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 10

NORTH-WEST HOUSING INFRASTRUCTURE FUND (HIF): PROJECTS IN REDHILLS

TE TUPU NGĀTAHI SUPPORTING GROWTH

AUCKLAND TRANSPORT & WAKA KOTAHI NZ TRANSPORT AGENCY

COMMISSIONERS

Chairperson	**Richard Blakey (Chairperson)**
Commissioners	**Mark Farnsworth**
	Vaughan Smith

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Note: The reports contained within this agenda are for consideration and should not be construed as a decision of Council. Should Commissioners require further information relating to any reports, please contact the Team Leader Hearings.

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ATTACHMENT 21

REDHILLS ARTERIAL TRANSPORT NETWORK
ASSESSMENT OF TRAFFIC NOISE
AND VIBRATION EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Redhills Arterial Transport Network

Assessment of Traffic Noise and Vibration Effects

December 2022 Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY
AT
New Zealand Government

Document Status

Responsibility	Name
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Reviewer	Rachel Foster, Claire Drewery
Approver	Bridget O'Leary

Revision Status

Version	Date	Reason for Issue
1.0	December 2022	Final for lodgement

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Abbreviations

Acronym / Term	Description
AADT	Annual Average Daily Traffic
AEE	Assessment of Effects on the Environment
AC	Auckland Council
AT	Auckland Transport
AUP: OP	Auckland Unitary Plan Operative in Part
BPO	Best Practicable Option
FTN	Frequent Transit Network
FUZ	Future Urban Zone
NoR	Notice of Requirement (under the Resource Management Act 1991)
PPF	Protected Premises and Facilities
RMA	Resource Management Act 1991
SH16	State Highway 16
SH18	State Highway 18
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Programme
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.
Altered Road	As defined in NZS 6806:2010 Section 1.5.2: • Subject to 1.5.4, an altered road means an existing road that is subject to the alterations of the horizontal or vertical alignment where at any assessment position at any one or more PPF meets criteria 1.5.2 (a) or (b).
New Road	As defined in NZS 6806:2010 Section 1.6: • A new road is any road which is to be constructed where no previously formed legal road existed. A new road excludes any existing road and any altered road but includes the formation of previously unformed legal road.

1 Executive Summary

Assessment undertaken

This report provides an assessment of road traffic noise effects for the Redhills Arterial Transport Network.

The report contains a review of the relevant traffic noise criteria and discussion of the appropriate criteria and assessment methodology for the Projects. Predictions of road traffic noise were carried out using the method recommended in NZS 6806 in accordance with rule E25.6.33 of the Auckland Unitary Plan – Operative in Part (AUP:OP).

The assessment of effects undertaken was two-fold: in accordance with NZS 6806 and in relation to the predicted noise level changes comparing the future traffic noise levels with and without the Project.

As required by NZS 6806, the assessment methodology included the prediction of existing and future traffic noise levels, both without (Existing and Do Nothing scenarios) and with the Projects with no acoustic mitigation applied (Do Minimum scenario).

The Existing scenario represents the current road network with current traffic volumes, i.e. the existing environment as it is experienced now. The Do Nothing scenario represents the current road network with future traffic volumes, assuming a full build out of the area. The Do Minimum scenario represents the proposed future road network, incorporating NoRs 1 to 2c and other transport projects in the area. This scenario assumes a full build out of the area, and the transport infrastructure to enable the development. This is a realistic scenario at a point in time when all NoRs are operational.

Noise effects of road traffic on existing noise sensitive locations, referred to as Protected Premises and Facilities (PPFs) within NZS 6806, have been assessed. PPFs within a 100m radius have been assessed as all projects fall under urban areas as defined by Statistics New Zealand. Where project areas are considered Altered Roads, these have been assessed by comparing the predicted noise levels in the design year without the Projects (Do Nothing) with the predicted noise levels in the design year with the Projects (Do Minimum). Project areas considered to be New Roads have been assessed by comparing the predicted Existing noise levels with the Do Minimum predictions.

Each PPF has been assessed against Noise Criteria Categories as set out in NZS 6806, with Category A setting the most stringent external noise criteria and being the preferred category. Where this cannot practicably be achieved, then Category B is the next preferred with higher external noise criteria. Category C, an internal noise criterion, is the least preferred category and should only be applied where external noise levels cannot practicably be reduced any further. Where Category A noise levels can be achieved, no further mitigation is required.

All Altered Roads in the NoR's did not meet the definition of an Altered Road in accordance with NZS 6806 and as set out in Section 3.1. NZS 6806 therefore does not apply, and mitigation is not required for these NoR's. Mitigation was considered where New Roads are planned for NoR 1.

Since the projects will be built in the more distant future, this Best Practice Option (BPO) will be confirmed for all current PPFs, at the time of construction. The review, confirmation and refinement of the BPO will aim to achieve the same noise criteria categories as determined with the current BPO as presented in Appendix 1.

In addition to an assessment against the Noise Criteria Categories of NZS 6806, each Project is also assessed against the change in noise level without and with a new project, and a general subjective response is applied to the predicted change.

Residences or noise sensitive activities that are not yet built or do not have building consent, are not included in the modelling, however noise levels at the currently vacant land are provided in the noise contour maps within the Appendices and are indicative of the potential noise environment for that land.

Traffic from new or upgraded roading projects is not generally expected to create any vibration issues. The smooth and even surface typical of urban roads would likely generate no more than negligible traffic vibration impacts. Therefore, traffic vibration has not been assessed for the Projects.

Assessment assumptions

All predictions are based on traffic flows along New and Altered roads a significant time in the future (in the Design Year 2048). These traffic volumes rely on the urbanisation of the area and implementation of surrounding transport projects.

The traffic noise effects from the Projects assume that all NoRs are operational together, i.e. when the design year of NoR 1 is reached, NoRs 2a to 2c are also operational. No allowance was made for individual NoRs being implemented, or some NoRs not being implemented at all. This is due to two reasons; the transport models did not allow for these options, and the individual or combined assessment of NoRs would lead to a large number of combinations that could not all be assessed. Therefore, the decision was made to assess the furthest point in time, when all surrounding areas were developed to capacity and the associated roading network.

Development of the surrounding areas and urbanisation of the receiving environment over time will likely increase activity and associated ambient noise levels. Therefore, any significant change predicted in this assessment may not hold the same significance at the Design Year, due to the change in environment at the time of construction.

As such, the results are indicative of a possible future scenario, but effects cannot be definitively determined at this stage. Reassessment of the road traffic noise at PPFs covered in this report should be carried out nearer the time of construction to determine if the recommended BPO is still relevant at the time of construction.

Results of assessment and recommended measures

NoR 1

The Project involves a proposed new corridor including a new urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.

The Project consists of a combination of New and Altered Roads.

For the Altered Roads under the Existing scenario, predictions show a road traffic noise level range between 37 – 62 dB $L_{Aeq(24h)}$, with all PPFs in Category A.

For the Altered Roads under the Do Nothing scenario, predictions show a road traffic noise level range between 39 – 64 dB $L_{Aeq(24h)}$, still with all PPFs in Category A.

For the Altered Roads under the Do Minimum scenario, predictions show a traffic noise level range between 41 – 63 dB $L_{Aeq(24h)}$, with all PPFs in Category A. Changes in road traffic noise levels in this scenario compared to the Do Nothing scenario are due to changes in the flow of traffic around the Project area's road network, in addition to decreased acoustic shielding caused by the demolition of some PPFs for construction of the Project.

None of the altered roads within NoR 1 met the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation options were not considered further.

There is only one PPF located within NoR 1 that required assessment against the New Roads criteria, which was 27 Redhills Road. However, road traffic noise levels are predicted to be 47 dB $L_{Aeq(24h)}$ at this PPF in the Do Minimum scenario, meaning that it falls under Category A and does not require further noise mitigation.

A noise level change of 12 dB is predicted between the Existing and Do Minimum scenarios at 27 Redhills Road, which could result in significant noise effects. However, ambient noise levels in the area are expected to increase as the area urbanises, therefore the noise level change may not be as noticeable at the time of construction. Furthermore, a noise barrier was considered at this PPF, however its performance would be compromised as access to the road would need to be maintained through a gap in the barrier.

NoR 2a

NoR 2a involves a new road corridor extending from the Fred Taylor Drive and Dunlop Road intersection to the other proposed new road corridors towards the centre of the Project area, including an upgrade of the Fred Taylor Drive and Dunlop Road intersections.

No PPFs fall within the 100m assessment area around the current design within the NoR 2a designation boundary, therefore NoR 2a has not been considered further in this assessment.

NoR 2b

The Project involves a new corridor including a new urban arterial transport corridor and upgrade of the Fred Taylor Drive and Baker Lane intersection.

Under the Existing scenario, predictions show a range of noise levels from 47 – 58 dB $L_{Aeq(24h)}$.

Under the Do Nothing scenario, predictions show a higher traffic noise level range between 50 – 62 dB $L_{Aeq(24h)}$, still with all PPFs in Category A. This increase in road traffic noise levels is due to the growth in road traffic throughout the Project area which would occur if construction of the project did not take place.

Under the Do Minimum scenario, predictions show a traffic noise level range between 49 – 60 dB $L_{Aeq(24h)}$, with all PPFs in Category A. This overall reduction was due to changes in the flow of traffic around the Project area's surrounding road network.

None of the altered roads within NoR 2b met the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation options were not considered further.

NoR 2c

The Project involves a new corridor including a new urban arterial transport corridor and upgrade of Red Hills Road, Nixon Road and Nelson Road intersection.

Under the Existing scenario, predictions show a range of noise levels from 48 – 60 dB $L_{Aeq(24h)}$.

Under the Do Nothing scenario, predictions show a traffic noise level range between 54 – 66 dB $L_{Aeq(24h)}$, with all except one PPF in Category A.

Under the Do Minimum scenario, predictions show a traffic noise level range between 51 – 61 dB $L_{Aeq(24h)}$, with all PPFs in Category A. Changes in road traffic noise levels in this scenario are due to changes in the flow of traffic around the Project area's road network, with a reduction in vehicle traffic predicted along Red Hills Road.

None of the altered roads within NoR 2c met the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation options were not considered further.

2 Introduction

This traffic noise assessment has been prepared to support Auckland Transport's (**AT**'s) Notices of Requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project**). The NoRs are to designate land for future local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**) to enable the future construction, operation and maintenance of the Project.

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part 2016 (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

This report assesses the traffic noise effects of the Redhills Arterial Transport Network identified in Table 2-1 and Figure 2-1 below.

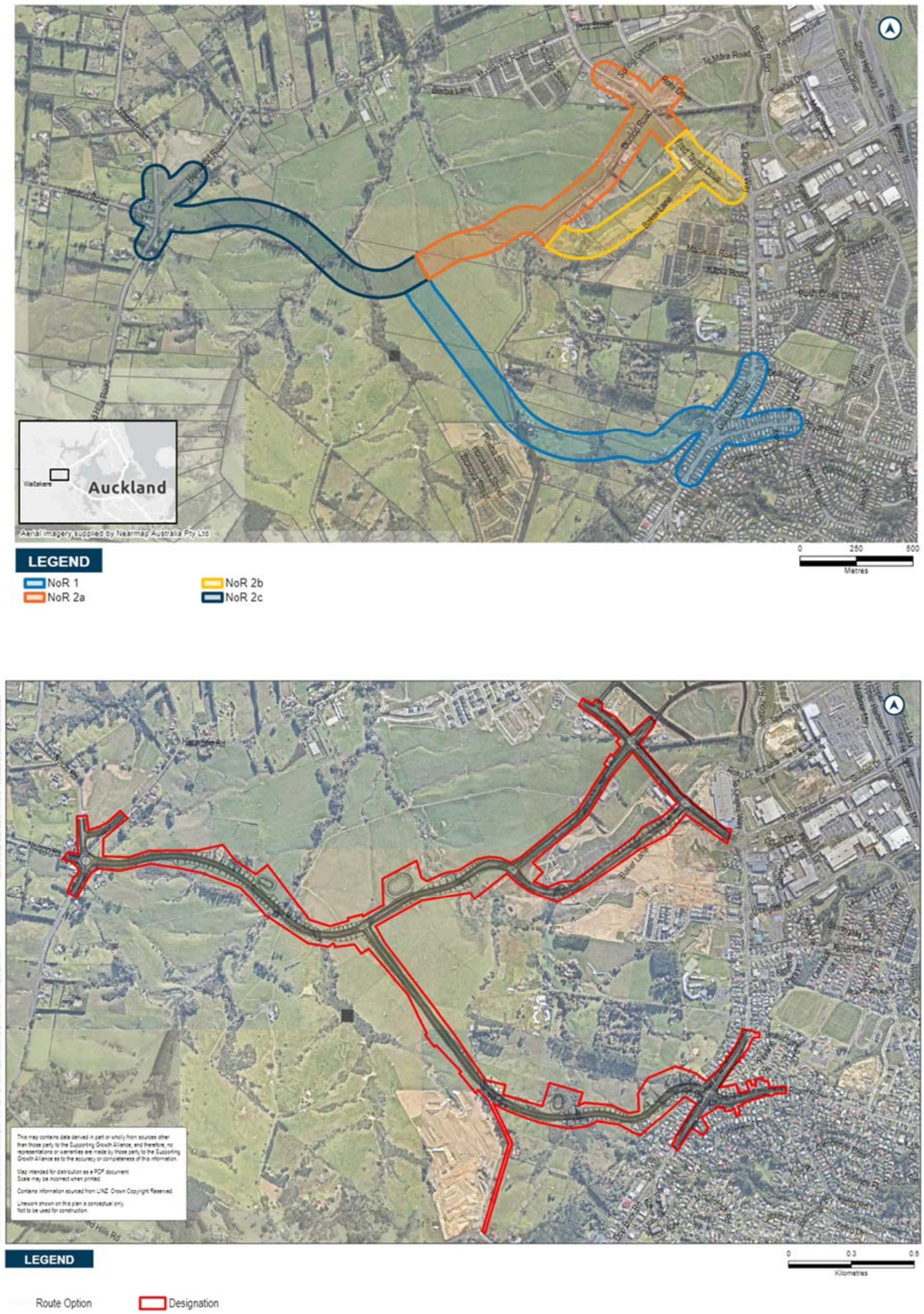


Figure 2-1: Redhills Arterial Transport Network – Overview of NoRs for Assessment

The Project consists of two new arterial corridors through the Project area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs in Table 2-1 below. Refer to the main AEE for a more detailed project description.

Table 2-1: Redhills Arterial Transport Network – Notices of Requirement and Projects

Notice	Project
NoR1	Redhills North-South Arterial Corridor
NoR2a	Redhills East-West Arterial Corridor – Dunlop Road
NoR2b	Redhills East-West Arterial Corridor – Baker Lane
NoR2c	Redhills East-West Arterial Corridor – Remaining connection

To safely tie into the existing road network, the RPP includes the upgrade of existing intersections where the new corridors will connect, as follows:

Signalisation of the intersection at Don Buck Road and Royal Road (NoR1)
Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a)
Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b)
A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Road (NoR 2c).

This report has primarily considered the Project area as a whole, however results for each NoR have been independently presented. Where relevant, NoR1 is referred to as the N-S Project, and NoR2a, NoR2b and NoR2c are collectively referred to as the E-W Project.

2.1 Purpose and Scope of Report

The Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project**). The NoRs under the Resource Management Act (**RMA**) are to designate land to enable the future construction, maintenance and operation of the Project.

This report provides an assessment of traffic noise effects of the Project. This assessment has been prepared to inform the Assessment of Effects on the Environment (**AEE**) for the NoRs. Effects associated with construction noise and vibration are assessed against different standards and criteria and are discussed in a separate report.

The key matters addressed in this report are as follows:

Identify and describe the existing and likely future noise environment
Describe the actual and potential adverse noise effects of road traffic of the Project
Recommend measures as appropriate to avoid, remedy or mitigate potential adverse noise effects
Present an overall conclusion of the level of potential traffic noise effects of the Project after recommended measures are implemented.

2.2 Report Structure

This report is structured to reflect the key matters listed above in Section 2.1

To provide a clear assessment of each project, descriptions and assessments have been separated to reflect each of the notices sought.

3 Assessment Criteria

3.1 Road Traffic Noise

Rule E25.6.33 of the Auckland Unitary Plan (**AUP:OP**) requires that New Roads and Altered Roads which are within the scope of NZS 6806:2010[1] comply with the requirements of that standard. The assessment of all NoRs has used NZS 6806.

NZS 6806 provides criteria and an assessment method for road-traffic noise. The standard is a tool which provides performance targets and requires assessment of different options for noise mitigation (ranging from low-noise road surfaces and barriers to building modification mitigation). These options are subject to an integrated design process in which the costs and benefits are considered. The performance targets in NZS 6806 are set to achieve reasonable noise levels considering adverse health effects associated with noise on people and communities, the effects of relative changes in noise levels, and the potential benefits of New and Altered Roads. NZS 6806 is an appropriate tool to assess road traffic noise from the Projects as it provides a suitable and tested traffic noise assessment and mitigation methodology and includes relevant noise criteria.

NZS 6806 is not applicable to New and Altered Roads predicted to carry less than an Annual Average Daily Traffic (**AADT**) of 2000 at the design year, or where the change in noise level due to a project (i.e. the horizontal or vertical realignment of a road) does not reach certain thresholds of effects (e.g. a change of at least 3 dB for at least one PPF).

To be defined as an Altered Road in accordance with NZS 6806 the following must apply:

The Do Minimum noise environment would be greater than or equal to 64 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 3 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the Do Nothing noise environment; or

The Do Minimum noise environment is greater than or equal to 68 dB $L_{Aeq(24h)}$ and, if no specific noise mitigation was undertaken, the alterations would increase road-traffic noise at the assessment position by 1 dB $L_{Aeq(24h)}$ or more at the design year, when compared with the do-nothing noise environment.

3.1.1 Protected premises and facilities

NZS 6806 requires noise effects to be assessed at noise sensitive locations within set distances of any project. These locations are known as protected premises and facilities (**PPFs**), and include existing houses, schools, marae and various other premises as defined in NZS 6806. Commercial and industrial premises do not fall within the definition of a PPF. Future (unbuilt) noise-sensitive premises are also not PPFs, unless they have already been granted building consent at the time of assessment.

The distances from the road within which properties are considered to be PPFs is set in the standard as:

Urban Areas – 100 metres from the edge of the nearside traffic lane

[1] New Zealand Standard 6806:2010 Acoustics – Road Traffic Noise

Rural Areas – 200 metres from the edge of the nearside traffic lane.

The Project extent falls within an Urban Area as defined by Statistics New Zealand[2] and therefore PPFs within 100 metres of the Project's road alignments have been assessed in this report. Buildings outside of these areas have not been assessed.

The assessment distance of 100 metres ensures the assessment is made at the most relevant receivers. Potential noise effects are still controlled at receivers further away by virtue of noise criteria applying at receivers nearest to the road.

3.1.2 NZS 6806 Noise Criteria

For each of the Projects the noise criteria as summarised in Table 3-1 below are applicable.

Table 3-1: NZS 6806 noise criteria

Category	Criterion	Altered Road	New Roads with a predicted traffic volume of 2000 to 75000 AADT at the design year
A	Primary	64 dB $L_{Aeq(24h)}$	57 dB $L_{Aeq(24h)}$
B	Secondary	67 dB $L_{Aeq(24h)}$	64 dB $L_{Aeq(24h)}$
C	Internal	40 dB $L_{Aeq(24h)}$	40 dB $L_{Aeq(24h)}$

The Project has both "Altered Roads" and "New Roads" as defined by NZS 6806. Altered Roads include Fred Taylor Drive, Don Buck Road and other ancillary roads that already exist and will be upgraded. Two new through roads are proposed to be built connecting Fred Taylor Drive to Redhill Road / Nixon Road Junction (the majority of the E-W Project) and connecting the E-W Project to Don Buck Road (N-S Project), both these new roads have been assessed as a "New Road" under NZS 6806.

Section 6.2 of NZS 6806 is therefore applicable to the Project where it states:

In certain circumstances it may be more appropriate to apply one of the sets of criteria to some assessment positions affected by a project, and another set of criteria to other assessment positions affect by the same project.

Such circumstances may include, but are not limited to:

An intersection between a new or altered road and an existing road
A 'tie-in', 'transition', or merger' where a new or altered road reconnects with an existing road
Where any PPFs are significantly affected by noise from another existing road in the vicinity.

Where PPFs are affected by noise from an existing road, mitigation is only required for road-traffic noise generated on the new or altered road.

[2] New Zealand: An Urban / Rural profile, Statistics New Zealand

For the Project, where the new road intersects with an existing road, all PPFs within 100m of the existing road will be assessed under the “Altered Road” criteria. PPFs located beyond this distance but still within 100m of the new road alignment will be subject to the “New Road” criteria.

3.1.3 Noise Prediction Scenarios

NZS 6806 specifies scenarios to be undertaken which include the following:

The “Existing noise environment”, which is the ambient noise levels at the date of assessment

A “Do Nothing” scenario, which represents the traffic noise levels at the PPFs at the design year assuming no alterations are made to the existing road

A “Do Minimum” scenario, which represents the traffic noise levels at the PPFs at the design year with the Project implemented, but without any specific noise mitigation. Road surfaces, safety barriers and other structures which are required for non-acoustic purposes may provide incidental noise mitigation and are included in this scenario

“Mitigation” scenarios, which represent the traffic noise levels at the PPFs at the design year with various specific noise mitigation options implemented with the aim of achieving the noise criteria categories.

The Do Nothing scenario includes the growth of the surrounding area without the Project but with other projects planned to be implemented by 2048. In practice, this would be an unrealistic scenario as the future growth at full build out at the design year (2048) could not occur without the existing rural transport network being upgraded to urban standards. We also understand that the current road network could not cope with the future traffic volumes, as these volumes would lead to link and intersection delays. Therefore, while the predictions suggest a significant increase in noise level in the Do Nothing scenario compared with the Existing scenario, this would not be a feasible option.

The Do Minimum scenario represents the proposed future road network, incorporating NoRs R1 to R2c and other transport projects in the area (refer to the discussion on Assessment Assumptions below). This scenario assumes a full build out of the area, and the transport infrastructure to enable the development. This is a realistic scenario at a point in time when all NoRs are operational. Considering the wider distribution of future traffic over an increased road network enabled by the NoRs, traffic volumes appear to reduce on individual roads when compared with the (theoretical) Do Nothing scenario.

3.1.4 Design Year

The criteria apply at a design year 10 to 20 years after the completion of a project. In this case the opening year for the Project has not yet been determined but the year 2048 has been selected as the design year for assessment purposes.

The decision to use 2048 as the design year was made in conjunction with the Project team on the basis of the available traffic modelling data and that it represents the most conservative year for assessment purposes that takes into account the traffic increase that will occur over time as the surrounding area develops.

We note that the traffic flows used in the Do Nothing and Do Minimum scenarios were modelled assuming other planned roading projects in the area are implemented. A full list of assumptions is included in Appendix 1.

Traffic volumes will likely change from current predictions with development intended for the Project area, and traffic noise will need to be reassessed nearer the time of detailed design and construction to confirm the recommended mitigation measures for the existing PPFs.

3.1.5 Noise Mitigation

NZS 6806 requires that noise mitigation options are assessed, and if practicable, noise levels within Category A should be achieved. If this is not practicable then mitigation should be assessed against Category B. However, if it is still not practicable to comply with categories A or B then mitigation should be implemented to ensure the internal criterion in Category C is achieved. Depending on the external noise level, building modification mitigation to achieve Category C could include ventilation and / or noise insulation improvements ranging from upgraded glazing through to new wall and ceiling linings. Building modification mitigation of Category C should only be implemented after the lowest practicable external noise level has been achieved. This means that structural mitigation such as road surface or barriers may also be implemented.

In circumstances where noise mitigation is warranted, NZS 6806 adopts a “Best Practicable Option” (BPO) approach. BPO considers the extent to which a mitigation option will achieve compliance with the relevant noise criteria and result in a noticeable noise reduction at assessment locations. The value-for-money of the option and the potential visual, shading and safety effects are also considered, amongst other things.

Where a requirement to consider mitigation measures is identified, NZS 6806 states that structural mitigation (low-noise road surfaces and noise barriers) should only be implemented if it achieves the following:

An average reduction of at least 3 dB $L_{Aeq(24h)}$ at relevant assessment positions of all PPFs which are part of a cluster; or

A minimum reduction of 5 dB $L_{Aeq(24h)}$ at any assessment position(s) for each PPF not in a cluster.

3.1.6 Road Traffic Vibration

Traffic vibration from new or upgraded roading projects is not generally expected to create issues. A key factor with new roads is the uniformity of the basecourse / pavement and the absence of near surface services. This is due to new or upgraded roads being designed to be smooth and even and avoiding vibration generated from passing traffic over uneven surfaces. Therefore, traffic vibration effects arising from operation of the Projects has not been assessed.

4 Existing Ambient Noise Environment

The criteria in NZS 6806 to assess road-traffic noise are not dependent on the existing noise levels. Measurements of existing levels are therefore not required for the assessment against that standard. However, an appreciation of the existing environment is required to assess the potential noise effects, regardless of compliance with any particular noise criteria.

Measurement results have also been used to verify the computer noise model for the existing environment, ensuring that predictions are accurate within the relevant tolerance.

4.1 Noise Monitoring Procedure

Noise survey equipment, meteorological conditions, data analysis and results are described below.

The noise monitoring was undertaken in general accordance with the relevant requirements of NZS 6801[3], 6802[4] and 6806. This meant the results could adequately inform both the operational and construction noise assessments, whilst providing a robust baseline dataset for the Project.

A measurement position at 440 Don Buck Road was selected to represent an existing environment that is unlikely to change significantly up until the design year, and where road traffic is currently the controlling noise source. The measurement position was free-field to avoid reflections from buildings or extraneous factors which could influence the sound levels, where practicable. Measurement and calibration details required by NZS 6801 are held on file.

The unattended noise monitoring results can be found in Appendix 2. Monitoring was undertaken for approximately 7 days.

4.2 Meteorological Conditions

During the surveys, meteorological data was obtained from Auckland, Motat Ews (41351) weather station operated by NIWA. This is the closest station where data was available at an hourly resolution or less.

The meteorological data from this weather station was used to identify periods when conditions were likely to have been outside the meteorological restrictions given in NZS 6801, and therefore data measured during these periods has been excluded from the noise analysis.

4.3 Data Analysis

Road traffic was the dominant noise source, with birdsong clearly audible. There is a natural variation in the noise environment throughout the day, and often variations for the weekends. Each day's data was analysed, and abnormal events excluded. A summary of the measured noise levels is presented in Table 4-1. The $L_{Aeq(24h)}$ was calculated for each day where there was sufficient data after unsatisfactory meteorological conditions and abnormal events were excluded.

[3] New Zealand Standard 6801:2008 Acoustics – Measurement of environmental sound

[4] New Zealand Standard 6802:2008 Acoustics – Environmental noise

The average $L_{Aeq(24h)}$ for the unattended measurement period was 59 dB.

Table 4-1: Summary of measured noise levels

Date	dB $L_{Aeq\ (24h)}$
19/11/19 (Not full 24 hrs)	59
20/11/19	59
21/11/19	60
22/11/19	59
23/11/19	56
24/11/19	56
25/11/19	61
26/11/19	60
27/11/19	60
28/11/19 (Not full 24 hrs)	62

Close to Don Buck Road noise levels are dominated by traffic. The measurements show relatively high existing noise levels which are likely to remain similar in the future as little change is anticipated adjacent to Don Buck Road.

5 Assessment Methodology

Road traffic data provided for the Redhills Arterial Transport Network relies on the development and urbanisation of the local areas, as it forms part of the wider strategic transport network. Some projects will have a direct impact on the traffic flow.

The purpose of this assessment is to determine the future potential impacts to support the future growth within the area. Therefore, it has been assumed all transport infrastructure developments will be constructed by the design year 2048 as indicated in Section 3.1.3. It should be noted an urban speed reduction is expected in some sections of the transport model at the time of growth and at the Do Nothing scenario (design year without Project). This differs from the NZS 6806 standard where the Do Nothing scenario should include no alterations to the roads assessed. Therefore, in accordance with the standard, speed change has been applied at the Do Minimum scenario only. As noted previously, the Do Nothing scenario is a theoretical scenario for these Projects as the existing road network would not be able to accommodate the traffic volume expected from the full future development of the area.

NZS 6806 sets reasonable criteria for road-traffic noise levels, considering health issues associated with noise and other matters. It is considered that road-traffic noise levels in compliance with NZS 6806 Category A would generally result in acceptable noise effects. Achieving the Category B criteria may also give rise to acceptable noise effects when considered with regard to the existing environment.

To determine the potential change in noise level due to the Projects, the Do Minimum (design year with Project) scenario has been compared with the Do Nothing (design year without Project) scenario.

Under NZS 6806, PPFs do not include premises which are not yet built, other than those where building consent has already been obtained but not yet lapsed. No such premises that fall under this Category were known at the time of this assessment.

Although the NZS 6806 assessment does not consider sites unless they contain, or have building consent for, a PPF, the predicted noise levels shown in the noise contour maps in Appendix 4 are considered indicative of the noise environment at adjacent sites without a PPF, including the future urbanisation areas.

5.1 Road Traffic Noise Model

A computer noise modelling software SoundPLAN (V8.2) has been used to predict road traffic noise impacts. The road traffic noise modelling employs the "*Calculation of Road Traffic Noise*" (CoRTN) algorithm, as recommended in NZS 6806. The CoRTN methodology has been adjusted for New Zealand Road Surfaces in accordance with LTNZ Report No. 326[5] and the Waka Kotahi *Guide to state highway road surface noise*[6]. The model settings are described in Table 5-1 below.

[5] https://www.nzta.govt.nz/assets/resources/research/reports/326/docs/326.pdf

[6] https://www.nzta.govt.nz/assets/resources/road-surface-noise/docs/nzta-surfaces-noise-guide-v1.0.pdf

Table 5-1: Road traffic noise modelling parameters

Parameter	Setting / source
Software	Sound Plan 8.2
Algorithm	CoRTN
Reflection	CoRTN
Ground absorption	0.6 for urban areas; 1 for grassed areas
Receiver height	1.5 m above height of each floor
Noise contour grid	1.5 m height, 5 m resolution
Receivers and grid position	Free-field

The CoRTN algorithm gives results in $L_{A10(18h)}$. To convert these results to $L_{Aeq(24h)}$ a minus 3 dB adjustment has been made. This adjustment has been implemented in the software in conjunction with the road surface adjustment detailed below.

The limitations and uncertainties of the prediction methodology, including input data, are discussed below.

5.1.1 Traffic data

All traffic data including AADT, percentage of heavy vehicles and posted speed limit has been sourced from the Project team and based on the SATURN model. The Existing scenario has been based on 2015 data as provided. Traffic volumes have to change significantly to affect noise levels to a meaningful degree. Therefore, using traffic data from 2015, which is the most up to date data, is appropriate to represent the existing circumstances. The change in traffic volume from 2015 to 2022 would amount to a less than 1 decibel change in noise level.

The CoRTN model has been developed based on 18-hour traffic data. However, in accordance with the requirements of NZS 6806, traffic data has been entered as the 24-hour daily traffic (AADT), which results in noise levels in the order of +0.2 dB higher than would have been calculated by CoRTN based on the 18-hour AADT. The CoRTN model assumes that traffic is free-flowing, it does not apply to interrupted vehicle flows, such as at intersection, and for low volume roads under 5,000 AADT.

5.1.2 Topography

Topographic contours for the Existing scenario have been provided from the Project team at a 1m resolution.

Contours for the Do Minimum scenario were obtained from the Project team for the assessment area and joined with the existing contours for the surrounding areas. Road gradients and screening have been determined from the contours.

5.1.3 Buildings

The footprints and heights for all buildings, building usage and all other structures within 200 metres of the roads have been obtained from the Project Team. The number of floors was determined assuming 2.8 m height per floor.

Noise levels were calculated at the centre of each façade, 1.5 m above each floor height with the noise levels stated being the highest of any façade.

Any buildings or structures within the designation boundaries for the Project have been removed from the model and not assessed for the Do Minimum scenario as they will be removed to provide for the Project.

5.1.4 Road alignments

Road alignments for existing roads were provided by the Project team as centrelines and widths for each carriageway section. Gradients have been calculated by SoundPLAN.

5.1.5 Road surfaces

Surfaces of existing roads in the Do Nothing scenario have been modelled as the current surfaces recorded by the Project team, which is Asphaltic Concrete (**AC-14**) in the majority of areas. For the Do Minimum scenario the road surface has also been modelled as AC-14 retaining the existing surface type on the altered roads and applied to the new roads, as advised by the Project team.

The procedure used to incorporate different road surfaces in the model is as follows:

In accordance with Transit Research Report 287, a minus 2 dB adjustment has been made for an asphaltic concrete road surface compared to CoRTN

Surface corrections relative to asphaltic concrete (AC-10) have been made in accordance with LTNZ Research Report 326 and the Waka Kotahi Guide to state highway road surface noise. The combination of surface corrections for cars and heavy vehicles has been made using the equation in the Waka Kotahi Guide to state highway road surface noise

The combined correction, including the adjustment from $L_{A10(18h)}$ to $L_{Aeq(24h)}$, has been entered in the modelling software as a total road surface correction.

5.1.6 Existing noise barriers

Site visits were undertaken to determine if there are existing noise barriers along the Project. There were no noise barriers in the Project area.

Existing boundary fences of private properties have not been included in the noise model as their condition is unknown, they may not provide effective acoustic shielding and there is no certainty that these barriers will be retained by the property owners over time.

This means that for some properties, the predicted traffic noise levels may be slightly higher than would actually be experienced. However, the assessment process will identify properties which may need new noise barriers erected or existing fences upgraded to provide adequate attenuation, as part of the mitigation appraisal.

7 Research Report 28. Traffic noise from uninterrupted traffic flows, Transit, 1994.

5.2 Uncertainties and Limitations

The predicted road traffic noise levels presented in the following sections are based on a road traffic noise model developed in accordance with NZS 6806 and relevant guidance. The accuracy of the model is largely dependent upon the limitations of the available input data as detailed above. Uncertainties in the modelled noise levels can occur for a number of reasons. Uncertainties are typically related to the effects of topographical screening, appropriateness of the traffic data in terms of volumes of light and heavy vehicles, speeds (observed vs posted) and road surface type.

As stated, the terrain model has been developed by the Project GIS team based on 1m vertical terrain resolution, which provides sufficient detail to accurately account for any acoustic shielding from localised topographical features.

The traffic data has been sourced from the Project Transport team and it is accepted that the forecasting of future traffic flows may not necessarily reflect the actual flows when the Design Year is reached. The sensitivity of the noise predictions to changes in traffic data is not as significant as the effects of topographical screening. For example, if all other factors of the traffic data remain unchanged (speed and % of heavy vehicles), then a doubling or halving of the traffic data will only result in a 3 dB change which is only just perceptible by most people. A change in traffic volume data by +25 % or -25% will result in a 1 dB change in predicted noise level, which would be imperceptible.

Nevertheless, an uncertainty remains which of the Projects will be implemented, at which time and in which combination. The assessment assumes that all NoRs are implemented and operational in the design year 2048. In the interim, some NoRs may be implemented earlier than others, which would have an effect on the traffic distribution across the network, and therefore affect the noise generation.

The accuracy of the model can be quoted to a reasonable degree based upon known validations of the CoRTN model and comparisons with the measured existing noise levels. Generally, road traffic noise levels are quoted with an accuracy within 2 dB. NZS 6806 states in Section 5.3.4.2 that “The difference between measured and predicted levels should not exceed ±2 dB.”

Table 5-2 compares the measured data with the predicted noise levels. The predicted traffic noise levels are within the tolerance of NZS 6806 and therefore the existing model is appropriately accurate for the calculation of traffic noise levels for all scenarios.

Table 5-2: Comparison of measured and predicted noise levels

Address	Measured noise level, $L_{Aeq,24hr}$, dB(A)	Predicted noise level, $L_{Aeq,24hr}$, dB(A)	Difference, dB(A)	Notes
440 Don Buck Road	59.2	60.4	+1.2	Within tolerance

5.3 Potential Traffic Noise Mitigation Options

For those PPFs where the NZS 6806 Category A criterion is predicted to be exceeded, the effect of the mitigation options on road-traffic noise levels at each PPF were modelled.

Traffic noise mitigation measures can be broadly categorised into three methods: low noise road surfaces, traffic noise barriers, and building modification. The first two methods involve structural mitigation as described in NZS6806, whilst the third involves building modification mitigation.

5.3.1 Road surfaces

Noise mitigation measures with the largest influence on the generation of road traffic noise is the road surface material.

For this Project, the road surfaces implemented remain unchanged with and without construction of the Project, i.e. asphaltic concrete along Fred Taylor Drive and Don Buck Road, and chip seal along Red Hills Road. The new roads were modelled with asphaltic concrete road surface finish.

5.3.2 Noise barriers

If low-noise road surfaces do not provide the required level of noise mitigation, noise barriers may be considered alongside road surfaces. Generally, barriers will only mitigate noise if they block the line-of-sight between the noise source and receiver. They are most effective and provide the widest area of mitigation when placed immediately adjacent to traffic lanes. In order to provide the most effective noise level reduction, an acoustic barrier must be of solid material (i.e. have no gaps) and have a minimum surface weight of 15 kg/m^2 (e.g. 17mm ply sheeting, 9 mm fibre cement, concrete, earth bunds etc.).

We note that as per Section 3.1.5, NZS 6806 requires noise barriers to achieve:

An average reduction of at least 3 dB $L_{Aeq(24h)}$ at relevant assessment positions of all PPFs which are part of a cluster; or

A minimum reduction of 5 dB $L_{Aeq(24h)}$ at any assessment position(s) for each PPF not in a cluster.

For this Project, noise barriers were not proposed for any of the NoR's.

5.3.3 Building modification

NZS 6806 requires that structural mitigation, such as noise barriers and low-noise road surfaces, should be implemented in preference to building modification mitigation.

Building modification can potentially inconvenience residents and does not provide any protection to outdoor amenity. However, if low-noise road surfaces and noise barriers are not practicable or do not provide the required level of noise reduction, building modification to PPFs may be considered.

Depending on the level of reduction required, building modification measures may range from provision of mechanical ventilation only (to allow doors and windows to be closed), to the upgrade or replacement of windows, wall linings, floors and ceiling linings.

For this Project there are no Category C PPFs and therefore building modification is not considered further.

5.4 Overview of Traffic Noise Effects

Adverse noise effects as a result of high levels of traffic noise may include sleep disturbance, loss of concentration, annoyance, a reduction in speech intelligibility and reduced productivity. The effects are not restricted to PPFs but would also affect future residential and other noise-sensitive developments as well which are not included in the NZS 6806 definition of PPF. Where new noise sensitive developments are established in the vicinity of a road, their design should take account of the potential noise effects and care should be taken to avoid or minimise them.

The magnitude of effects will largely depend on noise levels received in noise-sensitive spaces within buildings, although there are also potential annoyance effects associated with a loss of amenity when high noise levels are received in outdoor living or recreation spaces.

The subjective perception can generally be correlated with the numerical change in noise level. A 3 dB change in noise level is just perceptible to the majority of people. A 10 dB increase in noise level is subjectively considered to be a doubling of loudness resulting in a significant impact.

Table 5-3: Noise level change compared with general subjective perception

Noise level change	General subjective perception
1 – 2 decibels	Insignificant change
3 – 4 decibels	Perceptible change
5 – 8 decibels	Noticeable change
9 – 11 decibels	Halving / doubling of loudness
> 11 decibels	More than halving / doubling of loudness

6 Redhills Arterial Transport Network Overview

An overview of the Redhills Arterial Transport Network is shown in Figure 6-1, with a brief summary of each of the Projects provided in Table 6-1.

It should be noted that NoR 2a contains no PPFs under the current design at the time of writing of this assessment, and therefore has not been considered further in this assessment. It is recommended that NoR 2a is re-assessed closer to the time of construction in the event that any PPFs are subsequently established within the assessment area for this NoR.

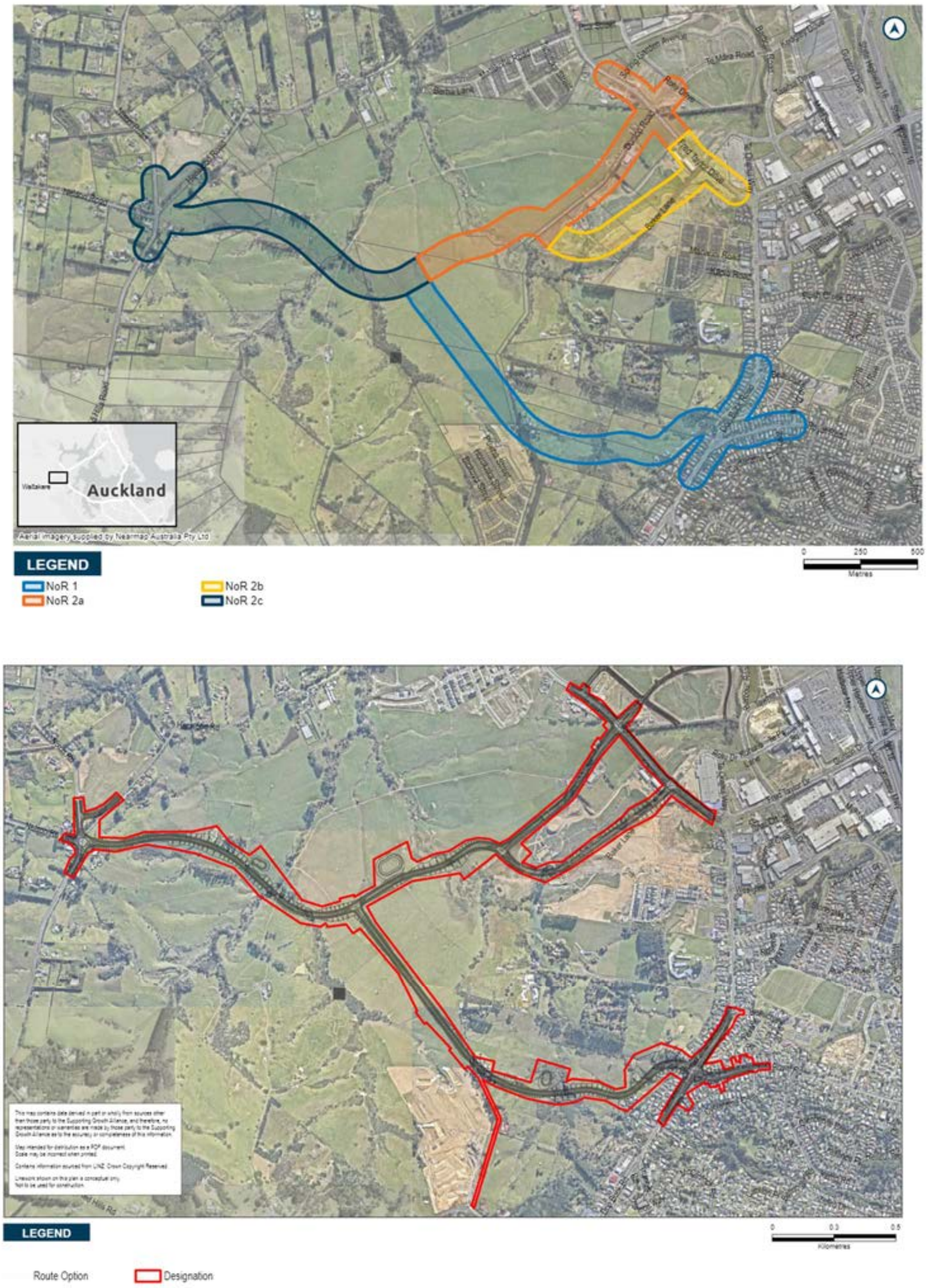


Figure 6-1: Redhills Arterial Transport Network – Overview of NoRs for Assessment

Table 6-1: Summary of NoR's

Corridor	NOR	Description	Requiring Authority
Redhills North-South Arterial Corridor	**NoR1**	New urban arterial transport corridor and upgrade of the Don Buck and Royal Road intersection.	Auckland Transport
Redhills East-West Arterial Corridor – Dunlop Road	**NoR2a**	New urban arterial transport corridor which intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR2c) at the intersection with the Redhills North-South arterial corridor.	Auckland Transport
Redhills East-West Arterial Corridor – Baker Lane	**NoR2b**	New urban arterial transport corridor which intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West corridor and Dunlop Road (NoR2a).	Auckland Transport
Redhills East-West Arterial Corridor – Remaining connection	**NoR2c**	New urban arterial transport corridor that intersects with the Redhills East-West Arterial Corridor – Dunlop Road intersection. This includes the upgrade of the existing Red Hills Road / Nelson Road / Nixon Road intersection, and the existing Nixon Road / Henwood Road intersection.	Auckland Transport

7 NoR 1: Redhills North-South Arterial Corridor

7.1 Project Corridor Features

The Project extends between intersections with Don Buck Road and Royal Road in the south east, to Red Hills Road, Nixon Road and Nelson Road in the north west. An overview of the proposed design has been provided in Section 6.

Key features of the proposed new corridor include a new urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.

7.2 Existing and Likely Future Environment

7.2.1 Planning context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 7-1 below provides a summary of the existing and likely future environment as it relates to the North-South Arterial Corridor within the RATN.

Table 7-1: North-South Arterial Corridor Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Rural	Residential – Mixed Housing Suburban	High	Urban
	Residential – Mixed Housing Urban		
	Residential – Terrace Housing and Apartment Building Zone		
	Business – Local Centre Zone		
Residential	Business – Local Centre Zone	Moderate	Urban
	Residential – Mixed Housing Urban	Low	
	Residential – Terrace Housing and Apartment Building Zone		

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

Land use today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Business	Business – Local Centre Zone	Low	Urban
Special Purpose	Special Purpose – School Zone	Low	Special Purpose

Please refer to the AEE for further information on the planning context.

7.2.2 Noise Environment

The Redhills Arterial Transport Network is currently located within an urban area (as defined by Statistics New Zealand) with few PPFs in close proximity to the proposed roads. The noise environment for most PPFs within the Project area is dominated by road traffic noise from vehicles on Don Buck Road, Royal Road, Fred Taylor Drive and the surrounding road network.

7.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, Do Minimum and Mitigation Option scenarios are shown in Appendix 3. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix 4. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

The traffic noise assessment for this NoR has been separated into the typology of Altered Road and New Road. Each PPF has been assessed against the relevant noise criteria of either a New or Altered Road, depending on the classification as described in Section 3.1.2.

Based on information provided by the Project team, the following residential buildings will be removed to make room for the Project alignment and have not been considered in the assessment:

2 Royal Road
4 Royal Road
6 Royal Road
23 Red Hills Road
1 Dunlop Road
1 Royal Road
25 Red Hills Road
443 Don Buck Road
445 Don Buck Road
456 Don Buck Road
458A Don Buck Road
460 Don Buck Road

7.3.1 Altered Roads

7.3.1.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the North-South Arterial Corridor upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 7-2.

Table 7-2: NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	169	169	169
Cat B	67 dB $L_{Aeq(24h)}$	0	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		**169**	**169**	**169**

Existing scenario predictions show the noise level within the Project area is between 37 – 62 dB $L_{Aeq(24h)}$ with all PPFs in Category A.

Under the Do Nothing scenario, predictions show a road traffic noise level range between 39 – 64 dB $L_{Aeq(24h)}$, with all PPFs in Category A.

Under the Do Minimum scenario, predictions show a traffic noise level range between 41 – 63 dB $L_{Aeq(24h)}$, with all PPFs in Category A.

7.3.1.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 7-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios.

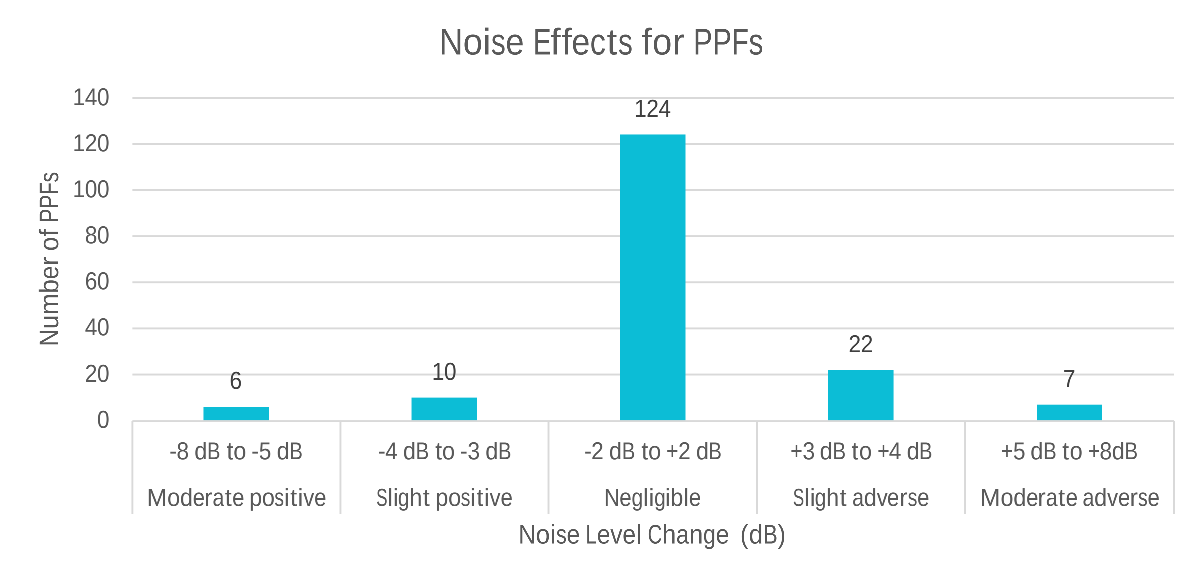


Figure 7-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads

Noise levels are predicted to change by a negligible margin (±2 dB between the Do Nothing and Do Minimum scenario) at 124 out of 169 PPFs after implementation of the Project.

Predictions indicate that 22 PPFs will experience an increase in noise level of 3-4 dB, resulting in slight adverse effects. Seven PPFs will experience an increase in noise level of 5-8 dB, resulting in moderate adverse noise effects.

Increases in noise levels at these PPFs are due to the demolition of some houses which would otherwise provide acoustic shielding to PPFs behind.

Predictions indicate that 10 PPFs will experience a decrease in noise levels of 3-4 dB, resulting in slight positive effects, and that 6 PPFs will experience a decrease in noise levels of 5-8 dB, resulting in moderate positive effects.

Positive noise changes (both slight and moderate) are due to the overall reduction in noise levels on several sub-arterial roads such as Red Hills Road. The construction of the Project is predicted to redistribute traffic volumes across the surrounding proposed road network.

Ambient noise levels will likely increase as the area urbanises and therefore the change in noise level due to the Project may not be as noticeable at the time.

Some PPFs may not exist anymore at the time of road construction particularly given the proposed zone change in the area allowing for urban development. Therefore, the predicted effects may not be experienced by current residents.

7.3.2 New Roads

7.3.2.1 Road Traffic Model Results Analysis

In accordance with NZS 6806 there is no Do Nothing scenario for the new road, so the Existing and Do Minimum scenarios are compared. A summary of the results of the NZS 6806 assessment is shown in Table 7-3.

Table 7-3: NZS 6806 Assessment and Summary – New Roads

Category		Number of PPFs	
	Criteria	Existing	Do Minimum
Cat A	57 dB $L_{Aeq(24h)}$	1	1
Cat B	64 dB $L_{Aeq(24h)}$	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0
Total		**1**	**1**

There is only one PPF located within NoR 1 that is to be assessed against new road criteria (27 Redhills Road). A noise level of 47 dB $L_{Aeq(24h)}$ is predicted at this PPF in the Do Minimum scenario. As a result, this PPF will fall in Category A for the Do Minimum Scenario, therefore mitigation measures were not investigated for this PPF.

7.3.2.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level has been considered in addition to the NZS 6806 assessment. The Existing scenario and Do Minimum scenario noise levels can be compared at 27 Red Hills Road to determine the predicted noise level increase or decrease at the assessed PPF as a result of the Project.

A noise level increase of 12 dB is predicted between the Existing and Do Minimum scenarios at 27 Red Hills Road, resulting in significant adverse effects. This increase is due to the introduction of the new noise source near the PPF.

However, ambient noise levels in the area will likely increase as the area urbanises and therefore the change in noise level due to the Project will likely not be as noticeable at the time.

Also, implementation of a noise barrier was considered at this PPF, however its performance would be compromised since a gap would be required to maintain access from the road, which would compromise the barrier's performance since line of sight would still be maintained to the PPF from the road through the gap.

7.4 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Redhills North-South Arterial Corridor. The altered roads in this NoR did not meet the definition of an Altered Road according to NZS 6806, so mitigation measures were not investigated for these sections.

A comparison of the predicted road traffic noise levels for Altered roads in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicates that noise level changes will be negligible for the majority of PPFs if the Project is constructed.

A comparison of the predicted road traffic noise levels for New roads in the Existing scenario and the Do Minimum scenario indicates that a noise level increase of 12 dB is predicted for the one PPF located within this NoR, potentially resulting in significant adverse effects. However, ambient noise levels in the area will likely increase as the area urbanises and therefore the change in noise level due to the Project will likely not be as noticeable at the time. Also, a noise barrier was investigated but not considered practical due to the gap that would be required to maintain access to the property compromising the performance of the barrier.

8 NoR 2b: Redhills East-West Arterial Corridor – Baker Lane

8.1 Project Corridor Features

The Project extends between intersections with Fred Taylor Drive in the north east and connects to the proposed East-West Corridor in the central section of the Project Area. An overview of the proposed design has been provided in Section 6.

Key features of the proposed new corridor include a new urban arterial transport corridor and upgrade of the Fred Taylor Drive and Baker Lane intersection.

8.2 Existing and Likely Future Environment

8.2.1 Planning context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the Baker Lane Corridor within the RATN.

Table 8-1: Baker Lane Corridor Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[10]	Likely Future Environment[11]
Rural	Residential – Mixed Housing Urban	High	Urban
	Residential – Terraced Housing and Apartment Zone		
Business	Business – Mixed Use Zone	Low	Business
	Business – Light Industry		
Residential	Residential – Mixed Housing Urban	Low	Urban
	Residential – Terraced Housing and Apartment Zone		
Special Purpose	Special Purpose – School Zone	Low	Special Purpose

[10] Based on AUP:OP zoning / policy direction
[11] Based on AUP:OP zoning / policy direction

Please refer to the AEE for further information on the planning context.

8.2.2 Noise Environment

The Redhills East-West Arterial Corridor – Baker Lane is currently located within an urban area with no PPFs in close proximity to the proposed roads. The noise environment for PPFs within the Project area is dominated by road traffic noise from vehicles on Fred Taylor Drive and the surrounding road network.

8.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, Do Minimum and Mitigation Option scenarios are shown in Appendix 3. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix 4. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Each PPF has been assessed against the Altered Roads criteria in accordance with NZS 6806. Based on information provided by the Project team, the following residential building will be removed to make room for the Project alignment and have not been considered in the assessment:

68 Fred Taylor Drive

8.3.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the East-West Arterial Corridor – Baker Lane upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 8-2.

Table 8-2 NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	10	10	10
Cat B	67 dB $L_{Aeq(24h)}$	0	0	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		**10**	**10**	**10**

Existing scenario predictions show noise levels within the Project area are between 47 – 58 dB $L_{Aeq(24h)}$ with all PPFs in Category A.

Under the Do Nothing scenario, predictions show a noise level range between 50 – 62 dB $L_{Aeq(24h)}$, still with all PPFs in Category A.

Under the Do Minimum scenario, predictions show a traffic noise level range between 49 – 60 dB $L_{Aeq(24h)}$, with all PPFs in Category A.

8.3.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 8-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios.

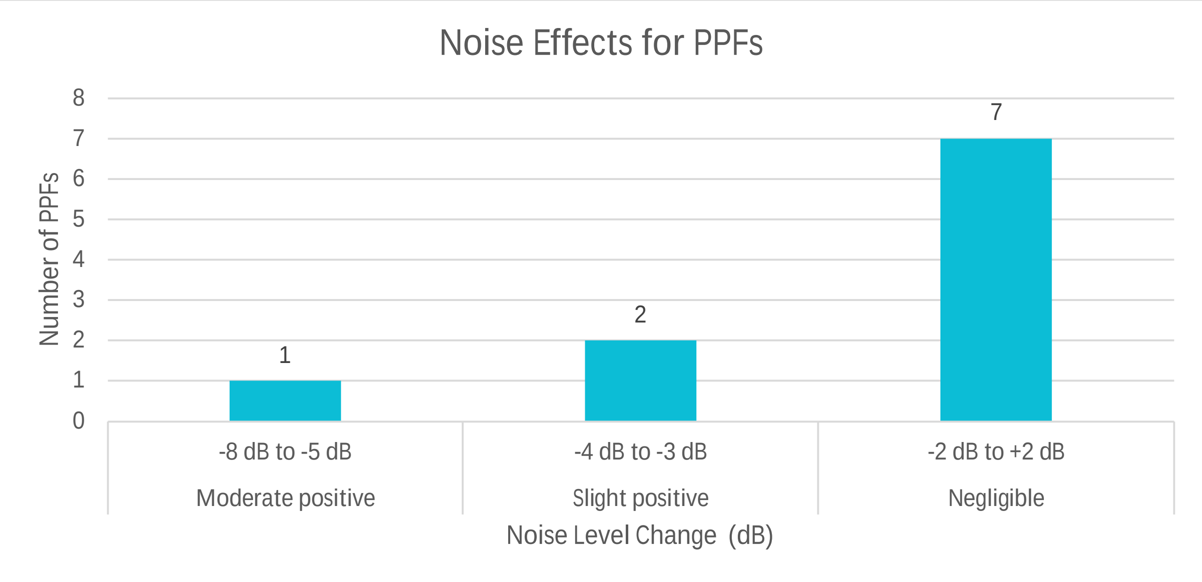


Figure 8-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads

Noise levels are predicted to change by a negligible margin at 7 out of 10 PPFs after implementation of the Project.

Predictions indicate that 2 PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects. 1 PPF will experience a decrease in noise level of 5-8 dB, resulting in moderate positive noise effects.

Positive noise changes (both slight and moderate) are due to the overall reduction in noise levels from Don Buck Road and Fred Taylor Drive, coming from the redistribution of traffic volumes across the surrounding proposed road network as a result of the Project.

8.4 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Redhills East-West Arterial Corridor – Baker Lane. The road did not meet the definition of an Altered Road in accordance with NZS 6806, therefore noise mitigation measures were not investigated further.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicates that most PPFs will experience a negligible change in noise levels, with three PPFs experiencing slight or moderate positive noise effects.

9 NoR 2c: Redhills East-West Arterial Corridor – Remaining Connection

9.1 Project Corridor Features

The Project extends between intersections with the proposed East-West Arterial Corridor – Dunlop Road in the central section of the Project Area, to the Red Hills Road, Nixon Road and Nelson Road intersection in the north west.

Key features of the proposed new corridor include a new urban arterial transport corridor and upgrade of Red Hills Road, Nixon Road and Nelson Road Intersection.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the Nixon Road Connection within the RATN.

Table 9-1: Nixon Road Connection Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[12]	Likely Future Environment[13]
Rural	Residential – Single House	High	Urban
	Residential – Mixed Housing Suburban		
	Residential – Mixed Housing Urban		
	Residential – Terraced Housing and Apartment Zone		

Please refer to the AEE for further information on the planning context.

9.2.2 Noise Environment

The noise environment for PPFs within the Project area is dominated by road traffic noise from vehicles on Red Hills Road, Nixon Road and Nelson Road.

12 Based on AUP:OP zoning / policy direction
13 Based on AUP:OP zoning / policy direction

9.3 Assessment of Road Traffic Noise Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Predicted road-traffic noise levels at all existing PPFs for the Existing, Do Nothing, Do Minimum and Mitigation Option scenarios are shown in Appendix 3. The cells are colour coded according to the NZS 6806 category: category A – green, category B – orange, and category C – red.

Noise contour maps showing indicative levels across a 100m radius from the alignment are provided in Appendix 4. Specific noise level values should not be taken directly from the contours as they are interpolated from a grid resulting in some localised inaccuracies.

Each PPF has been assessed against the Altered Road criteria in accordance with NZS 6806.

9.3.1 Road Traffic Model Results Analysis

An initial screening assessment has been carried out and the East-West Arterial Corridor – Remaining Connection upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. The Standard therefore does not apply, and mitigation options do not need to be considered. A summary of the results of the screening assessment are presented in Table 9-2.

Table 9-2: NZS 6806 Assessment and Summary – Altered Roads

Category		Number of PPFs		
	Criteria	Existing	Do Nothing	Do Minimum
Cat A	64 dB $L_{Aeq(24h)}$	7	6	7
Cat B	67 dB $L_{Aeq(24h)}$	0	1	0
Cat C	40 dB Internal $L_{Aeq(24h)}$	0	0	0
Total		**7**	**7**	**7**

Existing scenario predictions show the noise level within the Project area is between 48 – 60 dB $L_{Aeq(24h)}$ with all PPFs in Category A.

Under the Do Nothing scenario, predictions show a traffic noise level range between 54 – 66 dB $L_{Aeq(24h)}$, with all except one PPF in Category A. The increase in road traffic noise levels compared to the Existing scenario is due to the growth in road traffic throughout the Project area without the construction of the project.

Under the Do Minimum scenario, predictions show a traffic noise level range between 51 – 61 dB $L_{Aeq(24h)}$, with all PPFs in Category A. Changes in road traffic noise levels in this scenario are due to the redistribution of traffic around the Project area's road network, with a reduction in traffic volumes predicted along Red Hills Road.

9.3.2 Assessment of Road Traffic Noise Effects

The effects associated with a change in noise level have been considered in addition to the NZS 6806 assessment. The Do Nothing scenario and Do Minimum scenario can be compared to determine the predicted noise level increase or decrease at PPFs as a result of the Project. Figure 9-1 shows the predicted change in noise level at PPFs when comparing the Do Nothing and Do Minimum scenarios.

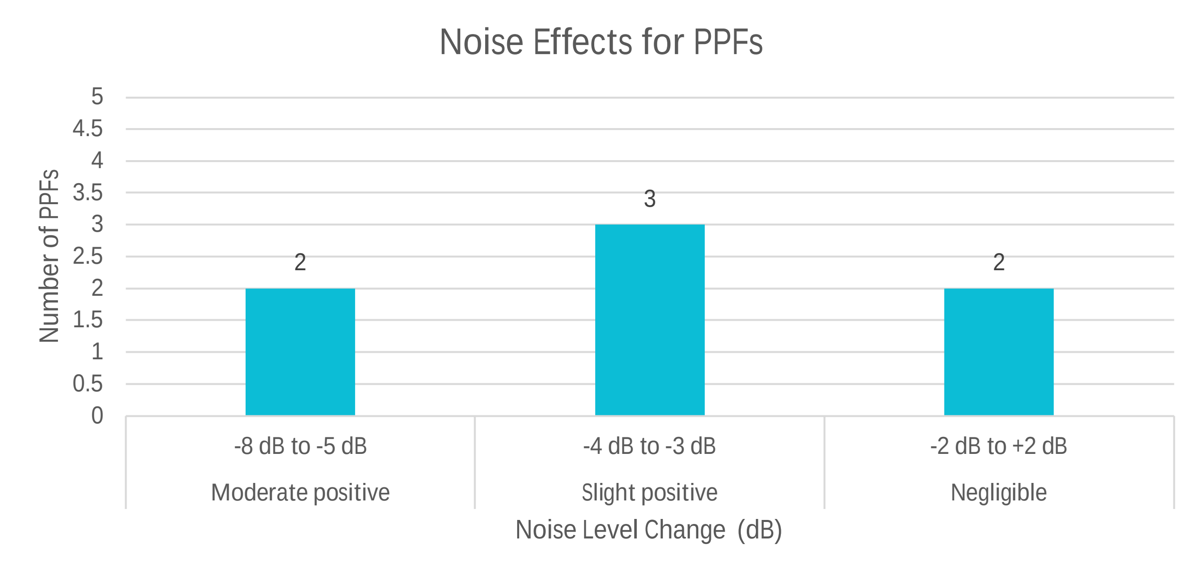


Figure 9-1: Change in Noise Level – Do Nothing Vs Do Minimum – Altered Roads

Noise levels are predicted to change by a negligible margin at 2 out of 7 PPFs after implementation of the Project.

Predictions indicate that 3 PPFs will experience a decrease in noise level of 3-4 dB, resulting in slight positive effects. 2 PPFs will experience a decrease in noise level of 5-8 dB, resulting in moderate positive noise effects.

Positive noise changes (both slight and moderate) are due to the overall reduction in noise levels on several sub-arterial roads such as Red Hills Road. The construction of the Project is predicted to redistribute traffic volumes across the surrounding proposed road network.

9.4 Conclusions

Road traffic noise levels have been assessed in accordance with NZS 6806 for the Redhills East-West Arterial Corridor – Remaining Connection. The altered roads do not meet the definition of an Altered Road in accordance with NZS 6806, therefore mitigation measures were not investigated further.

A comparison of the predicted road traffic noise levels in the Do Nothing scenario (representative of the design year without the Project) and the Do Minimum scenario (representative of the design year with the Project) indicated that noise level changes will result in either slight or moderate positive noise effects at five PPFs, while two PPFs are expected to experience negligible noise level changes.

10 Conclusion

An assessment of traffic noise has been carried out for the Redhills Arterial Transport Network for New and Altered Roads based on NZS 6806 and the predicted change in noise level. To determine the change in noise level a comparison has been made between the predicted road traffic noise levels in the Existing (for New Roads) or Do Nothing (for Altered Roads) scenario (representative of the design year without the Project, assuming traffic from full area development on the existing road network) and Do Minimum scenario (with the Project implemented).

All existing PPFs within 100m of each alignment have been considered within the assessment. Buildings that are within the NoR designation boundaries have been removed from the Do Minimum scenario as they will not remain following the Project implementation.

For Altered Roads in NoR 1, the North-South Arterial Corridor upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. All PPFs will meet the Category A criterion for the Do Minimum scenario. The Standard therefore does not apply, and mitigation options do not need to be considered. Predictions indicate that 29 PPFs will experience either slight adverse or moderate adverse noise effects due to the Project when comparing the Do Nothing and Do Minimum scenarios, with 124 PPFs experiencing a negligible change in noise levels. Sixteen PPFs will experience either slight or moderate positive noise effects. PPFs which experience an adverse change in noise levels (both slight and moderate) are due to the effects of the demolition of dwellings providing shielding from noise to PPFs behind them.

For New Roads in NoR 1, the single PPF at 27 Red Hills Road will be in Category A. Ambient noise levels will likely increase as the area urbanises and therefore any change in noise level due to the Project may not be as noticeable at the time.

NoR 2a does not contain any PPFs that will remain after the construction of the Project and was therefore excluded from assessment. As a result, no further consideration for NoR 2a was given, however this should be re-assessed closer to the time of construction.

For NoR 2b, the East-West Arterial Corridor – Baker Lane upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. All PPFs will meet the Category A criterion for the Do Minimum scenario. The Standard therefore does not apply, and mitigation options do not need to be considered. Noise levels are predicted to decrease at three PPFs, which will experience either slight positive or moderate positive noise effects due to the Project when comparing the Do Nothing and Do Minimum scenarios, with seven PPFs experiencing a negligible change in noise levels.

This decrease in noise level is due to the redistribution of traffic around the Project area's existing road network, reducing road traffic along Fred Taylor Drive and Don Buck Road.

For NoR 2c, the East-West Arterial Corridor – Remaining Connection upgrade does not meet the definition of Altered Road in accordance with NZS 6806 and as set out in Section 3.1. All PPFs will meet the Category A criterion for the Do Minimum scenario. The Standard therefore does not apply, and mitigation options do not need to be considered. Predictions indicate that five PPFs will experience either slight positive or moderate positive noise effects due to the Project when comparing the Do Nothing and Do Minimum scenarios, with two PPFs experiencing a negligible change in noise levels.

All predictions are based on traffic flow along New and Altered Roads at the design year (2048). These traffic volumes are predicated on the anticipated urbanisation of the area and implementation of surrounding infrastructure projects. Development of the surrounding areas will likely increase activity and associated noise levels. Therefore, any changes predicted for the traffic noise effects related to these Projects are not likely to represent such a significant change at the time of construction due to the change in environment.

As such, the results are indicative of a possible future scenario, but effects cannot be definitively determined at this stage. Reassessment of the road traffic noise at current PPFs will be carried out nearer the time of construction to confirm that the recommended mitigation still represents the best practicable option. The review, confirmation and refinement of the BPO shall aim to achieve the same noise criteria categories as determined in this document.

Nevertheless, the predictions show that all PPFs across all Projects will receive levels within the Category A criteria in the Do Minimum scenario (with the implementation of the Project), which is the most stringent Category in NZS 6806 and represents the lowest design noise levels. Therefore, resulting noise levels will be reasonable in a residential context at the majority of PPFs assessed and no further noise mitigation is deemed necessary at this stage.

Traffic vibration from new or upgraded roading projects is not generally expected to create any vibration issues. Therefore, traffic vibration has not been assessed for the Projects.

Appendix 1: Assumptions

Package	Project(s)	Existing	Do Nothing	Do Minimum
Whenuapai Arterials	Trig Road upgrade (NoR W1)	x	x	√
	Māmari Road upgrade (NoR W2)	x	x	√
	Brigham Creek Road upgrade (NoR W3)	x	x	√
	Spedding Road upgrade (NoR W4)	x	x	√
	Hobsonville Road upgrade (NoR W5)	x	x	√
Redhills Arterials	Fred Taylor Drive FTN upgrade	x	√	√
	Northside Drive East extension	x	√	√
	Don Buck Road FTN upgrade	x	√	√
	Royal Road FTN upgrade	x	√	√
Riverhead Arterials	Coatesville – Riverhead Highway upgrade	x	√	√
	Riverhead Road upgrade	x	√	√
Strategic Projects	Rapid Transit Corridor (RTC)	x	√	√
	Alternative State Highway (ASH)	x	√	√
	Brigham Creek Interchange	x	√	√
	Regional Active Mode Corridor (RAMC)	x	√	√
	SH16 Main Road upgrade	x	√	√
	Access Road upgrade	x	√	√
	Station Road upgrade	x	√	√
Growth	Land Use Assumptions	up to 2015	up to 2048+	up to 2048+

Key		
	√	Included
	x	Excluded
	*	Minimal Network Change

Appendix 2: Noise Monitoring Results

Noise Logger Report
440 Don Buck Road, Whenuapai

Item	Information
Logger Type	Svan
Serial number	20614
Address	440 Don Buck Road, Whenuapai
Location	440 Don Buck Road, Whenuapai
Facade / Free Field	Free field
Environment	road

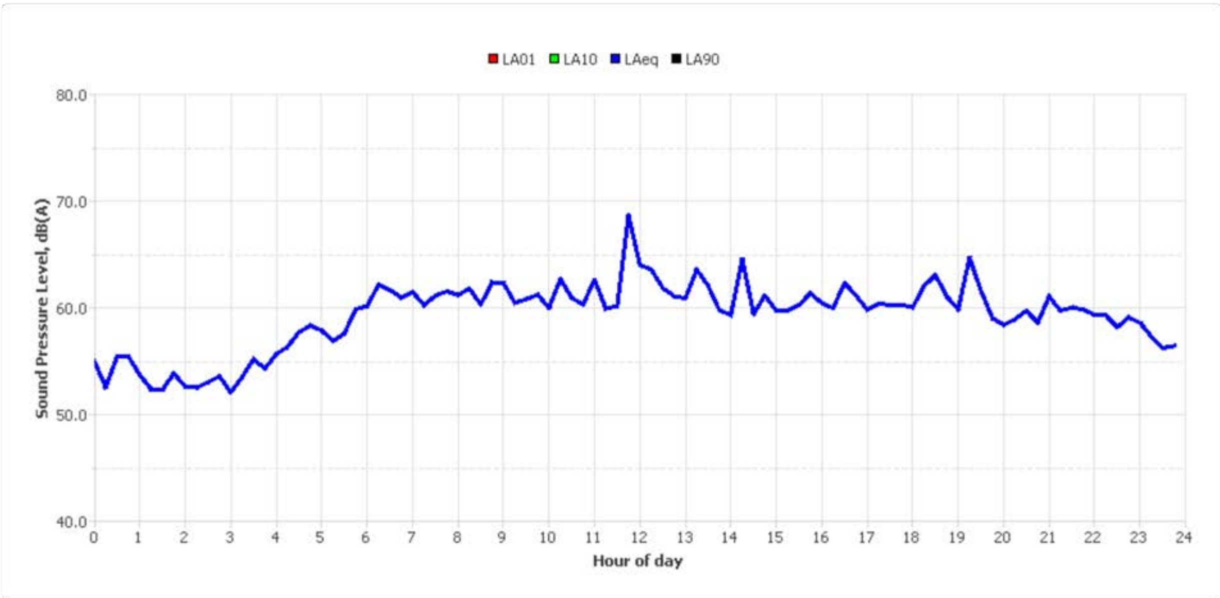
Measured noise levels

Logging Date	L_{Aeq} Day	Eve	Night	ABL Day	Eve	Night	$L_{Aeq,15hr}$	$L_{Aeq,9hr}$
Tue Nov 19 2019	-	60	56	-	-	-	60	56
Wed Nov 20 2019	62	61	57	-	-	-	62	57
Thu Nov 21 2019	63	61	57	-	-	-	63	57
Fri Nov 22 2019	63	63	57	-	-	-	63	57
Sat Nov 23 2019	62	59	54	-	-	-	61	54
Sun Nov 24 2019	59	58	53	-	-	-	59	53
Mon Nov 25 2019	64	63	58	-	-	-	64	58
Tue Nov 26 2019	62	60	57	-	-	-	62	57
Wed Nov 27 2019	61	62	58	-	-	-	61	58
Thu Nov 28 2019	64	-	57	-	-	-	64	57
Summary	**62**	**61**	**57**	**-**	**-**	**-**	**62**	**57**

Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

Typical Day



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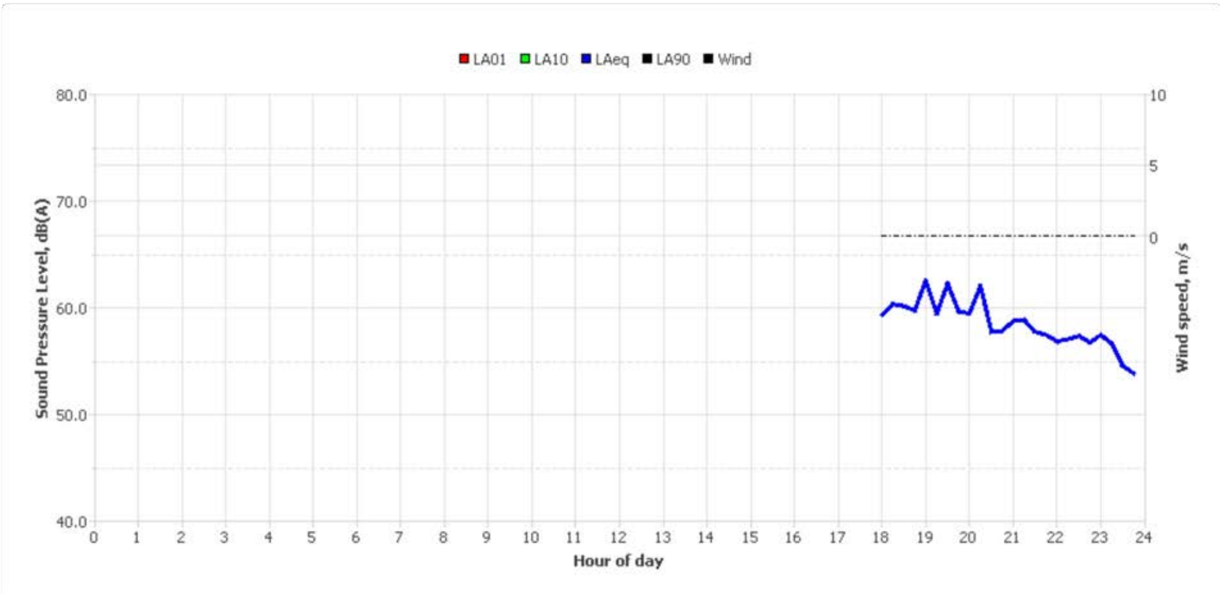

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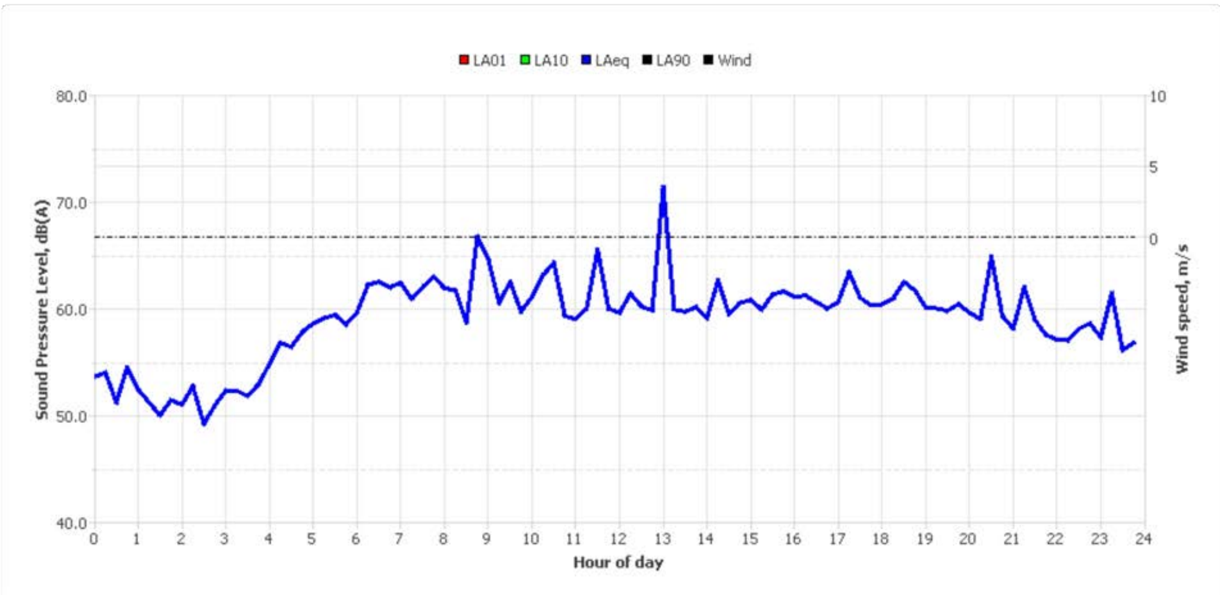

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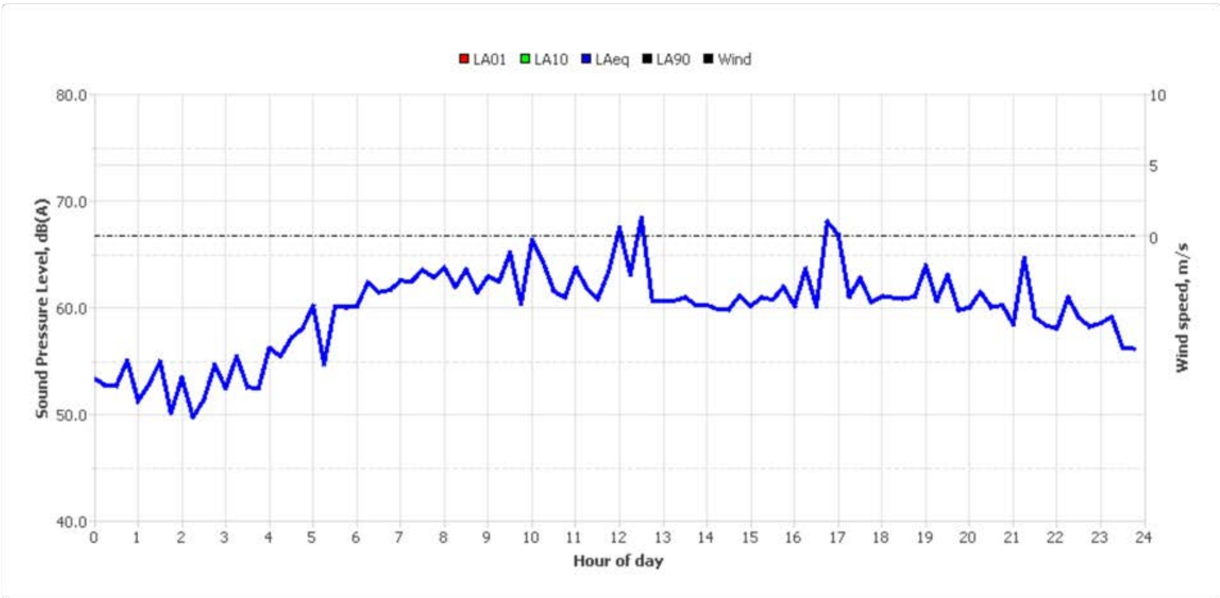

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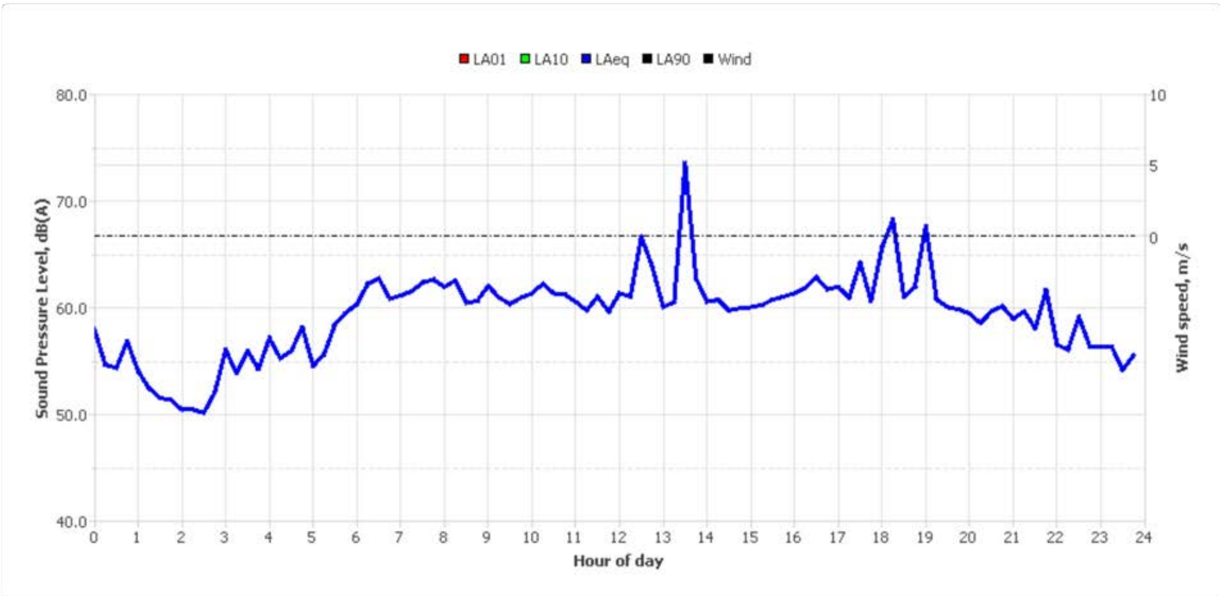

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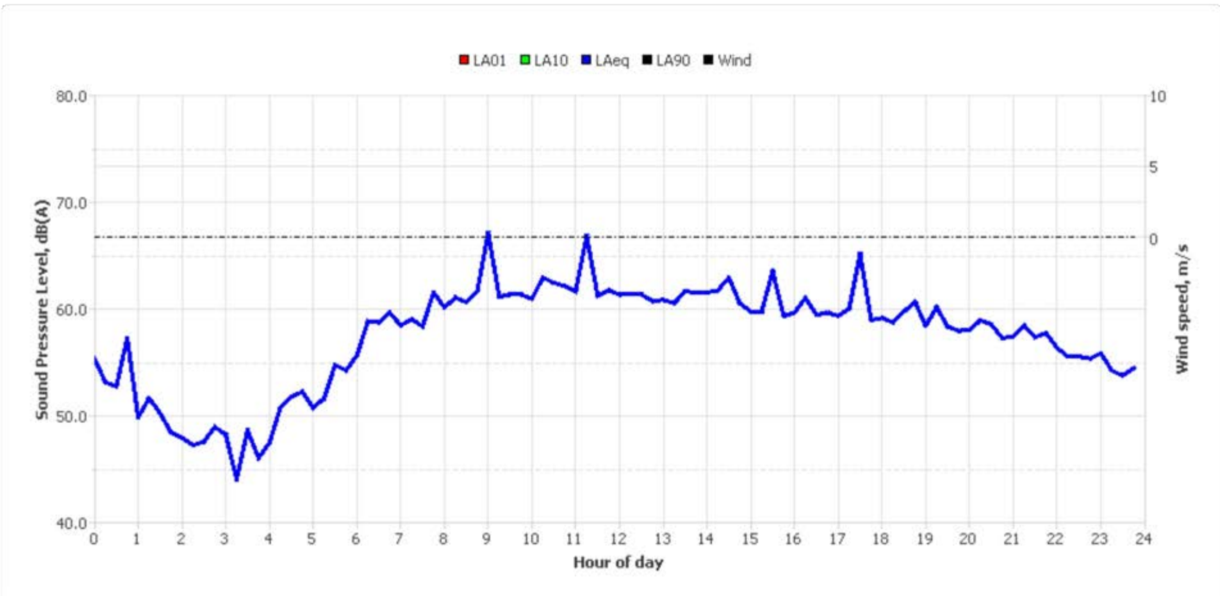

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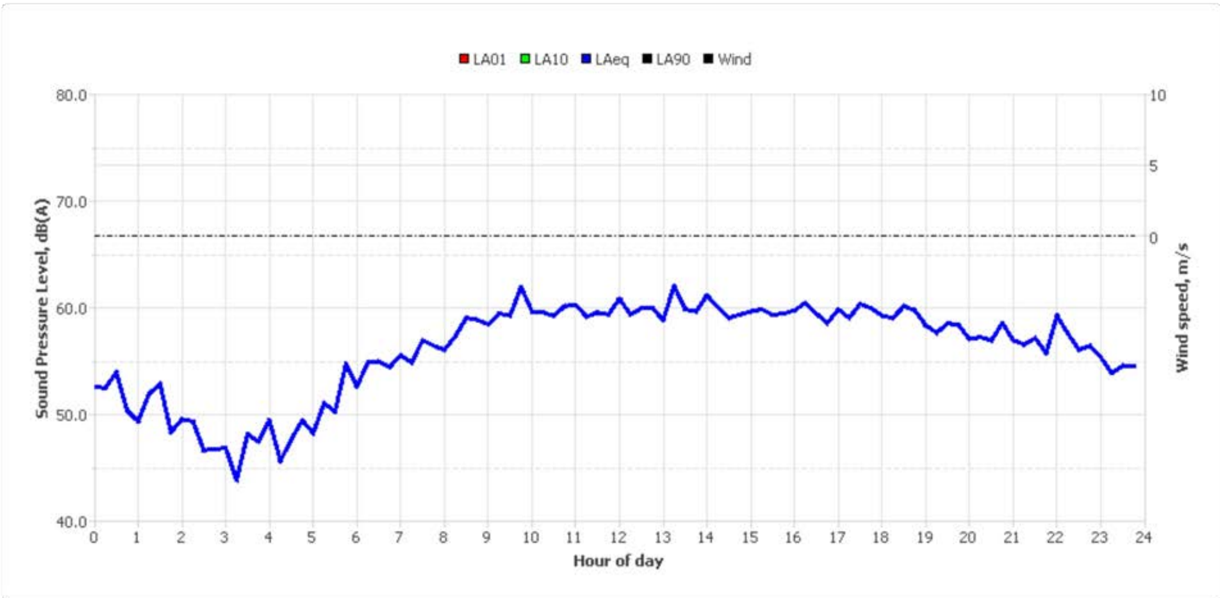

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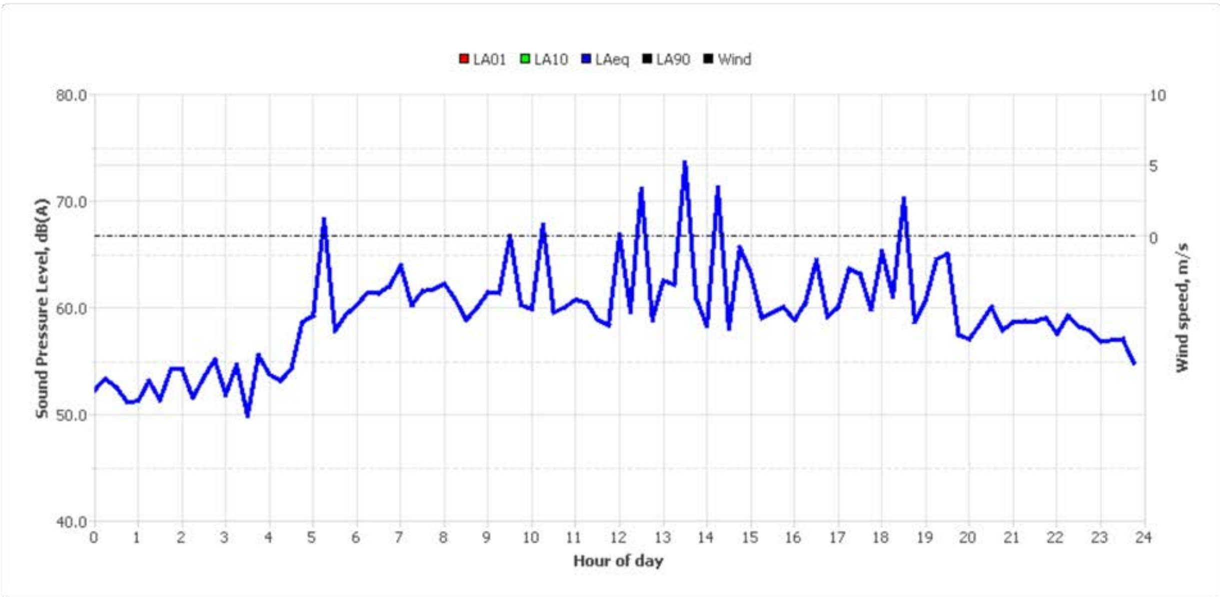

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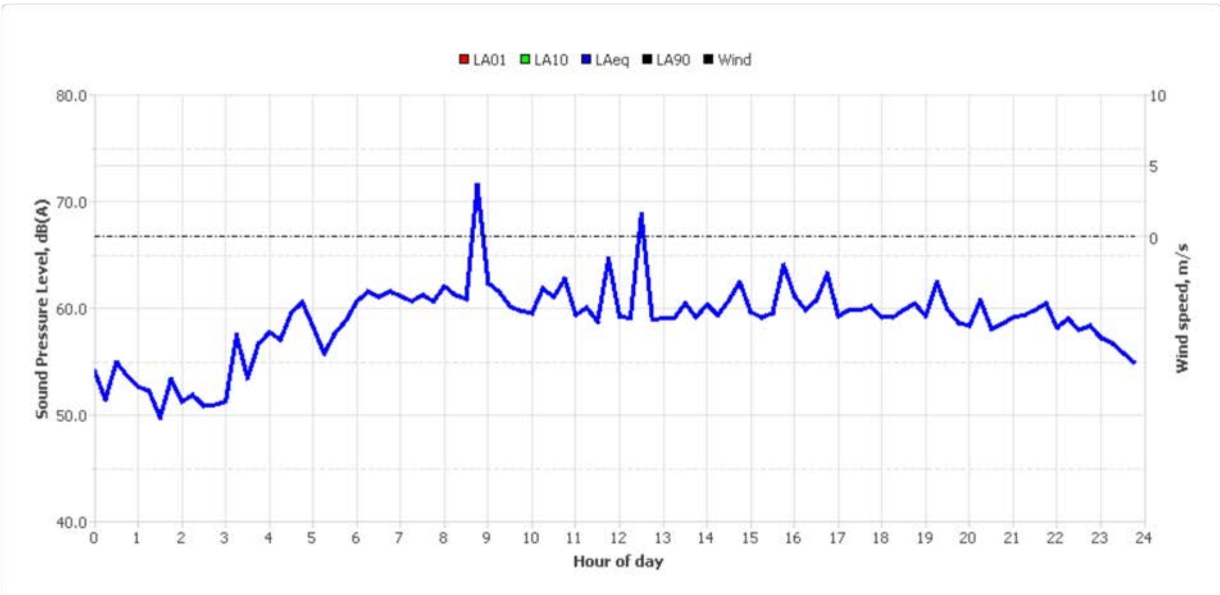

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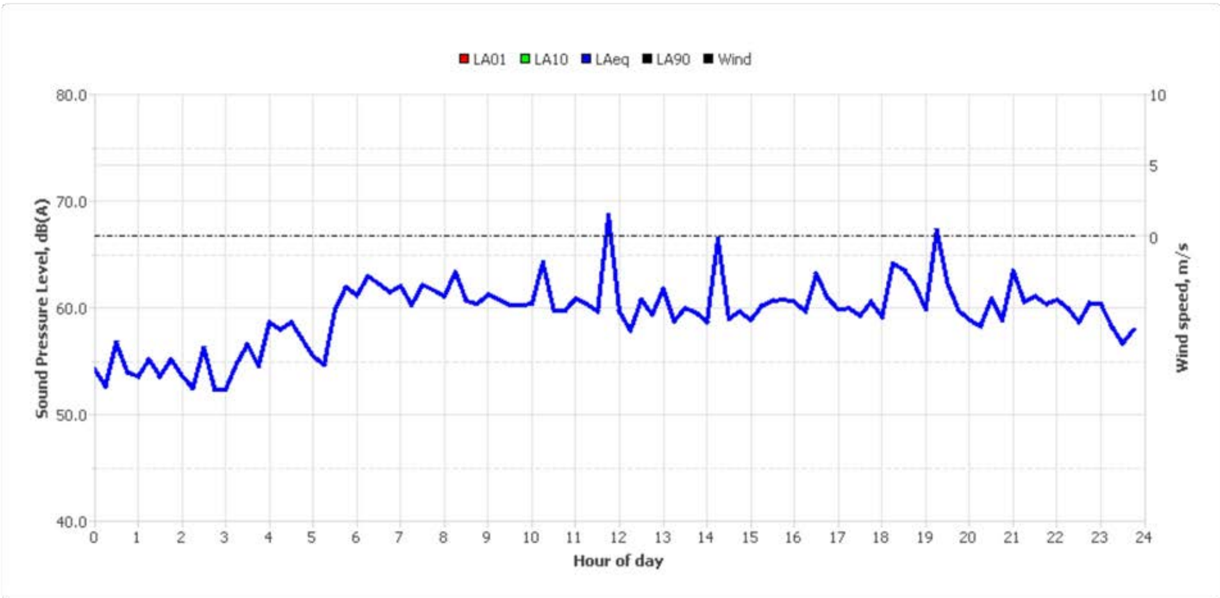

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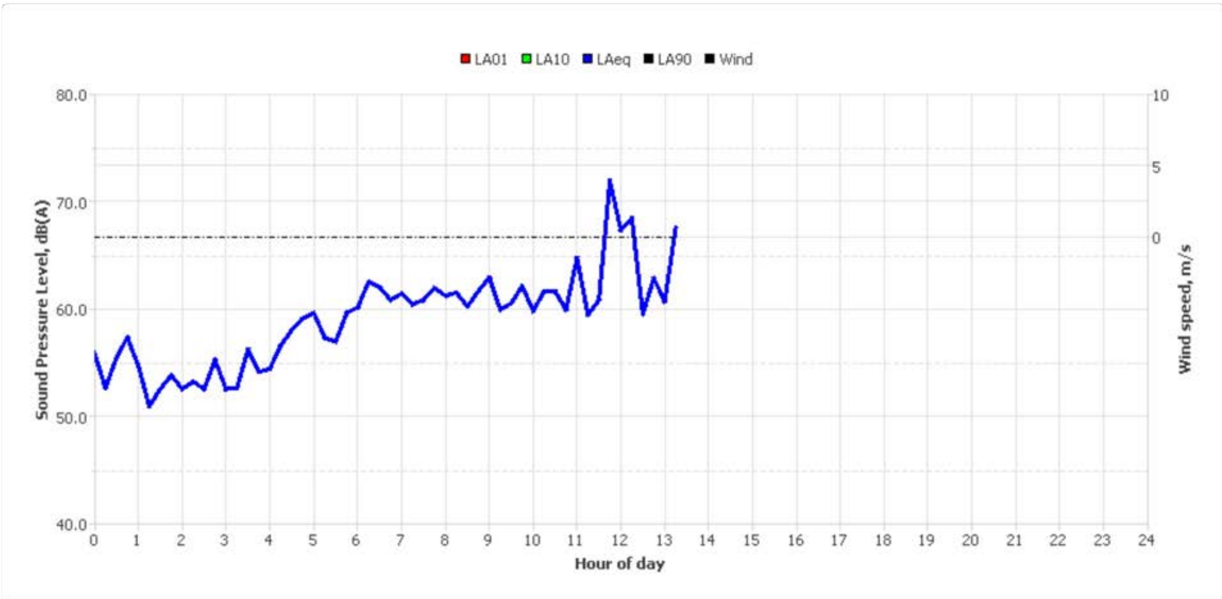

Appendix 3: Predicted Traffic Noise Levels

KEY

Cat A	Cat B	Cat C

NoR 1 Altered Roads

Address	Existing	Do Nothing	Do Minimum
40 Royal Road	60	62	63
20A Belleaire Court	60	62	63
32 Royal Road	59	61	63
432 Don Buck Road	62	64	63
428 Don Buck Road	61	63	62
434 Don Buck Road	61	62	62
492 Don Buck Road	61	63	62
38 Royal Road	57	58	61
2/47, Royal Road	56	57	61
30 Royal Road	57	60	61
20 Belleaire Court	59	60	61
31 Royal Road	56	58	61
36 Royal Road	57	57	61
490 Don Buck Road	59	61	60
480 Don Buck Road	61	63	60
27 Royal Road	55	58	60
37 Royal Road	55	57	60
29 Royal Road	56	58	60
25 Royal Road	54	56	60
51 Royal Road	55	57	60
461 Don Buck Road	58	60	60
459 Don Buck Road	58	59	59
34 Royal Road	56	57	59
440, Don Buck Road	59	61	59
423 Don Buck Road	59	60	59
486 Don Buck Road	59	61	59
40A Royal Road	55	58	59
2/14, Royal Road	58	60	59
44 Royal Road	55	58	59
463 Don Buck Road	57	59	59
16 Royal Road	54	56	59
23 Royal Road	53	56	59
49 Royal Road	54	56	59
131A Hobsonville Road	57	59	59
422 Don Buck Road	58	59	58
417 Don Buck Road	57	58	57
45 Royal Road	53	54	57

41 Royal Road	53	54	57
39 Royal Road	53	54	57
131 Hobsonville Road	56	58	57
478 Don Buck Road	59	61	57
19 Luckens Road	56	58	57
465 Don Buck Road	55	57	57
415 Don Buck Road	56	57	56
22A Trig Road	56	58	56
484 Don Buck Road	56	58	56
1, 33 Cyclarama Crescent	52	54	56
442 Don Buck Road	58	60	56
18 Belleaire Court	55	57	56
473 Don Buck Road	54	56	56
479 Don Buck Road	54	56	56
1, 53 Kemp Road	45	47	56
469 Don Buck Road	55	56	55
145A Hobsonville Road	57	58	55
21 Royal Road	52	54	55
34A Trig Road	54	56	55
407 Don Buck Road	54	55	55
476 Don Buck Road	57	59	55
2/14, Royal Road	53	55	55
457 Don Buck Road	52	53	54
444 Don Buck Road	56	57	54
31 Beauchamp Drive	52	54	54
147F Hobsonville Road	55	57	54
464 Don Buck Road	54	56	54
3 Royal Road	51	53	54
2 Cyclarama Crescent	49	52	54
448A Don Buck Road	46	48	54
420 Don Buck Road	53	54	53
490 Don Buck Road	52	53	53
431 Don Buck Road	53	55	53
470 Don Buck Road	56	58	53
444A Don Buck Road	47	49	53
450A Don Buck Road	46	48	53
450 Don Buck Road	54	55	53
438 Don Buck Road	46	48	53
28 Beauchamp Drive	51	53	53
452 Don Buck Road	54	55	53
462 Don Buck Road	53	54	53
29 Cyril Crescent	48	50	53
472 Don Buck Road	57	59	53
17 Royal Road	47	50	52
5 Royal Road	52	54	52
436 Don Buck Road	46	47	52

21 Cyclarama Crescent	50	52	52
454 Don Buck Road	52	54	52
13 Royal Road	55	58	52
416 Don Buck Road	51	53	52
446 Don Buck Road	56	57	52
17 Cyclarama Crescent	49	51	52
11 Royal Road	54	57	52
15 Royal Road	49	51	51
27 Cyclarama Crescent	50	52	51
9 Royal Road	52	55	51
425 Don Buck Road	51	52	51
3A Royal Road	47	49	51
1/7, Royal Road	52	54	51
426 Don Buck Road	43	45	51
2/14, Royal Road	45	47	51
13 Cyclarama Crescent	47	49	51
474 Don Buck Road	53	54	50
21 Royal Road	46	48	50
2/28, Royal Road	43	48	50
433 Don Buck Road	50	52	50
21 Cyclarama Crescent	49	51	50
459 Don Buck Road	48	50	50
29 Cyclarama Crescent	48	49	50
129B Hobsonville Road	47	50	50
437 Don Buck Road	50	52	50
26 Beauchamp Drive	48	50	50
441 Don Buck Road	50	52	50
435 Don Buck Road	50	52	50
440, Don Buck Road	46	48	49
145B Hobsonville Road	53	55	49
451 Don Buck Road	47	50	49
9A Royal Road	49	50	49
23 Royal Road	46	48	49
1/7, Royal Road	48	50	49
426 Don Buck Road	44	46	49
2/14, Royal Road	47	49	49
29 Beauchamp Drive	47	49	49
1/31, Cyclarama Crescent	48	49	49
413 Don Buck Road	47	49	49
19 Cyclarama Crescent	46	48	48
31 Royal Road	43	46	48
475 Don Buck Road	46	49	48
2/33, Cyclarama Crescent	46	48	47
439 Don Buck Road	50	51	47
424 Don Buck Road	45	47	47
6 Beauchamp Drive	45	48	47

15 Cyclarama Crescent	42	45	47
27A Royal Road	43	45	47
477 Don Buck Road	47	48	47
3A Louise Place	45	47	46
3 Beauchamp Drive	43	46	46
4 Beauchamp Drive	42	44	46
37 Cyclarama Crescent	45	47	46
1/31, Cyclarama Crescent	45	46	46
3A Louise Place	44	47	46
41A, Cyclarama Crescent	45	47	46
476A Don Buck Road	45	47	46
11 Cyclarama Crescent	43	45	46
18 Reverie Place	43	47	45
20 Reverie Place	42	46	45
16 Reverie Place	43	47	45
13 Reverie Place	44	46	45
39 Cyclarama Crescent	44	46	45
8 Beauchamp Drive	43	46	45
3 Cyclarama Crescent	41	43	45
25 Beauchamp Drive	43	46	45
3/427 Don Buck Road	44	46	45
39 Cyclarama Crescent	44	46	45
23 Beauchamp Drive	43	45	44
11 Reverie Place	42	44	44
27 Beauchamp Drive	42	45	44
14 Reverie Place	42	45	44
43 Royal Road	40	42	44
15 Reverie Place	42	44	44
9 Cyclarama Crescent	41	43	44
7 Reverie Place	42	44	44
5 Cyclarama Crescent	40	42	44
6 Cyclarama Crescent	40	42	44
9 Reverie Place	42	44	43
3 Kemp Road	39	42	43
7 Cyclarama Crescent	40	42	43
3/427 Don Buck Road	41	43	42
4 Cyclarama Crescent	37	39	42
411 Don Buck Road	40	42	42
5 Kemp Road	38	40	42
421 Don Buck Road	40	42	41

NoR 2 New Roads

Address	Existing	Do Minimum
27 Red Hills Road	35	47

NoR 2b Altered Roads

Address	Existing	Do Nothing	Do Minimum
554A Don Buck Road	50	53	52
554 Don Buck Road	47	52	49
552A Don Buck Road	50	55	52
558 Don Buck Road	52	53	56
556 Don Buck Road	47	50	49
560 Don Buck Road	55	58	59
562 Don Buck Road	57	61	59
552 Don Buck Road	53	61	55
552 Don Buck Road	58	62	60
54 Fred Taylor Drive	50	51	53

NoR 2c Altered Roads

Address	Existing	Do Nothing	Do Minimum
7, 31 Nelson Road	59	64	58
307, Red Hills Road	58	64	59
315 Red Hills Road	60	66	61
319 Red Hills Road	48	54	54
8 Nelson Road	50	55	56
315 Red Hills Road	55	60	56
319 Red Hills Road	49	55	51

Appendix 4: Noise Contour Maps

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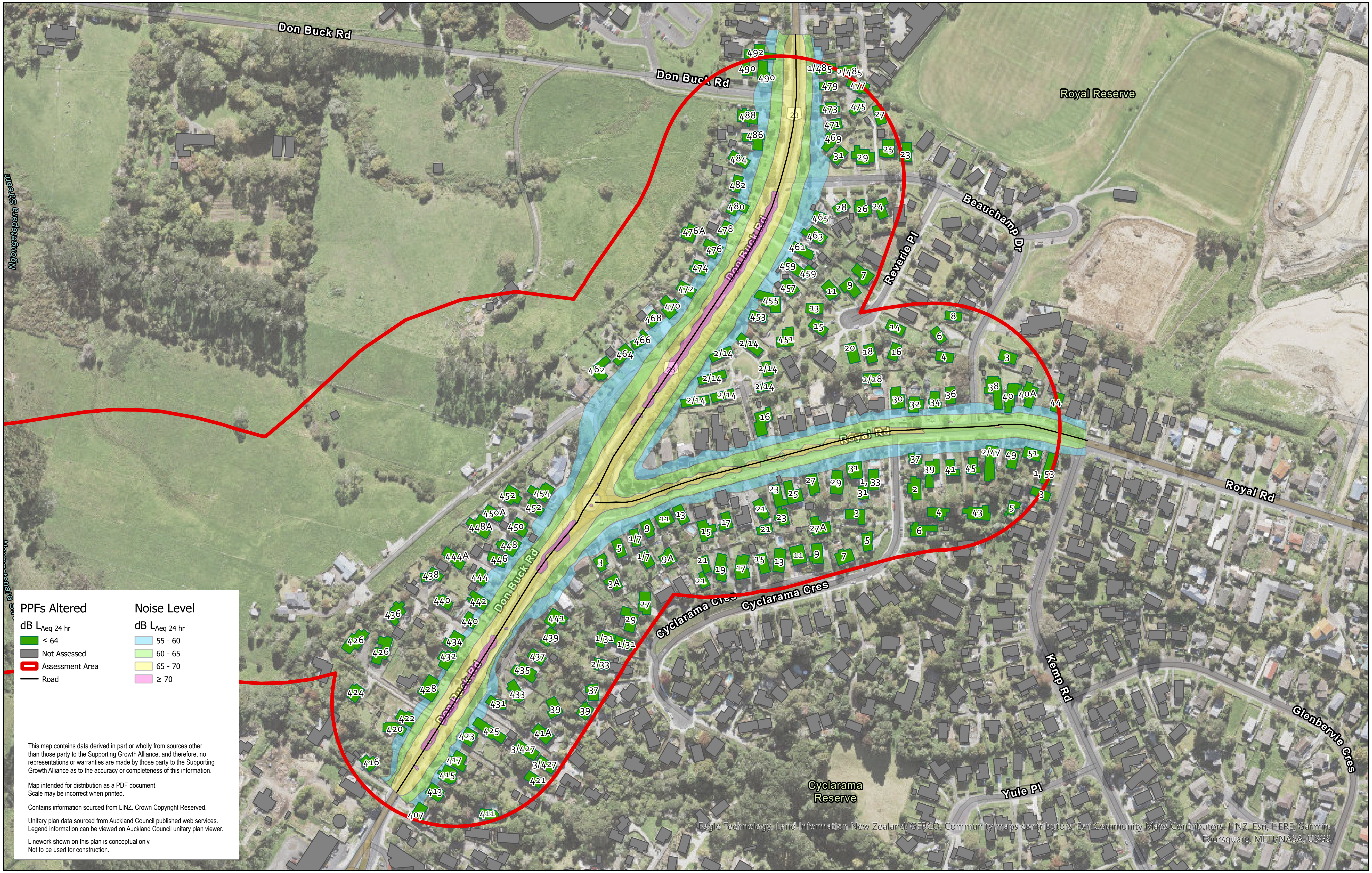

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Revision	Author	Verified	Approved	Date
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Title:

Supporting Growth

Redhills - Existing Scenario - NoR 1

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For the purpose of INTERNAL workshops (not for wider distribution)

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Project: North West HIF

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

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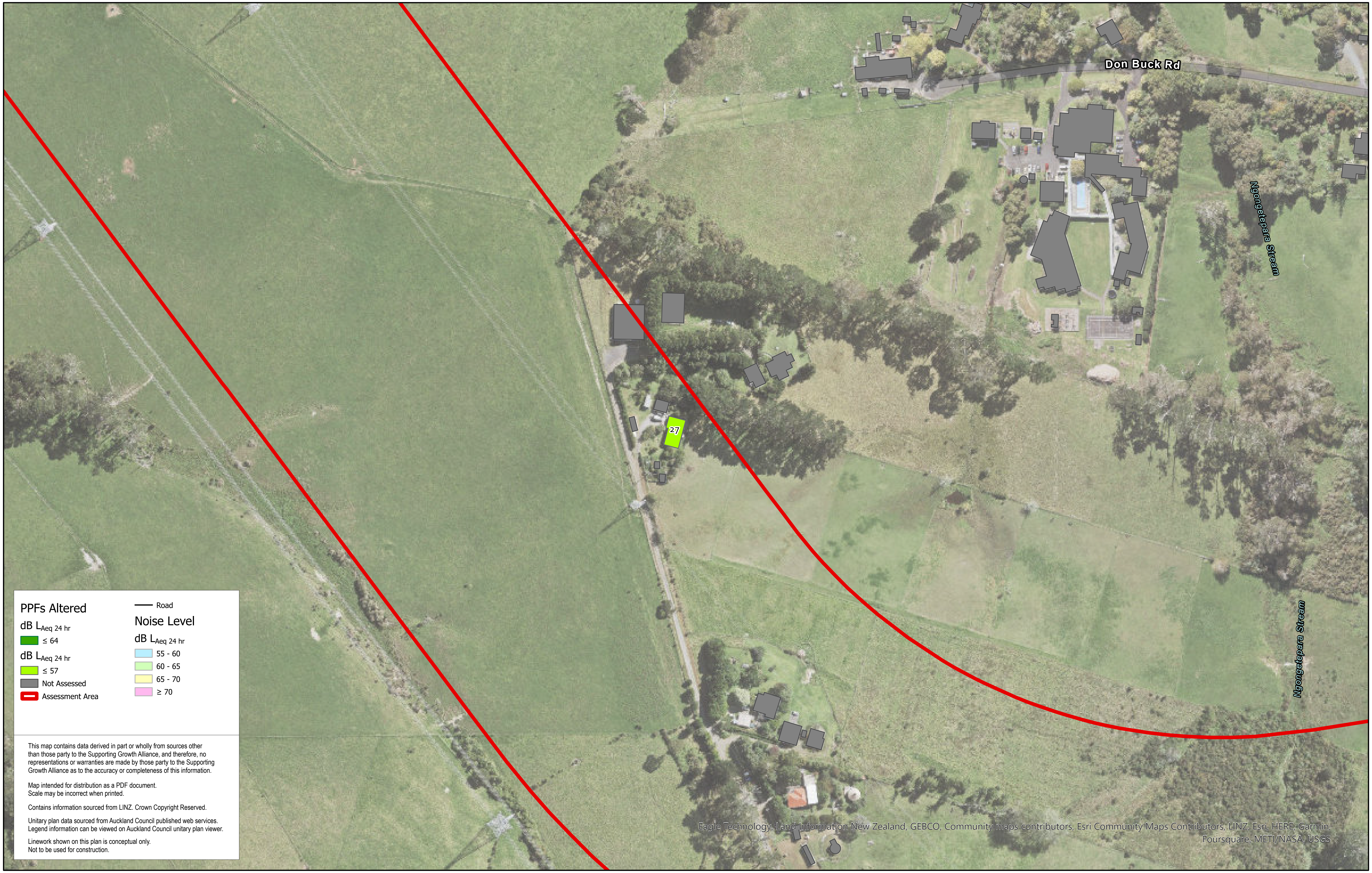

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PPFs Altered
dB $L_{Aeq\ 24\ hr}$
- ≤ 64
- Not Assessed
- Assessment Area
- Road

Noise Level
dB $L_{Aeq\ 24\ hr}$
- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

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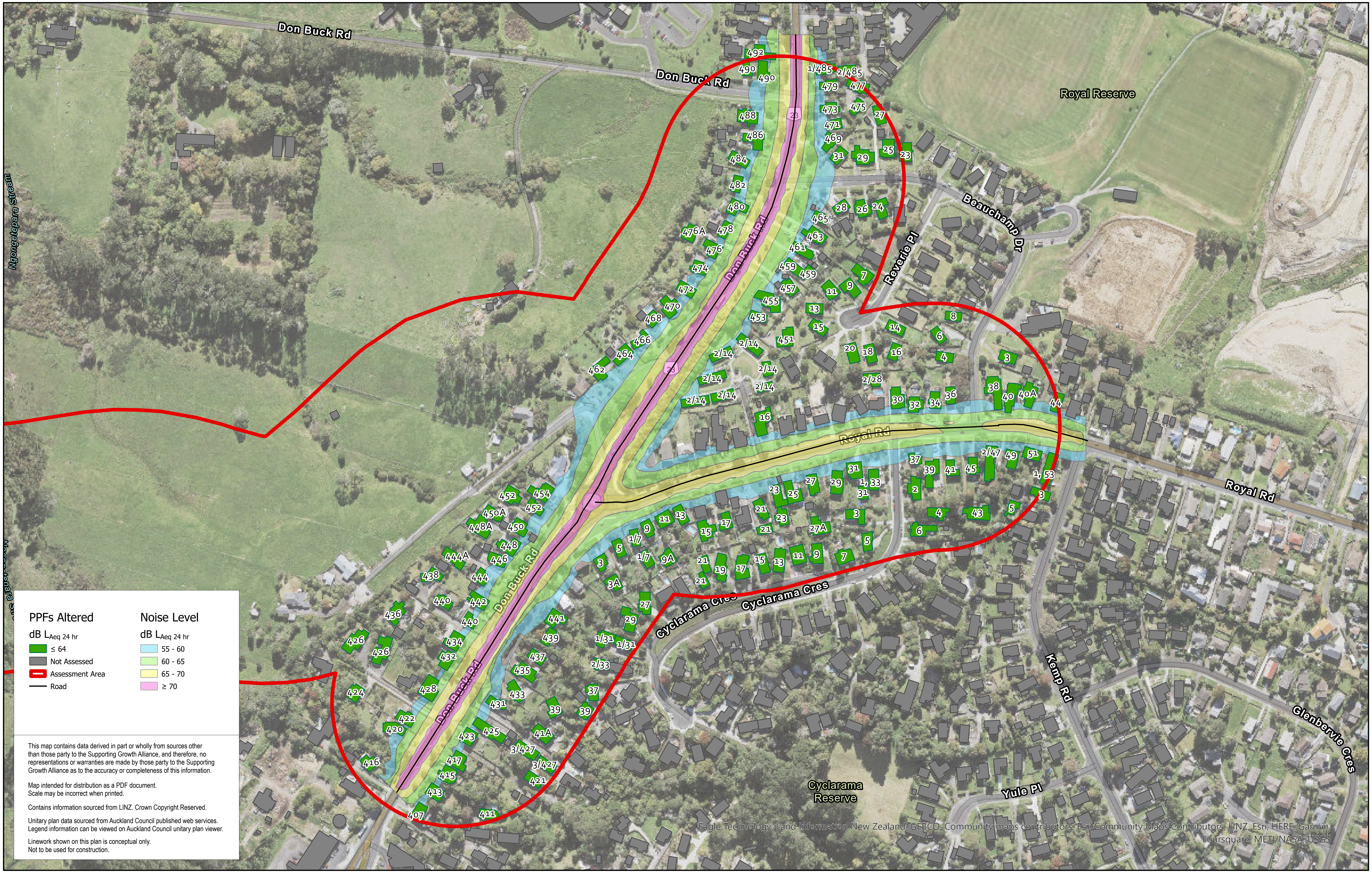

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Discipline: GIS

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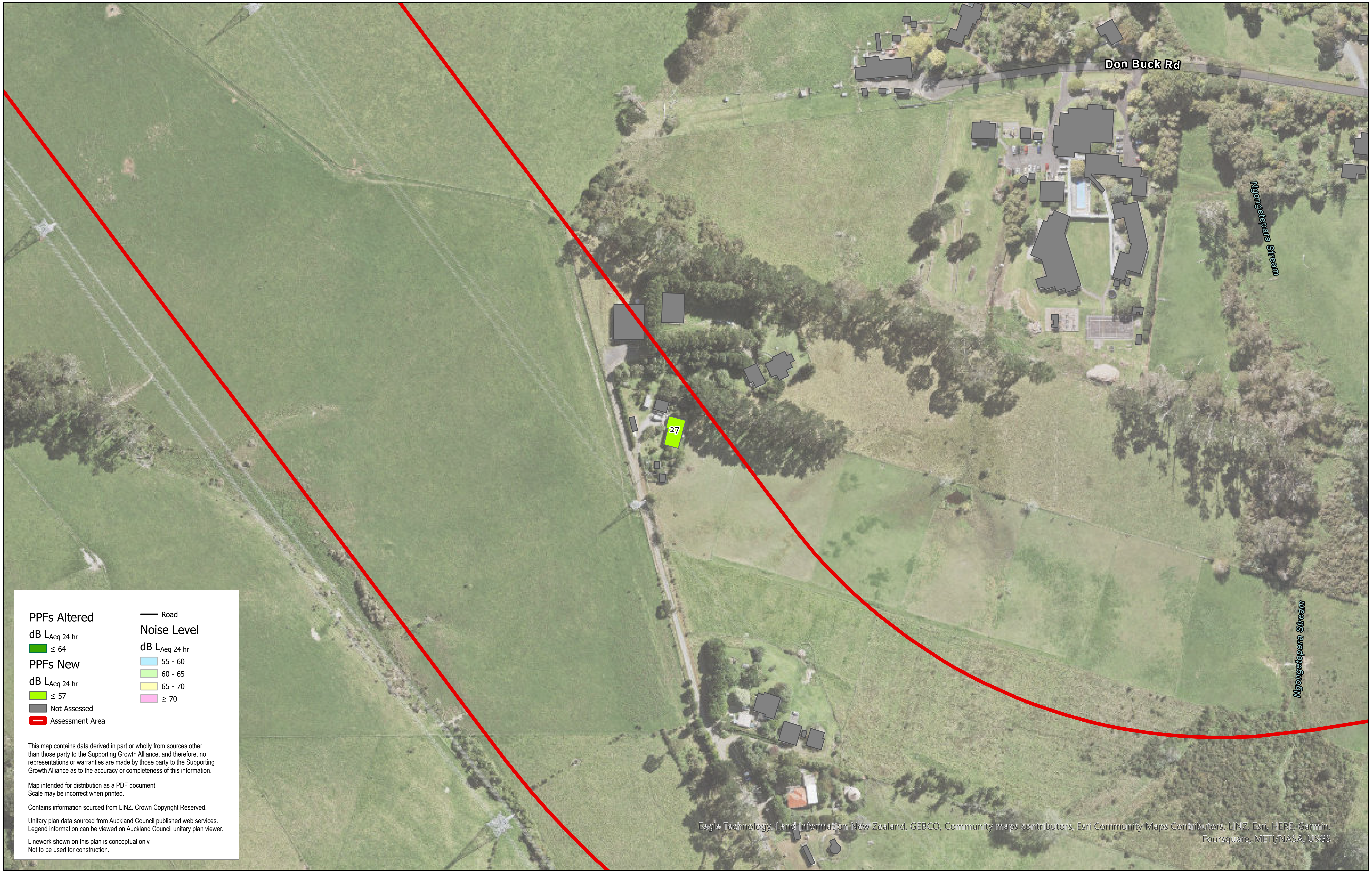

PPFs Altered

dB $L_{Aeq\ 24\ hr}$

- ≤ 64

PPFs New

dB $L_{Aeq\ 24\ hr}$

- ≤ 57
- Not Assessed
- Assessment Area

Road

Noise Level

dB $L_{Aeq\ 24\ hr}$

- 55 - 60
- 60 - 65
- 65 - 70
- ≥ 70

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Revision	Author	Verified	Approved	Date
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Discipline: GIS

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Revision	Author	Verified	Approved	Date
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Project: North West HIF

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

Date Printed:

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Revision	Author	Verified	Approved	Date
1	Author	DRAFT	DRAFT	dd/mm/yyyy

Title:

Supporting Growth

Redhills - Do Nothing Scenario - NoR 2c

Working Plans of Te Tupu Ngatahi.
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Project: **North West HIF**

TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-NV-NW-013**

Date Printed:

Name: 3_Do_Minimum

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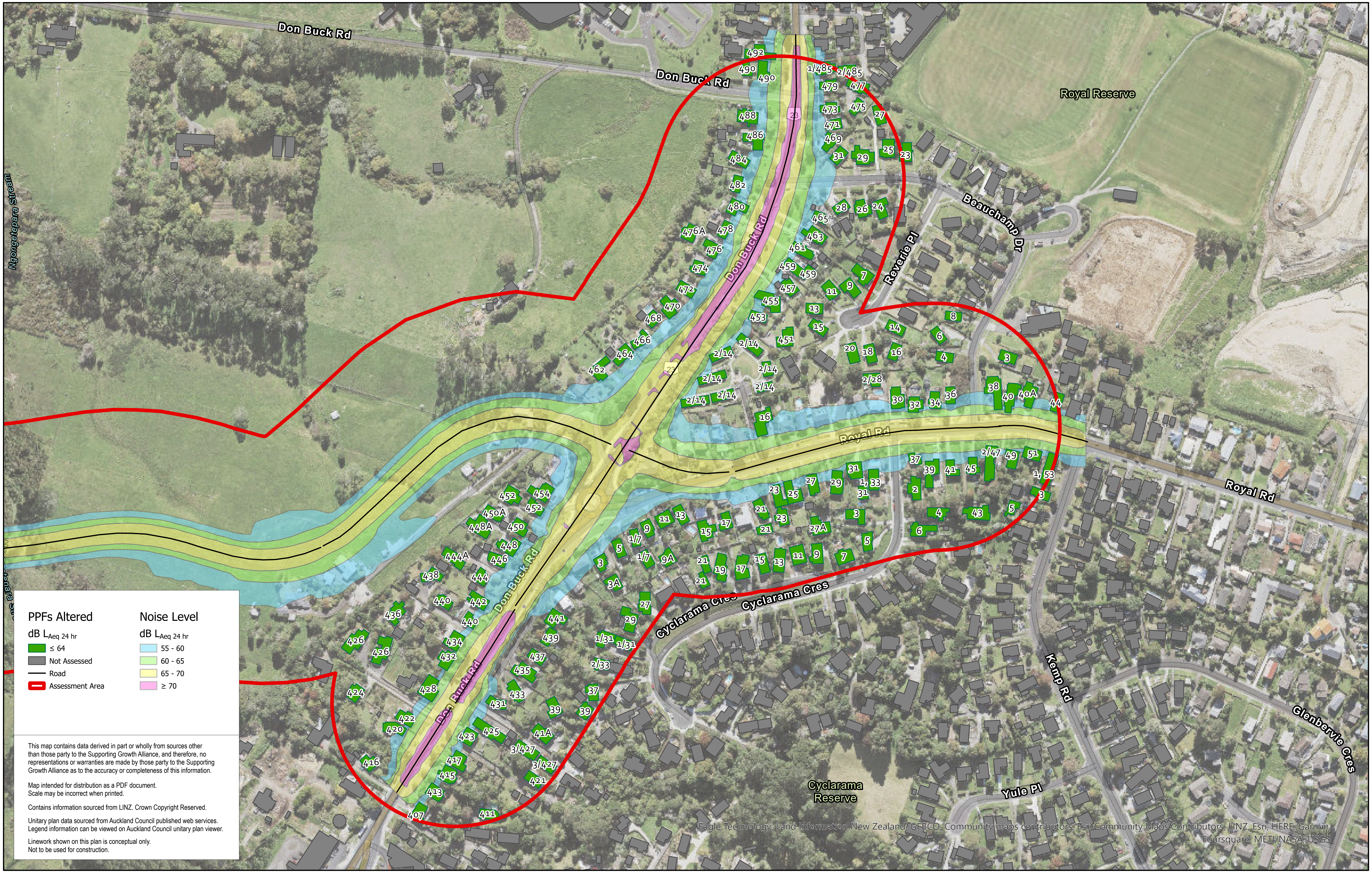

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Title:

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Redhills - Do Minimum Scenario - NoR 1

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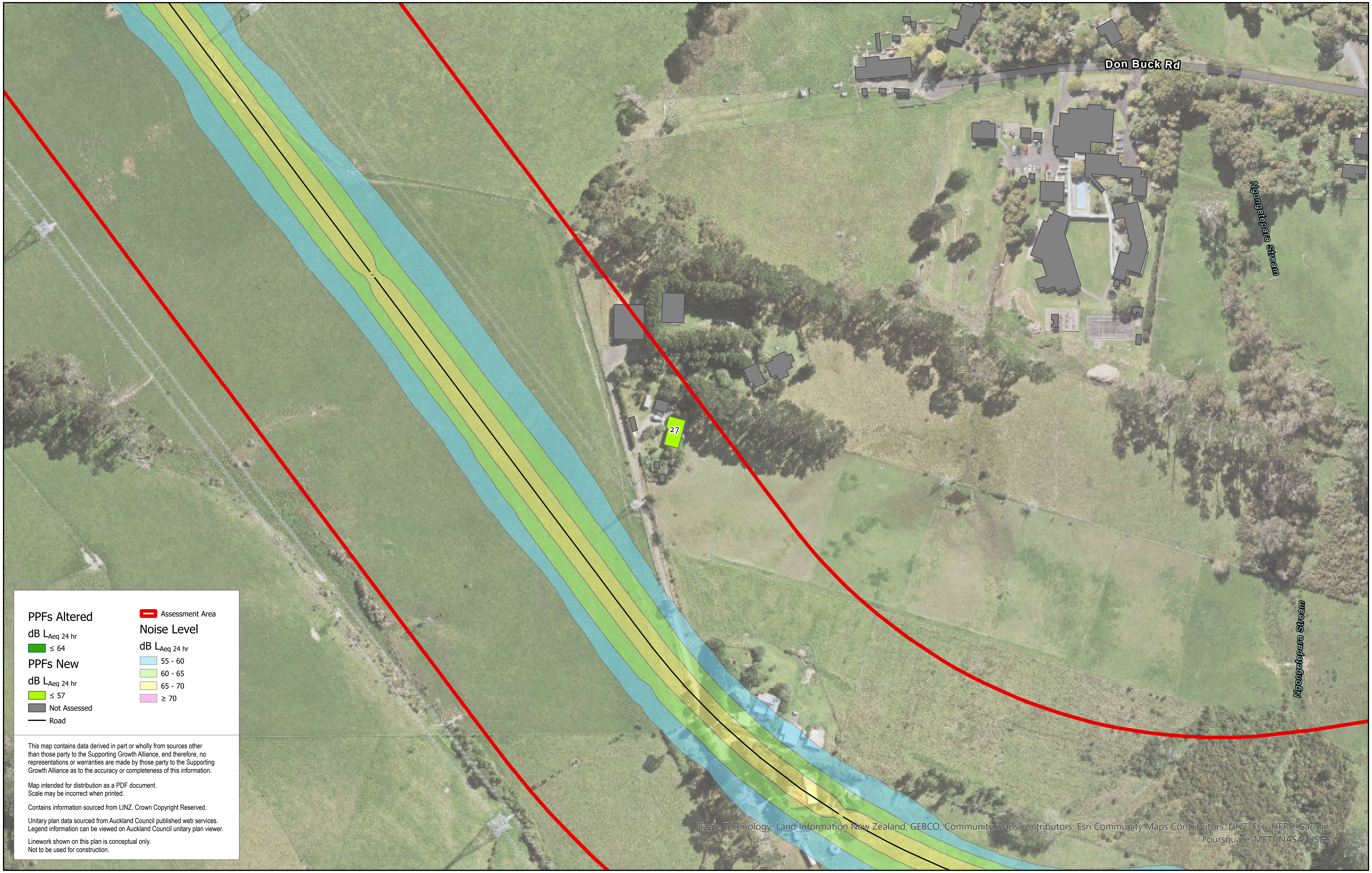
Project: North West HIF

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013



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Supporting Growth
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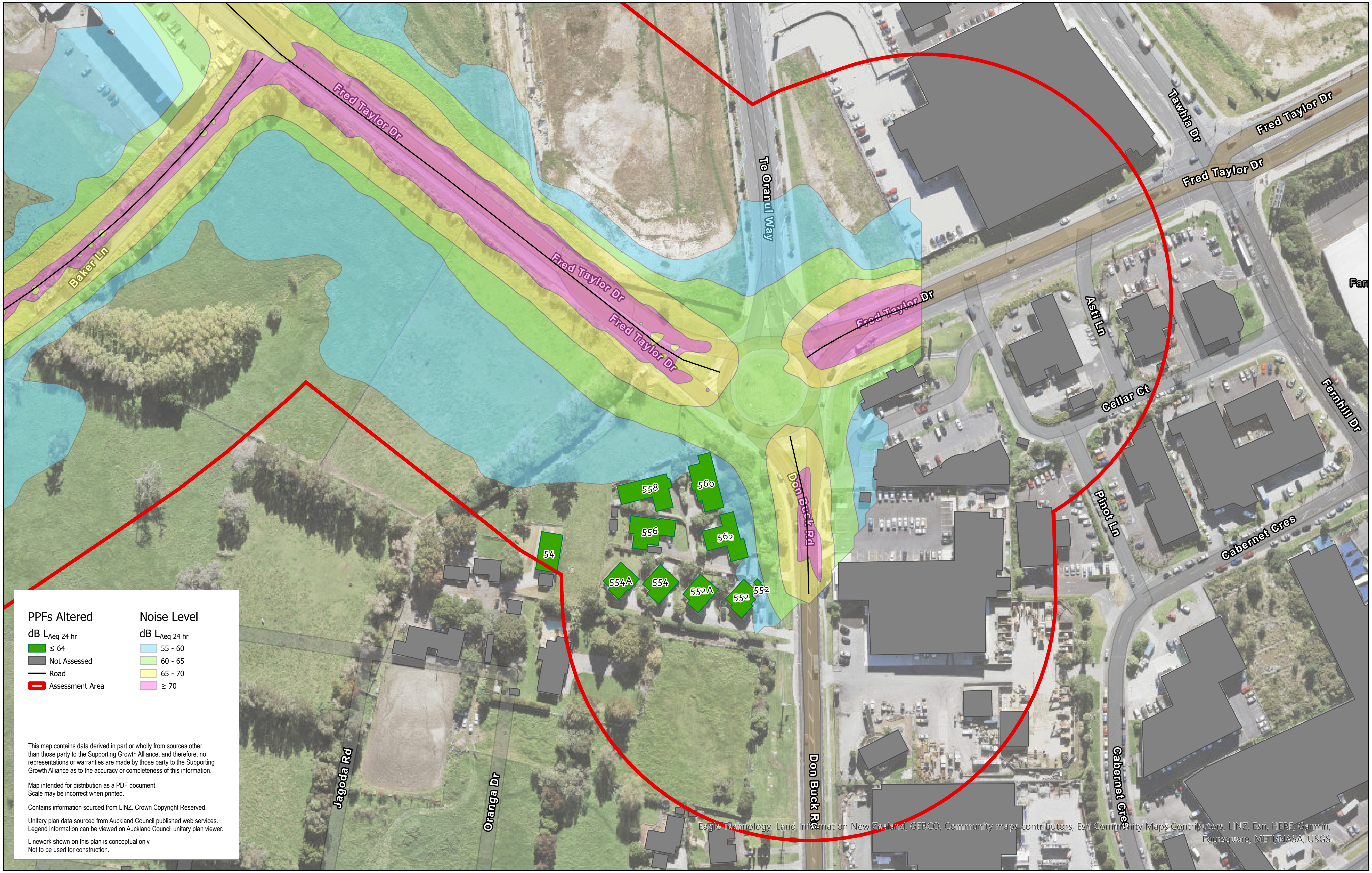

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Assessment Area	≥ 70

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Title:

Supporting Growth

Redhills - Do Minimum Scenario - NoR 2b

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Project: North West HIF

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Date Printed:

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Supporting Growth

Redhills - Do Minimum Scenario - NoR 2c

Working Plans of Te Tupu Ngatahi.
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Client: Supporting Growth

Project: North West HIF

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-NV-NW-013

ATTACHMENT 22

REDHILLS ARTERIAL TRANSPORT NETWORK ASSESSMENT OF HISTORIC HERITAGE EFFECTS

Supporting Growth

Redhills Arterial Transport Network

Assessment of Historic Heritage Effects

Version 1.0

August 2020

TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Document Status

Version no.	Responsibility	Name
1.0	Author	Sarah Macready (2020)
	Reviewer	Rod Clough (2020) Matthew Kerr-Ridge (2020)
	This report was authored in 2020 by Sarah Macready, who is no longer at Te Tupu Ngātahi Supporting Growth. I, Hans-Dieter Bader, have reviewed the report and approve it for release. I am satisfied it was accurate and complete when it was initially prepared. While some aspects may need to be updated due to changes since that time, these are minor and I am satisfied they would not materially change the assessment and conclusions reached.	
	Reviewer	Hans-Dieter Bader (2022)
	Approver	Bridget O'Leary (2022)

Revision Status

Version	Date	Reason for Issue
1.0	August 2020	Final for Lodgement

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Appendices

Acronyms

Acronym/Term	Description
ADR	Accidental Discovery Rule
ASL	Above Sea Level
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part 2016
CHI	Cultural Heritage Inventory (Auckland Council)
HNZPT	Heritage New Zealand Pouhere Taonga
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
ICOMOS	International Council on Monuments and Sites
NoR	Notice of Requirement
NZAA	New Zealand Archaeological Association
RMA	Resource Management Act 1991

1 Introduction

1.1 Background

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Supporting Growth Programme is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency to investigate, plan and deliver the transport network needed to support Auckland's future urban growth areas over the next 30 years.

1.2 Purpose of this Report

The Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project**). The NoRs under the Resource Management Act (**RMA**) are to designate land to enable the future construction, maintenance and operation of the Project.

This report provides an assessment of historic heritage effects associated with the construction, operation and maintenance of the Project. This assessment has been prepared to inform the Assessment of Environmental Effects for the NoRs.

The key matters addressed in this report are as follows:

(a) Identify and describe the historical background of the Project area;

(b) Describe the recorded historic heritage sites in the Project area;

(c) Describe the actual and potential adverse historic heritage effects of the Project;

(d) Recommend measures as appropriate to avoid, remedy or mitigate potential adverse historic heritage effects (including any conditions/management plan required); and

(e) Present an overall conclusion of the level of actual and potential adverse historic heritage effects of the Project after recommended measures are implemented.

1.2.1 Māori Cultural Values

This is an assessment of effects on archaeological and built heritage values and does not include an assessment of effects on Māori cultural values. Such assessments should only be made by Manawhenua. Māori cultural concerns may encompass a wider range of values than those associated with archaeological sites.

The historical association of the general area with the tangata whenua is evident from the recorded sites, traditional histories and known Māori place names.

2 Project Description

The Project consists of two new arterial corridors through the Project area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs:

Table 1: Redhills Notices of Requirement

Notice	Project	Description
NoR1	Redhills North-South Arterial Corridor	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.
NoR2a	Redhills East-West Arterial Corridor – Dunlop Road	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR2c) at the intersection with the Redhills North-South arterial corridor.
NoR2b	Redhills East-West Arterial Corridor – Baker Lane	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR2a).
NoR2c	Redhills East-West Arterial Corridor – Nixon Road connection	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road/Nelson Road/Nixon Road intersection, and the existing Nixon Road/Henwood Road intersection

To safely tie into the existing road network, the Project includes the upgrade of existing intersections where the new corridors will connect, as follows:

- Signalisation of the intersection at Don Buck Road and Royal Road (NoR 1);
- Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a);
- Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b); and
- A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Roads (NoR 2c).

The Project also provides a footprint for new stormwater wetlands for the treatment and attenuation of stormwater from the new corridors.

This report has primarily considered the Project area as a whole. Where relevant, NoR 1 is referred to as the N-S Project, and NoR2a, NoR2b and NoR2c are collectively referred to as the E-W Project.

The Project has been split between four NoRs to reflect the likely implementation of the Project. It may also be possible for each designation to be delivered in stages as the Project area develops.

An overview of the Project is provided in Figure 1. This design, along with the wider designation boundary, is referred to as the Project area throughout this report.

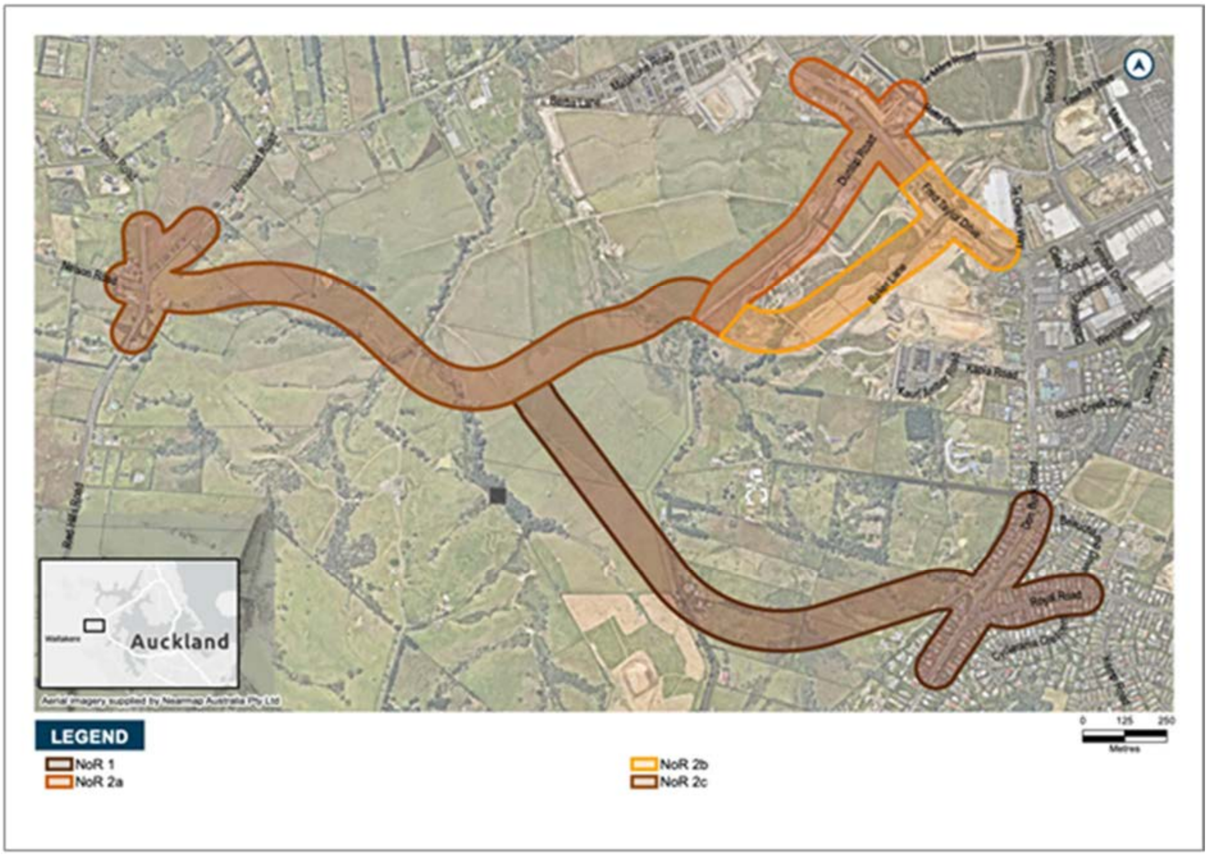

Figure 1: Redhills Arterial Transport Network

3 Assessment Framework

3.1 Statutory Context

3.1.1 Notice of Requirement

This assessment has been prepared to support the NoR process for the Project. Section 171 of the RMA sets out the matters that must be considered by a territorial authority in making a recommendation on a NoR. This includes consideration of the actual or potential effects (including positive effects) on the environment of allowing the requirement.

No regional resource consents are currently being applied for. The necessary regional resource consents will be sought prior to construction of the corridors, at which time any regional consenting matters will be assessed.

3.1.2 Resource Management Act 1991

Section 6 of the RMA sets out the matters of national importance that all persons exercising functions and powers under the RMA shall recognise and provide for when managing the use, development and protection of natural and physical resources. The matters of national importance of particular relevance to the Project and this assessment are: 'the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga' (section 6(e)); and 'the protection of historic heritage from inappropriate subdivision, use, and development' (section 6(f)).

Section 17 of the RMA states that there is a duty to avoid, remedy, or mitigate any adverse effects on the environment arising from an activity, including historic heritage.

Historic heritage is defined in section 2 of the RMA as:

> *'those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, deriving from any of the following qualities:*

(i) archaeological;
(ii) architectural;
(iii) cultural;
(iv) historic;
(v) scientific;
(vi) technological'.

Historic heritage includes:

(i) 'historic sites, structures, places, and areas;
(ii) archaeological sites;
(iii) sites of significance to Māori, including wāhi tapu;
(iv) surroundings associated with the natural and physical resources.

Regional and district plans[1] also contain sections that help to identify, protect and manage archaeological and other heritage sites. The plans are prepared under the provisions of the RMA and reflect the requirements of Part 2 of the RMA through their relevant Objectives, Policies and Rules.

[1] The AUP:OP is both the regional and district plan in the Auckland Region.

3.1.3 Heritage New Zealand Act Pouhere Taonga 2014

In addition to any requirements under the RMA, the Heritage New Zealand Pouhere Taonga Act 2014 (**HNZPTA**) protects all archaeological sites whether recorded or not. Those sites may not be damaged or destroyed unless an Authority to modify an archaeological site has been issued by Heritage New Zealand Pouhere Taonga (**HNZPT**) (under section 42 of the HNZPTA).

An archaeological site is defined by the section 6 of the HNZPTA as follows:

> '**archaeological site** means, subject to section 42(3),[2] –
>
> (a) any place in New Zealand, including any building or structure (or part of a building or structure) that –
>
> (i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and
>
> (ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and
>
> (b) includes a site for which a declaration is made under section 43(1)'.[3]

Authorities to modify archaeological sites can be applied for under the HNZPTA either in respect of archaeological sites within a specified area of land (section 44(a)), a specific archaeological site where the effects will be no more than minor (section 44(b)), or for the purpose of conducting a scientific investigation (section 44(c)). Applications that relate to sites of Māori interest require consultation with (and in the case of scientific investigations the consent of) the appropriate iwi or hapu and are subject to the recommendations of the Māori Heritage Council of HNZPT. In addition, an application may be made to carry out an exploratory investigation of any site or locality under section 56 of the HNZPTA, to confirm the presence, extent and nature of a site or suspected site.

Under section 52 of the HNZPTA, HNZPT may impose conditions on any Authority granted requiring an archaeological investigation to be carried out, if satisfied on reasonable grounds that the investigation is 'likely to provide significant information in relation to the historical and cultural heritage of New Zealand'. This ensures that information contained within a site that is affected by development (and any associated artefacts) is recorded and preserved, in mitigation of the modification of the site.

Under Part 4 of the HNZPTA, HNZPT has the power to list significant historic places and areas, wāhi tūpuna, wāhi tapu and wāhi tapu areas on the New Zealand Heritage List. The purpose of the Heritage List is to inform members of the public and landowners about the values of significant places and to assist in their protection under the RMA (section 65). HNZPT would be considered an affected party in relation to any consent application affecting an item on the New Zealand Heritage List. The criteria used to assign the level of significance (Category 1 or 2) are set out in section 66 of the HNZPTA.

[2] Under section 42(3) an Authority is not required to permit work on a pre-1900 building unless the building is to be demolished.

[3] Under section 43(1) a place post-dating 1900 (including the site of a wreck that occurred after 1900) that could provide 'significant evidence relating to the historical and cultural heritage of New Zealand' can be declared by HNZPT to be an archaeological site.

3.2 Relevant Standards and Guidelines

Appropriate management of historic heritage sites should be based on an understanding of their values and significance. The following policies and guidelines have been developed to assist in assessing heritage sites and determining appropriate management.

3.2.1 Regional Policy Statement

The Ngā rawa tuku iho me te āhua - Historic heritage and special character chapter of the Regional Policy Statement in the AUP:OP outlines the criteria to be used in assessing the significance of historic heritage for scheduling purposes (B5.2.2).

3.2.2 HNZPT Guidelines

HNZPT (2006: 9-10) has provided guidelines setting out criteria that are specific to the assessment of archaeological sites. These are:

- condition;
- rarity;
- contextual value;
- information potential;
- amenity value; and
- cultural associations.

3.2.3 ICOMOS New Zealand Charter

The International Council on Monuments and Sites (**ICOMOS**) 'New Zealand Charter for the Conservation of Places of Cultural Heritage Value' (revised 2010) is intended to provide support for decision makers in statutory or regulatory processes. It sets out principles to guide the conservation of places of cultural heritage value, whose qualities are defined as:

- have lasting values and can be appreciated in their own right;
- inform us about the past and the cultures of those who came before us;
- provide tangible evidence of the continuity between past, present and future;
- underpin and reinforce community identity and relationships to ancestors and the land; and
- provide a measure against which the achievements of the present can be compared.

The charter promotes the use of conservation plans in the management of cultural heritage places and sets out conservation principles and processes.

4 Methodology and Analysis

The New Zealand Archaeological Association's (**NZAA**) site record database (ArchSite), Auckland Council's Cultural Heritage Inventory (**CHI**), AUP:OP schedules and the HNZPT New Zealand Heritage List/Rārangi Kōrero were searched to determine whether any archaeological or other historic heritage sites had been recorded on or in the immediate vicinity of the Project area. Literature and archaeological reports relevant to the area were consulted (see Bibliography). Early survey plans and aerial photographs were checked for information relating to past and present land use.

A visual inspection of the Project area was conducted on 11 December 2019. The ground surface was examined for evidence of former occupation (in the form of shell midden, depressions, terracing or other unusual formations within the landscape, or indications of 19th century European settlement remains). Exposed and disturbed soils were examined where encountered for evidence of earlier modification, and an understanding of the local stratigraphy. Particular attention was paid to stream banks (topographical features where archaeological sites are often found to be located). Photographs were taken to record the topography and features of interest.

5 Historical Background[4]

Chapter Summary

The Upper Waitematā Harbour is associated with a number of iwi who settled and/or exercised fishing rights in the area for centuries prior to the arrival of Europeans. This is evident in the Māori place names recorded for the area and a number of archaeological sites identified in the coastal areas and along navigable waterways, which were the foci of Māori settlement. Subsistence was based largely on seafood and cultivated crops such as kumara, with forested areas inland providing additional resources such as birds, rats and edible and medicinal plants.

Early European settlement from the 1840s initially had a similar coastal focus, with extensive logging of the kauri forests, followed by gum digging and conversion of former forest land to farmland. The closest settlements to the Project area were at Brigham Creek and on the Hobsonville peninsula (where a number of early pottery works established).

The Project area is largely located within land previously owned by John Brigham, after whom Brigham Creek is named. Brigham's land ownership was formalised in 1857 through a Crown Grant of 1,971 acres bounded by the Ngongetepara and Waiteputa streams to the west and by Totara Creek and Sakaria Stream to the east. The land was farmed by Brigham and subsequent owners up to the present day, with the exception of a strip of residential development beside Don Buck Road and a housing development currently underway near the junction of Fred Taylor Drive and Don Buck Road.

5.1 Māori Settlement

Through time a number of iwi have had influence over the Upper Waitematā Harbour region. Of particular significance were Te Kawerau ā Maki , Waiohua and Ngāti Whātua and the many hapu related to these groups (Clough and Tanner 2004). However, other hapu from outside the region also maintained rights to fish in the waters of the Waitematā through the summer months, and archaeological sites in the area may relate to any of these groups. A number of Māori place names associated with the area have been recorded, some but not all of which are in use today (Figure 2: Māori place names in the Westgate/Brigham Creek/Whenuapai area (source: Kelly and Surridge 1990)). **Error! Reference source not found.**The closest of these to the Project area are the Totara and Waiteputa ('the water flowing forth') creeks, and to the east the Waipareira Stream ('the creek at the place before mentioned') which gave its name to the large block of land which contained the Hobsonville peninsula (Simmons 1987). Pitoitoi ('name of a bird') was the Māori name for Brigham Creek and Kopupaka ('the scorched stomach') was at the head of Pitoitoi, where it separates into the Totara and Waiteputa creeks (ibid.).

Settlement focussed mainly on the coastal areas and along navigable waterways, as shown by the distribution of recorded archaeological sites in the area (see section 6.2). Subsistence strategies employed by Māori inland from the coast consisted of the hunting (by spear and snare) of kaka, kereru, kiwi, wood-hen, tui and other small birds, while rats were caught in pits or traps (Best 1903, cited in Hayward and Diamond 1978). Forest plants would also have provided a range of foods with fruits, bracts and tubers from a variety of plants all gathered and consumed, while those Māori who dwelt on the coastlines of the Waitematā Harbour would have had an abundance of fish and shellfish

[4] The following historical background is derived from Macready and Clough 2008; Shakles et al. 2010; Phear and Low 2014 and Clough & Associates and Matthews & Matthews Architects 2016.

resources at their disposal as well as land for the cultivation of kumara and other crops in areas where suitable soils were present.

Figure 2: Māori place names in the Westgate/Brigham Creek/Whenuapai area (source: Kelly and Surridge 1990)

5.2 European Settlement

When Europeans first began to settle the Upper Waitematā they would have encountered a landscape covered in kauri forest (North 2000). By 1840, after the arrival of numerous settlers, several timber mills were founded in the upper harbour at Lucas Creek, Paremoremo and Rangitopuni (North 2000; Morris 1995). In a little less than 20 years, practically all of the kauri was logged and gum diggers replaced the timber workers (North 2000; Morris 1995). Other mills were established in Henderson in the 1840s and Swanson in the 1850s, exploiting the forests of the Waitakere Ranges (Brown 1992).

The acquisition of land by the Crown for sale to settlers occurred in the 1850s in the Whenuapai/Hobsonville/Brigham Creek area, in some cases following the adjusting and settling of earlier land claims by those who had bought land from its Māori owners. The western part of Whenuapai contained the Rarawaru Block, sold to the Crown by Ngati Whatua in 1851 (Turton 1877: Deed 233). It extended from the Waitematā River in the north, to land already owned by the Crown in the south and west, and to land 'which formerly belonged to Wellesley Hughes' in the east (ibid.). On 2 June 1853, 600 acres of land named the 'Waipareira Block' were sold by two chiefs of Ngati

Whatua, for £50. However, this sale proved to be controversial and later formed part of the 3000 acres of reserve land in West Auckland that was given back to Kawerau ā Maki (Hahn 2007). In 1857, however, two European settlers named as Joseph Newman and Thomas Summerville managed to acquire the 600 acre Waipareira Block, reportedly for the sum of £250 (Hahn 2007). Parts of the Waipareira Block on the Hobsonville peninsula were soon settled.

Brigham Creek is named after the early settler, landowner and entrepreneur John Brigham (1810-1885), who bought a considerable amount of land at Brigham Creek, Waiheke and elsewhere, pursuing his land claims through the Land Claims Commission (Madden 1966: 79). Brigham secured 1,971 acres as a Crown Grant in 1857 and much of the Project area was part of this claim (Figure 3: Map of Mr J. Brigham's Farm on the south bank of the Waitematā River (OLC 237) dated 1857. The general location of the Project area circled in red). The land was bordered by the Ngongetepara and Waiteputa streams to the west and by Totara Creek and Sakaria Stream to the east. Brigham Creek itself was a small settlement established, like many others during the middle of the 19th century, on one of the numerous waterways feeding the Waitematā Harbour (for example, Greenhithe, Hobsonville, Avondale and Henderson). A couple of advertisements for the sale of Brigham's Claim in the late 19th century give some idea of the type of the land available. One dating to 1893 states:

> 'The land is suitable for sheep farming or fruit growing, and would be suitable for cutting up into small holdings of say 30-100 acres each…' (*New Zealand Herald* 25 November 1893:8).

The advertisement also points out the gum fields located nearby and the close proximity to Auckland by 'water carriage'. A plan dated 1894 shows the subdivision of Brigham's Claim into smaller farm lots (Figure 4: Subdivision of Brigham's Claim Blocks IX, X, XIII, XIV, Waitematā SD (DP 2088) dated 1896, with the general location of the Project area circled in red) and by 1896 the land was up for sale again, being advertised as:

> '2000 acres of good agricultural land, specially suitable for strawberry and fruit growing, subdivided into lots from one to 100 acres…' (*Auckland Star*, 16 March 1896:4).

The Project area and its immediate surrounds was not a focus of early European settlement, which was instead concentrated to the south, around Henderson and Swanson and the Huruhuru Creeks, to the northeast around the Hobsonville peninsula, where a number of early pottery works were established (Clough, Macready and Plowman 2008) and on a smaller scale at Brigham Creek.

Of these settlements, Brigham Creek was the closest to the Project area. The land there was owned by the Sinton and Johnston families, who in the late 19th and early 20th centuries ran a store, a gum business, a slaughterhouse, a butchery and stock holding yards and accommodation for drovers taking their stock to the saleyards. The Sintons delivered supplies to gumdiggers' camps in the hills beyond Riverhead and the surrounding districts by packhorse twice weekly, while gum was conveyed to Auckland by steamer each fortnight and goods for the store were brought back on the return journey (Hodder 1975: 5-6; Morris 1995: 22, 34; Hahn 2007; Madden 1966). A number of local gumdiggers were allowed to live on the Sintons' land near Brigham Creek around the turn of the century (Madden 1966: 112; Hodder 1975: 6).

For the most part the Redhills/Westgate area would have followed the classic pattern of rural land use in the greater West Auckland area. This is, that kauri forest was first logged and cleared, the ground was then excavated and worked by gum diggers, and then the ground improved by farmers to enable the development of good pasture for livestock or crop cultivation. Much of the land in the general area at the end of the 19th century would have appeared barren and devoid of large trees after the loggers and gum diggers had passed through (Hahn 2007). Aerial views taken over the last 60 years (e.g. Figure 5: 1959 aerial view of the Project area , Figure 6: 2017 aerial view of the Project area (source: Auckland Council)) show that the Project area remained as undeveloped farmland apart from a strip of residential housing along Don Buck Road, until the housing development currently being undertaken by Westgate Joint Venture/Universal Homes to the west of the junction of Fred Taylor Drive and Don Buck Road (see section 7).

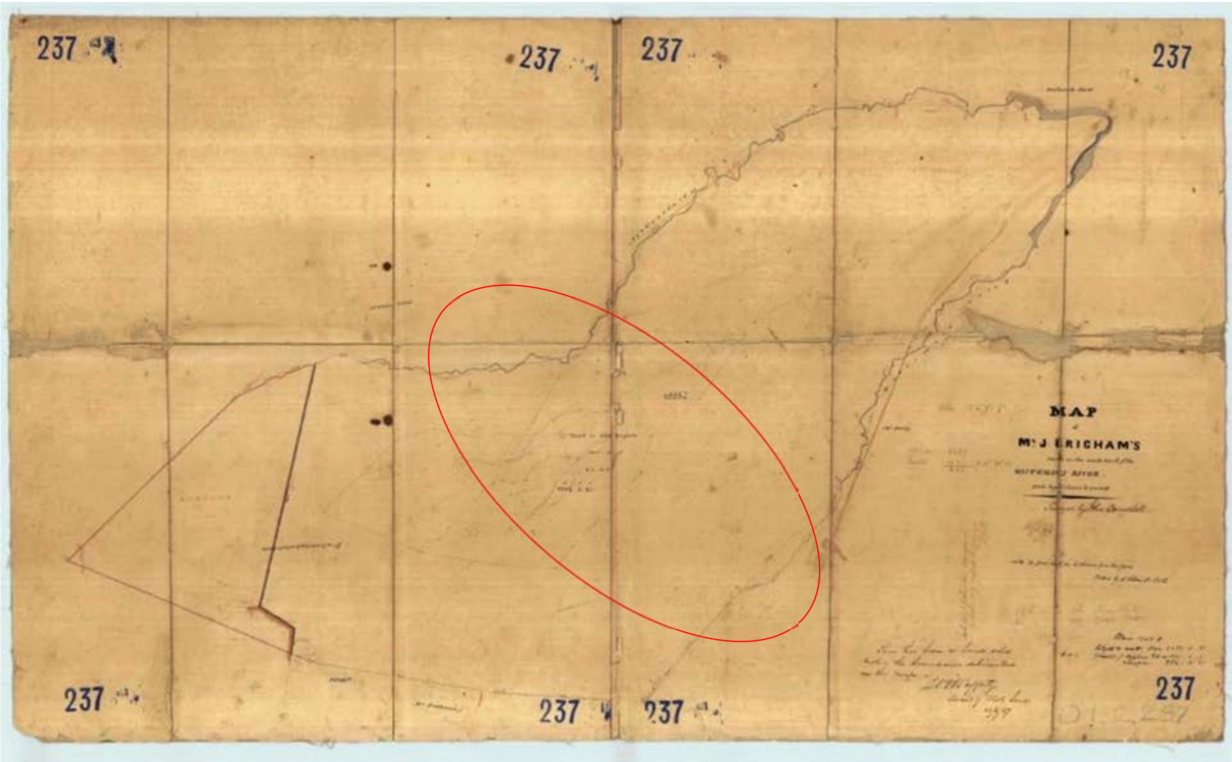

Figure 3: Map of Mr J. Brigham's Farm on the south bank of the Waitematā River (OLC 237) dated 1857. The general location of the Project area circled in red

Figure 4: Subdivision of Brigham's Claim Blocks IX, X, XIII, XIV, Waitematā SD (DP 2088) dated 1896, with the general location of the Project area circled in red

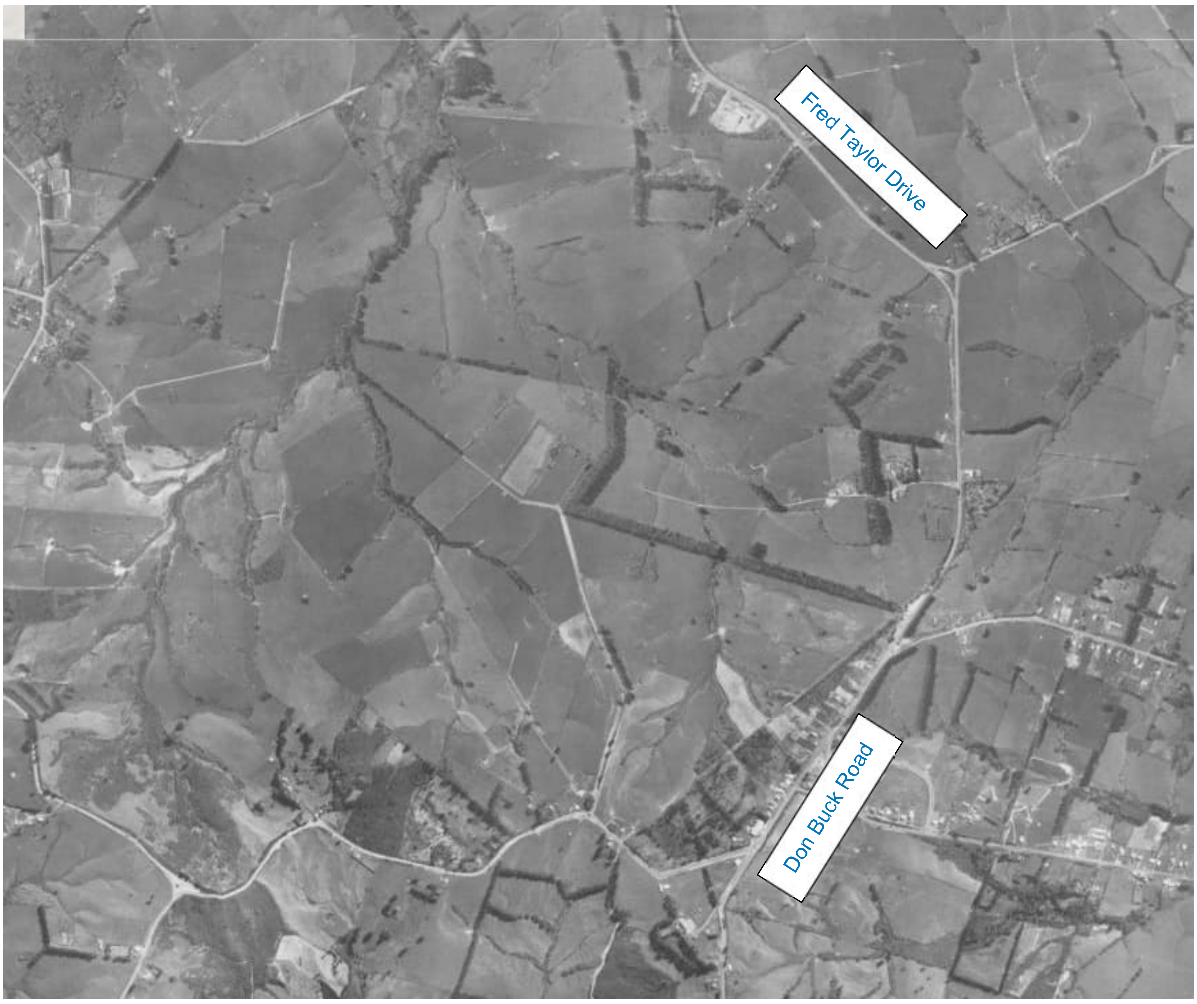

Figure 5: 1959 aerial view of the Project area

Figure 6: 2017 aerial view of the Project area (source: Auckland Council)

6 Historic Heritage Sites

Chapter Summary

The Project area is located inland some distance from the coast, where most Māori and early European archaeological sites have been recorded. The soils in the area were generally unsuitable for kumara cultivation and it was not a known area of Māori settlement. There are no archaeological sites recorded in the Project area or within c.400m – the nearest sites consist of a World War II plane crash site at 81 Fred Taylor Drive and a gumdiggers' camp and hut site at 295 Taupaki Road.

One historic heritage site, consisting of a wooden holding dam or sluice, is recorded in the Auckland Council's CHI (no. 18372) within the property at 60 Baker Lane, but this could no longer be located when the property was surveyed in 2014. There are two recorded historic heritage buildings within c.400m of the Project at 399 Don Buck Road and 44 Royal Road, which are scheduled in the AUP:OP. A third building recorded on the CHI has been demolished. None are in close proximity to the N-S or E-W Projects.

6.1 Archaeological Background

The creeks and inlets of the inner reaches of the Upper Waitematā Harbour were occupied by Māori for generations before the arrival of Europeans, evidence of which survives in the form of recorded place names, oral traditions and archaeological sites (although many sites have been destroyed by 19th and 20th century development and natural processes). The harbour provided not only abundant marine resources but also access to some significant communication and portage routes, such as the Rangitopuni River and Lucas Creek. The Waitematā Harbour was part of an inland water route stretching from north of Dargaville through to the centre of the North Island (via the Kaipara, Waitematā and Manukau Harbours and the Waikato River).

The Project area is located some distance inland, however, away from the focus of settlement along the coast, which is evident in the distribution of recorded archaeological sites shown in Figure 7. There are no recorded archaeological sites along or within c.400m of any of the proposed arterial connections. The three closest sites are: R11/3097 located to the north at 81 Fred Taylor Drive (the site of a Boeing B-17 plane crash during World War II); and R11/1376 and R11/3047 at 295 Taupaki Road, consisting of a gum diggers' camp and a hut site respectively. The nearest recorded archaeological site related to Māori settlement is some 2km to the east of the Project area. The soils in this general area were largely unsuitable for kumara cultivation (Campbell et al. 2013: 12), and it does not appear to have been settled by Māori, as noted in a recent heritage study of the area undertaken for Auckland Council (ibid.: 21).

Previous archaeological investigations in the Westgate/Massey area are few and are largely restricted to archaeological assessments for various developments, such as a subdivision at McWhirter Farm in Massey (Campbell and Clough 2003); an assessment of land on Royal Road in Massey (Judge and Clough 2007); an assessment for a subdivision at 9 Chamberlain Road, Massey (Foster 2008), and an assessment for footpath upgrades at Moire Park, Massey (Shakles, Piper-Jarrett and Phear 2014). Clough and Associates also undertook a survey of the Westgate Township area as part of the Northern Strategic Development Growth Area commissioned by Waitakere Council (Clough and Tanner 2004). No new archaeological or other historic heritage sites were located during that survey.

Of particular relevance was a survey and assessment carried out for the Westgate Partnership (now Joint Venture) of the land in the northeast of the Project area near the junction of Don Buck Road and Fred Taylor Drive (Phear and Low 2014). No archaeological sites were identified on the property and the archaeological potential was considered to be low. Bulk earthworks in this area are currently well advanced, and no suspected archaeological remains have been exposed (Jason Lo, Project Manager, Universal Homes, pers. comm. 11 Dec 2019).

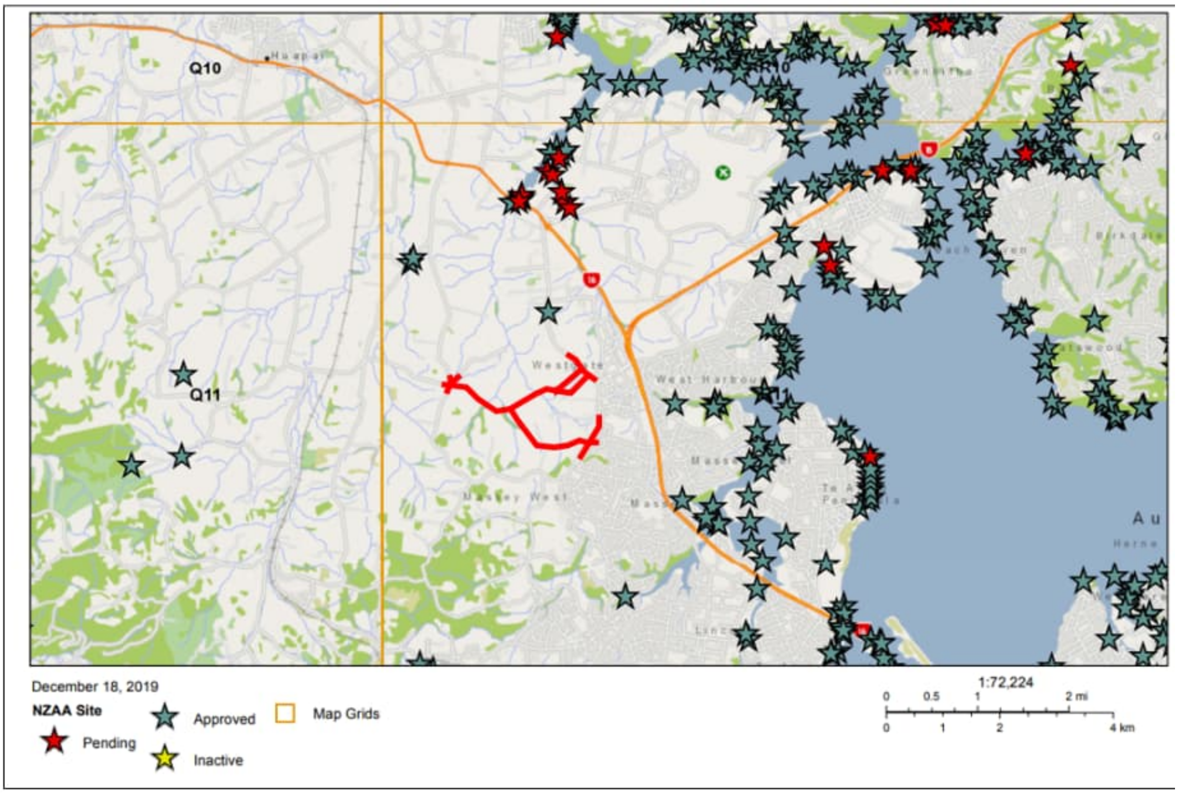

Figure 7: The distribution of recorded archaeological sites in the general area (source: NZAA ArchSite). Project area indicated in red

6.2 Recorded Historic Heritage Sites

The Auckland Council CHI has recorded one historic heritage site within or close to the E-W Project area – the remains of a feature described as a wooden holding damn/sluice (CHI No. 18372) at 60 Baker Lane (Figure 8: Historic heritage sites recorded on the Auckland Council CHI (blue squares indicate heritage buildings or structures – see Figure 10 for detail). Project area indicated in red , Figure 9: Detail from Auckland Council CHI identifying the recorded historic heritage buildings and structures in the vicinity of the Project area). A photograph of the feature indicates a small hollowed out log with two notches (Figure 10), and the CHI record states that there are what look to be wooden pilings associated with the water holding device (see Appendix 1). The feature is not recorded on the NZAA ArchSite database and could not be found during the 2014 archaeological survey that included this area (Phear and Low 2014).

Two other historic heritage buildings are recorded in the CHI within c.400m of the proposed Redhills arterial connections: CHI 3804, the 1930s Post Office at 399 Don Buck Road (scheduled on the AUP:OP as a historic heritage place, ID 51); and CHI 3322, a historic dwelling at 44 Royal Road (scheduled on the AUP:OP as a historic heritage place, ID 52) with an associated heritage oak tree (CHI 2163). Neither of these buildings or their curtilages is located in close proximity to the Project. A third building previously shown on the CHI (3388, a historic bungalow, shown in Figure 9) has recently been removed from the CHI. There is also the reported site of a heritage building (CHI 3327) called Midgely House (after the former landowner) at 15 Fred Taylor Drive, but the house has been demolished to make way for the Westgate Township.

Figure 8: Historic heritage sites recorded on the Auckland Council CHI (blue squares indicate heritage buildings or structures – see Figure 10 for detail). Project area indicated in red

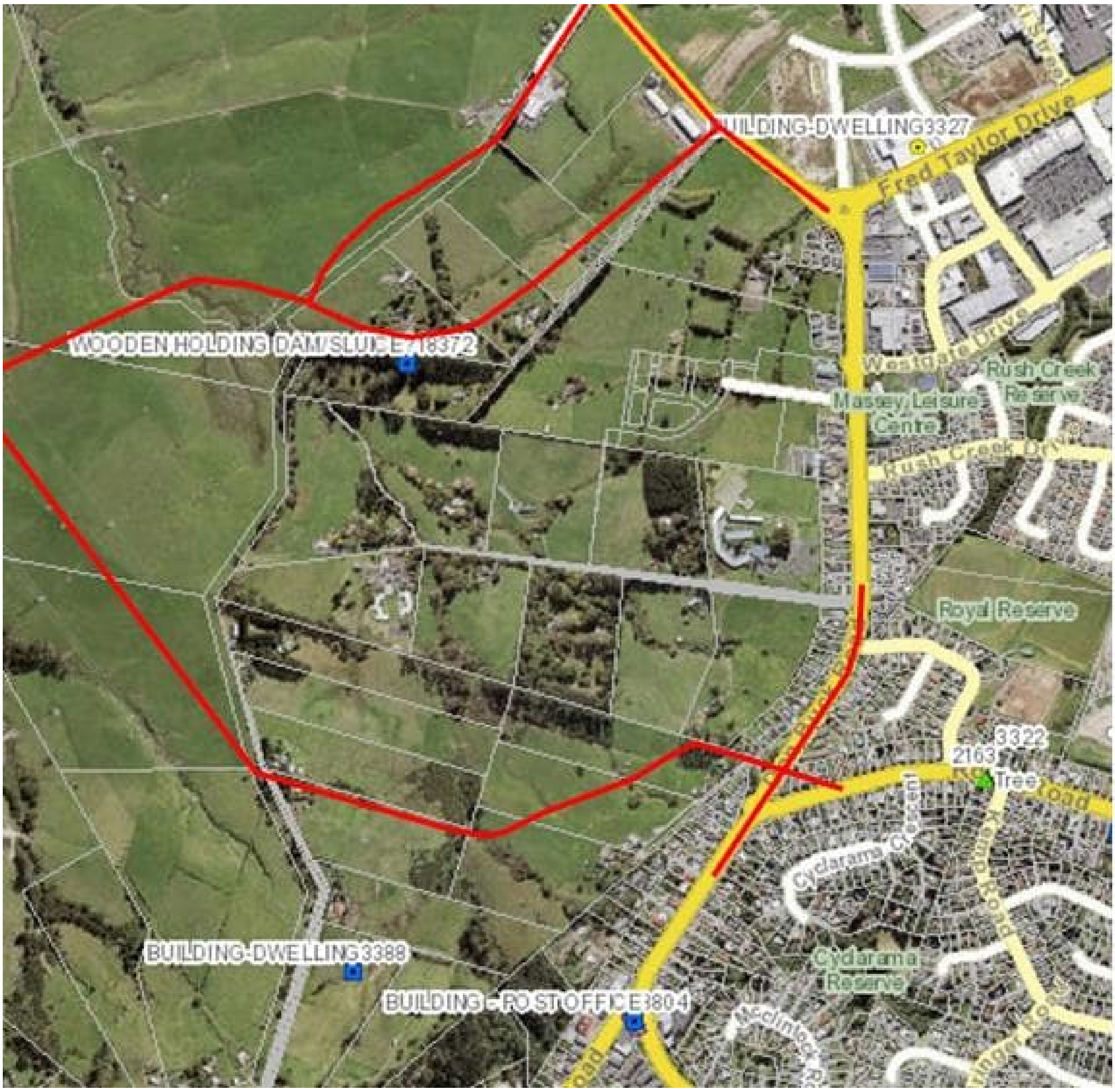

Figure 9: Detail from Auckland Council CHI identifying the recorded historic heritage buildings and structures in the vicinity of the Project area (indicated in red)

Figure 10: Photograph of the dam/sluice recorded at 60 Baker Lane (source: CHI no. 18372 site record)

7 Field Assessment

Chapter Summary

The proposed alignments within the Project area were inspected on 11 December 2019. Most areas along the alignments were inspected, including stream crossings where accessible. The western end of the proposed E-W Project and eastern end of the N-S Project between the Don Buck Road/ Royal Road intersection and the second stormwater treatment wetland to the west were not accessible but were viewed from a distance from roads and access roads.

The location of the water retention feature recorded in the CHI (18372) was searched, but the feature could not be found. Modifications in the form of modern culverting were evident and it was concluded that the feature is no longer present. It was presumably removed some time prior to 2014, when a previous survey of the property was undertaken but the feature could not be located. Its recorded location is in any case to the south of the proposed Baker Lane Project (NoR2b) area and would not be affected by them.

The land is predominantly in pasture, with stream banks generally in poor condition and eroded by stock trampling. No archaeological evidence was identified during the field survey, and it was concluded that the potential for unidentified subsurface archaeological remains to be present is low across the Project area.

The proposed alignments within the Project area were visually inspected on 11 December 2019. Apart from the area along Baker Lane that is currently under residential development and the residential area around the Don Buck Road/Royal Road intersection, the landscape across the Project area is undeveloped farmland in open fields. These are intersected by the Ngongetepara, Waiteputa and Red Hill streams, with gentle contours at elevations between 25m and 60m Above Sea Level (**ASL**). Towards the western end of the E-W Project and the eastern end of the N-S Project the ground rises a little more steeply to elevations of 90m ASL.

Most areas along the alignments were visually inspected, including stream crossings, where accessible. Areas not accessed but inspected at a distance were:

1. the western end of the E-W Project between the Waiteputa Stream and the junction of Henwood and Nixon Roads, which was viewed from Henwood Road and from a farm track alongside Waiteputa Stream; and

2. the area between the Don Buck Road/Royal Road intersection and the second stormwater treatment pond to the west, which was viewed from an access road to the properties located west of the junction, and from the access road to the properties at 21-29 Redhills Road.

While unable to be directly inspected, the inspections at a distance indicated that the inaccessible areas were similar in terms of land use and archaeological potential to the areas that had been directly inspected.

The proposed Baker Lane (NoR2b) alignment initially follows an existing lane from Fred Taylor Drive, but diverges to the north-west of the lane to meet the proposed extension of Dunlop Road (NoR2a) across what were the properties at 60-68 Baker Lane, which are now under subdivision development. Much of this area had been extensively earthworked (Figure 11: Photo taken from within the Baker Lane development, looking south-west over proposed Baker Lane alignment), with many of the trees removed near the recorded location of the water retention feature/sluice CHI 18372 described above (see Figure 10). The Ngongetepara Stream and its branches were very overgrown in the recorded location of the feature, and modern culverting was evident (**Error! Reference source not found.**, Figure 13). There was no sign of the recorded feature and, as noted above, it could not be found during the field survey in 2014 (Phear and Low 2014), so is assumed to have been removed or destroyed. The recorded location is to the south of the proposed Baker Lane works and would not be affected by them. The Baker Lane alignment has been largely modified and has little if any archaeological potential.

The proposed Dunlop Road alignment initially follows an existing access road past Steve Nuich Panel Beaters at 2 Dunlop Road and across farmland, to the point where it meets the proposed extension of Baker Lane and the remaining E-W Project (Figure 14). No archaeological features were observed in this area and unidentified features are unlikely to be present.

The remainder of the proposed E-W Project crosses open fields and, heading west, the Ngongetepara, Redhills and Waiteputa streams, reaching the junctions of Nixon/Henwood/Red Hills/Nelson Roads, where the road will bisect the property at 319 Red Hills Road, running close to the buildings on the property. The alignment, stream crossings and the two eastern stormwater treatment pond locations were inspected (Figure 15–Figure 17). The stream banks were generally in poor condition and eroded by stock trampling. The area west of the Waiteputa Stream was not accessed due to the presence of livestock. No archaeological features were observed or considered likely to be present along the E-W Project alignment or associated pond locations.

The northern part of the proposed N-S Project was accessed as far as the location of the first stormwater treatment pond, heading south (Figure 18: Looking south-east along the proposed N-S Project alignment, from near its junction with the proposed E-W Project). No archaeological features were observed. The remainder of the route was viewed from the access road leading to 21-25 Red Hills Road and from the access road to properties west of Don Buck Road near its intersection with Royal Road, and consisted of a similar landscape with no obvious potential for archaeological remains (Figure 19: Looking east from the access road to 21-29 Red Hills Road, across the proposed alignment of the N-S Project, Figure 20: Looking north-west from the access road to 21-29 Red Hills Road, across the proposed alignment of the N-S Project).

Overall, the proposed designations contain no identified archaeological or other historic heritage sites and the potential for unidentified subsurface archaeological remains to be present is low. However, it should be noted that archaeological survey techniques based on visual inspection cannot necessarily identify all sub-surface archaeological features, or detect wahi tapu and other sites of traditional significance to Māori, especially where these have no physical remains.

Figure 11: Photo taken from within the Baker Lane development, looking south-west over proposed Baker Lane alignment

Figure 12: Showing the general condition of the watercourses south of the Baker Lane alignment where the timber water retention feature/sluice CHI 18372 was recorded; looking north

Figure 13: Culvert observed at/near the recorded location of the timber water retention feature/sluice CHI 18372

Figure 14: Looking north-east along Dunlop Road alignment from within the farm at 2 Dunlop Road

Figure 15: Looking east over the general location of the proposed intersection of the extensions of Baker Lane and Dunlop Road

Figure 16: Looking west, showing the easternmost (Ngongetepara) stream that would be crossed by the E-W Project

Figure 17: Ngongetepara Stream

Figure 18: Looking south-east along the proposed N-S Project alignment, from near its junction with the proposed E-W Project

Figure 19: Looking east from the access road to 21-29 Red Hills Road, across the proposed alignment of the N-S Project

Figure 20: Looking north-west from the access road to 21-29 Red Hills Road, across the proposed alignment of the N-S Project

8 Assessment of Historic Heritage Effects

Chapter Summary

The construction of the Project will have no effects on any known archaeological or other historic heritage values. The recorded water retention feature at 60 Baker Lane is no longer present and was located beyond the extent of the proposed designation boundary. No other heritage sites had been recorded within or in the immediate vicinity of the Project area, and no archaeological or other historic heritage sites were identified during the field survey. The potential for unidentified subsurface archaeological remains to be exposed during Project works is low.

Any effects on archaeological or other historic heritage sites would be confined to the construction phase.

Archaeological features and remains can take the form of burnt and fire cracked stones, charcoal, rubbish heaps including shell, bone and/or 19th century glass and crockery, ditches, banks, pits, old building foundations, artefacts of Māori and early European origin or human burials.

The construction of the Project will have no effects on any known archaeological or other historic heritage values. No heritage sites had previously been recorded within or in the immediate vicinity of the Project area, with the exception of the water retention feature at 60 Baker Lane which is no longer present and which was located to the south of the proposed works. No archaeological or other historic heritage sites were identified during the field survey.

In any area where archaeological sites have been recorded in the general vicinity it is possible that unrecorded subsurface remains may be exposed during development. However, it is considered unlikely in this situation as the Project area is located some distance from the coast and navigable waterways, where Māori and early European archaeological sites tend to be concentrated, and the area has been farmland throughout the period of European ownership.

9 Mitigation

Chapter Summary

As the Project will have no effects on any known archaeological or other historic heritage sites, mitigation measures are not required.

The potential for unidentified subsurface archaeological remains to be exposed during construction is low, and can be appropriately managed under the AUP:OP Accidental Discovery Rule (**ADR**) (ED12.6.1), which should be adopted and included or referenced in the Construction Environmental Management Plan for the proposed designations.

An archaeological Authority (under the HNZPTA) will not be required for the Project as no known archaeological sites would be affected and the potential for unidentified sites to be present is low. However, an Authority could be sought as a precaution prior to construction to minimise any delays in the unlikely event that an unknown site is exposed. If an archaeological Authority is in place, the ADR would no longer apply in respect to archaeological sites.

There are no scheduled historic heritage sites located within the Project area. This assessment has established that the proposed designations will have no effect on any known archaeological or other historic heritage sites, and have little potential to affect unrecorded subsurface remains. Mitigation measures are therefore not required in respect to historic heritage.

9.1 Auckland Unitary Plan Operative in Part 2016

The very limited potential for unidentified archaeological remains to be exposed during construction is provided for under the AUP:OP ADR (E12.6.1), which should be adopted and included or referenced in the designation conditions. If suspected archaeological remains are exposed during future construction works, the ADR (E12.6.1) set out in the AUP:OP should be complied with. Under the ADR, works must cease within 20m of the discovery and Auckland Council, HNZPT, Mana Whenua and (in the case of human remains) New Zealand Police must be informed. The ADR would no longer apply in respect to archaeological sites if an Authority under the HNZPTA were in place.

9.2 Heritage New Zealand Act Pouhere Taonga 2014

An archaeological Authority will not be required for the Project as no known sites will be affected, and it is unlikely that any undetected sites are present. However, should any sites be exposed during construction the provisions of the HNZPTA must be complied with and an archaeological Authority would be required if modification of any archaeological sites is to occur.

If preferred for risk management purposes, an archaeological Authority could be sought as a precaution prior to construction to minimise construction disruption in the unlikely event an unknown site is exposed.

10 Recommendations and Conclusions

10.1 Recommendations

There should be no constraints on the Project on archaeological grounds, since no archaeological sites are known to be present and it is considered unlikely that any will be exposed during construction, nor are any other historic heritage sites present.

The AUP:OP ADR (E.12.6.1) should be adopted to provide for the very limited possibility that unrecorded archaeological remains may be exposed during construction, and should be included in the designation conditions. Under the ADR, if any subsurface archaeological evidence is unearthed during construction (e.g. intact shell midden, hangi, storage pits relating to Māori occupation, or cobbled floors, brick or stone foundation, and rubbish pits relating to 19th century European occupation), or if any human remains are exposed, work must cease within 20m of the discovery and Auckland Council, HNZPT, Mana Whenua and (in the case of human remains) the New Zealand Police must be notified. The relevant authorities will then determine the actions required.

If modification of an archaeological site does become necessary, an Authority must be applied for under section 44(a) of the HNZPTA and granted prior to any further work being carried out that will affect the site, noting that this is a legal requirement). Alternatively, consideration could be given to applying for an Authority in advance of earthworks as a precaution, to minimise delays in the unlikely event that archaeological sites are exposed by the Project.

Since archaeological survey cannot always detect sites of traditional significance to Māori, such as wāhi tapu, tangata whenua should be consulted regarding the possible existence of such sites within the Project area.

10.2 Conclusions

The proposed designations do not contain any previously recorded archaeological or other historic heritage sites and no such sites were identified during the field survey. The Project area is located some distance away from the main focus of Māori and early European settlement, which was along the coast and navigable waterways. The land has been used and modified for farming throughout the period of European ownership, and the Baker Lane area has recently been earthworked for subdivision development. Overall the potential for unidentified subsurface archaeological remains to be present and affected by construction is low, and the Project would have no known effects on archaeological or other historic heritage sites.

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Appendix 1. Recorded Historic Heritage Site Records (CHI)

Search results

Hide record   View record details

CHI Places Number:	18372
Data Entered by:	Natasha Barrett
Local Authority:	Waitakere City Council
NZAA Record Status:	Brief
Upgrade Exclusion:	None

Photograph and Map Filepaths:

ArcView Category:	Historic Structure
Site Type:	WOODEN HOLDING DAM/SLUICE?
Location:	60 Baker Lane | Don Buck road | State Highway 16 | SH 16 | Ngongetepara Stream | Massey | Waitakeres | Waitakere Ranges | Waitakere City Council
Description:	Located at 60 Baker Lane, near the corner of Don Buck road and SH 16. The sites is a Senegal tea site which is inspected occasionally by Greg Hoskins (Biosecurity Officer, ARC) so that he can treat any seedling plants which germinate. This is a wooden structure which appears to look like somre sort of water holding device (sluice?) Also present are what look to be wooden pilings. There are also reportedly other structures on the property. Greg noticed the structure in January 2001 when he started treating the pest plant and thought it looked like an old canoe buried in the stream bed. He returned to the site at the beginning of April and took the photos attached (18372_1 to 4). Graeme Murdoch noted the presence of the wandering jew plant in the photos indicates a settlement site. Grid reference estimated from aerials, property boundaries and course of stream.
Keywords:	DAM | NGONGETEPARA STREAM | PILINGS | SLUICE | WOODEN STRUCTURE
Grid Reference Source:	GIS Calculated
Metric Map Number:	R11
NZTM Easting:	1742583
NZTM Northing:	5923434
NZTM Map Sheet:	None
Metric Map Name:	None
Date Recorded:	01 Apr 2009
Reported By:	Greg Hoskings
Last Visited:	02 Apr 2009
State or Condition:	Appears to be reasonably stable apart from normal detoriation of wooden structures in water and possible farming threats.
Information Source:	Brief
NZHPT Registration Type:	None

Click on this link to view this cultural heritage site in the Auckland Council GIS Viewer

Suggest changes to this record

Search results

Hide record | View record details

CHI Places Number:	3388
WCC Computer Number:	243
Local Authority:	Waitakere City Council
Upgrade Exclusion:	None
Photograph and Map Filepaths:	
ArcView Category:	Historic Structure
Site Type:	BUILDING-DWELLING
Location:	17 Redhills Road | Swanson
Description:	bungalow two storeyed weatherboards, covered entrance portico gable roof, English cottage style, 6 pane casement windows, gable with low eave on one side
Legal Description:	Lot 2 DP 65390 BLKS IX X Waitemata SD
Grid Reference Source:	NZMS 260 Map Sheet
Metric Map Number:	R11
NZTM Easting:	1742488
NZTM Northing:	5922359
NZTM Map Sheet:	BA31
NZMG Easting:	2652926
NZMG Northing:	6484087
Metric Map Name:	None
Date Recorded:	15 12 93
Reported By:	Waitakere City Council
Owner:	Steele Anthony G & Stephanie R
Owners Address:	17-19 Red Hills Road
State or Condition:	good
NZHPT Registration Type:	None

Click on this link to view this cultural heritage site in the Auckland Council GIS Viewer

Suggest changes to this record

Search results

Hide record View record details

CHI Places Number:	3804
WCC Computer Number:	160
Date Record Updated:	28/08/2019 9:24:53 a.m.
Data Entered by:	Rachel Jenkins
Local Authority:	Waitakere City Council
District/Regional Plan Name:	Waitakere City Council District Plan Operative 2002
Listing Status in District/Regional Plan Scheduling:	Registered
Upgrade Exclusion:	None
Photograph and Map Filepaths:	
ArcView Category:	Historic Structure
Site Type:	BUILDING - POST OFFICE
Location:	399 Don Buck Road | Don Buck Road 399 | Massey | Triangle Road
Description:	Built in the 1930's, this is one of the oldest buildings in Massey. It adds a definite character to the area and is a community focal point. | Presently used by United Realty - real estate signs unsympathetic. Shop front with facade, gabled roof behind, white w.bd,
Keywords:	City of Waitemata District Scheme 1984 | CIVIC BUILDING | POST OFFICE | Proposed Auckland Unitary Plan | PROPOSED PLAN SCHEDULE | UP Schedule B | UPID00051
Notes:	Additional information by Anna Boyer 19/09/2011 | The site location was changed from 393-397 Don Buck Road to 399 Don Buck Road. The previous site address was incorrect. | Additional information by Rachel Jenkins (28/08/2019): This place was included in the City of Waitemata District Scheme 1984 Appendix D Register of Items of Special Interest, Category 1, item 12, class B.
Name:	Massey Post Office (former)
Legal Description:	SEC 1 SO 68814
Date of Construction:	1930s
Grid Reference Source:	GIS Calculated
Metric Map Number:	R11
NZTM Easting:	1742982
NZTM Northing:	5922272
NZTM Map Sheet:	BA31
NZMG Easting:	2653400
NZMG Northing:	6483960
Metric Map Name:	Auckland
Metric Map Edition:	Edition 1 1981
Date Recorded:	15/12/93 | 16/09/2011
Reported By:	Catherine Liang | Anna Boyer
State or Condition:	good verandah altered support
Information Source:	Scheme
NZHPT Registration Type:	None

ATTACHMENT 23

REDHILLS ARTERIAL TRANSPORT NETWORK
ASSESSMENT OF LANDSCAPE
AND VISUAL EFFECTS
PART 1 OF 3

Supporting Growth

Redhills Arterial Transport Network

Assessment of Landscape and Visual Effects

Version 1.0

August 2020

TE TUPU NGĀTAHI
Supporting Growth

WAKA KOTAHI
NZ TRANSPORT AGENCY

Document Status

Responsibility	Name
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Table 1: Glossary of Technical Terms / Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part 2016
HNC	High Natural Character
NoR	Notice of Requirement
ONC	Outstanding Natural Character
ONF	Outstanding Natural Feature
ONL	Outstanding Natural Landscape
RATN	Redhills Arterial Transport Network
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
TDM	Transport Design Manual
UDLMP	Urban Design and Landscape Management Plan
Waka Kotahi	Waka Kotahi NZ Transport Agency

Table 2: Glossary of Defined Terms

Term	Meaning
Auckland Council	Means the unitary authority for the Auckland Region.
Baseline Landscape (BL)	The landscape and visual character as it exists at the commencement of the assessment process – i.e. prior to the construction of the proposed development.
Change Management	Identification of ways to enhance the landscape and actions to avoid, remedy or mitigate adverse landscape effects.
Designation Boundary	The extent of the proposed NoR(s).
Future Receiving Landscape (FRL)	The landscape and visual character as a result of the future development proposed in the AUP:OP, including specific precinct plans relating to the Project Area. The FRL includes any existing baseline landscape elements (i.e. ONL's, protected vegetation, water ways, landform, sites and/or elements of cultural significance, and existing land-use scenarios) that are likely to endure following anticipated future development resulting from the likes of future zones, AUP:OP overlays and land development projects (planned and/or under construction).
Landscape	Is the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations[1].

[1] NZILA Landscape Assessment and Sustainable Management Practice Note 10.1.

Landscape Character	Is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects particular combinations of geology, landform, soils, hydrology, vegetation, land use and features of human settlement. These elements create a unique sense of place defining different areas of the landscape.
Landscape Effects	Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced. This may in turn affect the perceived value ascribed to the landscape.
Natural Character	The level of natural character (or naturalness) varies within each landscape/seascape and is the result of the combined levels of indigenous nature and perceived nature. These are typically defined by the extent to which natural elements, patterns and processes occur and are legible, and the nature and extent of human modification to the landscape and ecosystems.
Natural Character Effects	Natural character effects assessment is triggered by development proposed within the coastal environment, wetlands, lakes and rivers and their margins[2].
Permanent Effects (Operational Effects)	Describes the effects on the landscape of completed works (including integrated landscape mitigation measures), the significance of physical landscape change and ultimately the resulting effects of the Projects on landscape character, natural character and visual amenity for both public and private viewing audiences.
Redhills Arterial Transport Network (RATN (Project) or (Project Area)	Refers to the land being developed within the designation boundary. Includes the carriageway, batter slopes, intersections, bridging or culverting, landscape mitigation planting and street trees and construction laydown areas.
Study Area	Refers to the larger parcel of land identified as Redhills Precinct. The precinct is bordered by Red Hills Road along the western and southern boundaries, and by Don Buck Road and Henwood Road along the eastern and northern boundaries respectively.
Temporary Effects (Construction Effects)	Describes the anticipated impacts on the bio-physical elements and features of the landscape resource (landform, vegetation and hydrology) resulting from the construction of the Project. It also includes visual amenity effects for both public and private viewing audiences from construction works.
Visual Effects	Visual effects relate to the changes to amenity values of a landscape including the “natural and physical qualities and characteristics of an area that contribute to people’s appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes”[3].

[2] Resource Management Act 1991 and New Zealand Coastal Policy Statement 2010.

[3] Resource Management Act 1991.

1 Introduction

1.1 Background

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Supporting Growth Programme is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency (**Waka Kotahi**), to investigate, plan and deliver the transport networks needed to support Auckland's future urban growth areas over the next 30 years.

1.2 Purpose of this Report

The Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project** or the **RATN**). The NoRs under the Resource Management Act (**RMA**) are to designate land to enable the future construction, maintenance and operation of the Project.

This report provides an assessment of the landscape character, natural character and visual amenity effects associated with the construction, operation and maintenance of the Project. This assessment has been prepared to inform the Assessment of Environmental Effects (**AEE**) for the NoRs.

The key matters addressed in this report are as follows:

(a) Identify and describe the existing landscape character and visual amenity of the Project Area;

(b) Describe the actual and potential adverse physical landscape and visual amenity effects of construction of the Project;

(c) Describe the actual and potential adverse landscape character, natural character and visual amenity effects of operation of the Project;

(d) Recommend measures as appropriate to avoid, remedy or mitigate potential adverse landscape character, natural character and visual amenity effects (including any conditions/management plan required); and

(e) Present an overall conclusion of the level of potential adverse landscape character and visual amenity effects of the Project after recommended measures are implemented.

2 Project Description

The Project consists of two new arterial corridors through the Project Area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs:

Table 3: Redhills Notices of Requirement

Notice	Project	Description
NoR1	Redhills North-South Arterial Corridor	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.
NoR2a	Redhills East-West Arterial Corridor – Dunlop Road	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR2c) at the intersection with the Redhills North-South arterial corridor.
NoR2b	Redhills East-West Arterial Corridor – Baker Lane	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR2a).
NoR2c	Redhills East-West Arterial Corridor – Nixon Road connection	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road/Nelson Road/Nixon Road intersection, and the existing Nixon Road/Henwood Road intersection

To safely tie into the existing road network, the Project includes the upgrade of existing intersections where the new corridors will connect, as follows:

- Signalisation of the intersection at Don Buck Road and Royal Road (NoR 1);
- Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a);
- Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b); and
- A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Roads (NoR 2c).

The Project also provides for new stormwater wetlands for the treatment and attenuation of stormwater from the new corridors.

This report has primarily considered the Project Area as a whole. Where relevant, NoR 1 is referred to as the N-S Project, and NoR2a, NoR2b and NoR2c are collectively referred to as the E-W Project.

The Project has been split between four NoRs to reflect the likely implementation of the Project. It may also be possible for each designation to be delivered in stages as the Project Area develops.

An overview of the Project is provided in Figure 1. This design, along with the proposed designation boundary, is referred to as the Project Area throughout this report.

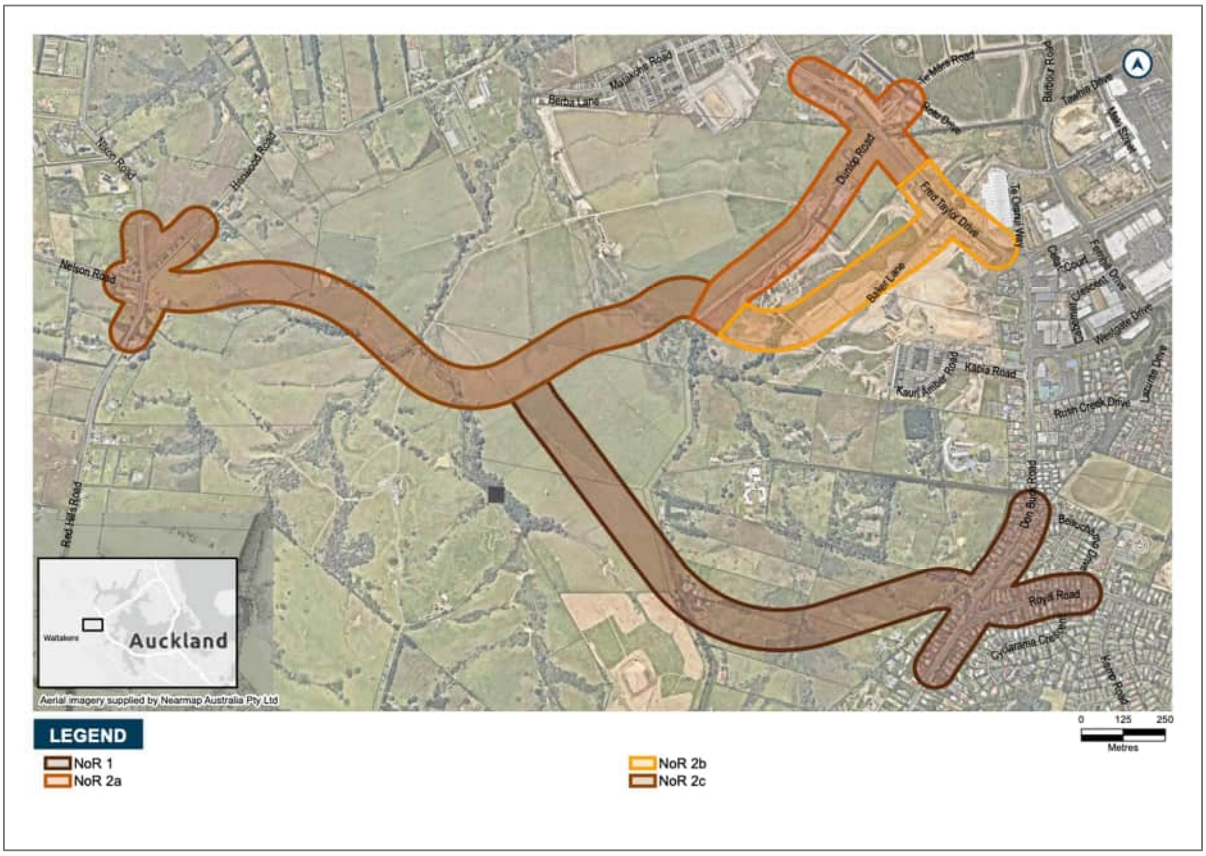


Figure 1: Redhills Arterial Transport Network

2.1 Project Features

The proposed NoRs are accompanied by an indicative alignment (package of works) to inform the proposed designation footprint and to assess an envelope of effects that includes operational and maintenance requirements, potential construction areas and areas required to mitigate effects. Through conditions on the proposed designations and future Outline Plan process, further design detail and assessment will be completed prior to construction.

The key matters addressed by this landscape character, natural character and visual effects assessment are as follows:

- The nature and extent of temporary physical landscape effects during the construction period of the Project with a specific focus on construction laydown areas, likely vegetation clearance, cut and fill slopes and potential bridge and/or culvert construction.
- The nature and extent of temporary physical impacts on private properties adjacent to the existing Don Buck Road and Royal Road corridors.
- Potential natural character effects on existing hydrological features and associated vegetation, in the location of the proposed bridge and culvert construction areas.
- The nature and scale of visual amenity effects on private and public viewing audiences, arising from the construction of the Project.
- The potential landscape character, natural character and visual amenity effects arising as a result of permanent landscape change, including how well the principle elements of the Project are likely to integrate into the future landscape.

- Consideration of future opportunities to integrate the Project with the proposed Blue-Green network.
- Mitigation measures to be included as conditions of the designation that will address the likely temporary and permanent landscape and visual effects arising from the construction and operation the Project.

2.2 Indicative Construction Methodology

An indicative construction methodology has been prepared to inform the assessment of the Project, and while subject to change, assists in determining the envelope of effects. An overview of the indicative construction methodology is set out in the AEE. A final construction methodology will be confirmed during detailed design phase and finalised once a contractor has been engaged for the work.

A summary of the key components of the indicative construction methodology are outlined below.

2.2.1 General Construction Overview

It is anticipated that the works will be broken down into separate construction stages based on the type of works required and the nature of the work environment. For the purposes of the assessment these anticipated stages are:

- **Stage 1**: Baker Lane from Fred Taylor Drive to the Dunlop Road intersection
- **Stage 2**: Dunlop Road from Fred Taylor Drive to the E-W Project intersection
- **Stage 3**: E-W Project from Dunlop Road intersection to Red Hills Road
- **Stage 4**: N-S Project from Don Buck Road to the E-W Project

It is expected the duration for each stage ranges from 1.5 years to 3 years.

2.2.1.1 Construction Methodology

Each zone has different construction activities depending on the type of work to be done and the surrounding environment. In all cases the general sequence of construction is likely to be:

1. Bulk earthworks over summer months
2. Divert or remove services
3. Construct permanent and temporary stormwater drainage and controls
4. Move traffic away from works longitudinally (on existing ‘live’ roads)
5. Construct earthworks and retaining structures and, if applicable, bridges
6. Construct new longitudinal drainage
7. Construct new pavement to half of the road
8. Move traffic onto newly constructed pavement (on existing ‘live’ roads)
9. Complete longitudinal drainage

10. Complete pavement and median
11. Move traffic to new alignment (on existing ‘live’ roads)
12. Complete footpath and cycleway

3 Assessment Criteria

3.1 Statutory Context

3.1.1 Notice of Requirement

This assessment has been prepared to support the NoR process for the Project. Section 171 of the RMA sets out the matters that must be considered by a territorial authority in making a recommendation on an NoR. This includes consideration of the actual or potential effects (including positive effects) on the environment of allowing the requirement.

No regional resource consents are currently being applied for. The necessary regional resource consents will be sought prior to construction of the corridors, at which time any regional consenting matters will be assessed.

3.1.2 Resource Management Act (RMA)

Section 6 of the RMA sets out matters of national importance which should be recognised and provided for. Section 6(a) requires the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers[4] and their margins, and the protection of them from inappropriate subdivision, use, and development. Section 6(b) requires the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development. Section 6(f) requires the protection of historic heritage from inappropriate subdivision, use and development.

Section 7 of the RMA sets out matters that decision makers shall have particular regard to, including section 7(c) the maintenance and enhancement of amenity values and section 7(f) the maintenance and enhancement of the quality of the environment. Section 8 requires that the principles of Tiriti o Waitangi (Treaty of Waitangi) are taken into account in relation to managing the use, development, and protection of natural and physical resources.

3.1.3 Auckland Unitary Plan Operative in Part (AUP:OP)

The Project is primarily on greenfield land which is zoned under the AUP:OP for:

- Residential - Terrace Housing and Apartment Buildings Zone
- Residential - Mixed Housing Urban Zone
- Residential - Mixed Housing Suburban Zone
- Residential - Single House Zone
- Business - Mixed Use Zone
- Business - Local Centre Zone
- Road Zone

The following overlays (Chapter D of the AUP:OP) apply to this assessment of landscape and visual effects for the Project:

- Natural Resources: D9 – Significant Ecological Areas

[4] A 'river' is defined in the RMA as a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse.

- Ridgeline Protection Overlay (Natural).

Auckland-wide zone objectives and policies will apply to the future resource consents required to implement the Project. They will also apply to future urban development of land adjacent to the Project, including the general Objectives and Policies included in Chapter E3 (Natural Resources), particularly E.3 Lakes, rivers, streams and wetlands (E3.2 and E3.3), and E15 Vegetation management and biodiversity (E15.2 and E15.3) which are relevant to an assessment of landscape, natural character and visual effects under the RMA.

3.1.4 Redhills Precinct Plan

Development of the land within the study area will be guided by the objectives and policies of the I610 Redhills Precinct. The objectives of the Redhills Precinct Plan having particular regard to landscape matters are[5]:

- Subdivision and development achieve a well-connected, adaptable, safe, attractive, healthy and pleasant environment for living and working with an emphasis on the importance of access to the public realm including parks, roads and the natural environment.
- A safe, efficient and integrated transport system is established within the Redhills Precinct that provides strategic roading connections, a choice of travel modes, encourages walking, cycling and use of public transport, and provides strong, legible connections to and through the precinct, whilst minimising crossings through natural features.
- The intrinsic character of the precinct and its location in proximity to the Northwest Wildlink is recognised and stream ecology and remnant vegetation is restored with opportunities created for natural wildlife corridors.
- Parks and open space corridors achieve an integrated, attractive and safe open space network across the precinct that integrates stormwater management, and ecological and recreational functions, while enhancing the amenity of cyclists and pedestrians who will have access through these open space areas.

3.2 Non-Statutory Guidance

3.2.1 Te Tupu Ngātahi Design Framework – Version 1.0

The Te Tupu Ngātahi Design Framework provides measurable guidance for outcomes-based decisions throughout each phase of the wider programme. The guidelines in the Te Tupu Ngātahi Design Framework set out the environmental, cultural and growth context for the Project and principles for implementation. Principles 1.1 through to 2.5 are of particular relevance to this landscape and visual assessment.

3.2.2 Transport Design Manual – Auckland Transport

The Transport Design Manual (**TDM**) has three sections that allow end user outcomes, engineering design and construction requirements to be clearly identified and designed. The Urban Street and Road Design Guide forms part of section 1 of the TDM and is of particular relevance to this landscape and visual assessment.

[5] 610 Redhills Precinct, 610.1 Description. Auckland Unitary Plan Operative in Part.

3.2.3 Bridging the Gap: Waka Kotahi NZ Transport Agency Urban Design Guidelines (2013)

While the Project is an AT project, Bridging the Gap provides relevant guidance for all transport projects. The guidelines set out 10 over-arching urban design principles, and guidance on specific elements of transport projects including bridges, retaining walls, earthworks, noise barriers, highway furniture, stormwater management devices, signalised junctions, roundabouts, tunnels, stopping places, landscape planting and public art[6].

The 10 urban design principles are outlined as follows:

- Designing for the context
- Integrating transport and land use
- Contributing to good urban form
- Integrating all modes of movement
- Supporting community cohesion
- Maintaining local connectivity
- Respecting cultural heritage values
- Designing with nature
- Creating a positive road user's experience
- Achieving a low maintenance design

3.2.4 New Zealand Transport Agency Landscape Guidelines (Final Draft, 2014)

Again, while the Project is an AT project, the guidelines provide relevant guidance for all road transport projects. The guidelines set out 10 over-arching landscape principles, and offer guidance related to policy, assessment methodology and landscape design requirements[7].

The 10 landscape principles are outlined as follows:

- A context sensitive and place based approach
- Facilitate green infrastructure and landscape integration
- Understand the physical conditions
- The right plant in the right place
- Promote biodiversity and build in resilience
- Champion low impact design
- Deliver a quality user experience
- Low maintenance and whole of life value

[6] https://www.nzta.govt.nz/assets/resources/bridging-the-gap/docs/bridging-the-gap.pdf

[7] https://www.nzta.govt.nz/assets/resources/nzta-landscape-guidelines/docs/nzta-landscape-guidelines-20140911.pdf

- Safety in design
- Facilitate community engagement and a collaborative approach

4 Assessment Methodology

Chapter Summary

This assessment was undertaken by a suitably qualified and experienced NZILA Registered Landscape Architect in accordance with the NZILA Landscape Assessment and Sustainable Management Practice Note 10.1, and also, with reference to nationally recognised guidance documents outlined in section 3 of this report.

The following section outlines the best-practice approach that has been undertaken to identify the landscape values and sensitivity of the Project Area and adjacent landscape. This methodology section provides explanatory notes and guidance so that each of the following sections remain concise.

4.1 Overview

The consideration of the sensitivity of a particular landscape or Project Area is based on the identification of landscape character and an evaluation of the landscape values therein, including regionally significant values such as: Significant Ecological Areas (**SEA**s), Outstanding Natural Landscapes (**ONL**s), Outstanding Natural Features (**ONF**s) and areas of High or Outstanding Natural Character (**HNC** or **ONC**). Landscape character is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects particular combinations of geology, landform, soils, vegetation, land use and features of human settlement. These elements create a unique sense of place defining different areas of the landscape.

A landscape that exhibits a 'high' degree of sensitivity will likely be highly susceptible or vulnerable to potential adverse effects associated with landscape change. Conversely a landscape or site that exhibits a 'low' degree of sensitivity will have more capacity to absorb change without significantly impacting upon existing landscape character and values within a site or broader contextual setting.

Change in a landscape does not, of itself, necessarily constitute an adverse landscape or visual effect. Landscape is dynamic and is constantly changing over time in both subtle and more dramatic transformational ways. These changes are both natural and human induced. Within the context of continual landscape change, is the importance of managing human induced change so that significant adverse effects are avoided or sufficiently mitigated to reduce the effects of the change in land use. Furthermore, landscape and visual effects can be temporary or permanent and that also contributes to the significance of landscape and visual effects.

In many cases, landscape change can bring about improvements to the quality of the existing environment. Therefore, the nature and significance of landscape and visual effects generated by any particular project can be:

- Positive (beneficial), contributing to the visual character and quality of the environment;
- Negative (adverse), detracting from the existing character and quality of the environment; or
- Neutral (benign), with essentially no effects on existing character or quality of the environment.

4.1.1 Scale of Effects

In determining the magnitude of potential and actual landscape and visual effects of the Project, a consistent 7-point rating scale has been used. The rating scale is symmetrical around 'moderate' and is based on the recommended NZILA Best Practice Guide. The following descriptions are provided which consider both NZILA and Waka Kotahi guidance documents.

7-point rating scale

- Effects that are **very low** are barely discernible. Mitigation is generally not required and in planning terms they are negligible;
- Effects that are **low** are discernible but where they do exist, they are likely too small to generate adverse effects either on their own or cumulatively. Additional mitigation is not required and in planning terms the landscape effects are considered to be less than minor;
- Effects that are **moderate-low** are discernible and where they do exist, they have the potential to generate adverse effects either on their own or cumulatively. Additional mitigation may be required and in planning terms the landscape effects are considered to be minor;
- Effects that are **moderate** are discernible, without being significant on their own. There is the potential for cumulative effects to be more significant, but they can generally be mitigated to an appropriate level. In landscape and visual terms, moderate effects may be acceptable provided an appropriate design/ mitigation response has been adopted. In planning terms moderate landscape effects are more than minor;
- Effects that are **moderate-high** are discernible and have the potential to be significant on their own. There is the potential for cumulative effects to be more significant however there is potential for additional mitigation measures to reduce effects to a lower degree. In planning terms moderate-high landscape effects are more than minor;
- Effects that are **high** are significant on their own and are likely to increase in a cumulative sense. In general, a high degree of effect may represent an unacceptable outcome in landscape and/or visual terms however, there may be potential for additional mitigation measures to reduce effects to a lower degree although these measures will need to be substantial. In planning terms, high effects would be more than minor and considered 'significant' in landscape and visual terms; and
- Effects that are **very high** are significant and in relation to landscape effects, additional mitigation is unlikely to reduce the degree of effect to any discernible degree. In planning terms, very high effects are more than minor and likely to be unacceptable in landscape and visual terms.

4.2 Methodology Breakdown

The methodology that forms the basis for the assessment is set out below:

- Identification of relevant statutory provisions and non-statutory guidance relating to landscape.
- Analysis and description of existing landscape elements, features and character of the existing 'Baseline Landscape'.
- Analysis and description of the landscape elements, features and character of the 'Future Receiving Landscape'.
- Analysis and description of perceptual, sensory and associative qualities of the Project Area and the identification of the viewing audience and visual catchment.

- Summary of landscape values, including inputs from other specialists such as ecology, arboriculture and heritage.
- Evaluation of the sensitivity of the landscape to landscape change arising from transport infrastructure upgrades.
- Analysis and description of the Project including construction methodology and timeline.
- Identification of the principle elements of the Project (effects generators) likely to result in landscape, natural character and visual effects.
- Identification of temporary (construction) vs permanent (operational) effects of the Project.
- Identification of general and targeted mitigation measures to respond to and reduce the magnitude of likely effects.
- Assessment of effects (adverse, neutral and/or positive) on the bio-physical aspects of the landscape resource, landscape character, natural character and visual amenity, taking account of the proposed mitigation measures.
- Summary of the overall landscape and visual effects of the Project and a determination of the significance of landscape effects.

4.3 Landscape Analysis

The landscape analysis that forms the basis for the assessment is derived from the following data collection and field work:

- Online data collection of aerial maps and AUP:OP/GIS overlays (including, but not limited to: SEA's, ONL's, ONF's, ONC, HNC and Land Cover Data Base, zones and catchments and hydrology);
- Desktop analysis of roading corridors, urban areas / future urban areas utilising Google Street View;
- Escorted specialist team visits to the Project Area; and
- Independent site visits to the Project Area to undertake on-site landscape and visual assessment and to undertake indicative public viewpoint photography.

4.4 Landscape Values

In the absence of any scheduled high value landscape areas (ONL, ONF, HNC and ONC) at a national, regional or district level within or adjacent to the Project Area, a summary is provided of local values. Local values generally consider three broad categories including: geographic, perceptual and associative values.[8]

[8] Landscape Guideline: Appendix 1: NZTA Landscape and Visual Assessment Guidelines

4.5 Landscape Sensitivity

The interface between the land and water (riparian margins) is particularly sensitive to landscape change and under Part 2 of the RMA (section 6(a)), the natural character of such features is to be preserved.

Other landscape character forming attributes may also be sensitive to the effects of landscape change such as topographical and landform features, vegetation (notable trees or patterns of contiguous land cover) and views afforded to noteworthy landmarks and/or landscape features within the contextual landscape.

4.6 Landscape Effects

Landscape effects derive from changes in the physical landscape, which may give rise to changes in its character and how this is experienced over time. This may in turn affect the perceived value ascribed to the landscape.

Landscape effects in this assessment relate to the following landscape attributes:

- Biophysical - Abiotic: Geophysical processes (Landform) and drainage patterns and processes.
- Biophysical – Biotic: Vegetation type (native / endemic and exotic vegetation) and vegetation cover and patterns (quality of vegetation and evident relationship to landform, climate, mature historic land use and ecological factors).
- Human attributes: Land uses / activities / buildings and structures and recreational areas.

Landscape and visual effects are assessed in two parts as outlined below; firstly, through the construction period where the bio-physical and human attributes the Project Area are required to be modified to implement the Project. Landscape and visual effects during the construction phase are generally considered to be temporary and dynamic in nature and may temporarily be heightened by the intervention of heavy machinery and the use of construction service areas. In the second part (operational phase), the overall significance and value of landscape and visual change is explored and ultimately the Project's impact on landscape character, natural character and visual amenity is assessed.

Temporary Effects (Construction Effects): Describes the anticipated impacts on the bio-physical elements and features of the landscape resource (landform, vegetation and hydrology) resulting from the construction of the Project. It also includes how these aspects translate into visual amenity effects for both public and private viewing audiences.

Permanent Effects (Operational Effects): Describes the completed works (including integrated landscape mitigation measures), the significance of physical landscape change and ultimately the resulting effects on landscape character, natural character and visual amenity for both public and private viewing audiences.

4.6.1 Natural Character Effects

Section 6(a) of the RMA requires the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers[9] and their margins, and the protection of them from inappropriate subdivision, use, and development. The natural character assessment for this Project applies to the waterbodies associated with Waiteputa Stream, Red Hill Stream and Ngongetepara Stream, outside of the coastal environment.

Assessing existing natural character is primarily concerned with the degree to which natural processes, natural patterns and natural elements have undergone human modification. Ecological survey and assessment for the Project Area generally underpin the landscape evaluation of existing natural character values.

4.7 Visual Effects

Visual effects relate to the changes that arise in the composition of available views as a result of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity. Visual effects are considered for both temporary (construction effects) and permanent effects (operational effects).

Potential effects considered in this assessment relate to the following visual amenity attributes:

- Visual quality and composition (legibility, coherence, setting, scenic quality)
- Visibility (extent of visibility to and from the Project Area)
- Views (viewing audience and views afforded to and from the Project Area)

The nature and magnitude of the visual effect can be influenced by a number of factors such as:

- The extent to which the Project Area is visible;
- Legibility and whether there are intervening elements in the landscape that restrict views towards the road corridor;
- Whether or not aspects of the Project appear 'at odds' with existing landscape character and composition;
- Distance between the viewer and the Project Area;
- The nature of the viewing audience, numbers and extent of the visual catchment.

4.7.1 Viewpoint Locations

For the purposes of this assessment, the visual effects of the Project have been assessed from 26 representative vantage points from within the Project Area and surrounding landscape. Refer to Appendix 3: Landscape Plans and Images: Map 16.

[9] A 'river' is defined in the RMA as a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse.

All viewpoint locations were visited, photographed and assessed in variable-fine weather conditions between November 2019 and January 2020. The viewpoints have been photographed at standing eye level, in portrait view with a digital SLR camera with a 50mm (and 30mm) lens.

4.8 Change Management

Change management is the process of identifying ways and opportunities to ensure and enable sustainable landscape management within the existing and future landscape[10]. The Project has been through the SGA MCA route selection process during which landscape and visual effects were tested and any significant effects avoided or 'designed-out' of the Project in line with specialist landscape input at the time. On that basis, the landscape mitigation measures proposed below in Section 7 deal with the localised effects likely to result from a series of 'effects generators' (construction activities) required to implement the Project, as well as any potential landscape and visual effects arising from the operational phase of the Project.

Design refinements through the detailed design phase can further minimise potential landscape and visual effects. These opportunities are also outlined below in Section 7 of this report.

4.9 Limitations

There are several crossovers with related specialities including arboriculture, ecology, historic heritage, flooding and urban design. This report references the latest data available in respect of these matters at the time of issue.

All site assessments have been undertaken from public and private land (where accessible) and supported through detailed desktop GIS mapping and aerial photograph information.

4.10 Project Assumptions

The findings of this landscape and visual assessment are underpinned by the following assumptions for the Project:

- The proposed designation boundary is sufficient to allow for flexibility in the detailed design stages of the Project.
- Any proposed stormwater wetlands, as identified on the engineering plans, will be suitably planted in native species as part of the Project works.
- Parts of the Project may be constructed by private developers as part of the continued urbanisation of the Project Area. This is likely to be achieved via a series of adjoining masterplans for the balance land.

[10] Sustainable Landscape Management recognises and protects the distinctive, representative or typical attributes that define landscape character and values, through the process of integrated assessment, planning and design to meet the needs of both present and future generations. NZILA Best Practice Note, 10.1.

5 Receiving Environment

Chapter Summary

Redhills is located in West Auckland, approximately 18km northwest of Auckland's CBD. The Redhills Precinct area is situated directly west of Massey and Westgate residential and commercial hubs and is bounded by Don Buck Road and Fred Taylor Drive to the east and Red Hills Road to the west. Refer to Appendix 2: Landscape Plans and Images: Maps 01 – 06.

The receiving environment is outlined in the following sections in two parts. Firstly, the existing baseline landscape is described which includes all existing biophysical landscape features and human attributes that contribute to the existing landscape character and visual amenity of the Project Area. The baseline landscape also comprises sections of the Project Area where urbanisation is imminent or already underway. A handful of developments (consented, in process or in early construction), form the basis of a dynamic and rapidly changing landscape context. These include but are not limited to:

- Malbec housing development (80 Fred Taylor Drive), within the northern extent of the Project Area. The eastern tributaries of Ngongetepara Stream have been incorporated into an urban stormwater design with riparian planting.
- 1 Dunlop Road – proposed Raphoe masterplan with bulk earthworks underway.
- A potential residential subdivision in the vicinity of the N-S Project and Don Buck Road.
- A potential residential subdivision off Redhills Road within the south-east extent of the Project Area, proximate to the proposed N-S Project.
- A potential larger comprehensive development plan situated around the intersection of the proposed N-S Project and E-W Project, comprising community services and a range of housing typologies alongside open space reserves associated with tributaries of the Ngongetepara Stream.

The future receiving landscape is described in the context of the AUP:OP zone provisions and the Redhills Precinct Plan 1 which indicates a basic urban framework (arterial network and green infrastructure) for the Project Area. The future receiving landscape also considers various plan change applications known to influence the Project Area, that are at various stages of the planning process. The latter are not referenced explicitly within this landscape assessment but acknowledged as contributing to the dynamic and evolving landscape context.

The Project Area is largely rural in character with a strong underlying natural landscape pattern dominated by an amphitheatre landform, rolling topography and a network of riparian corridors and associated overland flow paths. While there are tracts of native and exotic vegetation distributed through central and southern areas of the Project Area, open pasture is the most prevalent land cover within the notably undulating hill country.

There is a notable level of modification in the landscape which includes: an existing 110kV transmission line running in a north-west to south-east direction through the centre of the Project Area; re-shaping and re-alignment of natural watercourses and native vegetation removal to accommodate rural land use.

The contextual landscape exhibits the typical land use qualities of a peri-urban landscape, defined at the edges by an ever-increasing presence of urban development. Given the notable modification of the Project Area and localised landscape, the Project Area is considered to have low sensitivity to landscape change.

5.1 Approach to Receiving Environment

A key objective of the Project is to protect land now to ensure that the transport networks required to support growth areas in the future can be provided in an efficient and co-ordinated manner.

It is anticipated that unless urbanisation occurs (or is at least confirmed to occur), the transport corridor will not be constructed. As such, any effects associated with the construction or operation of the transport corridor will not eventuate in the environment as it exists today but in a future receiving environment that has or will imminently be urbanised.

In the context of the RMA assessment process, considering the environment as it exists today will not be a true reflection of the ‘real-world’ environment in which the transport corridor will be constructed and will operate. Accordingly, when considering the context within which the effects of the construction and operation of the transport corridor are likely to occur, this assessment addresses the anticipated environment at the time the Project is likely to be constructed.

The following outlines the key elements of the planning context for the Project:

- The Project is on greenfield land which is zoned under the AUP:OP for:
    - Residential-Single House Zone
    - Residential-Mixed Housing Suburban Zone
    - Residential-Mixed Housing Urban Zone
    - Residential-Terrace Housing and Apartment Buildings Zone
    - Business-Local Centre Zone.
- The Redhills Precinct includes an indicative arterial network (specified in ‘I610.10.1. Redhills Precinct: Precinct Plan 1’).
- AT is the requiring authority for designations along Fred Taylor Drive which provide for road widening to enable an approximately 30m wide corridor between Don Buck and Brigham Creek intersections.

The AUP:OP zoning (illustrated below) provides the future urban context in which the corridors will operate.

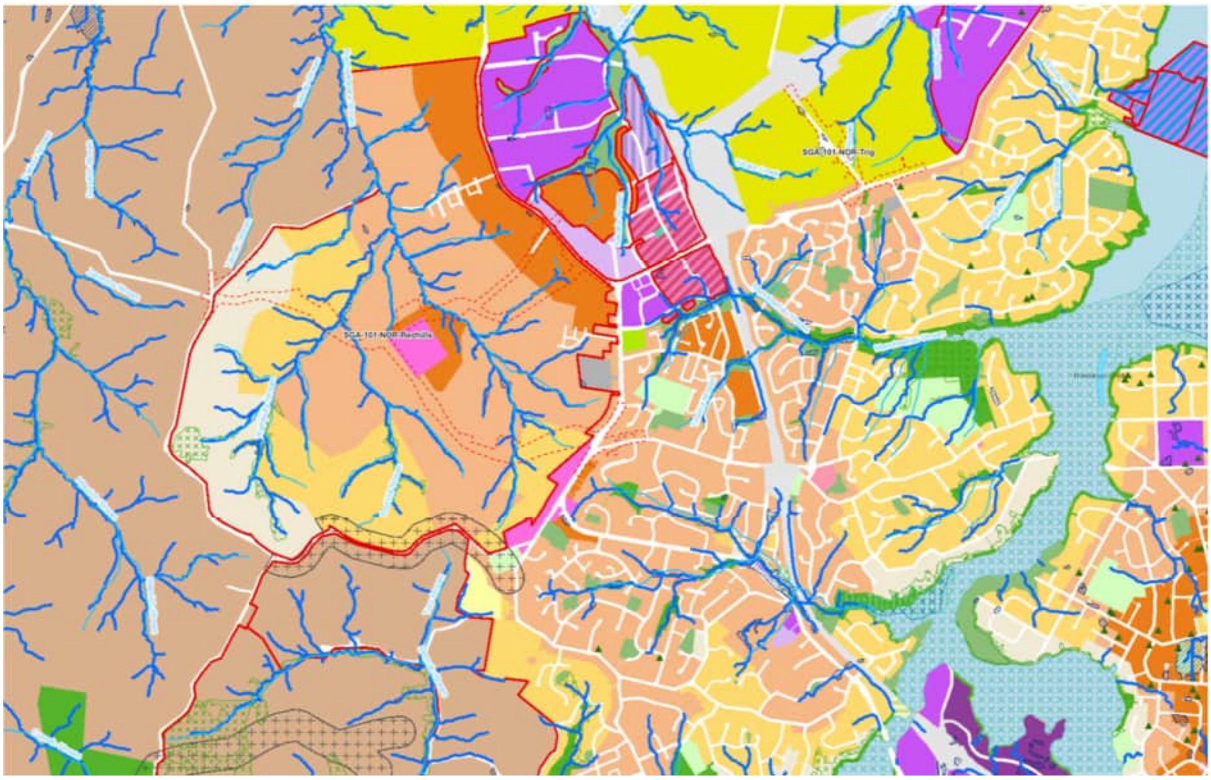


Figure 2: AUP:OP Zones and Overlays – Redhills Precinct and Contextual Landscape[11]

[11] Auckland Council GIS Database.

Table 4 sets out the likely receiving environment of the Project Area based on operative zoning provisions. This signals a high probability of land use change over time from the currently rural character of the area these scenarios have been used to inform the assessment.

Table 4: Redhills Arterial Transport Network receiving land use environment

Redhills Arterial Transport Network receiving environment	
Residential – Single House Zone	• Maintain and enhance amenity values of established neighbourhoods • ‘Generally characterised by one to two storey buildings with multi-unit development not anticipated’
Residential – Mixed Housing Suburban Zone	• ‘Largely characterised by one and two storey, mainly standalone buildings with boundary setbacks and landscaped gardens’, however ‘enables intensification through attached two storey housing in a variety of types and sizes’
Residential – Mixed Housing Urban Zone	• ‘Reasonably high-intensity zone enabling greater intensity of development than previously provided for’ • Development ‘typically up to three storeys in a variety of sizes and forms including detached dwellings, terraced housing and low-rise apartments’
Residential – Terraced Housing and Apartment Building Zone	• ‘A high-intensity zone…providing for urban residential living in the form of terraced housing and apartments…with the greatest density, height and scale of development of all the residential zones’ • Buildings enabled up to five, six or seven storeys • ‘Predominantly located around metropolitan, town and local centre zones and the public transport network’, also providing for a range of non-residential activities within an ‘urban residential character’
Business – Local Centre Zone	• ‘Generally located in areas of good public transport’ • ‘Primarily provides for local convenience needs of surrounding residential areas, including local retail, commercial services, offices, food and beverage, and appropriately scaled supermarkets’

5.2 Baseline Landscape

This assessment refers to the Project Area (covering the proposed designation) and the localised landscape of the Project Area, which includes approximately 600ha of zoned land.

The defining characteristics of the Project Area are summarised below:

- The land within the Project Area is ‘greenfield’ and predominantly rural in character with the exception of the lower northern portion bordering Fred Taylor Drive where urban development is underway.
- The underlying landform and associated hydrological patterns of the study area are strong landscape character forming elements that, if appropriately managed, have the potential to generate long-term landscape and natural character value into the future.
- Further afield, the contextual landscape is best described as a transitional landscape exhibiting an eclectic range of rural, residential and commercial activities located in close proximity. This is clearly driven by the development and urban growth that is occurring around the edges of the study area.

The existing landscape features of the Project Area are illustrated in Appendix 2**:** Landscape Plans and Images: Maps 01 – 06.

5.2.1 Landform and Hydrology

- The study area is an amphitheatre shape, rising 100m above sea level to the south and lowering to just under 25m above sea level to the north. It enjoys a northerly aspect.
- Red Hills Road traverses the prominent ridgeline along the western and southern perimeter of the study area and connects with Don Buck Road along the eastern fringe to create a bowl-shape that is accessible along the entire perimeter.
- The rolling landform is intersected by 3 streams: Waiteputa Stream, Red Hill Stream and Ngongetepara Stream and further defined by the main tributaries and overland flow paths associated with each stream.
- Within the extensive hydrological patterns are several areas classified by ecological assessment as wetlands, although according to the ecological assessment, they are all highly modified and dominated by exotic wetland species.
- The three separate watercourses culminate at the northern edge of the Project Area at Ngongetepara Stream which ultimately drains north into Brigham Creek.
- The landform and hydrological corridors within the lower north and north-eastern sections of the Project Area have been modified to accommodate urban and residential development adjacent to Fred Taylor Drive.

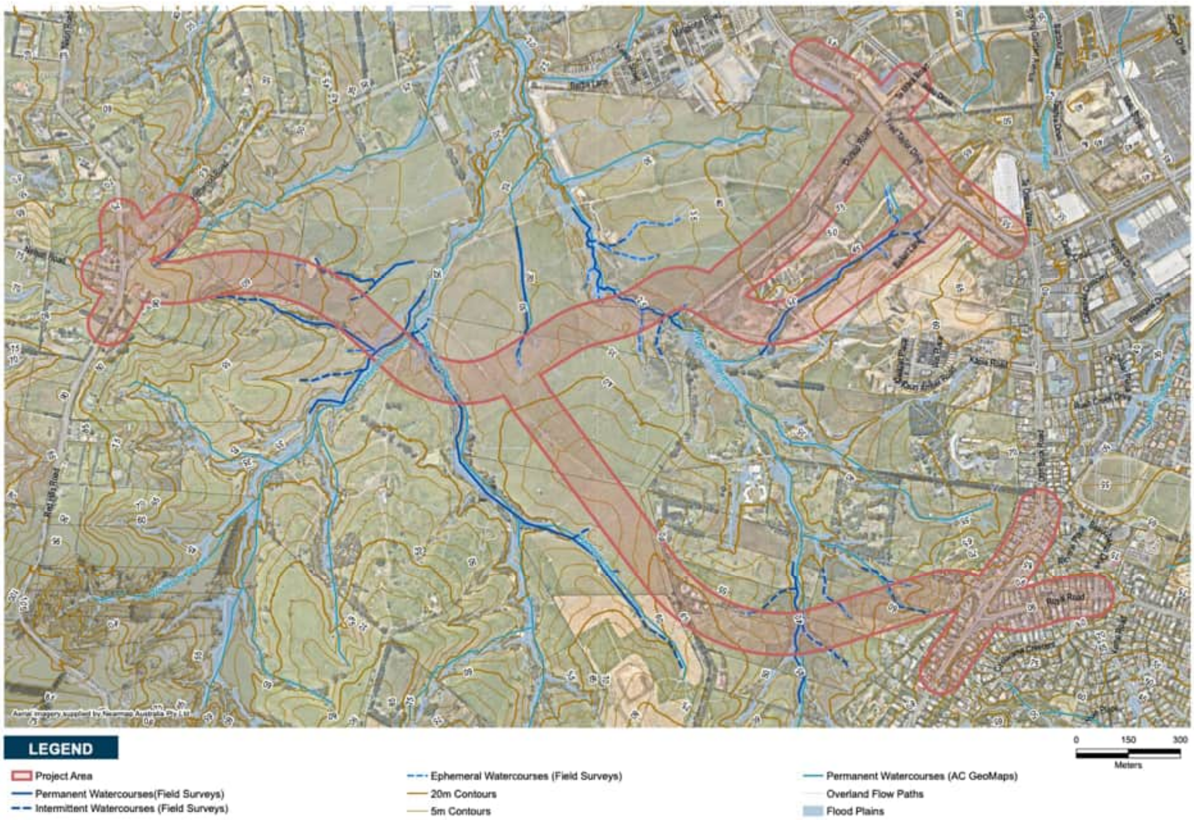


Figure 3: Existing Hydrological Features in relation to Project Areas (SGA graphic)

5.2.2 Land Cover

- The pastoral landscape within the study area largely consists of open pasture, exotic grass, shelter belt plantings, exotic trees and limited areas of native vegetation, interspersed with exotic trees.
- Existing vegetation within the NoR1 Project Area includes residential gardens through Royal Road and Don Buck Road, exotic tree land (including *pinus radiata*), exotic shrub and planted amenity gardens associated with rural residential properties through Red Hills Road.
- Existing vegetation within the NoR2b Project Area includes exotic wetland, interspersed with native and exotic shrubs and trees.
- Existing vegetation within the NoR2c Project Area includes exotic wetland, shrubs and trees, interspersed with native shrubs and trees.
- Residential gardens and shelter belt plantings are concentrated in the south-eastern quarter of the study area to the east of the Red Hills Road laneway.
- According to ecological survey, low value riparian vegetation and indigenous and exotic forest habitat within and directly adjacent to the Project Area are likely to serve as commuting corridors for long-tailed bats.

5.2.3 Land Use

- The study area consists of a range of rural residential properties, larger lifestyle blocks and a larger farming operation owned by a developer[12].
- Rural residential and lifestyle blocks are focussed within the eastern extent of the study area, off Red Hills Road.
- Other rural residential properties line the southern and western boundaries of the study area taking advantage of the elevated ridgeline and access afforded by Red Hills Road.
- St Paul's Primary School and Westbridge Residential School are located halfway along Don Buck Road.
- A commercial and retail strip is located at the Red Hills Road and Don Buck Road intersection, which includes a take away shop, bakery, petrol station, General Practitioners clinic and a pet grooming centre.
- The lower northern section of the study area, bordering Fred Taylor Drive, is currently undergoing urban development.

[12] Redhills Urban Design Statement, section 2. July 2020

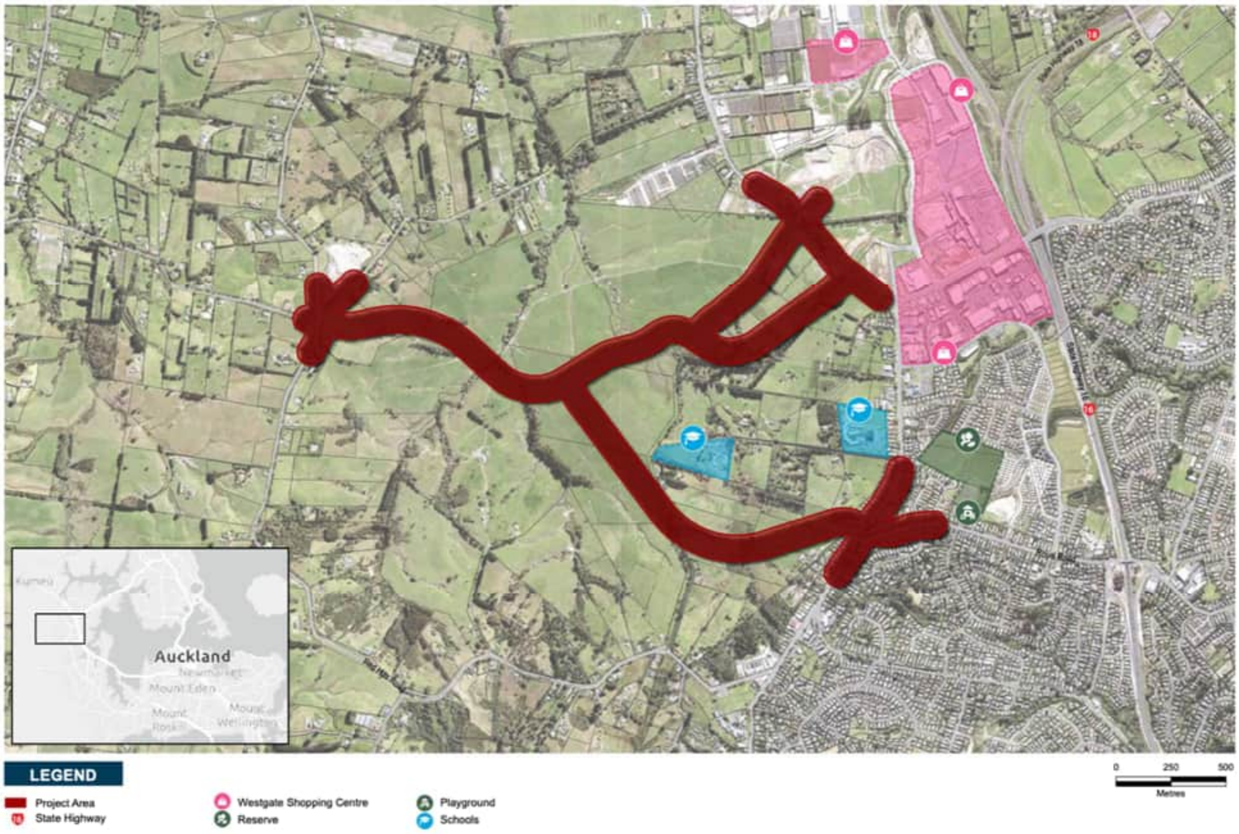


Figure 4: Existing Land Use Features in relation to Project Areas (SGA graphic)

5.2.4 Scheduled Landscape and Ecological Features

The study area features three SEA areas within the southern elevated boundary, outside of the Project Area. The southern boundary of the study area, between Sunnyvale Road and Don Buck Road is subject to the AUP:OP Ridgeline Protection Overlay. Refer to Appendix 2: Landscape Plans and Images: Map 05.

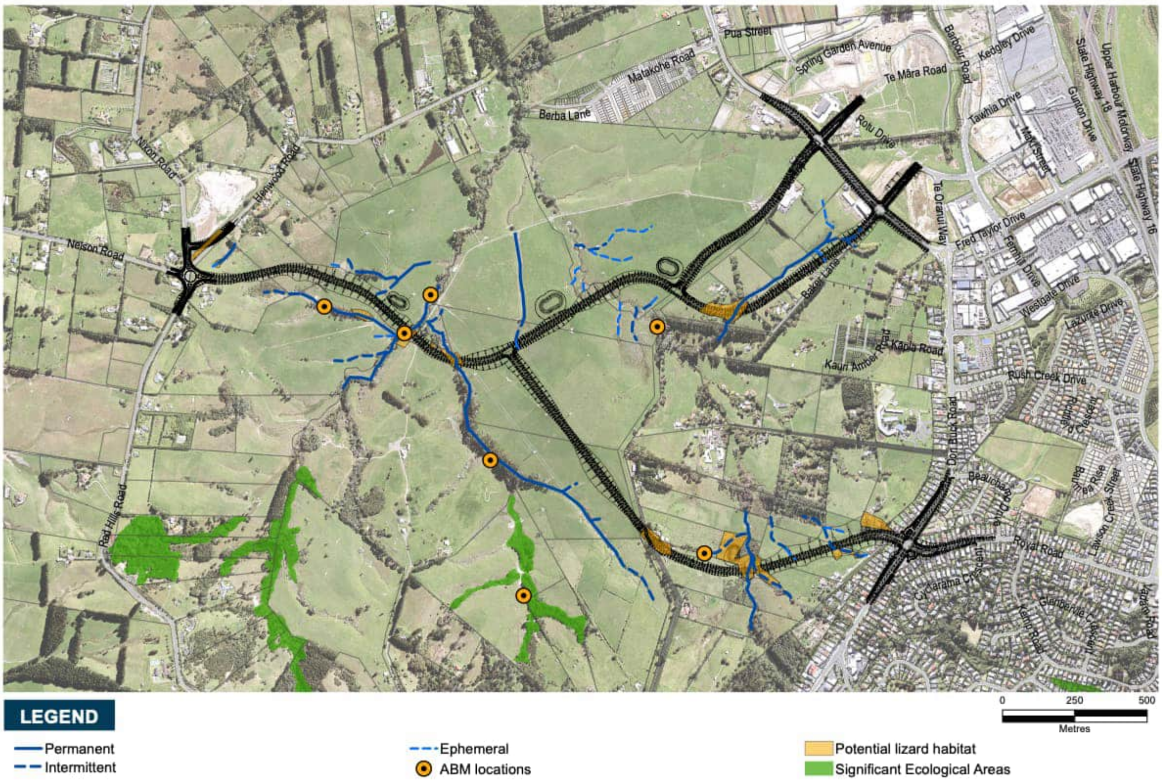


Figure 5: Ecological Features in Relation to Project Areas (SGA graphic)

5.3 Future Receiving Landscape

5.3.1 Overview

The land adjacent to the Project Area is expected to undergo a significant change from rural to urban land use and character within the foreseeable future. It's anticipated that some of the defining abiotic features and patterns of the landscape will endure if not define the pattern of urban development within the remaining greenfield areas of the Project Area. Defining landscape features include the riparian and modified wetland environments associated with Waiteputa Stream, Red Hill Stream and Ngongetepara Stream. Scheduled features such as the SEAs identified in Figure 5 above and the landscape character forming amphitheatre landform also have a high probability of featuring within the future urban landscape.

Conversely, it's expected that some of the less defining biotic (land cover) features of the landscape will undergo significant change alongside future development through the likely implementation of street tree plantings, public open space design and general landscaping within the private yards of future housing development.

The quality and natural character values of riparian and wetland environments are generally anticipated to be retained and, in some instances, enhanced as urban development progresses, in accordance with the policy direction of Chapter E3 of the AUP:OP which generally seeks to protect and enhance these landscape features.

5.3.2 Redhills Precinct Plan

The Redhills Precinct Plan anticipates high quality residential development and includes provision for a Green Road circuit that will provide a high amenity cycle and pedestrian route, connecting recreational spaces such as parks and stream corridors, and connections to commuter cycling routes. There is a strong emphasis on achieving an integrated and attractive open space network across the precinct that integrates stormwater management, ecological and recreational functions (refer to Appendix 2: Landscape Plans and Images: Map 05).

The key assumptions for the Future Receiving Landscape include:

- Considerable shift from rural character to urban.
- Focus on high quality open space connections and ecological outcomes.
- Overarching landform preserved through the alignment of arterial routes. Indicative collector road and Redhills Green Road proposed to generally follow existing contour which will maintain landform structure.
- Emphasis on open space networks across the precinct integrated with stormwater management, and ecological and recreational functions.

5.4 Viewing Context

The viewing audience consists of private landowners within the Redhills Precinct, adjacent to the Project Area and the transient viewing audience (i.e. vehicles travelling at 50km/h) along Red Hills Road, Don Buck Road and Fred Taylor Drive. Intermittent views may also be afforded from intersecting roads such as Royal Road, Matakohe Road, Nelson Road, Nixon Road, Henwood Road,

Over time, the viewing audience is expected to include residents and visitors of future urban developments within the Redhills Precinct as sections of the RATN are delivered simultaneously with urban development.

The key characteristics of the viewing context are outlined below:

- The underlying landform of the study area creates a north facing amphitheatre that is visually accessible from a range of vantage points along the elevated roads that border it to the west, south and east.
- Public vantage points offering the most expansive views over the Project are afforded along the southern boundary along Red Hills Road.
- Views from inside the study are afforded through the interior and are readily available from pastoral areas and rural residential properties. It's generally accepted that these vantage points will remain yet the extent and clarity of views towards the Project Area will change over time with ongoing development.
- Sensitive receivers for the Project exist within the eastern portion of the precinct from Red Hills Road, Westridge Residential, St Paul's Primary School and existing residents within the Royal Road and Don Buck Road catchment.
- Rural residential and lifestyle properties located along the Redhills Road ridge have superior views over the wider study area.

5.5 Landscape Values

There are no regionally or nationally significant landscapes (ONLs, ONFs or ONCs) within or immediately adjacent to the proposed designation boundary.

The highest landscape values are attributed to the three stream corridors and the limited fragments of indigenous vegetation associated with the blue-green areas of the Project Area. The SEA areas identified within the elevated southwestern extent of the Project Area also contribute to heightened landscape character values within local landscape.

Notable value is given to the overarching landform that shapes the Project Area and underlies the drainage patterns of the Project Area. The amphitheatre landform also provides north-facing aspect for the future urban neighbourhoods.

When considering the Baseline Landscape, there are a range of existing landscape qualities that come together that can be described as being picturesque and providing aesthetic value within the viewing catchment. These qualities include the landform and hydrological patterns mentioned above as well as the open ‘rural’ character of the balance of the study area, both of which contribute to the perceived undeveloped, rural character of the Project Area.

5.6 Landscape Sensitivity

Areas of the Baseline Landscape are sensitive to landscape change on the basis of the existing rural character and perceived visual amenity that is afforded to existing properties within the Redhills Precinct. This is particularly the case for properties within the elevated southern and eastern extents where superior views can be obtained over the currently undeveloped interior of the Redhills Precinct.

However, as a whole, the landscape sensitivity of the Redhills Precinct is moderated by the heavy landscape modification that has occurred as a result of rural land use and the obvious signs of urban development within the northern extents between Baker Lane and Dunlop Road. Landscape sensitivity to land use change is further moderated by the policy direction of the AUP:OP zones and decisions passed through the Unitary Plan Independent Hearings Panel where it was decided that the Redhills land is suitable for urban development.

Furthermore, it is noted that many of the sensitive hydrological features within the Project Area exist within a state of degradation, with unrestricted stock access to waterbodies and the limited native vegetation that exists. On that basis, it is considered that land use change (urbanisation) is likely to deliver some form of enhancement to the blue-green aspects of the landscape whereby works within riparian areas will trigger the regional consenting mechanisms that require protection and enhancement of riparian areas. Native planting delivered through street tree planting, open space design and private yard amenity planting is also likely to improve the general quality of the landscape within the existing peri-urban setting.

6 Assessment of Landscape and Visual Effects

Chapter Summary

This section identifies the principle elements of the Project that have the potential to impact on landscape as a physical resource and ultimately change the landscape character, natural character and visual amenity of the Project Area and local landscape.

Landscape and visual effects are assessed in two parts; firstly, through the construction period where the bio-physical and human attributes of the Project Area are required to be modified to implement the Project. Landscape and visual effects during the construction phase are generally considered to be temporary and dynamic in nature and may temporarily be heightened by the intervention of heavy machinery and the use of construction service areas. In the second part (operational phase), the significance and value of landscape and visual change is explored and ultimately the Project's impact on landscape character, natural character and visual amenity is assessed.

Overall, the temporary **physical landscape effects** resulting from the **construction** phase are assessed as **low** to **moderate-low** and **moderate-low** in relation to private properties, taking into account the proposed mitigation outlined in section 6.1.6.

Adverse **visual effects** for public viewing audiences is likely to be **low** to **moderate-low** for public viewing audiences during the **construction** phase, taking into account the proposed mitigation outlined in section 6.1.6.

Visual effects are likely to be heightened for private viewing audiences directly adjacent to the road corridor during the construction phase, on the basis of more direct and prolonged engagement with the construction activities of the Project. On that basis, visual effects for private viewing audiences is assessed as **low** to **moderate,** taking into account the mitigation outlined in section 6.1.6.

Adverse **landscape character** effects during the **operational** phase of the Project are assessed as **low,** taking into account the proposed mitigation outlined in section 6.2.4.

Adverse **natural character** effects during the operational phase of the Project are assessed as **very low** taking into account the heavily modified condition of the waterbodies and the proposed mitigation outlined in section 6.2.4.

Adverse **visual effects** for the public viewing audience is assessed as **low** during the operational phase of the Project, moving to beneficial over time. For the private viewing audience, the visual effects are likely to be **low** to **moderate-low reducing** over an extended period of time.

6.1 Assessment of Construction Effects

This section identifies the principal elements of the Project that are likely to give rise to temporary adverse landscape effects on landscape as a physical resource. The construction activities required to implement the Project are categorised under three broad headings as follows:

- **Site enabling works** - site establishment, demolition and vegetation clearance;
- **Project formation works** - bulk earthworks and formation of new road surface and batter slopes, culvert upgrades, stormwater wetlands, private driveway regrades and bridge construction;
- **Finishing works** - lighting, signage, footpath/cycleway details and line markings, streetscape elements (to be determined at detailed design) and landscaping (including street trees, mitigation planting and riparian/wetland planting (to be determined by detailed design and resource consents)).

The principal elements of the Project expected to impact on the physical landscape resource are outlined below and assessed in the following sections:

- Re-alignment and profiling of adjacent land within the existing road corridors of the Project Area to accommodate corridor widening, active modes of transport and to integrate the new alignment sections (N-S Project and E-W Project) into existing infrastructure surrounding Redhills Precinct.
- Clearance and/or disturbance of broad areas of existing road-side vegetation within the existing road corridors of the Project as well as the greenfield sections.
- Potential construction of indicative new stormwater wetlands.
- Construction of proposed bridge (or culvert) crossings.

6.1.1 Site Enabling Works

6.1.1.1 Construction Areas

Site compound and laydown areas are to be established at 9 locations within the Project Area. The designation footprint includes the areas required to construct the Project, providing space for manoeuvring, setup and temporary storage of construction plant and to establish construction management measures. Larger construction buffer areas are proposed around wetlands and stream crossings to allow for construction works to be undertaken around sensitive natural features within the Project Area.

The proposed site compound and laydown areas are located within pastoral land that is already somewhat modified by existing rural land use or within existing service areas where buildings are already present in the landscape. It is recommended that all areas be grassed (reinstated) at the completion of the construction period. Overall, the physical landscape effects resulting from establishment and use of the construction work areas within the Project Area is assessed to be **low,** taking into account the existing modification of the landscape and the recommended mitigation measures.

6.1.1.2 Vegetation Clearance – Existing Road Sections

Broad areas of street-side vegetation are proposed to be removed to accommodate the Project works. This includes trees and shrubs located within the road reserve and private boundaries along Fred Taylor Drive, Don Buck Road, Royal Road, Red Hills Road, Nelson Road, Nixon Road and Henwood Road.

Private garden plantings comprising native and exotic shrubs and trees make up the majority of vegetation to be removed. Some noteworthy tree species located within private properties and the road reserve are also required to be removed; these include a semi mature Rimu (*dacrydium cupressinum*), Puriri (*vitex lucens*) and several Pohutukawa trees (*metrosiderous excelsa*). While such vegetation is not considered significant on an individual basis, the vegetation collectively contributes to the roads amenity and provides a degree of screening and privacy for properties adjacent to the existing road corridors.

Several of the noteworthy trees appear to be located within the general vicinity of the proposed berm and footpath/cycleway alignment and it is reasonable to assume that some of these trees may be able to be accommodated within the future road reserve. On that basis, it is recommended (if practicable and subject to detailed design) that the footpaths and cycleways within these localised areas be refined to either avoid noteworthy trees or leave them in place within a bespoke footpath and cycle way design.

An area of planted native and exotic species located above the existing timber and concrete block retaining wall, adjacent to the footpath, at the intersection of Royal Road and Don Buck Road will also be impacted by the Project works. This planted area comprises native species such as Nikau, Oioi, *comprosma sp* (ground covers and shrubs), Ti Kouka *Cordyline australis* and harakeke and may have been designed to integrate the structure into the street environment and provide a planted buffer between Don Buck Road and Jack Smyth Court (homes for the elderly). It is recommended that where practicable, affected vegetation be replaced during the finishing works period to re-establish the planted buffer currently afforded to residents to the east.

Figure 6: Existing timber retaining wall and buffer planting at Don Buck Road / Royal Road intersection

Figure 7: Existing retaining wall feature and buffer planting at Don Buck Road / Royal Road intersection

New street tree plantings along the entire length of the proposed alignment will mitigate for the loss of individual or small groupings of existing native trees and shrubs. This is also expected to reduce the impact of the scale of landscape change associated with the clearance of existing road-side vegetation. Mitigation for vegetation clearance on private property is discussed below.

Overall, the physical landscape effects resulting from vegetation clearance within the existing road corridors of the Project Area is assessed to be **moderate-low,** taking into account the loss of existing mature trees, disturbance to an established native planting area and the opportunities afforded through mitigation to reinstate and replace affected vegetation.

6.1.1.3 Vegetation Clearance – Greenfield Sections

Vegetation clearance is limited through the greenfield sections of the Project Area due to the existing modified condition of the landscape and noteworthy vegetation (including SEAs) located outside of the Project Area.

Several mature exotic trees and native shrubs are required to be removed between 456 and 458A Don Buck Road to make way for the N-S Project to tie-in with Don Buck Road. A group of mature pine trees (*Pinus radiata*) located further west will also be removed to make way for the corridor as it travels north towards the interior of the Redhills Precinct.

Figure 8: View southwest from Don Buck Road reserve towards exotic mature trees (to be removed)

Garden plantings, including mature exotic trees and native and exotic scrubs are required to be removed within the private boundaries of 23 and 25 Red Hills Road. This relates to CH800-1000 of the N-S Project (see figure 9 below).

Figure 9: View northwest outside 23 Red Hills Road. Existing garden planting to be removed

As depicted in the site photos below, the proposed bridge (or culvert) crossings are anticipated to have negligible impacts (subject to future regional consenting) on the limited vegetation types present within each of the stream crossing areas.

Figure 10: View southeast towards the proposed E-W Project crossing over Waiteputa Stream

Figure 11: View southwest towards the proposed E-W Project crossing over Ngongetepara Stream

Figure 12: View northeast towards the proposed N-S Project crossing over Ngongetepara Stream

For all greenfield areas impacted by the Project works, it is recommended that existing indigenous vegetation impacted by the Project works (albeit limited) be replaced during the finishing phase of the construction period. As the detailed design progresses and regional consents are sought, the extent and type of indigenous vegetation affected by the bridge and/or culvert construction works will be determined. It is understood that at that point, landscape enhancement measures (over and above the mitigation recommended by this assessment) will be designed and integrated into the Urban Design and Landscape Management Plan (**UDLMP**).

Overall, the physical landscape effects resulting from vegetation clearance within the greenfield areas of the Project Area is assessed to be **low,** taking into account the limited distribution of native species within riparian areas of the streams, and the mitigation strategies proposed.

6.1.2 Project Formation Works

6.1.2.1 Don Buck Road / Royal Road Intersection

The proposed road realignment and widening through the Don Buck Road and Royal Road intersection will result in moderate scale cut and fill slopes adjacent to the new road corridor which will alter the existing modified landform of the existing road reserve and adjacent private properties.

Notable modification is proposed along Royal Road between CH50 – 150 (Refer to Appendix 2: Landscape Plans and Images: Map 06), to where the existing corridor is proposed to curve north towards a perpendicular intersection with Don Buck Road and the proposed N-S Project. These changes will impact on several dwellings at the western end of Royal Road (as outlined above) and will result in a cut face into the existing elevated housing area between 6 – 16 Royal Road (approximately 1m - 3.5m high). A retaining wall (approximately 1m high) is proposed along the eastern side of the new intersection between 2 Royal Road and 453 Don Buck Road. The proposed retaining wall will replace the existing timber retaining wall and be set back into the slope on account of the proposed corridor widening. The new wall will be of a similar scale to that which currently exists.

A retaining wall and upgraded slip lane are proposed along the other side of the road in front of 462 – 484 Don Buck Road. A 'like for like' design is proposed by the RATN that will ensure continued access to affected properties via a new tie-in with Don Buck Road located further west. Impacts on private boundaries are discussed below in section 6.1.4.

Small to moderate-scale fill slopes along Don Buck Road and Royal Road will generally be absorbed into the existing modified road corridor and adjacent property boundaries. Impacts on private properties are discussed below in section 6.1.4.

Overall, the physical landscape effects resulting from land modification within the existing Don Buck Road / Royal Road corridors is assessed to be **moderate-low,** taking into account the noteworthy modification of the Royal Road / Don Buck Road intersection and the opportunity to reinstate other affected sections of the road corridor with a similar design to that existing.

6.1.2.2 N-S Project

The N-S Project is proposed to tie into the Royal Road intersection between the private properties of 456 and 458A Don Buck Road. From there the N-S Project alignment traverses a moderately steep slope trending southwest towards 23 Red Hills Road; at which point, it curves north to align with the existing 110kV transmission line running in a north-west to south-east direction through the centre of the Project Area to intersect with the proposed E-W Project.

The proposed N-S Project generally conforms to the natural topography of the receiving landscape with the exception of the elevated section (CH60-CH600) where site constraints combined with the requirement to tie-in with the elevated Royal Road intersection results in a steep section of road (8%) and large-scale fill slopes into the surrounding rolling topography. Given the open pastoral landscape in which the landform modification is to occur, it is possible to shape the large fill batters to a natural profile effectively creating a false ridgeline that will eventually flank future urban development to the north (Mixed Housing Suburban Zone as indicated by the AUP:OP). Landscape character effects are discussed further in section 6.2.1 below.

Smaller fill slopes associated with the remainder of the alignment and the proposed Waiteputa Stream crossing are similarly proposed into existing pastoral landform and will therefore have a negligible impact on the existing modified landform.

An indicative stormwater wetland (W3) is proposed between CH600 and CH700 on elevated land adjacent to Waiteputa Stream and will require earthworks to re-shape the land and achieve optimal depths and edge profiles. W3 is proposed within modified pastoral land and outside of existing waterways; on that basis, the physical landscape effects required to construct W3 are considered to be very low.

6.1.2.3 E-W Project

Small to moderate-scale fill slopes associated with the proposed Red Hills, Nixon and Nelson roundabout will generally be absorbed into the existing modified road corridor and adjacent property boundaries. Impacts on private properties is discussed below in section 6.1.4.

From the proposed roundabout the E-W Project descends along a south-east trending spur roughly parallel to a tributary of the Waiteputa Stream. Moderate scale fill slopes (up to 6m high) are proposed along this stretch of the corridor towards the proposed Waiteputa Stream bridge (or culvert) crossing after which cut slopes are proposed (approximately 6m deep) towards the intersection with the proposed N-S Project.

An indicative stormwater wetland (W1) is proposed between CH700 and CH800 and will require earthworks to re-shape the land and achieve optimal depths and edge profiles.

The fill slopes are proposed to integrate into the surrounding pastoral landform (outside of riparian margins) and will therefore have a negligible impact on the existing pastoral landform.

6.1.2.4 Dunlop Road and Baker Lane

Dunlop Road and Baker Lane are proposed to align with existing urban development with Baker Lane requiring small to moderate fill slopes to moderate existing earth worked landform and to integrate with the Fred Taylor Drive surface level.

Overall, the physical landscape effects resulting from earthworks within the Project Area is assessed as **low,** taking into the account the existing modified pastoral landscape in which earthworks are proposed with the proposed mitigation measures included in the Project works.

6.1.3 Site Finishing Works

Finishing works are expected to include lighting, signage, footpath/cycleway details and line markings. Streetscape elements and landscaping (to be determined by detailed design) will also be implemented. These activities will occur within the already modified areas of the Project and generally bring some relief to the exposed areas of the landscape and visual effects associated with bare earth. Physical landscape effects are expected to be negligible through this final phase of the construction process.

6.1.4 Impacts on Private Property

Residential properties within and adjacent to the Project Area (either partially or fully designated) will be impacted by the Project in the following ways:

- Surface level changes between private property boundaries and the upgraded road corridor, requiring existing driveways and private access ways to be regraded;
- Encroachment into private yard areas and the removal of private garden plantings and mature trees (as outlined above), ancillary buildings and boundary fences;
- Construction of noise mitigation measures and retaining walls;
- Demolition of existing dwellings and ancillary buildings (required properties) ;
    - 458A Don Buck Road (northern dwelling to be removed only)
    - 2, 4 and 6 Royal Road
    - 1 Dunlop Road
    - 68 Fred Taylor Drive
    - 23 Red Hills Road

For partially affected properties, where existing dwellings are assumed to remain, it is recommended that boundary fences and garden plantings (removed through the Project works) be reinstated on completion of the works affecting the property. Noise mitigation measures and/or retaining walls (if proposed) are recommended to integrate with private boundary fencing reinstatement (i.e. to avoid double layering of noise walls and boundary fences). It is also recommended that retaining walls and/or noise mitigation measures incorporate any reinstatement planting required to replace vegetation lost through the Project works (if practicable).

For affected private properties, where existing dwellings are assumed to be removed, it is recommended that, after completion of the works affecting the property, the remnant land be grassed and maintained within the road corridor to mitigate adverse visual amenity effects potentially arising from residual land.

On the basis of the above, the physical landscape effects on private properties is assessed as **moderate-low** and can be adequately remedied from a landscape perspective.

6.1.5 Visual Effects

The consideration of visual effects through the construction phase acknowledges the full range of activities (and their resultant visual impact), required to implement the new and upgraded road corridors. As discussed earlier, this includes site enabling works (site establishment, demolition and vegetation clearance), bulk earthworks and surface formation, bridge and/or culvert construction and the 'finishing works' period where it is anticipated that street trees, lighting, footpath/cycleway details and line marking will be implemented, alongside any other urban design and landscape features of the Project.

The Project works are anticipated to be broken down into 4 separate and independent construction stages, each ranging in duration between 1.5 to 3 years, which will be dependent on other construction activities (associated with urban development) that is expected to occur congruently with the development of each NoR. Given that each construction stage is independent, it is possible that resident and transient viewing audiences may concurrently experience adverse visual effects from two or more of the proposed stages through the construction period.

It is anticipated that construction activities required to implement the Project will be generally consistent in nature and scale to road works and infrastructure activities commonly anticipated by transient viewing audiences within the existing road sections of the Project Area. Similarly, as alluded to above, it's anticipated and likely that the new N-S Project and E-W Project sections will be constructed congruently with associated urban development, likely resulting in a heavily modified receiving landscape at the time of construction.

Another important consideration is that landscape change by way of vegetation removal and land modification (on private rural property), albeit at a lesser scale, forms part of the expected backdrop of the rural environment.

Notwithstanding the above, some vantage points within the Project Area are likely to witness heightened adverse visual effects through the construction phase. These areas are outlined below:

- Royal Road / Don Buck Road intersection where noteworthy earthworks, road realignment and vegetation clearance are proposed.
- Along Don Buck Road (adjacent to sensitive receivers at Jack Smyth Court elderly residential area), where the existing retaining wall and buffer planting is proposed to be temporary impacted and reinstated.
- Private properties within the Royal Road / Don Buck Road upgrade catchment, where physical landscape effects will occur along roadside boundaries.
- A localised receiving audience west of the Don Buck Road / Royal Road roundabout with views towards the elevated section of the N-W Project (CH0 – CH600) where noteworthy fill slopes and vegetation clearance (at the Don Buck Road intersection) are proposed.
- Red Hills / Nelson / Nixon and Henwood Road intersection where noteworthy earthworks, road realignment and vegetation clearance are also proposed.

- Elevated sections along Red Hills Road where superior views into the Redhills Precinct are afforded.

The nature and significance of the potential adverse visual effects is considered to be moderated through the Project Area by the following aspects:

- Road works and construction activities can generally be expected to occur within main roads (Royal Road / Don Buck Road and Red Hills / Nelson / Nixon Roads);
- The landscape is notably modified by rural land use activities;
- Construction activities are already underway within the northern extent of the Redhills Precinct;
- Construction of the proposed NoRs will occur congruently with future urban development adjacent to the Project Area.

Visual effects through the interior of the site are considered to be moderated by the anticipated development that is likely to coincide with these sections of the Project and the distance between the Project works and superior vantage points along Red Hills Road, mentioned above.

Representative viewpoint images are provided in Appendix 1. Representative Viewpoint Images. The supporting commentary for each location outlines the existing visual composition as well as the landscape change that is anticipated to occur that might translate into adverse visual effects during the construction period.

Overall, adverse visual effects for the transient public viewing audience are likely to range between **low** to **moderate-low** through the construction phase**,** taking into account those areas listed above where adverse effects are likely to be heighted during the temporary construction period.

Adverse visual effects during the construction phase are likely to be heightened for the private viewing audience, particularly those located directly adjacent the existing Don Buck Road / Royal Road corridor who will experience more frequent and prolonged engagement with the construction activities of the Project. On that basis, visual effects for private viewing audiences are likely to range between **low** (for those immediately impacted by construction activities**)** to **moderate** (those residents separated from the Project works)**.**

6.1.6 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

The matters outlined below address the temporary construction impacts on the physical landscape, during the construction phase of the Project. An UDLMP is recommended as a condition on the designation which should include the matters outlined below:

- Reinstate site compounds and construction yards by removing any left-over fill and shaping ground to integrate with surrounding landform. Reinstate with grass at the completion of works.
- Retain noteworthy trees and vegetation identified within the Project Area where practicable.
- Reinstate the retaining wall and native and exotic buffer planting above the existing timber retaining wall at the Don Buck Road / Royal Road intersection.
- Reinstate private fences and garden plantings for existing, remaining properties temporarily affected by Project works.

- For affected private properties, where existing dwellings are assumed to be removed, it is recommended that, after completion of the works affecting the property, if the remnant land is maintained within the road corridor it be grassed to mitigate adverse visual amenity effects potentially arising from residual land.

Refer to Appendix 2: Landscape Plans and Images: Maps 06 - 19 which illustrate the general location of the proposed mitigation measures.

6.2 Assessment of Operational Effects

6.2.1 Effects on Landscape Character

The principle elements of the Project will permanently alter the character of the baseline landscape within the Project Area, particularly within the greenfield areas of the Project. At the completion of the Project, the upgraded corridor will resemble that of an urban arterial on account of the additional vehicle lanes, active modes of transport, reduced speed limit, structured street tree plantings, integrated stormwater management and an increased visual amenity within the existing road sections and intersections within the Project Area.

By the time the Project is operational it can reasonably be assumed that further sections of the Redhills Precinct will have urbanised, alongside (if not as part) of the implementation of the NoR sections. As discussed previously in section 5.1, the AUP:OP zones indicate a local centre at the northern intersection of the N-S Project / E-W Project intersection; high density residential typologies directly adjacent and Residential - Mixed Housing Urban (medium – high density) residential typologies through the interior and northern extents of the Redhills Precinct. Residential – Mixed Housing Suburban and Residential – Single House development will be concentrated within the elevated sections within the western extent of the Redhills Precinct.

As indicated by the Redhills Precinct Plan, future urbanisation might reasonably include the development of an interconnected Redhills Green Road and corresponding Recreation Open Space areas interpreted through future masterplans for the balance areas of the Redhills Precinct.

New street tree plantings along the length of the proposed alignment will assist with mitigating the landscape character and visual effects arising from the removal of mature trees and shrubs within the Project Area.

Localised sections (stream crossings) within the Project Area have been identified by ecological survey as high value (bat habitat), therefore it is suggested (subject to detailed design) that ecological survey and recommendations inform the species selection of street trees. In a general landscape character sense, any potential fauna planting strategies (including potential bat hop overs) are considered to introduce a unique future landscape design opportunity that will (overtime) enhance the urban amenity and neighbourhood character of future urban development adjacent to the Project Area and potentially contribute to the unique sense of place of the Redhills Precinct.

For private properties adjacent to the Project, specifically along Royal Road and Don Buck Road, the proposed earthworks will permanently impact on private property in the following ways:

- Encroachment into some private yards, impacting on residential amenity and existing entrance way design;

- Surface level changes between private property and the upgraded road corridor and subsequent regrading of some driveways and private access ways;
- Greater proximity of the carriageway and footpath/cycleway to property boundaries and increased traffic volumes;
- Introduction of noise mitigation walls or other mitigation features and retaining walls.

In assessing the landscape character effects of a transport corridor within a landscape 'live zoned' for urban development, there is an overlap with urban design considerations. This is expressed through the consideration of urban amenity, neighbourhood character and sense of place. For the Project specifically, the following aspects have been considered and are also addressed by the Urban Design specialists and are recommended for inclusion in the UDLMP.

- **Bridge/culvert structures** – It is noted that the proposed stream crossings are subject to detailed design and could be culvert crossings. Bridge crossings are preferred over culverts from a landscape and natural character perspective as this offers the best opportunity for natural and/or planted regeneration of native species within the riparian corridors, thus improving the natural character values of the landscape within the Project Area. It is recommended that the proposed bridges (if implemented) be designed to contribute to the local sense of place and urban amenity of the future urban landscape.
- **Reinstatement of Retaining wall (Don Buck / Royal Road intersection) –** It is recommended that the new retaining wall be designed to contribute to the local sense of place and urban amenity of the future urban landscape.
- **Pedestrian and cycling connectivity -** Connectivity is addressed though the vertical alignments of the Project but there are future opportunities to integrate with adjacent open space areas (as indicated on the Redhills Precinct Plan). It is recommended that through the UDLMP open space and cycleway routes be identified and connection opportunities investigated.
- **Noise mitigation measures / retaining walls –** It is recommended that noise mitigation measures and retaining walls be designed to integrate with private boundary fencing (i.e. to avoid double layering of noise walls and boundary fences). It is also recommended that noise mitigation measures and retaining walls incorporate existing and reinstatement planting in a way that contributes to the streetscape character, minimises visual amenity effects on residents and integrates with the layout and design of outdoor living spaces.
- **Proposed noise mitigation wall (25 Redhills Road) –** A 27m long x 1.8m high noise mitigation wall is proposed to mitigate the noise effects for the existing dwelling at 25 Red Hills Road (should this dwelling remain in place). It is noted that should this mitigation feature be required there are several contextual features within the proposed road corridor that would enable the noise wall to be integrated (through a high level of design input) as a purposeful feature within the road corridor.
- **Indicative stormwater wetlands –** Indicative stormwater wetlands are proposed at three locations within the Project Area. It is recommended that any stormwater wetlands (if provided) be planted with appropriate (low maintenance) native species and integrated into the surrounding urban landscape context, so that they provide a hydrological and ecological function and are safe places to visit. Given the future urban location and scale of the proposed wetlands, it is important that they enhance the landscape and visual amenity of the local landscape.
- **Fill slopes –** moderate to large-scale fill slopes, if not otherwise actively integrated back into the adjacent urban development parcel (i.e. remain within the road reserve) are likely to read

as left-over spaces and will do little to enhance the amenity of the road corridor and adjacent urban neighbourhood. In relation to large-scale fill slopes, there is the potential for landscape character and visual amenity effects to arise, therefore it is recommended that residual fill slopes (those retained within the road reserve) be planted in native species or otherwise integrated with adjacent land use through site specific landscape and urban design.

- Based on the scale of indicative earthworks and long sections through the alignment, there are specific locations within the Project Area where it is considered that a planted or specific landscape design response would provide one or more of the following benefits: additional green infrastructure to the road corridor, reduced maintenance requirements, a vegetated backdrop to adjacent urban housing and integrate the road corridor with adjacent land use through specific landscape and urban design interventions to avoid potential adverse landscape character and visual amenity effects associated severance issues. Specific areas for assessment are illustrated in Appendix 2 – landscape Plans and Images: Maps 06 – 19 and include the following locations:
    - N-S Project (CH0 – CH700) (refer also to specialist urban design framework section 3.1, Table 1 Urban Design Evaluation (2.4))
    - E-W Project (CH350 – CH1050)
    - E-W Project (CH1600-1700)
- On the basis of the above, it is recommended as a matter for the UDLMP that fill slopes be assessed against adjacent land use and integrated through specific landscape and urban design treatment. These treatments should be included in a planting plan for the Project Area.
- It is recommended that all fill slopes be shaped to a natural profile to integrate into the surrounding landform and future land use scenario. Fill slopes associated with proposed bridge (or culvert) crossings are recommended to be shaped to natural landform at a suitable gradient to allow riparian planting to be established.

On the basis of the above, the magnitude and nature of landscape character change within the Project Area is considered to accord with that which will occur throughout the localised landscape over time within adjacent development areas. Overtime, the Project is expected to have a positive impact on the developing landscape and urban amenity values of the local landscape.

Based on the above considerations and mitigation measures, adverse landscape character effects are assessed as **low**.

6.2.2 Natural Character Effects

Potential effects on natural character arise from landform modification and subsequent vegetation clearance (although limited), associated with potential bridge or culvert construction, within the margins of Waiteputa Stream, Red Hill Stream and Ngongetepara Stream. Removal of vegetation within wetland and stream environments has the potential to alter the character of these areas by heightening the impression of further human modification.

As noted earlier, limited areas of native vegetation are expected to be impacted by the Project works. It is understood that as regional consents are sought, the full extent and type of indigenous vegetation affected (within the Waiteputa Stream, Red Hill Stream and Ngongetepara Stream environments) will be determined and riparian and wetland mitigation planting will be designed and integrated into the Landscape and Urban Design Management Plan. This will ensure that natural character values are preserved, if not enhanced.

Based on the assessment of the quality of existing riparian and wetland vegetation, the Project is likely to give rise to **very low** natural character effects.

6.2.3 Visual Amenity Effects

Once the Project is completed, the public viewing audience will engage with a similar visual environment to that which currently exists within the existing road sections of the Project Area, within the backdrop of continued urban development through the balance areas of the Redhills Precinct.

Conversely, viewing audiences located within the existing greenfield areas of the Project (if they remain) will engage with an entirely different visual environment. As discussed earlier, visual change of the magnitude proposed will be perceived within the context of adjacent urban development which over time will (itself) substantially change the scale and character of the Redhills landscape, which in turn will absorb the landscape and visual changes proposed within the Project Area.

Adverse visual effects are likely to be heightened for the localised receiving audience located directly west of the existing Don Buck Road / Royal Road roundabout (422 – 456 Don Buck Road). This is because the Receiving Landscapes of existing dwellings in this row of housing equates roughly with the levels proposed through the longitudinal section of the elevated portion of the proposed N-S Project. Where existing dwellings currently enjoy superior views over the Redhills Precinct, these have the potential to be disrupted by the elevated section of road corridor, drawing focus towards the southern fill slopes and potentially distorting the horizon view. This type of visual effect could be perceived as significant for the existing receiving audience; however, such effects are considered to be moderated by the AUP:OP zone overlay for this localised setting that signals Business – Local Centre development surrounded by Mixed Housing Suburban development. It's reasonable to consider that this type of policy direction would enable future urban development to respond to the design constraints and potential resulting visual impacts of the elevated sections of the N-S Project. Notwithstanding the urban development opportunities afforded to the receiving audience, it is recommended that the southern fill slopes (CH0 - 600 - if retained within the road reserve) be subject to a specific planting or landscape and urban design response to mitigate the visual prominence of the elevated section of corridor on the localised receiving audience.

Overall, visual effects, over time, are anticipated to move to the positive for the public viewing audience, based on improved visual amenity and appeal for users associated with streetscape design, maturing street trees and accessibility to active modes of transport.

Nevertheless, residual adverse effects are anticipated from some private properties because as a direct result of the Project, residents will experience a degree of material change to the visual composition and residential amenity of private space and entryways. For existing properties set back from the Project Area, the visual amenity effects will be an incremental increase in existing effects from the road corridor. However, for properties directly adjacent to the Project Area (immediately impacted by the Project), residual amenity effects may be heightened by the greater proximity of the carriageway and footpaths/cycleways to property boundaries and the permanent loss of yard space.

Overall, adverse visual effects within the Project Area are likely to be **low** (moving to beneficial) for transient viewing audiences through the operational phase of the Project. For the private viewing audience, the visual effects are likely to be **low** to **moderate-low** reducing over an extended period of time.

6.2.4 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The matters outlined below address the principle elements of the Project that are likely to give rise to permanent adverse effects on landscape character, natural character and visual amenity.

It is recommended a UDLMP is a condition on the designation which should include the following matters.

- Bridges (if applicable) - It is recommended that any proposed bridges be designed to contribute to the local sense of place and urban amenity of the future urban landscape.
- Reinstatement of retaining wall (Don Buck / Royal Road intersection) – It is recommended that the new retaining wall be designed to contribute to the local sense of place and urban amenity of the future urban landscape.
- Walking and cycling connectivity – Investigate opportunities to integrate with existing and future open space (as indicated by the Precinct Plan).
- Noise mitigation measures / retaining walls – It is recommended that noise mitigation measures and retaining walls be designed to integrate with private boundary fencing (i.e. to avoid double layering of noise walls and boundary fences). It is also recommended that noise mitigation measures and retaining walls incorporate existing and reinstatement planting in a way that contributes to the streetscape character, minimises visual amenity effects on residents and integrates with the layout and design of outdoor living spaces. Refer to Bridging the Gap: Waka Kotahi Urban Design Guidelines (2013), Section 4.13 Retaining Walls and Section 4.15 Noise Barriers.
- The 27m long x 1.8m high noise mitigation wall proposed to mitigate the noise effects for 25 Red Hills Road should be designed to integrate with the contextual features of the road corridor and be designed (with a high level of design input) as a purposeful streetscape feature within the road corridor.
- Cut and fill slopes – Cut and fill slopes should be shaped to a natural profile to integrate into the surrounding natural landform. Fill slopes associated with proposed bridge (or culvert crossings) are recommended to be shaped to natural landform at a suitable gradient to allow riparian planting to be established.
- Planting Plan – A planting plan should be prepared for the Project including for:
  1. Reinstatement planting of the Don Buck Road / Royal Road buffer planting.
  2. Reinstatement planting in relation to private properties.
  3. Treatment of fill slopes to integrate them with adjacent land use. Specific areas for assessment are noted on Appendix 2 – landscape mitigation plans 06 – 19 and include the following locations:
     - N-S Project (CH0 – CH700) northern and southern fill slopes (refer also to specialist urban design framework section 3.1, Table 1 Urban Design Evaluation (2.4))
     - E-W Project (CH350 – CH1050)
     - E-W Project (CH1600-1700)
- Street trees – Ecological analysis to determine species selection relative to local landscape context and ecological opportunities.

- The UDLMP planting plan should integrate with riparian planting recommended with regional consents.

Refer to Appendix 2. Landscape Plans and Images: Maps 06 - 19 which illustrate the general location of the mitigation measures.

6.3 Future Resource Consent and Detailed Design Considerations

There is significant opportunity to enhance the landscape character, natural character and visual amenity of the Project Area. The following design opportunities are suggested to be considered at the detailed design phase and implemented through the UDLMP (if practicable) alongside the mitigation measured outlined above in section 6.2.4.

The opportunities are summarised as follows:

- **Riparian planting** – native riparian and wetland planting associated with stream crossings (including fill slopes within riparian areas), subject to regional consent stage.
- **Indicative stormwater wetlands -** Stormwater wetlands are proposed at three locations within the Project Area. It is recommended that any stormwater wetlands be planted with appropriate (low maintenance) native species and integrated into the surrounding urban landscape context, so that they provide a hydrological and ecological function and are safe places to visit. Given the future urban location and scale of the proposed wetlands, it is important that they enhance the landscape and visual amenity of the local landscape. Bridging the Gap: Waka Kotahi Urban Design Guidelines (2013), Section 4.17 Stormwater Management Devices.
- **Expand reinstatement planting areas** to include a greater extent of wetland and riparian margin beneath and surrounding the upgraded proposed stream crossings, to enhance the natural character values of water bodies and to integrate proposed stream crossings into the landscape.
- **Ecological design of potential bat hop overs** - Should ‘bat hop-overs’ be implemented within the permanent works, the following principles should inform an integrated ecological and landscape design approach to locations within the Project Area indicated by ecological assessment.
    - Trees are tall enough so that bats commuting along the top of the tree canopy are higher than vehicles driving along the road (>5 m).
    - The canopy extends over the road reducing the distance that the bats fly without a continuous vegetated linkage (ideally canopy would touch) (refer to the Assessment of Ecological Effects).
    - Compensation planting for the loss of mature trees could occur within the ‘hop-over’ locations and should include native forest species that will provide long-term habitat such as kahikatea, kauri, totara and rimu. Fast growing exotic tree species should also be included that are known to provide short-medium term. This should form the criteria for the development of detailed landscape planting plans at the Outline Plan of Works stage.

7 Recommendations and Conclusions

This landscape, natural character and visual assessment finds that the proposed features and scale of the NoRs are able to be integrated into the existing landscape, with the landscape mitigation measures proposed in this report (implemented through an UDLMP) adequate to remedy the adverse effects arising from the Project.

Positive landscape character and visual amenity effects are likely to arise, over time, as a result of the Project, while broader landscape enhancement measures are likely to be designed into the Project at the detailed design and resource consent stage, as envisaged by the AUP:OP Chapter E.3 and the Redhills Precinct Plan.

The following table provides a summary of the potential landscape character, natural character and visual effects of the construction and operational phases of the Project, with the mitigation measures implemented as recommended in this report

Table 5: Redhills Arterial Transport Network Summary of Landscape and Visual Effects

	Temporary Effects - Construction (with mitigation implemented)	Permanent Effects – Operation (with mitigation implemented)
Physical Landscape Effects **(earthworks, construction areas and vegetation clearance)**	**Low to moderate-low** **Moderate-low** for affected private properties	N/A
Visual Effects	**Low to moderate-low** for public viewing audiences **Low to moderate** for private viewing audiences	N/A
Effects on Landscape Character	N/A	**Low**
Effects on Natural Character Values	N/A	**Very low**
Effects on Visual Amenity	N/A	**Low** for public viewing audiences (moving to beneficial overtime) **Low to moderate-low** for private viewing audiences (reducing over an extended period of time)

Appendix 1. Representative Viewpoint Analysis

Viewpoints 01 – 04 – Fred Taylor Drive / Baker Lane (NoR 2b)

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 21 - 22**

Viewpoints 1, 2 and 4 illustrate the view looking southwest through the proposed Baker Lane corridor, while viewpoint 3 illustrates the view north looking back towards Taylor Drive from the end of proposed Baker Lane. As depicted in the photographs, this section of land is currently under development and forms the northern extent of the Project Area where urban development is underway as discussed in section 5 of this report.

Viewpoints 2 and 4 demonstrate the existing vegetation types existing within the minor tributaries of the Ngongetepara Stream along the perimeter of proposed Baker Lane and within the proposed bridge (or culvert) crossing at CH2100. Mature exotic trees are visible from this vantage point are likely to be removed and replaced with street trees through the Baker Lane corridor.

Notable visual changes to this section of the existing landscape will include the proposed Baker Lane road corridor and associated fill slopes (to both sides) and urban housing typologies including Residential – mixed Housing Urban and Terrace housing and Apartment buildings as indicated by the AUP:OP zones.

The viewing audience is currently restricted though this section of the Project Area due to ongoing development works, however viewpoint 1 depicts the general view afforded to the transient viewing audience (i.e. vehicles travelling between 50-80km/h) along Fred Taylor Drive. In time the proposed corridor will be experienced by residents and visitors of the adjacent urban environment; therefore, the magnitude and nature of visual change associated with this section of the Project is considered to accord with that of the future localised urban landscape.

Viewpoint 05

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 23**

Viewpoint 5 illustrates the view looking southwest towards Westbridge Residential School and the rural residential properties (21,23, 25 Redhills Road) located further south. Existing land use through this section is defined by the rolling, elevated landform defined by the tributaries of Ngongetepara Stream and shelter belt and amenity plantings associated with existing land use. As discussed in section 5.6, this area of the Redhills Precinct currently exhibits a heightened degree of rural character and perceived visual amenity.

The immediate landscape depicted in this view is not impacted by the Project, parts of the lower N-S Project section are likely to be visible (adjacent to future urban development) in the background of the view. Properties (including the school) are also afforded views north towards NoR 2b (Baker Lane).

Viewpoint 06 and 07

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 23 - 24**

Viewpoint 6 illustrates the contextual view looking southwest from elevated land north of proposed Dunlop Lane (NoR 2a). The land from which this vantage point is captured will be immediately absorbed into high density residential development in accordance with the AUP:OP zoning for the northern extent of the Redhills Precinct.

From this general location, is might be possible to view sections of the E-W Project (NoR 2c), proposed stormwater wetlands (W1 and W2) and sections of the N-S Project, all within the distant view of this vantage point. The existing Transmission lines offer a visual reference point for the N-S Project alignment which is proposed to generally align towards the intersection with the E-W Project. The proposed road corridors will be visually absorbed by the Business - Town Centre and medium to high density residential typologies associated with the new road corridor as indicated by the AUP:OP zones.

Viewpoint 7 illustrates the existing localised condition of the Ngongetepara Stream, at the proposed crossing point (CH1600). A bridge crossing (subject to regional consents) over this section of the project would afford better riparian revegetation outcomes for the stream and underpin greater natural character enhancement within the Project Area. A culverted option will require fill slopes to cover sections of the riparian margins; however, those fill slopes would be able to be planted to integrate into the riparian corridor.

Viewpoint 08

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 24**

Viewpoint 8 illustrates the contextual view looking north from elevated land overlooking the proposed N-S Project and E-W Project intersection. Intermittent sections of the N-S Project might be visible from this general location, with the indicated Business - Town Centre and medium to high density residential typologies visible in the background of the proposed road corridor.

Viewpoint 09 and 10

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 25**

Viewpoint 09 illustrates the view looking northeast into the riparian margins of the tributaries of Waiteputa Stream and Red Hill Stream intersecting in the background of the view. As depicted in the photograph, the stream environment is heavily modified and very little native terrestrial vegetation exists within the proposed crossing point (CH850). Proposed W1 is located in the general vicinity of the existing barn and will require small-moderate fill batters to integrate into the adjoining landform, which will be visible from this localised vantage point. It's suggested (subject to detailed design) that the treatment of fill slopes be integrated into adjacent land use. It is suggested that fill slopes proposed between CH 700 – 780 be integrated with planting for visual cohesion.

Viewpoint 10 illustrates the view looking northwest towards the western boundary of the Redhills Precinct. The views follow the proposed E-W Project alignment directly adjacent (on the right-hand side) of a tributary of Waiteputa Stream and the mature shelterbelt planting. Fill slopes (approximately 6m high) will modify the existing ridge formation of the landform through this section. Given the open nature of the pastoral landscape in this area, the proposed fill slopes are anticipated to visually integrate into the receiving landform.

Viewpoint 11 and 12

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 26**

Viewpoints 11 and 12 illustrate the view looking northeast from the localised receiving environment of the elevated section of the N-S Project. The views demonstrate the superior elevation over the Project Area.

Adverse visual effects are likely to be heightened for the localised receiving audience located directly west of the existing Don Buck Road / Royal Road roundabout (422 – 456 Don Buck Road). This is because the RL's of existing dwellings in this row of housing equates roughly with the levels proposed through the longitudinal section of the elevated portion of the proposed N-S Project. Where existing dwellings currently enjoy superior views over the Redhills Precinct, these have the potential to be disrupted by the elevated section of road corridor, drawing focus towards the southern fill slopes and potentially distorting the horizon view. This type of visual effect could be perceived as significant for the existing receiving audience; however, such effects are considered to be moderated by the AUPIOP zone overlay for this localised setting that signals Business – Local Centre development surrounded by Mixed Housing Suburban development. It's reasonable to consider that this type of policy direction would enable future urban development to respond to the design constraints and potential resulting visual impacts of the elevated sections of the N-S Project. Notwithstanding the urban development opportunities afforded to the receiving audience, it is recommended that the southern fill slopes (CH0 - 600 - if retained within the road reserve) be subject to a specific planting or landscape and urban design response to mitigate the visual prominence of the elevated section of corridor on the localised receiving audience.

Viewpoint 13 and 14

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 27**

Viewpoints 13 and 14 illustrates the view looking east and southeast from the elevated western extent of the proposed E-W Project corridor. The viewing audience from this general vicinity have superior views over the Redhills area and will view the E-W Project corridor from above, within the context of adjacent urban development. The proposed alignment generally conforms to the natural topography of the land and as such is likely to appear integrated with the natural landform. Recommendations to shape the southern fill slopes into natural landform, adjacent to the tributary of the Waiteputa Stream will play an important role in integrating the proposed land modification.

Viewpoint 15 and 16, and 18

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 28-29**

Viewpoints 15, 16 and 18 illustrate the distant views afforded from the elevated pastoral areas (future medium density housing) towards the N-S Project corridor, specifically the elevated eastern section of the corridor. It's likely, given the proposed elevation of this section of the proposed corridor that the southern road corridor and southern fill slopes will be visible. It's likely that these elements will read in unison with the spurs visible in the foreground of viewpoint 16. Visibility towards the N-S Project corridor is likely to diminish, over time, as future urban development is implemented.

Viewpoint 17

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 29**

Viewpoints 17 illustrates the close-range view looking northwest from outside 29 Red Hills Road. The N-S Project corridor will sweep past this vantage point, in front of the 110kV transmission lines running in a north-west to south-east direction through the centre of the Redhills Area. The E-W Project corridor will be visible in the background view running down the south-east trending spur behind the white house visible in the view. From viewpoint 17, the N-S Project corridor will be visible as an integrated road and expected feature within the future urban neighbourhood of this location.

Similarly, the E-W Project corridor, visible in the background view will read as an integrated roading corridor within the future low to medium density housing development that will occur upon the elevated east facing slopes.

Viewpoint 19-21

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 30 - 31**

Viewpoints 19 – 21 illustrates the views looking west and south-west along Don Buck Road towards the eastern boundary of the Redhills precinct. Viewpoint 19 illustrates the existing timber retaining wall and buffer planting at the Don Buck Road / Royal Road intersection. This feature will be impacted by the project works and is recommended to be reinstated in a general like-for-like design. The existing vegetation to the right of the view will also be impacted by the project works and while this vegetation is not proposed to be reinstated, new street tree plantings will generally replace the vegetative structure of the current view.

Viewpoint 20 illustrates the existing view from 488 Don Buck Road, along the accessway to St Paul's Primary School and Westbridge Residential School. Given that medium density housing is proposed within the general area, intermittent views towards the project area are unlikely to be maintained.

Viewpoint 22 - 23

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 31**

Viewpoints 22 and 23 illustrate the distant views looking east from Nixon Road and Henwood Road / Nixon Road intersection from rural zoned land. Views towards the Project areas are limited due to intervening elements in the landscape and perceived visual change from these locations will result predominately from the future urban development areas.

Viewpoint 23 - 26

Refer to **Appendix 2**: Landscape Plans and Images: **Map 20 and 32 - 33**

Viewpoints 24 - 26 illustrates the contextual vantage points along the ring Road route of Red Hills Road to Nixon Road. Views afforded from these superior vantage points will undergo substantial change as urban development is implemented in accordance with the AUPOIP. The proposed NoRs from these elevated vantage points will be visible as an integrated and potentially organising feature within the future urban framework. Proposed street trees throughout the proposed alignments will also provide some degree of visual legibility to future urban form, as perceived from these vantage points. The AUPOIP Ridgeline Protection Overlay is anticipated to generally preserve the superior views towards greater Auckland in the background.

Appendix 2. Landscape Plans and Images

ATTACHMENT 24

REDHILLS ARTERIAL TRANSPORT NETWORK
ASSESSMENT OF LANDSCAPE
AND VISUAL EFFECTS
PART 2 OF 3

Supporting Growth

Redhills New Arterial Network

Appendix 2

Landscape Plans and Images

Version 1.0

August 2020

TE TUPU NGĀTAHI Supporting Growth

NZ TRANSPORT AGENCY WAKA KOTAHI

LEGEND

REDHILLS ARTERIAL TRANSPORT NETWORK (RATN) - PROPOSED DESIGNATION BOUNDARY

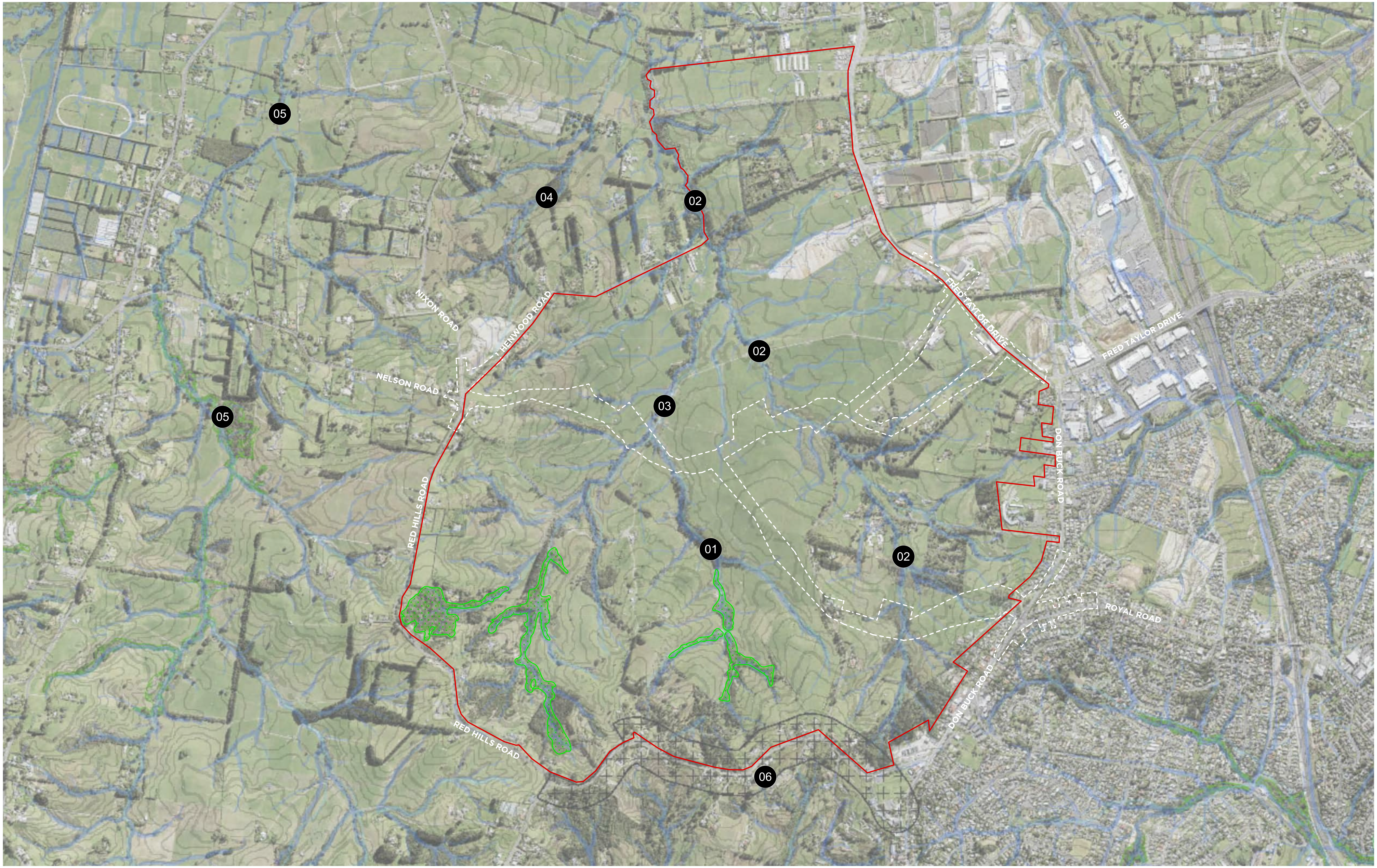
01	REDHILLS PRECINCT BOUNDARY	05	NORTHWEST SHOPPING CENTRE	09	WAITAKERE
02	WESTGATE SHOPPING CENTRE	06	WEST HARBOUR	10	HENDERSON CREEK
03	WESTGATE	07	ROYAL HEIGHTS	11	TE ATATU PENINSULA
04	MASSEY WEST	08	TAUPAKI		

DATE	AUGUST 2020
SCALE	1:20,000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

PROJECT LOCATION AND LOCAL CONTEXT

01



REDHILLS ARTERIAL TRANSPORT NETWORK (RATN) - PROPOSED DESIGNATION BOUNDARY

STREAMS + OVERLAND FLOW PATHS (AUP OIP GIS)

SEA (Terrestrial)

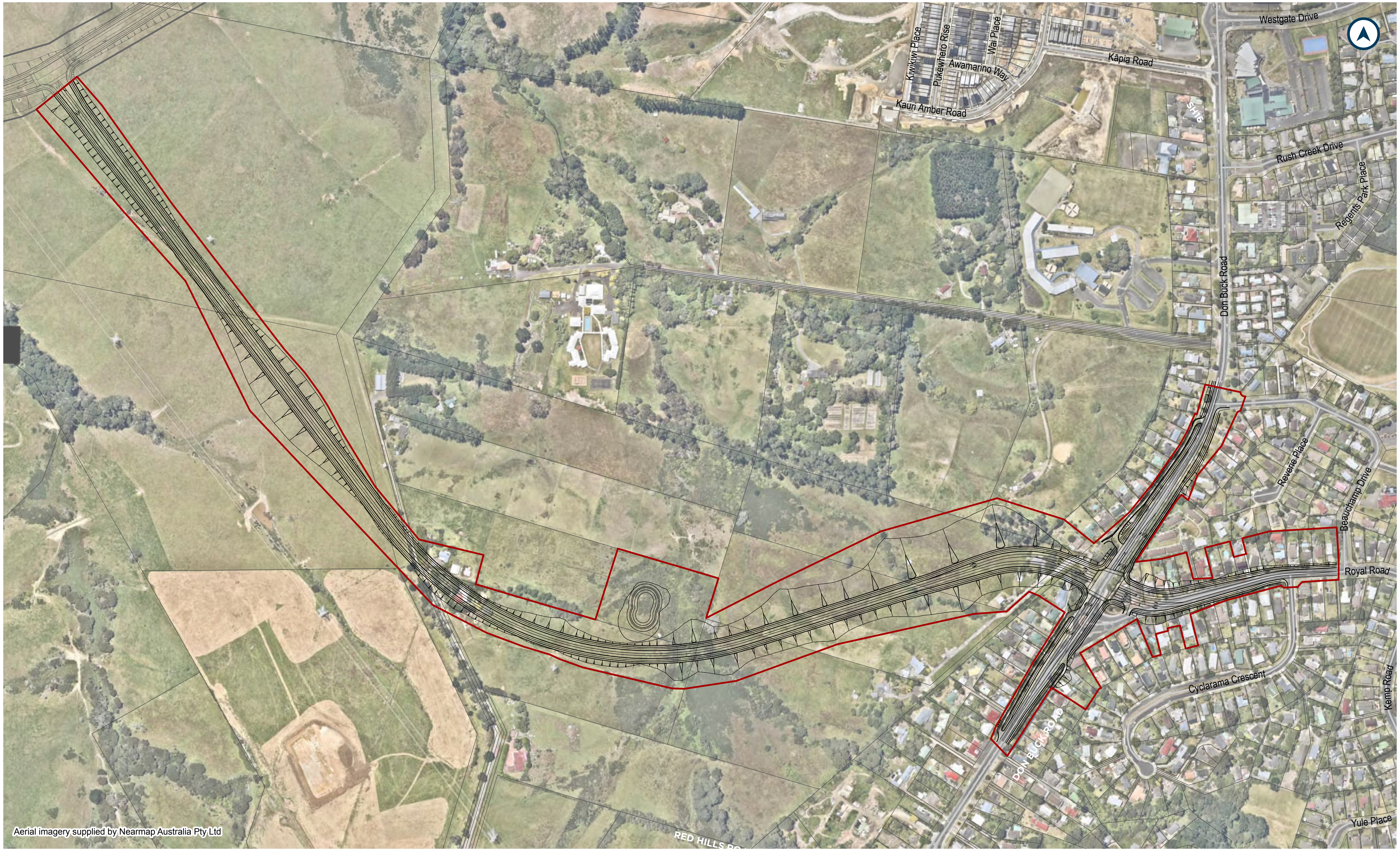
01	RED HILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

DATE	AUGUST 2020
SCALE	1:15,000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

BASELINE LANDSCAPE - LOCAL LANDSCAPE

02



0 75 150

Metres

LEGEND

- North-South Alignment
- East-West Alignment
- North-South Portion of Designation Boundary
- East-West Portion of Designation Boundary

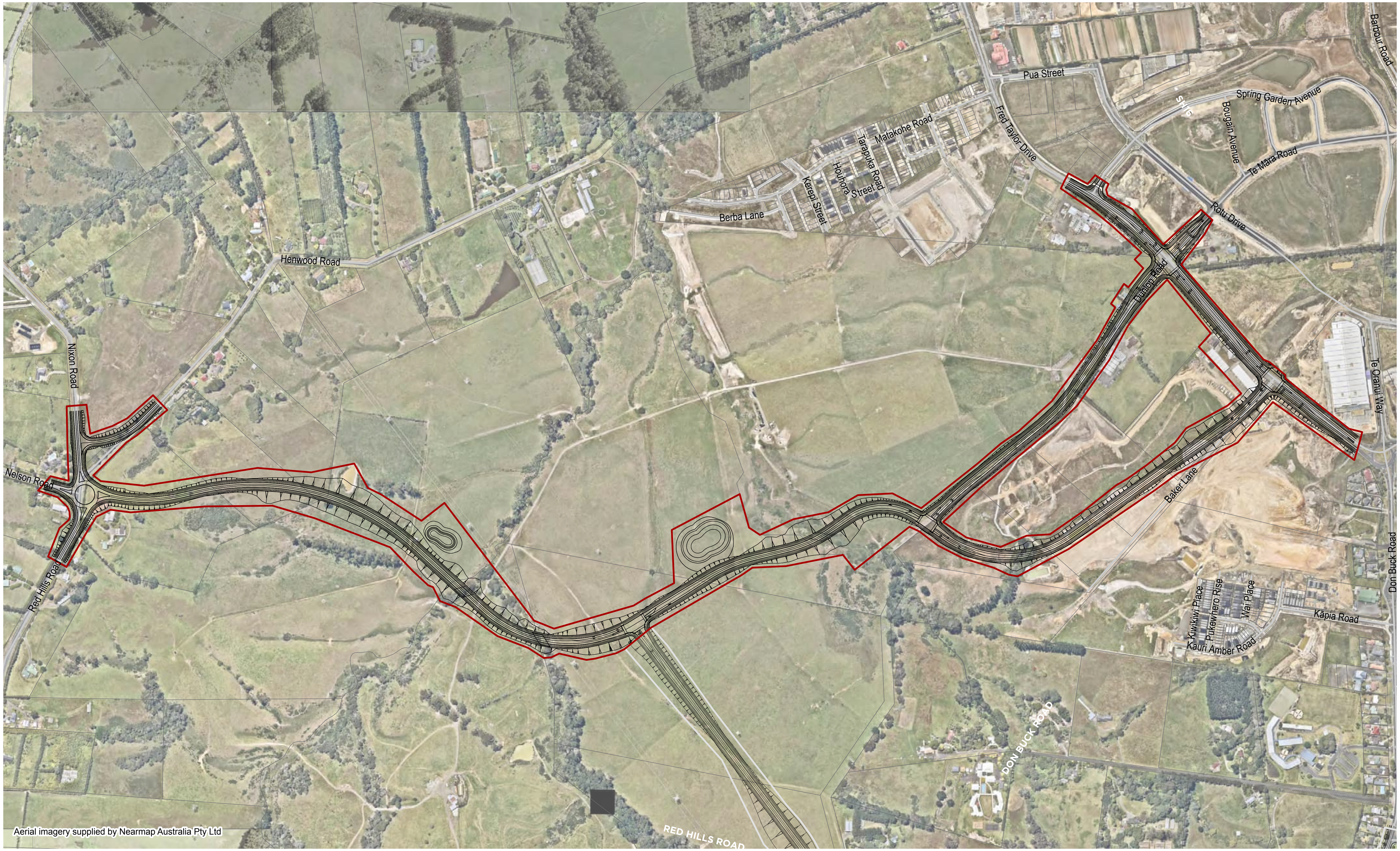
01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

DATE	AUGUST 2020
SCALE	1:5000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	SGA
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

NORTH-SOUTH CORRIDOR - AERIAL BASE

03



LEGEND

East-West Alignment
North-South Alignment

East-West Portion of Designation Boundary
North-South Portion of Designation Boundary

0 125 250
Metres

01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

DATE	AUGUST 2020
SCALE	1:5000 @ A3
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DRAWN BY	SGA
REVISION	FINAL R5

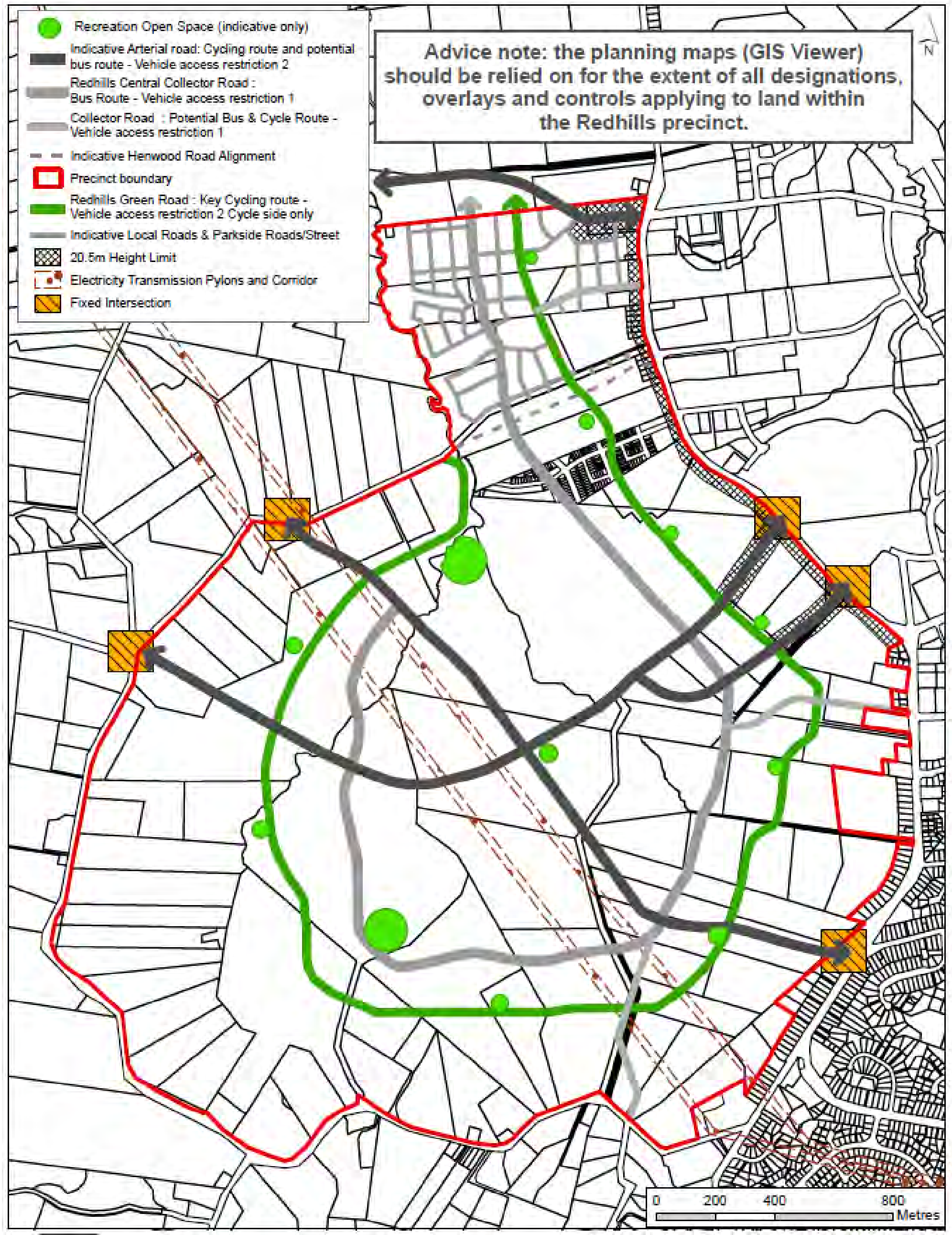
REDHILLS ARTERIAL TRANSPORT NETWORK
EAST-WEST CORRIDOR - AERIAL BASE

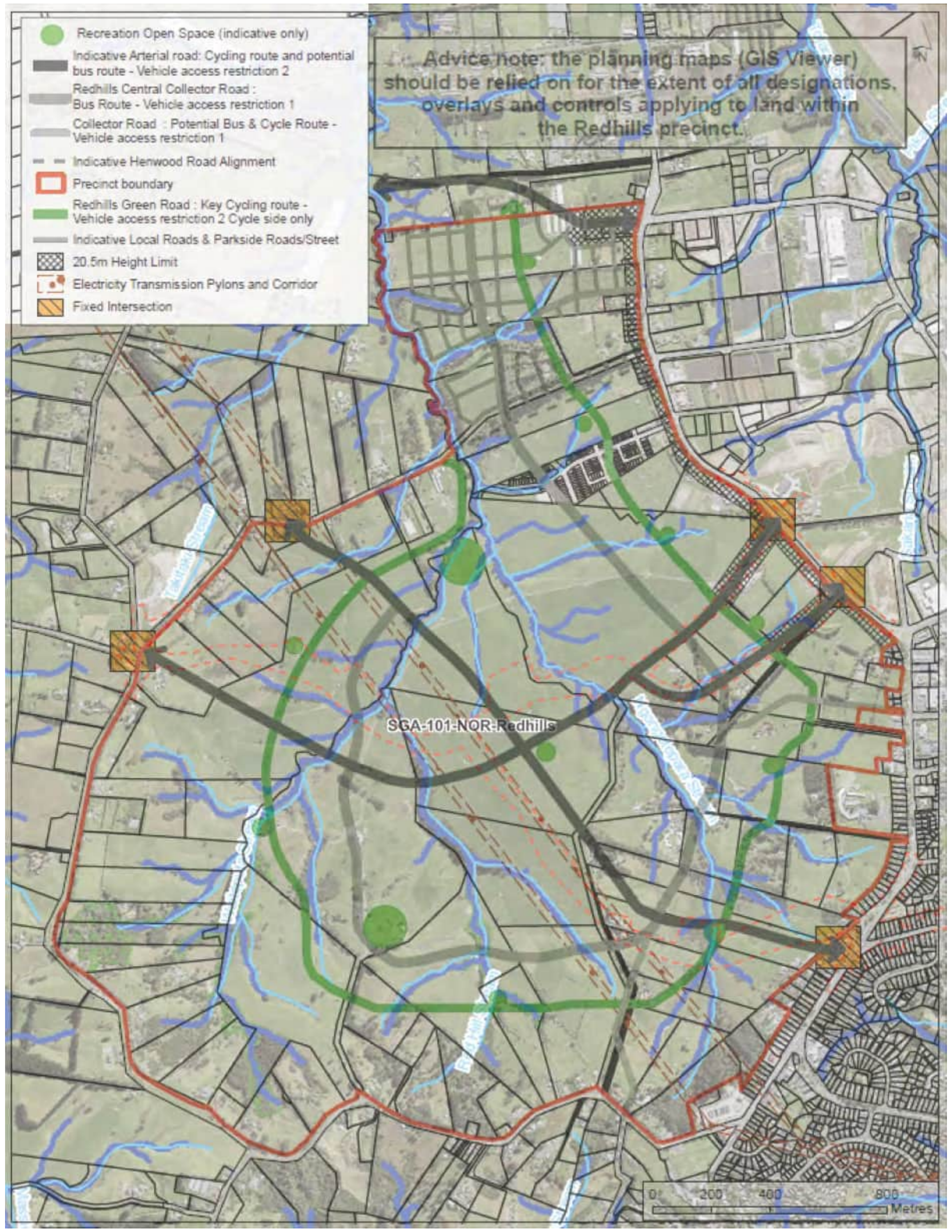
04

not the infrastructure works identified in Table I610.6.1.1 and Table I610.6.2.1 will be triggered by the subdivision and/or development.

I610.10. Precinct plans

I610.10.1. Redhills Precinct: Precinct Plan 1



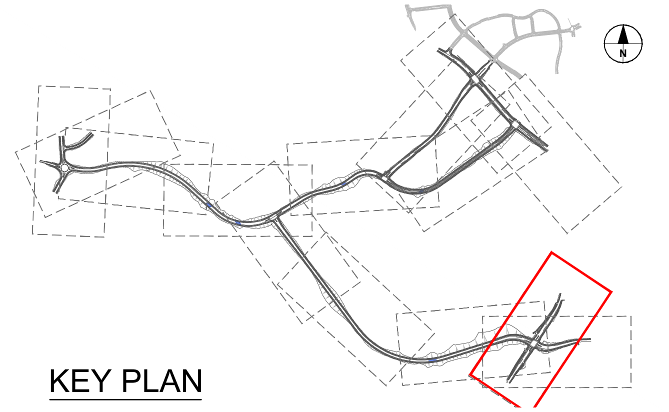


DATE	AUGUST 2020
SCALE	N/A
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

REDHILLS PRECINCT PLAN

05



KEY PLAN

LANDSCAPE MITIGATION KEY

a) Reinstate site compounds and construction yards by removing any left-over fill and shaping ground to integrate with surrounding landform. Reinstate with grass at the completion of works.

b) Retain noteworthy trees and vegetation identified within the Project area where practicable.

c) Reinstate the retaining wall and native and exotic buffer planting above the existing timber retaining wall at the Don Buck Road / Royal Road intersection.

d) Reinstate private fences and garden plantings (with the exception of required properties) for existing, remaining dwellings affected by Project works.

e) For affected private properties, where existing dwellings are assumed to be removed, it is recommended that, after completion of the works affecting the property, the remnant land be grassed and maintained within the road corridor to mitigate adverse visual amenity effects potentially arising from residual land.

f) Bridges (if applicable) - to be designed to contribute to the local sense of place and urban amenity of the future urban landscape.

g) Retaining wall (Don Buck / Royal Road intersection) – It is recommended that the new retaining wall be designed to contribute to the local sense of place and urban amenity of the future urban landscape.

h) Walking and cycling connectivity: investigate opportunities to integrate with existing and future open space (as indicated by the Precinct Plan)

i) Noise mitigation measures / retaining walls – designed to integrate with private boundary fencing (i.e. to avoid double layering of noise walls and boundary fences). It is also recommended that noise mitigation measures and retaining walls incorporate existing and reinstatement planting in a way that contributes to the streetscape character, minimises visual amenity effects on residents and integrates with the layout and design of outdoor living spaces.

j) The 27m long x 1.8m high noise mitigation wall proposed to mitigate the noise effects for 25 Red Hills Road should be designed to integrate with the contextual features of the road corridor and be designed (with a high level of design input) as a purposeful streetscape feature within the road corridor.

k) Cut and fill slopes should be shaped to a natural profile to integrate into the surrounding natural landform. Fill slopes associated with proposed bridge (or culvert crossings) are recommended to be shaped to natural landform at a suitable gradient to allow riparian planting to be established.

l) Planting Plan: a planting plan should be prepared for the Project including for:

1. Reinstatement planting of the Don Buck Road / Royal Road buffer planting.

2. Reinstatement planting in relation to private properties.

3. Treatment of fill slopes to integrate them with adjacent land use. Specific areas for assessment include the following locations:
   - North-South corridor (CH0 – CH700)
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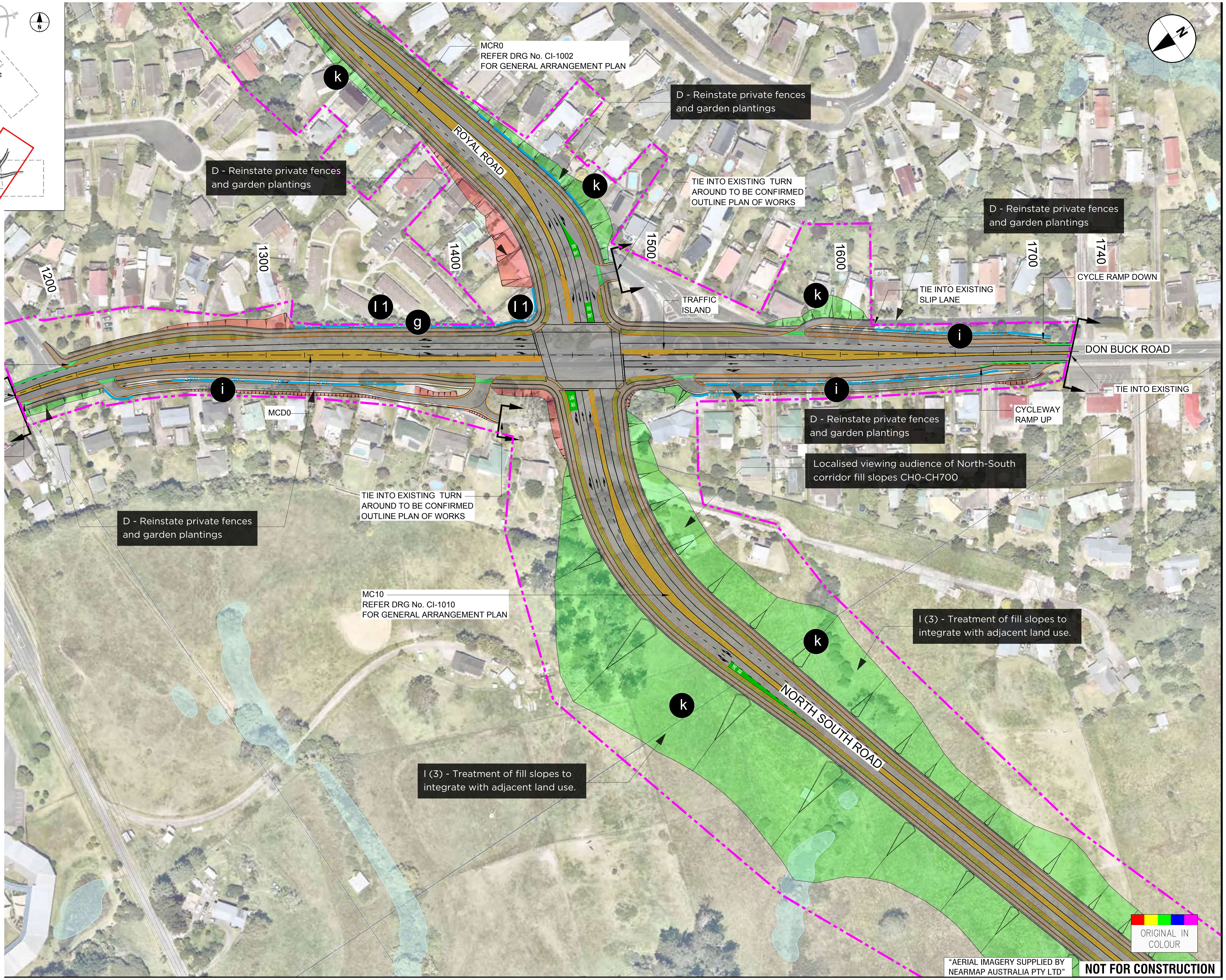
   - East-West corridor (CH1600-1700)

4. Street trees - ecological analysis to determine species selection relative to local landscape context and ecological opportunities.



NOT FOR CONSTRUCTION

01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

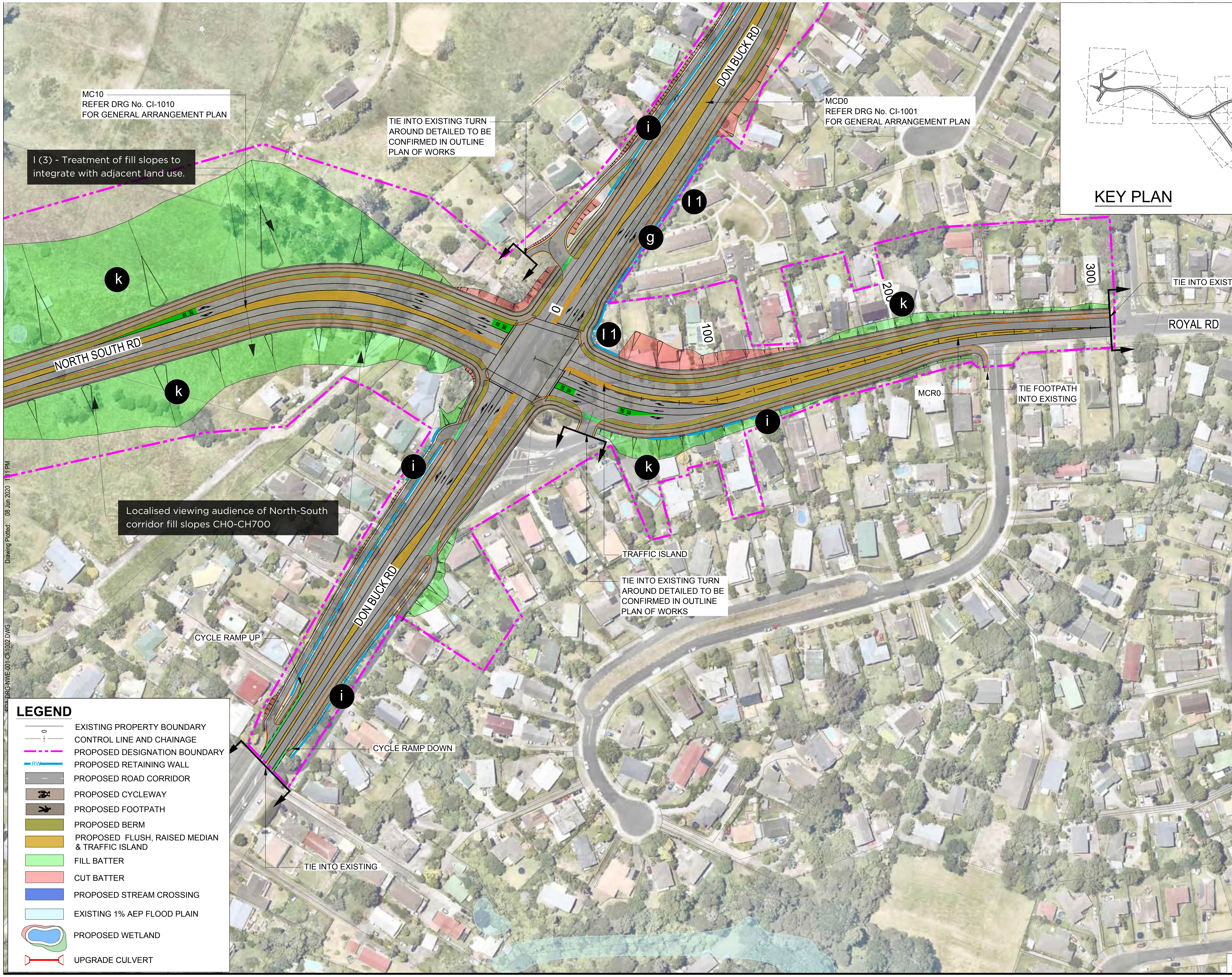
● APPROXIMATE LOCATION OF MIITGATION MEASURES

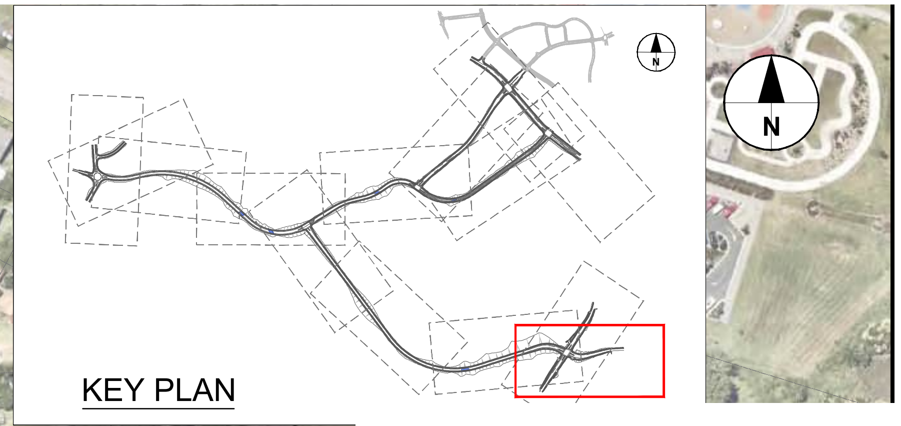
DATE	AUGUST 2020
SCALE	1:2000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (1 OF 14)

06





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01	REDHILL STREAM
02	NGONGETEPARA STREAM
03	WAITEPUTA STREAM
04	TAKITAKI STREAM
05	PAKINUI STREAM
06	RIDGELINE PROTECTION OVERLAY

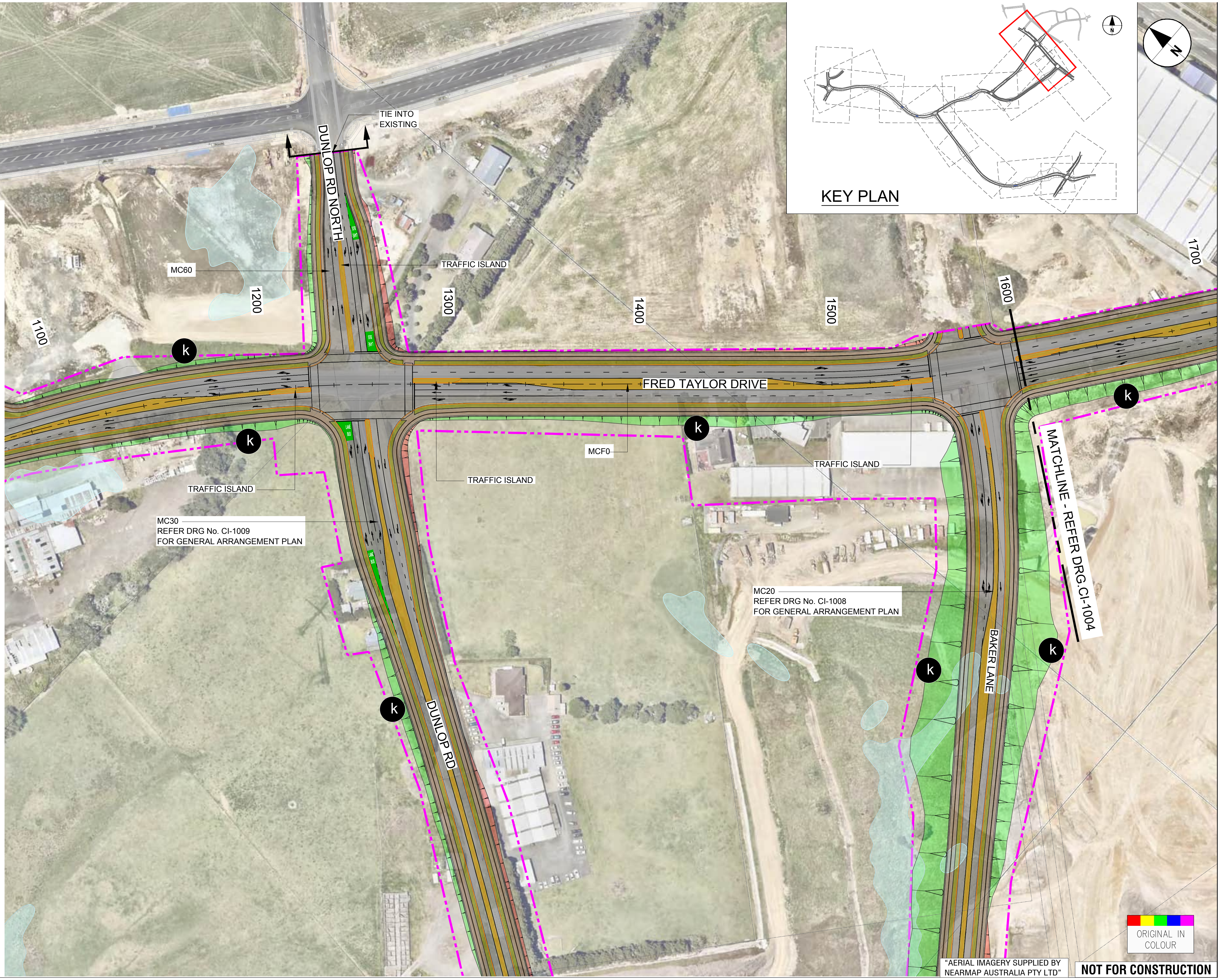
● APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
SCALE	1:2000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (2 OF 14)

07



NOT FOR CONSTRUCTION

LANDSCAPE MITIGATION KEY

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01	REDHILL STREAM
02	NGONGETEPARA STREAM
03	WAITEPUTA STREAM
04	TAKITAKI STREAM
05	PAKINUI STREAM
06	RIDGELINE PROTECTION OVERLAY

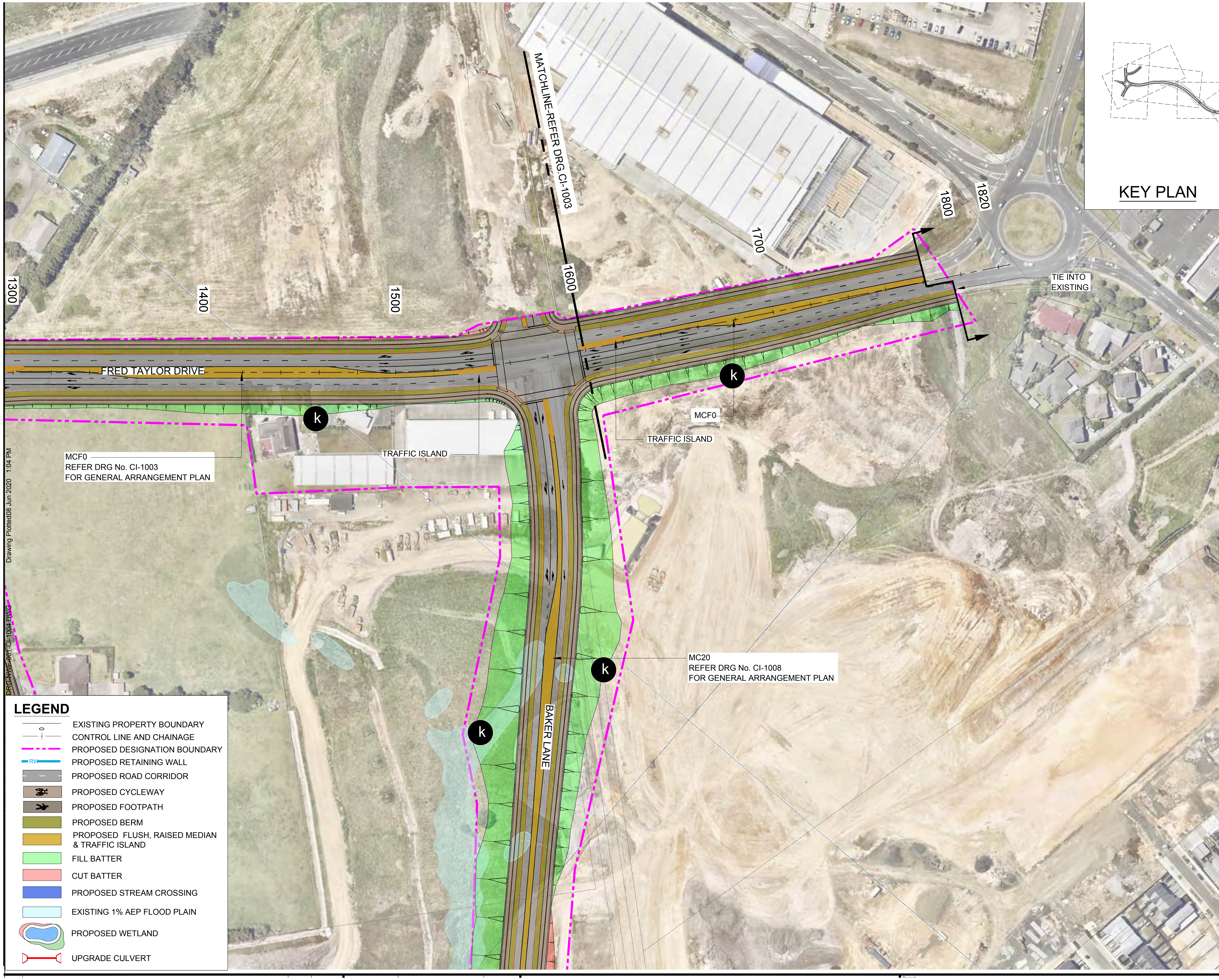
● APPROXIMATE LOCATION OF MIITGATION MEASURES

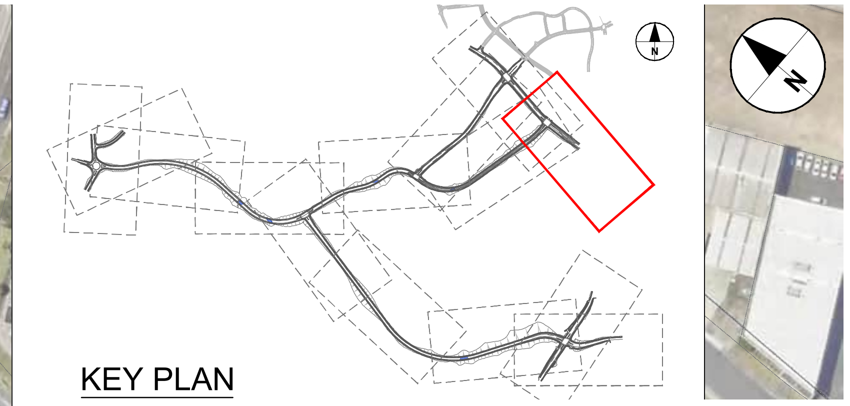
DATE	AUGUST 2020
SCALE	1:2000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (3 OF 14)

08





LANDSCAPE MITIGATION KEY

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01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

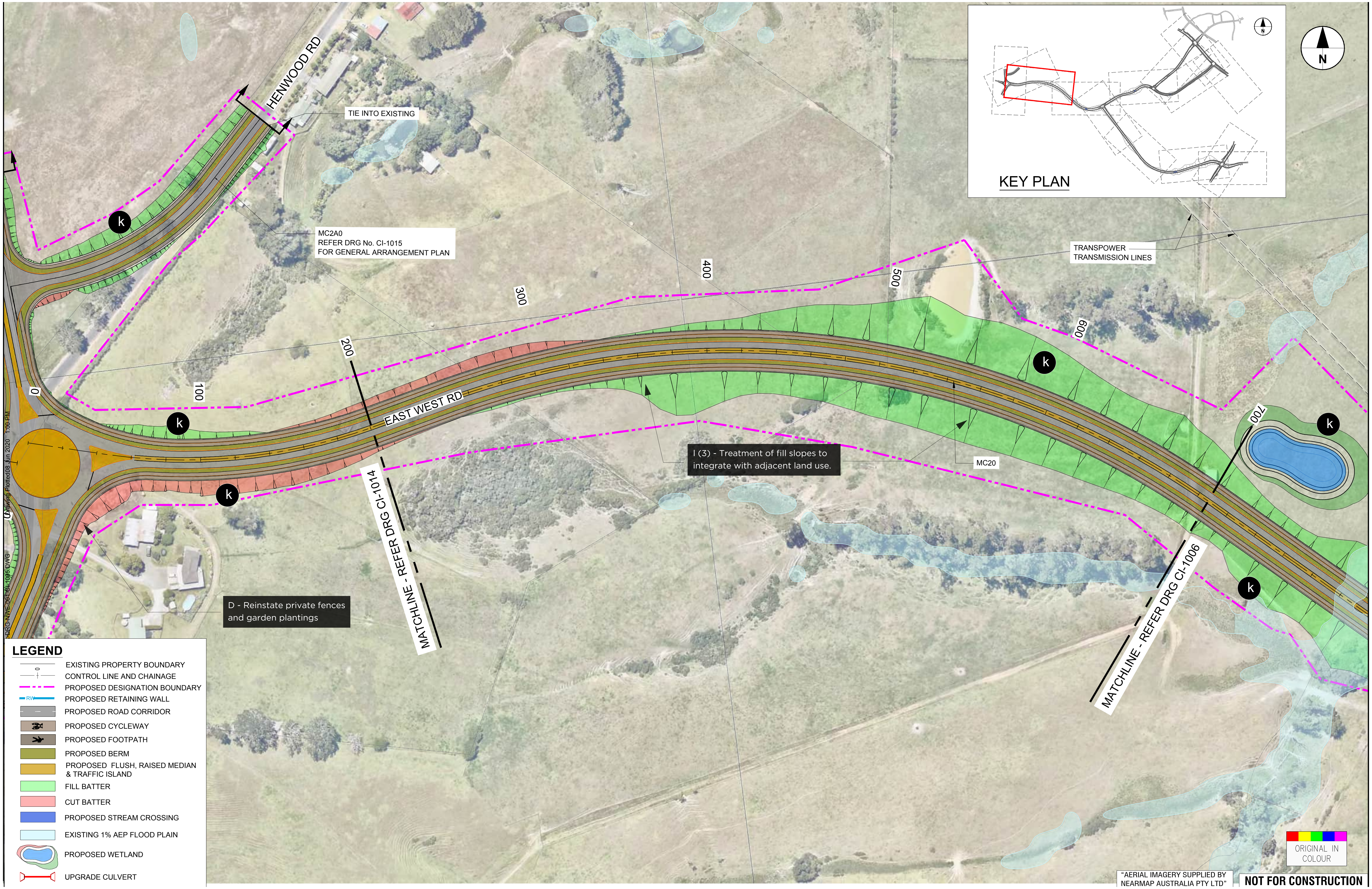
● APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
SCALE	1:2000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (4 OF 14)

09



NOT FOR CONSTRUCTION

01	REDHILL STREAM
02	NGONGETEPARA STREAM
03	WAITEPUTA STREAM
04	TAKITAKI STREAM
05	PAKINUI STREAM
06	RIDGELINE PROTECTION OVERLAY

● APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
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PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

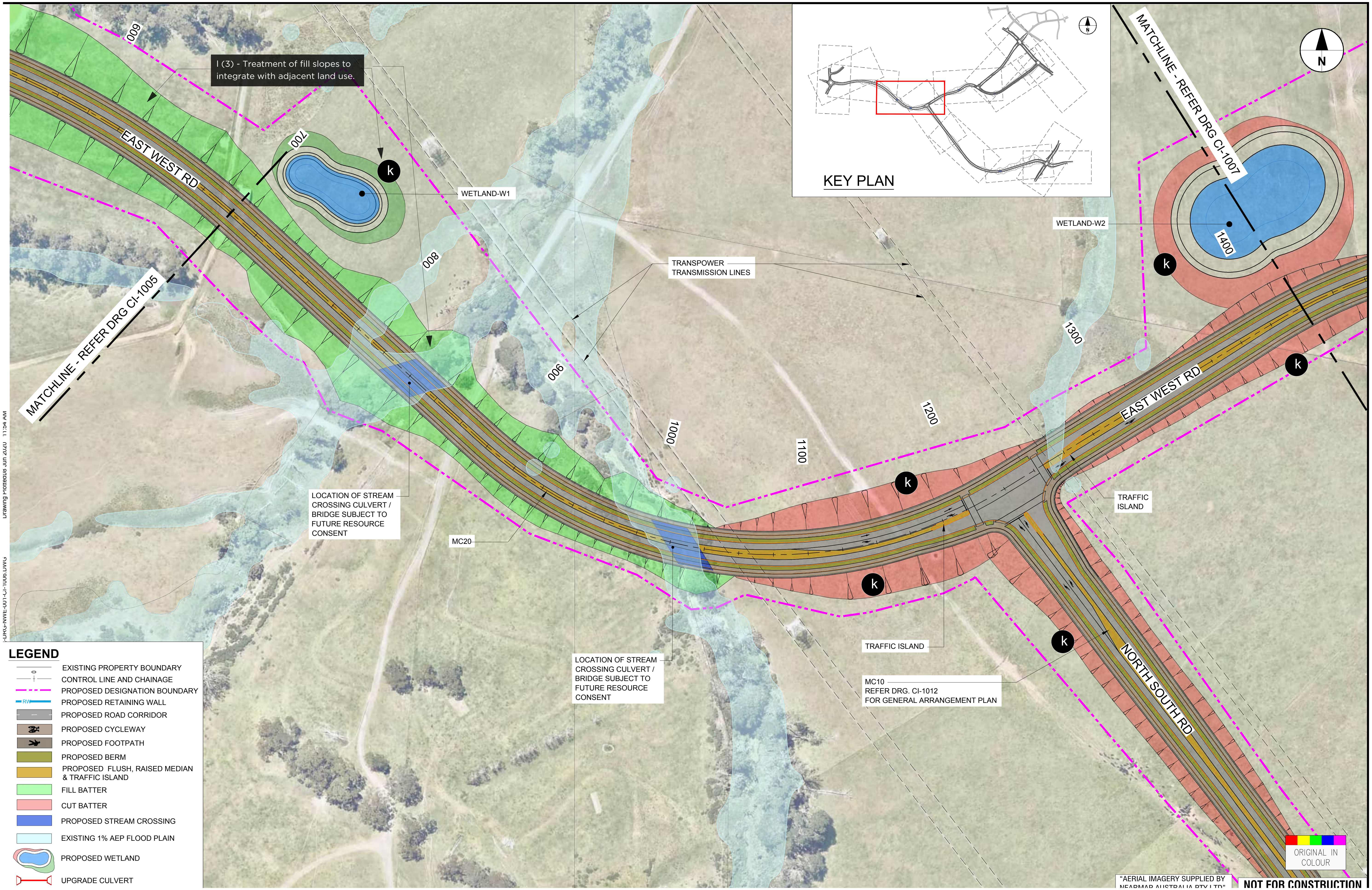
REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (5 OF 14)

10

ATTACHMENT 25

REDHILLS ARTERIAL TRANSPORT NETWORK
ASSESSMENT OF LANDSCAPE
AND VISUAL EFFECTS
PART 3 OF 3



01 REDHILL STREAM
02 NGONGETEPARA STREAM
03 WAITEPUTA STREAM
04 TAKITAKI STREAM
05 PAKINUI STREAM
06 RIDGELINE PROTECTION OVERLAY

APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
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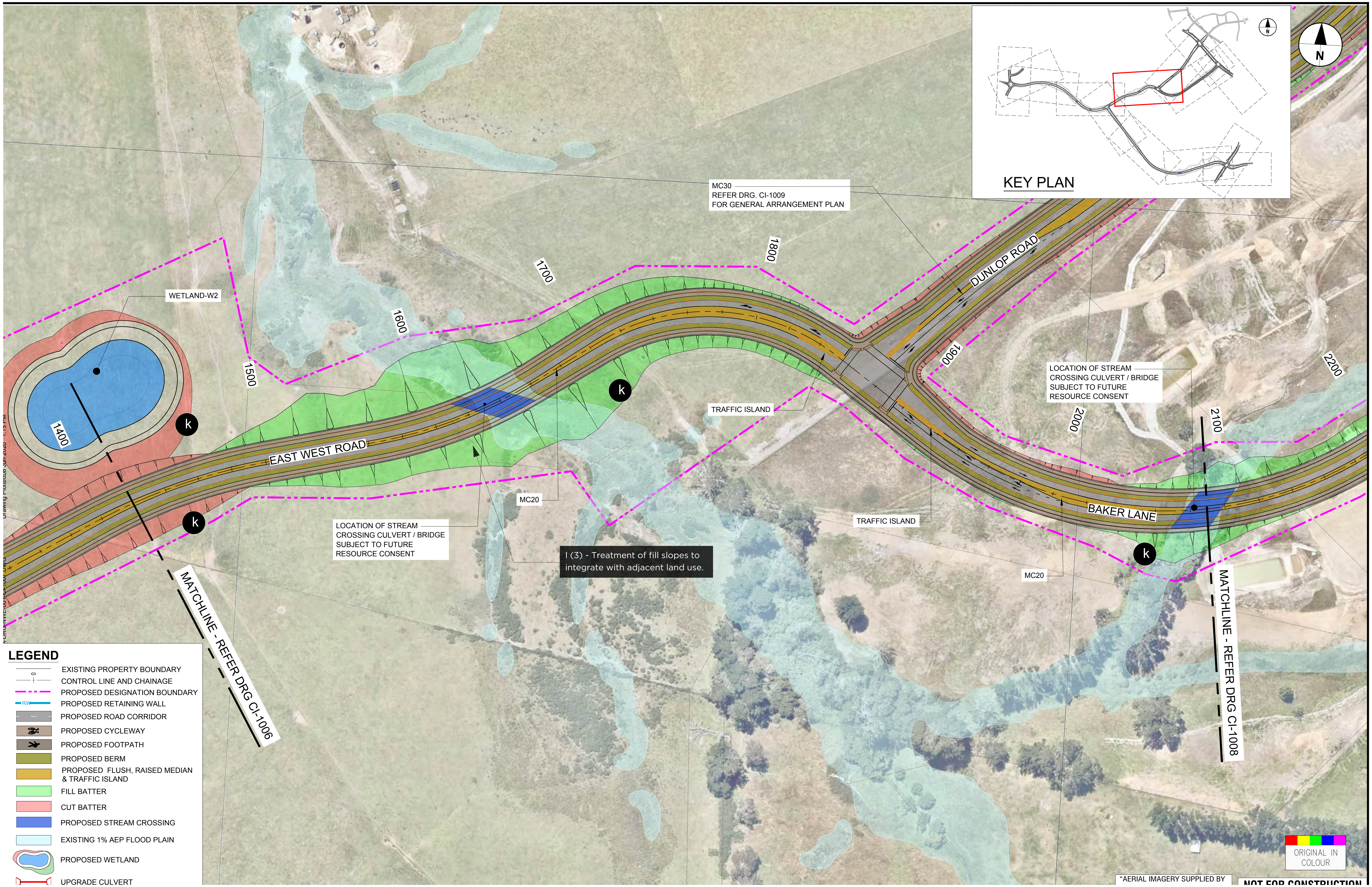
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (6 OF 14)

11



01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
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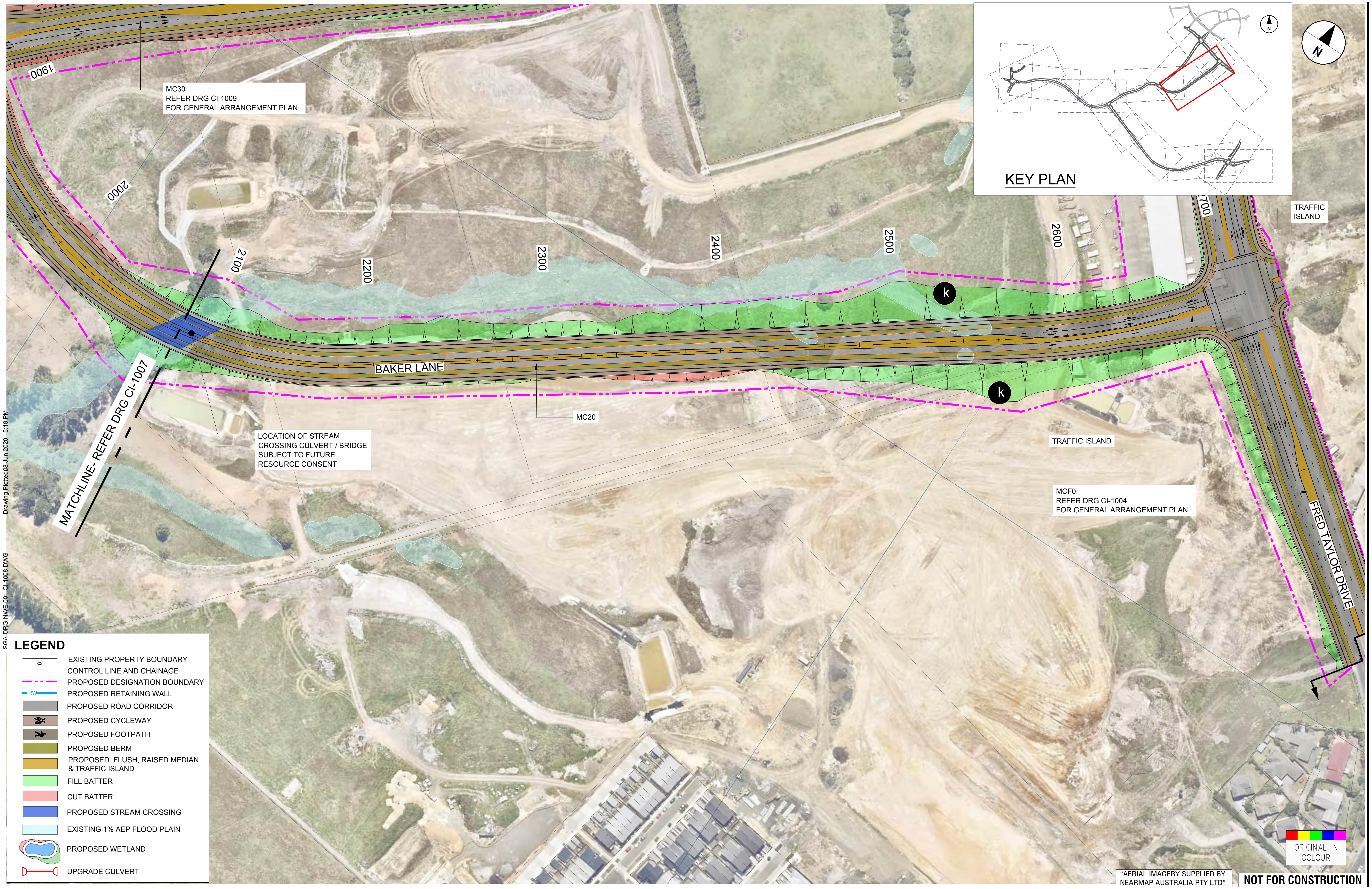
REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (7 OF 14)

12



01	REDHILL STREAM
02	NGONGETEPARA STREAM
03	WAITEPUTA STREAM
04	TAKITAKI STREAM
05	PAKINUI STREAM
06	RIDGELINE PROTECTION OVERLAY

● APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
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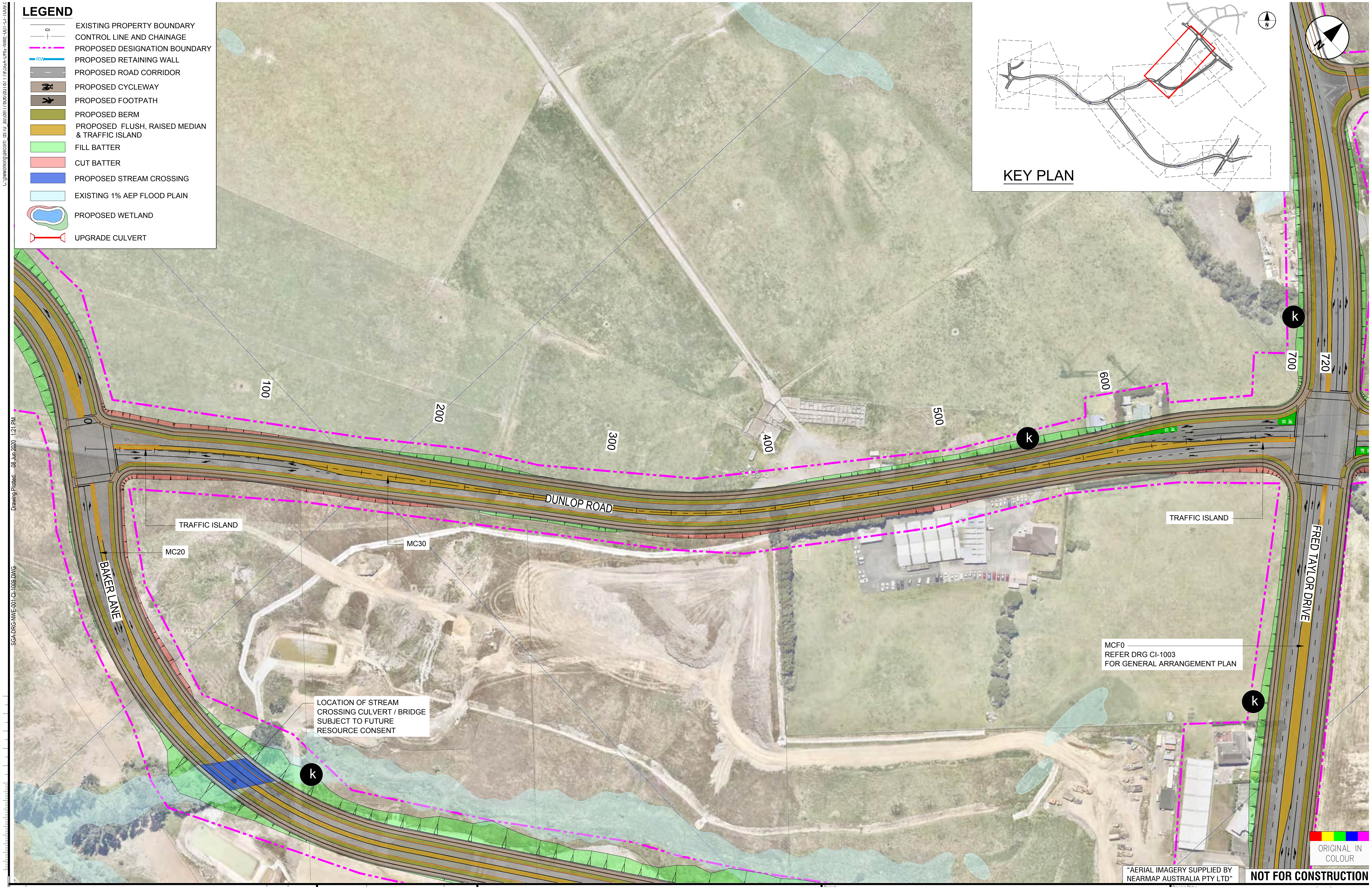
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (8 OF 14)

13



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02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

● APPROXIMATE LOCATION OF MIITGATION MEASURES

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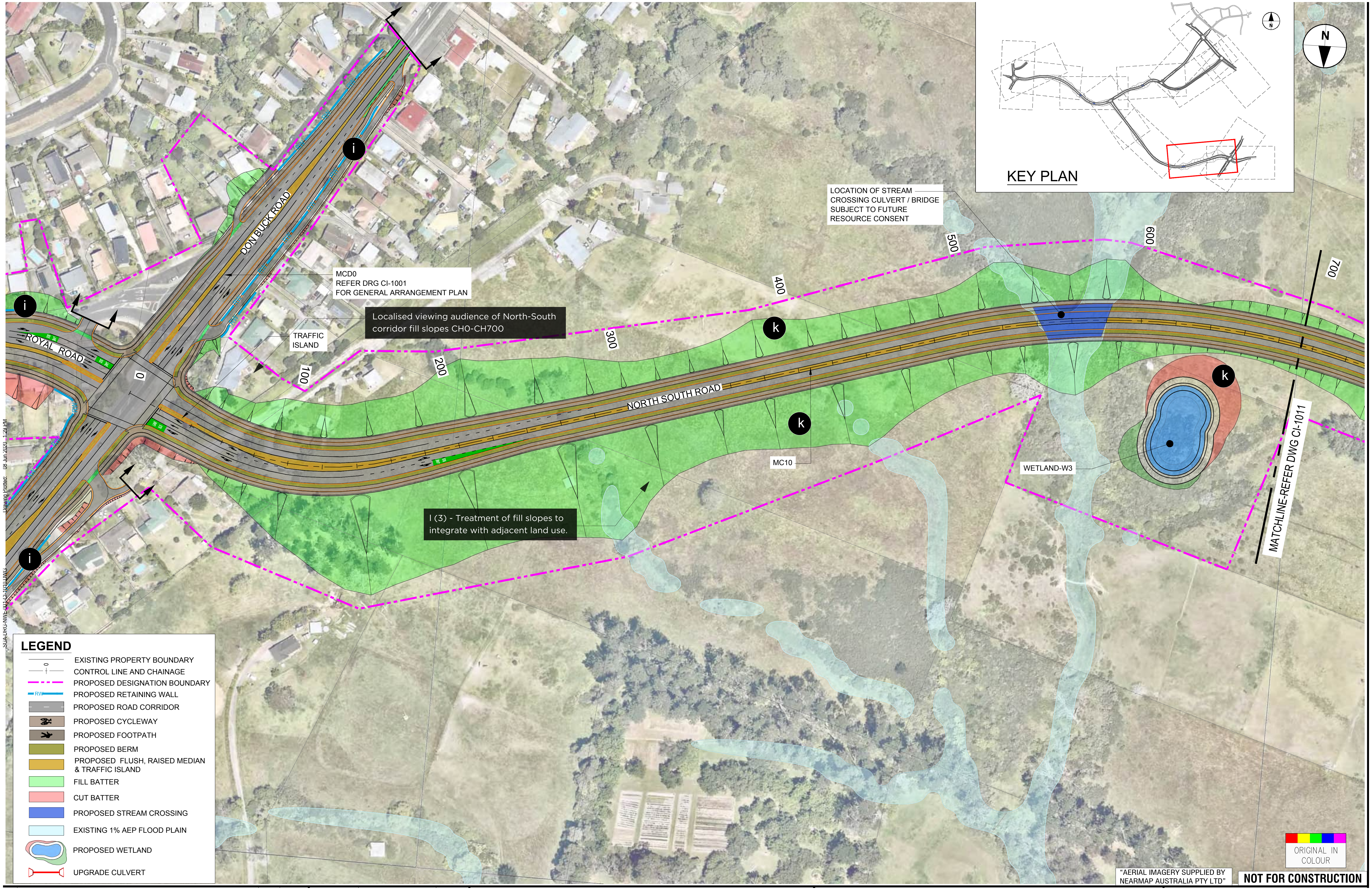
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (9 OF 14)

14



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03	WAITEPUTA STREAM		
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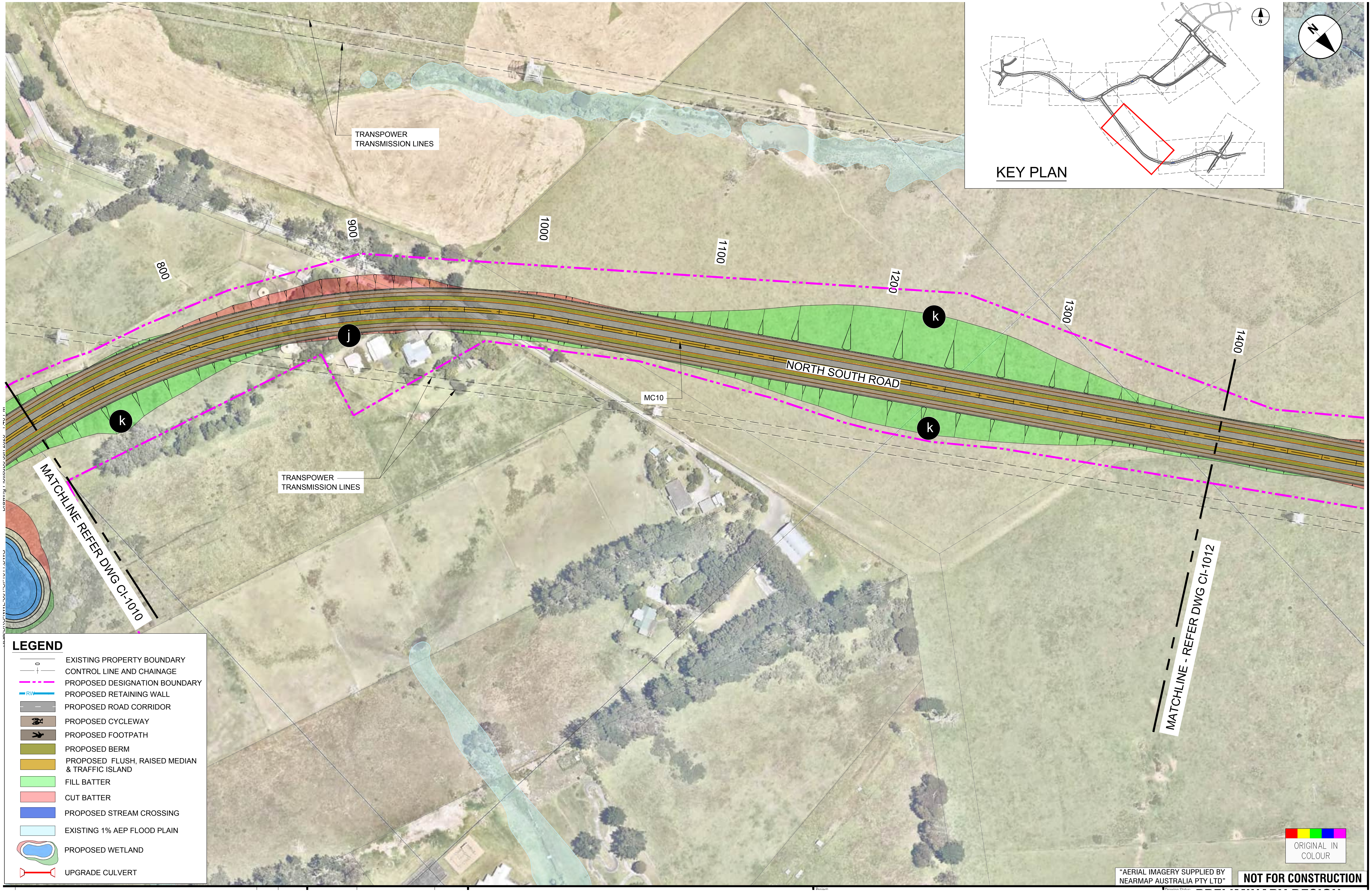
REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (10 OF 14)

15



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04	TAKITAKI STREAM
05	PAKINUI STREAM
06	RIDGELINE PROTECTION OVERLAY

● APPROXIMATE LOCATION OF MIITGATION MEASURES

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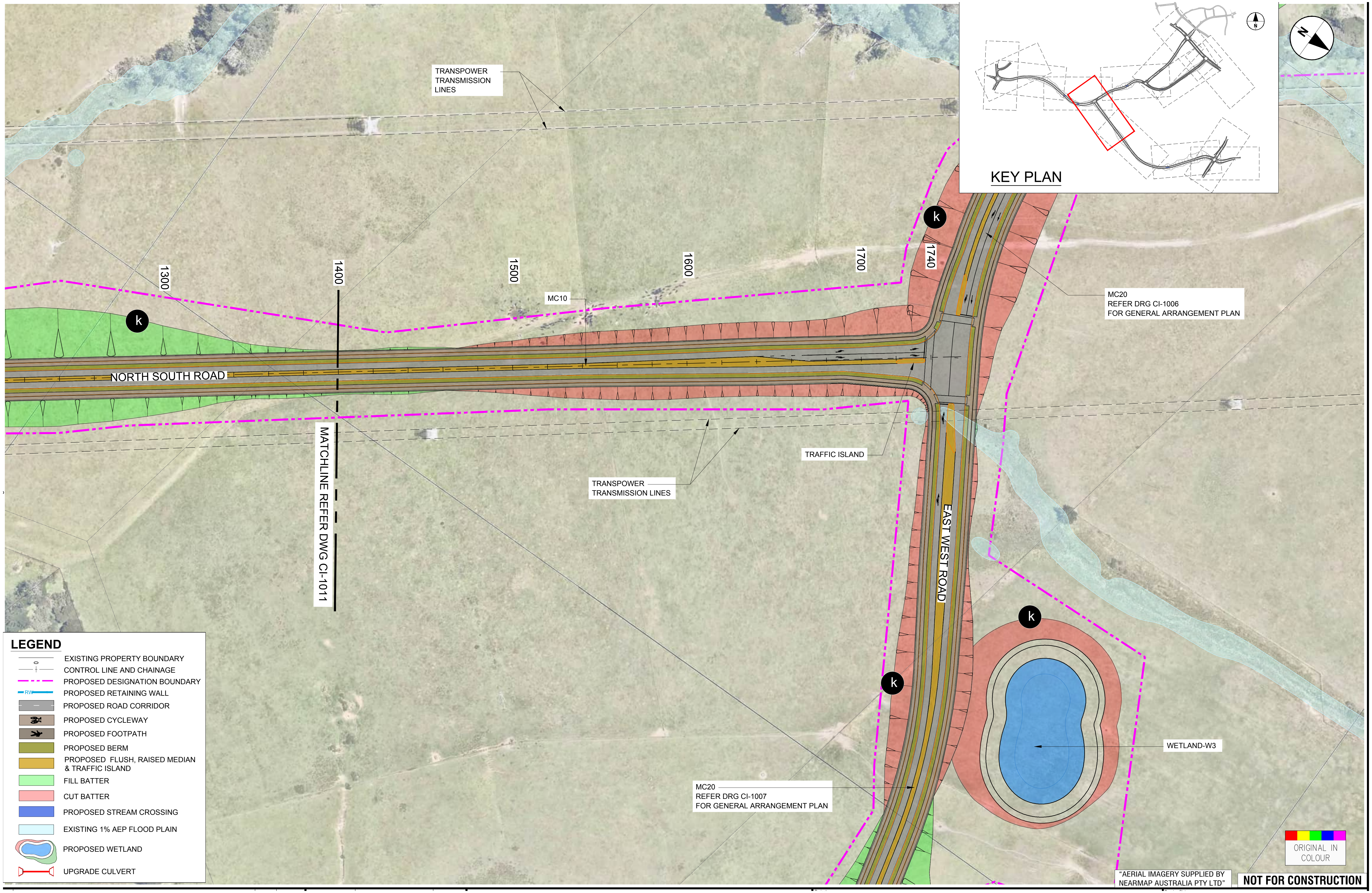
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (11 OF 14)

16



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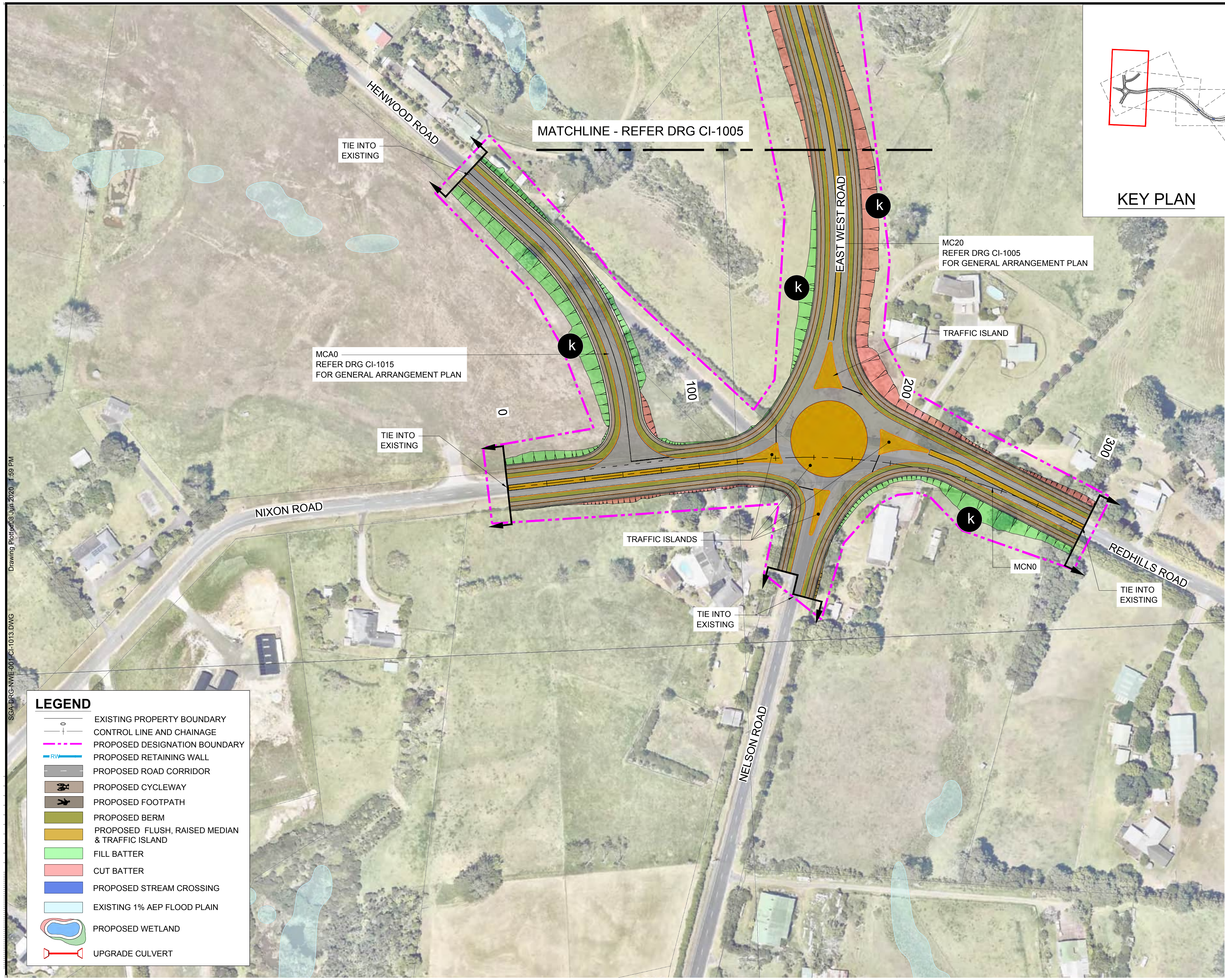
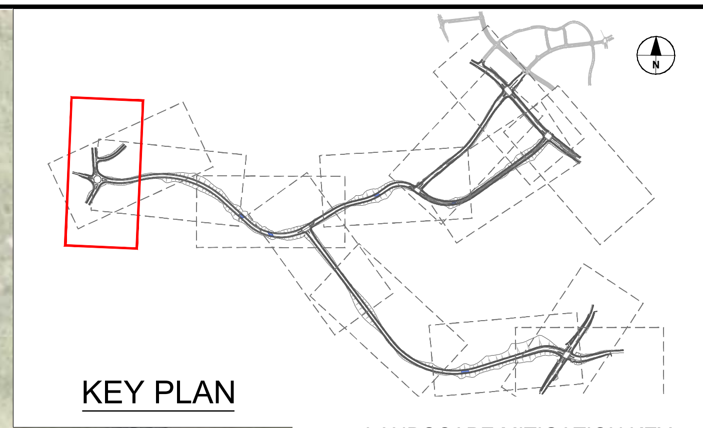
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (12 OF 14)





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c) Reinstate the retaining wall and native and exotic buffer planting above the existing timber retaining wall at the Don Buck Road / Royal Road intersection.

d) Reinstate private fences and garden plantings (with the exception of required properties) for existing, remaining dwellings affected by Project works.

e) For affected private properties, where existing dwellings are assumed to be removed, it is recommended that, after completion of the works affecting the property, the remnant land be grassed and maintained within the road corridor to mitigate adverse visual amenity effects potentially arising from residual land.

f) Bridges (if applicable) - to be designed to contribute to the local sense of place and urban amenity of the future urban landscape.

g) Retaining wall (Don Buck / Royal Road intersection) – It is recommended that the new retaining wall be designed to contribute to the local sense of place and urban amenity of the future urban landscape.

h) Walking and cycling connectivity: investigate opportunities to integrate with existing and future open space (as indicated by the Precinct Plan)

i) Noise mitigation measures / retaining walls – designed to integrate with private boundary fencing (i.e. to avoid double layering of noise walls and boundary fences). It is also recommended that noise mitigation measures and retaining walls incorporate existing and reinstatement planting in a way that contributes to the streetscape character, minimises visual amenity effects on residents and integrates with the layout and design of outdoor living spaces.

j) The 27m long x 1.8m high noise mitigation wall proposed to mitigate the noise effects for 25 Red Hills Road should be designed to integrate with the contextual features of the road corridor and be designed (with a high level of design input) as a purposeful streetscape feature within the road corridor.

k) Cut and fill slopes should be shaped to a natural profile to integrate into the surrounding natural landform. Fill slopes associated with proposed bridge (or culvert crossings) are recommended to be shaped to natural landform at a suitable gradient to allow riparian planting to be established.

l) Planting Plan: a planting plan should be prepared for the Project including for:

1. Reinstatement planting of the Don Buck Road / Royal Road buffer planting.
2. Reinstatement planting in relation to private properties.
3. Treatment of fill slopes to integrate them with adjacent land use. Specific areas for assessment include the following locations:
   - North-South corridor (CH0 - CH700)
   - East-West corridor (CH350 - CH1050)
   - East-West corridor (CH1600-1700)
4. Street trees - ecological analysis to determine species selection relative to local landscape context and ecological opportunities.

01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

● APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
SCALE	1:2000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (13 OF 14)

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LANDSCAPE MITIGATION KEY

a) Reinstate site compounds and construction yards by removing any left-over fill and shaping ground to integrate with surrounding landform. Reinstate with grass at the completion of works.

b) Retain noteworthy trees and vegetation identified within the Project area where practicable.

c) Reinstate the retaining wall and native and exotic buffer planting above the existing timber retaining wall at the Don Buck Road / Royal Road intersection.

d) Reinstate private fences and garden plantings (with the exception of required properties) for existing, remaining dwellings affected by Project works.

e) For affected private properties, where existing dwellings are assumed to be removed, it is recommended that, after completion of the works affecting the property, the remnant land be grassed and maintained within the road corridor to mitigate adverse visual amenity effects potentially arising from residual land.

f) Bridges (if applicable) - to be designed to contribute to the local sense of place and urban amenity of the future urban landscape.

g) Retaining wall (Don Buck / Royal Road intersection) – It is recommended that the new retaining wall be designed to contribute to the local sense of place and urban amenity of the future urban landscape.

h) Walking and cycling connectivity: investigate opportunities to integrate with existing and future open space (as indicated by the Precinct Plan)

i) Noise mitigation measures / retaining walls – designed to integrate with private boundary fencing (i.e. to avoid double layering of noise walls and boundary fences). It is also recommended that noise mitigation measures and retaining walls incorporate existing and reinstatement planting in a way that contributes to the streetscape character, minimises visual amenity effects on residents and integrates with the layout and design of outdoor living spaces.

j) The 27m long x 1.8m high noise mitigation wall proposed to mitigate the noise effects for 25 Red Hills Road should be designed to integrate with the contextual features of the road corridor and be designed (with a high level of design input) as a purposeful streetscape feature within the road corridor.

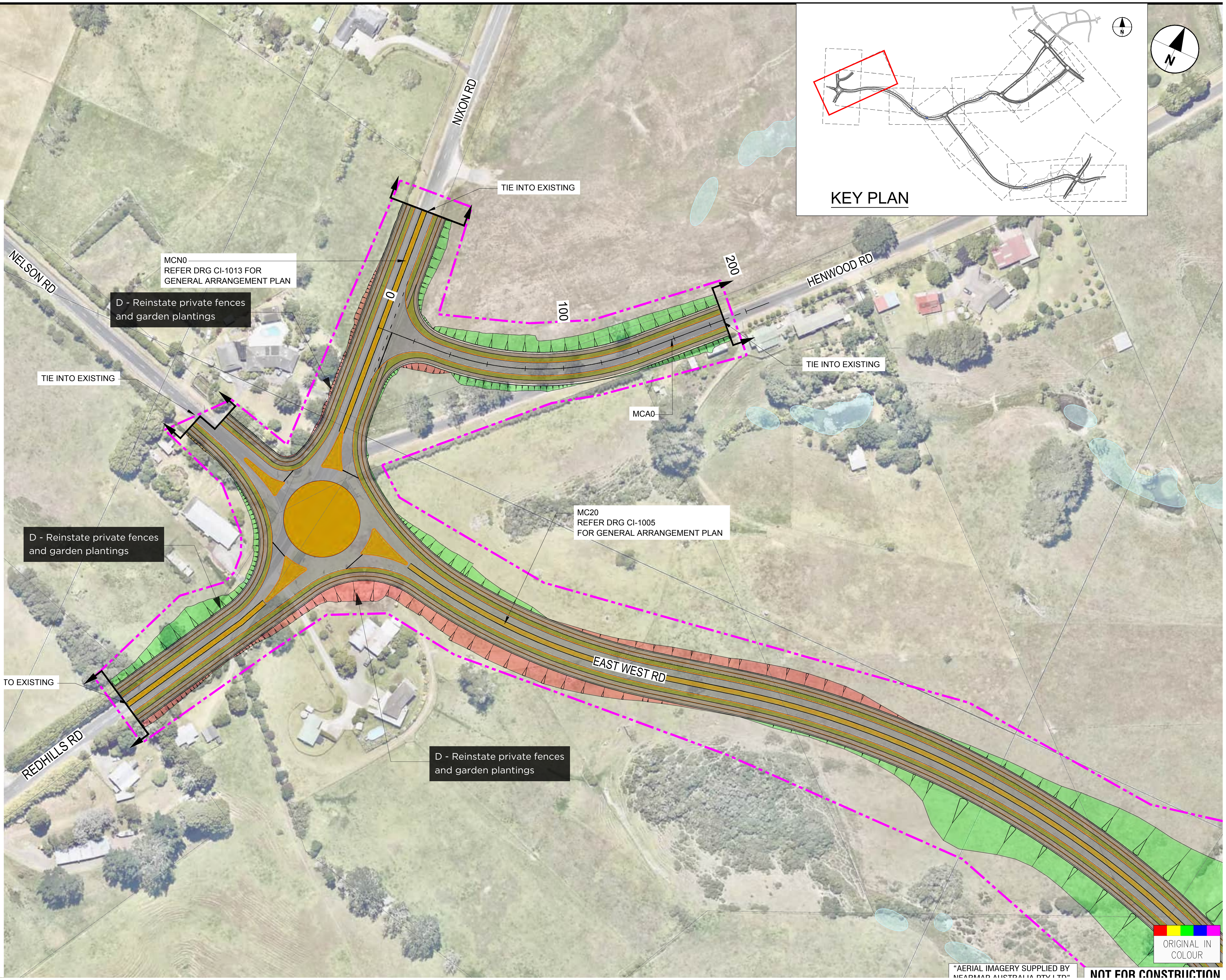
k) Cut and fill slopes should be shaped to a natural profile to integrate into the surrounding natural landform. Fill slopes associated with proposed bridge (or culvert crossings) are recommended to be shaped to natural landform at a suitable gradient to allow riparian planting to be established.

l) Planting Plan: a planting plan should be prepared for the Project including for:
   1. Reinstatement planting of the Don Buck Road / Royal Road buffer planting.

   2. Reinstatement planting in relation to private properties.

   3. Treatment of fill slopes to integrate them with adjacent land use. Specific areas for assessment include the following locations:
      - North-South corridor (CH0 – CH700)
      - East-West corridor (CH350 – CH1050)
      - East-West corridor (CH1600-1700)

   4. Street trees - ecological analysis to determine species selection relative to local landscape context and ecological opportunities.



"AERIAL IMAGERY SUPPLIED BY NEARMAP AUSTRALIA PTY LTD"

NOT FOR CONSTRUCTION

01	REDHILL STREAM	05	PAKINUI STREAM
02	NGONGETEPARA STREAM	06	RIDGELINE PROTECTION OVERLAY
03	WAITEPUTA STREAM		
04	TAKITAKI STREAM		

● APPROXIMATE LOCATION OF MIITGATION MEASURES

DATE	AUGUST 2020
SCALE	1:2000 @ A3
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

GENERAL ARRANGEMENT LAYOUT PLAN (14 OF 14)

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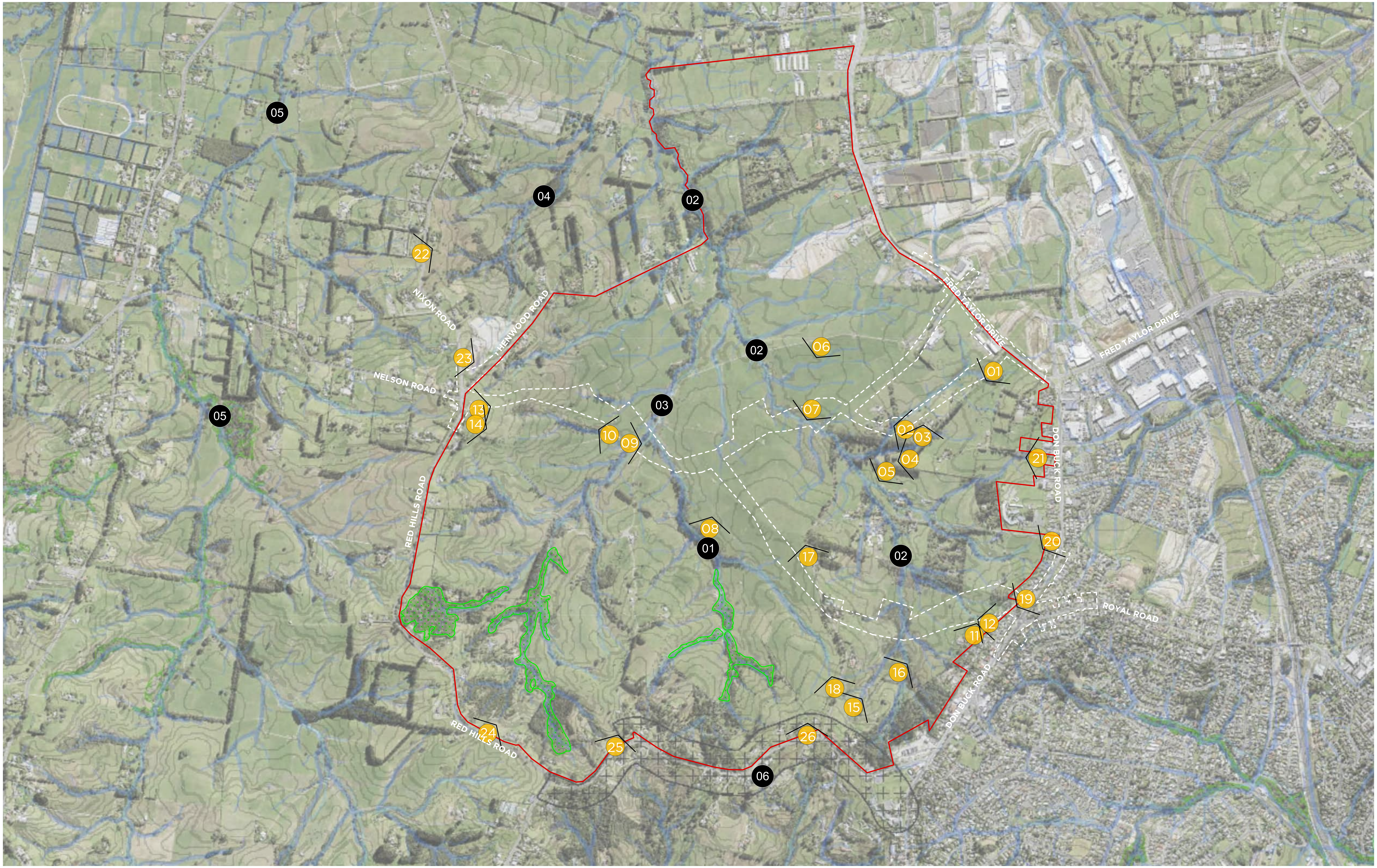

REDHILLS ARTERIAL TRANSPORT NETWORK (RATN) - PROPOSED DESIGNATION BOUNDARY

STREAMS + OVERLAND FLOW PATHS (AUP OIP GIS)

SEA (Terrestrial)

REPRESENTATIVE VIEWPOINTS

01	RED HILL STREAM		
02	NGONGETEPARA STREAM		
03	WAITEPUTA STREAM	05	PAKINUI STREAM
04	TAKITAKI STREAM	06	RIDGELINE PROTECTION OVERLAY

DATE	AUGUST 2020
SCALE	1:15,000 @ A3
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DRAWN BY	K. HOLYOAKE
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REDHILLS ARTERIAL TRANSPORT NETWORK

VIEWPOINT LOCATION PLAN

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Viewpoint Photograph 01. Baker Lane looking south-west into Redhills Precinct. 50mm focal length. Standing eye level.

Viewpoint Photograph 02. Looking west along riparian edge. 50mm focal length. Standing eye level.

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DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK

VIEWPOINT LOCATIONS 01 & 02

Viewpoint Photograph 03. Looking north over constructed stormwater - towards Dunlop Road. 50mm focal length. Standing eye level.

Viewpoint Photograph 04. Looking west into centre of Redhills Precinct. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
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Viewpoint Photograph 05. Looking south-west towards low density residential housing. 50mm focal length. Standing eye level.

Viewpoint Photograph 06. View south-west from farm track. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
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PROJECT ID	NORTH-WEST HIF NOR
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Viewpoint Photograph 07. Looking south-west over Ngongetepara Stream. 50mm focal length. Standing eye level.

Viewpoint Photograph 08. Looking north-east towards East West Road / North South Road intersection. Fred Taylor Drive in the distance. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
SCALE	N/A
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Viewpoint Photograph 9. Looking east towards along East West Road crossing over Red Hills Stream. 50mm focal length. Standing eye level.

Viewpoint Photograph 10. Looking north-west towards Nixon Road / Redhills Road intersection. 50mm focal length. Standing eye level.

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Viewpoint Photograph 11. View from 458 Don Buck Road to the north towards the upper section of proposed North South Road. 50mm focal length. Standing eye level.

Viewpoint Photograph 12. View between 458 and 458A Don Buck Road to the west. Transmission lines in the background and proposed North South Road following transmision line alignment. 50mm focal length. Standing eye level.

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REDHILLS ARTERIAL TRANSPORT NETWORK

VIEWPOINT LOCATIONS 11 & 12

Viewpoint Photograph 13. View east from 319 Redhills Road. Transmission lines in the background and proposed North South Road following transmision line alignment. 50mm focal length. Standing eye level.

Viewpoint Photograph 14. View east from 319 Redhills Road. Transmission lines in the background and proposed North South Road following transmision line alignment. 50mm focal length. Standing eye level.

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PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL
TRANSPORT NETWORK
VIEWPOINT LOCATIONS 13 & 14

Viewpoint Photograph 15. View towards 458 Don Buck Road. Top of proposed North South Road. 50mm focal length. Standing eye level.

Viewpoint Photograph 16. As above - closer to proposed road. 50mm focal length. Standing eye level.

Viewpoint Photograph 17. View to the north-west from 27 Redhills Road. Transmission lines in the foreground - location of proposed North South Road alignment. 50mm focal length. Standing eye level.

Viewpoint Photograph 18. View to the north-west. Transmission lines overhead. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
SCALE	N/A
PROJECT ID	NORTH-WEST HIF NOR
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Viewpoint Photograph 19. 50mm focal length. Standing eye level.

Viewpoint Photograph 20. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
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Viewpoint Photograph 21. 50mm focal length. Standing eye level.

Viewpoint Photograph 22. 50mm focal length. Standing eye level.

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SCALE	N/A
PROJECT ID	NORTH-WEST HIF NOR
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Viewpoint Photograph 23. 50mm focal length. Standing eye level.


Viewpoint Photograph 24. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
SCALE	N/A
PROJECT ID	NORTH-WEST HIF NOR
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Viewpoint Photograph 25. 50mm focal length. Standing eye level.

Viewpoint Photograph 26. 50mm focal length. Standing eye level.

DATE	AUGUST 2020
SCALE	N/A
PROJECT ID	NORTH-WEST HIF NOR
DRAWN BY	K. HOLYOAKE
REVISION	FINAL R5

REDHILLS ARTERIAL TRANSPORT NETWORK
VIEWPOINT LOCATIONS 25 & 26

ATTACHMENT 26

REDHILLS ARTERIAL TRANSPORT NETWORK
ASSESSMENT OF ECOLOGICAL EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Redhills Arterial Transport Network

Assessment of Ecological Effects

December 2022

Version 1

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

Version no.	Responsibility	Name
2020 Draft	Author	Kate Feickert Lyndsey Smith
	Reviewer	Matthew Kerr-Ridge Fiona Davies
1.0	Author	Dannie Cullen Michiel Jonker
	Reviewer	Fiona Davies
	Approver	Bridget O'Leary

Revision Status

Version	Date	Reason for Issue
1.0	December 2022	Final for Issue

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Appendices

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Abbreviations

Acronym / Term	Description
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
ED	Ecological District
NoR	Notice of Requirement (under the Resource Management Act 1991)
RMA	Resource Management Act 1991
SG	Te Tupu Ngātahi Supporting Growth
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.
Ecological Baseline	Means the prevailing ecological state at the time of the assessment.
Likely Future Ecological Environment	The likely future environment informed by the Auckland Unitary Plan (AUP).
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.
Hydroperiod	Flow and or soil saturation period of streams or wetlands.
Project Area	Area of land that is within the proposed designation boundary.
Project Footprint	Area of land that is within the road design.
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”.
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.”
Rapid Habitat Assessment	The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015).

1 Executive Summary

This Ecological Impact Assessment (EcIA) has been prepared to support AT's notices of requirement (NoRs) for the Redhills Arterial Transport Network (the Project) (Table 1-1).

Table 1-1: Redhills Arterial Transport Network – Notices of Requirement and Projects

Notice	Project
NoR 1	Redhills North-South Arterial Corridor
NoR 2a	Redhills East-West Arterial Corridor – Dunlop Road
NoR 2b	Redhills East-West Arterial Corridor – Baker Lane
NoR 2c	Redhills East-West Arterial Corridor – Nixon Road connection

As the Redhills Arterial Transport Network 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 alternatives assessment, the designation boundary and future regional resource consents.

In order to inform the ecological baseline, ecological features within the Project Area 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 within the Project Area

Vegetation Type	Classification (Singers et al. 2017)	Ecological Value
Brown Field	BF	Low
Exotic Forest	EF	Moderate
Exotic Grassland	EG	Low
Exotic Scrub	ES	Low
Planted Vegetation – Exotic (amenity)	PL.3	Low
Treeland – Exotic-Dominated	TL.3	Moderate
Mānuka, Kānuka Scrub	VS3	High

[1] Only district plan vegetation were included as it is an NoR application.

Table 1-3: Ecological values of District Plan trees within the Project Area

Vegetation Type	Classification (Singers et al. 2017)	Ecological Value
Treeland – Exotic-Dominated	TL.3	Low

Table 1-4: Ecological values of terrestrial fauna within the Project Area

Fauna Type	Ecological Value
Mammals	
Long-tailed bats	Very High
Birds	
Non-TAR birds	Low
Northern New Zealand dotterel	Very High
North Island kākā	High
North Island fernbird	High
Herpetofauna	
Copper skink	High
Ornate skink	High

Table 1-5: Ecological values of streams with the Project Area

Stream ID	Ecological Value
RH-S1a	Low
RH-S1b	Low
RH-S2a	Moderate
RH-S2b	Low
RH-S2c	Low
RH-S3	Moderate
RH-S4	Low
RH-S5a	Moderate
RH-S5b	Low
RH-S5c	Low
RH-S5d	Low
RH-S5e	Low
RH-S6	Moderate

Stream ID	Ecological Value
RH-S7a	Moderate
RH-S7b	Low
RH-S7c	Low
RH-S7d	Low
RH-S8	Low
RH-S9	Moderate
RH-S10	Low

Table 1-6: Ecological values of wetlands within the Project Area

Wetland ID	Ecological Value
RH-O1	Low
RH-W1a	Moderate
RH-W1b	Low
RH-W2	Moderate
RH-W3	Moderate
RH-W4	Moderate
RH-W5	Moderate
RH-W6	High
RH-W7	High
RH-W8	Low
RH-W9	Moderate
RH-W10	Moderate
RH-W11	High
RH-W12	Moderate
RH-W13	Moderate
RH-W14	Moderate

Construction Effects

Table 1-7 to Table 1-9 provides a summary of district plan matter ecological effects during construction prior to any mitigation[2]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

To address the effects of construction activities (noise, light and dust) on long-tailed bats, a Bat Management Plan (BMP) for the Project 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, TL.3, and VS3 habitat
- Lighting design to reduce light levels and spill from construction areas
- Restriction of nightworks around EF, TL.3, and VS3 habitat

Bat management should be incorporated with any regional consent conditions that may be required for regional compliance.

All native fauna is protected by the Wildlife Act 1953 (WA 1953), therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

Table 1-7: Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation

Ecological Feature	Permanent loss of habitat / ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)
TL.3	Very Low

Table 1-8: Summary of ecological effects during construction prior to mitigation for bats

Ecological Feature	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
Long-tailed bats[3]	**Moderate**	Low **WA 1953 requirements**	Low **WA 1953 requirements**

[2] Herpetofauna have been considered but excluded in the assessment of ecological effects as construction effects are considered Very Low.

[3] Roost loss has been considered but excluded as an effect as the consequence of roost loss (if it does occur at all) is considered Negligible in the context of this Project.

Table 1-9: Summary of ecological effects during construction prior to mitigation for birds

Ecological Feature[4]	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	Mortality or injury to birds due to removal of district plan vegetation
Non-TAR birds	Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
Northern New Zealand dotterel	Low	-	-
North Island kākā	Very Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
North Island fernbird	Low	-	-

The residual (post-mitigation) level of effect for all construction effects is considered **Very Low**.

Operational Effects

Table 1-10 to Table 1-11 provides a summary of district plan matter ecological effects during operation[5]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Operational effect mitigation measures will include:

To address the operational effects (disturbance and loss in connectivity) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation
- Light and noise management through design.

Table 1-10: Summary of ecological effects during operation prior to mitigation for bats

Ecological Feature	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
Long-tailed bats	**High**	**Very High**

[4] Construction effects on Northern New Zealand dotterel and North Island fernbird has been considered but excluded in the assessment of ecological effects as these species are not expected to utilise TL.3 (district plan vegetation only) habitat, therefore the effect is considered less than Negligible in the context of this Project.

[5] Herpetofauna have been considered but excluded in the assessment of ecological effects as operational effects are considered Very Low.

Table 1-11: Summary of ecological effects during operation prior to mitigation for birds

Ecological Feature	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
Non-TAR birds	Low	Low
Northern New Zealand dotterel	Low	Low
North Island kākā	Low	Low
North Island fernbird	Low	Low

The residual (post-mitigation) level of effect for all operational effects are **Very Low** or **Low**.

2 Introduction

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part (AUP:OP) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Supporting Growth Programme is a collaboration between Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi), to investigate, plan and deliver the transport networks needed to support Auckland's future urban growth areas over the next 30 years.

2.1 Purpose and Scope of this Report

The Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (NoRs) for the Redhills Arterial Transport Network (the Project). The NoRs under the Resource Management Act (RMA) are to designate land to enable the future construction, maintenance and operation of the Project.

This report provides an assessment of ecological effects associated with the construction, operation and maintenance of the Project. This assessment has been prepared to inform the Assessment of Environmental Effects (AEE) for the NoRs.

The key matters addressed in this report are as follows:

- Identify and describe the existing ecological environment
- Describe the actual and potential adverse ecological effects of construction of the Project enabled by the NoRs
- Describe the actual and potential adverse ecological effects of operation of the Project enabled by the NoRs
- Recommend measures as appropriate to avoid, remedy or mitigate potential adverse ecological effects enabled by the NoRs
- Present an overall conclusion of the level of potential adverse ecological effects of the Project enabled by the NoRs after recommended measures are implemented
- Comment on the future potential effects that will arise from future resource consent applications and offer guidance for the framework to be adopted at that time.

3 Project Description

The Project consists of two new arterial corridors through the Project Area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs:

Table 3-1: Redhills Notices of Requirement

Notice	Project	Description
NoR 1	Redhills North-South Arterial Corridor	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.
NoR 2a	Redhills East-West Arterial Corridor – Dunlop Road	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR 2c) at the intersection with the Redhills North-South arterial corridor.
NoR 2b	Redhills East-West Arterial Corridor – Baker Lane	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR 2a).
NoR 2c	Redhills East-West Arterial Corridor – Nixon Road connection	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road / Nelson Road / Nixon Road intersection, and the existing Nixon Road / Henwood Road intersection.

To safely tie into the existing road network, the Project includes the upgrade of existing intersections where the new corridors will connect, as follows:

- Signalisation of the intersection at Don Buck Road and Royal Road (NoR 1)
- Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a)
- Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b)
- A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Roads (NoR 2c).

The Project also provides for new stormwater wetlands for the treatment and attenuation of stormwater from the new corridors.

The Project has been split between four NoRs to reflect the likely implementation of the Project. It may also be possible for each designation to be delivered in stages as the Project Area develops.

An overview of the Project is provided in Figure 3-1. This design, along with the wider designation boundary, is referred to as the Project Area throughout this report.

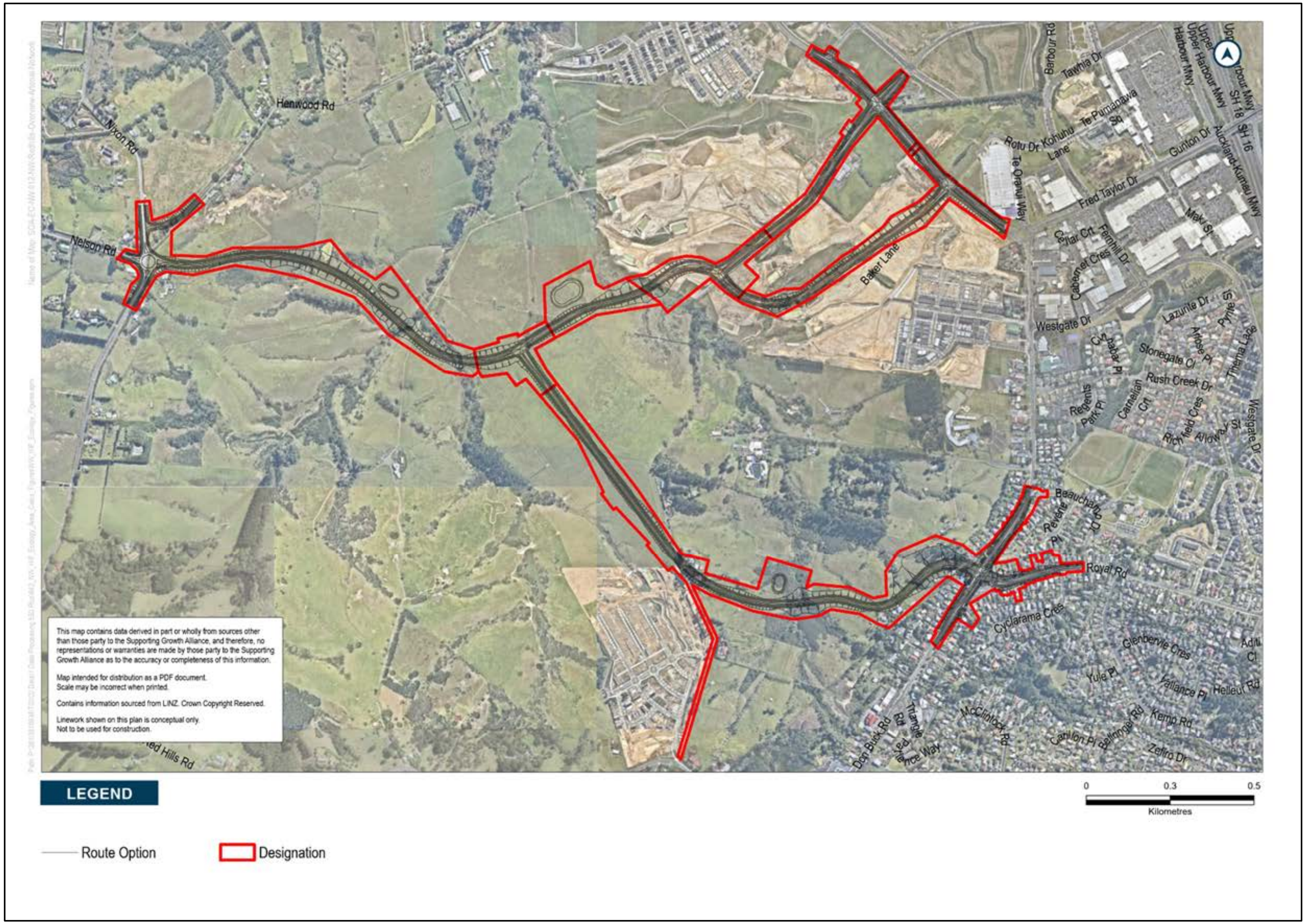

Figure 3-1: Redhills Arterial Transport Network Overview

4 Assessment Approach

4.1 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 4-1 below. Note that for Stage 2 (Level of Effect) and Stage 3 (Impact Management) additional consideration was given to the permitted baseline and the likely future ecological environment under the AUP:OP.

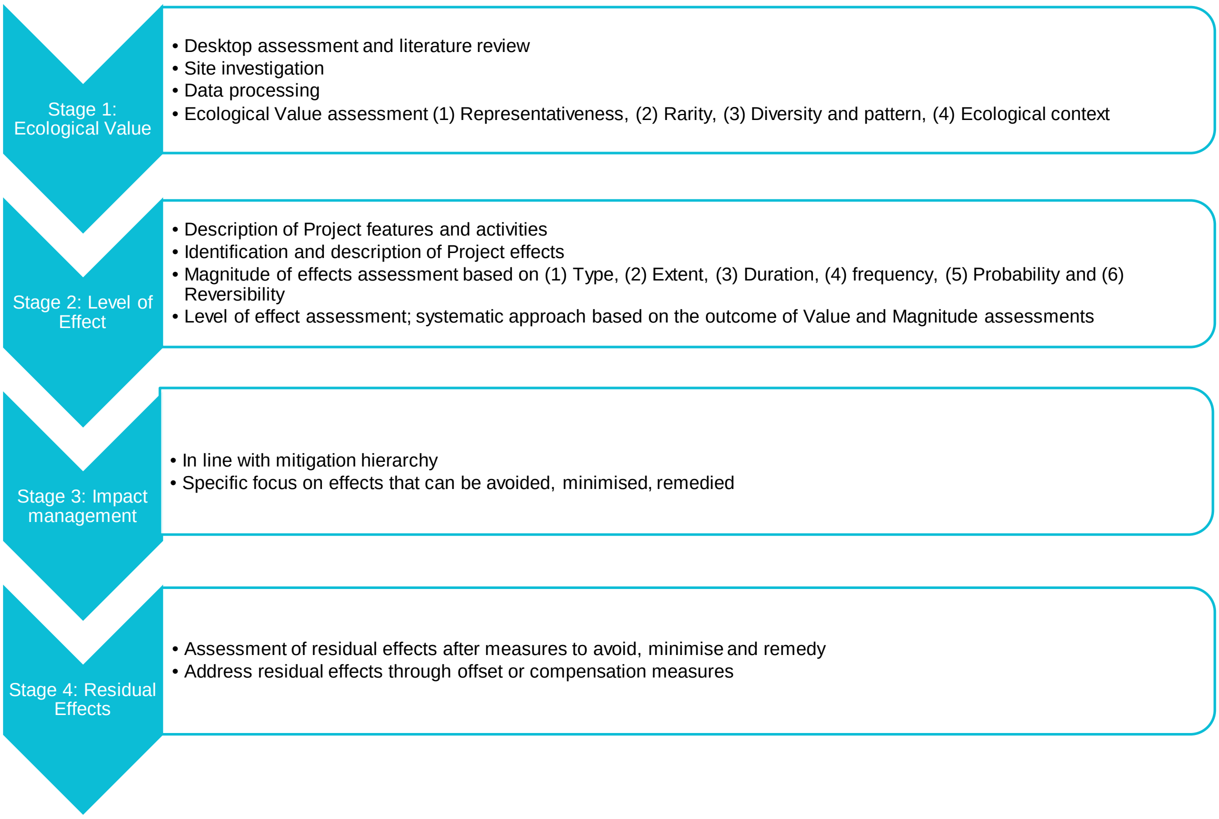

Figure 4-1: Approach process followed for this assessment

4.2 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 Project relates to proposed designations 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 alternatives assessment, the designation boundary and future regional resource consents. A discussion on regional matters is presented in Section 8.4.

Appendix C sets out the split between District and Regional matters in the AUP:OP

4.3 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 C. 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 Section 8.4. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix C.

5 Assessment Methodology

Desktop and site investigations were undertaken for ecological features within all NoRs. Ecological features within the proposed designation boundary and a distance of approximately 100 m radius of the designation have been mapped and included in 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 5.1).

5.1 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 the Project Area has been included in the desktop review, along with their connectivity to the 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 the Project Area 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 herpetofauna 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 the Project Area, varying search distances were used depending on the species context.

5.2 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[6] of the Project Area.

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 GeoMaps7
- Department of Conservation (DOC) Bioweb records8
- Department of Conservation Threat Classification Series9

6 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".

7 https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

8 https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

9 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/

- Ecological Regions and Districts of New Zealand (McEwen, 1987)
- iNaturalist records[10], 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) New Zealand Freshwater Fish Database[11]
- New Zealand Bird Atlas eBird database[12]; recorded within 10 km2 grid squares
- NZ River Name Lines (LINZ Data Service[13])
- Spatial data (wetland delineation) by RMA Ecology (provided by Hugh Green Group)
- Supporting Growth Alliance (SGA) – North West – Assessment of Ecological Effects (Supporting Growth, 2022).

5.3 Site Investigations

Site investigations 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 terrestrial, 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.

5.3.1 Terrestrial Habitat

Site walkovers were undertaken in October 2019, November 2019, and September 2022 by experienced ecologists to map and describe the habitats present within and adjacent to the Project Area. 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 bats, birds, and herpetofauna.

Habitat assessment focused on areas of potentially significant value, such as habitat that was 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 Area.

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 Area.

Common plant names are predominantly used within this report. Maps showing the vegetation cover are provided in Appendix E. Terrestrial ecological value assessment methodology is discussed in Section 5.4.

[10] https://www.inaturalist.org/
[11] https://nzffdms.niwa.co.nz/search
[12] https://ebird.org/atlasnz/home
[13] https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/

5.3.2 Bat Surveys

Bat activity surveys were undertaken using seven Automatic Bat Monitors (ABMs) (SM4BAT FS with SMM-U2 microphone) from 1 – 26 November 2019. The ABMs were placed along streams and vegetated linear features as these areas are more likely to be used by long-tailed bats for foraging and commuting (Borkin & Parsons, 2009; O'Donnell et al., 2006) (Figure 5-1).

When deployed, ABMs were pre-set to start recording 60 minutes before sunset, and cease recording 60 minutes after sunrise (a 'night'). The ABMs were left on site for a minimum of 14 nights, during weather conditions when bats would be active (Sedgeley, 2012).

Weather conditions while the ABMs were on site were also monitored through the NIWA Cliflo website; to ensure that conditions were suitable for bats to be active. This weather information is presented in Appendix K. Weather conditions are compared against guidelines provided in Smith et al., (2017). As these guidelines take a cautious approach to ensure monitoring occurs in optimal conditions; bats are often detected on nights when conditions are considered 'unsuitable' for monitoring. Therefore, whilst only nights with 'suitable' conditions are counted toward the total number of survey nights, bat passes recorded on 'unsuitable' nights are not discounted and are included in the final total. In total, 19 nights were considered suitable for bat activity[14].

[14] All ABMs were deployed on 1 November 2019. ABMs 1, 2, 5, 6, and 7 were retrieved on 18 November 2019 (17 nights of monitoring; eleven with suitable weather conditions). ABMs 3 and 4 were retrieved on 26 November 2019 (25 nights of monitoring, 19 with suitable weather conditions).

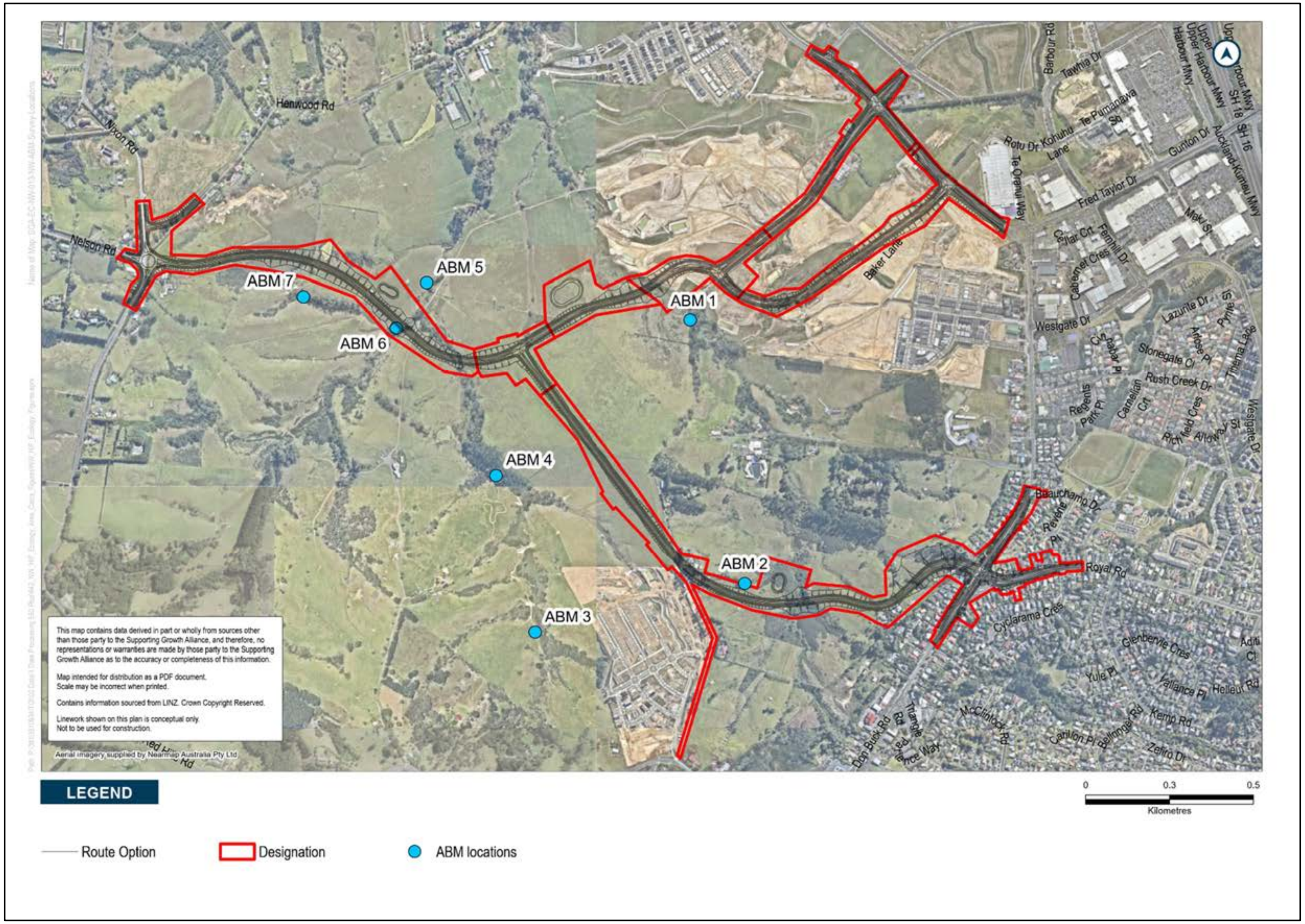

Figure 5-1: Automatic Bat Monitor (ABM) locations

5.3.3 Freshwater Habitat

Where access allowed, streams within the Project Area 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 5.3.

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, NZ Freshwater Fish Database records (NIWA, 2022) 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 5.4.

5.3.4 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 5.3.

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[15] 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 5.4.

5.4 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

[15] "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 four matters and corresponding aspects for terrestrial, freshwater and wetland features are detailed below:

Terrestrial Ecology

- Representativeness: Typical structure, species composition and indigenous representation
- Rarity / distinctiveness: Species of conservation significance, distinctive ecological values
- Diversity and pattern: Habitat diversity, species diversity and patterns in habitat use
- Ecological context: Size, shape and buffering function, sensitivity to change, ecological networks (linkages, pathways, migration).

Freshwater Ecology

- Representativeness: RHA score for accessible sites and riparian habitat modification based on desktop stream and catchment assessments
- Rarity / distinctiveness: Species of conservation significance informed by the potential occurrence of Threatened and At-Risk (TAR) fish species
- 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
- Ecological context: Stream order and hydroperiod.

Wetland Ecology

- Representativeness: Hydrological modification based on observations of drains, ponds and catchment land use. Native vegetation informed by site visit and review of landcover information
- Rarity / distinctiveness: Wetland type (rare or distinctive); distinctive ecological values (ecosystem services) in a larger catchment context
- Diversity and pattern: Representation of different hydroperiods (permanent, seasonal or temporary) and the structural complexity of vegetation cover
- Ecological context: flood attenuation, streamflow regulation, sediment trapping, water purification, connectivity and migration.

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.

6 Positive Effects

The following section outlines the positive effects of the proposed alignment for the Project in relation to specific ecological features. The statement regarding positive effects assumes that native planting will occur on the roadsides as part of the landscape management. Potential positive effects include:

- Improved blue / green infrastructure (stormwater wetlands, swales, raingardens) and associated landscaping (which will be indigenous species)
- 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)
- 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 (where required) and improved riparian habitat connectivity
- Mass revegetation of sloping berms, batters, and embankments to connect with retained forest remnant / mature trees.

7 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 Project Area. 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 E). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within the Project Area.

7.1 Historical Ecological Context

The Project Area lies within the Tamaki Ecological District, which has a warm humid climate and is characterised by volcanic cones, isthmus, harbours and volcanic terrain (McEwen, 1987). Originally forested, the landscape would have been dominated by northern North Island lowland broadleaved forest with abundant taraire (*Beilschmiedia tarairi*) and pūriri (*Vitex lucens*) (Singers et al., 2017).

Presently, only 7% of the native land cover; and 1% of freshwater wetlands and wetland forests remain in the Tamaki Ecological District (Auckland Regional Council, 2013), Reduction to around 20% of former extent is usually considered to be significant. Reduction to below 5% is considered to be severe (Walker et al., 2008). The reductions in the Tamaki Ecological District are well below these levels.

7.2 Terrestrial Ecology (Flora)

7.2.1 Desktop Review

Auckland GeoMaps aerial imagery shows that the original forest has been cleared and that the terrestrial habitats within the Project Area are dominated by agricultural land. Regenerating forest fragments in the wider Redhills area (outside of the Project Area) include tawa (*Beilschmiedia tawa*), kohekohe (*Dysoxylum spectabile*), rewarewa (*Knightia excelsa*), hīnau (*Elaeocarpus dentatus*) podocarp forest (WF13), kānuka (*Kunzea ericoides*) scrub / forest (VS2) and mānuka (*Leptospermum scoparium*), kānuka scrub (VS3).

The AUP:OP Natural Heritage data set was checked for notable trees. No notable trees occur within or adjacent to the Project Area.

There are no SEAs within the Project Area. The closest SEA which has been listed within the AUP:OP is SEA_T_2031 which is approximately 150 m south of the Project Area (Table 7-1). A further four SEAs are present within the Ngongetepara Stream catchment which is crossed by the Project. These include three terrestrial SEAs (SEA_T_2030, 6336 and 6337) and one marine SEA (SEA_M2_57b). These SEAs will not be directly affected by the Project, however, indirect impacts on habitats and the species they support could occur as the Ngongetepara Stream and its tributaries is a habitat linkage between the Project Area and the SEAs (e.g., sediment discharge, disturbance of species etc.). There are no other SEAs within 500 m of the Project Area. The SEAs along the Ngongetepara Stream catchment have been described in Table 7-1 and the location in relation to the Project Area is shown on Figure 7-1.

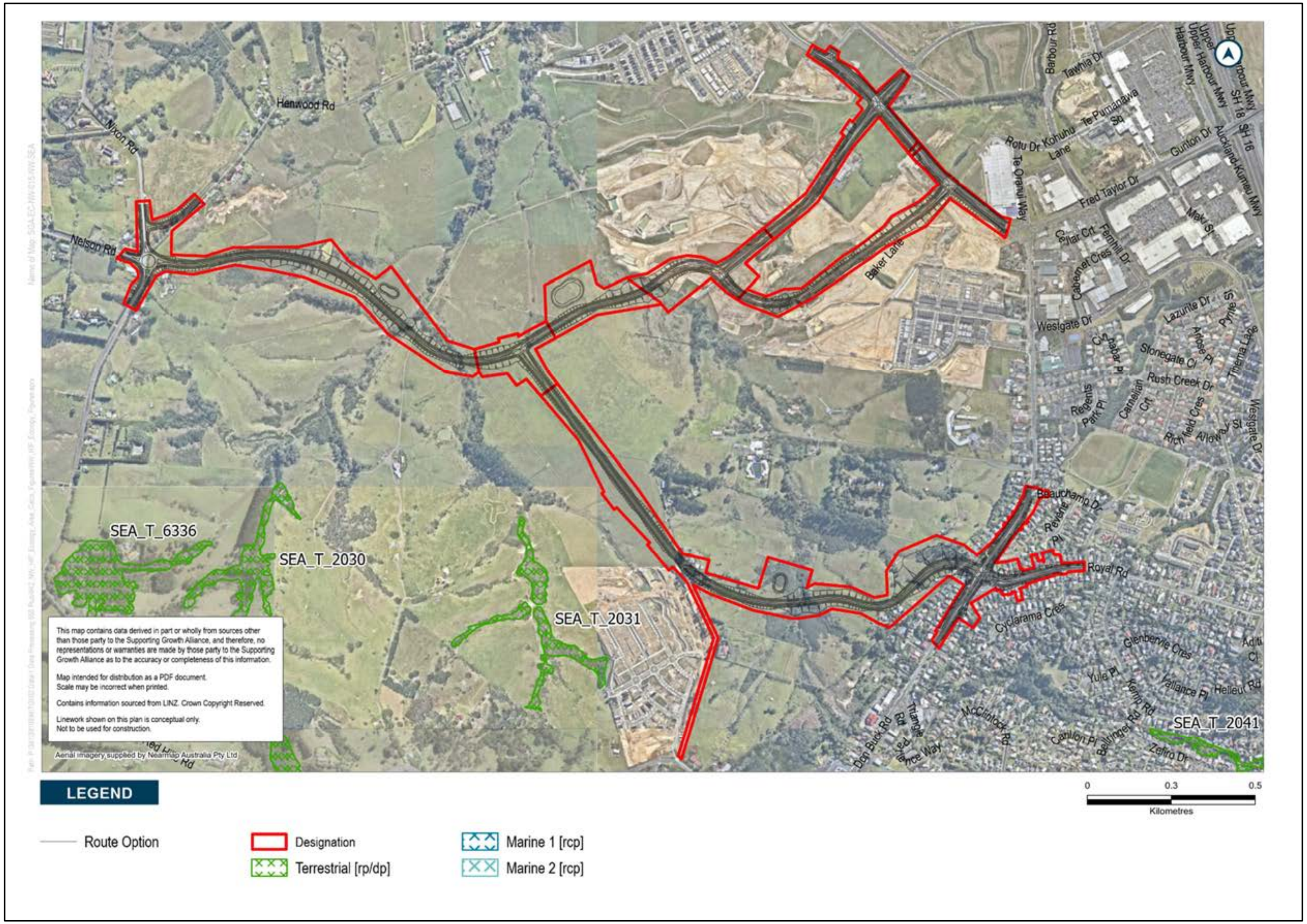

Figure 7-1: SEAs located near Project Area

Table 7-1: SEAs within the Ngongetepara Stream catchment

SEA	Approximate Distance from Project Area	SEA Type	Description
SEA_T_2031	150 m	Terrestrial	Oioi / restiad rushland reedland; and scrubland dominated by kānuka. Impacted by grazing.
SEA_T_2030	600 m	Terrestrial	Areas of wetland comprised of either reeds or sedges, with an area of open water. Fringed with shrubland which is kānuka-dominated.
SEA_T_6336	800 m	Terrestrial	An area of forest and open water. Forest is either pine or kānuka dominated. There is also some area of kānuka-dominated treeland.
SEA_T_6337	1.1 km	Terrestrial	An area of kānuka scrub / forest.
SEA-M2-57b	3 km	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.

7.2.2 Site Investigations

The Project Area is dominated by exotic grassland with small areas of exotic forest, exotic scrub, regenerating mānuka (*Leptospermum scoparium*), kānuka (*Kunzea robusta*) scrub and indigenous / exotic planted vegetation. These habitats were classified according to Singers et al. (2017) and mapped in Appendix E.

Table 7-2: Vegetation types present within Project Area

Habitat	Classification (Singers et al., 2017)	Description
Brown Fields (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. There are two types of exotic forest in the Project Area, eucalyptus and radiata pine. Understory vegetation was generally sparse due to deep shade, also these areas were largely unfenced and affected by grazing. Understorey vegetation was generally restricted to sparse woolly nightshade, cabbage tree, tree ferns and privet.

Habitat	Classification (Singers et al., 2017)	Description
Exotic Grassland	EG	Grassland dominated by exotic species. The exotic grass species included Yorkshire fog (*Holcus lanatus*), rye grass (*Lolium perenne*), cocksfoot (*Dactylis lomerate*) couch grass (*Cynodon dactylon*), sweet vernal grass (*Anthoxanthum odoratum*) and kikuyu grass (*Cenchrus clandestinus*).
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover / biomass of exotic species. This includes gorse, woolly nightshade and privet. These plants generally dominated these areas with few other species present.
Planted Vegetation – Exotic (amenity)	PL.3	Planted amenity, including parks and gardens and areas of indigenous planting along existing roadsides.
Treeland – Exotic-Dominated	TL.3	The tree canopy cover in this habitat was discontinuous and between 20-80%. This habitat was exotic-dominated, with <25% indigenous species. For the purposes of this report this habitat also includes shelter belts of radiata pine (*Pinus radiata*). Other species present included ironwood (*Casuarina* sp.), crack willow (*Salix fragilis*) and eucalyptus species (*Eucalyptus* spp.). The understorey was generally dominated by exotics such as arum lily (*Zantedeschia aethiopica*) and woolly nightshade. Regenerating indigenous species included tree ferns and cabbage trees (*Cordyline australis*).
Mānuka, kānuka scrub	VS3	The majority of this habitat occurred outside the Project Area, however, a small amount (approx. 0.05 ha) was within the Project Area. This early successional habitat has regenerated after disturbance. Species present include mānuka, ponga (*Cyathea dealbata*), mamaku (*C. medullaris*) and wheki (*Dicksonia squarrosa*), karamu (*Coprosma lucida* and *C. robusta*), twiggy coprosma (*C. rhamnoides*) and mingimingi (*Leucopogon fasciculatus*). The understorey was dominated by exotic species including Chinese privet (*Ligustrum sinense*), woolly nightshade (*Solanum mauritianum*) and European gorse (*Ulex europeaus*). The patches of VS3 habitat within the Project Area were small and isolated, with more continuous stands occurred outside the Project Area.

7.2.3 Ecological Value

Appendix F details the ecological value for the terrestrial vegetation identified within the Project Area. Table 7-3 describes the habitats observed within the Project Area and their ecological value in accordance with the EIANZ Guidelines (Roper-Lindsay et al., 2018). As described in Section 7.2.2, the surveys identified the presence of kānuka and mānuka within areas of indigenous regeneration and planting. These species have been listed as 'Threatened – Nationally Vulnerable' (de Lange et al., 2017) because of the spread of myrtle rust within New Zealand and the risk that this poses to all Myrtaceae species. These species are currently common throughout the Tamaki Ecological District, in addition the individuals within the Project Area are predominantly immature or semi-mature. Therefore, the presence of these Threatened species has not altered the valuation of the habitats within which they occur.

Table 7-3: Ecological values of the vegetation types present within the Project Area

Habitat	Classification (Singers et al., 2017)	Ecological Value
Brown Fields (includes cropland)	BF	Low
Exotic Forest	EF	Moderate
Exotic Grassland	EG	Low
Exotic Scrub	ES	Low
Planted Vegetation – Exotic (amenity)	PL.3	Low
Treeland – Exotic-Dominated	TL.3	Moderate
Mānuka, Kānuka Scrub	VS3	High

7.3 Terrestrial Ecology (Fauna)

7.3.1 Bats

7.3.1.1 Desktop Review

Existing records (Department of Conservation, 2022[16]; Supporting Growth Alliance, 2022) confirm the presence of long-tailed bats (*Chalinolobus tuberculatus*) within 1 km of the Project Area (Figure 7-2). The conservation status of this species is 'Threatened – Nationally Critical' (O'Donnell et al., 2018). The nearest record is 50 metres north of the designation boundary within a stream / wetland complex with associated TL.3 vegetation (Figure 7-3).

[16] Bat surveys for this Project were completed in 2019 (detailed in Section 7.3.1.2), the results of these surveys have since been submitted to Department of Conservation. Therefore, the Department of Conservation bat records include the results of these surveys (as seen in Figure 7-2 Figure 7-3).

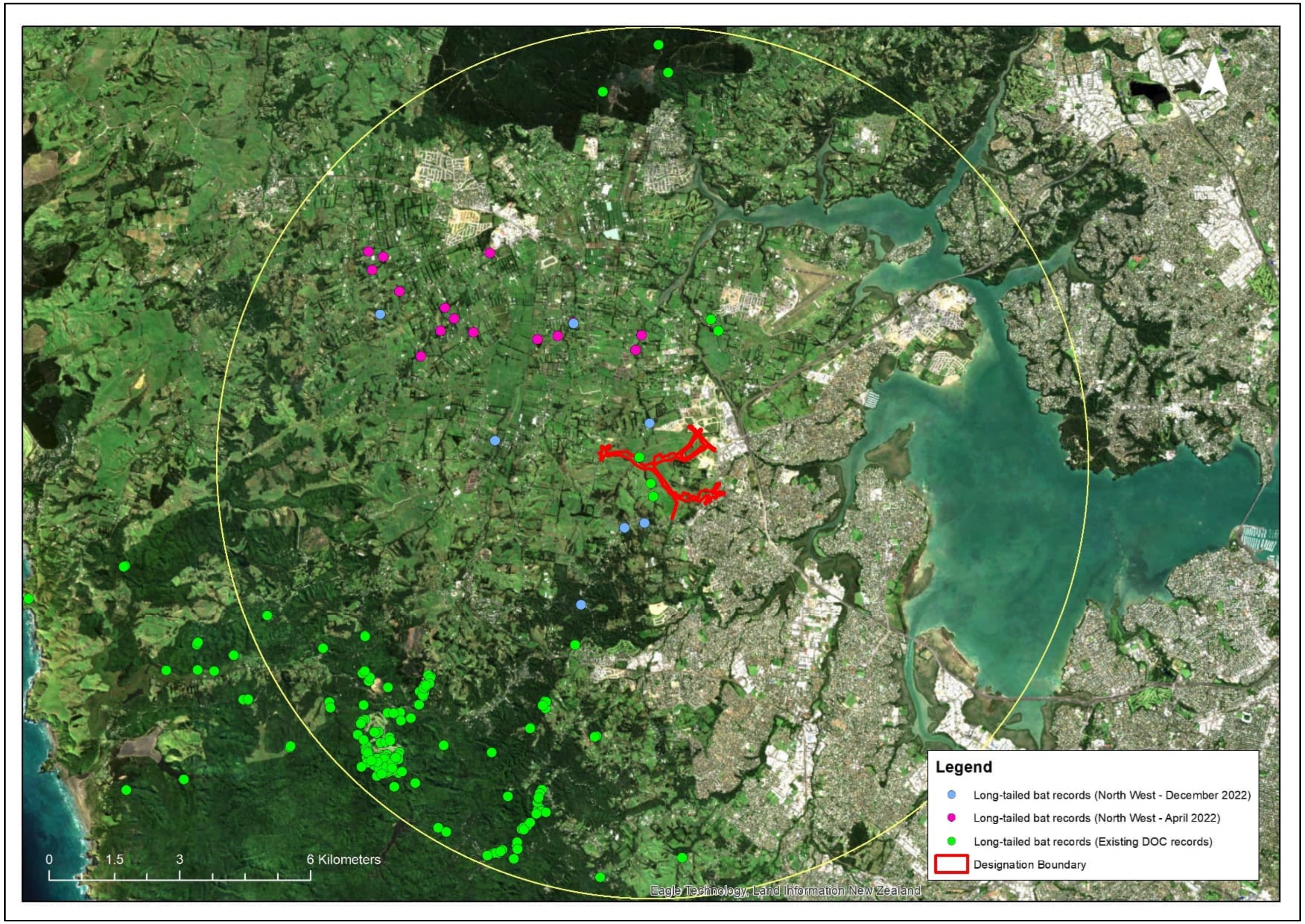

Figure 7-2: Existing long-tailed bat records within a 10 km radius of the Project Area (Department of Conservation, 2022; Supporting Growth Alliance 2022)

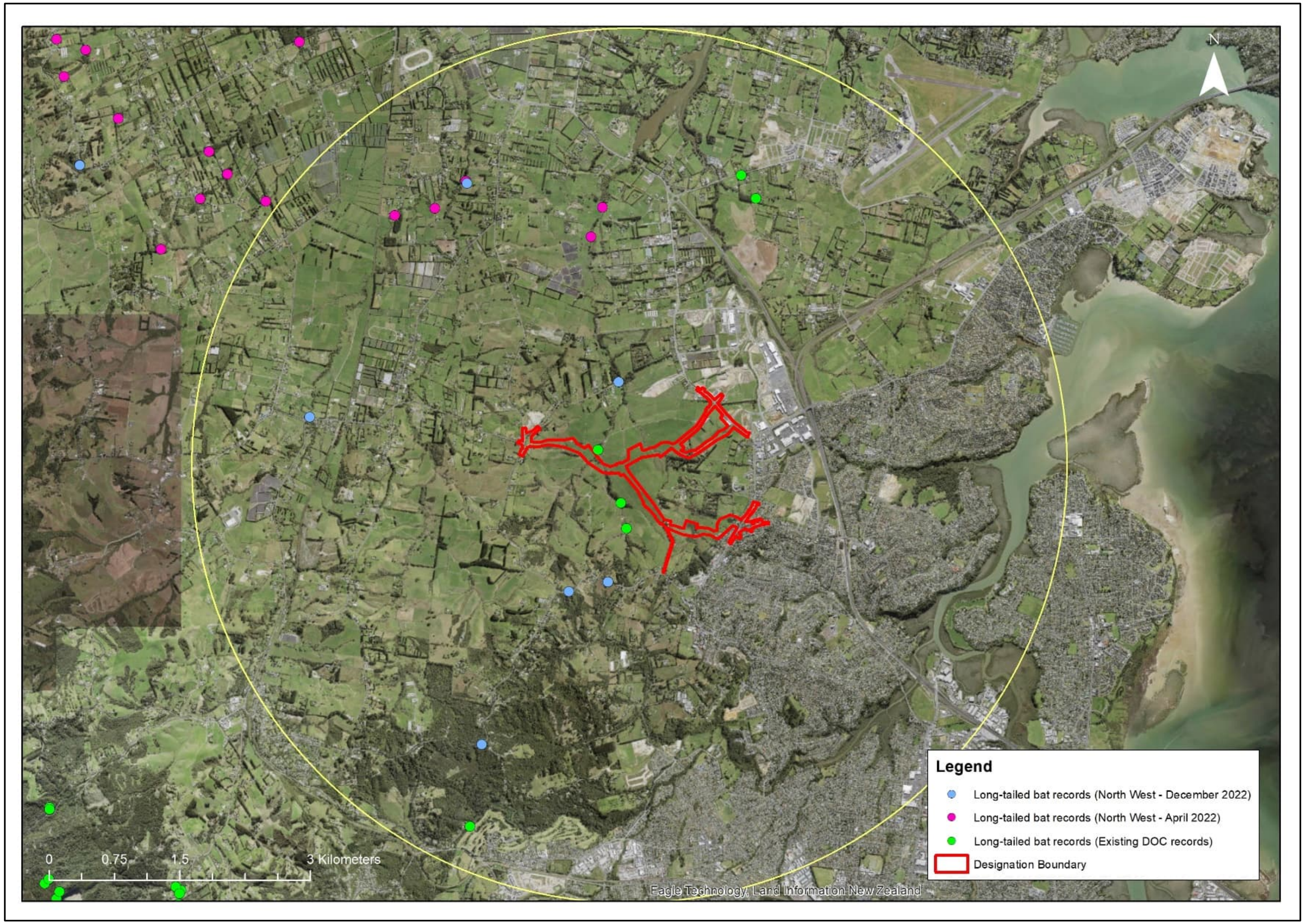

Figure 7-3: Existing long-tailed bat records within a 5 km radius of the Project Area (Department of Conservation, 2022; Supporting Growth Alliance 2022)

7.3.1.2 Site Investigations

Analysis of the ABM data identified a low number[17] of bat passes at three of the seven ABM sites. These three ABMs were located along Red Hill Stream which extends into the vegetated foothills of the Waitakere Ranges. Table 7-4 presents the number of bat passes recorded at each ABM throughout the monitoring period.

The results indicate that the corridors of low value riparian vegetation and indigenous and exotic forest habitat within the Project Area provide suitable foraging and commuting habitat for indigenous bats. Mature trees (*Eucalyptus* sp. and *Pinus* sp.) with suitable roosting features (branch and trunk cavities) were identified within and adjacent to the Project Area (including district plan vegetation located along the northern side of Henwood Road).

[17] Low number = < 10 bat passes at each ABM during 19 nights of monitoring.

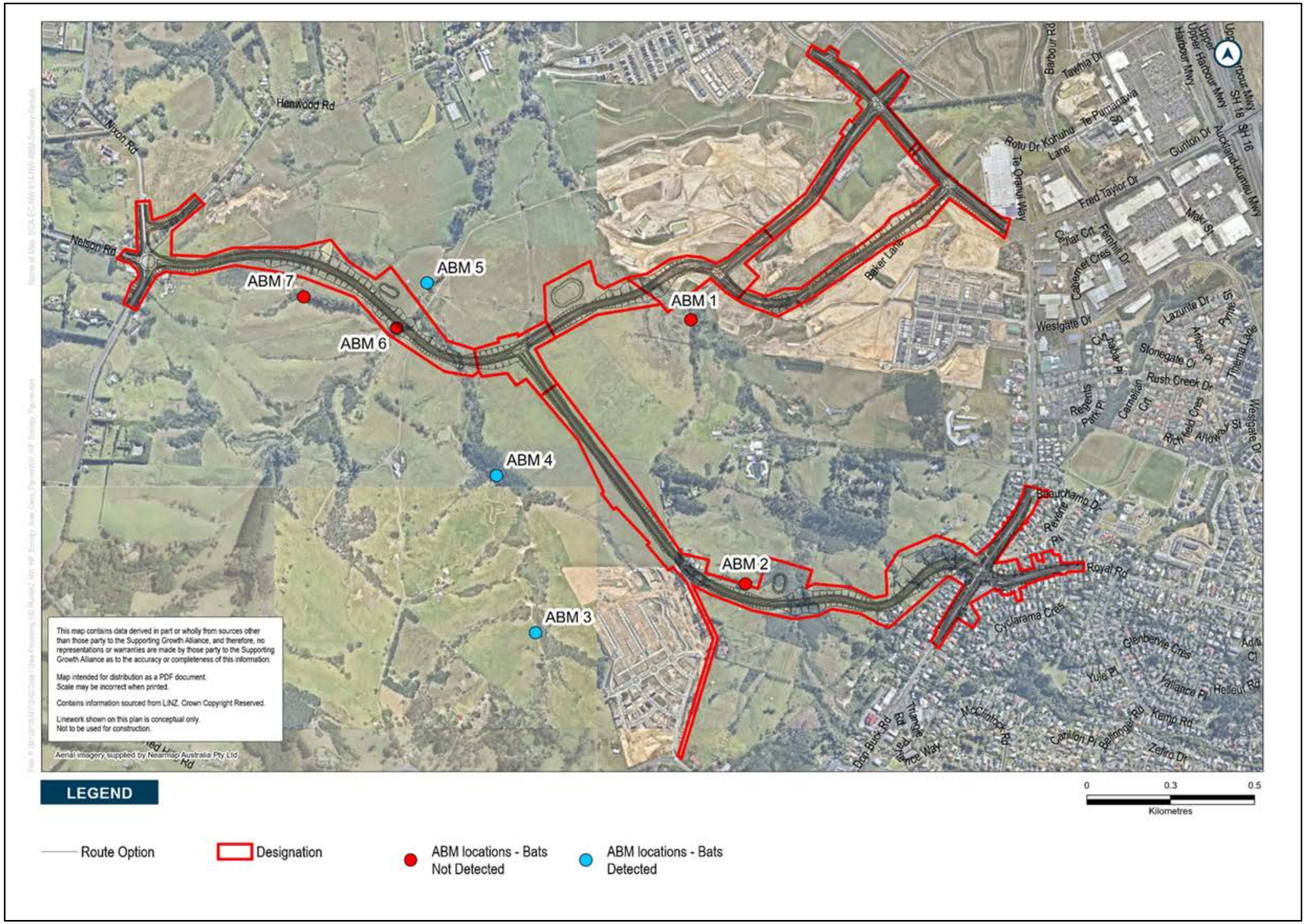

Figure 7-4: ABM locations. Blue circles denote bat passes and red circles denote no bat passes.

Table 7-4: Number of long-tailed bat passes during ABM survey

Date (start of monitoring)*	ABM ID	Number of bat passes
02-Nov-2019	ABM 3	1
02-Nov-2019	ABM 4	6
03-Nov-2019	ABM 4	4
04-Nov-2019	ABM 4	5
07-Nov-2019	ABM 3	5
11-Nov-2019	ABM 5	2
12-Nov-2019	ABM 3	1
15-Nov-2019	ABM 5	2
21-Nov-2019	ABM 3	2

Notes: * = Monitoring was continuous between 1 – 26 November 2019, however, bats were not recorded every night. Therefore, not every night of monitoring is listed in the table.

7.3.1.3 Ecological Value

The conservation status of long-tailed bats is 'Threatened – Nationally Critical' (O'Donnell et al., 2018), therefore the ecological value of long-tailed bats is **Very High**.

7.3.2 Birds

7.3.2.1 Desktop Review

New Zealand Bird Atlas database[18] identified 52 forest, freshwater and coastal bird species (30 of which are indigenous) within a 2 km radius of the Project Area (Appendix D). This included 12 indigenous bird species which are listed as 'At Risk' or 'Threatened' (Robertson et al., 2021) (Table 7-5). These indigenous bird species are associated with coastal and marine habitats located > 1.5 km from the Project Area.

North Island fernbird (*Bowdleria punctata vealeae*) (At Risk – Declining) is associated with freshwater wetlands. The wetland habitat within SEA_T_2030, located approximately 600 m from the Project Area has the potential to support this species. Therefore, North Island fernbird may commute through the Project Area, between coastal wetlands located to the north and east, through to those within the SEA.

Additionally, North Island kākā (*Nestor meridionalis septentrionalis*) (At Risk – Recovering) are recorded to be present in the wider landscape. As they are a highly mobile it is anticipated that this species may utilise the Project Area.

Table 7-5: TAR bird species recorded within a 2 km of the Project Area

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Banded dotterel	*Charadrius bicinctus*	At Risk – Declining
Banded rail	*Gallirallus philippensis assimilis*	At Risk – Declining
Caspian tern	*Hydroprogne caspia*	Threatened – Nationally Vulnerable
Eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk – Declining
Lesser knot	*Calidris canutus rogersi*	At Risk – Declining
New Zealand dabchick	*Poliocephalus rufopectus*	Threatened – Nationally Increasing
North Island fernbird	*Bowdleria punctata vealeae*	At Risk – Declining
Northern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened – Nationally Increasing
Pied shag	*Phalacrocorax varius*	At Risk – Recovering
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk – Declining
Royal spoonbill	*Platalea regia*	At Risk – Naturally Uncommon

[18] https://birdatlas.co.nz/

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
South Island pied oystercatcher	*Haematopus finschi*	At Risk – Declining
Variable oystercatcher	*Haematopus unicolor*	At Risk – Recovering
White-fronted tern	*Sterna striata*	At Risk – Declining

7.3.2.2 Site Investigations

During the site investigation, incidental bird observations were recorded. A total of 22 bird species were recorded, including 12 indigenous species (Appendix D). The indigenous bird species that were observed are presented in Table 7-6. These species could nest in scrub and trees within the Project Area, while the exotic wetland and areas of open water could provide nesting habitat for pūkeko, paradise shelduck, pied stilt, spur-winged plover, and white-faced heron. Northern New Zealand dotterel (Threatened – Nationally Increasing) was observed in Brown Field (BF) habitat associated with residential development construction at Baker Lane, Westgate (which is located within the Project Area).

Table 7-6: Incidental indigenous bird species identified in the Project Area during the site investigation

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Australasian harrier	*Circus approximans*	Not Threatened
Grey warbler	*Gerygone igata*	Not Threatened
North Island fantail	*Rhipidura fuliginosaplacabilis*	Not Threatened
Northern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened – Nationally Increasing
Paradise shelduck	*Tadorna variegata*	Not Threatened
Pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Not Threatened
Silvereye	*Zosterops lateralis lateralis*	Not Threatened
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened
White-faced heron	*Ergretta novaehollandiae*	Not Threatened

7.3.2.3 Ecological Value

The habitats in the Project Area are suitable for non-TAR forest and wetland indigenous bird species that have adapted to agricultural and urban environments, these would be considered **Low** ecological value. However, connective linkages through the Project Area could be of value to some TAR bird species as they migrate through the Project Area. Table 7-7 presents the ecological value for TAR bird species identified within the Project Area.

Table 7-7: Ecological value for TAR bird species

Species	Habitat	Conservation Status (Robertson et al., 2021)	Ecological Value
North Island fernbird*	EW, OW	At Risk – Declining	**High**
North Island kākā*	TL.3, VS3	At Risk – Recovering	**High**
Northern New Zealand dotterel**	BF	Threatened – Nationally Increasing	**Very High**

Notes: * = Inferred from desktop records and habitat. ** = Observed during site visit in Project Area.

7.3.3 Herpetofauna

7.3.3.1 Desktop Review

A review of the DOC Bioweb database found five indigenous lizard records within a 6 km radius of the Project Area (Table 7-8). No records were found within the Project Area; however, this is likely to indicate that herpetofauna surveys have not been completed in the local area, rather than herpetofauna are not present. Four of the five indigenous lizard species identified in the DOC Bioweb search have a conservation status of ‘At Risk’ (Hitchmough et al., 2021).

Table 7-8: Indigenous lizard species observations recorded within 6 km of the Project Area

Common Name	Scientific Name	Conservation Status (Hitchmough et al., 2021)
Elegant gecko	*Naultinus elegans*	At Risk – Declining
Copper Skink	*Oligosoma aeneum*	At Risk – Declining
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining
Ornate skink	*Oligosoma ornatum*	At Risk – Declining
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened

7.3.3.2 Site Investigations

Indigenous herpetofauna were not identified during opportunistic searches completed during the site walkover. However, the introduced plague skink (*Lampropholis delicata*) was identified within the Project Area. Copper skink and ornate skink have been recorded within 500 m of the Project Area. Copper skink and ornate skink habitat includes fragmented modified forest edge, scrub and rank grassland habitats (‘surrogate habitats’) in Auckland (van Winkel, Baling & Hitchmough, 2018). This habitat type is present within the Project Area and is connected to high quality SEA habitat to the south-west.

Forest geckos, elegant geckos, and pacific geckos (identified in the desktop review) require intact or regenerating forest habitat for survival. The forest habitat within the Project Area is small (approximately 0.28 ha), early successional and highly fragmented. It is therefore unlikely that these species would occur within the Project Area and they have not been considered further in this report.

7.3.3.3 Ecological Value

Table 7-9 presents the ecological value of herpetofauna identified within the Project Area.

Table 7-9: Ecological value for TAR herpetofauna species

Species	Habitat	Conservation Status (Hitchmough et al., 2021)	Ecological Value
Ornate skink	• EF (with appropriate understorey) • EG • ES • PL.3 • TL.3 (with appropriate understorey) • VS3 (with appropriate understorey)	At Risk – Declining	High
Copper skink	• EF (with appropriate understorey) • EG • ES • PL.3 • TL.3 (with appropriate understorey) • VS3 (with appropriate understorey)	At Risk – Declining	High

7.4 Aquatic Ecology

7.4.1 Desktop Review

7.4.1.1 Streams

Auckland GeoMaps layers indicate that the Project could cross three named streams; Red Hill Stream, Waiteputa Stream and Ngongetepara Stream (Figure 7-5).

In 2015, Golder Associates classified streams within the Redhills catchment (Figure 7-6). The classification indicates five permanent stream branches, four intermittent, two ephemeral, one unclassified and seven described as wetlands within the Project Area (Golder Associates, 2015). The classification of streams 2, 3, 6, 7, 11, 15, and 19 in Golder Associates mapping could not be determined because they were masked by the wetland layer.

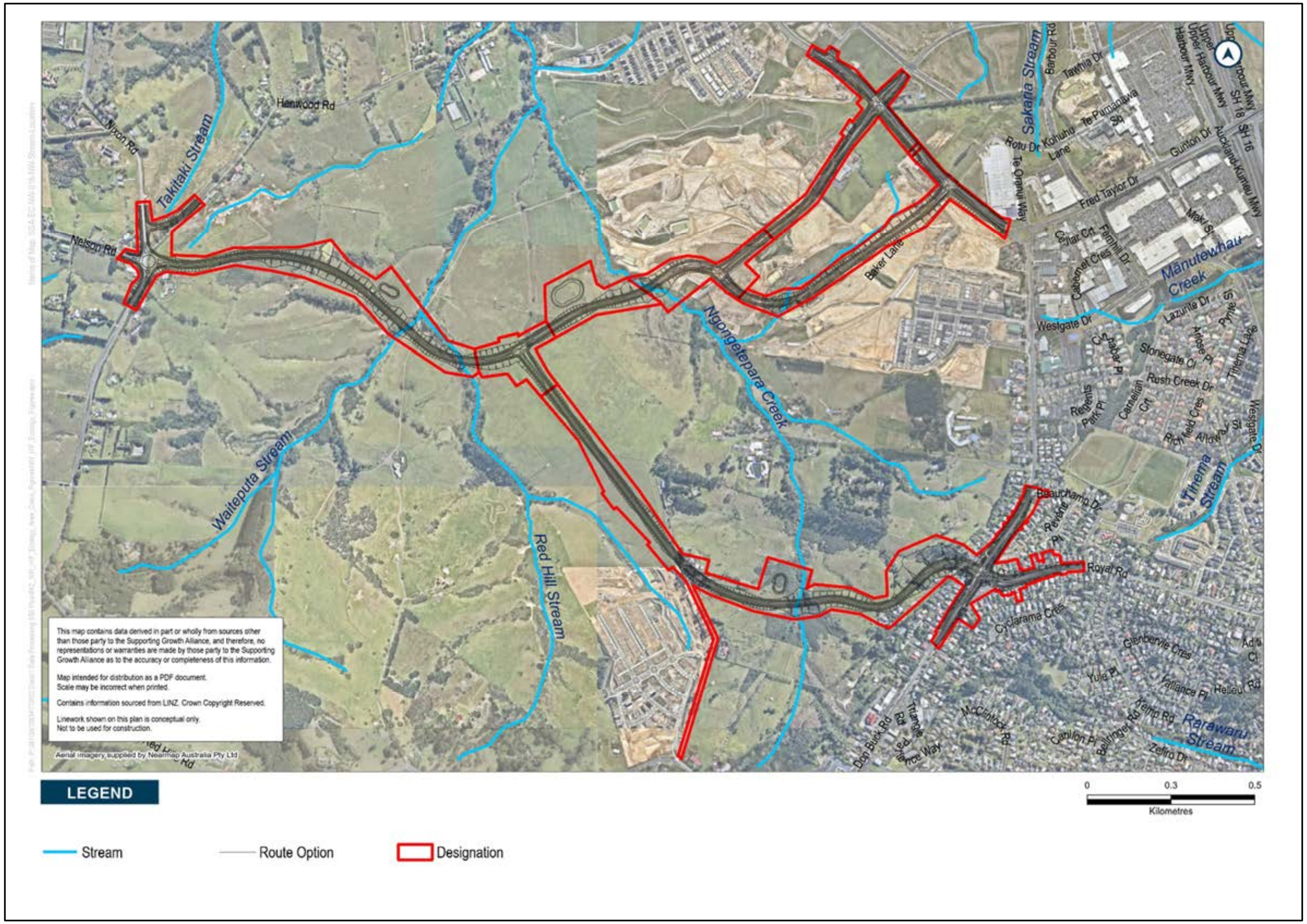

Figure 7-5: Named streams within the Project Area

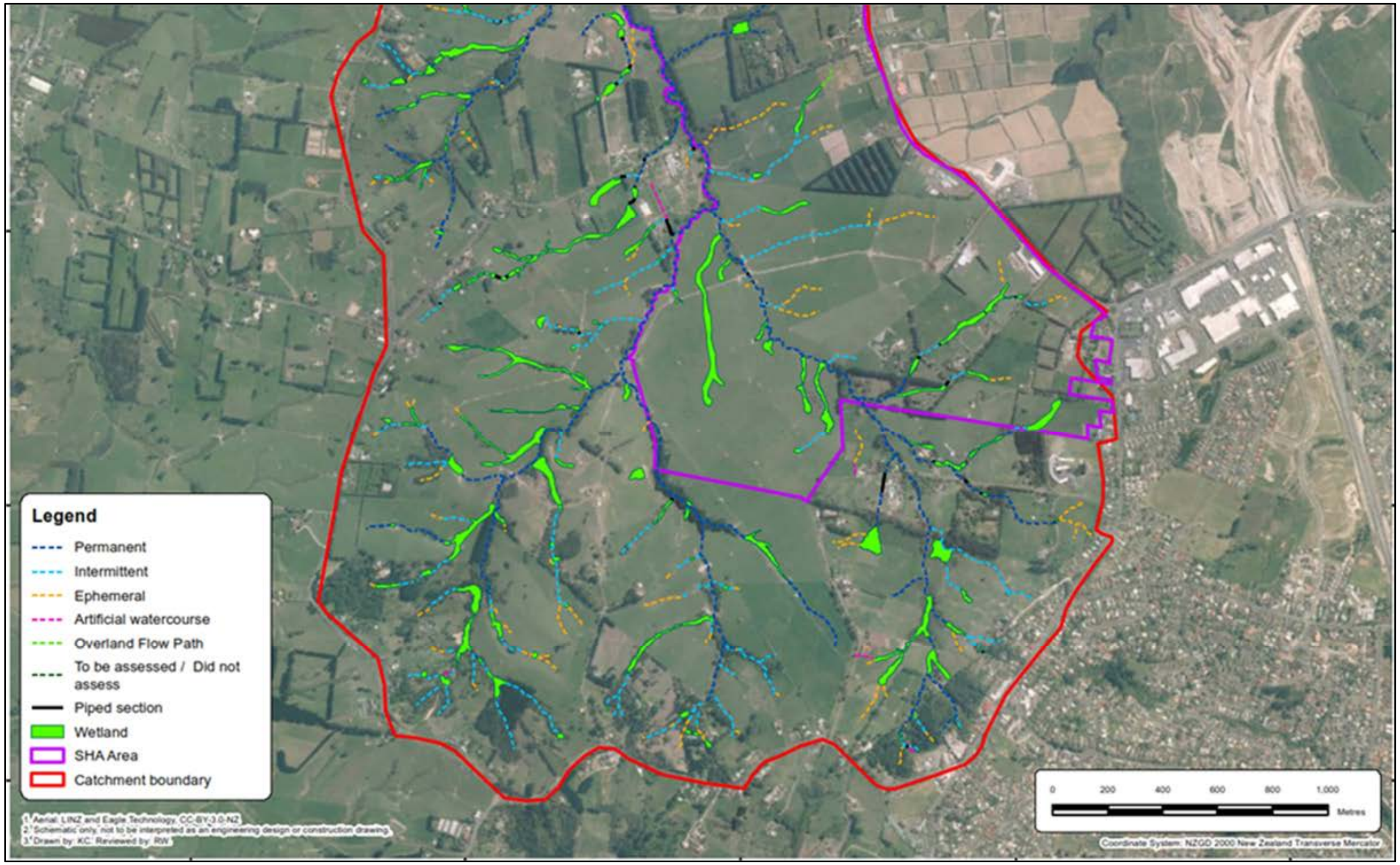

Figure 7-6: Classification of streams by Golder Associates in the Redhills Catchment (Golder Associates, 2015)

7.4.1.2 Fish

The New Zealand Freshwater Fish Database (NZFFD) (Stoffels, 2022) did not hold fish records for Red Hill Stream and Waiteputa Stream, which are tributaries of Ngongetepara Stream. However, the database indicates that three fish species, and two freshwater invertebrate species have been recorded in the Ngongetepara Stream. This includes longfin eel (*Anguilla dieffenbachia*) which is classified as 'At Risk – Declining' (Dunn et al., 2018). The desktop review results are presented in Table 7-10 and Table 7-11.

Table 7-10: Freshwater fish species recorded in Ngongetepara Stream

Common Name	Scientific Name	Conservation Status (Dunn et al., 2018)
Shortfin eel	Anguilla australis	Not Threatened
Longfin eel	Anguilla dieffenbachii	At Risk – Declining
Banded kōkopu	Galaxias fasciatus	Not Threatened

Table 7-11: Freshwater invertebrate species recorded in Ngongetepara Stream

Common Name	Scientific Name	Conservation Status (Grainger et al., 2018)
Kōura	Paranephrops planifrons	Not Threatened
Freshwater shrimp	Paratya curvirostis	Not Threatened

7.4.2 Site Investigations

7.4.2.1 Streams

All streams within the Project Area were numbered, classified (permanent, intermittent, or ephemeral) and mapped.

Twenty stream branches associated with wetland complexes were identified during the site investigations within the Project Area. These were assessed against the stream classification criteria developed by Storey and Wadhwa, 2009. The streams are mapped in Appendix E and are listed in Table 7-12.

All permanent and intermittent streams accessed during the site investigations were surveyed using the Rapid Habitat Assessment (RHA). The streams measured overall habitat quality scores that ranged from 'Poor' to 'Moderate' (Table 7-12). Detailed RHA results are presented in Appendix J. The RHA category was included within the ecological value assessment.

Table 7-12: Summary of streams identified in the Project Area

Stream ID	Classification	RHA Category
RH-S1a	Intermittent	Poor

Stream ID	Classification	RHA Category
RH-S1b	Intermittent	Poor
RH-S2a	Permanent	Moderate
RH-S2b	Intermittent	Poor
RH-S2c	Intermittent	Poor
RH-S3	Permanent	Moderate
RH-S4	Intermittent	Poor
RH-S5a	Permanent	Moderate
RH-S5b	Intermittent	Poor
RH-S5c	Intermittent	Poor
RH-S5d	Intermittent	Poor
RH-S5e	Intermittent	Poor
RH-S6	Permanent	Moderate
RH-S7a	Permanent	Moderate
RH-S7b	Intermittent	Poor
RH-S7c	Intermittent	Poor
RH-S7d	Intermittent	Poor
RH-S8	Intermittent	Poor
RH-S9	Intermittent	Poor
RH-S10	Intermittent	Poor

7.4.2.2 Fish

Fish surveys were not carried out during site investigations, however longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area (Table 7-10). The freshwater habitats within the Project Area were assessed for their potential to support native fish during the RHA. No freshwater fish were observed during site investigations.

7.4.3 Ecological Value

Appendix G details the ecological value for the aquatic habitats identified within the Project Area. Information obtained for the ecological baseline (Section 7.4) was used to score the matters that inform the ecological value. The ecological values of freshwater habitats are presented in Table 7-13.

Table 7-13: Summary of aquatic ecological value identified in the Project Area

Stream ID	Ecological Value
RH-S1a	Low

Stream ID	Ecological Value
RH-S1b	Low
RH-S2a	Moderate
RH-S2b	Low
RH-S2c	Low
RH-S3	Moderate
RH-S4	Low
RH-S5a	Moderate
RH-S5b	Low
RH-S5c	Low
RH-S5d	Low
RH-S5e	Low
RH-S6	Moderate
RH-S7a	Moderate
RH-S7b	Low
RH-S7c	Low
RH-S7d	Low
RH-S8	Low
RH-S9	Moderate
RH-S10	Low

7.5 Wetland Ecology

7.5.1 Desktop Review

The Golder Associates (2015) report identifies seven wetlands within the Project Area; identified as green polygons in Figure 7-6. Whilst not individually described, these wetlands were identified as ‘natural wetlands, farm ponds and boggy wetland-like areas’.

7.5.2 Site Investigations

A total of 16 wetlands within the Project Area were identified and assessed. Details regarding the vegetation cover and NPS-FM classification for each wetland is presented in Table 7-14. Refer to Appendix E for a map showing the spatial distribution of wetlands.

Table 7-14: Summary of wetlands identified in the Project Area

Wetland ID	Vegetation / Wetland Type[19]	NPS-FM Classification	Potential for TAR Species
RH-O1	Open Water	Artificial (stock water dam)	-
RH-W1a	Exotic Wetland	Natural	North Island fernbird
RH-W1b	Exotic Wetland	Natural	-
RH-W2	Exotic Wetland	Natural	North Island fernbird
RH-W3	Exotic Wetland	Natural	-
RH-W4	Exotic Wetland	Natural	-
RH-W5	Exotic Wetland	Natural	North Island fernbird
RH-W6	Exotic Wetland	Natural	North Island fernbird
RH-W7	Exotic Wetland	Natural	North Island fernbird
RH-W8	Exotic Wetland	Natural	-
RH-W9	Exotic Wetland	Natural	North Island fernbird
RH-W10	Exotic Wetland	Natural	North Island fernbird
RH-W11	Exotic Wetland	Natural	North Island fernbird
RH-W12	Exotic Wetland	Natural	North Island fernbird
RH-W13	Exotic Wetland	Natural	North Island fernbird
RH-W14	Exotic Wetland	Natural	-

7.5.3 Ecological Value

Appendix H details the ecological value for the wetland habitats identified within the Project Area. Information obtained for the ecological baseline (Section 7.5) was used to score the matters that inform the ecological value. The ecological values of wetland habitats are presented in Table 7-15.

Table 7-15 Summary of wetland ecological value identified in the Project Area

Wetland ID	Ecological Value
RH-O1	Low
RH-W1a	Moderate
RH-W1b	Low
RH-W2	Moderate
RH-W3	Moderate

[19] Open water, as an ecological feature, has been included under the wetland section.

Wetland ID	Ecological Value
RH-W4	Moderate
RH-W5	Moderate
RH-W6	High
RH-W7	High
RH-W8	Low
RH-W9	Moderate
RH-W10	Moderate
RH-W11	High
RH-W12	Moderate
RH-W13	Moderate
RH-W14	Moderate

8 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 4 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

8.1 Construction Effects – Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within and adjacent to the Project Area (as they relate to district matters) have been identified:

- Vegetation removal subject to district controls (refer to Appendix E).
- 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 bridges20.

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 A). The effects assessment has considered the current ecological baseline only, under the assumption that the likely future ecological environment (considering permitted activities) will not change substantially.

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix E 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 8.1.2 and 8.1.3.

Table 8-1: Assessment of ecological effects for terrestrial vegetation (district plan vegetation only) and impact management during construction

	Permanent loss of habitat / ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)
Effect Description	**Baseline**
Level of effect prior to impact management	**TL.3 (total area of 2246 m^2)** The magnitude of effect is assessed as **Low** due to the direct, local, permanent, but unlikely probability that fragmentation and edge effect will occur.

[20] Herpetofauna have been considered but excluded in the assessment of ecological effects as construction effects are considered **Very Low**.

	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.
Impact management and residual level of effect	N/A
Management of residual effect	N/A

8.1.2 Bats

Bats may utilise the habitats associated with the Project Area for roosting or foraging. Specifically, areas of Exotic Forest (EF), Exotic-Dominated Treeland (TL.3), and Mānuka, Kānuka Scrub (VS3). 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. The ABM survey indicated that vegetation within the Project Area provides suitable foraging and commuting habitat for bats. Additionally, it can be assumed that bats will utilise roost sites within the Project Area as mature trees (*Eucalyptus* sp. and *Pinus* sp.) with suitable roosting features (branch and trunk cavities) were identified within and adjacent to the Project Area.

Additionally, bats may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Roost loss[21]
- Mortality or injury to bats.

Table 8-2 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[21] Roost loss has been considered but excluded as an effect as the consequence of roost loss (if it does occur at all) is considered Negligible in the context of this Project.

Table 8-2: Assessment of ecological effects for bats and impact management during construction

<table>
<tr><th rowspan="2">Effect Description</th><th>Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.)</th><th>Effects due to removal of district plan vegetation:
- Loss of foraging habitat
- Mortality or injury to bats</th></tr>
<tr><th>Baseline</th><th>Baseline</th></tr>
<tr><td>Level of effect prior to impact management</td><td>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.</td><td><u>Loss of foraging habitat</u>

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.

<u>Mortality or injury to bats</u>

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.

<u>Wildlife Act 1953</u>

Long-tailed bats are protected under the Wildlife Act 1953 and some of the district plan trees may have bat roost potential. Therefore the requirements of the Wildlife Act 1953 will need to be adhered to during vegetation removal.</td></tr>
<tr><td>Impact management and residual level of effect</td><td>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, TL.3, and VS3 habitat</td><td>A BMP should be developed to include consideration for:

The provisions of the Wildlife Act 1953
Design and implementation of a vegetation removal protocol, including pre-felling surveys.</td></tr>
</table>

	Lighting design to reduce light levels and spill from construction areas Restriction of nightworks around EF, TL.3, and VS3 habitat Bat management should be incorporated 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

8.1.3 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 the Project Area. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Mortality or injury to birds.

Table 8-3 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 8-3: Assessment of ecological effects for birds and impact management during construction

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[22]: - Loss of foraging habitat - Mortality or injury to birds
	Baseline	**Baseline**
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 Project Area. 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 bird (Northern New Zealand dotterel)</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 this species is **Very High**. The Northern New Zealand dotterel was observed at the Universal Homes residential development construction site. It is expected that the road will be constructed once the residential development is already constructed, therefore Northern New Zealand dotterel are unlikely to be present, and therefore would not be impacted by disturbance effects during construction. Additionally Northern New Zealand dotterel are increasingly breeding in modified habitats including construction sites (Waka Kotahi, 2012), suggesting that they can become acclimatised to construction disturbance. As such the overall level of effect would be considered **Low** prior to mitigation and no impact management is required. **<u>Terrestrial TAR bird (North Island kākā)</u>**	**<u>Non-TAR birds</u>** The magnitude of effect is assessed as **Negligible** due to the direct and local extent of effect, and unlikely probability and permanent duration for loss of foraging habitat, and likely probability and short-term (<5 years) duration for mortality of injury to birds. 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 (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 **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **<u>Wildlife Act 1953</u>** All native birds are protected under the Wildlife Act 1953, therefore requirements of the Wildlife Act 1953 will need to be adhered to during vegetation removal.

[22] Construction effects on Northern New Zealand dotterel and North Island fernbird has been considered but excluded in the assessment of ecological effects as these species are not expected to utilise TL.3 (district plan vegetation only) habitat, therefore the effect is considered less than Negligible in the context of this Project.

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[22]: - Loss of foraging habitat - Mortality or injury to birds
	Baseline	**Baseline**
	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 this 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>Wetland TAR bird (North Island fernbird)</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 **High**, 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	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.
Management of residual effect	N/A	N/A

8.2 Operational Effects – Terrestrial Ecology

The Project involves upgrading existing roads, and the construction of new roads largely within a rural landscape that is located in future residential 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[23].

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 A). The effects assessment has considered one scenario – the current ecological baseline.

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.2.1 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.

Table 8-4 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.

[23] Herpetofauna have been considered but excluded in the assessment of ecological effects as operational effects are considered **Very Low**.

Table 8-4: Assessment of ecological effects for bats and impact management during operation

	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**	**Baseline**
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.	The magnitude of effect is assessed as **High** due to the high probability of loss in connectivity due to the proposed road located in areas with confirmed bat movement. 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.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation • Light and noise management through design. The residual impact is assessed as **Very Low** post mitigation.	A BMP should be developed to include consideration for: • Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation • Light and noise management through design. The residual impact is assessed as **Low** post mitigation.
Management of residual effect	N/A	N/A

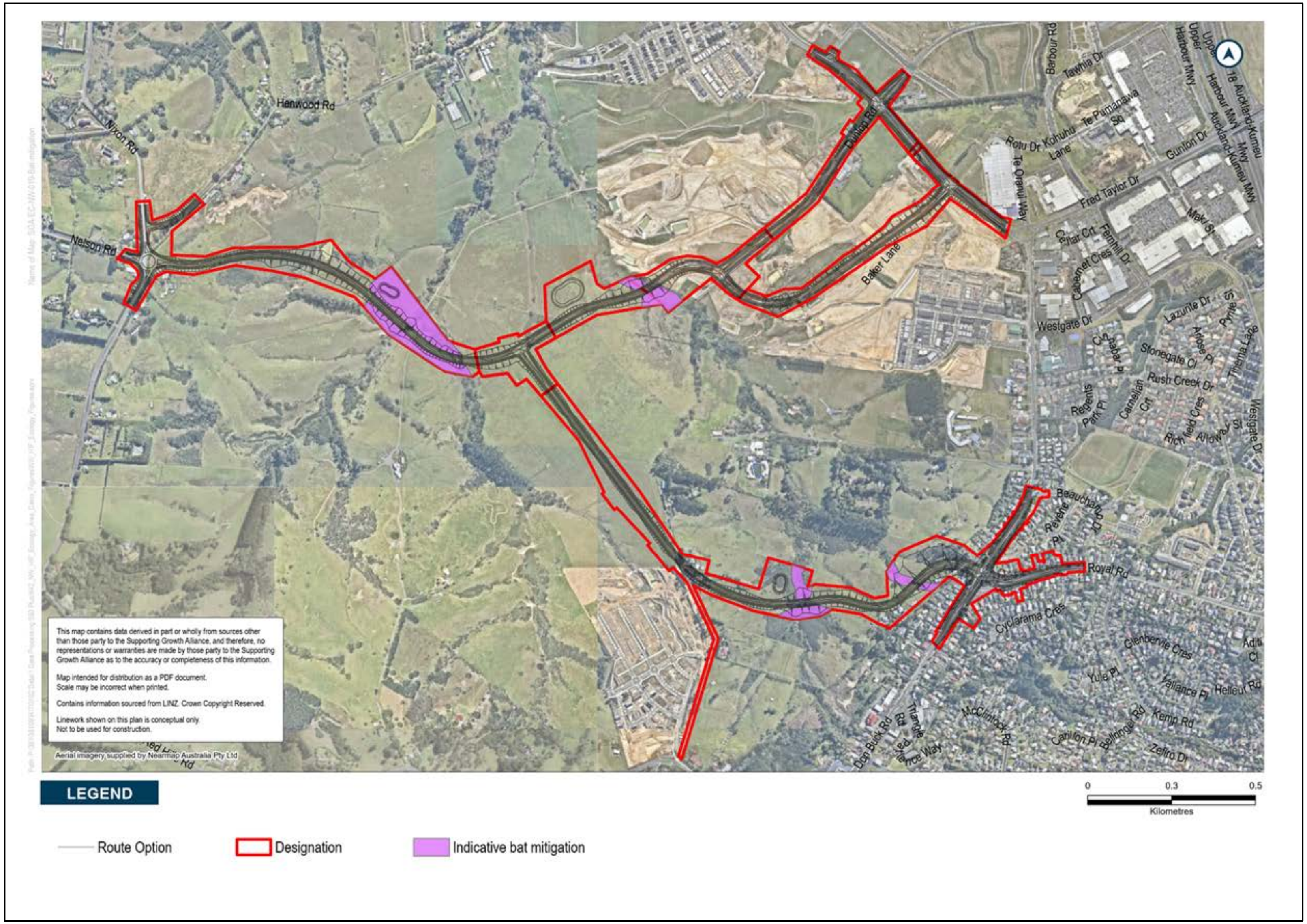

Figure 8-1: Indicative long-tailed bat mitigation locations for Redhills Arterial Transport Network

8.2.2 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 the Project Area, while noise, light and vibration may also affect connectivity in the broader landscape.

Table 8-5 outlines the operational effect assessment and impact management for birds.

Table 8-5: Assessment of ecological effects for birds and impact management during operation

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	Baseline
Level of effect prior to impact management	**Non-TAR birds** 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. **Terrestrial TAR birds (Northern New Zealand dotterel)** 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. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** due to an 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 **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (North Island fernbird)** The magnitude of effect is assessed as **Low** due to an unlikely probability and local extent of disturbance.	**Non-TAR birds** 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. **Terrestrial TAR birds (Northern New Zealand dotterel)** The magnitude of effect is assessed as **Low** due to unlikely probability, and 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. The Northern New Zealand dotterel was observed at the Universal Homes residential development construction site. It is expected that the road will be constructed once the residential development is already constructed, therefore Northern New Zealand dotterel are unlikely to be present, and therefore would not be impacted by loss in connectivity and the level of effect would be considered **Low**. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** as North Island kākā are a highly mobile species and there is an unlikely probability of loss in connectivity.

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	**Baseline**
	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.	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 (North Island fernbird)** The magnitude of effect is assessed as **Low** due to a likely probability and local extent of loss in connectivity. 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.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

8.3 Effects Conclusions

The ecological level of effects assessed as **Moderate**, **High** or **Very High** for the Project are described in Section 8.3.1.

8.3.1 Long-Tailed Bats

- **Moderate** level of effect for disturbance and displacement to roosts and individuals (existing) during construction
- **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
- **Very High** level of effect for loss in connectivity due to the presence of the road during operation.

The post mitigation level of effect is considered to be **Very Low** to **Low** for construction and operational related effects.

8.3.2 Wildlife Act 1953

All native fauna is protected by the Wildlife Act 1953, therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

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 the Project. 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 Project Area, including suitable habitat that is potentially being used by native fauna (bats, birds, and herpetofauna). Loss of vegetation that is subject to district plan controls is discussed in Section 8.1.

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 8-6 under the Footprint column.

[24] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges from **Low** to **High** ecological value (Section 7.2.3). 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 8-6: Potential area of permanent terrestrial vegetation loss within the road footprint

Feature	Classification*	Footprint (m^2)
Brown Field (includes cropland)	BF	64,374 m^2
Exotic Grassland	EG	15,7444 m^2
Exotic Scrub	ES	5,943 m^2
Planted Vegetation – Exotic	PL.3	10,615 m^2
Exotic-Dominated Treeland^	TL.3	7,612 m^2
Mānuka, Kānuka Scrub	VS3	823 m^2

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation.

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 Act Authority permit applications (if required).

8.4.2 Bats

Mature trees in suitable habitat areas (EF, TL.3, and VS3) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats and roosts will be re-assessed prior to obtaining any regional resource consents for vegetation removal (relevant under regional matters)and managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

If the presence of bat habitat and bat roosts are confirmed at regional consenting stage then a BMP will likely be required which should address the following:

- 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 Northern New Zealand dotterel, and migratory North Island kākā. The Northern New Zealand dotterel was observed at the Universal Homes residential development construction site in Brown Fields (BF) habitat which is of **Low** value. Habitats available for North Island kākā (EF, TL.3, and VS3) provide low quality, nonbreeding habitat and may be used seasonally and infrequently for roosting and foraging. The value of these habitats ranges from **Moderate** to **High**. TAR birds associated with wetland habitats are likely to include North Island fernbird, and the value of these habitats range from **Moderate** to **High**. Non-TAR native birds are highly likely to be present within the NoR and utilise all identified habitats.

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 **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 as it is considered district plan vegetation.

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. A Lizard Management Plan (LMP) would be required to ensure the management of effects and ensure compliance with the Wildlife Act 1953 (including a Wildlife Act Authority permit for the implementation of the LMP).

8.4.5 Freshwater Ecology

The construction of the Project will directly impact 11 streams, ranging from **Low** to **Moderate** ecological value. Approximately 846 m (510 m of permanent stream, 336 m of intermittent stream) of stream reclamation will be required to accommodate the Project works. The predicted permanent and intermittent stream loss for the Project is presented in Table 8-7. These calculations will require re-evaluation as part of the future regional consent process. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features.

Table 8-7: Potential stream loss (permanent and intermittent) within the Project Area

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*
RH-S2a	Permanent	Moderate	88.5
RH-S3	Permanent	Moderate	97.6
RH-S5a	Permanent	Moderate	139.5
RH-S5c	Intermittent	Low	43.4
RH-S6	Permanent	Moderate	79.5
RH-S7a	Permanent	Moderate	104.7
RH-S7c	Intermittent	Low	21.8
RH-S7d	Intermittent	Low	108.3
RH-S8	Intermittent	Low	14.5
RH-S9	Intermittent	Moderate	123.4
RH-S10	Intermittent	Low	24.8

Notes: * = Lengths are approximate and include an additional 12 metres (as the construction footprint for a culvert is approximately 6 metres).

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 the Project will impact 13 natural wetlands (RH-O1 is considered an artificial wetland) ranging from **Low** to **High** ecological value. Approximately 7,568 m^2 of direct wetland loss will occur (Table 8-8).

Table 8-8: Potential wetland loss within the Project Area

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
RH-O1	Open Water	Low	321
RH-W1a	Exotic Wetland	Moderate	122
RH-W1b	Exotic Wetland	Low	91
RH-W2	Exotic Wetland	Moderate	63
RH-W3	Exotic Wetland	Moderate	568
RH-W4	Exotic Wetland	Moderate	884
RH-W6	Exotic Wetland	High	519
RH-W7	Exotic Wetland	High	2255
RH-W8	Exotic Wetland	Low	1513
RH-W10	Exotic Wetland	Moderate	367
RH-W11	Exotic Wetland	High	168
RH-W12	Exotic Wetland	Moderate	536
RH-W13	Exotic Wetland	Moderate	70
RH-W14	Exotic Wetland	Moderate	93

Notes: * = Areas are indicative.

9 Conclusion

Construction Effects

To address the effects of construction activities (noise, light and dust) on long-tailed bats, a Bat Management Plan (BMP) for the Project 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, TL.3, and VS3 habitat
- Lighting design to reduce light levels and spill from construction areas
- Restriction of nightworks around EF, TL.3, and VS3 habitat
- Bat management should be incorporated with any regional consent conditions that may be required for regional compliance.

All native fauna is protected by the Wildlife Act 1953 (WA 1953), therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

Table 9-1 to Table 9-3 provides a summary of district plan matter ecological effects during construction prior to any mitigation[25]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

To address the effects of construction activities (noise, light and dust) on long-tailed bats, a Bat Management Plan (BMP) for the Project 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, TL.3, and VS3 habitat
- Lighting design to reduce light levels and spill from construction areas
- Restriction of nightworks around EF, TL.3, and VS3 habitat
- Bat management should be incorporated with any regional consent conditions that may be required for regional compliance.

All native fauna is protected by the Wildlife Act 1953 (WA 1953), therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will

[25] Herpetofauna have been considered but excluded in the assessment of ecological effects as construction effects are considered Very Low.

need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

Table 9-1: Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation

Ecological Feature	Permanent loss of habitat / ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)
TL.3	Very Low

Table 9-2: Summary of ecological effects during construction prior to mitigation for bats

Ecological Feature	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
Long-tailed bats[26]	**Moderate**	Low **WA 1953 requirements**	Low **WA 1953 requirements**

Table 9-3: Summary of ecological effects during construction prior to mitigation for birds

Ecological Feature[27]	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	Mortality or injury to birds due to removal of district plan vegetation
Non-TAR birds	Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
Northern New Zealand dotterel	Low	-	-
North Island kākā	Very Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
North Island fernbird	Low	-	-

The residual (post-mitigation) level of effect for all construction effects is considered **Very Low**.

[26] Roost loss has been considered but excluded as an effect as the consequence of roost loss (if it does occur at all) is considered Negligible in the context of this Project.

[27] Construction effects on Northern New Zealand dotterel and North Island fernbird has been considered but excluded in the assessment of ecological effects as these species are not expected to utilise TL.3 (district plan vegetation only) habitat, therefore the effect is considered less than Negligible in the context of this Project.

Operational Effects

Table 9-4 to Table 9-5 provide a summary of district plan matter ecological effects during operation[28]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Operational effect mitigation measures will include:

To address the operational effects (disturbance and loss in connectivity) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation
- Light and noise management through design.

Table 9-4: Summary of ecological effects during operation prior to mitigation for bats

Ecological Feature	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
Long-tailed bats	**High**	**Very High**

Table 9-5: Summary of ecological effects during operation prior to mitigation for birds

Ecological Feature	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
Non-TAR birds	Low	Low
Northern New Zealand dotterel	Low	Low
North Island kākā	Low	Low
North Island fernbird	Low	Low

The residual (post-mitigation) level of effect for all operational effects are **Very Low** or **Low**.

[28] Herpetofauna have been considered but excluded in the assessment of ecological effects as operational effects are considered Very Low.

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1 Appendix A – 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 10-1 for terrestrial ecological value and Table 10-2 aquatic ecological value

Table 10-1: 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 10-2: 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
Riparian habitat modification

Representativeness (including SEV, RHA and ecological integrity)
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 10-3.

Table 10-3: 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 10-4.

Table 10-4: 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

Magnitude	Description
	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 10-5.

Table 10-5: 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 10-6.

Table 10-6: 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 10-6, 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 B – Auckland Unitary Plan Activities

Auckland Unitary Plan – E26 Infrastructure

Table E26.4.3.1 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	Discretionary	N/A
(A90) Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	Permitted	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	Permitted	Permitted	Restricted Discretionary	N/A
(A92) Tree alteration or removal of any tree greater than 4m in height and / or greater than 400mm in girth	Restricted Discretionary	Restricted Discretionary	N/A	N/A
(A93) Tree trimming, alteration and removal not otherwise provided for	D	D	D	N/A

Auckland Unitary Plan – E26 Infrastructure

Table E26.3.3.1 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	P	P	P	P	P	P	Refer to E26.3.5.4. Vegetation

Activity	Activity Status						Permitted Standards
	Rural zones, coastal areas and riparian areas [rp]	SEA [rp]	ONF [dp]	HNC [dp]	ONL [dp]	ONC [dp]	
alteration or removal							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
(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)		

Activity	Activity Status	Permitted Standards
(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 C – Regional Plan, District Plan, and Wildlife Act Matters

Table 10-7: 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 rural zone • riparian margins • coastal areas • 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: • Roads • Public spaces • ONFs • ONLs • HNCs • 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).	✓		✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Birds (native)	Vegetation removal.	Nest loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	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 Wof 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					

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
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.			✓
	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.	✓		✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	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).		✓	
	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 D – Desktop and Incidental Bird Records

Table 10-8: Desktop bird records within 2 km of the Project Area

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
Banded dotterel	Pohowera	*Charadrius bicinctus*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Barbary dove	-	*Streptopelia risoria*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Canada goose	-	*Branta canadensis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Desktop record – iNaturalist / eBird (Bird Atlas)
Chaffinch	Pahirini	*Fringilla coelebs*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Common pheasant	Peihana	*Phasianus colchicus*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Dunnock	-	*Prunella modularis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Dabchick	Weweia	*Poliocephalus rufopectus*	Threatened – Nationally Increasing	Desktop record – iNaturalist / eBird (Bird Atlas)
Eastern rosella	-	*Platycercus eximius*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Greenfinch	-	*Carduelis chloris*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Grey duck x mallard hybrid	-	*Anas platyrhynchos x superciliosa*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Greylag goose	Kuihi	Anser anser	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Little shag	Kawau paka	*Phalacrocorax melanoleucos*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised	Desktop record - iNaturalist / eBird (Bird Atlas)
Mallard	-	*Anas platyrhynchos*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Muscovy duck	-	*Cairina moschata*	Introduced, not established	Desktop record – iNaturalist / eBird (Bird Atlas)
Myna	-	*Acridotheres tristis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
New Zealand pigeon	Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
North Island fernbird	Mātātā	*Poodytes punctatus*	At Risk – Declining	Assumed present based on suitable habitat present in the Project Area.

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
North Island kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk – Recovering	Known to be present in wider landscape and assumed present based on suitable habitat present in the Project Area.
Northern New Zealand dotterel	Tūturiwhatu	*Charadrius obscurus aquilonius*	At Risk – Recovering	Desktop record – iNaturalist / eBird (Bird Atlas)
Paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Pied shag	Kāruhiruhi	*Phalacrocorax varius*	At Risk – Recovering	Desktop record – iNaturalist / eBird (Bird Atlas)
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Red knot	Huahou	Calidris canutus	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Rock pigeon	-	*Columba livia*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Royal spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk – Naturally Uncommon	Desktop record – iNaturalist / eBird (Bird Atlas)
Shining cuckoo	Pīpīwharauroa	*Chrysococcyx lucidus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Skylark	Kaireka	*Alauda arvensis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)

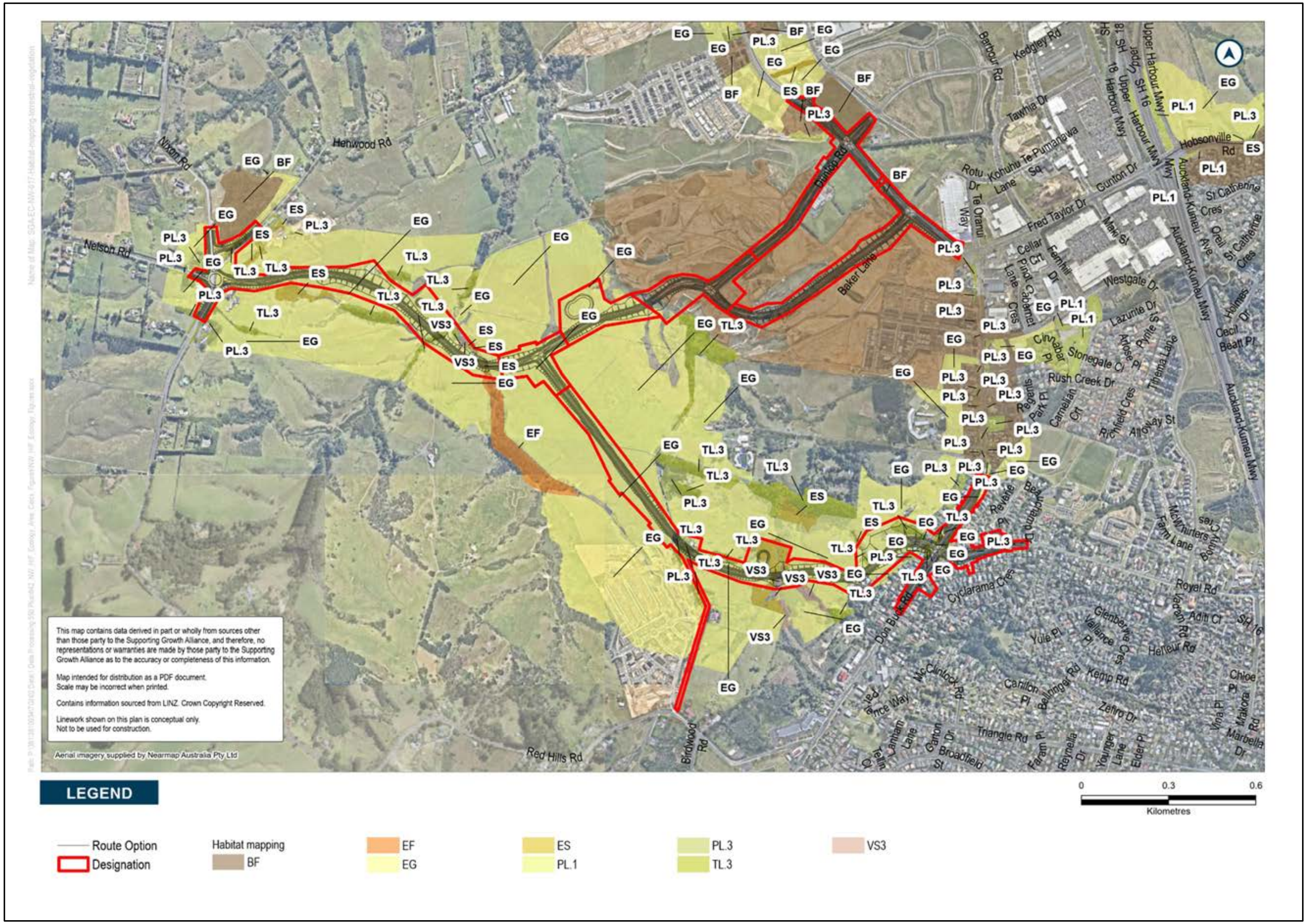
Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
South Island pied oystercatcher	Tōrea	*Haematopus finschi*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Southern black-backed gull	Karoro	*Larus dominicanus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Spotted dove	-	*Streptopelia chinensis tigrina*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Starling	-	*Sturnus vulgaris*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Swamp Harrier	Kāhu	*Circus approximans*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Variable oystercatcher	Tōrea pango	*Haematopus unicolor*	At Risk – Recovering	Desktop record – iNaturalist / eBird (Bird Atlas)
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
White-fronted tern	Tara	*Sterna striata*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Yellowhammer	-	*Emberiza citrinella*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)

Table 10-9: Incidental bird species identified in the Project Area during the site investigation

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Australasian harrier	*Circus approximans*	Indigenous – Not Threatened
Blackbird	*Turdus merula*	Introduced and Naturalised
Canada goose	*Branta canadensis*	Introduced and Naturalised
Common pheasant	*Phasianus colchicus*	Introduced and Naturalised
Eastern rosella	*Platycercus eximius*	Introduced and Naturalised
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised
Grey warbler	*Gerygone igata*	Indigenous – Not Threatened
Indian peafowl	*Pavo cristatus*	Introduced and Naturalised
Mallard	*Anas platyrhynchos*	Introduced and Naturalised
Myna	*Acridotheres tristis*	Introduced and Naturalised
North Island fantail	*Rhipidura fuliginosaplacabilis*	Indigenous – Not Threatened
Norhern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened – Nationally Increasing
Paradise shelduck	*Tadorna variegata*	Indigenous – Not Threatened
Pied stilt	*Himantopus himantopus leucocephalus*	Indigenous – Not Threatened
Pūkeko	*Porphyrio melanotus melanotus*	Indigenous – Not Threatened
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Indigenous – Not Threatened
Silvereye	*Zosterops lateralis lateralis*	Indigenous – Not Threatened
Skylark	*Alauda arvensis*	Introduced and Naturalised
Song thrush	*Turdus philomelos*	Introduced and Naturalised
Spur-winged plover	*Vanellus miles novaehollandiae*	Indigenous – Not Threatened
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Indigenous – Not Threatened
White-faced heron	*Ergretta novaehollandiae*	Indigenous – Not Threatened

5 Appendix E – Ecological Habitat Maps

5.1 Terrestrial Vegetation



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Nixon Rd
Henwood Rd
Nelson Rd
Red Hills Rd
Birdwood Rd
Baker Lane
Don Buck Rd
Hobsonville Rd
Fred Taylor Dr
Westgate Dr
Upper Harbour Mwy
Auckland-Kumeu Mwy
Royal Rd
0 0.3 0.6
Kilometres
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Route Option
Designation
Habitat mapping
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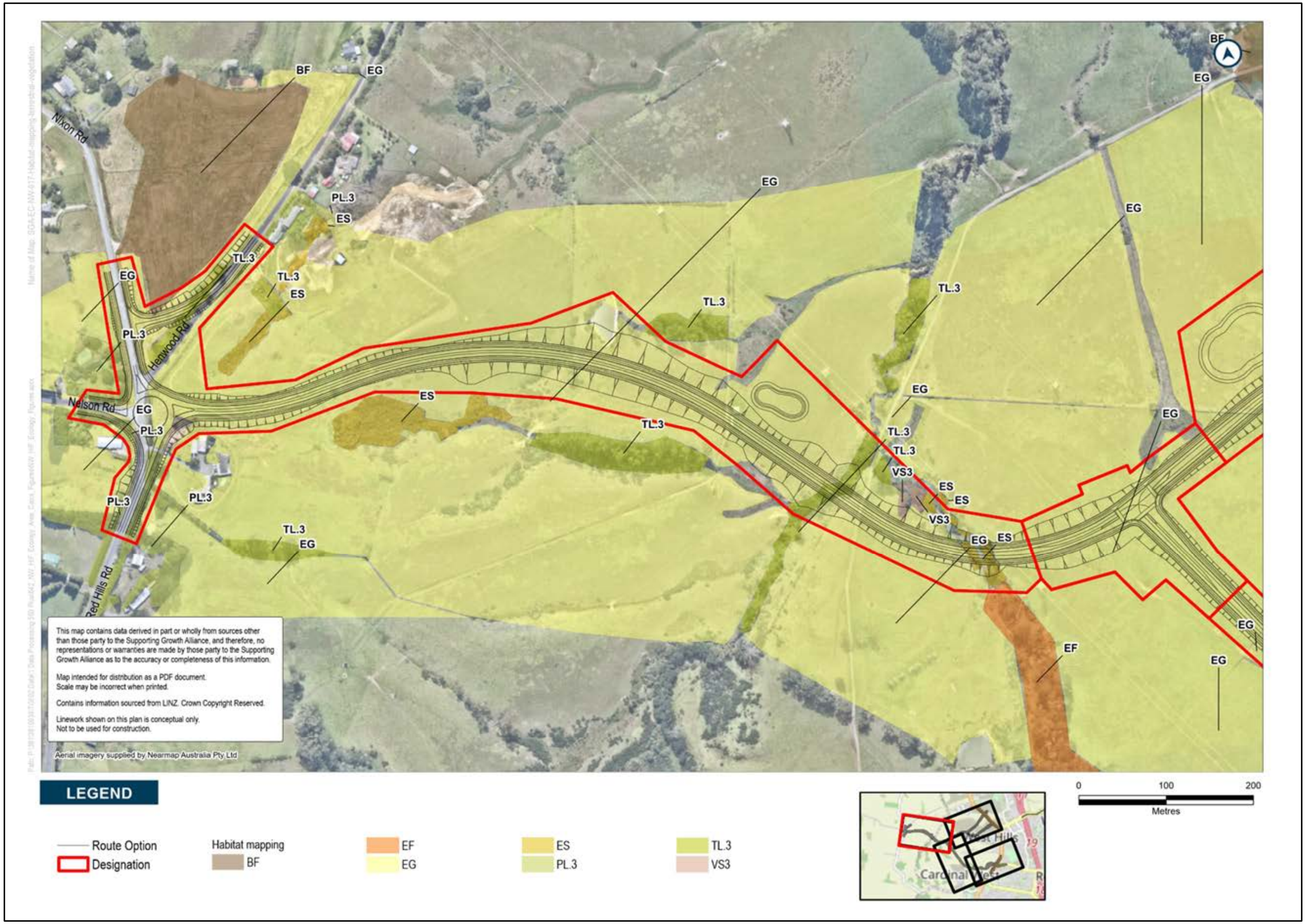
EF
EG
ES
PL.1
PL.3
TL.3
VS3



BF
EG
Nixon Rd
PL.3
ES
TL.3
EG
TL.3
ES
PL.3
Henwood Rd
Nelson Rd
EG
PL.3
PL.3
PL.3
TL.3
EG
ES
TL.3
TL.3
EG
TL.3
EG
TL.3
TL.3
VS3
ES
ES
VS3
EG
ES
EG
EG
EF
EG
EG
BF
Red Hills Rd
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Route Option
Designation
Habitat mapping
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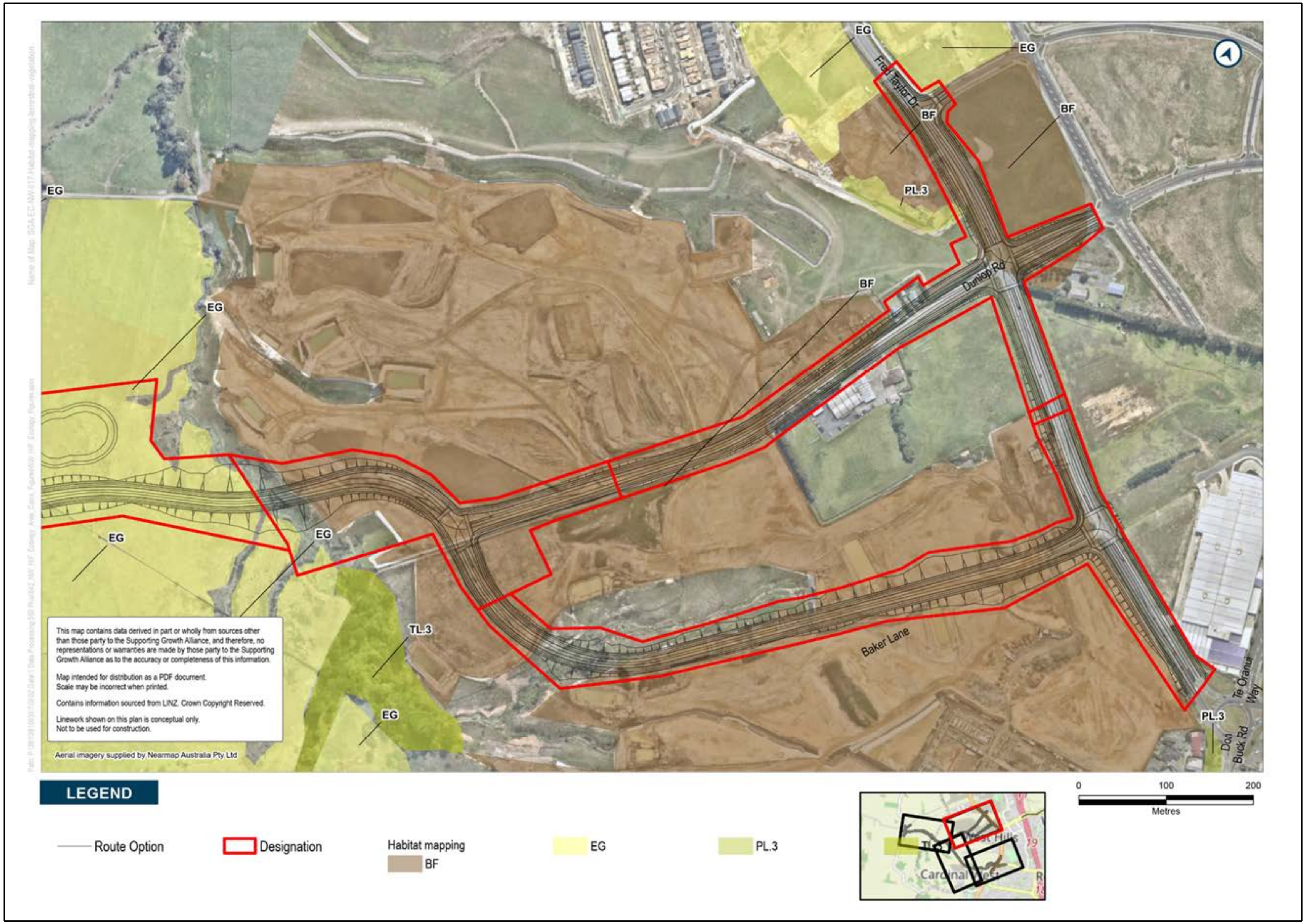
EF
EG
ES
PL.3
TL.3
VS3
0
100
200
Metres



EG
EG
Fred Taylor Dr
BF
BF
PL.3
EG
Dunlop Rd
BF
EG
EG
EG
TL.3
EG
Baker Lane
PL.3
Te Oranui Way
Don Buck Rd
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Route Option
Designation
Habitat mapping
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EG
PL.3
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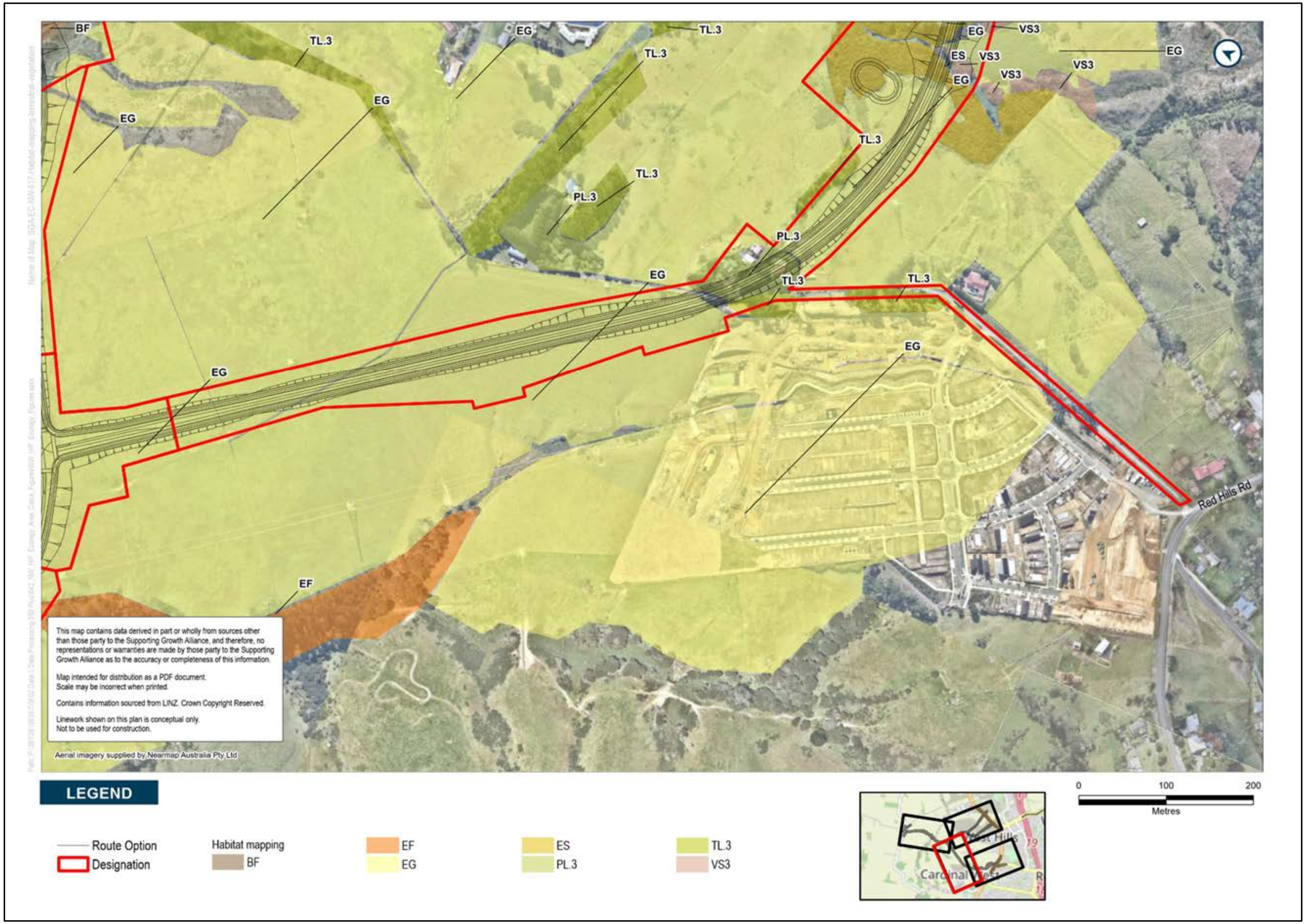
Metres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TL.3
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EG
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VS3
ES
VS3
EG
VS3
VS3
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PL.3
EG
TL.3
TL.3
EG
EG
EF
Red Hills Rd
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Route Option
Designation
Habitat mapping
BF
EF
EG
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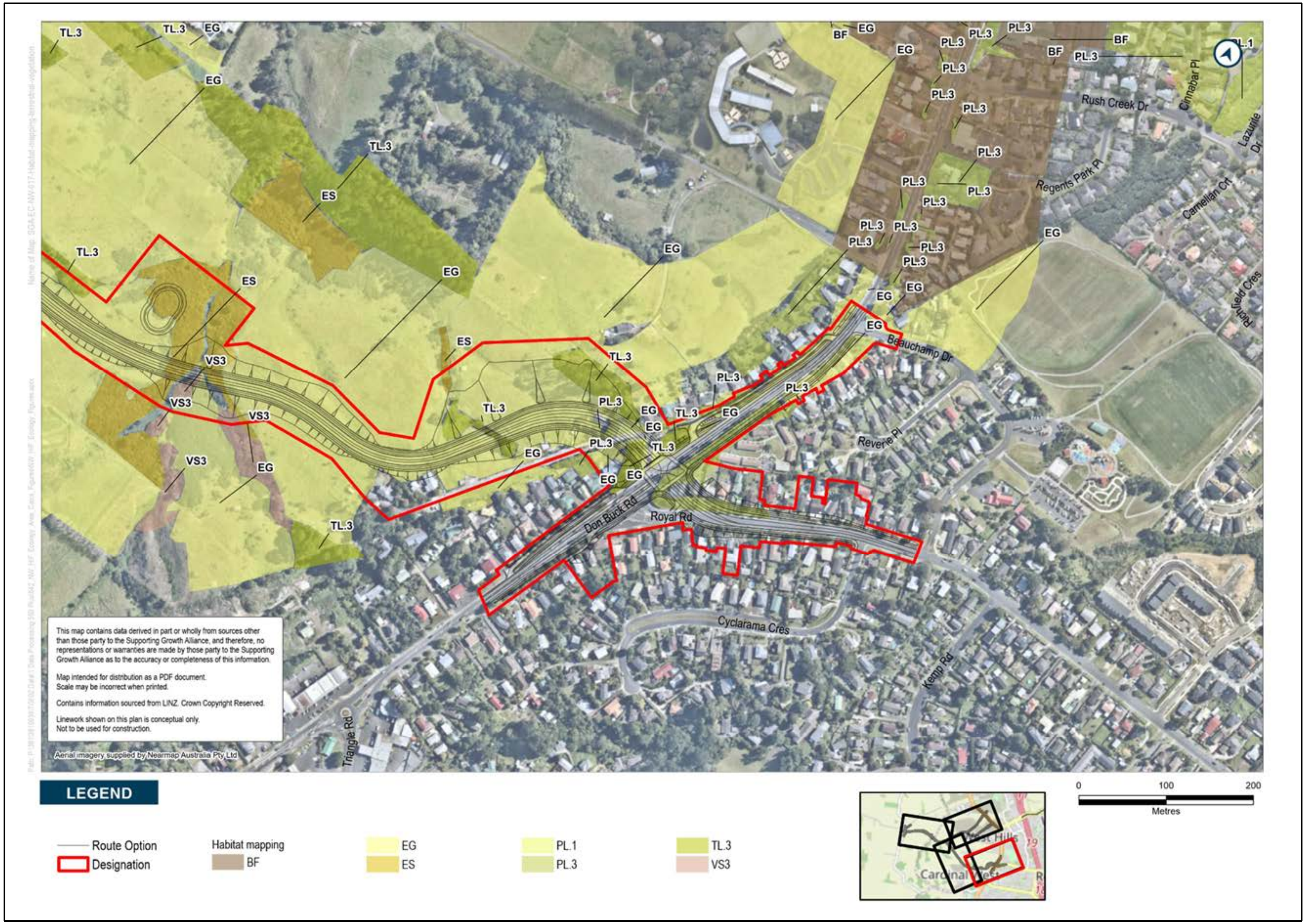
PL.3
TL.3
VS3
0
100
200
Metres



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Cinnabar Pl
Regents Park Pl
Camellan Crt
Beauchamp Dr
Reverie Pl
Don Buck Rd
Royal Rd
Cyclarama Cres
Kemp Rd
Triangle Rd
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LEGEND
Route Option
Designation
Habitat mapping
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EG
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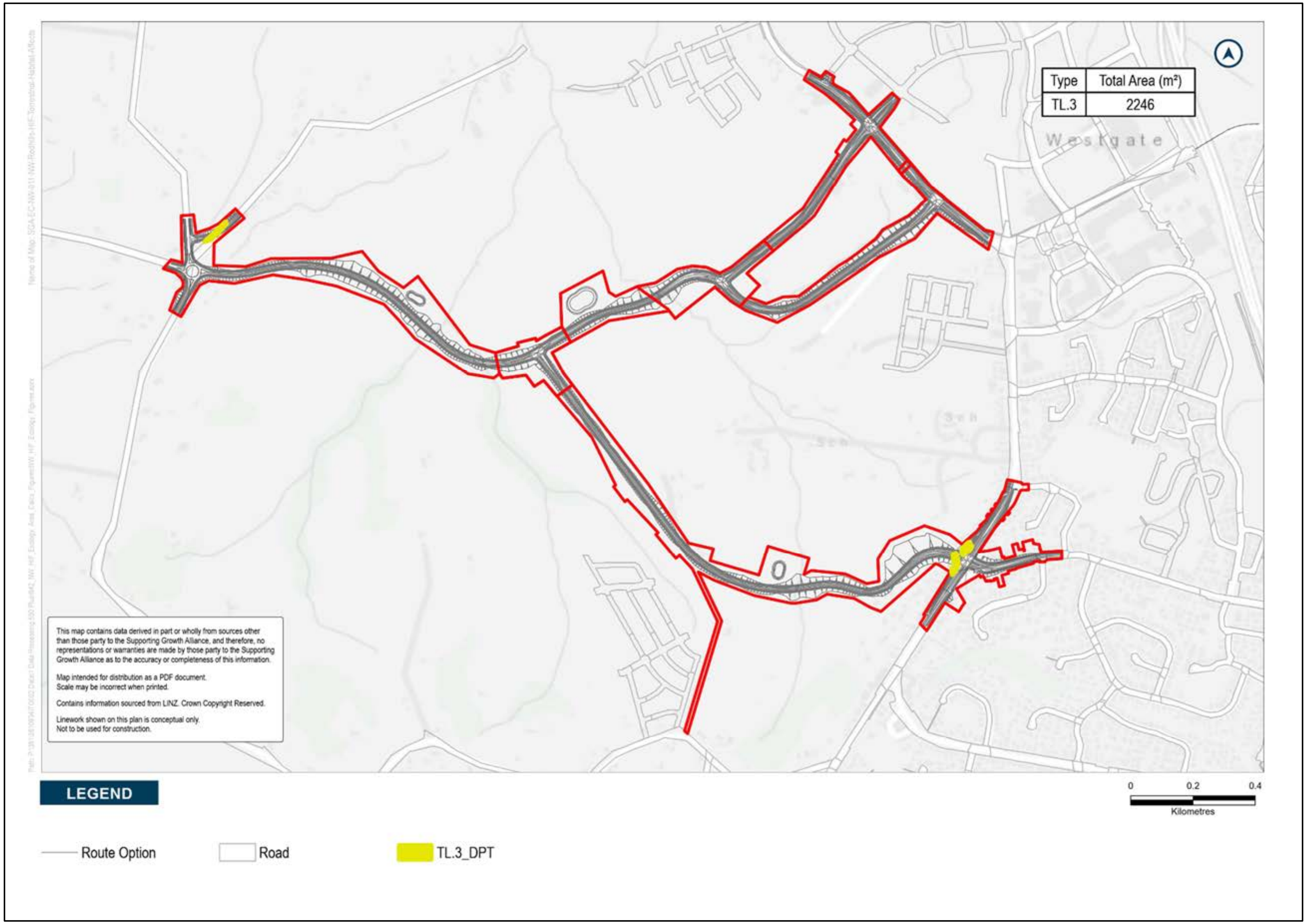
PL.1
PL.3
TL.3
VS3
0
100
200
Metres

5.2 District Plan Vegetation


Type | Total Area (m²)
TL.3 | 2246
Westgate
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Route Option
Road
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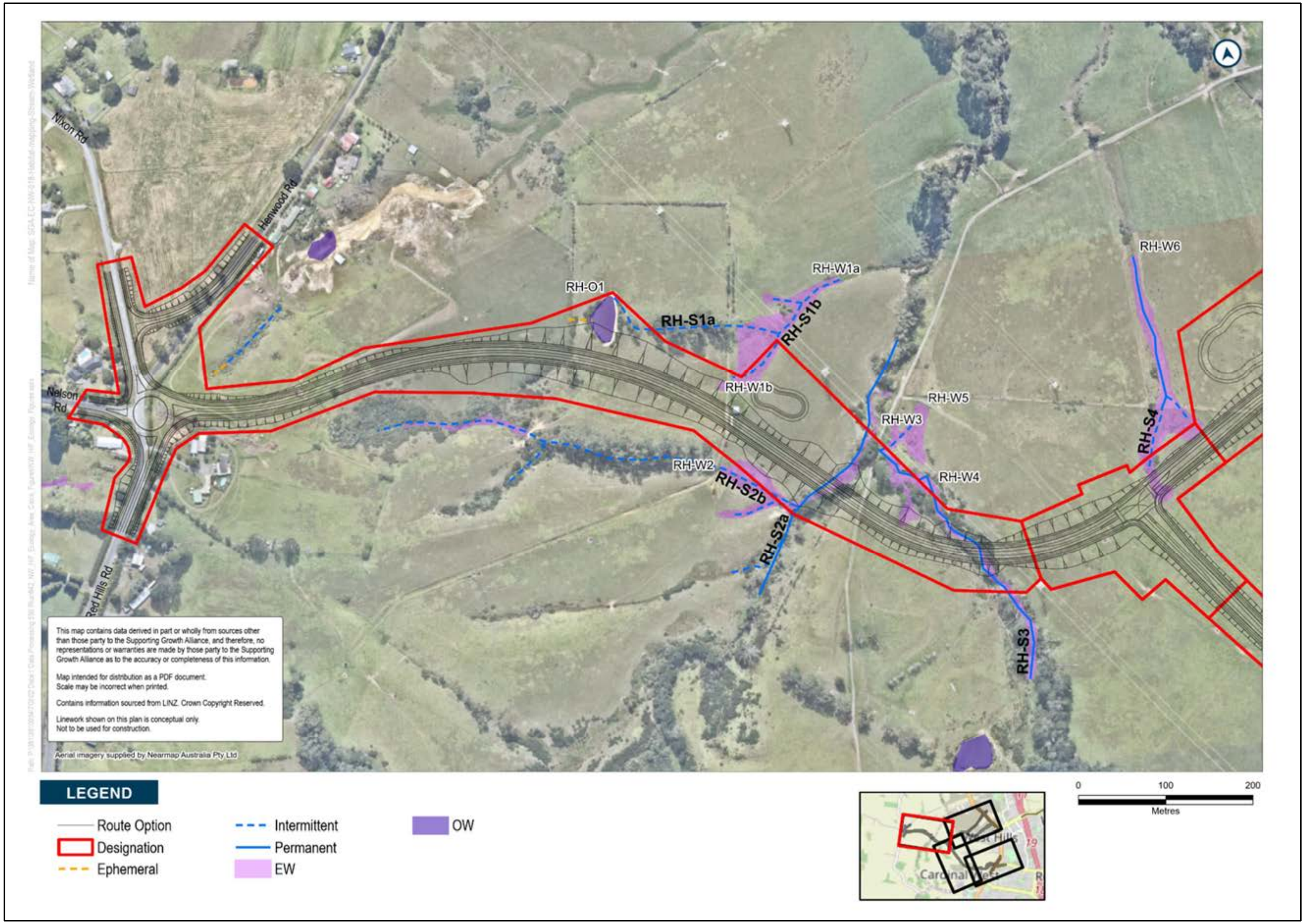
0.2
0.4
Kilometres

5.3 Freshwater Streams and Wetland Habitat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Nelson Rd
Red Hills Rd
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RH-S1a
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RH-W1b
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RH-S2a
RH-W3
RH-W4
RH-W5
RH-W6
RH-S4
RH-S3
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Route Option
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Intermittent
Permanent
EW
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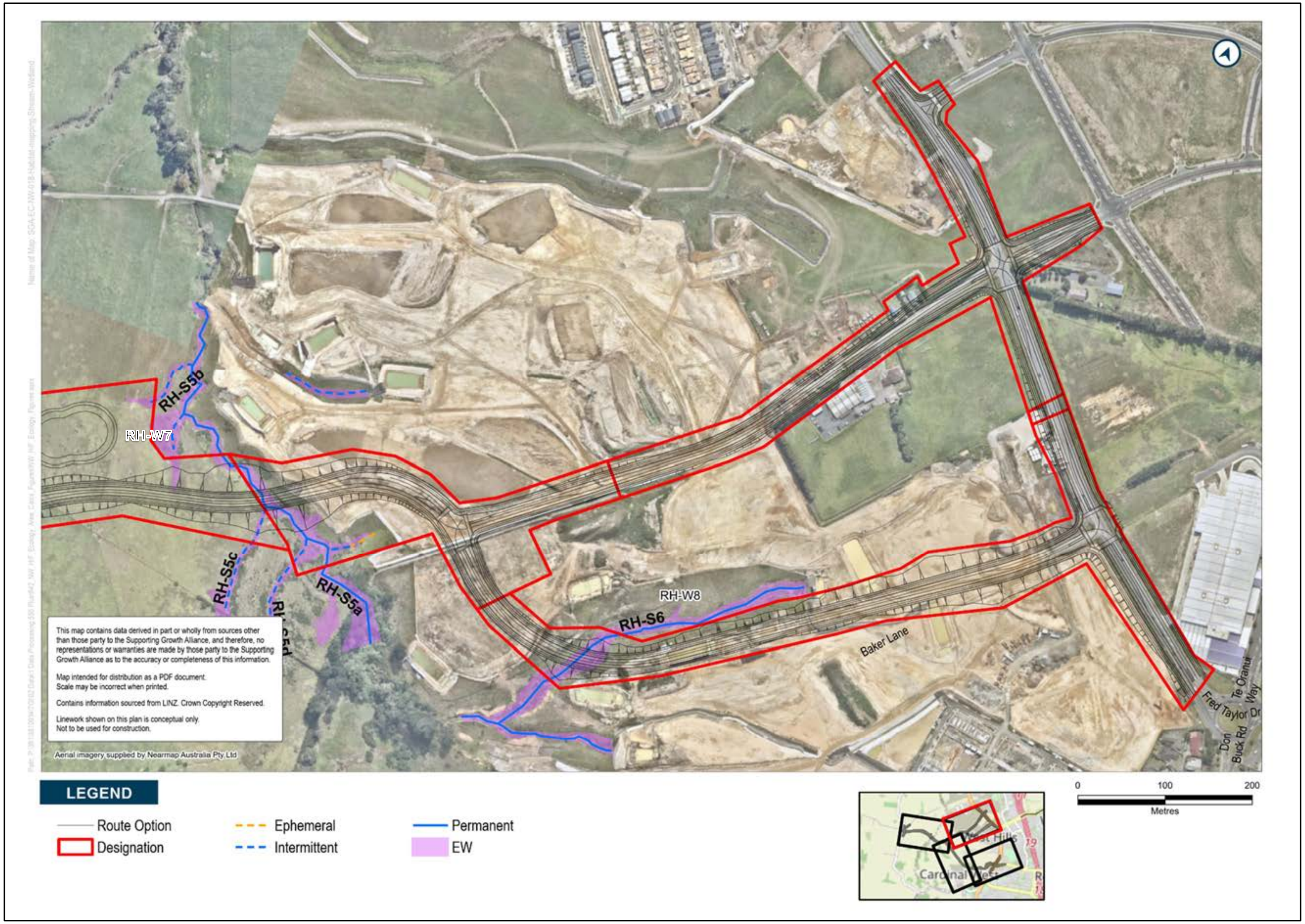
100
200
Metres



RH-S5b
RH-W7
RH-S5c
RH-S5a
RH-W8
RH-S6
Baker Lane
Te Oranui Way
Fred Taylor Dr
Don Buck Rd
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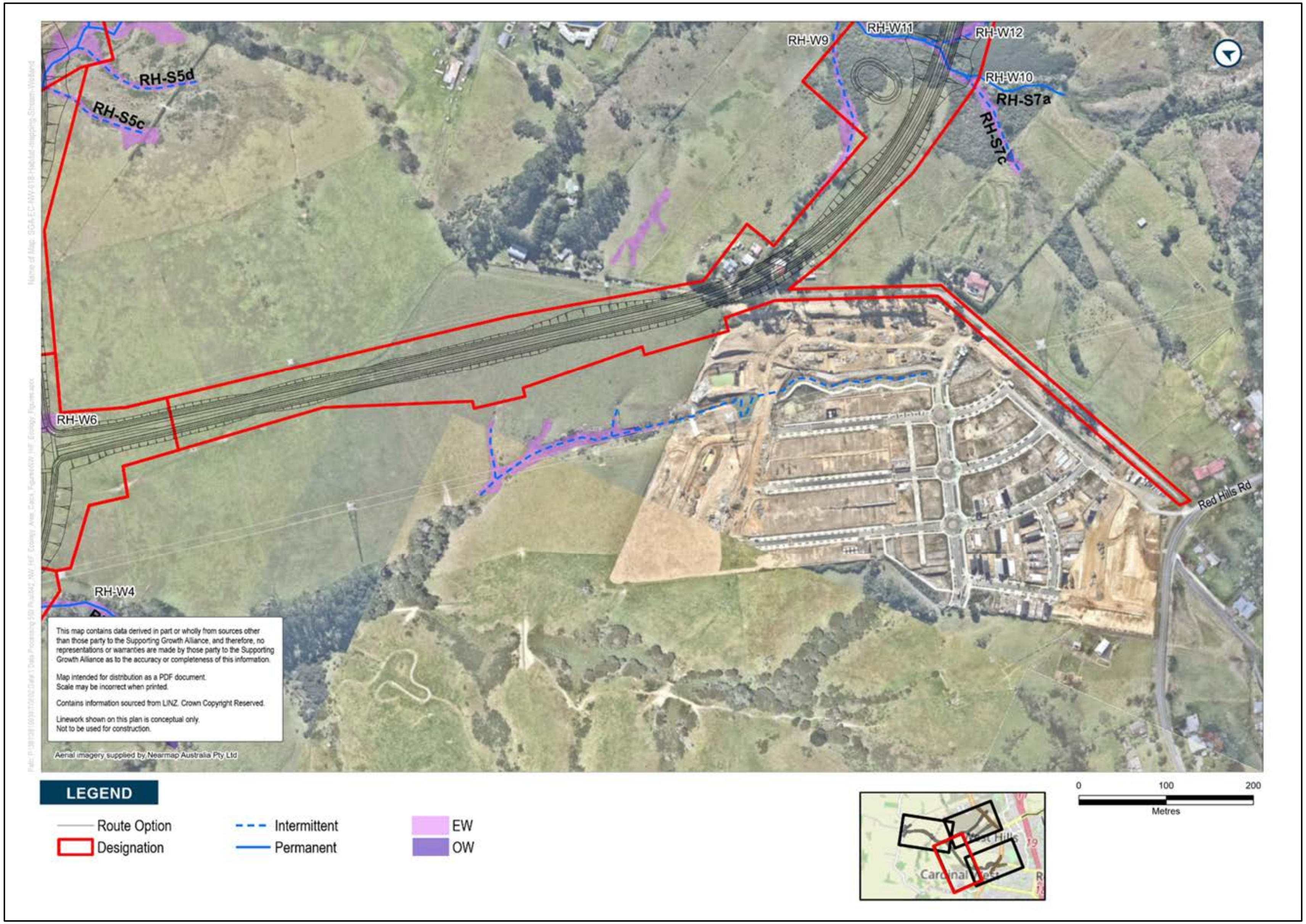
LEGEND
Route Option
Designation
Ephemeral
Intermittent
Permanent
EW
0
100
200
Metres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RH-S5c
RH-W6
RH-W4
Red Hills Rd
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LEGEND
Route Option
Designation
Intermittent
Permanent
EW
OW
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100
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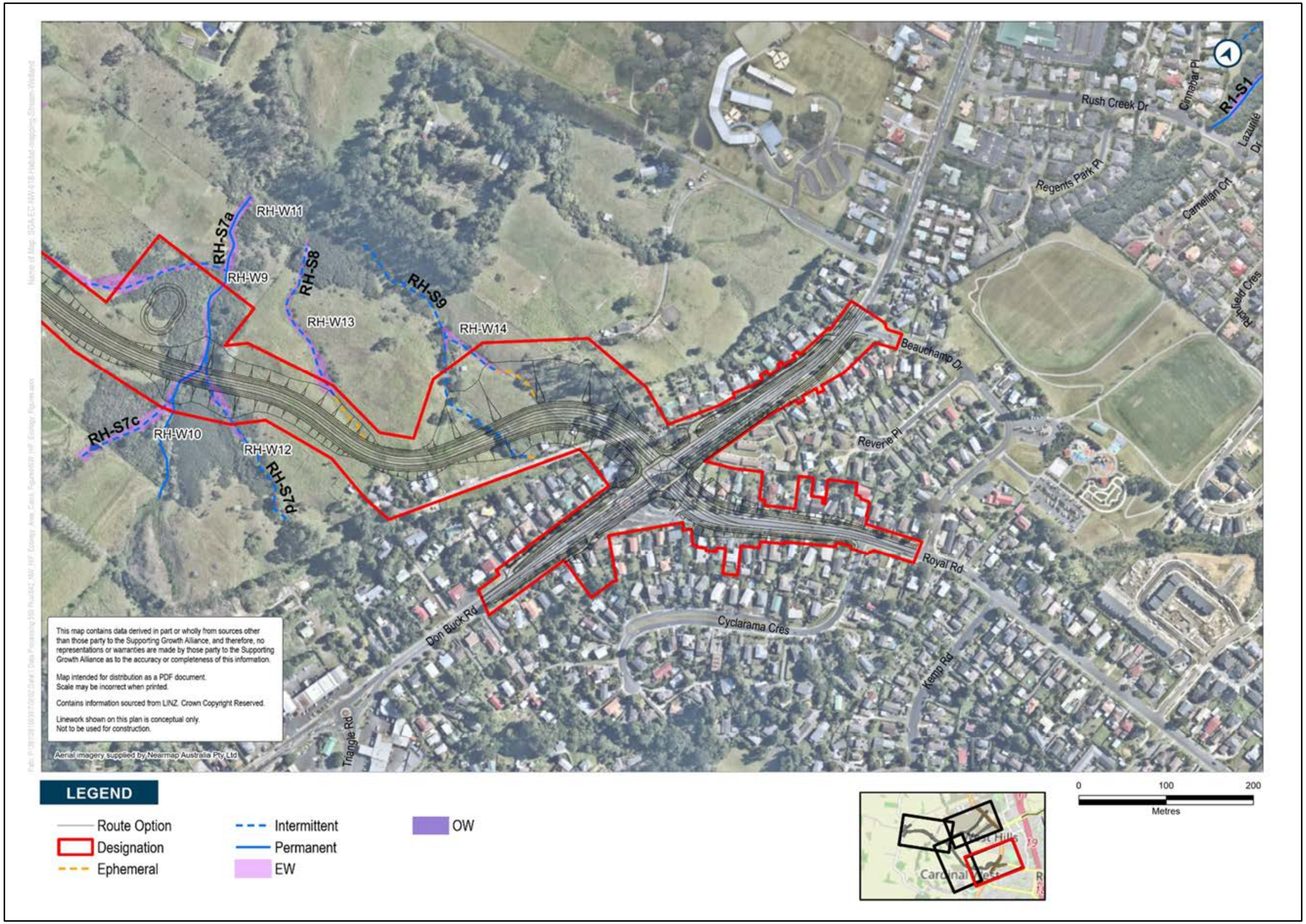
Metres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RH-W9
RH-S8
RH-S9
RH-W13
RH-W14
RH-S7c
RH-W10
RH-W12
RH-S7d
R1-S1
Rush Creek Dr
Cinnabar Pl
Lazurite Dr
Regents Park Pl
Camellia Crt
Beauchamp Dr
Reverie Pl
Royal Rd
Don Buck Rd
Cyclarama Cres
Kemp Rd
Triangle Rd
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LEGEND
Route Option
Designation
Ephemeral
Intermittent
Permanent
EW
OW
0
100
200
Metres

6 Appendix F – Terrestrial Value Assessment

Table 10-10: Assessment of ecological value for terrestrial ecology features in the Project Area

Attributes to be considered	BF	EF	EG	ES	PL.3	TL.3	VS3	Justification
Representativeness	**1**	**2**	**1**	**2**	**2**	**2**	**4**	
Typical structure and composition	1	1	1	1	1	1	3	BF, EF, EG, ES, PL.3, TL.3: Habitats have been significantly altered by human activities (exotic dominated). VS3: Habitat has been insignificantly affected by human activities.
Indigenous representation	1	2	1	2	2	2	4	BF, EG: <10% of the species are indigenous. EF, ES, PL.3, TL.3: 10-50% of the species are indigenous. VS3: >90% of the species are indigenous.
Rarity / distinctiveness	**4**	**4**	**3**	**3**	**3**	**4**	**3**	
Species of conservation significance	4	4	3	3	3	4	3	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using ecological features associated with the Project Area (EF, TL.3). No TAR bird species expected to be reliant on terrestrial ecological features associated with the Project Area. Northern New Zealand Dotterel is present and likely breeding in current construction area associated with a residential development would score 4 (BF), and seasonal use by kākā, would score 3 (EF, TL.3). Copper skink and ornate skink (At Risk – Declining, value score 3) likely to utilise ecological features within the Project Area (EF, EG, ES, PL.3, and TL.3 and VS3 (with appropriate understorey)).
Distinctive ecological values	-	2	1	1	1	1	2	BF: Habitat not playing an important role in provisional or regulatory ecosystem services at any scale.

Attributes to be considered	BF	EF	EG	ES	PL.3	TL.3	VS3	Justification
								EG, ES, PL.3, TL.3: Habitat playing an important role in provisional or regulatory ecosystem services typically on Local scale. EF: Habitat playing an important role in provisional or regulatory ecosystem services typically on Catchment scale. VS3: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale.
Diversity and pattern	**1**	**3**	**1**	**1**	**1**	**3**	**3**	
Habitat diversity	-	1	-	-	-	1	2	Increased habitat diversity in areas with indigenous species present: VS3. Increased habitat diversity in areas with late succession: EF, TL.3, VS3.
Species diversity	-	1	-	-	-	1	2	Increased species diversity in areas with indigenous species present: VS3. Increased species diversity in areas with late succession: EF, TL.3, VS3.
Patterns in habitat use	1	3	1	1	1	3	3	EF, TL.3, VS3 rated high due to potential seasonal utilisation by long-tailed bat and kākā. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**1**	**0**	**0**	**0**	**3**	**3**	
Size, shape and buffering	-	1	-	-	-	1	1	EF, TL.3, VS3 are represented by small (or isolated), patches of habitat surrounded by pasture but provide buffering to stream / wetland areas.
Sensitivity to change	-	-	-	-	-	-	1	VS3: Intact habitat. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	-	-	-	-	3	3	Aged woody structure (TL.3 and VS3) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and kākā.

Attributes to be considered	BF	EF	EG	ES	PL.3	TL.3	VS3	Justification
Ecological Value	**L**	**M**	**L**	**L**	**L**	**M**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 10-11: Assessment of ecological value for terrestrial ecology features in the Project Area (fauna)

Attributes to be considered	Long-tailed bat	Non-TAR bird	Northern New Zealand dotterel	North Island fernbird	North Island kākā	Copper skink / ornate skink	Justification
Representativeness	**0**	**2***	**0**	**0**	**0**	**0**	
Typical structure and composition	-	2*	-	-	-	-	
Indigenous representation	-	-	-	-	-	-	
Rarity / distinctiveness	**4**	**2**	**4**	**3**	**3**	**3**	
Species of conservation significance (fauna only)	4	2	4	3	3	3	Long-tailed bat: Threatened – Nationally Critical Northern New Zealand dotterel: Threatened – Nationally Increasing North Island fernbird: At Risk – Declining North Island kākā: At Risk – Recovering Copper skink, ornate skink: At Risk – Declining

Attributes to be considered	Long-tailed bat	Non-TAR bird	Northern New Zealand dotterel	North Island fernbird	North Island kākā	Copper skink / ornate skink	Justification
Species of conservation significance	-	-	-	-	-	-	
Distinctive ecological values	-	-	-	-	-	-	
Diversity and pattern	**0**	**2***	**0**	**0**	**0**	**0**	
Habitat diversity	-	2*	-	-	-	-	
Species diversity	-	-	-	-	-	-	
Patterns in habitat use	-	-	-	-	-	-	
Ecological context	**0**	**2***	**0**	**0**	**0**	**0**	
Size, shape and buffering	-	2*	-	-	-	-	
Sensitivity to change	-	-	-	-	-	-	-
Ecological networks (linkages, pathways, migration)	-	-	-	-	-	-	-
Ecological Value	**VH**	**L**	**VH**	**H**	**H**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High. * = Scores not representative of corresponding row, scores required to produce 'Low' combined value.

Table 10-12: Assessment of ecological value for terrestrial ecology features in the Project Area (district plan vegetation)

Attributes to be considered	TL.3	Justification
Representativeness	**2**	
Typical structure and composition	1	TL.3: Habitat has been significantly altered by human activities (exotic dominated).
Indigenous representation	2	TL.3: 10-50% of the species are indigenous.
Rarity / distinctiveness		
Species of conservation significance	1	Areas of TL.3 are small, isolated and adjacent to roads, therefore unlikely to be utilised by bats. Non-TAR bird species expected to utilise TL.3.
Distinctive ecological values	1	
Diversity and pattern	**1**	
Habitat diversity	1	
Species diversity	1	
Patterns in habitat use	1	
Ecological context	**1**	
Size, shape and buffering		
Sensitivity to change		
Ecological networks (linkages, pathways, migration)	1	
Ecological Value	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7 Appendix G – Aquatic Value Assessment

Table 10-13: Assessment of ecological value for aquatic ecology features (RH-S1a to RH-S5c)

Attributes to be considered	RH-S1a	RH-S1b	RH-S2a	RH-S2b	RH-S2c	RH-S3	RH-S4	RH-S5a	RH-S5b	RH-S5c	Justification
Representativeness	**1**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	
Riparian habitat modification	1	1	2	1	1	2	1	2	1	1	RH-S2a, S3, S5a = RHA total score is 40-70% relative to reference. All other RHA total scores are <40%.
Rarity / distinctiveness	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
Species of conservation significance	3	3	3	3	3	3	3	3	3	3	Longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area.
Diversity and pattern	**1**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	
Level of natural diversity	1	1	3	1	1	2	1	2	1	1	Instream RHA scores: S1a = 8 (1) S1b = 6 (1) S2a = 30 (3) S2b = 6 (1) S2c = 6 (1) S3 = 22 (2) S4 = 6 (1) S5a = 19 (2) S5b = 6 (1) S5c = 6 (1)

Attributes to be considered	RH-S1a	RH-S1b	RH-S2a	RH-S2b	RH-S2c	RH-S3	RH-S4	RH-S5a	RH-S5b	RH-S5c	Justification
Ecological context	**3**	**3**	**4**	**3**	**3**	**4**	**3**	**4**	**3**	**3**	
Stream order	1	1	3	1	1	3	1	3	1	1	Order 2 streams = RH-S2a, S3, S5a All other streams are zero order streams.
Hydroperiod	3	3	4	3	3	4	3	4	3	3	Intermittent streams = RH-S1a, S1b, S2b, S2c, S4, S5b, S5c, S5 Permanent streams = RH-S2a, S3, S5a
Ecological Value	**L**	**L**	**M**	**L**	**L**	**M**	**L**	**M**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High.

Table 10-14: Assessment of ecological value for aquatic ecology features (RH-S5d to RH-S10)

Attributes to be considered	RH-S5d	RH-S5e	RH-S6	RH-S7a	RH-S7b	RH-S7c	RH-S7d	RH-S8	RH-S9	RH-S10	Justification
Representativeness	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	
Riparian habitat modification	1	1	2	2	1	1	1	1	1	1	RH-S6, S7a = RHA total score is 40-70% relative to reference. All other RHA total scores are <40%.
Rarity / distinctiveness	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
Species of conservation significance	3	3	3	3	3	3	3	3	3	3	Longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area.
Diversity and pattern	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	
Level of natural diversity	1	1	2	2	1	1	1	1	2	1	Instream RHA scores: S5d = 6 (1)

Attributes to be considered	RH-S5d	RH-S5e	RH-S6	RH-S7a	RH-S7b	RH-S7c	RH-S7d	RH-S8	RH-S9	RH-S10	Justification
											S5e = 6 (1) S6 = 19 (2) S7a = 24 (2) S7b = 8 (1) S7c = 8 (1) S7d = 9 (1) S8 = 6 (1) S9 = 17 (2) S10 = 6 (1)
Ecological context	**3**	**3**	**4**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	
Stream order	1	1	2	2	1	1	1	1	1	1	Order 1 streams = RH-S6, S7a All other streams are zero order.
Hydroperiod	3	3	4	4	3	3	3	3	3	3	Intermittent streams = RH-S5d, S5e, S7b, S7c, S7d, S8, S9, S10 Permanent streams = RH-S6, S7a
Ecological Value	**L**	**L**	**M**	**M**	**L**	**L**	**L**	**L**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High.

8 Appendix H – Wetland Value Assessment

Table 10-15: Assessment of ecological value for wetland ecology features (RH-W1a to RH-W10)

Attributes to be considered	RH-W1a	RH-W2	RH-W3	RH-W4	RH-W5	RH-W6	RH-W7	RH-W8	RH-W9	RH-W10	Justification
Representativeness	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**	
Hydrological modification	2	3	3	3	3	3	3	1	3	3	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity / distinctiveness	**3**	**3**	**1**	**1**	**3**	**3**	**3**	**1**	**3**	**3**	
Species of conservation significance	3	3	1	1	3	3	3	1	3	3	North Island fernbird (At Risk – Declining, value score of 3) likely utilising large, palustrine wetlands that are present in the Project Area.
Vegetation type of conservation significance	1	1	1	1	1	1	1	1	1	1	Exotic-dominated vegetation.
Diversity and pattern	**3**	**2**	**4**	**4**	**2**	**4**	**4**	**3**	**3**	**3**	
Diversity of habitat types	3	2	4	4	2	4	4	3	3	3	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, small wetlands (< 100 m2) that provide only temporary (<3 months / year) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal, and temporary habitat were scored higher.

Attributes to be considered	RH-W1a	RH-W2	RH-W3	RH-W4	RH-W5	RH-W6	RH-W7	RH-W8	RH-W9	RH-W10	Justification
Ecological context	**3**	**3**	**4**	**4**	**3**	**4**	**4**	**2**	**3**	**3**	
Flood attenuation	2	2	3	3	2	2	4	2	2	2	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered include surface roughness, slope, size of flood benches, and sinuosity.
Streamflow augmentation	2	2	3	3	2	3	4	2	3	3	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation / inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	3	3	3	3	3	4	3	2	3	3	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	3	3	3	3	4	3	2	3	3	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher,

Attributes to be considered	RH-W1a	RH-W2	RH-W3	RH-W4	RH-W5	RH-W6	RH-W7	RH-W8	RH-W9	RH-W10	Justification
											while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	2	2	4	4	2	4	4	1	3	3	Scores reflect differences in the position of wetlands within the larger stream networks.
Ecological Value	**M**	**M**	**M**	**M**	**M**	**H**	**H**	**L**	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 10-16: Assessment of ecological value for wetland ecology features (RH-W11 to RH-W14, RH-W1b, RH-01)

Attributes to be considered	RH-W11	RH-W12	RH-W13	RH-W14	RH-W1b	RH-O1	Justification
Representativeness	**3**	**3**	**3**	**3**	**1**	**1**	
Hydrological modification	3	3	3	3	1	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity / distinctiveness	**3**	**3**	**3**	**1**	**1**	**1**	
Species of conservation significance	3	3	3	1	1	1	North Island fernbird (At Risk – Declining, value score of 3) likely utilising large, palustrine wetlands that are present in the Project Area.
Vegetation type of conservation significance	1	1	1	1	1	1	Exotic-dominated vegetation.
Diversity and pattern	**4**	**3**	**3**	**3**	**1**	**2**	

Attributes to be considered	RH-W11	RH-W12	RH-W13	RH-W14	RH-W1b	RH-O1	Justification
Diversity of habitat types	4	3	3	3	1	2	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, small wetlands (< 100 m2) that provide only temporary (<3 months / year) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal, and temporary habitat were scored higher.
Ecological context	**3**	**3**	**3**	**3**	**2**	**4**	
Flood attenuation	3	2	2	2	1	1	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered include surface roughness, slope, size of flood benches, and sinuosity.
Streamflow augmentation	3	3	3	3	1	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation / inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	3	3	3	3	1	4	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	3	3	3	2	2	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	3	3	3	3	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Ecological Value	**H**	**M**	**M**	**M**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

9 Appendix I – Impact Assessment

Phase	Project Activity	Resource	Ecological Value	Main Effect Description	Detailed Effect Description	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (pre-mitigation)
Construction	Noise/vibration/lighting	Long-tailed bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	Long-tailed bat	Very High	Operation- Bats	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.	Indirect	Regional	Permanent (>25 years)	-	Highly Likely	Irreversible	High	Very High
Operation	Presence of the road	Long-tailed bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Highly Likely	Irreversible	Moderate	High
Construction	Noise/vibration/lighting	Non-TAR Bird	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	Low
Construction	Noise/vibration/lighting	Northern New Zealand Dotterel	Very High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Construction	Noise/vibration/lighting	North Island Fernbird	High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	Non-TAR Bird	Low	Operation- Birds	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.	Indirect	Local	Permanent (>25 years)	-	Definite	Irreversible	High	Low
Operation	Presence of the road	Northern New Zealand Dotterel	Very High	Operation- Birds	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.	Indirect	Local	Permanent (>25 years)	-	Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	North Island Fernbird	High	Operation- Birds	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.	Indirect	Local	Permanent (>25 years)	-	Likely	Irreversible	Low	Low
Operation	Presence of the road	Non-TAR Bird	Low	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Definite	Irreversible	High	Low
Operation	Presence of the road	Northern New Zealand Dotterel	Very High	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Moderate
Operation	Presence of the road	North Island Fernbird	High	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Low
Construction	Noise/vibration/lighting	North Island kākā	High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	North Island kākā	High	Operation- Birds	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.	Indirect	Regional	Permanent (>25 years)	-	Unlikely	Irreversible	Low	Low
Operation	Presence of the road	North Island kākā	High	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Low
Construction	Vegetation removal	TL.3 (District Plan)	Low	Construction- Terrestrial habitat	District plan vegetation only. Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Very Low
Construction	Vegetation removal	Long-tailed bat	Very High	Construction- Bats	District plan vegetation only. Loss of foraging habitat due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Low
Construction	Vegetation removal	Long-tailed bat	Very High	Construction- Bats	District plan vegetation only. Kill or injure individual bats due to vegetation removal.	Direct	Local	Short-term (<5 years)	-	Unlikely	-	Negligible	Low
Construction	Vegetation removal	Non-TAR Bird	Low	Construction- Birds	District plan vegetation only. Loss of foraging habitat due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Very Low
Construction	Vegetation removal	Non-TAR Bird	Low	Construction- Birds	District plan vegetation only. Kill or injure individual due to vegetation removal.	Direct	Local	Short-term (<5 years)	-	Likely	-	Negligible	Very Low
Construction	Vegetation removal	North Island kākā	High	Construction- Birds	District plan vegetation only. Loss of foraging habitat due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Very Low
Construction	Vegetation removal	North Island kākā	High	Construction- Birds	District plan vegetation only. Kill or injure individual due to vegetation removal.	Direct	Local	Short-term (<5 years)	-	Unlikely	-	Negligible	Very Low

10 Appendix J – Rapid Habitat Assessment Results

Table 10-17: Summary of RHA values

Stream ID	Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
RH-S1a	1	2	1	1	2	2	1	3	8	8	**29**	**P**
RH-S1b	1	1	1	1	2	1	1	2	8	4	**22**	**P**
RH-S2a	1	6	6	8	7	3	7	4	5	7	**54**	**M**
RH-S2b	1	1	1	1	2	1	1	2	9	4	**23**	**P**
RH-S2c	1	1	1	1	2	1	1	2	8	6	**24**	**P**
RH-S3	1	4	4	4	5	5	5	4	9	7	**48**	**M**
RH-S4	1	1	1	1	2	1	4	3	9	5	**28**	**P**
RH-S5a	1	2	4	2	6	5	6	3	9	5	**43**	**M**
RH-S5b	1	1	1	1	2	1	3	2	8	4	**24**	**P**
RH-S5c	1	1	1	1	2	1	3	2	7	4	**23**	**P**
RH-S5d	1	1	1	1	2	1	3	2	7	4	**23**	**P**
RH-S5e	1	1	1	1	2	1	3	2	9	4	**25**	**P**
RH-S6	1	2	3	3	6	5	8	4	9	5	**46**	**M**
RH-S7a	1	4	1	4	8	7	9	5	9	7	**55**	**M**
RH-S7b	1	1	2	1	3	1	8	2	7	4	**30**	**P**
RH-S7c	1	2	1	1	3	1	8	2	9	5	**33**	**P**
RH-S7d	1	1	1	2	3	2	9	4	9	7	**39**	**P**
RH-S8	1	1	1	1	2	1	1	2	4	4	**18**	**P**
RH-S9	1	3	1	2	6	5	3	3	5	6	**35**	**P**
RH-S10	1	1	1	1	2	1	1	2	4	4	**18**	**P**

Notes:

* = Corresponding habitat values for each habitat quality score

P = Poor (Score 10-40)

M = Moderate (Score 41-60)

G = Good (Score 61-80)

E = Excellent (Score 81+)

Light blue shading = Permanent stream

No shading = Intermittent stream

11 Appendix K – Bat Survey Weather Conditions

Date	ABMs deployed	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable for ABM data to be used
1-Nov	All	36.0	13.7	**9.2**	0.0	**No**
2-Nov	All	23.8	9.2	11.0	0.0	✓
3-Nov	All	22.3	7.8	**8.7**	0.0	**No**
4-Nov	All	18.0	5.8	11.0	0.0	✓
5-Nov	All	17.3	5.1	**7.7**	0.0	**No**
6-Nov	All	15.5	2.6	14.8	0.0	✓
7-Nov	All	23.8	5.7	14.6	0.0	✓
8-Nov	All	23.8	7.6	18.1	0.0	✓
9-Nov	All	41.8	14.7	17.0	0.0	✓
10-Nov	All	45.7	16.7	13.1	**4.2**	**No**
11-Nov	All	33.8	12.5	11.3	0.0	✓
12-Nov	All	29.2	7.0	**5.4**	0.0	**No**
13-Nov	All	18.4	4.1	11.4	0.0	✓
14-Nov	All	46.8	13.6	13.2	0.0	✓
15-Nov	All	39.6	9.4	**7.1**	0.0	**No**
16-Nov	All	19.8	6.3	13.0	0.0	✓
17-Nov	All	19.4	6.7	16.5	0.0	✓
18-Nov	3 & 4	26.6	7.3	10.0	0.2	✓
19-Nov	3 & 4	12.2	3.1	**4.8**	0.0	**No**
20-Nov	3 & 4	27.0	5.8	11.9	0.0	✓
21-Nov	3 & 4	34.6	14.3	11.4	0.0	✓
22-Nov	3 & 4	32.8	7.6	13.2	0.0	✓
23-Nov	3 & 4	34.2	12.5	15.1	0.0	✓
24-Nov	3 & 4	31.7	10.9	17.2	0.0	✓
25-Nov	3 & 4	36.4	12.4	13.4	0.0	✓

Date	ABMs deployed	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable for ABM data to be used
26-Nov	3 & 4	12.2	4.3	-	0.0	✓

12 Appendix L – Site Photographs (2019)

Plate 1 – Exotic scrub (ES) present in the Project Area.

Plate 2 – ABM in situ in the Project Area, adjacent to stream and treeland habitat.

Plate 3 – Exotic wetland (EW) present in the Project Area. Small stand of exotic eucalyptus forest in background.

Plate 4 – Exotic wetland (EW) present in the Project Area.

Plate 5 – Example of a typical stream channel on site in ‘Poor’ condition, with damage from stock pugging and removal of natural riparian vegetation.

Plate 6 – Example of habitat where opportunistic searches for lizards were undertaken.

Plate 7 – Exotic-dominated treeland (TL.3) present in the Project Area.

Plate 8 – Open water area present in the Project Area (stock water dam).

Figure 10-1: Site photographs (2019)

ATTACHMENT 27

REDHILLS ARTERIAL TRANSPORT NETWORK ASSESSMENT OF FLOODING EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Redhills Arterial Transport Network

Assessment of Flooding Effects

December 2022

Version 1.0

Document Status

Responsibility	Name
Author	Saleem Akhter
Reviewer	Mike Summerhays, Roger Seyb
Approver	Bridget O'Leary

Revision Status

Version	Date	Reason for Issue
1.0	December 2022	Final for Lodgement

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Abbreviations

Acronym / Term	Description
AC	Auckland Council
AEE	Assessment of Effects on the Environment
ARI	Average Recurrence Interval
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
CC	Climate change
CEMP	Construction Environmental Management Plan
FUZ	Future Urban Zone
MfE	Ministry for the Environment
MPD	Maximum Probable Development
NoR	Notice of Requirement (under the Resource Management Act 1991)
PWV	Precipitable water vapour
RCP	Representative Concentration Pathways
RATN	Redhills Arterial Transport Network
RL	Reduced level
RMA	Resource Management Act 1991
SGA	Te Tupu Ngātahi Supporting Growth Alliance
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym / Term	Description
AT	Auckland Transport an Auckland Council controlled organisation.
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Dry Pond	A permanent pond that is normally dry but during rainfall events temporarily stores stormwater runoff to control discharges. Dry ponds provide limited water quality treatment.
Freeboard	An allowance above the modelled flood level, be it road level or other features (e.g. existing floor level). For buildings freeboard shall be measured from the top water level to the finished floor level. The relevant design manual shall be referred to for the appropriate freeboard and method of calculation.
Lay down areas	An area that has been cleared for the temporary storage of materials and equipment and may include site compounds, stockpiles, sediment retention ponds.
MPD	Maximum Probable Development according to the AUP:OP zonings
Pre-development	Prior to construction of the Project
Post-development	After construction of the Project
Redhills Arterial Transport Network Assessment Package	Two Notices of Requirement (for Don Buck Road and Coatesville-Riverhead Road) and one alteration to an existing designation (Fred Taylor Drive) for the Redhills Riverhead Package of Projects for Auckland Transport.
Stormwater Wetland	Constructed wetlands that temporarily store runoff and support conditions suitable for the growth of wetland plants. Stormwater wetlands provide enhanced water quality treatment of stormwater runoff through vegetation uptake, retention and settling.
Terrain	An elevation model which includes the ground levels based on 2016 LiDAR and the concept design ground levels.
Wet Pond	A permanent pond that has a standing pool of water and provides water quality treatment, and storage of stormwater runoff to reduce the peak water volume from a rainfall event and provide downstream erosion protection.

1 Executive Summary

This report provides an assessment of flood risks associated with the construction, operation and maintenance of the North West – Redhills Arterial Transport Network (**RATN**). The relative location of this site is shown in Figure 1-1 below.

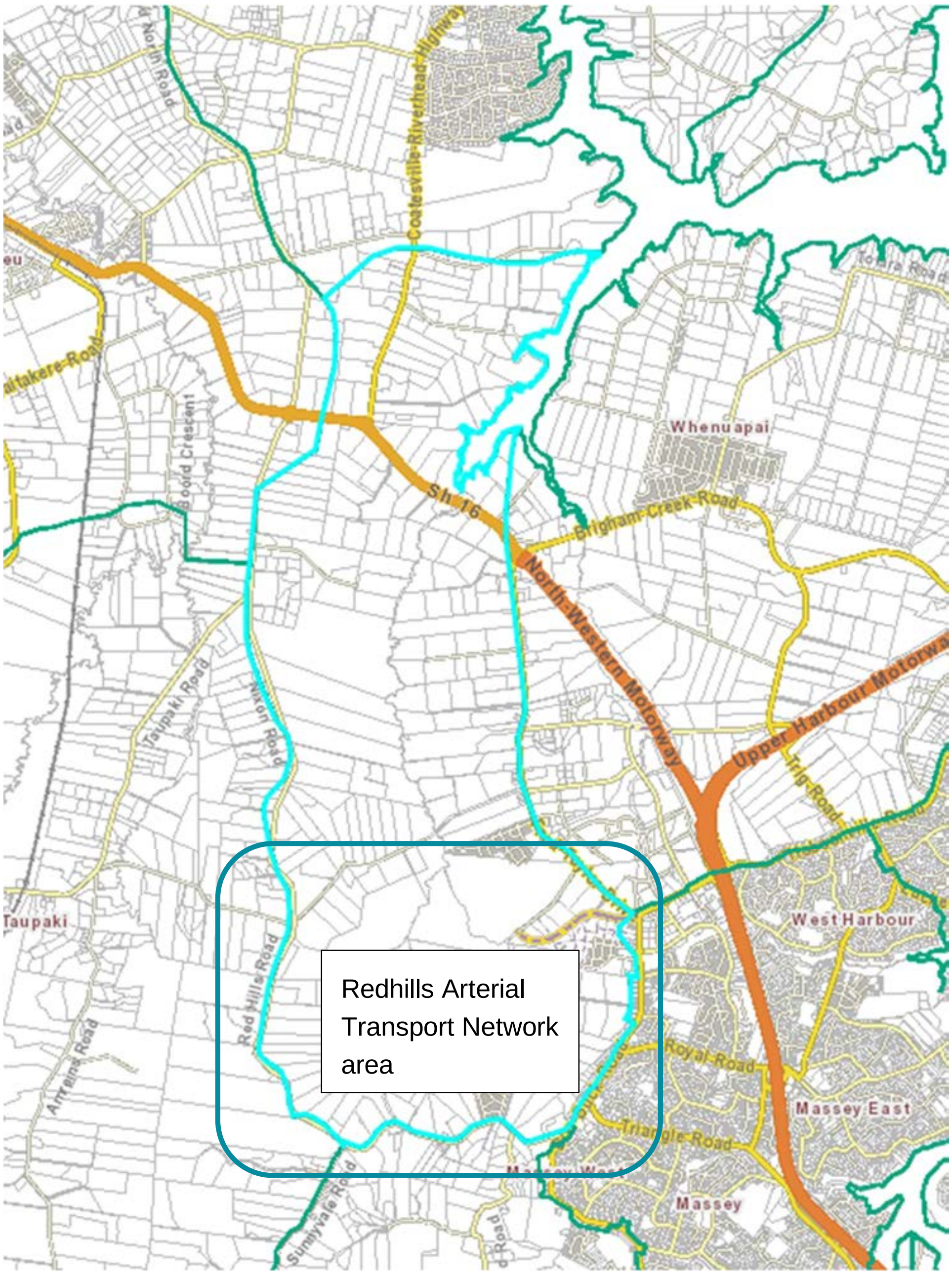

Figure 1-1: Location of the Redhills Arterial Transport Network

Flooding is a natural hazard and has therefore been considered as part of the Redhills Arterial Transport Network Notices of Requirement. The works required for the Redhills Arterial Transport Network 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 mitigated 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 risk 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
- effects to existing habitable buildings / infrastructure and potential future effects on upstream and downstream properties.

Methodology

The assessment of flooding effects for the Redhills Arterial Transport Network has involved the following steps:

- Desktop assessment to identify potential flooding locations from Auckland Council GeoMaps
- Modelling of the pre-development terrain with Maximum Probable Development (**MPD**) and 100year 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 to understand the increased risk of greater climate change impacts
- Producing flood level maps for the pre-development scenario to show the flood levels and extents (greater than 50 mm) that need to be considered
- Inspection and review of flood maps at key locations such as proposed bridges and major earthworks to ensure allowed for in future design.

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 ponds) and incorporating land for that purpose into the proposed boundaries. These devices have been designed to attenuate the 100year ARI event by using 10% of the total roading impervious catchment area (proposed and existing) as the required device size – which is sufficient for a device in accordance with Auckland Council and Waka Kotahi guidance[1,2].

The assessment considers that flooding effects will be subject to further assessment at a detailed design stage. It is expected that coordination and integration of the corridor design with future urban development within the Redhills area will be undertaken to confirm and mitigate potential future adverse effects.

Positive Effects

The main positive effects that could be designed allow for:

- existing widened roadway to be above the flood plains
- ability to convey flows without worsening flooding impacts upstream or downstream of the works
- added water quality treatment and attenuation of the total proposed roadway impervious area for Dunlop Road (an existing road) as opposed to just the additional impervious area.,

The scale of these effects will be determined at detailed design stage.

[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)

Construction phase effects

The potential construction flooding effects can be appropriately managed with the measures set out in Section 6.1 . 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. 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

Redhills Arterial Transport Network

The Redhills Arterial Transport Network is near the top of the Redhills catchment therefore flood flows and stormwater effects will be minimised.

There is a minor risk of flooding at locations of bridges, particularly on the main stream reach. Existing overland flow paths can be accommodated although these may be impacted by the future development within the area, with some of the flow reduced by piping.

Potential flooding effects will be appropriately managed and will be negligible up to minor effects subject to the recommended design outcomes and conditions outlined in this Report.

Water quality and attenuation ponds will be optimised to minimise ongoing operational costs and maximise benefit.

The operational flood risks are classified as minor. Operational impacts will aim to be resolved during detailed design by optimising the design of culverts to minimise flood effects upstream and downstream of culvert 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.

Sensitivity Analysis

The sensitivity analysis for the potential increased rainfall due to climate change found there was a slight change to the identified flood effects at key locations under a more severe climate change scenario (3.8° temperature change). However, no additional mitigation is required as it is anticipated these effects can be mitigated utilising appropriate design.

2 Introduction

This flooding assessment has been prepared for the North West Redhills Arterial Transport Network Notices of Requirement (**NoRs**) for Auckland Transport (**AT**). The NoRs aim to designate land for future 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.

An overview of the Redhills Arterial Transport Network is provided in Figure 2-1 below.

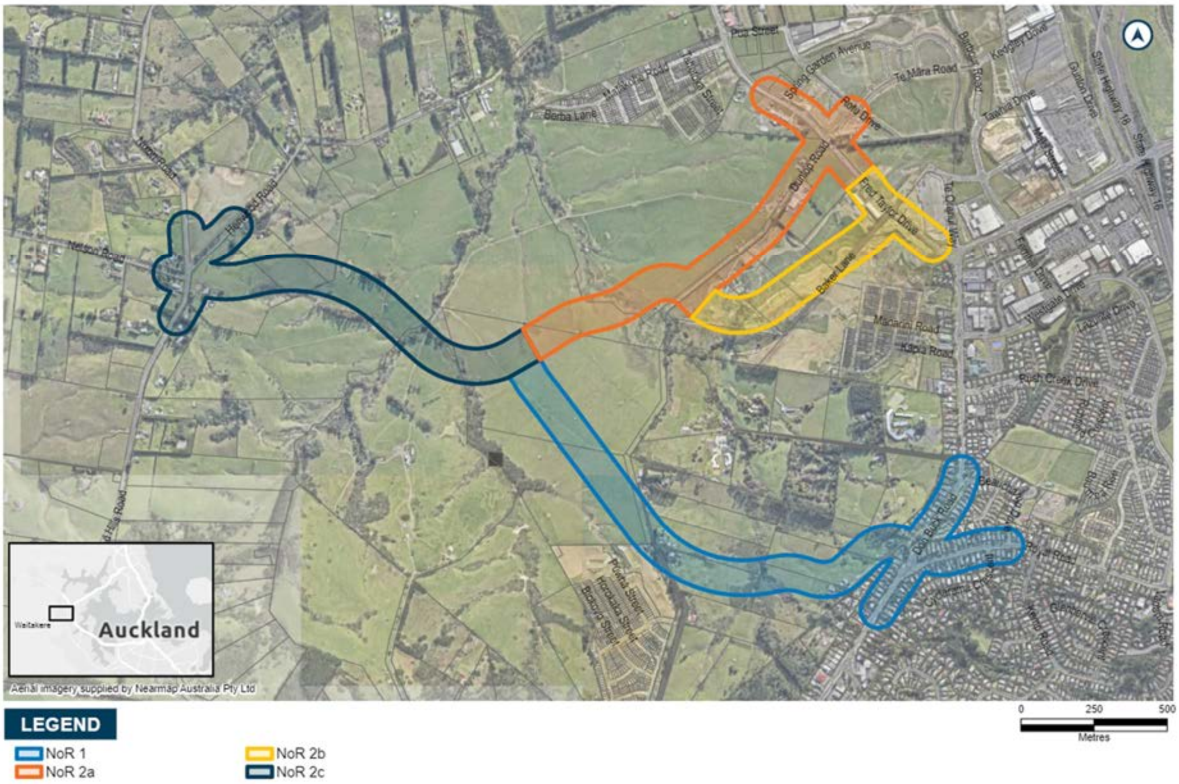

Figure 2-1: Redhills Arterial Transport Network

A brief summary of the Redhills Arterial Transport Network project corridors and corresponding NoRs is provided in Table 2-1 below.

Table 2-1: Redhills Arterial Transport Network Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Redhills North-South Arterial Corridor	**NoR1**	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.	Auckland Transport
Redhills East-West Arterial Corridor – Dunlop Road	**NoR2a**	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR2c) at the intersection with the Redhills North-South arterial corridor.	Auckland Transport

Corridor	NOR	Description	Requiring Authority
Redhills East-West Arterial Corridor – Baker Lane	**NoR2b**	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR2a).	Auckland Transport
Redhills East-West Arterial Corridor – Nixon Road connection	**NoR2c**	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road / Nelson Road / Nixon Road intersection, and the existing Nixon Road / Henwood Road intersection.	Auckland Transport

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

2.1 Purpose and Scope of this Report

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Redhills Arterial Transport Network on the existing and likely future environment as it relates to flooding / stormwater effects and recommends measures that may be implemented to minimise, remedy and / or mitigate these effects.

The key matters addressed in this report are as follows:

- Identify and describe the actual and potential flooding effects of each Project corridor within the RATN
- Recommend measures as appropriate to minimise, remedy or mitigate actual and potential flooding effects (including any conditions / management plan required) for each Project corridor within the RATN
- Present an overall conclusion of the level of actual and potential flooding effects for each Project corridor within the RATN 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:

- Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines
- Description of the Redhills Arterial Transport Network corridor and project features as it relates to stormwater
- Identification and description of the existing and likely future flooding environment
- Description of the actual and potential adverse flooding effects of construction and operation
- Recommended measures to minimise, remedy or mitigate potential adverse flooding effects
- Overall conclusion of the level of potential adverse flooding effects after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the RATN. The AEE also contains a detailed description of works to be authorised, likely staging and the typical construction methodologies that will be used to implement this work.

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 base case model was used to assess the flood water levels and extents of the existing (pre-development) terrain based on the Auckland Council 2016 LiDAR.

3 Assessment Methodology

3.1 Assessment of flooding effects

The assessment of flooding effects has involved the following steps using the Auckland Council and SGA GIS.

- Desktop assessment to identify potential flooding locations, namely:
  - Existing buildings appear to be near / within the existing flood plains
  - Where works are near stream crossings and major overland flow paths
- Flood modelling of the pre-development (without SGA) case, including:
  - Flood modelling of the proposed future land use case using imperviousness based on AUP: OP land zoning with the 100yr ARI plus two climate change rainfall scenarios, being 2.1 and 3.8° temperature increases
  - Identifying potential changes in the predicted flood water levels for the two climate change scenarios to understand the risk of future increased climate change impacts
- Inspection of the flood maps to identify flooding effects, including:
  - At key cross drainage locations such as culverts and bridges to understand predicted water levels for the two climate change scenarios
  - Existing buildings showing potential for flooding by comparing flood extents with the existing building footprints.

3.2 Outcomes based approach

The stormwater and flooding considerations are based on an indicative design designation boundary which incorporate flexibility for design changes to respond to the future environment. The effects assessment is based on being able to meet the requirements of the proposed designation flooding condition and provide any required mitigation within the designation boundary.

The proposed designation flood condition requires the design 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).

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 100yr ARI flood levels (with allowances for full development according to the AUP:OP zonings with associated imperviousness 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:

- Auckland Unitary Plan Operative in Part
- Auckland Council GIS resources (Auckland GeoMaps)
- Concept Design Drawings
- Flood maps created by the SGA modelling team
- NZTA Stormwater Specification P46
- New Zealand Bridge Manual (SP/M/022) for freeboard allowance.

A full list of references is provided in Section 13.

3.4 Flood Modelling

3.4.1 Stormwater Catchment Overview

The Redhills catchment is approximately 1,366 ha in total area and drains via the Waiteputa and Ngongetepara Streams to the upper reaches of the Waitematā Harbour.

The Redhills Arterial Transport Network area is situated within the Redhills stormwater catchment as shown in Figure 3-1.

The AUP:OP allows for the area between Fred Taylor Drive and Redhills / Nixon Roads to be fully developed in future.

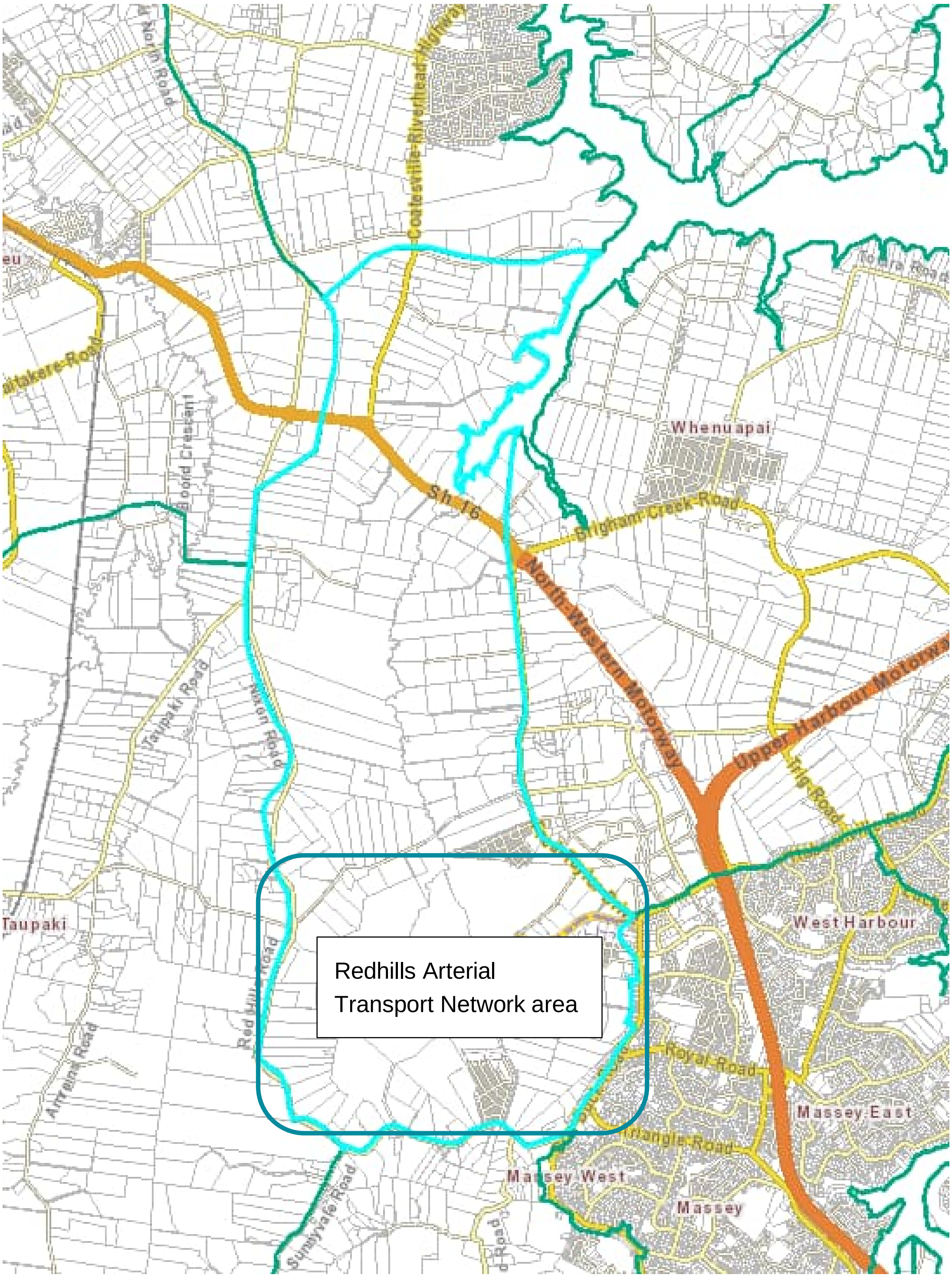

Figure 3-1: Redhills catchment area with Redhills Arterial Transport Network area shown

The assessment in this report is limited to the routes shown in Figure 3-2 below being:

- Nixon Road intersection
- East-West and North-South Arterials
- Dunlop Road
- Baker Lane
- Fred Taylor Drive intersections
- Don Buck Road intersection.

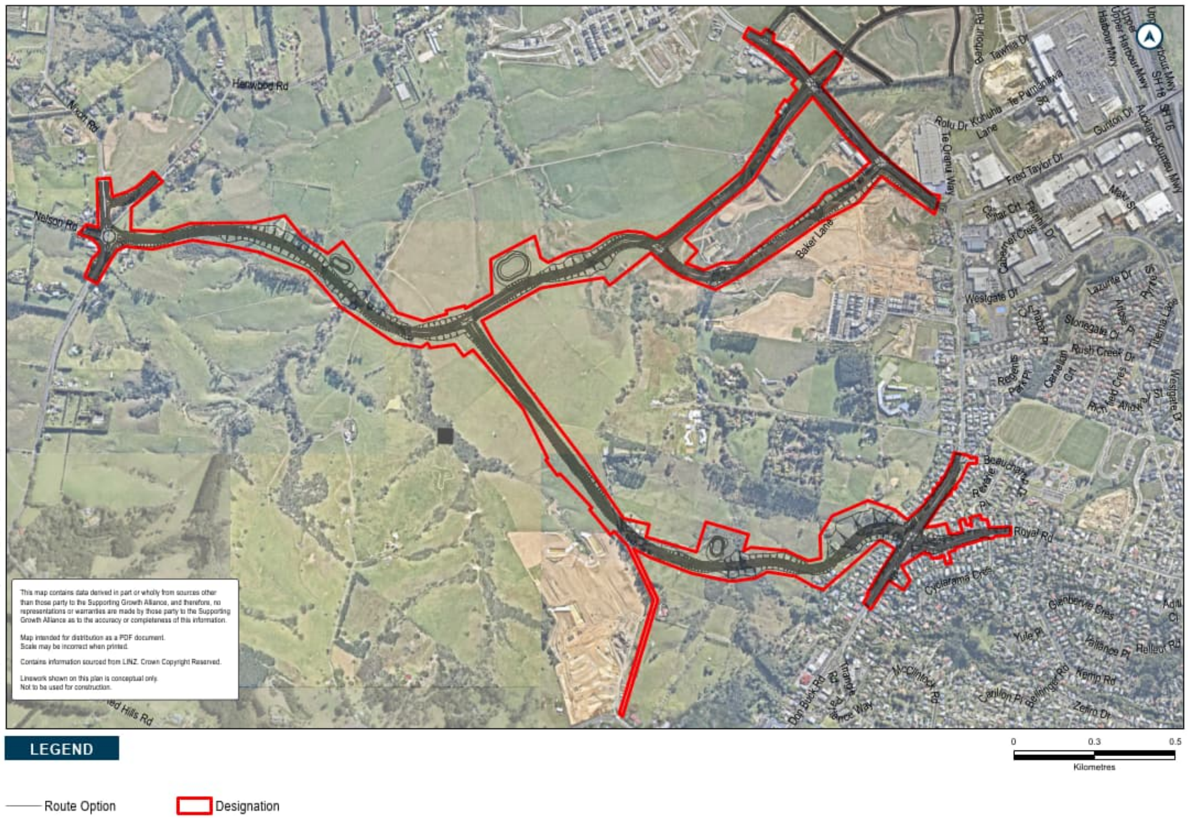

Figure 3-2: Proposed Redhills Arterial Transport Network alignments

3.4.2 Modelling Approach

SGA produced the Redhills catchment model based on the Auckland Council Rapid Flood Hazard Assessment (**RFHA**) approach with any existing road culverts 675mm and greater included in the model which is a higher standard than the AC approach which only includes bridges and culverts with sizes 1200mm and greater. The reason for selecting 675mm is that the risk of blockage and not operating is much greater for pipes 600mm and smaller.

Previous modelling results for the area shown on Auckland Council GeoMaps indicates those results to be based on 2009 RFHA using the existing land cover and no climate change effects.

The SGA modelling allows for the area to be developed to the future allowable impervious coverage as per the AUP:OP zoning and the Auckland Council Healthy Waters Impervious coverage memo (refer section 3.4.6 below) along with climate change rainfall.

The two climate change rainfall scenarios modelled for the assessment of effects were based on the Auckland Council TP108 rainfall for the area and were:

- Scenario 1: Without SGA: Future 100year ARI rainfall event with 2.1°C of warming and future land-use
- Scenario 2: Without SGA: Future 100yr ARI rainfall event with 3.8°C of warming and future land-use.

The modelling used the existing terrain (AC 2016 LiDAR). The type and size of cross drainage structures are not fixed and will be assessed further for subsequent regional consenting and design phases. Changes to these structures may alter the future model outputs and upsizing the crossings may be required to reduce upstream and downstream flood risk.

More details of the Redhills model build approach can be found in SGA North West Local – Redhills Base Case Stormwater Model Build report December 2020 version 0.2.

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 climate change of warming to 3.8°C – which is an extreme climate change scenario increase (RCP 8.5).

3.4.4 Site Geology

Soil description obtained from the New Zealand Geology Maps indicated three main soil groups in the proposed location of the identified roads. The three main soil groups are as follows (GNS Science, 2018):

- East Cost Bays Formation of Warkworth Subgroup (Waitematā Group)
  - This group have alternating sandstone and mudstone with variable volcanic content and interbedded volcanistic grits. The rock group include alternating sandstone / siltstone
- Late Pilocene to Middle Pleistocene pumiceous river deposits
  - Pumiceous mud, sand and gravel with muddy peat and lignite: rhyolite pumice, including non-welded ignimbrite, tephra and alluvia. The main rock group is sandstone
- Holocene River Deposits
  - Sand, silt mud and clay with local gravels and peat beds

3.4.5 Modelling Outputs

The 100 year future climate change rainfall with 2.1° temperature increase model run predicted the flood extent results to 50mm deep are shown in Figure 3-3 and Figure 3-4 below. This is for the upper catchment area where the RATN is proposed.

Note some of this flood extent may create flows that are less than $2m^3/s$ therefore they could be classified as overland flow paths and not flood plains although the effects still need to be considered.

The modelling outputs were used to identify the predicted flooding extents and flow rates for the proposed alignment.

For those areas identified as having potential flood effects mitigation measures have been proposed which can be addressed at detailed design stage (e.g. formation levels and widths, bridge size, pond location and culverts).

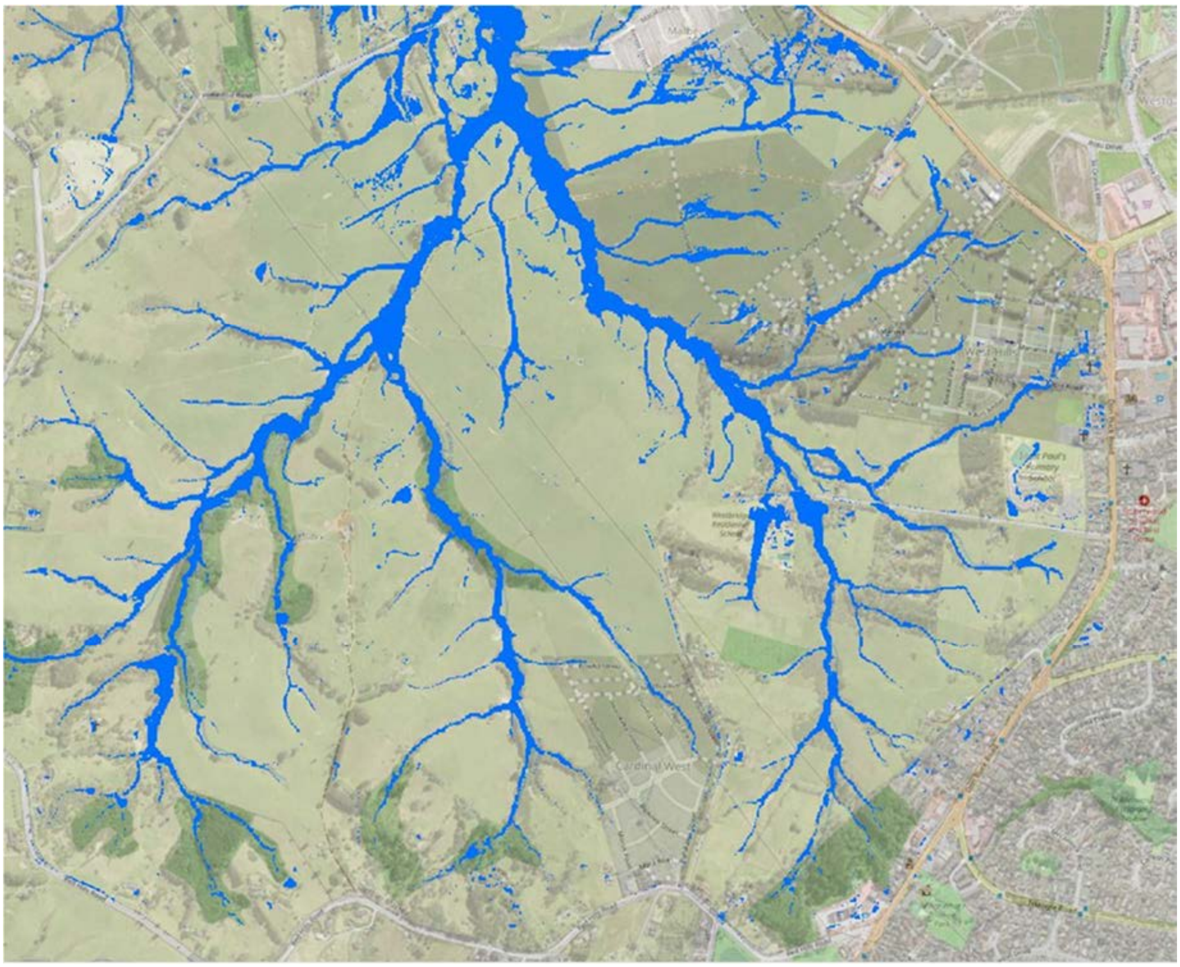

Figure 3-3: Predicted future 100yr ARI with climate change flood extent for the upper reaches of the Redhills catchment (SGA modelling)

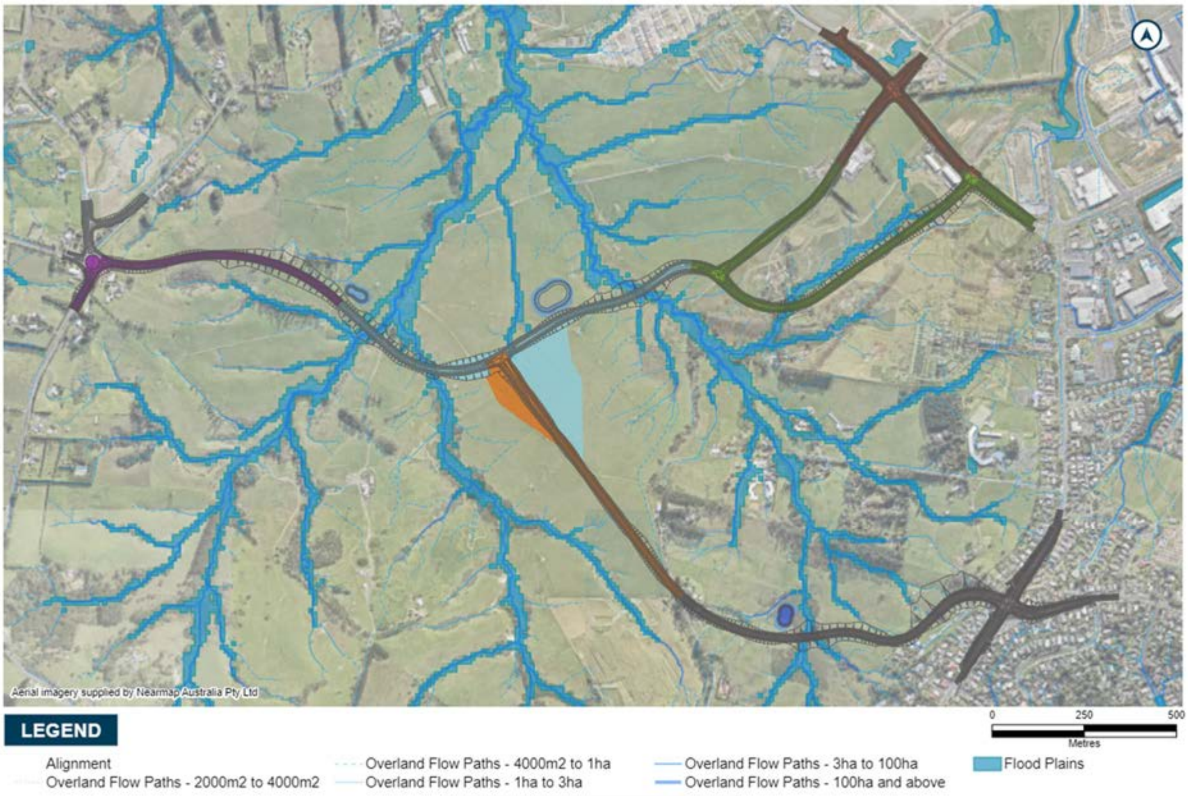

Figure 3-4: Predicted 100yr ARI flood extent with the RATN overlaid

The required freeboard for bridges and culverts that could be used to assess the suitability of the detailed design is set out in Table 3-1.

Table 3-1: Freeboard allowance for the level of serviceability to traffic (NZ Bridge Manual)

Waterway Structure	Situation	Freeboard	
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

3.4.6 Future Development

Development within the Redhills Arterial Transport Network (RATN) area will change catchment hydrology, the terrain, building and property types that are potentially exposed to flooding. The assessment has therefore generally considered effects on potential future development areas. It is anticipated that future developments will take account of flood risk and manage that risk within their development. Figure 3-5 below shows the Auckland Unity Plan: Operative in Part zones for the Redhills Arterial Transport Network area.

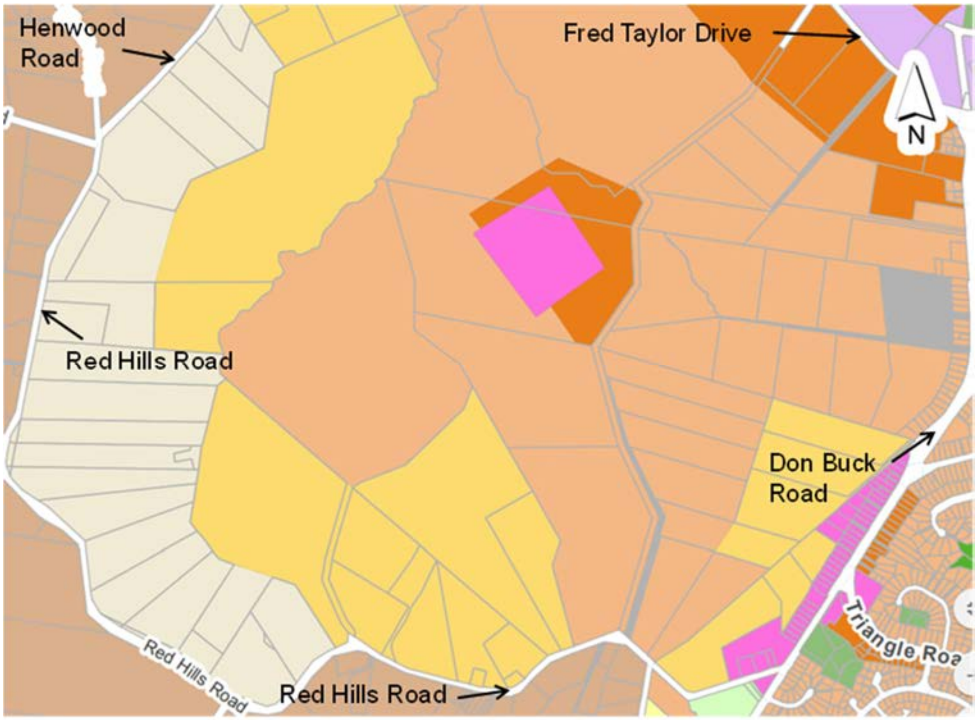

Figure 3-5: Auckland Unitary Plan Zones

According to the AUP:OP the RATN site is located within the following development zones.

- Business – Business Local Centre zone
- Residential – Terrace Housing and Apartment Buildings Zone
- Residential – Mixed Housing Urban Zone
- Residential – Mixed Housing Suburban Zone
- Residential – Single House Zone.

Auckland Council Healthy Waters has provided guidance on the maximum impervious area on the site through their "Land Use Zone Imperviousness for Hydraulic Modelling based on the Auckland Unitary Plan Operative in Part" memo dated 4 Sept 2019 which has been used in the SGA modelling.

Table 3-2 sets out the basis for consideration of the maximum impervious area for future developments within the site.

Table 3-2: AC Healthy Waters recommended maximum impervious coverage based on AUP:OP zonings

Development	Maximum Impervious Area (% of the site area)
Business: Business Local Centre zone	100
Residential: Terrace housing and apartment buildings zone	70
Residential: Mixed housing urban zone	60
Residential: Mixed housing suburban zone	60
Residential: Single house zone	60

3.4.7 Model Limitations

The modelled scenarios use imperviousness assumptions associated with the future land use(s) shown in the Auckland Plan. However, it is possible that significant change in the catchments may take place before or shortly after the corridor is constructed. Therefore, it is anticipated that further modelling will be required during the corridor detailed design phase to take account of catchment characteristics at that time.

Rapid Flood Hazard Assessment models have a relatively coarse terrain grid and do not include stormwater drainage pipes smaller than 600mm diameter. 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.

Generally Redhills Arterial Transport Network is located on elevated terrain (near ridgelines) and it is unlikely that upgrades to existing culverts will be required. However, any new or upgraded culverts will be confirmed at the detailed design stage and will take into account matters such as consent requirements, asset owner requirements, level of service, stream simulation design, fish passage and possible blockage.

Normal modelling limitation set out in the SGA North West Local – Redhills Base Case Stormwater Model Build report December 2020 version 0.2 also apply to this assessment

3.4.8 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.

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 on 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 risk have been identified. Further mitigation at these locations has been included where necessary to encourage flood resilience.

In the future it is possible there may be different requirements for climate change, however, at this time a pragmatic approach has been taken and the sensitivity analysis has been prepared to better understand the risk of climate change and enable decision makers to respond to this.

3.5 Stormwater infrastructure

3.5.1 Stormwater devices

While stormwater effects apart from flooding were not fully assessed, provision was made for the future management of potential stormwater effects (stormwater quantity and stormwater quality) by

[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.

identifying the space required for stormwater management devices (i.e. attenuation ponds 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. Potential sites are shown as Wetlands 1 to 3 in Figure 3-6 below.

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.

The flood model does not account for the flood water storage capacity provided by the proposed wetlands even though they are designed with attenuation capacity for the additional runoff generated by the increased impervious area from the new road infrastructure.

The possible wetland locations are shown in Figure 3-6 below with catchments shown in Figure 3-7.

The road catchments contributing to each wetland are:

- Wetland 1: Road catchment 1
- Wetland 2: Road catchments 2 to 5
- Wetland 3: Road catchment 6.

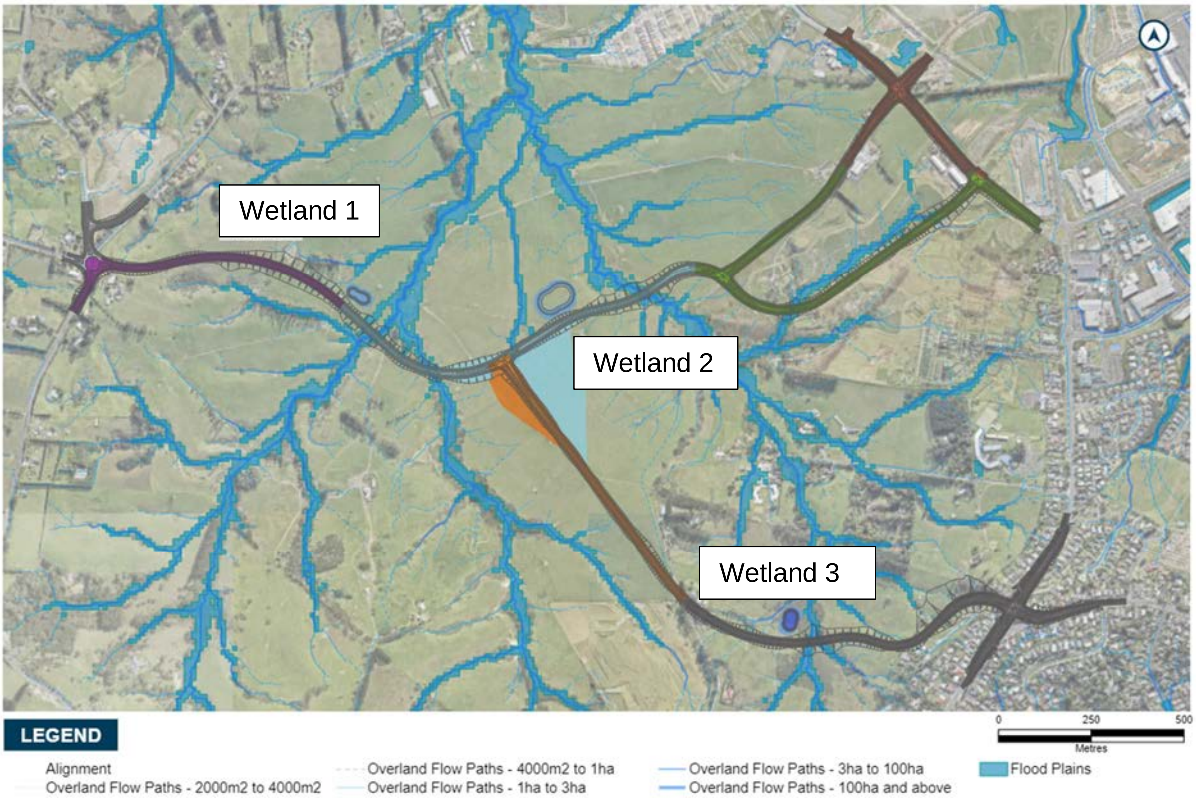

Figure 3-6: Possible wetland locations

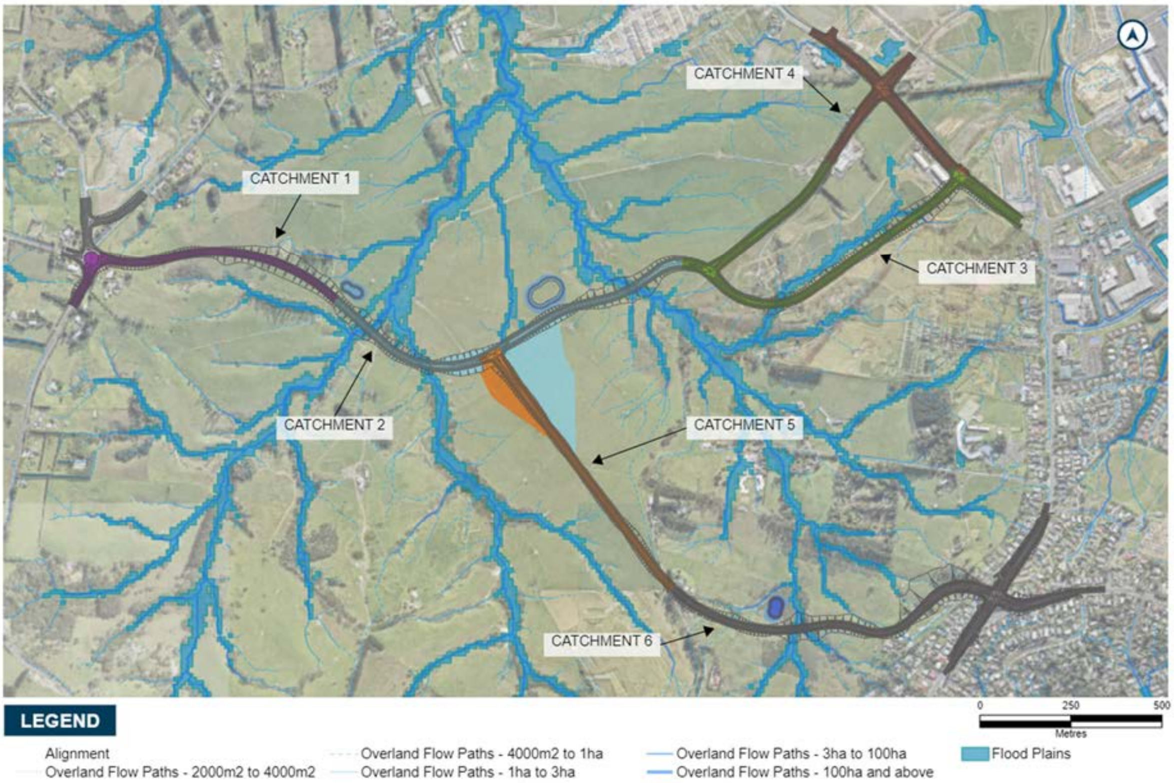

Figure 3-7: Wetland catchments

3.5.2 Stormwater bridges and culverts

Stormwater bridges and culverts have been assessed on the alignment of the main streams and overland flow paths as shown in Figure 3-3 and Figure 3-4 above.

Figure 3-8 below indicates potential bridge and culvert locations based on predicted overland flow paths from modelling.

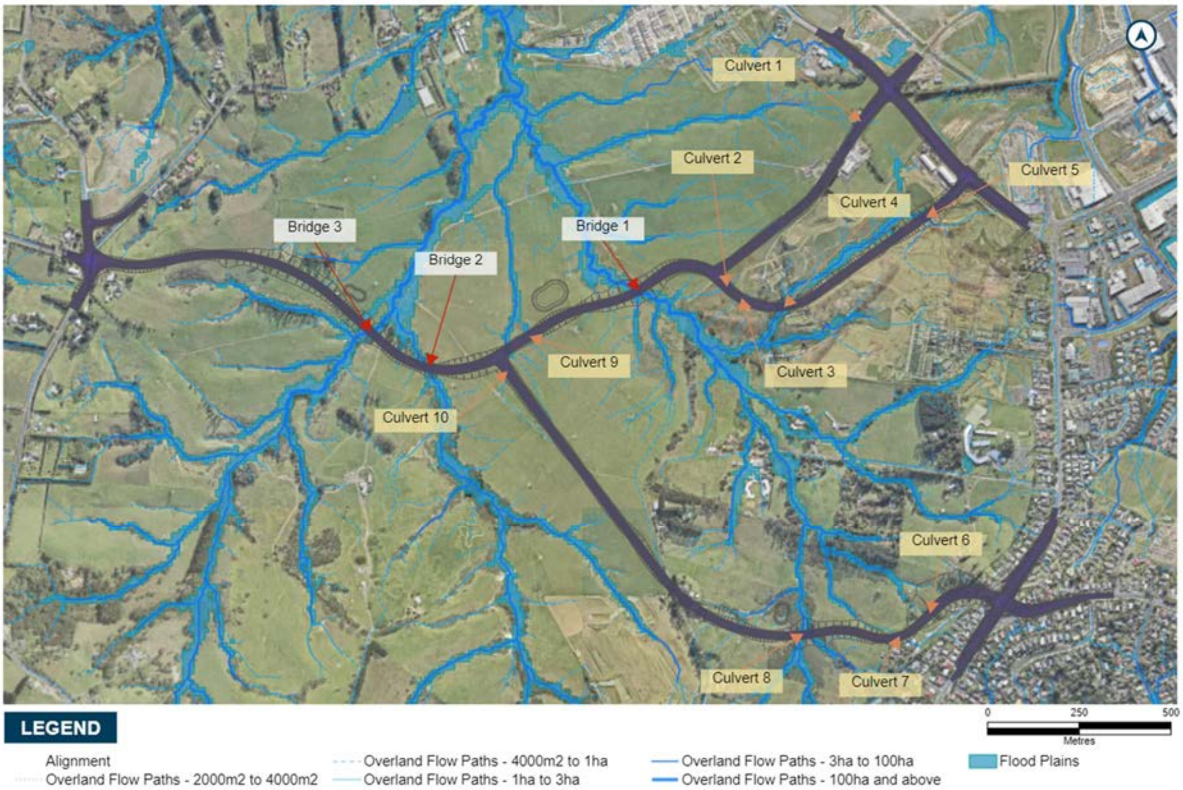

Figure 3-8: Potential bridge and culvert locations

The flows and water levels at the potential bridge and culvert sites shown in Figure 3-8: Potential bridge and culvert locations above have been assessed for the two climate change scenarios; 100yr future climate change rainfall with 2.1°C of temperature increase, and 100yr future climate change rainfall with 3.8° temperature increase. The results are shown in Table 3-3 below.

These results can then be used in the detailed design phase to assess road level based on freeboards above predicted flood levels and bridge / culvert openings can be sized to achieve flood neutrality upstream and downstream of the bridge or culvert.

Table 3-3 shows that although the predicted flow rates increase from the 2.1 to 3.8° temperature increase scenario the predicted water levels do not change dramatically.

Table 3-3: Bridge and culvert information

	100yr future flow (m3/s)		100yr future water level (m)	
Structure	2.1° temperature increase	3.8° temperature increase	2.1° temperature increase	3.8° temperature increase
Culvert 1	0.21	0.41	53.98	53.99
Culvert 2	0.37	0.51	36.51	36.53
Culvert 3	0.19	0.25	36.82	36.83
Culvert 4	5.95	8.29	33.28	33.37
Culvert 5	1.40	1.96	47.04	47.07
Culvert 6	0.59	0.75	57.21	57.24
Culvert 7	0.16	0.29	51.56	51.59
Culvert 8	11.32	15.48	41.80	41.94
Culvert 9	0.63	0.87	32.79	32.80
Culvert 10	1.78	2.37	32.18	32.21
Bridge 1	47.13	64.40	26.03	26.35
Bridge 2	27.79	37.03	29.59	29.84
Bridge 3	44.46	58.34	27.72	28.06

4 Summary of Modelling Results

A summary of the operational effects for each of the corridors is set out in Table 4-1 below and discussed in more detail in Section 7. The Redhills Arterial Transport Network will result in negligible to minor flooding effects as the detailed design phase can resolve all issues from a flood neutrality (quantity) and water quality perspective, achieving the outcomes set out in Section 3.2.

Indicative mitigation measures have been provided in Section 7 which will minimise flooding effects and help enable the outcomes.

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 4-1: Summary of flood modelling results

Corridor name	Location	Potential effect without mitigation	Potential effect with implementation of the recommended flooding outcomes
Redhills North-South Arterial Corridor	There are no existing buildings predicted to be affected by flooding that could be further affected by the proposed infrastructure works. Increased runoff and water quality due to impervious road area can be accommodated within proposed wetland sites.	Increased runoff and greater potential environmental pollution effects.	Improvement due to attenuation of road surface runoff and treatment.
Redhills East-West Arterial Corridor – Dunlop Road			
Redhills East-West Arterial Corridor – Baker Lane			
Redhills East-West Arterial Corridor – Nixon Road connection	Houses affected by construction will be removed and are near the top of the catchment therefore no flooding effects.		

5 Positive Effects

The main positive effects that could be designed for are:

- proposed roadways to be above the flood plains
- ability to convey flows without worsening flooding impacts upstream or downstream of the works
- added water quality treatment and attenuation of the total roadway impervious area of Dunlop Road (an existing road that is proposed to be widened) as opposed to just the additional roadway area.

6 Construction Effects

Construction effects apply to the entire project, however are more likely at locations within or adjacent to overland flows or flood prone areas. The proposed construction works which could result in flooding effects include:

- Construction of new culvert crossings or upgrading of existing culvert crossings
- Installation of diversion drains / realignment of existing overland flow paths
- Construction of new attenuation ponds or upgrading of existing attenuation ponds
- Temporary use of lay down areas.

The potential effects of these are:

- Bulk earthworks to complete the contouring for new landscape features e.g. attenuation ponds and new or upgraded culverts require a dry works area and can alter overland flow paths or generate erosion and sediment effects

- The siting of attenuation ponds within an existing overland flow path can obstruct runoff and result in flows being diverted towards existing properties due to the need for embankments.

Section 6.1 below describes methods for minimising / mitigating these potential effects.

6.1 Recommended Measures to Minimise, Remedy or Mitigate Construction Effects

The management and mitigation measures for construction effects are outlined below:

General

- Carrying out earthworks during the summer / dry months to reduce the risk of flooding
- Locating lay down areas outside of predicted overland flow paths and flood plains, where possible
- Managing the overland flow paths to make sure flows are not diverted toward existing buildings or properties
- Construction Environmental Management Plans (CEMP) be developed prior to construction in conjunction with an experienced Stormwater Engineer and shall consider the effects of temporary works, earthworks, storage of materials, temporary diversion and drainage on flow paths, flow levels and velocities. Including (but not limited to):
  - Siting construction yards and stockpiles outside the predicted flood plains
  - 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 extreme flood events
  - Actions to take in response to heavy rain warnings which may include reducing the conveyance of materials and plant that are considered necessary to be stored or sited within the predicted flood plain or significant overland flow path.

Construction of new and existing culvert crossings and stormwater wetlands and ponds:

- 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 to allow flows to be maintained while new culverts and ponds 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 (> 600mm in size) a working clearance of ±20m from the upstream extent and ±15m from the downstream extents should be provided.

7 Operational Effects

There are a range of operational effects particularly from proposed crossings. Future detailed design will be subject to a separate flooding assessment at the resource consent stage. For the project the assessment of operational flooding effects considered:

- New culvert crossings (≥ 600 mm diameter)

- Areas where the new road embankment encroaches onto predicted flood plain and flood prone land
- The potential 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 on a different alignment
- 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 mitigation measures set out in Section 7.1 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.

7.1 Recommended Measures to Minimise, 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. This is where existing predicted overland flow paths run parallel to the proposed roads and do not cross under the road
- 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 development or 0.05m for existing floors at risk of flooding (none identified at this stage)
- 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.

8 NoR1: Redhills North-South Arterial Corridor

8.1 Catchment Characteristics

The corridor is located near the top of the catchment and as such on the Waiteputa Stream. The flood modelling predicts there will be minor flooding as it is near the top of the catchment. Auckland Council GeoMaps does not show greater flood extent than identified in the modelling.

8.2 Existing and Likely Future Environment

8.2.1 Planning Context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the North-South Arterial Corridor within the RATN.

Table 8-1: North-South Arterial Corridor Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[4]	Likely Future Environment[5]
Rural	Residential – Mixed Housing Suburban	High	Urban
	Residential – Mixed Housing Urban		
	Residential – Terrace Housing and Apartment Building Zone		
	Business – Local Centre Zone		
Residential	Business – Local Centre Zone	Moderate	Urban
	Residential – Mixed Housing Urban	Low	
	Residential – Terrace Housing and Apartment Building Zone		
Business	Business – Local Centre Zone	Low	Urban

[4] Based on AUP:OP zoning/policy direction
[5] Based on AUP:OP zoning/policy direction

Land use today	Zoning	Likelihood of Change for the environment[4]	Likely Future Environment[5]
Special Purpose	Special Purpose – School Zone	Low	Special Purpose

Please refer to the AEE for further information on the planning context.

8.3 Proposed works

Two road stormwater catchments (Catchment 1 & 2 shown on Figure 3-7) is created along the transport corridor and runoff from the catchment flows into two proposed stormwater wetland (Wetland 1 & 2 shown on Figure 3-6) for treatment and attenuation.

8.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

8.4.1 Positive Effects

The corridor crosses an existing flood prone areas although no increased flooding risks are anticipated. The proposed road is above the existing alignment and predicted flood plain, therefore improving freeboard and reducing any potential flood risk.

8.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 6 above.

The proposed upgraded Stormwater Wetlands 1 and 2 are located outside of the predicted flood plain and overland flow paths.

8.4.3 Recommended Measures to Minimise, 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 considered by, and 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 in Section 6.1 apply.

8.4.4 Assessment of Operational Effects

The flood modelling results are shown in Table 3-3 which show little difference between 100 year future climate change 2.1 and 3.8° temperature increase predictions for water levels and flow rates .

8.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

Wetland 1 will provide treatment and attenuation along with appropriately sized bridge and culverts openings to reduce flood neutrality issues.

Further assessment at the detailed design stage can be used to confirm the preferred mitigation.

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.

8.5 Conclusions

The corridor is near the top of catchments and there is little difference between the 100 year future with climate change events for the 2.1 and 3.8° temperature rise.

No potential flooding risks during operations are anticipated.

9 NoR R2a: Redhills East-West Arterial Corridor – Dunlop Road

9.1 Catchment Characteristics

The corridor is located near the top of the catchment on the Ngongetepara Stream. The flood modelling predicts there will be minor flooding as it is near the top of the catchment. Auckland Council GeoMaps does not show greater flood extent than identified in the modelling.

9.2 Existing and Likely Future Environment

9.2.1 Planning Context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 9-1 below provides a summary of the existing and likely future environment as it relates to the Dunlop Road Corridor within the RATN.

Table 9-1: Dunlop Road Corridor Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[6]	Likely Future Environment[7]
Rural	Residential – Mixed Housing Urban	High	Urban
	Residential – Terraced Housing and Apartment Zone		
	Business – Local Centre		
Business	Business – Mixed Use Zone	Low	Urban
	Business – Light Industry		
Residential	Residential – Mixed Housing Urban	Low	Urban
	Residential – Terraced Housing and Apartment Zone		

Please refer to the AEE for further information on the planning context.

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

9.3 Proposed works

Two road stormwater catchments (Catchment part 2 & 4 shown on Figure 3-7) is created along the transport corridor and runoff from the catchment flows into one proposed stormwater wetland (Wetland 2 shown on Figure 3-6) for treatment and attenuation.

9.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

9.4.1 Positive Effects

The corridor crosses an existing flood prone areas although no increased flooding risks are anticipated. The proposed road is above the existing alignment and predicted flood plain, therefore improving freeboard and reducing any potential flood risk.

9.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 6 above.

The proposed upgraded Stormwater Wetland 2 is located outside of the predicted flood plain and overland flow paths.

9.4.3 Recommended Measures to Minimise, 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 considered by, and 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 in Section 6.1 apply.

9.4.4 Assessment of Operational Effects

The flood modelling results are shown in Table 3-3 which show little difference between 100 year future climate change 2.1 and 3.8° temperature increase predictions for water levels and flow rates.

9.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

Wetland 1 will provide treatment and attenuation along with appropriately sized bridge and culverts openings to reduce flood issues.

Further assessment at the detailed design stage can be used to confirm the preferred mitigation.

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

The corridor is near the top of catchments and there is little difference between the 100yr future with climate change events for the 2.1 and 3.8° temperature rise.

No potential flooding risks during operations are anticipated.

10 NoR R2b: Redhills East-West Arterial Corridor – Baker Lane

10.1 Catchment Characteristics

The corridor is located near the top of the catchment and as such on the Ngongetepara Stream. The flood modelling predicts there will be minor flooding as it is near the top of the catchment. Auckland Council GeoMaps does not show greater flood extent than identified in the modelling.

10.2 Existing and Likely Future Environment

10.2.1 Planning Context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

Table 10-1 below provides a summary of the existing and likely future environment as it relates to the Baker Lane Corridor within the RATN.

Table 10-1: Baker Lane Corridor Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[8]	Likely Future Environment[9]
Rural	Residential – Mixed Housing Urban	High	Urban
	Residential – Terraced Housing and Apartment Zone		
Business	Business – Mixed Use Zone	Low	Urban
	Business – Light Industry		
Residential	Residential – Mixed Housing Urban	Low	Urban
	Residential – Terraced Housing and Apartment Zone		
Special Purpose	Special Purpose – School Zone	Low	Special Purpose

Please refer to the AEE for further information on the planning context.

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

10.3 Proposed works

One road stormwater catchment (Catchment 3 shown on Figure 3-7) is created along the transport corridor and runoff from the catchment flows into one proposed stormwater wetland (Wetland 2 shown on Figure 3-6) for treatment and attenuation.

10.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

10.4.1 Positive Effects

The corridor crosses an existing flood prone areas although no increased flooding risks are anticipated. The proposed road is above the existing alignment and predicted flood plain, therefore improving freeboard and reducing any potential flood risk.

10.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 6 above.

The proposed upgraded Stormwater Wetland 2 is located outside of the predicted flood plain and overland flow paths.

10.4.3 Recommended Measures to Minimise, 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 considered by, and 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 in Section 6.1 apply.

10.4.4 Assessment of Operational Effects

The flood modelling results are shown in Table 3-3 which show little difference between 100yr future climate change 2.1 and 3.8° temperature increase predictions for water levels and flow rates.

10.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

Wetland 1 will provide treatment and attenuation along with appropriately sized bridge and culverts openings to reduce flood neutrality issues.

Further assessment at the detailed design stage can be used to confirm the preferred mitigation.

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.

10.5 Conclusions

The corridor is near the top of catchments and there is little difference between the 100yr future with climate change events for the 2.1 and 3.8° temperature rise.

No potential flooding risks during operations are anticipated.

11 NoR R2c: Redhills East-West Arterial Corridor – Nixon Road connection

11.1 Catchment Characteristics

The corridor is located near the top of the catchment and as such on the Ngongetepara Stream. The flood modelling predicts there will be minor flooding as it is near the top of the catchment. Auckland Council GeoMaps does not show greater flood extent than identified in the modelling.

11.2 Existing and Likely Future Environment

11.2.1 Planning Context

Within the Project area there are a range of zones under the AUP:OIP which influence the existing and likely future land use patterns for assessment purposes.

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

Table 11-1: Nixon Road Connection Existing and Likely Future Environment

Land use today	Zoning	Likelihood of Change for the environment[10]	Likely Future Environment[11]
Rural	Residential – Single House	High	Urban
	Residential – Mixed Housing Suburban		
	Residential – Mixed Housing Urban		
	Residential – Terraced Housing and Apartment Zone		

Please refer to the AEE for further information on the planning context.

11.3 Proposed works

Two road stormwater catchment (Catchments 5 and 6 shown on Figure 3-7) are created along the transport corridor and runoff from the catchment flows into one proposed stormwater wetland (Wetland 1 and 2 shown on Figure 3-6) for treatment and attenuation.

[10] Based on AUP:OP zoning/policy direction
[11] Based on AUP:OP zoning/policy direction

11.4 Assessment of Flooding Effects and Measures to Minimise, Remedy or Mitigate Actual or Potential Adverse Effects

11.4.1 Positive Effects

The corridor crosses an existing flood prone areas although no increased flooding risks are anticipated. The proposed road is above the existing alignment and predicted flood plain, therefore improving freeboard and reducing any potential flood risk.

11.4.2 Assessment of Construction Effects

Potential construction effects have been described in Section 6 above.

The proposed upgraded Stormwater Wetlands 2 and 3 are located outside of the predicted flood plain and overland flow paths.

11.4.3 Recommended Measures to Minimise, 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 considered by, and 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 in Section 6.1 apply.

11.4.4 Assessment of Operational Effects

The flood modelling results are shown in Table 3-3 which show little difference between 100yr future climate change 2.1 and 3.8° temperature increase predictions for water levels and flow rates.

11.4.5 Recommended Measures to Minimise, Remedy or Mitigate Operational Effects

Wetland 1 will provide treatment and attenuation along with appropriately sized bridge and culverts openings to reduce flood neutrality issues.

Further assessment at the detailed design stage can be used to confirm the preferred mitigation.

Compliance with the recommended flooding outcomes set out in Section 3.2, to be included in the designation conditions, will mean that potential flooding effects will be negligible up to minor and appropriately managed.

11.5 Conclusions

The corridor is near the top of catchments and there is little difference between the 100yr future with climate change events for the 2.1 and 3.8° temperature rise. No potential flooding risks during operations are anticipated.

12 Conclusion

The assessment reviewed the flood risk for:

- NoR 1 Redhills North-South Arterial Corridor
- NoR 2a Redhills East-West Arterial Corridor – Dunlop Road
- NoR 2b Redhills East-West Arterial Corridor – Baker Lane
- NoR 2c Redhills East-West Arterial Corridor – Nixon Road connection.

The assessment found that there was unlikely to be an increased risk from flood effects during construction and flood effects will be managed as set out in Section 6.1.

The assessment identified during operations likely positive effects based on the vertical elevation of the future 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. Additional modelling of the final design at a detailed design stage will be used to confirm that flood effects are minimised, remedied or mitigated as appropriate.

The sensitivity analysis for the potential increased rainfall due to climate change found there was no change to the identified flood risk at key locations under a more severe climate change scenario (3.8 degree temperature change).

13 References

Auckland Council (Nov 2011) Auckland Council Stormwater Modelling Specification

Auckland Council GeoMaps (accessed 2021)

Te Tupu Ngātahi flood model: SGA North West Local – Redhills Base Case Stormwater Model December 2020 version 0.2

New Zealand Transport Agency (April 2016) NZTA P46 Stormwater Specification

New Zealand Transport Agency (2013) Bridge Manual SP/M/022 third edition

ATTACHMENT 28

REDHILLS ARTERIAL TRANSPORT NETWORK URBAN DESIGN EVALUATION

Supporting Growth

Redhills Arterial Transport Network

Urban Design Evaluation

December 2022

Version 1.0

TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Document Status

Version	Responsibility	Name
2020 Draft	Author	S Bowden E Chen
	Reviewer	Matthew Kerr-Ridge
1.0	Author	Stuart Bowden
	Approver	Bridget O'Leary

Revision Status

Version	Date	Reason for Issue
1.0	December 2022	Final for lodgement

Table of Contents

Tables

Figures

Acronyms

Acronym/Term	Description
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part 2016
E-W Project	East-West Arterial Transport Corridor
N-S Project	North-South Arterial Transport Corridor
RATN	Redhills Arterial Transport Network
SH16	State Highway 16
SH18	State Highway 18
THAB	Terrace Housing and Apartment Buildings Zone
The Design Framework	Te Tupu Ngātahi Design Framework
Waka Kotahi	Waka Kotahi NZ Transport Agency

1 Introduction

The Supporting Growth Programme was established to investigate, plan and protect the transport corridors needed to support Auckland's future urban growth areas over the next 30 years.

In collaboration with key programme partners Auckland Transport (**AT**), Waka Kotahi NZ Transport Agency (**Waka Kotahi**), Manawhenua, Auckland Council and KiwiRail, the Supporting Growth project teams will be informing and guiding the transport investment, business case and route protection processes for each of the Supporting Growth Programme corridors over the next five years.

This urban design framework and evaluation provides an overview of the urban design considerations and inputs that applied during option development and refinement and the identification of future transport and land use integration opportunities for the Redhills Arterial Transport Network (**RATN**).

The projects in the RATN are listed in Table 1, with an illustration of the RATN context and extent shown in **Error! Reference source not found.**.

Table 1: Redhills Arterial Transport Network – Projects and Notice Reference

Notice	Project	Description	Requiring Authority
NoR1	Redhills North-South Arterial Transport Corridor	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.	AT
NoR2a	Redhills East-West Arterial Transport Corridor – Dunlop Road	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West connection (NoR2c) at the intersection with the Redhills North-South arterial corridor.	AT
NoR2b	Redhills East-West Arterial Transport Corridor – Baker Lane	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR2a).	AT
NoR2c	Redhills East-West Arterial Transport Corridor – Nixon Road Connection	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road / Nelson Road / Nixon Road intersection, and the existing Nixon Road / Henwood Road intersection.	AT

1.1 Purpose and scope of this evaluation

This urban design evaluation (UDE) provides an overview of the urban design considerations and inputs as well as an evaluation and identification of future transport and land use integration opportunities for the RATN.

This UDE has been prepared to inform the Assessment of Effects on the Environment (AEE) Notices of Requirement (NoRs) being sought by Auckland Transport (AT) for the Project under the Resource Management Act 1991 (RMA).

This UDE 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 within each

NoR, and the typical methodologies that will be used to implement this work. These have been reviewed by the author of this evaluation and have been considered as part of this UDE. As such, they are not repeated here.

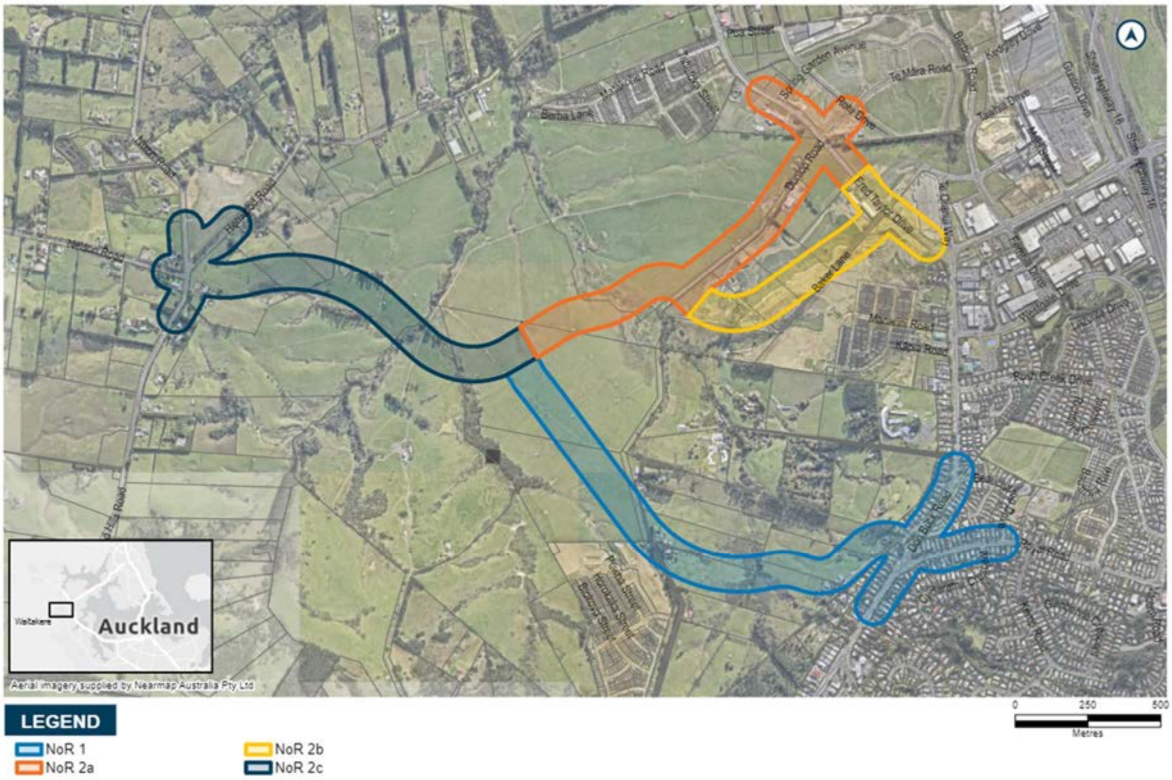

Figure 1: Redhills Arterial Transport Network Context and Extent

2 The Design Context

This evaluation which has been prepared for the combined NoRs is based on the guidance and principles established in the Te Tupu Ngātahi programme wide document – Te Tupu Ngātahi Design Framework (Design Framework or Design Framework Principles).

The Design Framework takes a systems approach as the basis on which urban areas are organised and understood and pulls these apart as a series of layers; environment, social, built form, movement and land use, with cultural and sustainability values underpinning and spanning across these. In this way transport networks are not seen in isolation rather in terms of how they can contribute to the urban system as a whole.

There are twenty design principles that have been established (as part of the Design Framework) within these layers to provide high level guidance on the attributes of responsive, resilient, sustainable, vibrant and high-quality urban environments. Each of the principles describe what 'good looks like' and what to aim for in the design of transport networks. The principles sit within an integrated system across the various layers, to be prioritised and applied according to desired outcomes articulated in the strategic policy direction and the unique needs of each context.

The Design Framework principles are relevant across the Projects within the Te Tupu Ngātahi Supporting Growth Programme as they contribute to the understanding of the development of route options in terms of; place context, built form interfaces, movement functions and modal priorities. They also inform the design development of route options at each phase with specific urban design considerations including;

- Land use and corridor interface
- Connectivity and access
- Character and sense of place
- Integration with future development
- Response to topography

The Design Framework sits within the context of a range of established strategic plans, policies and design guidance that guide urban development outcomes at the:

- National level (e.g. National Policy Statement (NPS) on Urban Development, Government Policy Statement (GPS) on Land Transport, Medium Density Housing Standards (MDRS), NZ Transport Agency Bridging the Gap, Regional Land Transport Plan); and
- Local level (e.g. Auckland Plan 2050, Auckland Transport Alignment Project (ATAP), Auckland Transport Roads and Streets Framework, Transport Design Manual, Auckland Unitary Plan (AUP:OP), AT Sustainability Framework, Auckland Transport Code of Practice).

The established strategic plans and guidance outlined above informed the development of the Design Framework content and they are referenced in general terms as they relate to the attributes that will contribute to healthy, connected and sustainable communities. Where more recent design guidance was available that did not form part of these published reports, the Design Framework included more detail, e.g. the approach to the location of rail, rapid transit and the role of active modes.

2.1.1 National Policy Statement on Urban Development 2020 (NPS:UD)

The NPS:UD came into effect on 20 August 2020 and sets out a list of things that local authorities must do to give effect to the objectives and policies defined within the NPS:UD. The NPS:UD does not explicitly address or refer to urban design but sets out the characteristics and rationale for well-functioning urban environments that enable all communities to provide for their social, economic, and cultural well-being and for their health and safety, now and into the future. This includes, amongst other requirements, the enabling of increased commercial and residential activity around:

- centre zones;
- areas with employment opportunities; and
- areas that are well serviced by existing or planned public transport or where there is high demand for housing or business.

This aligns with the Design Framework principle of increasing density in and around centres to create vibrant walkable/cyclable communities that support public transport, have compact urban forms, a strong sense of place and a community focal point.

2.1.2 Auckland Council

At a local level, the key urban design considerations and provisions of the AUP:OP relevant to the Project include:

- Regional Policy Statement B2: Urban Growth and Form;
- Regional Policy Statement B3: Infrastructure Transport and Energy;
- Regional Policy Statement B4: Natural Heritage (E38: Urban Subdivision);
- Chapter E38: Subdivision;
- Chapter H: Zones (including structure planned zones);
- Chapter I: Precincts (Puhinui Precinct, Manukau Precinct, Florence Carter Avenue Precinct, Flat Bush Precinct); and
- Chapter M: Appendix 1 Structure plan guidelines.

The specific urban design commentary within the corridor evaluations (outlined in the sections below) broadly address the objectives and policies of the relevant sections of the Regional Policy Statement and Chapters of the AUP:OP as listed above.

In addition, the Auckland Plan 2050 sets the vision and direction for Auckland and the Design Framework directly references this plan. It illustrates how the outcomes of the Auckland Plan are linked to the design principles set out in the Design Framework.

3 Project Description

3.1 RATN Form and Function

The RATN consists of an East-West and a North-South arterial transport corridor (referred to as the E-W Project and the N-S Project respectively), each with capacity for a two-lane arterial standard carriageway and new footpaths and dedicated cycleways on both sides of the road. The corridors are:

- A new East-West corridor from the intersection of Nixon, Nelson and Red Hills Roads in the west to Fred Taylor Drive in the east;
- A split of the East-West corridor on approach to Fred Taylor Drive into a connection via Baker Lane and a public transport prioritised route that meets Dunlop Road; and
- A new North-South corridor from the intersection of Don Buck and Royal Roads intersection in the south and connecting to a new intersection with the new E-W Project in the North.

To safely tie into the existing road network, the RATN also includes the upgrade of existing intersections where the new corridors will connect, as follows:

- Signalisation of the intersection at Fred Taylor Drive and Dunlop Road;
- Signalisation of the intersection at Fred Taylor Drive and Baker Lane;
- Signalisation of the intersection at Don Buck and Royal Roads; and
- A new roundabout at the intersection of Red Hills, Nelson and Nixon Roads.

The RATN also provides a footprint for new stormwater wetlands for the treatment and attenuation of stormwater from the new corridors.

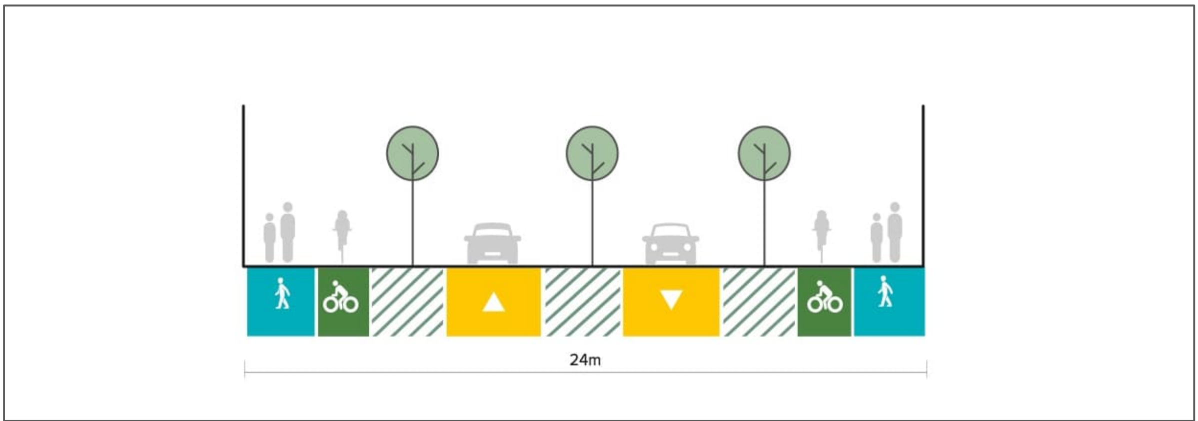

Figure 2: RATN N-S Project and E-W Project Indicative Typical Cross-section

3.2 Existing Environment

3.2.1 Urban Features

The current Redhills environment is typified as a transitional landscape on the periphery of the current extent of the urban environment of North West Auckland. The area is generally characterised by a range of rural and urban land uses, including areas of developing or recently developed urban land use (Figure 1).

Key features within and surrounding the RATN area include:

- Westgate Metropolitan Centre is approximately 1.3km to the north-east of the RATN area providing a range of commercial and retail land uses (e.g. the NorthWest Mall and Westgate shopping area) as well as community facilities and open space.
- State Highway 16 (**SH16**) is accessible from Royal Road approximately 1km to the east, providing a connection to the Auckland CBD. State Highway 18 (**SH18**) is accessible from Fred Taylor Drive approximately 1km to the north east of the RATN area.
- Westgate and Massey are immediately east of the RATN area and are characterised by suburban residential land uses in the form of single detached housing.
- A commercial and retail strip is located at the Red Hills Road and Don Buck Road intersection, which includes a takeaway, petrol station, doctors office and pet grooming centre.

The majority of the Redhills area is greenfield and rural in character. This rural land is predominantly in the form of open pasture for farming and grazing and consists of a range of rural residential properties, larger lifestyle blocks and a larger farming operation owned by a developer. These properties vary in size with the majority containing rural/semi-rural dwellings and/or farm accessory buildings.

The lower northern portion of the Redhills area bordering Fred Taylor Drive is currently undergoing urban development. The wider Redhills area is zoned for a range of residential and business land uses under the AUP:OP, and this urban development is set to continue on the balance of land in general accordance with the Redhills Precinct Plan.

Land use along the eastern extent of the RATN area is generally more urban, characterised by predominantly low-density, single detached residential development along Don Buck Road and Royal Road.

3.2.2 Physical Features

The Redhills area is a natural amphitheatre shape, with Red Hills Road traversing the prominent ridgeline along the western and southern perimeter of the RATN area and connecting with Don Buck Road along the eastern fringe to create a bowl-shape that is accessible along the entire perimeter.

The landform within the RATN area is dominated by rolling and undulating topography and a network of riparian corridors and associated overland flow paths. While there are tracts of native and exotic vegetation distributed through the central/southern areas, open pasture is the most prevalent land cover. The landscape is also notably modified, including re-shaped and realigned natural watercourses and the presence of an existing Transpower 11kv transmission line running in a north-west to south-east direction through the centre of Redhills.

3.2.3 Future Receiving Environment

Both the current residential and business zonings under the AUP:OP and the provisions of the Redhills Precinct Plan clearly indicate future land use changes for the RATN (Figure 2). The key land use features that will comprise the future urban environment include:

- Future residential areas (Single House, Mixed Housing Suburban, Mixed Housing Urban and Terrace Housing and Apartment Buildings (**THAB**) zones);
- Transitioning residential areas (including areas in the north eastern portion of the RATN currently being developed);

- Existing residential areas that are experiencing infill and greater density (for example along Don Buck Road);
- Business zoned areas including the central Redhills zone, and along the eastern boundary of the Redhills Precinct at Don Buck Road.

The Business - Local Centre zoned land in the centre of the Redhills Precinct is proposed to form the heart and focal point for the Redhills community. The AUP:OP/Precinct Plan proposes:

- Corridors that intersect at the centre and enhance its use by passing traffic and public transport, walking and cycling;
- Support more intensive development surrounding the centre;
- Support the creation of a safe and accessible environment for pedestrians, cyclists and public transport; and
- Create a low speed, main street environment with active frontages to key public interfaces.

The Business Local Centre zoned land adjacent to Don Buck Road is predominantly occupied by low-density residential housing, similar to the surrounding land use. However, in the future this is expected to be further developed as a business zone due to its location along an arterial corridor and its close proximity to SH16, SH18 and the Westgate Metropolitan Centre.

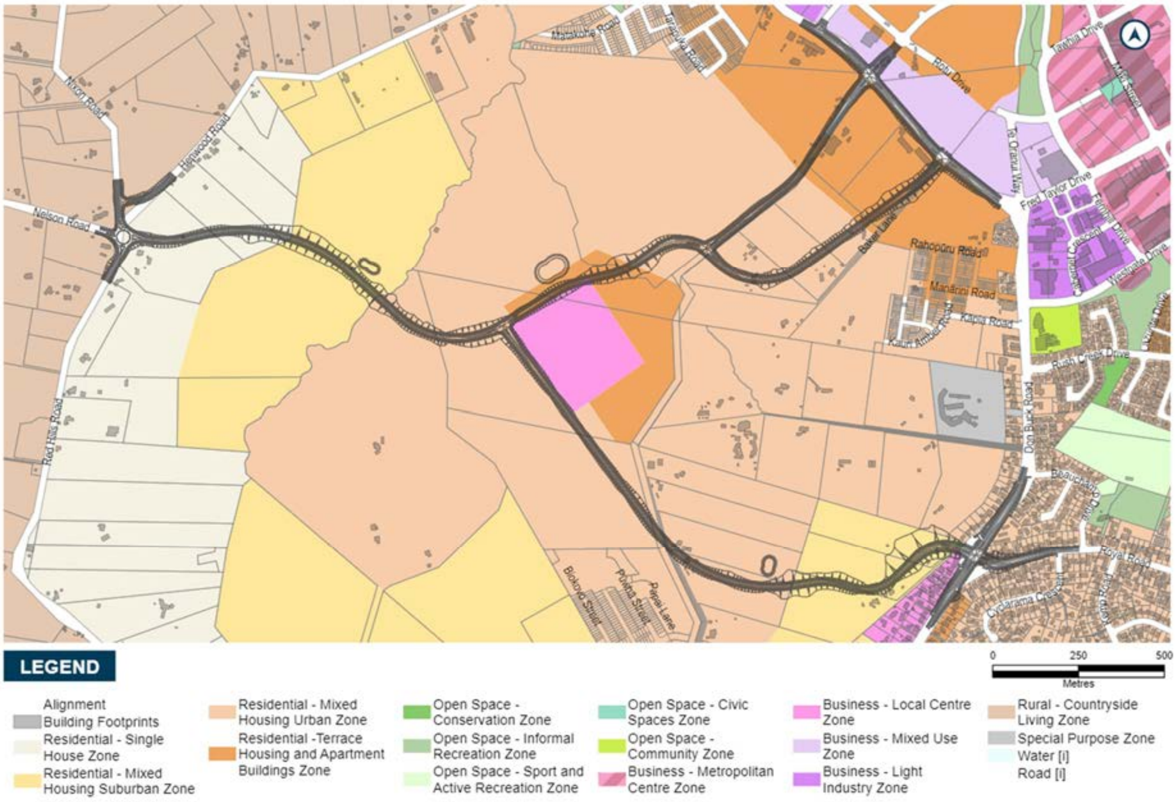

Figure 3: AUP:OP zoning for the RATN Project Area

4 Urban Design Evaluation and Recommendations

4.1 Introduction

This section evaluates urban design matters across the RATN against the relevant Design Framework Principles. It provides urban design focused commentary on the current design detail and recommends the framework for how and where urban design outcomes should be considered in future design stages. These recommendations could form the basis of an urban design specific designation condition, and where there is an overlap of urban design outcomes with other considerations (for example ecological, landscape, visual or water quality related recommendations) these could be integrated with other relevant designation conditions.

4.2 Evaluation against the Design Framework Principles

Table 2: Urban Design Evaluation

ENVIRONMENT		
Principle	**Explanation**	**Application to the RATN corridors**
1.1 **Support and enhance ecological corridors and biodiversity**	Mitigate the effects on or enhance existing ecological corridors through the placement and design of movement corridors.	• The proposed RATN corridor cross sections inherently supports a range of options to preserve or enhance existing natural systems (at a range of scales), for example berm widths and edge conditions that can accommodate vegetation types that support and reinforce ecological restoration strategies. • The proposed RATN corridor arrangement and alignment provides spatial provisions (at boundaries and within berms) that have the potential to support ecological connectivity and biodiversity in the local environment by providing contiguous space for diverse planting responses and alignments that minimise stream interruptions. • The crossings of the Redhills Stream, Waiteputa Stream and Ngongetepara Stream on the E-W Project have the potential to incorporate bridging structures, where they might serve to reinforce broader connectivity outcomes for ecology, water quality and cross corridor walking and cycling facilities.
1.2 **Support water conservation and enhance water quality in a watershed**	Take into account and work with the existing watershed as part of a whole system.	• The proposed typical RATN corridor cross section provides spatial provisions (up to 6m width in aggregate) to adopt the use of natural drainage and treatment systems to address water quality and reduce hard engineering solutions. • The adopted spatial provisions within the proposed typical cross section supports the use of in corridor stormwater management systems, for example linear swale treatment and raingardens.

1.3 **Minimise land disturbance, conserve resources and materials**	Respect the existing topography, landforms and urban structure in the placement of strategic corridors. Minimise the quantity of hard engineering materials required. Minimise, mitigate any adverse effects of activities on the environment.	• The E-W Project concept demonstrates a close and connected alignment to the existing landform, generally balancing earthworks while minimising unnecessary disturbance and materials. • The E-W Project demonstrates an efficient alignment in relation to existing property boundaries in the Dunlop Road / Baker Lane portions to the east, minimising land impacts and inefficient residual land portions. • The N-S Project traverses across undulating land and culverted stream tributaries before climbing steeply at 8% for approximately 325m and connecting with Don Buck Road at the intersection with Royal Road. This alignment requires significant fill to achieve a compliant longitudinal approach geometry and intersection grading with Don Buck Road. The corridor alignment and grading are designed to minimise the required earthworks by maximising the allowable longitudinal grading on approach to the intersection. User accessibility, land use integration and visual mitigation strategies to address this section of corridor are described under the response to Principles 2.4 and 2.5.
1.4 **Adapt to a changing climate and respond to the microclimatic factors of each area**	Design for predicted future regional climatic impacts in the corridor location. Consider the positive contribution that the orientation of transport corridors can make to the local climatic environment of future places and streets.	• The RATN corridor designs, including crossings of the Redhills Stream, Waiteputa Stream and Ngongetepara Stream, adopts a vertical geometry that accommodates stormwater events including the applied climate change factors as stated in the Auckland Council Stormwater Code of Practice. • The RATN corridor designs provide for street tree planting zones that, when delivered, will contribute to reducing urban heat island effects in the more intensively urbanised environment of Redhills. • The RATN corridors provide for active modes and accommodates prioritised public transport options to support modal shift and reduce transport related climate change contributions.
SOCIAL		
Principle	**Explanation**	**Application to the RATN corridors**
2.1 **Identity and place**	The identity or spirit of place is generally acknowledged as the unique amalgam of the inherent built, natural and cultural qualities of a place. Responding to identity in the location and type of new corridors can provide a sense of continuity and contribute to our collective memory.	• The RATN corridors pass through a largely existing rural edge environment and while this is planned to change to mixed and more intense land uses, the flexible cross-section potentially provides space for any new identity drivers that may be established in adjacent development sites, for example place specific pavement treatments, planting types or street furniture. • Broader land development character drivers for the local centre and zones along both RATN corridors are largely unknown but the inherent spatial flexibility afforded by the indicative typical cross section is capable of responding to a range of identity drivers that may arise from urban centre or higher density land

		uses. This includes active edges, permeable access edges, vegetation scaled to low and medium scaled built form, natural landscape identity drivers or more urbanised hard urban space qualities.
2.2 **Respect culturally significant sites and landscapes**	Acknowledge significant sites and features in the layout of movement corridors including ridgelines or horizons.	• Overall, the RATN corridors will not affect any identified sites of significance to Manawhenua under the AUP:OP, however there are features of value to Manawhenua in the wider Redhills area, which have been acknowledged through hui (i.e. streams). These will be addressed through designation conditions which provide for preparation of Cultural Advisory Reports, Cultural Monitoring Plans, and mana whenua input into the Urban and Landscape Design Management Plan. • There are no early European archaeological sites recorded within or in close proximity to the RATN corridors. The nearest sites are more than 400m away (including a plane crash site during World War II, a gum diggers' camp and hut site, a 1930's Post Office and historic dwelling).
2.3 **Adaptive corridors**	Corridors should demonstrate flexibility to respond to changes in their function and physical interfaces. Consider an adaptive approach in the way strategic corridors are designed to be able to respond to changes in land use, the way we move around or utilise technology over time.	• The typical RATN corridor cross section presents a flexible, re-configurable and adaptable environment for changing transport needs, for example future bus priority measures at intersections, bus stops and future expansion of any walking and cycling networks within the grain of adjacent development. • The RATN cross section provides space for several modes, with spatial provisions at the corridor edges that accommodate active frontages, provide permeability for access to adjacent land use types and movement corridors.
2.4 **Social cohesion**	Provide clear, effective and legible connectivity between community and social functions.	• The RATN corridor alignments and function deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to the location of the proposed Redhills local centre as shown on the Redhills Structure Plan and connecting (via stream crossing locations) to the potential open space network within the future Redhills area. • The flexibility inherent in the proposed RATN corridor cross section supports the creation of spaces where people can seamlessly connect through a permeable interface at the corridor boundary. • Where the N-S Project climbs to meet Don Buck Road, the combination of the road grading and potential significant fill embankments may limit or preclude vehicular access (but not pedestrian and cycle access) from adjacent mixed housing suburban zoned land to the N-S Project. The future establishment of an urban integration strategy that is focused on integration with built form= and character of adjacent development should be prepared to address and manage this interface.

2.5 **Safe corridors**	Provide a safe and convenient network of routes accessible to people of all ages and abilities.	• The RATN corridors deliver a greater level of access and movement to future local communities that will promote a sense of personal safety. • The proposed active travel solutions are proposed as fully segregated and prioritised, for example with signalised intersections at Fred Taylor Drive and Don Buck Road. • The proposed E-W Project facilities, configuration and alignment accommodates the universal design approach and accessibility to all parts of user journeys. • The existing topography and longitudinal grading of the proposed N-S Project require a maximum of 8% gradient on the approach to Don Buck Road. This physical environment will potentially pose a barrier to some users with disabilities or other physical ability limitations (for example, children, the elderly). Future design stages should include the demonstration of an access alternatives strategy that addresses universal access needs for the N-S Project.
BUILT FORM		
Principle	**Explanation**	**Application to the RATN corridors**
3.1 **Align corridors with density**	Locate stations/stops and corridors within walking distance of higher density development to facilitate modal shift, support commercial and mixed use centres and contribute to vibrant, active urban environments.	• The proposed RATN corridor alignments and arrangement provides an even and easy access network for all proposed growth areas within Redhills. • The RATN corridors directly address (skirts the proposed zoned areas) the local centre and THAB zoning at the centre of Redhills and the THAB zoning along Fred Taylor Drive.
3.2 **Corridor scaled to the surrounding context and urban structure**	Align the speed, type and scale of transport corridors and infrastructure with the environment that it moves through (appropriate scale to the context).	• The RATN corridor configurations and scale provide an appropriate response to the potential needs of the adjacent precinct functions, for example through efficient localised movement, alignment with higher density living (THAB zones) and the provision of mixed mode travel. • The corridor alignment acknowledges and accommodates lodged precinct planning and private development land use proposals of major landholders in the north east and eastern portions of Redhills.
3.3 **Facilitate an appropriate interface between place and movement**	Facilitate the opportunity for place as well as movement in corridors (people-oriented streets).	• The RATN corridor cross sections provides a flexible platform to address the opportunity for place as well as movement function, for example separated pedestrian and cycle facilities, potential road median spaces. • The corridor cross section provides flexibility in supporting appropriate public private interfaces and connectivity at a fine grain (pedestrian) level, for example direct pedestrian access from THAB or other higher density living is accommodated and encouraged by placing pedestrian circulation closest to the corridor boundary.

		• Direct new private vehicular access is not accommodated, however a pedestrian permeable interface or active frontage interface is supported where adjacent to the future THAB zone (or where required). • The RATN corridor cross sections provides clear and flexible allocation of street space between competing uses by allowing for separated modes.
MOVEMENT		
Principle	**Explanation**	**Application to the RATN Corridors**
4.1 **Connect nodes**	Provide tangible connectivity between identified activity nodes.	• The corridor alignment provides tangible and direct connectivity between complementary destinations, for example the proposed local urban centre / THAB zones in the centre of Redhills to the Westgate and Northwest town centres and transport hub, regional open space facilities in Westgate and the potential public transport interchanges and Royal Road / SH16.
4.2 **Connect modes**	Provide for choice in travel and the ability to connect at interchanges between modes.	• The RATN corridors provide simple but complete connectivity for all modes (walking, cycling, public transport and private vehicle). • The E-W Project provides a direct and potentially prioritised active mode and public transport connection to the future transport interchange at Westgate. • The N-S Project provides a direct and convenient connection to Royal Road (at Don Buck Road) that will serve as the direct link to a potential public transport interchange on SH16.
4.3 **Support access to employment and industry**	Align the corridor location and typology to provide direct and efficient access to areas of employment and industry.	• The corridor alignment provides direct and legible access to employment centres at Westgate and via regional transport networks (SH16 and SH18) to regional employment centres throughout the North West of Auckland.
4.4 **Prioritise active modes and public transport**	Provision of quality active mode corridors and dedicated public transport corridors to enable a modal shift away from private vehicle use.	• The RATN corridor cross sections accommodate high-quality active travel facilities, for example separated pedestrian and cycle pathways.
4.5 **Support inter-regional connections and strategic infrastructure**	Consider the location and alignment of significant movement corridors and placement of infrastructure (power, wastewater, water) to the network.	• The proposed N-S Project will run in close proximity to two Transpower transmission lines (110kv and 220kv). • The alignment is located as close as possible to the Transpower grid, reducing visual and physical land fragmentation issues and allowing for flexible future land use opportunities in the surrounding land.

4.6 **Support legible corridor function**	Consider how areas can be clearly navigated and understood by users moving from place to place.	• The RATN typical corridor cross section accommodates a range of modes and inherently flexibly supports future community connectivity, mobility and choice.
LANDUSE		
Principle	**Explanation**	**Application to the RATN corridors**
5.1 **Public transport directed and integrated into centres**	Locate rapid transit interchanges within centres (local, town and metro) to support a mix of uses and provide modal choice to a larger number of users.	• The E-W Project alignment accommodates a direct public transport connection along Dunlop Road between the Redhills local centre and Westgate town centre. • The N-S Project facilitates a direct public transport connection (as part of a local bus route loop) between the Redhills urban centre and the public transport interchange potentially located at Royal Road / SH16.
5.2 **Strategic corridors as urban edges**	Strategic corridors as potential definers of a land use edge.	• This principle is not relevant to the RATN corridors.

4.3 Summary of urban design evaluation and recommendations for the RATN

Overall, the proposed RATN corridor design and configuration is generally supportive of the Design Framework principles. A summary of the recommended urban design outcomes and opportunities are outlined below and illustrated in Figure 4 and Figure 5. These are recommended to form a part of the Urban and Landscape Design Management Plan (ULDMP) in future delivery stages. This is to ensure the detailed design of the corridor responds appropriately to the principles and the project specific urban design outcomes sought.

The ULDMP should address the following Project specific outcomes:

ENVIRONMENT

- A landscape plan that considers recommendations from the landscape and visual, flooding and ecological assessments including street tree and stormwater raingarden and wetland planting, construction compound and private property reinstatement and treatment of batter slopes. The landscape plan should also demonstrate integration of Redhills Stream, Waiteputa Stream and Ngongetepara Stream where the corridor intersects with the existing Blue-Green Network. The landscape outcomes should support the principles of Auckland's Urban Ngahere Strategy and reinforce the wider vegetation patterns of the local landscape and create connections to proposed greenways and the wider walking and cycling network.
- Integration of stormwater raingardens, ponds and wetlands to ensure an appropriate interface with adjacent land uses, specifically where wetlands are proposed in areas zoned high density.

- Measures to demonstrate that the project has adapted to the changing climate such as incorporating street trees and other corridor landscaping in future urbanised areas, supporting modal shift and accounting for flood hazard risks.

SOCIAL

- In future design stages, Manawhenua shall be invited to provide input into relevant cultural, landscape and design matters including how desired outcomes reflect their identity and values.
- The identification, development and integration of key local community and identity drivers for the RATN should be demonstrated. Key RATN local identity community functions to be addressed include:
  - Business – Local Centre Zone;
  - Links to the adjacent Westgate Metropolitan Centre to the east of Fred Taylor Drive;
  - Links to the Local centre zoning along Don Buck Drive.
- Key RATN distinctive landscape character qualities of open spaces, stream and conservation zones include;
  - Open space linkages along Redhills Stream, Waiteputa Stream and Ngongetepara Stream; and
  - Linkages and crossing points with the Recreation Open Space network indicated in the Redhills Precinct: Precinct Plan 1.Kellaway Drive Reserve.
- The proposed corridor alignment and function can deliver a positive contribution to the sense of belonging and participation, as well as community resilience by supporting direct access to existing local, neighbourhood and town centres, schools, community functions and open spaces. Key school, community and business functions within the RATN to be addressed include:
  - Linkages and crossing points with the Recreation Open Space network indicated in the Redhills Precinct: Precinct Plan 1.Kellaway Drive Reserve;
  - Rongomai Park / recreational reserve; and
  - Barry Curtis Park.
- A CPTED review of the RATN should address, at a minimum, any identified CPTED risks including:
  - Any proposed underpass environments resulting from the project response to topographical constraints; and
  - Under bridge environments at the Redhills Stream, Waiteputa Stream and Ngongetepara Stream overbridges or culverts.

BUILT FORM

- Known or planned changes of land use and residential density that have the potential to alter the perceived scale and impact of the proposed corridor functions should be identified and addressed.
- Resolution of any potential conflict between placemaking aspirations within local communities and the scale and operating speed of the proposed movement functions of the corridor should be addressed.
- An urban interface approach within the corridor that:

  - provides an appropriate interface to any proposed local, neighbourhood and town centres and enables buildings and spaces to positively address and integrate with the RATN;
  - responds to the spatial character of proposed centre environments and supports quality public realm infrastructure, ample pedestrian footpath width, frequent pedestrian crossing points and street trees for shade and amenity; and
  - recognises the transition of densities from Residential – Terrace Housing and Apartment Building to Residential to Mixed Housing Suburban Zone and provides a corridor interface that supports permeable pedestrian access and responds to the changing built form interface and spatial character of adjacent future development.

MOVEMENT

- Permeability of the corridor for active modes that addresses cross corridor connectivity (midblock crossings), modal priority and permeable access to destinations such as centres, transport interchanges, open spaces and community facilities. Demonstration of place specific active mode cross corridor solutions should include:
  - Across the RATN corridors at the proposed local centre;
  - Coinciding with stream or recreation open space interfaces with the RATN; and
  - At any proposed bus station locations along the RATN.
- Legibility, connectivity demands, safety and modal priority for active modes should be addressed for intersections within the RATN. Demonstration of specific intersection responses to ensure connectivity between the proposed high density residential, local centres and other community facilities should include the intersections of the RATN and:
  - Red Hills Road and NoR2c
  - NoR1 and NoR 2c;
  - NoR1 and Don Buck Road;
  - Dunlop Road and Fred Taylor Drive;
  - Fred Taylor Drive and Baker Lane; and
  - Dunlop Road and Baker Lane.

LANDUSE

- Demonstration of how any residual land portions following the construction of the Project are redefined and integrated with the expected future land use function, in particular areas immediately adjacent to the local centre and higher density zones.

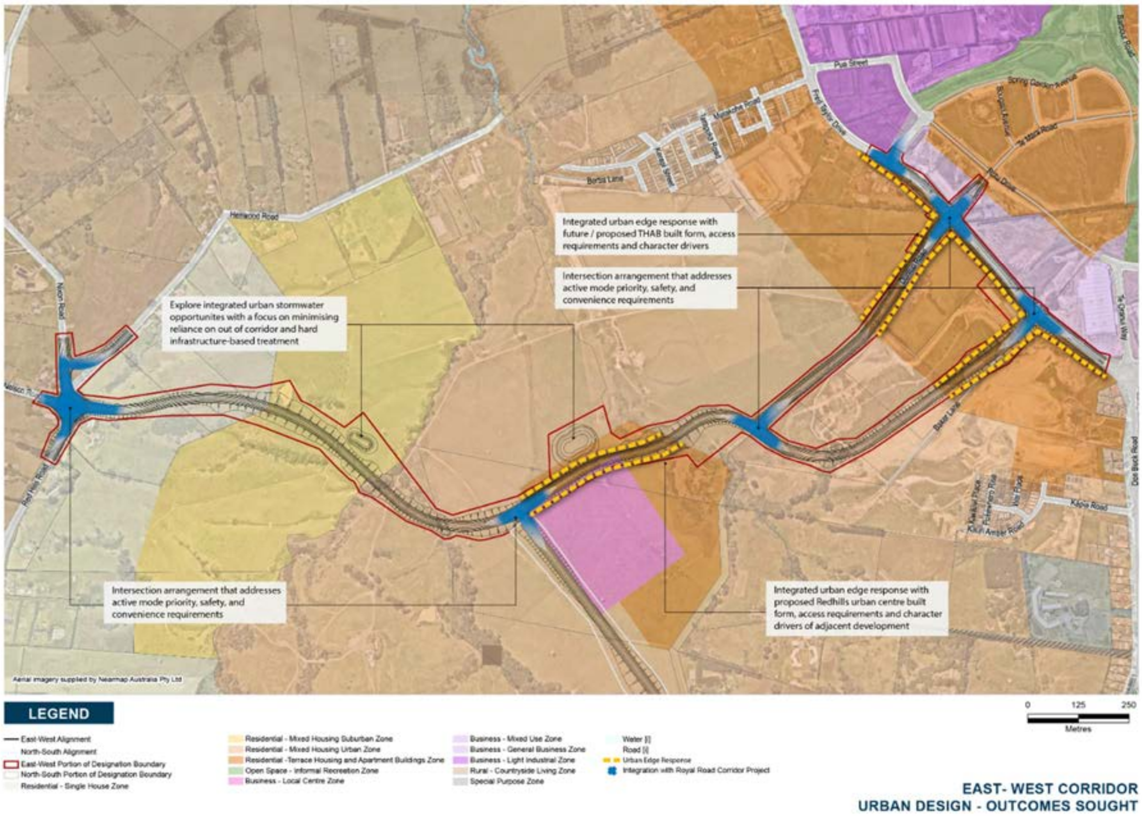

Figure 4: E-W Project Urban Design Outcomes Sought

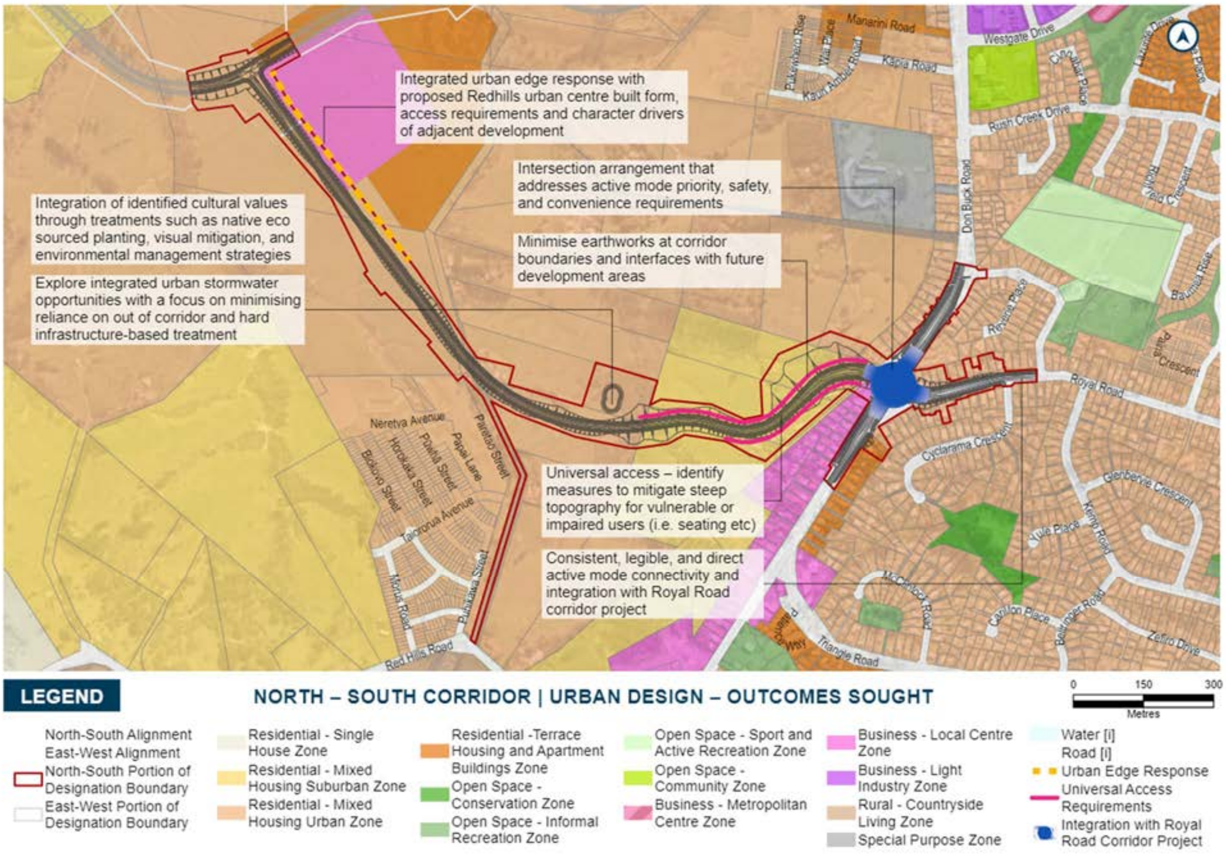

Figure 5: N-S Project Urban Design Outcomes Sought

ATTACHMENT 29

CULTURAL IMPACT ASSESSMENT

CULTURAL IMPACT ASSESSMENT

FOR

TE TUPU NGĀTAHI NORTH WEST PROJECT (LOCAL AND STRATEGIC TRANSPORT NETWORK)

PREPARED FOR

TE TUPU NGĀTAHI

DECEMBER 2022

Ref. TKITT000054

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TE KAWERAU A MAKI

"Kawerau Iwi, Kawerau Mana, Kawerau Tangata"

Report No.	TKITT000054		
Prepared by:	Edward Ashby	Mana Taiao Manager	
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Revision:	Version 2		

EXECUTIVE SUMMARY

The North West Project proposes to upgrade and develop new sections of the local and strategic transport network extending from Whenuapai through Westgate and Brigham Creek to Waimauku. A significant element of the project is the Alternative State Highway (ASH) from Brigham Creek to western Huapai. The project sits within and across an important cultural landscape at the crossroads between the Hikurangi, Waitematā, and Kaipara Valley takiwa. It is the northern part of Te Kawerau ā Maki's heartland and contains a number of significant cultural sites and resources from our most ancient traditions through to our major Treaty settlement redress. A total of 51 cultural sites and resources were identified across the wider project area. The project was assessed against these sites and resources resulting in the documenting of eight significant adverse effects, 15 minor adverse effects, three negligible adverse effects, one potential significant beneficial effect*, one minor beneficial effect*, and 25 neutral effects. Where adverse effects were identified offsets (or further mitigation) were suggested. The significant adverse effects relate to the removal of productive topsoil, impacts to fresh water (including the taniwha), impacts to the Kumeū River (including the taniwha), impacts to fish species, setting impacts to Nga Rau Pou ā Maki, impacts to Pukewhakataratara, impacts to Wai paki i rape ō Ruarangi, and impacts to the cultural landscape. There is particular concern regarding a strategy of supporting urban growth in a flood prone catchment that holds the most regionally significant topsoil in northern Auckland. Due to these sensitivities the iwi cannot support the ASH component of the project. Advice is provided on suggested limits and offsets, and recommendations are provided for the project overall.

PEPEHA

Ko Hikurangi te maunga

Ko ngā Rau Pou ā Maki ngā tohu whakahī

Ko te Wao Nui ā Tiriwa te ngahere

Ko te Manukanuka ā Hoturoa me te Waitematā ngā moana

Ko Waitākere te awa

Ko Tainui te waka

Ko Tawhiakiterangi te tupuna

Ko Te Kawerau ā Maki te iwi

Hikurangi is the mountain

The many posts of Maki (Waitākere Ranges peaks) are the markers

Te Wao nui ā Tiriwa is the forest

Manukau and Waitematā are the harbours

Waitākere is the river

Tainui is the canoe

Tawhiakiterangi is the person

Te Kawerau ā Maki is the tribe

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INTRODUCTION

1.0 Project Background

Te Kawerau Iwi Tiaki Trust ('the Trust') have been commissioned by Te Tupu Ngātahi (an alliance involving Waka Kotahi, Auckland Transport, BECA, AECOM, Bell Gully and Buddle Finlay) (hereafter the Client) to prepare a Cultural Impact Assessment (CIA) for proposed upgrades and new sections of the local and strategic transport network extending from Hobsonville/Whenuapai through Westgate and Brigham Creek to Kumeū, Taupaki and Waimauku. The proposed transport network project is known as the 'North West Project'.

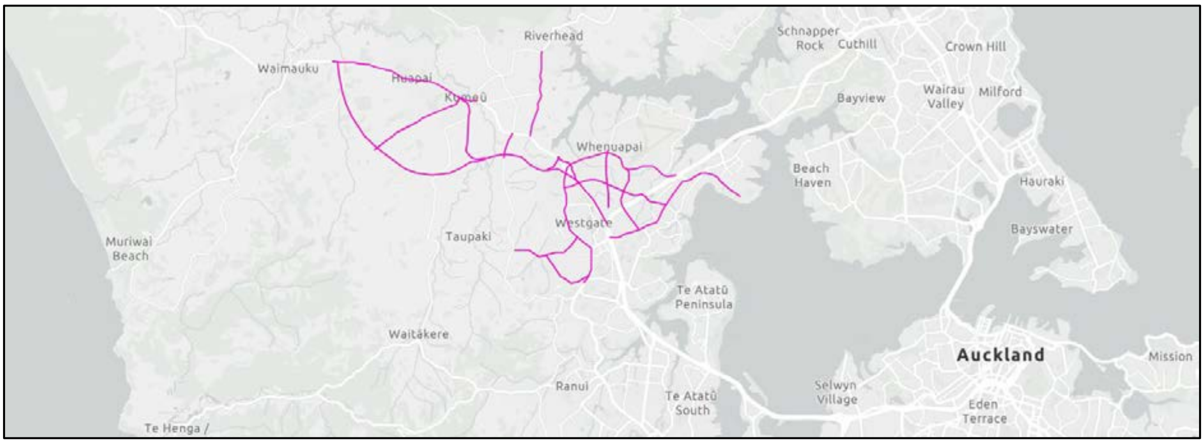


Figure 1: Plan showing Site regional context

The Client seeks to identify and protect the preferred transport network in Auckland's future growth areas. The wider strategy of Te Tupu Ngātahi is to support growth in housing and employment, to provide people with genuine travel choices, to address climate change by achieving transformative mode shift, and to address transport safety issues. For the North West Project the specific outcomes include an extensive walking and cycling network, 71km of bus lanes plus a rapid transit corridor to Kumeū-Huapai, safety upgrades, and state highway upgrades including an alternative route for State Highway 16. The network works will generally involve transport corridor widening/realignment, new corridors, bulk earthworks, bridge construction/stream crossings, stormwater management (e.g. ponds), vegetation removal/replanting, and installation of related infrastructure.

Specific to the 'strategic network' components of the North West Project are: the Alternative State Highway (ASH) route will include a new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange; The SH16 main road (Main Rd) upgrade will include upgrading the existing corridor to a 24m wide urban corridor, including a 600m section of active mode only upgrade and realignment of Station Road to form a new signalised intersection with SH16; The development of a new rapid transit corridor (including the Regional Active Mode Corridor – RTC) and active mode corridor will be in one co-located corridor; The upgrade of Access Road (Access Rd) from a 20m width to a 30m four-lane cross-section with separated cycle lanes and footpaths on both sides of the corridor within the urban section and the north side within the rural section.

This CIA report has been prepared by the Trust as a legal entity of Te Kawerau ā Maki who are a mana whenua iwi of wider Tāmaki Makaurau (Auckland), but with particular lead interests in Hikurangi (West Auckland) and the Upper Waitematā Harbour. The purpose of this CIA report is to provide the Client and relevant statutory agencies with documentation of Te Kawerau ā Maki's cultural values, interests, and associations with the project area and its natural resources, and the potential impacts of the proposed project activities on these. This impact assessment also provides recommendations as to how to avoid, remedy or mitigate any potential cultural effects that arise from the project.

Te Kawerau ā Maki engagement in statutory processes including provision of technical advice for impact assessments is guided by our tikanga (customs and protocols) and mātauranga (tribal knowledge) and framed by Te Tiriti ō Waitangi, our Te Kawerau ā Maki Claims Settlement Act 2015, our Iwi Management Plan (IMP), and our organisational strategic values: Mana Motuhake (independence); Kaitiakitanga (guardianship and sustainable management); Whānaungatanga (people focused); Auahatanga (innovation); Mātauranga Māori (culture-driven).

2.0 Site Description

The project is situated in northern West Auckland/southwest Kaipara running from Hobsonville to Waimauku. It essentially runs along the low-lying alluvial plains between the Waitākere Ranges to the southwest, the Riverhead hill country to the north, and the Waitematā Harbour to the east. The project is situated primarily within the catchment of the Kumeū River. For the most part the project follows the alignment of SH16 and its various feeder roads, however the proposed Alternative State Highway crosses rural land to the west between the townships of Taupaki and Kumeū/Huapai.

The wider proposed project area (hereafter the Study Area) includes the entire alignment including the local and strategic network and a wider catchment of 4km radius from the project footprint. This wider area is appropriate for placing the project within its proper cultural landscape context and for capturing any potential setting impacts.

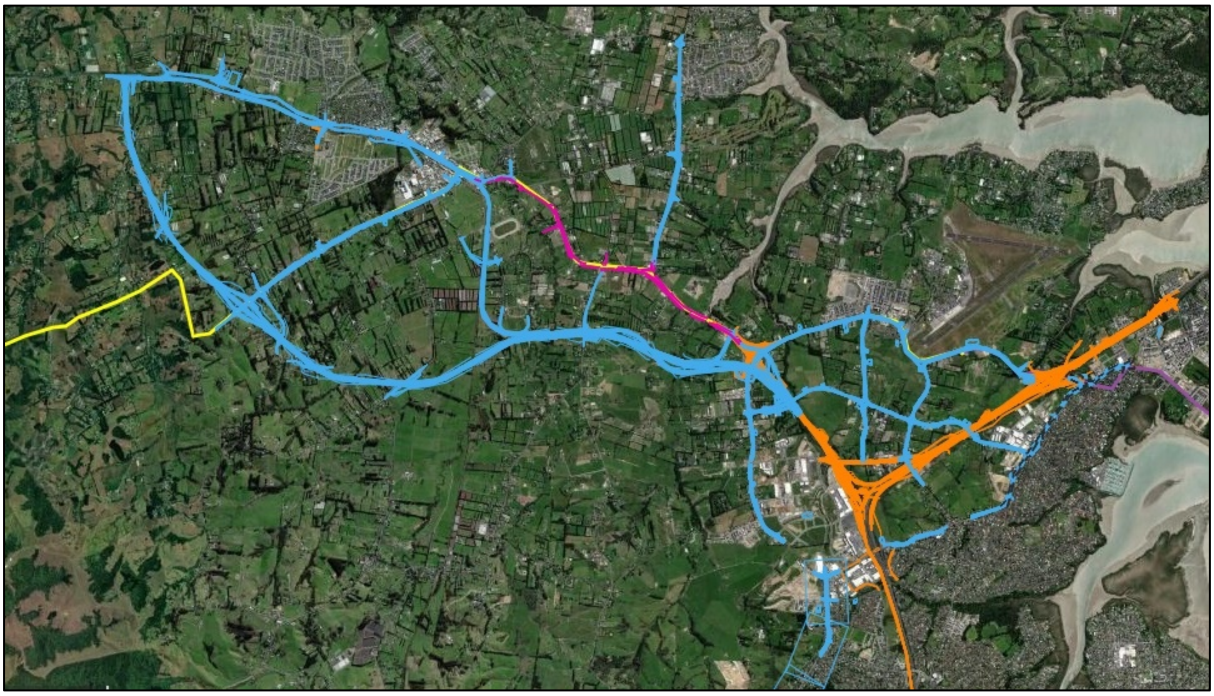


Figure 2: Plan showing Site (supplied by Client)

For the purposes of this report, the proposed project site (hereafter the Site) includes the local and strategic network footprint, including both its construction (including temporary compounds) and operational phases. Specifically this includes the Redhills, Riverhead, and Whenuapai 'arterials' as well as the strategic corridors known as ASH, Main Rd, RTC, and Access Rd.

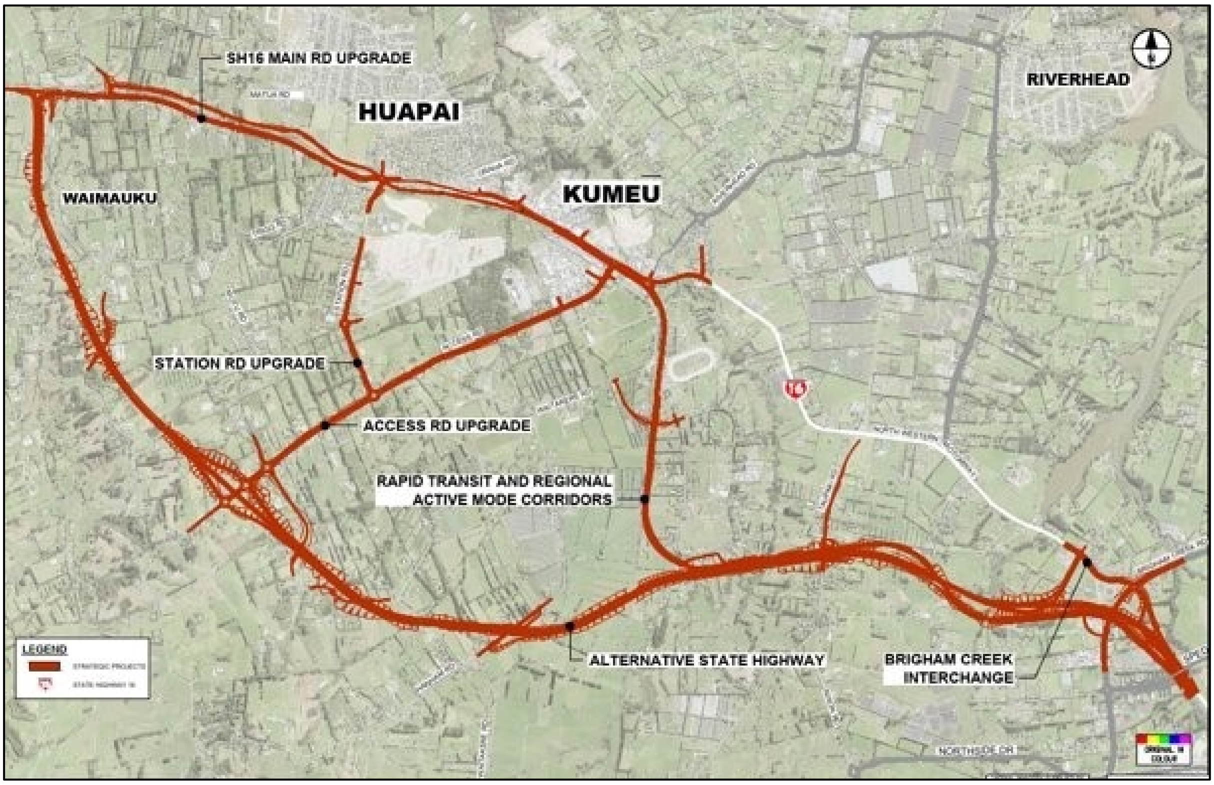


Figure 3: Plan showing Strategic Network (supplied by Client)

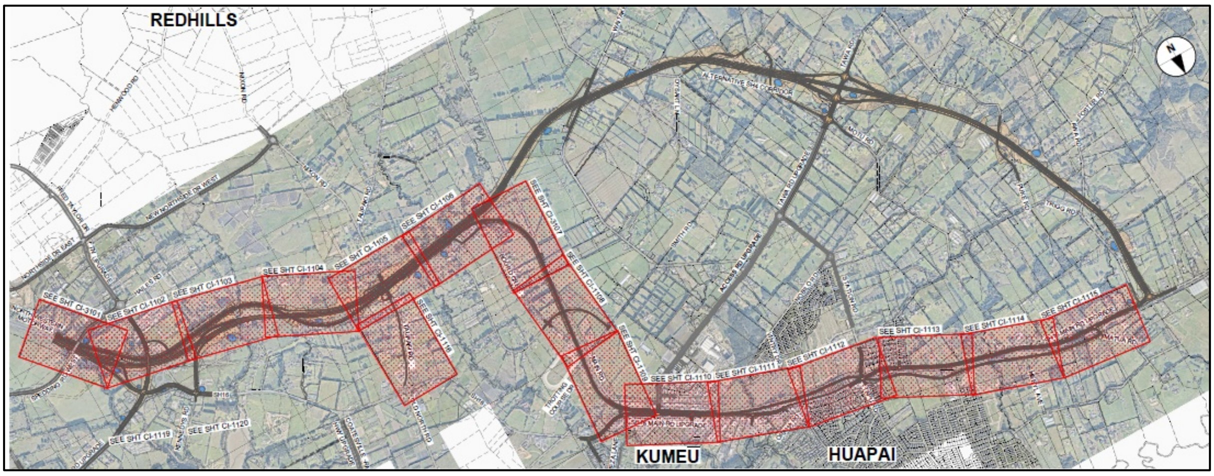


Figure 4: Plan of the Rapid Transit Corridor and Regional Active Mode (supplied by Client)

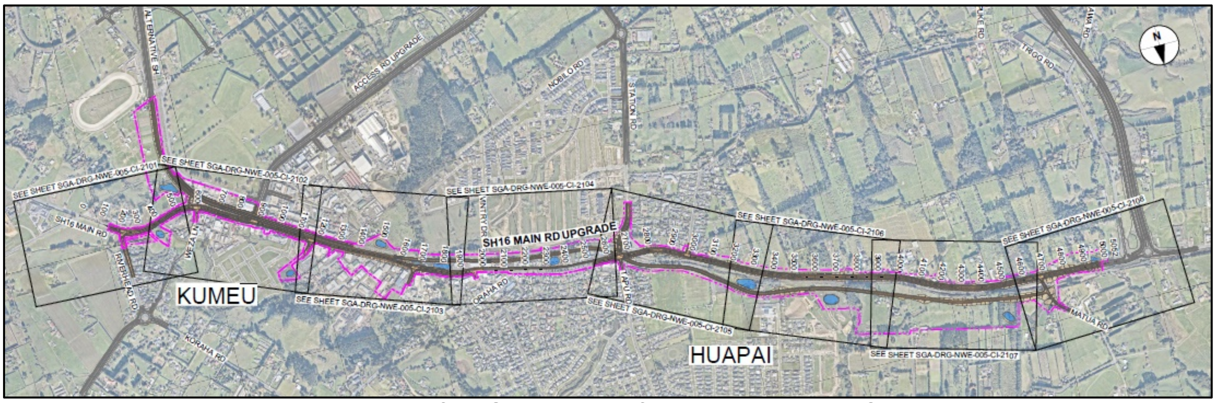


Figure 5: Plan of the SH16 Main Rd footprint (supplied by Client)

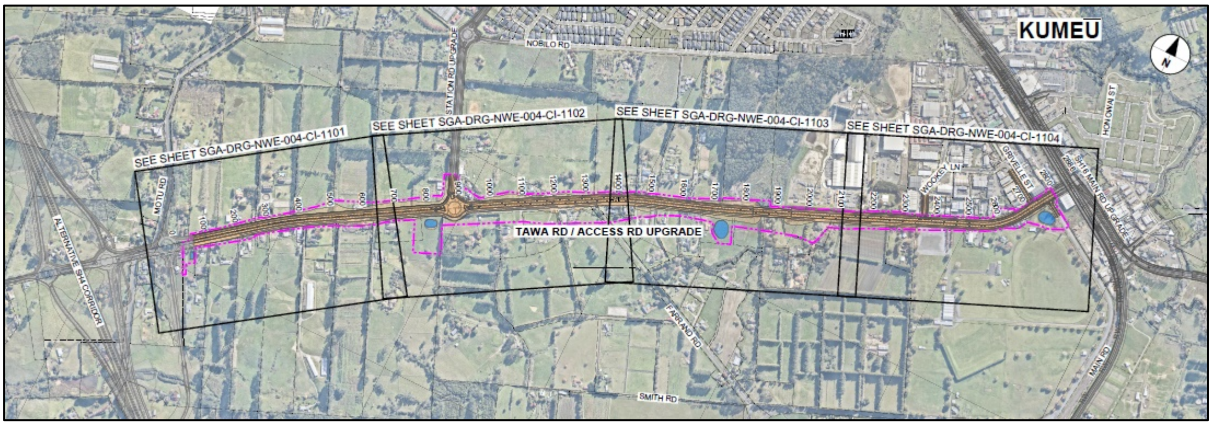


Figure 6: Plan of the Access Rd footprint (supplied by Client)

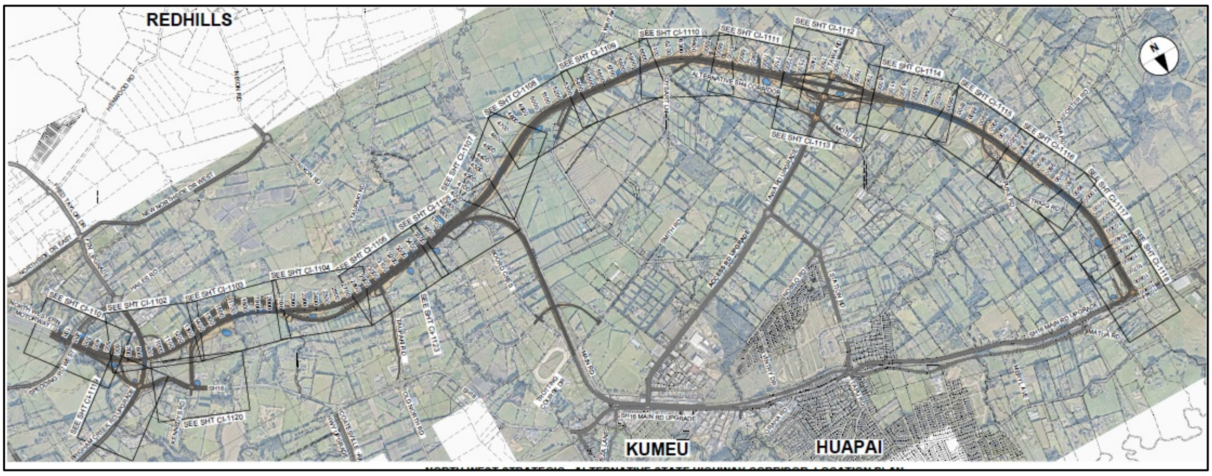


Figure 7: Plan of the Alternative State Highway footprint (supplied by Client)

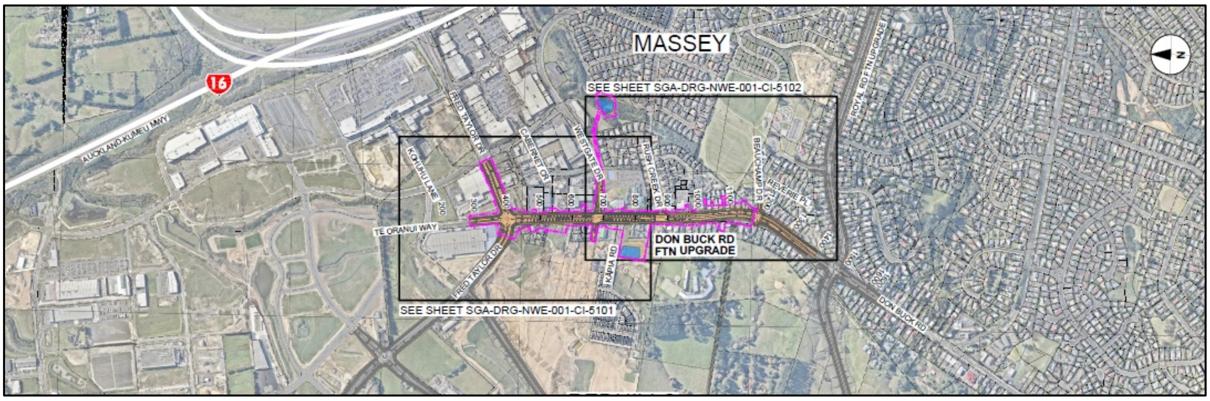


Figure 8: Plan of Don Buck Rd Local Network footprint (Supplied by Client)

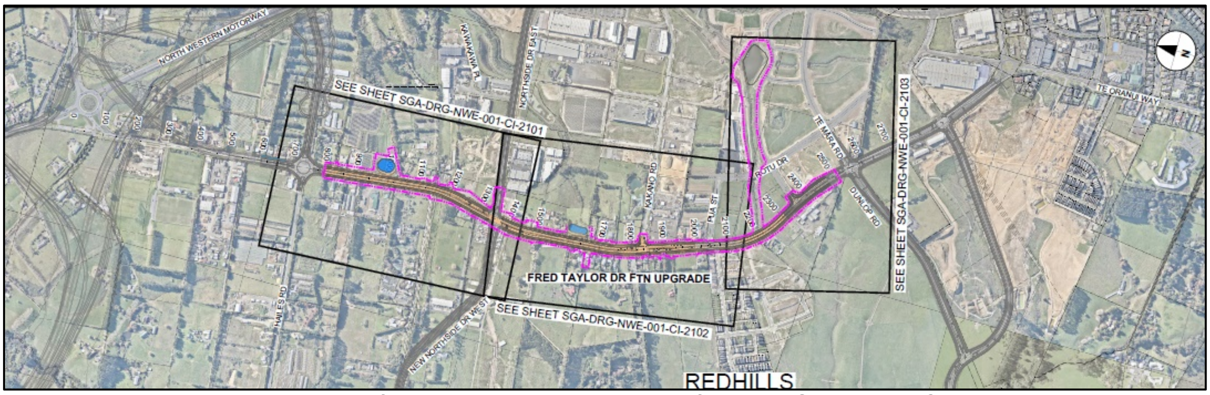


Figure 9: Plan of Fred Taylor Dr Local Network footprint (Supplied by Client)

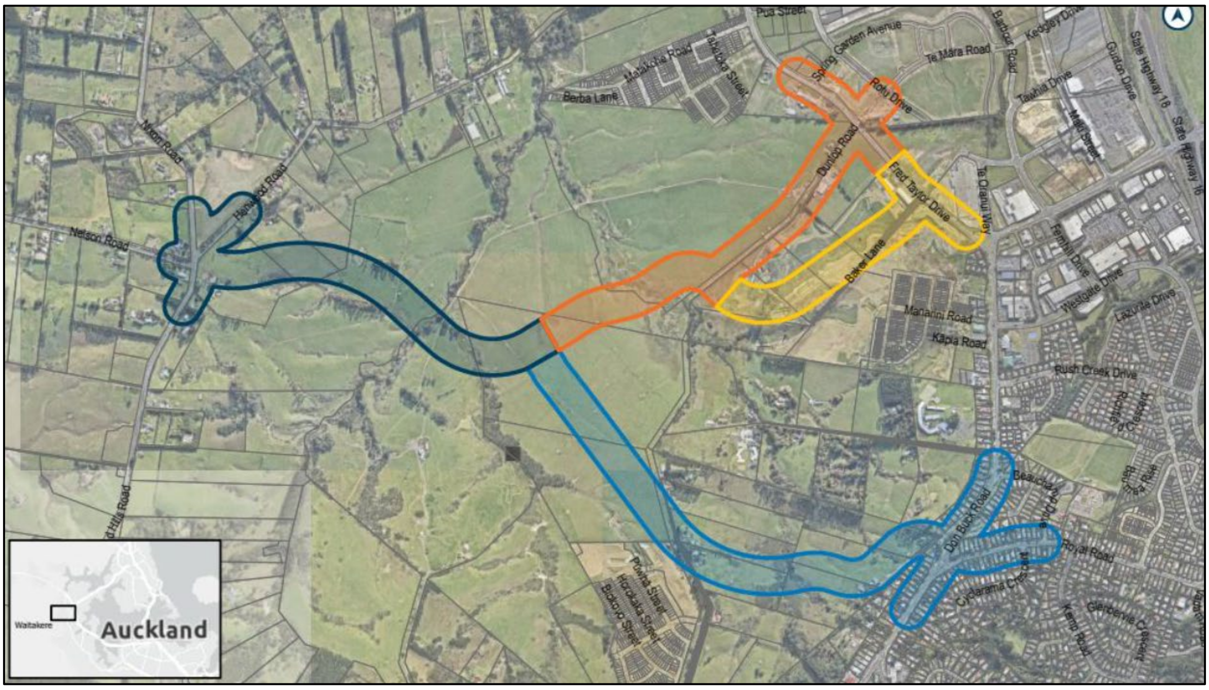


Figure 10: Plan of Red Hills Arterial footprint (Supplied by Client)

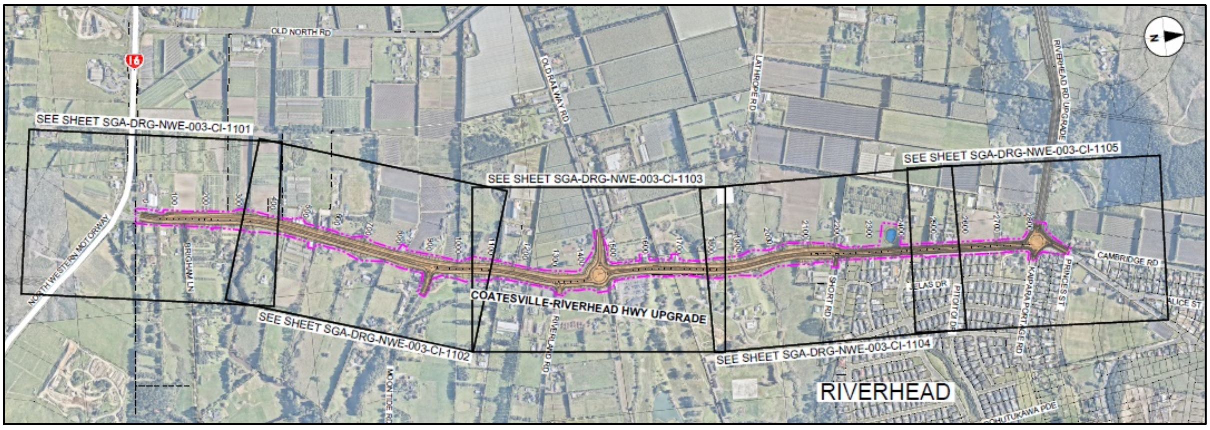


Figure 11: Plan of Coatesville-Riverhead HWY Local Network footprint (Supplied by Client)

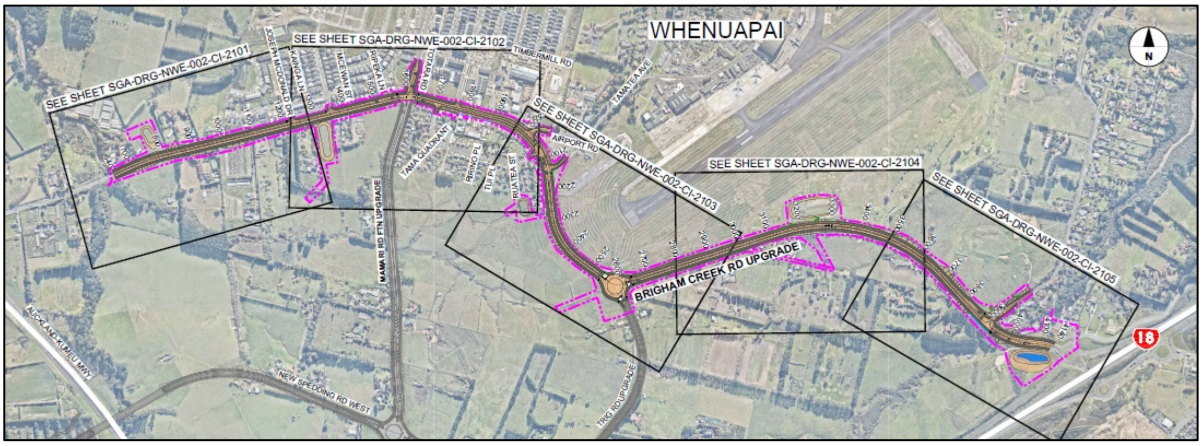


Figure 12: Plan of Brigham Creek Rd Local Network footprint (Supplied by Client)

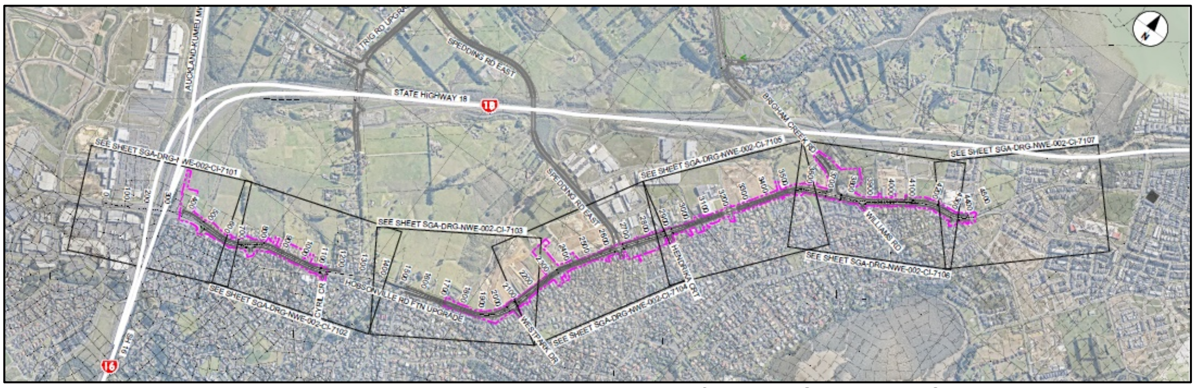


Figure 13: Plan of Hobsonville Rd Local Network footprint (Supplied by Client)

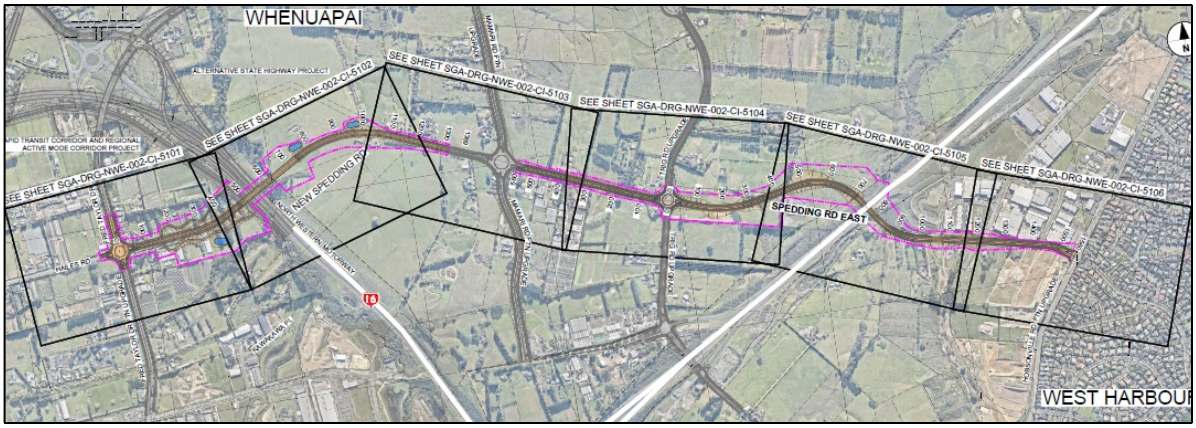


Figure 14: Plan of New Spedding Rd Local Network footprint (Supplied by Client)

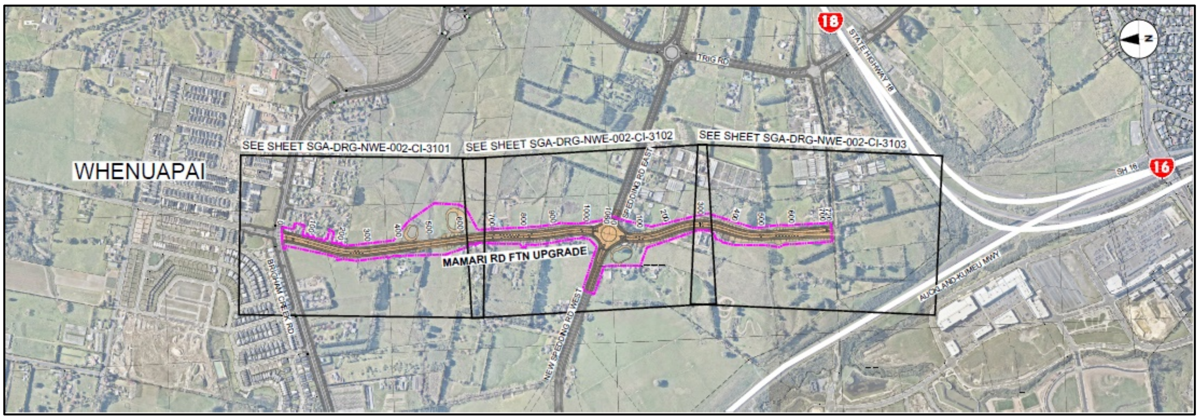


Figure 15: Plan of Mamari Rd Local Network footprint (Supplied by Client)

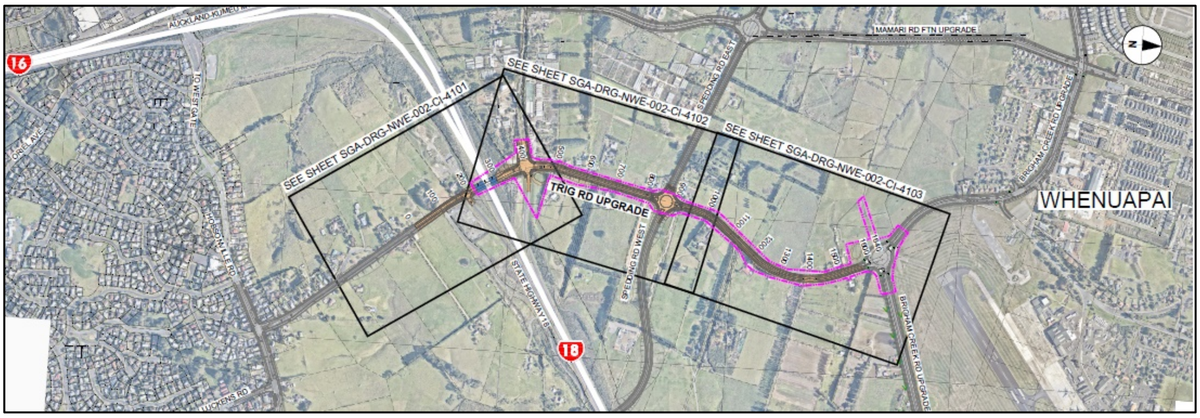


Figure 16: Plan of Trig Rd Local Network footprint (Supplied by Client)

Figure 17: Plan of Trig Rd Corridor footprint (Supplied by Client)

3.0 Aims and Objectives

The aim of this CIA report is to document Te Kawerau ā Maki's cultural values, interests, and associations with the Site; identify specific cultural sites and resources; assess the values of these sites and resources; identify the potential impacts that arise from project activities and assess the significance of effect; and provide recommendations as to how to avoid, remedy or mitigate the potential effects to Te Kawerau ā Maki.

This impact assessment will:

- provide a baseline of known environmental or natural features and resources that may hold cultural values;
- provide a statement of cultural association Te Kawerau ā Maki has with the Site and Study Area;
- identify any known cultural sites and resources within the Site or Study Area;
- describe the value or significance of such sites and resources;
- identify the potential for unrecorded cultural sites (i.e. buried Māori archaeology);
- identify the cultural constraints and risks associated with the Site and the potential significance of effects; and
- provide recommendations for further assessment where necessary and/or measures to avoid, remedy or mitigate adverse effects upon Te Kawerau ā Maki.

4.0 Statutory Context

Te Tiriti o Waitangi

The key guiding document in any consideration of planning or practice that may impact upon the cultural values or wellbeing of Mana Whenua is Te Tiriti o Waitangi. The principles of the Treaty are recognised and provided for in the sustainable management of ancestral lands, water, air, coastal sites, wāhi tapu and other taonga, and natural and physical resources. The Treaty is articulated in law through an evolving set of principles. These include:

a. reciprocity
b. rangatiratanga
c. partnership
d. shared decision-making
e. active protection
f. mutual benefit
g. right of development
h. redress.

While Article 1 of the Treaty enables the Crown to govern and make laws, Article 2 guarantees Māori rangatiratanga over their people, lands and taonga (things of value). Māori values, associations and interests with their taonga applies regardless of property titles or other constructs, and the Treaty requires that the Crown actively protect these associations and interests (including through but not limited to statutes). Article 3 provides for equality and equity of citizenship and outcome.

Te Kawerau ā Maki Claims Settlement Act 2015

Te Kawerau ā Maki Claims Settlement Act (TKaMCSA) records the acknowledgements and apology given by the Crown to Te Kawerau ā Maki for historic grievances and breaches of Te Tiriti ō Waitangi and gives effect to provisions of the Deed of Settlement that settles the historical claims of Te Kawerau ā Maki. The Act binds the Crown to Te Kawerau ā Maki to work together in accordance with Te Tiriti. The Settlement as delivered through the Act provided both cultural and commercial redress to Te Kawerau ā Maki. This includes binding protocols between Government Ministries and Te Kawerau ā Maki (Part 2, s21 to s26), a recognised and agreed area of interest (Part 1, s12(2b), Part 1 of attachments to Act), and statutory acknowledgements and deeds of recognition (Part 2, s27 to s40, and Schedule 1).

Statutory acknowledgements require relevant consent authorities, the Environment Court, and Heritage New Zealand Pouhere Taonga to: (a) have regard to the statutory acknowledgement; (b) require relevant consent authorities to record the statutory acknowledgement on statutory plans and to provide summaries of resource consent applications or copies of notices of applications to the trustees; and (c) enable the trustees and any member of Te Kawerau ā Maki to cite the statutory acknowledgement as evidence of the association of Te Kawerau ā Maki with a statutory area. The statutory acknowledgement supports Te Kawerau ā Maki trustees being considered as affected persons in relation to an activity within the area under s95E and s274 of the Resource Management Act (1991), and s59(1) and 64(1) of the Heritage New Zealand Pouhere Taonga Act (2014).

Te Kawerau ā Maki Statutory Acknowledgement Areas are:

- Taumaihi (part of Te Henga Recreation Reserve)
- Motutara Settlement Scenic Reserve and Goldie Bush Scenic Reserve
- Swanson Conservation Area
- Henderson Valley Scenic Reserve

- Coastal statutory acknowledgement
- Waitākere River and tributaries
- Kumeū River and tributaries
- Rangitōpuni Stream and tributaries
- Te Wai-ō-Pareira / Henderson Creek and tributaries
- Motutara Domain (part of Muriwai Beach Domain Recreation Reserve)
- Whatipū Scientific Reserve

Heritage New Zealand Pouhere Taonga Act 2014

Statutory protection of Māori archaeology and wāhi tapu is provided for under the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA), which is administered by Heritage New Zealand Pouhere Taonga (HNZPT), an autonomous Crown Entity. Under the Act all *in situ* materials, sites, and features older than 1900AD are considered archaeological sites whether previously recorded or not and are afforded automatic protection from damage, modification, or destruction without first obtaining an Archaeological Authority from HNZPT. Moveable objects and artefacts that are not *in situ* but that are from an archaeological context, or are of Māori origin, are controlled under the Protected Objects Act (1975). The HNZ Act S45(2)b stipulates that works on sites of interest to Māori can only occur if (a) the practitioners can demonstrate they have the requisite competencies for recognising and respecting Māori values, and (b) the practitioners undertaking the works have access to appropriate cultural support. Under the Act Mana Whenua are enabled to provide advice or assessment regarding the management or decision taking arising from impacts to their cultural sites, provided these meet the Act's criteria. It is noted that Te Kawerau ā Maki never ceded our sovereignty to govern our taonga to HNZPT and view the HNZPTA as overstepping its authority or role as the decision-maker over the taonga of Te Kawerau ā Maki, thus being in direct breach of Article II of Te Tiriti ō Waitangi.

Resource Management Act 1991

The Resource Management Act (RMA) 1991 provides statutory recognition of the Treaty of Waitangi and the principles derived from the Treaty. It introduces the Māori resource management system via the recognition of kaitiakitanga and tino rangatiratanga and accords Territorial Local Authorities with the power to delegate authority to iwi over relevant resource management decisions. The Act contains over 30 sections, which require Councils to consider matters of importance to tangata whenua. Some of the most important of these are:

- Take into account principles of the Treaty of Waitangi and their application to the management of resources (Section 8).
- Recognition and provision for, as a matter of national importance, the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga (Section 6(e)).
- Having particular regard to the exercise of kaitiakitanga or the iwi's exercise of guardianship over resources (Section 7(a)).
- Requiring the Minister for the Environment to consider input from an iwi/hapū authority when preparing a national policy statement (Section 46).
- The ability for local authorities to transfer their functions, powers or duties under the Act to iwi authorities (Section 33).
- Development of joint management agreements between councils and iwi/hapū authorities (Section 36B to 36E).
- Having regard to any relevant planning document recognised by an iwi/hapū authority (sections 35A(b), 61.2A(a), 66.2A(a), 74.2A).
- The obligation to consult with iwi/hapū over consents, policies and plans. (Combination of all the sections above and Clause 3(1)(d) of Part 1 of the first schedule of the Resource Management Act).

An assessment of impacts on cultural values and interests (CIA) can assist both applicants and the council in meeting statutory obligations in a number of ways, including:

- preparation of an Assessment of Environmental Effects (AEE) in accordance with s88(2)(b) and Schedule 4 of the Resource Management Act 1991 (RMA)
- requests for further information under s92 of the RMA in order to assess the application
- providing information to assist the council in determining notification status under ss95 to 95F of the RMA
- providing information to enable appropriate consideration of the relevant Part II matters when making a decision on an application for resource consent under s104 of the RMA, or when undertaking a plan change
- consideration of appropriate conditions of resource consent under s108 of the RMA.

It is noted that Te Kawerau ā Maki never ceded our sovereignty to govern our taonga to local authorities and view the RMA as enabling councils to overstep their authority or role as the decision-maker over the taonga of Te Kawerau ā Maki, thus being in direct breach of Article II of Te Tiriti ō Waitangi.

Reserves Act 1977 and Conservation Act 1987

Section 4 of the Conservation Act, which is invoked by the Reserves Act, states that the Act must be interpreted and administered as to give effect to the principles of the Treaty of Waitangi.

Public Works Act 1981

The PWA and its predecessor legislation have had a considerable negative impact upon Māori amounting to a breach of Te Tiriti Article II and international conventions. Te Kawerau ā Maki's last kāinga at Kōpironui was stolen by the Crown under the PWA in the 1950s leaving our people landless. While tacit protections for Māori land have been inserted into the PWA it remains a deeply problematic piece of legislation, both in terms of acquisition of land but also disposal of 'formerly' Māori land, that is not compliant with Te Tiriti o Waitangi or tikanga Māori.

5.0 Planning Policy Context

UN Declaration on the Rights of Indigenous Peoples

New Zealand supported the UN Declaration on the Rights of Indigenous Peoples (2007) in 2010. This support was an affirmation of fundamental rights and the aspirations of the Declaration. Article 11 states that indigenous peoples have the right to practise and revitalise their cultural traditions and customs, including the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts, designs, ceremonies, technologies and visual and performing arts and literature (clause 1). States shall provide redress through effective instruments, which may include restitution, developed in conjunction with indigenous peoples, with respect to their cultural, intellectual, religious and spiritual property taken without their free, prior and informed consent or in violation of their laws, traditions and customs. (clause 2). Article 18 and 31 note that indigenous peoples have the right to participate in decision-making in matters which would affect their rights, through representatives chosen by themselves in accordance with their own procedures, as well as to maintain and develop their own indigenous decision-making institutions. Further that Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge,
and traditional cultural expressions.

ICOMOS New Zealand Charter 2010

The International Council on Monuments and Sites (ICOMOS) is UNESCOs principal advisor in matters concerning the conservation and protection of historic monuments and sites and advises the World Heritage Committee on the administration of the World Heritage Convention (which includes provision of nationally significant heritage). The New Zealand National Committee (ICOMOS NZ) produced a New Zealand Charter in 2010 which has been adopted as a standard reference document by councils. The Charter sets out conservation purposes, principles, processes and practice. The scope covers tangible and intangible heritage, the settings of heritage, and cultural landscapes. Of particular relevance the Charter states that tangata whenua kaitiakitanga over their taonga extends beyond current legal ownership wherever such cultural heritage exists. The Charter also states that the conservation of Māori heritage requires incorporation of mātauranga and therefore is conditional on decisions made in association with tangata whenua and should procced only in this context.

National Policy Statement for Freshwater Management 2020

The NPS for freshwater management provides national policy settings that relevant statutory agencies including local authorities must comply with. Central to the NPS is the concept of Te Mana ō Te Wai set out in s1.3. This is an aspirational concept that means that the integrity (physical and spiritual) of all water is upheld to its highest possible quality or state. The Crown's interpretation of the concept is that the fundamental importance of water is recognised and that by protecting the health of freshwater we protect the health and well-being of the wider environment, including by protecting wai mauri, and the restoration of the balance between water, the environment, and communities. It provides six principles for the management of water (s1.3(4)). Relevant to tangata whenua are: (a) Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater; (b) Kaitiakitanga: the obligation of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations; (c) Manākitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others. Policy 2.2(2) states that tangata whenua are actively involved in freshwater management (including decision-making processes), and Māori freshwater values are identified and provided for. Policy 2.2(3) requires that freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments. Section 3.4 sets out how councils must actively involve tangata whenua in the management of fresh water.

Auckland Unitary Plan

At a Local Government level, the Auckland Unitary Plan (AUP) provides for the protection and management of matters of importance to Mana Whenua including the environment and cultural heritage. These matters are set out in the Regional Policy Statement Chapter B6, but are also embedded in the lower-order policies and rules throughout the Plan.

Policy B6.2.2 provides for the recognition of Treaty of Waitangi/Te Tiriti ō Waitangi partnerships and participation. This includes Policy B6.2.2(1) that provides for Mana Whenua to actively participate in the sustainable management of natural and physical resources including ancestral lands, water, sites, wāhi tapu and other taonga.

Policy B6.3.2 deals with recognising Mana Whenua values and includes clause (1) that enables Mana Whenua to identify their values associated with ancestral lands, freshwater, biodiversity, and cultural heritage places and areas, and clause (2) that requires the integration of Mana Whenua values, mātauranga and tikanga in the management of natural and physical resources within the ancestral rohe. Clause (3) ensures that any assessment of environmental effects for an activity that may affect Mana Whenua values includes an appropriate assessment of adverse effects on those values. Clause (6) of the policy requires resource management decisions to have particular regard to potential impacts on: the holistic nature of the Mana Whenua world view; the exercise of kaitiakitanga; mauri; customary activities; sites and areas with significance spiritual or cultural heritage value; and any protected customary right under the Takutai Moana Act (2011).

Policy B6.5.2 provides for the active protection of Mana Whenua cultural heritage. Clause (2) sets out a framework for identifying and evaluating Mana Whenua cultural heritage using the assessment factors of: mauri; wāhi tapu; kōrero tūturu; rawa tūturu; hiahiatanga tūturu; and whakaaronui o te wā. Clause (4) requires the protection of places and areas listed in Schedule 12 Sites and Places of Signifiance to Mana Whenua from adverse effects. Clause (7) provides for the inclusion of a Māori cultural assessment in structure planning and plan change processes, and clause (9) encourages appropriate design, materials and techniques for infrastructure in areas of known historic settlement and occupation.

Iwi Management Plan

Te Kawerau ā Maki Resource Management Statement (1995) was lodged with Council explicitly as an iwi authority planning document under sections 66(c) and 74(b) of the RMA 1991 (since repealed). The IMP describes the continuing role of Te Kawerau ā Maki as kaitiaki (guardians) and provides policies to guide statutory authorities and applicants. Policy 2.2(2) promotes the integration of Te Kawerau ā Maki tikanga in resource management, while clause (3) requires engagement by all agencies within the rohe to help give effect to the kaitiaki role of the iwi. Policy 4.1.2(3) requires that cumulative effects upon Te Kawerau ā Maki are fully recognised and provided for. Policy 4.2.2 concerns Te Kawerau ā Maki cultural heritage and requires the protection of all heritage sites including access requirements (s4.2.2(1)); the involvement of Te Kawerau ā Maki in all instances where potential effects may arise (s4.2.2(2)); and the recognition of Te Kawerau ā Maki cultural and spiritual values (s4.2.2(3 and 4)). Policy 4.3.2 concerns the management of kōiwi, while s4.4.2 regards the management of water. Activities in the Coastal Marine Area are covered by s4.5.2. Waste management policies are described in s4.6.2 and land and landscape policies are set out in s4.7.2. Indigenous flora and fauna policy settings are described in s.4.8.2 including opposition to all destruction of native flora and fauna without Te Kawerau ā Maki written consent. Policy 4.9.2 concerns Te Kawerau ā Maki participation in design of the built environment and interpretation of heritage. The IMP also details formal support and adoption of the 1993 Matātua Declaration on cultural and intellectual property rights of indigenous peoples.

6.0 Te Ao Māori

Our worldview is the framework by which we understand and navigate our physical and metaphysical environment. A full account of the cosmological underpinnings of Te Ao Māori is not offered here but in brief it recognises both the spiritual and the physical, is guided by different domains governed by atua or distinct spiritual entities, and involves several core concepts including whakapapa, mana, wairua, mauri, tapu, and noa. Te Ao Māori places emphasis on the holistic link between people and the environment. Mātauranga is the knowledge or wisdom about the world developed over generations and passed down from tūpuna, while tikanga is the evolving set of principles and customary practices by which Māori give effect to this knowledge to navigate the world safely.

Papatūānuku

The primordial goddess embodying the whenua or land. She is the earthmother to all living things. This whakapapa is one of the reasons why whenua is the name for placenta as well as land, and why in Te Ao Māori tangata whenua belong to the whenua and not the other way around. Papatūānuku is a source of rejuvenation and life.

Ranginui

The primordial god embodying the sky or heavens. He is the skyfather to all living things. When he was separated from his wife Papatūānuku by their children, his tears became the rain which is considered tapu until it reaches the ground (wai Māori).

Tūmatauenga

The god of war and human activities and a progenitor of humanity.

Tāwhirimātea

The god of weather including thunder, lightning, wind, clouds and storms. He was opposed to the forced separation of his parents Papatūānuku and Ranginui and therefore he wars with his brothers and their descendants to this day.

Tāne

The god of forests and animals and an originator and protector of humans. Responsible for separating the embrace of his parents and ushering in Te Ao Marama (the age of light).

Tangaroa

The god of the sea, lakes, rivers and animals that live in them. There is a close and sometimes contentious relationship between Tangaroa and Tāne reflected in creatures such as reptiles and whales and in the dynamic between the sea and the coastline.

Rongo

The god of cultivated plants and agriculture also associated with peace.

Haumia-tiketike

The god of uncultivated plants and wild foraging.

Matā-oho

The local god of volcanic activity and earthquakes that formed the Tāmaki volcanic field.

Whakapapa

The sacred genealogy linking all things. Humans whakapapa not only to human tūpuna (ancestors), but also to the whenua, atua and their respective lineages. All indigenous animals and plants have an interconnected whakapapa. Whakapapa is a prerequisite of mana whenua, whānaungatanga, and kaitiakitanga.

Mana

A core metaphysical concept regarding the inherent authority or power of people, places or objects. Mana is derived or delegated from atua and, in the case of humans, is both inherited and earned through actions. Everything including people has an element or degree of mana. A person or tribe's mana can increase or decrease depending on the success, failure or nature of actions (or inactions) and is directly tied to their wellbeing. Undertaking the responsibilities of manakitanga and kaitiakitanga successfully are examples of maintaining or enhancing mana and contribute to cementing mana whenua.

Tapu

A core metaphysical concept regarding a state or degree of sacredness, prohibition, being set apart or forbidden. Tapu is a state where a person, place or thing is under the protection of or dedicated to an atua and is thus removed from profane or normal or common things and uses. Tapu is closely linked to mana and governs the behaviour of individuals and the wider society. Everything including people has an element or degree of tapu that must be preserved and respected. It is a priority of rangatira, tohunga and kaitiaki to maintain tapu and to ensure it is not diluted by common things. As with mana, the maintenance of tapu is directly linked to the wellbeing of both individuals and the tribe.

Noa

A core metaphysical concept regarding a normal or common (and sometimes profane) state that is in essence the opposite of tapu. Noa actions and things (whakanoa) can dilute tapu.

Wairua

A core metaphysical concept regarding the immortal spiritual or non-physical element of people, places or things.

Mauri

A core metaphysical concept regarding the essence that binds the physical and the spiritual together to enable life to exist and to thrive. Mauri is a sacred element and can be weakened or enhanced. When damaged or diluted the binding between the physical and the spiritual realms is weakened and life begins to falter and fail. It is the sacred obligation of mana whenua, through the act of kaitiakitanga, to maintain the balance of mauri within people, places, objects, ecosystems, and the hapū or iwi.

Mātauranga

The body of knowledge or customary wisdom and skill embedded within the tohunga, whānau, hapū and iwi. Mātauranga is passed down the generations from tūpuna but is also added onto through successive generations of uri, and culturally encodes hundreds of years of observations, measurements, theory, and custom regarding Te Ao Māori and the environment.

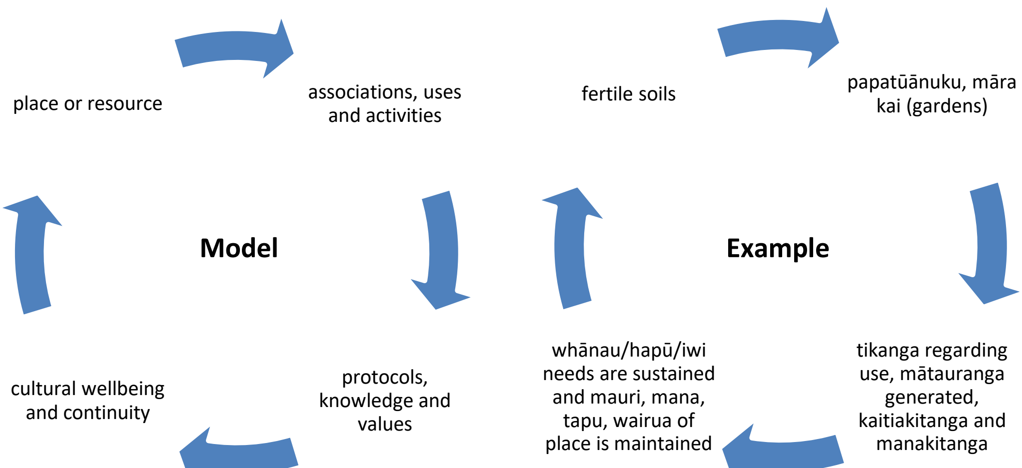
Tikanga

The lore, customs, practices, protocols, rules and methods that give effect to the application of mātauranga in navigating the natural and social world. There are different tikanga for different contexts and in different domains.

Cultural Values

Cultural values are the shared norms that govern the continuation of culture and provide the framework for social and individual actions. Key values include: rangatiratanga (chiefly authority or self-governorship), whānaungatanga (kinship and reciprocal connection through shared whakapapa), wairuatanga (spirituality), manakitanga (hospitality and showing care), and kaitiakitangata (guardianship or stewardship).

A model of how cultural values function is provided below.



7.0 Scoping and Consultation

The Study Area comprises a 4000m radius from the Site (from any point along its corridor). This radius is considered appropriate given the large scale of the Site and the presence of heritage sites within the catchment that could have setting or indirect impacts. Within this area all appropriate and known cultural sites, areas, landscapes and resources have been identified. Te Kawerau ā Maki however reserve the right to withhold certain information regarding wāhi tapu or sites that are culturally and spiritually sensitive to the iwi.

This report includes all known or appropriate-to-report elements of the natural and cultural environment within the Site and Study Area considered to hold cultural value for Te Kawerau ā Maki. This information forms the baseline of the assessment. This includes native biodiversity and ecology, geological and topographic features, natural resources including water bodies, built heritage such as marae, socio-cultural features such as papakāinga, cultural landscapes, historic or cultural sites, Māori archaeological sites, pou whenua and significant cultural public art.

Mātauranga/cultural knowledge of the Site and Study Area has been obtained, where appropriate, from Te Kawerau ā Maki kaumatua, kuia and other holders of knowledge within the iwi. Readily available published and unpublished written records, illustrations, maps, archaeological and geological records were reviewed during preparation of this cultural assessment. Spatially referenced heritage asset data was reviewed from the Auckland Council Cultural Heritage Inventory (CHI) and the New Zealand Archaeological Association (NZAA) recording scheme database (ArchSite). Other information, reports, and impact assessments available for the Site that have been provided by the Client have been reviewed including: engineering and design drawings of the route and a summary analysis of impacts identified from other disciplines. The opinions contained within this document may change and/or develop as new information is released.

This Cultural Impact Assessment involved a desktop study based on review of technical information, cultural knowledge of the area, and research, as well as site visits along the corridor to assess and confirm site conditions.

8.0 Assessment Approach

Following standard Environmental Impact Assessment (EIA) methodologies and planning terminology, but adapted for CIA purposes, this report will:

a. **Identify** the cultural sites, areas and resources (defined as both tangible and intangible cultural heritage, natural resources of cultural interest, and socio-cultural features) within a Study Area encompassing the proposed Site and a wider area that may be directly or indirectly impacted. The Study Area is defined as approximately 4000m radius of the Site to correspond with a likely area of setting impacts (e.g. noise, visual), indirect impacts, and a logical catchment of the cultural landscape.

b. Provide comment on the cultural **value** of the identified cultural sites, areas and resources. Māori cultural value is not derived from national or local policy but is defined and determined by tangata whenua and their particular world view and culture. Māori values are distinct from historic, archaeological or other value-systems, and are recognised by the courts and statute as their own legitimate knowledge-system with tangata whenua being the experts. Māori values are informed by whakapapa and guided by tikanga and kawa, with emphasis placed on the associative and living connection to places and resources which sustain cultural knowledge (mātauranga), practices, and spiritual and physical wellbeing. All cultural sites, areas and resources are of value to Te Kawerau ā Maki, who hold a holistic view of the environment and the unique relationship of the iwi to the whenua. It is difficult to apply a Western paradigm of value hierarchy or significance ranking (i.e. ‘low, medium, high’) when using a Te Ao Māori lens. Nevertheless, the methodology here attempts to distinguish the relative importance of matters as determined by a number of criteria, including the degree of mana, tapu or mauri, the degree to which a resource has specific kōrero or mātauranga, its sensitivity to changes (ability to absorb impacts), and its relative scarcity. This approach recognises that a matters' value is intrinsic but relative to context. This approach is supported by RMA Part II matters noting the relationship of tangata whenua with their lands, waters, and taonga as nationally significant. The approach is set out below:

- high: cultural sites/areas/resources that retain their integrity overall, are either rare or are common but hold specific customary uses or mātauranga, are considered a wāhi tohu or landscape indicator, or have a high sensitivity to change.
- medium: cultural sites/areas/resources that retain the key elements of their integrity, are either uncommon or are common but hold specific customary uses or mātauranga, or have a moderate sensitivity to change.
- low: cultural sites/areas/resources that have been significantly degraded or damaged, are common and do not hold specific current customary uses or mātauranga, or have a low sensitivity to change.

Value is also assigned against the cultural values identified in the AUP Policy B6.5.2(2):

i. Mauri: the mauri (life force and life-supporting capacity) and mana (integrity) of the place or resource holds special significance to Mana Whenua;
ii. Wāhi Tapu: the place or resource is a wāhi tapu of special, cultural, historic, metaphysical and or spiritual importance to Mana Whenua;
iii. Kōrero Tūturu: The place has special historical and cultural significance to Mana Whenua;
iv. Rawa Tūturu: the place provides important customary resources for Mana Whenua
v. Hiahiatanga Tūturu: the place or resource is a repository for Mana Whenua cultural and spiritual values; and
vi. Whakaaronui o te Wa: the place has special amenity, architectural or educational significance to Mana Whenua.

c. Identify the potential **impacts** to cultural resources and elements. Only Mana Whenua can define the impact to their cultural values, but guidance is noted below. Cultural impacts can be:

- no change
- negligible: changes result in small impacts on integrity of the site/area/resource such that their function is reduced but not notably diminished, ability to understand/appreciate/use/access is impacted to a inconsequential degree, the ability to interpret the cultural landscape or setting is impacted but the change can easily be absorbed.
- minor: changes result in small impacts on integrity of the site/area/resource such that their function is reduced but not significantly diminished, ability to understand/appreciate/use/access is impacted to a small degree, the ability to interpret the cultural landscape or setting is impacted to a small degree or change can otherwise be largely absorbed.
- moderate: changes result in appreciable/significant impacts on the integrity of the site/area/resource such that their function is impeded, ability to understand/appreciate/use/access is impacted to a notable degree, the ability to interpret the cultural landscape or setting is impacted to a notable degree or change can otherwise not be absorbed.
- major: changes result in large scale/total impacts on the integrity of the site/area/resource such that their function is effectively destroyed, ability to understand/appreciate/use/access is impacted to a significant degree/is no longer possible, the ability to interpret the cultural landscape or setting is impacted to a significant degree or change can otherwise not be absorbed and the landscape or setting is no longer recognisable/able to function.

Impacts can be either adverse or beneficial. Impacts can also be temporary or permanent. They can occur during the construction or the operational phase of a development. Impacts can be:

i. direct (i.e. physical impacts resulting from a development, impacts to the settings of cultural sites or the character of cultural landscapes, visual, noise, odour, or culturally inappropriate land use activities).
ii. indirect (i.e. traffic congestion, erosion due to vegetation loss, or other secondary impacts that occur over time or in a secondary location to the original activity).
iii. cumulative (i.e. impacts which are caused by the combined result of past, current and future activities, or in-combination impacts).

d. Define the **significance of effect** resulting from combining the value of a cultural site, area or resource and the level of potential impact to that site, area or resource. Significance of effect is assessed pre-mitigation but can also be assessed again post-mitigation to ascertain the *residual effect* and effectiveness of any proposed mitigation. Significant effects (within a planning framework) are those with moderate or large effects (either adverse or beneficial). This method is outlined below in Table 1. Note that positive effects will be coloured green.

Table 1: Significance of effect

		LEVEL OF IMPACT				
		No Change	Negligible	Minor	Moderate	Major
CULTURAL VALUE	High	Neutral	Minor	Moderate	Large	Large
	Medium	Neutral	Negligible	Minor	Moderate	Large
	Low	Neutral	Negligible	Negligible	Minor	Moderate

9.0 Assumptions and Limitations

Te Kawerau ā Maki are the experts of our own culture and tikanga. This expertise and the equal weighting of mātauranga Māori evidence is accepted in the courts and by statute. Through a necessity to work within a Western planning framework we utilise planning language where possible to aid in mutual understanding, however there is difficulty in the translation and application of some core cultural concepts to such a framework. This is particularly an issue when segmenting or demarcating value spatially, when ascribing a type of significance hierarchy, and when limiting value to tangible elements, whereas Māori hold a holistic perspective that operates differently to typical Western paradigms. This means that where there is doubt or confusion over a term or point of discussion, readers should contact Te Kawerau ā Maki directly for clarification.

Due to the sensitive nature of certain cultural knowledge, areas and sites (e.g. burial grounds), Te Kawerau ā Maki reserves the right not to identify the exact spatial extents or provide full information of such areas to retain and protect this knowledge within the iwi. In other situations, while a general area may be known to be of cultural significance the exact spatial extent or location of the site may have been lost over successive generations. Where possible and appropriate, sites are described and defined to enable discussion of the impacts while acknowledging these limitations.

The environmental and archaeological data relied upon for elements of this report are derived from secondary sources and it is assumed the data and opinions within these and other secondary sources is reasonably accurate.

The CHI and ArchSite databases are a record of known archaeological and historic sites. They are not an exhaustive record of all surviving historic or cultural sites and resources and do not preclude the existence of further sites which are unknown at present. The databases also utilise a site location point co-ordinate system rather than detailing site extents or cultural landscapes.

ENVIRONMENTAL BASELINE

10.0 Topography and Geology

The Site is situated across the alluvial plains of the Kumeū River and Upper Waitematā Harbour, which crosses a number of underlying geological substrata. Near the mid-point of the network near Westgate this includes Waitematā Group East Coast Bays Formation being of "*Alternating sandstone and mudstone with variable volcanic content and interbedded volcaniclastic grits.*" Near Whenuapai and Riverhead the underlying geology is of Late Pliocene to Middle Pleistocene pumiceous river deposits being of "*Pumiceous mud, sand and gravel with muddy peat and lignite: rhyolite pumice, including non-welded ignimbrite, tephra and alluvia*." Within the Kumeū basin the underlying geology is Holocene river deposits consisting of "*Sand, silt mud and clay with local gravel and peat beds.*" Near Waimauku and Huapai the underlying geology is Tauranga Group Middle Pleistocene - Late Pleistocene river and hill slope deposits being "*Predominantly pumiceous sand, silt, mud and clay, with interbedded gravel and peat.*"

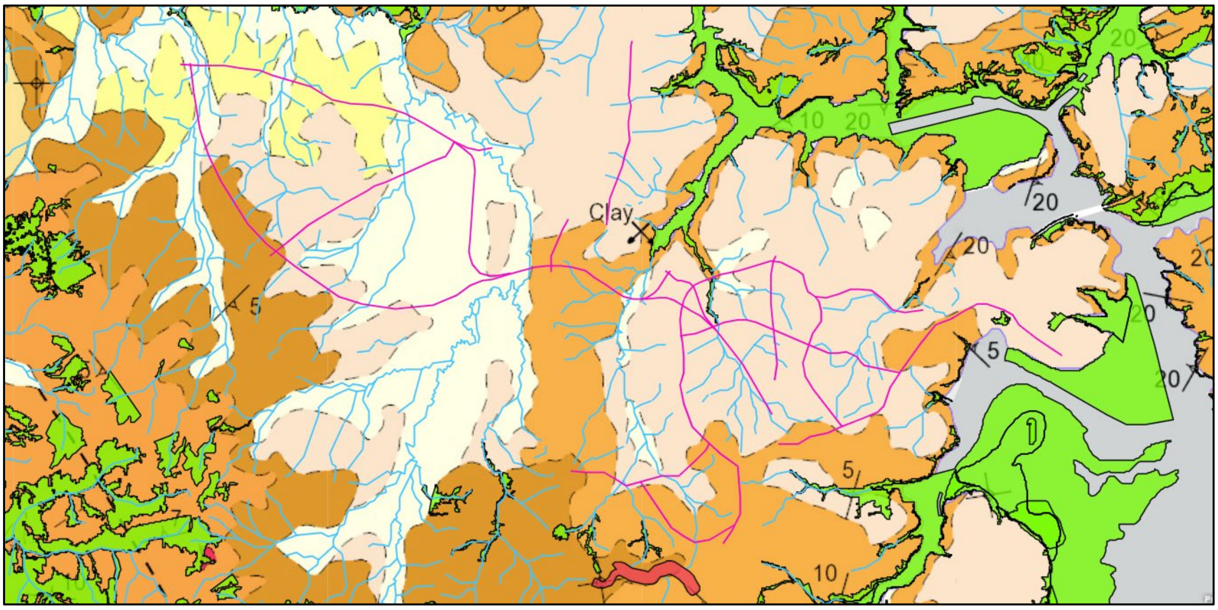


Figure 18: Map showing the underlying geology of the Study Area (adapted from GNS Science)

While all whenua is associated with Papatūānuku, alluvial soils are particularly valued due to their unique composition and higher organic content making them highly productive for horticulture, and thus containing a strong sense of mauri. The Land-Use Capability of these alluvial soils ranges from 1 (negligible limitations to horticulture) to 3 (moderate limitations to horticulture) meaning they are of very high productive quality, and in fact the largest area of high quality horticultural soils in northern Auckland.

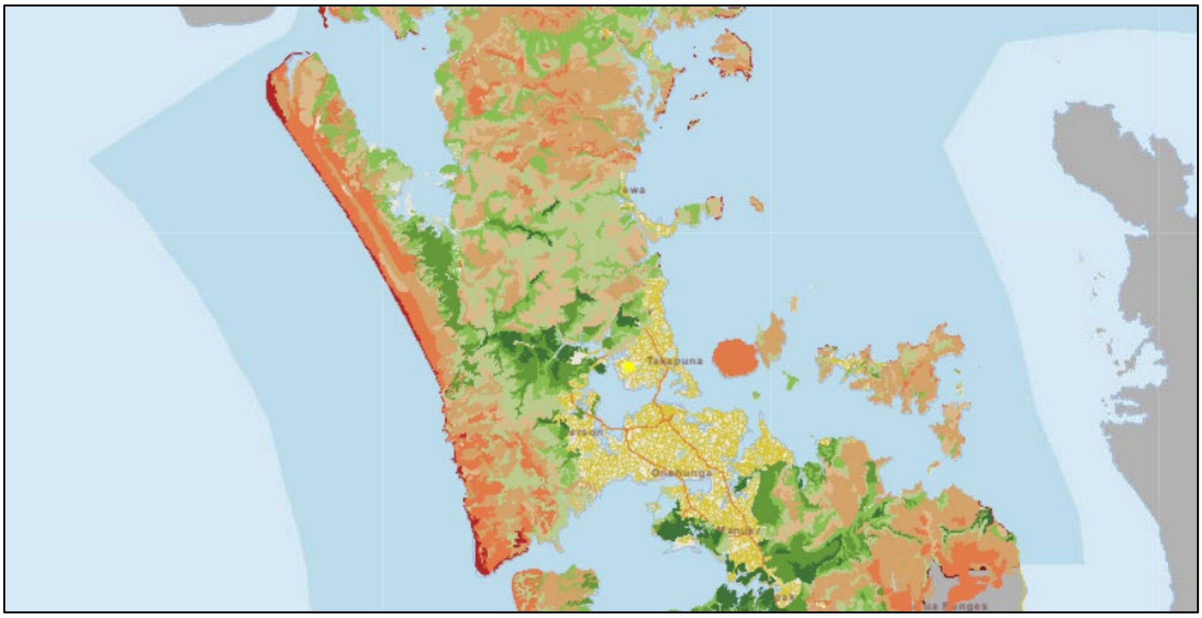


Figure 19: Land-use capability map showing high productivity within the Study Area (from Auckland Council)

The topography of the Site is low-lying alluvial plains for the most part, with steeper terrain to the south along the Waitakēre Ranges and to the north along the Riverhead hillcountry. The major drainage catchment is the Kumeū River but the Site also drains to Te Wai Roa ō Kahu (Upper Waitematā Harbour) and to Te Wai ō Pareira (Henderson Creek) via Manutewhau awa. The landscape is predominantly of an open rural (pasture) character but with areas of urban character at Whenuapai, Westgate, Kumeū and Huapai. There are no Outstanding Natural Features (ONFs) or Outstanding Natural Landscapes (ONLs) within or immediately adjoining the Site footprint, although ONLs are within the western part of the Study Area.

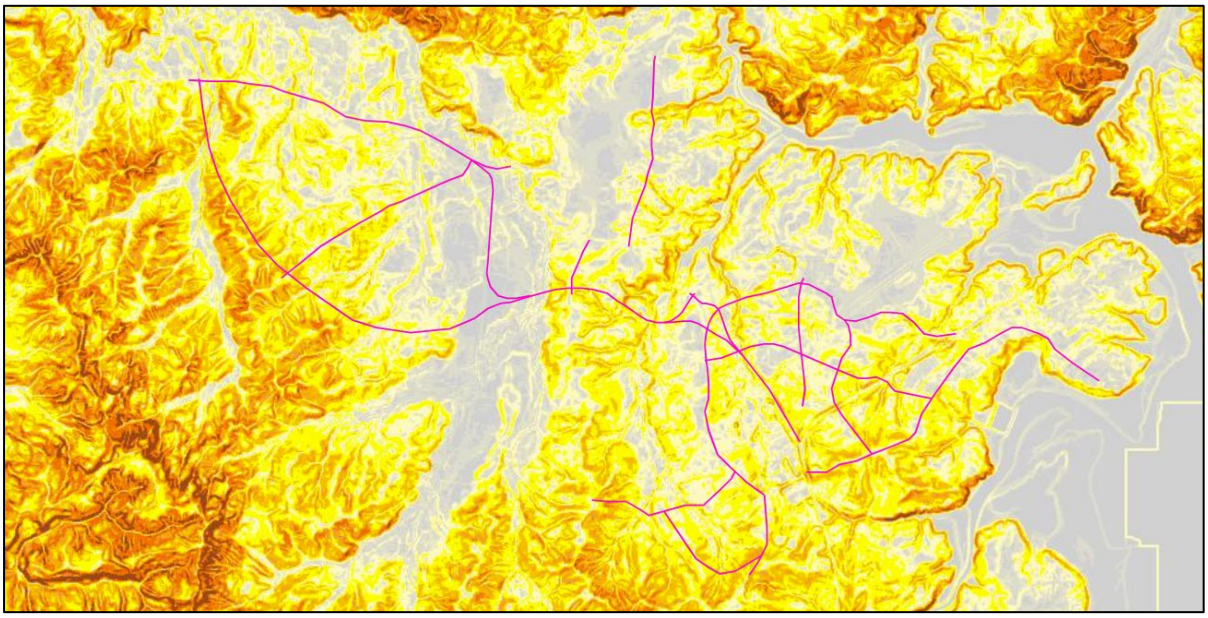


Figure 20: Map showing slope within the Study Area

11.0 Natural Resources and Ecology

Freshwater

The natural resources and ecology of the wider Study Area include significant freshwater ecosystems and habitat. This includes Te Waitematā, Te Wai ō Pareira (Henderson Creek), Wai Whauwhaupaku (Swanson Stream), Manutewhau awa (Massey-West Harbour), Wai huruhuru manawa (Massey), Wai Totora (Westgate), Wai Whakataratara (Westgate), Ngongetepara awa (Westgate-Whenuapai), Waiteputa (Westgate-Massey West), Taketakemanu awa (Westgate-Taupaki), Rawawaru (Whenuapai), Te Waiarohia ō Ngariki (Whenuapai), Pītoitoi awa (Brigham Creek), Te Wai Roa ō Kahu (Upper Waitematā Harbour), Rangitōpuni awa (Riverhead), Pakinui awa (Taupaki), Te Awa Kumeū, Ahukāramuramu awa (Waimauku), Waikoukou Awa (Waimauku), and the Te Awa Kaipara. In addition there are likely to be numerous wetland areas across the Study Area and Site. Freshwater and marine SEAs in the Study Area include SEA-M2-57b, SEA-M2-55a, and SEA-M2-56a.

The Site directly crosses a large number of (around 26 notable) rivers, streams or major tributaries most notably Te Waiarohia ō Ngariki, Wai Totora, Ngongetepara awa, Kumuū awa, and Ahukāramuramu awa.

The freshwater ecosystems within these waterways and waterbodies is not yet assessed (at the time of writing an ecological assessment was not available) but it is possible to include:

- indigenous fishes including tuna (eel), toitoi (bully), Īnanga, and kokopu
- indigenous freshwater invertebrates including mayflies, mud snails, dragonflies, freshwater mussels (kākahi), kōura (freshwater crayfish), and many others

Terrestrial

The natural resources and ecology of the wider Study Area include significant terrestrial ecosystems and habitat. This includes the Waitākere Ranges indigenous forest (Te Wao Nui ā Tiriwa) to the south and smaller pockets of vegetation Significant Ecological Area to the west and northwest. The Waitākere SEAs include old growth broadleaf and conifer forest of high biodiversity and habitat value across many endemic plant, fungi, invertebrate and vertebrate species. SEAs include: SEA_T_7036, SEA_T_2650, SEA_T_6381, SEA_T_6674, SEA_T_6743, SEA_T_2648, SEA_T_4866, and SEA_T_6540. There are also a number of scheduled trees within the Study Area and along the Site corridors including pohutakawa, kauri, rimu, tōtora, and karaka.

Generally, however the area is typified by exotic vegetation including large areas of ryegrass, kikuyu grass, and other pasture grasslands, as well as exotic trees including poplars, willow and other species but particularly pine at Riverhead.

The terrestrial ecosystems across the area are not yet assessed (at the time of writing an ecological assessment was not available) but it is possible to include:

- indigenous plants including tī kōuka, harakeke (flax), kauri, mānuka, kānuka, kahikatea, rārahu (braken fern), ponga, tōtora, rimu, pohutakawa, karaka, miro, tawa, mosses, liverworts and hornworts
- indigenous fungi including wood ear, sooty black mould, blue mushroom, and puffball
- indigenous herpetofauna including green gecko, forest gecko, copper skink, ornate skink, and although unlikely the Hochstetter's frog is found in the adjacent Waitākere Ranges

- indigenous invertebrates including earthworms (including giant North Auckland variety), wētā, grasshopper and many others

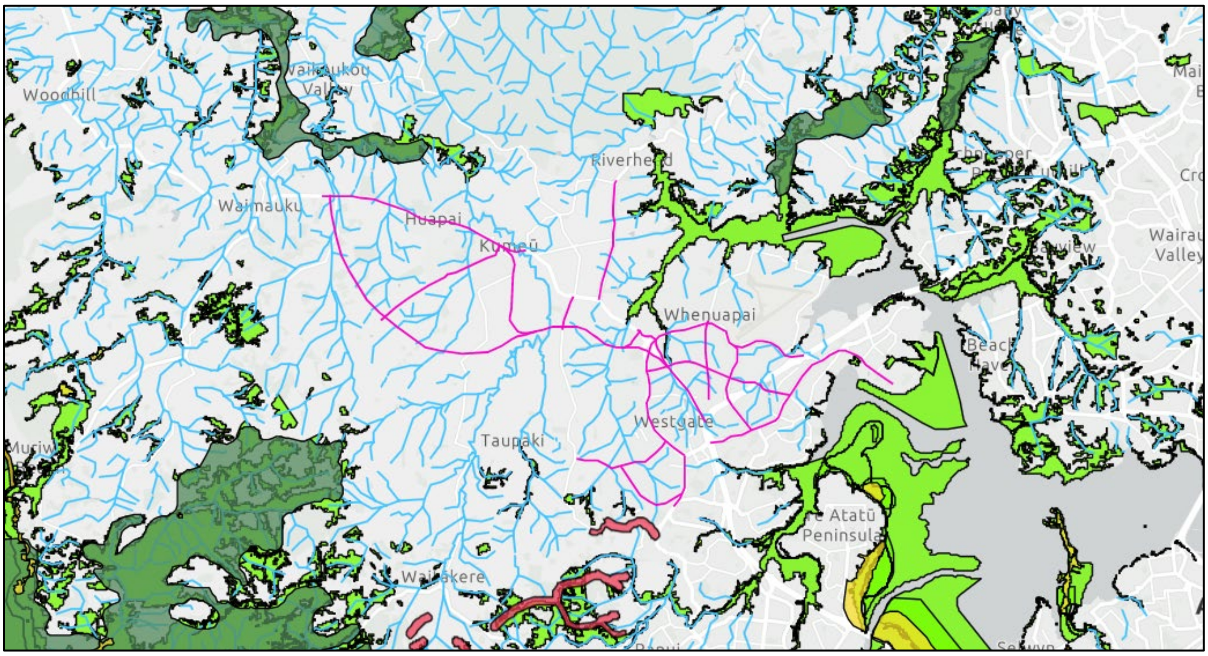


Figure 21: Map showing streams, significant ecological areas, and other natural features

Avifauna

As the Study Area covers marine, freshwater, forest, low-land plains, and hillcountry there are a wide variety of bird species as well as the native long-tailed bat (pekapeka) that interact with the area. The forested slopes of the Waitākere Ranges and Riverhead provide important roosting opportunity for bats as noted in the preliminary bat assessment carried out by the Client within a 10km radius of the Site. There are even several recordings of bats within the area we know as Ahipekapeka (west of Brigham Creek). The indigenous forest and SEAs to the south and west provide habitat for native birds such as tui, pīwakawaka, kereu, and ruru. The hillcountry and open plains provide habitat for kahu. The streams and coastal areas provide habitat for species such as tarāpuka (gull), takapu (gannet), kōtare (kingfisher), tōrea-pango (oystercatcher), poaka (stilts), pūtangitangi (paradise duck) and pūkeko. Importantly, several kawau (black shag or cormorant) have been spotted around Waimauku, Westgate, and the Upper Waitematā Harbour. The kawau is considered the kaitiaki of Te Kawerau's rohe.

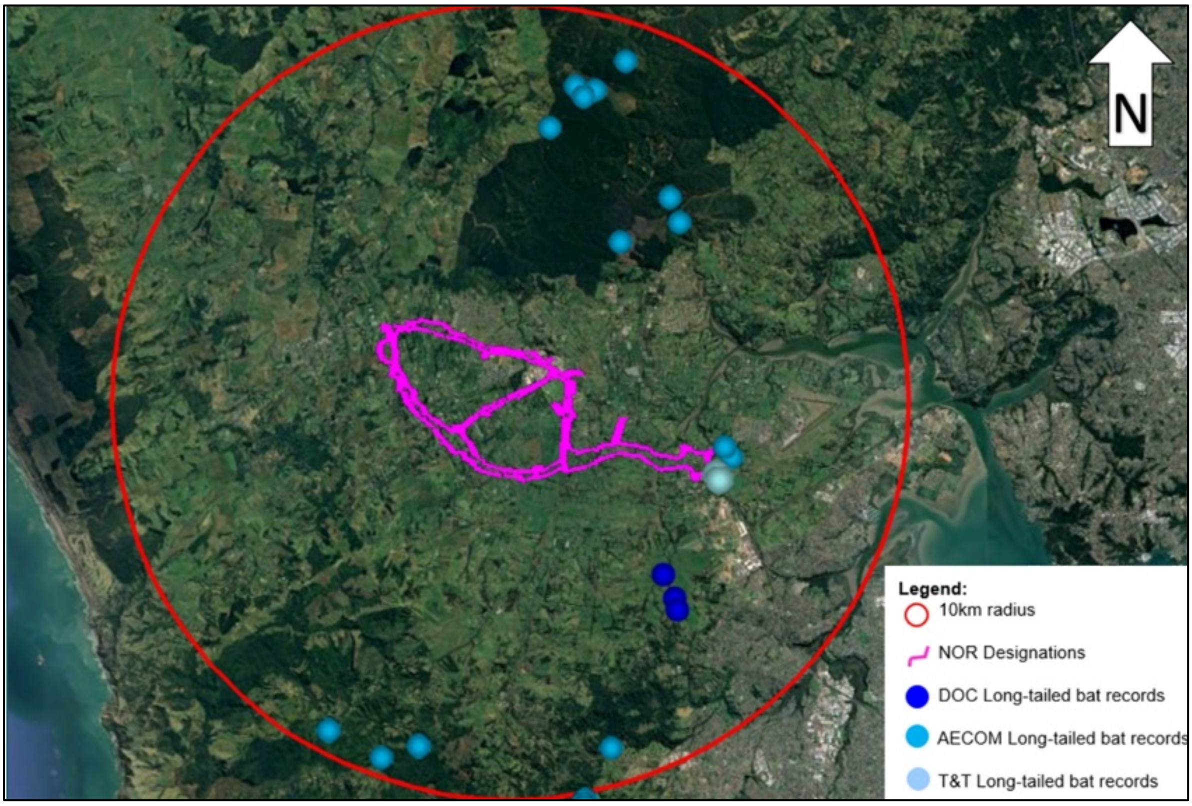


Figure 22: Map showing bat sightings within 10km of the Site (supplied by Client)


Figure 23: Image of a kawau (from NZ Birds Online)

15.0 Potential Direct Impacts

Direct impacts are likely to occur from bulk earthworks (permanent adverse), stream realignment (permanent adverse), works within a waterway (temporary and permanent adverse), construction and operational discharges to waterways (temporary and permanent adverse and beneficial), vegetation clearance (temporary and permanent adverse), noise pollution during construction of the Site network and operation of the ASH (temporary and permanent adverse), light pollution (permanent adverse), and changes to the setting of cultural sites (permanent adverse and beneficial),

16.0 Potential Indirect Impacts

Indirect impacts are likely to occur from vegetation clearance causing erosion (temporary adverse), severing habitat for terrestrial species during operation of ASH (permanent adverse), and subsequent large-scale urban intensification of the catchment enabled by the ASH (permanent adverse).

17.0 Potential Cumulative Impacts

Cumulative impacts are likely to occur from hydrological changes to the catchment (permanent adverse), net changes in stormwater contaminant discharges or quality (permanent adverse and beneficial), changes to the setting of and between wāhi tohu (permanent adverse), subsequent large-scale urban intensification of the catchment enabled by the ASH (permanent adverse), light pollution (permanent adverse), changes to the cultural landscape (permanent adverse and beneficial), and increased walking and cycling opportunities linked to human access and health and emissions (permanent beneficial).

18.0 Summary of Effects

Specific potential impacts identified as relating to the proposed project are included in Table 3 below:

Table 3: Summary of potential cultural impacts

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
Waimauku-Whenuapai Cultural Landscape	Direct, indirect and cumulative permanent adverse construction and operation impacts arising from ASH including: Built form of ASH within rural setting Changes to the setting of and between wāhi tohu (visual, artificial lighting at night, audial, aural, spiritual)	Major Adverse	Large Adverse	Urban and Landscape Design Management Plan Cut and fill batters shaped to a natural profile. Boundary fences and planting to be reinstated for partially affected properties. A planting plan, including limiting removal of noteworthy trees	Moderate Adverse direct effects but Large Adverse indirect and cumulative effects	Cultural Design Plan including funding for implementation. Scheduling (schedule 12 AUP) all identified Māori Sites of Significance within Study Area through a Private

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	Changes to the rural character necessitated through subsequent large-scale urban intensification of the catchment enabled by the ASH …………………… Potential direct permanent beneficial operation impacts arising from Local Network (Don Buck Rd, Fred Taylor Dr, Coatesville-Riverhead HWY, Brigham Creek Rd, Hobsonville Rd, New Spedding Rd, Mamari Rd, Trig Rd) and existing corridor Strategic Network (Main Rd, RTC, Access Rd) upgrades that can contribute cultural design, place naming, and walking and cycling access opportunities	………….. Potential Negligible Beneficial (Non-ASH)	……………….. Potential Minor Beneficial (Non-ASH)	and vegetation where practicable. Where practicable retaining stockpiles and reusing soil on site. Construction Noise and Vibration Management Plan. Site Specific Construction Management Schedule Pre and Post Building Condition Survey where vibration may exceed certain criteria. Road surface material, option that reduces noise at the source Best practise rail design and installation Installation of noise barriers Building modification mitigation should above mitigation not achieve desired outcome Ecological and landscape planting will help integrate the corridors with rural areas. Alongside the limited access points, the ecological and landscaping will		Plan Plan Change. Establishment of a Cultural Heritage and Offset fund and trust be established for the benefit of TKāM and NWōK with regard to the conservation, interpretation, and education regarding taonga within the Study Area. Permanent exclusion of urban intensification (Rural Zone) west of ASH and low density east of ASH (CSL Zone) RFR in favour of TKaM placed on any land within the Designation that may eventually be disposed of by NZTA

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
				create a green buffer which will reinforce rural areas and will help avoid future development in rural areas.		
Whenua (productive soils)	Direct, indirect and cumulative permanent adverse construction impacts arising from: Bulk earthworks primarily from ASH but also from the wider Strategic and Local Network Removal of regionally significant high productivity soils (mauri) necessitated through subsequent large-scale urban intensification of the catchment enabled by the ASH	Major Adverse	Large Adverse	Where practicable retaining stockpiles and reusing soil on site. Cut and fill batters shaped to a natural profile.	Large Adverse	Topsoil Conservation Plan Permanent exclusion of urban intensification (Rural Zone) west of ASH and low density east of ASH (CSL Zone)
Wai Māori (fresh water)	Direct, indirect and cumulative temporary and permanent adverse construction and operation impacts arising from: Earthworks within proximity to watercourses (particularly ASH) Vegetation clearance along watercourse embankments Significantly increased impervious area within sensitive receiving water	Moderate Adverse	Large Adverse	Construction Environmental Management Plans. Operational impacts worked through and resolved during detailed design by optimising the design of culverts and bridges and new channels to minimise flood effects upstream and downstream of crossings. Vegetated swales Stormwater wetlands	Moderate Adverse	Permanent exclusion of urban intensification (Rural Zone) west of ASH and low density east of ASH (CSL Zone)

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	environment (primarily ASH) Changes to hydrology of the catchment resulting from new roads and culverts (primarily ASH) Increased risk of operational discharges of heavy metals and other contaminants from traffic enabled by the ASH Changes to the landuse and discharge type necessitated through subsequent large-scale urban intensification (and net impervious area) of the catchment enabled by the ASH …………………… Potential direct and cumulative permanent beneficial impacts relating to the Local Network (Don Buck Rd, Fred Taylor Dr, Coatesville-Riverhead HWY, Brigham Creek Rd, Hobsonville Rd, New Spedding Rd, Mamari Rd, Trig Rd) and existing corridor Strategic Network (Main Rd, RTC, Access Rd) upgrades arising from: Improved stormwater management upgrades including swales, wetlands,	………….. Minor Beneficial (Non-ASH)	……………… Moderate Beneficial (Non-ASH)	Stormwater ponds Tree pits/rain gardens on routes with walking/cycling Use of bridges where possible (instead of culvert-reclamation systems)		

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	ponds, and tree pits/rain gardens					
Waitematā ō Kahumatamomoe	No change to low potential negligible net or cumulative adverse impact resulting from works within catchment. On balance likely neutral once up-stream mitigations in place.	Neutral	Neutral	Nil	Neutral	Nil
Te Wai Roa ō Kahu	No change to low potential negligible net or cumulative adverse impact resulting from works within catchment. On balance likely neutral once up-stream mitigations in place.	Neutral	Neutral	Nil	Neutral	Nil
Wai ō Pareira	No change to low potential negligible net or cumulative adverse impact resulting from works within catchment. On balance likely neutral once up-stream mitigations in place.	Neutral	Neutral	Nil	Neutral	Nil
Te Awa Mānutewhau	Direct temporary and permanent construction and operation adverse impact from: Upgrades to Don Buck Rd Wetland 2 occurring directly within awa Slight increase in net impervious surface	Minor Adverse	Moderate Adverse	Refer to 'Wai Māori' mitigations above	Minor Adverse	Riparian planting for 200m in both directions from impact Mauri health monitoring for 5 years
Te Waiarohia ō Ngariki	Direct and cumulative permanent construction and	Minor Adverse	Moderate Adverse	Refer to 'Wai Māori' mitigations above	Minor Adverse	Riparian planting for 200m in both

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	operation adverse impacts resulting from upgrades to southeast end of Brigham Creek Road and Trig Road upgrades from: Construction earthworks in proximity to the awa Works within the awa to install new culverts Permanent fill batter slopes adjacent to the awa Increase in impervious surface Construction of Hobsonville Rd Wetland 4					directions from impact Mauri health monitoring for 5 years
Wai Rawawaru	No change	Neutral	Neutral	Nil	Neutral	Nil
Wai Totara	Direct and cumulative permanent construction and operation adverse impacts resulting from upgrades to southeast end of Brigham Creek Road and RTC/RAMC from: Construction earthworks in proximity to the awa Permanent fill batter slopes adjacent to the awa New section of road (New Spedding Rd and RTC) and net	Minor Adverse	Moderate Adverse	Refer to 'Wai Māori' mitigations above New bridges over the span of the awa thus avoiding direct works in stream bed/banks	Minor Adverse	Cultural Design Riparian planting for 200m in both directions from impact Mauri health monitoring for 5 years

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	increase in impervious surface					
Te Awa Ngongetepara	Direct and cumulative temporary and permanent construction and operation adverse impacts resulting from upgrades to northwest end of Brigham Creek Road and from new RTC alignment from: Construction earthworks in proximity to the awa Site compound, stockpile, sediment pond, and lay-down area adjacent to awa Permanent fill batter slopes adjacent to the awa Increase in impervious surface from RTC	Minor Adverse	Moderate Adverse	Refer to 'Wai Māori' mitigations above Proposed new RTC overbridge to avoid works within stream	Minor Adverse	Cultural design Riparian planting for 200m in both directions from impact Mauri health monitoring for 5 years
Waiteputa	Direct permanent construction and operation adverse impacts resulting from the new Redhills Arterial from: Construction earthworks in proximity to the awa Permanent fill batter slopes adjacent to the awa New section of road and net increase in impervious surface	Minor Adverse	Moderate Adverse	Refer to 'Wai Māori' mitigations above Lighting design to reduce light spill, buffer planting,	Minor Adverse	Cultural Design Riparian planting for 200m in both directions from impact Mauri health monitoring for 5 years

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
Te Awa Pītoitoi	Direct and cumulative temporary and permanent construction and operation adverse impacts resulting from upgrades to northwest end of Brigham Creek Road from: Construction earthworks in proximity to the awa Site compound, stockpile, sediment pond, and lay-down area adjacent to awa Increase in impervious surface	Negligible Adverse	Minor Adverse	Refer to 'Wai Māori' mitigations above	Negligible Adverse	Riparian planting for 200m in both directions from impact Mauri health monitoring for 5 years
Te Awa Rangitōpuni	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Awa Pakinui	Direct permanent operation adverse impact to the setting of the awa and its context which will be changed with the introduction of the new RTC and bridge about 250m to the north.	Negligible Adverse	Minor Adverse	Urban and Landscape Design Management Plan	Minor Adverse	Cultural design
Te Awa Kumeū	Direct and cumulative construction and operation adverse impacts from: Works within the awa and its tributaries may impact the taniwha RTC and ASH new alignment significant earthworks in proximity to the	Major Adverse	Large Adverse	Refer to 'Wai Māori' mitigations above Proposed new RTC/ASH overbridge to avoid works within stream	Large Adverse	Avoid realignment of river Minimise earthworks in proximity Constructio n compounds set back 500m from river Cultural design

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	awa, particularly cut on east side RTC and ASH permanent fill batter slopes adjacent to the awa ASH stormwater wetland 4, 5 and 6, and Main Rd/RTC Wetland 2 in close proximity to awa RTC and ASH construction compounds in proximity to the awa Main Rd construction compound near east side of existing SH16 bridge RTC and ASH setting impacts from new bridge structures over the awa Works in awa for SH16 temporary road realignment, deconstruction of existing bridge, and construction of new bridge RTC and ASH new alignment net increase in impervious surface					Riparian planting for 500m in both directions from impact Mauri health monitoring for 5 years Establishment of a Cultural Heritage and Offset fund and trust be established for the benefit of TKāM and NWōK with regard to the conservation, interpretation, and education regarding taonga within the Study Area.
Te Awa Ahukāramuramu	Direct and cumulative permanent construction and operation adverse impacts resulting from upgrades to ASH/RTC/Main Rd from:	Minor Adverse	Moderate Adverse	Refer to 'Wai Māori' mitigations above Proposed new RTC/Main Rd bridge to avoid works within stream	Minor Adverse	Cultural Design Riparian planting for 200m in both directions from impact

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	Construction earthworks in proximity to the awa Permanent fill batter slopes adjacent to the awa Increase in impervious surface Construction of RTC/SH Wetland 10 and ASH Wetland 15					Mauri health monitoring for 5 years
Waikoukou	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Awa Kaipara	Indirect and cumulative permanent adverse impacts from up-stream discharges and unlocking further urban intensification	Minor Adverse	Moderate Adverse	Refer to ‘Wai Māori’ mitigations above	Minor Adverse	Mauri health monitoring for 5 years
Native Ngahere and Rākau	No change	Neutral	Neutral	Nil	Neutral	Nil
SEA and Rakau within or adjacent to Site Footprint	Direct permanent construction adverse impacts relating to works near Brigham Creek SEA and other native vegetation along stream corridors	Minor Adverse	Minor Adverse	A planting plan, including limiting removal of noteworthy trees and vegetation where practicable.	Neutral	Nil
Native Fungi within or adjacent to Site Footprint	Direct permanent construction adverse impacts relating to earthworks, although scale of impact unknown as no assessments	Negligible Adverse	Negligible Adverse	Nil	Negligible Adverse	Include fungi identification in ecological assessments
Native Fishes within or adjacent to Site Footprint	Direct and cumulative temporary and permanent construction and operation adverse impacts from:	Moderate Adverse	Moderate Adverse	Nil	Moderate Adverse	Fresh water ecological management plan Use of fish passage design

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	Works within waterways that could cause injury, death or displacement Realignment of Kumeū river could cause injury, death or displacement Installation of culverts Sediment and other construction discharges Increase in impervious surface and related discharges					Mauri health monitoring for 5 years
Native Invertebrates within or adjacent to Site Footprint	Direct permanent construction and operation adverse impacts relating to: Earthworks Light pollution although scale of impact unknown as no assessments	Negligible Adverse	Negligible Adverse	Nil	Negligible Adverse	Include terrestrial invertebrate identificatio n in ecological assessmen ts
Native herpetofauna within or adjacent to Site Footprint	Direct permanent construction and operation adverse impacts relating to: Earthworks that could cause injury, death or displacement, Removal of vegetation including rank grasses that could cause displacement Segmentation of the landscape/habitats	Moderate Adverse	Minor Adverse	Nil	Minor Adverse	Lizard manageme nt plan

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	by the ASH, although scale of impact unknown as no assessments					
Native Avifauna within or adjacent to Site Footprint	Direct, indirect and cumulative temporary and permanent construction and operation adverse impacts from: Removal of trees and vegetation along Site corridor leading to displacement Bird strike from ASH in proximity to Waitākere Ranges Light pollution from ASH and subsequent urban intensification Loss of open habitat for Kahu (Hawks)	Minor Adverse	Minor Adverse	Impact management for TAR birds incl. North Island fernbird, banded rail and spotless crake to be incorporated into detailed design.	Minor Adverse	Bird Manageme nt Plan Permanent exclusion of urban intensificati on (Rural Zone) west of ASH and low density east of ASH (CSL Zone)
Native Bats	Direct, indirect and cumulative temporary and permanent construction and operation adverse impacts from: Removal of trees and vegetation along Site corridor leading to displacement Light pollution from ASH and subsequent urban intensification	Minor Adverse	Minor Adverse	Bat management plan to be developed and incorporated into detailed design. Significant ecological planting to mitigate impacts on bats has been incorporated into the designation footprint. This will lead to the enhancement of riparian areas and will green much of the corridor.	Minor Adverse	Bat manageme nt plan
Nga Rau Pou ā Maki (northern ridgeline)	Direct and cumulative permanent operation adverse impacts to the setting of the	Moderate Adverse	Large Adverse	Urban and Landscape Design Management Plan	Large Adverse	Establishm ent of a Cultural Heritage fund and trust be

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	northern ranges from ASH and the subsequent urban intensification of the lands below					established for the benefit of TKāM and NWōK with regard to the conservation, interpretation, and education regarding taonga within the Study Area. Permanent exclusion of urban intensification (Rural Zone) west of ASH and low density east of ASH (CSL Zone)
Te Ara Pukewhakataratara	Direct and cumulative permanent construction adverse impacts arising from Don Buck Rd further earthworks and modification of Pukewhakataratara Ridgeline	Negligible Adverse	Minor Adverse	Nil	Minor Adverse	Cultural design plan to recognise the site
Pukewhakataratara	Direct and cumulative permanent construction adverse impacts arising from Don Buck Rd further earthworks and modification of Pukewhakataratara	Minor Adverse	Moderate Adverse	Nil	Moderate Adverse	Minimise earthworks Cultural design plan to recognise the site Enter the site in Schedule 12 as a Māori Site of Significance

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
Wai ō Pareira Kāinga	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Mānutewhau Kāīnga	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Rawawaru Kāīnga	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Ngongetepara Kāīnga	No change to negligible adverse direct and cumulative effects from earthworks and unlocking further urban intensification	Negligible Adverse	Minor Adverse	Nil	Minor Adverse	Cultural design
Te Ahipekapeka	Direct and cumulative permanent construction and operation adverse impacts arising from Coatesville-Riverhead HWY further earthworks and impervious surface	Negligible Adverse	Minor Adverse	Nil	Minor Adverse	Cultural design plan to recognise the site
Turanga ō Kawau	No change	Neutral	Neutral	Nil	Neutral	Nil
Maraeroa	No change	Neutral	Neutral	Nil	Neutral	Nil
Pītoitoi Kāīnga	No change	Neutral	Neutral	Nil	Neutral	Nil
Taurangatira	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Tōangaroa	No change	Neutral	Neutral	Nil	Neutral	Cultural design
Wai paki i rape ō Ruarangi	Direct temporary construction adverse impacts from: Main Rd construction compound near east side of existing SH16 bridge	Major Adverse	Large Adverse	Nil	Large Adverse	Cultural design

Name	Summary of impact	Level of Impact	Significance of effect	Proposed mitigation	Residual effect	Offsetting
	Main Rd/RTC Wetland 2 in close proximity to awa Works in awa for SH16 temporary road realignment, deconstruction of existing bridge, and construction of new bridge					
Tuuraki awatea	No change to negligible adverse setting and temporary down-stream impacts.	Negligible Adverse	Minor Adverse	Refer to 'Wai Māori' mitigations above	Neutral	Nil
Pukeharakeke	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Ihumatāo	No change to negligible adverse cumulative effects from unlocking further urban intensification	Neutral	Neutral	Nil	Neutral	Nil
Te Patumāhoe Kāīnga	No change	Neutral	Neutral	Nil	Neutral	Nil
Kahutōpuni	No change	Neutral	Neutral	Nil	Neutral	Nil
Te Ara Rimu	No change	Neutral	Neutral	Nil	Neutral	Nil
Waimauku	No change to negligible adverse cumulative effects from unlocking further urban intensification within a flood-prone area	Negligible Adverse	Minor Adverse	Nil	Minor Adverse	Permanent exclusion of urban intensification (Rural Zone) west of ASH and low density east of ASH (CSL Zone)
Taumata	No change to negligible adverse setting impacts.	Neutral	Neutral	Nil	Neutral	Nil
Kāhukurī	No change	Neutral	Neutral	Nil	Neutral	Nil
Treaty Settlement Land	No change	Neutral	Neutral	Nil	Neutral	Nil

Table 4: Summary of Cultural Effects

Measures	Count
Significance of Effect ::	
Neutral	25
Negligible Beneficial	0
Minor Beneficial	1*
Moderate Beneficial	1*
Large Beneficial	0
Negligible Adverse	3
Minor Adverse	15
Moderate Adverse	3
Large Adverse	5

*Beneficial impacts were noted for the non-ASH elements in terms of landscape and water assuming all mitigations and offsets implemented, but overall (with ASH) the impact was adverse.

CONCLUSION

The North West Project proposes to upgrade and develop new sections of the local and strategic transport network extending from Hobsonville/Whenuapai through Westgate and Brigham Creek to Kumeū, Taupaki and Waimauku. A significant element of the project is the Alternative State Highway (ASH) from Brigham Creek to western Huapai. The project aims to support urban growth in the area and to provide people with genuine travel choices, to address climate change by achieving transformative mode shift, and to address transport safety issues. The project sits within and across an important cultural landscape at the crossroads between the Hikurangi, Waitematā, and Kaipara Valley takiwa. It is the northern part of Te Kawerau ā Maki's heartland and contains a number of significant cultural sites and resources from our most ancient traditions through to our major Treaty settlement redress. Sited between Nga Rau Pou ā Maki (the Waitākere Ranges) and Rangitōpuni (Riverhead Forest) on the alluvial plains of the Kumeū and Kaipara valleys, the project covers an area of numerous streams and the most productive soils in the northern half of the Auckland region. The valley is also protected by the taniwha Tangihua.

This CIA identified a total of 51 cultural sites and resources, ranging in relative value from low to predominantly high, and encompassing productive soil, rivers, landmarks, sacred sites, historical sites, traditional walking routes, and flora and fauna. The project was assessed against these sites and resources resulting in the documenting of eight significant adverse effects, 15 minor adverse effects, three negligible adverse effects, one potential significant beneficial effect*, one minor beneficial effect*, and 25 neutral effects. Where adverse effects were identified offsets (or further mitigation) were suggested. The significant adverse effects relate to the removal of productive topsoil, impacts to fresh water (including the taniwha), impacts to the Kumeū River (including the taniwha), impacts to fish species, setting impacts to Nga Rau Pou ā Maki, impacts to Pukewhakataratara, impacts to Wai paki i rape ō Ruarangi, and impacts to the cultural landscape.

While some of the cumulative impacts identified and measured, in particular future urban intensification, cannot be tied singularly to the project, it is reasonable to include them in this CIA given the strategic scope of the project and its aspirations to unlock urban development and support urban growth. Many harms can be mitigated to some degree or offset or compensated. However, at a strategic level, it is reasonable to question the wisdom of supporting urban growth in a flood prone catchment that holds the most regionally significant topsoils in northern Auckland, and that (through the ASH) places high risk of urbanising the fringes of the northern Waitākere Ranges. The destruction of a food bowl for the benefit of more concrete warehouses seems to be the opposite of sustainability or forward planning. The removal of highly organic topsoils at such a scale certainly is at odds with the project aim of addressing climate change. It is the role of iwi to be kaitiaki of the mauri of the resources in their rohe for the inter-generational benefit of all. The sensitivity of the receiving environment here is witnessed by the fact we hold there to be a taniwha protecting it. Te Kawerau ā Maki has maintained for half a decade now that the Crown (in all its varying forms including Council and NZTA) would be better off working with us to plan for growth at Riverhead where the soils are far less productive and flood prone and we have the scale of land to strategically plan for inter-generational wellbeing. It is frustrating to watch more of our taonga risk disappearing due to the acts of the Crown.

Due to the sensitivities of the landscape, we are not supportive of the ASH component of the project. We would prefer that the existing SH16 corridor be widened. This is a choice between existing homes and the environment. We choose to support te taiao. Should it (the ASH) proceed against our opposition and advice we have suggested limits and offsets to what that might look like. Our preference is for the Crown to work with Te Kawerau ā Maki on strategic and inter-generational growth in ways where we both benefit and where the environmental impacts are lower.

RECOMMENDATIONS

Table 5: Recommendations and outcome alignment

No.	Recommendation	TKaM Strategic Value alignment	IMP policy alignment	Legislative alignment	AUP policy alignment	Other policy alignment
1	Te Kawerau ā Maki do not oppose the proposal, with the exception of the ASH component which we do oppose (and prefer SH16 be widened instead), otherwise provided that the mitigations and offsets discussed are incorporated – we desire notice of the outcome of the application and the final designation conditions	Mana Motuhake				
2	Undertake further discussions and work to enable TKaM participation in design, construction and operation phases of the project e.g. through project board position and/or MOU and including procurement or training opportunities	Mana Motuhake, Kaitiakitanga, Whanaungatanga, Auaha	2.2 (integration of tikanga)	RMA 6(e), 7(a), 8	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga), B6.3.2(3) (AEE to include CIA), B6.3.2(6) (decisions to reflect cultural impacts), B6.5.2(7) (cultural landscapes in structure plans), B6.5.2(9) (cultural design of infrastructure)	UNDRIP, NPSFW, NZCPS, ICOMOS
3	Avoid realignment of the Kumeū River as a matter of spiritual integrity	Kaitiakitanga	2.2 (integration of tikanga), 4.2.2 (cultural heritage)	RMA 6(e), 7(a)	B6.3.2(2) (integrate tikanga), B6.3.2(6) (decisions to reflect cultural impacts)	UNDRIP, ICOMOS, NPSFW
4	Should the ASH proceed against our advice, permanent exclusion of urban intensification (Rural Zone to remain) west of ASH and low density east of ASH (CSL Zone) should be provided	Kaitiakitanga	2.2 (integration of tikanga), 4.1.2 (cumulative effects),	RMA 6(e), 7(a), 8	B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga),	UNDRIP

No.	Recommendation	TKaM Strategic Value alignment	IMP policy alignment	Legislative alignment	AUP policy alignment	Other policy alignment
			4.2.2 (cultural heritage), 4.7.2 (landscape)		B6.3.2(6) (decisions to reflect cultural impacts), B6.5.2(7) (cultural landscapes in structure plans)	
5	Avoid where possible significant earthworks on the areas of cultural value (sites) identified in this report, and where not possible, work with TKaM on design and construction monitoring that incorporates our tikanga	Kaitiakitanga	2.2 (integration of tikanga), 4.2.2 (cultural heritage), 4.3.2 (koiwi), 4.9.2 (cultural design)	RMA 6(e), 7(a), 8; HNZPTA s45	B6.2.2(1) (participation), B6.3.2(2) (integrate tikanga), B6.5.2(9) (cultural design of infrastructure), E11 and E12 rules (ADP)	UNDRIP, ICOMOS
6	Cultural Heritage and Offset fund and trust be established for the benefit of TKāM and NWōK with regard to the conservation, interpretation, and education regarding taonga within the Study Area. The budget for this fund will need to be negotiated but must be meaningful	Kaitiakitanga	2.2 (integration of tikanga), 4.2.2 (cultural heritage), 4.9.2 (cultural design)	RMA 6(e)	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga), B6.5.2(7) (cultural landscapes in structure plans), B6.5.2(9) (cultural design of infrastructure)	UNDRIP, ICOMOS
7	Work with TKaM on water sensitive design that incorporates our tikanga, noting the importance of not mixing waters and soil and plant filtration, and giving effect to Mana ō te Wai, and including elements such as riparian planning buffers and long-term mauri monitoring	Kaitiakitanga, Mātauranga	2.2 (integration of tikanga), 4.4.2 (management of water), 4.5.2 (coastal)	RMA 6(e), 7(a), 8	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga), B6.5.2(9) (cultural design of infrastructure)	UNDRIP, NPSFW, NZCPS

No.	Recommendation	TKaM Strategic Value alignment	IMP policy alignment	Legislative alignment	AUP policy alignment	Other policy alignment
8	Work with TKaM on ecologically sensitive design that incorporates our tikanga, including eco-sourced vegetation, a 100% native plant commitment, habitat enhancement, fish passages, and green corridors, and ensure and ecological offsetting framework is designed in partnership with TKaM	Kaitiakitanga, Mātauranga	2.2 (integration of tikanga), 4.7.2 (landscape), 4.8.2 (flora and fauna), 4.9.2 (cultural design)	RMA 6(e), 7(a), 8	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga)	UNDRIP
9	Develop in conjunction with TKaM an ecological restoration and management plan for the wetlands and streams that removes pests, monitors water, biodiversity and mauri quality including with cultural indicators, and includes enhancements such as native riparian planting	Kaitiakitanga	2.2 (integration of tikanga), 4.4.2 (management of water), 4.7.2 (landscape), 4.8.2 (flora and fauna), 4.9.2 (cultural design)	RMA 6(e), 7(a), 8	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga)	UNDRIP, NPSFW, NZCPS
10	Work with TKaM on a darkness sensitive design that incorporates our tikanga, and limits the degree of light pollution generated	Kaitiakitanga	2.2 (integration of tikanga), 4.1.2 (cumulative effects), 4.7.2 (landscape)	RMA 6(e), 7(a)	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga)	UNDRIP, NZCPS
11	Work with TKaM on cultural design incorporation and interventions, such as ensuring inter- and intra- cultural site visibility and settings is maintained, undertaking place naming and educational and physical (artistic) interpretation of cultural sites and history, and opportunity to input to the built form of elements of the project (e.g. bridges)	Kaitiakitanga, Auaha, Mātauranga	2.2 (integration of tikanga), 4.1.2 (cumulative effects), 4.2.2 (cultural heritage), 4.7.2 (landscape), 4.9.2 (cultural design)	RMA 6(e)	B6.2.2(1) (participation), B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga), B6.5.2(9) (cultural design of infrastructure)	ICOMOS
12	Actively support aspirations of TKaM to enter cultural sites within the Study Area onto the Auckland Council schedule of Sites of Significance to Mana Whenua, potentially through a private plan change	Kaitiakitanga	4.2.2 (cultural heritage), 4.7.2 (landscape)	RMA 6(e), 7(a), 8	B6.3.2(1) (identify values), B6.5.2(7) (cultural landscapes in structure plans/plan changes)	ICOMOS

No.	Recommendation	TKaM Strategic Value alignment	IMP policy alignment	Legislative alignment	AUP policy alignment	Other policy alignment
13	Develop and implement a Topsoil Conservation Plan	Kaitiakitanga	2.2 (integration of tikanga), 4.1.2 (cumulative effects)	RMA 6(e), 7(a), 8	B6.3.2(1) (identify values) B6.3.2(2) (integrate tikanga), B6.3.2(6) (decisions to reflect cultural impacts), B6.5.2(7) (cultural landscapes in structure plans), B6.5.2(9) (cultural design of infrastructure)	UNDRIP
14	In addition to the ecological management plan and topsoil management plan, TKāM should co-develop an urban/landscape design management plan and heritage management plan	Kaitiakitanga	4.2.2 (cultural heritage), 4.7.2 (landscape)	RMA 6(e), 7(a), 8	B6.2.2(1) (participation), B6.3.2(2) (integrate tikanga), B6.3.2(6) (decisions to reflect cultural impacts), B6.5.2(7) (cultural landscapes in structure plans)	UNDRIP, ICOMOS
15	Cultural monitoring, including pre-works cultural inductions, and the monitoring of cultural sites and resources for the construction period of the project, should be resourced at the cost of the Client	Kaitiakitanga, Whanau Mātauranga Māori	2.2 (integration of tikanga)	RMA 6(e), 7(a)	B6.2.2(1) (participation), B6.3.2(2) (integrate tikanga)	UNDRIP
16	Any lands within the designation that NZTA may wish to dispose of in the future should first be offered to TKaM to provide opportunity to re-acquire whenua alienated from TKaM	Mana Motuhake				

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Murdoch, G. (2011). *Te Kawerau ā Maki Claim Overview Report*. Unpublished Report.
Taua, T.W. (2009). *He kohikohinga korero mo Hikurangi.* In F. Macdonald and R. Kerr (ed). West – The History Of Waitakere. Random House.