1)	GF	51.2	58.1	58.0	57.4
151 Pomona Road, Kumeu	GF	53.1	60.1	54.9	54.9
191 Pomona Road, Kumeu	1.FL	57.8	64.8	62.1	59.9
194 Pomona Road, Kumeu	GF	57.1	64.0	62.1	59.7
212 Pomona Road, Kumeu	GF	61.3	68.3	59.4	57.0
214 Pomona Road, Kumeu	GF	53.5	60.3	58.4	57.1
218 Pomona Road, Kumeu	GF	61.5	68.4	58.1	56.4
18 Puke Road, Kumeu	GF	52.9	62.5	52.2	52.2
21 Puke Road, Kumeu	GF	52.4	65.1	50.4	50.3
22 Puke Road, Kumeu	GF	49.3	58.6	55.2	55.2
27 Puke Road, Kumeu	GF	49.7	54.2	47.3	47.3
37 Puke Road, Kumeu	GF	48.0	57.7	50.1	49.9
80 Puke Road, Kumeu	GF	47.6	59.3	48.6	48.5
104 Puke Road, Kumeu	GF	49.4	59.4	53.6	53.6
107 Puke Road, Kumeu	GF	50.5	63.2	56.4	56.4
133 Puke Road, Kumeu	GF	48.1	54.0	55.6	55.5
139 Puke Road, Kumeu (2)	GF	46.4	52.0	58.5	58.6
139 Puke Road, Kumeu (1)	GF	51.7	56.9	55.2	55.3
145 Puke Road, Kumeu	GF	46.4	51.8	55.6	55.6
151 Puke Road, Kumeu	GF	45.9	51.4	55.2	55.2
157 Puke Road, Kumeu	GF	46.4	52.4	59.6	59.3
284 State Highway 16, Kumeu	GF	50.9	52.3	57.8	55.7
362 Taupaki Road, Taupaki	GF	62.4	64.7	50.9	50.9
364 Taupaki Road, Taupaki	GF	63.7	65.9	51.6	51.5
367 Taupaki Road, Taupaki	GF	56.5	58.8	54.8	54.1

PPF Address (NoR S1 New Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
370 Taupaki Road, Taupaki	GF	61.2	63.5	53.3	53.2
374 Taupaki Road, Taupaki	1.FL	51.5	53.8	63.7	62.6
375 Taupaki Road, Taupaki	GF	63.7	65.9	55.8	55.1
377 Taupaki Road, Taupaki	1.FL	51.8	54.1	60.3	58.9
405 Taupaki Road, Kumeu	GF	49.6	51.9	55.5	55.8
137 Tawa Road, Kumeu	GF	59.1	57.6	64.1	63.2
141 Tawa Road, Kumeu	1.FL	55.0	56.6	60.0	59.3
145 Tawa Road, Kumeu	GF	52.4	53.8	55.4	54.9
148 Tawa Road, Kumeu	GF	48.5	53.1	56.5	56.5
154 Tawa Road, Kumeu	GF	54.5	55.2	57.8	57.3
155 Tawa Road, Kumeu	GF	56.5	55.1	56.4	56.2
176 Tawa Road, Kumeu	GF	51.0	51.6	49.1	49.0
227 Trigg Road, Kumeu (2)	GF	55.5	57.8	54.2	54.1
227 Trigg Road, Kumeu (1)	GF	54.3	56.8	52.5	52.5
609 Waitakere Road, Kumeu	GF	52.7	60.6	49.1	48.8
637 Waitakere Road, Kumeu	GF	62.4	70.4	57.9	57.4
646 Waitakere Road, Kumeu (2)	GF	55.6	63.4	57.9	57.5
646 Waitakere Road, Kumeu (1)	GF	54.2	60.3	60.6	57.7
670 Waitakere Road, Kumeu	GF	49.5	54.5	60.8	58.2
679 Waitakere Road, Kumeu	GF	47.6	53.1	59.6	58.7
682 Waitakere Road, Kumeu	GF	49.9	54.6	56.0	55.4
710 Waitakere Road, Kumeu	GF	51.2	55.9	54.9	54.1
723 Waitakere Road, Kumeu	GF	53.0	57.9	58.1	56.8

1.2 NoR S2

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
24 Access Road, Kumeu	GF	59.9	64.8	43.2
26 Access Road, Kumeu (3)	GF	60.4	65.3	40.2
26 Access Road, Kumeu (1)	GF	51.8	55.6	39.2
27 Access Road, Kumeu (2)	GF	55.5	60.2	44.6
1-23 Croatia Avenue, Huapai, Kumeu (14)	GF	47.4	50.4	41.0
1-23 Croatia Avenue, Huapai, Kumeu (13)	GF	47.5	50.1	40.0
1-23 Croatia Avenue, Huapai, Kumeu (12)	GF	46.5	50.2	41.6

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
1-23 Croatia Avenue, Huapai, Kumeu (11)	GF	47.6	50.5	42.6
1-23 Croatia Avenue, Huapai, Kumeu (10)	GF	46.9	49.2	41.9
1-23 Croatia Avenue, Huapai, Kumeu (9)	GF	48.4	49.8	45.7
1-23 Croatia Avenue, Huapai, Kumeu (8)	GF	47.9	49.4	44.4
1-23 Croatia Avenue, Huapai, Kumeu (7)	GF	50.3	50.6	47.9
1-23 Croatia Avenue, Huapai, Kumeu (6)	GF	47.4	49.9	39.7
1-23 Croatia Avenue, Huapai, Kumeu (5)	GF	47.2	49.8	39.7
1-23 Croatia Avenue, Huapai, Kumeu (4)	GF	46.7	49.7	41.1
1-23 Croatia Avenue, Huapai, Kumeu (3)	GF	47.1	49.6	42.6
1-23 Croatia Avenue, Huapai, Kumeu (2)	3.FL	54.7	57.5	53.5
1-23 Croatia Avenue, Huapai, Kumeu (1)	GF	48.3	52.0	43.6
56 Dida Park Drive, Huapai, Kumeu	GF	47.1	51.5	37.6
58 Dida Park Drive, Huapai, Kumeu	GF	49.4	52.5	44.5
44 Gilbransen Road, Kumeu	GF	56.3	55.5	44.2
47 Gilbransen Road, Kumeu (2)	1.FL	51.2	51.0	42.0
47 Gilbransen Road, Kumeu (1)	GF	58.1	57.2	47.6
50 Gilbransen Road, Kumeu (2)	GF	62.6	61.6	49.8
50 Gilbransen Road, Kumeu (1)	GF	59.3	58.4	47.0
44A Gilbransen Road, Kumeu	GF	57.4	56.6	45.7
44B Gilbransen Road, Kumeu	GF	57.2	56.4	45.8
44C Gilbransen Road, Kumeu	GF	58.0	57.1	46.4
44D Gilbransen Road, Kumeu	GF	58.5	57.6	46.9
8 Grivelle Street, Kumeu (2)	GF	51.5	55.0	42.7
8 Grivelle Street, Kumeu (1)	GF	51.3	55.8	40.6
7 Main Road, Kumeu	GF	61.2	61.7	57.3
342 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	60.7
344 Main Road, Huapai, Kumeu	GF	62.4	62.3	58.0
346 Main Road, Huapai, Kumeu	GF	57.4	57.5	53.0
348 Main Road, Huapai, Kumeu	1.FL	66.0	65.8	61.6
350 Main Road, Huapai, Kumeu	1.FL	63.8	63.7	59.7
351 Main Road, Huapai, Kumeu	GF	65.6	65.4	61.6
352 Main Road, Huapai, Kumeu	GF	64.4	64.3	60.2
353 Main Road, Huapai, Kumeu	GF	65.9	65.7	62.3
354 Main Road, Huapai, Kumeu	GF	62.6	62.6	58.8
355 Main Road, Huapai, Kumeu	GF	64.4	64.2	60.5
356 Main Road, Huapai, Kumeu	GF	64.5	64.4	60.4
357 Main Road, Huapai, Kumeu	GF	65.7	65.5	62.5
358 Main Road, Huapai, Kumeu	GF	60.8	60.8	56.7
359 Main Road, Huapai, Kumeu	GF	65.0	64.8	62.0
360 Main Road, Huapai, Kumeu	1.FL	62.0	61.9	57.9

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
361 Main Road, Huapai, Kumeu	GF	62.9	62.8	59.6
362 Main Road, Huapai, Kumeu (2)	1.FL	65.9	65.8	61.7
362 Main Road, Huapai, Kumeu (1)	1.FL	62.3	62.2	58.1
364 Main Road, Huapai, Kumeu	GF	60.8	60.8	56.7
365 Main Road, Huapai, Kumeu	GF	61.8	61.7	58.6
366 Main Road, Huapai, Kumeu	GF	57.9	57.9	53.7
367 Main Road, Huapai, Kumeu	GF	65.1	65.0	62.1
368 Main Road, Huapai, Kumeu	GF	61.4	61.3	57.3
370 Main Road, Huapai, Kumeu	GF	61.4	61.4	57.3
372 Main Road, Huapai, Kumeu	GF	63.8	63.7	59.6
376 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	61.0
382 Main Road, Huapai, Kumeu	GF	66.7	66.5	62.6
395 Main Road, Huapai, Kumeu (2)	GF	59.2	59.6	56.3
395 Main Road, Huapai, Kumeu (1)	GF	56.2	57.1	52.8
399 Main Road, Huapai, Kumeu	GF	62.0	62.3	59.2
401 Main Road, Huapai, Kumeu	GF	61.1	61.4	58.5
405 Main Road, Huapai, Kumeu	GF	66.8	66.4	55.2
407 Main Road, Huapai, Kumeu	GF	67.5	66.9	58.7
407A Main Road, Huapai, Kumeu	1.FL	66.6	65.9	58.2
9 Matua Road, Huapai, Kumeu	GF	53.0	56.3	41.5
11 Matua Road, Huapai, Kumeu	GF	51.6	54.4	42.0
15 Matua Road, Huapai, Kumeu	GF	50.4	52.8	40.0
17 Matua Road, Huapai, Kumeu	GF	50.1	52.8	42.1
19 Matua Road, Huapai, Kumeu	GF	49.7	51.6	42.4
21 Matua Road, Huapai, Kumeu	1.FL	53.0	55.7	43.0
22 Matua Road, Huapai, Kumeu	GF	62.0	66.8	41.6
23 Matua Road, Huapai, Kumeu	1.FL	51.7	54.4	41.9
24 Matua Road, Huapai, Kumeu	GF	52.9	56.0	40.6
384 Matua Road, Kumeu	GF	56.7	57.6	48.7
392 Matua Road, Kumeu	GF	59.1	59.7	48.2
402 Matua Road, Kumeu	1.FL	62.4	64.9	63.2
411 Matua Road, Kumeu	GF	58.1	59.3	55.8
392B Matua Road, Kumeu	GF	59.7	60.0	50.4
5 Merlot Heights, Huapai, Kumeu	1.FL	53.1	54.8	45.5
6 Merlot Heights, Huapai, Kumeu	GF	49.7	52.4	41.0
7 Merlot Heights, Huapai, Kumeu	1.FL	54.2	55.7	46.6
9 Merlot Heights, Huapai, Kumeu	1.FL	54.4	55.7	46.8
10 Merlot Heights, Huapai, Kumeu	GF	49.2	51.4	41.7
11 Merlot Heights, Huapai, Kumeu	GF	49.1	50.3	43.7
17 Merlot Heights, Huapai, Kumeu	GF	48.3	49.7	41.8
18 Merlot Heights, Huapai, Kumeu	GF	49.4	51.2	43.0

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
19 Merlot Heights, Huapai, Kumeu	GF	46.9	48.4	41.2
21 Merlot Heights, Huapai, Kumeu	GF	47.7	48.9	41.6
22 Merlot Heights, Huapai, Kumeu	GF	47.2	48.7	42.0
23 Merlot Heights, Huapai, Kumeu	GF	47.3	48.7	40.8
25 Merlot Heights, Huapai, Kumeu	GF	48.0	49.3	42.2
26 Merlot Heights, Huapai, Kumeu	GF	47.3	49.9	41.6
27 Merlot Heights, Huapai, Kumeu	GF	47.9	49.3	41.6
29 Merlot Heights, Huapai, Kumeu	GF	47.9	49.3	41.5
31 Merlot Heights, Huapai, Kumeu	GF	47.0	48.6	40.9
1 Oraha Road, Huapai, Kumeu	GF	52.9	53.5	46.1
3 Oraha Road, Huapai, Kumeu	GF	53.2	54.1	45.0
6 Oraha Road, Huapai, Kumeu	1.FL	56.0	61.2	43.5
8 Oraha Road, Huapai, Kumeu	GF	66.0	71.6	38.6
10 Oraha Road, Huapai, Kumeu	GF	61.3	66.9	41.9
12 Oraha Road, Huapai, Kumeu	GF	62.9	68.5	41.2
18 Oraha Road, Huapai, Kumeu	GF	59.5	65.0	40.4
20 Oraha Road, Huapai, Kumeu	GF	54.8	55.3	44.1
25 Oraha Road, Huapai, Kumeu	1.FL	65.0	70.1	43.9
27 Oraha Road, Huapai, Kumeu	GF	64.9	70.3	41.3
29 Oraha Road, Huapai, Kumeu	1.FL	61.2	66.5	41.7
31 Oraha Road, Huapai, Kumeu	GF	62.5	68.0	39.4
32 Oraha Road, Huapai, Kumeu	GF	49.9	53.5	43.0
33 Oraha Road, Huapai, Kumeu	GF	54.7	59.7	38.1
35 Oraha Road, Huapai, Kumeu	GF	61.9	67.3	40.1
39 Oraha Road, Huapai, Kumeu	GF	57.3	62.5	38.4
5-21 Oraha Road, Huapai, Kumeu	1.FL	64.0	66.7	52.2
1 Pinotage Place, Huapai, Kumeu	1.FL	52.4	55.6	40.6
3 Pinotage Place, Huapai, Kumeu	1.FL	54.0	57.5	41.5
5 Pinotage Place, Huapai, Kumeu	GF	50.3	53.7	38.6
7 Pinotage Place, Huapai, Kumeu	1.FL	51.6	55.2	39.8
9 Pinotage Place, Huapai, Kumeu	GF	48.7	52.1	37.4
11 Pinotage Place, Huapai, Kumeu	GF	48.8	52.1	37.7
13B Pinotage Place, Huapai, Kumeu	1.FL	53.9	58.3	40.2
22 Riverhead Road, Kumeu	1.FL	58.9	63.4	58.7
23 Riverhead Road, Kumeu	GF	57.8	63.2	57.7
24 Riverhead Road, Kumeu	1.FL	60.2	65.8	62.1
26 Riverhead Road, Kumeu	GF	58.8	64.9	61.3
27 Riverhead Road, Kumeu	GF	57.3	62.5	59.4
28 Riverhead Road, Kumeu	1.FL	59.9	65.8	62.5
29 Riverhead Road, Kumeu	GF	56.8	62.3	59.1
30 Riverhead Road, Kumeu	GF	57.8	63.7	60.4

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
31 Riverhead Road, Kumeu (2)	GF	52.4	53.7	48.8
31 Riverhead Road, Kumeu (1)	GF	54.5	56.0	52.0
32 Riverhead Road, Kumeu	1.FL	59.1	65.3	61.8
33 Riverhead Road, Kumeu	1.FL	56.4	58.2	53.1
34 Riverhead Road, Kumeu	GF	56.9	63.1	59.7
35 Riverhead Road, Kumeu	GF	56.3	61.8	58.5
36 Riverhead Road, Kumeu	GF	57.2	63.6	58.1
37 Riverhead Road, Kumeu	GF	55.7	61.2	57.1
38 Riverhead Road, Kumeu	GF	57.1	63.4	55.2
39 Riverhead Road, Kumeu	GF	50.8	53.1	47.6
40 Riverhead Road, Kumeu	GF	54.3	60.0	48.1
41 Riverhead Road, Kumeu	GF	56.6	63.1	53.9
42 Riverhead Road, Kumeu	1.FL	55.1	59.8	50.1
43 Riverhead Road, Kumeu	GF	58.6	65.8	53.6
44 Riverhead Road, Kumeu	1.FL	59.3	65.9	53.2
45 Riverhead Road, Kumeu	1.FL	59.6	66.7	48.2
46 Riverhead Road, Kumeu	1.FL	58.1	64.4	49.5
47 Riverhead Road, Kumeu	GF	55.3	61.7	41.9
49 Riverhead Road, Kumeu	1.FL	56.5	62.5	44.5
51 Riverhead Road, Kumeu	GF	57.1	64.1	46.3
52 Riverhead Road, Kumeu	GF	57.1	63.7	47.5
53 Riverhead Road, Kumeu	GF	55.9	62.8	42.6
54 Riverhead Road, Kumeu	GF	56.6	63.5	38.7
56 Riverhead Road, Kumeu	GF	55.0	61.7	40.0
58 Riverhead Road, Kumeu	GF	50.2	56.4	39.8
21A Riverhead Road, Kumeu	1.FL	59.5	60.9	56.7
39A Riverhead Road, Kumeu	GF	55.8	61.5	56.8
529 State Highway 16, Kumeu	GF	65.1	64.0	53.2
551 State Highway 16, Kumeu	GF	61.1	60.1	49.6
573 State Highway 16, Kumeu	GF	65.7	64.6	53.7
583 State Highway 16, Kumeu	GF	59.8	58.8	47.9
587 State Highway 16, Kumeu	GF	67.9	66.8	58.0
601 State Highway 16, Kumeu	1.FL	68.5	67.5	57.6
623 State Highway 16, Kumeu	1.FL	68.0	67.1	59.4
631 State Highway 16, Kumeu	GF	70.1	69.2	59.4
641 State Highway 16, Kumeu (2)	GF	57.2	56.3	48.4
641 State Highway 16, Kumeu (1)	GF	61.2	60.3	51.5
643 State Highway 16, Kumeu	1.FL	70.5	69.6	59.8
647 State Highway 16, Kumeu	1.FL	70.0	69.1	60.3
665 State Highway 16, Kumeu	GF	69.8	68.9	62.4
677 State Highway 16, Kumeu	GF	68.7	68.6	62.9

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
693 State Highway 16, Kumeu	1.FL	62.0	62.2	53.0
695 State Highway 16, Kumeu	GF	65.4	65.3	53.4
631A State Highway 16, Kumeu	GF	61.5	60.7	51.7
4 Station Road, Huapai, Kumeu	GF	59.4	64.5	58.8
6 Station Road, Huapai, Kumeu	GF	56.1	58.4	52.7
8 Station Road, Huapai, Kumeu	GF	55.6	57.1	51.9
10 Station Road, Huapai, Kumeu	GF	53.6	54.9	49.9
12 Station Road, Huapai, Kumeu	GF	50.1	51.4	47.7
14 Station Road, Huapai, Kumeu	GF	49.7	51.3	47.3
20 Station Road, Huapai, Kumeu	GF	53.8	58.3	55.7
22 Station Road, Huapai, Kumeu	GF	58.7	63.9	62.6
24 Station Road, Huapai, Kumeu	GF	58.0	63.3	61.6
25 Station Road, Huapai, Kumeu	1.FL	61.8	67.6	56.3
26 Station Road, Huapai, Kumeu	GF	50.3	53.8	51.3
28 Station Road, Huapai, Kumeu	GF	50.0	51.7	48.5
30 Station Road, Huapai, Kumeu	GF	49.1	50.3	46.1
32 Station Road, Huapai, Kumeu	GF	49.4	50.5	45.9
34 Station Road, Huapai, Kumeu	GF	49.9	51.8	48.2
36 Station Road, Huapai, Kumeu	GF	50.3	53.8	49.6
38 Station Road, Huapai, Kumeu	GF	58.6	64.1	58.0
40 Station Road, Huapai, Kumeu (9)	GF	49.7	51.4	46.3
40 Station Road, Huapai, Kumeu (8)	GF	50.8	52.9	46.3
40 Station Road, Huapai, Kumeu (7)	GF	51.5	53.7	43.7
40 Station Road, Huapai, Kumeu (6)	GF	49.9	50.9	43.9
40 Station Road, Huapai, Kumeu (5)	GF	58.7	63.9	49.0
40 Station Road, Huapai, Kumeu (4)	GF	51.7	55.8	46.5
40 Station Road, Huapai, Kumeu (3)	GF	51.0	52.2	46.3
40 Station Road, Huapai, Kumeu (2)	GF	50.2	51.3	45.4
40 Station Road, Huapai, Kumeu (1)	GF	50.3	54.3	40.8
3 Sunny Crescent, Huapai, Kumeu	GF	51.5	51.8	40.7
4 Sunny Crescent, Huapai, Kumeu	GF	49.3	49.8	42.7
7 Sunny Crescent, Huapai, Kumeu	GF	50.8	51.1	41.4
8 Sunny Crescent, Huapai, Kumeu	GF	49.5	49.9	45.6
11 Sunny Crescent, Huapai, Kumeu	1.FL	51.9	52.1	43.6
12 Sunny Crescent, Huapai, Kumeu	GF	47.4	48.4	42.7
16 Sunny Crescent, Huapai, Kumeu	1.FL	52.5	53.4	49.0
20 Sunny Crescent, Huapai, Kumeu	GF	50.9	51.6	47.1
24 Sunny Crescent, Huapai, Kumeu	GF	51.2	51.8	46.9
28 Sunny Crescent, Huapai, Kumeu	GF	50.0	50.8	46.2
29 Sunny Crescent, Huapai, Kumeu	GF	48.3	49.4	42.8
32 Sunny Crescent, Huapai, Kumeu	GF	48.7	49.6	44.2

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
33 Sunny Crescent, Huapai, Kumeu	GF	50.2	50.7	42.3
36 Sunny Crescent, Huapai, Kumeu	GF	49.9	50.5	45.7
37 Sunny Crescent, Huapai, Kumeu	GF	48.7	49.5	42.4
41 Sunny Crescent, Huapai, Kumeu	GF	48.3	49.3	43.5
42 Sunny Crescent, Huapai, Kumeu	GF	47.6	48.5	42.3
45 Sunny Crescent, Huapai, Kumeu	1.FL	50.2	51.1	45.3
46 Sunny Crescent, Huapai, Kumeu	GF	49.6	50.3	43.7
49 Sunny Crescent, Huapai, Kumeu	GF	49.3	50.4	44.2
50 Sunny Crescent, Huapai, Kumeu	GF	48.1	49.4	42.3
53 Sunny Crescent, Huapai, Kumeu	GF	48.0	49.6	43.0
54 Sunny Crescent, Huapai, Kumeu	GF	47.2	48.4	41.1
57 Sunny Crescent, Huapai, Kumeu	GF	47.9	49.4	41.8
61 Sunny Crescent, Huapai, Kumeu	GF	47.6	49.2	42.4
3 Tapu Road, Huapai, Kumeu	GF	62.3	62.6	61.2
5 Tapu Road, Huapai, Kumeu	GF	51.9	52.7	48.8
7 Tapu Road, Huapai, Kumeu	GF	50.3	51.0	47.8
9 Tapu Road, Huapai, Kumeu	GF	63.4	63.7	62.1
10 Tapu Road, Huapai, Kumeu	GF	64.4	64.6	63.3
11 Tapu Road, Huapai, Kumeu	GF	65.2	65.5	62.1
12 Tapu Road, Huapai, Kumeu	GF	51.2	51.8	52.1
13 Tapu Road, Huapai, Kumeu	GF	64.6	64.8	57.5
14 Tapu Road, Huapai, Kumeu	GF	65.4	65.7	62.6
15 Tapu Road, Huapai, Kumeu	GF	63.0	63.3	53.2
16 Tapu Road, Huapai, Kumeu	GF	66.2	66.4	58.9
17 Tapu Road, Huapai, Kumeu	GF	64.9	65.1	53.7
18 Tapu Road, Huapai, Kumeu	1.FL	54.6	55.1	52.4
19 Tapu Road, Huapai, Kumeu	1.FL	64.6	64.8	47.8
20 Tapu Road, Huapai, Kumeu	1.FL	54.4	54.5	47.2
21 Tapu Road, Huapai, Kumeu	GF	62.6	62.9	48.3
22 Tapu Road, Huapai, Kumeu	1.FL	67.8	68.0	57.4
23 Tapu Road, Huapai, Kumeu	GF	63.8	64.1	49.1
24 Tapu Road, Huapai, Kumeu	GF	63.2	63.5	43.0
25 Tapu Road, Huapai, Kumeu	GF	63.4	63.6	48.4
26 Tapu Road, Huapai, Kumeu	1.FL	53.1	52.9	48.7
27 Tapu Road, Huapai, Kumeu	GF	63.8	64.0	48.3
28 Tapu Road, Huapai, Kumeu	1.FL	53.2	53.1	47.4
30 Tapu Road, Huapai, Kumeu	GF	64.2	64.5	49.3
32 Tapu Road, Huapai, Kumeu	1.FL	52.9	52.8	46.3
36 Tapu Road, Huapai, Kumeu	GF	62.5	62.7	43.8
38 Tapu Road, Huapai, Kumeu	1.FL	64.0	64.3	49.2
40 Tapu Road, Huapai, Kumeu	GF	63.6	63.8	48.2

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
42 Tapu Road, Huapai, Kumeu	GF	64.6	64.9	48.1
44 Tapu Road, Huapai, Kumeu	GF	61.4	61.6	42.9
16A Tapu Road, Huapai, Kumeu	GF	52.6	53.5	49.4
2 Tokay Place, Huapai, Kumeu	GF	49.5	50.5	43.3
3 Tokay Place, Huapai, Kumeu	GF	50.6	51.6	43.8
4 Tokay Place, Huapai, Kumeu	1.FL	51.9	52.5	45.3
5 Tokay Place, Huapai, Kumeu	GF	50.3	51.0	45.0
6 Tokay Place, Huapai, Kumeu	1.FL	49.7	50.9	43.8
7 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	43.2
8 Tokay Place, Huapai, Kumeu	1.FL	50.2	51.0	43.9
9 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	43.5
10 Tokay Place, Huapai, Kumeu	1.FL	48.7	50.1	42.7
11 Tokay Place, Huapai, Kumeu	1.FL	51.0	51.7	45.8
12 Tokay Place, Huapai, Kumeu	1.FL	49.1	50.1	43.4
15 Tokay Place, Huapai, Kumeu	1.FL	50.5	51.5	45.3
17 Tokay Place, Huapai, Kumeu	1.FL	53.0	53.6	48.0
19 Tokay Place, Huapai, Kumeu	GF	47.1	48.3	40.8
1 Trigg Road, Huapai, Kumeu	GF	59.6	62.1	55.5
2 Trigg Road, Huapai, Kumeu	1.FL	60.5	62.0	54.4
3 Trigg Road, Huapai, Kumeu	GF	58.4	61.6	49.1
4 Trigg Road, Huapai, Kumeu	GF	54.2	53.8	46.6
5 Trigg Road, Huapai, Kumeu	GF	58.2	63.7	46.9
6 Trigg Road, Huapai, Kumeu	1.FL	60.0	59.4	52.0
8 Trigg Road, Huapai, Kumeu	GF	54.9	59.0	46.5
10 Trigg Road, Huapai, Kumeu	GF	53.2	57.7	43.2
12 Trigg Road, Huapai, Kumeu	GF	53.8	57.9	44.5
14 Trigg Road, Huapai, Kumeu	1.FL	56.5	61.8	47.3
15 Trigg Road, Huapai, Kumeu	GF	56.7	62.1	43.2
16 Trigg Road, Huapai, Kumeu (2)	1.FL	56.6	61.9	44.7
16 Trigg Road, Huapai, Kumeu (1)	1.FL	55.0	55.1	46.2
17 Trigg Road, Huapai, Kumeu	GF	49.9	51.5	43.5
18 Trigg Road, Huapai, Kumeu	GF	54.0	58.9	40.8
19 Trigg Road, Huapai, Kumeu	GF	48.1	49.2	42.9
20 Trigg Road, Huapai, Kumeu	GF	55.4	61.0	41.0
21 Trigg Road, Huapai, Kumeu	1.FL	57.8	62.6	45.7
22 Trigg Road, Huapai, Kumeu	GF	55.8	61.5	41.3
23 Trigg Road, Huapai, Kumeu	1.FL	52.6	55.0	47.0
24 Trigg Road, Huapai, Kumeu (2)	GF	52.2	52.4	42.6
24 Trigg Road, Huapai, Kumeu (1)	GF	56.0	61.9	40.2
25 Trigg Road, Huapai, Kumeu	GF	54.9	59.1	43.0
26 Trigg Road, Huapai, Kumeu	GF	55.9	61.7	40.8

PPF Address (NoR S2 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
14A Trigg Road, Huapai, Kumeu	GF	57.5	63.9	43.1
17A Trigg Road, Huapai, Kumeu	GF	48.9	50.1	46.0
19A Trigg Road, Huapai, Kumeu	GF	48.9	50.0	44.7
23A Trigg Road, Huapai, Kumeu	GF	50.0	52.5	44.1
103 Vinistra Road, Huapai, Kumeu	GF	46.9	50.2	40.8
1 Vintners Close, Huapai, Kumeu	GF	55.7	60.3	45.7
2 Vintners Close, Huapai, Kumeu	GF	57.7	63.7	44.2
3 Vintners Close, Huapai, Kumeu	1.FL	54.2	54.6	50.7
4 Vintners Close, Huapai, Kumeu	GF	51.2	53.5	44.9
5 Vintners Close, Huapai, Kumeu	GF	52.2	52.8	49.3
6 Vintners Close, Huapai, Kumeu	1.FL	52.3	53.1	47.5
7 Vintners Close, Huapai, Kumeu	1.FL	55.4	56.1	52.4
8 Vintners Close, Huapai, Kumeu	1.FL	51.4	52.5	48.7
9 Vintners Close, Huapai, Kumeu	1.FL	52.9	53.7	49.6
22 Weza Lane, Kumeu	1.FL	55.5	56.7	51.6
24 Weza Lane, Kumeu	GF	53.9	55.1	49.7
26 Weza Lane, Kumeu	1.FL	55.3	56.6	51.3
28 Weza Lane, Kumeu	GF	52.6	53.9	48.8
32 Weza Lane, Kumeu	GF	53.8	55.1	50.0
34 Weza Lane, Kumeu	GF	51.7	53.0	47.7
36 Weza Lane, Kumeu	GF	52.2	53.8	48.6
38 Weza Lane, Kumeu	GF	51.7	53.3	47.3
40 Weza Lane, Kumeu	1.FL	53.3	55.3	49.0
42 Weza Lane, Kumeu	1.FL	52.7	54.3	47.6
44 Weza Lane, Kumeu	GF	46.4	48.8	41.9
45 Weza Lane, Kumeu	GF	50.7	52.4	45.5
65 Weza Lane, Kumeu	GF	52.2	54.0	46.2
69 Weza Lane, Kumeu	GF	46.8	51.2	40.8
22 Wookey Lane, Kumeu (2)	1.FL	52.8	52.2	43.9
22 Wookey Lane, Kumeu (1)	1.FL	52.6	52.0	43.7

1.3 NoR S3

1.3.1 Altered Road

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
24 Access Road, Kumeu	GF	59.9	64.8	37.3

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
1-23 Croatia Avenue, Huapai, Kumeu (9)	GF	48.4	49.8	38.6
1-23 Croatia Avenue, Huapai, Kumeu (8)	GF	47.9	49.4	38.0
1-23 Croatia Avenue, Huapai, Kumeu (7)	GF	50.3	50.6	41.1
1-23 Croatia Avenue, Huapai, Kumeu (2)	3.FL	54.7	57.5	42.5
107 Fred Taylor Drive, Whenuapai, Auckland	GF	51.9	56.5	36.8
107A Fred Taylor Drive, Whenuapai, Auckland	GF	52.4	57.0	37.1
38 Gilbransen Road, Kumeu	GF	49.6	49.0	32.2
42 Gilbransen Road, Kumeu	GF	51.2	50.6	34.1
44 Gilbransen Road, Kumeu	GF	56.3	55.5	38.3
47 Gilbransen Road, Kumeu (2)	1.FL	51.2	51.0	37.4
47 Gilbransen Road, Kumeu (1)	GF	58.1	57.2	43.3
47 Gilbransen Road, Kumeu (3)	GF	49.9	49.8	34.8
50 Gilbransen Road, Kumeu (2)	GF	62.6	61.6	48.0
50 Gilbransen Road, Kumeu (1)	GF	59.3	58.4	43.9
44A Gilbransen Road, Kumeu	GF	57.4	56.6	39.8
44B Gilbransen Road, Kumeu	GF	57.2	56.4	40.3
44C Gilbransen Road, Kumeu	GF	58.0	57.1	41.0
44D Gilbransen Road, Kumeu	GF	58.5	57.6	41.8
8 Grivelle Street, Kumeu (2)	GF	51.5	55.0	35.3
8 Grivelle Street, Kumeu (1)	GF	51.3	55.8	34.8
3 Lockyer Road, Kumeu	GF	51.0	50.5	33.6
5 Lockyer Road, Kumeu	GF	49.4	48.9	35.4
7 Lockyer Road, Kumeu	GF	50.1	49.6	34.7
9 Lockyer Road, Kumeu	GF	55.1	54.2	39.1
7 Main Road, Kumeu	GF	61.2	61.7	46.1
342 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	45.6
344 Main Road, Huapai, Kumeu	GF	62.4	62.3	42.7
346 Main Road, Huapai, Kumeu	GF	57.4	57.5	39.4
348 Main Road, Huapai, Kumeu	1.FL	66.0	65.8	45.9
350 Main Road, Huapai, Kumeu	1.FL	63.8	63.7	44.2
351 Main Road, Huapai, Kumeu	GF	65.6	65.4	48.6
352 Main Road, Huapai, Kumeu	GF	64.4	64.3	44.3
353 Main Road, Huapai, Kumeu	GF	65.9	65.7	48.3
354 Main Road, Huapai, Kumeu	GF	62.6	62.6	42.5
355 Main Road, Huapai, Kumeu	GF	64.4	64.2	42.8
356 Main Road, Huapai, Kumeu	GF	64.5	64.4	43.0
357 Main Road, Huapai, Kumeu	GF	65.7	65.5	44.6
358 Main Road, Huapai, Kumeu	GF	60.8	60.8	38.7
359 Main Road, Huapai, Kumeu	GF	65.0	64.8	44.8
360 Main Road, Huapai, Kumeu	1.FL	62.0	61.9	41.8

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
361 Main Road, Huapai, Kumeu	GF	62.9	62.8	45.6
362 Main Road, Huapai, Kumeu (2)	1.FL	65.9	65.8	42.4
362 Main Road, Huapai, Kumeu (1)	1.FL	62.3	62.2	42.1
364 Main Road, Huapai, Kumeu	GF	60.8	60.8	37.0
365 Main Road, Huapai, Kumeu	GF	61.8	61.7	47.5
366 Main Road, Huapai, Kumeu	GF	57.9	57.9	35.8
367 Main Road, Huapai, Kumeu	GF	65.1	65.0	47.7
368 Main Road, Huapai, Kumeu	GF	61.4	61.3	39.6
370 Main Road, Huapai, Kumeu	GF	61.4	61.4	38.3
372 Main Road, Huapai, Kumeu	GF	63.8	63.7	39.4
376 Main Road, Huapai, Kumeu	1.FL	65.3	65.1	40.0
382 Main Road, Huapai, Kumeu	GF	66.7	66.5	39.5
395 Main Road, Huapai, Kumeu (2)	GF	59.2	59.6	37.3
395 Main Road, Huapai, Kumeu (1)	GF	56.2	57.1	35.3
399 Main Road, Huapai, Kumeu	GF	62.0	62.3	40.0
401 Main Road, Huapai, Kumeu	GF	61.1	61.4	41.7
405 Main Road, Huapai, Kumeu	GF	66.8	66.4	40.0
407 Main Road, Huapai, Kumeu	GF	67.5	66.9	43.6
407A Main Road, Huapai, Kumeu	1.FL	66.6	65.9	45.7
9 Matua Road, Huapai, Kumeu	GF	53.0	56.3	34.1
11 Matua Road, Huapai, Kumeu	GF	51.6	54.4	33.1
15 Matua Road, Huapai, Kumeu	GF	50.4	52.8	33.2
17 Matua Road, Huapai, Kumeu	GF	50.1	52.8	34.0
19 Matua Road, Huapai, Kumeu	GF	49.7	51.6	34.4
21 Matua Road, Huapai, Kumeu	1.FL	53.0	55.7	37.1
22 Matua Road, Huapai, Kumeu	GF	62.0	66.8	34.6
23 Matua Road, Huapai, Kumeu	1.FL	51.7	54.4	35.9
24 Matua Road, Huapai, Kumeu	GF	52.9	56.0	33.8
239 Matua Road, Kumeu	GF	55.0	54.3	42.9
392 Matua Road, Kumeu	GF	59.1	59.7	29.6
402 Matua Road, Kumeu	1.FL	62.4	64.9	41.7
411 Matua Road, Kumeu	GF	58.1	59.3	41.4
392B Matua Road, Kumeu	GF	59.7	60.0	27.3
5 Merlot Heights, Huapai, Kumeu	1.FL	53.1	54.8	39.1
7 Merlot Heights, Huapai, Kumeu	1.FL	54.2	55.7	39.5
9 Merlot Heights, Huapai, Kumeu	1.FL	54.4	55.7	39.3
11 Merlot Heights, Huapai, Kumeu	GF	49.1	50.3	34.4
17 Merlot Heights, Huapai, Kumeu	GF	48.3	49.7	33.3
11 Meryl Avenue, Kumeu	GF	53.2	52.6	40.8
30 Meryl Avenue, Kumeu (1)	GF	59.8	57.0	56.2
1 Oraha Road, Huapai, Kumeu	GF	52.9	53.5	36.3

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
3 Oraha Road, Huapai, Kumeu	GF	53.2	54.1	36.1
6 Oraha Road, Huapai, Kumeu	1.FL	56.0	61.2	38.3
8 Oraha Road, Huapai, Kumeu	GF	66.0	71.6	32.3
10 Oraha Road, Huapai, Kumeu	GF	61.3	66.9	34.9
12 Oraha Road, Huapai, Kumeu	GF	62.9	68.5	33.4
18 Oraha Road, Huapai, Kumeu	GF	59.5	65.0	33.4
20 Oraha Road, Huapai, Kumeu	GF	54.8	55.3	36.0
25 Oraha Road, Huapai, Kumeu	1.FL	65.0	70.1	37.5
27 Oraha Road, Huapai, Kumeu	GF	64.9	70.3	35.0
5-21 Oraha Road, Huapai, Kumeu	1.FL	64.0	66.7	42.8
529 State Highway 16, Kumeu	GF	65.1	64.0	44.0
551 State Highway 16, Kumeu	GF	61.1	60.1	40.6
573 State Highway 16, Kumeu	GF	65.7	64.6	41.0
583 State Highway 16, Kumeu	GF	59.8	58.8	39.3
587 State Highway 16, Kumeu	GF	67.9	66.8	44.8
601 State Highway 16, Kumeu	1.FL	68.5	67.5	44.8
623 State Highway 16, Kumeu	1.FL	68.0	67.1	45.9
631 State Highway 16, Kumeu	GF	70.1	69.2	45.0
641 State Highway 16, Kumeu (2)	GF	57.2	56.3	38.4
641 State Highway 16, Kumeu (1)	GF	61.2	60.3	40.8
643 State Highway 16, Kumeu	1.FL	70.5	69.6	45.4
647 State Highway 16, Kumeu	1.FL	70.0	69.1	44.4
665 State Highway 16, Kumeu	GF	69.8	68.9	44.0
677 State Highway 16, Kumeu	GF	68.7	68.6	38.5
631A State Highway 16, Kumeu	GF	61.5	60.7	41.2
4 Station Road, Huapai, Kumeu	GF	59.4	64.5	35.8
6 Station Road, Huapai, Kumeu	GF	56.1	58.4	35.4
8 Station Road, Huapai, Kumeu	GF	55.6	57.1	35.2
10 Station Road, Huapai, Kumeu	GF	53.6	54.9	34.9
12 Station Road, Huapai, Kumeu	GF	50.1	51.4	33.4
14 Station Road, Huapai, Kumeu	GF	49.7	51.3	33.5
20 Station Road, Huapai, Kumeu	GF	53.8	58.3	34.9
22 Station Road, Huapai, Kumeu	GF	58.7	63.9	36.8
4 Sunny Crescent, Huapai, Kumeu	GF	49.3	49.8	31.5
8 Sunny Crescent, Huapai, Kumeu	GF	49.5	49.9	31.9
12 Sunny Crescent, Huapai, Kumeu	GF	47.4	48.4	30.8
16 Sunny Crescent, Huapai, Kumeu	1.FL	52.5	53.4	35.3
20 Sunny Crescent, Huapai, Kumeu	GF	50.9	51.6	33.0
24 Sunny Crescent, Huapai, Kumeu	GF	51.2	51.8	32.3
28 Sunny Crescent, Huapai, Kumeu	GF	50.0	50.8	32.9
32 Sunny Crescent, Huapai, Kumeu	GF	48.7	49.6	32.8

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
36 Sunny Crescent, Huapai, Kumeu	GF	49.9	50.5	33.9
42 Sunny Crescent, Huapai, Kumeu	GF	47.6	48.5	32.2
45 Sunny Crescent, Huapai, Kumeu	1.FL	50.2	51.1	34.3
46 Sunny Crescent, Huapai, Kumeu	GF	49.6	50.3	34.5
3 Tapu Road, Huapai, Kumeu	GF	62.3	62.6	41.0
5 Tapu Road, Huapai, Kumeu	GF	51.9	52.7	34.1
7 Tapu Road, Huapai, Kumeu	GF	50.3	51.0	34.4
9 Tapu Road, Huapai, Kumeu	GF	63.4	63.7	38.7
10 Tapu Road, Huapai, Kumeu	GF	64.4	64.6	45.1
11 Tapu Road, Huapai, Kumeu	GF	65.2	65.5	36.9
12 Tapu Road, Huapai, Kumeu	GF	51.2	51.8	45.3
13 Tapu Road, Huapai, Kumeu	GF	64.6	64.8	35.6
14 Tapu Road, Huapai, Kumeu	GF	65.4	65.7	41.6
15 Tapu Road, Huapai, Kumeu	GF	63.0	63.3	34.1
16 Tapu Road, Huapai, Kumeu	GF	66.2	66.4	38.7
17 Tapu Road, Huapai, Kumeu	GF	64.9	65.1	32.9
18 Tapu Road, Huapai, Kumeu	1.FL	54.6	55.1	44.5
19 Tapu Road, Huapai, Kumeu	1.FL	64.6	64.8	33.9
20 Tapu Road, Huapai, Kumeu	1.FL	54.4	54.5	43.3
21 Tapu Road, Huapai, Kumeu	GF	62.6	62.9	31.2
22 Tapu Road, Huapai, Kumeu	1.FL	67.8	68.0	39.5
23 Tapu Road, Huapai, Kumeu	GF	63.8	64.1	31.3
24 Tapu Road, Huapai, Kumeu	GF	63.2	63.5	35.0
26 Tapu Road, Huapai, Kumeu	1.FL	53.1	52.9	40.2
28 Tapu Road, Huapai, Kumeu	1.FL	53.2	53.1	40.5
30 Tapu Road, Huapai, Kumeu	GF	64.2	64.5	32.5
32 Tapu Road, Huapai, Kumeu	1.FL	52.9	52.8	40.1
36 Tapu Road, Huapai, Kumeu	GF	62.5	62.7	32.4
38 Tapu Road, Huapai, Kumeu	1.FL	64.0	64.3	34.8
16A Tapu Road, Huapai, Kumeu	GF	52.6	53.5	39.9
2 Tokay Place, Huapai, Kumeu	GF	49.5	50.5	34.8
3 Tokay Place, Huapai, Kumeu	GF	50.6	51.6	35.4
4 Tokay Place, Huapai, Kumeu	1.FL	51.9	52.5	37.5
5 Tokay Place, Huapai, Kumeu	GF	50.3	51.0	34.7
6 Tokay Place, Huapai, Kumeu	1.FL	49.7	50.9	35.2
7 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	33.5
8 Tokay Place, Huapai, Kumeu	1.FL	50.2	51.0	35.7
9 Tokay Place, Huapai, Kumeu	GF	48.8	49.6	33.4
10 Tokay Place, Huapai, Kumeu	1.FL	48.7	50.1	34.0
11 Tokay Place, Huapai, Kumeu	1.FL	51.0	51.7	36.4
12 Tokay Place, Huapai, Kumeu	1.FL	49.1	50.1	34.2

PPF Address (NoR S3 Altered Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
15 Tokay Place, Huapai, Kumeu	1.FL	50.5	51.5	36.2
17 Tokay Place, Huapai, Kumeu	1.FL	53.0	53.6	38.4
19 Tokay Place, Huapai, Kumeu	GF	47.1	48.3	31.8
1 Trigg Road, Huapai, Kumeu	GF	59.6	62.1	41.5
2 Trigg Road, Huapai, Kumeu	1.FL	60.5	62.0	43.5
3 Trigg Road, Huapai, Kumeu	GF	58.4	61.6	37.8
4 Trigg Road, Huapai, Kumeu	GF	54.2	53.8	37.5
5 Trigg Road, Huapai, Kumeu	GF	58.2	63.7	36.5
6 Trigg Road, Huapai, Kumeu	1.FL	60.0	59.4	42.6
8 Trigg Road, Huapai, Kumeu	GF	54.9	59.0	35.6
10 Trigg Road, Huapai, Kumeu	GF	53.2	57.7	35.5
12 Trigg Road, Huapai, Kumeu	GF	53.8	57.9	37.0
14 Trigg Road, Huapai, Kumeu	1.FL	56.5	61.8	38.0
14A Trigg Road, Huapai, Kumeu	GF	57.5	63.9	35.6
1 Vintners Close, Huapai, Kumeu	GF	55.7	60.3	34.8
2 Vintners Close, Huapai, Kumeu	GF	57.7	63.7	34.7
3 Vintners Close, Huapai, Kumeu	1.FL	54.2	54.6	38.0
4 Vintners Close, Huapai, Kumeu	GF	51.2	53.5	34.2
5 Vintners Close, Huapai, Kumeu	GF	52.2	52.8	35.2
6 Vintners Close, Huapai, Kumeu	1.FL	52.3	53.1	36.2
7 Vintners Close, Huapai, Kumeu	1.FL	55.4	56.1	37.9
8 Vintners Close, Huapai, Kumeu	1.FL	51.4	52.5	34.2
9 Vintners Close, Huapai, Kumeu	1.FL	52.9	53.7	36.2
2 Waina Drive, Kumeu	GF	51.0	50.9	35.1
22 Wookey Lane, Kumeu (2)	1.FL	52.8	52.2	39.1
22 Wookey Lane, Kumeu (1)	1.FL	52.6	52.0	38.8

1.3.2 New Road

PPF Address (NoR S3 New Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
23 Boord Crescent, Kumeu	GF	57.1	55.9	46.9
37 Boord Crescent, Kumeu	GF	58.4	57.0	46.4
51 Boord Crescent, Kumeu	GF	58.5	57.1	47.0
61 Boord Crescent, Kumeu	GF	52.8	51.9	37.0
62 Boord Crescent, Kumeu	GF	51.8	51.8	43.4
68 Boord Crescent, Kumeu (2)	1.FL	54.4	53.8	41.5
68 Boord Crescent, Kumeu (1)	GF	57.0	55.8	38.8
82 Boord Crescent, Kumeu	GF	48.5	49.8	44.4

PPF Address (NoR S3 New Road)	Floor	Existing	Do-nothing	Do-minimum
		dB $L_{Aeq(24h)}$		
88 Boord Crescent, Kumeu (2)	GF	52.2	51.9	40.2
88 Boord Crescent, Kumeu (1)	GF	55.4	54.4	37.5
96 Boord Crescent, Kumeu	1.FL	54.6	53.8	41.7
108 Boord Crescent, Kumeu	GF	51.6	51.3	41.8
186 Boord Crescent, Kumeu	GF	57.3	55.8	44.2
291 Boord Crescent, Kumeu	1.FL	54.4	54.2	39.2
293 Boord Crescent, Kumeu	1.FL	53.0	53.2	40.2
300 Boord Crescent, Kumeu	GF	53.1	53.1	40.1
51A Boord Crescent, Kumeu	GF	56.7	55.4	43.7
196 Fred Taylor Drive, Whenuapai, Auckland	GF	50.2	51.9	46.4
198 Fred Taylor Drive, Whenuapai, Auckland	1.FL	49.3	51.3	43.4
200 Fred Taylor Drive, Whenuapai, Auckland	GF	47.6	49.6	43.0
208 Fred Taylor Drive, Whenuapai, Auckland	GF	54.2	55.7	33.6
14 Joseph Dunstan Drive, Taupaki	GF	51.1	53.4	35.9
91 Joseph Dunstan Drive, Taupaki	GF	48.8	50.7	43.2
284 State Highway 16, Kumeu	GF	50.9	52.3	39.9
362 Taupaki Road, Taupaki	GF	62.4	64.7	33.3
364 Taupaki Road, Taupaki	GF	63.7	65.9	33.2
367 Taupaki Road, Taupaki	GF	56.5	58.8	35.8
370 Taupaki Road, Taupaki	GF	61.2	63.5	34.9
374 Taupaki Road, Taupaki	1.FL	51.5	53.8	44.8
375 Taupaki Road, Taupaki	GF	63.7	65.9	37.3
377 Taupaki Road, Taupaki	1.FL	51.8	54.1	40.1
405 Taupaki Road, Kumeu	GF	49.6	51.9	42.8
13 Trotting Course Drive, Kumeu	GF	54.5	56.7	48.2
15 Trotting Course Drive, Kumeu	GF	50.7	52.8	45.2
901 Waitakere Road, Kumeu	1.FL	55.9	58.5	46.7
906 Waitakere Road, Kumeu	GF	62.9	65.5	47.7
927 Waitakere Road, Kumeu	1.FL	59.5	61.9	44.3

1.4 NoR S4

PPF Address (NoR S4 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
24 Access Road, Kumeu	GF	59.9	64.8	57.8	57.8
26 Access Road, Kumeu (3)	GF	60.4	65.3	56.2	56.2
26 Access Road, Kumeu (1)	GF	51.8	55.6	48.0	48.0
27 Access Road, Kumeu (2)	GF	55.5	60.2	54.2	54.2
27 Access Road, Kumeu (1)	GF	52.4	54.5	44.9	44.9
40 Access Road, Kumeu	GF	61.3	66.3	56.7	56.7
44 Access Road, Kumeu	GF	60.7	65.7	56.3	56.3
60 Access Road, Kumeu	GF	60.0	64.9	56.1	56.1
64 Access Road, Kumeu	GF	62.0	67.0	58.0	58.0
95 Access Road, Kumeu (2)	GF	53.1	58.1	51.0	51.0
95 Access Road, Kumeu (1)	GF	56.2	61.5	55.3	55.3
116 Access Road, Kumeu (4)	1.FL	52.5	59.8	52.7	52.7
116 Access Road, Kumeu (3)	1.FL	47.1	54.2	47.0	47.0
116 Access Road, Kumeu (2)	GF	59.6	68.1	59.3	59.3
116 Access Road, Kumeu (1)	GF	55.0	63.0	55.3	55.3
121 Access Road, Kumeu (2)	GF	48.0	53.9	47.8	47.8
121 Access Road, Kumeu (1)	GF	49.0	56.3	49.8	49.8
161 Access Road, Kumeu	GF	55.3	63.5	58.1	58.1
162 Access Road, Kumeu	GF	52.1	60.2	53.6	53.6
165 Access Road, Kumeu	GF	50.3	58.3	52.8	52.8
171 Access Road, Kumeu	GF	56.8	65.1	59.2	59.2
174 Access Road, Kumeu	GF	54.4	62.5	56.3	56.3
175 Access Road, Kumeu	GF	48.9	56.5	50.7	50.7
176 Access Road, Kumeu (2)	GF	53.6	61.7	56.1	56.1
176 Access Road, Kumeu (1)	GF	51.8	59.6	53.6	53.6
181 Access Road, Kumeu	GF	54.9	63.2	56.3	56.3
184 Access Road, Kumeu (2)	1.FL	58.9	67.4	62.7	62.7
184 Access Road, Kumeu (1)	GF	57.9	66.3	62.4	62.4
199 Access Road, Kumeu	GF	52.9	60.8	53.4	53.4
211 Access Road, Kumeu	GF	53.3	61.3	54.2	54.2
218 Access Road, Kumeu	GF	55.3	63.7	60.5	60.5
233 Access Road, Kumeu	GF	50.6	58.4	55.6	55.6
236 Access Road, Kumeu	GF	52.8	60.2	58.2	58.2
127A Access Road, Kumeu	GF	52.0	59.6	53.5	53.5
127B Access Road, Kumeu	GF	49.6	57.3	50.8	50.8
64 Farrand Road, Kumeu	GF	47.4	54.4	48.3	48.3
8 Grivelle Street, Kumeu (2)	GF	51.5	55.0	47.9	47.9
8 Grivelle Street, Kumeu (1)	GF	51.3	55.8	48.8	48.8

PPF Address (NoR S4 Altered Road)	Floor	Existing	Do-nothing	Do-minimum	Mitigation option
		dB $L_{Aeq(24h)}$			
150 Motu Road, Kumeu	1.FL	60.7	72.7	45.3	45.4
158 Motu Road, Kumeu	1.FL	55.6	65.9	47.7	47.9
164 Motu Road, Kumeu	1.FL	60.7	71.9	51.9	51.8
147 Station Road, Kumeu	GF	49.9	56.5	51.2	51.2
150 Station Road, Kumeu	GF	58.8	65.7	49.8	49.8
152 Station Road, Kumeu	GF	57.0	63.8	53.9	53.9
17 Tawa Road, Kumeu	GF	57.7	65.3	63.8	63.8
25 Tawa Road, Kumeu	1.FL	60.5	68.3	66.5	66.5
59 Tawa Road, Kumeu	GF	58.3	66.3	64.7	63.1
63 Tawa Road, Kumeu	GF	52.8	60.2	61.4	61.4
66 Tawa Road, Kumeu	GF	49.3	56.3	56.0	56.0
73 Tawa Road, Kumeu	GF	57.1	64.8	62.5	62.0
76 Tawa Road, Kumeu	GF	58.2	65.8	66.8	61.8
79 Tawa Road, Kumeu	GF	59.0	67.1	63.2	59.8
83 Tawa Road, Kumeu (2)	GF	51.0	57.6	48.9	48.6
83 Tawa Road, Kumeu (1)	GF	50.0	56.6	48.0	47.9
86 Tawa Road, Kumeu (2)	GF	54.6	62.3	56.5	55.8
86 Tawa Road, Kumeu (1)	GF	54.6	64.2	52.5	52.1

2 Appendix B: Noise Level Contours and NZS6806 Categories

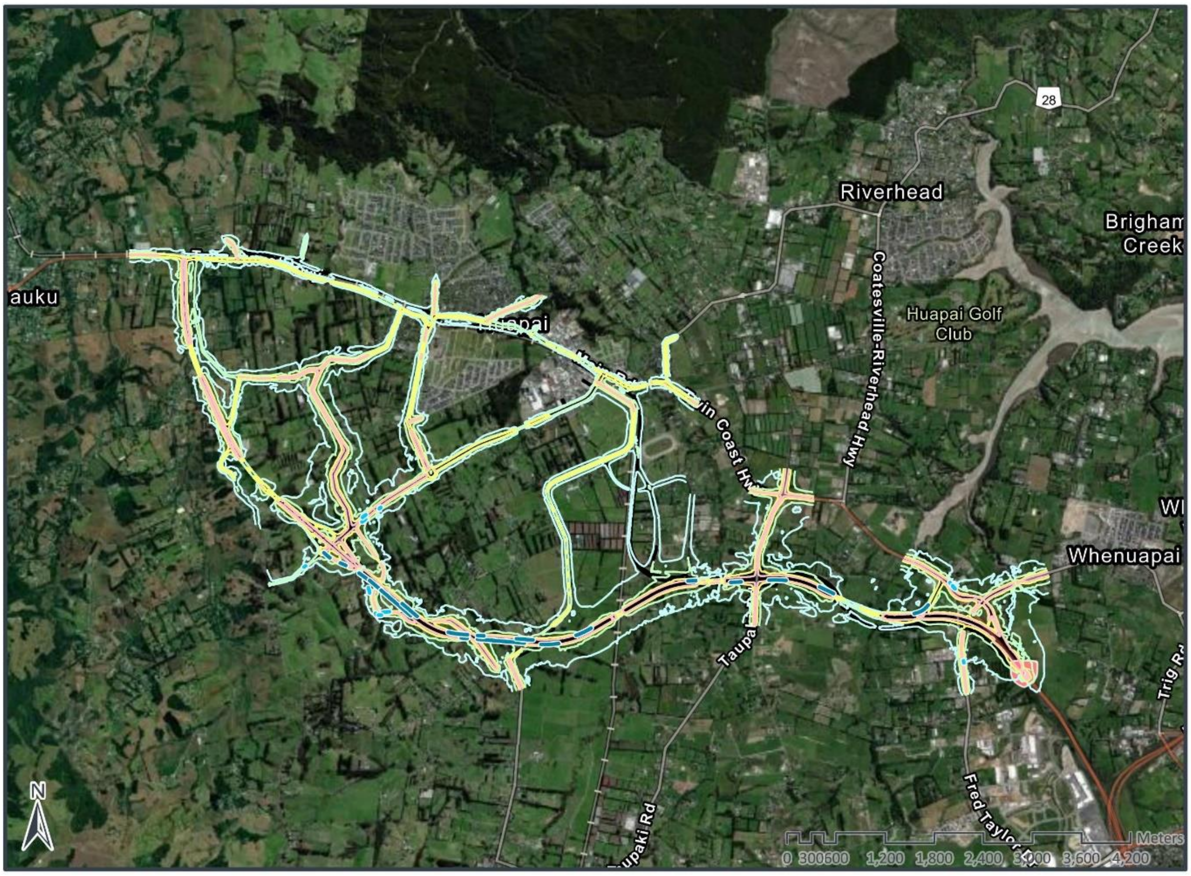
For all figures in this appendix, the following applies:

Situation	Description
Existing	current road layout and traffic volume
Do-nothing	current road layout and future traffic volume (2048+)
Do-minimum	future road layout of the Project of interest only, traffic volumes (2048+) assume that all Projects of the Nort Western Strategic Package have been implemented, but without specific noise mitigation. Where no mitigation option is proposed, the noise level contours shown represent the combined traffic noise from the Project road, all existing local roads and other North West Strategic Package roads in the vicinity.
Mitigation Option	the same as for the Do-minimum Situation but including noise mitigation in the form of barriers, where considered to be BPO. The noise level contours shown represent the combined traffic noise from the Project road including mitigation, all existing local roads and other North West Strategic Package roads in the vicinity.

The legend is shown on the next page.

NORTH WEST STRATEGIC PACKAGE

Overview Map



Map Legend

New Road (dB $L_{Aeq(24h)}$)
- < 57 Category A
- 57 - 64 Category B
- > 64 Category C

Altered Road (dB $L_{Aeq(24h)}$)
- < 64 Category A
- 64 - 67 Category B
- > 67 Category C

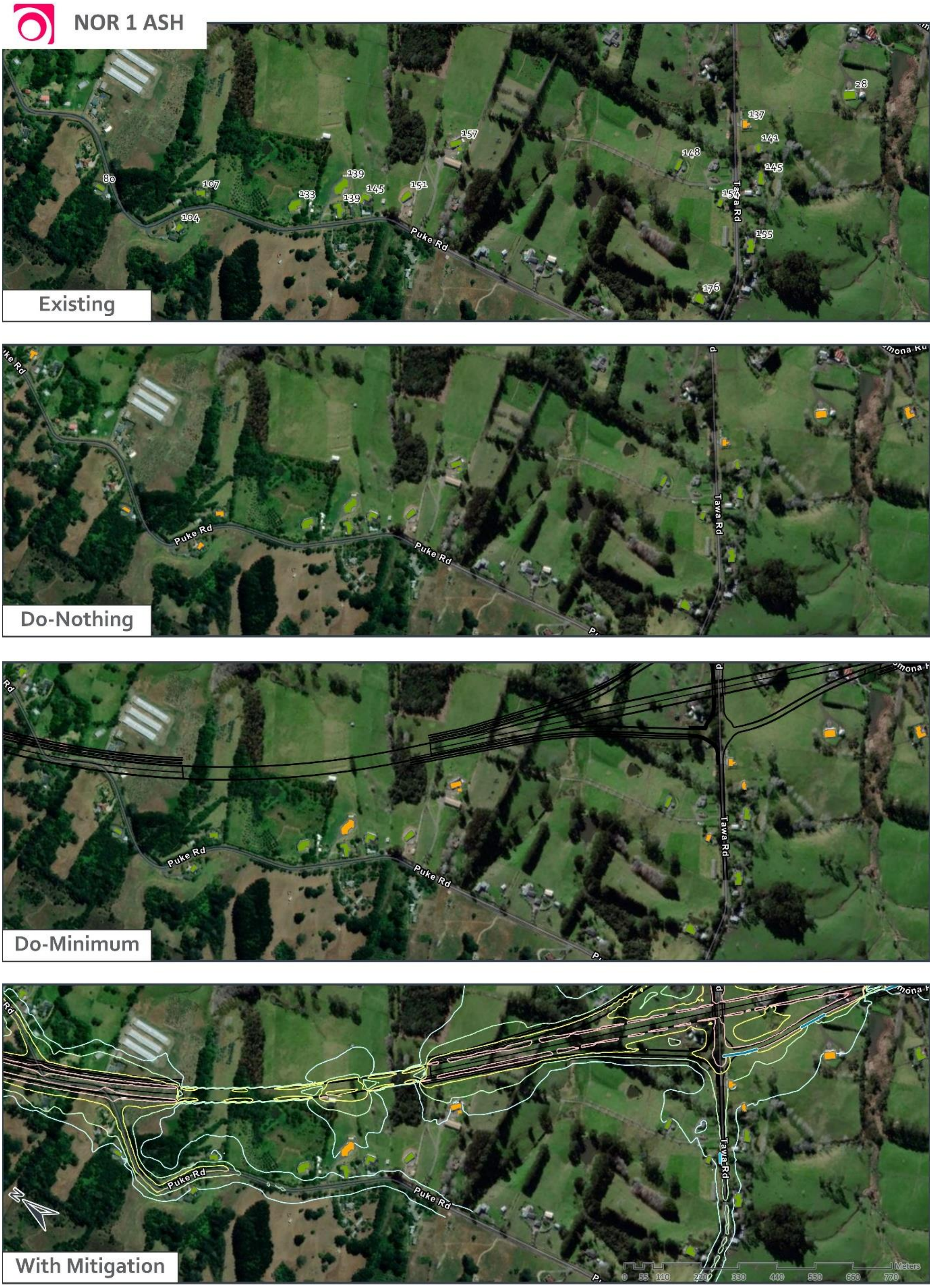
Noise wall
- At residence
- At ASH

Contours dB $L_{Aeq(24h)}$
- 55
- 60
- 65
- 70
- Project Road

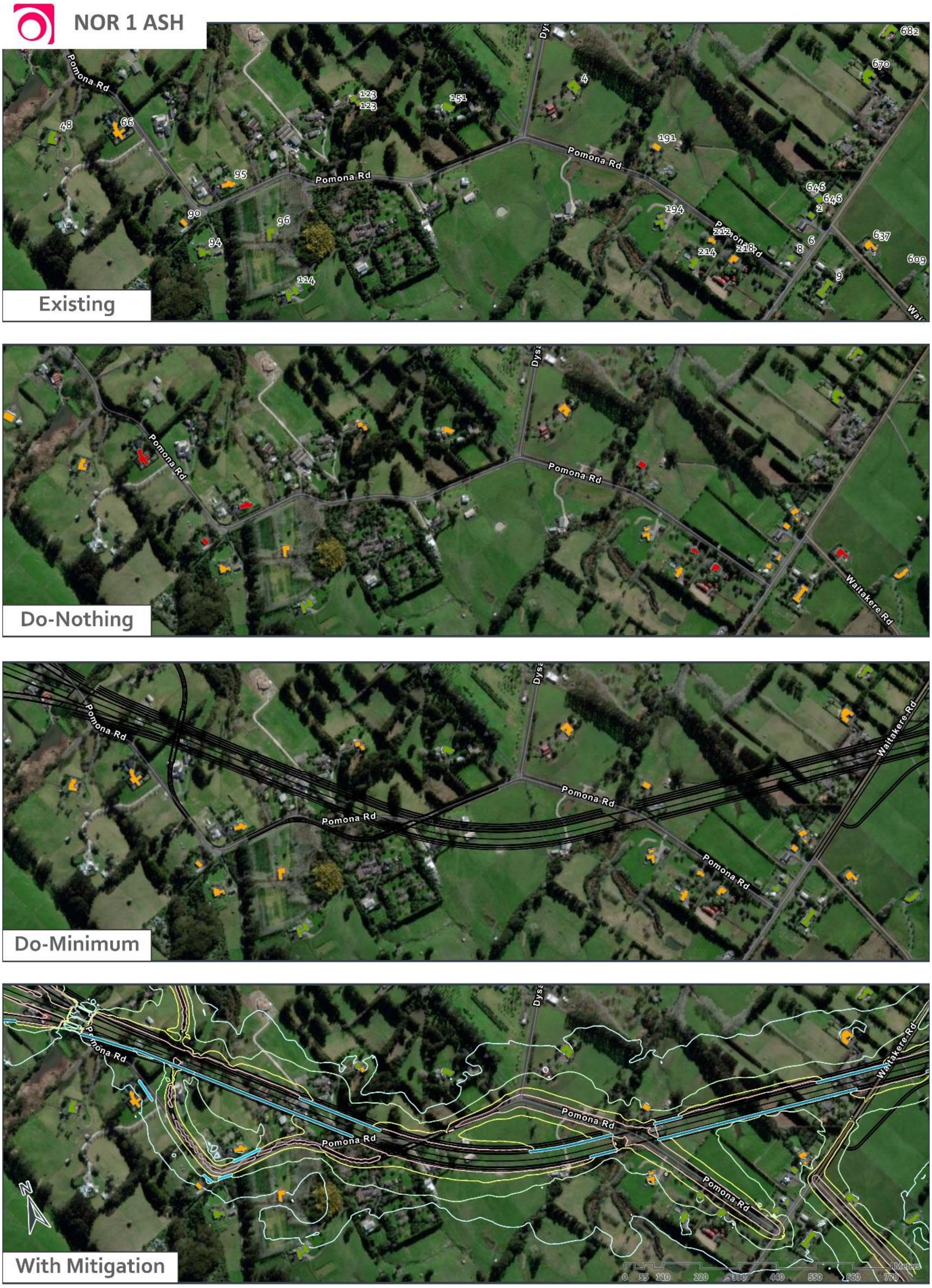
2.1 NoR S1

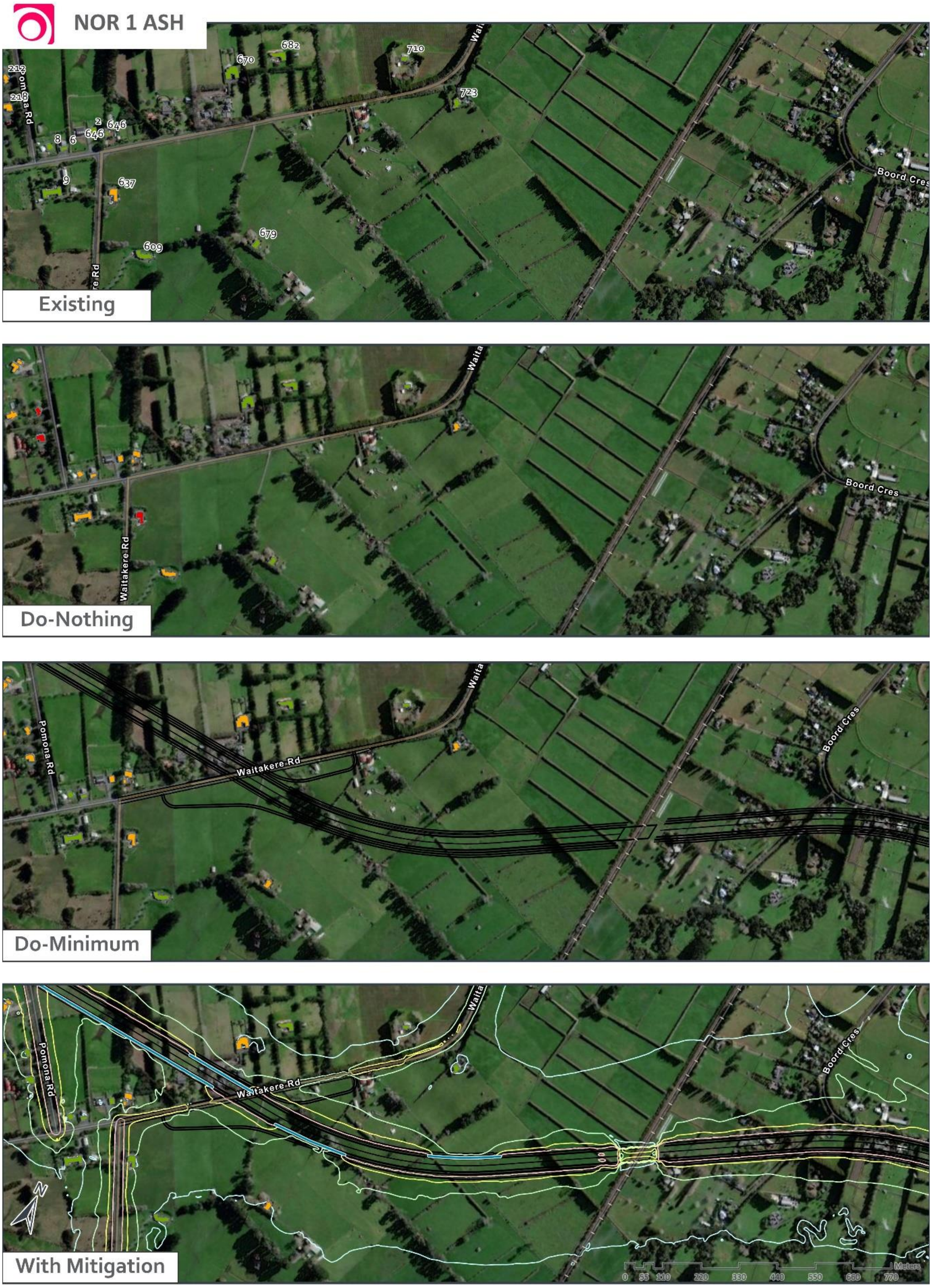

NOR 1 ASH
Existing
Do-Nothing
Do-Minimum
With Mitigation
SH 16
Twin Coast Hwy
Matua Rd
728
726
392
392B
402
761
763
677
695
693
N
Meters

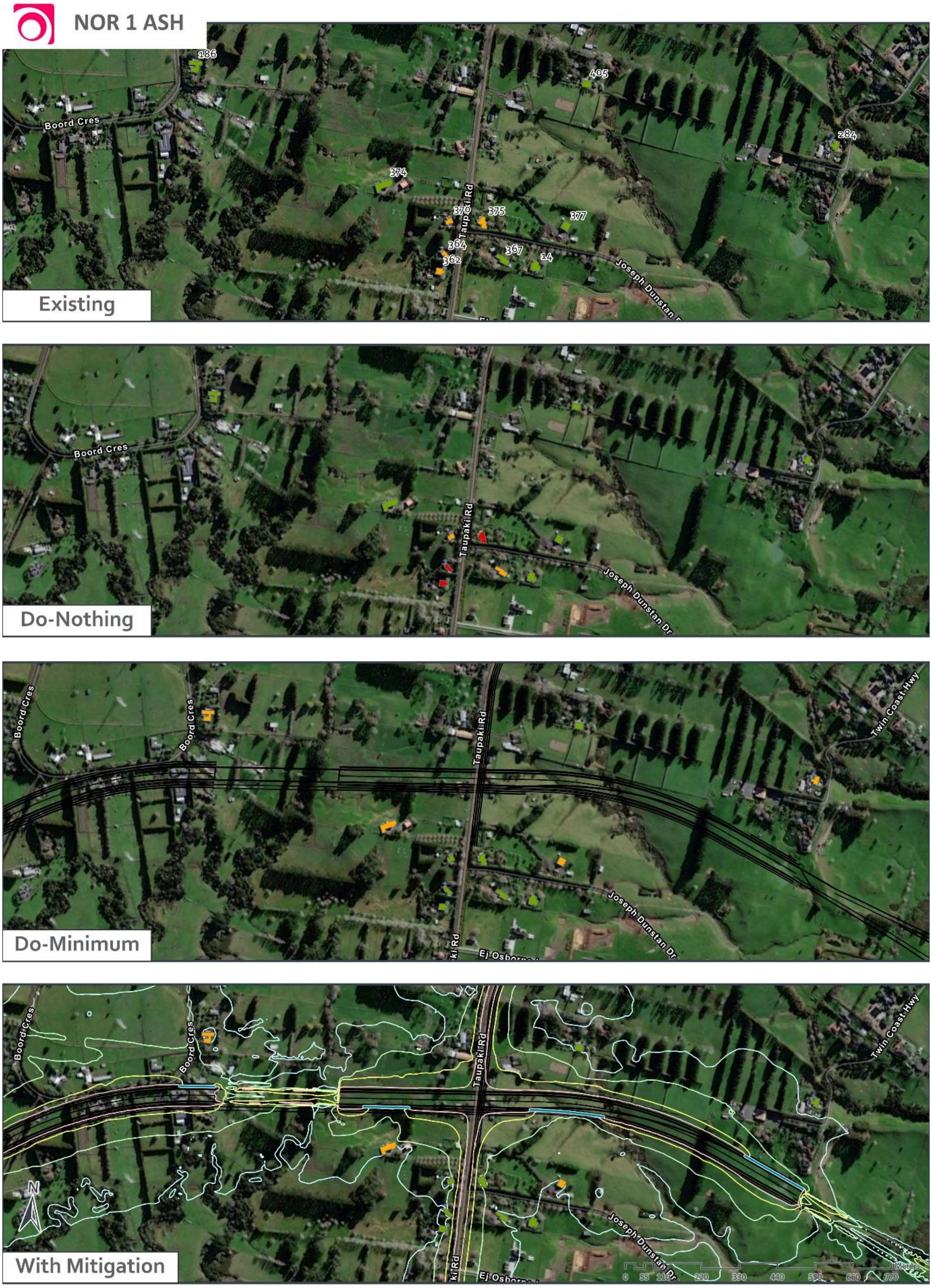

NOR 1 ASH
Foster Rd
Trigg Rd
Puke Rd
81
227
227
18
21
27
37
22
116
131
80
107
104
Existing
Do-Nothing
Do-Minimum
With Mitigation
0 55 110 220 330 440 550 660 770
Meters


NOR 1 ASH
Existing
Do-Nothing
Do-Minimum
With Mitigation
Puke Rd
Tawa Rd
28
137
141
145
148
154
155
157
176
80
104
107
133
139
145
151
Meters
0
55
110
220
330
440
550
660
770


NOR 1 ASH
Existing
Do-Nothing
Do-Minimum
With Mitigation
Tawa Rd
Motu Rd
Aurea Ter
Puke Rd
176
148
154
155
145
141
137
150
158
16
86
86
76
66
79
73
63
59
83
83
28
Meters
0
55
110
220
330
440
550
660
770


NOR 1 ASH
Existing
Do-Nothing
Do-Minimum
With Mitigation
Pomona Rd
Waitakere Rd
48
66
95
90
94
96
114
123
151
4
191
194
212
214
218
646
637
609
670
682
6
8
9
0 55 110 220 330 440 550 660 770
Meters


NOR 1 ASH
Existing
Do-Nothing
Do-Minimum
With Mitigation
Pomona Rd
Waitakere Rd
Boord Cres
212
218
670
682
710
723
2
646
8
6
646
9
637
679
609
0 55 110 220 330 440 550 660 770
Meters


NOR 1 ASH
Existing
Do-Nothing
Do-Minimum
With Mitigation
Boord Cres
Taupaki Rd
Joseph Dunstan Dr
Twin Coast Hwy
Ej Osborne
186
405
284
374
370
375
377
364
367
362
14


NOR 1 ASH
Twin Coast Hwy
Kennedys Rd
Brigham Creek
Brigham Creek Rd
Existing
Do-Nothing
Ngongetepara Stream
Do-Minimum
With Mitigation
Meters


NOR 1 ASH
Northwestern Mtwy
Fred Taylor Dr
218
208
210
143
141
139
137
135
133
131
125
127
129
172
121
107
196
198
Hailes Rd
Existing
SH 16
Do-Nothing
Ngongetepara Stream
Do-Minimum
With Mitigation

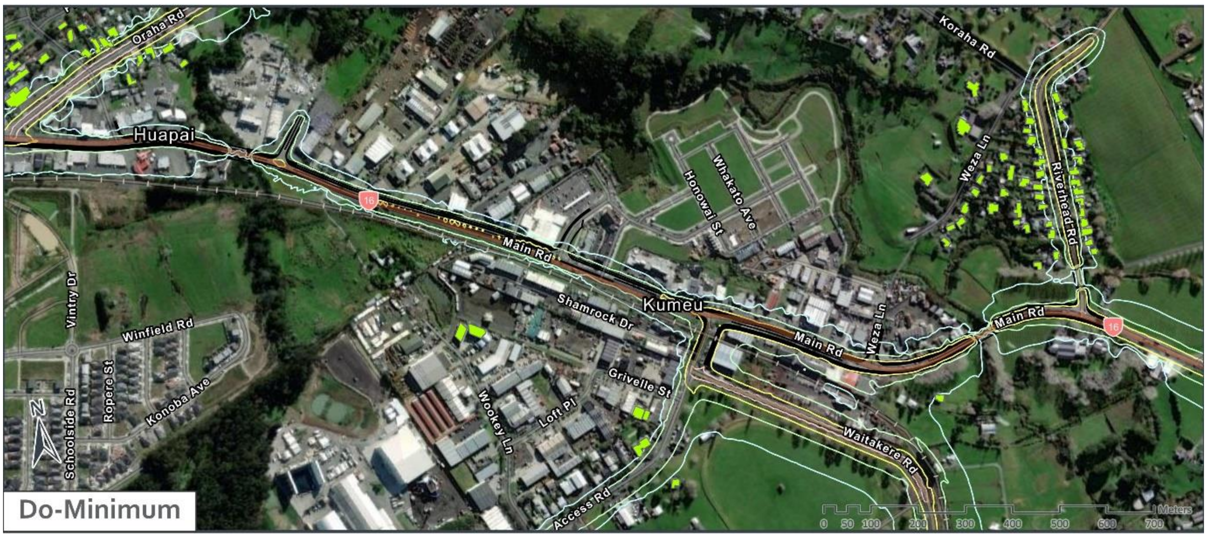
2.2 NoR S2

NOR 2 SH16
Existing
Do-Nothing
Do-Minimum
Twin Coast Hwy
Meryl Ave
McIndoe Rd
Korako Dr
Madden Ave
Lockyer Rd
Gilbransen Rd
Van Rixel Dr
Aporo Dr
Matua Rd
Lewis Younie Rd
Cutfield Ln
Kuawa Dr
Eric Farley Dr
384
431
392
392B
402
665
647
643
631
623
641
631A
677
695
693
601
587
573
583
551
529
44D
44A
44C
44B
47
50


NOR 2 SH16
Existing
Do-Nothing
Do-Minimum
Main Rd
Huapai
Vintry Dr
Station Rd
Trigg Rd
Sunny Cres
Pinotage Pl
Oraha Rd
Schoolside Rd
Winfield Rd
Konoba Ave
Podgora Ave
Ropere St
Coast Hwy
N
Meters

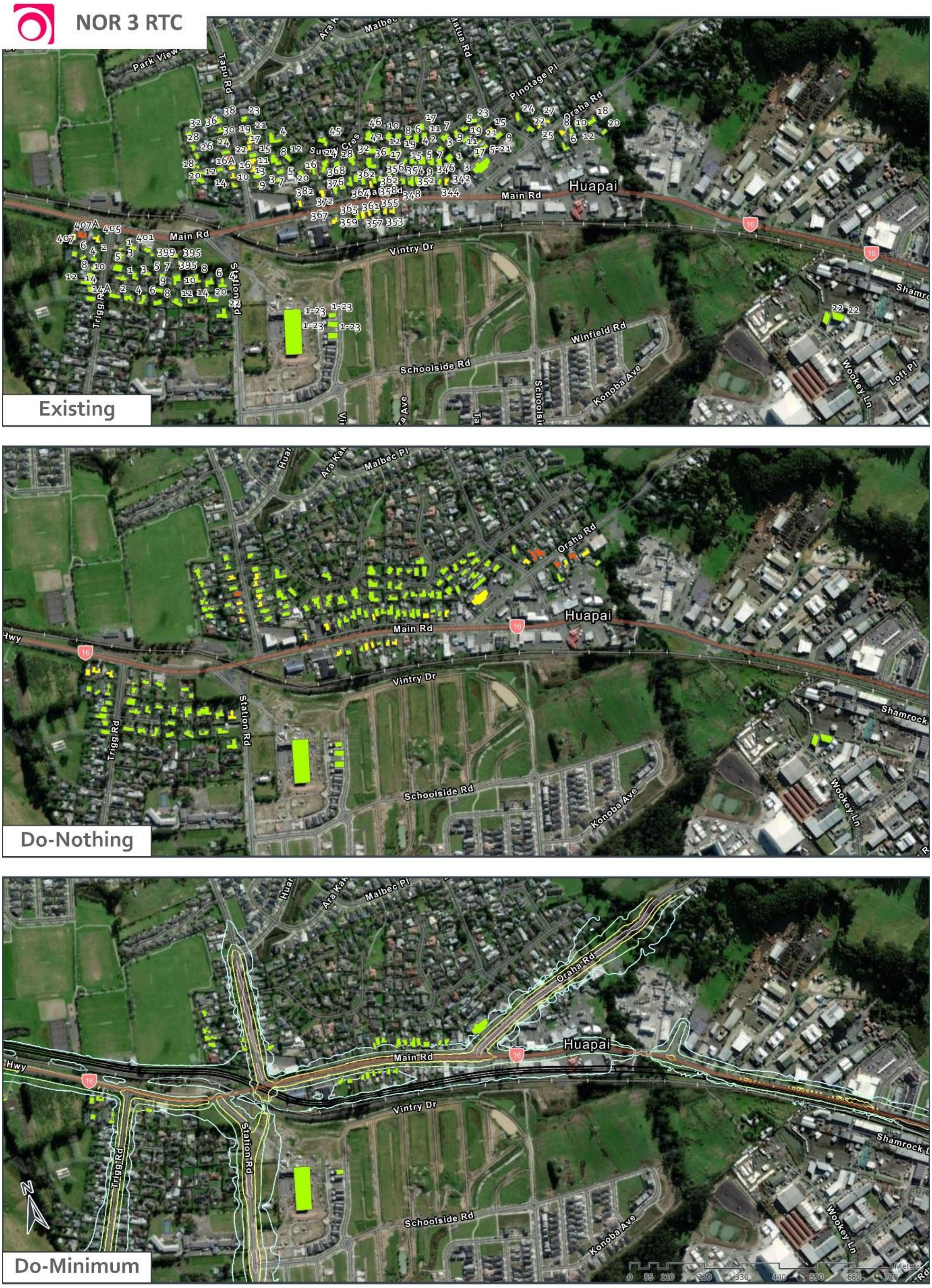

NOR 2 SH16
Huapai
Kumeu
Main Rd
Shamrock Dr
Koraha Rd
Winfield Rd
Konoba Ave
Schoolside Rd
Wookey Ln
Loft Pl
Access Rd
Waitakere Rd
Existing


Oraha Rd
Huapai
Kumeu
Main Rd
Shamrock Dr
Koraha Rd
Weza Ln
Riverhead Rd
Honowai St
Whakato Ave
Vintry Dr
Winfield Rd
Ropere St
Konoba Ave
Schoolside Rd
Wookey Ln
Loft Pl
Grivelle St
Access Rd
Waitakere Rd
Do-Nothing

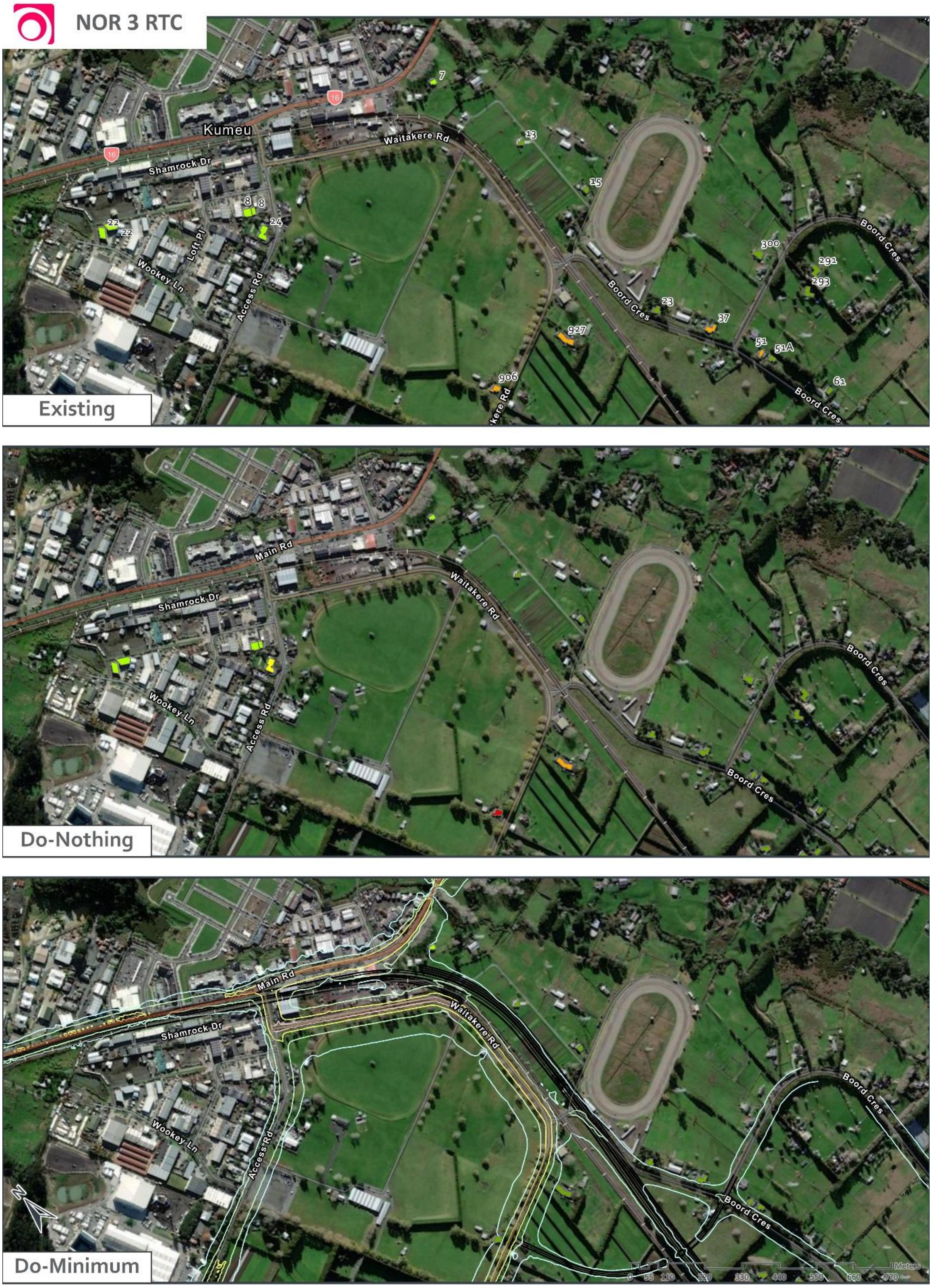

Oraha Rd
Huapai
Kumeu
Main Rd
Shamrock Dr
Koraha Rd
Weza Ln
Riverhead Rd
Honowai St
Whakato Ave
Vintry Dr
Winfield Rd
Ropere St
Konoba Ave
Schoolside Rd
Wookey Ln
Loft Pl
Grivelle St
Access Rd
Waitakere Rd
Do-Minimum

2.3 NoR S3


NOR 3 RTC
Matua Rd
Korako Dr
Meryl Ave
Madden Ave
Twin Coast Hwy
Coast Hwy
Existing
Gilbransen Rd
Trigg Rd
Do-Nothing
Do-Minimum



NOR 3 RTC
Existing
Do-Nothing
Do-Minimum
Main Rd
Huapai
Vintry Dr
Station Rd
Trigg Rd
Schoolside Rd
Konoba Ave
Winfield Rd
Oraha Rd
Malbec Pl
Pinotage Pl
Park View
Tapu Rd
Wookey Ln
Loft Pl


NOR 3 RTC
Kumeu
Waitakere Rd
Shamrock Dr
Wookey Ln
Loft Pl
Access Rd
Boord Cres
Existing
Main Rd
Do-Nothing
Do-Minimum


NOR 3 RTC
291
293
300
61
51A
51
Boord Cres
68
68
88
88
96
108
37
62
82
15
23
927
906
901
Existing
Do-Nothing
Do-Minimum
0 55 110 220 330 440 550 660 770
Meters

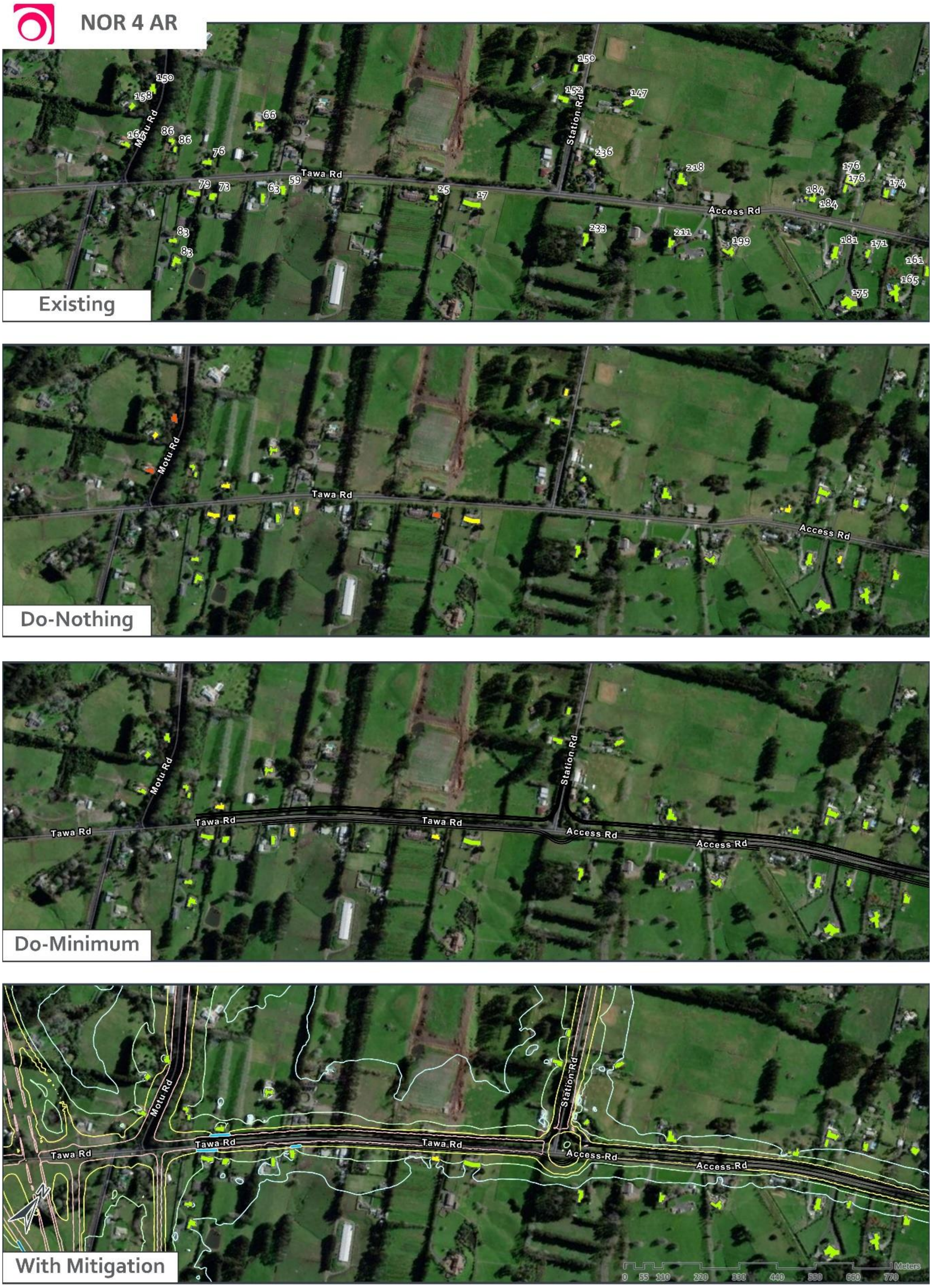

NOR 3 RTC
108
186
405
284
Boord Cres
374
Taupaki Rd
370
375
377
364
367
14
362
Joseph Dunstan Dr
Ej Osborne Ln
Existing
Boord Cres
Taupaki Rd
Joseph Dunstan Dr
Do-Nothing
Boord Cres
Taupaki Rd
Joseph Dunstan Dr
N
0 55 110 220 330 440 550 660 770 Meters
Do-Minimum


NOR 3 RTC
Twin Coast Hwy
Northwestern Mtwy
Fred Taylor Dr
Joseph Dunstan Dr
Hailes Rd
284
208
196
198
200
91
Existing
Joseph Dunstan Dr
Fred Taylor Dr
Do-Nothing
Joseph Dunstan Dr
Fred Taylor Dr
Do-Minimum


NOR 3 RTC
Twin Coast Hwy
Northwestern Mtwy
Fred Taylor Dr
Hailes Rd
Northside Dr
Totara Creek
208
196
198
107A
107
Existing
Do-Nothing
Do-Minimum

2.4 NoR S4


NOR 4 AR
Existing
Do-Nothing
Do-Minimum
With Mitigation
Access Rd
Kumeu
Wookey Ln
Loft Pl
Shamrock Dr
Grivelle St
Main Rd
Station Rd


NOR 4 AR
Existing
Do-Nothing
Do-Minimum
With Mitigation
Motu Rd
Tawa Rd
Station Rd
Access Rd
150
158
16
86
86
66
76
79
73
63
59
83
83
25
17
152
147
236
218
233
211
199
176
176
174
184
184
181
171
161
165
175
0 55 110 220 330 440 550 660 770
Meters

ATTACHMENT 46

NORTH-WEST STRATEGIC SOCIAL IMPACT ASSESSMENT

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Social Impact Assessment

December 2022

Version 1

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

Responsibility	Name
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Table of Contents

1 Introduction 2
1.1 Purpose and Scope of this Report 2
2 Strategic Assessment Package Overview 3
3 Assessment Methodology 5
3.2 Impact Identification 6
3.3 Determining the social area of influence 7
3.3.1 Assumptions 7
3.4 Impact Rating and Assessment of Impacts 8
3.5 Recommendation of mitigation and management strategies 10
4 Statutory and Policy Context for Considering Social Impacts 11
4.1 Statutory Framework 11
4.1.1 The Resource Management Act 1991 11
4.2 Regional and local planning context 11
4.2.1 Auckland Plan 2050 11
4.3 Auckland Future Urban Land Supply Strategy 2017 12
4.4 Local Board Plans 12
4.5 Kumeū – Huapai Centre Plan 2017 13
4.6 North West Spatial Land Use Strategy 14
4.7 Draft Rodney Local Parks Management Plan 15
5 Literature Review 16
5.1 Impacts of route protection 16
5.2 Construction phase impacts 17
5.2.1 Operation phase impacts 18
6 Social Area of Influence and Community Profile 20
6.1.1 Transport 21
6.2 Wider community 21
6.2.1 Existing environment 23
6.2.3 Transport 25
6.2.4 Community facilities 26
6.3 Local Community 28
6.3.1 NoR 1 – Alternative State Highway including Brigham Creek Interchange 28
6.3.2 NoR 2 – SH16 Main Road Upgrade 30
6.3.3 NoR 3 – Rapid Transit Network and Active Mode Corridor (including Kumeū and Huapai Transit Stations) 33
6.3.4 NoR 4 – Access Road Upgrade 34
7.2 Regional impacts 37

7.2.1 Route protection 37
7.2.2 Construction 37
7.2.3 Operation 38

7.3 Alternative State Highway incl Brigham Creek Interchange (NoR 1) 42

7.3.1 Route protection phase 42
7.3.2 Construction phase 44
7.3.3 Operational phase 45
7.3.4 Conclusions 48

7.4 NoR 2 – State Highway 16 Main Road Upgrade 49

7.4.1 Route protection phase 49
7.4.2 Construction phase 50
7.4.3 Operation phase 51
7.4.4 Conclusions 52

7.5 NoRs 3, KS and HS (Rapid Transit Corridor and Regional Active Mode Corridor, Kumeū Rapid Transit Station and Huapai Rapid Transit Station) 53

7.5.1 Route protection phase 53
7.5.2 Construction phase 56
7.5.3 Operation phase 58
7.5.4 Conclusions 61

7.6 NoR s4: Access Road Upgrade 62

7.6.1 Route protection and construction impacts 62
7.6.2 Operation impacts 63

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
CC2W	City Centre to Westgate
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
SIA	Social Impact Assessment
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Strategic Assessment Package	Four Notices of Requirement (for ASH, RTC, Station Road and SH16) and one alteration to an existing designation (SH16 Main Road) for the Whenuapai Arterial Transport Network for Auckland Transport.

1 Executive Summary

This Social Impact Assessment (**SIA**) has been prepared for the North West Strategic Notices of Requirement (**NoRs**) for Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) (the "**Strategic Assessment Package**").

The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

The NoRs considered in this SIA are:

- Alternative State Highway, including Brigham Creek Interchange
- SH16 Main Road Upgrade
- Rapid Transit Corridor and Regional Active Mode Corridor
- Kumeū Rapid Transit Station
- Huapai Rapid Transit Station
- Access Road Upgrade

Social impacts have been identified drawing on a range of data sources including a literature review of other similar projects, a community profile of the local, wider and regional communities, and interviews with local stakeholders and community organisations.

Social impacts are identified for each of the 6 NoRs at local, wider and regional scales. Impacts are considered at the route protection, construction and operational stages.

On the whole, the NoRs will have largely positive impacts for the communities they serve. The NoRs will improve the connectivity and reliability of the North West transport network and provide additional transport choices, making it easier for people to travel to and through this area. Route protection of the corridors will provide certainty to the local, wider and regional communities that plans are in place to help manage the traffic congestion which is currently an issue for many in the North West.

The NoRs will also give rise to some potential negative impacts. These primarily relate to the route protection phase (if local residents are uncertain and anxious about the future of their communities) and the construction phase (if noise, vibration and additional traffic movements cause disruption to the local and wider communities). Some negative impacts could be experienced during the operational phase of particular projects if access to community assets such as community halls and parks is made more difficult, or if some people perceive that their quality of environment has declined as a result of the projects. Recommendations are provided in the SIA as to how these negative impacts can be managed and mitigated.

1 Introduction

This Social Impact Assessment (**SIA**) has been prepared for the North West Strategic Notices of Requirement (**NoRs**) for Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) (the "**Strategic Assessment Package**").

The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

This report assesses the potential social impacts of the North West Strategic Assessment Package identified in and Table 1-1 below. Refer to the AEE for a more detailed project description.

Table 1-1: North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR KS	Kumeu Rapid Transit Station
NoR HS	Huapai Rapid Transit Station
NoR S4	Access Road Upgrade

1.1 Purpose and Scope of this Report

The SIA forms part of a suite of technical reports prepared to support the assessment of effects within the Strategic Assessment Package. Its purpose is to inform the AEE that accompanies the Strategic Assessment Package sought by Waka Kotahi and AT.

The purpose of this SIA is to assess the actual and potential social impacts associated with the planning (route protection phase), construction, operation and maintenance of the Strategic Assessment Package on the existing and likely future environment and recommend measures that may be implemented to avoid, remedy and/or mitigate these impacts.

The scope of this report is as follows:

a) Social context of the Strategic Assessment Package area.
b) Actual and potential social impacts of each Project corridor within the Strategic Assessment Package.
c) Recommended measures as appropriate to avoid, remedy or mitigate actual and potential social impacts (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package; and
d) Overall conclusion of the level of actual and potential social impacts for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

2 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 2-1, with a brief summary of the Strategic Assessment Package projects provided in Table 2-1.

The Strategic Package has been developed to provide additional transport connections through the North West, particularly to facilitate the projected growth in this area.

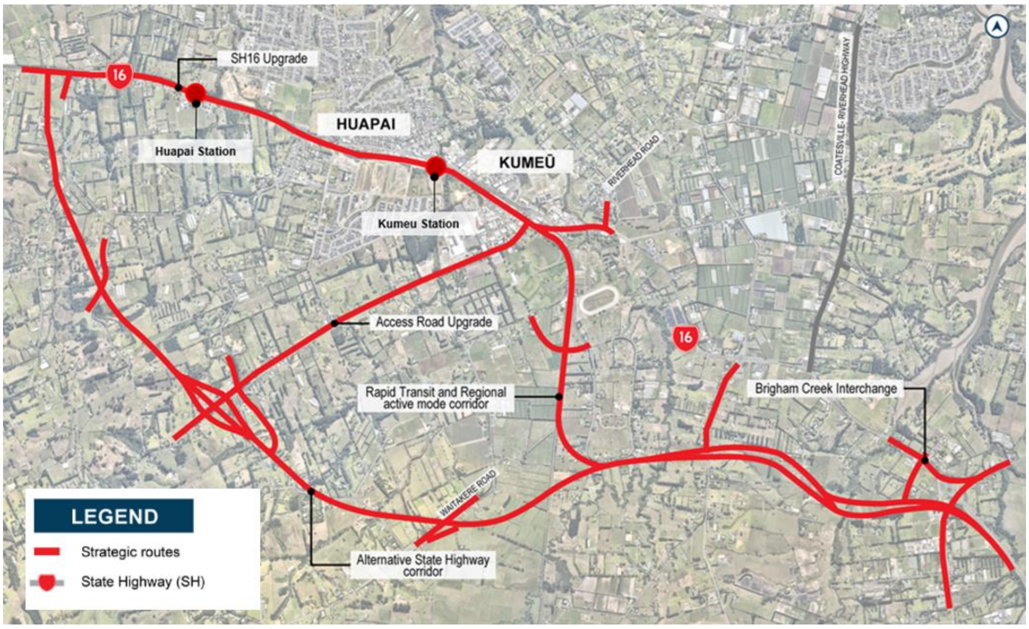

Figure 2-1: North West Strategic Assessment Package – Overview of NoRs for Assessment

Table 2-1: Strategic Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Alternative State Highway	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange.	Waka Kotahi
State Highway 16 Main Road Upgrade (alteration to existing designation 6766)	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New Rapid Transit Corridor and active mode corridor in one co-located corridor.	Waka Kotahi
Kumeū RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway.	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road Upgrade	S4	Upgrade of Access Road to a four-lane cross-section with separated cycle lanes	Auckland Transport

Corridor	NOR	Description	Requiring Authority
		and footpaths on both sides of the corridor.	

The AEE contains further information on the Projects, including a project description, key project features and the planning context. Other technical assessments should also be referred to for more information on aspects of the Projects such as traffic impacts (Transport Assessment) and anticipated landscape impacts (Landscape Effects Assessment).

3 Assessment Methodology

3.1 Assessment methodology

The methodology used for this SIA is based on the International Association for Impact Assessment (IAIA) Guidelines[1] and Waka Kotahi social impact assessment guidelines[2]. The methodology has been developed to identify and predict the key social impacts of the construction and operation of the Projects from the perspective of those potentially affected by it.

The methodology undertaken for this SIA consists of the following steps:

- **Step One – Scoping and contextualisation:** obtaining an understanding of what is proposed, determining study areas (geographical areas)
- **Step Two – Information gathering:** desk-top data analysis, research, and stakeholder and community engagement (consisting of both a review of engagement undertaken by the Supporting Growth Programme, and interviews undertaken by the social research team)
- **Step Three – Determining the social area of influence:** identifying and describing the communities likely to be impacted (positively or negatively) by each Project, at a range of scales.
- **Step Four – Impact identification:** determining the nature of likely social impacts
- **Step Five – Assessment of impacts:** outlining the anticipated scale, extent, distribution and duration of impacts
- **Step Six – Mitigation and management recommendations:** recommendation of mitigation and management opportunities to address identified impacts

Each of these steps are elaborated on below.

3.1.1 Scoping and contextualisation

The following sources and methods were used to develop an understanding of the proposed project and the context in which it is proposed:

- Project briefings
- A review of Project documentation, including design drawings, technical reports, the Project GIS viewer and engagement summary reports
- Information about the North West community, including Census 2018 data, Local Board plans and Auckland Unitary Plan Operative in Part (AUP:OP) zoning.

3.1.2 Information gathering

Preparation for this report has included:

- Review of Te Tupu Ngātahi briefing documents, technical reports (Landscape and Visual, Urban Design, Transport, Construction Noise, Operational Noise[3]), construction plans and GIS viewer

[1] Social Impact Assessment: Guidance for assessing and managing the social impacts of project – International Association for Impact Assessment, April 2015. Retrieved from https://www.iaia.org/uploads/pdf/SIA_Guidance_Document_IAIA.pdf.

[2] https://www.nzta.govt.nz/assets/resources/guide-to-assessing-social-impacts-for-state-highway-projects/16-243-People-and-place-state-highway-social-impact-guide-2017-FINAL.pdf

[3] To date a first draft of each of these reports (Version 1) has been reviewed.

- Review of North West Strategic engagement summary report (2021) covering public engagement carried out between November 2020 and February 2021[4]. See the North West DBC Engagement Summary Report for a list of groups engaged with during this period.
- Interviews with community organisations and stakeholders: Kumeū Community Centre, Kumeū Showgrounds, Matua Ngaru School, Kumeū Cricket Club, West Coast Rangers Football Club.

A copy of the engagement summary report was provided to the social research team; this was used to draw out information on community values and attitudes towards the NoRs.

Literature Review

The IAIA Social Impact guidelines (2015) recommends that there is adequate awareness of social research methods and appropriate reference is given to literature on the methods of SIAs and social research. A review of literature was conducted, including of case studies and SIAs for similar infrastructure projects, to inform the methodology for this SIA.

The purpose of this literature review is to provide a profile (drawing on peer reviewed literature as well as other social impact assessments and technical reports) of the *potential* social impacts (both positive and negative) associated with:

- Route protection for infrastructure projects
- Provision of infrastructure for transport (including rapid transit networks, roads and active transport)

This literature review is part of the *scoping* stage of the impact assessment. It is intended to canvas a range of similar projects (noting that the scale and nature of these projects will differ from the NoRs assessed in this report) and provide insight into the sorts of impacts that have been experienced on those projects, the sorts of mitigation that could be effective, and lessons that have been learned from other projects. The inclusion of a project in the literature review does not mean that the exact same impacts will be experienced in these NoRs.

3.2 Impact Identification

The IAIA guidelines and Waka Kotahi social impact assessment guidelines[5] have been used to consider the potential social impacts of the project, on the basis of both the existing and future community, the nature of the proposed works, and the social impacts anticipated.

IAIA describes a range of social impact 'categories'[6]. These categories have been used as a guide, and the following selected as most relevant to this project:

- **People's way of life** – how people carry out and get to their daily activities such as work, education, and domestic activities including consideration of access to and between communities and places/centres where people live, work and play.
- **Their community** –
  - **Community cohesion** – connectivity between people

[4] https://www.supportinggrowth.govt.nz/assets/supporting-growth/docs/Northwest-Auckland/2020/2021-Consultation/North-west-Engagement-Summary-June-2021.pdf
[5] https://www.nzta.govt.nz/assets/resources/guide-to-assessing-social-impacts-for-state-highway-projects/16-243-People-and-place-state-highway-social-impact-guide-2017-FINAL.pdf
[6] International Principles for Social Impact Assessment 2003 – SIA principles – Frank Vanclay

  - **Stability, character, services and facilities -** the current and future social infrastructure within a community, it's unique character/identity and the stability of a community
- **Sustaining oneself –** how people sustain and provide for themselves.
- **Their health and wellbeing** – health being a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity.
- **The quality of the living environment and amenity**– the quality of the air and water people use, availability and quality of the food that they eat, the level of hazard or risk, dust and noise they are exposed to, the adequacy of sanitation, their physical safety, and their access to and control over resources.
- **Their fears and aspirations** – their perceptions about their safety, their fears and aspirations about the future community. It is recognised that there will be a high degree of social change planned in the area of assessment and the assessment has sought to consider the Project within the context of this planned social change.

3.3 Determining the social area of influence

The SIA has established a 'social area of influence' within which social impacts are expected to be experienced. For this SIA, the social area of influence includes three levels - Regional, Wider and Local communities.

Each of the 6 NoRs considered in this SIA occur within a similar geographical area. As such, one 'Regional' community and one 'Wider' community has been determined for all 6 NoRs. A description of the existing and future regional and wider communities is provided in Section 5. The local communities differ slightly for each NoR, reflecting the fact that each NoR will traverse through different areas of land (although there will be some overlap between NoRs).

The social areas of influence are defined as follows:

- **Regional Community:** North West Auckland. Some consideration is also given to how the Project's impacts may be experienced at an Auckland-wide scale.
- **Wider community:** Those areas within an approximate 5km radius of the NoRs. This includes the communities of Waimauku, Huapai, Kumeū, Riverhead, Redhills, Taupaki and Westgate.
- **Local community:** Those areas within a 200m radius of each of the NoR corridors (200m from the centreline of each corridor), considered to be the area which will experience the most direct impacts of construction and/or operation (in respect to changes in the environment).

Section 5 provides a more detailed overview of the existing and future social environment at each of these scales.

3.3.1 Assumptions

Growth and development in the North West is underway, and will continue to occur in parts of the local and wider communities; this has been signalled through the Future Urban Zoning of some areas of West Auckland through the AUP(OP). It is likely that parts of the 'future' environment will be significantly more urbanised in future than they currently are, while other areas will retain their current zoning.

Based on information provided in the Future Urban Land Supply Strategy, it is anticipated that Future Urban Zoned (FUZ) land will not be live zoned until after structure planning of the area occurs; this is scheduled to occur between 2028 and 2032.

It is therefore assumed based on information received from Te Tupu Ngātahi that:

- For those parts of the community that are currently live zoned, both construction and operation will occur in the 'existing' environment.
- For areas currently zoned FUZ, construction will likely occur in parallel with the urbanisation of these areas, although urbanisation may be advanced given the long-term nature of the strategic projects. Operation will occur in a significantly more urbanised 'future' environment.
- Plan changes, re-zoning and development staging is likely to follow the approximate timings set out in the Urban Land Supply Strategy 2017.
- Early land use and transport integration work has been done in the Kumeū-Huapai and Riverhead town centres (Auckland Council Spatial Land Use Strategy) but further integration work will be done after these NoRs have been lodged (e.g. structure planning and any Council-led plan changes). This will involve collaboration with Auckland Council, AT and Waka Kotahi.
- While timing for construction of each NoR is not confirmed, it is assumed full build out of all projects will occur by 2048.
- It is assumed that the Projects will not all be constructed in parallel.

This is a high level assessment, based on the approximate designation envelope. A number of specific details for each NoR have not yet been confirmed, and as such these have not been considered in the SIA. The SIA therefore gives a high level indication of the types of social impacts that the NoRs may give rise to, but there may be other impacts that need to be considered once a more detailed construction methodology and design are confirmed. For example:

- The extent of construction impacts on Fred Taylor Park, and the amount of land that needs to be acquired for the ASH, have not yet been confirmed. At the time that this SIA was prepared, discussions were still underway with Auckland Council Parks to determine appropriate mitigation for Fred Taylor Park; social impacts relating to Fred Taylor Park will therefore depend on both the scale of land acquisition and the mitigation proposed.
- The specific location of construction laydown areas for each NoR has not been confirmed. The impacts relating to laydown areas will depend on their location (for example, if they are located in a local park then the community may be unable to use the park for recreation for the duration of construction; if they are located in close proximity to residential properties then occupants of these properties may experience higher levels of noise, vibration and disturbance to their daily routines).

3.4 Impact Rating and Assessment of Impacts

This report considers the actual and potential social impacts associated with the following project stages:

- Route protection
- Construction
- Operation and maintenance

Impacts identified through an SIA can be either positive or negative, on the basis of whether the anticipated social consequences will either enhance or detract from community values, social processes or social infrastructure.

The scale of each impact can be identified as *very low, low, moderate, high or very high.* When determining the likely scale of an impact, consideration is given to the likelihood, duration, distribution and scale of the impact relative to the existing and/or future environment (i.e. the magnitude of change from the existing or proposed future condition).

It is important that every aspect of a potential impact is considered when determining an overall impact rating. For example, an activity with a short-term duration would likely be low impact but could increase to moderate if the impact was deemed to be severe during this short time period.

Table 3-1 provides an overview of the matters that will inform the assessment of the scale; however this is not definitive, it is dependent on the context and nature of the impact that is being assessed:

Table 3-1: Matters informing the assessment of scale

Impact Rating	Criteria
Very Low (negligible)	• Short/term temporary duration (temporary e.g. weeks/months); • Small extent of impact on the community being considered (e.g. less than 10% of community extent) and • Very low or negligible level or severity of impact (the degree of change anticipated to the community system, process or value identified in the community profile assessed at a community level).
Low	• Transitional duration (e.g. months or for periods of construction activity); • Small to medium extent of impact on a community (e.g. between 10% and up to 50% of a community impacted – factoring severity); and • Low level of severity of impact (there is low degree to which it will affect the community systems, processes and values identified in the profile).
Moderate	• Transitional to long-term duration (e.g. months to years, e.g. impacts that will extend over and throughout a construction period or beyond); • Medium scale or extent of impact for community (e.g. likely to impact half or more of an identified community extent); and • Low to moderate level of severity of impact.
High	• Long-term duration (e.g. years to permanent impact); • Medium to large scale extent of impact for community (e.g. likely to impact more than half of an identified community extent); and • Moderate to high level of severity of impact (the degree to which it will affect the community systems, processes and values identified in the profile).
Very High	• Long-term duration (e.g. more likely to be permanent;

Impact Rating	Criteria
	• Large extent or scale of impact for community (e.g. most of a community is likely to experience this impact; and Significant severity (e.g. is likely to result in major change to the community system, process or value identified in the community profile).

3.5 Recommendation of mitigation and management strategies

The final step of the SIA is the identification of ways to address the identified potential social impacts and re-assess actual and potential impacts with recommended mitigation/management measures in place.

4 Statutory and Policy Context for Considering Social Impacts

This assessment is informed by an understanding of the statutory context in which the construction and operation of the Project will occur. This also assists in understanding the likely aspirations of the local, wider and regional communities in regard to what sort of changes they wish to see in their community in the future.

4.1 Statutory Framework

4.1.1 The Resource Management Act 1991

The Resource Management Act (RMA) requires the decision-making process to include consideration of the actual and potential effects of activities on the environment. The RMA interpretation of ‘environment’ (Part 1, Section 2) is (**emphasis** added):

Environment includes:

a) *Ecosystems and their constituent parts, including people and communities; and*
b) *All natural and physical resources; and*
c) *Amenity values; and*
d) *the **social, economic, aesthetic and cultural conditions** which affect the matters stated in paragraphs a) to c) or which are affected by those matters*

This interpretation is central to considering the social impacts with respect to the environment. Other sections of the RMA integral to assessment of social impacts include Section 5 which defines the purpose of the RMA as ‘to promote the sustainable management of natural and physical resources’.

Schedule 4(7) Matters that Must be Addressed by Assessment of Environmental Effects, states that an assessment of an activity’s effects on the environment must address “any effect on those in the neighbourhood and, where relevant, the wider community, **including any social, economic or cultural effects”.**

4.2 Regional and local planning context

4.2.1 Auckland Plan 2050[7]

The AEE should be referred to for a detailed overview of the Auckland Plan 2050. Of particular relevance to this SIA are the following key outcomes of the Plan:

- *Opportunity and prosperity: Auckland is prosperous with many opportunities and delivers a better standard of living for everyone.*
- *Transport and access: Aucklanders will be able to get where they want to go more easily, safely and sustainably.*
- *Homes and places: Aucklanders live in secure, healthy and affordable homes, and have access to a range of inclusive public places.*

[7] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/Pages/default.aspx

- *Belonging and participation: All Aucklanders will be part of and contribute to society, access opportunities, and have the chance to develop to their full potential*

4.3 Auckland Future Urban Land Supply Strategy 2017[8]

The Auckland Future Urban Land Supply Strategy 2017 signals when land within Auckland's key growth areas can be expected to be development-ready over the next few decades. The strategy is intended to provide strategic direction around how population growth will be accommodated, and how future urban land will be sequenced. A detailed overview of the Strategy is provided in the AEE, and information about the anticipated staging of development in the North West is discussed in the Community Profile.

4.4 Local Board Plans

The wider community in which the Project is occurring traverses three Local Board areas: Rodney, Henderson – Massey and Upper Harbour. Each of these Local Boards released a Local Board Plan in 2020 which sets out the key issues and opportunities for the area over the next three years. While the Projects will not be built within the next three years, the Local Board Plans are useful in providing an indication of the direction that the community is heading in, and the key aspirations for each Local Board area.

The table below (Table 4-1) sets out the key 'aspirations' listed in each Plan:

Table 4-1: Local Board aspirations

Local Board	Aspirations
Henderson-Massey[9]	1. Henderson-Massey is a great place to live, work and play 2. A thriving, inclusive and engaged community 3. Thriving Māori culture and identify 4. Everyone contributes to building resilience and living sustainably 5. It's easy to get around Henderson-Massey safely without using a car
Rodney[10]	1. Safe, improved transport options connect our communities 2. Our natural environment is healthy and protected 3. Infrastructure and development meets the needs of our growing communities 4. Our communities are resilient and have access to what they need 5. Our local parks and recreation facilities meet the needs of our growing community
Upper Harbour[11]	1. Empowered, connected and resilient Upper Harbour communities 2. An efficient and accessible travel network 3. Healthy and active communities 4. Our unique natural environment is protected and enhanced

[8] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/housing-plans/Documents/future-urban-land-supply-strategy.pdf
[9] https://www.aucklandcouncil.govt.nz/about-auckland-council/how-auckland-council-works/local-boards/all-local-boards/henderson-massey-local-board/Documents/henderson-massey-local-board-plan-2020-english.pdf
[10] https://www.aucklandcouncil.govt.nz/about-auckland-council/how-auckland-council-works/local-boards/all-local-boards/rodney-local-board/Documents/rodney-local-board-plan-2020-english.pdf
[11] https://www.aucklandcouncil.govt.nz/about-auckland-council/how-auckland-council-works/local-boards/all-local-boards/upper-harbour-local-board/Documents/upper-harbour-local-board-plan-2020-english.pdf

Local Board	Aspirations
	5. A resilient local economy

4.5 Kumeū – Huapai Centre Plan 2017[12]

The Kumeū – Huapai Centre Plan 2017 (developed by the Rodney Local Board) provides a framework for how the town centre is expected to develop both in the short term and over the next 30 years.

The vision outlined in the Plan is that *"Kumeū – Huapai is an attractive town centre that focuses on the river, has improved connections, and celebrates its heritage and rural remote areas."*

The 4 key goals of the Centre Plan are:

- *We want our town centre to look better*
- *We want to get around the centre more easily*
- *Let's improve the river and our natural environment*
- *The town centre is about the people*

Short and long-term actions have been identified to achieve these goals. Short-term goals include limiting commercial sprawl along SH16, reviewing speed limits through the town centre, adding pedestrian crossings, providing more public open space and community facilities and encouraging redevelopment within the town centre to achieve a diverse mixed-use centre.

Medium and longer-term actions (over the next 6-30 years) include town centre upgrades, improving access to the River, constructing cycleways through the area, and developing a 'civic heart' around the library and arts centre. There is also an aspiration to relocate industrial activities away from the centre into nearby industrial zoned areas; this aligns with the North West Spatial Land Use Strategy (outlined in Section 4.6 below) which proposes a new industrial area to the south of the town centre along Access Road.

Several aspirations also align with the Te Tupu Ngātahi NoRs; these include investigating rapid transit corridors and shared paths along SH16 and ensuring that Te Tupu Ngātahi projects in the NW are succesfully implemented.

The Centre Plan was developed through collaboration with the community and includes useful insights into the aspirations of the Kumeū – Huapai community. Community sentiment expressed in the Plan includes:

- The community would like a better-looking town centre. The current centre design is unattractive and messy.
- Improvements desired for the town centre include relocation of industrial businesses away from the main highway, more trees, seating, artwork, and pedestrian only areas.
- The town centre is not safe for pedestrians and cyclists currently, and there is not enough public transport. The high volumes of traffic through the town centre make access, parking, and moving

12 [12] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/place-based-plans/Documents/kumeu-huapai-centre-plan.pdf

around the centre on foot difficult. Active mode and public transport infrastructure are desired, as well as better roading to allow for future growth in commuter numbers.

- The natural environment (particularly along the Kumeū River and Huapai Stream) should be improved and planting throughout the town centre should be increased.
- There is a desire for the town centre to be a more social, thriving space with a strong sense of place. Suggestions include more restaurants, a variety of shops, a village square and community facilities like playgrounds, gardens and a recreation facility.

4.6 North West Spatial Land Use Strategy[13]

The North West Spatial Land Use Strategy (adopted by Auckland Council in 2021) provides a high-level overview of how FUZ land in the North West is expected to be used. A detailed overview of the Spatial Land Use Strategy is included in the AEE.

Figure 4-1 shows the preferred option for future land use in this area:

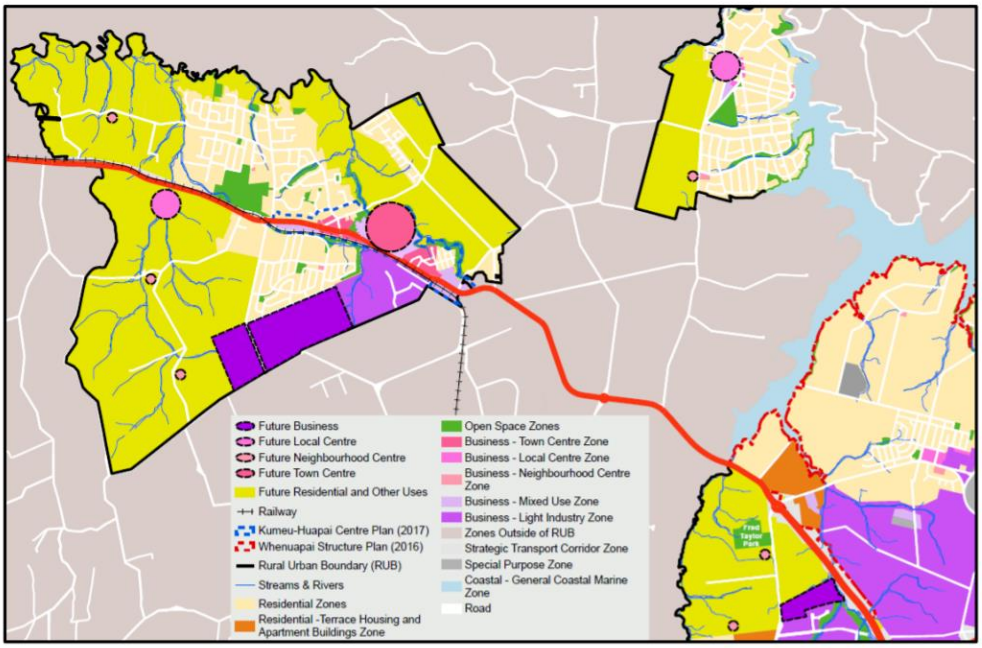

Figure 4-1. Future land use as per the Spatial Land Use Strategy

Of particular note are the following:

- 80ha of business land is planned in south Kumeū and south Redhills (it is intended that industrial activities currently operating in Kumeū will relocate to this area, as also sought by the Kumeū Huapai Centre Plan.)
- An expansion of the existing Town Centre in Kumeū – Huapai and in Riverhead, and a new Local Centre towards the west of Kumeū – Huapai. The proposed Rapid Transit Network stop in Kumeū – Huapai is intended to be located near the Local Centre to support this future growth area. Smaller Neighbourhood Centres are anticipated in Redhills.

13 https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/place-based-plans/structure-plans/Documents/spatial-land-use-startegy-north-west.pdf

4.7 Draft Rodney Local Parks Management Plan[14]

The Rodney Local Parks Management Plan was prepared by the Rodney Local Board and provides a framework for the management of parks in the Rodney District, including information on how specific parks should be managed. The Plan notes that because many residents in Rodney are some distance from large urban settlements, parks play an important role in supporting the needs of rural communities and providing a space for the community to gather and socialise.

The Plan acknowledges that significant growth is planned in the Rodney district, and that parks will therefore need to accommodate more people and offer a wider range of recreational activities.

The Plan sets out 'management intentions' for a number of parks within the Kumeū – Huapai area; key intentions relating to use of the parks are summarised below:

Park / Reserve	**Management intentions[15]**
Huapai Domain	• Manage the reserve to provide for a variety of active sport, recreation and event uses • Investigate the opportunity to develop an indoor sports/courts facility with associated services in the park • Work with mana whenua to raise awareness of the cultural significance of the site including through interpretation of the history of the park and wider area • Investigate opportunities to improve existing play spaces in the park with the community. Consider potential new locations for junior playground, expanding options for teen play, how to provide a diversity of play experiences and referencing the local area through design.
Huapai Service Centre/Kumeū Library	• Work with Auckland Transport to create a shared pathway alongside State Highway 16 to deliver on this priority project in the Rodney Greenways Plan. Any improvements to connectivity have the potential to improve access and use of this reserve
Kumeū River Reserves	• Work with mana whenua to raise awareness of the cultural significance of the site including through interpretation of the history of the park and wider area • Enable opportunities to develop and enhance pathways through the park to deliver on this priority project in the Rodney Greenways Plan • Where opportunities arise, work with the Department of Conservation to protect the park's values and enhance mutual benefits, for example creating pedestrian connections between parks, pest plant and animal management and ecological restoration

14 https://ehq-production-australia.s3.ap-southeast-2.amazonaws.com/fc62313c538cecaa301ee1f054114150342c16bb/original/1654806090/8bb2944b749ff301f908ccef161836d4_Draft_Rodney_Local_Parks_Management_Plan_-_Volume_1.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIBJCUKKD4ZO4WUUA%2F20220914%2Fap-southeast-2%2Fs3%2Faws4_request&X-Amz-Date=20220914T212034Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=eff6053e3b341c9d0fe7eacf38cbf24d8619caea1ee855c1e0478f02676ae315

15 https://ehq-production-australia.s3.ap-southeast-2.amazonaws.com/9e1167891835f94f4e62624f4c98eedb96c9a4cf/original/1654806265/2e7a562ab7c62d2662fae1519eecacb6_Draft_Rodney_Local_Parks_Management_Plan_-_Volume_2_-_Individual_parks_in_Kume%C5%AB_subdivision.pdf?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIBJCUKKD4ZO4WUUA%2F20220914%2Fap-southeast-2%2Fs3%2Faws4_request&X-Amz-Date=20220914T212033Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=3d22672127acf0884cb9c156f50e3915b4d776c94aec0c75d8deed3910385826

Park / Reserve	Management intentions[15]
Oraha Road Park	• Support community initiatives to plant a community garden at 45 Oraha Road for teaching and education purposes

5 Literature Review

The IAIA Social Impact guidelines (2015) recommends that there is adequate awareness of social research methods and appropriate reference is given to literature on the methods of SIAs and social research.

This section summarises the relevant literature that was reviewed to inform the methodology for this SIA.

This literature review has included a review of case studies and SIAs for similar infrastructure projects relating to:

- Route protection
- Transport projects (roading, rapid transit and active mode infrastructure)

Appendix A lists the case studies and literature that was reviewed. Below, a summary of the main social impacts identified is provided, grouped by 'route protection impacts' and 'impacts of transport projects' (including rapid transit, active modes and roading).

The purpose of this literature review is to review similar impacts that have been experienced in other similar projects and provide an overview of *potential* impacts that could be experienced in the Projects. It is important to note that the case studies below are each of differing scales and contexts and will not be directly comparable to the Projects assessed in this report; the fact that a particular impact has occurred in one of the projects described below does not guarantee that it will also be experienced for any of the Projects, or that it will be experienced to the same extent.

5.1 Impacts of route protection

There is limited literature available on the impacts of long-term route protection on communities; in the studies that are available, both positive and negative impacts of route protection are identified. The following was identified from the research:

- Protecting a corridor for a future project generally provides certainty to stakeholders and the local community. By identifying the corridor in planning documents, development around the corridor can be managed to avoid incompatible land uses being established.
- For landowners, Infrastructure Australia note that route protection can provide early notice that a project will be going ahead, which allows the local community time to plan and prepare for this and provides a degree of certainty around what they can and cannot do on their land in terms of land use and development[16].
- The route protection process (including the selection of preferred route options) could lead to uncertainty and anxiety for landowners around if and when their property may be acquired, and for

[16] https://www.infrastructureaustralia.gov.au/sites/default/files/2019-06/CorridorProtection.pdf

the wider community in terms of not knowing how their community may change and when this may occur[17][18].

- Property acquisition can have adverse social impacts on the community once construction has begun on projects. Property acquisition was assessed as leading to changes in community character (depending on the scale of acquisition and the size of the community) as people move out of the area and the makeup of the community shifts.
- Both route protection and property acquisition (full or partial) can also cause stress and anxiety, for property owners who are unsure whether they will be able to remain in their property or not, and for the wider community if it is unclear how the community may be changed by the project.
- Effective consultation and communication with the local community is important in helping the community understand the purpose of route protection (as opposed to project construction) [19].
- In longer term route protection projects (i.e. where construction of the project is not anticipated to begin for several decades), communication with the community can assist in managing community expectations around when this infrastructure will be provided (i.e. making it clear to the community that construction will not be starting as soon as route protection is obtained) and what can be done with their land in the interim.

5.2 Construction phase impacts

Regardless of the type of transport project (i.e. active mode, road, rapid transit), similar construction impacts are typically reported in case studies:

- The potential temporary reduction in local amenity/quality of environment arising from construction noise and vibration.
- Access during construction. It was identified that because people may find it harder to access their properties (if there is additional construction traffic along their road, for example) or to access businesses and community facilities, this could impact people's quality of life if they are unable to access services and facilities (or spend longer trying to reach these locations).
- The extent of these impacts in other projects has varied according to the scale and duration of the work. Construction of a major rail project in a busy city centre can result in impacts on businesses due to noise, vibration and ongoing traffic management outside premises.
- Positive impacts can also be experienced if there are local employment opportunities generated through the construction phase.
- Management plans were typically recommended to assist in minimising construction impacts as much as possible.
- Regular, ongoing communication with local residents and businesses was also recommended so that these affected groups know what to expect throughout the construction process, have time to prepare for temporary disruptions, and have opportunities to raise any concerns or complaints with the project team.
- It is recommended to maintain access to businesses and community facilities as far as practicable during the construction period; signage and wayfinding can assist with this.

[17] https://www.nzta.govt.nz/assets/projects/east-west-link-application-to-the-environmental-protection-authority-epa/Technical-Report-11-Social-Impact-Assessment.pdf
[18] 16-243-People-and-place-state-highway-social-impact-guide-2017-FINAL.pdf (nzta.govt.nz)
[19] https://www.infrastructureaustralia.gov.au/sites/default/files/2019-06/CorridorProtection.pdf

- In some projects, a Business Hardship Fund has been deemed necessary (i.e where there is significant impact on businesses over an extended period) to ameliorate some of the business loss during years of construction[20].

5.2.1 Operation phase impacts

There were similar themes across the operational impacts identified in the SIAs and case studies reviewed, however these differed slightly according to the type of project (i.e. active mode vs roading). These have been split into potential social impact themes below.

Community connectivity:

- New transport links can boost community connectivity by providing ways for people to move through the community and access recreation, employment, education and other services. These benefits were felt in particular with multi-modal solutions such as rapid transit, active modes or public transport, as these services allow for all people to move around an area rather than just those who have access to a car. Introducing rapid transit networks to cities can contribute to more vibrant urban environments by bringing more people and activity into the area.
- New roads can create a sense of severance if they are perceived as 'dividing' existing communities or large properties.

Way of life:

- Transport infrastructure can improve way of life by improving people's ability to move through the area to access goods and services. If time spent in traffic is reduced (i.e. if a new road improves traffic flows or a rapid transit network cuts down commuting time) this also frees up time for people to enjoy other activities.
- New roads can sometimes relieve pressure on existing roads and facilitate growth in the area through the provision of supporting infrastructure. These impacts are greatest if public transport and active modes are also facilitated along the corridor.

Health and wellbeing:

- Rapid transit users have a reduced risk of traffic accidents (compared to driving a private vehicle) and experience health benefits from this, as well as from the walking and cycling that often occurs at either end of a rapid transit trip (i.e. walking from home to the station and the station to work).
- Safe active mode infrastructure in a community can encourage more people to take up walking and cycling for both recreational and commuting purposes;
- Separating active mode infrastructure typically maximises the health and wellbeing benefits as it reduces the risk of traffic accidents while walking or cycling.
- Rapid transit networks should be designed to be safe and accessible in order to maximise the number of people who can benefit from using the network.
- There is also an association between longer commute times and poorer mental health, as a result of stress and having less time to spend with friends, family or doing other activities. Conversely, walking and cycling can improve mental health by allowing people to get out of the house, exercise, make social connections and gain access to green spaces.
- Health and wellbeing benefits can occur if new roads succeed in reducing the time people spend stuck in traffic, therefore reducing the stress that this can bring. If roads are upgraded to be safer,

[20] https://www.cityraillink.co.nz/targetedhardshipfund

traffic accidents can also be reduced which has clear health and wellbeing benefits for communities.

Quality of environment:

- For people in close proximity to newly constructed roads, there can be negative impacts on amenity and outlook if the road obstructs their outlook (particularly in rural areas where views may previously have been devoid of any urban form). Property owners in closer proximity to new active mode infrastructure could lose amenity, outlook and privacy if there is not appropriate screening (such as landscaping) between their property and the pathway.
- Planting/screening and careful design of the active mode infrastructure or road may go some way towards mitigating impacts. However, the efficacy of this mitigation will depend on the scale of the infrastructure and how close the property is.

6 Social Area of Influence and Community Profile

This section describes the social context in which the Projects will likely take place, considering the existing and future communities at three different scales:

- Regional community – Auckland and West Auckland
- Wider community – Waimauku, Huapai, Kumeū, Riverhead, Taupaki, Redhills and Westgate (5km from the project extent)
- Local community – 200m from project extent (from the centreline of each NoR corridor)

This community profile describes current and planned future land uses, features of the communities of interest and the key current or planned community facilities. Statistical data on the population within these areas has been drawn on to understand the demographic makeup of the 'community'.

Based on the Future Urban Land Supply Strategy, it is assumed that significant development will take place in parts of the community (Kumeū, Huapai, Whenuapai, Riverhead, Redhills, Whenuapai) between 2028 and 2032. It is assumed that construction will likely take place in the 'existing' environment where the Projects traverse live zoned land, and in parallel with construction of new urbanised areas where the Projects traverse FUZ land. Operation of all Projects will occur within the 'future' environment, noting that in currently live zoned land the 'future' environment will be similar to the existing environment in terms of land use, while FUZ land will be significantly more urbanised.

It is acknowledged that the future environment can be described at a macro level, drawing on plans and understandings of the anticipated built environment, dwellings housing, jobs, and the visions of Auckland Council. However, details of the population, demographics, character and values of this 'future' community are yet to be formed. It is also possible that a number of the residents and businesses currently within the local and wider communities will have moved out of the area by the time construction of the projects begins; as such the community character and/or character of the Kumeū – Huapai business area may have changed over time.

6.1 Regional Community – Auckland and West Auckland

Auckland is experiencing rapid growth, with the region's population projected to reach 2 million by 2028. 'Development areas' have been identified across Auckland, and these areas are expected to undergo significant growth (in terms of both business and housing growth) to help accommodate Auckland's growing population over the next several decades. Many of these areas are on the fringe of Auckland's existing urban area and have been zoned Future Urban Zone (FUZ) under the AUP(OP).

North West Auckland has historically been characterised by large rural areas and less development than other parts of the region, however this is now changing with areas of West Auckland including Whenuapai, Redhills and Kumeū – Huapai – Riverhead having been identified as development areas. Housing developments are already underway throughout this area, and more development is scheduled to occur over the coming decades. There is also a focus on developing business activity throughout West Auckland to provide opportunities for residents to work closer to their homes[21].

[21] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/development-strategy/future-auckland/Pages/what-westgate-look-like-future.aspx

Westgate is expected to become the "key node" of the North West[22]. Significant retail, business and community facilities will be clustered in this area, including a library, community hub, open space areas, transport interchange and town square.

6.1.1 Transport

Existing key transport connections in Auckland's North West include SH16 (running from central Auckland to Wellsford), SH18 (running between the North Shore and SH16) and the North West rail line (Western Line services run between the CBD and Swanson, via Henderson and New Lynn). Each of these connections plays an important role in moving both people and freight to and through the North West (noting that there are no passenger rail services to Kumeū or Huapai currently).

SH16 in particular provides resilience within the wider Upper North Island state highway network as an alternative to SH1[23] (for example, SH16 is a key detour route when there are crashes or closures on SH1 or the Auckland Harbour Bridge).

Cars are the dominant mode of transport throughout the Auckland region. In the 2018 Census, 68% of respondents drove to work in either a private or company vehicle. 7%[24] of respondents took the public bus to work, while 3% used a train and 5% either biked or walked. Public transport and active mode use is higher for those travelling to and from education; 21% of respondents walk or jog to and from education, 18% take either a public or school bus, and 4% use a train.

Traffic congestion is a significant issue for Aucklanders; Auckland Council estimates that each year commuters spend an average of 20 working days stuck in traffic[25].

In 2016, Auckland Council carried out public consultation to understand existing transport movements and aspirations for the future transport network, with a particular focus on development areas for the next 30 years (including North West Auckland)[26]. Respondents from the North West were generally supportive of improved connections from the North West to Coatesville, Riverhead and the North Shore, as well as road upgrades and safety improvements in general. The business community were also keen to see improved connections from the North West to other parts of Auckland. In terms of public transport, both the public and business community were supportive of improvements in the public transport network occurring as quickly as possible. Finally, feedback from across all development areas was that more cycleways and pedestrian facilities are needed.

6.2 Wider community

The wider community is defined as those areas within 5km of the proposed NoR corridors. This includes the communities of Waimauku, Huapai, Kumeū, Riverhead, Redhills, Taupaki and Westgate as shown in Figure 6-1.

22 https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/development-strategy/future-auckland/Pages/what-westgate-look-like-future.aspx
23 https://www.nzta.govt.nz/projects/sh16-brigham-creek-and-waimauku/
24 Note all percentages are rounded to the nearest whole
25 https://www.aucklandcouncil.govt.nz/mayor-of-auckland/mayor-priorities/Pages/improving-aucklands-transport.aspx
26 https://www.supportinggrowth.govt.nz/assets/supporting-growth/docs/2016-Engagement-Summary-Report-TFUG.pdf

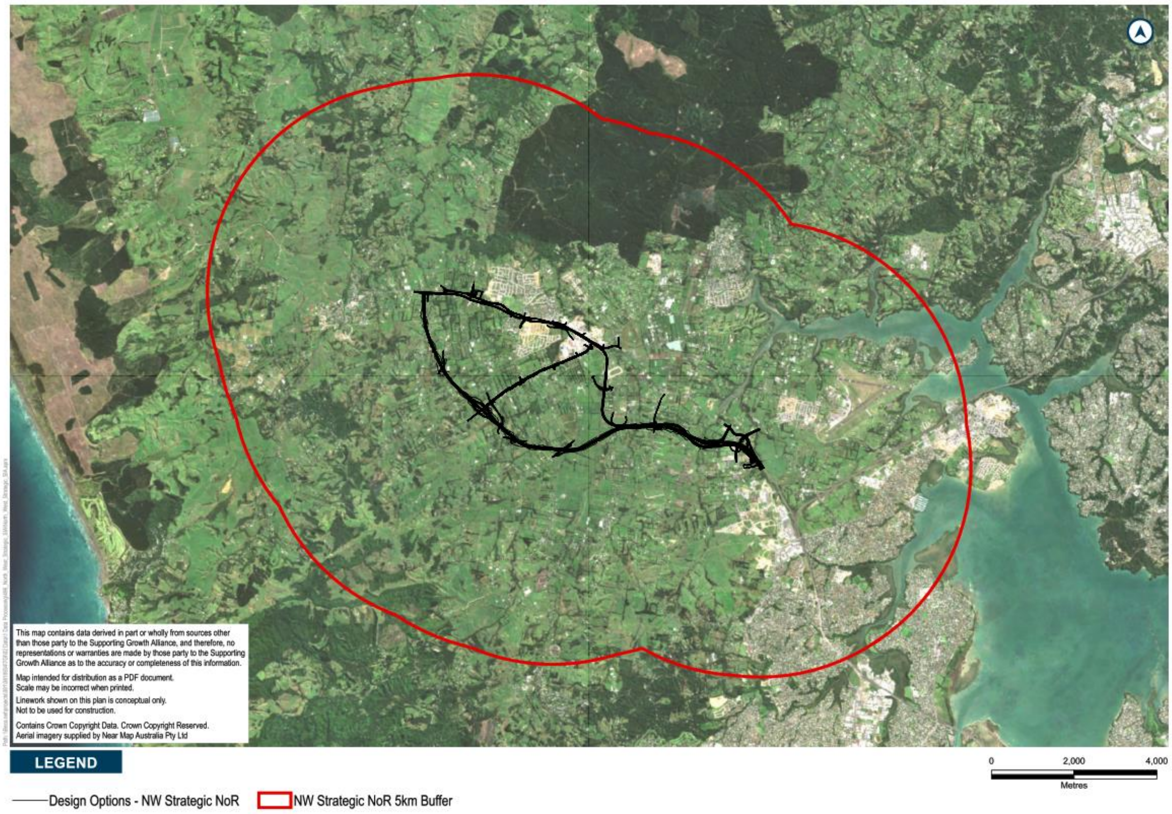

Figure 6-1: Wider community extent (shown in red). NoRs are shown in black.

The wider community is within the statistical areas[27] of Taupaki, Whenuapai, Kumeū Rural East, Kumeū Rural West, Kumeū – Huapai, Waimauku and Waipatukahu, as shown in Figure 6-2 below:

[27] Note 'Statistical Areas' are aggregated meshblocks as defined by Statistics NZ.

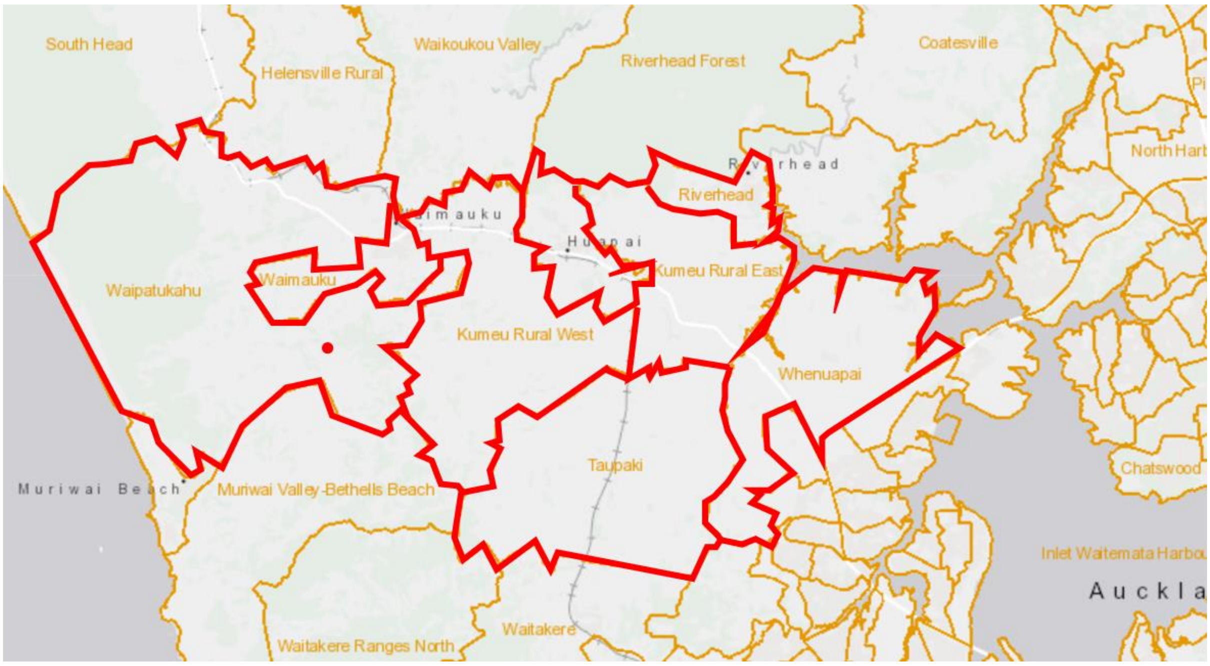

Figure 6-2. Statistical area boundaries

Below are descriptions of the existing and future environments for these communities.

6.2.1 Existing environment

The existing environment is a mix of rural, urban and ‘future urban’ land. Outside of the town centres (Westgate, Kumeū, Huapai, Waimauku and Riverhead) land is predominantly rural, with a mix of lifestyle blocks and farms. During engagement conducted by Te Tupu Ngātahi, residents of these rural areas noted that many of them had lived in the area for a long time and placed strong value on the area’s quiet, rural feel.

There are also some areas of greenfield land that are anticipated to be developed in future. The Redhills greenfield area is around 580ha and has been live zoned through the AUP(OP), with a local centre and various residential zones.

The town centres of Westgate, Kumeū, Huapai, Massey, Waimauku and Riverhead are characterised by a mix of residential and commercial/industrial development. Parts of these areas have long been established as residential areas (predominantly single storey, standalone dwellings), while other areas are seeing rapid urban development (predominantly two to three storey townhouses) and a rapidly growing population. Throughout the wider community, there is therefore a mix of residents who have lived in the area for a long time (particularly in the rural areas of the community) and residents who are very new to the area and have moved in with an expectation that the area will continue to urbanise.

Appendix B outlines key demographic statistics for the wider community (drawing on statistical area units in the 2018 Census). Of particular relevance from these statistics are the following trends:

- Population growth occurred between the 2013 and 2018 Census in all statistical areas within the wider community, but particularly in Kumeū – Huapai where the population increased by 143% between 2013 and 2018.

- In the more urban statistical areas (Kumeū - Huapai and Whenuapai), the number of people who did not reside in their current residence one year ago is higher than the Auckland average. In the other statistical areas, this figure was below the Auckland average. This is indicative of a fairly stable community in the rural parts of the wider community, and urban areas which are more prone to change and growth in residents.
- In most parts of the wider community (with the exception of Kumeū – Huapai and Whenuapai), the percentage of people who work from home is significantly higher than the Auckland average (likely because the wider community includes a large number of rural and lifestyle properties). For example, the percentages of people who work from home in Kumeū East, Kumeū West and Taupaki are 19%, 20% and 21% respectively. The Auckland average is 8.7%[28].
- Car use is the dominant mode of commuting for work and education (higher than the Auckland average) and there are low rates of public and active transport use. For example, in Kumeū – Huapai 84% of commuters drive a private or work vehicle compared to the Auckland average of 70%, while only 1.5% of commuters use the bus compared to an Auckland average of 7%. The exceptions to this are train use in the statistical area of Taupaki, and school bus use in Kumeū Rural East, Kumeū Rural West, Taupaki and Kumeū – Huapai; usage is higher than the Auckland average in these areas.

6.2.2 Future environment

Figure 6-3 shows the current zoning of land in the wider community. The bulk of the area is zoned Rural Production or Countryside Living, while the yellow areas represent areas of FUZ land.

[28] Noting that these statistics are drawn from the 2018 census; numbers of people working from are likely to be higher across Auckland currently due to Covid-19.

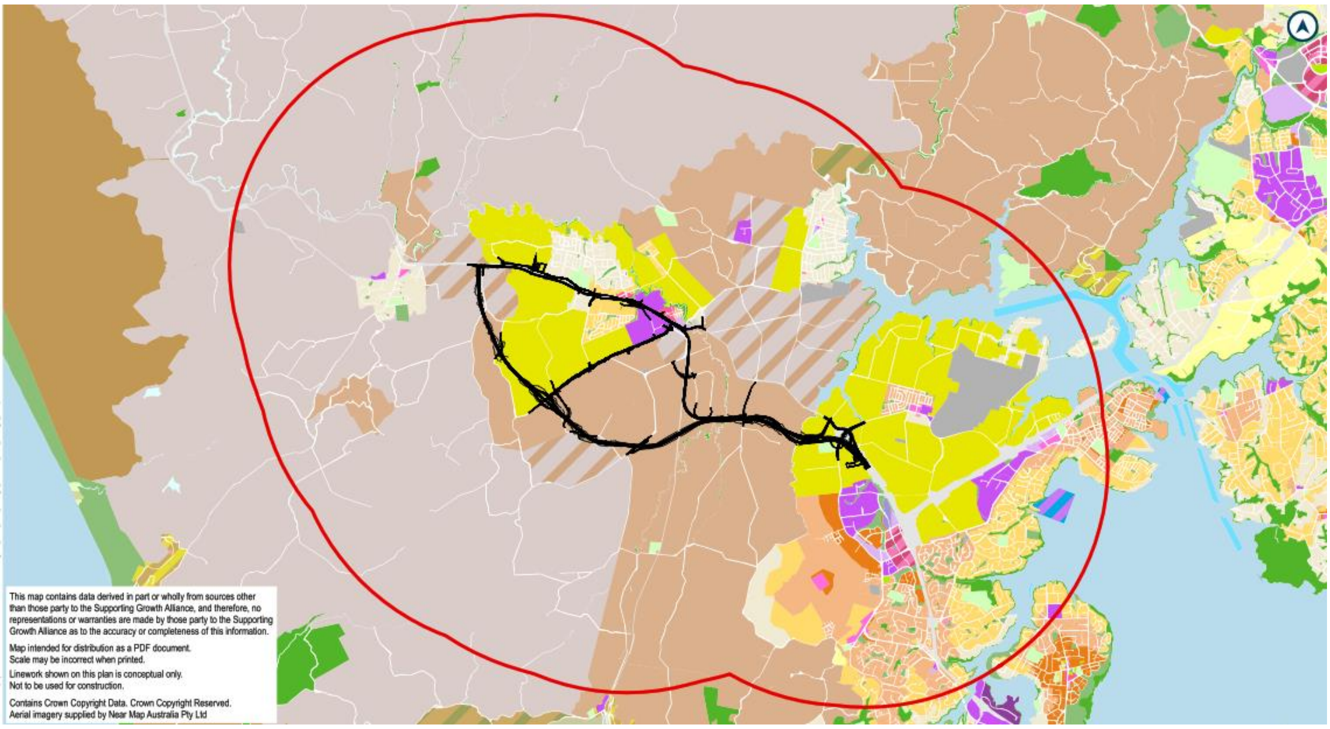

Figure 6-3. Current zoning of approximate wider community area

Auckland Council have signalled that FUZ land within the North West will not be live zoned until structure planning has occurred; this is indicatively programmed for 2025. Once this land becomes live zoned, Kumeū-Huapai, Riverhead, Redhills and Westgate/Massey will over time become significantly more urbanised. This is anticipated to change the character of these areas from predominantly rural to more developed areas. The Future Urban Land Supply Strategy indicates that this land is expected to be live zoned between 2028 and 2032. This 'decade two' development is expected to provide an additional 6,600 dwellings in Kumeū – Huapai – Riverhead, 11,600 dwellings in Whenuapai (Stage Two) and 1,400 in Redhills North.

In terms of business land use, the NW Spatial Land Use Strategy anticipates that 70ha of business land will be provided south of Kumeū (along Access Road) as well as 10ha to the south of Redhills North. It is anticipated that industrial activities currently occurring in the Kumeū Town Centre may relocate to this new business land, as sought through the Kumeū – Huapai Centre Plan. The Strategy also anticipates an expansion of the existing Kumeū – Huapai Town Centre, as well as the creation of a new Local Centre just west of Kumeū – Huapai.

6.2.3 Transport

Existing environment

The Kumeū – Huapai Centre Plan notes that many local residents currently travel out of the area for work each day, to the larger employment hubs of North Harbour, Albany and the CBD.

SH16 and SH18 are the key transport connections for people making these trips, with SH18 providing the main connection to and from North Harbour and Albany, and SH16 connecting people to the CBD.

Over 36,000 vehicles a day use the route between Brigham Creek and Kumeū, and over 15,000 vehicles are travelling between Huapai and Waimauku each day[29].

A lack of transport choice is an issue for the North West. This is a particular issue in the Rodney Local Board area, where bus services are limited, there are no trains, and roads are often unsealed with no footpaths. In Henderson-Massey and Upper Harbour, the transport network has improved over the past decade but there are still limited options for public transport and cycling, particularly for short journeys.

Car use is therefore the dominant way of travelling around the area; the impacts of traffic congestion have therefore been exacerbated as the population of the area grows and there are more cars on the roads. The vast majority of people within the wider community commute to and from work by private vehicle, and most students either drive to and from education or take a school bus (see the Census statistics summarised above and in Appendix 1).

Future environment

In engagement carried out by Te Tupu Ngātahi[30], there were high levels of support from the local community for transport solutions which would move traffic away from the Kumeū – Huapai town centre and reduce traffic congestion (although there were mixed opinions on how this should be done – for example some people expressing a preference for new roads, and others preferring public transport and active mode solutions).

Members of the community noted that better connections to SH16 and the North Shore were needed, as well as more opportunities to walk and cycle to local destinations. There was a preference amongst respondents for separated, safe walking and cycling facilities. While there was a desire to see more walking and cycling infrastructure, most stakeholders interviewed as part of the social research felt that driving would likely remain the dominant way of getting around the area in future, as people would still need to travel long distances and visit multiple destinations on one journey (such as work, school drop off and a supermarket trip), which would be best suited to a car.

In future it is anticipated that more transport choices will be available to the community, as evidenced by the work Te Tupu Ngātahi is pursuing.

6.2.4 Community facilities

Existing environment

Community facilities and services within the wider community (such as schools, parks and community centres) are clustered along SH16 and in centres; these are mapped in Figure 6-4 below. Community facilities include:

- **Kumeū Community Centre:** Two halls which can be hired out for events; also home to regular community classes and events such as indoor netball, church meetings, exercise and craft classes.
- **Kumeū Fire Station:** Fire station used by the Kumeū – Huapai Volunteer Fire Brigade, located on Main Road.
- **Matua Ngaru School:** Year 0-8 school in Huapai, sharing a boundary with Huapai Domain.

29 https://www.nzta.govt.nz/projects/sh16-brigham-creek-and-waimauku/

30 https://www.supportinggrowth.govt.nz/assets/supporting-growth/docs/Northwest-Auckland/2020/2021-Consultation/North-west-Engagement-Summary-June-2021.pdf

- **Kumeū Library:** Small library and Council buildings on Main Road.
- **Te Manawa:** Large community hub in Westgate, providing services such as a library, customer service centre, rooms for hire, commercial kitchen, creative, work and study spaces and a Citizens Advice Bureau.
- **Fred Taylor Park:** Located near the Brigham Creek roundabout, this park is one of the two home grounds of the West Coast Rangers Football Club (along with Huapai Domain). A clubroom, football fields and parking area are located within the park.
- **Riverhead War Memorial Park:** This park is located in the centre of Riverhead and is home to Riverhead Bowling Club and the Kumeū Rugby Football and Sports Club, who have three sports fields and a clubroom facility.
- **Moire Park:** Located in Massey; home to Massey Rugby Football Club (clubrooms and several fields)
- **Huapai Domain:** Huapai Domain is the largest of the parks within the wider community. The park includes football grounds, tennis and netball courts, cricket pitches, two playgrounds, changing room and toilet facilities, a skate ramp, and picnic tables. Kumeū Cricket Club operates out of Huapai Domain and has a club house in the Domain. The Domain is also one of the home grounds (alongside Fred Taylor Park) of the West Coast Rangers Football Club, which is the 5th largest club in Auckland with around 1400 members. The Domain is well used by both clubs (the football club, for example, reported that over winter there are multiple teams training every week night, and games on both Saturdays and Sundays) and it was reported in stakeholder interviews that the space is seen as a key community hub for those living in the Kumeū – Huapai area.

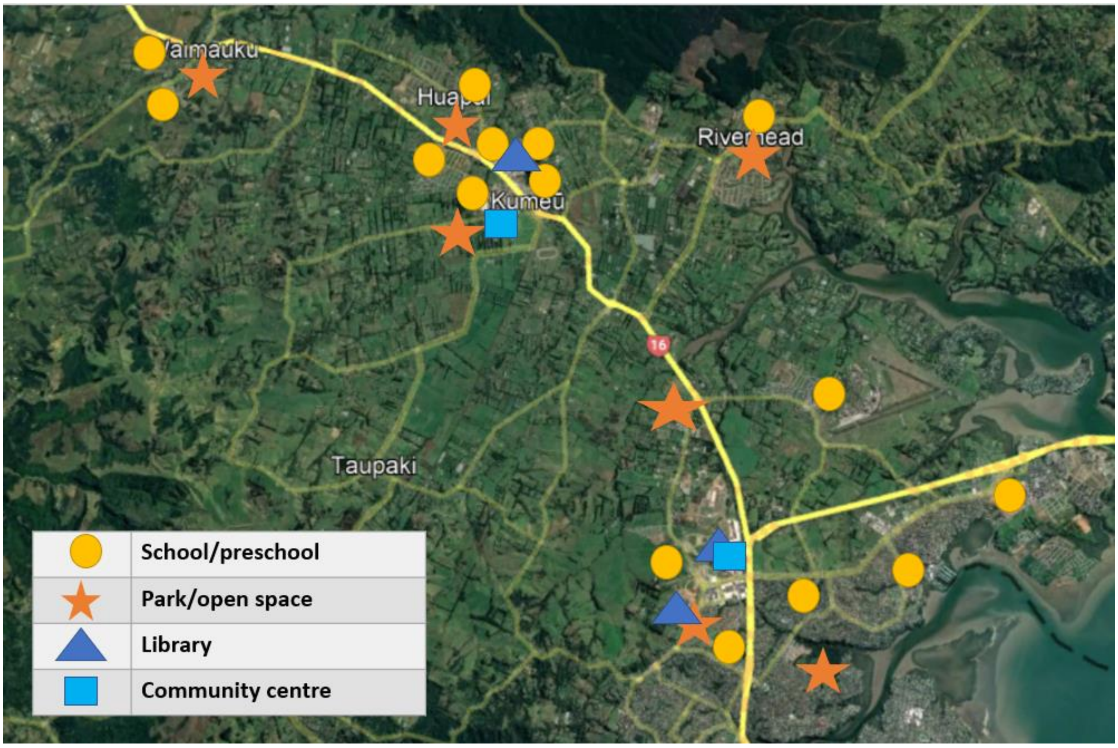

Figure 6-4. Community facilities in wider community

Future environment

It is anticipated that more community facilities will be provided over the coming decades as the population continues to grow and more demand is placed on existing resources such as schools and parks. The Rodney Local Board Plan, for example, identifies an objective to create new green and open spaces including a new indoor courts facility in Kumeū – Huapai.

In addition to this, the Kumeū – Huapai town centre is likely to look different in the future. The North West Spatial Land Use Strategy indicates that the town centre is expected to expand in future to cater for projected growth. The Kumeū-Huapai Centre Plan (2017) notes that the town centre(s) along Main Road currently feel "like state highway rather than a town centre" due to the narrow footpaths, lack of pedestrian crossings and high number of carparks with street frontages pushed back behind parking areas. The Centre Plan notes that this environment encourages vehicles to continue at high speed when travelling through the town centre. The Plan sets out an intention to, in tandem with growth of the surrounding area, create more of a 'town centre' feel along Main Road. Key initiatives proposed in the Plan include installing pedestrian crossings or a pedestrian bridge, installing 'gateway' features at the start and end of the town centre, and creating a potential 'civic heart'.

A number of local community facilities have a long history in the area; the Kumeū Cricket Club, for example, has been running since the 1950s and the Kumeū Showgrounds has recently celebrated its centenary. The Kumeū Community Centre has also been operating for decades. In interviews with these organisations, it was expressed that there is a strong desire (from those involved in the organisations, and from the wider community) for these facilities to continue operating and serving the community into the long term future. Sports clubs (Kumeū Cricket Club and the West Coast Rangers football club) already serve a large catchment and expect that their membership will grow as the population of the wider area increases.

As set out in the Rodney Local Parks Management Plan, Auckland Council has intentions to improve the facilities at a number of parks throughout Kumeū in future; for example providing a community garden at Oraha Road and investigating an indoor sport facility at Huapai Domain. In addition, it was reported in stakeholder interviews that the West Coast Rangers and Kumeū Cricket Clubs are looking into merging and upgrading their existing clubroom facilities at Huapai Domain, to provide one larger clubroom.

6.3 Local Community

The local community has been defined as those areas within 200m of the centre line of each NoR corridor, as this is considered the area within which people will experience the most direct impacts of the Projects (for example, construction noise). A separate 'local community' has been defined for each NoR, and consideration is given to both the existing and likely future environments.

6.3.1 NoR 1 – Alternative State Highway including Brigham Creek Interchange

Figure 6-5 shows the extent of the local community area for NoR 1:

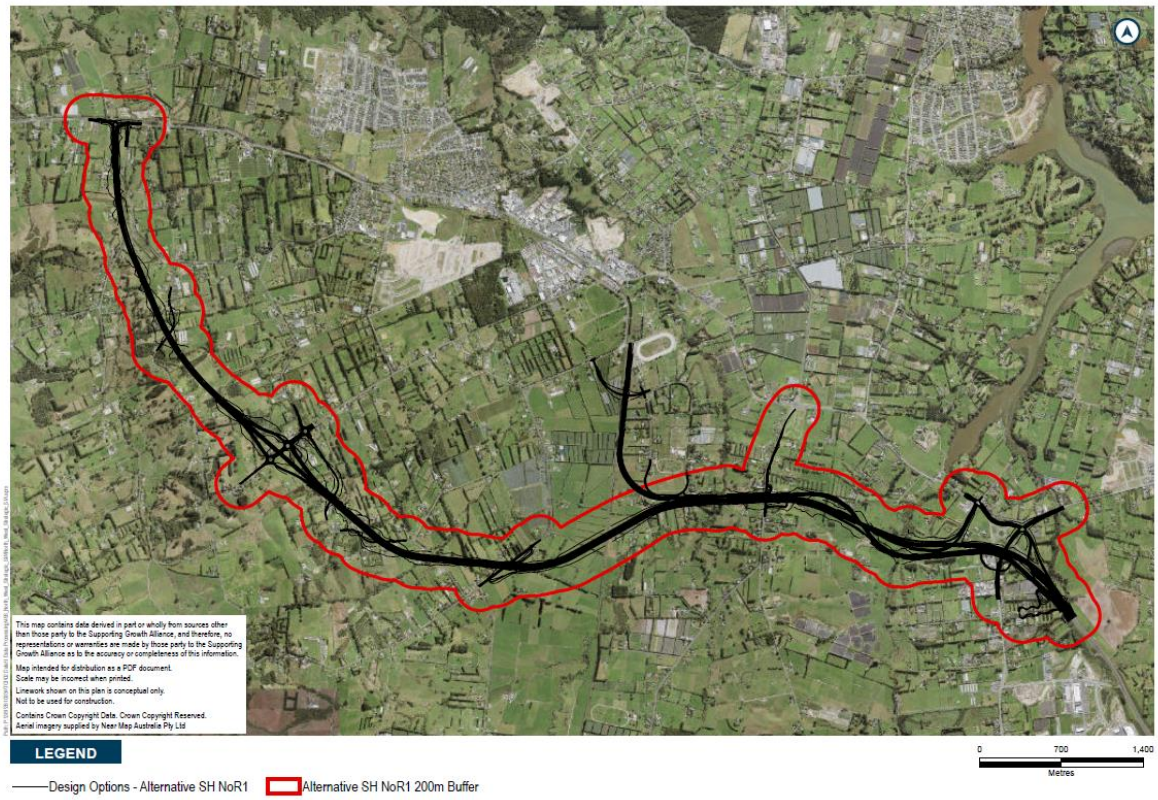

Figure 6-5. Extent of local community for NoR1 (local community extent shown in red, ASH corridor in black)

Existing environment

The existing local community is predominantly made up of rural properties to the southwest of SH16. Land is zoned either Mixed Rural, Rural Production or Countryside Living. During previous engagement with Te Tupu Ngātahi, residents in this area stated that they valued the quiet countryside feel of the environment, with some landowners having lived in the same area for decades.

There are no bus routes in the local community (with the exception of bus routes that travel up and down SH16 and can be accessed from Waimauku) and limited footpaths. Traffic congestion along SH16 is a concern for local residents when trying to access local amenities and employment[31].

The only community facility identified within the local community is Fred Taylor Park, near the Brigham Creek roundabout. As stated above, this is a well-used park primarily used for football, but also popular for informal recreation such as jogging and dog walking. The park was until recently the home ground of Waitakere United Football Club, however the club has now merged with West Coast United FC to form the West Coast Rangers Football Club. Both Fred Taylor Park and Huapai Domain are considered the home grounds of this newly formed club, and both parks are regularly used for trainings and games (noting that Huapai Domain is not within the 'local community' for this NoR). Fred Taylor Park has four full sized fields and two training fields, as well as a clubroom facility.

Likely future environment

[31] As reported in Te Tupu Ngātahi engaegment carried out in 2021

In future, the rural and countryside living zoned areas of the local community are likely to remain predominantly rural. These areas are outside of Auckland's Rural Urban Boundary and this boundary is assumed not to be changing.

The Project corridor traverses two areas of land that are currently zoned Future Urban, and in future these areas will be more urbanised. These areas are Kumeū – Huapai and Redhills. These areas have not been subject to structure planning yet which limits the certainty around what the future environment will look like; however based on the FUZ zoning of these areas it is likely that these sections will undergo some development and growth and be home to new communities.

Fred Taylor Park has, as mentioned above, recently become one of the two home grounds for the newly formed West Coast Rangers Football Club and is expected to remain in use by the club for games and trainings into the future.

6.3.2 NoR 2 – SH16 Main Road Upgrade

Figure 6-6 shows the extent of the local community area for NoR2:

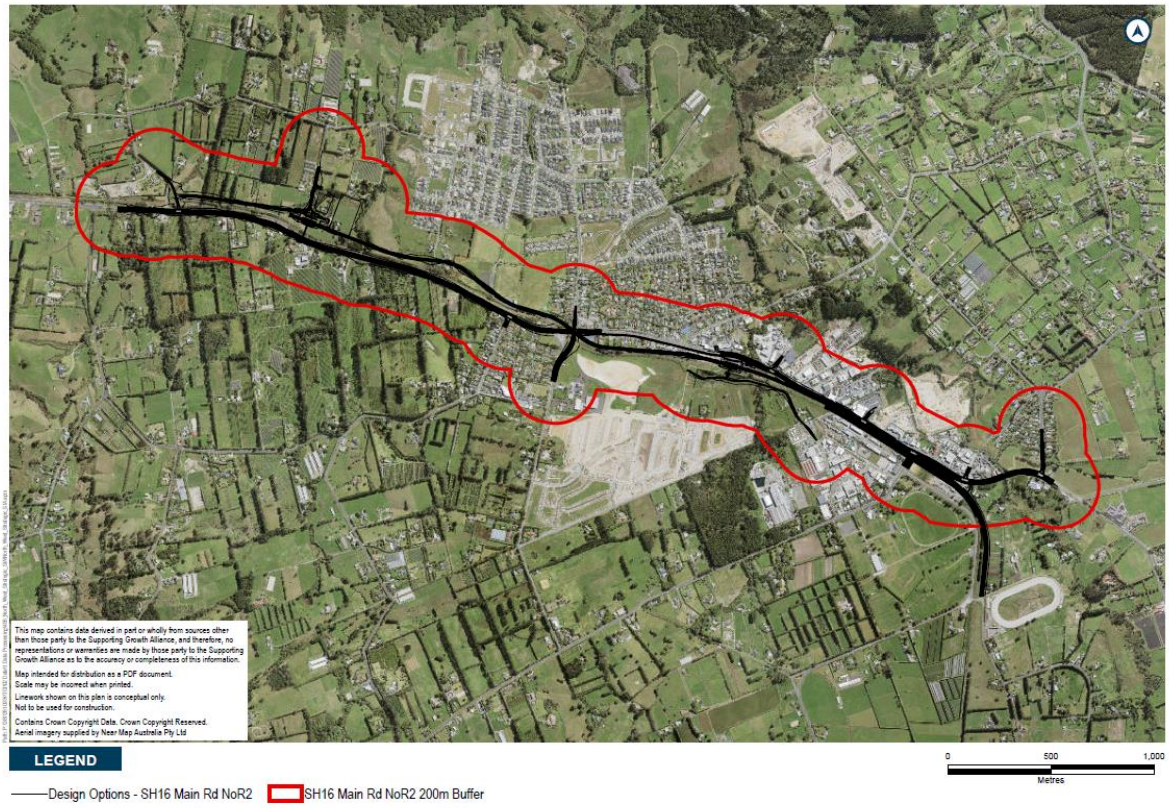

Figure 6-6. Extent of local community for NoR2 (Main Road corridor shown in black, local community boundary shown in red)

Existing environment

The SH16 Main Road Upgrade NoR covers approximately 4.5km of the SH16 corridor, from east of Kumeū to west of Huapai. This corridor runs through the town centres of Kumeū and Huapai.

The Kumeū township hosts a mix of industrial and commercial businesses, on both sides of the highway. A wide range of services are available, including supermarkets, gyms, pharmacies, a post office, cafes and restaurants, as well as more industrial businesses such as car repairs, construction yards, a film studio and lumber stores. The main community facilities in Kumeū are the Community Centre, which hosts community groups, sports and exercise classes, and the Kumeū Library.

Kumeū Community Centre is a well-used community facility; it was reported during stakeholder interviews that the centre is in use 4-5 nights per week and booked most weekends for multiple events, with groups making bookings up to 2 years in advance for a regular weekly slot. The centre has two halls; one smaller and one large high ceilinged room suitable for indoor sports or theatre. Examples of events held at the Centre include Rotary Club meetings, dance classes, church, birthdays and parties and indoor netball. People typically drive to and from events at the Community Centre and the carpark is reportedly (as discussed in stakeholder interviews) usually full when events are on. It was noted in stakeholder interviews that vehicle access right up to the door of the Centre is important, as many of the events are popular with the elderly (line dancing, Lions Club, indoor bowls etc) and there is a weekly dance event for people with intellectual disabilities, who are sometimes dropped off in a van .It was also reported that people in wheelchairs sometimes attend events at the Centre, meaning vehicle access right up to the doors of the centre is important. The closest alternative community halls are in Riverhead, Waimauku and Hobsonville, however it was noted in interviews that these venues are not large enough to host many of the events (such as indoor netball) that are hosted at the Kumeū Community Centre.

Kumeū Showgrounds are also withing the local community area. The Showgrounds are on a large corner site with fields, carpark, a club room and a large area of sheds. The entire site is hired out for large annual events such as the Kumeū Show, the Hot Rod Show and several festivals, which attract crowds from all over Auckland and further afield, and generate large amounts of traffic around the Showgrounds as well as bringing many people into the area for the night or to stay for a weekend. There are also more regular events such as the monthly farmers market, and smaller parts of the site are leased for livestock and the Pony Club in between the larger events. A corner of the Showgrounds (the corner of Access Road and Waitakere Road) is also used by the community for dog training, and there are floodlights in this area to facilitate this.

It was reported during stakeholder interviews that the Kumeū Showgrounds are a unique site / venue, with ASB Showgrounds being the only real alternative venue in Auckland that is capable of hosting such large events. At the time that this SIA was being prepared there was uncertainty around future use of the ASB Showgrounds due to a change in lease[32]; it was noted during stakeholder interviews that the Kumeū Showgrounds would potentially need to accommodate much larger events like the Easter Show if ASB Showgrounds were no longer able to hold these events.

For both the Community Centre and the Showgrounds, traffic congestion is an issue currently for users of both facilities. There is significant traffic congestion around the Showgrounds when there are events on, with additional paddocks often needing to be used for parking when the Showgrounds carpark is full. It was noted during stakeholder interviews that for some people, congestion has become so much of a problem that it deters people from coming to events at the Showgrounds. Similarly, the Community Centre carpark is frequently full during regular events and users of the Centre sometimes have to park on surrounding streets if they cannot find space in the carpark.

[32] See for example https://www.stuff.co.nz/business/129091967/auckland-showgrounds-future-back-up-in-the-air-after-new-operator-departs

As stated earlier, the Kumeū – Huapai town centre is currently car-centric and not pedestrian-friendly, with limited formalised pedestrian crossing points and shops being set back from the road to allow for car parking space.

Huapai township, immediately west of Kumeū along Main Road, is smaller than Kumeū. Businesses are again clustered on either side of Main Road and include restaurants, several childcare facilities, takeaway outlets and an arts centre. The main community facilities in Huapai are the Kumeū Library, Matua Ngaru School and Huapai Domain. The volunteer fire brigade station for Kumeū – Huapai is also located along Main Road just outside of Huapai township.

Huapai Domain is the largest of these facilities. The Domain has both cricket and football pitches, as well as tennis and netball courts, a playground, a skate ramp and picnic tables and walking tracks. The Domain is popular for informal recreation such as dog walking and jogging. Until recently, the Domain was the home ground of the Nor West United Football Club; however this club has recently merged with the West Coast United Club to form West Coast Rangers Club, and both Huapai Domain and Fred Taylor Park are the home grounds of this new club. Huapai Domain is used for most of the ‘community’ teams (with the premier teams using Fred Taylor Park), with the Domain being used for trainings every night in winter, and for games on both Saturdays and Sundays. Teams travel from all over Auckland for games at the Domain, with occasional visits from teams further afield such as Hamilton and Tauranga.

Kumeū Cricket Club was established in the 1950s and serves a large catchment, with members coming from as far afield as Bethells and Helensville to the Huapai Domain. The Domain has five cricket ovals including one premier oval; it was noted in stakeholder interviews that few other clubs have a high quality premier oval which results in people travelling specifically to play at Kumeū.

Both the cricket and football clubs have clubrooms in close proximity to one another. The clubrooms are both well used and were described in interviews as being an important hub for each club, providing a place to congregate as well as allowing a vantage point over the majority of the fields and cricket ovals. Other groups also make use of the clubrooms for one-off or semi-regular events such as Residents Association meetings, church and birthday parties.

Matua Ngaru School share a border with Huapai Domain and it was reported during stakeholder interviews that the School makes frequent use of the fields for sports days, trainings and as an informal route for students to cut across when walking to school from the surrounding streets.

Currently the area south of SH16 (outside of the urban zoned areas) is predominantly rural. North of SH16 there are some existing residential areas between Kumeū and Huapai; these are predominantly standalone one or two storey dwellings. There is also development of new residential land underway on both sides of SH16. There are also several vineyards along this section of SH16, some of which are also used as restaurants and wedding venues.

Likely future environment

While parts of the future environment in this local community will remain rural, the majority of the local community on both sides of Main Road is zoned Future Urban or is already zoned for urban or business land use. It is therefore anticipated that in future, the FUZ land will be urbanised and some areas of live zoned land will be intensified.

The Kumeū – Huapai – Riverhead sections of FUZ are scheduled for live zoning between 2028 and 2032, with the intention that structure planning will occur prior to live zoning. 6600 new dwellings are expected to be provided through this development (noting that this includes Riverhead which is not within the local community).

As outlined earlier, the Kumeū – Huapai town centre is likely to also undergo change in order to become more pedestrian-friendly. In addition to the planned upgrades to the town centre, it is anticipated that more businesses (both industrial and commercial) and community facilities will be established to provide for the growing population. The North West Spatial Land Use Strategy indicates that the Kumeū – Huapai town centre will grow in size, and industrial activities will eventually shift from Main Road to south Redhills and south Kumeū. Again, as no structure planning has yet occurred for this area it is difficult to predict the extent or timing of this development.

During interviews, operators of the community facilities were asked about their future plans. Both the Kumeū Community Centre and Kumeū Showgrounds are intending to continue operating and growing. Kumeū Showgrounds may become a home for more, or larger, events (especially with the potential change in use of the ASB Showgrounds in central Auckland), and the Community Centre is intending on expanding the number of events held at the Centre (although there are no plans to physically expand the facility). The West Coast Rangers and Cricket Club are also both expecting their membership to grow as the surrounding area urbanises and both expressed a desire to upgrade their clubrooms, including adding more changing room facilities and potentially merging the two clubrooms into one larger facility. It was reported that talks were previously underway regarding a potential indoor multi-sport facility for the Domain, however this has stalled since the Covid-19 pandemic began.

6.3.3 NoR 3 – Rapid Transit Network and Active Mode Corridor (including Kumeū and Huapai Transit Stations)

This community profile covers the local communities for NoRs KS (Kumeū Rapid Transit Station) and HS (Huapai Rapid Transit Station) in addition to NoR 3 (Rapid Transit Corridor and Active Mode Corridor) as the rapid transit stations are located along the RTC and are assessed as a collective in the impact assessment.

Figure 6-7 shows the extent of the local community area for NoR 3 (including NoRs KS and HS). The Rapid Transit Network and Active Mode corridor follow the Alternative State Highway and the Main Road upgrades and as such the local communities for NoR 3 overlaps with those for NoRs 1 and 2. See the Main Road and ASH community profiles (above) for an outline of the existing and likely future environments along these corridors.

The only section of the RTC and RAMC that does not follow either the Main Road or ASH NoRs is the connecting section between the ASH and SH16 (circled below in yellow).

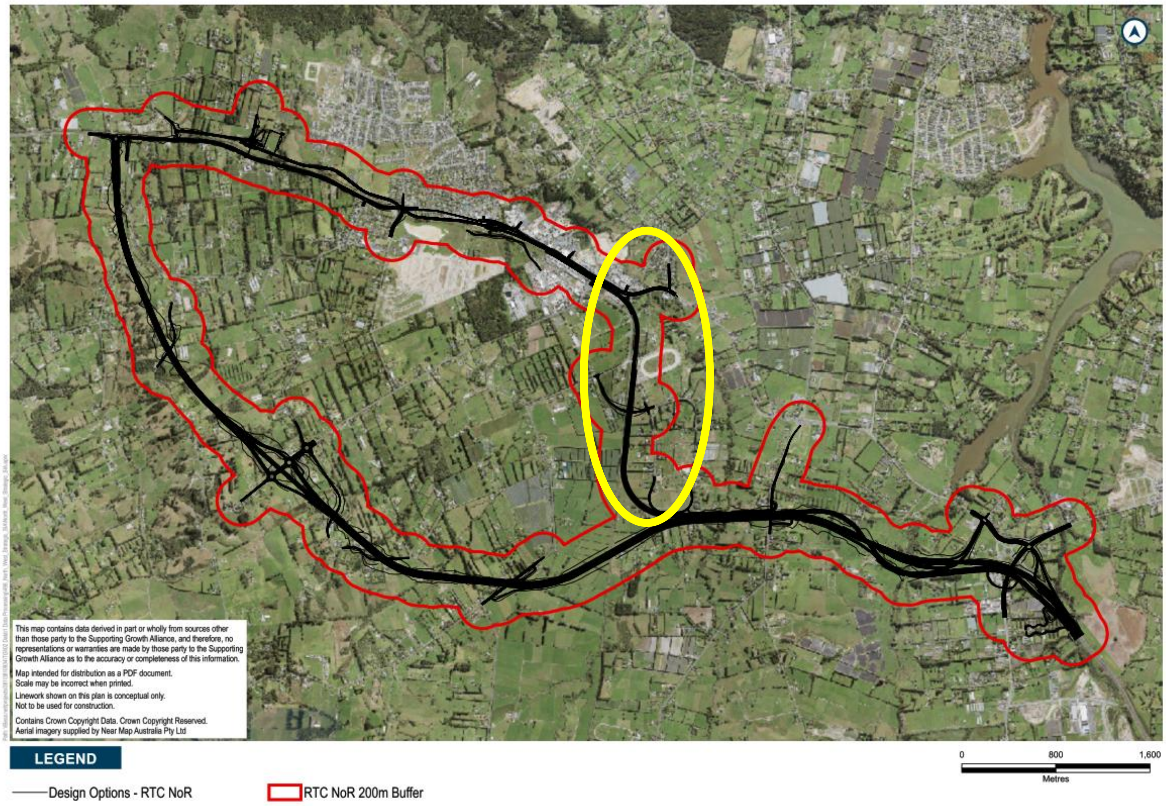

Figure 6-7. Extent of local community for NoR3 (local community extent shown in red, NoR in black).

This section of NoR 3 is zoned Rural – Countryside Living Zone and as such it is anticipated that the future environment will remain fairly similar in terms of land use and character. The local community along this section of the network is made up of rural properties.

6.3.4 NoR 4 – Access Road Upgrade

Figure 6-8 shows the extent of the local community for NoR 4.

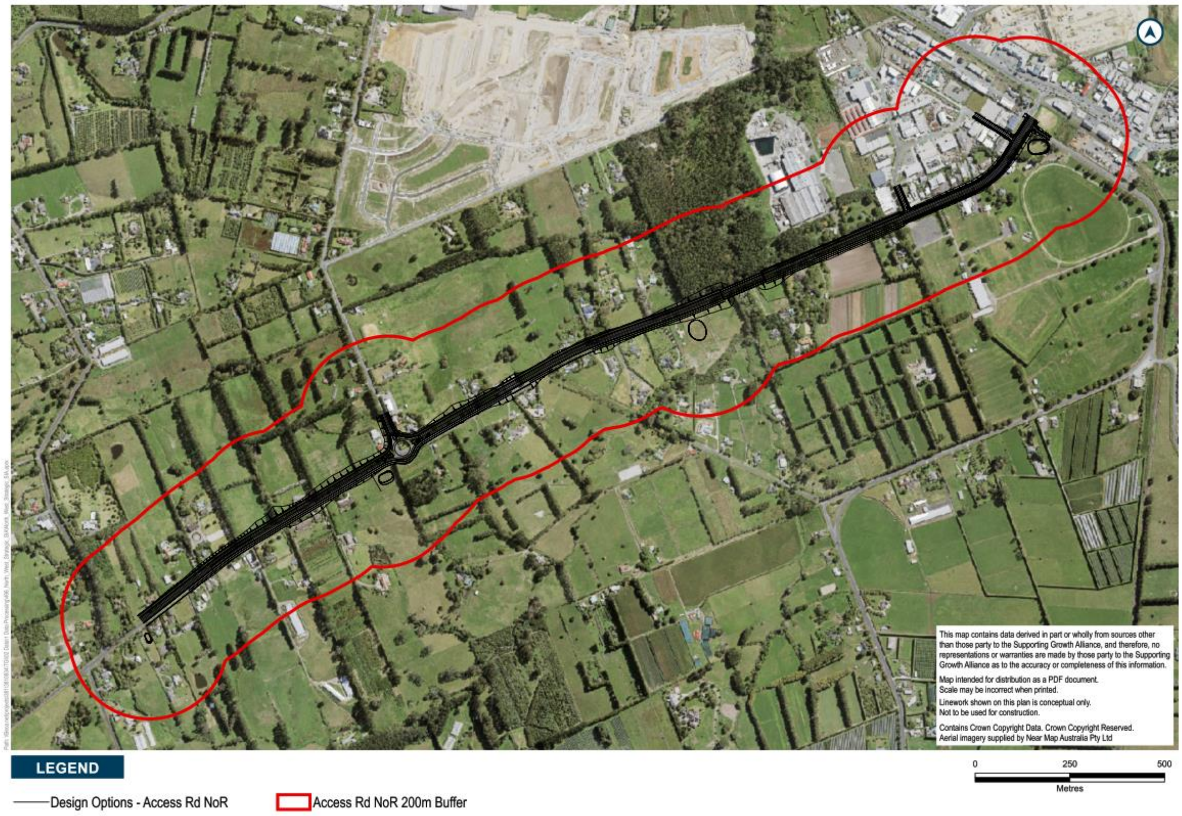

Figure 6-8. Extent of local community for NoR 4.

Existing environment

Access Road runs south-west from Kumeū township for approximately 700m.

The land on the northern side of Access Road is currently rural along most of its length. At the north eastern end there is an area of Business – Light Industry zoned land which is currently home to businesses such as Kumeū Film Studios, a vet clinic, boat repair store and preschool. Kumeū Racquets Club is also located within this industrial area. Members of the community have reported that there is often heavy traffic congestion along Access Road, with the Film Studios generating a lot of traffic as well as people coming and going from homes and businesses along the road.

On the southern side of Access Road, land is again predominantly rural (Countryside Living Zone) and populated by rural properties. Kumeū Showgrounds and the Kumeū Community Centre are both located on the southern side of the road near the intersection with SH16. Kumeū Showgrounds is used to host large events such as the Kumeū Show, monthly markets, fireworks displays and an annual classic car festival. The Community Centre is a smaller venue that is also well used, including for community group meetings and exercise classes. See section 6.3.2 for a more detailed overview of these facilities.

Likely future environment

Access Road currently runs along the south-eastern boundary of the Future Urban Zone south of SH16. In future, the northern side of Access Road will likely abut an urbanised area. This potential timing for this is between 2028 and 2035.

The southern side of Access Road is anticipated to retain its rural zoning; rural properties and the Showgrounds and Community Centre are therefore likely to remain in future.

Development of the FUZ zone will lead to an increase in the number of dwellings along Access Road and it is anticipated that this will add to the number of cars on the road. Local residents have already commented that traffic congestion occurs along Access Road (particularly because of the businesses at the north-eastern end) and it is anticipated that this could worsen if traffic solutions are not put in place, particularly when there are large events on at the Kumeū Showgrounds.

7 Assessment of social impacts

7.1 Introduction

The following section sets out the potential social impacts of each Project (both positive and negative). This is separated into planning, construction and operational phase impacts at regional, wider and local community levels. It includes, where required, mitigation and management recommendations.

This assessment is based on the assumptions listed in Section 3.3.1.

An assessment of social impacts is provided for each Project at the wider and local community levels (NoRs 3, KS and HS are considered together). One regional summary is provided which considers all 6 NoRs; this is to avoid overlap as many of the Projects are anticipated to have similar social impacts at a regional scale. Where there are specific regional impacts associated with a particular Project, this is noted.

7.2 Regional impacts

7.2.1 Route protection

At a regional scale, obtaining route protection for each of the corridors will have **moderate positive** impacts on people's **aspirations** for the region. Census data shows that most people currently move around the North West by car, with low rates of active and public transport patronage. Traffic congestion along SH16 is an issue which also puts pressure on other parts of the network.

Local Board Plans for the North West (Henderson-Massey, Rodney and Upper Harbour) state clear aspirations around improving the resilience of the transport network, making it easier to get around the area, and investing in active mode infrastructure.

The route protection of each Project will provide some certainty to the regional community that these aspirations will be realised through the creation of new transport corridors and the provision of additional transport choice. This will impact positively on both decision makers, who will be able to plan for development to occur around the future transport corridors, and for people around the region who regularly travel through the North West.

7.2.2 Construction

Construction impacts are expected to be negligible at a regional scale for the *Alternative State Highway* and *Access Road Upgrades.* Construction for both of these Projects will be occurring away from main transport corridors so should not disrupt regional transport flows along SH16.

Construction impacts from the Main Road upgrades and construction of the urban section of the RTC will be more significant at a regional scale. SH16 is a main transport corridor used by people from around the region to access work, education, recreation, goods and services and to connect to other parts of Auckland. It is anticipated (see the Transport Assessment appended to the AEE for more details) that traffic management during construction of the Projects may include temporary road closures and/or stop-go management of traffic flows, and that there will be an increase in construction traffic movements on existing roads (construction of the RTC will predominantly be occurring offline, but there will likely still be additional traffic movements and potentially traffic management for construction traffic along Main Road). Works are anticipated to occur in a linear fashion, and as such construction impacts will not be concentrated in one area for long periods of time; this will somewhat minimise the extent of disruption caused by the works. However, SH16 is a busy and already congested corridor and any further disruption to traffic flows along this road would adversely affect people’s **way of life** and ability to **sustain themselves** in that it would become more difficult to move about the region using SH16.

This is considered to be a **moderate negative impact**.

If construction for each project occurs at different times (i.e if the projects are constructed sequentially, or if there are gaps between one project ending and another commencing), the period of time that people experience impacts over will significantly increase. Impacts such as traffic delays and diversions, reduction in local amenity, noise and vibration will all be experienced for a longer duration than if projects are constructed at the same time, and this will increase the severity of these impacts as more people will be impacted for a longer period of time.

It is also noted, however, that if the ASH is in place before construction on the Main Road upgrades or RTC/RAMC occurs, traffic disruption could be somewhat mitigated as there will be an alternative route in place through Kumeū and Huapai.

Mitigation and management

Clear information should be provided across the regional community about anticipated construction timeframes and any detours that will be in place during the construction period. This may somewhat mitigate disruption by allowing people time to plan alternative routes or travel times ahead of time.

7.2.3 Operation

At a regional scale, the following social impacts are considered to be of relevance to the Projects:

- Way of life
- Community cohesion
- Sustaining oneself
- Health and wellbeing
- Fears and aspirations

These are discussed in more detail below, considering both the existing and future environments across the North West and wider Auckland region.

Overall, impacts on the regional community are expected to be **high positive**.

Way of life

At present, SH16 is the main transport corridor through Kumeū and Huapai and serves a range of purposes including providing an alternative to SH1, facilitating freight movement through the area, and important link for the local and wider community to access houses, businesses, education and other services. Because of the range of movements through the corridor, and the residential and business growth that is occurring (and will continue to occur), traffic congestion and pressure on the wider network in North West Auckland has increased. Traffic congestion can adversely impact on people’s way of life by causing delays for people moving through the region, reducing the amount of time people have available for other activities, and can cause stress.

The Projects will improve the resilience of the transport network by providing additional transport corridors and mode choice. This will reduce traffic congestion on existing corridors and reduce the number of vehicles on the road as people shift to active or public transport to move around the region. The Transport Assessment (appended to the AEE) states that when the Projects are operational, general traffic on Main Road is forecast to decrease by 84%, and freight traffic by 71%. This will have positive impacts on way of life as people will be able to move through the area much more quickly, having more time to pursue other activities.

In future, parts of North West Auckland will be significantly more urbanised, and the population of the area will grow as a result, with more people travelling in and out of the area each day for work, education, retail and recreation. The Projects will help to facilitate this growth by allowing for traffic to move freely throughout the area, and for improving people’s transport choice when moving throughout the North West.

Importantly, the provision of the RTC and RAMC (as well as the provision of walking and cycling facilities along other corridors) means that the benefits of the Projects are extended beyond just those who can drive and have access to a car.

Community cohesion

The Projects will increase the connectivity of the North West region, allowing people to both travel more easily throughout the North West and to connect to other parts of Auckland by both improving transport choice and reducing congestion on existing corridors. As parts of the North West urbanise and more communities, amenities and services grow in the area, the Projects will assist people in accessing these community amenities and connecting with family and friends in the area.

A number of community facilities in Kumeū and Huapai already serve a large catchment, with people coming from all over Auckland for events at Kumeū Showgrounds, sports games at Huapai Domain or events at the Kumeū Community Centre. The Projects will make it easier for people to come and go from the North West to make use of these facilities and events, particularly those who do not have a car and are reliant on public transport to access the area.

The Projects will also connect into other parts of the wider transport network such as the planned SH16 upgrades; the benefits will therefore be experienced by people travelling throughout the wider region rather than just the Kumeū – Huapai area.

Sustaining oneself

The Projects will improve accessibility throughout the North West, making it easier for people to meet their daily needs, including accessing employment, goods and services, using a range of transport modes.

In future it is anticipated that parts of the North West will be more urbanised, and that more businesses, workplaces and education providers will be established to cater for the growing population. Existing business/retail hubs such as Westgate will likely continue to grow, while other new business areas are established as indicated in the Future Urban Land Supply Strategy. The Projects will help to facilitate this growth by assisting people in accessing these amenities and services.

As discussed earlier, the RTC, RAMC and other walking and cycling facilities will extend these benefits to a wider subset of the population by ensuring that those without access to a car (or without the ability to drive a car) can access the benefits of the transport network to meet their daily needs.

Fears and aspirations

The NoRs will, on the whole, impact both positively and negatively on the social aspirations set out in Local Board Plans and the Auckland Plan.

A number of aspirations in the Auckland Plan and Local Board Plans for the North West region (Henderson-Massey, Rodney and Upper Harbour) relate to improving transport options and helping communities to access their everyday needs. For example:

- Safe, improved transport options connect our communities (Rodney Local Board Plan)
- An efficient and accessible travel network (Upper Harbour Local Board Plan)
- Aucklanders have access to a range of inclusive public places (Auckland Plan)

There are also clear aspirations around sustainability expressed in these plans, including:

- Aucklanders will be able to get where they want to go more easily, safely and sustainably (Auckland Plan)
- Everyone contributes to building resilience and living sustainably (Henderson-Massey Local Board Plan)
- It's easy to get around Henderson-Massey safely without using a car (Henderson-Massey Local Board Plan)

The Projects will contribute to the realization of these aspirations by improving transport choice for Aucklanders moving through North West Auckland and therefore improving people's ability to access places around the region. By providing transport choice and reducing congestion along SH16, the travel network will be more resilient and will be accessible to more people. The provision of public transport and active mode infrastructure will assist people in moving around the area sustainably and will be particularly beneficial for those who do not have a car or do not drive.

It is noted that when considered in isolation, the ASH will not contribute to those aspirations that relate to improving sustainable transport around the region. While active mode facilities will be located alongside the ASH, the construction of a new highway could cause frustration for some in the regional community and could contribute to fears that Auckland's sustainability goals are not being met (including those aspirations around sustainable travel listed in the Auckland Plan and Local Board Plans). However it is noted that route protection provides some flexibility around the final form of the ASH and that sustainability can potentially be incorporated into the design.

Health and wellbeing

The provision of walking and cycling infrastructure through the RAMC and planned walking and cycling facilities along Access Road, Main Road and the ASH will facilitate health benefits across the North West community by increasing opportunities for people to exercise (by walking and cycling) on active mode infrastructure. This will have benefits for people's physical and mental health and wellbeing.

It is understood that the RAMC will connect to other walking and cycling infrastructure across the region (such as the Northwestern cycleway) which will make it easier for people to use active modes to travel further afield, either for recreation or to access work, education and other services. As parts of the North West urbanise and more businesses, workplaces and education centres are established to cater for the growing population, the active mode infrastructure will provide a way for people to walk and cycle to these locations.

Lastly, a reduction in both general and freight traffic along SH16 Main Road will have health benefits for pedestrians and cyclists in that a safer street environment will be facilitated, with reduced risk of conflict between pedestrians/cyclists and vehicles.

7.3 Alternative State Highway incl Brigham Creek Interchange (NoR 1)

7.3.1 Route protection phase

Wider community

Wider community impacts are similar to those outlined in the regional summary above.

There has been strong support from the wider community (expressed through Te Tupu Ngātahi engagement) for a solution to the traffic congestion along SH16. For some members of the community, route protection of the corridor may impact positively on their aspirations for the community, as it will provide confirmation that a solution is underway. For decision makers and land use planners, confirmation of route protection will help to inform decision making and funding of land use in the area. There has historically been an underinvestment in infrastructure in the North West, and confirmation that land is being designated for transport infrastructure may impact positively on people's aspirations for the area.

Overall, impacts on the wider community are expected to be **low positive.** Again, the provision of clear, up to date information about funding, integration with land use development and construction timeframes (even indicative) may help the community to understand and plan for the project.

Local community

Route protection sought for the ASH corridor is long-term, with the intention being that construction of the corridor will not start for years. For some in the local community, route protection will provide certainty about the location of the proposed transport corridor, and may ease any existing uncertainty that residents currently feel around what their community may look like in future.

If more clarity cannot be provided to the local community around anticipated timing of construction, however, further stress and anxiety could be expected. This stress will be felt particularly by those whose properties have been identified for potential land impact, partial or full property acquisition, especially if it is not clear when acquisition will occur. During Te Tupu Ngātahi engagement[33], landowners have expressed concern about the property acquisition process and in particular noted that it was difficult for them to plan ahead due to uncertainty around which properties were being acquired, and when acquisition and construction was expected to take place. These impacts (uncertainty and anxiety) will likely increase in severity the longer residents remain uncertain about the timing and nature of construction.

As properties begin to be acquired (closer to construction) and people relocate from the local community, community character may change, particularly if families who have been in the area for a long time move out of the area. There is also the possibility of this happening once the designation has been confirmed if people want to move away from the uncertainty.

It is noted that these impacts will likely be more significant for those in the rural zoned parts of the local community. These areas are not anticipated to undergo much change (in terms of land use) in future and engagement carried out by Te Tupu Ngātahi has found that the community values its quiet,

[33] See the North West DBC Engagement Summary report

rural feel, with many residents having lived in the area for a long time. For this community, anxiety and uncertainty may threaten their sense of stability.

In the FUZ areas of the local community, change and growth is expected and as such there may be more tolerance for uncertainty around the timing of this project.

Overall, impacts on the local community during the planning phase of the project are anticipated to be **moderate negative.**

Impacts could be reduced to **low negative** if the community are provided with accurate, up to date information about what to expect throughout the planning and route protection phase, particularly details around property acquisition and timings. This will provide the community, including affected landowners with a greater degree of certainty around the future of their properties and the development in the surrounding area. Prior to property acquisition and construction timing being identified, it will be important to have clear messaging on what people can and cannot do on their properties once the designation is confirmed. This could also be addressed through appropriate NoR conditions, including the requirement for a ‘project website’ (or similar) to be established once the designation has been confirmed, and directly affected parties to be notified. It is also recommended that affected landowners are provided with a dedicated contact person to call during throughout the time that the designation is in place for any general queries. This should ideally be a phone number separate to the general project number, and should be staffed by one person so that landowners feel confident that there is someone they can call for any queries or concerns.

7.3.2 Construction phase

Impacts on the wider and local communities are summarised below as well as recommended management and mitigation measures.

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale with mitigation
Wider community	• Potential for some disruption to traffic during construction on the sections of the ASH that adjoin SH16 (intersection near Foster Road and Brigham Creek interchange) – potential **low negative** impacts on **way of life** if it becomes more difficult temporarily for people to go about their daily activities • Disruption to existing roading networks/traffic flow will be minimal during construction as most construction will occur away from SH16 and existing communities and businesses. • Disruption to traffic flows, and subsequent impacts on people's **way of life** and **community cohesion** will be most significant where connections to SH16 are being constructed; near Foster Road and the new Brigham Creek Interchange. This construction could cause temporary **very low negative** impacts on people's ability to move around the area to access services and amenities, and could cause stress for people if traffic delays are significant. • There is potential for some additional traffic congestion around SH16 (temporary) due to construction traffic coming and going from construction site (the Transport Assessment notes that there will be an increase in traffic volume due to construction traffic) – however this area is already typically heavily congested so any additional traffic is unlikely to have a significant impact on people's **way of life** and ability to move around the community (assessed as **very low negative**). • Fred Taylor Park is within the proposed designation (operational impacts on the park are discussed later in this report) and public use of this park, as well as use by the football club, will likely be inhibited during construction. The current design shows two playing fields of Fred Taylor Park in the designation. This will have **low - moderate negative** impacts on people's **way of life** in that the Football Club's use of this park will be restricted, and also **health and wellbeing** in that informal users of the park will no longer be able to use the facility for exercise.	**Very low negative** impacts on way of life, community cohesion. **Low - moderate negative** impacts on way of life and health and wellbeing (relating to Fred Taylor Park).	• The Construction Management Plan should set out measures to manage and minimize disruption where possible (for example, clearly identifying diversions that may be needed while the interchange is under construction). • Provide clear communication to the North West community in advance of these works occurring so that people can plan their trips accordingly. • It is understood that conversations are currently underway with Auckland Council to determine how impacts on Fred Taylor Park and Huapai Domain can best be mitigated; a preferred solution will be determined following detailed design.	**Very low negative** – negligible impacts on way of life, community cohesion **Low negative** impacts on health and wellbeing and way of life (relating to Fred Taylor Park)
Local community	As above, plus: • Construction of the ASH will be occurring in a predominantly rural environment, which current residents value for its quiet rural character. Noise and vibration caused by construction will have the potential to temporarily alter this **community character (low negative**), from a quiet rural environment to one characterized by construction noise and busy-ness. • People's **way of life** will be adversely affected during the construction period if noise, vibration and traffic congestion from construction changes the way that people go about their daily activities. This could include avoiding working from home or spending less time outdoors. It is noted that this will be a temporary disruption (as stated in the Construction Noise Assessment, high noise and vibration is only likely to be experienced by individual properties for weeks to months as construction moves down the alignment in a linear fashion). This impact is assessed as **low - moderate negative,** with severity increasing to moderate the longer construction lasts. • Traffic congestion on local roads (from construction traffic) may also cause traffic delays for local residents on top of potential congestion along SH16; this could further impact **way of life** by extending the time that it takes local residents to get places. • Noise, vibration and traffic congestion may give rise to adverse impacts on **health and wellbeing** by causing stress and anxiety for local residents, particularly if it disrupts daily activities such as working from home or sleeping. Again, this impact will be	**Low negative** impacts on community cohesion. **Low - moderate negative** impacts on way of life and health and wellbeing	• Clear communication about the upcoming construction period should be provided to local residents so that they are mentally prepared for the works and have a chance to ask questions about the construction period. • Limiting construction activity at night or at weekends could help to mitigate impacts on people's mental health (if practicable), or otherwise implementing measures to minimise noise impacts as identified in the Construction Noise Assessment.	**Low negative** impacts on community cohesion **Low negative** impacts on health and wellbeing **Low negative (potentially moderate negative for some in the community)** impacts on way of life (impacts will likely still be moderate negative for those residents who spend a lot of time at home and are therefore affected by construction noise and vibration more constantly).

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale with mitigation
	temporary and is assessed as **low – moderate negative** with severity expected to increase the longer people are subject to these disruptions.			

7.3.3 Operational phase

Operational impacts are summarised below for the wider and local community.

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
Wider community	**Positive impacts:** • Impacts on the wider community are predominantly positive as the provision of the ASH will help to facilitate easier movement around the wider community. This will positively impact **way of life, sustaining oneself** and **community cohesion** in that it will be easier for members of the community to go about their daily activities, including accessing work, education, retail and recreation and connecting to other people and places throughout the community. These changes (particularly when considered as part of a wider suite of transport network upgrades) will also help to realise the **aspirations** that the wider community have expressed (both through engagement and through Local Board Plans) for improving people's ability to move easily around the local environment. These impacts are assessed as **low positive,** noting that these impacts will increase once other NoRs are also operational and wider transport network benefits are delivered. • The provision of walking and cycling infrastructure along the ASH will make it easier for people to exercise as part of their daily activities, positively impacting both **way of life** and **health and wellbeing (low positive).** • The ASH will provide an alternative route for vehicles moving through West Auckland. By relocating vehicles (particularly large freight vehicles) away from SH16, it will become easier for members of the wider community to safely and efficiently access businesses and services in Kumeū – Huapai, providing benefits in terms of **way of life** and **health and wellbeing (low positive).** This could also minimize people's usual commuting time, freeing up time for them to spend on other activities. Relocating heavy vehicles away from SH16 could also help to achieve the **aspirations** of the Kumeū – Huapai Centre Plan in helping to create a more pedestrian and cyclist-friendly destination. Finally, a reduction in inter-regional trips and heavy vehicle traffic along SH16 could improve **quality of environment** for those living along SH16. Both of these impacts are assessed as **low positive,** noting that these benefits will be increased once other projects are in place contributing to improvements in Kumeū and Huapai. • As the FUZ areas of the wider community urbanise and the population of the wider community grows significantly, the ASH will be an important addition to the local transport network as it will help to facilitate movement around the area. Additionally, areas such as Westgate are anticipated to	**Low positive** impacts on way of life, aspirations, sustaining oneself and community cohesion. **Low negative** impacts on way of life and **very low negative** impacts on health and wellbeing relating to impacts on Fred Taylor Park.	**Mitigation and management** At the time that this SIA was prepared, discussions around appropriate mitigation for Fred Taylor Park were ongoing with Auckland Council Parks. From a social perspective, mitigation options that allow both the football club and wider community to continue accessing active, green space either at or near the current Park are preferable.It is understood that a preferred mitigation option will be determined following detailed design. It is recommended that in developing this mitigation, Te Tupu Ngātahi liaise with the West Coast Rangers Football Club to understand their needs in regards to Fred Taylor Park, and to help the Football Club understand the likely impacts on their operations. This will allow the Football Club to plan ahead for how to run trainings and games across their two home grounds to make best use of the space they have available.	**Very low negative**

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
	develop as employment/retail/commercial hubs and the ASH will facilitate movement of people to and from these areas. • It is noted that the travel benefits of the ASH will primarily be felt by those who have access to a vehicle and can drive. Provision of the RTC and RAMC, and the upgrade of SH16 will expand these benefits (relating to way of life, community cohesion etc) further by ensuring that transport choice is provided to those who cannot or do not drive. **Negative impacts:** • The designation envelope will require permanent acquisition of part of Fred Taylor Park, assumed to be two fields (it is understood that these are currently used as 'training fields'). Parking areas, the clubrooms and the three main playing fields will be outside of the designation and are not anticipated to be impacted. The loss of the training fields will reduce the amount of space that the West Coast Rangers Football Club has available on training and game days; however the Club should still be able to function particularly given that the Club can also make use of Huapai Domain. • The loss of part of Fred Taylor Park will also reduce the amount of green space that the community have for informal recreation, particularly when the main fields are being used by the football club. This will have **low negative** impacts on **way of life** if people's use of the park for recreation and football is limited, and potentially **very low negative** impacts on people's **health and wellbeing** if people's ability to use the park for exercise is limited.			
Local community	**Positive impacts:** • Depending where people live, some members of the local community could benefit from the ASH in terms of **way of life** and **sustaining oneself** (i.e. if they can easily access the ASH and can use this as an alternative to SH16 when accessing daily needs/amenities). People living close to the proposed interchanges at Brigham Creek, Tawa Road and SH16 west of Huapai will likely benefit most. These impacts are assessed as **low positive.** • During engagement with Te Tupu Ngātahi, locals expressed **aspirations** for traffic congestion along SH16 to be reduced, and these aspirations could be met by the establishment of the ASH. This impact is assessed as **low positive.** • For people living along other parts of the corridor, it will not be as convenient to access the ASH and the benefits may therefore be limited • for these people. **Negative impacts:** • Noise and vibration from the road may disturb **quality of environment** and limit people's ability to go about daily activities or limit their enjoyment of these activities (such as working from home or spending time outdoors at their properties). Census data[34] indicates that there are high numbers of people working from home in this area and this group would likely to be particularly impacted (in terms of **way of life**) by the ongoing noise that the road will generate, particularly given that the area is currently a quiet rural	**Low positive** impacts on way of life, aspirations, sustaining oneself. **Low negative** impacts on quality of environment, community cohesion and way of life for rural properties. **Very low negative** impacts on quality of environment and way of life for rural properties.	**Mitigation and Management** • The provision of noise barriers (either human-made or through natural barriers) could reduce disruption for people working from home and/or spending time outdoors. • As recommended in the Landscape Assessment, mitigation planting along the corridor could help to reduce the visual dominance of the ASH for those properties that will look out towards the highway. • Property owners should be kept up to date on the project and should be able to easily ask questions and seek information about the project. Communication with these property owners should occur when there are any project updates that may affect their land, and should be focused around providing property owners with as much detail as is possible at that time. This may somewhat minimise impacts on community character, or feelings of severance, if the immediate community has more time to understand and prepare for the changes before they occur.	**Very low negative**

[34] See the 'Social Area of Influence' section of this report.

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
	environment.. The works will be carried out in a linear fashion, so impacts will not be concentrated on one area for lengthy periods of time; however there will still be periods of higher noise and vibration as the works move along the corridor.This impact will be particularly felt in those parts of the local community that are anticipated to remain rural for the foreseeable future. For those areas of the local community that are zoned FUZ (Kumeū – Huapai and Redhills), the impact will be less as by the time the ASH is operational as it is anticipated that these FUZ areas will already be busier, noisier urban environments. Impacts on the rural community are therefore assessed as **low negative,** while impacts on the urban community are expected to be **very low negative.** • The local community is currently a quiet rural area and locals have stated during engagement that they value this community character and have aspirations to retain it. While some parts of the wider community are anticipated to become more urban in future, the bulk of the local community area is expected to remain rural. **Community character** and people's perceptions of the **quality and amenity of their environment** could be adversely impacted if the ongoing noise and vibration from the road is perceived as changing the character of the area from a quiet rural area to a noisier, more busy environment (i.e. with more noise and movement than is currently experienced) in which some people's previously unimpeded 'rural' outlook is now dominated by a highway. This change will be noticeable during both day and night. • Impacts on **community character** and **quality of environment** will be felt most by those parts of the local community that are anticipated to remain rural. In the two areas of the local community that are FUZ (Kumeū – Huapai and Redhills) the environment will be significantly more urbanized by the time the ASH is operational; the road itself will run through a busier, noisier environment than what currently exists and as such will be more in keeping with the urban context. These impacts are anticipated to be **very low negative** in the urban environment and **low negative** in the rural environment. • Severance impacts could also be experienced within the rural community which the ASH cuts through. These impacts are anticipated to be **low negative** in terms of impacts on community character.			

7.3.4 Conclusions

The ASH will predominantly give rise to positive social impacts at a wider community scale. The ASH provides a new connection in the North West transport network and will facilitate the movement of people through the area, helping them to connect to employment, education, business and recreation. This will have positive impacts on people's way of life and on community connectivity as they may more easily be able to go about their daily activities and connect to community facilities and amenities. Spending less time in traffic can also reduce stress and frees up time for people to spend on other activities. Importantly, the ASH will help to facilitate the projected future growth in the area by providing transport linkages.

The main benefit of the ASH will be the relocation of traffic (particularly inter-regional trips and freight) away from SH16 and on to an alternate route, therefore reducing congestion on SH16 and contributing to safer, more pedestrian friendly spaces along SH16 by removing heavy vehicles from the area. The ASH alone does not improve transport choice for the community; the provision of other NoRs including the RTC and RAMC will, however, provide this additional transport choice and help to reduce traffic congestion further by encouraging commuters to move to public or active transport.

The most significant negative impact of the ASH will be the permanent acquisition of land at Fred Taylor Park. It is anticipated that two of the five fields at the park will be impacted, which will reduce the amount of space that the West Coast Rangers Football Club will have for training, and that the wider community has for informal recreation and exercise. On a more long-term basis, it is recommended that Te Tupu Ngātahi continue working with Auckland Council Parks to determine suitable mitigation, but also liaise with the West Coast Rangers to understand how their needs can be met through any mitigation options.

At a more local scale, social impacts will be both positive and negative. Overall, the ASH will improve community connectivity and way of life by improving access through the community and potentially reducing traffic congestion. Negative impacts are anticipated to include disruption to way of life, community character and quality of environment as a result of the noise, vibration, light pollution and visual bulk of the highway in an environment that is currently predominantly rural. These impacts will be experienced the greatest by those parts of the local community that are anticipated to remain rural into the future. Landscape screening at key points and regular communication with the local community may help to mitigate some of these impacts.

Finally, while this assessment has focused on the provision of the ASH, the ASH will make up just one part of a wider suite of improvements to the North West transport network. It is anticipated that as a whole, this package of NoRs will have high positive impacts on the wider and regional communities in terms of improving network resilience and connectivity around West Auckland, and reducing traffic congestion for commuters.

7.4 NoR 2 – State Highway 16 Main Road Upgrade

7.4.1 Route protection phase

Wider community

Wider community impacts are similar to those described for the regional community; notably that confirmation of route protection may positively impact on community aspirations by confirming that these upgrades will be going ahead in future.

Local community

Improvements to Main Road (particularly improvements to pedestrian and cyclist mobility through the area) will impact positively on the local community's **aspirations** for the future of this part of the community.

For businesses located along Main Road, the route protection of the corridor will provide some certainty around the future of the area. However, route protection of the NoR corridor may cause some businesses to relocate or not renew leases if there is not clear information provided about when acquisition and construction is expected to take place, and businesses owners cannot plan ahead with confidence (i.e. it may be preferable to business owners to not renew a 10 year lease and move elsewhere than renew the lease but be uncertain as to whether construction will begin within this lease period). This could result in vacant businesses along Main Road, with new businesses reluctant to move in until after the upgrades have occurred along Main Road. This would have an adverse social impact on **quality of environment** along Main Road if there is an increase in vacant properties and/or these properties become run-down, and an adverse impact on people's **way of life** and ability to **sustain oneself** if people in the local community need to travel further afield to access goods and services that were previously available along Main Road. These impacts are anticipated to be **low negative,** with the potential to increase to **moderate negative** the longer the issue persists. Providing the community and business owners with information about the timeframes for implementation (in particular advising that the projects are not planned for implementation in the short term) and likely construction timeframes as soon as this is available will mitigate these impacts by reducing the likelihood that businesses will move out of the area early.

7.4.2 Construction phase

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale without mitigation
Wider community	• Potential for significant traffic disruption along SH16 during the construction phase – potential impacts on **way of life** if it becomes more difficult for people to move through the area to go about their daily activities. SH16 is a major transport corridor for people travelling through the North West and is already often heavily congested, so temporary road closures, temporary speed limit reductions or stop/go traffic management (as outlined in the Transport Assessment) could cause significant delays and disruption to people's routines. The scale of this impact is likely to be moderate negative, although the duration of the impact will be temporary. • **Community cohesion** could also be adversely affected if it becomes harder for people to, for example, visit family and friends or access community facilities and activities (such as sports at Huapai Domain or classes at Kumeū Community Centre) throughout the wider community as a result of construction along Main Road. These impacts will be temporary and are anticipated to be low negative (noting that people in the wider community likely travel to a range of places to visit friends and family, not all of which will necessitate travel to or through Main Road). • Construction could temporarily impact people's ability to access the remaining businesses along Main Road (for example if carparking is limited due to construction, or if there are temporary closures of the road or detours in place which mean people cannot access Main Road). This could affect people's **way of life** and ability to **sustain oneself** if they need to travel further afield to access goods and services. Again, these impacts are expected to be **low negative** (recognizing that Main Road is likely only one of the places that people in the wider community travel to access goods and services, and other business centres such as Westgate will still be operational during this time) and temporary in duration. • It is noted that construction along Main Road is also anticipated as part of the RTC/RAMC NoR (NoR 3). While this section of the report focuses on construction impacts arising from the SH16 Main Road upgrades NoR, it is noted that the impacts listed above could increase in severity (i.e. from low negative to moderate negative, or from moderate negative to high negative) if construction for these two NoRs does not occur at the same time and there is construction related disruption along Main Road for an extended period of time.	**Moderate negative** (temporary) impacts on way of life. **Low negative** (temporary) impacts on community cohesion and sustaining oneself	• Preparation of a Traffic Management Plan which identifies diversions/detours to be put in place for the duration of construction. • The wider community should be kept informed (ideally well in advance) of construction works and traffic management plans so that people can plan ahead in regards to their movements during this time. Community facilities such as Kumeū Showgrounds, Kumeū Community Centre, Matua Ngaru School, Kumeū Cricket Club and West Coast Rangers Football Club should be advised of the likely construction timeframe well in advance of construction starting, so that they can advise their members to allow extra time for their journeys. • A 24/7 complaints and queries line should be set up for the duration of the construction period, with the phone number disseminated to the community so that the community have a dedicated contact number for any issues during the construction period.	**Low negative** impacts on way of life, community cohesion and sustaining oneself.
Local community	• Each of the impacts listed above will also be experienced by the local community; however it is anticipated that the severity of these impacts will be greater (**moderate negative**) for those in the local community, who are more likely to regularly use Main Road as a destination for accessing employment, goods and services. • Additionally, people's **way of life** will be adversely affected during the construction period if noise, vibration and traffic congestion from construction changes the way that people go about their daily activities, or if access to their property is restricted temporarily during construction. This could include avoiding working from home or spending less time outdoors. Noise, vibration and traffic congestion could also adversely impact people's **quality of environment** and may give rise to adverse impacts on **health and wellbeing** by causing stress and anxiety for local residents, particularly if it disrupts daily activities such as working from home or sleeping. As noted in the Construction Noise Assessment, however, construction will occur in a linear nature (i.e. moving along the alignment) and so high levels of noise and vibration will only be experienced by each household for a short period (i.e. weeks or months) compared with the overall construction duration of the projects. Each of these impacts	**Moderate negative** impacts on way of life, community cohesion and sustaining oneself. **Moderate - low negative** impacts on quality of environment and health and wellbeing.	In addition to the mitigation recommended for the wider community: • Clear communication about the long term nature of the designations, and about anticipated construction timeframes and periods ,should be provided to local residents so that they are mentally prepared for the works (and understand that construction is not planned for the short to medium term) and have a chance to ask questions about the construction period and/or plan around the works. • As recommended in the Transport Assessment, temporary access to private properties should be provided wherever existing accessways are blocked by construction works. • Business owners should be kept up to date on construction progress. Business owners should also be advised of the long term nature of the designations (i.e the projects are not intended to be implemented in the short or medium term) as this will help them to plan ahead for the future of their business.	**Low negative** impacts on community cohesion **Very low negative** impacts on health and wellbeing **Low negative** (moderate negative for some in the community) impacts on way of life (impacts will likely still be moderate negative for those residents who spend a lot of time at home and are therefore affected by construction noise and vibration more constantly).

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale without mitigation
	are anticipated to be **low negative,** increasing to **moderate negative** if the construction period is longer than anticipated. • If businesses experience reduced patronage for an ongoing period as a result of construction, business owners could experience stress and anxiety about their ability to continue operating. This would give rise to **low negative** impacts on the health and wellbeing of this group, increasing to **moderate negative** the longer construction lasts.		• Waka Kotahi's current Broader Outcomes strategy encourages projects to deliver secondary benefits to the community, including economic benefits. There is an opportunity to consider how to embed broader outcomes into the Projects by considering innovative ways to support local businesses through the construction period.	

7.4.3 Operation phase

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
Wider community	**Positive impacts:** Overall, impacts on the wider community will be positive, including: • The SH16 Main Road upgrades will help to facilitate easier movement around the wider community for those who regularly travel to or through Main Road, particularly those who wish to walk or cycle and will now have the infrastructure to facilitate this. Drivers may also benefit from the upgrades if other road users switch to walking and cycling instead of driving, reducing the number of cars on the road and improving traffic flows. This will have **moderate positive** impacts on **way of life, sustaining oneself and community cohesion** in that it will be easier for those who use Main Road regularly to go about their daily activities, including accessing work, recreation, retail, education and connecting to other people and places throughout the community. • By creating spaces for walkers and cyclists along Main Road, the upgrades could also result in more members of the community spending time on Main Road (particularly if additional upgrades as outlined in the Kumeū – Huapai Centre Plan are implemented, such as the creation of new civic spaces). This could provide additional opportunities for members of the community to socialize and improve **community cohesion.** • The upgrades are also expected to have **high positive** impacts on **fears and aspirations** for the wider community. The upgrades will contribute towards the realization of the community's aspirations (as expressed in both Local Board Plans and the Kumeū – Huapai Centre Plan) to create a more pedestrian friendly Main Road environment and improve people's ability to move around the area; particularly when considered as part of the wider set of strategic projects including the RTC and RAMC. • The provision of walking and cycling infrastructure along Main Road will make it easier for people to exercise as part of their daily activities, both on the walking and cycling facilities along Main Road and across the wider network of walking and cycling infrastructure that is proposed throughout the wider community. This will have **low positive** impacts on both **way of life** and **health and wellbeing**. • As the FUZ areas of the wider community urbanise and the population of the wider community grows significantly, the Main Road upgrades will be an important addition to the transport network which will help to facilitate movement around the area, particularly for walkers and cyclists.	**Low positive** impacts on health and wellbeing. **Moderate positive** impacts on way of life, sustaining oneself, community cohesion. **High positive** impacts on fears and aspirations.	N/A	N/A
Local community	• The positive impacts noted above (for the wider community) will also apply to the local community.	As above	N/A	N/A

7.4.4 Conclusions

SH16 Main Road is a major transport corridor for people travelling through the North West, as well as for people accessing businesses and community services along Main Road. The Main Road upgrades have potential to significantly disrupt people's movements along SH16 Main Road during the construction phase, adversely impacting both the wider and local community's ability to move throughout the area and making it harder for people to connect to employment, education, business, recreation and social events throughout the North West. While this is a temporary impact, its severity will increase the longer construction causes delays along this main transport corridor, especially if the RTC/RAMC upgrades follow shortly after (or before) and the cumulative construction period for the two NoRs is therefore lengthy. Noise and vibration from construction, in addition to traffic congestion, will also impact the local community's way of life during the construction period.

The Traffic Management Plan should provide measures to manage traffic delays where practicable. The wider and local community should also be provided with clear information about the anticipated construction period (including expected construction length and detail on any diversions that will be in place) and be provided a contact number for any complaints or queries they have during the construction period. This will somewhat mitigate adverse social impacts by allowing the community to understand what the works entail and plan ahead for disruption.

Once operational, the Main Road upgrades will give rise to positive social impacts at both a wider and local community scale. The upgrades will make it easier to move along Main Road, particularly by improving transport choice so that people can safely walk or cycle either into the town centre or through the area before connecting into the wider walking and cycling network. The upgrades will also help to facilitate improvement of the Kumeū – Huapai town centre, as sought in the Kumeū – Huapai Centre Plan. By the time the upgrades are operational, parts of the wider community will be more urbanised than they currently are (with larger populations) and it is anticipated that the business community along Main Road will have grown; the Main Road upgrades will play an important part in providing connections through this community and facilitating growth.

7.5 NoRs 3, KS and HS (Rapid Transit Corridor and Regional Active Mode Corridor, Kumeū Rapid Transit Station and Huapai Rapid Transit Station)

Three NoRs are discussed in this section:

1. NoR 3: Rapid Transit Corridor and Active Mode Corridor
2. NoR KS: Kumeū Rapid Transit Station
3. NoR HS: Huapai Rapid Transit Station

Both transit stations are located along the RTC and as such will impact on a similar local community. All three NoRs are therefore assessed as a package here, and where there are impacts that are specific to the transit stations these are noted.

7.5.1 Route protection phase

Wider community

Impacts on the wider community during the route protection phase are on the whole considered to be **low positive** in regards to people's **aspirations** for the area. As expressed in the Kumeū – Huapai Centre Plan, Local Board Plans and Te Tupu Ngātahi engagement, the community are keen to see a) solutions to traffic congestion along SH16 and b) provision of additional active mode and public transport infrastructure. Route protection of the RTC/RAMC will provide the community with confirmation that these improvements will occur in future, and will give clarity around where these networks will be. Route protection of the Kumeū and Huapai Transit Stations will provide confirmation that people will be able to travel from the wider community to use these services, for example by driving to the park and ride facility.

Local community

Business community

A significant area of existing business land along Main Road (primarily on the southern side of Main Road) falls within the designation envelope. The route protection phase could have impacts on the **health and wellbeing** and **way of life** of business owners as well as the **quality of environment** of the town centre.

Business owners and operators are likely to experience stress and anxiety and difficulty in planning ahead due to lack of information on when they will need to vacate their premises prior to construction. This could have **moderate negative** impacts on their **health and wellbeing** and ability to **sustain themselves**. If business owners are unsure of how long they will be able to remain on Main Road for, some may also choose to relocate or not renew leases. This could also impact on the **quality of environment** (**low negative**) of Main Road if there is an increase in vacant properties and people's perceptions of the amenity and quality of the area is reduced. Finally, there could be **low negative** impacts on people's **way of life** and ability to **sustain oneself** if people in the local community need to travel further afield to access goods and services that were previously available along Main Road. These changes in quality of environment, way of life and sustaining oneself will be temporary in duration (anticipated to last for some of the route protection phase as well as the construction phase).

For other businesses (those within the local community but outside of the designation envelope) the route protection phase could have **moderate positive** impacts in terms of their **aspirations** for the area and their future in the community, by confirming that transport solutions are in place for Main Road.

Residential communities (urban and rural)

Route protection sought for the ASH corridor is long-term, with the intention being that construction of the corridor will not start for years. If more clarity cannot be provided to the local community around anticipated timing of construction, further stress and anxiety could be expected. This stress will be felt particularly by those whose properties have been identified for potential land impact, partial or full property acquisition, especially if it is not clear when acquisition will occur. During Te Tupu Ngātahi engagement, landowners have expressed concern about the property acquisition process and in particular noted that it was difficult for them to plan ahead due to uncertainty around which properties were being acquired, and when acquisition and construction was expected to take place. These impacts on people's **health and wellbeing** (uncertainty and anxiety) will likely increase in severity (up to **moderate negative)** the longer residents remain uncertain about the timing and nature of construction.

Non-impacted landowners in the local community may also experience some anxiety about the scale of construction works needed to construct the RTC/RAMC; for example if they are unsure of how they will be able to move around the area to access work and education during the construction period. These impacts on **health and wellbeing** are expected to be **low negative.**

As properties begin to be acquired and people relocate from the local community, **community character** may change, particularly if families who have been in the area for a long time move out of the area. These impacts are anticipated to be **low negative**

It is noted that these impacts will likely be more significant for those in the rural zoned parts of the local community. These areas are not anticipated to undergo much change (in terms of land use) in future and engagement carried out by Te Tupu Ngātahi has found that the community values its quiet, rural feel, with many residents having lived in the area for a long time. For this community, anxiety and uncertainty may threaten the sense of stability and rural values of the area. In the urban zoned and FUZ areas of the local community, change and growth is expected and as such there may be more tolerance for uncertainty around the timing of this project.

In regards to positive impacts, the local community have expressed (through Te Tupu Ngātahi engagement) a desire to see solutions to the traffic congestion along SH16. Confirmation of route protection for the RTC/RAMC could have **moderate positive** impacts on people's **aspirations** for the area in that it will provide some certainty that solutions are going to be provided in future.

Mitigation and management

With regards to the above impacts on the business community, it is anticipated that there will be some movement and change in the makeup of the businesses along Main Road, as indicated in the Kumeū – Huapai Centre Plan (which identifies 'relocation of industrial land use' away from Main Road as a medium – long term action) and the North West Spatial Land Use Strategy (which identifies an area of future industrial land south of SH16, intended for new businesses as well as businesses relocating from Main Road). This will somewhat mitigate any stress or anxiety that the route protection phase may create, as some business owners will already be conscious of the need to move in future in line with these strategy documents. Providing accurate information on construction timeframes (including the long term nature of the designation) and the acquisition process to business owners as soon as possible will reduce impacts on health and wellbeing to **low negative** as it will allow them to plan ahead with more certainty. This information should include clear guidelines around what people can and cannot do on their land once it is designated. This would also reduce the likelihood of businesses moving out of the area 'early' and leaving local residents without goods and services; this is anticipated to reduce impacts on quality of environment, way of life and sustaining oneself to **very low negative.** It is recommended that Te Tupu Ngātahi liaise with Auckland Council around these communications so that there is consistency around messaging being provided to business owners in relation to a) the Project and b) implementation of the North West Spatial Land Use Strategy.

Accurate information should also be provided to the local community around construction timeframes, as well as information on how construction may impact local residents and how this is intended to be managed. This should include community organisations such as schools and community centres. This is anticipated to reduce people's anxiety and uncertainty about the project to **very low negative.**

7.5.2 Construction phase

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale with mitigation
Wider community	For the wider community, most impacts will relate to disruption along SH16 and surrounding roads • The majority of construction for the RTC/RAMC will occur offline. However as noted in the Transport Assessment, temporary diversions along SH16 may be needed during construction of the new bridge on the NAL and the new signalised intersection with Tapu Road and Station Road. For the construction of other key structures such as interfaces with local roads and construction of under and overpasses, the Transport Assessment notes that there is potential for one-way traffic management (such as temporary stop/go signs) to occur at certain key construction stages. There is potential for traffic disruption along SH16 during the construction phase both due to these anticipated diversions and traffic management measures, and as a result of construction traffic along SH16 – potential impacts on **way of life** if it becomes more difficult for people to move through the area to go about their daily activities. SH16 is a major transport corridor for people travelling through the North West and is already often heavily congested, so construction works (including temporary road closures, speed limit reductions and stop/go measures – as outlined in the Transport Assessment) along the corridor could cause delays and disruption to people's routines. The scale of this impact is likely to be **low - moderate negative** noting that the bulk of the construction will occur offline, with the severity of the impact increasing (from moderate to high) the longer construction causes disruption along the road. • **Community cohesion** could also be adversely affected if it becomes harder for people to, for example, visit family and friends or access community facilities and activities (such as sports or classes) throughout the wider community as a result of construction along Main Road. These impacts will be temporary and are anticipated to be **low – moderate negative** (with severity increasing the longer construction causes disruption along the road). • Construction could temporarily impact people's ability to access the remaining businesses along Main Road (for example if carparking is limited due to construction, or if there are temporary traffic management procedures or detours in place which mean people cannot easily access Main Road). This could affect people's **way of life** and ability to **sustain oneself** if they need to travel further afield to access goods and services. These impacts are expected to be **low negative** (recognising that Main Road is likely only one of the places that people in the wider community travel to access goods and services, and other business centres such as Westgate will still be operational during this time) and temporary in duration. • It is noted that construction along Main Road is also anticipated as part of the Main Road upgrades. While this section of the report focuses on construction impacts arising from the RTC/RAMC NoR, it is noted that the impacts listed above could increase in severity (i.e.from low negative to moderate negative, or from moderate negative to high negative) if construction for these two NoRs does not occur at the same time and there is construction related disruption along Main Road/SH16 for an extended period of time. • Parts of Huapai Domain are located within the designation envelope, including sections of football fields, tennis courts and carparks. During construction, it is anticipated that parts of the Domain will be off-limits to the public, and access from SH16 will be closed to the public. This is a large, well-used community resource that is home to a number of community facilities and activities (such as the football club, tennis courts, cricket	**Low - moderate negative** (temporary) impacts on way of life **Low – moderate negative** (temporary) impacts on community cohesion and sustaining oneself. In relation to Huapai Domain: **high negative** impacts on way of life, community cohesion and health and wellbeing	• Preparation of a Construction Management Plan which identifies measures to minimize disruption from noise and vibration where practicable. • Preparation of a Traffic Management Plan which identifies diversions/detours to be put in place for the duration of construction, as also recommended in the Integrated Transport Assessment. • The wider community should be kept informed (ideally well in advance) of construction works and traffic management plans so that people can plan ahead in regards to their movements during this time. • A 24/7 complaints and queries line should be set up for the duration of the construction period, with the phone number disseminated to the community so that the community have a dedicated contact number for any issues during the construction period. • At the time that this SIA was prepared, a draft mitigation plan • During construction, if access to the Domain from SH16 is not possible, alternative access through the streets surrounding the Domain should be clearly signposted so that it is easy for people to find their way to and from the Domain.	**Low negative** impacts on way of life. **Low negative** impacts on community cohesion and sustaining oneself. In relation to Huapai Domain: **low negative** impacts on way of life, community cohesion and health and wellbeing.

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale with mitigation
	pitches) as well as a popular location for informal recreation (jogging, using the playgrounds, walking dogs). Restricting access to this facility will have **high negative** impacts on the wider community. People's **way of life** and **health and wellbeing** will be impacted if they are no longer able to participate in formal or informal recreation (i.e. if the football club needs to temporarily close), and this could also adversely impact **community cohesion** if people no longer have opportunities to participate in activities that usually connect them to others in the community, such as social sport or meeting up with other people in the Domain informally.			
Local community	• Each of the impacts listed above will also be experienced by the local community; however it is anticipated that the severity of these impacts will be greater (**high negative**) for those in the local community, who are more likely to regularly use SH16 as both a transport route and a destination for accessing goods and services. • Additionally, people's **way of life** will be adversely affected during the construction period if noise, vibration and traffic congestion from construction changes the way that people go about their daily activities. This could include avoiding working from home or spending less time outdoors. Noise, vibration and traffic congestion could also adversely impact people's **quality of environment** and may give rise to adverse impacts on **health and wellbeing** by causing stress and anxiety for local residents, particularly if it disrupts daily activities such as working from home or sleeping. The Construction Noise Assessment notes that high levels of noise and vibration will likely only be experienced by individual households for a temporary period of weeks – months (as construction will move down the alignment in linear fashion), however this still constitutes an adverse impact on people's quality of environment. • These impacts are anticipated to be **low negative** (increasing to **moderate negative** the longer construction lasts) for residents in urban parts of the local community, noting that there is already a lot of movement and activity along SH16 as well as ongoing development of areas such as the Huapai Triangle. As noted in the Construction Noise assessment, construction will occur in a linear nature (i.e. moving along the alignment) and so high levels of noise and vibration will only be experienced by each household for a short period (i.e. months) compared with the overall construction duration of the projects (noting that some areas such as interchanges and construction compounds will have ongoing noise and vibration for longer periods of time, and residents living near these areas will experience more prolonged periods of disruption). • In the rural zoned areas of the local community, residents have noted that they value the quiet, peaceful character of the rural environment (noting these areas are expected to remain rural in future) and as such, impacts on **quality of environment** and **health and wellbeing** are expected to be **moderate negative** in these areas, as a rise in noise and disruption will be more noticeable in this environment albeit the disruption will still be temporary (weeks to months). Census data indicates that in the rural parts of the local community there are higher than average numbers of people working from home than in more urbanized parts of the community; impacts on **way of life** will also therefore be more significant (**moderate negative)** if more people's work routines are disrupted by the works. • If businesses experience reduced patronage for an ongoing period as a result of construction, business owners could experience stress and anxiety about their ability to continue operating. This would give rise to **low negative** impacts on the health and wellbeing of this group and their ability to sustain themselves, increasing to **moderate negative** the longer construction lasts.	**High negative** impacts on way of life, community cohesion, sustaining oneself, quality of environment and health and wellbeing (as above) **Low to moderate negative** impacts on quality of environment and health and wellbeing for the urban community **Moderate negative** impacts on quality of environment and health and wellbeing for the rural community.	In addition to the mitigation recommended for the wider community: • Clear communication about the upcoming construction period should be provided to local residents so that they are mentally prepared for the works and have a chance to ask questions about the construction period and/or plan around the works. • If access to private properties is affected by temporary road closures, alternative property access should be provided (as recommended in the Transport Assessment). • Business owners should be kept up to date on construction progress. There is also an opportunity to consider how broader outcomes could be achieved through the project, by exploring different options to support businesses through the construction period. `	**Moderate - high negative** impacts on community cohesion, way of life, sustaining oneself, quality of environment and health and wellbeing **Low to moderate negative** impacts on way of life (impacts will likely still be moderate negative for rural residents who spend a lot of time at home and are therefore affected by construction noise and vibration more constantly).

	Impact without mitigation	Overall scale without mitigation	Recommended mitigation or management	Overall scale with mitigation
	Note: the construction of Kumeū and Huapai Rapid Transit Stations has been considered as part of the above assessment			

7.5.3 Operation phase

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
Wider community	*Note: operational impacts of Kumeū and Huapai Rapid Transit Stations are considered as part of the following assessment (i.e.as part of the wider RTC network). Where impacts are specific to the operation of the stations themselves, these are noted.* **Positive impacts:** • Once operational, the RTC and RAMC will facilitate easier movement around the wider community and further afield (through connections to the wider transport network). • The Transport Assessment states that in 2048 there are anticipated to be 1,300 passengers boarding rapid transit in each peak 2 hour period from Kumeū, and 2600 boarding from Huapai. This is a significant number of people benefiting directly from the provision of the new RTC. • Active and public transport users will have a safe, efficient way of travelling, while drivers will also benefit from people making the switch from driving to public or active transport, reducing traffic congestion on the roads. • This will have **high positive** impacts on **way of life, sustaining oneself and community cohesion** in that it will be easier for those who use Main Road regularly to go about their daily activities, including accessing work, recreation, retail, education and connecting to other people and places throughout the community. • Of note, the provision of the RTC and RAMC will assist more vulnerable groups (such as the elderly or those unable to drive) to access key services and amenities throughout the community. • The **quality of environment** in the Kumeū – Huapai town centre may also improve as a result of these upgrades (alongside the Main Road upgrades) with the creation of an improved pedestrian streetscape and reduction in traffic congestion through Main Road, as well as more pedestrians moving through the town centre. This also aligns with the **aspirations** of the wider community (as expressed in Local Board Plans and the Kumeū – Huapai Centre Plan) around making it easier to get around the region, and improving the streetscape in Kumeū – Huapai town centre. These impacts are anticipated to be **moderate positive.** • The provision of walking and cycling infrastructure along the RAMC will make it easier for people to exercise as part of their daily activities, both on the walking and cycling facilities along the RAMC and across the wider network of walking and cycling infrastructure that is proposed throughout the wider community. This will have **moderate positive** impacts on both **way of life** and **health and wellbeing**. • As the FUZ areas of the wider community urbanise and the population of the wider community grows significantly, the RTC and RAMC will be critical in facilitating this growth by providing transport choice for those moving around the area.	**High positive** impacts on way of life, sustaining oneself, community cohesion. **Moderate positive** impacts on quality of environment, aspirations and health and wellbeing. In relation to Huapai Domain: **High negative** impacts on way of life, community cohesion and health and wellbeing for users of this facility. In relation to Huapai Tavern: **Low to moderate negative** impacts on community cohesion.	• As stated in section 7.5.2, At the time that this SIA was prepared, discussions around appropriate mitigation for Fred Taylor Park and Huapai Domain were ongoing with Auckland Council Parks. From a social perspective, mitigation options that allow both the football club and wider community to continue accessing active, green space either at or near the current Park are preferable. It is understood that a preferred mitigation option will be determined following detailed design. • It is recommended that in developing this mitigation, Te Tupu Ngātahi liaise with the West Coast Rangers Football Club to understand their needs in regards to Huapai Domain, and to help the Football Club understand the likely impacts on their operations. This will allow the Football Club to plan ahead for how to run trainings and games across their two home grounds to make best use of the space they have available. • It is understood that Huapai Tavern will be relocated closer to the proposed Kumeū Station location. Impacts relating to the loss of this community hub will be mitigated if the Tavern is relocated to this site and can still be used by the community.	**Low negative**

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
	Negative impacts • There will be some change in the long-term makeup of the business community along Main Road due to the acquisition of businesses (primarily on the south side of SH16). However, this is not considered a significant impact on community cohesion or quality of environment as the town centre is undergoing transitions regardless (for example, the relocation of industrial businesses away from the town centre) and changes in the business community are considered likely as this transition occurs. • As discussed under 'construction impacts', a section of Huapai Domain is within the designation envelope and will no longer be able to be used by the community once the RTC is operational; this section of the domain currently provides a range of recreation opportunities to the community including tennis courts, club rooms and football fields as well as carparking for these facilities. This facility is currently well used for both organized and informal recreation, and it is anticipated that numbers using the Domain will grow as the area around the Domain continues to urbanise and more people move into the area. • Without mitigation, the removal of this valued resource will have **high negative,** permanent impacts on people's **way of life, health and wellbeing** and **community cohesion** if they are no longer able to participate in organized sport or access the social and physical benefits that come from this. • The existing site for the Huapai Tavern will be impacted by both the RTC and Kumeū stations, and will need to be removed. It is understood that the Tavern is a well used place for the community to congregate, and has heritage values. This could have **low-moderate negative impacts** on **community cohesion** if this informal community hub is removed.			
	Impacts specific to Kumeū and Huapai stations: • In addition to the benefits discussed above, the rapid transit stations will play an important role in increasing the connectivity benefits of the transport network. Both stations will transport people into existing and/or future town centres (the Kumeū Station is centrally located on Main Road, close to shops, the library and community centre; the Huapai Station is located across the road from an anticipated future Local Centre) which will have **moderate positive** impacts on **way of life, sustaining oneself** and **community connectivity** in that it will become much easier for people to access goods, services, community amenities and to connect with family and friends. • This will be particularly beneficial for people who cannot walk far (i.e. are elderly or have mobility limitations) and will be able to use public transport to travel right into town centres. • The Huapai Rapid Transit Station will have provision for 500 cars in a park and ride facility. This will have **moderate positive** benefits in terms of people being able to access the facility from the wider North West area; Census data shows that currently most people in the wider community commute by car, and it is important to ensure that these people can access the station (noting that over time car use may decline as the surrounding public transport network becomes more established). It is also noted that the need for a park and ride was specifically requested by the community during Te Tupu Ngātahi engagement.	**Moderate positive** impacts on way of life, sustaining oneself and community connectivity		
Local community	• The positive impacts noted above (for the wider community) will also apply to the local community. However, it is anticipated that a larger proportion of the local community will make use of the RAMC and RTC as well as spending more time along Main Road (given their closer proximity to the network) and as such the **health and wellbeing** and **quality of environment** impacts are considered **high positive** at this scale. **Negative impacts:**	As above, but **high positive** impacts on health and wellbeing and quality of environment.	• The Traffic Management Plan should consider whether traffic flows to and from the Huapai Park and Ride need to be managed. • In the rural community, visual screening (i.e. through landscaping) could be considered along the corridor to minimize adverse impacts on people's outlook.	**Low negative**

	Impact without mitigation	Overall scale without mitigation	Suggested mitigation	Overall scale with mitigation
	• In the rural section of the local community, some severance impacts may be observed where the RTC cuts through the middle of existing rural communities. This could have **low negative** impacts on people's sense of **community** as they may feel separated from the rest of the community. • There could also be **low negative** impacts on **quality of environment** in the rural environment; currently people in these areas have noted (in Te Tupu Ngātahi engagement) that they value the quiet rural character of these areas, however once the RTC is operational some people's outlook will change from unimpeded rural views to views of a major transport corridor. This could adversely impact on people's perception of the amenity and quality of their surrounding environment. • It is possible that the 500 car park and ride at Huapai Rapid Transit Station could result in traffic congestion (particularly around peak times) as people enter and exit the station in vehicles. This could have **low negative** impacts on **quality of environment** for those living in close proximity to the station, if the area becomes congested at particular times.	**Low negative** impacts on community cohesion for the rural community. **Low negative** impacts on quality of environment in both the urban and rural communities.		

7.5.4 Conclusions

The most significant construction impacts from the RTC/RAMC will be experienced along SH16/Main Road and surrounding rural roads. The construction of the RTC/RAMC has the potential to disrupt traffic flows along SH16, both as a result of construction traffic and temporary detours/traffic management measures. This could disrupt people's movements through the area, adversely impacting their ability to access goods and services as well as to connect to recreation, employment, education and social events throughout the North West. While this is a temporary impact, its severity will increase the longer construction causes delays along this main transport corridor, especially if the RTC/RAMC upgrades follow shortly after (or before) and the cumulative construction period for the two Projects is therefore lengthy.

The local community will also experience temporary impacts on their quality of environment and way of life as a result of noise, vibration and additional traffic movements during the construction period; particularly those in the rural community for whom the existing environment is quiet and generally undisturbed.

There will also be significant impacts on Huapai Domain during construction without mitigation, as parts of the Domain will become unusable to the public. This recreation facility is currently well used by the public (and will likely be even more heavily used as the population in the surrounding area grows) and it is recommended that the current discussions with Auckland Council to find a suitable mitigation option continue.

It is also recommended that the Traffic Management Plan and Construction Management Plan outline measures to minimise disruption to the wider and local communities where practicable. The wider and local community should also be provided with clear information about the anticipated construction period (including expected construction length and detail on any diversions that will be in place) and be provided a contact number for any complaints or queries they have during the construction period. This will somewhat mitigate adverse social impacts by allowing the community to understand what the works entail and plan ahead for disruption.

Once the RTC/RAMC is operational, impacts on the wider and local community will generally be very positive. The RTC and RAMC will improve connectivity throughout the community and will assist people in accessing goods, services, employment, education, recreation and connecting to friends and family. The provision of public transport and active mode infrastructure means that a wide range of people in the community can access the benefits of the expanded transport network, including those who do not or cannot drive. Along with the Main Road upgrades, the provision of the RTC and RAMC will contribute to the improvement of the Kumeū – Huapai town centre. As parts of the wider community urbanise and experience population growth, the RTC will play a critical role in providing transport choice to the community and facilitating growth of the area. The provision of Rapid Transit Stations in both Kumeū and Huapai will help to connect people directly into the centres of these towns.

Negative operational impacts include the potential for severance amongst the rural community, as well as a change in outlook for some rural properties. Again, it is recommended that an alternative sports and recreation facility is provided within the wider community, and that park users are involved in site selection so that adverse impacts from the acquisition of part of Fred Taylor Park and Huapai Domain are minimised.

7.6 NoR s4: Access Road Upgrade

Overall, the Access Road upgrades are anticipated to have low negative social impacts, as the upgrades are fairly small in scale (widening of the road from 20m to 30m, and addition of walking and cycling facilities) and are only occurring on an existing arterial road, however on the whole the project will improve the existing situation for current and future communities. Rather than a detailed social impact assessment (as has been provided for the other NoRs) a brief summary of key impacts is provided here.

7.6.1 Route protection and construction impacts

The designation envelope for the Access Road upgrades is small and involves limited road widening; as such community cohesion and way of life are not expected to be adversely impacted during the route protection phase.

During construction, there will be additional noise and vibration experienced by the local community which could temporarily reduce the quality of the environment and impact on way of life if people are unable to, for example, spend time outdoors or work from home due to construction noise. While this impact cannot be fully mitigated, it is anticipated that the Construction Management Plan will outline measures for minimising disruption to residents where practicable.

People’s way of life may also temporarily be impacted during the construction phase if it becomes more difficult to access other parts of the community due to construction traffic or temporary road closures. This could also impact people travelling to and from businesses in the Kumeū industrial area, such as the Kumeū Film Studios, if their commute becomes lengthier. It is recommended that the community are provided with information on the expected construction programme in advance of construction beginning. This will allow for the community to plan ahead to minimise any disruption on their daily activities.

Construction may impact the Kumeū Community Centre’s ability to operate (temporarily) if construction works in the carpark of the site are sufficiently disruptive (i.e. block entrance to the Centre, prevent people from parking at or near the Centre or are too noisy to allow classes in the Centre to go ahead). This would have negative impacts on people’s way of life (if they can no longer attend classes at the Centre) and community cohesion (if people temporarily do not have the opportunity to connect to others in the community through classes and events at the Centre. This will impact particularly on those who are reliant on a car to get to and from the Centre and are not able to use public or active transport (for example, the elderly or people with a disability).

This is a temporary impact and can be somewhat mitigated by communicating with the Centre in the lead-up to the construction period so that they can plan for this temporary period of disruption (for example by rescheduling classes, providing a shuttle bus to the Centre from nearby streets or temporarily moving to an alternative venue). There are a large number of events held at the Centre and the earlier these groups can be advised of the upcoming construction period, the easier it will be for these groups to make alternative arrangements during the construction period.

Finally, access to Kumeū Showgrounds during events at the Showgrounds could be temporarily made more difficult for both event staff and event attendees if there is construction along Access Road. If practicable, it is recommended that the construction timeline takes into account and avoids any major events at the Showgrounds to minimise disruption to these events.

7.6.2 Operation impacts

The Access Road upgrades will improve connectivity between the ASH and SH16, assisting people to move freely around the area. In particular, the provision of safe, separated walking and cycling infrastructure along the road will assist the local community in using active modes to access SH16 for their daily needs and activities, as well as for exercise and recreation.

In future, it is anticipated that the business land along the northern end of Station Road will be expanded; the Access Road upgrades will improve the connectivity between these businesses and the RTC and ASH. Members of the community have reported traffic congestion being generated in this area, particularly with cars coming and going from the Kumeū Film Studios, and the road widening and provision of active mode infrastructure will help to reduce this congestion.

The removal of carparks at the Kumeū Community Centre may also impact on people’s ability to access community facilities (such as classes) at the Centre. This impact will be somewhat mitigated by the provision of walking and cycling infrastructure along Access Road, as this will provide the opportunity for people in the local community to access the centre via walking or cycling rather than driving.

Appendix A – Literature review summary

Type of project	Project/case study	Location	Link / Reference
Rapid transit	City Rail Link	Auckland, New Zealand	• https://at.govt.nz/media/1168704/pm68crlsocialimpactassessment.pdf • https://www.cityraillink.co.nz/targetedhardshipfund • https://www.rnz.co.nz/news/national/450715/city-rail-link-impact-on-businesses-hardship-fund-to-provide-payments
	Light Rail Network	Hamilton, Ohio, USA	• City of Hamilton Rapid Transit Office (2008). Community Impact and Economic Analysis of Light Rail Transit
	Sydney Metro network	Sydney, Australia	• https://www.sydneymetro.info/sites/default/files/document-library/Sydenham%20to%20Bankstown%20Environmental%20Impact%20Statement%20Volume%204%20Technical%20Paper%205%20-%20Social%20impact%20assessment.pdf
	Gold Coast Rapid Transit	Gold Coast, Australia	• https://assets.website-files.com/5fe233fb8f19d976ab4a9215/6063d4ff3b83947bdc66a166_ch12-social-impacts-4cd890de.pdf
	Various bus rapid transit projects (literature review)	N/A	• https://wrirosscities.org/sites/default/files/Social-Environmental-Economic-Impacts-BRT-Bus-Rapid-Transit-EMBARQ.pdf
Active mode infrastructure	Te Whau Pathway	Auckland, New Zealand	• https://www.aucklandcouncil.govt.nz/ResourceConsentDocuments/56BUN60337530AppxNSocial%20Impact%20Assessment.pdf
	Various shared use paths	Massachusetts, USA	• https://www.mass.gov/doc/masstrails-shared-use-path-impacts-study/download
Roading	Transmission Gully	Wellington, New Zealand	• https://www.nzta.govt.nz/assets/projects/transmission-gully-application/docs/technical-report-17.pdf
	East West Link	Auckland, New Zealand	• https://www.nzta.govt.nz/assets/projects/east-west-link-application-to-the-environmental-

Type of project	Project/case study	Location	Link / Reference
			protection-authority-epa/Technical-Report-11-Social-Impact-Assessment.pdf
	Te Rapa Bypass	Waikato, New Zealand	• https://www.hamilton.govt.nz/our-council/council-publications/operativedistrictplan/Documents/Designations/Te%20Rapa%20NOR%20App%20L.pdf
	Lincoln Road upgrades	Auckland, New Zealand	• http://www.aucklandcity.govt.nz/council/documents/districtplanwaitakere/changes/54/pa54app15socialimpactassessment.pdf

Appendix B – Statistics for wider community

Statistics obtained from Census 2018 data.

Census Area	Population	Population change 2013 - 2018	Total private dwellings	Usual residence one year ago	Means of travel to work	Means of travel to education
Kumeū Rural West	1626	+6%	606	Same residence: 85% Elsewhere: 12.3%	Private or company vehicle: 71.8% Work from home: 19.7% Bus:1.2% Bike: 0% Walk or jog: 1.2% Train: 0.6%	Private vehicle: 62% Study at home: 5.7% Bus (school or public): 26% Bike: 0% Walk or jog: 3.3% Train: 3.3%
Kumeū Rural East	2028	+13%	675	Same residence: 82.7% Elsewhere: 13.9%	Private or company vehicle: 74.1% Work from home: 18.8% Bus:1.3% Bike: 0% Walk or jog: 1.3% Train: 0%	Private vehicle: 65.9% Study at home: 4.4% Bus (school or public): 22.2% Bike: 0.7% Walk or jog: 2.2% Train: 2.2%

Census Area	Population	Population change 2013 - 2018	Total private dwellings	Usual residence one year ago	Means of travel to work	Means of travel to education
Kumeū - Huapai	3432	+143%	1335	Same residence: 65% Elsewhere: 30.9%	Private or company vehicle: 84.3% Work from home: 8% Bus:1.5% Bike: 0.5% Walk or jog: 1.5% Train: 0.5%	Private vehicle: 64.7% Study at home: 5.7% Bus (school or public): 17.1% Bike: 3.8% Walk or jog: 6.8% Train: 3.4%
Whenuapai	3888	+4%	1584	Same residence: 73.4% Elsewhere: 23.4%	Private or company vehicle: 68% Work from home: 12.7% Bus: 2% Bike: 2.9% Walk or jog: 8.8% Train: 0%	Private vehicle: 55.2% Study at home: 10.2% Bus (school or public): 25.3% Bike: 0.3% Walk or jog: 6.9% Train: 0.7%
Taupaki	1617	+6%	576	Same residence: 82.7%	Private or company vehicle: 71.6%	Private vehicle: 69.7%

Census Area	Population	Population change 2013 - 2018	Total private dwellings	Usual residence one year ago	Means of travel to work	Means of travel to education
				Elsewhere: 15.5%	Work from home: 20.6% Bus: 0.7% Bike: 1% Walk or jog: 1% Train: 1.3%	Study at home: 5.4% Bus (school or public): 21.7% Bike: 0% Walk or jog: 6.9% Train: 5.4%
Waimauku	1338	+14%	459	Same residence: 81.8% Elsewhere: 15.9%	Private or company vehicle: 65.2% Work from home: 13.4% Bus: 1.2% Bike: 0.4% Walk or jog: 2% Train: 0.4%	Private vehicle: 46% Study at home: 4.8% Bus (school or public): 23.8% Bike: 0.8% Walk or jog: 23% Train: 0.8%
Waipatukahu	1461	+17%	516	Same residence: 86.8% Elsewhere: 10.2%	Private or company vehicle: 77.7% Work from home: 16.8% Bus: 1.1% Bike: 0%	Private vehicle: 61% Study at home: 4.8% Bus (school or public): 30.5% Bike: 0%

Census Area	Population	Population change 2013 - 2018	Total private dwellings	Usual residence one year ago	Means of travel to work	Means of travel to education
					Walk or jog: 1.5% Train: 0.4%	Walk or jog: 0.8% Train: 0.8%

ATTACHMENT 47

NORTH-WEST STRATEGIC ASSESSMENT OF FLOODING EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Northwest Strategic Assessment of Flooding Effects

December 2022

Version 1

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Table of Contents

1 Executive Summary 8
2 Introduction 12
2.1 Purpose and Scope of this Report 12
2.2 Report Structure 13
2.3 Preparation for this Report 14
3 Assessment Methodology 15
3.1 Chapter Summary 15
3.2 Outcomes based approach 15
3.3 Desktop Assessment 16
3.3.1 Recent flooding in Kumeū 16
3.4 Flood Modelling 18
3.4.1 Stormwater Catchment Overview 18
3.4.2 Modelling Parameters 19
3.4.3 Climate Change 20
3.4.4 Modelling Outputs 20
3.4.5 Future Urban Zone 21
3.4.6 Model Limitations 22
3.5 Sensitivity Analysis 22
3.6 Stormwater management devices 23
4 Strategic Assessment Package Overview 24
5 Summary of Modelling Results 25
6 Strategic Positive Effects 27
7 Strategic Construction Effects 28
7.1 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects 28
8 Strategic Operational Effects 30
8.1 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects 30
9 NoR S1: Alternative State Highway, including Brigham Creek Interchange 32
9.1 Project Corridor Features 32
9.1.1 Catchment Characteristics 32
9.2 Existing and Likely Future Environment 32
9.2.1 Planning Context 32
9.3 Proposed works 33
9.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects 33
9.4.1 Positive Effects 33
9.4.2 Assessment of Construction Effects 35
9.4.3 Recommended measures to avoid, remedy or mitigate construction effects 35
9.4.4 Assessment of Operational Effects 36

9.4.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects..41

9.5 Conclusions....41

10 NoR S2: SH16 Main Road Upgrade....43

10.1 Project Corridor Features....43

10.1.1 Catchment Characteristics....43

10.2 Existing and Likely Future Environment....43

10.2.1 Planning Context....43

10.3 Proposed works....44

10.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects....44

10.4.1 Positive Effects....44

10.4.2 Assessment of Construction Effects....45

10.5 Recommended measures to avoid, remedy or mitigate construction effects......45

10.5.1 Assessment of Operational Effects....45

10.5.2 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects..48

10.6 Conclusions....48

11 NoR S3: RTC and RAMC; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station....50

11.1 Project Corridor Features....50

11.1.1 Catchment Characteristics....50

11.2 Existing and Likely Future Environment....50

11.2.1 Planning Context....50

11.3 Proposed Works....52

11.3.1 Rapid Transit Corridor (RTC) and Regional Active Mode Corridor (RAMC) 52

11.3.2 NoR KS: Kumeū Rapid Transit Station....52

11.3.3 NoR HS: Huapai Rapid Transit Station....53

11.3.4 Other works....53

11.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects....53

11.4.1 Positive Effects....53

11.4.2 Assessment of Construction Effects....54

11.4.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects 54

11.4.4 Assessment of Operational Effects....55

11.4.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects..56

11.5 Conclusions....56

12 NoR S4: Access Road Upgrade....58

12.1 Project Corridor Features....58

12.2 Proposed Works....58

12.3 Existing and Likely Future Environment 58

12.3.1 Planning Context 58

12.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects 59

12.4.1 Positive Effects 59
12.4.2 Assessment of Construction Effects 59
12.4.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects 59
12.4.4 Assessment of Operational Effects 60
12.4.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects .. 61

12.5 Conclusions 61

13 Sensitivity Analysis 62

13.1 NoR S1: Alternative State Highway, including Brigham Creek Interchange 62
13.2 NoR S2: SH16 Main Road Upgrade 62
13.3 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station 62
13.4 NoR S4: Access Road Upgrade 63

14 Conclusion 64
15 References 65

Appendices

Appendix 1: Flood model results
Appendix 2: Sensitivity analysis results

Table of Figures

Figure 1-1: Location of the projects in the Strategic Assessment Package 8

Figure 3-1 Flooding closed the main road in Kumeū. (Source: 1 NEWS) 17

Figure 3-2 A house surrounded by flood waters in Auckland's Kumeū. (Source: 1 NEWS) 18

Figure 3-3: Existing 100yr ARI flood plain for Kumeū-Huapai Catchment (Auckland Council GIS) 19

Figure 4-1: Northwest Strategic Assessment Package – Overview of NoRs for Assessment 24

Figure 9-1: Flood Difference Maps for Ngongetepara Stream bridge crossing 34

Figure 9-2: Flood Difference Maps for Pomona Road 35

Figure 9-3: Flood Difference Maps for Totara Creek bridge crossing 36

Figure 9-4: Flood Difference Maps for Karure Stream crossing 37

Figure 9-5: Flood Difference Maps for Boord Crescent 38

Figure 9-6: Flood Difference Maps for Boord Crescent 38

Figure 9-7: Flood Difference Maps for Pomona Road 39

Figure 9-8: Flood Difference Maps for Foster Road 40

Figure 9-9: Flood Difference Maps for Foster Road 41

Figure 10-1: Flood Difference Maps for Strategic Projects 45
Figure 10-2: Flood Difference Maps for Strategic Projects 46
Figure 10-3: Flood Difference Maps for Strategic Projects 47
Figure 10-4: Flood Difference Maps for Main Road near proposed Huapai Station 48
Figure 11-1: Flood Difference Maps for RAMC 54
Figure 11-2: Flood Difference Maps for Huapai Station 56
Figure 12-1: Flood Difference Maps for Access Road 60

Table of Tables

Table 2-1: Northwest Strategic Assessment Package – Notices of Requirement and Projects 12
Table 3-1: Flooding effects assessment criteria 20
Table 3-2 Freeboard allowance for the level of serviceability to traffic (NZ Bridge Manual) 21
Table 4-1: Strategic Assessment Package Project Summary 24
Table 5-1: Summary of flood modelling results 25
Table 9-1: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment 32
Table 10-1: SH16 Main Road Upgrade Existing and Likely Future Environment 43
Table 11-1: RTC and RAMC Existing and Likely Future Environment 50
Table 11-2: Kumeū Rapid Transit Station Existing and Likely Future Environment 51
Table 11-3: Huapai Rapid Transit Station Existing and Likely Future Environment 52
Table 12-1: Access Road Upgrade Existing and Likely Future Environment 58
Table 15-1: Alternative State Highway, including Brigham Creek Interchange, summary of flood levels at key crossings 66
Table 15-2: SH16 Main Road upgrade existing and future flood levels at key crossings 69
Table 15-3: Rapid Transit Corridor existing and future flood levels at key crossings 71
Table 15-4: Access Road upgrade existing and future flood levels at key crossings 73
Table 15-5: Consideration of sensitivity at key crossings identified NoR S1 74
Table 15-6: Consideration of sensitivity at key crossings identified NoR S2 77
Table 15-7: Consideration of sensitivity at key crossings identified NoR S3, KS and HS 79
Table 15-8: Consideration of sensitivity at key crossings identified NoR S4 81

Glossary of Acronyms / Terms

Abbreviations	Description
AC	Auckland Council
AEE	Assessment of Effects on the Environment
ARI	Average Recurrence Interval of a rainfall event
ASH	Alternative State Highway
AT	Auckland Transport
AUP: OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
CC	Climate change
CC2W	City Centre to Westgate
CEMP	Construction Environmental Management Plan
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
Ha	Hectares which is used for catchment areas
MfE	Ministry of the Environment
MPD	Maximum Probable Development based on zonings as permitted under AUP:OP
NAL	North Auckland Line Railway
NoR	Notice of Requirement (under the Resource Management Act 1991)
Package	Strategic Assessment Package
Projects	Projects within the Strategic Assessment Package include: • Alternative State Highway (ASH), including Brigham Creek Interchange (BCI) • the Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (RAMC) • State Highway 16 (SH16) Main Road Upgrade • Two RTC Stations, located at Kumeū and Huapai • The upgrade of Access Road local arterial corridor
RCP	MfE Representative Concentration Pathways
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RL	Reduced level

Abbreviations	Description
RUB	Rural Urban Boundary
SGA	Te Tupu Ngātahi Supporting Growth Alliance
SH16	State Highway 16
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

1 Executive Summary

This report provides an assessment of flood effects associated with the construction, operation and maintenance of the Projects that comprise the Strategic Assessment Package. The Projects are shown on Figure 1-1 below.

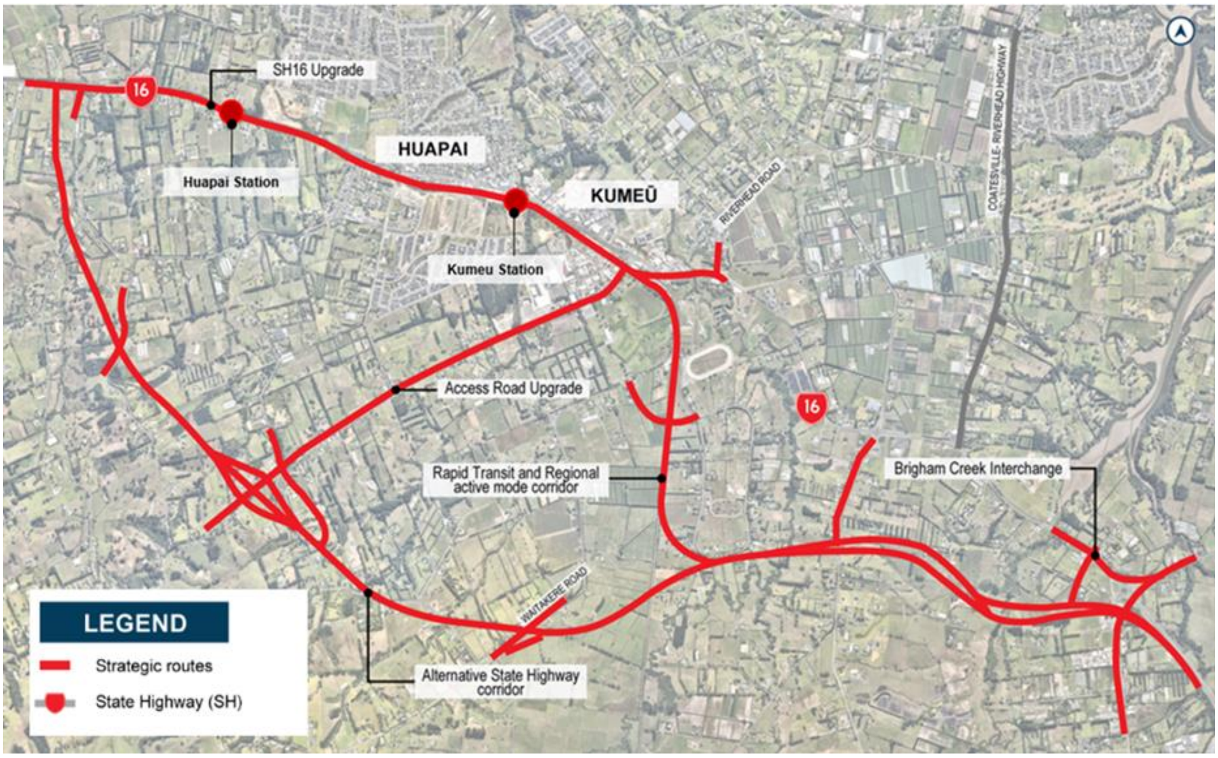

Figure 1-1: Location of the projects in the Strategic Assessment Package

Flooding is a natural hazard and has therefore been considered as part of the Strategic Package Notices of Requirement. The works required for the Strategic Package have the potential to lead to flooding effects and an assessment of predicted flood effects is provided to demonstrate that these effects can be appropriately controlled in the future. It is also acknowledged that there will be a subsequent process for seeking regional resource consents which will address a wider range of potential stormwater quantity and quality effects.

In the context of this assessment, flood hazard effects may include changes to:

- the flood freeboard to existing habitable buildings, overland flow paths,
- the ability to access property by residents and emergency vehicles,
- the level of flooding to roads and flooding arising from the blockage of stormwater drainage.
- the effects considered relate to existing habitable buildings / infrastructure and potential future effects on upstream and downstream properties.

Methodology

The assessment of flooding effects for the Northwest Strategic Package has involved the following steps:

- Desktop assessment to identify potential flooding locations from Auckland Council Geomaps.

- Modelling of the pre-development and post-development terrain with Maximum Probable Development (MPD) and 100yr Average Recurrence Interval (ARI) plus climate change rainfall.
- Two climate scenarios were modelled, one allowing for 2.1 °C of temperature increase and one for 3.8 °C of temperature increase. The higher climate change scenario has been used to undertake a sensitivity analysis.
- Producing flood level maps for pre-development and post-development scenarios and flood difference maps to show the change in flood levels and extents as a result of the Project.
- Review of flood difference maps at key locations such as bridges and where there are noticeable changes in flood extents or flood levels to understand the reason for the change and potential future opportunities to reduce the effects

While stormwater effects apart from flooding are not assessed, provision is made for the future mitigation of potential stormwater effects (stormwater quantity, stormwater quality and instream structures) by identifying the space required for stormwater management devices (for example drainage channels and ponds) and incorporating land for that purpose into the proposed designation boundaries. These devices have been designed to attenuate the 100year ARI using 10% of the total impervious road catchment area in accordance with Auckland Council and Waka Kotahi guidance[1,2]. Note for existing roads being widened this allows for greater impervious road area being treated than the widened road area alone.

Flooding effects will be subject to further verification at a detailed design stage to ensure compliance with conditions. It is expected that coordination and integration of the corridor design with future urban zone (FUZ) development will be undertaken to confirm and address potential future adverse effects.

Positive Effects

There is the potential for positive effects associated with the projects. These include where new bridges are proposed which raise the existing road levels reducing the potential for flood levels to overtop the road and reducing flood hazard. Additional positive effects can be realised through upgrades to existing culverts or new culvert crossings to improve flow under the proposed project corridor. The scale of these effects will be confirmed at detailed design stage. Water quality treatment allowances will result in improved environmental outcomes as the total road area, and not just the additional road area, for existing roads have been included for treatment.

Construction phase effects

The potential construction flooding effects can be appropriately managed with the measures set out in Section 7.1. It is expected that construction works can be carried out in a way that will appropriately manage the risk. Flood risk mitigation measures will be captured in the Construction Environmental Management Plan (CEMP) and it is recommended this be included as a condition of the proposed designation.

Operational phase effects

NoR S1: Alternative State Highway (ASH), including Brigham Creek Interchange (BCI)

The assessment of operational effects found negligible to moderate flood effects during the operational phase of the corridor. There is space within the designation to mitigate this risk by

[1] Auckland Council's Stormwater Management Devices in the Auckland Region, Guideline Document 2017/001 (December 2017)
[2] Waka Kotahi NZTA's Stormwater Design Philosophy Statement (May 2010)

potentially providing overland flow paths or secondary inlets which can be addressed at the detailed design stage. A range of potential mitigation measures for operational effects have been set out in Section 8.1 and it is anticipated the most appropriate mitigation will be identified and will form part of detailed design.

Potential flooding effects will be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in this Report.

NoR S2: SH16 Main Road Upgrade

The assessment of operational effects found negligible to moderate flood effects during the operational phase of the corridor. A range of mitigation measures which might be implemented for operational effects have been set out in Section 8.1. There is space within the designation to mitigate this risk by providing new or upsized crossings with the aim of achieving flood neutrality which can be addressed at the detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in this Report.

NoR S3: Rapid Transit Corridor (RTC), including the Regional Active Mode Corridor (RAMC)

The assessment of operational effects found minor to moderate flood effects during the operational phase of the corridor. There is space within the designation to mitigate this risk by providing overland flow paths or secondary inlets which can be addressed at the detailed design stage. A range of potential mitigation measures for operational effects have been set out in Section 8.1 and it is anticipated the most appropriate mitigation will be identified and will form part of detailed design.

There was a moderate effect to flooding at properties along the RAMC. Several wetlands are proposed within the flood plain. For these wetlands potential mitigation could include raising the embankment and installing diversion drains for the overland flow path.

Potential flooding effects will be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in this Report.

NoR S4: Access Road Upgrade

There was a moderate effect as a result of increased flood levels at open space along the Access Road corridor. This effect could be mitigated by designing, installing and maintaining diversion drains alongside road to discharge into culvert crossing at Waitakere Rd. Mitigation will be finalised as part of detailed design.

Potential flooding effects will be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in this Report.

Sensitivity Analysis

A sensitivity analysis has been undertaken to consider the effects of additional rainfall under a more severe climate change scenario (3.8° temperature increase compared to the standard 2.1° temperature increase). The sensitivity analysis identified an increased risk of flooding at some locations. However, this increased risk can be addressed through the mitigation measures described in the report.

Conclusion

There may be some temporary construction phase flooding risk associated with temporary works required for the construction of culverts and stormwater management infrastructure. However, the details of the construction approach will be confirmed at detailed design.

It is expected that construction works can be carried out in a way that will appropriately manage the risk, and this can be defined through flood risk mitigation measures captured in the CEMP. Flood hazard has been identified as a matter to be addressed in the CEMP and included as a condition of the proposed designation.

Potential operational effects include increased flood water levels upstream and downstream of crossings and bridges. Effects were assessed as negligible to moderate. Operational impacts will likely be resolved during detailed design by optimising the design of culverts and bridges to minimise flood effects upstream and downstream of crossings. Potential flooding effects will be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in this Report.

2 Introduction

This flooding assessment has been prepared for the Northwest Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement (**NoRs**) for Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) (the "**Strategic Assessment Package**"). The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the construction, operation and maintenance of transport infrastructure in the Northwest area of Auckland.

The Strategic Assessment Package will provide route protection for the strategic projects, which include:

- Alternative State Highway (ASH), including Brigham Creek Interchange (BCI)
- the Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (RAMC)
- State Highway 16 (SH16) Main Road Upgrade
- Two RTC Stations, located at Kumeū and Huapai
- The upgrade of Access Road local arterial corridor

This report assesses the flooding effects of the Northwest Strategic Assessment Package identified in Figure 4-1 and Table 2-1 below.

Refer to the main AEE for a more detailed project description.

Table 2-1: Northwest Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (ASH), including Brigham Creek Interchange (BCI)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR S4	Access Road Upgrade
NoR HS	Huapai RTC Station
NoR KS	Kumeū RTC Station

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Strategic Assessment Package. Its purpose is to inform the AEE that accompanies the Strategic Assessment Package sought by Waka Kotahi and AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Strategic Assessment Package on the existing and likely future environment as it relates to flooding effects and recommends measures that may be implemented to avoid, remedy and / or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the stormwater context of the Strategic Assessment Package area;
b) Identify and describe the potential flooding effects of each Project corridor within the Strategic Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate potential flooding effects (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package; and
d) Present an overall conclusion of the level of potential flooding effects for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

This report draws a distinction between stormwater effects and flood hazard effects, which are a subset of potential stormwater effects.

Stormwater effects are broadly divided into:

- Quantity effects (such as flooding, erosion and changes to hydrology - which may cause effects on stream habitat, baseflow and sediment movement in streams),
- Quality (including the discharge of contaminants – which may cause effects on aquatic fauna, public health and amenity values) and the effects on streams due to the presence of in-stream structures.

These effects are considered through RMA section 13, 14 and 15 consents and are administered by regional councils (or, in the case of Auckland, as regional consents by the Auckland Council as a Unitary Authority).

Provision is made for the future management of the stormwater effects (stormwater quantity, stormwater quality and instream structures) by identifying the space required for stormwater management devices (for example drainage channels and wetlands) and incorporating land for that purpose into the NoRs. In identifying the land required for these devices, preliminary sizing and siting has been undertaken and offset allowances made for construction phase works.

The designation is a land use or district planning mechanism. Hence, the assessment of effects has been limited to flood hazard matters as they are the only matters that would trigger a District Plan consent requirement under the AUP:OP. In presenting information on flood hazard effects, it is therefore acknowledged that there will be a subsequent process for seeking regional council consents.

Flood hazard effects include changes to; the flood freeboard to buildings, the depth of flooding on property, the creation of new overland flow paths, the ability to access property by residents and emergency vehicles and potential flood prone areas caused by blockage of culverts.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Strategic Assessment Package as it relates to stormwater;
c) Identification and description of the existing and likely future flooding environment;
d) Description of the potential positive effects of the Project;

e) Description of the potential adverse flooding effects of construction of the Project;
f) Description of the potential adverse flooding effects of operation of the Project;
g) Recommended measures to avoid, remedy or mitigate potential adverse flooding effects; and
h) Overall conclusion of the level of potential adverse flooding effects of the Project after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Project, likely staging and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of flooding effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2.3 Preparation for this Report

In preparation of this report several resources were used to support the assessment. These included technical specialist inputs, previous reports, catchment flood models and team workshops.

The AUP:OP was used to identify the existing and likely future environment. Information from the Project Team and SGA Redhills and Kumeū models were used to assess the flood water levels and extents of the existing (pre-development) terrain.

It should be noted the existing terrain has been used for flood modelling of the pre-development and post-development scenarios as there is no information about what future landforms will take.

3 Assessment Methodology

3.1 Chapter Summary

The assessment of flooding effects has involved the following steps using the AC and SG GIS to identify where:

- Desktop assessment to identify potential flooding locations, namely:

– Existing buildings appear to be near/within the existing flood plains.
– Where the Projects involve work near stream crossings and major overland flow paths.

- Flood modelling of the pre-development (without SGA) and post-development (with SGA) terrain, including:

– Flood modelling of the proposed future land use using Maximum Probable Development (MPD) development with the 100year ARI plus climate change rainfall
– Model results were used to identify changes in the flood water levels to create flood difference maps.

- Inspection of the flood difference maps to identify flooding effects, including:

– At key cross drainage locations such as culverts and where there are noticeable deep flood levels, consideration was given to flood hazard issues.
– Properties and buildings with habitable floors showing potential to flooding hazard through flood extent within the existing building footprints.

- A sensitivity analysis to assess the potential impact of extreme climate change (3.8°) compared to the existing projected climate change temperature increase (2.1°).

3.2 Outcomes based approach

The stormwater and flooding considerations are based on an indicative design and proposed designation boundary which incorporate flexibility for design changes to respond to the future environment and detailed design. The effects assessment is based on the Project being able to meet the requirements of the proposed designation condition and provide any required mitigation within the proposed designation boundary.

The proposed conditions for the future detailed design require the Project be designed to achieve the following outcomes:

- No increase in flood levels for existing authorised habitable floors that are already subject to flooding (that is, no increase in flood level where the flood level using the pre project model scenario is above the habitable floor level)
- No more than a 10% reduction in freeboard for existing authorised habitable floors (that is, if existing freeboard was 500mm, an acceptable change would be to reduce freeboard to 450mm)
- No increase of more than 50mm in flood level on land zoned for urban or future urban development where there is no existing habitable dwelling

- No new flood prone areas (with a flood prone area defined as a potential ponding area that relies on a single culvert for drainage and does not have an overland flow path)
- No more than a 10% average increase of flood hazard (defined as flow depth times velocity) for main access to authorised habitable dwellings existing at the time the Outline Plan is submitted.

Compliance with the recommended flooding outcomes, secured by the proposed condition, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

Where the above outcomes can be achieved through alternative measures outside of the designation such as flood stop banks, flood walls and overland flow paths, this may be agreed with the affected property owner and Auckland Council.

This assessment identifies where flood effects require consideration and the types of mitigation measures that could be implemented to address the effect. The designation boundary has been confirmed to provide sufficient land to accommodate those potential mitigation measures identified.

Compliance with these flooding outcomes would be demonstrated through a detailed stormwater design and further flood modelling of the pre-development and post-development 100year ARI flood levels (with allowances for MPD and climate change) at the resource consent stage.

3.3 Desktop Assessment

To identify locations considered to be at risk of flooding effects a desktop study was carried out to identify areas where:

- Existing buildings are near / within the existing flood plains
- The project involves carrying out significant work near the stream crossings / major overland flow paths
- The project may alter the existing flood plains, ponding volumes, and natural drainage paths.

The following reference materials were used to perform the desktop study:

- Whenuapai Structure Plan
- Auckland Unitary Plan Operative in Part
- Auckland Council GeoMaps
- Concept Design Drawings
- Flood maps created by the SGA modelling team
- Indicative Construction Methodologies
- NZTA Stormwater Specification P46
- New Zealand Bridge Manual (SP/M/022) for freeboard allowance.

A full list of references is provided in Section 13.

3.3.1 Recent flooding in Kumeū

Auckland Council 2022 Stormwater Conference paper (Kumeū Floods – Predicted twelve years earlier – Jahangir Islam et al.) noted the following:

> *"On the evening of August 30 last year, during a level 4 covid lockdown, an extreme weather event caused extensive flooding of community, residential and commercial areas across West Auckland. Winds gusts were predicted to a maximum of 90 km/h. Auckland Civil Defense &*

Emergency Management issued a weather watch alert from the NZ MetService of a potential incoming weather event for Auckland from 2pm and overnight on August 30, 2021. Emergency Services responded to requests for assistance during the event with emergency evacuations carried out overnight on the 30th and throughout the following day. Auckland Council (AC) received overall total of 210 emergency requests for service (RFS) jobs. Of the 210 RFS received by council, 6 homes were reported to have water entering living areas however many more were unreported.

Auckland Region's second largest river system recorded the largest flood on record over the 43-year monitoring period at the Waimauku flow gauging site on the Kaipara River. The river flood level peaked at 9:30am on August 31. The recorded flood level was half a meter above the 1979 highest previously recorded flood level. The Rain Radar rainfall indicated 24-hour totals from the radar were greater than 230mm in Taupaki Catchment, upstream of Kumeū township".

The Auckland Council paper identified the August 2021 event was greater than 250year return period and the modelling was based on existing impervious coverage which is less than the future, fully developed, impervious coverage.

The impact of the flooding in Kumeū was significant and included a large area of commercial development adjacent to State Highway 16 (SH16). The road itself was also affected and was closed for eight hours due to flood waters.

Figure 3-1 Flooding closed the main road in Kumeū. (Source: 1 NEWS)

Figure 3-2 A house surrounded by flood waters in Auckland's Kumeū. (Source: 1 NEWS)

It is acknowledged that there is an existing flooding issue in the Kumeū township area which this project will not solve. The flood effects assessment has focused on ensuring that additional flood effects are not created as a result of the Project and to mitigate any increased flooding created by the Project where possible.

As noted in section 3.4.2 the model is conservative and assumes maximum probable development (MPD) land use without any additional attenuation delivered through other developments. The increased roadway imperviousness attenuation allowed for in this Project also has not been allowed in the modelling.

It is anticipated that there will be a further response to flooding in the North-West from developers and Council and further consideration should be given at the detailed design stage for flooding in the Kumeū township area.

3.4 Flood Modelling

3.4.1 Stormwater Catchment Overview

The Northwest Strategic Package projects are situated within four stormwater catchments namely, Kumeū-Huapai, Taupaki, Redhills and Whenuapai as shown in Figure 3-3 below.

Kumeū-Huapai catchment is 3,865Ha and is drained northwards by the Kumeū River and Ahukuramu Stream. The Taupaki catchment is 3,977Ha and is drained by two major unknown streams that converge into the Pakinui Stream. The catchment receiving environment for the Kumeū-Huapai and Taupaki is known as Kaipara, as they discharge to the Kaipara Harbour

Redhills catchment is approximately 1,366Ha and drains via two major streams namely, Waiteputa Stream and Ngongetepara Stream. The catchment receiving environment is Waitemata catchment.

Whenuapai catchment size is 1,931Ha and is drained by numerous creeks and streams, including Brigham Creek that forms the area's north-western boundary and Waiarohia Inlet which forms the area's north-eastern boundary. The catchment has two primary stream catchments, namely Totara Creek flowing to Brigham Creek and Waiarohia Stream flowing to the Waiarohia Inlet.

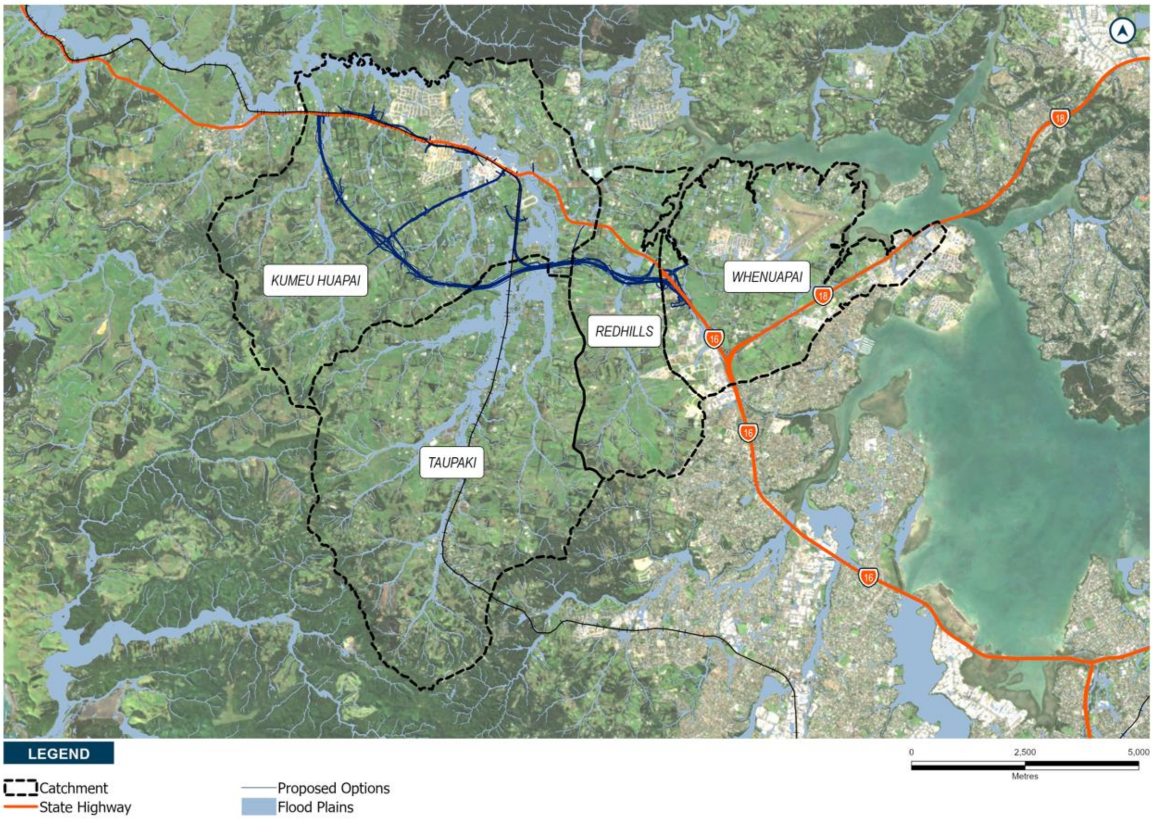

Figure 3-3: Existing 100yr ARI flood plain for Kumeū-Huapai Catchment (Auckland Council GIS)

3.4.2 Modelling Parameters

Auckland Council had produced Redhills and Whenuapai Rapid Flood Hazard Assessment catchment models which were adapted for this assessment. The Kumeū-Huapai-Taupaki model was developed by the SGA Modelling team using TUFLOW software.

To assess the flooding effects of the Projects on these catchments, two scenarios were considered for each NoR:

The two scenarios modelled for the assessment of effects were:

Scenario 1: Pre-development (without SGA)

- Future 100yr ARI rainfall events with 2.1° C of temperature increase to reflect climate change and future land-use without the project in place

Scenario 2: Post-development (with SGA)

- Future 100yr ARI rainfall events with 2.1° C temperature increase to reflect climate change and future land-use with the project in place
-

- For the sensitivity analysis a further two scenarios were modelled:

Scenario 3: Pre-development increased climate change (without SGA)

- Future 100yr ARI rainfall event with 3.8 ° C of temperature increase to reflect climate change and future land-use without the project in place

Scenario 4: post- development increased climate change (with SGA)

- Future 100yr ARI rainfall event with 3.8 ° C of temperature increase to reflect climate change and future land-use with the project in place

The proposed imperviousness for the maximum probable development (MPD) land use was applied, i.e. the model assumes the maximum impervious surface limits of the current zone or, if the land is zoned Future Urban in the Auckland Unitary Plan, the probable level of development arising from zone changes.

The modelling used an indicative design for the road which may not be the final design. The type and size of cross drainage structures are not fixed and will be verified for subsequent regional consenting and detailed design phases. Changes to these structures will alter the model outputs and upsizing the crossings may be required to mitigate upstream and downstream flood risk within design parameters.

New culverts have been added to convey flows at existing overland flow paths and some existing culverts have been extended to allow for the proposed road widening. To extend the culverts the existing grade has been extrapolated and the inlet and outlet invert levels have been established based on the existing pipe grade and overall length.

3.4.3 Climate Change

Climate change is accounted for in the model runs as per the revised Auckland Council (AC) Code of Practise (CoP) version 3 dated January 2022, which allows for 2.1°C of warming and a 16.8% increase on rainfall. A sensitivity analysis to understand the risk of increased climate change by comparing the results of 2.1°C of warming to 3.8°C of warming see Section 13.

For future detailed design climate change projections may be different to those used now along with rainfall inputs, impervious coverage and other modelling related parameters that can impact predicted model outputs and therefore mitigation needed to achieve flood neutrality.

3.4.4 Modelling Outputs

The modelling outputs were used to identify changes in predicted flood water levels and flooding extents. Increased flood hazard is associated with higher risk effects, for example a change in flood water level on land can result in the loss of use of the land or a reduction in the performance of drainage systems. The assessment criteria for the flooding assessment are shown in Table 3-1. For those areas identified as having potential flood effects mitigation measures have been proposed which can be confirmed at detailed design stage.

Table 3-1: Flooding effects assessment criteria

Effect	Change in flood water level on neighbouring property	Change in flood water level at habitable buildings
Positive	A reduction in flood level	A reduction in flood level
Negligible	Less than 0.05 m	Less than 0.05 m
Minor	0.05m to 0.5 m	0.05m to 0.15 m
Moderate	Greater than 0.5 m	Greater than 0.15 m

The required freeboard for bridges and culverts used to assess the suitability of the indicative design is set out in Table 3-2.

Table 3-2 Freeboard allowance for the level of serviceability to traffic (NZ Bridge Manual)

Waterway Structure	Situation	Freeboard	
		Measurement Points	**Level (m)**
Bridge	Normal circumstances	From the predicted peak flood water level to the underside of the superstructure	0.6
	Where the possibility that large trees may be carried down the waterway exists		1.2
Culvert	All situations	From the predicted flood water level to the road surface	0.5

3.4.5 Future Urban Zone

Development within the FUZ areas will change catchment hydrology, the terrain, building and property types that are potentially exposed to flooding. The assessment has therefore considered specific effects on existing properties and more generally considered effects on potential future development. It is anticipated that future developments will take account of flood risk and manage that risk within their development.

The model does not include the additional runoff generated by the increased impervious area from the new road as stormwater devices have been designed to adequately capture this additional runoff (see Section 3.6). However, the model does account for the increased impervious area as a result of development according to the AUP:OP zonings and the allowable impervious coverage within each zone.

Hence, the model output incorporates a degree of conservatism around future flood effects as it is anticipated that future developments outside the designation will need to design, construct and operate their own stormwater devices to ensure they can mitigate the stormwater generated by additional impervious areas to the pre-development scenario.

It is expected that coordination and integration of the corridor design with future development will be required to confirm and address potential future effects. Mitigation measures in the future detailed design will reflect the actual development in these areas. See Section 3.4.6 for more detail of the limitations of this assessment.

3.4.6 Model Limitations

All of the corridors have upstream and/or downstream catchments. The modelled scenarios use imperviousness assumptions associated with the future land use(s) shown in the Auckland Plan, Whenuapai Structure Plan and relevant Precinct Plans. However, it is probable that significant change in the catchments will take place before or shortly after the corridor is constructed.

The models include the existing roads and existing culverts where the culverts are 600 mm or greater. This modelling approach follows the Auckland Council Rapid Flood Hazard Assessment approach but allows for pipes down to 600mm to be modelled as opposed to 1200mm in the standard AC approach. This assumes that culverts < 600 mm diameter are considered to be fully blocked (which also aligns with the AC Code of Practise) although larger culverts are considered to be fully functional and no allowances for capacity reduction has been used.

Culverts have been added at selected crossings of the project corridors. However, the results from the models are considered appropriate to assess the relative or overall flooding effects due to the project corridors for the current stage of design.

The SGA design model is based on a preliminary design. The new culverts and bridges are indicative, they may not be the final solution as this will be determined by the detailed design. Future modelling will be used to ensure flood effects will be adequately mitigated and flood neutrality can be achieved.

The culvert sizes are an initial estimate used to assess the relative effects of flooding outside the corridors. Larger culverts can be constructed if required to mitigate effects with the size or levels of service. New or upgraded culverts will be confirmed at the future detailed design stage and will consider matters such as consent requirements, asset owner requirements, level of service, stream simulation design, fish passage, blockage.

3.5 Sensitivity Analysis

Sensitivity is the degree to which a system is affected, adversely or beneficially, by a given exposure[3]. In this instance the sensitivity of the designation to increased rainfall as a result of climate change has been considered.

As set out in Section 3.4.3, the flood model has allowed for 2.1°C of warming and a 16.8% increase on rainfall based on the AC CoP. However, given the uncertainty of climate change effects in the future the assessment has also considered a more severe climate change scenario based on 3.8°C of warming and a 32.7% increase in rainfall.

The results for 3.8°C of warming have been compared to those reported in the flood assessment for 2.1°C of warming and areas where higher rainfall may increase flooding have been identified. Further mitigation at these locations has been included where necessary to encourage flood resilience.

[3] Intergovernmental Panel on Climate Change. (2007). Climate Change 2007: Contribution of Working Group II to the Fourth Assessment Report. Cambridge, UK: Cambridge University Press.

In the future it is possible there may be different requirements for climate change. However, at this stage a pragmatic approach has been taken using the current design thinking (2.1°) along with a sensitivity analysis using the more extreme rainfall predictions (3.8°).

3.6 Stormwater management devices

While stormwater effects apart from flooding are not assessed, provision is made for the future management of potential stormwater effects (stormwater quantity and stormwater quality) by identifying the space required for stormwater management devices (SWMDs, i.e. treatment swale and wetlands) and incorporating land for that purpose into the NORs. In identifying the land required for these devices, preliminary sizing and siting has been undertaken and extra space allowed for constructing the works.

Some key assumptions that were used to identify the amount of land sought for stormwater management works within the designation include the following:

- Wetlands are sized to attenuate 100 year peak flows from the corridor (as of the required stormwater wetland sizing criteria this gives the largest footprint). Quality and retention/detention requirements are able to fit within the footprint
- Allowance is made for wetland attenuation storage and hydraulic gradients from corridor inlet to discharge point (typically a minimum of 2.0 to 2.5m vertically)
- Wetland geometry and footprints were modelled to determine the required cut and fill and a 15m buffer added for construction purposes and maintenance access
- A minimum 6m buffer is provided around the corridor earthworks extents to provide space for construction purposes and allow for works such as drainage channels and culvert inlets/outlets and flexibility in the vertical alignment
- Diversion channels are identified where they are needed to prevent upstream flooding.

These allowances are considered appropriate for sizing the devices at this early stage of the design process and also provide some flexibility for future refinement. The design of devices is not discussed further in this report as this is considered a matter that will be developed further for the future regional consents and implementation processes.

In general, the approach has been to avoid SWMDs in floodplains where possible. If this is not possible, the design has sought to employ offline systems located in low velocity flood zones where has minimal risk of scour for resilient and maintainable systems.

The flood model does not account for the flood water storage capacity provided by the proposed SWMDs (wetlands or swales) even though they are designed with attenuation capacity for the additional runoff generated by the increased impervious area from the new road infrastructure.

While the project is not intended to remediate existing flood hazards, it is anticipated the proposed SWMDs will provide improvements in water quality and attenuation where practicable.

4 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 4-1 below, with a brief summary of the Strategic Assessment Package projects provided in Table 4-1.

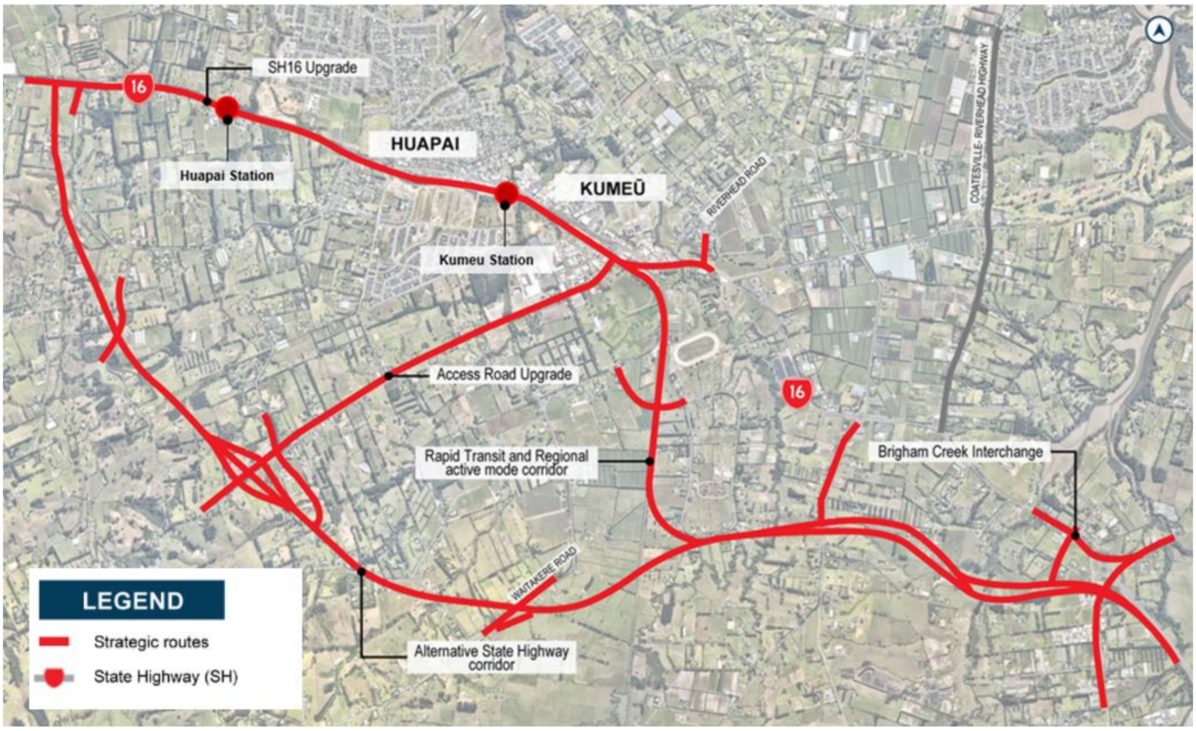

Figure 4-1: Northwest Strategic Assessment Package – Overview of NoRs for Assessment

Table 4-1: Strategic Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Alternative State Highway	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange.	Waka Kotahi
State Highway 16 Main Road Upgrade (alteration to existing designation 6766)	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New Rapid Transit Corridor and active mode corridor in one co-located corridor.	Waka Kotahi
Kumeū RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway.	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road Upgrade		Upgrade of Access Road to a four-lane cross-section with separated cycle lanes and footpaths on both sides of the corridor.	Auckland Transport

Please refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

5 Summary of Modelling Results

A summary of the operational effects for each of the corridors is set out in Table 5-1 below and discussed in more detail in Section 8.

Indicative mitigation measures have been provided in in Section 8 which will minimise flooding effects and help enable the outcomes set out in Section 3.2 to be met. The outcomes generally reflect a negligible up to minor flood effect i.e. <0.05m increase in flood depth. The outcomes set out in Section 3.2 will form part of the designation conditions and compliance with those conditions will ensure the residual flood effects for all NoRs will be negligible up to minor.

Table 5-1: Summary of flood modelling results

Corridor name	Location	Potential effect without mitigation	Potential effect with implementation of the recommended flooding outcomes
NoR S1	Ngongetepara Stream crossing (Points 15A and 4A in Figure 9-1)	+0.17m upstream, +0.03m downstream Minor effect upstream, no effect downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Pomona Road (Point 57 and Point 58 in Figure 9-2)	-0.50m upstream, +0.03m downstream Positive effect upstream and negligible effect downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Totara Creek (Points 14A and 2A in Figure 9-3)	+0.09m upstream, +0.52m downstream Minor effect upstream, moderate effect downstream Less than 1.2m freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Karure Stream (Point 5A and 16A in Figure 9-4)	+0.58m upstream, +1.63m downstream Moderate effect upstream and downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Boord Crescent (Point 6A and 7A in Figure 9-6)	+1.52m upstream, +0.32m downstream Moderate effect upstream and minor effect downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Pomona Road crossings	+0.25m upstream, +0.06m downstream	No more than 0.05 m increase in flood level, Negligible up to minor effect

Corridor name	Location	Potential effect without mitigation	Potential effect with implementation of the recommended flooding outcomes
	(Points 10A and 11A in Figure 9-2)	Moderate effect upstream and minor effect downstream Adequate freeboard	
	Foster Road crossings (Point 71 and Point 72 in Figure 9-8)	+0.49m upstream, -0.01m downstream Moderate effect upstream, positive effect downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
NoR S2	Kumeū Township (Point SH7)	+0.30 m Moderate effect	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Foster Road (Point 12A and 13A in Figure 10-3)	+0.09m upstream, +0.09m downstream Minor effect upstream and downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Main Road (Point 29 and 30 in Figure 10-4)	+0.79m upstream, -0.27m downstream Moderate effect upstream and positive effect downstream	No more than 0.05 m increase in flood level, Negligible up to minor effect
NoR S3, NoR KS, NoR HS	RTC / RAMC (Point 31 and 32 in Figure 10-4)	+0.67m upstream, -0.27m downstream Moderate effect upstream and minor effect downstream	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Karure Stream crossing (Point RTC2 in Figure 9-4)	+1.74 m Moderate effect	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Kumeū Rapid Transit Station (RAMC1 in Figure 11-1)	0.0 m	no flood hazard effects
	Huapai Rapid Transit Station (Point 27 and 28 in Figure 10-4)	+0.25m upstream, +0.05m downstream Minor effect upstream, negligible effect downstream	No more than 0.05 m increase in flood level, Negligible up to minor effect
NoR S4	Unnamed stream crossing (Point 1C and 2C in Figure 12-1)	+0.01m upstream, -0.04m downstream Negligible effect upstream, positive effect downstream Adequate freeboard	No more than 0.05 m increase in flood level, Negligible up to minor effect
	Access Road (Point AC1 to AC3 in Figure 12-1)	+0.12 m to +0.22 m Minor to moderate effect	No more than 0.05 m increase in flood level, Negligible up to minor effect

6 Strategic Positive Effects

The positive effects for projects are those where the predicted 100yr ARI flood level difference map shows a decrease in water levels and an increase in freeboard for bridges, culverts and habitable buildings using the criteria set out in

Table 3-1 and Table 3-2. There are positive flooding effects for all NoRs.

Positive flooding effects for the projects include raising the existing road levels which will have a positive effect for road users by preventing flood flows across the road and reducing flood hazard.

Where new bridges are proposed, the maximum freeboard requirement has been adopted to provide flood resilience. The positive effects from the proposed new bridges identified by the model include:

- All proposed new bridges have a freeboard of 1.2 m, including over Totara Creek, Ngongetepara Stream and Kumeū River.
- New bridges over Totara Creek, Ngongetepara Stream and Kumeū River which have been confirmed to increase the freeboard for the road and decrease water levels upstream and downstream of the bridge crossing for the 100yr ARI flood level.

The projects create the opportunity to improve existing culvert capacities and/or propose new culvert crossings to improve overland and stream flow in the area. For example, at Chainage 4140 there is a positive effect upstream due to increased conveyance under the road.

It is noted that the proposed culverts and bridges form part of the indicative design and the final design may include different crossings. The final design will be subject to further flood modelling at the detailed design stage. The final design will ensure that adequately mitigated and flood neutrality can be achieved.

7 Strategic Construction Effects

The construction effects apply to the entire project, however based on the location of works in terms overland flows or known flood extents in the vicinity. The proposed construction works which can result in flooding effects include:

- Construction of new culvert crossings or upgrading of existing culvert crossings
- Construction of new bridges over streams or overland flow paths
- Installation of diversion drains / realignment of existing overland flow paths
- Construction of new wetlands
- Temporary use of lay down areas.

For all NoRs there is an increased flood risk for the proposed construction works. The potential effects of these are:

- Bulk earthworks to complete the contouring for new landscape features e.g. wetlands and new or upgraded culverts require a dry works area and can alter overland flow paths or generate erosion and sediment effects
- The construction of new bridges over streams will require temporary staging platforms for piling rigs and cranes to be constructed on the banks and possibly over the stream bed and potentially causing a constriction to flood flows and raising upstream flood levels
- The siting of wetlands within an existing overland flow path can obstruct runoff and result in flows being diverted towards existing properties.

Section 7.1 below describes methods for minimising/mitigating these potential effects.

7.1 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

The management and mitigation measures for construction effects are:

General:

- Carrying out earthworks during the summer / dry months to reduce the risk of flooding
- Locating lay down areas outside of existing overland flow paths
- Managing the overland flow paths to make sure flows are not diverted toward existing buildings or properties
- Construction Environmental Management Plan (CEMP) be developed prior to construction by an experienced Stormwater Engineer and shall consider the effects of temporary works, earthworks, storage of materials and temporary diversion and drainage on flow paths, flow level and velocity. Including:
  - Siting construction yards and stockpiles outside the flood plain
  - Diverting overland flow paths away from area of work
  - Minimizing the physical obstruction to flood flows at the road sag points
  - Staging and programming to provide new drainage prior to raising road design levels and carry out work when there is less risk of high flow events

- Methods to reduce the conveyance of materials and plant that is considered necessary to be stored or sited within the flood plain (e.g. actions to take in response to the warning of heavy rainfall events).

Construction of new and existing culvert crossings and wetlands:

- Existing culvert extensions should be done prior to commencement of bulk earthworks to allow for the passage of clean water across the site
- Installing temporary diversions or to allow flows to be maintained while new culverts and wetlands are constructed
- For larger embankments requiring a longer duration of works or for overland flow paths with more regular and higher flow rates diversions should be installed prior to works commencing
- Where no diversion is required a 6m working clearance between any earthworks and designation boundary should be adopted to accommodate access and materials
- For larger diameter pipes a working clearance of ±20m from the upstream extent and ±15m from the downstream extents should be provided.

Construction of new bridges:

- Temporary platforms should generally be set back as far as practicable from the stream banks and main channel to minimise the risk of flooding

Staging of earthworks for the abutments and stockpiling of materials outside the flood plain to mitigate the potential for blocking flow paths and flood plains.

8 Strategic Operational Effects

There are a range of operational effects particularly from proposed new bridges and crossings. The model is based on an indicative design which may be subject to further refinement and it may be that some of these structures are modified in the future. For the project the assessment of operational flooding effects considered:

- New culvert crossings (≥ 600 mm diameter)
- New bridge structures at Totara Creek, Ngongetepara Stream, Kumeū River and its tributaries, and Ahukuramu Stream
- Significant areas where the new road embankment encroaches existing flood prone areas
- The extent of flooding on existing properties due to the new project corridor

The effects of these are:

- Increasing impervious areas resulting in increased runoff and potentially increased flood levels
- Altering existing overland flow paths resulting in flows being redirected towards existing properties
- Obstructing an existing overland flow path resulting in ponding at existing low points or newly created depressions along the corridor
- Improving flows under the road reducing upstream flood levels and increasing flood levels at properties further downstream.

The new bridge structures resulted in positive effects (see Section 6). For the culverts the effects were considered to be negligible to moderate prior to mitigation. This includes all NoRs (see Table 5-1).

The mitigation measures set out in Section 8.1 have been designed to assist in minimising flood effects. There are a range of potential mitigation measures that can be applied and additional modelling during detailed design will consider which measures are most appropriate to ensure adverse flood effects are minimised, remedied or mitigated. The detailed design would then need to demonstrate compliance with outcomes set out in Section 3.2 as required by an appropriate designation condition.

8.1 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

It is recommended that during detailed design additional flood modelling is carried out and mitigation measures implemented as required to achieve the outcomes set out in Section 3.2. Compliance with these outcomes will be required as a designation condition. Based on the interim design potential mitigation measures have been identified in order to show that the feasibility to meet these outcomes has been considered.

Mitigation measures which may be implemented include:

- Creating new overland flow path diversions to discharge to nearby overland flow paths or streams to mitigate ponding and decrease flood levels at affected properties
- Increasing culvert sizes so that the upstream and downstream water level differences do not increase by more than 0.5m on land zoned for urban and future urban development
- Upgrading culverts by adding smaller culverts to create a balance between the flood level differences upstream and downstream

- Installing drains at the toe of embankment sloping towards the culverts can also allow for additional storage to decrease the velocity and peak flow through the culvert crossings
- Optimising the proposed bridge span and freeboard during detailed design
- Integrating development design requirements for FUZ upstream and downstream of the proposed corridor.

Where the above outcomes can be achieved through alternative measures outside of the designation such as flood stop banks, flood walls and overland flow paths, this may be agreed with the affected property owner and Auckland Council.

9 NoR S1: Alternative State Highway, including Brigham Creek Interchange

9.1 Project Corridor Features

9.1.1 Catchment Characteristics

The corridor crosses several overland flow paths and six major streams, namely Totara Creek, Ngongetepara Stream, Karure Stream, Kumeū River and Ahukuramu Stream. The existing 100year ARI flood maps from the latest catchment models with MPD and existing terrain show flooding at:

- new potential bridge crossings at Totara Creek, Ngongetepara Stream, Kumeū River, unnamed streams at Chainages 7,200 and 10,000
- properties at 32, 40 and 44 Brookvale Lane, Taupaki; and
- properties at 116 Foster Road, Huapai.

Existing flood prone areas from Auckland Council Geomaps are evident where overland flow paths and streams traverse the corridor.

9.2 Existing and Likely Future Environment

9.2.1 Planning Context

The Alternative State Highway (**ASH**) corridor, including the Brigham Creek Interchange (**BCI**), is largely rural and is proposed to traverse land zoned under the AUP:OP as Rural – Countryside Living Zone, Rural – Mixed Rural Zone and Rural – Rural Production Zones.

The ASH corridor will also traverse two separate areas of FUZ in Redhills North and Kumeū-Huapai with the Brigham Creek Interchange also currently sitting within proposed FUZ land. Table 9-1 below provides a summary of the existing and likely future environment as it relates to the ASH and BCI.

Table 9-1: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[4]	Likely Future Environment[5]
Rural	Rural - Mixed Rural Zone, Rural - Countryside Living Zone Rural - Production Zone	Low	Rural
Undeveloped greenfield areas	Future Urban	High	Urban

[4] Based on AUP:OP zoning/policy direction
[5] Based on AUP:OP zoning/policy direction

Please refer to the AEE for further information on the planning context.

9.3 Proposed works

For NoR S1 the Project involves the construction of a new four-lane motorway corridor with a cross-section of approximately 50m to accommodate a four-lane dual carriageway and separated cycle lanes and footpaths. The typical cross section includes an active mode corridor with central and side barriers.

An underpass is proposed at Taupaki Road and bridges over the NAL with further grade separations at Waitakere Road, Pomona Road, Tawa Road, Puke Road and Foster Road.

Other proposed works in NoR S1 which are relevant for the flooding assessment include:

- Construction of new bridges over Totara Creek, Ahukuramu Stream, Ngongetepara Stream, Kumeū River and tributaries
- Construction of new culvert crossings for overland flow paths / streams
- Construction of diversion drains / realignment of overland flow paths
- Construction of new wetlands of which two (ASH Wetland 5 and 15) are partially within the current 100year flood plain [6].

9.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

9.4.1 Positive Effects

Ngongetepara Stream bridge crossing

New bridges are also proposed at Ngongetepara Stream (Points 15A and 4A in Figure 9-1) which will increase the freeboard for the road with the bridge soffit > 1.2m. This reduces the potential flood effects for road users.

[6] The preference is to locate wetlands outside of the flood plain where possible. There is flexibility within the designation to design stormwater ponds to avoid the floodplain and this will be confirmed at outline plan stage through the final design

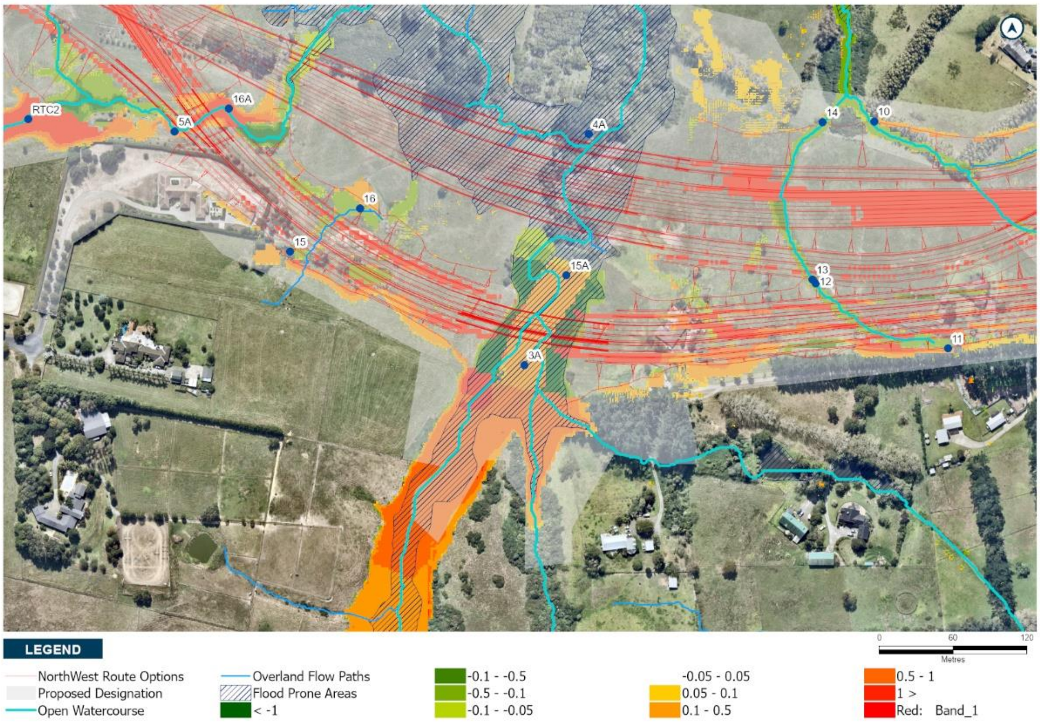

Figure 9-1: Flood Difference Maps for Ngongetepara Stream bridge crossing

The new proposed culvert crossing at 73 Pomona Road (Chainage 7900) shows a decrease in the 100year ARI flood level upstream and a decrease downstream of the crossing (Point 57 and Point 58 in Figure 9-2). The level between the design road level centre line and the flood level is 12.7m freeboard which is above the 0.5m freeboard required over a culvert. Similarly, the new crossing proposed at 146 Motu Road (Chainage 7400) shows a decrease of -0.02m upstream and -0.19m downstream which is a positive effect.

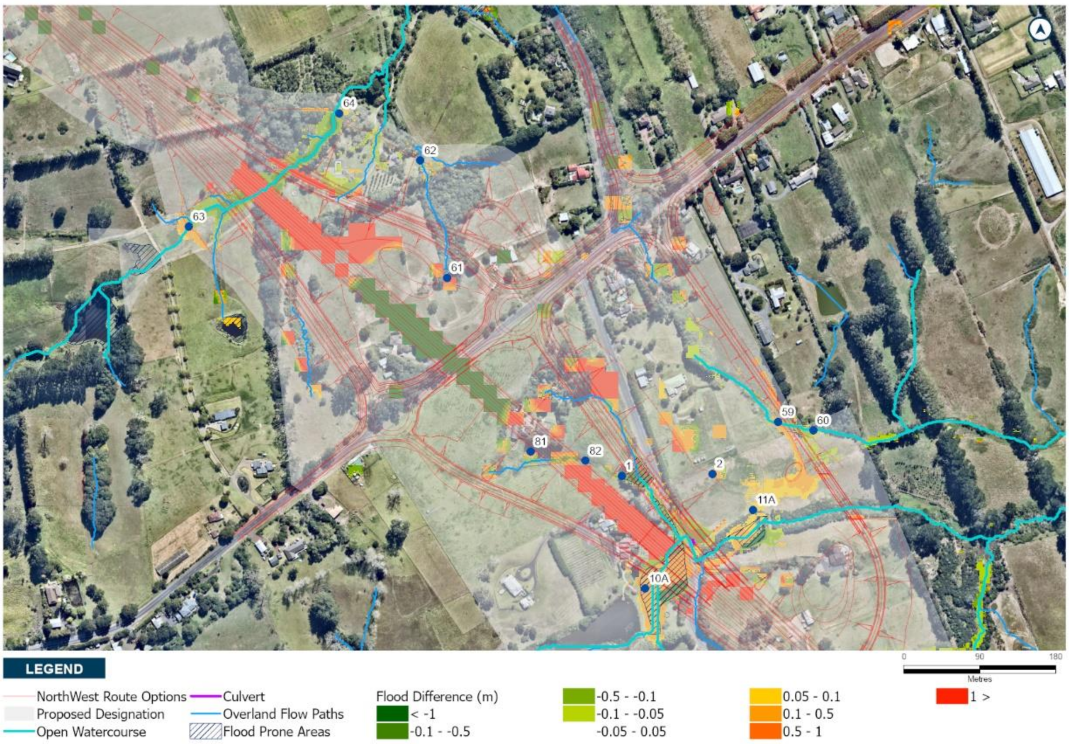

Figure 9-2: Flood Difference Maps for Pomona Road

9.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Stream crossings are key sites for potential flooding effects during construction, this includes:

- Totara Creek
- Ngongetepara Stream
- Unnamed Stream
- Unnamed Stream and Pomona Road
- Kumeū River
- Ahukuramu Stream

9.4.3 Recommended measures to avoid, remedy or mitigate construction effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes. Various culverts need to be installed or upgraded. There could be increased flood levels or new flow paths created during construction if adequate flow diversions are not provided.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

Lay down areas will be confirmed during the construction phase and therefore siting them with respect to flooding constraints should be considered further through the CEMP.

All other mitigation measures as set out in Section 7.1 apply.

9.4.4 Assessment of Operational Effects

9.4.4.1 Brigham Creek Interchange

Totara Creek bridge crossing

The proposed 30m Totara Creek bridge spans across a 30m wide 100year ARI flood plain with bridge piers set outside the main river channel.

The results for the 100year ARI pre-development scenario show that the flood level at the location of the proposed bridge structure is RL 17.59m upstream and RL 14.34m downstream. For post-development the flood level increases to RL 17.68 (+0.06 m) upstream and RL 14.86m (+0.63 m) downstream (refer to Points 14A and 2A in Figure 9-3). The potential effects of the bridge on flood hazards are considered minor upstream and moderate downstream.

The structure has a freeboard of 0.72m between the 100year ARI flood level and bridge soffit which is below the 1.2m required freeboard. However, there are no effects on any nearby buildings. Potential mitigation options include lifting the alignment to increase freeboard. The designation boundary includes sufficient area to enable mitigation to be undertaken and a final solution can be at a future stage of design.

Figure 9-3: Flood Difference Maps for Totara Creek bridge crossing

Karure Stream crossing

The Karure Stream bridge provides adequate freeboard (+2.86 m) however, there is a moderate effect upstream and downstream of this crossing (+0.58m upstream, +1.63m downstream). Mitigation at this location is to increase the bridge opening to ensure that stream is not obstructed by embankments to avoid flood effects. This is possible within the existing designation boundary and a final solution can be addressed at a future stage of design.

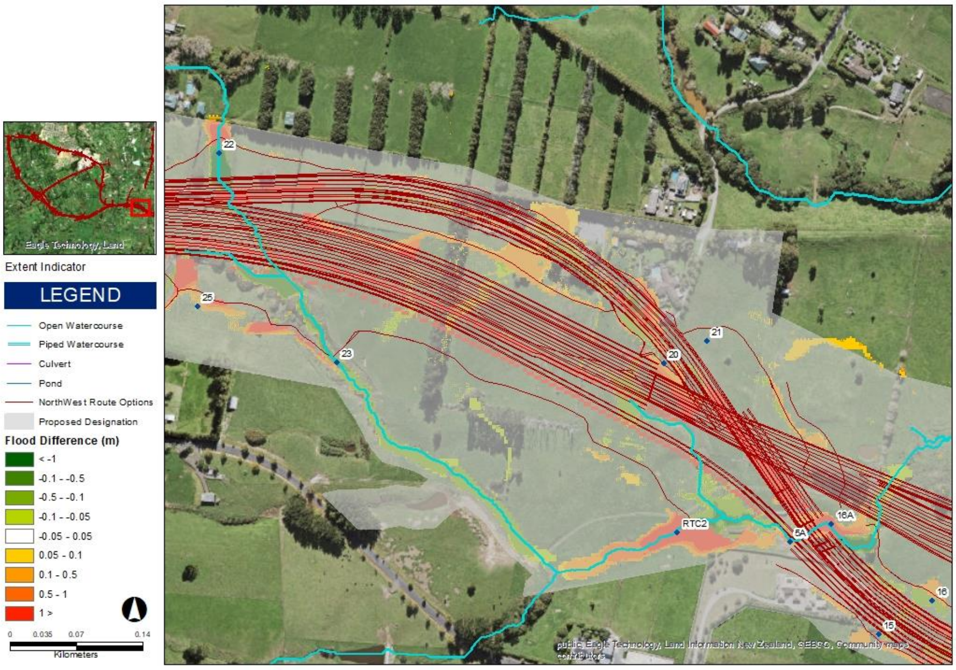

Figure 9-4: Flood Difference Maps for Karure Stream crossing

9.4.4.2 Boord Crescent, Kumeu

At this location there is a permanent stream which runs parallel to the proposed alignment. Consideration should be given to adjusting the alignment to avoid the stream or to provide a bridge crossing. A bridge crossing would also help to avoid a moderate effect for flood hazard at 182 Boord Crescent (Chainage 3300, Point 6A and 7A in Figure 9-6). Both the unnamed stream crossing and the crossing adjacent to the railway line are too narrow and could be widened to allow for more water to pass under the road alignment. Additional crossings will be required under the RTC and railway line to allow water to move from east to west to help balance the additional capacity provided a wider bridge opening(s). This mitigation could be accommodated within the designation the final solution will be provided at a future stage of design.

Wetland 5 at 176A Boord Crescent is located partially within the flood plain due to its size. However, during design and construction the flood plain will be modified by the proposed bridge. As a result of the changed terrain the flood plain would be diverted away from the wetland. Therefore, this is considered to have a negligible effect on flood hazard.

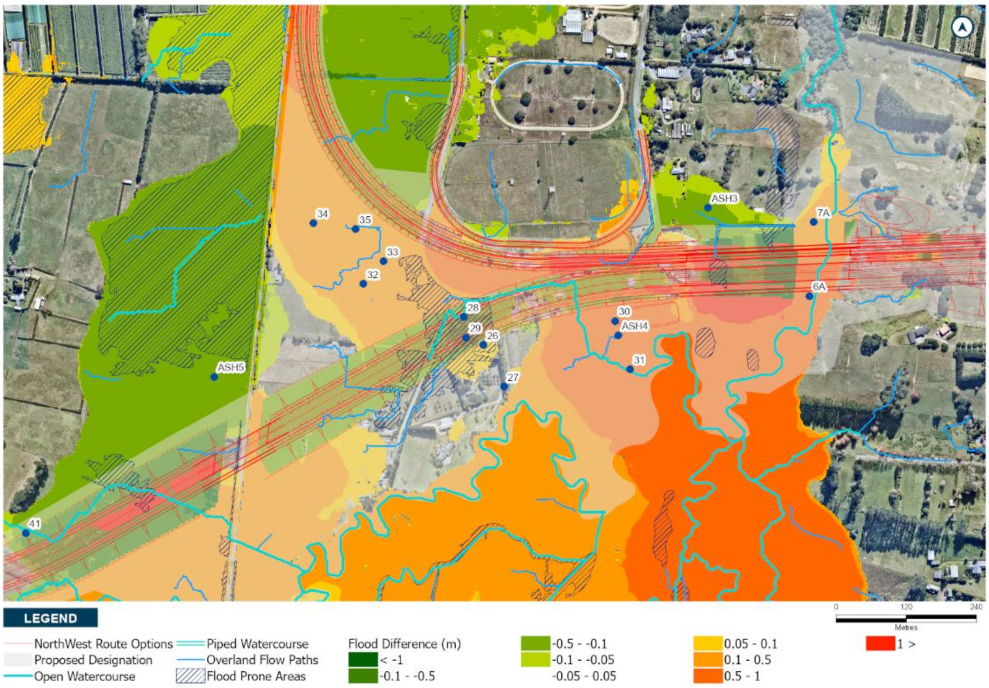

Figure 9-5: Flood Difference Maps for Boord Crescent

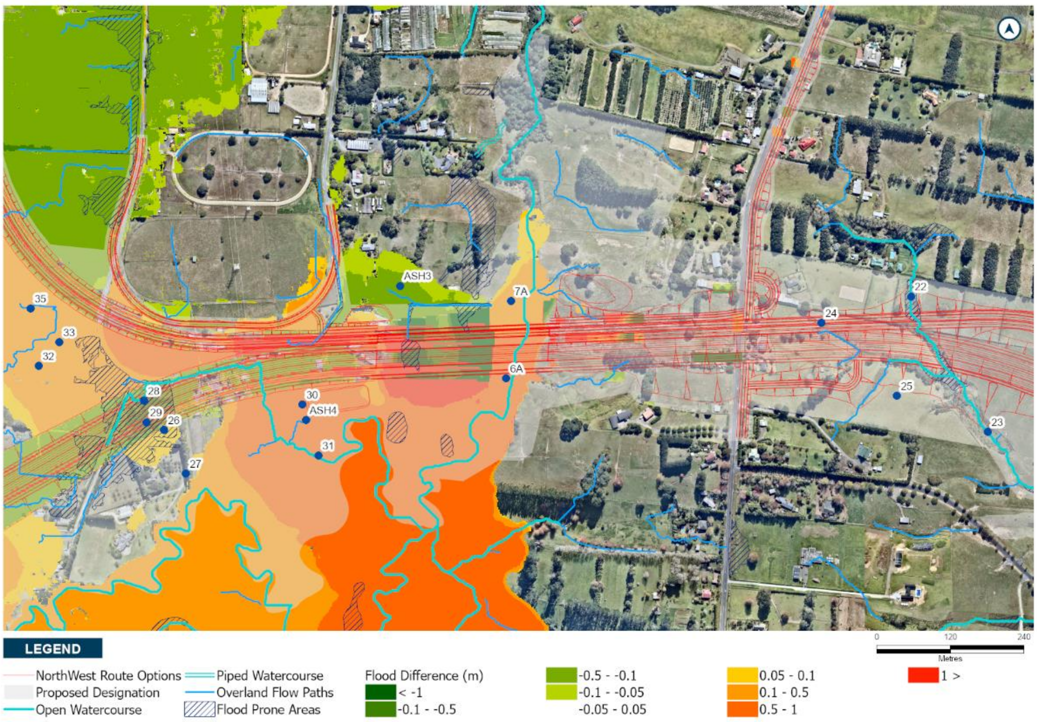

Figure 9-6: Flood Difference Maps for Boord Crescent

9.4.4.3 Pomona Road

For the crossing at 191 Pomona Road (Chainage 5820-5980, Points 8A and 9A in Figure 9-7) there is a minor effect directly upstream and a positive effect downstream. However, there is additional areas with an increase flood hazard upstream of the crossing (Points ASH1 and ASH8) which sees an increase in flood level more than 0.5m on areas of open space which is a moderate effect. The effect is due to a lack of drainage being modelled. Mitigation could include realigning the existing overland flow path alongside the embankment toe to discharge under the crossing. This can be provided within the designation the final mitigation will be confirmed during detailed design.

The proposed new crossing at 34 Pomona Road (Chainage 7200, Points 10A and 11A in Figure 9-2) shows an increase in flood hazard of +0.30m upstream and +0.07m downstream which is a minor effect. Mitigation could include design of the bridge to achieve flood neutrality. This can be done within the designation boundary and a final solution can be addressed at a future stage of design.

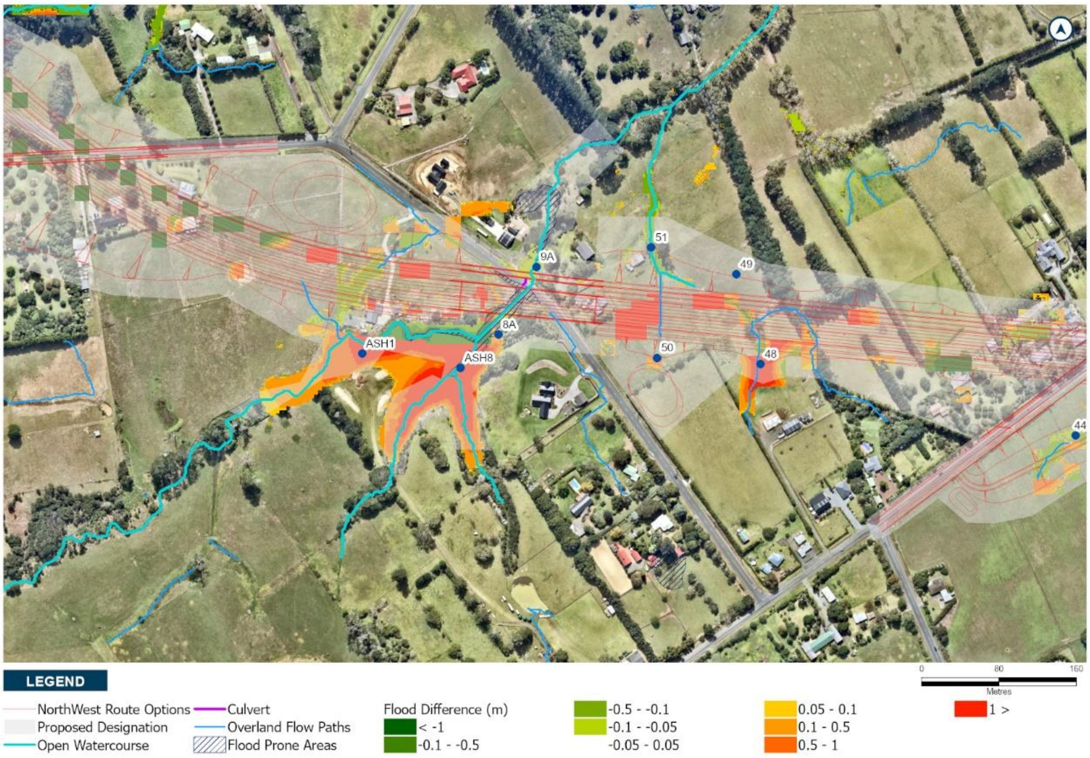

Figure 9-7: Flood Difference Maps for Pomona Road

9.4.4.4 Foster Road

At 62 Foster Road (Chainage 9500, Point FR1 and FR2 in Figure 9-8) the embankment is obstructing an overland flow path. Mitigation should ensure the size and the orientation of the embankments are optimised to avoid this effect. This can be done within the existing designation and the final mitigation will be confirmed at detailed design.

The new proposed culvert crossing at 58 Foster Road (Chainage 9700) shows an increase in the 100year ARI flood level upstream of the crossing. The level between the design road level centre line and the flood level is ± 3.33m freeboard which is above the 0.5m freeboard required over a culvert. The flood difference map shows an increase greater than 0.5m upstream which is considered a moderate effect (Point 71 and Point 72 in Figure 9-8).

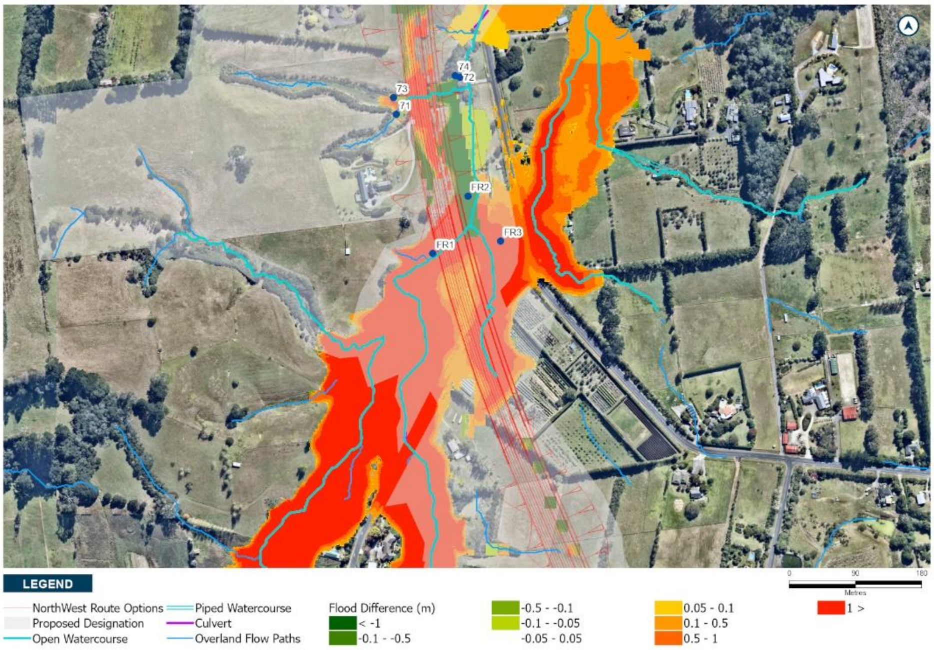

Figure 9-8: Flood Difference Maps for Foster Road

Wetland 14 at 23 Foster Road is partially within the flood plain, however only a berm is located within flood plain. This could be confirmed at detailed design with the potential for the pond design to be adjusted.

Wetland 15, at the intersection of Foster Road and SH16, is located within the current flood plain, however the proposed location is between two new alignment and both are raised so will change the flood plain behaviour. It is likely in the future in this location the terrain will change. The bridge located on SH16 (NoR S3) and the intersection of Foster Road may need to consider providing a wider overland flow path to mimic the existing flood plain, this is discussed in Section 10.5.1.3.

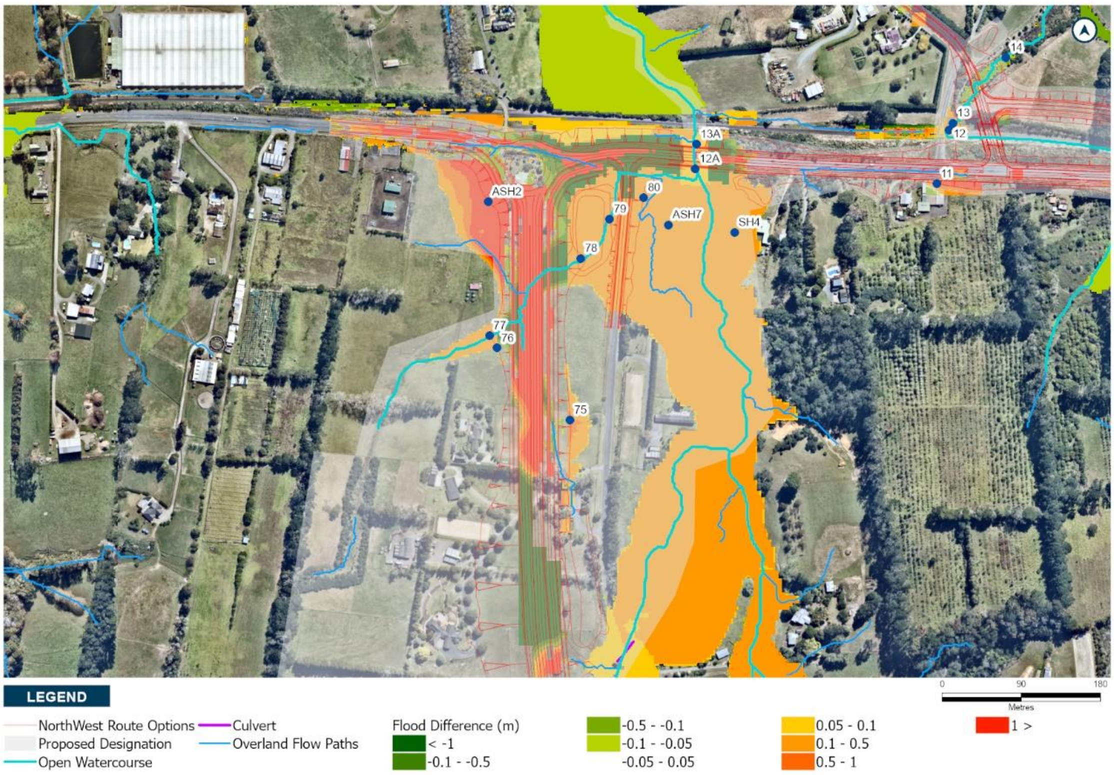

Figure 9-9: Flood Difference Maps for Foster Road

9.4.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically the following has been considered:

- Realign existing overland flow path alongside embankment toe to discharge under bridge/retaining wall and/or move road embankments away from stream
- Optimise bridge opening in detail design so that the upstream and downstream water level differences do not increase by more than 0.5m on land zoned for urban and future urban development.

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Mitigation measures will be confirmed as part of the Outline Plan process.

Compliance with the recommended flooding outcomes set out in Section 3.2, to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

9.5 Conclusions

Positive effects were identified as a result of the new road alignment for bridges at Totara Creek, Ngongetepara Stream. However, the elevated road increased flooding upstream and downstream of these locations. Detailed design would consider how to optimise the bridge design would ensure that resulting flood effects are minimised.

New proposed culvert crossings at 73 Pomona Road (Chainage 7900) and 146 Motu Road (Chainage 7400) showed a decrease upstream and downstream of the crossings which is a positive effect.

The construction activities for the Alternative State Highway include proposed new culverts, new bridges, new wetlands, and diversion drains or realignment of existing overland flow paths to facilitate these works. No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

The assessment of operational effects found negligible to moderate flood effects during the operational phase of the corridor. There is space within the designation to mitigate this risk by providing overland flow paths or secondary inlets which can be addressed at the detailed design stage. Potential mitigation measures for operational effects have been set out in Section 8.1.

Potential flooding effects can be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

10 NoR S2: SH16 Main Road Upgrade

10.1 Project Corridor Features

10.1.1 Catchment Characteristics

The corridor crosses several overland flow paths, unnamed streams and Kumeū River. Existing flood prone areas from AC Geomaps are evident where overland flow paths and streams traverse the corridor.

In addition, the existing 100year ARI flood maps from the latest Kumeū-Huapai catchment model with MPD and existing terrain show flooding at:

- Kumeū River bridge crossings at Chainage 380 and 1730
- Property at 22 Riverhead Rd, Kumeū
- Properties at 550, 573 and 695 State Highway 16, Huapai
- Properties at 9-11, 14, 16 Weza Lane, Huapai
- Properties downstream between Chainage 1200 and 1740, zoned Business – Light Industry Zone; and
- Properties at 68, 74, 395, 399 and 401 Main Road, Huapai.

Key stormwater management assets in NoR S2 include:

- Huapai Reserve North Wet Detention Pond (SAP ID 2000066734)
- Huapai Res Irrigation pond Wet Detention Pond (SAP ID 2000712914)

10.2 Existing and Likely Future Environment

10.2.1 Planning Context

SH16 Main Road is proposed to be upgraded to a 24m urban corridor along the urban extent of SH16 traversing through well-established retail, commercial and residential environs through Kumeū Huapai. This corridor contains a range of business, residential and open space and rural land uses under the AUP:OP (see zoning column in Table 10-1) between the eastern extent of the Kumeū-Huapai township and the western extent of the upgraded corridor (the intersection with the proposed ASH).

Table 10-1 provides a summary of the existing and likely future environment as it relates to the SH16 Main Road Upgrade.

Table 10-1: SH16 Main Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[7]	Likely Future Environment[8]
Rural	Rural Mixed Rural Zone,	Low	Rural

[7] Based on AUP:OP zoning/policy direction
[8] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[7]	Likely Future Environment[8]
	Rural Countryside Living Zone		
Business	Business (Industrial)	Low	Business (Industrial)
	Business (Local Centre)	Low	Business (Local Centre)
	Business (Mixed Use)	Low	Business (Mixed Use)
Residential	Residential	Low	Residential
Open Space	Open Space – Sport and Active Recreation	Low	Open Space
Undeveloped greenfield areas	Future Urban	High	Urban

Please refer to the AEE for further information on the planning context.

10.3 Proposed works

For NoR S2 the Project involves the widening of the existing 20m wide two-lane urban arterial to a 24m wide corridor with walking and cycling facilities on both sides of the corridor and the realignment of Station Road to form a new signalised intersection with SH16 and Tapu Road.

Other proposed works in NoR S2 which are relevant for the flooding assessment include:

- Construction of three new bridges over Kumeū River
- Construction of new culvert crossings for overland flow paths / streams
- Construction of diversion drains / realignment of overland flow paths
- Construction of stormwater wetlands including upgrade of Huapai Res Irrigation pond Wet Detention Pond (SAP ID 2000712914)

10.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

10.4.1 Positive Effects

There are positive effects for Kumeū township downstream of SH16 (see Figure 10-1). This is due to the raised elevation of SH16/RTC which prevents SH16 overtopping in certain places and reduces the flood depth downstream. However, there is an up to moderate effect upstream which can potentially be avoided at detailed design through new or improved crossings in this area.

Figure 10-1: Flood Difference Maps for Strategic Projects

10.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Stream crossings are key sites for potential flooding effects during construction, this includes:

- Kumeū River crossings
- Ahukuramu Stream

10.5 Recommended measures to avoid, remedy or mitigate construction effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes.

The potential flooding effects during construction will be managed through flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

10.5.1 Assessment of Operational Effects

10.5.1.1 Kumeū River Bridge no 1, 2 and 3

Raising the elevation of the road is exacerbating existing flooding issues in Kumeū town centre (see Section 3.3.1). In order to reduce the effects of flooding to be consistent with the pre-development scenario it is recommended the vertical alignment of SH16 is maintained at the existing level as much as possible. The RTC should still be raised in order to improve resilience for the new road. Where the road is raised there will be a positive effect associated with increased freeboard for the road and improved flood resilience. With the recommendation to leave SH16 at the current level as much as possible SH16 will still overtop between Kumeū River Bridge and Access Road as it currently does.

10.5.1.2 Kumeū Township

In the existing situation SH16 is predicted to overtop resulting in widespread flooding in the town centre. With the new road alignment water can no longer pass easily over SH16 and into the town centre. The RTC also prevents water passing easily from east to west. As a result of the obstruction, there is a reduction in flood levels north of SH16 and west of Riverhead Road. This area which is positively affected includes the majority of Kumeū township which is downstream of SH16 (see Figure 10-1).

However, due to water being held back by SH16 and RTC there is a minor effect on properties at the junction of SH16 and RTC of up to +0.30m at 7 Main Road, Kumeū (Point SH7). To mitigate this effect there is the potential for further crossings opposite Kumeū District Trotting Club under the RTC to allow water to pass under the elevated alignment. The modelling included an opening at this location, but this opening may need to be larger, or an additional opening provided. This potential mitigation can be provided within the existing designation and a final solution can be confirmed as part of the Outline Plan.

An alternative mitigation was considered which involved acquiring land at this location and lowering the ground level to provide flood attenuation. However, this was not considered feasible due to the flat terrain and the shallow water table.

Mitigation would be confirmed at detailed design stage which would provide more information about the crossings over Kumeū River and its tributaries and the final road alignment.

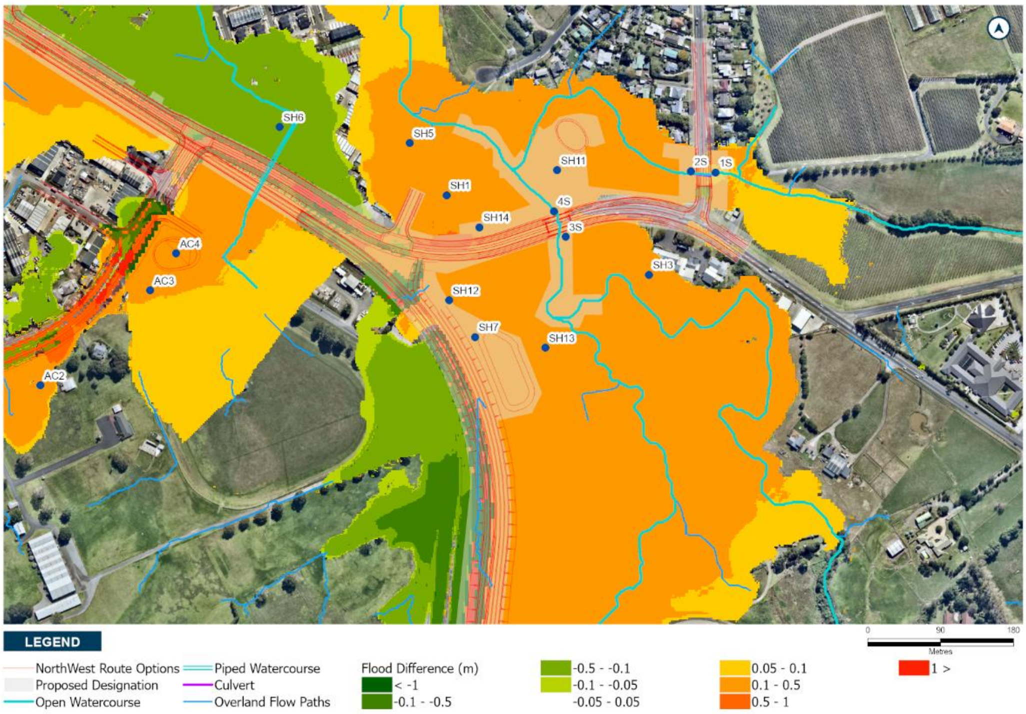

Figure 10-2: Flood Difference Maps for Strategic Projects

10.5.1.3 Foster Road

There is a minor effect at the Ahukuramu Stream bridge (Point 12A and 13A in Figure 10-3) with an increase of +0.09 m. The bridge over the stream should be longer and/or the intersection at Foster Road may need to be altered to provide a wider overland flow path to mimic the existing overland flow path. With a wider opening and increased capacity under the road the effect upstream of SH16 near Foster Road could be minimised. This mitigation is possible within the current designation and a final solution can be addressed at a future stage of design.

Figure 10-3: Flood Difference Maps for Strategic Projects

10.5.1.4 Main Road Huapai

Huapai Reserve North Wet Detention Pond (SAP ID 2000066734, near Point 25 in Figure 10-4) is not proposed to be upgraded. This pond is not directly impacted by the current alignment, however, may be affected by construction of the new RAMC.

At 587 Main Road, Huapai (Point 29 and 30 in Figure 10-4) there is a moderate effect upstream (+0.79 m) and a positive effect downstream (-0.27 m). This effect could be avoided by increased the culvert size at detailed design to achieve flood neutrality. Specific mitigation will be confirmed during detailed design.

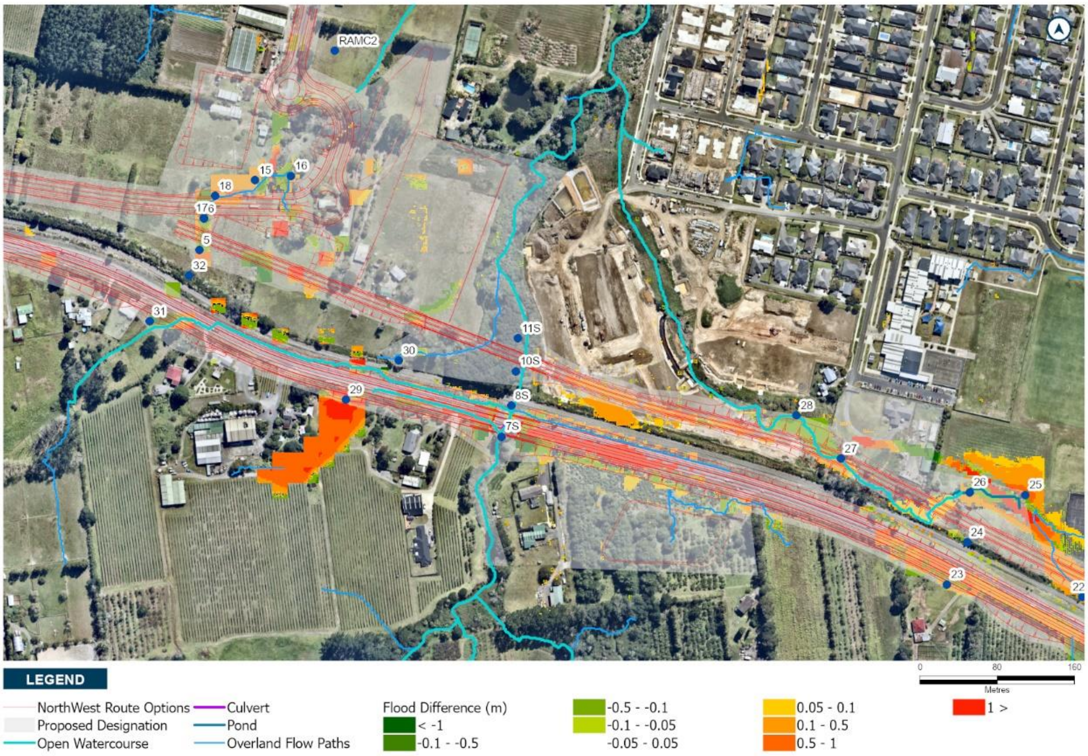

Figure 10-4: Flood Difference Maps for Main Road near proposed Huapai Station

10.5.2 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically the following has been considered:

- In order to reduce the effects of flooding south-east of Kumeū township it is recommended the vertical alignment of SH16 is maintained at the existing level. The RTC should still be raised in order to improve resilience for the new road.
- Provide sufficient stormwater capacity under RTC to enable water to pass under the elevated alignment

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Mitigation measures will be confirmed as part of the Outline Plan process.

Compliance with the recommended flooding outcomes set out in Section 3.2, to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

10.6 Conclusions

Positive effects were identified as a result of the new road alignment for the three bridges at Kumeū River. However, the elevated road increased flooding upstream and downstream of these locations. Detailed design to optimise the bridge design would ensure that resulting flood effects are negligible.

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

The assessment of operational effects found negligible to moderate flood effects during the operational phase of the corridor. A range of mitigation measures which might be implemented for operational effects have been set out in Section 8.1. There is space within the designation to mitigate this risk by providing new or upsized crossings with the aim of achieving flood neutrality which can be addressed at the detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

11 NoR S3: RTC and RAMC; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

11.1 Project Corridor Features

11.1.1 Catchment Characteristics

The Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) crosses several overland flow paths, unnamed streams and major streams namely; Kumeū River, Totara Creek and Ngongetepara Stream. Existing flood prone areas from AC GIS are evident where overland flow paths and streams traverse the corridor.

The existing 100-year ARI flood maps from the latest Kumeū-Huapai catchment model with MPD and existing terrain show flooding at:

- Kumeū River bridge crossing at Chainage 1740
- properties at 993 Waitakere Rd, Kumeū
- properties at 12, 32, 40 and 58 Brookvale Lane, Taupaki

11.2 Existing and Likely Future Environment

11.2.1 Planning Context

The RTC and RAMC form a single, integrated corridor (Note the RAMC only extends to the eastern entrance to Kumeū). This corridor predominately traverses rural land outside of the FUZ, however for assessment purposes it can be split into two sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. This rural section traverses land zoned under the AUP:OP as Rural – Countryside Living Zone, with an area zoned as FUZ in Redhills North.

The **urban section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[9] along this section. This urban section contains a range of land uses zoned under the AUP:OP as a mix of business zonings between the eastern extent of the Kumeū-Huapai township and Station Road. Table 11-1 below provides a summary of the Northwest existing and likely future environment as it relates to the RTC and the RAMC.

Table 11-1: RTC and RAMC Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[10]	Likely Future Environment[11]
Rural	Rural	Low	Rural

[9] Another Northwest Strategic project – refer to Section **Error! Reference source not found.** of this report
[10] Based on AUP:OP zoning/policy direction
[11] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[10]	Likely Future Environment[11]
Undeveloped greenfield areas	Future Urban	High	Urban
Business	Business (Industrial)	Low	Business (Industrial)
	Business (Local Centre)	Low	Business (Local Centre)
	Business (Town Centre)	Low	Business (Town Centre)
Residential	Residential	Low	Residential
Open Space	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary. The land is zoned under the AUP:OP as Business - Town Centre Zone.

An active modes overbridge is proposed across the NAL with active mode connections to:

- The Huapai Triangle crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and
- Wookey Lane crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and Business - Light Industry Zone.

Table 11-2: Kumeū Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[23]	Likely Future Environment[24]
Business	Business (Industrial)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential - Mixed Housing Suburban Zone	Low	Urban
Open Space (located to the north of the	Open Space – Informal Recreation	Low	Open Space

proposed station location)	Open Space – Sport and Active Recreation		

Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL and SH16 to FUZ land. Future connections will be determined as part of structure plan process.

Table 11-3: Huapai Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[25]	Likely Future Environment[26]
Residential (located to the east of the proposed station location)	Residential – Single House Zone	Low	Urban
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

Please refer to the AEE for further information on the planning context.

11.3 Proposed Works

11.3.1 Rapid Transit Corridor (RTC) and Regional Active Mode Corridor (RAMC)

The RTC is split into the following sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. Within the rural section, the RTC requires an extended width to accommodate both the RTC and RAMC.
- The **urbanised section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[12] along this section. Within this section, the RTC requires approximately 38m width to locate two FTN rail or lanes, separated active mode facilities and the SH16 Main Road Upgrade.

11.3.2 NoR KS: Kumeū Rapid Transit Station

Kumeū Station is proposed to be located between SH16 Main Road and the NAL, near Matua Road and west of the Kumeu River bridge. The Project provides for a bus services interchange, walking and cycling access as well as on demand travel (e.g., taxi pick up and drop off). An active mode overbridge will connect the Kumeu Station over NOR S3 RTC.

11.3.3 NoR HS: Huapai Rapid Transit Station

The proposed Huapai Station is located on the northern side of the NAL, at the end of Meryl Avenue. The Project provides for bus services interchange, walking and cycling on demand travel (pick up drop off) as well as park-and-ride. An active mode overbridge will connect the station over the RTC and NAL to the southern side of the FUZ, within the AC Spatial Strategy's indicative town centre.

11.3.4 Other works

Other proposed works in NoR S3 which are relevant for the flooding assessment include:

- Construction of new bridges over Kumeū River, Totara Creek and Ngongetepara Stream.
- Construction of new culvert crossings for overland flow paths / streams
- Construction of diversion drains / realignment of overland flow paths
- Construction of wetlands for RTC project corridor
- Construction of wetlands for RAMC project corridor
- Upgrade of Huapai Res Irrigation pond Wet Detention Pond (SAP ID 2000712914)

11.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

11.4.1 Positive Effects

The upgrade of the bridge over Kumeū River (points 10S and 11S in Figure 10-4) provides improvement to flood resilience with adequate freeboard between the 100yr flood level and bridge soffit level >1.2 m. The new bridge allows for water to move more easily under the road and results in minor positive effects upstream and downstream of the crossing.

A positive effect is also associated with the Kumeū River crossing (Point 5S and 6S in Figure 11-1) with a reduction in the flood depth. The bridge also provides greater than 1.2m freeboard. There is also a positive effect at 223 Main Road (Chainage 1600, Point 9S in Figure 11-1) which a reduction in flood level. This reflects the broader positive effects due to a reduction in flooding across the town centre see Section 10.5.1.2.

Figure 11-1: Flood Difference Maps for RAMC

11.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 7 above.

Stream crossings are key sites for potential flooding effects during construction, this includes:

- Kumeū River crossings
- Karure Stream crossing

11.4.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes. Various culverts need to be installed or upgraded. There could be increased flood levels or new flow paths created during construction if adequate flow diversions are not provided.

The potential flooding effects during construction will be considered by, and managed through, flood risk mitigation measures to be set out in the Construction Environmental Management Plan (CEMP).

Lay down areas will be confirmed during the construction phase and therefore siting them with respect to flooding constraints should be considered further through the CEMP.

All other mitigation measures as set out in Section 7.1 apply.

11.4.4 Assessment of Operational Effects

11.4.4.1 Rapid Transit Corridor (RTC) and Regional Active Mode Corridor (RAMC)

The new proposed culvert crossing at 623 State Highway 16 (Chainage 4140, Point 31 and 32 in Figure 10-4) shows an increase in the 100year ARI flood level upstream and downstream of the crossing. The level between the design road level centre line and the flood level is ± 1.34m freeboard which is above the 0.5m freeboard required over a culvert. However, the flood difference map shows an increase more than 0.5m upstream which is considered a moderate effect (Point 31 and Point 32 in Figure 10-4). One potential option for mitigation in the upgrading of the culvert to allow more water to pass under the road to decrease the flood level upstream. Final mitigation will be confirmed at detailed design stage.

Karure Stream

The new embankments for NoR S3 are obstructing Karure Stream causing flooding upstream of the crossing, including Point RTC2 (Figure 9-4). Increasing bridge opening to ensure the stream is not obstructed by embankments will avoid the effect. This is possible within the existing designation boundary and a final solution can be confirmed at detailed design stage.

Where the proposed road design runs parallel to the rail line the elevation of both corridors creates an area of ponding (Point RTC 1). Potential mitigation includes the construction and operation of a new culvert crossing under RTC which would avoid this effect by alleviating ponding. The final mitigation will be confirmed at detailed design stage.

11.4.4.2 Kumeū Rapid Transit Station

At the proposed station location (301 Main Road, Huapai, Point RAMC1 in Figure 11-1) there are no flood hazard effects. During detailed design the network for the station will need to confirm no flood hazard effects.

11.4.4.3 Huapai Rapid Transit Station

The new proposed culvert crossing at Chainage 3460 (point 27 and 28 Figure 10-4) shows an increase in the 100yr ARI flood level upstream and downstream of the crossing. The level between the design road level centre line and the flood level is ± 2.65m freeboard which is above the 0.5m freeboard required over a culvert. For a post-development the flood level +0.02m upstream and -0.53m downstream which is a negligible effect upstream and positive effect downstream. The overall effect can be considered positive.

The new proposed culvert crossing at Meryl Avenue Chainage 180 shows an increase in the 100year ARI flood level upstream and downstream of the crossing. The level between the design road level centre line and the flood level is ± 1.08m freeboard which is above the 0.5m freeboard required over a culvert. The flood difference map shows an increase between 0.05m and 0.5m upstream which is considered a minor effect and a decrease downstream which is a positive effect (Point 15 and Point 16 in Figure 11-2). Potential mitigation includes optimising culvert in detailed design to achieve flood neutrality. The final mitigation will be confirmed at detailed design stage.

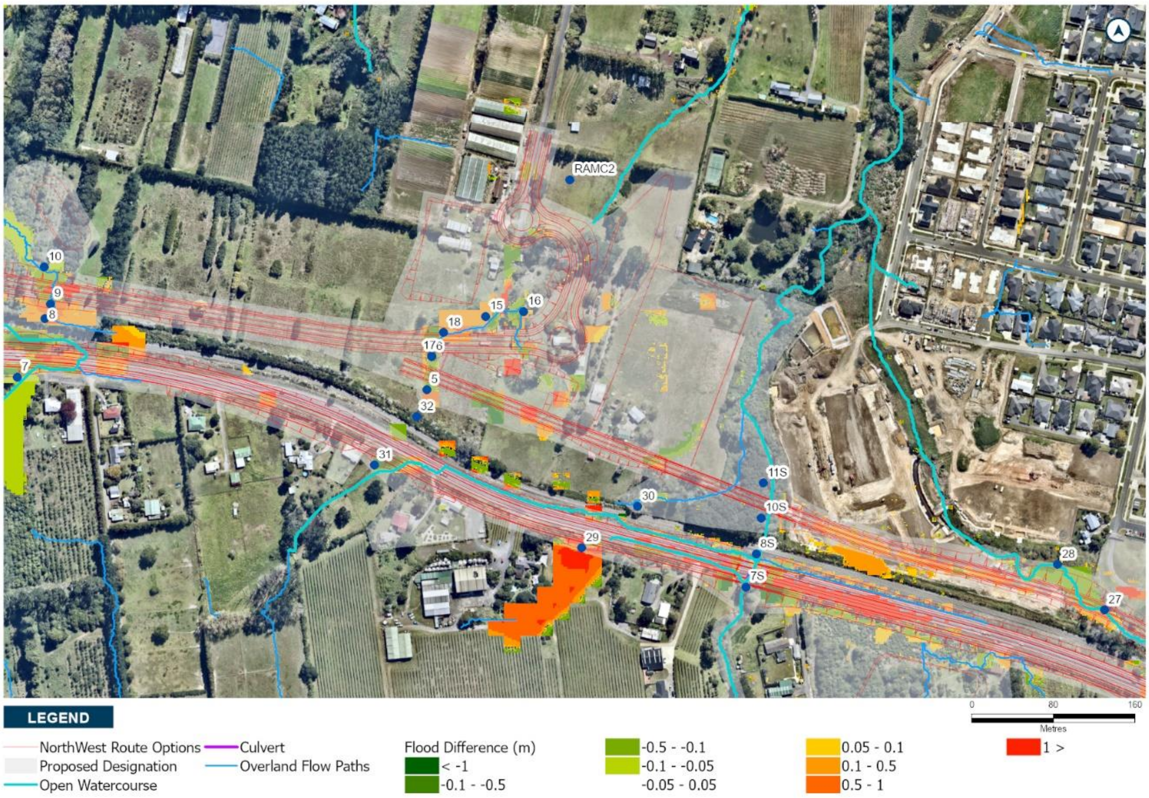

Figure 11-2: Flood Difference Maps for Huapai Station

11.4.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically the following has been considered:

- Increase bridge opening over Karure Stream to ensure that stream is not obstructed by embankments
- Considering raising the vertical alignment to increase freeboard at Chainage 60
- Install and maintain a new culvert crossing under RTC with new channel alongside the rail corridor to connect to existing network and upgrade existing inlet capacities.
- Design, install and maintain a new culvert crossing under RTC to alleviate ponding at Waitakere Road, Kumeū.

11.5 Conclusions

A positive effect is also associated with the Kumeū River crossings due to an increased freeboard improving resilience of the road and a reduction in flood level upstream and downstream of the crossings.

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

The assessment of operational effects found minor to moderate flood effects during the operational phase of the corridor. A range of potential mitigation measures for operational effects have been set out in Section 8.1. There is space within the designation to mitigate this risk by providing overland flow paths or secondary inlets which can be addressed at the detailed design stage.

Potential flooding effects can be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

12 NoR S4: Access Road Upgrade

12.1 Project Corridor Features

The corridor is mostly on a ridge between Motu Road and Farrand Road and then crosses an unnamed stream and an overland flow path just before Grivelle Street. Existing flood plains and flood prone areas are identified in Auckland GIS.

The existing 100year flood maps from the latest Kumeū-Huapai catchment model with MPD and existing terrain show flooding at properties; 27, 35, 95, 116, 123, 151 and 161 Access Road, Kumeū. Existing flood prone areas from AC GIS are evident next to the corridor.

12.2 Proposed Works

For S4 the project proposes to widen the existing corridor from two vehicle lanes, one per direction, and a small segment with footpaths at the eastern end to include two vehicle traffic lanes, as well as new facilities for walking and cycling.

Other proposed works in NoR S3 which are relevant for the flooding assessment include:

- Construction of a new bridge over unnamed stream at Chainage 1820
- Construction of diversion drains / realignment of overland flow paths
- Construction of four wetlands

12.3 Existing and Likely Future Environment

12.3.1 Planning Context

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai.

- The northern side of Access Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zoning at the north-eastern section of Access Road.
- The southern side of Access Road is predominantly zoned under the AUP:OP as Rural – Countryside Living, with exception to the Kumeū Showgrounds which are zoned as Rural – Mixed Rural Zone are identified as a precinct (I517 Kumeū Showgrounds Precinct) in the AUP:OP.

Table 12-1 below provides a summary of the existing and likely future environment as it relates to Access Road.

Table 12-1: Access Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[13]	Likely Future Environment[14]
Business	Business (Light Industrial) Zone	Low	Business (Light Industrial)

[13] Based on AUP:OP zoning/policy direction
[14] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[13]	Likely Future Environment[14]
Rural	Rural – Countryside Living Zone Rural – Mixed Rural Zone	Low	Rural
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

Please refer to the AEE for further information on the planning context.

12.4 Assessment of Flooding Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

12.4.1 Positive Effects

Existing road at Chainage 1820 overtops during a 100yr flood event. The new bridge over the unnamed stream provides an improvement to flood resilience. The new bridge has a freeboard > 1.2m between the 100yr ARI flood level and bridge soffit level. The 100yr ARI flood difference at the bridge shows there is negligible effect on the water levels upstream and downstream.

12.4.2 Assessment of Construction Effects

As set out in Section 7 flood effects from construction works are not anticipated.

12.4.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Flood effects from construction are not anticipated, however, resource consents for diversion and discharge of stormwater and stream works will be sought as part of future resource consent processes. Where works are in the flood plain it is expected these can be managed through flood risk mitigation measures captured in the Construction Environmental Management Plan (CEMP).

All other mitigation measures as set out in Section 7.1 apply.

12.4.4 Assessment of Operational Effects

Figure 12-1: Flood Difference Maps for Access Road

12.4.4.1 Unnamed Stream Bridge Crossing

The proposed 120m bridge (refer to points 1C and 2C in Figure 12-1) spans across an unnamed stream with bridge piers set outside the main river channel.

The results for the 100yr ARI pre-development scenario show that the flood level at the location of the proposed bridge structure is RL 24.41m upstream and RL 24.24m downstream. The results for the post-project development scenario show a negligible increase compared to the pre-project development upstream only (+0.01 m). The structure has a freeboard of 1.67m between the 100yr ARI flood level and bridge soffit which is above the 1.2m required freeboard and there are no effects on any nearby buildings. The potential effect of the bridge on flood hazards is therefore considered negligible.

12.4.4.2 Access Road

Positive effects are likely where road's elevation has been raised which will result in the road no longer overtopping. The elevated alignment provides adequate freeboard e.g. Adjacent to 127A Access Road (Chainage 1820-1940, Point 1C and 2C in Figure 12-1).

However, because the raised alignment no longer overtops during the 100year event water is trapped upstream which results in a minor to moderate effect with respect to flood hazard (see points AC1 to AC3 in Figure 12-1). One way this effect can be mitigated by installing diversion drains alongside road to discharge into culvert crossing at Waitakere Rd to enable water to flow from these areas and discharge into the stormwater network. This mitigation is possible within the designation boundary as drains would run parallel to the proposed upgraded road.

12.4.5 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The potential mitigation measures could be adopted as set out in Section 8.1. Specifically the following has been considered:

- Diversion drains alongside the corridor to realign existing overland flow paths to discharge toward the existing culvert under Waitakere Road

While the potential operational effects were assessed as moderate these are likely to be significantly reduced with the mitigation measures above. Mitigation measures will be confirmed as part of the Outline Plan process.

Compliance with the recommended flooding outcomes set out in Section 3.2, to be included in the designation conditions, will ensure that potential flooding effects will be negligible up to minor and appropriately managed.

12.5 Conclusions

No increased risk from flooding was identified during the assessment of construction effects and flood effects will be managed as set out Section 7.1.

Positive effects were identified Chainage 1820 where the raised elevation will result in the road no longer overtopping and provides adequate freeboard >1.2 m. However, the elevated road alignment currently shows increased flood levels at properties either side of the road.

There was a moderate effect as a result of increased flood levels at open space along the Access Road corridor. One way this effect can be mitigated is by designing, installing and maintaining diversion drains alongside road to discharge into culvert crossing at Waitakere Rd. The final mitigation will be confirmed as part of detailed design.

Potential flooding effects can be appropriately managed and will be negligible up to minor subject to the recommended design outcomes and conditions outlined in set out in Section 3.2 of this report being met.

13 Sensitivity Analysis

13.1 NoR S1: Alternative State Highway, including Brigham Creek Interchange

There is an increase in flood level at the following key crossings:

- Totara Creek
- Ngongetepara Stream
- Karure stream
- Unnamed Stream
- Kumeū River

However, at all these crossings there remains adequate freeboard for the 100year event even during a more severe climate change scenario. Any resource consent will be supported by an assessment of the detailed design with respect to flood effects and this will include the relevant climate change scenario. The increased flood effects as a result of increased rainfall under a more severe climate change scenario are noted as a risk. However, this increased risk can be addressed through the mitigation measures described in the report.

13.2 NoR S2: SH16 Main Road Upgrade

There is an increase in flood level at the following key crossings:

- Kumeū River
- Ahukuramu Stream

For a more severe climate change scenario there would no longer be adequate freeboard for the 100year event. However, it is noted that the designation is flexible to allow for the vertical alignment to change during detailed design. Any resource consent will be supported by an assessment of the detailed design with respect to flood effects and this will include the relevant climate change scenario. The increased flood effects as a result of increased rainfall under a more severe climate change scenario are noted as a risk. However, this increased risk can be addressed through the mitigation measures described in the report.

13.3 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

The key crossings for NoR S3 include Kumeū River. There is an increase in flood effects at this crossing. There remains adequate freeboard for the 100year event even during a more severe climate change scenario. Any resource consent will be supported by an assessment of the detailed design with respect to flood effects and this will include the relevant climate change scenario. The increased flood effects as a result of increased rainfall under a more severe climate change scenario are noted as a risk. However, this increased risk can be addressed through the mitigation measures described in the report.

13.4 NoR S4: Access Road Upgrade

There is one crossing in NoR S4 over an unnamed stream. At this location the effect increases from negligible to moderate. However, there remains adequate freeboard. Any resource consent will be supported by an assessment of the detailed design with respect to flood effects and this will include the relevant climate change scenario. The increased flood effects as a result of increased rainfall under a more severe climate change scenario are noted as a risk. However, this increased risk can be addressed through the mitigation measures described in the report.

14 Conclusion

The assessment of the potential flood effects for the Projects was based on an indicative design of the new road.

There will be a number of positive effects associated with the development particularly where new bridges are proposed which raise the existing road levels reducing the potential for flood levels to overtop the road and reducing flood hazard. Additional positive effects can be realised through upgrades to existing culverts or new culvert crossings to improve overland and stream flow under the roads.

The assessment found that there was unlikely to be additional risk of flood effects during construction as all proposed lay down areas will be outside of the flood plain and overland flow paths. For those areas where there is an increased risk mitigation measures such as carrying out construction works during dry weather and using diversion drains will be adequate to manage this risk.

Potential operational effects included increased flood levels upstream and downstream of crossings and bridges. Some of the effects were assessed as moderate based on an increase in flood level of greater than 0.15m for habitable buildings and 0.5m for general property. These effects are a result of the changing terrain, based on the spatial land take for the new infrastructure, which obstructs existing overland flows and flood plains. These effects are likely overstated as they can be addressed through detailed design of the bridges, culverts and crossings to manage flows upstream and downstream to minimise flooding effects.

There are some stormwater wetlands proposed within or near to the flood plain or which have been found to flood during the 100yr ARI. For these wetlands mitigation is proposed to raise the embankment and install diversion drains for any overland flow paths to reduce the risk of flooding.

A number of management and mitigation measures have been provided to ensure that effects will be adequately managed.

A sensitivity analysis has been undertaken to consider the effects of additional rainfall under a more severe climate change scenario. The sensitivity analysis identified an increased risk of flooding at some locations. However, this increased risk can be addressed through the mitigation measures described in the report.

15 References

Auckland Council (Nov 2011) Stormwater Modelling Specification

Auckland Council GeoMaps (accessed 2021)

SGA flood models, as follows:

Available Models	**Strategic Package Projects within the catchment models**
Kumeū-Huapai Rapid Flood Hazard Assessment	Alternative State Highway, including Brigham Creek Interchange (NoR S1) State Highway Main Road Upgrade (NoR S2) Rapid Transit Corridor and Regional Active Mode Corridor (NoR S3) Access Road Upgrade (NoR S4)
Taupaki Rapid Flood Hazard Assessment	Alternative State Highway, including Brigham Creek Interchange (NoR S1) Rapid Transit Corridor and Regional Active Mode Corridor (NoR S3)
Redhills Rapid Flood Hazard Assessment	Alternative State Highway, including Brigham Creek Interchange (NoR S1) Rapid Transit Corridor and Regional Active Mode Corridor (NoR S3)
Whenuapai Rapid Flood Hazard Assessment	Alternative State Highway, including Brigham Creek Interchange (NoR S1) Rapid Transit Corridor and Regional Active Mode Corridor (NoR S3)

New Zealand Transport Agency (April 2016) NZTA P46 Stormwater Specification

New Zealand Transport Agency (2013) Bridge Manual SP/M/022 third edition

1 Appendix 1 – Flood model results

1.1 NoR S1: Alternative State Highway, including Brigham Creek Interchange

Table 15-1: Alternative State Highway, including Brigham Creek Interchange, summary of flood levels at key crossings

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
Adjacent to 16 – 18 Spedding Road (Chainage 100, Points 14A and 2A in Figure 9-3)	Totara Creek Bridge	Totara Creek Bridge, 30m long Bridge soffit level 16.96m	17.59m upstream, 14.34m downstream Existing road level 18.08m	17.68m upstream, 14.86m downstream	+0.09m upstream, +0.52m downstream	Minor effect upstream, moderate effect downstream Less than 1.2m freeboard
87 Joseph Dunstan Drive (Chainage 3200, Points 15A and 4A in Figure 9-1)	Existing ground level 6.36m	Ngongetepara Stream bridge, 530m long Bridge soffit level 21.75m	9.4m upstream, 9.21m downstream	9.57m upstream, 9.24m downstream	+0.17m upstream, +0.03m downstream	Minor effect upstream, no effect downstream Adequate freeboard
Chainage 2000 (Point 5A and 16A in Figure 9-4)	n/a	Karure stream bridge, 40m long Bridge soffit level 16.83m	13.39m upstream, 12.23m downstream Existing ground level 14.0m	13.97m upstream, 13.86m downstream	+0.58m upstream, +1.63m downstream	Moderate effect upstream and downstream Adequate freeboard
182 Boord Crescent (Chainage 3300, Point 6A and 7A in Figure 9-5)	n/a	Unnamed Stream bridge, 100m long Bridge soffit level 32.16m	29.09m upstream, 29.53m downstream Existing ground level 28.34 m	30.61m upstream, 29.85m downstream	+1.52m upstream, +0.32m downstream	Moderate effect upstream and minor effect downstream Adequate freeboard
Point ASH3 in Figure 9-5	186 Boord Crescent, Kumeū	Building / house, site level RL 28.22m	28.63m	29.39m	-0.24m	Positive
Point ASH4 in Figure 9-5	176 Boord Crescent, Kumeū (Wetland 5)	Open space RL 29.94 m	29.99m	31.21m	+1.22m	Moderate effect

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
Point ASH5 in Figure 9-5	749 Waitakere Road, Kumeū	Open Space, Rural zone, site level RL 32.67 m	33.11m	33.07m	-0.04m	Positive effect
Point ASH6 in Figure 9-5	44 Brookvale Lane, Taupaki	Building / house, site levels; RL 30.51 m	30.59m	31.34m	+0.75m	Moderate effect
191 Pomona Road (Chainage 5900, Points 8A and 9A in Figure 9-7)	Culvert under Pomona Road, size unknown	Bridge over an unnamed Stream and Pomona Road, 120m long Bridge soffit level 43.6 m	38.53m upstream, 37.40m downstream	38.63m upstream, 37.25m downstream	+0.1m upstream, -0.15m downstream	Minor effect upstream, positive effect downstream Adequate freeboard
Point ASH1 in Figure 9-7	170 Pomona Road / 32 Hanham Road, Kumeū	Open Space, Rural zone, site level RL 39.65m	40.34m	41.55m	+1.21m	Moderate effect
Point ASH8 in Figure 9-7	32 Hanham Road, Kumeū	Open space, rural, site level RL 37.63m	38.69 m	40.74 m	+2.05 m	Moderate effect
73 Pomona Road (Chainage 6500, Point 57 and 58 in Figure 9-2)	n/a Existing ground level 46.08 m	(x2) 3500 mm x 1000 mm box culverts Design road CL level 59.78 m	53.63m upstream, 49.75m downstream	52.13m upstream, 49.78m downstream	-0.50m upstream, +0.03m downstream	Positive effect upstream and negligible effect downstream Adequate freeboard
34 Pomona Road (Chainage 7200, Points 10A and 11A in Figure 9-2)	n/a Existing ground level 40.92 m	Kumeū River bridge, 40m long Bridge soffit level 52.89 m	42.31m upstream, 40.46m downstream	42.56m upstream, 40.52m downstream	+0.25m upstream, +0.06m downstream	Moderate effect upstream and minor effect downstream Adequate freeboard
146 Motu Road (Chainage 7400, Point 63 and 64 in Figure 9-2)	n/a	3500 mm x 1000 mm box culvert	46.79m upstream, 42.22m downstream	47.10m upstream, 42.28m downstream	+0.31m upstream, +0.06m downstream	Moderate effect upstream and minor effect downstream

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
62 Foster Road (Chainage 10,000, Point FR1 and FR2 in Figure 9-8)	n/a Existing ground level 15.57 m	Ahukuramu Stream bridge, 320m long Bridge soffit level 25.75 m	20.26m upstream, 19.97m downstream	n/a	n/a	n/a Adequate freeboard
58 Foster Road (Chainage 10,700, Point 71 and 72 in Figure 9-8)	n/a Existing ground level 18.39 m	(x2) 3000 mm x 1000 mm box culverts Design Road CL level 22.79 m	21.04m upstream, 19.49m downstream	21.53m upstream, 19.50m downstream	+0.49m upstream, -0.01m downstream	Moderate effect upstream, positive effect downstream Adequate freeboard
Point ASH2 in Figure 9-8	727 State Highway 16, Huapai	Building / house, site level RL 19.15 m	19.60 m	21.23m	+1.63m	Moderate effect
Point ASH7 in Figure 9-8	23 Foster Road, Huapai	Open space, proposed Wetland 15, top level RL 20.3 m	19.29m	19.46m	+0.17m	Minor effect

1.2 NoR S2: SH16 Main Road Upgrade

Table 15-2: SH16 Main Road upgrade existing and future flood levels at key crossings

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
2-12 Main Road (Riverhead Rd Chainage 160, Point 1S and 2S in Figure 10-2)	1800 mm diameter pipe	1800 mm diameter pipe	24.45m upstream, 23.41m downstream Existing road level 23.87 m	24.57m upstream, 24.52m downstream	+0.12m upstream, +0.11m downstream	Minor effect upstream and downstream
12 Weza Lane (Chainage 380, Point 3S and 4S in Figure 10-2)	Kumeū River bridge Existing road level 24.9 m	Kumeū River bridge no 1, 30m long Bridge soffit level RL 26.41 m	22.53m upstream, 22.51m downstream	25.27m upstream, 24.58m downstream	+0.26m upstream, +0.07m downstream	Moderate effect upstream and minor effect downstream Adequate freeboard
Point SH1 in Figure 10-2	16 Main Road, Kumeū Current flooding issues	Building / house, site level RL 24.27m	23.37 m	24.44 m	+1.07m	Moderate effect
Point SH5 in Figure 10-2	11 Weza Lane, Huapai	Building / house, site level RL 23.09 m	23.17 m	24.33 m	+1.16m	Moderate effect
Point SH6 in Figure 10-2	64 Main Road, Kumeū	Building / house, site level RL 22.55 m	22.52 m	23.79 m	+1.27m	Moderate effect
Point SH7 in Figure 10-2	7 Main Road, Kumeū	Open space, proposed Wetland 2, top level RL 22.0 m	24.09 m	25.34 m	+0.30 m	Moderate effect
Point SH11 in Figure 10-2	550 Main Road Kumeū Within flood plain	Open space for proposed Wetland 1, top level RL 23.6m	22.47 m	24.52 m	+0.18 m	Moderate effect

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
Point SH12 in Figure 10-2	7 Main Road, Kumeū Current flood prone area	Building / house, site level RL 24.23m	24.08 m	25.25 m	+1.17m	Moderate effect
SH13 in Figure 10-2	7 Main Road, Kumeū	Building / house, site level RL 24.32 m	24.26 m	25.46 m	+1m	Moderate effect
SH14 in Figure 10-2	16 Main Road, Kumeū	Building, site level RL 23.63m	23.66 m	25.09 m	+1.43m	Moderate effect
583 Main Road, Huapai (Chainage 3760, Point 7S and 8S in Figure 10-2)	Kumeū River bridge Existing road level 21.4 m	Kumeū River bridge no 3, 30m long Bridge soffit level RL 23.42 m	21.75m upstream, 21.94m downstream	21.72m upstream, 21.63m downstream	-0.03m upstream, -0.31m downstream	Positive effect upstream and downstream Adequate freeboard
(SH16 chainage 500, Point 12A and 13A in Figure 10-3)	Ahukuramu Stream bridge Existing road level 17.08m	Ahukuramu Stream bridge, 30m long Bridge soffit level 21.20 m	19.34m upstream, 19.33m downstream	19.43m upstream, 19.42m downstream	+0.09m upstream, +0.09m downstream	Minor effect upstream and downstream Adequate freeboard
587 Main Road, Huapai (Point 29 and 30 in Figure 10-4)	n/a	750 mm diameter pipe	24.50m upstream, 20.89m downstream	25.29m upstream, 20.61m downstream	+0.79m upstream, -0.27m downstream	Moderate effect upstream and positive effect downstream

1.3 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

Table 15-3: Rapid Transit Corridor existing and future flood levels at key crossings

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
Chainage 1730 (point 5S and 6S in Figure 11-1)	Kumeū River bridge Existing road level 20.66m	Kumeū River bridge No 2, 30m long Bridge soffit level RL 23.34 m	21.84m upstream, 21.79m downstream	21.88m upstream, 21.57m downstream	+0.04m upstream, -0.22m downstream	Negligible effect upstream, positive effect downstream Adequate freeboard
223 Main Road, Huapai (Chainage 1600, Point 9S in Figure 11-1)	n/a	Kumeū River bridge, 210m long Bridge soffit level 23.05 m	21.86m upstream	21.76m upstream	-0.1m	Positive effect Adequate freeboard
Point RAMC1 in Figure 11-1	301 Main Road, Huapai	Proposed station location, site level 23.49 m	24.93 m	24.93 m	0.0m	n/a
Point RAMC2 in Figure 10-4	11 Meryl Ave, Huapai	Open space, proposed Wetland 14, top level RL 22.6 m	24.24 m	24.24 m	0.0m	n/a
50 Gilbransen Road, Huapai (Chainage 3460, Point 27 and 28 in Figure 10-4)	n/a Existing ground level 23.45 m	(x2) 3500 mm x 1000 mm box culverts Design road CL level 27.26 m	24.36m upstream, 23.58m downstream	24.61 upstream, 23.63m downstream	+0.25m upstream, +0.05m downstream	Minor effect upstream, negligible effect downstream
623 State Highway 16 (Chainage 4140, Point 31 and 32 in)	Unknown	4000 mm x 1000 mm box culvert Design road CL level 30.93 m	29.87 m upstream, 25.78 m downstream Existing road CL level 30.50 m	29.70 m upstream, 26.17 m downstream	+0.67 m upstream, +0.27 downstream	Moderate effect upstream, minor effect downstream

Chainage	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
29 Meryl Ave, Huapai (Chainage 3760-3880, Point 10S and 11S in Figure 10-4)	n/a	Kumeū River bridge, 120m long Bridge soffit level RL 21.95m	19.94m upstream, 19.64m downstream Existing ground level 19.18 m	19.93m upstream, 19.62m downstream	-0.01m upstream, -0.02m downstream	Positive effect upstream and downstream Adequate freeboard
32 Meryl Ave, Huapai (Chainage 4140, Point 5 and 6 in Figure 10-4)	n/a	2000 mm x 1000 mm box culvert Design road Cl level 29.45 m	25.39m upstream, 24.67m downstream	26.08m upstream, 25.16m downstream	+0.69m upstream, +0.49m downstream	Positive effect upstream and minor effect downstream Adequate freeboard
32 Meryl Ave, Huapai (Chainage 60, Point 17 and 18 in Figure 10-4)	n/a	2000 mm x 1000 mm box culvert Design road CL level 25.55 m	24.67m upstream, 24.48m downstream	25.16m upstream, 24.80m downstream	+0.49m upstream, +0.32m downstream	Minor effect both upstream and downstream Adequate freeboard
31 Meryl Ave, Huapai (Meryl Ave Chainage 180, Point 15 and 16 in Figure 10-4)	n/a Existing ground level 24.06 m	2000 mm x 1000 mm box culvert Design road CL level 25.82m	24.44m upstream, 22.25m downstream	24.75m upstream, 22.34m downstream	+0.31m upstream, -0.09m downstream	Minor effect upstream and positive effect downstream
Point RTC2 in Figure 10-4	Lot 1, Joseph Dunstan Drive, Taupaki	Karure Stream crossing, Open space, site level RL 17.67 m	18.13m	19.87 m	+1.74 m	Moderate effect
Point RTC1 in Figure 9-5	Part Taupaki Block Waitakere Road, Kumeū, site level RL 30.79 m	Open Space between Rail and RTC	31.41	32.74 m	+0.55 m	Moderate effect

1.4 NoR S4: Access Road Upgrade

Table 15-4: Access Road upgrade existing and future flood levels at key crossings

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	100year flood level (RL) pre-development	100year flood level (RL) post-development	Level difference for 100year flood	Potential effect without mitigation
Adjacent to 127A Access Road (Chainage 1820-1940, Point 1C and 2C in Figure 12-1)	Culvert, size unknown Existing road level RL 23.8 m	Unnamed stream bridge, 120m long Bridge soffit level RL 26.04 m	24.36m upstream, 24.73m downstream	24.37m upstream, 24.23m downstream	+0.01m upstream, -0.04m downstream	Negligible effect upstream, positive effect downstream Adequate freeboard
Point AC1 in Figure 12-1	95 Access Road, Kumeū	Building / house/driveway, site level RL m	27.92	28.06 m	+0.16 m	Moderate effect
Point AC2 in Figure 12-1	35 Access Road, Kumeū	Building / house/driveway, site level RL m	26.80	27.01 m	+0.22 m	Moderate effect
Point AC3 in Figure 12-1	27 Access Road, Kumeū	Building, site level	23.59	24.64 m	+0.12 m	Minor effect

2 Appendix 2 – Sensitivity Analysis results

2.1 NoR S1: Alternative State Highway, including Brigham Creek Interchange

Table 15-5: Consideration of sensitivity at key crossings identified NoR S1

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change between V2 and V3	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
Adjacent to 16 – 18 Spedding Road (Chainage 100, Points 14A and 2A in Figure 9-3)	Totara Creek Bridge	Totara Creek Bridge, 30m long Bridge soffit level 16.96 m	17.68m upstream, 14.86m downstream	17.74m upstream, 15.49m downstream	+0.06m upstream, +0.63m downstream	Minor effect upstream, moderate effect downstream Less than 1.2m freeboard
87 Joseph Dunstan Drive (Chainage 3200, Points 15A and 4A in Figure 9-1)	n/a	Ngongetepara Stream bridge, 530m long Bridge soffit level 21.75 m	9.57m upstream, 9.24m downstream	10.03m upstream, 9.75m downstream	+0.46m upstream, +0.51m downstream	Moderate effect upstream and downstream Adequate freeboard
Chainage 2000 (Point 5A and 16A in Figure 9-4)	n/a	Karure stream bridge, 40m long Bridge soffit level 16.83 m	13.97m upstream, 13.86m downstream	14.09m upstream, 13.96m downstream	+0.12m upstream, +0.10m downstream	Moderate effect upstream and downstream Adequate freeboard
182 Boord Crescent (Chainage 3300, Point 6A and 7A in Figure 9-5)	n/a	Unnamed Stream bridge, 100m long Bridge soffit level 32.16 m	30.61m upstream, 29.85m downstream	31.11m upstream, 30.24m downstream	+0.50m upstream, +0.39m downstream	Moderate effect upstream and minor effect downstream Adequate freeboard
Point ASH3 in Figure 9-5	186 Boord Crescent, Kumeū	Building / house, site level RL 28.22 m	29.39 m	29.75 m	+0.36 m	Moderate effect

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change between V2 and V3	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
Point ASH4 in Figure 9-5	176 Boord Crescent, Kumeū (Wetland 5)	Open space RL 29.94 m	31.21 m	31.81 m	+0.60 m	Moderate effect
Point ASH5 in Figure 9-5	749 Waitakere Road, Kumeū	Open Space, Rural zone, site level RL 32.67 m	33.06 m	33.09 m	+0.03 m	Positive effect
Point ASH6 in Figure 9-5	44 Brookvale Lane, Taupaki	Building / house, site levels; RL 30.51 m	31.34 m	31.92 m	+0.58 m	Moderate effect
191 Pomona Road (Chainage 5900, Points 8A and 9A in Figure 9-7)	Culvert under Pomona Road, size unknown	Bridge over an unnamed Stream and Pomona Road, 120m long Bridge soffit level 43.6 m	38.63m upstream, 37.25m downstream	38.83m upstream, 37.56m downstream	+0.20m upstream, +0.31m downstream	Moderate effect upstream, minor effect downstream Adequate freeboard
Point ASH1 in Figure 9-7	170 Pomona Road / 32 Hanham Road, Kumeū	Open Space, Rural zone, site level RL 39.65 m	41.55 m	41.76 m	+0.21 m	Moderate effect
Point ASH8 in Figure 9-7	32 Hanham Road, Kumeū	Open space, rural, site level RL 37.63 m	40.74 m	41.03 m	+0.29 m	Moderate effect
73 Pomona Road (Chainage 6500, Point 57 and 58 in Figure 9-2)	n/a Existing ground level 46.08 m	(x2) 3500 mm x 1000 mm box culverts Design road CL level 59.78 m	52.13m upstream, 49.78m downstream	51.23m upstream, 49.81m downstream	+0.10m upstream, +0.03m downstream	Minor effect upstream and positive effect downstream Adequate freeboard
34 Pomona Road (Chainage 7200, Points 10A and 11A in Figure 9-2)	n/a Existing ground level 40.92 m	Kumeū River bridge, 40m long	42.56m upstream, 40.52m downstream	42.78m upstream, 40.64m downstream	+0.20m upstream, +0.12m downstream	Moderate effect upstream and downstream

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change between V2 and V3	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
		Bridge soffit level 52.89 m				Adequate freeboard
146 Motu Road (Chainage 7400, Point 63 and 64 in Figure 9-2)	n/a	3500 mm x 1000 mm box culvert	47.10m upstream, 42.28m downstream	47.30m upstream, 42.43m downstream	+0.20m upstream, +0.15m downstream	Moderate effect upstream and positive effect downstream
58 Foster Road (Chainage 10,700, Point 71 and 72 in Figure 9-8)	n/a Existing ground level 18.39 m	(x2) 3000 mm x 1000 mm box culverts Design Road CL level 22.79 m	21.53m upstream, 19.50m downstream	22.07m upstream, 20.72m downstream	+0.54m upstream, +1.22m downstream	Moderate effect upstream and downstream Adequate freeboard
Point ASH2 in Figure 9-8	727 State Highway 16, Huapai	Building / house, site level RL 19.15 m	21.23 m	21.33 m	+0.10 m	Moderate effect
Point ASH7 in Figure 9-8	23 Foster Road, Huapai	Open space, proposed Wetland 15, top level RL 20.3 m	19.46 m	20.67 m	+1.21 m	Moderate effect

2.2 NoR S2: SH16 Main Road Upgrade

Table 15-6: Consideration of sensitivity at key crossings identified NoR S2

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
2-12 Main Road (Riverhead Rd Chainage 160, Point 1S and 2S in Figure 10-2)	1800 mm diameter pipe	1800 mm diameter pipe	24.57m upstream, 24.52m downstream	24.97m upstream, 24.97m downstream	+0.40m upstream, +0.45 m downstream	Moderate effect upstream and downstream
12 Weza Lane (Chainage 380, Point 3S and 4S in Figure 10-2)	Kumeū River bridge	Kumeū River bridge no 1, 30m long Bridge soffit level RL 26.41 m	25.27m upstream, 24.58m downstream	25.65m upstream, 25.03m downstream	+0.38m upstream, +0.46m downstream	Moderate effect upstream and minor effect downstream Adequate freeboard
Point SH1 in Figure 10-2	16 Main Road, Kumeū	Building / house, site level RL 24.27m Current flooding issues	24.44 m	24.87 m	+0.44m	Moderate effect
Point SH5 in Figure 10-2	11 Weza Lane, Huapai	Building / house, site level RL 23.09 m	24.33 m	24.73 m	+0.40 m	Minor effect
Point SH6 in Figure 10-2	64 Main Road, Kumeū	Building / house, site level RL 22.55 m	23.79 m	24.25 m	+0.46 m	Minor effect
Point SH7 in Figure 10-2	7 Main Road, Kumeū	Open space, proposed Wetland 2, top level RL 22.0 m	25.34 m	25.70 m	+0.36 m	Moderate effect
Point SH11 in Figure 10-2	550 Main Road Kumeū	Open space for proposed Wetland 1, top level RL 23.6m	24.52 m	24.97 m	+0.45 m	Moderate effect

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
		Within flood plain				
Point SH12 in Figure 10-2	7 Main Road, Kumeū	Building / house, site level RL 24.23m Current flood prone area	25.25 m	25.58 m	+0.32 m	Moderate effect
SH13 in Figure 10-2	7 Main Road, Kumeū	Building / house, site level RL 24.32 m	25.46 m	25.84 m	+0.38 m	Moderate effect
SH14 in Figure 10-2	16 Main Road, Kumeū	Building, site level RL 23.63m	25.09 m	25.52 m	+0.44 m	Moderate effect
583 Main Road, Huapai (Chainage 3760, Point 7S and 8S in Figure 10-2)	Kumeū River bridge	Kumeū River bridge no 3, 30m long Bridge soffit level RL 23.42 m	21.72m upstream, 21.63m downstream	22.67m upstream, 22.66m downstream	+0.96m upstream, +1.03m downstream	Moderate effect upstream and downstream Inadequate freeboard
(SH16 chainage 500, Point 12A and 13A in Figure 10-3)	Ahukuramu Stream bridge Existing road level 17.08m	Ahukuramu Stream bridge, 30m long Bridge soffit level 21.20 m	19.43m upstream, 19.42m downstream	20.62m upstream, 20.60m downstream	+1.19m upstream, +1.18m downstream	Minor effect upstream and downstream Inadequate freeboard
587 Main Road, Huapai (Point 29 and 30 in Figure 10-4)	n/a	750 mm diameter pipe	25.29m upstream, 20.61m downstream	25.44m upstream, 20.68m downstream	+0.16m upstream, +0.07m downstream	Moderate effect upstream and positive effect downstream

2.3 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

Table 15-7: Consideration of sensitivity at key crossings identified NoR S3, KS and HS

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
Chainage 1730 (point 5S and 6S in Figure 11-1)	Kumeū River bridge Existing road level 20.66m	Kumeū River bridge No 2, 30m long Bridge soffit level RL 23.34 m	21.88m upstream, 21.57m downstream	22.28m upstream, 22.24m downstream	+0.40m upstream +0.67m downstream	Moderate effect upstream and downstream Adequate freeboard
223 Main Road, Huapai (Chainage 1600, Point 9S in Figure 11-1)	n/a	Kumeū River bridge, 210m long Bridge soffit level 23.05 m	21.76m upstream	22.32m	0.56m	Moderate effect
Point RAMC1 in Figure 11-1	301 Main Road, Huapai	Proposed station location, site level 23.49 m	24.93 m	24.93 m	+0.0m	n/a
Point RAMC2 in Figure 10-4	11 Meryl Ave, Huapai	Open space, proposed Wetland 14, top level RL 22.6 m	24.24 m	24.27 m	+0.03m	Negligible effect
50 Gilbransen Road, Huapai (Chainage 3460, Point 27 and 28 in Figure 10-4)	n/a	(x2) 3500 mm x 1000 mm box culverts Design road CL level 27.26 m	24.61 upstream, 23.63m downstream	24.70 upstream, 23.72m downstream	+0.09m upstream, +0.09m downstream	Minor effect upstream and downstream
29 Meryl Ave, Huapai (Chainage 3760-	n/a	Kumeū River bridge, 120m long	19.93m upstream, 19.62m downstream	20.18m upstream, 19.84m downstream	+0.25m upstream, +0.22m downstream	Moderate effect upstream and downstream

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
3880, Point 10S and 11S in Figure 10-4)		Bridge soffit level RL 21.95m				Adequate freeboard
32 Meryl Ave, Huapai (Chainage 4140, Point 5 and 6 in Figure 10-4)	n/a	2000 mm x 1000 mm box culvert Design road Cl level 29.45 m	26.08m upstream, 25.16m downstream	26.28m upstream, 25.42m downstream	+0.20m upstream, +0.20m downstream	Minor effect upstream and moderate effect downstream Adequate freeboard
32 Meryl Ave, Huapai (Chainage 60, Point 17 and 18 in Figure 10-4)	n/a	2000 mm x 1000 mm box culvert Design road CL level 25.55 m	25.16m upstream, 24.80m downstream	25.38m upstream, 25.02m downstream	+0.22m upstream, +0.22m downstream	Moderate effect both upstream and downstream Adequate freeboard
31 Meryl Ave, Huapai (Meryl Ave Chainage 180, Point 15 and 16 in Figure 10-4)	n/a Existing ground level 24.06 m	24.44m upstream, 22.25m downstream	24.75m upstream, 22.34m downstream	24.97m upstream, 22.48m downstream	+0.22m upstream, +0.10m downstream	Moderate effect upstream and positive effect downstream
Point RTC2 in Figure 10-4	Lot 1, Joseph Dunstan Drive, Taupaki	Karure Stream crossing, Open space, site level RL 17.67 m	19.87 m	19.95 m	+0.08 m	Moderate effect
Point RTC1 in Figure 9-5	Part Taupaki Block Waitakere Road, Kumeū	Open Space between Rail and RTC, site level RL 30.79 m	32.74 m	32.77 m	+0.03 m	Moderate effect

2.4 NoR S4: Access Road Upgrade

Table 15-8: Consideration of sensitivity at key crossings identified NoR S4

Location	Existing Cross Drainage / Property address	Modelled Cross Drainage / Affected area	2.1° temperature change	3.8° temperature change	Flood level change	Change in potential effect without mitigation
			100yr flood level (RL) post-development	100yr flood level (RL) post-development		
Adjacent to 127A Access Road (Chainage 1820-1940, Point 1C and 2C in Figure 12-1)	Culvert, size unknown Existing road level RL 23.8 m	Unnamed stream bridge, 120m long Bridge soffit level RL 26.04 m	24.37m upstream, 24.23m downstream	24.70m upstream, 24.56m downstream	+0.32m upstream, +0.34m downstream	Moderate effect upstream and downstream
Point AC1 in Figure 12-1	95 Access Road, Kumeū	Building / house/driveway, site level RL 27.72 m	28.06 m	28.11 m	+0.05 m	Moderate effect
Point AC2 in Figure 12-1	35 Access Road, Kumeū	Building / house/driveway, site level RL 26.73 m	27.01 m	27.07 m	+0.06 m	Moderate effect
Point AC3 in Figure 12-1	27 Access Road, Kumeū	Building, site level 23.18m	24.64 m	24.96 m	+0.32 m	Moderate effect

ATTACHMENT 48

NORTH-WEST STRATEGIC
ASSESSMENT OF ECOLOGICAL EFFECTS
PART 1 OF 3

North West Strategic Assessment of Ecological Effects

December 2022

Version 1

Document Status

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1 Executive Summary 1
2 Introduction 14
2.1 Purpose and Scope of this Report 14
2.2 Report Structure 15
3 Assessment Approach 16
3.1 EcIA Assessment 16
3.2 EcIA and the Likely Future Ecological Environment 16
3.3 Assessment of District Plan Matters and Approach to Regional Matters 17
3.4 Wildlife Act Matters 17
4 Assessment Methodology 18
4.1 Zone of Influence 18
4.2 Desktop Review 18
4.3 Site Investigations 19
4.3.1 Terrestrial Habitat 19
4.3.2 Bat Surveys 20
4.3.3 Freshwater Habitat 20
4.3.4 Wetland Habitat 20
4.4 Ecological Value Assessment 21
5 Strategic Assessment Package Overview 23
6 Area Wide Ecological Desktop Review 25
6.1 Historical Ecological Context 25
6.2 Terrestrial Habitat and Fauna 25
6.2.1 Terrestrial Vegetation 25
6.2.2 Bats 27
6.2.3 Birds 28
6.2.4 Herpetofauna 29
6.3 Freshwater Habitat and Fauna 30
6.3.1 Streams 30
6.3.2 Fish 31
6.4 Wetland Habitat 32
7 Strategic Area Positive Effects 33
8 NoR S1: Alternative State Highway, Including Brigham Creek Interchange 35
8.1 Project Corridor Features 35
8.1.1 Alternative State Highway Design Features 35
8.1.2 Brigham Creek Interchange Overview 36
8.2 Existing and Likely Future Environment 36
8.2.1 Planning Context 36
8.2.2 Permitted Activities and the Future Ecological Environment 37
8.2.3 Ecological Baseline 38

8.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects 55
8.3.1 Construction Effects - Terrestrial Ecology 55
8.3.2 Operational Effects - Terrestrial Ecology 67
8.3.3 Effects Conclusions 79
8.4 Design and Future Resource Consent Considerations 79
8.4.1 Terrestrial Ecology 80
8.4.2 Bats 81
8.4.3 Birds 81
8.4.4 Lizards 81
8.4.5 Freshwater Ecology 81
8.4.6 Wetland Ecology 83
9 NoR S2: SH16 Main Road Upgrade 85
9.1 Project Corridor Features 85
9.2 Existing and Likely Future Environment 85
9.2.1 Planning Context 85
9.2.2 Permitted Activities and the Future Ecological Environment 86
9.2.3 Ecological Baseline 87
9.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects 96
9.3.1 Construction Effects - Terrestrial Ecology 96
9.3.2 Operational Effects - Terrestrial Ecology 106
9.3.3 Effects Conclusions 116
9.4 Design and Resource Consent Considerations 116
9.4.1 Terrestrial Ecology 116
9.4.2 Bats 117
9.4.3 Birds 117
9.4.4 Lizards 117
9.4.5 Freshwater Ecology 117
9.4.6 Wetland Ecology 118
10 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station 119
10.1 Project Corridor Features 119
10.2 Existing and Likely Future Environment 119
10.2.1 Planning Context 119
10.2.2 Permitted Activities and the Future Ecological Environment 121
10.2.3 Ecological Baseline 122
10.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects 137
10.3.1 Construction Effects - Terrestrial Ecology 137
10.3.2 Operational Effects - Terrestrial Ecology 160
10.3.3 Effects Conclusions 188

10.4 Design and Resource Consent Considerations 189

10.4.1 Terrestrial Ecology 189
10.4.2 Bats 191
10.4.3 Birds 191
10.4.4 Lizards 191
10.4.5 Freshwater Ecology 191
10.4.6 Wetland Ecology 192

11 NoR S4: Access Road Upgrade 195

11.1 Project Corridor Features 195
11.2 Existing and Likely Future Environment 195

11.2.1 Planning Context 195
11.2.2 Permitted Activities and the Future Ecological Environment 196
11.2.3 Ecological Baseline 196

11.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects 201

11.3.1 Construction Effects - Terrestrial Ecology 201
11.3.2 Operational Effects - Terrestrial Ecology 210
11.3.3 Effects Conclusions 221

11.4 Design and Resource Consent Considerations 221

11.4.1 Terrestrial Ecology 221
11.4.2 Bats 222
11.4.3 Birds 222
11.4.4 Lizards 222
11.4.5 Wetland Ecology 222

12 Conclusion 223
13 References 231

Appendices

Appendix 1: Ecological Impact Assessment Methodology
Appendix 2: Auckland Unitary Plan Activities
Appendix 3: Regional Plan, District Plan and Wildlife Act Matters
Appendix 4: Desktop Bird Records
Appendix 5: Strategic Ecological Habitat Maps
Appendix 6: Terrestrial Value Assessment
Appendix 7: Aquatic Value Assessment
Appendix 8: Wetland Value Assessment
Appendix 9: Impact Assessment
Appendix 10: Rapid Habitat Assessment Results
Appendix 11: Long-Tailed Bat Acoustic Monitoring Report (2021-2022)
Appendix 12: Incidental Bird Observations
Appendix 13: External Review of Proposed Long-Tailed Bat Mitigation
Appendix 14: Long-Tailed Bat Mitigation

Table of Figures

Figure 3-1: Approach process followed for this assessment....16
Figure 5-1 North West Strategic Assessment Package – Overview of NoRs for Assessment....23
Figure 6-1 Long-tailed bat records within 10 km radius of the Project Area....28
Figure 8-1 Alternative State Highway Typical Cross Sections....36

Table of Tables

Table 1-1 North West Strategic Assessment Package – Notices of Requirement and Projects....1
Table 1-2 Ecological values of terrestrial vegetation types for each NoR....1
Table 1-3 Ecological values of District Plan trees for each NoR....2
Table 1-4 Ecological values of terrestrial fauna for each NoR....2
Table 1-5 Ecological values of directly impacted streams for each NoR....3
Table 1-6 Ecological values of directly impacted wetlands for each NoR....4
Table 1-7 Summary of ecological effects during construction prior to mitigation for district plan trees..6
Table 1-8 Summary of ecological effects during construction prior to mitigation for bats....7
Table 1-9 Summary of ecological effects during construction prior to mitigation for birds....7
Table 1-10 Summary of ecological effects during construction prior to mitigation for lizards....9
Table 1-11 Summary of ecological effects during operation prior to mitigation for bats....10
Table 1-12 Summary of ecological effects during operation prior to mitigation for birds....11
Table 1-13 Summary of ecological effects during operation prior to mitigation for lizards....12
Table 2-1 North West Strategic Assessment Package – Notices of Requirement and Projects....14
Table 5-1 Strategic Assessment Package Project Summary....23
Table 6-1 Significant Ecological Areas present within 2 km of the Project Area....25
Table 6-2 Desktop study At-Risk and Threatened bird species records and their conservation status28
Table 6-3 Native lizard species records within 5 km buffer of NoRs....30
Table 6-4 Desktop assessment of named streams that will be crossed Project wide (LINZ Database)
....30
Table 6-5 Native freshwater fish species recorded within the catchments associated with NoRs S1-S4, HS and KS....31
Table 7-1 Summary of positive effects associated with each NoR....33
Table 8-1 Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment....37
Table 8-2 Vegetation types present within NoR S1....38
Table 8-3 TAR bird species likely to occur within suitable habitat in NoR S1....40
Table 8-4 Ecological value for terrestrial fauna (TAR species only)....43
Table 8-5 Summary of streams identified in NoR S1....45

Table 8-6 Summary of freshwater ecological value identified in NoR S1 46

Table 8-7 Summary of wetlands identified in NoR S1 48

Table 8-8 Summary of wetland ecological value identified in NoR S1 52

Table 8-9 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S1 56

Table 8-10 Assessment of ecological effects for bats and impact management during construction for NoR S1 58

Table 8-11 Assessment of ecological effects for birds and impact management during construction for NoR S1 62

Table 8-12 Assessment of ecological effects for lizards and impact management during construction for NoR S1 67

Table 8-13 Assessment of ecological effects for bats and impact management during operation for NoR S1 69

Table 8-14 Assessment of ecological effects for birds and impact management during operation for NoR S1 73

Table 8-15 Assessment of ecological effects for lizards and impact management during operation for NoR S1 78

Table 8-16 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S1 80

Table 8-17 Potential stream loss (permanent and intermittent) within NoR S1 82

Table 8-18 Potential wetland loss within NoR S1 83

Table 9-1 SH16 Main Road Upgrade Existing and Likely Future Environment 85

Table 9-2 Vegetation types present within NoR S2 87

Table 9-3 TAR bird species likely to occur within suitable habitat in NoR S2 89

Table 9-4 Ecological value for terrestrial fauna (TAR species only) 92

Table 9-5 Summary of streams identified in NoR S2 93

Table 9-6 Summary of freshwater ecological value identified in NoR S2 94

Table 9-7 Summary of wetlands identified in NoR S2 94

Table 9-8 Summary of wetland ecological value identified in NoR S2 95

Table 9-9 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S2 96

Table 9-10 Assessment of ecological effects for bats and impact management during construction for NoR S2 99

Table 9-11 Assessment of ecological effects for birds and impact management during construction for NoR S2 101

Table 9-12 Assessment of ecological effects for lizards and impact management during construction for NoR S2 106

Table 9-13 Assessment of ecological effects for bats and impact management during operation for NoR S2 108

Table 9-14 Assessment of ecological effects for birds and impact management during operation for NoR S2......111

Table 9-15 Assessment of ecological effects for lizards and impact management during operation for NoR S2......115

Table 9-16 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S2......116

Table 9-17 Potential stream loss (permanent and intermittent) within NoR S2......118

Table 9-18 Potential wetland loss within NoR S2......118

Table 10-1 RTC and RAMC Existing and Likely Future Environment......120

Table 10-2 Kumeū Rapid Transit Station Existing and Likely Future Environment......121

Table 10-3 Huapai Rapid Transit Station Existing and Likely Future Environment......121

Table 10-4 Vegetation types present within NoR S3......122

Table 10-5 TAR bird species likely to occur within suitable habitat in NoR S3......124

Table 10-6 Ecological value for terrestrial fauna (TAR species only)......127

Table 10-7 Summary of NoR S3 streams identified in NoR S3, NoR HS, and NoR KS......129

Table 10-8 Summary of freshwater ecological value identified in NoR S3, NoR HS, and NoR KS......130

Table 10-9 Summary of wetlands identified in NoR S3, NoR HS and NoR KS......131

Table 10-10 Summary of wetland ecological value identified in NoR S3, NoR HS and NoR KS......135

Table 10-11 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S3......138

Table 10-12 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR HS......139

Table 10-13 Assessment of ecological effects for bats and impact management during construction for NoR S3......141

Table 10-14 Assessment of ecological effects for bats and impact management during construction for NoR HS......143

Table 10-15 Assessment of ecological effects for bats and impact management during construction for NoR KS......145

Table 10-16 Assessment of ecological effects for birds and impact management during construction for NoR S3......147

Table 10-17 Assessment of ecological effects for birds and impact management during construction for NoR HS......152

Table 10-18 Assessment of ecological effects for birds and impact management during construction for NoR KS......157

Table 10-19 Assessment of ecological effects for lizards and impact management during construction for NoR S3......159

Table 10-20 Assessment of ecological effects for lizards and impact management during construction for NoR HS......160

Table 10-21 Assessment of ecological effects for lizards and impact management during construction for NoR KS......160

Table 10-22 Assessment of ecological effects for bats and impact management during operation for NoR S3....162
Table 10-23 Assessment of ecological effects for bats and impact management during operation for NoR HS....164
Table 10-24 Assessment of ecological effects for bats and impact management during operation for NoR KS....166
Table 10-25 Assessment of ecological effects for birds and impact management during operation for NoR S3....170
Table 10-26 Assessment of ecological effects for birds and impact management during operation for NoR HS....175
Table 10-27 Assessment of ecological effects for birds and impact management during operation for NoR KS....179
Table 10-28 Assessment of ecological effects for lizards and impact management during operation for NoR S3....185
Table 10-29 Assessment of ecological effects for lizards and impact management during operation for NoR HS....186
Table 10-30 Assessment of ecological effects for lizards and impact management during operation for NoR KS....187
Table 10-31 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S3....190
Table 10-32 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR HS....190
Table 10-33 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR KS....190
Table 10-34 Potential stream loss (permanent and intermittent) within NoR S3....192
Table 10-35 Potential stream loss (permanent and intermittent) within NoR HS....192
Table 10-36 Potential wetland loss within NoR S3....192
Table 10-37 Potential wetland loss within NoR HS....193
Table 10-38 Potential wetland loss within NoR KS....194
Table 11-1 Access Road Upgrade Existing and Likely Future Environment....195
Table 11-2 Vegetation types present within NoR S4....197
Table 11-3 TAR bird species likely to occur within suitable habitat in NoR S4....198
Table 11-4 Ecological value for terrestrial fauna (TAR species only)....199
Table 11-5 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S4....201
Table 11-6 Assessment of ecological effects for bats and impact management during construction for NoR S4....203
Table 11-7 Assessment of ecological effects for birds and impact management during construction for NoR S4....206

Table 11-8 Assessment of ecological effects for lizards and impact management during construction for NoR S4 210

Table 11-9 Assessment of ecological effects for bats and impact management during operation for NoR S4....212

Table 11-10 Assessment of ecological effects for birds and impact management during operation for NoR S4....216

Table 11-11 Assessment of ecological effects for lizards and impact management during operation for NoR S4....220

Table 11-12 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S4....221

Table 12-1 Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation 223

Table 12-2 Summary of ecological effects during construction prior to mitigation for bats....223

Table 12-3 Summary of ecological effects during construction prior to mitigation for birds....224

Table 12-4 Summary of ecological effects during construction prior to mitigation for lizards 226

Table 12-5 Summary of ecological effects during operation prior to mitigation for bats 227

Table 12-6 Summary of ecological effects during operation prior to mitigation for birds 227

Table 12-7 Summary of ecological effects during operation prior to mitigation for lizards 229

Table 13-1 Matters and considerations for the assessment of terrestrial ecological value 233

Table 13-2 Matters and considerations for the assessment of aquatic ecological value....233

Table 13-3 Magnitude of effect assessment terminology....235

Table 13-4 Magnitude of effect descriptions....236

Table 13-5 Ecological value descriptions 236

Table 13-6 Ecological effect matrix....237

Table 13-7 Ecological effects of road infrastructure construction broken down into AUP:OP Regional and District Plan matters, and Wildlife Act (1953) 242

Table 13-8 Desktop bird records within 2 km of the Project Areas 246

Table 13-9 Assessment of ecological value for terrestrial ecology features for NoR S1 (1 of 2)....268

Table 13-10 Assessment of ecological value for terrestrial ecology features for NoR S1 (2 of 2)....270

Table 13-11 Assessment of ecological value for terrestrial ecology features for NoR S1 (TAR birds) 273

Table 13-12 Assessment of ecological value for terrestrial ecology features for NoR S1 (District Plan vegetation) 274

Table 13-13 Assessment of ecological value for terrestrial ecology features for NoR S2 276

Table 13-14 Assessment of ecological value for terrestrial ecology features for NoR S2 (fauna)....278

Table 13-15 Assessment of ecological value for terrestrial ecology features for NoR S2 (TAR birds) 280

Table 13-16 Assessment of ecological value for terrestrial ecology features for NoR S2 (District Plan vegetation) 282

Table 13-17 Assessment of ecological value for terrestrial ecology features for NoR S3 284
Table 13-18 Assessment of ecological value for terrestrial ecology features for NoR S3 (fauna)......286
Table 13-19 Assessment of ecological value for terrestrial ecology features for NoR S3 (TAR birds) 288
Table 13-20 Assessment of ecological value for terrestrial ecology features for NoR S3 (District Plan vegetation) 290
Table 13-21 Assessment of ecological value for terrestrial ecology features for NoR KS..................292
Table 13-22 Assessment of ecological value for terrestrial ecology features for NoR KS (fauna) 294
Table 13-23 Assessment of ecological value for terrestrial ecology features for NoR HS..................296
Table 13-24 Assessment of ecological value for terrestrial ecology features for NoR HS (fauna) 298
Table 13-25 Assessment of ecological value for terrestrial ecology features for NoR HS (District Plan vegetation) 299
Table 13-26 Assessment of ecological value for terrestrial ecology features for NoR S4 301
Table 13-27 Assessment of ecological value for terrestrial ecology features for NoR S4 (TAR birds) 303
Table 13-28 Assessment of ecological value for terrestrial ecology features for NoR S4 (District Plan vegetation) 305
Table 13-29 Assessment of ecological value for aquatic ecology features (S1-S1 to S1-S8)............307
Table 13-30 Assessment of ecological value for aquatic ecology features (S1-S9 to S1-S18)..........308
Table 13-31 Assessment of ecological value for aquatic ecology features (S1-S19 to S1-S24)........310
Table 13-32 Assessment of ecological value for aquatic ecology features (S1-S25 to S2-S6)..........312
Table 13-33 Assessment of ecological value for aquatic ecology features for (S4-S1, W3-S1, and W4-S1)...314
Table 13-34 Assessment of ecological value for wetland ecology features (S1-W1 to S1-W10).......316
Table 13-35 Assessment of ecological value for wetland ecology features (S1-W11 to S1-W20).....317
Table 13-36 Assessment of ecological value for wetland ecology features (S1-W31 to S1-W40).....318
Table 13-37 Assessment of ecological value for wetland ecology features (S1-W41 to S1-W50).....320
Table 13-38 Assessment of ecological value for wetland ecology features (S1-W51 to S1-W60).....321
Table 13-39 Assessment of ecological value for wetland ecology features (S1-W61 to S1-W69).....322
Table 13-40 Assessment of ecological value for wetland ecology features (S1-W70 to S1-W72).....323
Table 13-41 Assessment of ecological value for wetland ecology features (S2-W1 to S2-W10).......325
Table 13-42 Assessment of ecological value for wetland ecology features (S2-W11 to S2-W16).....326
Table 13-43 Assessment of ecological value for wetland ecology features (S4-W1) 327
Table 13-44 Summary of RHA values 330

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
CC2W	City Centre to Westgate
ED	Ecological District
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
Project Area	Area that is located within the designation footprint (including all its associated NoRs)
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
TAR	Threatened or At Risk
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency
ZOI	Zone of Influence

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Current ecological baseline	Means the prevailing ecological state at the time of the assessment.
Ecological Feature	Specific aspects of an ecosystem that are described and evaluated; the term includes components such as species and habitats and related processes and functions, such as habitat buffers and roosting and feeding habitat.
Greenfields	Generally rural land identified to be urbanised over time.
Hydroperiod	Flow and or soil saturation period of streams or wetlands.
Likely Future Ecological Environment	The likely future environment informed by the Auckland Unitary Plan (AUP).
Primary Study Area	Area associated with the designation boundary.
Project Area	Area of land that is within the proposed designation boundary.
Project Footprint	Area of land that is within the road design.
Rapid Habitat Assessment	The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015).
Secondary Study Area	Area associated with a 100 m radius from the designation boundary.
Significant Ecological Area	An overlay within the Auckland Unitary Plan Operational in Part, whereby areas of terrestrial, freshwater or marine habitat of significant indigenous vegetation or significant habitats of indigenous fauna are identified and protected from the adverse effects of subdivision, use or development.
Wetland	Defined in the Resource Management Act 1991 as "includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions".
Whenuapai Assessment Package	Four Notices of Requirement and one alteration to an existing designation for the Whenuapai Arterial Transport Network for Auckland Transport.
Zone of Influence	The Zone of Influence is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities."

1 Executive Summary

This Ecological Impact Assessment (EcIA) has been prepared for the North West Strategic Projects Notices of Requirement (NoRs) for Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) (the “Strategic Assessment Package”) (Table 1-1).

Table 1-1 North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR KS	Kumeu Rapid Transit Station
NoR HS	Huapai Rapid Transit Station
NoR S4	Access Road Upgrade

As the Strategic Assessment Package relates to proposed designations, this EcIA assesses district plan matters only. Regional matters (along with Wildlife Act (1953) compliance) will be subject to a future consenting phase along with a supporting EcIA. As such, regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the designation boundary and future regional resource consents.

In order to inform the ecological baseline, ecological features within each Notice of Requirement (NoR) boundary were identified, mapped and their value assessed in terms of representativeness, rarity/distinctiveness, diversity/pattern and ecological context. A summary of the ecological values are provided for terrestrial vegetation (Table 1-2), district plan trees[1] (Table 1-3), terrestrial fauna (Table 1-4), streams (Table 1-5) and wetlands (Table 1-6).

Table 1-2 Ecological values of terrestrial vegetation types for each NoR

Vegetation Type	Abbrev.	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
Brown Field	BF	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Exotic Forest	EF	Moderate	-	-	-	-	-
Exotic Forest – Native Understorey	EF.1	High	-	High	-	-	-
Exotic Forest – Exotic Understorey	EF.2	Moderate	-	Moderate	-	-	-
Exotic Grassland	EG	Low	Low	Low	Low	Low	Low
Exotic Scrub	ES	Low	Low	Low	Low	Low	Low

[1] Only district plan vegetation (trees >4m in high and or in open space) were included as it is an NoR application.

Vegetation Type	Abbrev.	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
Planted Vegetation – Native (recent)	PL.1	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Planted Vegetation - Native (mature)	PL.2	High	-	-	-	-	High
Planted Vegetation – Exotic (amenity)	PL.3	Low	Low	Low	Low	-	Low
Treeland – Mixed Native/Exotic	TL.2	High	High	High	High	High	-
Treeland – Exotic-Dominated	TL.3	Moderate	Moderate	Moderate	Moderate	Low	Moderate
Kānuka Scrub/Forest	VS2	High	-	-	-	-	-
Pūriri Forest	WF7	Very High	-	-	-	-	-
Kahikatea, pukatea forest	WF8	-	Very High	Very High	-	-	-

Table 1-3 Ecological values of District Plan trees for each NoR

Vegetation Type	Abbrev.	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
Exotic Forest	EF	Moderate	-	-	-	-	-
Treeland – Mixed Native/Exotic	TL.2	Moderate	-	-	-	-	-
Treeland – Exotic-Dominated	TL.3	Moderate	Low	Low	Low	-	Low
Kahikatea, pukatea forest	WF8	-	Low	Low	-	-	-
Unitary Plan Notable Trees	-	-	Negligible	Negligible	-	-	-
Open Space Trees (Huapai Domain)	-	-	-	Low	-	-	-

Table 1-4 Ecological values of terrestrial fauna for each NoR

Fauna Type	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
Mammals						
Long-tailed bats	Very High	Very High	Very High	Very High	Very High	Very High
Birds						

Fauna Type	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
Long-tailed cuckoo	Very High	Very High	Very High	Very High	Very High	Very High
Brown teal	Very High	Very High	Very High	Very High	Very High	-
Dabchick	Very High	Very High	Very High	Very High	Very High	-
Banded rail	High	High	High	High	High	-
North Island fernbird	High	High	High	High	High	-
Spotless crake	High	High	High	High	High	-
New Zealand pipit	High	High	High	High	High	High
North Island kākā	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Little black shag	Moderate	Moderate	Moderate	Moderate	Moderate	-
Pied shag	Moderate	Moderate	Moderate	Moderate	Moderate	-
Herpetofauna						
Copper skink	High	High	High	High	High	High
Ornate skink	High	High	High	High	High	High

Table 1-5 Ecological values of directly impacted streams for each NoR

Stream ID	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
S1-S1a	Moderate	-	-	-	-	-
S1-S2	Moderate	-	-	-	-	-
S1-S1b	High	-	-	-	-	-
S1-S3	Low	-	-	-	-	-
S1-S9	Low	-	-	-	-	-
S1-S10	Low	-	-	-	-	-
S1-S13	Low	-	-	-	-	-
S1-S14	Low	-	-	-	-	-
S1-S16	Low	-	-	-	-	-
S1-S20a	Moderate	-	Moderate	-	-	-
S1-S20d	Low	-	Low	-	-	-
S1-S20e	Low	-	Low	-	-	-
S1-S21	Moderate	-	Moderate	-	-	-

Stream ID	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
S1-S23	Low	-	Low	-	-	-
S1-S25	Low	-	Low	-	-	-
S1-S27	Low	-	-	-	-	-
S1-S28	Low	-	-	-	-	-
W4-S1	High	-	High	-	-	-
S2-S1	-	Low	-	-	-	-
S2-S3	-	Moderate	-	-	-	-
S2-S4	-	-	-	-	High	-

Table 1-6 Ecological values of directly impacted wetlands for each NoR

Wetland	NPS-FM	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
S1-W1	Natural	Low	-	-	-	-	-
S1-W2	Natural	Low	Low	-	-	-	-
S1-W4	Natural	Moderate	-	-	-	-	-
S1-W56	Natural	Low	-	-	-	-	-
S1-W6	Natural	High	-	-	-	-	-
S1-W11	Natural	High	-	-	-	-	-
S1-W12	Natural	Low	-	-	-	-	-
S1-W19	Natural	High	-	-	-	-	-
S1-W20	Natural	Moderate	-	-	-	-	-
S1-W21	Natural	High	-	-	-	-	-
S1-W22	Natural	High	-	-	-	-	-
S1-W23 & S1-W23 (OW)	Natural	Low	-	-	-	-	-
S1-W24 & S1-W24 (OW)	Natural	Low	-	-	-	-	-
S1-W25	Natural	Low	-	-	-	-	-
S1-W31 & S1-W31 (OW)	Natural	Low	-	-	-	-	-

Wetland	NPS-FM	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
S1-W33	Natural	Low	-	-	-	-	-
S1-W34 & S1-W34 (OW)	Natural	Low	-	-	-	-	-
S1-W38	Natural	Low	-	Low	-	-	-
S1-W39	Natural	Low	-	Low	-	-	-
S1-W40	Natural	High	-	-	-	-	-
S1-W41	Natural	Moderate	-	Moderate	-	-	-
S1-W42	Natural	Low	-	Low	-	-	-
S1-W43 & S1-W43 (OW)	Natural	Low	-	Low	-	-	-
S1-W44	Natural	Moderate	-	Moderate	-	-	-
S1-W45 & S1-W45 (OW)	Natural	Low	-	Low	-	-	-
S1-W46 & S1-W46 (OW)	Natural	Moderate	-	Moderate			
S1-W47	Natural	Low		Low			
S1-W50 & S1-W50 (OW)	Natural	Low		Low			
S1-W53	Natural	High					
S1-W54	Natural	Moderate		Moderate			
S1-W69	Natural	Moderate		Moderate			
S1-W72	Natural	Negligible					
S1-W2			Low				
S2-W2			High	High	High		
S2-W3			Moderate	Moderate	Moderate		
S2-W5 & S2-W5 (OW)			Low	Low	Low		
S2-W6			Low				

Wetland	NPS-FM	NoR S1	NoR S2	NoR S3	NoR HS	NoR KS	NoR S4
S2-W8			Moderate	Moderate			
S2-W9 & S2-W9 (OW)			High	High			
S2-W10			Low				
S2-W11			Low				
S2-W12			Moderate	Moderate		Moderate	
S2-W12a			Moderate	Moderate		Moderate	
S4-W1							Low

Construction Effects

Table 1-7 to Table 1-10 provides a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been suggested and final mitigation will be confirmed as a condition through an Ecological Management Plan. Construction effect mitigation measures will include:

- A Bat Management Plan (BMP) for NoR S1, S3, HS, KS, and S4. Details of the BMP will depend on bat habitat within the future ecological environment and is likely to include bat habitat surveys prior to construction, siting of compounds and laydown areas to avoid bat habitat, lighting design to reduce light levels and spill from construction areas and restriction of nightworks around treeland bat habitat.
- Bird management will be required for brown teal and dabchick at NoR S1, S2, S3, HS, and KS. Considerations for bird management will include a bird survey prior to construction to confirm Threatened or At Risk (TAR) species are not present and to provide guidance if TAR species are present, including the avoidance of the bird breeding season (September to February) during construction).

Table 1-7 Summary of ecological effects during construction prior to mitigation for district plan trees

Construction - Terrestrial vegetation (district plan vegetation only)	
NoR	**Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)**
NoR S1	Very Low (EF), Low (TL.2 & TL.3)
NoR S2	Very Low (TL.3, WF8, & Unitary Plan notable tree)
NoR S3	Very Low (TL.3, WF8, Unitary Plan notable tree, Unitary Plan open space trees)
NoR HS	Very Low (TL.3)

Construction - Terrestrial vegetation (district plan vegetation only)	
NoR KS	N/A
NoR S4	Low (TL.3)

Table 1-8 Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats			
NoR	**Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)**	**Loss of foraging habitat due to removal of district plan vegetation**	**Mortality or injury to bats due to removal of district plan vegetation**
NoR S1	**Moderate**	Low	**Moderate**
NoR S2	Low	Low	Low
NoR S3	**Moderate**	Low	Low
NoR HS	**Moderate**	Low	Low
NoR KS	**Moderate**	N/A	N/A
NoR S4	Low	Low	**Moderate** *Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 1-9 Summary of ecological effects during construction prior to mitigation for birds

Construction - Birds				
NoR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.)**	**Loss of foraging habitat due to removal of district plan vegetation**	**Nest loss due to removal of district plan vegetation**	**Mortality or injury to birds due to removal of district plan vegetation**
NoR S1				
Non-TAR Birds	Low	Low	Low	Low
Long-tailed cuckoo	Low	Very Low	Very Low	Very Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low

Construction - Birds				
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR S2				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR S3				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Very Low	N/A	N/A	N/A
NoR HS				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low

Construction - Birds				
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR KS				
Non-TAR Birds	Low	N/A	N/A	N/A
Long-tailed cuckoo	Low	N/A	N/A	N/A
New Zealand pipit	Very Low	N/A	N/A	N/A
North Island kākā	Very Low	N/A	N/A	N/A
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR S4				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low

Table 1-10 Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	**Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)**
NoR S1	Low
NoR S2	Very Low
NoR S3	Very Low
NoR HS	Very Low
NoR KS	Very Low

Construction – Lizards	
NoR S4	Very Low

The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** or **Very Low**.

Operational Effects

Table 1-11 to Table 1-13 provides a summary of district plan matter ecological effects during operation due to the presence of the road resulting in disturbance or loss in connectivity to bats, birds and lizards. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effect mitigation measures will include:

- A BMP for all NoRs. The BMP should include the retention of mature trees where possible, buffer planting, hop-overs and unders at strategic locations as outlined in Appendix 14. In addition, the BMP should consider lighting design along strategic location of the road (stream crossings).
- Bird management will be required for long-tailed cuckoo at NoR S1, and S3. Bird management will also be required for brown teal and dabchick at NoR S1, S3, and HS. Considerations for bird management will include retention of vegetation near wetland habitat (where practicable), buffer planting between the road alignment and suitable habitat adjacent to the road, and installation of vegetation hop-overs in key areas.

Table 1-11 Summary of ecological effects during operation prior to mitigation for bats

Operation - Bats		
NoR	**Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration**	**Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**
NoR S1	**High**	**Very High**
NoR S2	Low	**Moderate**
NoR S3	**High**	**High**
NoR HS	**Moderate**	**Moderate**
NoR KS	**Moderate**	**Moderate**
NoR S4	**Moderate**	**Moderate**

Table 1-12 Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds		
NoR	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure
NoR S1		
Non-TAR Birds	Low	Low
Long-tailed cuckoo	Low	**Moderate**
New Zealand pipit	Very Low	Low
North Island kākā	Very Low	Low
Brown teal, dabchick	**Moderate**	**Moderate**
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Very Low	Very Low
NoR S2		
Non-TAR Birds	Very Low	Very Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Brown teal, dabchick	Low	Low
North Island fernbird, banded rail, spotless crake	Very Low	Very Low
Little black shag, pied shag	Very Low	Very Low
NoR S3		
Non-TAR Birds	Very Low	Very Low
Long-tailed cuckoo	Low	**Moderate**
New Zealand pipit	Very Low	Low
North Island kākā	Very Low	Low
Brown teal, dabchick	**Moderate**	**Moderate**

Operation - Birds		
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Very Low	Low
NoR HS		
Non-TAR Birds	Low	Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Low	Low
North Island kākā	Low	Low
Brown teal, dabchick	**Moderate**	Low
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Low	Low
NoR KS		
Non-TAR Birds	Low	Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Low	Low
North Island kākā	Low	Low
Brown teal, dabchick	Low	Low
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Low	Low
NoR S4		
Non-TAR Birds	Very Low	Very Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Very Low	Low
North Island kākā	Very Low	Low

Table 1-13 Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards		
NoR	**Disturbance and displacement of existing and future lizards due to**	**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road,**

Operation - Lizards		
	light, noise, and vibration effects from the presence of the road	leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure
NoR S1	Low	Low
NoR S2	Low	Low
NoR S3	Low	Low
NoR HS	Low	Low
NoR KS	Low	Low
NoR S4	Low	Low

The residual (post-mitigation) level of effect for all operational effects are **Negligible, Very Low** or **Low**.

Positive Effects

There is the potential for positive effects which apply to each of the NoRs. This includes improved blue/green infrastructure and associated landscaping, and mass revegetation of sloping berms, batters and embankments to connect with retained forest remnant/mature trees. Additionally, the scale of the proposed bat mitigation in association with the revegetation and stormwater wetlands mentioned above will have positive ecological outcomes for native fauna. Specifically, the development of the ASH will result in a ‘green’ corridor which will buffer the rural areas to the south of the ASH against future urban development for portions to the north of the ASH. Similarly, the proposed bat mitigation associated with Ngongetepara, Kumeu and Ahukuramu watercourses are likely to improve ecological connectivity around and through the future urban environment.

2 Introduction

This Ecological Impact Assessment (EcIA) has been prepared for the North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement (NoRs) for Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) (the "Strategic Assessment Package").

The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (Te Tupu Ngātahi) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

This report assesses the transport effects of the North West Strategic Assessment Package identified in Table 2-1 below. Refer to the main AEE for a more detailed project description.

Table 2-1 North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR KS	Kumeu Rapid Transit Station
NoR HS	Huapai Rapid Transit Station
NoR S4	Access Road Upgrade

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Strategic Assessment Package. Its purpose is to inform the AEE that accompanies the Strategic Assessment Package sought by Waka Kotahi and AT.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Strategic Assessment Package on the existing and likely future environment as it relates to ecological effects (District Plan/NoR matters) and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the ecological context/baseline of the Strategic Assessment Package area;
b) Identify and describe the actual and potential ecological effects of each Project corridor, resulting from activities which relate to district matters in the AUP:OP, within the Strategic Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential ecological effects (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package;
d) Set out ecological considerations that will need to be considered and assessed as part of a future regional resource consent;

e) Present an overall conclusion of the level of actual and potential ecological effects for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Strategic Assessment Package as it relates to Ecology;
c) A discussion on area wide positive effects;
d) An area wide desktop assessment;
e) Identification and description of the existing and likely future ecological environment for each NoR;
f) Description of the actual and potential adverse ecological effects of construction and operation of each NoR as they relate to district plan matters, including recommended measures to avoid, remedy or mitigate potential adverse ecological effects;
g) Description of potential adverse ecological effects for consideration during resource consenting;
h) Overall conclusion of the level of potential adverse ecological effects for each NoR after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Project, likely staging and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of ecological effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

3 Assessment Approach

3.1 EcIA Assessment

The approach followed in this study is consistent with the approach outlined in the Ecological Impact Assessment (EcIA) Guidelines (Roper Lindsay et al., 2018) (hereinafter referred to as the EIANZ Guidelines). The overarching goal of the ecological assessment is to determine the ecological effects of specific Project features or activities. The requirements for such an assessment are outlined with the EIANZ Guidelines and forms the basis of this report. This process is summarised in Figure 3-1 below. Note that that for the impact management (Stage 3) additional consideration was given to the permitted baseline and the future environment under the UP.

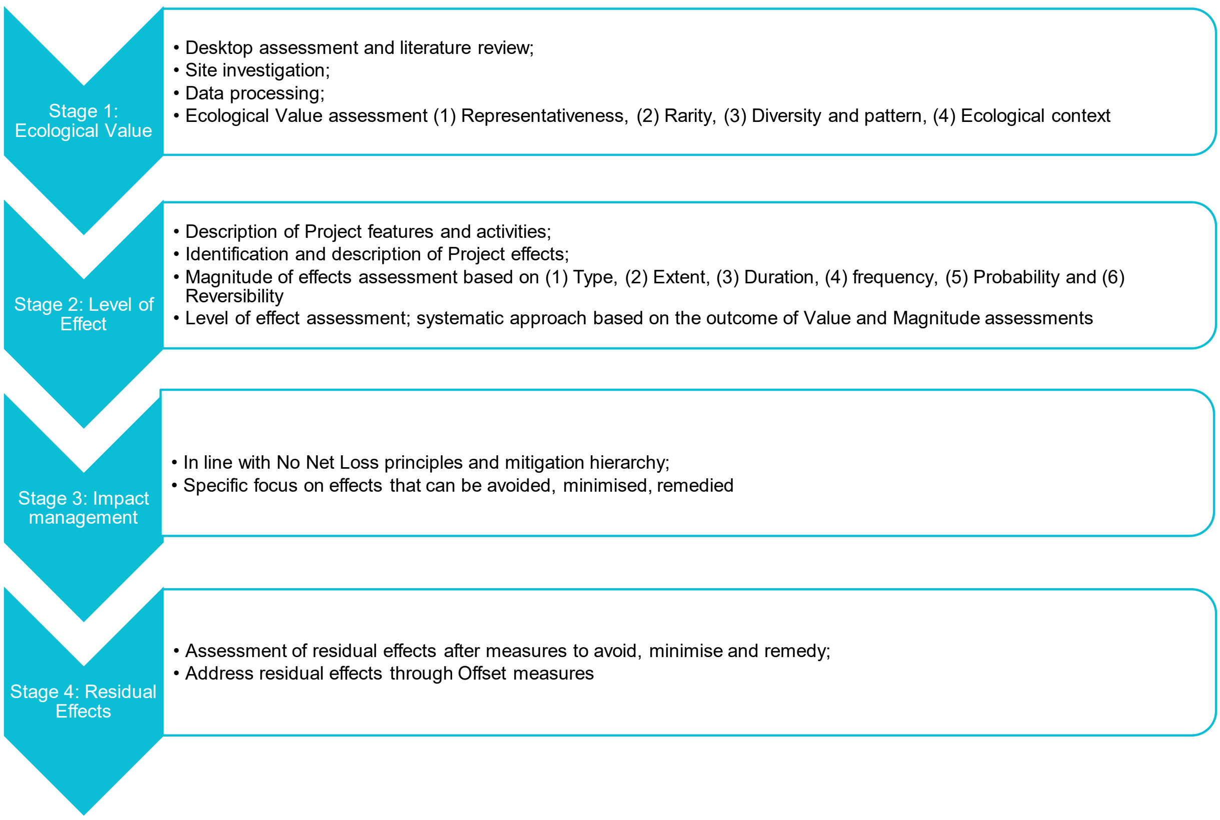

Figure 3-1: Approach process followed for this assessment

3.2 EcIA and the Likely Future Ecological Environment

The EIANZ Guidelines provide guidance to assist with the assessment of the likely future ecological environment in this report. The assessment states:

"The ecologist needs to consider the permitted baseline in order to describe the potential "future ecological environment and to assess effects at that time, and should discuss this with the project planner or legal advisor if in any doubt".

The NW Planning Team has advised of the following to inform the assessment of the likely future environment:

- The purpose of the NoRs within the Strategic Assessment Package is to protect the transport corridors that will support the future urbanisation of Whenuapai, Redhill's North, Kumeū and Huapai. Construction and operation of the new and upgraded corridors will not occur until urbanization has at least been confirmed by way of a plan change or is under development. Guidance on the future urbanization can be taken form the Spatial Land Use Strategy – North West (2021).
- In addition the AUP:OP permits activities for infrastructure, which will also change the likely future environment. These activities include vegetation clearance and the removal of trees, excluding notable trees and street trees. The relevant permitted activities for ecology provisions are set out in Appendix 2.
- Given the planned urbanization of Whenuapai, Redhills North, Kumeū and Huapai, assessing the effects on the environment solely as it exists today (i.e., at the time of ecological site investigation/the preparation of this ecology assessment) will not provide an accurate reflection of the environment in which ecological effects, resulting from the construction and operation of each of the NoRs, will be experienced.
- The assessment of ecological effects should therefore take account of the likely future environment, which takes account of permitted activities for infrastructure and planned urbanisation within the FUZ.

A summary of the likely future environment is provided in the assessment section of each NoR (Sections 8.2, 9.2, 10.2, and 11.2).

3.3 Assessment of District Plan Matters and Approach to Regional Matters

Designations are a form of 'spot zoning' over a route in a district plan. The designation authorises Waka Kotahi or AT, as the relevant requiring authority, to undertake work and activity without the need for land use consent. The designated area is still subject to restrictions on land use under regional matters in the AUP:OP.

As the North West Strategic Assessment Package relates to proposed designation this ecological effects assessment assesses District plan matters only. Regional matters will be subject to a future consenting phase along with a supporting ecological impact assessment (EcIA). As such regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the designation boundary and future regional resource consents and are presented in Sections 8.4, 9.4, 10.4, and 11.4.

Appendix 3 sets out the split between District and Regional matters in the AUP:OP

3.4 Wildlife Act Matters

The Wildlife Act (1953) includes specific provisions for activities that may disturb, injure or kill native animals. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3. The scope of this report pertains to District matters and although not required for NoRs, further consideration has been given to ecological effects under the Wildlife Act in Sections 8.4, 9.4, 10.4, and 11.4. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 3.

4 Assessment Methodology

Desktop and site investigations were undertaken for ecological features within all six NoRs. Ecological features within the proposed designation boundary and a distance of approximately 100 m^2 radius of the designation have been mapped and included onto this assessment. Vegetation, stream and wetland features were investigated and mapped to provide context for potential adjustments to the proposed designation boundary. In addition to the area including into the ecological mapping, potential habitat for native fauna was considered within the Zone of Influence (ZOI) (see Section 4.1).

4.1 Zone of Influence

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may go beyond the boundary of the Project Area. It is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities." The distance of the ZOI and type of effect from the Project can be different for different species and habitat types. The ZOI is used throughout this report to describe the impacts of the Project (construction and operation) on adjacent or connected terrestrial, freshwater and wetland habitats and associated native species. For example, all Significant Ecological Area's (SEA's) within 2 km of each Project Area has been included in the desktop review, along with their connectivity to each Project Area. This is to ensure that important habitat within the wider landscape has been taken into consideration and can be used to inform the potential for flora and fauna to be present within each of the Project Areas and also whether the Project ZOI extends out to these SEA's.

The ZOI of the Project on different species differs depending on how individual species use their environment e.g., mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Projects and this was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or dispersal ability within each of the Project Areas, varying search distances were used depending on the species context.

4.2 Desktop Review

A desktop review of existing ecological records was undertaken to gain an understanding of the species and habitats that could be present within the ZOI[3] of each of the six Projects.

The sources of information that were reviewed to determine the likelihood of a species or habitat occurring within or adjacent to each of the Project Areas include:

- Auckland Council Geomaps[4];
- Department of Conservation (DOC) Bioweb records[5];

[2] The designation boundary has undergone several rounds of refinement. The ecological mapping was undertaken on the initial designation boundary and is considered sufficiently wide to provide a contingency for relatively small adjustment during refinement. The 100 m area mapping was included to provide additional context regarding the nature and extent of ecological features (including wetlands).

[3] Defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities".

[4] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[5] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

- Department of Conservation Threat Classification Series[6];
- Ecological Regions and Districts of New Zealand (McEwen, 1987);
- iNaturalist records[7], records within approximately 2-5 km buffer of Project Areas;
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017);
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database[8];
- New Zealand Bird Atlas eBird database[9]; recorded within 10km^2 grid squares. Results from grid square AA65;
- NZ River Name Lines (LINZ Data Service[10]);
- SGA Redhills Notice of Requirement (2020).

4.3 Site Investigations

Site investigations[11] were undertaken in order to:

- Prepare an ecological baseline of terrestrial, freshwater and wetland ecology;
- Inform the assessment of each of the NoRs against the relevant district matters (terrestrial ecology);
- Set out freshwater and wetland matters which may be considered as part of a future regional resource consent, or under relevant wildlife legislation;
- Inform the designation footprint.

4.3.1 Terrestrial Habitat

Site walkovers were undertaken between November 2021 and January 2022 by ecologists; to map and describe the habitats present within and adjacent to the Project Areas of each of the six NoRs. Habitats were classified into ecosystem type based on those described in Singers et al. (2017). The habitats were also assessed as to their potential to support indigenous fauna, including birds, bats, and lizards.

Habitat assessment focused on areas of potentially significant value, such as habitat that was identified as an SEA, classified as forest habitat on Auckland Council's Geomaps – Ecosystems Current Extent (Singers et al., 2017) or appears to be wetland or forest habitat based on aerial photos and during site investigation. Species records from relevant literature and biodiversity databases were used to focus search efforts on certain areas within the Project areas.

During the site walkovers the vegetation assessment included recording the dominant or characteristic species present and the general quality described, including structure, maturity, presence of weeds and evidence of grazing and foliar dieback. Vegetation surveys also included searches for any rare or threatened plant species previously recorded within the Project Areas.

[6] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text and in Section 12. https://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/

[7] https://www.inaturalist.org/

[8] https://nzffdms.niwa.co.nz/search

[9] https://ebird.org/atlasnz/home

[10] https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/

[11] Not all features where subject to a site investigation due to access constraints. Features assessed at desktop level are identified throughout the report.

Common plant names are predominantly used within this report. Maps showing the vegetation cover along the NoRs are provided in Appendix 5. Terrestrial ecological value assessment methodology is discussed in Section 4.4.

A bat survey was undertaken for the wider study area using a landscape scale approach (Appendix 11). Bat monitors were deployed between November 2021 and January 2022 and again during March and April 2022. Monitoring data for 14 suitable days for each survey period (i.e., weather conditions not constraining bat activity) were analysed and used for the report.

4.3.2 Bat Surveys

A bat survey was undertaken for the wider North West study area (Appendix 11). The stream corridors associated with Totara Creek, Ngongetepara, Kumeu and Ahukuramu catchments are considered the most likely to indicate bat activity. The bat monitors were deployed between November 2021 and January 2022. Monitoring data for 14 suitable days (weather conditions not constraining bat activity) were analysed and used for the report.

4.3.3 Freshwater Habitat

Where access allowed, streams within the six NoRs identified on Auckland Council Geomaps (‘Named Streams’) were ground truthed and classified as permanent, intermittent or ephemeral, according to the stream definitions described by Storey & Wadhwa (2009). Any additional streams observed during site walkovers were also classified. Streams are mapped in Appendix 5.

Freshwater assessments were undertaken on all streams identified on site and included stream classification and implementation of the Rapid Habitat Assessment (RHA) protocol and were undertaken by experienced ecologists. The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015). Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be included during the regional resource consenting phase. As such, macroinvertebrate and fish surveys were not undertaken as part of this assessment. However, NIWA fish records (Franklin et al*.,* 2018) were used to inform potential ecological value of streams. Access was restricted at several locations and as such stream assessments were based solely on desktop information. Freshwater ecological value assessment methodology is discussed in Section 4.4.

4.3.4 Wetland Habitat

Potential wetland habitat areas were identified by ecologists based on Auckland Council Geomaps contours and the presence of wetland vegetation on aerial maps Including a review of historical images). Potential wetlands were mapped and where access permitted, verified through the use of the rapid technique outlined in wetland delineation protocol (Ministry for the Environment, 2020). Because the wetland delineation predominantly relied on desktop assessment, a more conservative delineation was adopted. Ambiguous areas were assumed to be wetlands. Wetland areas are mapped in Appendix 5.

Note that the scope of the specialist study, for route protection, did not provide for a detailed wetland delineation. The key focus was to confirm wetland presence and approximate extent. This approach is considered practical for the purposes of route protection, while it is expected that a more detailed wetland assessment will be undertaken during the regional resource consenting phase.

Wetlands were assessed based on the RMA definition of a wetland[12] and classified into ecosystem type based on those described in Singers et al. (2017). If the habitat present met this definition, it was then further evaluated against the provisions of the NPS-FM for natural wetlands (assessed for potential exclusion on the basis of being artificial or pasture dominated, and temporary rain derived ponding). Details regarding the wetland value assessment is outlined in Section 4.4.

4.4 Ecological Value Assessment

The ecological value of each ecological feature (terrestrial, freshwater and wetland) was assessed using a spreadsheet template by assigning a score of 0 (None), 1 (Low), 2 (Moderate), 3 (High) or 4 (Very High) based on professional judgement (with justification) to attributes associated with each of the four ecological matters recommended within EIANZ (2018): (1) Representativeness 2) Rarity/distinctiveness 3) Diversity and pattern 4) Ecological context including. Considerations in relation to the four matters and corresponding aspects for terrestrial, freshwater and wetland features are detailed below:

Terrestrial Ecology

1) **Representativeness**: Typical structure, species composition and indigenous representation
2) **Rarity/distinctiveness**: Species of conservation significance, distinctive ecological values
3) **Diversity and pattern**: Habitat diversity, species diversity and patterns in habitat use
4) **Ecological context**: Size, shape and buffering function, sensitivity to change, ecological networks (linkages, pathways, migration)

Freshwater Ecology

1) **Representativeness**: RHA score for accessible sites and riparian habitat modification based on desktop stream and catchment assessments
2) **Rarity/distinctiveness**: Species of conservation significance informed by the potential occurrence of Threatened and At-Risk (TAR) fish species
3) **Diversity and pattern**: Level of natural diversity informed by the habitat diversity subsection of the RHA. Stream order, slope and hydroperiod were applied as desktop proxies to judge the likely habitat diversity for streams where access was constraint
4) **Ecological context**: Stream order and hydroperiod

Wetland Ecology

1) **Representativeness**: Hydrological modification based on observations of drains, ponds and catchment land use. Native vegetation informed by site visit and review of landcover information;
2) **Rarity/distinctiveness**: Wetland type (rare or distinctive); distinctive ecological values (ecosystem services) in a larger catchment context;
3) **Diversity and pattern**: Representation of different hydroperiods (permanent, seasonal or temporary) and the structural complexity of vegetation cover
4) **Ecological context**: flood attenuation, streamflow regulation, sediment trapping, water purification, connectivity and migration

[12] "wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions"

The score for each matter was constrained to the highest score for each aspect (for example a High score allocated to a wetland for flood attenuation will result in a High score for the Ecological context matter). The combined ecological value score (ranging from Very High to Negligible), for the four matters, was determined in accordance with the EIANZ Guidelines.

5 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 5-1 below, with a brief summary of the Strategic Assessment Package projects provided in Table 5-1

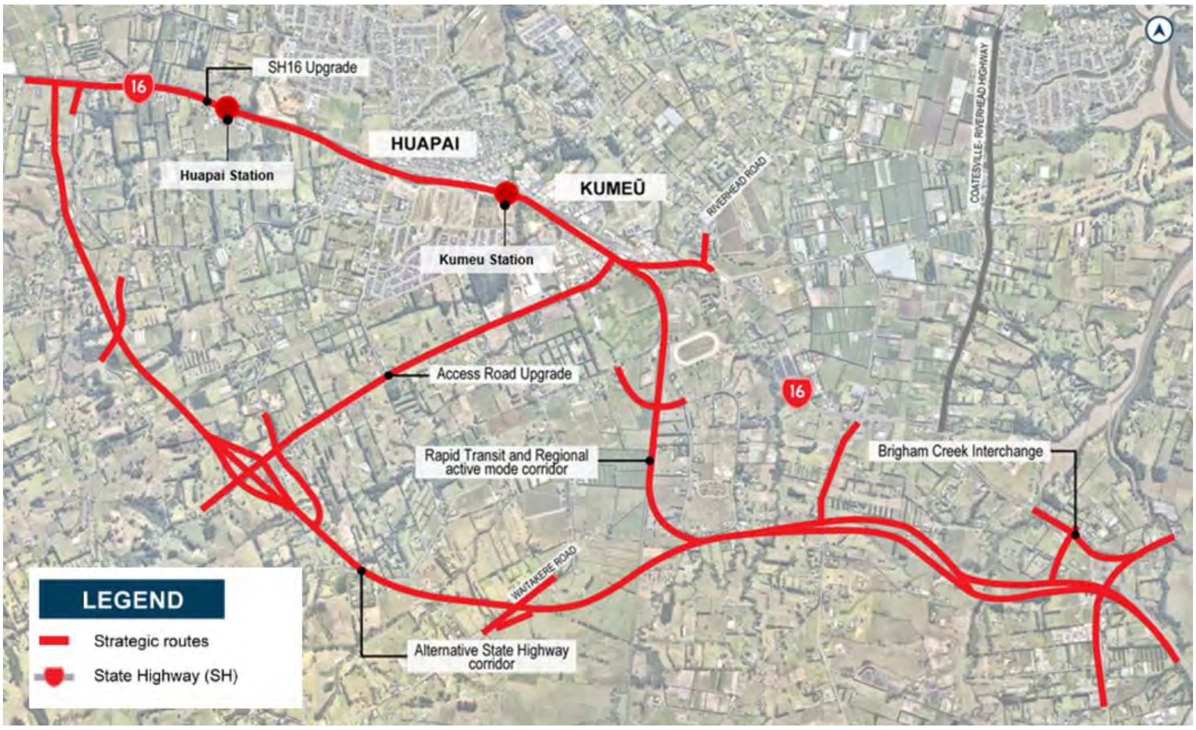

Figure 5-1 North West Strategic Assessment Package – Overview of NoRs for Assessment

Table 5-1 Strategic Assessment Package Project Summary

Corridor	NoR	Description	Requiring Authority
Alternative State Highway, Including Brigham Creek Interchange	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange.	Waka Kotahi
State Highway 16 Main Road Upgrade (alteration to existing designation 6766)	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New Rapid Transit Corridor and active mode corridor in one co-located corridor.	Waka Kotahi
Kumeu RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway.	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road Upgrade	S4	Upgrade of Access Road to a four-lane cross-section with separated cycle lanes	Auckland Transport

Corridor	NoR	Description	Requiring Authority
		and footpaths on both sides of the corridor.	

Please refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

6 Area Wide Ecological Desktop Review

This section presents the findings of an area wide (all six NoRs) desktop study (which includes a review of the documents listed in Section 4.2 for all of the habitats and species ('ecological features') present within the ZOI of NoRs S1-S4, NoR HS, and NoR KS. Because of the scale of the available data, all NoR specific baseline ecological environment sections below (Sections 8.2.2, 9.2.2, 10.2.2 and 11.2.2) will refer back to this area wide desktop review section.

6.1 Historical Ecological Context

The majority of NoRs (NoR S1 Alternative State Highway (ASH), including Brigham Creek Interchange (BCI), NoR S2 SH16 Main Road Upgrade, NoR S3 Rapid Transit Corridor (RTC), including the Regional Active Mode Corridor (RAMC), NoR KS Kumeu RTC Station, NoR HS Huapai RTC Station and NoR S4 Access Road Upgrade) are present within the Rodney Ecological District (ED), while the Brigham Creek Interchange (BCI) sections of NoR S1 and NoR S3 are within Tamaki Ecological District. In the Project Area, the EDs are characterised by fertile soils from sediments containing volcanic ash (McEwen, 1987). Originally forested, the landscape would have been dominated by northern North Island lowland mixed podocarp broadleaved forest with abundant pūriri and kahikatea, pukatea forest riparian, floodplain and swampy areas and kauri podocarp, broadleaved forest on the steeper slopes and ridge lines (Singers, 2017).

Presently, only 18% indigenous land cover (Rodney ED) and 11% (Tamaki ED) of the native land cover; and 3% (Rodney ED) and 1% (Tamaki ED) of freshwater wetlands and wetland forests remain in the Tamaki Ecological District (Lindsay et al., 2009). The extent of remaining indigenous vegetation cover in the Project Area is severely limited and reduced to small fragments of regenerating vegetation following historical clearance.

6.2 Terrestrial Habitat and Fauna

6.2.1 Terrestrial Vegetation

Where natural habitat remains, the AUP:OP has mapped and classified habitats as terrestrial or marine SEAs. SEAs which occur within 2 km of the six NoRs are presented and described in Table 6-1. A distance of 2 km was selected as potential ZOI for adverse effects of the Project depending on the potential receiving environment and the habitats and species present with a SEA.

Table 6-1 Significant Ecological Areas present within 2 km of the Project Area

SEA	Relevant NoR	Distance from Relevant NoR (km)	SEA Type Terrestrial/ Marine	SEA Description
SEA_T_7036	NoR S1	1.05	Terrestrial	• Representative of <10% natural extent within ED: Kauri, podocarp, broadleaved forest (WF11) (24.67ha)
	NoR S2	0.75		
	NoR S3	0.60		

SEA	Relevant NoR	Distance from Relevant NoR (km)	SEA Type Terrestrial/ Marine	SEA Description
	NoR S4	1.95		• Threatened ecosystems: *Machaerina* sedgeland, (WL11) (5.9ha), Puriri forest, (WF7) • Threatened species: *Coprosma rigida* • Rare species: Kaikomako (*Pennantia corymbose*) and Pacific gecko (*Hoplodactylus pacificus*) • Habitat diversity: Pūriri forest (WF7), Mānuka, kānuka scrub (VS3), Kānuka scrub/forest (VS2), Broadleaved species scrub/forest (VS5), Unclassified (UC) and Kauri, podocarp, broadleaved forest (WF11)
	NoR KS	1.30		
	NoR HS	0.60		
SEA_T_2649	NoR S2	1.10	Terrestrial	• Representative of <10% natural extent within ED: Kauri, podocarp, broadleaved forest (WF11) (3.59 ha)
	NoR S3	1.00		
	NoR S4	1.70		
	NoR HS	1.80		
	NoR KS	1.00		
SEA_T_2650	NoR S1	0.50	Terrestrial	• Representative of <10% natural extent within ED: MF4 (24.43 ha) • Threatened ecosystems: Kahikatea Forest, (MF4) (24.4ha) • Threatened species: tuna / longfin eel (*Anguilla dieffenbachia*), īnanga / whitebait (*Galaxius maculatus, Paranephrops)* • LENZ LVL 4 remaining vegetation: <10% indigenous cover left, 10-20% left • Rare species: Kaikomako (*Pennantia corymbose*)
	NoR S2	0.65		
	NoR HS	0.60		
SEA_T_6311	NoR S1	1.60	Terrestrial	• Representative of <10% natural extent within ED: Kauri, podocarp, broadleaved forest (WF11) (1.27 ha) • Habitat diversity: Kauri, podocarp, broadleaved forest (WF11) and Pūriri forest (WF7)
SEA_T_6329	NoR S2	1.50	Terrestrial	• Representative of <10% natural extent within ED: Kahikatea Forest (MF4) (3.09 ha) • Threatened ecosystems: Kahikatea Forest (MF4) (3.1 ha)
	NoR S1	1.50		
SEA_T_6381	NoR S1	1.60	Terrestrial	• Threatened species: Kākā (*Nestor meridionalis septentrionalis*)
SEA_T_6382	NoR S1	1.65	Terrestrial	• Threatened species: Kākā (Nestor meridionalis septentrionalis)

SEA	Relevant NoR	Distance from Relevant NoR (km)	SEA Type Terrestrial/ Marine	SEA Description
				• Habitat diversity: Taraire, tawa, podocarp forest (WF9), Kānuka scrub/forest (VS2) • Buffer: Buffers a Protected Area.
SEA_T_6813	NoR S1	1.90	Terrestrial	• Habitat type supports typical species richness. • Migration pathway.
SEA_T_2034	NoR S1	0.00	Terrestrial	• An area of riparian vegetation, which is an important migration pathway for threatened fish species including īnanga (*Galaxias maculatus*). Threatened species: īnanga (*Galaxias maculatus*).
	NoR S3	0.00		
SEA-M2-57b	NoR S1	0.00	Marine	• This area covers the inner Waitematā Harbour, and it contains various mudflats and mangrove-lined inlets and creeks, with a natural succession between terrestrial, freshwater and marine habitats. These habitats are an important migration corridor for indigenous freshwater fish and for coastal fringe bird species.
	NoR S3	0.00		

6.2.2 Bats

The DOC and Supporting Growth desktop records confirm the presence of long-tailed bats (*Chalinolobus tuberculatus*) within a 10 km radius of the four NoRs (Figure 6-1). The conservation status of this species is ‘Nationally Critical’ (O’Donnell et al., 2017). There are records of bats within 3 km to the south of the Project Area, near Redhills; and 3 km to the north of the Project Area in the Riverhead Forest. The presence of bats has also been confirmed along Totara Creek by the Tonkin & Taylor (T&T) ecological assessment for the Spedding Block Whenuapai Plan Change (Tonkin & Taylor, 2020). The Tonkin & Taylor report concludes that riparian margins across the Plan Change area (Spedding Block) are likely to support bats foraging and movement between known bat populations in the Waitakere ranges and Riverhead Forest.

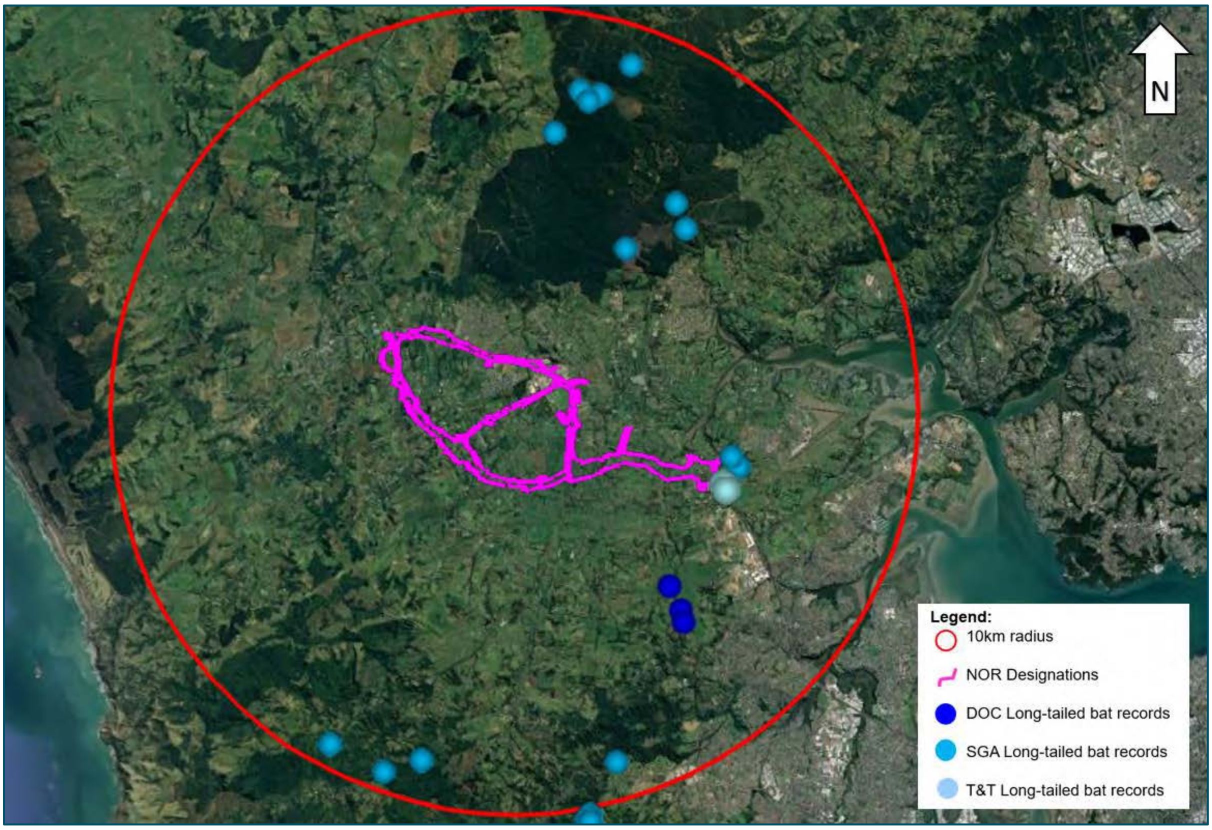

Figure 6-1 Long-tailed bat records within 10 km radius of the Project Area

6.2.3 Birds

The area wide desktop review identified 58 forest, freshwater, and coastal bird species (35 of which are native) within a 2 km buffer of the six NoRs. The full species list can be found in Appendix 4. This included 18 native bird species which are listed as 'At Risk' or 'Threatened' (Robertson et al., 2021) (Table 6-2). The majority of these native bird species are associated with coastal and marine habitats which are located < 1 km from NoRs S1 and S3, and > 1 km from NoRs S2, S4, HS and KS.

Table 6-2 Desktop study At-Risk and Threatened bird species records and their conservation status

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk – Declining
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk – Declining
Black shag	Kawau	*Phalacrocorax carbo novaehollandiae*	At Risk – Naturally Uncommon
Black-billed gull	Tarāpuka	*Larus bulleri*	Threatened – Nationally Critical
Brown teal	Pāteke	*Anas chlorotis*	At Risk – Recovering

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable
Dabchick	Weweia	*Poliocephalus rufopectus*	Threatened – Nationally Increasing
Little black shag	Kawau tūī	*Phalacrocorax sulcirostris*	At Risk – Naturally Uncommon
Long-tailed cuckoo*	Koekoeā	*Eudynamys taitensis*	Threatened – Nationally Vulnerable
New Zealand pipit	Hīoi	*Anthus novaeseelandiae*	At Risk – Declining
North Island fernbird*	Mātātā	*Poodytes punctatus*	At Risk – Declining
North Island kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk – Recovering
Northern New Zealand dotterel	Tūturiwhatu	*Charadrius obscurus aquilonius*	At Risk – Recovering
Pied shag*	Kāruhiruhi	*Phalacrocorax varius*	At Risk – Recovering
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk – Declining
Southern Diving-Petrel	-	*Pelecanoides urinatrix chathamensis*	At Risk – Relict
Spotless crake*	Pūweto	*Zapornia tabuensis*	At Risk – Declining
White-fronted tern	Tara	*Sterna striata*	At Risk – Declining

Notes: * - No records within 2 km buffer of NoRs but are anticipated to occur in the wider Project Area.

6.2.4 Herpetofauna

A review of the DOC Bioweb database found four native lizard records within a 5 km buffer of the NoRs (Table 6-3). No records were found within the NoR boundaries. However, this is likely to indicate that lizard surveys have not been completed, rather than lizards not being present. Three of the four native lizard species identified in the DOC Bioweb search have a threat status of 'At Risk' (Hitchmough et al., 2021).

The copper skink (At Risk – Declining) is widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record is less than 1 km from one of the NoR boundaries. As such, this species is highly likely to occur within and adjacent to all of the NoR areas.

Table 6-3 Native lizard species records within 5 km buffer of NoRs

Common name	Latin name	Threat Class (Hitchmough et al., 2021)
Auckland green gecko	*Naultinus elegans*	At Risk – Declining
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened – Taxonomically indeterminate
Copper skink	*Oligosoma aeneum*	At Risk – Declining
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining
Ornate skink*	*Oligosoma ornatum*	At Risk – Declining
Moko skink*	*Oligosoma moco*	At Risk – Relict

Notes: * - No records within 5 km buffer of NoRs but are anticipated to occur in the wider Project Area.

6.3 Freshwater Habitat and Fauna

6.3.1 Streams

The NZ River Name Lines (LINZ Data Service) map indicated that NoRs S1, S2 and S3 will cross a number of named rivers and streams (Table 6-4). Various tributaries will also be affected in NoRs S1, S2, S3, HS, KS, and S4, these are detailed in the relevant NoR sections (8.2.3.4, 9.2.3.4, 10.2.3.4, and 11.2.3.4).

Table 6-4 Desktop assessment of named streams that will be crossed Project wide (LINZ Database)

Relevant NoR	Stream Name
NoR S1: Alternative State Highway, including Brigham Creek Interchange	Ahukuramu Stream
	Kumeu River
	Pakinui Stream
	Karure Stream
	Ngongetepara Creek
	Brigham Creek
	Totara Creek
NoR S2: SH16 Main Road Upgrade	Kumeu River
NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor	Kumeu River
	Pakinui Stream
	Karure Stream

Relevant NoR	Stream Name
	Ngongetepara Creek
	Brigham Creek
	Totara Creek

6.3.2 Fish

The NIWA freshwater fish database was reviewed for native fish records within stream catchments affected by the Project. Of the fish recorded, three species are classified as ‘At Risk – Declining’; īnanga (*Galaxias maculatus*), longfin eel (*Anguilla australis*) and torrentfish (*Cheimarrichthys fosteri*) (Dunn et al., 2017). The desktop review results are presented in Table 6-5.

Table 6-5 Native freshwater fish species recorded within the catchments associated with NoRs S1-S4, HS and KS

Common Name	Scientific Name	Conservation Status (Dunn et al., 2017)	Streams and Relevant NoRs					
			S1, S3	S1, S3	S1, S3	S1	S1 - S4, KS	S1, S3
			Brigham Creek	Ngongetepara Stream	Totara Creek	Ahukuramu Stream	Kumeu River	Pakinui Stream
Banded kōkopu	*Galaxias fasciatus*	Not Threatened	X	X	X	X	X	
Common bully	*Gobiomorphus cotidianus*	Not Threatened	X		X	X	X	
Crans bully	*Gobiomorphus basalis*	Not Threatened	X					
Īnanga	*Galaxias maculatus*	At Risk - Declining	X		X		X	
Koura	*Paranephrops*	N/A	X			X	X	
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	X	X	X		X	
Redfin bully	*Gobiomorphus huttoni*	Not Threatened					X	
Shortfin eel	*Anguilla australis*	Not Threatened	X	X	X	X	X	X
Torrentfish	*Cheimarrichthys fosteri*	At Risk - Declining				X		

Common Name	Scientific Name	Conservation Status (Dunn et al., 2017)	Streams and Relevant NoRs					
			S1, S3	S1, S3	S1, S3	S1	S1 - S4, KS	S1, S3
			Brigham Creek	Ngongetepara Stream	Totara Creek	Ahukuramu Stream	Kumeu River	Pakinui Stream
Unidentified eel	*Anguilla* sp.	N/A		X	X		X	
Unidentified galaxiid	*Galaxias* sp.	N/A					X	

6.4 Wetland Habitat

A desktop review of existing ecological records was undertaken to gain an understanding of the wetland habitat that could be present within the ZOI of each of the six NoRs. There has been limited study or the wetland ecosystems within the Project Area. This is likely due to the high levels of modification in the landscape, particularly historical drainage and reclamation. The Auckland Council floodplain mapping and 'ecosystem potential extent' data set would suggest that the Kumeū River floodplain was once a swamp and flood-plain kahikatea, pukatea forest (WF8). As the habitat type is now almost entirely absent, this would imply the wetlands have been largely converted to agriculture, however numerous modified wetlands are likely to remain throughout the landscape. No specific desktop information on wetlands within the NoRs have been identified, however, most are likely to be modified by historical agricultural and existing urban expansion.

7 Strategic Area Positive Effects

The following section outlines the positive effects of the proposed alignment for each NoR in relation to specific ecological features (Table 7-1). The statement regarding positive effects assumes that native planting will occur on the roadsides as part of the landscape management.

There is the potential for positive effects which apply to each of the NoRs. These include:

- Improved blue/green infrastructure (stormwater wetlands, swales, raingardens) and associated landscaping (which will be indigenous species).
- Mass revegetation of sloping berms, batters and embankments to connect with retained forest remnant/mature trees. Particularly relevant for NoR S1 which largely traverses the rural zone.
- The scale of the proposed bat mitigation in association with the revegetation and stormwater wetlands mentioned above will have positive ecological outcomes for native fauna. Specifically, the development of the ASH will result in a 'green' corridor which will buffer the rural areas to the south of the ASH against future urban development for portions to the north of the ASH. Similarly, the proposed bat mitigation associated with Ngongetepara, Kumeu and Ahukuramu watercourses are likely to improve ecological connectivity around and through the future urban environment.

Table 7-1 Summary of positive effects associated with each NoR

<table>
<tr><th>Relevant NoR</th><th>Ecological Feature</th><th>Positive Effect</th></tr>
<tr><td>NoR S1, NoR S3</td><td>Ahukuramu Stream, Kumeu River, Pakinui Stream, Karure Stream, Ngongetepara Creek, Brigham Creek and Totara Creek.</td><td rowspan="4">The Project landscape planting will tie into stream and riparian corridors. Riparian vegetation will be retained (where practicable) and enhanced (weeds control and indigenous vegetation planted).</td></tr>
<tr><td>NoR S2</td><td>Ahukuramu Stream and Kumeu River tributaries.</td></tr>
<tr><td>NoR S4</td><td>Kumeu River tributaries, Totara Creek and Brigham Creek tributaries.</td></tr>
<tr><td>NoR HS, NoR KS</td><td>Kumeu River tributaries</td></tr>
<tr><td>NoR S1, NoR S3</td><td>Ahukuramu Stream, Kumeu River, Pakinui Stream, Karure Stream, Ngongetepara Creek, Brigham Creek and Totara Creek.</td><td rowspan="2">Existing infrastructure upgrades will include new bridge structures, culvert upgrades and additional/improvements to stormwater infrastructure. Upgrading undersized structures and improvements in culvert design such as embedding culverts with natural substrate/increased design capacity will improve habitat connectivity for freshwater and terrestrial species. This will include improved fish passage and</td></tr>
<tr><td>NoR S2</td><td>Ahukuramu Stream and Kumeu River tributaries.</td></tr>
</table>

Relevant NoR	Ecological Feature	Positive Effect
		improved riparian habitat connectivity.

8 NoR S1: Alternative State Highway, Including Brigham Creek Interchange

8.1 Project Corridor Features

The ASH corridor features an east-west alignment, crossing several catchments including that of Totara Creek, Ngongetepara, Kumeu and Ahukuramu systems. The portion of the ASH to the east of the North Auckland Line (NAL) is characteristically flat with more sensitive ecological features associated with the riparian zones and floodplain areas of Totara Creek, Ngongetepara and Kumeu systems. The central portion of the ASH (between the NAL and Tawa Road) crosses several head water systems associated with Kumeu tributaries. To the west of Tawa Road the topography is notably steeper with several patches of mature native vegetation present. On the western end the corridor crosses the Ahukuramu Stream.

The proposed BCI is located in Redhills North. The interchange is the eastern connection of the ASH and is mostly situated to the west of Totara Creek and associated SEA (M2-57b and T_2034).

Details regarding the design features are outlined within the AEE, but are summarised below for the ASH (Section 8.1.1) and BCI (Section 8.1.2)

8.1.1 Alternative State Highway Design Features

Key features of the proposed new corridor include the following:

The construction of a new four-lane motorway corridor with a cross-section of approximately 50 m to accommodate a four-lane dual carriageway and separated cycle lanes and footpaths. The typical cross section includes an active mode corridor with central and side barriers (

- Figure 8-1).
- An underpass at Taupaki Road and bridges over the NAL with further grade separations at Waitakere Road, Pomona Road, Tawa Road, Puke Road and Foster Road. Tawa Road is designed to future proof for a full diamond interchange;
- The western end of the alignment ties-in at a proposed three-legged roundabout with SH16 Main Road, immediately west of Foster Road;
- The re-alignment of the following local roads:
  - Pomona Road, approximately 1.5 km (two sections);
  - Motu Road, approximately 200 m; and
  - Puke Road, approximately 500 m.
- Likely posted speed of 100 km/h, design speed (of which effects will be assessed on) is 110 km/h;
- Stormwater dry ponds, wetlands and culverts;
- Batter slopes to enable the construction of the corridor, and associated cut and fill activities;

- Vegetation removal within the proposed corridor;
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Figure 8-1 Alternative State Highway Typical Cross Sections

8.1.2 Brigham Creek Interchange Overview

The proposed BCI is located in Redhills North and to the west of Whenuapai. This interchange is anchored to the ASH, RTC and Regional Active Mode Corridor strategic projects whilst facilitating a connection to Fred Taylor Drive and Brigham Creek Road. The proposed BCI currently sits within FUZ land. The existing SH16/Fred Taylor Drive/Brigham Creek Road Roundabout will be replaced by a fully grade separated interchange with on and off ramps in a 'Split-Fork" type arrangement.

Note: As part of the Waka Kotahi SH16/18 Connections Project (a non-SGA project), SH16 (south of BCI) is expected to be widened to accommodate an extra lane in each direction as well as a new City Centre to Westgate RTC and active mode facility on the southern side.

SGA's Alternative State Highway, via BCI, will tie in to the SH16/18 Connections Projects.

8.2 Existing and Likely Future Environment

8.2.1 Planning Context

The ASH corridor, including the BCI (NoR S1), is largely rural and is proposed to traverse land zoned under the AUP:OP as Rural – Countryside Living Zone, Rural – Mixed Rural Zone and Rural – Rural Production Zones.

The ASH corridor will also traverse two separate areas of FUZ in Redhills North and Kumeū-Huapai with the BCI also currently sitting within FUZ land.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the ASH and BCI.

Table 8-1 Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[13]	Likely Future Environment[14]	Implications of Future Environment on Ecological Features
Rural	Rural - Mixed Rural Zone Rural - Countryside Living Zone Rural - Production Zone	Low	Rural	All ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features are likely to be relatively unchanged.
Undeveloped greenfield areas (rural)	Future Urban	**High**	Urban	As land is developed, the majority of terrestrial vegetation (such as planted vegetation, forestry and shelterbelts outside riparian and wetland features adjacent to the NoR will be cleared and developed. However, these features may be present during the construction phase of the road (depending on the time difference between road construction and urban development). Streams, wetlands and riparian vegetation is likely to be retained and potentially locally improved through protection within esplanade reserves and habitat enhancement. Habitat connectivity may be reduced as road crossings and urbanisation fragment the catchment.

8.2.2 Permitted Activities and the Future Ecological Environment

The areas of existing undeveloped greenfields are zoned FUZ in the AUP:OP, and as such are planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding district plan vegetation), are identified as permitted activities within Chapters E26 and E15 of the AUP:OP. As such the ecological features (i.e., terrestrial habitat); excluding natural wetlands, streams and riparian edges; which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

13 Based on AUP:OP zoning/policy direction
14 Based on AUP:OP zoning/policy direction

8.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') present within the NoR S1 boundary. All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

8.2.3.1 Terrestrial Habitat

Table 8-2 summarises the vegetation types and their classification (Singers et al., 2017) associated with NoR S1. Maps are presented in Appendix 5.

Table 8-2 Vegetation types present within NoR S1

Habitat	Classification*	Description of Habitat
Brown Field (includes cropland)	BF	This definition includes Industrial zones, metaled carparks, rail corridors, unmanaged or managed land within urban settings, road median strips, pavements, cracks in concrete. Substrate includes metal (stone chip) and concrete surfaces. largely exotic herbfield (weeds) and occasional exotic or native woody species. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites.
Exotic Forest	EF	Forest vegetation with >50% cover of exotic species in the canopy. Generally used to describe single species forestry plantations. This level of distinction was used for desktop habitat assessment where the understory vegetation was not assessed.
Exotic Forest – Native Understorey	EF.1	Forest vegetation with >50% cover of exotic species in the canopy. Where understorey is indigenous species dominated (>50%) and/or groundcover biomass.
Exotic Forest – Exotic Understorey	EF.2	Forest vegetation with >50% cover of exotic species in the canopy. Where understorey is exotic species dominated (<50% native understorey) and/or groundcover biomass.
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, garden lawns and sport pitches.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. The future trajectory is uncertain. Dominant species include gorse, woolly nightshade and privet species.
Exotic Wetland	EW	Wetland ecosystems with >50% exotic plant biomass.
Planted Wetland - Native (recent)	PLW	Native restoration plantings with <50% exotic biomass.
Planted Vegetation – Native (recent)	PL.1	Native restoration plantings with <50% exotic biomass. Recently planted native scrub and forest <20 years old.

Habitat	Classification*	Description of Habitat
Planted Vegetation - Native (mature)	PL.2	Native restoration plantings with <50% exotic biomass. Mature planted native scrub and forest >20 years old.
Planted Vegetation – Exotic (amenity)	PL.3	Exotic amenity plantings. This includes planted exotic vegetation within parks, amenity areas and private gardens.
Machaerina sedgeland	WL11	Sedgeland-rushland wetland type, in depressions and freshwater margins. Species of *Machaerina, Eleocharis*, lake clubrush and locally *Carex* spp.
Treeland – Mixed Native/Exotic	TL.2	Tree canopy cover 20-80%. Mixed native/exotic: with 25-75% native tree cover. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms and amenity areas.
Treeland – Exotic-Dominated	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms and amenity areas.
Kānuka Scrub/Forest	VS2	Kānuka-dominated forest with insufficient emergent secondary species to determine trajectory to mature forest type. Occurs on hillslopes, ridges, terraces, and plains especially on free-draining soils. Species include kānuka (*Kunzea ericoides*), *Coprosma* spp*. and Pittosporum* spp.
Pūriri Forest	WF7	Remnant/regenerating pūriri, tōtara forest. Occurs on recent alluvial terraces and floodplain/river valleys. Secondary successions dominated by podocarp trees, notably totara.

Notes: * = Information from Singers et al. (2017).

8.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for all NoRs. The results of the bat survey are detailed in Appendix 11. The ABM survey confirmed bat activity at survey locations ABM2, ABM11, ABM17, ABM21, ABM23, ABM25 and ABM27 during the November-December assessment and at all locations (excluding ABM3, ABM12, ABM18, ABM19, and ABM21) during the March-April assessment. Within NoR S1, these areas coincide with the Ahukuramu Stream, Ngongetepara Creek, Kumeu River, and Pakinui Stream and associated corridors. High (100-300) and Very High (>300) number of bat passes were detected for locations ABM6, ABM7, ABM10, ABM11 and ABM17 during the March-April assessment (associated with the ASH west of Tawa Road). The T+T Structure Plan study (T+T, 2020) also detected low levels of bat activity along Totara Creek.

Trees throughout the Project area for NoR S1 were identified as having bat roost potential, this included mature trees, which were largely restricted to exotic species such as radiata pine (*Pinus* *radiata*), macrocarpa (*Hesperocyparis macrocarpa*), poplar (*Populus* spp.), ironwood (*Casuarina* spp.) and eucalyptus (*Eucalyptus* spp.). In addition to potential bat roost habitat, foraging habitat occurs throughout the NoR. Potential bat foraging habitat includes mature Treeland habitat but also less mature riparian (exotic and indigenous), wetland/open water and indigenous habitat features such as Treeland (TL.2), Kānuka Scrub/Forest (VS2) and Pūriri Forest (WF7), particularly where these follow linear commuting/foraging corridors, such as stream catchments or vegetated ridgelines.

Birds

No dedicated bird surveys were undertaken for the Project. However, incidental observations of bird species were noted during site walkovers. The full list of birds observed or heard within NoR S1 are available in Appendix 12. The majority of these species are common, introduced and naturalised or common native species such as tūī and silvereye. However, pied shag (At Risk – Recovering) was observed adjacent to Totara Creek (W3-S1) near associated mangroves. Although not observed at the time of survey, potential habitat was identified for a number of other TAR bird species, summarised in Table 8-3 below.

Table 8-3 TAR bird species likely to occur within suitable habitat in NoR S1

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
Banded rail (*Gallirallus philippensis assimilis*)	At Risk – Declining	Breeding and foraging within coastal wetland habitat (saltmarsh and mangroves). Roosting and breeding within wetlands above the high tide. Uncommon but widespread in the Auckland region (Bellingham, 2013).	Likely to occur around the Brigham Creek stream mouth at the Brigham Creek Bridge crossing within coastal Mangrove Forest and scrub (SA1.2). No suitable roosting or breeding habitat within the NoR but may utilise adjacent mangrove for foraging.
Brown teal/Pāteke (*Anas chlorotis*)	At Risk – Recovering	Wetlands with open water, including stock ponds and small streams that retain overhanging marginal vegetation. Rare but widespread in the Auckland region. Reliant on pest predator control (Williams, 2013).	Has the potential to utilise a wide range of open water and wetland locations. However, as this species is reliant on pest control it is unlikely to be resident or breeding within the NoR, but could be present.
Dabchick/Weweia (*Poliocephalus rufopectus*)	Threatened – Nationally Increasing	Small shallow freshwater lakes and ponds, with dense marginal vegetation. Uncommon but widespread in the	Has the potential to utilise any freshwater open water habitat, including stock water ponds, ornamental ponds and stormwater ponds. Likely to breed in

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
		Auckland region (Szabo, 2013).	associated marginal wetland vegetation.
Little black shag/Kawau tūī (*Phalacrocorax sulcirostris*)	At Risk – Naturally Uncommon	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Armitage, 2013).	Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds and stormwater ponds, and around Brigham Creek. No breeding or roosting sites observed.
Long-tailed cuckoo/koekoeā (*Eudynamys taitensis*)	Threatened - Nationally Vulnerable	Summer migrant to New Zealand arriving spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper and yellowhead. Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage throughout New Zealand (Gill, 2013).	Has the potential to briefly occur on migration passage across the project area. Can occur in native/exotic forest, scrub, farmland or urban areas on passage to breeding/winter habitat.
New Zealand pipit/Hīoi (*Anthus novaeseelandiae*)	At Risk – Declining	Occur in open habitat such as coastal and alpine grasslands, but also utilise modified landscapes such as pasture and scrub within the rural landscape. Rare but widespread in the Auckland region (Beauchamp, 2013).	Has the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub. Habitat suitability is low throughout NoR S1 due to agricultural intensification and likely moderate to high pest predator numbers.
North Island fernbird/Mātātā (*Bowdleria punctata vealeae*)	At Risk – Declining	Dense wetland vegetation. Rare but widespread in the Auckland region (Miskelly, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW) and

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
			Machaerina sedgeland (WL11).
North Island kākā (*Nestor meridionalis septentrionalis*)	At Risk – Recovering	Kākā are generally restricted to indigenous forest habitat and offshore islands in the Auckland region. However, they make seasonal migrations to the Auckland mainland, particularly in winter where they often utilize exotic pine and eucalyptus trees in rural and urban areas. Rare but widespread (seasonal migrant) in the Auckland region (Moorhouse, 2013).	Has the potential to utilise any mature treeland (TL.2, TL.3), exotic forest (EF.1. EF.2) or mature indigenous forest types. There is no breeding habitat within the NoR but likely to infrequently utilise exotic trees for seasonal foraging and roosting throughout winter season.
Pied shag (*Phalacrocorax varius*)	(At Risk – Recovering)	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Powlesland, 2013).	Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds and stormwater ponds, and around Brigham Creek. No breeding or roosting sites observed.
Spotless crake/pūweto (*Porzana tabuensis plumbea*)	At Risk – Declining	Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation. Rare but widespread in the Auckland region (Fitzgerald, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW), *Machaerina* sedgeland (WL11) and marginal vegetation associated with stock water ponds, ornamental ponds and stormwater ponds.

Lizards

Native lizards were not identified during opportunistic searches completed during the site walkover. However, the introduced plague skink (*Lampropholis delicata*) was identified within NoR S1 at 54 Puke Road and south of Brigham Creek roundabout. Copper skink have been recorded within 1.5 km of NoR S1. Copper skink is likely to be associated with most of the vegetation units presented in Table 8-2 where there is appropriate understorey. Habitat with potential to support copper skink within NoR S1 is represented by areas with sufficient understorey relating to vegetation units EF, EF.1, EF.2, EG (rank grass that is defined as unmanaged, not grazed or mown), ES, PL.1, PL.2, PL.3, TL.2, TL.3, VS2 and WF7 habitat. Other native lizard species are generally restricted to indigenous forest, indigenous scrub, coastal habitat types or habitat contiguous to such area. As habitat connectivity to SEAs is limited within the wider Project Area it is unlikely that any other species listed in Table 6-3 will occur within the Project Area, however ornate skink have been included together with copper skink, as although unlikely, they have potential of occurring within suitable modified habitat, such as dense riparian vegetation.

8.2.3.3 Terrestrial Ecological Value

Appendix 6 presents the ecological value for the terrestrial vegetation identified within NoR S1. Information obtained for the ecological baseline (Sections 8.2.3.1 and 8.2.3.2), as well as the desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological value of habitats ranged from **Negligible** (e.g., BF) to **Very High** (e.g., VS2, WF7).

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with EIANZ Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk - Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments for individual species are considered to range from **Moderate** to **Very High** (Table 8-4).

Table 8-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units[15]	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	EF, EF.1, EF.2, TL.2, TL.3, VS2, WF7	Threatened – Nationally Critical	**Very High**
TAR Birds	Long-tailed cuckoo	EF, EF.1, EF.2, PL.2, TL.2, TL.3, VS2, WF7	Threatened – Nationally Vulnerable	**Very High**

[15] Habitat units included in the table also include non-terrestrial habitat units. This is because all birds have been assessed under the terrestrial section for practical reasons.

Fauna Type	Species Within Habitat	Habitat Units[15]	Conservation Status (NZ Classification System)	Ecological Value
	Brown teal, dabchick	OW, PLW, WL.11	Threatened – Nationally Increasing	
	Banded rail	SA1.2	At Risk - Declining	**High**
	North Island fernbird, spotless crake	OW, PLW, WL.11		
	New Zealand pipit	EG, ES		
	North Island kākā	EF, EF.1, EF.2, PL.2, TL.2, TL.3, VS2, WF7	At Risk – Recovering	**Moderate**
	Little black shag	OW, PLW, WL.11	At Risk – Nationally Uncommon	
	Pied shag		At Risk – Recovering	
Herpetofauna (Lizards)	Copper skink	EF, EF.1, EF.2, EG, ES, PL.1, PL.2, PL.3, TL.2, TL.3, VS2, WF7	At Risk – Declining	**High**
	Ornate skink	EF, EF.1, EF.2, TL.2, TL.3, VS2, WF7		

8.2.3.4 Freshwater Habitat

All potential streams within NoR S1 were mapped (Appendix 5) and classified as either permanent or intermittent. Ephemeral streams were mapped when possible. Permanent or intermittent streams that were within the designation boundary were numbered and assessed.

Stream classification, description and RHA assessment

A total of 33 stream branches were identified during the desktop and site investigations within NoR S1. The streams are detailed further in Table 8-5.

In summary, streams within NoR S1 were classified as follows:

- A total of 19 stream branches were identified as intermittent, as three or more of the intermittent stream criteria (Storey & Wadhwa, 2009) were met.
- A total of 14 stream branches were identified as permanent, as there was evidence of continuous flow.

A total of 11 streams (eight intermittent and three permanent) were not accessible and are indicated by * in Table 8-5. The ecological value for these streams were assessed at a desktop level (Section 8.2.3.6).

All other streams were accessed during site investigations and surveyed using the RHA. The streams measured overall habitat quality scores that ranged from ‘Poor’ to ‘Moderate’ (Table 8-5). Detailed RHA results are presented in Appendix 10. The RHA category was included within the ecological value assessment for each of the streams where it was applied (Section 8.2.3.6).

Table 8-5 Summary of streams identified in NoR S1

Stream ID	Classification	RHA Category
S1-S1a	Permanent	Moderate
S1-S2	Permanent	Poor
S1-S1b	Permanent	Moderate
S1-S1c	Permanent	Moderate
S1-S3	Intermittent	Poor
S1-S4*	Intermittent	N/A
S1-S5*	Permanent	N/A
S1-S6*	Intermittent	N/A
S1-S7*	Intermittent	N/A
S1-S8*	Intermittent	N/A
S1-S9	Intermittent	Poor
S1-S10	Intermittent	Poor
S1-S11	Permanent	Moderate
S1-S13*	Intermittent	N/A
S1-S14	Intermittent	Poor
S1-S15*	Permanent	N/A
S1-S16*	Intermittent	N/A
S1-S17	Permanent	Moderate
S1-S18*	Permanent	N/A
S1-S19	Intermittent	Poor
S1-S20a	Permanent	Moderate
S1-S20d	Intermittent	Moderate
S1-S20e	Intermittent	Moderate
S1-S21	Permanent	Moderate
S1-S22	Permanent	Moderate

Stream ID	Classification	RHA Category
S1-S23	Intermittent	Poor
S1-S24	Permanent	Poor
S1-S25*	Intermittent	N/A
S1-S26	Intermittent	Poor
S1-S27*	Intermittent	N/A
S1-S28	Intermittent	Poor
S1-S29	Intermittent	N/A
W3-S1	Permanent	Moderate
W4-S1	Permanent	N/A

Notes: * = Streams assessed at a desktop level due to access restrictions.

8.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however the following At Risk - Declining species have been recorded in the wider catchment area associated with NoR S1 (Table 6-5):

- Īnanga – Brigham Creek, Totara Creek and Kumeu River
- Longfin eel – Brigham Creek, Ngongetepara Stream, Totara Creek, Kumeu River
- Torrentfish – Ahukuramu Stream.

The freshwater habitats within NoR S1 were assessed for their potential to support native fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey. In addition, the following species were observed onsite:

- Īnanga at S1-S1a (Ahukuramu Stream) (1 Foster Road)
- Unidentified eels observed at S1-S1b (116 Foster Road) and S1-S17 (Kumeu River) (374 Taupaki Road)
- Freshwater mussel shells (*Echyridella menziesii*) (At Risk - Declining) observed on dry banks of S1-S17 (Kumeu River) (176A Boord Crescent).

8.2.3.6 Freshwater Ecological Value

Appendix 7 presents the ecological value for the aquatic habitats identified within NoR S1. Information obtained for the ecological baseline (Section 8.2.3.4 and 8.2.3.5), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological values of freshwater habitats are presented in Table 8-6.

Table 8-6 Summary of freshwater ecological value identified in NoR S1

Stream ID	Ecological Value
S1-S1a	Moderate

Stream ID	Ecological Value
S1-S2	Moderate
S1-S1b	High
S1-S1c	Moderate
S1-S3	Low
S1-S4*	Low
S1-S5*	Moderate
S1-S6*	Low
S1-S7*	Low
S1-S8*	Low
S1-S9	Low
S1-S10	Low
S1-S11	Moderate
S1-S13*	Low
S1-S14	Low
S1-S15*	Moderate
S1-S16*	Low
S1-S17	High
S1-S18*	Moderate
S1-S19	Low
S1-S20a	Moderate
S1-S20d	Low
S1-S20e	Low
S1-S21	Moderate
S1-S22	High
S1-S23	Low
S1-S24	High
S1-S25*	Low
S1-S26	Low
S1-S27*	Low

Stream ID	Ecological Value
S1-S28	Low
S1-S29	Moderate
W3-S1	High
W4-S1	High

8.2.3.7 Wetland Habitat

A total of 54 wetlands within NoR S1 were identified and assessed. Details regarding the vegetation cover and NPS-FM classification for each wetland is presented in Table 8-7. Refer to Appendix 5 for a map showing the spatial distribution of wetlands.

Table 8-7 Summary of wetlands identified in NoR S1

Wetland ID	Vegetation/Wetland Type[16]	NPS-FM Classification	Potential for TAR Species
S1-W1	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W2	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W3*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W4	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W5	Planted Wetland (PLW)	Natural wetland	Potential for fernbird and spotless crake.
S1-W56*	Exotic Wetland	Natural wetland	Unlikely to support TAR birds.
S1-W6	Planted Wetland (PLW) and small area of EW	Natural wetland	Potential for fernbird and spotless crake.
S1-W7	*Machaerina* sedgeland (WL11)	Artificial (constructed for stock watering)	Unlikely to support TAR birds.
S1-W8	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W9	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.

[16] Open water, as an ecological feature, has been included under the wetland section.

Wetland ID	Vegetation/Wetland Type[16]	NPS-FM Classification	Potential for TAR Species
S1-W10 & S1-W10 (OW)	*Machaerina* sedgeland (WL11) & Open Water (OW)	Natural wetland	Potential for fernbird and spotless crake.
S1-W11	*Machaerina* sedgeland (WL11)	Natural wetland	Potential for fernbird and spotless crake.
S1-W12*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W13*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W14*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W15*	*Machaerina* sedgeland (WL11)	Natural wetland	Potential for fernbird and spotless crake.
S1-W16 & S1-W16 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Wetland unlikely to support TAR birds. Pond potential to support dabchick and spotless crake.
S1-W17	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W18	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds.
S1-W19	*Machaerina* sedgeland (WL11)	Natural wetland	Potential for fernbird and spotless crake.
S1-W20*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W21*	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.
S1-W22*	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.
S1-W23 & S1-W23 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds.
S1-W24 & S1-W24 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds. King fern present.
S1-W25*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.

Wetland ID	Vegetation/Wetland Type[16]	NPS-FM Classification	Potential for TAR Species
S1-W26*	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.
S1-W27*	*Machaerina* sedgeland (WL11)	Natural wetland	Potential for dabchick, fernbird and spotless crake.
S1-W28*	Exotic Wetland (EW)	Artificial wetland	Potential for spotless crake.
S1-W29*	Exotic Wetland (EW)	Natural wetland	Potential for spotless crake and fernbird.
S1-W30*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W31 & S1-W31 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds.
S1-W32*	Planted Wetland (PLW)	Natural wetland	Potential spotless crake and fernbird.
S1-W33*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W34 & S1-W34 (OW)*	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds.
S1-W36*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.
S1-W37	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W38*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W39	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W40	*Machaerina* sedgeland (WL11)	Natural wetland	Unlikely to support TAR birds.
S1-W41	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W42*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W43 & S1-W43 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Potential for spotless crake and dabchick.

Wetland ID	Vegetation/Wetland Type[16]	NPS-FM Classification	Potential for TAR Species
S1-W44	*Machaerina* sedgeland (WL11)	Natural wetland	Unlikely to support TAR birds.
S1-W45 & S1-W45 (OW)*	Exotic Wetland (EW) & Open Water (OW)	EW: Natural wetland OW: Artificial wetland (Farm ponds)	Potential for spotless crake and dabchick.
S1-W46 & S1-W46 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Exotic Wetland unlikely to support TAR birds. Pond potential to support spotless crake and dabchick.
S1-W47*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S1-W48*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.
S1-W49*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.
S1-W50 & S1-W50 (OW)*	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds.
S1-W51*	Planted Wetland (PLW)	Artificial wetland	Potential for spotless crake.
S1-W53*	Planted Wetland (PLW)	Natural wetland	Potential for spotless crake.
S1-W54	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.
S1-W55	Planted Wetland (PLW)	Artificial wetland	Potential for spotless crake.
S1-W57 & S1-W57 (OW)	Planted Wetland (PLW) & Open Water (OW)	Artificial wetland (Stormwater Pond)	Potential for dabchick and spotless crake.
S1-W58	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick and spotless crake.
S1-W59	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick and spotless crake.
S1-W60	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Unlikely to support TAR birds.
S1-W61	Open Water (OW)	Artificial Wetland	Potential for dabchick and spotless crake.

Wetland ID	Vegetation/Wetland Type[16]	NPS-FM Classification	Potential for TAR Species
		(Ornamental Pond)	
S1-W62	Open Water (OW)	Artificial Wetland (On-stream farm pond)	Potential for dabchick, fernbird and spotless crake.
S1-W63	Open Water (OW)	Artificial Wetland (On-stream farm pond)	Potential for dabchick, and spotless crake.
S1-W64	Open Water (OW)	Artificial Wetland (On-stream farm pond)	Potential for dabchick, and spotless crake.
S1-W65	Open Water (OW)	Artificial Wetland (Farm pond)	Unlikely to support TAR birds.
S1-W66	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick, and spotless crake.
S1-W67	Open Water (OW)	Artificial Wetland	Potential for dabchick.
S1-W68	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.
S1-W69*	Exotic Wetland (EW)	Natural Wetland	Unlikely to support TAR birds.
S1-W70	Open Water (OW)	Artificial wetland	Potential for dabchick.
S1-W71	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.
S1-W72	Exotic Wetland (EW)	Natural Wetland	Unlikely to support TAR birds.

Notes: * = Wetlands assessed at a desktop level due to access restrictions.

8.2.3.8 Wetland Ecological Value

Appendix 8 presents details of the ecological value for the wetland habitats identified within NoR S1. Information obtained for the ecological baseline (Section 8.2.3.7), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological values of wetland habitats are presented in Table 8-8.

Table 8-8 Summary of wetland ecological value identified in NoR S1

Wetland ID	Ecological Value
S1-W1	Low
S1-W2	Low

Wetland ID	Ecological Value
S1-W3	Low
S1-W4	Moderate
S1-W5	High
S1-W56	Low
S1-W6	High
S1-W7	Moderate
S1-W8	Low
S1-W9	Low
S1-W10 & S1-W10 (OW)	Very High
S1-W11	High
S1-W12	Low
S1-W13	Low
S1-W14	Low
S1-W15	High
S1-W16 & S1-W16 (OW)	Moderate
S1-W17	Low
S1-W18	Moderate
S1-W19	High
S1-W20	Moderate
S1-W21	High
S1-W22	High
S1-W23 & S1-W23 (OW)	Low
S1-W24 & S1-W24 (OW)	Low
S1-W25	Low
S1-W26	Moderate
S1-W27	Very High
S1-W28	Low
S1-W29	Low
S1-W30	Low

Wetland ID	Ecological Value
S1-W31 & S1-W31 (OW)	Low
S1-W32	Moderate
S1-W33	Low
S1-W34 & S1-W34 (OW)	Low
S1-W36	Low
S1-W37	Low
S1-W38	Low
S1-W39	Low
S1-W40	High
S1-W41	Moderate
S1-W42	Low
S1-W43 & S1-W43 (OW)	Low
S1-W44	Moderate
S1-W45 & S1-W45 (OW)	Low
S1-W46 & S1-W46 (OW)	Moderate
S1-W47	Low
S1-W48	Negligible
S1-W49	Negligible
S1-W50 & S1-W50 (OW)	Low
S1-W51	Moderate
S1-W53	High
S1-W54	Moderate
S1-W55	Moderate
S1-W57 & S1-W57 (OW)	Moderate
S1-W58	Low
S1-W59	Low
S1-W60	Low
S1-W61	Low
S1-W62	Low

Wetland ID	Ecological Value
S1-W63	Low
S1-W64	Low
S1-W65	Low
S1-W66	Low
S1-W67	Low
S1-W68	Low
S1-W69	Moderate
S1-W70	Negligible
S1-W71	Negligible
S1-W72	Negligible

8.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 8.3 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

8.3.1 Construction Effects - Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within and adjacent to NoR S1 (as they relate to district matters) have been identified:

- Vegetation removal subject to district controls (refer to Appendix 5).
- Disturbance and displacement to roosts/nests and individual (existing) bats, birds and lizards due to construction activities (noise, light, dust etc.). It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the project footprint/designation or underneath structures such as bridges.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline (refer Section 8.2.2) and the 'existing environment' (i.e., allowing for permitted activities) (refer Section 8.2.1).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.3.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it relates to loss in foraging habitat, and mortality and injury) is assessed in Sections 8.3.1.2 and 8.3.1.3.

Table 8-9 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S1

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**EF (total area of 690.59 m^2)** The magnitude of effect is assessed as **Negligible** due to the small extent of the vegetation and the low likelihood that fragmentation and edge effect will occur despite definite removal of the vegetation. The ecological value of EF is assessed to be **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **TL.2 (total area of 198.56 m^2)** The magnitude of effect is assessed as **Low** due to the small extent of the vegetation and the low likelihood that fragmentation and edge effect will occur despite definite removal of the vegetation. The ecological value of TL.2 is assessed to be **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **TL.3 (total area of 9664.11 m^2)** The magnitude of effect is assessed as **Low** due to the low likelihood that fragmentation and edge effect will occur despite definite removal of the vegetation. The ecological value of TL.3 is assessed to be **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the Baseline.
Impact management and residual level of effect	N/A	N/A

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A

8.3.1.2 Bats

Bats may utilise the habitats associated with NoR S1 for roosting or foraging. Specifically, areas of Exotic Forest (EF), Exotic Forest – Native Understorey (EF.1), Exotic Forest – Exotic Understorey (EF.2), Mixed Native/Exotic Treeland (TL.2), Exotic-Dominated Treeland (TL.3), Kānuka Scrub/Forest (VS2) and Pūriri Forest (WF7). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. Although bat foraging has been confirmed, ABM survey at the Project scale cannot confirm roost occupation within or adjacent to the designation boundary. However, it can be assumed that bats will utilise roost sites within the Project Area based on:

- Confirmed habitat suitability (numerous trees with moderate to high bat roost potential, connected to linear stream corridors and wetlands)
- Confirmed foraging presence and;
- Frequent utilisation of numerous roosting sites throughout their home range (Smith et al., 2017).

Additionally, bats may be impacted by removal of district plan vegetation through the following effects:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Roost loss
- Mortality or injury to bats

Table 8-10 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

Table 8-10 Assessment of ecological effects for bats and impact management during construction for NoR S1

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Roost loss - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required.	Same as Baseline due to the retention of vegetation within riparian corridors and the low likelihood of change within the Rural zone where mature trees are likely to remain. Portions of the NoR associated with the FUZ may also provide bat habitat if construction occurs prior to urbanisation.	***Loss of foraging habitat & Roost loss*** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. ***Mortality or injury to bats*** The magnitude of effect is assessed as **Low** due to likely probability, but local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Roost loss - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid EF, EF.1, EF.2, TL.2, TL.3, VS2 and WF7 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around EF, EF.1, EF.2, TL.2, TL.3, VS2 and WF7 habitat.	Same as Baseline.	A BMP should be developed to include consideration for: • The provisions of the Wildlife Act. • Timing of vegetation removal. • Design and implementation of a vegetation removal protocol, including pre-felling surveys. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Roost loss - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	• Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

8.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat adjacent to NoR S1. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 8-11 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 8-11 Assessment of ecological effects for birds and impact management during construction for NoR S1

	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **High** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as	Same as Baseline.	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with district plan vegetation and the high probability that these effects could occur. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **High**, and the overall	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very**		level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very**	

	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (brown teal, dabchick)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance and frequent occurrence. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **<u>Wetland TAR birds (North Island fernbird, banded rail, spotless crake)</u>** The magnitude of effect is assessed as **Low** due to the likely probability and continuous occurrence. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low**		**Low** prior to mitigation. As such no impact management is required.	

	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (little black shag, pied shag)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as Very **Low** prior to mitigation. As such no impact management is required.			
Impact management and residual level of effect	**<u>Brown teal, dabchick</u>** Impact management is required for brown teal and dabchick. The Bird Management Plan should consider the following: • Where practical, construction works near suitable wetland habitat (refer Table 8-7) should commence prior to the bird breeding season (September to	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	February) in order to discourage bird nesting. • Bird management should be consistent with any regional consent conditions that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

8.3.1.4 Lizards

Construction effects on lizards within habitat adjacent to the NoR associated with noise, light and vibration are presented in Table 8-12. Construction activity mostly relates to the construction of new roads. Lizards present in areas adjacent to the proposed new roads may not be habituated to noise and vibration. Overall, the likelihood of disturbance is expected to be Low. Regional matters as they relate to vegetation removal and lizards are further discussed in Section 8.4.4.

Table 8-12 Assessment of ecological effects for lizards and impact management during construction for NoR S1

Effect Description	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the highly likely probability of local lizard disturbance adjacent to construction related noise and vibration in areas where new roads are constructed. The ecological value of copper skink and ornate skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

8.3.2 Operational Effects - Terrestrial Ecology

The Project involves the construction of a new state highway largely within a rural landscape with sections located in future urban zoned areas; therefore, it is likely that operational effects such as fragmentation and noise and lighting may increase from the current baseline. In general, potential operational effects from the Project that relate to District plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline (refer Section 8.2.2) and the 'existing environment' (i.e., allowing for permitted activities) (refer Section 8.2.1).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.3.2.1 Bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roost). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity should be assessed in the context of confirmed bat activity in the broader landscape, the presence of two important ecological nodes (namely Riverhead Forest and Waitakere Ranges), the low degree of existing fragmentation and the future environment (mainly remaining rural).

Table 8-13 outlines the effect assessment for:

- Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to additional fragmentation of terrestrial habitat due to the presence of the infrastructure.
- Disturbance and displacement of bats due to light, noise and vibration from the road.

Table 8-13 Assessment of ecological effects for bats and impact management during operation for NoR S1

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Moderate** due to the relatively local extent of disturbance and high likelihood of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** for the disturbance of individual bats and roosts. As such impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **High** due to the high probability of loss in connectivity due to the operation of the ASH in areas with confirmed bat movement and the presence of two known ecological nodes likely important to the regional bat population The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Very High** for loss in connectivity. As such impact management is required.	Same as Baseline.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting and retention of existing mature trees between	Same as Baseline.	A BMP should be developed as outlined in Appendix 14[18]. The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer	Same as Baseline.

[18] As verified by Dr Ian Davidson-Watts of Davidson-Watts Ecology (Pacific) Limited in Appendix **Error! Reference source not found.**.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	the road alignment and features with potential for bat roosts[17]. • Light and noise management through design. • Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Low** post mitigation.		planting and existing mature tree features that will be retained, as well as indicating areas where early planting[19] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity	

[17] This may be in addition to the buffer planting proposed in Appendix **Error! Reference source not found.** and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			thresholds, robust monitoring and potential corrective action. The residual impact is assessed as **Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

8.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S1, while noise, light and vibration may also affect connectivity in the broader landscape.

Table 8-14 outlines the operational effect assessment and impact management for birds.

Table 8-14 Assessment of ecological effects for birds and impact management during operation for NoR S1

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	<u>**Non-TAR birds**</u> The magnitude of effect is assessed as **High**, due to the definite likelihood of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. <u>**Terrestrial TAR birds (long-tailed cuckoo)**</u> The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. <u>**Terrestrial TAR birds (New Zealand pipit)**</u> The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effect if disturbance occurs.	Same as Baseline.	<u>**Non-TAR birds**</u> The magnitude of effect is assessed as **High** due to the definite likelihood of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. <u>**Terrestrial TAR birds (long-tailed cuckoo)**</u> The magnitude of effect is assessed as **Low** due to an unlikely probability, but potentially more than local extent of the effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. Further information on impact management is detailed in the row below. <u>**Terrestrial TAR birds (New Zealand pipit)**</u> The magnitude of effect is assessed as **Low** due to a lower probability and potentially more than local extent of the effect.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability, infrequent and local extent of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (brown teal, dabchick)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **<u>Wetland TAR birds (North Island fernbird, banded rail, spotless crake)</u>** The magnitude of effect is assessed as **Low** due to likely probability and local level of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such impact management is not required.		The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Low** due to an unlikely probability and regional extent of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (brown teal, dabchick)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **<u>Wetland TAR birds (North Island fernbird, banded rail, spotless crake)</u>** The magnitude of effect is assessed as **Low** due to likely probability and local level of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such impact management is not required.	

<table>
<tr><th rowspan="2">Effect Description</th><th colspan="2">Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)</th><th colspan="2">Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure</th></tr>
<tr><th>Baseline</th><th>Likely Future Ecological Environment</th><th>Baseline</th><th>Likely Future Ecological Environment</th></tr>
<tr><td></td><td><u>Wetland TAR birds (little black shag, pied shag)</u>
The magnitude of effect is assessed as Negligible due to the unlikely probability of effect.
The ecological value of these species is Moderate, and the overall level of effect is assessed as Very Low prior to mitigation. As such no impact management is required.</td><td></td><td><u>Wetland TAR birds (little black shag, pied shag)</u>
The magnitude of effect is assessed as Low due to the unlikely probability of the effect.
The ecological value of these species is Moderate, and the overall level of effect is assessed as Low prior to mitigation. As such no impact management is required.</td><td></td></tr>
<tr><td>Impact management and residual level of effect</td><td><u>Brown teal, dabchick</u>
Impact management is required for brown teal and dabchick. The following mitigation measures should be implemented where practicable:
Retention of vegetation near wetland habitat, where practicable.
Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically at S1-W6, S1-W10, S1-W27, and S1-W66).
Installation of vegetation hop-overs in key areas where the road corridor fragments local areas of suitable habitat (open water and some wetlands).
The residual impact is assessed as Very Low post mitigation.</td><td></td><td><u>Long-tailed cuckoo</u>
Impact management is required for long-tailed cuckoo. This is due the Very High value of the species. Since it is a highly mobile migrant species, it is anticipated that mitigation associated with landscape planting, riparian planting and bat mitigation will result in a Very Low residual impact post mitigation.
<u>Brown teal, dabchick</u>
Impact management is required for brown teal and dabchick. The following mitigation measures should be implemented where practicable:
Retention of vegetation near wetland habitat, where practicable.
Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically at S1-W6, S1-W10 & S1-W10 (OW), S1-W16, S1-W27, S1-W45, S1-W59 (OW), and S1-W64).</td><td></td></tr>
</table>

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			• Installation of vegetation hop-overs in key areas where the road corridor fragments local areas of suitable habitat (open water and some wetlands). The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

8.3.2.3 Lizards

Suitable habitat (EF, EF.1, EF.2, EG, ES, PL.1, PL.2, PL.3, TL.2, TL.3, VS2, WF7) was identified within the NoR boundary which could potentially support native copper skink and ornate skink (At Risk – Declining). Native lizards require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

The majority of NoR S1 will be a new road, while a portion of it involves upgrading an existing interchange and localised works to existing local roads. In areas where the new state highway is constructed, it is likely that there will be some localised lizard disturbance from noise, vibration and lighting and fragmentation of lizard habitat for a period during operation. However, in areas with existing roads, it is not expected to result in the additional fragmentation of lizard habitat. Similarly, resident (existing and future) lizards are likely to be habituated to disturbance such as noise, vibration and lighting and no additional effect on lizards is expected, provided that the post-upgraded road will not result in higher levels of noise and vibration.

Table 8-15 outlines the operational effect assessment and impact management for lizards.

Table 8-15 Assessment of ecological effects for lizards and impact management during operation for NoR S1

Effect Description	Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of disturbance if the effect occurs. The ecological value of copper skink and ornate skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to the likely probability and relatively local extent of loss in connectivity if the effect occurs. The ecological value of copper skink and ornate skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

8.3.3 Effects Conclusions

The ecological level of effects assessed as **Moderate**, **High** or **Very High** for NoR S1, and therefore require impact management, are described in Sections 8.3.3.1 to 8.3.3.3.

8.3.3.1 Long-tailed bats

- **Moderate** level of effect for disturbance and displacement to roosts and individuals (existing) during construction for the Baseline and Future Environment.
- **Moderate** level of effect for mortality or injury to bats due to the removal of district plan vegetation during construction for the Baseline and Future Environment.
- **Very High** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.
- **High** level of effect for the disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low** to **Low** for construction and operational related effects.

8.3.3.2 Long-tailed cuckoo

- **Moderate** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Negligible.**

8.3.3.3 Brown teal, dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) during construction for the Baseline and Future Environment.
- **Moderate** level of effect for disturbance and displacement to roosts and individual birds (existing) due to the presence of the road during operation for the Baseline and Future Environment.
- **Moderate** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Negligible** for construction and operational effects

8.4 Design and Future Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for NoR S1. Wildlife Act Authority permits are also discussed in relation to the potential killing or injuring of native fauna associated with the Project activities.

8.4.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoRs, including suitable habitat that is potentially being used by native fauna (bats, birds, and lizards). Loss of vegetation that is subject to district plan controls is discussed in Section 8.3.1.

The amounts and types of all[20] terrestrial habitat and vegetation (including habitat used by native fauna) that could be lost as a result of the Project is presented in Table 8-16 under the Footprint column.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges from **Negligible** to **Very High** ecological value (Section 8.2.3.3). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 8.4.2 to 8.4.4 below.

Table 8-16 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S1

Feature	Classification*	Footprint (m²)
Brown Field (includes cropland)	BF	4,976
Exotic Forest^	EF	4,355
Exotic Forest – Native Understorey	EF.1	2,809
Exotic Forest – Exotic Understorey	EF.2	4,843
Exotic Grassland	EG	#
Exotic Scrub	ES	17,792
Planted Vegetation – Native	PL.1	38,499
Planted Vegetation – Mixed	PL.2	2,574
Planted Vegetation – Exotic	PL.3	206,716
Mixed Native/Exotic Treeland^	TL.2	9,007
Exotic-Dominated Treeland^	TL.3	115,719
Kānuka Scrub/Forest	VS2	3,010
Pūriri Forest	WF7	2,395

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation. # = Not mapped due to the extent.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent (for example, removal of vegetation in the riparian setback) and wildlife permit applications (if required).

20 Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

8.4.2 Bats

Mature trees in suitable habitat areas (EF, EF.1, EF.2, TL.2, TL.3, VS2, and WF7) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats and roosts will likely be re-assessed prior to obtaining any Regional resource consents for vegetation removal (relevant under regional matters) and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

The presence of bat habitat and bat roosts will require a BMP. The objectives of bat management will be to, where practicable:

- Identify bat priority areas that may be affected by the Project.
- Avoid bat priority areas through alignment and design.
- Avoid effects of lighting and noise on bats within bat priority areas.
- Avoid injury and/or death of roosting bats during vegetation removal.
- Avoid disturbance through construction management (seasonal restriction on vegetation removal December to April)
- Outline additional mitigation where avoidance is not feasible including any offset/compensation that may be required.

8.4.3 Birds

TAR birds associated with terrestrial habitats are likely to include migratory kākā and long-tailed cuckoo. The habitats available (EF, EF.1, EF.2, TL.2, TL.3, VS2, and WF7) provide low quality, nonbreeding habitat and may be used seasonally and infrequently for roosting and foraging. The value of these habitats ranges from **Low** to **Very High.**

TAR birds associated with wetland habitats are likely to include brown teal, dabchick, North Island fernbird, spotless crake, little black shag, and pied shag. TAR birds associated with mangrove forest and scrub (SA1.2) habitats are likely to include banded rail.

Not Threatened native birds are highly likely to be present within the NoR and utilise all identified terrestrial habitats (excluding Brown Fields). Vegetation clearance required for construction could result in the loss of these habitats of local value to native birds. The value of these habitat ranges from **Low** to **Very High** and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

8.4.4 Lizards

Native copper skink and ornate skink are likely to be present within vegetation impacted by the Project. Therefore, there is potential that site clearance required for construction could kill or injure native lizard species and result in the removal of their habitat. Any vegetation clearance where copper skink or ornate skink are likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

8.4.5 Freshwater Ecology

The construction of NoR S1 will directly impact 18 streams, ranging from **Low** to **Moderate** ecological value. Approximately 1,811.5 m of stream reclamation will be required to accommodate the Project works in NoR S1. The road alignment was adjusted to avoid and minimise effects on the Kumeu River (and associated floodplains) south of Boord Crescent. Similarly, more sensitive stream and wetland complexes (for example 32 and 34 Pamona Road) and 133 Puke Road will be bridged.

The predicted permanent and intermittent stream loss for the Project is presented in Table 8-17. These calculations will require re-evaluation as part of the future regional consent process. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 8-17 Potential stream loss (permanent and intermittent) within NoR S1

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*
S1-S1a	Permanent	Moderate	38
S1-S2	Permanent	Moderate	30
S1-S1b	Permanent	High	219
S1-S3	Intermittent	Low	46
S1-S9	Intermittent	Low	48.5
S1-S10	Intermittent	Low	121.5
S1-S13*	Intermittent	Low	176.5
S1-S14	Intermittent	Low	115
S1-S16*	Intermittent	Low	143
S1-S20a	Permanent	Moderate	99
S1-S20d	Intermittent	Low	106.5
S1-S20e	Intermittent	Low	42
S1-S21	Permanent	Moderate	69.5
S1-S23	Intermittent	Low	91.5
S1-S25*	Intermittent	Low	253
S1-S27*	Intermittent	Low	101
S1-S28	Intermittent	Low	30.5
W4-S1	Permanent	High	81

Notes: * = Some assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, lengths are indicative.

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

8.4.6 Wetland Ecology

Wetland extent and approximate value was considered during the Multi Criteria Assessment (MCA) to inform the Alternatives Assessment for all of the proposed alignment options. This was achieved through a desktop wetland delineation for all of the NoR options along with a proxy based assessment of ecological value (catchment condition, vegetation cover, relationship with other ecological features).

The construction of NoR S1 will impact 32 natural wetlands ranging from **Negligible** to **High** ecological value. Approximately 31,534 m^2 of direct wetland loss will occur (Table 8-18). It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 8-18 Potential wetland loss within NoR S1

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S1-W1	Exotic Wetland (EW)	Low	248
S1-W2	Exotic Wetland (EW)	Low	988.5
S1-W4	Exotic Wetland (EW)	Moderate	3860
S1-W56	Exotic Wetland	Low	86
S1-W6	Planted Wetland (PLW) and small area of EW	High	1176.5
S1-W11	*Machaerina* sedgeland (WL11)	High	552
S1-W12	Exotic Wetland (EW)	Low	210.5
S1-W19	*Machaerina* sedgeland (WL11)	High	193
S1-W20	Exotic Wetland (EW)	Moderate	6670
S1-W21	Planted Wetland (PLW)	High	1011
S1-W22	Planted Wetland (PLW)	High	1054
S1-W23 & S1-W23 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	2001.5
S1-W24 & S1-W24 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	975.5
S1-W25	Exotic Wetland (EW)	Low	275
S1-W31 & S1-W31 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	85
S1-W33	Exotic Wetland (EW)	Low	235.5
S1-W34 & S1-W34 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	90
S1-W38	Exotic Wetland (EW)	Low	700

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S1-W39	Exotic Wetland (EW)	Low	555
S1-W40	*Machaerina* sedgeland (WL11)	High	537.5
S1-W41	Exotic Wetland (EW)	Moderate	1696.5
S1-W42	Exotic Wetland (EW)	Low	812
S1-W43 & S1-W43 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	168.5
S1-W44	*Machaerina* sedgeland (WL11)	Moderate	127.5
S1-W45 & S1-W45 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	577.13
S1-W46 & S1-W46 (OW)	Exotic Wetland (EW) & Open Water (OW)	Moderate	1122
S1-W47	Exotic Wetland (EW) & Open Water (OW)	Low	3733
S1-W50 & S1-W50 (OW)	Exotic Wetland (EW)	Low	930
S1-W53	Planted Wetland (PLW)	High	278
S1-W54	Planted Wetland (PLW)	Moderate	169
S1-W69	Exotic Wetland	Moderate	388
S1-W72	Exotic Wetland	Negligible	28

Notes:
* = Some assessments were carried out at a desktop level, therefore areas are indicative.

9 NoR S2: SH16 Main Road Upgrade

9.1 Project Corridor Features

The SH16 Main Road Upgrade is along the existing SH16. The portion of the upgrade to the east of Tapu Road is developed with residual ecological features associated with the existing Kumeu Tributary and Kumeu River (Main Road upgrade). To the west of Tapu Road the area is more rural with ecological features relating to road planting, hedgerows and riparian features of three low order streams.

9.2 Existing and Likely Future Environment

9.2.1 Planning Context

SH16 Main Road is proposed to be upgraded to a 24 m urban corridor along the urban extent of SH16 traversing through well-established retail, commercial and residential environs through Kumeū Huapai. This corridor contains a range of business, residential and open space and rural land uses under the AUP:OP (see zoning column in Table 8-1) between the eastern extent of the Kumeū-Huapai township and the western extent of the upgraded corridor (the intersection with the proposed ASH).

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the SH16 Main Road Upgrade.

Table 9-1 SH16 Main Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[21]	Likely Future Environment[22]	Implications of Future Environment on Ecological Features
Rural	Rural Mixed Rural Zone, Rural Countryside Living Zone	Low	Rural	All existing ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features are likely to be relatively unchanged.
Business	Business (Industrial)	Low	Business (Industrial)	All existing ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features are likely to be relatively unchanged.
	Business (Local Centre)	Low	Business (Local Centre)	All existing ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features

[21] Based on AUP:OP zoning/policy direction
[22] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[21]	Likely Future Environment[22]	Implications of Future Environment on Ecological Features
				are likely to be relatively unchanged.
	Business (Mixed Use)	Low	Business (Mixed Use)	All existing ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features are likely to be relatively unchanged.
Residential	Residential	Low	Residential	All existing ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features are likely to be relatively unchanged.
Open Space	Open Space – Sport and Active Recreation	Low	Open Space	All existing ecological features are likely to remain similar or the same. Vegetation cover, streams and wetland features are likely to be relatively unchanged.
Undeveloped greenfield areas	Future Urban	High	Urban	As land is developed, the majority of terrestrial vegetation (such as planted vegetation, forestry and shelterbelts) outside riparian zones will be cleared and developed. Streams, wetlands and riparian vegetation is likely to be largely retained and potentially locally improved through protection within esplanade reserves and habitat enhancement. Habitat connectivity may be reduced as road crossings and urbanisation fragment the catchment.

Please refer to the AEE for further information on the planning context.

9.2.2 Permitted Activities and the Future Ecological Environment

The areas of existing undeveloped greenfields are zoned FUZ in the AUP:OP, and as such are planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding district plan vegetation), are identified as permitted activities within Chapters E26 and E15 of the AUP:OP. As such the ecological features (i.e., terrestrial habitat); excluding natural wetlands, streams and riparian edges;which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

9.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species (‘ecological features’) present within the NoR S2. All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

9.2.3.1 Terrestrial Habitat

Table 9-2 summarises the vegetation types and their classification (Singers et al., 2017) associated with NoR S2. Maps are presented in Appendix 5.

Table 9-2 Vegetation types present within NoR S2

Habitat	Classification*	Description of Habitat
Brown Field (includes cropland)	BF	This definition includes Industrial zones, metaled carparks, rail corridors, unmanaged or managed land within urban settings, road median strips, pavements, cracks in concrete. Substrate includes metal (stone chip) and concrete surfaces. largely exotic herbfield (weeds) and occasional exotic or native woody species. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites.
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, garden lawns and sport pitches.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. The future trajectory is uncertain. Dominant species include gorse, woolly nightshade and privet species.
Exotic Wetland	EW	Wetland ecosystems with >50% exotic plant biomass.
Planted Wetland - Native (recent)	PLW	Native restoration plantings with <50% exotic biomass.
Planted Vegetation - Native	PL.1	Native restoration plantings with <50% exotic biomass. Recently planted native scrub and forest <20 years old.
Planted Vegetation - Exotic	PL.3	Exotic amenity plantings. This includes planted exotic vegetation within parks, amenity areas and private gardens.
Mixed Native/Exotic Treeland	TL.2	Tree canopy cover 20-80%. Mixed native/exotic: with 25-75% native tree cover. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature

Habitat	Classification*	Description of Habitat
		riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms and amenity areas.
Exotic-Dominated Treeland	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms and amenity areas.
Kānuka Scrub/Forest	VS2	Kānuka-dominated forest with insufficient emergent secondary species to determine trajectory to mature forest type. Occurs on hillslopes, ridges, terraces, and plains especially on free-draining soils. Species include kānuka (*Kunzea ericoides*), *Coprosma* spp. *and Pittosporum* spp.
Raupō reedland	WL19	Raupō-dominated freshwater wetland. Depressions and lake and lagoon margins with recent and organic soils. Raupō, locally with purua grass, lake clubrush, jointed twig rush, pūkio, swamp millet. Includes modified wetland examples where *Carex* spp., *Juncus* spp. and swamp millet are common.
Kahikatea, pukatea forest	WF8	Dominated by podocarp–broadleaved forest, with emergent trees or a canopy of kahikatea and pukatea, and locally, rimu. Swamp maire occurs in areas with a high water table, and tawa, māhoe and locally, tītoki on areas of drier ground. Kiekie, whekī and supplejack are often abundant, creating a dense structure and sub-canopy.

Notes: * = Information from Singers et al. (2017).

9.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for all NoRs. The results of the bat survey are detailed in Appendix 11. Although bats were not detected within NoR S2, suitable foraging and commuting habitat occurs (such as vegetated riparian corridors, Kumeu River and mature shelterbelts). Bats have been detected within 0.8 km (ABM9 during the March-April ABM survey) and as such the occasional utilisation by bats within and adjacent to NoR S2 cannot be excluded for the baseline or for the FUZ.

Roost potential for long-tailed bats was considered to be **Negligible** or **Low** within the SH16 Upgrade designation boundary, due to the small number of impacted mature trees and lack of suitable trees with cracks/crevices/loose bark/cavities.

Birds

No dedicated bird surveys were undertaken for the Project. However, incidental observations of bird species were noted during site walkovers. The full list of birds observed or heard within NoR S2 are available in Appendix 12. The majority of these species are common, introduced and naturalised or common native species such as silvereye and welcome swallow. Although not observed at the time of survey, potential habitat was identified for a number of other TAR bird species, summarised in Table 9-3 below.

Table 9-3 TAR bird species likely to occur within suitable habitat in NoR S2

Species	Conservation status (Robertson et al., 2021)	Distribution and habitat	Project Area Habitat
Brown teal/Pāteke (*Anas chlorotis*)	At Risk – Recovering	Wetlands with open water, including stock ponds and small streams that retain overhanging marginal vegetation (Williams, 2013). Rare but widespread in the Auckland region. Reliant on pest predator control.	Has the potential to utilise a wide range of open water and wetland locations. However, as this species is reliant on pest control it is unlikely to be resident or breeding within the NoR but could be present.
Dabchick/Weweia (*Poliocephalus rufopectus)*	Threatened – Nationally Increasing	Small shallow freshwater lakes and ponds, with dense marginal vegetation. Uncommon but widespread in the Auckland region (Szabo, 2013).	Has the potential to utilise any freshwater open water habitat, including stock water ponds, ornamental ponds and stormwater ponds. Likely to breed in associated marginal wetland vegetation.
North Island Fernbird/mātātā (*Bowdleria punctata vealeae*)	At Risk – Declining	Dense wetland vegetation. Rare but widespread in the Auckland region (Miskelly, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW) and Raupō Reedland (WL19).
North Island kākā (*Nestor meridionalis septentrionalis*)	At Risk – Recovering	Kākā are generally restricted to indigenous forest habitat and offshore islands in the Auckland region. However, they make seasonal migrations to the Auckland mainland, particularly in winter where they often utilize exotic pine and eucalyptus trees in rural and urban areas. Rare but widespread (seasonal migrant) in the Auckland region (Moorhouse, 2013).	Has the potential to utilise any mature treeland (TL.2, TL.3), exotic forest (EF.1. EF.2) or mature indigenous forest types. There is no breeding habitat within the NoR but likely to infrequently utilise exotic trees for seasonal foraging and roosting throughout winter season.

Species	Conservation status (Robertson et al., 2021)	Distribution and habitat	Project Area Habitat
Little black shag/Kawau tūī (*Phalacrocorax sulcirostris*)	At Risk – Naturally Uncommon	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Armitage, 2013).	Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds and stormwater ponds. No breeding or roosting sites observed.
Long-tailed cuckoo/koekoeā (*Eudynamys taitensis*)	Threatened - Nationally Vulnerable	Summer migrant to New Zealand arriving spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper and yellowhead. Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage throughout New Zealand (Gill, 2013).	Has the potential to briefly occur on migration passage across the project area. Can occur in native / exotic forest, scrub, farmland or urban areas on passage to breeding / winter habitat.
New Zealand pipit/Hīoi (*Anthus novaeseelandiae*)	At Risk – Declining	Occur in open habitat such as, coastal and alpine grasslands, but also utilise modified landscapes such as pasture and scrub within the rural landscape. Rare but widespread in the Auckland region (Beauchamp, 2013).	Has the potential to utilise any open habitat such as Exotic Grassland (EG) and Exotic Scrub (ES). Habitat suitability is low due to agricultural intensification and likely moderate to high pest predator numbers.
Pied Shag (*Phalacrocorax varius*)	(At Risk – Recovering)	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the	Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds and stormwater ponds.

Species	Conservation status (Robertson et al., 2021)	Distribution and habitat	Project Area Habitat
		Auckland region (Powlesland, 2013).	No breeding or roosting sites observed.
Spotless crake/pūweto *(Porzana tabuensis)*	At Risk – Declining	Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation. Rare but widespread in the Auckland region (Fitzgerald, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW), Raupō Reedland (WL19) and marginal vegetation associated with stock water ponds, ornamental ponds and stormwater ponds.

Lizards

Native lizards and introduced lizards were not identified during opportunistic searches completed during the site walkover, however copper skink have been recorded within 0.5 km of NoR S2. Copper skink is likely to be associated with most of the vegetation units presented in Table 9-2 where there is appropriate understorey. However, habitat with a higher potential to support copper skink within NoR S2 is represented by EG, ES, PL.1, PL.3, TL.2, TL.3 and WF8 habitat. Other native lizard species are generally restricted to indigenous forest, indigenous scrub, coastal habitat types or habitat contiguous to such area. As habitat connectivity to SEAs is limited within the wider project ZOI it is unlikely that any other species listed in Table 6-3 will occur within the Project Area, however ornate skink have been included together with copper skink as they have a low probability of occurring within suitable modified habitat, such as dense riparian vegetation.

9.2.3.3 Terrestrial Ecological Value

Appendix 6 presents the ecological value for the terrestrial vegetation identified within NoR S2. Information obtained for the ecological baseline (Sections 9.2.3.1 and 9.2.3.2), as well as the desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological value of habitats ranged from **Negligible** (e.g., BF) to **Very High** (e.g., WF8).

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with EIANZ Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk - Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments for individual species are considered to range from **Moderate** to **Very High** (Table 9-4).

Table 9-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	TL.2, TL.3, WF8	Threatened – Nationally Critical	**Very High**
TAR Birds	Long-tailed cuckoo	TL.2, TL.3, WF8, VS2	Threatened – Nationally Vulnerable	**Very High**
	Brown teal, dabchick	OW, PLW, WL.11, WL19	Threatened – Nationally Increasing	
	North Island fernbird, spotless crake	OW, PLW, WL.11, WL19	At Risk - Declining	**High**
	New Zealand pipit	EG, ES		
	North Island kākā	TL.2, TL.3, WF8, VS2	At Risk – Recovering	**Moderate**
	Little black shag	OW, PLW, WL.11, WL19	At Risk – Nationally Uncommon	
	Pied shag		At Risk – Recovering	
Herpetofauna (Lizards)	Copper skink	EG, ES, PL.1, PL.3, TL.2, TL.3, WF8	At Risk – Declining	**High**
	Ornate skink	TL.2, TL.3, WF8		

9.2.3.4 Freshwater Habitat

All potential streams within NoR S2 were mapped (Appendix 5) and classified as either permanent or intermittent. Ephemeral streams were mapped when possible. Permanent or intermittent streams that were within the designation boundary were numbered and assessed.

Stream classification and RHA assessment

A total of six stream branches were identified during the desktop and site investigations within NoR S2. The streams are detailed further in Table 9-5.

In summary, streams within NoR S2 were classified as follows:

- One stream branch (S2-S1) was identified as intermittent as three or more of the intermittent stream criteria (Storey & Wadhwa, 2009) were met.
- Five stream branches were identified as permanent as there was evidence of continuous flow.

All streams were accessible during site investigations and surveyed using the RHA. The streams measured overall habitat quality scores that ranged from ‘Poor’ to ‘Moderate’ (Table 9-5). Detailed RHA results are presented in Appendix 10.

The barrier to fish migration was assessed at each stream, to describe any fragmentation or loss of connectivity. This is described as either total barrier, partial barrier or no barrier to fish migration.

Table 9-5 Summary of streams identified in NoR S2

Stream ID	Classification	RHA Category
S2-S1	Intermittent	Poor
S2-S2	Permanent	Moderate
S2-S3	Permanent	Poor
S2-S4	Permanent	Poor
S2-S5	Permanent	Moderate
S2-S6	Permanent	Poor

9.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however the following At Risk-Declining species have been recorded in the wider catchment area associated with NoR S2 (Table 6-5):

- Īnanga – Kumeu River
- Longfin eel – Kumeu River

The freshwater habitats within NoR S2 were assessed for their potential to support indigenous fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey.

9.2.3.6 Freshwater Ecological Value

Appendix 7 presents the ecological value for the aquatic habitats identified within NoR S2. Information obtained for the ecological baseline (Section 9.2.3.4 and 9.2.3.5), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological values for freshwater habitats are presented in Table 9-6.

Table 9-6 Summary of freshwater ecological value identified in NoR S2

Stream ID	Ecological Value
S2-S1	Low
S2-S2	Moderate
S2-S3	Moderate
S2-S4	High
S2-S5	High
S2-S6	Moderate

9.2.3.7 Wetland Habitat

A total of 16 wetlands within NoR S2 were identified and assessed. Details regarding the vegetation cover and NPS-FM classification for each wetland is presented in Table 9-7.

Table 9-7 Summary of wetlands identified in NoR S2

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species
S1-W2	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S2-W1*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S2-W2	Planted Wetland (PLW)	Natural wetland	Potential for fernbird and spotless crake.
S2-W3	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.
S2-W4*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.
S2-W5 & S2-W5 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland/partially dammed	Potential for spotless crake and dabchick.
S2-W6	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S2-W7*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S2-W8*	Exotic Wetland (EW)	Natural wetland	Potential for spotless crake.
S2-W9 & S2-W9 (OW)	Raupō reedland (WL19) & Open Water (OW)	Natural wetland	Potential for spotless crake and dabchick.

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species
S2-W10*	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.
S2-W11	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.
S2-W12*	Exotic Wetland (EW)	Natural wetland	Potential for spotless crake.
S2-W13	Raupō reedland (WL19)	Natural wetland	Potential for fernbird and spotless crake.
S2-W14	Exotic Wetland (EW)	Artificial wetland (drainage ditch)	Unlikely to support TAR birds.
S2-W15	Planted Wetland (PLW)	Natural wetland	Potential for dabchick.
S2-W16	Open Water (OW)	Artificial wetland	Potential for dabchick.

Notes: * = Wetlands assessed at a desktop level due to access restrictions.

9.2.3.8 Wetland Ecological Value

Appendix 8 presents the ecological value for the wetland habitats identified within NoR S2. Information obtained for the ecological baseline (Section 9.2.3.7), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological values for wetland habitats are presented in Table 9-8.

Table 9-8 Summary of wetland ecological value identified in NoR S2

Wetland ID	Ecological Value
S1-W2	Low
S2-W1	Low
S2-W2	High
S2-W3	Moderate
S2-W4	Low
S2-W5 & S2-W5 (OW)	Low
S2-W6	Low
S2-W7	Low
S2-W8	Moderate
S2-W9 & S2-W9 (OW)	High
S2-W10	Low

Wetland ID	Ecological Value
S2-W11	Low
S2-W12	Moderate
S2-W13	Moderate
S2-W14	Negligible
S2-W15	Low
S2-W16	Low

9.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 9.3 assesses the ecological effects of activities which relate to plan district matters under the AUP:OP.

9.3.1 Construction Effects - Terrestrial Ecology

Refer to Section 8.3.1.

9.3.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e. bats and birds (as it relates to loss in foraging habitat, and mortality and injury) is assessed in Sections 9.3.1.2 and 9.3.1.3.

Table 9-9 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S2

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	<u>**TL.3 (total area of 214.24 m^2)**</u> The magnitude of effect is assessed as **Negligible** due to the small extent of tree loss and the very low probability that this will result in additional fragmentation and edge effect. The ecological value of TL.3 is assessed to be **Low**, and the overall level of effect is assessed	Same as Baseline.

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	Likely Future Ecological Environment
	as **Very Low** prior to mitigation. As such no impact management is required. **WF8 (total area of 99.48 m^2)** The magnitude of effect is assessed as **Negligible** due to the small extent of tree loss and the very low probability that this will result in additional fragmentation and edge effect. The ecological value of WF8 is assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Unitary Plan Notable Tree (one mature eucalyptus located on the southern boundary of 396 Main Road)** The magnitude of effect is assessed as **Negligible** due to small extent and low probability associated with this effect. The ecological value of this tree is assessed to be **Negligible**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

9.3.1.2 Bats

Bats may utilise the habitats associated with NoR S2 for roosting or foraging. Specifically, areas of TL.2, TL.3, and WF8. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. Although bat foraging has been confirmed, ABM survey at the Project scale cannot confirm roost occupation within or adjacent to the designation boundary. However, it can be assumed that bats will utilise roost sites within the Project Area based on:

- Confirmed habitat suitability (numerous trees with moderate to high bat roost potential, connected to linear stream corridors and wetlands); and
- Confirmed foraging presence

Additionally, bats may be impacted by removal of district plan vegetation through the following effects[23]:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Mortality or injury to bats

Table 9-10 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[23] Roost lost has been considered but discounted as an effect as the consequence of roost loss (if it does occur at all) is considered less than **Negligible** in the context of this NoR.

Table 9-10 Assessment of ecological effects for bats and impact management during construction for NoR S2

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability, relatively short period of construction related effects, and the low baseline bat activity rate. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline due to the retention of vegetation within riparian corridors and the low likelihood of change within the Rural zone where mature trees are likely to remain.	The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of bats. Management might include inspection of trees to confirm potential roost features, constraining the timing of vegetation removal, pre-clearance inspections prior to vegetation removal.	Same as Baseline.
Management of residual effect	N/A	N/A	N/A	N/A

9.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S2. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 9-11 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 9-11 Assessment of ecological effects for birds and impact management during construction for NoR S2

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		**Effects due to removal of district plan vegetation:** - **Loss of foraging habitat** - **Nest loss** - **Mortality or injury to birds**	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as	Same as Baseline.	**Non-TAR birds** ***Nest loss & Mortality or injury to birds*** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with district plan vegetation. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Non-TAR birds** ***Loss of foraging habitat*** The magnitude of effect is assessed as **Low** due to the likely probability and local and restricted extent if impact occurs.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	Low prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very**		The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs.	

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)** The magnitude of effect is assessed as **Low** due to the likely probability, but short duration of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **Wetland TAR birds (North Island fernbird, spotless crake)** The magnitude of effect is assessed as **Low** due to the likely probability and short duration of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low**		The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (little black shag, pied shag)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as Very **Low** prior to mitigation. As such no impact management is required.			
Impact management and residual level of effect	**<u>Brown teal, dabchick</u>** Impact management is required for brown teal and dabchick. The Bird Management Plan should consider the following: • Where practical, construction works near suitable wetland habitat (Table 9-7) should commence prior to the bird breeding season (September to	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	February) in order to discourage bird nesting. • Bird management should be consistent with any regional consent conditions that may be required for regional compliance. The residual impact is assessed as **Negligible** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

9.3.1.4 Lizards

Construction effects on lizards associated with noise, light and vibration are presented in Table 9-12. Construction activity relates to the upgrade of an existing road and as such lizards are likely to be habituated to noise and vibration from the existing road. Regional matters as they relate to vegetation removal and lizards are further discussed in Section 9.4.4.

Table 9-12 Assessment of ecological effects for lizards and impact management during construction for NoR S2

Effect Description	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to unlikely probability of lizard disturbance due to construction related noise and vibration. The ecological value of copper skink and ornate skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

9.3.2 Operational Effects - Terrestrial Ecology

The Project involves the upgrading of an existing road in a mixed urban/rural landscape and future urban environment; therefore, although some impacts may increase from the current baseline, many operational effects such as fragmentation and noise and lighting are likely to be pre-existing. In general, potential operational effects from the Project that relate to District plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline (refer Section 9.2.2 and the ‘existing environment’ (i.e., allowing for permitted activities) (refer Section 9.2.1).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

9.3.2.1 Bats

The loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity should be assessed in the context of confirmed (but low frequency) bat activity in the broader landscape, the existing degree of fragmentation and that of the future urban environment.

Table 9-13 outlines the effect assessment for:

- Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to additional fragmentation of terrestrial habitat due to the presence of the infrastructure.
- Disturbance and displacement of bats due to light, noise and vibration from the road.

Table 9-13 Assessment of ecological effects for bats and impact management during operation for NoR S2

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability and infrequent occurrence. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low**. As such no impact management is required.	Same as Baseline. Riparian features with bat habitat potential will remain present within the FUZ.	The magnitude of effect is assessed as **Low** due to unlikely probability (existing fragmentation) at a regional extent. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity. As such impact management is required.	Same as Baseline as riparian features associated with the Kumeu tributaries and Kumeu River will remain present in the FUZ
Impact management and residual level of effect	N/A	N/A	A BMP should be developed to include consideration for: • Lighting design to minimise light levels and light spill along the road corridor in areas not currently affected by light spill. • Buffer planting both sides of the road corridor associated with the Kumeu River (S2-S5) and Kumeu Tributary (S2-S4) crossings to further reduce noise and light resulting in disturbance from the road. The	Same as Baseline.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
			extent of buffer planting is outlined in Appendix 14. • Retention of large, mature trees where practicable, to act as hop overs. The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

9.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S2, while noise, light and vibration may also affect connectivity in the broader landscape.

Table 9-14 outlines the operational effect assessment and impact management for birds.

Table 9-14 Assessment of ecological effects for birds and impact management during operation for NoR S2

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low** as NoR S2 is along the existing State Highway 16/Main Road and birds are likely to be habituated to noise, light and vibration from the road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Low** as NoR S2 is along the existing State Highway 16/Main Road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Terrestrial TAR birds (New Zealand pipit) The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)**		**Terrestrial TAR birds (New Zealand pipit)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)**	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect.		The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect.	
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

9.3.2.3 Lizards

Suitable habitat (EG, ES, PL.1, PL.3, TL.2, TL.3 and WF8) was identified within the NoR boundary which could potentially support native lizards. Native lizards require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

NoR S2 corridor includes upgrading the existing State Highway 16/Main Road. The proposed upgrade is therefore not expected to result in the additional fragmentation of lizard habitat. Similarly, resident (existing and future) lizards are likely to be habituated to disturbance such as noise, vibration and lighting and no additional effect on lizards is expected, provided that the post-upgraded road will not result in higher levels of noise and vibration.

Table 9-15 outlines the operational effect assessment and impact management for lizards.

Table 9-15 Assessment of ecological effects for lizards and impact management during operation for NoR S2

Effect Description	Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as the Project is not expected to further exacerbate existing disturbance adjacent to the NoR. The ecological value of copper skinks and ornate skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as the Project is not expected to further exacerbate existing and future restrictions on lizard dispersal adjacent to the NoR. The ecological value of copper skinks and ornate skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

9.3.3 Effects Conclusions

The ecological level of effects assessed as **Moderate**, **High** or **Very High** for NoR S2, and therefore require impact management, are described in Sections 9.3.3.1 and 9.3.3.2.

9.3.3.1 Long-tailed bats

- **Moderate** level of effect for the loss in connectivity to bats due the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low**.

9.3.3.2 Brown teal, dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) during construction for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Negligible**.

9.4 Design and Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for NoR S2. Wildlife Act Authority permits are also discussed in relation to the potential killing or injuring of native fauna associated with the Project activities.

9.4.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoRs, including suitable habitat that is potentially being used by native fauna (bats, birds and lizards). Loss of vegetation that is subject to district plan controls is discussed in Section 9.3.1.

The amounts and types of all[24] terrestrial habitat and vegetation (including habitat used by native fauna) that could be lost as a result of the Project is presented in Table 9-16 under the Footprint column.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges from **Negligible** to **Very High** ecological value (Section 9.2.3.3). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 9.4.2 to 9.4.4 below.

Table 9-16 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S2

Feature	Classification*	Footprint (m^2)
Brown Field (includes cropland)	BF	#
Exotic Grassland	EG	#

[24] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

Feature	Classification*	Footprint (m²)
Exotic Scrub	ES	21,532
Planted Vegetation – Native	PL.1	1,595
Planted Vegetation – Exotic	PL.3	6,783
Mixed Native/Exotic Treeland	TL.2	1,398
Exotic-Dominated Treeland^	TL.3	1,502
Kahikatea, pukatea forest	WF8	167

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation. # = Not mapped due to the extent.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent (for example, removal of vegetation in the riparian setback) and wildlife permit applications (if required).

9.4.2 Bats

Mature trees in suitable habitat areas (TL.2, TL.3, and WF8) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats should be re-assessed prior to obtaining any regional resource consents for vegetation removal and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

9.4.3 Birds

Native birds are likely to be present within the NoR and utilise all identified terrestrial habitats (excluding Brown Field). Vegetation clearance required for construction could result in the loss of these habitats of local value to native birds. The value of these habitats ranges from **Low** to **Very High** value and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

9.4.4 Lizards

Native copper skink and ornate skink are likely to be present within vegetation impacted by the Project. Therefore, there is potential that site clearance required for construction could kill or injure native lizard species and result in the removal of their habitat. Any vegetation clearance where copper skink is likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

9.4.5 Freshwater Ecology

The construction of NoR S2 will directly impact two streams ranging from **Low** to **Moderate** value. Approximately 155.5 m of stream loss will be required to accommodate the Project works in NoR S2 (Table 9-17). These calculations will require re-evaluation as part of the future regional consent process. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 9-17 Potential stream loss (permanent and intermittent) within NoR S2

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*
S2-S1	Intermittent	Low	25
S2-S3	Permanent	Moderate	75

Notes: * = Some assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, lengths are indicative.

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed. Culvert designs will provide for fish passage where required. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

9.4.6 Wetland Ecology

The construction of NoR S2 will directly impact 11 natural wetlands ranging from **Low** to **High** ecological value. Approximately 13,887 m^2 of wetland loss will be required to accommodate the Project works (Table 9-18) in NoR S2. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 9-18 Potential wetland loss within NoR S2

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S1-W2	Exotic Wetland (EW)	Low	988.5
S2-W2	Planted Wetland (PLW)	High	1083
S2-W3	Planted Wetland (PLW)	Moderate	2074.5
S2-W6	Exotic Wetland (EW)	Low	134
S2-W11	Exotic Wetland (EW)	Low	566

Notes:
* = Some assessments were carried out at a desktop level, therefore areas are indicative.

10 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

10.1 Project Corridor Features

Approximately the first 40% of the RTC (from the BCI) is directly associated with the ASH and therefore shares the same ecological features as the ASH, notably the Totara Creek, Ngongetepara and Kumeu rivers. South of Boord Crescent the RTC runs north, parallel to the NAL through a relatively flat rural landscape. Through Huapai the RTC continues parallel and south to the existing SH16 with the main ecological features related to a large Kumeu Tributary and associated riparian and wetland features. Near the Tapu Road and existing SH16 junction the RTC crosses the SH16 and continues parallel and to the north of the existing SH16. The more notable ecological features include several low order stream crossings and natural wetlands. The Kumeu Rapid Transit Station is located to the south of the existing NAL, running parallel to a valley bottom wetland which drains east into a Kumeu Tributary. The riparian features of the Kumeu Tributary are well defined by a mature tree line. To the south of the NAL, the direct catchment consists of pasture and life zone, while to the north is mainly brownfields.

The Huapai Rapid Transit Station is located to the north of the existing SH16 and west of Huapai Town life zone. Ecological features within the designation boundary includes an intermittent stream and wetland complex (partially damned) which forms part of a larger Kumeu tributary draining to the east of the designation. The direct catchment consists of pasture and is fragmented by the existing SH16 and NAL.

10.2 Existing and Likely Future Environment

10.2.1 Planning Context

The Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) form a single, integrated corridor (Note the RAMC only extends to the eastern entrance to Kumeū). This corridor predominately traverses rural land outside of the FUZ, however for assessment purposes it can be split into two sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. This rural section traverses land zoned under the AUP:OP as Rural – Countryside Living Zone, with an area zoned as FUZ in Redhills North.
- The **urban section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[25] along this section. This urban section contains a range of land uses zoned under the AUP:OP as a mix of business zonings between the eastern extent of the Kumeū-Huapai township and Station Road

[25] Another North West Strategic project – refer to Section **Error! Reference source not found.** of this report

Table 10-1 below provides a summary of the North West existing and likely future environment as it relates to the RTC and the RAMC.

Table 10-1 RTC and RAMC Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[26]	Likely Future Environment[27]	Implications of Future Environment on Ecological Features
Rural	Rural	Low	Rural	N/A
Undeveloped greenfield areas	Future Urban	High	Urban	Loss of exotic vegetation. Roadside and garden planting likely to be retained or regained in Future Environment.
Business	Business (Industrial)	Low	Urban	N/A
	Business (Local Centre)	Low	Urban	N/A
	Business (Town Centre)	Low	Urban	N/A
Residential	Residential	Low	Urban	N/A
Open Space	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space	Ecological features and current value likely retained.
Future Urban Zone/Undeveloped greenfield areas	Future Urban	**High**	Urban	N/A

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL with active mode connections to:

- The Huapai Triangle crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and

[26] Based on AUP:OP zoning/policy direction
[27] Based on AUP:OP zoning/policy direction

- Wookey Lane crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and Business - Light Industry Zone.

Table 10-2 Kumeū Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[28]	Likely Future Environment[29]
Business	Business (Industrial)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential - Mixed Housing Suburban Zone	Low	Urban
Open Space (located to the north of the proposed station location)	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL and SH16 to FUZ land. Future connections will be determined as part of structure plan process.

Table 10-3 Huapai Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[30]	Likely Future Environment[31]
Residential (located to the east of the proposed station location)	Residential – Single House Zone	Low	Urban
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

10.2.2 Permitted Activities and the Future Ecological Environment

The areas of existing undeveloped greenfields are zoned FUZ in the AUP:OP, and as such are planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding district plan vegetation), are identified as permitted activities within Chapters E26 and E15 of the AUP:OP. As such the ecological features (i.e., terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be

[28] Based on AUP:OP zoning/policy direction
[29] Based on AUP:OP zoning/policy direction
[30] Based on AUP:OP zoning/policy direction
[31] Based on AUP:OP zoning/policy direction

present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

10.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') present within the NoR S3, NoR HS, and NoR KS. All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

10.2.3.1 Terrestrial Habitat

Table 10-4 summarises the vegetation types and their classification (Singers et al., 2017) associated with NoR S3, NoR HS and NoR KS. Maps are presented in Appendix 5.

Table 10-4 Vegetation types present within NoR S3

Habitat	Classification*	Description of Habitat	Relevant NoR
Brown Field (includes cropland)	BF	This definition includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites. Consists of small areas patches of rural homesteads.	NoR S3, NoR HS, NoR KS
Exotic Forest – Native Understorey	EF.1	Exotic canopy species are dominant with >50% native understorey.	NoR S3
Exotic Forest – Exotic Understorey	EF.2	Exotic canopy species are dominant with <50% native understorey and/or groundcover biomass.	NoR S3
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture, gardens for most of the NoR S2.	NoR S3, NoR HS, NoR KS
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along historical farm drains. Dominant species include gorse, woolly nightshade and privet species.	NoR S3, NoR HS, NoR KS
Exotic Wetland	EW	Wetland ecosystems with >50% exotic plant biomass.	NoR S3, NoR HS, NoR KS
Planted Wetland - Native (recent)	PLW	Native restoration plantings with <50% exotic biomass.	NoR S3, NoR HS

Habitat	Classification*	Description of Habitat	Relevant NoR
Planted Vegetation - Native	PL.1	Native restoration plantings with <50% exotic biomass. Planted native scrub and forest <20 years old.	NoR S3, NoR HS, NoR KS
Planted Vegetation - Exotic	PL.3	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species.	NoR S3, NoR HS
Mixed Native/Exotic Treeland	TL.2	Mixed native/exotic: with 25-75% native tree cover.	NoR S3, NoR KS
Exotic-Dominated Treeland	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. This includes tree lined streams, gardens and mature trees within amenity plantings and shelter belts.	NoR S3, NoR HS, NoR KS
Kahikatea, pukatea forest	WF8	Dominated by podocarp–broadleaved forest, with emergent trees or a canopy of kahikatea and pukatea, and locally, rimu. Swamp maire occurs in areas with a high water table, and tawa, māhoe and locally, tītoki on areas of drier ground. Kiekie, whekī and supplejack are often abundant, creating a dense structure and sub-canopy.	NoR S3
Machaerina sedgeland	WL11	Sedgeland-rushland wetland type, in depressions and freshwater margins. Species of *Machaerina, Eleocharis*, lake clubrush and locally *Carex* spp.	NoR S3
Raupō reedland	WL19	Raupō-dominated freshwater wetland. Depressions and lake and lagoon margins with recent and organic soils. Raupō, locally with purua grass, lake clubrush, jointed twig rush, pūkio, swamp millet. Includes modified wetland examples where *Carex* spp., *Juncus* spp. and swamp millet are common.	NoR S3

Notes: * = Information from Singers et al. (2017).

10.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for all NoRs. The results of the bat survey are detailed in Appendix 11. The ABM survey confirmed bat activity at survey locations ABM2, ABM11, ABM17, ABM21, ABM23, ABM25 and ABM27 during the November-December assessment and at all locations (excluding ABM3, ABM12, ABM18, ABM19, and ABM21) during the March-April assessment. Within NoR S3, these areas coincide with Ngongetepara Creek, Kumeu River, Karure Stream, and Pakinui Stream and associated corridors. High (100-300) and Very High (>300) number of bat passes were detected for locations ABM6, ABM7, ABM10, ABM11 and ABM17 during the March-April assessment (associated with the ASH west of Tawa Road). The T+T Structure Plan study (T+T, 2020) also detected low levels of bat activity along Totara Creek.

Bats were not detected within the Huapai Station NoR (NoR HS) or Kumeu Station NoR (NoR KS). However, they were detected 1.6 km south of NoR HS during the March-April Assessment (ABM16) detected 0.8 km south of NoR KS during the March-April Assessment (ABM9).

Birds

No dedicated bird surveys were undertaken for the Project. However, incidental observations of bird species were noted during site walkovers. The full list of birds observed or heard within NoR S3, NoR HS, and NoR KS are available in Appendix 12. The majority of these species are common, introduced and naturalised or common native species such as silvereye and welcome swallow. However, pied shag (At Risk – Recovering) was observed adjacent to Totara Creek (W3-S1) near associated mangroves. Although not observed at the time of survey, potential habitat was identified for a number of other TAR bird species, summarised in Table 10-5 below.

Table 10-5 TAR bird species likely to occur within suitable habitat in NoR S3

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
Banded rail (*Gallirallus philippensis assimilis*)	At Risk – Declining	Breeding and foraging within coastal wetland habitat (saltmarsh and mangroves). Roosting and breeding within wetlands above the high tide. Uncommon but widespread in the Auckland region (Bellingham, 2013).	Likely to occur around the Brigham Creek stream mouth at the Brigham Creek Bridge crossing within coastal Mangrove Forest and scrub (SA1.2). No suitable roosting or breeding habitat within the NoR but may utilise adjacent mangrove for foraging.
Brown teal/Pāteke (*Anas chlorotis*)	At Risk – Recovering	Wetlands with open water, including stock ponds and small streams that retain overhanging marginal vegetation. Rare but widespread in the Auckland region. Reliant on pest predator control (Williams, 2013).	Has the potential to utilise a wide range of open water and wetland locations. However, as this species is reliant on pest control it is unlikely to be resident or breeding within the NoRs but could be present.
Dabchick/Weweia (*Poliocephalus rufopectus*)	Threatened – Nationally Increasing	Small shallow freshwater lakes and ponds, with dense marginal vegetation.	Has the potential to utilise any freshwater open water habitat, including stock water

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
		Uncommon but widespread in the Auckland region (Szabo, 2013).	ponds, ornamental ponds and stormwater ponds. Likely to breed in associated marginal wetland vegetation.
Little black shag/Kawau tūī (*Phalacrocorax sulcirostris*)	At Risk – Naturally Uncommon	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Armitage, 2013).	Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds and stormwater ponds, and around Brigham Creek. No breeding or roosting sites observed.
Long-tailed cuckoo/koekoeā (*Eudynamys taitensis*)	Threatened - Nationally Vulnerable	Summer migrant to New Zealand arriving spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper and yellowhead. Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage throughout New Zealand (Gill, 2013).	Has the potential to briefly occur on migration passage across the Project Area. Can occur in native/exotic forest, scrub, farmland or urban areas on passage to breeding/winter habitat.
New Zealand pipit/Hīoi (*Anthus novaeseelandiae*)	At Risk – Declining	Occur in open habitat such as coastal and alpine grasslands, but also utilise modified landscapes such as pasture and scrub within the rural landscape. Rare but widespread in the Auckland region (Beauchamp, 2013).	Has the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub. Habitat suitability is low throughout the NoRs due to agricultural intensification and likely moderate to high pest predator numbers.
North Island fernbird/Mātātā	At Risk – Declining	Dense wetland vegetation.	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
(*Bowdleria punctata vealeae*)		Rare but widespread in the Auckland region (Miskelly, 2013).	includes native planted wetlands (PLW) and *Machaerina* sedgeland (WL11).
North Island kākā (*Nestor meridionalis septentrionalis*)	At Risk – Recovering	Kākā are generally restricted to indigenous forest habitat and offshore islands in the Auckland region. However, they make seasonal migrations to the Auckland mainland, particularly in winter where they often utilize exotic pine and eucalyptus trees in rural and urban areas. Rare but widespread (seasonal migrant) in the Auckland region (Moorhouse, 2013).	Has the potential to utilise any mature treeland (e.g., TL.2, TL.3), exotic forest (e.g., EF.1. EF.2) or mature indigenous forest types. There is no breeding habitat within the NoR but likely to infrequently utilise exotic trees for seasonal foraging and roosting throughout winter season.
Pied shag (*Phalacrocorax varius*)	(At Risk – Recovering)	Occur in coastal inlets, lakes and ponds, including stormwater ponds. Roosting and breeding in overhanging trees. Common and widespread in the Auckland region (Powlesland, 2013).	Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds and stormwater ponds, and around Brigham Creek. No breeding or roosting sites observed.
Spotless crake/pūweto (*Porzana tabuensis plumbea*)	At Risk – Declining	Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation. Rare but widespread in the Auckland region (Fitzgerald, 2013).	Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW), *Machaerina* sedgeland (WL11) and marginal vegetation associated with stock water ponds, ornamental ponds and stormwater ponds.

Lizards

Native lizards were not identified during opportunistic searches completed during the site walkover. However, copper skink have been recorded within 0.5 km of NoR S3, NoR HS, and NoR KS. Copper skink is likely to be associated with most of the vegetation units presented in Table 10-4 where there is appropriate understorey. However, habitat with a higher potential to support copper skink within NoR S3, NoR HS, and NoR KS is represented by isolated patches of EF1, EF.2, EG, ES, PL.1, PL.3, TL.2, TL.3 and WF8. Other native lizard species are generally restricted to indigenous forest, indigenous scrub, coastal habitat types or habitat contiguous to such area. As habitat connectivity to SEAs is limited within the wider project ZOI it is unlikely that any other species listed in Table 6-3 will occur within the Project Area, however ornate skink have been included together with copper skink as they have a low probability of occurring within suitable modified habitat, such as dense riparian vegetation.

10.2.3.3 Terrestrial Ecological Value

Appendix 6 presents the ecological value for the terrestrial vegetation identified within NoR S3, NoR HS and NoR KS. Information obtained for the ecological baseline (Sections 10.2.3.1 and 10.2.3.2), as well as the desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological value of habitats ranged from **Negligible** (e.g., BF) to **Very High** (e.g., VS2, WF8).

Notwithstanding the ecological value associated with vegetation/habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with EIANZ Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk - Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments for individual species are considered to range from **Moderate** to **Very High** (Table 10-6).

Table 10-6 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	TL.2, TL.3, WF8	Threatened – Nationally Critical	**Very High**
TAR Birds	Long-tailed cuckoo	TL.2, TL.3, WF8, VS2	Threatened – Nationally Vulnerable	**Very High**

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
	Brown teal, dabchick	OW, PLW, WL.11, WL19	Threatened – Nationally Increasing	
	North Island fernbird, spotless crake	OW, PLW, WL.11, WL19	At Risk - Declining	**High**
	New Zealand pipit	EG, ES		
	North Island kākā	TL.2, TL.3, WF8, VS2	At Risk – Recovering	**Moderate**
	Little black shag	OW, PLW, WL.11, WL19	At Risk – Nationally Uncommon	
	Pied shag		At Risk – Recovering	
Herpetofauna (Lizards)	Copper skink	EG, ES, PL.1, PL.3, TL.2, TL.3, WF8	At Risk – Declining	**High**
	Ornate skink	TL.2, TL.3, WF8		

10.2.3.4 Freshwater Habitat

All potential streams within NoR S3, NoR HS and NoR KS were mapped (Appendix 5) and classified as either permanent or intermittent. Ephemeral streams were mapped when possible. Permanent or intermittent streams that were within the designation boundary were numbered and assessed.

Stream classification and RHA assessment

A total of 21 stream branches were identified during the desktop and site investigations within NoR S3. One stream was identified within NoR KS (S2-S4), and no streams were identified within NoR HS. The streams are detailed further in Table 10-7.

In summary, streams within NoR S3 and NoR KS (S2-S4) were classified as follows:

- Nine stream branches were identified as intermittent as three or more of the intermittent stream criteria (Storey & Wadhwa, 2009) were met.
- A total of 12 stream branches were identified as permanent as there was evidence of continuous flow.

Two intermittent streams (S1-S5 and S1-S27) and one permanent stream (S1-S18) were not accessible, therefore an RHA was not undertaken, and ecological value was assessed at a desktop level (Section 10.2.3.6).

All other streams were accessible during site investigations and surveyed using the RHA. The streams measured overall habitat quality scores that ranged from ‘Poor’ to ‘Moderate’. Detailed RHA results are presented in Appendix 10.

Table 10-7 Summary of NoR S3 streams identified in NoR S3, NoR HS, and NoR KS

Stream ID	Classification	RHA Category	Relevant NoR
S2-S1	Intermittent	Poor	NoR S3, NoR HS
S2-S2	Permanent	Moderate	NoR S3, NoR HS
S2-S3	Permanent	Poor	NoR S3
S2-S4	Permanent	Poor	NoR S3, NoR KS
S2-S5	Permanent	Moderate	NoR S3
S2-S6	Permanent	Poor	NoR S3
S1-S17	Permanent	Moderate	NoR S3
S1-S18*	Permanent	N/A	NoR S3
S1-S19	Intermittent	Poor	NoR S3
S1-S20a	Permanent	Moderate	NoR S3
S1-S20d	Intermittent	Moderate	NoR S3
S1-S20e	Intermittent	Moderate	NoR S3
S1-S21	Permanent	Moderate	NoR S3
S1-S22	Permanent	Moderate	NoR S3
S1-S23	Intermittent	Poor	NoR S3
S1-S24	Permanent	Poor	NoR S3
S1-S25*	Intermittent	N/A	NoR S3
S1-S26	Intermittent	Poor	NoR S3
S1-S27*	Intermittent	N/A	NoR S3
S1-S28	Intermittent	Poor	NoR S3
W3-S1	Permanent	Moderate	NoR S3

Notes: * = Streams assessed at a desktop level.

10.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however the following At Risk - Declining species have been recorded in the wider catchment area associated with NoR S3, NoR HS, and NoR KS (Table 6-5):

- Īnanga – Brigham Creek, Ngongetepara Stream, Totara Creek, Kumeu River and Pakinui Stream
- Longfin eel – Brigham Creek, Ngongetepara Stream, Totara Creek and Kumeu River

The freshwater habitats within NoR S3 were assessed for their potential to support native fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey. In addition, the following species were observed onsite:

- Unidentified eels observed at S1-S17 (Kumeu River) (374 Taupaki Road)
- Freshwater mussel shells (*Echyridella menziesii*) (At Risk - Declining) observed on dry banks of S1-S17 (Kumeu River) (176A Boord Crescent)

10.2.3.6 Freshwater Ecological Value

Appendix 7 presents the ecological value for the aquatic habitats identified within NoR S3, and NoR KS. Information obtained for the ecological baseline (Section 10.2.3.4 and 10.2.3.5), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological values for freshwater habitats are presented in Table 10-8.

Table 10-8 Summary of freshwater ecological value identified in NoR S3, NoR HS, and NoR KS

Stream ID	Ecological Value	Relevant NoR
S2-S1	Low	NoR S3, NoR HS
S2-S2	Moderate	NoR S3, NoR HS
S2-S3	Moderate	NoR S3
S2-S4	High	NoR S3, NoR KS
S2-S5	High	NoR S3
S2-S6	Moderate	NoR S3
S1-S17	High	NoR S3
S1-S18*	Moderate	NoR S3
S1-S19	Low	NoR S3
S1-S20a	Moderate	NoR S3
S1-S20d	Low	NoR S3
S1-S20e	Low	NoR S3
S1-S21	Moderate	NoR S3

Stream ID	Ecological Value	Relevant NoR
S1-S22	High	NoR S3
S1-S23	Low	NoR S3
S1-S24	High	NoR S3
S1-S25*	Low	NoR S3
S1-S26	Low	NoR S3
S1-S27*	Low	NoR S3
S1-S28	Low	NoR S3
S1-S29	Moderate	NoR S3
W4-S1	High	NoR S3

10.2.3.7 Wetland Habitat

A total of 53 wetlands within NoR S3, NoR HS, and NoR HS were identified and assessed. Details regarding the vegetation cover and NPS-FM classification for each wetland is presented in Table 10-9.

Table 10-9 Summary of wetlands identified in NoR S3, NoR HS and NoR KS

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species	Relevant NoR
S1-W2	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S2-W1*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S2-W2	Planted Wetland (PLW)	Natural wetland	Potential for fernbird and spotless crake.	NoR S3, NoR HS
S2-W3	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.	NoR S3, NoR HS
S2-W4*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3
S2-W5 & S2-W5 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland/partially dammed[32]	Potential for spotless crake and dabchick.	NoR S3, NoR HS

[32] A review of historical images could not confirm if the wetland feature existed prior to the construction of the pond. It was considered that at least a part of the feature did extent prior to the construction of the farm pond and would therefore consider a modified natural wetland, rather than an artificial wetland

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species	Relevant NoR
S2-W6	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S2-W7*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3, NoR HS
S2-W8*	Exotic Wetland (EW)	Natural wetland	Potential for spotless crake.	NoR S3
S2-W9 & S2-W9 (OW)	Raupō reedland (WL19) & Open Water (OW)	Natural wetland	Potential for spotless crake and dabchick.	NoR S3
S2-W10*	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S2-W11	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S2-W12*	Exotic Wetland (EW)	Natural wetland	Potential for spotless crake.	NoR S3, NoR KS
S2-W12a*	Exotic Wetland (EW)	Natural wetland	Potential for spotless crake.	NoR S3, NoR KS
S2-W13	Raupō reedland (WL19)	Natural wetland	Potential for fernbird and spotless crake.	NoR S3
S2-W14	Exotic Wetland (EW)	Artificial wetland (drainage ditch)	Unlikely to support TAR birds.	NoR S3
S2-W15	Planted Wetland (PLW)	Natural wetland	Potential for dabchick.	NoR S3
S2-W16	Open Water (OW)	Artificial wetland	Potential for dabchick.	NoR S3, NoR KS
S2-W16a	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3, NoR KS
S1-W36*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3
S1-W37	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species	Relevant NoR
S1-W38*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W39	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W40	*Machaerina* sedgeland (WL11)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W41	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W42*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W43 & S1-W43 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Potential for spotless crake and dabchick.	NoR S3
S1-W44	*Machaerina* sedgeland (WL11)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W45 & S1-W45 (OW)*	Exotic Wetland (EW) & Open Water (OW)	EW: Natural wetland OW: Artificial wetland (Farm ponds)	Potential for spotless crake and dabchick.	NoR S3
S1-W46 & S1-W46 (OW)	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Exotic Wetland unlikely to support TAR birds. Pond potential to support spotless crake and dabchick.	NoR S3
S1-W47*	Exotic Wetland (EW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W48*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3
S1-W49*	Exotic Wetland (EW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species	Relevant NoR
S1-W50 & S1-W50 (OW)*	Exotic Wetland (EW) & Open Water (OW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W51*	Planted Wetland (PLW)	Artificial wetland	Potential for spotless crake.	NoR S3
S1-W53*	Planted Wetland (PLW)	Natural wetland	Potential for spotless crake.	NoR S3
S1-W54	Planted Wetland (PLW)	Natural wetland	Unlikely to support TAR birds.	NoR S3
S1-W55	Planted Wetland (PLW)	Artificial wetland	Potential for spotless crake.	NoR S3
S1-W57 & S1-W57 (OW)	Planted Wetland (PLW) & Open Water (OW)	Artificial wetland (Stormwater Pond)	Potential for dabchick and spotless crake.	NoR S3
S1-W58	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick and spotless crake.	NoR S3
S1-W59	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick and spotless crake.	NoR S3
S1-W60	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Unlikely to support TAR birds.	NoR S3
S1-W61	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick and spotless crake.	NoR S3
S1-W62	Open Water (OW)	Artificial Wetland (On-stream farm pond)	Potential for dabchick, fernbird and spotless crake.	NoR S3
S1-W63	Open Water (OW)	Artificial Wetland (On-stream farm pond)	Potential for dabchick, and spotless crake.	NoR S3
S1-W64	Open Water (OW)	Artificial Wetland (On-stream farm pond)	Potential for dabchick, and spotless crake.	NoR S3
S1-W65	Open Water (OW)	Artificial Wetland (Farm pond)	Unlikely to support TAR birds.	NoR S3

Wetland ID	Vegetation Type	NPS-FM Classification	Potential for TAR Species	Relevant NoR
S1-W66	Open Water (OW)	Artificial Wetland (Ornamental Pond)	Potential for dabchick, and spotless crake.	NoR S3
S1-W67	Open Water (OW)	Artificial Wetland	Potential for dabchick.	NoR S3
S1-W68	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3
S1-W69*	Exotic Wetland (EW)	Natural Wetland	Unlikely to support TAR birds.	NoR S3
S1-W71	Open Water (OW)	Artificial wetland	Unlikely to support TAR birds.	NoR S3

Notes: * = Wetlands assessed at a desktop level due to access restrictions

10.2.3.8 Wetland Ecological Value

Appendix 8 presents the ecological value for the wetland habitats identified within NoR S3, NoR HS and NoR KS. Information obtained for the ecological baseline (Section 10.2.3.7), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological values for wetland habitats are presented in Table 9-8.

Table 10-10 Summary of wetland ecological value identified in NoR S3, NoR HS and NoR KS

Wetland ID	Ecological Value	Relevant NoR
S1-W2	Low	NoR S3
S2-W1	Low	NoR S3
S2-W2	High	NoR S3, NoR HS
S2-W3	Moderate	NoR S3, NoR HS
S2-W4	Low	NoR S3
S2-W5 & S2-W5 (OW)	Low	NoR S3, NoR HS
S2-W6	Low	NoR S3
S2-W7	Low	NoR S3, NoR HS
S2-W8	Moderate	NoR S3
S2-W9 & S2-W9 (OW)	High	NoR S3
S2-W10	Low	NoR S3
S2-W11	Low	NoR S3

Wetland ID	Ecological Value	Relevant NoR
S2-W12	Moderate	NoR S3, NoR KS
S2-W12a	Moderate	NoR S3, NoR KS
S2-W13	Moderate	NoR S3
S2-W14	Negligible	NoR S3
S2-W15	Low	NoR S3
S2-W16	Low	NoR S3, NoR KS
S2-W16a	Negligible	NoR S3, NoR KS
S1-W36*	Low	NoR S3
S1-W37	Low	NoR S3
S1-W38	Low	NoR S3
S1-W39	Low	NoR S3
S1-W40	High	NoR S3
S1-W41	Moderate	NoR S3
S1-W42	Low	NoR S3
S1-W43 & S1-W43 (OW)	Low	NoR S3
S1-W44	Moderate	NoR S3
S1-W45 & S1-W45 (OW)*	Low	NoR S3
S1-W46 & S1-W46 (OW)	Moderate	NoR S3
S1-W47	Low	NoR S3
S1-W48	Negligible	NoR S3
S1-W49	Negligible	NoR S3
S1-W50 & S1-W50 (OW)*	Low	NoR S3
S1-W51	Moderate	NoR S3
S1-W53	High	NoR S3
S1-W54	Moderate	NoR S3
S1-W55	Moderate	NoR S3
S1-W57 & S1-W57 (OW)	Moderate	NoR S3
S1-W58	Low	NoR S3
S1-W59	Low	NoR S3

Wetland ID	Ecological Value	Relevant NoR
S1-W60	Low	NoR S3
S1-W61	Low	NoR S3
S1-W62	Low	NoR S3
S1-W63	Low	NoR S3
S1-W64	Low	NoR S3
S1-W65	Low	NoR S3
S1-W66	Low	NoR S3
S1-W67	Low	NoR S3
S1-W68	Low	NoR S3
S1-W69	Moderate	NoR S3
S1-W70	Negligible	NoR S3

10.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 10.3 assess the ecological effects of activities which relate to district plan matters under the AUP:OP.

10.3.1 Construction Effects - Terrestrial Ecology

Refer to Section 8.3.1.

10.3.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in Table 10-11 (NoR S3) and Table 10-12 (NoR HS) below. No vegetation to be removed that is subject to district controls was identified in NoR KS. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it relates to loss in foraging habitat, and mortality and injury) is assessed in Sections 10.3.1.2 and 10.3.1.3.

Table 10-11 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S3

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**TL.3 (total area of 2980.09 m^2) & Huapai Domain Trees (District Plan only) (total area of 3871 m^2)** The magnitude of effect is assessed as **Negligible** due to the small overall extent of the vegetation that will be removed and the low likelihood that fragmentation and edge effect will occur despite definite removal of the vegetation. The ecological value of TL.3 and Huapai Domain Trees are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **WF8 (total area of 99.75 m^2)** The magnitude of effect is assessed as **Negligible** due to the small extent of tree loss and the very low probability that this will result in additional fragmentation and edge effect. The ecological value of WF8 is assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. The magnitude of effect is assessed as **Negligible** as although there is a definite likelihood that these trees will be removed, this does not necessarily translate to the definite loss of habitat for fauna. The ecological value of the Notable Tree is assessed to be **Negligible**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

Table 10-12 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR HS

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**TL.3 (total area of 141.31 m^2)** The magnitude of effect is assessed as **Negligible** as although there is a definite likelihood that these trees will be removed, this does not necessarily translate to the definite loss of habitat for fauna. The ecological value of TL.3 is assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

10.3.1.2 Bats

Bats may utilise the habitats associated with NoR S3, NoR HS, and NoR KS for roosting or foraging. Specifically, areas of EF.1, EF.2, TL.2, TL.3, and WF8 habitat. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. Although bat foraging has been confirmed, ABM survey at the Project scale cannot confirm roost occupation within or adjacent to the designation boundary. However, it can be assumed that bats will utilise roost sites within the Project Area based on:

- Confirmed habitat suitability (numerous trees with moderate to high bat roost potential, connected to linear stream corridors and wetlands); and
- Confirmed foraging presence.

Additionally, bats may be impacted by removal of district plan vegetation through the following effects[33]:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Mortality or injury to bats

Table 10-13 (NoR S3), Table 10-14 (NoR HS) and Table 10-15 (NoR KS) outline the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[33] Roost loss has been considered but discounted as an effect as the **consequence** of roost loss (if it does occur at all) is considered less than **Negligible** in the context of this NoR.

Table 10-13 Assessment of ecological effects for bats and impact management during construction for NoR S3

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid EF.1, EF.2, TL.2, TL.3, and WF8 habitat. • Lighting design to reduce light levels and spill from construction areas.	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of bats. Management might include inspection of trees to confirm potential roost features, constraining the timing of vegetation removal, pre-clearance inspections prior to vegetation removal.	Same as Baseline.

	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	• Restriction of nightworks around EF.1, EF.2, TL.2, TL.3, and WF8 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-14 Assessment of ecological effects for bats and impact management during construction for NoR HS

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the likely probability and local extent of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required	Same as Baseline as riparian and wetland features are likely to remain present in the future.	The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid TL.2 and TL.3 habitat. • Lighting design to reduce light levels and spill from construction areas.	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of bats. Management might include inspection of trees to confirm potential roost features, constraining the timing of vegetation removal, pre-clearance inspections prior to vegetation removal.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	• Restriction of nightworks around TL.2 and TL.3 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-15 Assessment of ecological effects for bats and impact management during construction for NoR KS

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to due to the relatively short duration of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required	Same as Baseline as riparian (Kumeu Tributary) and wetland features are likely to remain present in the future
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Surveys prior to construction to confirm presence/likely absence. Surveys to confirm bat roost locations if activity is confirmed. • Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar). • Siting of compounds and laydown areas to avoid TL.2, TL.3, and WF8 habitat. • Lighting design to reduce light levels and spill from construction areas. • Restriction of nightworks around TL.2, TL.3, and WF8 habitat. • Bat management should be incorporated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	N/A
Management of residual effect	N/A	N/A

10.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S3, NoR HS and NoR KS. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 10-16(NoR S3), Table 10-17 (NoR HS) and Table 10-18 (NoR KS) outline the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 10-16 Assessment of ecological effects for birds and impact management during construction for NoR S3

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.) Baseline	Likely Future Ecological Environment	Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as	Same as Baseline.	**<u>Non-TAR birds</u>** ***Nest loss & Mortality or injury to birds*** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with district plan vegetation. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Non-TAR birds</u>** ***Loss of foraging habitat*** The magnitude of effect is assessed as **Low** due to the likely probability and local extent if impact occurs. The ecological value of birds in the context of habitat features are	Same as Baseline.

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very**		assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **High**, and the overall	

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (brown teal, dabchick)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **<u>Wetland TAR birds (North Island fernbird, banded rail, spotless crake)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low**		level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (little black shag, pied shag)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability of disturbance. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.			
Impact management and residual level of effect	**<u>Brown teal, dabchick</u>** Impact management is required for brown teal and dabchick. The Bird Management Plan should consider the following: • Where practical, construction works near suitable wetland habitat (refer Table 10-9) should commence prior to the bird breeding season	Same as Baseline.	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	(September to February) in order to discourage bird nesting. • Bird management should be consistent with any regional consent conditions that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-17 Assessment of ecological effects for birds and impact management during construction for NoR HS

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to a likely probability, infrequent occurrence, and short duration of effect if disturbance occurs. The ecological value of these species is **Very High**, and the	Same as Baseline.	**Non-TAR birds** ***Nest loss*** ***Mortality or injury to birds*** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with district plan vegetation. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Non-TAR birds** ***Loss of foraging habitat*** The magnitude of effect is assessed as **Low** due to the likely probability and local and restricted extent if impact occurs.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very**		The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs.	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	Low prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (brown teal, dabchick)</u>** The magnitude of effect is assessed as **Low** due to a likely probability, frequent occurrence, and short period of disturbance. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **<u>Wetland TAR birds (North Island fernbird, banded rail, spotless crake)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low**		The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.			
Impact management and residual level of effect	**Brown teal, dabchick** Impact management is required for brown teal and dabchick. The Bird Management Plan should consider the following: • Where practical, construction works near suitable wetland habitat (refer Table 10-9) should commence prior to the bird breeding season	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	(September to February) on order to discourage bird nesting. • Bird management should be consistent with any regional consent conditions that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.			
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-18 Assessment of ecological effects for birds and impact management during construction for NoR KS

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)	
	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and short duration of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
	<u>Wetland TAR birds (brown teal, dabchick)</u> The magnitude of effect is assessed as **Low** due to a likely probability and frequent occurrence of disturbance. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **<u>Wetland TAR birds (North Island fernbird, banded rail, spotless crake)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Wetland TAR birds (little black shag, pied shag)</u>** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	**<u>Brown teal, dabchick</u>** Impact management is required for brown teal and dabchick. The Bird Management Plan should consider the following: • Where practical, construction works near suitable wetland habitat (refer Table 10-9) should commence prior to the bird breeding season (September to February) on order to discourage bird nesting. • Bird management should be consistent with any regional consent conditions that may be required for regional compliance.	N/A

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
	The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A

10.3.1.4 Lizards

Construction effects on lizards associated with noise, light and vibration are presented in Table 10-19. Construction activity relates to upgrading existing roads and the construction of new roads. Lizards are likely to be habituated to noise and vibration from the existing roads, however lizards present in areas of the proposed new roads will not be habituated to noise and vibration. Regional matters as they relate to vegetation removal and lizards are further discussed in Section 10.4.4.

Table 10-19 Assessment of ecological effects for lizards and impact management during construction for NoR S3

Effect Description	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability, short duration, and local extent of impact. The ecological value of copper skink and ornate skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

Table 10-20 Assessment of ecological effects for lizards and impact management during construction for NoR HS

Effect Description	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability, short duration, and local extent of impact. The ecological value of copper skink and ornate skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

Table 10-21 Assessment of ecological effects for lizards and impact management during construction for NoR KS

Effect Description	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to the unlikely probability, short duration, and local extent of impact. The ecological value of copper skink and ornate skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

10.3.2 Operational Effects - Terrestrial Ecology

The Project involves the construction of new road and the upgrading of an existing road in a rural landscape and future urban environment; therefore, it is likely that operational effects such as fragmentation and noise and lighting may increase from the current baseline. In general, potential operational effects from the Project that relate to District plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline (refer Section 10.2.2) and the 'existing environment' (i.e., allowing for permitted activities) (refer Section 10.2.1).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

10.3.2.1 Bats

The loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity should be assessed in the context of confirmed bat activity in the broader landscape, the existing degree of fragmentation and that of the future urban environment.

Table 10-22 (NoR S3), Table 10-23 (NoR HS), and Table 10-24 (NoR KS) outlines the effect assessment for:

- Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to additional fragmentation of terrestrial habitat due to the presence of the infrastructure.
- Disturbance and displacement of bats due to light, noise and vibration from the road.

Table 10-22 Assessment of ecological effects for bats and impact management during operation for NoR S3

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Moderate** due to the highly likely probability and relatively local extent of disturbance. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** disturbance of individual bats and roosts. As such impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Moderate** due to the high probability of loss in connectivity due to the operation of the RTC in confirmed bat movement and the presence of two known ecological nodes likely important to the regional bat population. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** for loss in connectivity. As such impact management is required.	Same as Baseline.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting and retention of existing mature trees between the road	Same as Baseline.	A BMP should be developed as outlined in Appendix 14. The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early	Same as Baseline.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	alignment and features with potential for bat roosts[34]. • Light and noise management through design. • Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Low** post mitigation.		planting[35] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting. Restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring and potential corrective action.	

[34] This may be in addition to the buffer planting proposed in Appendix **Error! Reference source not found.** and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			The residual impact is assessed as **Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-23 Assessment of ecological effects for bats and impact management during operation for NoR HS

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the unlikely probability but permanent duration of the impact. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** disturbance of individual bats and roosts. As such impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to the unlikely probability of loss in connectivity at a regional extent due to the construction of new roads. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate.** As such impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting and retention of existing mature trees between the road alignment and features with potential for bat roosts[36]. • Light and noise management through design. • Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.	A BMP should be developed as outlined in Appendix 14. The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early planting[37] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal	Same as Baseline.

[36] This may be in addition to the buffer planting proposed in Appendix **Error! Reference source not found.** and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
			as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring and potential corrective action. The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-24 Assessment of ecological effects for bats and impact management during operation for NoR KS

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the unlikely probability but permanent duration of the impact. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate**. As such impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to the unlikely probability and regional extent of loss in connectivity due to the construction of new roads. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed **Moderate**. As such impact management is required.	Same as Baseline.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting and retention of existing mature trees between the road alignment and features with potential for bat roosts[38]. • Light and noise management through design.	Same as Baseline.	A BMP should be developed as outlined in Appendix 14**.** The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early	Same as Baseline.

[38] This may be in addition to the buffer planting proposed in Appendix **Error! Reference source not found.** and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	• Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Very Low** post mitigation.		planting[39] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting. Restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring and potential corrective action. The residual impact is assessed as **Very Low** post mitigation.	

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

10.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S3, NoR HS and NoR KS, while noise, light and vibration may also affect connectivity in the broader landscape. Notably open water associated with wetland S2-W9 will remain post development and may provide suitable habitat for wetland TAR birds including spotless crake and dabchick.

Table 10-25 (NoR S3), Table 10-26 (NoR HS), and Table 10-27 (NoR KS) outline the operational effect assessment and impact management for birds.

Table 10-25 Assessment of ecological effects for birds and impact management during operation for NoR S3

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Low** due to the likely probability of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Low** for both effects, due to the likely probability of loss in connectivity in areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Low** due to the unlikely probability and regional extent of effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	Terrestrial TAR birds (New Zealand pipit) The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)**		**Terrestrial TAR birds (New Zealand pipit)** The magnitude of effect is assessed as **Low** due to the unlikely probability and regional extent of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** due to the unlikely probability and regional extent of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)**	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **Wetland TAR birds (North Island fernbird, banded rail, spotless crake)** The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)** The magnitude of effect is assessed as **Negligible** due to the unlikely		The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **Wetland TAR birds (North Island fernbird, banded rail, spotless crake)** The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)** The magnitude of effect is assessed as **Low** due to the likely probability of impact.	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	probability and local extent of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.		The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	**Brown teal, dabchick** Impact management is required for brown teal and dabchick. The following mitigation measures should be implemented: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road. • Installation of vegetation hop-overs in key areas where the road corridor fragments local areas of suitable habitat (open water and some wetlands).	Same as Baseline.	**Long-tailed cuckoo** Impact management is required for long-tailed cuckoo. This is due the **Very High** value of the species. Since it is a highly mobile migrant species, it is anticipated that mitigation associated with landscape planting, riparian planting and bat mitigation will result in a **Negligible** residual impact post mitigation. **Brown teal, dabchick** Impact management is required for brown teal and dabchick. The following mitigation measures should be implemented: • Retention of vegetation near wetland habitat, where practicable.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	The residual impact is assessed as **Very Low** post mitigation.		• Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically at S1-W27, S1-W45, S1-W59 (OW), S1-W64, S2-W5 & S2-W5 (OW), S2-W9 (OW), and S2-W15). • Installation of vegetation hop-overs in key areas where the road corridor fragments local areas of suitable habitat (open water and some wetlands). The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-26 Assessment of ecological effects for birds and impact management during operation for NoR HS

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to the highly likely probability and local extent of impact. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to the highly likely probability and local extent of impact. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and regional extent of effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	Terrestrial TAR birds (New Zealand pipit) The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.		**Terrestrial TAR birds (New Zealand pipit)** The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Wetland TAR birds (brown teal, dabchick) The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required. **Wetland TAR birds (North Island fernbird, banded rail, spotless crake)** The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)**		**Wetland TAR birds (brown teal, dabchick)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability of local impacts. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (North Island fernbird, banded rail, spotless crake)** The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)**	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	The magnitude of effect is assessed as **Low** due to the likely probability of local impacts. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.		The magnitude of effect is assessed as **Low** due to the likely probability of local impacts. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	<u>**Brown teal, dabchick**</u> Impact management is required for brown teal and dabchick. The following mitigation measures should be implemented: • Retention of vegetation near wetland habitat, where practicable. • Buffer planting between the road alignment and suitable habitat adjacent to the road (specifically at S2-W5 & S2-W5 (OW)). • Installation of vegetation hop-overs in key areas. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.	N/A	N/A

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-27 Assessment of ecological effects for birds and impact management during operation for NoR KS

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to the highly likely probability and local extent of impact. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to the highly likely probability and local extent of impact. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	Terrestrial TAR birds (long-tailed cuckoo) The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (New Zealand pipit)** The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effects. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)**		**Terrestrial TAR birds (long-tailed cuckoo)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and regional extent of effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such impact management is required. **Terrestrial TAR birds (New Zealand pipit)** The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effects. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)**	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effects. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability of local impacts. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (North Island fernbird, banded rail, spotless crake)**		The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent (regional extent for loss in connectivity) of effects. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (brown teal, dabchick)** The magnitude of effect is assessed as **Negligible** due to the unlikely probability of local impacts. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (North Island fernbird, banded rail, spotless crake)**	

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)** The magnitude of effect is assessed as **Low** due to the likely probability of local impacts. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.		The magnitude of effect is assessed as **Low** due to a likely probability of local impacts. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (little black shag, pied shag)** The magnitude of effect is assessed as **Low** due to the likely probability of local impacts. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A	N/A	N/A

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

10.3.2.3 Lizards

Suitable habitat (e.g., EF1, EF.2, EG, ES, PL.1, PL.3, TL.2, TL.3, and WF8) was identified within the NoR S3, NoR HS, and NoR KS boundary which could potentially support native lizards. Native lizards require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

The majority of NoR S3 will be a new road while both stations will also be new. In areas where the new NoR S3 is not in proximity to existing infrastructure (for example the NAL and the SH16), it is likely that there will be some localised lizard disturbance from noise, vibration and lighting and fragmentation of lizard habitat for a period during operation. However, in areas where the NoR is near existing roads and brown fields, it is not expected to result in the additional fragmentation of lizard habitat. Similarly, resident (existing and future) lizards are likely to be habituated to disturbance such as noise, vibration and lighting and no additional effect on lizards is expected, provided that the post-upgraded road will not result in higher levels of noise and vibration.

Table 10-28 (NoR S3), Table 10-29 (NoR HS), and Table 10-30 (NoR KS) outlines the operational effect assessment and impact management for lizards.

Table 10-28 Assessment of ecological effects for lizards and impact management during operation for NoR S3

Effect Description	Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent of impact. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent of impact. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-29 Assessment of ecological effects for lizards and impact management during operation for NoR HS

Effect Description	Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent of impact. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent of impact. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

Table 10-30 Assessment of ecological effects for lizards and impact management during operation for NoR KS

Effect Description	Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent of impact. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** due to the unlikely probability and local extent of impact. The ecological value of copper skink is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

10.3.3 Effects Conclusions

The ecological level of effects assessed as **Moderate**, **High** or **Very High** for NoR S3, and therefore require impact management, are described in Sections 10.3.3.1 to 10.3.3.3, for NoR HS in Sections 10.3.3.4 to 10.3.3.5, and for NoR KS in Sections 10.3.3.6 to 10.3.3.7.

10.3.3.1 NoR S3 – Long-tailed bats

- **Moderate** level of effect for disturbance and displacement to roosts and individuals (existing) during construction for the Baseline and Future Environment.
- **High** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.
- **High** level of effect for the disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low** to **Low** for construction and operational effects.

10.3.3.2 NoR S3 – Long-tailed cuckoo

- **Moderate** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Negligible.**

10.3.3.3 NoR S3 – Brown teal, dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) during construction for the Baseline and Future Environment.
- **Moderate** level of effect for disturbance and displacement to roosts and individual birds (existing) due to the presence of the road during operation for the Baseline and Future Environment.
- **Moderate** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low** for construction and operational effects.

10.3.3.4 NoR HS – Long-tailed bats

- **Moderate** level of effect for disturbance and displacement to roosts and individuals (existing) during construction for the Baseline and Future Environment.
- **Moderate** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.
- **Moderate** level of effect for the disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low** for construction and operational effects.

10.3.3.5 NoR HS – Brown teal, dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) during construction for the Baseline and Future Environment.
- **Moderate** level of effect for disturbance and displacement to roosts and individual birds (existing) due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low** for construction and operational effects.

10.3.3.6 NoR KS – Long-tailed bats

- **Moderate** level of effect for disturbance and displacement to roosts and individuals (existing) during construction for the Baseline and Future Environment.
- **Moderate** level of effect for loss in connectivity due to the presence of the road during operation for the Baseline and Future Environment.
- **Moderate** level of effect for the disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low** for construction and operational effects.

10.3.3.7 NoR KS – Brown teal, dabchick

- **Moderate** level of effect for disturbance and displacement to nests and individuals (existing) during construction for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Very Low**.

10.4 Design and Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for NoR S3, NoR HS and NoR KS. Wildlife Act Authority permits are also discussed in relation to the potential killing or injuring of native fauna associated with the Project activities.

10.4.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoRs, including suitable habitat that is potentially being used by native fauna (bats, birds and lizards). Loss of vegetation that is subject to district plan controls is discussed in Section 10.3.1. The amounts and types of all[40] terrestrial habitat and vegetation (including habitat used by native fauna) that could be lost as a result of the Project is presented in Table 10-31 (NoR S3), Table 10-32 (NoR HS) and Table 10-33 (NoR KS) under the Footprint column.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges from **Negligible** to **Very High** ecological value (Section 10.2.3.3). Some of

[40] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

these habitat areas are likely to provide habitat to native fauna, as discussed in Sections 10.4.2 to 10.4.4 below.

Table 10-31 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S3

Feature	Classification*	Footprint (m²)
Brown Field (includes cropland)	BF	3,358
Exotic Forest – Native Understorey	EF.1	22
Exotic Forest – Exotic Understorey	EF.2	
Exotic Grassland	EG	#
Exotic Scrub	ES	40,427
Planted Vegetation – Native	PL.1	7,075
Planted Vegetation – Exotic	PL.3	64,680
Mixed Native/Exotic Treeland	TL.2	3,366
Exotic-Dominated Treeland^	TL.3	44,869
Kahikatea, pukatea forest	WF8	167

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation. # = Not mapped due to the extent.

Table 10-32 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR HS

Feature	Classification*	Footprint (m²)
Exotic Grassland	EG	#
Exotic Scrub	ES	10,813
Planted Vegetation – Native	PL.1	905
Planted Vegetation – Exotic	PL.3	8,314
Mixed Native/Exotic treeland	TL.2	978
Exotic-Dominated Treeland^	TL.3	11,960

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation. # = Not mapped due to the extent.

Table 10-33 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR KS

Feature	Classification*	Footprint (m²)
Exotic Grassland	EG	#
Exotic Scrub	ES	4,195

Feature	Classification*	Footprint (m²)
Planted Vegetation – Native	PL.1	665
Planted Vegetation –Exotic	PL.3	670
Mixed Native/Exotic Treeland	TL.2	1,910
Exotic-Dominated Treeland	TL.3	101

Notes: * = Classification from Singers et al. (2017). # = Not mapped due to the extent.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent (for example, removal of vegetation in the riparian setback) and wildlife permit applications (if required).

10.4.2 Bats

Mature trees in suitable habitat areas (EF.1, EF.2, TL.2, TL.3, and WF8) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats should be re-assessed prior to obtaining any regional resource consents for vegetation removal and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

10.4.3 Birds

Native birds are highly likely to be present within NoR S3, NoR HS and NoR KS and utilise all identified terrestrial habitats (excluding Brown Fields). Vegetation clearance required for construction could result in the loss of these habitats of local value to native birds. The value of these habitats ranges from **Low** to **Very High** value and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

10.4.4 Lizards

Native copper skink are likely to be present within vegetation impacted by the Project. Therefore, there is potential that site clearance required for construction could kill or injure native lizard species and result in the removal of their habitat. Any vegetation clearance where copper skink are likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

10.4.5 Freshwater Ecology

The construction of NoR S3 will directly impact seven existing streams, ranging from **Low** to **Moderate** ecological value. Approximately 598.5 m of stream loss will be required to accommodate the Project works in NoR S3 (Table 10-34). The construction of NoR HS will directly impact one existing stream (S2-S1) (Notes: * = Some assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, lengths are indicative.

). No streams are expected to be directly impacted by the construction of NoR KS. These calculations will require re-evaluation as part of the future regional consent process. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 10-34 Potential stream loss (permanent and intermittent) within NoR S3

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*
S1-S20a	Permanent	Moderate	99
S1-S20d	Intermittent	Low	106.5
S1-S20e	Intermittent	Low	34.5
S1-S21	Permanent	Moderate	69.5
S1-S23	Intermittent	Low	91.5
S1-S25*	Intermittent	Low	116.5
W4-S1	Permanent	High	81

Notes: * = Some assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, lengths are indicative.

Table 10-35 Potential stream loss (permanent and intermittent) within NoR HS

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*
S2-S1	Intermittent	Low	11

Notes: * = Some assessments were carried out at a desktop level, making it difficult to accurately delineate stream width and length. Therefore, lengths are indicative.

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

10.4.6 Wetland Ecology

The construction of NoR S3 will impact 19 natural wetlands ranging from **Low** to **High** ecological value. Approximately 19,749 m^2 of direct wetland loss will occur (Table 10-36). It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 10-36 Potential wetland loss within NoR S3

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S1-W38	Exotic Wetland (EW)	Low	700
S1-W39	Exotic Wetland (EW)	Low	555
S1-W41	Exotic Wetland (EW)	Moderate	1696.5

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S1-W42	Exotic Wetland (EW)	Low	812
S1-W43 & S1-W43 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	168.5
S1-W44	*Machaerina* sedgeland (WL11)	Moderate	127.5
S1-W45 & S1-W45 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	577.13
S1-W46 & S1-W46 (OW)	Exotic Wetland (EW) & Open Water (OW)	Moderate	1122
S1-W47	Exotic Wetland (EW) & Open Water (OW)	Low	1238
S1-W50 & S1-W50 (OW)	Exotic Wetland (EW)	Low	1585
S1-W54	Planted Wetland (PLW)	Moderate	67
S1-W69	Exotic Wetland	Moderate	388
S2-W2	Planted Wetland (PLW)	High	1083
S2-W3	Planted Wetland (PLW)	Moderate	824
S2-W5 & S2-W5 (OW)	Exotic Wetland (EW) & Open Water (OW)	Low	1566
S2-W8	Exotic Wetland (EW)	Moderate	2065.5
S2-W9 & S2-W9 (OW)	Raupō reedland (WL19) & Open Water (OW)	High	1241
S2-W12	Exotic Wetland (EW)	Moderate	3559.5
S2-W12a*	Exotic Wetland (EW)	Moderate	373

Notes:* = Some assessments were carried out at a desktop level, therefore areas are indicative.

The construction of NoR HS will impact three natural wetlands ranging from **Low** to **High** ecological value. Approximately 4,537 m^2 of wetland loss will be required to accommodate the Project works (Table 10-37). It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 10-37 Potential wetland loss within NoR HS

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S2-W2	PLW	High	1128
S2-W3	PLW	Moderate	851
S2-W5	EW	Low	2558

Notes: * = Some assessments were carried out at a desktop level, therefore areas are indicative.

The construction of NoR KS will impact two natural wetlands that are of **Moderate** ecological value. Approximately 1,156 m^2 of wetland loss will be required to accommodate the Project works (Table 10-38). It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

Table 10-38 Potential wetland loss within NoR KS

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
S2-W12	EW	Moderate	713
S2-W12a	EW	Moderate	443

Notes: * = Some assessments were carried out at a desktop level, therefore areas are indicative.

11 NoR S4: Access Road Upgrade

11.1 Project Corridor Features

The NoR S4 corridor features a north-east, southwest alignment along the existing Access Road. The corridor crosses a Kumeu Tributary with mature riparian features and small hillslope wetlands. The direct catchment is rural, but large parts of the area to the north of NoR S4 will be FUZ. Main ecological features associated with the baseline include exotic grassland, mature roadside planting and mature shelterbelts.

11.2 Existing and Likely Future Environment

11.2.1 Planning Context

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai.

- The northern side of Access Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zoning at the north-eastern section of Access Road.
- The southern side of Access Road is predominantly zoned under the AUP:OP as Rural – Countryside Living, with exception to the Kumeū Showgrounds which are zoned as Rural – Mixed Rural Zone are identified as a precinct (I517 Kumeū Showgrounds Precinct) in the AUP:OP.

Table 11-1 below provides a summary of the existing and likely future environment as it relates to Access Road.

Table 11-1 Access Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[41]	Likely Future Environment[42]	Implications of Future Environment on Ecological Features
Business	Business (Light Industrial) Zone	Low	Business (Light Industrial)	N/A
Rural	Rural – Countryside Living Zone Rural – Mixed Rural Zone	Low	Rural	N/A
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban	Loss or decrease of existing features. However, stream corridor is likely to

[41] Based on AUP:OP zoning/policy direction
[42] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[41]	Likely Future Environment[42]	Implications of Future Environment on Ecological Features
				persist in the Future Environment Mature exotic trees adjacent to the NoR, associated with the roadside and shelterbelt will be lost in the likely Future Environment, but may be present during the construction phase of the upgrade.

Please refer to the AEE for further information on the planning context.

11.2.2 Permitted Activities and the Future Ecological Environment

The areas of existing undeveloped greenfields are zoned FUZ in the AUP:OP, and as such are planned for urbanisation. Vegetation clearance within the FUZ, excluding habitat for TAR species, vegetation within 10 m of a riparian strip, and tree removal (excluding district plan vegetation), are identified as permitted activities within Chapters E26 and E15 of the AUP:OP. As such the ecological features (i.e., terrestrial habitat), excluding natural wetlands, streams and riparian edges, which are currently present adjacent to the NoR, will likely be removed by future development, and will not be present when the upgraded transport corridor is operational (albeit we have assumed they will still be present during construction). Subsequently, our effects assessment has taken this into account.

11.2.3 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species (‘ecological features’) present within the NoR S4. All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix 5). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within this NoR.

11.2.3.1 Terrestrial Habitat

Table 11-2 summarises the vegetation types and their classification (Singers et al., 2017) associated with NoR S4. Maps are presented in Appendix 5.

Table 11-2 Vegetation types present within NoR S4

Habitat	Classification*	Description of Habitat
Brown Field (includes cropland)	BF	This definition includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites. Consists of small areas patches of rural homesteads.
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture and gardens for most of the NoR S4.
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along historical farm drains. Dominant species include gorse, woolly nightshade and privet species.
Exotic Wetland	EW	Wetland ecosystems with >50% exotic plant biomass.
Planted Vegetation - Native	PL.1	Native restoration plantings with <50% exotic biomass. Planted native scrub and forest <20 years old.
Planted Vegetation - Mixed	PL.2	Planted native scrub and forest >20 years old.
Planted Vegetation - Exotic	PL.3	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species.
Exotic-Dominated Treeland	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. This includes tree lined streams, gardens and mature trees within amenity plantings and shelter belts.

Notes: * = Information from Singers et al. (2017).

11.2.3.2 Terrestrial Fauna

Bats

Area wide bat surveys have been undertaken for all NoRs. The results of these surveys are detailed in Appendix 11. Within NoR S4, the ABM survey confirmed bat activity at ABM9 during the March-April assessment (associated with S4-S1).

Birds

No dedicated bird surveys were undertaken for the Project and no incidental observations of bird species were noted. Although not observed at the time of survey, potential habitat was identified for a number of other TAR bird species, summarised in Table 11-3 below.

Table 11-3 TAR bird species likely to occur within suitable habitat in NoR S4

Species	Conservation Status (Robertson et al., 2021)	Distribution and Habitat	Project Area Habitat
Long-tailed cuckoo/koekoeā (*Eudynamys taitensis*)	Threatened - Nationally Vulnerable	Summer migrant to New Zealand arriving spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper and yellowhead. Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage throughout New Zealand (Gill, 2013).	Has the potential to briefly occur on migration passage across the project area. Can occur in native/exotic forest, scrub, farmland or urban areas on passage to breeding/winter habitat.
New Zealand pipit/Hīoi (*Anthus novaeseelandiae*)	At Risk – Declining	Occur in open habitat such as coastal and alpine grasslands, but also utilise modified landscapes such as pasture and scrub within the rural landscape. Rare but widespread in the Auckland region (Beauchamp, 2013).	Has the potential to utilise any open habitat such as Exotic Grassland and Exotic Scrub. Habitat suitability is low throughout NoR S4 due to agricultural intensification and likely moderate to high pest predator numbers.
North Island kākā (*Nestor meridionalis septentrionalis*)	At Risk – Recovering	Kākā are generally restricted to indigenous forest habitat and offshore islands in the Auckland region. However, they make seasonal migrations to the Auckland mainland, particularly in winter where they often utilize exotic pine and eucalyptus trees in rural and urban areas. Rare but widespread (seasonal migrant) in the Auckland region (Moorhouse, 2013).	Has the potential to utilise any mature treeland. There is no breeding habitat within the NoR but likely to infrequently utilise exotic trees for seasonal foraging and roosting throughout winter season.

Lizards

Native lizards were not identified during opportunistic searches completed during the site walkover. Copper skink have been recorded 3 km northeast of NoR S4. Copper skink is likely to be associated with most of the vegetation units presented in Table 11-2 where there is appropriate understorey. However, habitat with a higher potential to support copper skink within NoR S4 includes EG, ES, PL.1, PL.2, PL.3, and TL.3. Other native lizard species are generally restricted to indigenous forest, indigenous scrub, coastal habitat types or habitat contiguous to such area. As habitat connectivity to SEAs is limited within the wider project ZOI it is unlikely that any other species listed in Table 6-3 will occur within the Project Area, however ornate skink have been included together with copper skink as they have a low probability of occurring within suitable modified habitat, such as dense riparian vegetation.

11.2.3.3 Terrestrial Ecological Value

Appendix 6 presents the ecological value for the terrestrial vegetation identified within NoR S4. Information obtained for the ecological baseline (Sections 11.2.3.1 and 11.2.3.2), as well as the desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological value of habitats ranged from **Negligible** (e.g., BF) to **High** (e.g., PL.2).

Notwithstanding the ecological value associated with habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with EIANZ Guidelines):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is **Low**, while the value for copper skink (At Risk - Declining) is **High**. The combined value of **Low** therefore understates the conservation value of the species;
- Species may not be restricted to a single vegetation unit;
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.

For the reasons outlined above, the ecological value assessments for individual species are considered to range from **Moderate** to **Very High** (Table 11-4).

Table 11-4 Ecological value for terrestrial fauna (TAR species only)

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Bats	Long-tailed bat	TL.3	Threatened – Nationally Critical	**Very High**
TAR Birds	Long-tailed cuckoo	TL.3	Threatened – Nationally Vulnerable	
	New Zealand pipit	EG, ES	At Risk - Declining	**High**
	North Island kākā	TL.3	At Risk – Recovering	**Moderate**

Fauna Type	Species Within Habitat	Habitat Units	Conservation Status (NZ Classification System)	Ecological Value
Herpetofauna (Lizards)	Copper skink	EG, ES, PL.1, PL.2, PL.3, TL.3	At Risk – Declining	**High**
	Ornate skink	TL.3		

11.2.3.4 Freshwater Habitat

All potential streams within NoR S4 were mapped (Appendix 5) and classified as either permanent or intermittent. Ephemeral streams were mapped when possible. Permanent or intermittent streams that were within the designation boundary were numbered and assessed.

Stream classification and RHA assessment

One stream branch was identified during the desktop and site investigations within NoR S4. Stream S4-S1 was accessed during site investigations and was identified as permanent as there was evidence of continuous flow and the stream measured an overall 'Moderate' habitat quality score. Detailed RHA results are presented in Appendix 10.

11.2.3.5 Freshwater Fauna

Fish surveys were not carried out during site investigations, however 'At Risk – Declining' species īnanga and longfin eel have been recorded upstream of S4-S1. The freshwater habitats within NoR S4 were assessed for their potential to support indigenous fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey.

11.2.3.6 Freshwater Ecological Value

Appendix 7 presents the ecological value for the aquatic habitats identified within NoR S4. Information obtained for the ecological baseline (Sections 11.2.3.4 and 11.2.3.5), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological value of S4-S1 was **Moderate**.

11.2.3.7 Wetland Habitat

One wetland within NoR S4 was identified and assessed via desktop (S4-W1). This was classified as a NPS-FM 'natural wetland' with an Exotic Wetland (EW) vegetation type.

11.2.3.8 Wetland Ecological Value

Appendix 8 presents the ecological value for the wetland habitat (S4-W1) identified within NoR S4. Information obtained for the ecological baseline (Section 11.2.3.7), as well as the area wide desktop assessment (Section 6), was used to score the matters that inform the ecological value. The ecological value of S4-W1 was **Low**.

11.3 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 11.3 assess the ecological effects of activities which are district matters under the AUP:OP.

11.3.1 Construction Effects - Terrestrial Ecology

Refer to Section 8.3.1.

11.3.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix 5 and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it relates to loss in foraging habitat, and mortality and injury) is assessed in Sections 11.3.1.2 and 11.3.1.3.

Table 11-5 Assessment of ecological effects for terrestrial vegetation (district plan trees only) and impact management during construction for NoR S4

Effect Description	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	**TL.3 (total area of 2,263.35 m^2)** The magnitude of effect is assessed as **Moderate** due to the extent of removal and high likelihood that habitat loss and additional fragmentation may occur. The ecological value of TL.3 is assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

11.3.1.2 Bats

Bats may utilise the habitats associated with NoR S4 for roosting or foraging. Specifically, mature trees associated with exotic-dominated treeland stands (TL.3) and shelterbelts. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. Although bat foraging has been confirmed, ABM survey at the Project scale cannot confirm roost occupation within or adjacent to the designation boundary. However, it can be assumed that bats will utilise roost sites within the Project Area based on:

- Confirmed habitat suitability (numerous trees with moderate to high bat roost potential, connected to linear stream corridors and wetlands)
- Confirmed foraging presence and;

Additionally, bats may be impacted by removal of district plan vegetation through the following effects[43]:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Mortality or injury to bats

Table 11-6 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[43] Roost lost has been considered but discounted as an effect as the **consequence** of roost loss (if it does occur at all) is considered less than **Negligible** in the context of this NoR.

Table 11-6 Assessment of ecological effects for bats and impact management during construction for NoR S4

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to an unlikely probability, local extent if impact occurs and relatively short period of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	***Loss of foraging habitat*** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. ***Mortality or injury to bats*** The magnitude of effect is assessed as **Low** due to a likely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required.	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects for both impacts will be the same as the Baseline.

Effect Description	Disturbance and displacement to roosts and individual bats (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Impact management and residual level of effect	N/A	N/A	A BMP should be developed to include consideration for: • Timing of vegetation removal. • Vegetation removal protocols including pre-felling surveys. The residual impact is assessed as **Very Low** post mitigation.	Same as Baseline.
Management of residual effect	N/A	N/A	N/A	N/A

11.3.1.3 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S4. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Disturbance and displacement to existing individuals due to construction activities (noise, light, dust etc.)
- Loss of foraging habitat
- Nest loss
- Mortality or injury to birds

Table 11-7 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 11-7 Assessment of ecological effects for birds and impact management during construction for NoR S4

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the NoR. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to unlikely probability, short duration, and local extent of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as	Same as Baseline.	**<u>Non-TAR birds</u>** ***Nest loss & Mortality or injury to birds*** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with district plan vegetation. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Non-TAR birds</u>** ***Loss of foraging habitat*** The magnitude of effect is assessed as **Low** due to a likely probability and local extent if impact occurs. The ecological value of birds in the context of habitat features are	Same as Baseline.

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to unlikely probability, short duration, and local extent of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (North Island kākā)</u>** The magnitude of effect is assessed as **Negligible** due to unlikely probability, short duration, and local extent of effect if disturbance occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very**		assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (New Zealand pipit)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **High**, and the overall	

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	Low prior to mitigation. As such no impact management is required.		level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance inspections should be undertaken prior to vegetation removal.	Same as Baseline.

	Disturbance and displacement to roosts and individual birds (existing) due to construction activities (noise, light, dust etc.)		Effects due to removal of district plan vegetation: - Loss of foraging habitat - Nest loss - Mortality or injury to birds	
Effect Description	**Baseline**	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Management of residual effect	N/A	N/A	N/A	N/A

11.3.1.4 Lizards

Construction effects on lizards associated with noise, light and vibration are presented in Table 11-8. Construction activity relates to the upgrade of an existing road and as such lizards are likely to be habituated to noise and vibration from the existing road. Regional matters as they relate to vegetation removal and lizards are further discussed in Section 11.4.4.

Table 11-8 Assessment of ecological effects for lizards and impact management during construction for NoR S4

Effect Description	Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.)	
	Baseline	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Negligible** due to unlikely probability of lizard disturbance due to construction related noise and vibration. The ecological value of copper skink is assessed as **High**, and the overall level of effect due to construction disturbance is assessed as **Very Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

11.3.2 Operational Effects - Terrestrial Ecology

The Project involves the upgrading of an existing road in a rural landscape and future urban environment; therefore, although some impacts may increase from the current baseline, many operational effects such as fragmentation and noise and lighting are likely to be pre-existing. In general, potential operational effects from the Project that relate to District plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix 1). The effects assessment has considered two scenarios – the current ecological baseline (refer Section 11.2.2 and the 'existing environment' (i.e., allowing for permitted activities) (refer Section 11.2.1).

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

11.3.2.1 Bats

The loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The level of effect on bats due to operational impacts associated with loss in connectivity should be assessed in the context of confirmed (but low frequency) bat activity in the broader landscape, the existing degree of fragmentation and that of the future urban environment.

Table 11-9 outlines the effect assessment for:

- Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to additional fragmentation of terrestrial habitat due to the presence of the infrastructure.
- Disturbance and displacement of bats due to light, noise and vibration from the road.

Table 11-9 Assessment of ecological effects for bats and impact management during operation for NoR S4

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the unlikely probability and relatively local extent of disturbance. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** disturbance of individual bats and roosts. As such impact management is required.	It is assumed that urbanisation (and the associated tree removal) may not have occurred at the time of road construction. As such the level of effects will be the same as the Baseline.	The magnitude of effect is assessed as **Low** due to relatively low likelihood and existing fragmentation. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** for loss in connectivity. As such impact management is required.	Same as Baseline stream riparian corridor likely to be present in the FUZ.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting and retention of existing mature trees between the road alignment and features with potential for bat roosts[44]. • Light and noise management through design.	Same as Baseline.	A BMP should be developed as outlined in Appendix 14. The map indicates the location and extent of measures to mitigate potential connectivity effects and includes hop-overs/underpasses, buffer planting and existing mature tree features that will be retained, as well as indicating areas where early	Same as Baseline.

[44] This may be in addition to the buffer planting proposed in Appendix **Error! Reference source not found.** and will depend on the presence and location of roosts at the time of construction. The requirement for planting mature trees (as buffer) to mitigate roost disturbance, will depend on the future context such as the location of known roosts, the presence of existing buffer and the feasibility of including other design consideration that can control disturbance effects.

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
	• Future presence of roosts within the alignment (placement of flaps on features with high roost potential). The residual impact is assessed as **Negligible** post mitigation.		planting[45] (or planting of mature trees) will occur. The BMP should also have additional consideration for: • Lighting design to minimise light levels and light spill along the road corridor. • As an alternative to early restoration planting, restoration planting can make use of mature trees to achieve the same goal as early restoration planting. • Assumptions in the efficacy of the proposed mitigation will be addressed through an adaptive management framework that will outline bat activity thresholds, robust monitoring and potential corrective action. The implementation of the proposed impact management measures will reduce the level of effect to **Very Low**.	

Effect Description	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration		Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
Management of residual effect	N/A	N/A	N/A	N/A

11.3.2.2 Birds

Noise, vibration and lighting disturbance caused by the presence of the road could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to NoR S4, while noise, light and vibration may also affect connectivity in the broader landscape.

Table 11-10 outlines the operational effect assessment and impact management for birds.

Table 11-10 Assessment of ecological effects for birds and impact management during operation for NoR S4

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Low** due to the likely probability and local effect. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effects. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.		**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Low** due to the likely probability and local effect. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Terrestrial TAR birds (long-tailed cuckoo)</u>** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effects. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline with the exception of: **<u>Non-TAR birds</u>** ***Loss in connectivity*** The magnitude of effect is assessed as **Negligible** due to the unlikely probability and local effect. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
	Terrestrial TAR birds (New Zealand pipit) The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.		**Terrestrial TAR birds (New Zealand pipit)** The magnitude of effect is assessed as **Low** due to an unlikely probability and regional extent of effect. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** due to an unlikely probability and regional extent of effect. The ecological value of these species is **Moderate**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual	N/A	N/A	N/A	N/A

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)		Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	Likely Future Ecological Environment	Baseline	Likely Future Ecological Environment
level of effect				
Management of residual effect	N/A	N/A	N/A	N/A

11.3.2.3 Lizards

Suitable habitat (EG, ES, PL.1, PL.2, PL.3 and TL.3) was identified within the NoR boundary which could potentially support native lizards. Native lizards require vegetated corridors to facilitate natural dispersal, although they are considered to be relatively resident species and do not require migration or large-scale movement to support reproduction, refuge and feeding.

NoR S4 corridor includes upgrading the existing Access Road. The proposed upgrade is therefore not expected to result in the additional fragmentation of lizard habitat. Similarly, resident (existing and future) lizards are likely to be habituated to disturbance such as noise, vibration and lighting and no additional effect on lizards is expected, provided that the post-upgraded road will not result in higher levels of noise and vibration.

Table 11-11 outlines the operational effect assessment and impact management for lizards.

Table 11-11 Assessment of ecological effects for lizards and impact management during operation for NoR S4

Effect Description	Disturbance and displacement of existing and future lizards due to light, noise and vibration effects from the presence of the road		Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure	
	Baseline	**Likely Future Ecological Environment**	**Baseline**	**Likely Future Ecological Environment**
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** as the Project is not expected to further exacerbate existing disturbance adjacent to the NoR. The ecological value of copper skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.	The magnitude of effect is assessed as **Low** as the Project is not expected to further exacerbate existing and future restrictions on lizard dispersal adjacent to the NoR. The ecological value of copper skinks is assessed to be **High**, and the overall level of effect due to the presence of the road is assessed as **Low** prior to mitigation. As such no impact management is required.	Same as Baseline.
Impact management and residual level of effect	N/A	N/A	N/A	N/A
Management of residual effect	N/A	N/A	N/A	N/A

11.3.3 Effects Conclusions

The ecological level of effects assessed as **Moderate**, **High** or **Very High** for NoR S4, and therefore require impact management, include:

- **Moderate** level of effect for mortality or injury to long-tailed bats due to the removal of district plan vegetation during construction for the Baseline only.
- **Moderate** level of effect for loss in connectivity for long-tailed bats due to the presence of the road during operation for the Baseline and Future Environment.

The post mitigation level of effect is considered to be **Negligible** to **Very Low** for construction and operational effects.

11.4 Design and Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for NoR S4. Wildlife Act Authority permits are also discussed in relation to the potential killing or injuring of native fauna associated with the Project activities.

11.4.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the NoRs, including suitable habitat that is potentially being used by native fauna (bats, birds and lizards). Loss of vegetation that is subject to district plan controls is discussed in Section 11.3.1. The amounts and types of all[46] terrestrial habitat and vegetation (including habitat used by native fauna) that could be lost as a result of the Project is presented in Table 11-12 under the Footprint column.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges from **Negligible** to **Very High** ecological value (Section 11.2.3.3). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 11.3.1.2 to 11.4.4 below.

Table 11-12 Potential area of permanent terrestrial vegetation loss within the road footprint for NoR S4

Feature	Classification*	Footprint (m^2)
Exotic Grassland	EG	#
Exotic Scrub	ES	2,541
Planted Vegetation – Native	PL.1	205
Planted Vegetation – Mixed	PL.2	102
Planted Vegetation – Exotic	PL.3	12,519
Exotic-Dominated Treeland^	TL.3	13,370

[46] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation. # = Not mapped due to the extent.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent (for example, removal of vegetation in the riparian setback) and wildlife permit applications (if required).

11.4.2 Bats

Mature trees in suitable habitat areas (TL.3) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats should be re-assessed prior to obtaining any regional resource consents for vegetation removal and to support an application for a wildlife permit. The loss of some of this habitat is already assessed because they are district plan trees.

11.4.3 Birds

Native birds are likely to be present within the NoR and utilise all identified terrestrial habitats (excluding Brown Fields). Vegetation clearance required for construction could result in the loss of these habitats of local value to native birds. The value of these habitats ranges from **Low** to **Very High** value and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

11.4.4 Lizards

Native lizards are likely to be present within vegetation impacted by the Project. Therefore, there is potential that site clearance required for construction could kill or injure native lizard species and result in the removal of their habitat. Any vegetation clearance where lizards are likely to occur will also need to be managed in accordance with the Wildlife Act 1953.

11.4.5 Wetland Ecology

The construction of NoR S4 will impact one **Low** value wetland (S4-W1). Approximately 317 m^2 of wetland loss will be required to accommodate the Project works in NoR S4. It is expected that details regarding the offset/compensation requirements will be addressed during the future regional resource consent application.

12 Conclusion

Construction Effects

Table 12-1 to Table 12-4 provides a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been suggested and will be conditioned through an Ecological Management Plan. Construction effect mitigation measures will include:

- A BMP for NoR S1, NoR S3, NoR HS, NoR KS, and NoR S4. Details of the BMP will depend on bat habitat within the future ecological environment and is likely to include bat habitat surveys prior to construction, siting of compounds and laydown areas to avoid bat habitat, lighting design to reduce light levels and spill from construction areas and restriction of nightworks around treeland bat habitat.
- Bird management will be required for brown teal and dabchick at NoR S1, NoR S2, NoR S3, NoR HS, and NoR KS. Considerations for bird management will include a bird survey prior to construction to confirm Threatened or At Risk (TAR) species are not present and to provide guidance if TAR species are present, including the avoidance of the bird breeding season (September to February) during construction (as it relates to the existing stormwater pond).

Table 12-1 Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation

Construction - Terrestrial vegetation (district plan vegetation only)	
NoR	**Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)**
NoR S1	Very Low (EF), Low (TL.2 & TL.3)
NoR S2	Very Low (TL.3, WF8, & Unitary Plan notable tree)
NoR S3	Very Low (TL.3, WF8, Unitary Plan notable tree, Unitary Plan open space trees)
NoR HS	Very Low (TL.3)
NoR KS	N/A
NoR S4	Low (TL.3)

Table 12-2 Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats			
NoR	**Disturbance and displacement to roosts and individuals (existing) due to**	**Loss of foraging habitat due to removal of district plan vegetation**	**Mortality or injury to bats due to removal of district plan vegetation**

Construction - Bats			
	construction activities (noise, light, dust etc.)		
NoR S1	**Moderate**	Low	**Moderate**
NoR S2	Low	Low	Low
NoR S3	**Moderate**	Low	Low
NoR HS	**Moderate**	Low	Low
NoR KS	**Moderate**	N/A	N/A
NoR S4	Low	Low	**Moderate** *Low

Notes: * = Indicates a level of effect associated with the Likely Future Ecological Environment that is different from the baseline level of effects.

Table 12-3 Summary of ecological effects during construction prior to mitigation for birds

Construction - Birds				
NoR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.)**	**Loss of foraging habitat due to removal of district plan vegetation**	**Nest loss due to removal of district plan vegetation**	**Mortality or injury to birds due to removal of district plan vegetation**
NoR S1				
Non-TAR Birds	Low	Low	Low	Low
Long-tailed cuckoo	Low	Very Low	Very Low	Very Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR S2				
Non-TAR Birds	Low	Very Low	Low	Low

Construction - Birds				
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR S3				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Very Low	N/A	N/A	N/A
NoR HS				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR KS				
Non-TAR Birds	Low	N/A	N/A	N/A

Construction - Birds				
Long-tailed cuckoo	Low	N/A	N/A	N/A
New Zealand pipit	Very Low	N/A	N/A	N/A
North Island kākā	Very Low	N/A	N/A	N/A
Brown teal, dabchick	**Moderate**	N/A	N/A	N/A
North Island fernbird, banded rail, spotless crake	Low	N/A	N/A	N/A
Little black shag, pied shag	Low	N/A	N/A	N/A
NoR S4				
Non-TAR Birds	Low	Very Low	Low	Low
Long-tailed cuckoo	Low	Low	Low	Low
New Zealand pipit	Very Low	Very Low	Very Low	Very Low
North Island kākā	Very Low	Very Low	Very Low	Very Low

Table 12-4 Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	**Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)**
NoR S1	Low
NoR S2	Very Low
NoR S3	Very Low
NoR HS	Very Low
NoR KS	Very Low
NoR S4	Very Low

Overall comment

The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** or **Very Low**.

Operational Effects

Table 12-5 to Table 12-7 provides a summary of district plan matter ecological effects during operation due to the presence of the road resulting in disturbance or loss in connectivity to bats, birds and lizards. The summary represents the level of effect for the baseline and the likely future ecological environment as one where they are the same and with a * where they differ. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effect mitigation measures will include:

- A BMP for all NoRs. The BMP should include the retention of mature trees, buffer planting, hop-overs and unders at strategic locations as outlined in Appendix 14. In addition, the BMP should consider lighting design along strategic location of the road (stream crossings).
- Bird management will be required for long-tailed cuckoo at NoR S1 and S3. Bird management will also be required for brown teal and dabchick at NoR S1, S3, and HS. Considerations for bird management will include retention of vegetation near wetland habitat (where practicable), buffer planting between the road alignment and suitable habitat adjacent to the road, and installation of vegetation hop-overs in key areas.

Table 12-5 Summary of ecological effects during operation prior to mitigation for bats

Operation - Bats		
NoR	**Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration**	**Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape**
NoR S1	**High**	**Very High**
NoR S2	Low	**Moderate**
NoR S3	**High**	**High**
NoR HS	**Moderate**	**Moderate**
NoR KS	**Moderate**	**Moderate**
NoR S4	**Moderate**	**Moderate**

Table 12-6 Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds		
NoR	**Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)**	**Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**

Operation - Birds		
NoR S1		
Non-TAR Birds	Low	Low
Long-tailed cuckoo	Low	**Moderate**
New Zealand pipit	Very Low	Low
North Island kākā	Very Low	Low
Brown teal, dabchick	**Moderate**	**Moderate**
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Very Low	Very Low
NoR S2		
Non-TAR Birds	Very Low	Very Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Very Low	Very Low
North Island kākā	Very Low	Very Low
Brown teal, dabchick	Low	Low
North Island fernbird, banded rail, spotless crake	Very Low	Very Low
Little black shag, pied shag	Very Low	Very Low
NoR S3		
Non-TAR Birds	Very Low	Very Low
Long-tailed cuckoo	Low	**Moderate**
New Zealand pipit	Very Low	Low
North Island kākā	Very Low	Low
Brown teal, dabchick	**Moderate**	**Moderate**
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Very Low	Low
NoR HS		
Non-TAR Birds	Low	Low
Long-tailed cuckoo	Low	Low

Operation - Birds		
New Zealand pipit	Low	Low
North Island kākā	Low	Low
Brown teal, dabchick	**Moderate**	Low
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Low	Low
NoR KS		
Non-TAR Birds	Low	Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Low	Low
North Island kākā	Low	Low
Brown teal, dabchick	Low	Low
North Island fernbird, banded rail, spotless crake	Low	Low
Little black shag, pied shag	Low	Low
NoR S4		
Non-TAR Birds	Very Low	Very Low
Long-tailed cuckoo	Low	Low
New Zealand pipit	Very Low	Low
North Island kākā	Very Low	Low

Table 12-7 Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards		
NoR	**Disturbance and displacement of existing and future lizards due to light, noise, and vibration effects from the presence of the road**	**Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure**
NoR S1	Low	Low
NoR S2	Low	Low
NoR S3	Low	Low

Operation - Lizards		
NoR HS	Low	Low
NoR KS	Low	Low
NoR S4	Low	Low

Overall comment

The residual (post-mitigation) level of effect for all operational effects are **Negligible, Very Low** or **Low**.

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1 Appendix 1 – Ecological Impact Assessment Methodology

The standard by which this EcIA was undertaken follows the guidelines published by the Environment Institute of Australia and New Zealand (EIANZ Guidelines) (Roper-Lindsay et al., 2018).

1.1 Assessment of Ecological Value

The first step in the EcIA approach is to assess the value of ecological features in terms of Representativeness, Rarity, Diversity and Pattern, and Ecological context. Details on each matter and its associated considerations are provided in Table 13-1 for terrestrial ecological value and Table 13-2 aquatic ecological value

Table 13-1 Matters and considerations for the assessment of terrestrial ecological value

Representativeness
Typical structure and composition
Indigenous representation
Rarity/distinctiveness
Species of conservation significance
Range restricted or endemic species
Distinctive ecological values
Diversity and pattern
Habitat diversity
Species diversity
Patterns in habitat use
Ecological context
Size, shape and buffering
Sensitivity to change
Ecological networks (linkages, pathways, migration)

Table 13-2 Matters and considerations for the assessment of aquatic ecological value

Representativeness (including SEV, RHA and ecological integrity)
Extent to which site/catchment is typical of characteristic
Instream habitat modification

Representativeness (including SEV, RHA and ecological integrity)
Riparian habitat modification
Hydrological modification
Catchment conditions
Geomorphological modification
Water quality modification
Presence of alien and invasive species
Invertebrate assemblage representation
Fish assemblage representation
Rarity/descriptiveness
Pool characterisation
Species of conservation significance
Range restricted or endemic species
Stream type (rare or distinctive)
Diversity and pattern
Distinctive ecological values
Level of natural diversity
Diversity metrics
Complexity of community
Ecological context (Ecosystem services, importance sensitivity)
Stream order
Catchment size
Hydroperiod
Sensitivity to flow modification
Sensitivity water quality modification
Sensitivity to sedimentation/erosion
Connectivity and migration

1.2 Assessment of Ecological Effects

The ecological effects assessment includes several steps that collectively assess the way the Project will interact with elements of the physical and biological, environment to produce effects to habitat and receptors. The method for determining the level of effect are outlined in the following sections.

Basic impact characteristic terminology and respective descriptors are incline with the EIANZ Guidelines and are provided in Table 13-3.

Table 13-3 Magnitude of effect assessment terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect)	Direct
		Indirect
Extent	The “reach” of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local
		Regional
		National
Duration	The time period over which a resource/receptor is affected	Temporary (days or months)
		Short-term (<5 years)
		Long-term (15-25 years)
		Permanent (>25 years)
Frequency	A measure of the constancy or periodicity the receptor will be affected	Infrequently
		Periodically
		Frequently
		Continuously
Likelihood	The probability of an effect occurring if it is unplanned	Highly Unlikely
		Unlikely
		Likely
		Highly Likely
		Definite
Reversibility	The degree to which the ecological effect can be reversed in a reasonable time scale through natural processes or mitigation	Totally
		Partially
		Irreversible
		Not applicable

Based on the above-mentioned descriptors, the characteristics of each effect are used to assign a magnitude to the specific effect. Magnitude designations are provided in Table 13-4.

Table 13-4 Magnitude of effect descriptions

Magnitude	Description
Very High	Total loss of, or very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and or attributes will be fundamentally changes and may be lost from the site altogether; and/or loss of very high proportion of the known population or range of the elements/features
High	Major loss or major alteration to key elements/features of the existing baseline such that the post-development character, composition and/or attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the element/feature
Moderate	Loss or alteration to one or more key elements/features of the existing baseline such that the post-development character, composition and/or attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the element/feature
Low	Minor shift away from the existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline conditions will be similar or pre-development circumstances or patterns; and or having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; and/or having negligible effect on the known population or range of the element/feature

The magnitude of an effect is considered in relation to the ecological value of the habitat or receptor to be impacted on. The ecological value of habitat or receptors are the primary focus of the ecological assessment. The ecological value of habitat or receptors are typically expressed on a local, district, regional or national scale. The ecological value designations are provided in Table 13-5.

Table 13-5 Ecological value descriptions

Value	Description
Very high	Area rates High for three or all the four assessment matters. Likely to be of National importance and recognised as such
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder or Area rates High for 1 so the assessment matters, moderate for the remainder. Likely to be regionally important and recognised as such
Moderate	Area rates High for one matter, Moderate and Low Dortha remainder, or Area rates Moderate for 2 or more assessment matters Low or Very low for the remainder. Likely to be important at the level of the Ecological District
Low	Area rates Low or Very low for most assessment matters and Moderate for one. Limited ecological value other as local habitat for tolerant species
Negligible	Area rates Very low for three matters and Moderate, Low or Very low for the remainder

Once magnitude of effect and the ecological value of the habitat or receptor have been determined, the level of effect can be assigned for each effect using the matrix shown in Table 13-6.

Table 13-6 Ecological effect matrix

		Ecological Values				
		Very High	High	Moderate	Low	Negligible
Magnitude	Very High	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Negligible	Negligible	Negligible	Negligible	Negligible

From Table 13-6, the level of effect designations are defined below:

- **Negligible**: An effect of negligible consequence is one where habitat or receptors will not be affected in any meaningful way by a Project activity or the predicted effect is indistinguishable from natural background variations;
- **Low**: An effect of minor consequence is one where habitat or receptors will experience a noticeable effect, but the effect magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low ecological value. In either case, the magnitude should be well within applicable standards;
- **Moderate**: An effect of moderate consequence has an effect magnitude that is within applicable standards but higher than that of a minor effect. The emphasis for moderate effects is to show that the effect has been reduced or minimised in line with the mitigation hierarchy;
- **High**: A high level of effect of is one where an accepted limit or standard may be exceeded, or moderate magnitude of effect will occur to moderate or high value habitat or receptors;
- **Very High**: A very high level of effect will occur when the magnitude and value of effects are assessed as high or very high. Typically, very high level of effects notably exceeds standard limits.

1.3 Impact Management

Informed by the level of effects suitable impact management measures are provided consistent with the mitigation hierarchy. The priority in mitigation is to first apply mitigation measures to the source of the impact (avoid) and then to address the resultant effects (reduce or minimise) of the impact.

1.4 Residual Impacts

Once mitigation measures are declared, the next step in the effect assessment process was to assign residual impact significance. This is a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional recommended mitigation measures.

1.5 Managing Uncertainty

Biophysical impacts are difficult to predict with certainty, but uncertainty stemming from on-going development of the Project design and implementation is inevitable, and the environment is variable over time. If uncertainties are relevant to the effect assessment, they were stated and approached conservatively, to identify a range of likely residual effects and relevant mitigation measures.

1.6 Cumulative Effects

Cumulative impacts and effects are those that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects. No structured methods were employed to assess cumulative impacts, but where relevant descriptions of potential cumulative effects have been provided.

2 Appendix 2 – Auckland Unitary Plan Activities

Auckland Unitary Plan – E26 Infrastructure

Table E26.4.3.1 below is relevant for considering effects and recommending mitigation in relation to tree removal. Note that, except for Trees in Roads, in Open Space Zones and Notable Trees, trees are not protected under the AUP.

Table E26.4.3.1 Activity table - Network utilities and electricity generation – Trees in roads and open space zones and the Notable Trees Overlay

Activity	Activity Status			Permitted Standards or Matters of Discretion / Control
	Trees in roads [dp]	Open space zones [dp]	Notable trees [dp]	
(A89) Tree removal of Notable Trees	N/A	N/A	D	N/A
(A90) Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	P	N/A	N/A	N/A
(A91) Tree alteration or removal of any tree less than 4m in height and/or less than 400mm in girth	P	P	RD	N/A
(A92) Tree alteration or removal of any tree greater than 4m in height and/or greater than 400mm in girth	RD	RD	N/A	N/A
(A93) Tree trimming, alteration and removal not otherwise provided for	D	D	D	N/A

Auckland Unitary Plan – E26 Infrastructure

The table below is relevant for considering effects and recommending mitigation in relation to vegetation clearance. Also refer to Table E15.4.1.

Table E26.3.3.1 Activity table – Network utilities and electricity generation and vegetation management

Activity	Activity Status						Permitted Standards
	Rural zones, coastal areas and riparian areas [rp]	SEA [rp]	ONF [dp]	HNC [dp]	ONL [dp]	ONC [dp]	
(A76) Vegetation alteration or removal	P	P	P	P	P	P	Refer to E26.3.5.4. Vegetation alteration or removal for Permitted Activity Standards
(A77) Vegetation alteration or removal that does not comply with Standards E26.3.5.1 to E26.3.5.4	RD	RD	RD	RD	RD	RD	
(A78) Vegetation alteration or removal not otherwise provided for	D	D	D	D	D	D	

Note: Greyed-out boxes relate to Regional Activities which are not considered as part of the NoR and will be relevant for future Regional Resource Consents.

Auckland Unitary Plan – E15 Vegetation management and biodiversity

Table E15.4.1 below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to vegetation clearance in urban and FUZ zones, and adjacent to riparian areas.

Table E15.4.1 Activity table - Auckland-wide vegetation and biodiversity management rules

Activity	Activity Status	Permitted Standards
Riparian areas (as described below)		
(A16) Vegetation alteration or removal within 20m of rural streams, other than those in Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A
(A17) Vegetation alteration or removal within 10m of rural streams in the Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A

Activity	Activity Status	Permitted Standards
(A18) Vegetation alteration or removal within 20m of a natural wetland, in the bed of a river or stream (permanent or intermittent), or lake	RD	N/A
(A19) Vegetation alteration or removal within 10m of urban streams	RD	N/A
All other zones and areas not covered above (i.e. Urban Zones and FUZ)		
(A22A) Vegetation alteration or removal	P	Refer to E15.6. Vegetation alteration or removal for Permitted Activity Standards
All areas		
(A23) Permitted activities in Table E15.4.1 that do not comply with one or more of the standards in E15.6	RD	N/A

Auckland Unitary Plan – E26 Infrastructure - Earthworks

The table below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to earthworks.

Table E26.5.3.1 Activity table - Earthworks all zones and roads [dp]

Activity	Activity Status	Permitted Standards
(A95) Earthworks up to 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A96) Earthworks up to 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A97) Earthworks greater than 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	N/A
(A97A) Earthworks greater than 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	N/A

3 Appendix 3 – Regional Plan, District Plan and Wildlife Act Matters

Table 13-7 Ecological effects of road infrastructure construction broken down into AUP:OP Regional and District Plan matters, and Wildlife Act (1953)

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
		Construction			
Terrestrial habitat	Vegetation removal (including trees) outside of roads and public spaces in: a) a rural zone b) riparian margins c) coastal areas d) SEAs This also includes other terrestrial habitat of value identified in the EcIA.	Permanent loss of habitat/ecosystem, fragmentation and edge effects.		✓	
	Vegetation removal (including trees) in: a) Roads b) Public spaces c) ONFs d) ONLs e) HNCs f) ONCs	Permanent loss of habitat/ecosystem, fragmentation and edge effects.	✓		
	Earthworks – leading to invasion of bare earth surfaces with weeds and transfer of weeds (seeds and fragments) between earthworks areas.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
Bats	Vegetation removal.	Roost loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	Construction activities (Noise, light, dust etc.).	Disturbance and displacement to roosts and to individuals (existing).	✓		✓
Birds (native)	Vegetation removal.	Nest loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Construction activities (noise, light, dust etc).	Disturbance and displacement of roosts and individuals (existing).	✓		✓
Herpetofauna (native)	Vegetation removal.	Lizard habitat loss		✓	
	Vegetation removal.	Kill or injure individual			✓
	Construction activities (noise, light, dust etc).	Disturbance and displacement of individuals (existing).	✓		✓
	Reclamation/culverting/other structures e.g., bank armouring.	Permanent loss/modification of habitat/ecosystem.		✓	
Freshwater habitat – wetland or stream (including riparian margins)	Vegetation removal.	Permanent loss of habitat/ecosystem, fragmentation and edge effects.		✓	
	Construction activities – earthworks (leading to sediment discharge), machinery use and chemical storage (leading to leaks/spills).	Uncontrolled discharge leading to habitat and water quality degradation.		✓	
	Diversion, abstraction or bunding of watercourses and water level/flow/ periodicity changes.	Detrimental effects on habitats including plant composition and fauna.		✓	
Fish (native)	Reclamation/diversion /other structures e.g., bank armouring.	Loss of aquatic habitat.		✓	
	Reclamation/diversion /culverting/other structures e.g., bank armouring.	Kill or injure individual.			✓
Operation					
Terrestrial habitat	Presence of the road - use of road edges as dispersal corridors by invasive plant species.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
	Road maintenance - increased use of herbicides.	Increased weed incursion, unintentional spray of indigenous vegetation.		✓	
Bats	Vehicle movement.	Kill or injure individual.			✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise/vibration.	Disturbance and displacement of (new and existing) roosts and individuals.	✓		✓
Birds (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise/vibration.	Disturbance and displacement of (new and existing) nests and individuals.	✓		✓
Herpetofauna (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise/vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting.	Disturbance of nocturnal lizard behaviour.	✓		✓
Freshwater habitat – wetland or stream (including riparian margins)	Vehicle (cartage) movement - risk of spills of potential toxins (oil, milk, chemicals).	Temporary degradation of instream/wetland habitat and water quality.		✓	
	Presence of bridge.	Shading leading to change in ecosystem structure.		✓	
	Gradual change in hydrology from presence of the road/stormwater, including reclamations.	Effect on downstream habitat (including erosion/sediment discharge) due to change in hydrology (increase or decrease).		✓	

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Stormwater discharges - pollutants (such as heavy metals and herbicides).	Permanent degradation of wetland or instream habitat and water quality.		✓	
Fish (native)	Presence of culvert.	Loss of connectivity due to culvert preventing fish passage up and downstream.		✓	

4 Appendix 4 - Desktop Bird Records

Table 13-8 Desktop bird records within 2 km of the Project Areas

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk - Declining	iNaturalist
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk - Declining	eBird (Bird Atlas), iNaturalist
Black shag	Kawau	*Phalacrocorax carbo novaehollandiae*	At Risk - Naturally Uncommon	eBird (Bird Atlas), iNaturalist
Black-billed gull	Tarāpuka	*Larus bulleri*	Threatened - Nationally Critical	iNaturalist
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised	eBird (Bird Atlas)
Brown teal	Pāteke	*Anas chlorotis*	At Risk - Recovering	iNaturalist
Canada goose	-	*Branta canadensis*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened - Nationally Vulnerable	iNaturalist
Chaffinch	Pahirini	*Fringilla coelebs*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Common pheasant	Peihana	*Phasianus colchicus*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Dabchick	Weweia	*Poliocephalus rufopectus*	Threatened – Nationally Increasing	eBird (Bird Atlas)
Eastern rosella	-	*Platycercus eximius*	Introduced and Naturalised	eBird (Bird Atlas)
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	eBird (Bird Atlas), iNaturalist
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised	eBird (Bird Atlas)
Greenfinch	-	*Carduelis chloris*	Introduced and Naturalised	eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Grey duck x mallard hybrid	-	*Anas platyrhynchos x superciliosa*	Not Threatened	eBird (Bird Atlas)
Grey warbler	Riroriro	*Gerygone igata*	Not Threatened	eBird (Bird Atlas)
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	eBird (Bird Atlas)
Laughing kookaburra	-	*Dacelo novaeguineae*	Introduced and Naturalised	eBird (Bird Atlas)
Little black shag	Kawau tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	iNaturalist
Little shag	Kawau paka	*Phalacrocorax melanoleucos*	Not Threatened	eBird (Bird Atlas)
Long-tailed cuckoo	Koekoeā	*Eudynamys taitensis*	Threatened – Nationally Vulnerable	Assumed present based on suitable habitat present in the Project Area.
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Mallard	-	*Anas platyrhynchos*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Muscovy duck	-	*Cairina moschata*	Introduced, not established	eBird (Bird Atlas)
Myna	-	*Acridotheres tristis*	Introduced and Naturalised	eBird (Bird Atlas)
New Zealand pigeon	Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
New Zealand pipit	Hīoi	*Anthus novaeseelandiae*	At Risk - Declining	iNaturalist
North Island fernbird	Mātātā	*Poodytes punctatus*	At Risk – Declining	Assumed present based on suitable habitat present in the Project Area.
North Island kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk – Recovering	SEA_T_6381 and SEA_T_6382
North Island kōkako	Kōkako	*Callaeas wilsoni*	At Risk - Recovering	iNaturalist

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Northern New Zealand dotterel	Tūturiwhatu	*Charadrius obscurus aquilonius*	At Risk - Recovering	iNaturalist
Paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened	eBird (Bird Atlas), iNaturalist
Peafowl	Pīkao	*Pavo cristatus*	Introduced and Naturalised	eBird (Bird Atlas)
Pied shag	Kāruhiruhi	*Phalacrocorax varius*	At Risk – Recovering	Assumed present based on suitable habitat present in the Project Area.
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	eBird (Bird Atlas)
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	eBird (Bird Atlas), iNaturalist
Red junglefowl (chicken)	Heihei	*Gallus gallus domesticus*	Introduced and Naturalised	eBird (Bird Atlas)
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk - Declining	eBird (Bird Atlas)
Rock pigeon	-	*Columba livia*	Introduced and Naturalised	eBird (Bird Atlas)
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened	eBird (Bird Atlas), iNaturalist
Skylark	Kaireka	*Alauda arvensis*	Introduced and Naturalised	eBird (Bird Atlas)
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised	eBird (Bird Atlas)
Southern black-backed gull	Karoro	*Larus dominicanus*	Not Threatened	eBird (Bird Atlas)
Southern Diving-Petrel	-	*Pelecanoides urinatrix chathamensis*	At Risk - Relict	iNaturalist
Spotless crake	Pūweto	*Zapornia tabuensis*	At Risk – Declining	Assumed present based on suitable habitat present in the Project Area.

Common Name	Māori Name	Scientific Name	Conservation Status	Record Source
Spotted dove	-	*Streptopelia chinensis tigrina*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
Starling	-	*Sturnus vulgaris*	Introduced and Naturalised	eBird (Bird Atlas), iNaturalist
Sulphur-crested Cockatoo	-	*Cacatua galerita*	Introduced and Naturalised	iNaturalist
Swamp Harrier	Kāhu	*Circus approximans*	Not Threatened	eBird (Bird Atlas), iNaturalist
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened	eBird (Bird Atlas), iNaturalist
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
White-fronted tern	Tara	*Sterna striata*	At Risk - Declining	iNaturalist
Wild turkey	Korukoru	*Meleagris gallopavo*	Introduced and Naturalised	eBird (Bird Atlas)
Yellowhammer	-	*Emberiza citrinella*	Introduced and Naturalised	eBird (Bird Atlas)