TE TUPU NGĀTAHI
SUPPORTING GROWTH

Drury Arterial Network
Assessment of Ecological Effects

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WAKA KOTAHI NZ TRANSPORT AGENCY

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Responsibility	Name
Author	Kate Feickert, Conor Reid, Michiel Jonker
Reviewer	Fiona Davies Gerry Kessels (Blue Wattle Ecology)

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1 Glossary of acronyms and defined terms

Table 1: Glossary of technical terms / acronyms

Acronym	Term
ABM	Automatic Bat Monitor
AEE	Assessment of Effects on the Environment
AR	Acoustic Recorder
AT	Auckland Transport
AUP	Auckland Unitary Plan
AUPOiP	Auckland Unitary Plan Operative in Part
BMP	Bird Management Plan
DOC	Department of Conservation
EcIA	Ecological Impact Assessment Guidelines
ECR	Environmental Compensation Ratio
EIANZ	Environment Institute of Australia and New Zealand
EMMP	Environmental Management and Monitoring Plan
EMP	Ecological Management Plan
ESCP	Erosion and Sediment Control Plan
Freshwater NES	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
FTN	Frequent Transit Network
FUZ	Future Urban Zone
GIS	Geographic Information System
HQS	Habitat Quality Score
LMP	Lizard Management Plan
NIMT	North Island Main Trunk
NoR	Notice of Requirement (under the Resource Management Act 1991)
NZCPS	New Zealand Coastal Policy Statement
REC	River Environment Classification
RHA	Rapid Habitat Assessment
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SEA-M	Significant Ecological Area (Marine)
SEV	Stream Ecological Valuation

Acronym	Term
SH1	State Highway 1
SH22	State Highway 22
ZOI	Zone of Influence

Table 2: Glossary of defined terms

Term	Meaning
Auckland Council	Means the unitary authority for the Auckland Region.
Auckland Plan 2050 – Development Strategy	The Development Strategy sets out how Auckland will grow and change over the next 30 years.
Blue Green Network	In the Structure Plan a proposed 'Blue Green Network' seeks to provide contiguous ecological linkages, connecting significant terrestrial and marine ecological areas through restored riparian margins as well as other restoration opportunities.
Drury Package	Five Notices of Requirement for the Drury Arterial Network for Auckland Transport and Waka Kotahi NZ Transport Agency.
Ecological Feature	Specific aspects of an ecosystem that are described and evaluated; the term includes components such as species and habitats and related processes and functions, such as habitat buffers and roosting and feeding habitat.
Greenfields	Generally rural land identified to be urbanised over time.
Hydroperiod	Period when wet throughout the year.
KiwiRail	KiwiRail Holdings Limited
NoR D1	Project: Alteration to Waka Kotahi designation 6707 – State Highway 22 (SH22) Upgrade
NoR D2	Project: Jesmond to Waihoehoe West FTN Upgrade
NoR D3	Project: Waihoehoe Road East Upgrade
NoR D4	Project: Ōpāheke North-South FTN Arterial
NoR D5	Project: Ponga Road and Ōpāheke Road Upgrade
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.
Waka Kotahi	Waka Kotahi New Zealand Transport Agency (formerly NZ Transport Agency)
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."

2 Executive Summary

2.1 NoR D1: Alteration to Designation 6707 – State Highway 22 Upgrade

This Ecological Impact Assessment (EcIA) has been prepared to support the Notice of Requirement for the Alteration to Designation 6707 – for the upgrade of State Highway 22 (NoR D1) (herein referred to as 'the Project'). The assessment method follows the Environment Institute of Australia and New Zealand (EIANZ) Guidelines. These were used to assess the ecological value of identified ecological features and evaluate the magnitude and level of potential effects that the Project could have on these features.

The report assesses the potential effects on the environment relating to district plan matters contained in the Auckland Unitary Plan Operative in Part (AUPOiP). Regional plan and/or Freshwater NES resource consent applications will be sought at a later date for the Project, with any required mitigation assessed fully at that time. However, potential ecological effects of the activities likely requiring resource consents and/or wildlife permits at a later stage of the Project have also been considered in this report to inform design and the designation boundary for the Project.

Assessment methodology

A desktop study was completed to identify existing records of indigenous species and habitats that could be present within and adjacent to the Project Area. This guided field assessment, which included a high-level site walkover to classify habitats (using Singers *et al.* (2017)) and to assess habitat suitability for indigenous fauna, such as lizards. A bat presence / absence survey was completed using ABMs; and bird surveys included point counts, transects and acoustic monitoring which were undertaken where appropriate. Streams were classified as permanent, intermittent and ephemeral and stream habitat was assessed using the Rapid Habitat Assessment methodology. The key outcome of these surveys was to establish an ecological baseline for the Project Area and to assign value for all potential ecological features which could be affected by the Project.

Existing and likely future environment

The existing landscape surrounding the Project Area is dominated by rural landuse with some small areas of business development. The Project Area has been highly modified in the past for agriculture activities and development of private properties, with almost all original vegetation cleared and replaced with exotic species. Streams within the catchment have been highly modified by previous road construction and adjacent agricultural practices in the past. Most streams are unfenced and lacking suitable vegetation cover. Where natural habitats remain within the zone of influence of the Project, these have largely been classified as terrestrial or marine SEAs under the AUPOiP, notably SEA_T_530b (part of the Ngakoroa Stream wetlands) is within and directly adjacent to the Project Area.

The AUPOiP zoning/overlay identifies the majority of the existing rural landscape as Future Urban Zone (FUZ). This future urban land will therefore largely undergo a significant change from rural to urban over the next couple of decades. However, it is assumed that in a future urbanised scenario, permanent stream corridors and areas of indigenous vegetation, such as Raupō reedland (WL19), will generally be retained. It is therefore considered that in a future scenario, many ecological features of value such as vegetated stream corridors will remain.

Although generally of low value to native wildlife, the habitats still remaining within the existing, largely rural landscape (dominated by exotic grass, exotic scrub and mature exotic trees), are largely permeable to the movement of mobile, native species and may support Not Threatened species of bird and lizard. However, once urban development occurs , these low value habitats and the potential connectivity they provide will largely be lost. Any remaining native wildlife is therefore likely to be concentrated and more dependent on the remaining stream corridors, as ecological permeability throughout the FUZ will have been reduced. Therefore, retained stream corridors will become increasingly important for native wildlife to remain viable and relatively their value will become more important in a future scenario.

Ecological Effects and Impact Management

At Risk - Declining bird species are likely to be present in the Ngakoroa Stream wetlands within and directly adjacent the Project Area. Coastal wetland birds at this location are considered to be of **High** ecological value. The Project construction could potentially have a **Moderate** level of ecological effect due to the disturbance of coastal wetland birds. These birds are most vulnerable during the breeding season when disturbance due to construction activity may cause displacement and nest abandonment. A Bird Management Plan is recommended to reduce the potential adverse effects of construction from **Moderate** to **Low**. Impact management requirements would include programming noisy works to avoid the bird breeding season (September – February) where practicable, pre-construction nesting bird surveys and mitigating construction lighting and noise/vibration disturbance.

In addition, there is potential for the presence of At Risk - Recovering bird species at a freshwater pond on Burberry Road. As a result, the ecological value of freshwater wetland bird habitat at this location is considered to be **High.** However, as this pond will not be directly affected by the project, when taking in to account the magnitude of effect of the construction and operation of the Project, the level of effect is **Low** and impact management is not required.

Urbanisation may negatively or positively affect the future value of some ecological features identified within this assessment. At Risk - Declining species like spotless crake, fernbird and banded rail that currently reside in the landscape are generally those which can adapt to human modified environments. Urbanisation may cause negative impacts such as increased disturbance. However, if structure plan recommendations are implemented then positive outcomes, such as riparian buffer planting along stream corridors (which could reduce disturbance, such as noise and lighting from the existing baseline), may occur. The habitat value for these species could therefore change in a future scenario and may need to be resurveyed. The wetland habitats (associated with coastal wetland birds) within and adjacent to the Project Area, specifically wetland D2W5 associated with the Ngakoroa Stream (Figure 16 and Appendix 7, Drawing SGA-EX-DL-004.1) are included as part of the pre-construction wetland bird survey area (identified in Appendix 11). It is recommended that this location should be resurveyed at the same time as resource consent approvals are sought in order to in order to confirm the ecological value identified has been retained and mitigation measures detailed in this EcIA are still required.

Stream and wetland impacts have been considered as part of design and future resource consent considerations. High value streams and wetlands have been avoided or bridged, however some impacts on low/moderate value streams and wetlands will be unavoidable. Impact management will therefore be required as part of future consent processes to mitigate for the loss of stream and wetland hydrological function and ecological value. There are opportunities to accommodate any future compensation / offset requirements, beyond the Project footprint within land required within the designation boundary for construction.

Conclusion

The majority of habitats and species likely to occur within the Project Area are generally modified, exotic, are of **Low** ecological value and are likely to support Not Threatened native species of birds and lizards which have adapted to an already modified landscape. The Project level of effects on these habitats and species are also generally **Low** and therefore specific impact management has not been recommended (excluding Wildlife Act compliance).In a future scenario where urbanisation is likely to have further modified these habitats, it is likely that any remaining native species will generally be restricted to retained stream corridors, wetlands and / or vegetated areas within reserves and open spaces areas. Stream corridors and remaining vegetation will therefore be of greater importance for native wildlife in a future environment and the Project should focus on the retention and enhancement of these areas to maintain ecological integrity across the landscape.

The Ngakoroa Stream corridor has been highlighted for its **High** value wetland habitat and potential to support At Risk - Declining wetland bird species. Specific impact management has been recommended for these species to minimise Project impacts during the Ngakoroa Bridge construction works, particularly during the breeding season. The future viability of At Risk - Declining and Threatened species within the Project Area will be dependent on the quality of catchment wide mitigation within the stream network. Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species and may even be improved for some species, however reassessment is recommended to confirm this.

It is considered that future resource consent requirements can be adequately managed in a future consent process. The proposed alignment has minimised effects on streams, wetlands, terrestrial habitats and species of value. Where practicable, any offset requirements for streams and wetlands can be included within the designation boundary.

Table 1 summarises the ecological values, magnitude of operational and construction effects and subsequent level of effect for each ecological feature for NoR D1.

2.2 NoR D2: Jesmond to Waihoehoe West FTN Upgrade

This EcIA has been prepared to support the Notice of Requirement for Jesmond to Waihoehoe West FTN Upgrade (NoR D2) (herein referred to as ‘the Project’). The assessment method follows the EIANZ Guidelines. These were used to assess the ecological value of identified ecological features and evaluate the magnitude and level of potential effects that the Project could have on these features.

The report assesses the potential effects on the environment relating to district plan matters contained in the AUPOiP. Regional plan and/or Freshwater NES resource consent applications will be sought at a later date for the Project, with any required mitigation assessed fully at that time. However, potential ecological effects of the activities likely requiring resource consents and/or wildlife permits at a later stage of the Project have also been considered in this report to inform design and the designation boundary for the Project.

Assessment methodology

A desktop study was completed to identify existing records of indigenous species and habitats that could be present within the Project Area. This guided field assessment, which included a high-level site walkover to classify habitats (using Singers *et al.* (2017)) and to assess habitat suitability for indigenous fauna, such as lizards. A bat presence / absence survey was also completed using ABMs; and bird surveys included point counts, transects and acoustic monitoring which were undertaken where appropriate. Streams were classified as permanent, intermittent and ephemeral and stream surveys were completed using the Rapid Habitat Assessment methodology. The key outcome of these surveys was to establish an ecological baseline for the Project Area and to assign value for all potential ecological features which could be affected by the Project.

Existing and likely future environment

The existing landscape surrounding the Project Area is dominated by rural landuse with a growing urban development within the existing Drury town centre. The Project Area has been highly modified in the past for agriculture activities and private properties, with almost all original vegetation cleared and replaced with exotic species. Streams within the catchment have been highly modified by previous road construction and adjacent agricultural practices in the past. Most streams are unfenced and lacking suitable vegetation cover. Where natural habitats remain within the zone of influence of the Project, these have largely been classified as terrestrial or marine SEAs under the AUPOiP, notably SEA_T_530b (part of the Ngakoroa Stream wetlands) is within and directly adjacent to the Project Area.

The AUPOiP zoning/overlay identifies the majority of the existing rural landscape as Future Urban Zone (FUZ). This future urban land will therefore largely undergo a significant change from rural to urban over the next couple of decades. However, it is assumed that in a future urbanised scenario, stream corridors and areas of indigenous vegetation, such as Oioi, restiad rushland/ reedland (WL10) will generally be retained. It is therefore considered that in a future scenario, many ecological features of value such as vegetated stream corridors will remain.

The existing environment is largely a rural landscape dominated by exotic grass, exotic scrub and mature exotic trees. Although generally of low value to native wildlife, the habitats still remain largely permeable to the movement of mobile native species and may support Not Threatened species of bird and lizard. However, once urban development occurs, these low value habitats and the potential connectivity they provide will largely be lost. Any remaining native wildlife is therefore likely to be concentrated and more dependent on the remaining stream corridors, as ecological permeability throughout the FUZ will largely have been reduced. Therefore, retained stream corridors will become increasingly important for native wildlife to remain viable and relatively their value will become more important in a future scenario.

Ecological Effects and Impact Management

At Risk - Declining bird species are likely to be present in the Ngakoroa Stream wetlands within and directly adjacent the Project Area. Coastal wetland birds at this location are considered to be of High ecological value. The Project construction was considered to have a **Moderate** level of ecological effect due to potential disturbance of coastal wetland birds. The birds are most vulnerable during the breeding season when disturbance due to construction activity may cause displacement and nest abandonment. A Bird Management Plan is recommended to reduce the potential adverse effects of construction from **Moderate** to **Low**. Impact management requirements would include programming noisy works to avoid the bird breeding season (September – February) where practicable, pre-construction nesting bird surveys and mitigating construction lighting and noise/vibration disturbance.

In addition, there is potential for the presence of At Risk - Recovering bird species at artificial wetlands adjacent to Jesmond Road. As a result, the ecological value of freshwater wetland bird habitat at this location is considered to be **Moderate.** However, as birds are unlikely to breed at this location, when taking in to account the magnitude of effect of the construction and operation of the Project, the level of effect is **Low** and impact management is not required.

Urbanisation may negatively or positively affect the future value of some ecological features identified within this assessment. At Risk - Declining species like spotless crake, fernbird and banded rail that currently reside in the landscape are generally those which can adapt to human modified environments. Urbanisation may cause negative impacts such as increased disturbance. However, if structure plan recommendations are implemented then positive outcomes, such as riparian buffer planting along stream corridors (which could reduce disturbance, such as noise and lighting from the existing baseline), may occur. The habitat value for these species could therefore change in a future scenario and may need to be resurveyed. The wetland habitats (associated with coastal wetland birds) within and adjacent to the Project Area, specifically wetland D2W5 associated with the Ngakoroa Stream (Figure 16 and Appendix 7, Drawing SGA-EX-DL-004.2) are included as part of the pre-construction wetland bird survey area (identified in Appendix 11). It is recommended that this location should be resurveyed at the same time as resource consent approvals are sought in order to confirm the ecological value identified has been retained and mitigation measures detailed in this EcIA are still required.

Stream and wetland impacts have been considered as part of design and future resource consent considerations. High value streams and wetland have largely been avoided or bridged, however some impacts on low/moderate value streams and wetlands will be unavoidable. Impact management will therefore be required as part of future consent processes to mitigate for the loss of stream, wetland hydrological function and ecological value. There are opportunities to accommodate any future compensation / offset requirements, beyond the Project footprint within land required within the designation boundary for construction.

Conclusion

Most of the habitats and species likely to occur within the Project Area are generally modified, exotic, are of **Low** ecological value and are likely to support Not Threatened native species of birds and lizards which have adapted to an already modified landscape. The Project level of effects on these habitats and species are also generally **Low** and therefore specific impact management has not been recommended (excluding Wildlife Act compliance). In a future scenario where urbanisation is likely to have further modified these habitats it is likely that any remaining native species will generally be restricted to retained stream corridors and wetlands and or vegetated areas within reserves and open space areas. Stream corridors and remaining vegetation will therefore be of greater importance for native wildlife in a future environment and the Project should focus on the retention and enhancement of these areas to maintain ecological integrity across the landscape.

The Ngakoroa Stream corridor has been highlighted for its **High** value wetland habitat and potential to support At Risk Declining wetland bird species. Specific impact management has been recommended for these species to minimise Project impacts during the Ngakoroa Bridge construction works, particularly during the breeding season. The future viability of At Risk Declining and Threatened species within the Project Area will be dependent on the quality of catchment wide mitigation within the stream network. Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species and may even be improved for some species, however reassessment is recommended to confirm this.

It is considered that future resource consent requirements can be adequately managed in a future consent process. The proposed alignment has minimised effects on streams, wetlands, terrestrial habitats and species of value. Where practicable, any offset requirements for streams and wetlands can be included within the designation boundary.

Table 1 summarises the ecological values, magnitude of operational and construction effects and subsequent level of effect for each ecological feature for NoR D2.

2.3 NoR D3: Waihoehoe Road East Upgrade

This EcIA has been prepared to support the Notice of Requirement for Waihoehoe Road East Upgrade (NoR D3) (herein referred to as 'the Project'). The assessment method follows the EIANZ Guidelines. These were used to assess the ecological value of identified ecological features and evaluate the magnitude and level of potential effects that the Project could have on these features.

The report assesses the potential effects on the environment relating to district plan matters contained in the AUPOiP. Regional plan and/or Freshwater NES resource consent applications will be sought at a later date for the Project, with any required mitigation assessed fully at that time. However, potential ecological effects of the activities likely requiring resource consent and/or wildlife permits at a later stage of the Project have also been considered in this report to inform design and the designation boundary for the Project.

Assessment methodology

A desktop study was completed to identify existing records of indigenous species and habitats that could be present within the Project Area. This guided field assessment, which included a high-level site walkover to classify habitats (using Singers *et al.* (2017)) and to assess habitat suitability for indigenous fauna, such as lizards. A bat presence / absence survey was also completed using ABMs; and any notable habitat for native birds was assessed for its suitability to support threatened species (no specific bird surveys where carried out for this Project as habitat suitability was limited). Streams were classified as permanent, intermittent and ephemeral and stream surveys were completed using the Rapid Habitat Assessment methodology. The key outcome of these surveys was to establish an ecological baseline for the Project Area and to assign value for all potential ecological features which could be affected by the Project.

Existing and likely future environment

The existing landscape surrounding the Project Area is dominated by rural landuse. The Project Area has been highly modified in the past for agriculture activities and private properties, with all original vegetation cleared and replaced with exotic species. Streams within the catchment have been highly modified by previous road construction and adjacent agricultural practices in the past. Most streams are unfenced and lacking suitable vegetation cover. Where natural habitats remain within the zone of influence of the Project these have largely been classified as terrestrial SEAs under the AUPOiP. No SEAs occur within the Project area.

The AUPOiP zoning/overlay identifies the majority of the existing rural landscape as FUZ. This future urban land will therefore largely undergo a significant change from rural to urban over the next couple of decades.However, it is assumed that in a future urbanised scenario, ecological features of value such as vegetated stream corridors and areas of indigenous vegetation will generally be retained.

The existing environment is a largely rural landscape dominated by exotic grass and mature exotic trees. Although generally of low value to native wildlife, the habitats still remain largely permeable to the movement of mobile native species and may support Not Threatened species of bird and lizard. However, once urban development occurs, these low value habitats and the potential connectivity they provide will largely be lost. Any remaining native wildlife is therefore likely to be concentrated and more dependent on the remaining stream corridors, as ecological integrity throughout the FUZ will have been reduced. Therefore, retained stream corridors will become increasingly important for native wildlife to remain viable and relatively their value will become more important in a future scenario.

Ecological Effects and Impact Management

No indigenous habitat remain within or adjacent to the Project Area. Habitat present is restricted to highly modified exotic vegetation types, with limited botanical value. The exotic habitat was however assessed for its potential to support indigenous threatened species. Habitat is limited to exotic vegetation associated with private properties and farmland, with the potential to support some native species such as urban tolerant native forest birds and copper skink. The ecological value of these species is **Low** and the exotic habitat available was also considered to be **Low** value. The level of effects from the construction and operation of the road widening was considered to be **Low** and therefore no impact management was recommended (excluding Wildlife Act requirements).

Stream and wetland impacts have been considered as part of design and future resource consent considerations. Streams and wetland have largely been avoided as part of the options assessment, route refinement and initial design phase. However, one low value intermittent stream and a small area of exotic wetland may be affected. Impact management will therefore be required as part of future consent processes to mitigate for the loss of stream and wetland hydrological function and ecological value. There are opportunities to accommodate any future compensation / offset requirements beyond the Project footprint within land required within the designation boundary for construction.

Conclusion

The habitats and species likely to occur within the Project Area are modified, exotic, are of **Low** ecological value and are likely to support Not Threatened native species of birds and lizards which have adapted to an already modified landscape. The Project level of effects on these habitats and species are also **Low** and therefore specific impact management has not been recommended (excluding Wildlife Act compliance). In a future scenario, where urbanisation is likely to have further modified these habitats, it is likely that any remaining native species will generally be restricted to retained stream corridors and wetlands. Stream corridors and remaining vegetation will therefore be of greater importance for native wildlife in a future environment and the Project should focus on the retention and enhancement of these areas to maintain ecological integrity across the landscape. Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species. Pre-construction surveys to confirm a change in ecological value are not required because there are no ecological features effected by the Project within the Project Area that result in a **Moderate** or higher level of ecological effect (as they relate to district plan matters).

It is considered that future resource consent requirements can be adequately managed in a future consent process. Where possible the proposed alignment has minimised effects on streams, wetlands, terrestrial habitats and species of value.

Table 1 summarises the ecological values, magnitude of operational and construction effects and subsequent level of effect for each ecological feature for NoR D3.

2.4 NoR D4: Ōpāheke North-South FTN Arterial

This EcIA has been prepared to support the Notice of Requirement for Ōpāheke North-South FTN Arterial (NoR D4) (herein referred to as 'the Project'). The assessment method follows the EIANZ Guidelines. These were used to assess the ecological value of identified ecological features and evaluate the magnitude and level of potential effects that the Project could have on these features.

The report assesses the potential effects on the environment relating to district plan matters contained in the AUPOiP. Regional plan and/or Freshwater NES resource consent applications will be sought at a later date for the Project, with any required mitigation assessed fully at that time. However, potential ecological effects of the activities likely requiring resource consent and/or wildlife permits at a later stage of the Project have also been considered in this report to inform design and the designation boundary for the Project.

Assessment methodology

A desktop study was completed to identify existing records of indigenous species and habitats that could be present within the Project Area. This guided field assessment, which included a high-level site walkover to classify habitats (using Singers *et al.* (2017)) and to assess habitat suitability for indigenous fauna, such as lizards. A bat presence / absence survey was also completed using ABMs; and any notable habitat for native birds was assessed for its suitability to support threatened species (no specific bird surveys where carried out for this Project as habitat suitability was limited). Streams were classified as permanent, intermittent and ephemeral and stream surveys were completed using the Rapid Habitat Assessment methodology. The key outcome of these surveys was to establish an ecological baseline for the Project Area and to assign value for all potential ecological features which could be affected by the Project.

Existing and likely future environment

The existing landscape surrounding the Project Area is dominated by rural landuse. The Project Area has been highly modified in the past for agriculture activities and private properties, with almost all original vegetation cleared and replaced with exotic species. Streams within the catchment have been highly modified by adjacent agricultural practices in the past. Most streams are unfenced and lacking suitable vegetation cover. Where intact indigenous habitats remain within the zone of influence of the Project these have largely been classified as terrestrial SEAs under the AUPOiP. No SEAs occur within the Project area.

The AUPOiP zoning/overlay identifies the majority of the existing rural landscape as Future Urban Zone (FUZ) including residential and industrial areas. This future urban land will therefore largely undergo a significant change from rural to urban over the next couple of decades. However, it is assumed that in a future urbanised scenario, stream corridors and areas of indigenous vegetation such as remnant stands of regenerating native forest adjacent to the Project (MF4 Kahikatea forest), will generally be retained. It is therefore considered that in a future scenario, many ecological features of value such as vegetated stream corridors will remain.

The existing environment is a largely rural landscape dominated by exotic grass, exotic scrub and mature exotic trees. Although generally of **Low** value to native wildlife, the habitats remain largely permeable to the movement of mobile native species and may support Not Threatened species of bird and lizard. However, once urban development occurs, these low value habitats and the potential connectivity they provide will largely be lost. Any remaining native wildlife is therefore likely to be concentrated and more dependent on the remaining stream corridors, as ecological integrity throughout the FUZ will have been reduced. Therefore, retained stream corridors will become increasingly important for native wildlife to remain viable and relatively their value will become more important in a future scenario.

Ecological Effects and Impact Management

The Project will impact mainly exotic terrestrial vegetation types of **Negligible** or **Low** value (regional and district vegetation). Although of Low value botanically, these features have been considered for their potential to support common, Threatened and At Risk native fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was considered to be **Very low** or **Low** and therefore no specific impact management has been recommended for these matters.

Some **Moderate** value ecological features have been identified (as they relate to district plan matters):

- Forest birds – A Kahikatea stand (Critically Endangered) adjacent to the Project Area has potential for At Risk – Recovering kākā,
- Freshwater wetland birds – there is potential for At Risk – Declining wetland bird species (New Zealand dabchick and Spotless Crake) to be present (although not breeding) at artificial wetlands D4W1.
- Herpetofauna – At Risk – Declining Ornate skink (along with Not Threatened copper skink) are potentially present in rural and urban forests, grasslands and shrublands, in low scrub and sedges when habitat is connected to suitable native forest.

However, the magnitude of effects and overall level of effects from the construction and operation of the Project on these **Moderate** value features was considered to be **Low,** so impact management was not required.

Stream and wetland impacts have been considered as part of design and future resource consent considerations. Where possible streams and wetland habitat was avoided as part of the options assessment, route refinement and initial design phase of the Project. However, two permanent and six intermittent streams and eight exotic wetland areas will be crossed by the Project. These habitats are generally highly modified; however, the Waipokapū Stream was considered to be **High** ecological value due to its retained hydrological and biological function. Three of the streams will be bridged, while the other intermittent streams will likely be culverted. Impact management will therefore be required as part of future consent processes to mitigate for the loss of stream and wetland hydrological function and ecological value. There are opportunities to accommodate any future compensation / offset requirements, beyond the Project footprint within land required within the designation boundary for construction.

Conclusion

Most habitats and species likely to occur within the Project Area are generally modified, exotic, are of **Low** ecological value and are likely to support Not Threatened native species of birds and lizards which have adapted to an already modified landscape. The Project level of effects on these habitats and species are also generally **Low** and therefore specific impact management has not been recommended (excluding Wildlife Act compliance). In a future scenario, where urbanisation is likely to further modify these habitats, it is likely that any remaining native species will generally be restricted to retained stream corridors and wetlands. Stream corridors and remaining vegetation will therefore be of greater importance for native wildlife in a future environment and the Project should focus on the retention and enhancement of these areas to maintain ecological integrity across the landscape.

The future viability of At Risk Declining species such as the ornate skink within the Project Area will be dependent on the quality of catchment wide mitigation within the stream network (e.g. the Waihoehoe Stream and Waipokapū Stream corridors). Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species and may even be improved for some species. Pre-construction surveys to confirm a change in ecological value are not required because there are no ecological features effected by the Project within the Project Area that result in a **Moderate** or higher level of ecological effect (as they relate to district plan matters).

It is considered that future resource consent requirements can be adequately managed in a future consent process. Where possible the proposed alignment has minimised effects on streams, wetlands, terrestrial habitats and species of value.

Table 1 summarises the ecological values, magnitude of operational and construction effects and subsequent level of effect for each ecological feature for NoR D4.

2.5 NoR D5: Ponga and Ōpāheke Road Upgrade

This EcIA has been prepared to support the Notice of Requirement for the Ponga Road and Ōpāheke Road Upgrade (NoR D5) (herein referred to as 'the Project'). The assessment method follows the EIANZ Guidelines. These were used to assess the ecological value of identified ecological features and evaluate the magnitude and level of potential effects that the Project could have on these features.

The report assesses the potential effects on the environment relating to district plan matters contained in theAUPOiP. Regional plan and/or Freshwater NES resource consent applications will be sought at a later date for the Project, with any required mitigation assessed fully at that time. However, potential ecological effects of the activities likely requiring resource consent and/or wildlife permits at a later stage of the Project have also been considered in this report to inform design and the designation boundary for the Project.

Assessment methodology

A desktop study was completed to identify existing records of indigenous species and habitats that could be present within and adjacent to the Project Area. This guided field assessment, which included a high-level site walkover to classify habitats (using Singers *et al.* (2017)) and to assess habitat suitability for indigenous fauna, such as lizards. A bat presence / absence survey was also completed using ABMs; and any notable habitat for native birds was assessed for its suitability to support threatened species, including a five minute bird count (5MBC) survey within suitable native habitat. Streams were classified as permanent, intermittent and ephemeral and stream surveys were completed using the Rapid Habitat Assessment methodology. The key outcome of these surveys was to establish an ecological baseline for the Project Area and to assign value for all potential ecological features which could be affected by the Project.

Existing and likely future environment

The existing landscape surrounding the Project Area is dominated by rural landuse. The Project Area has been highly modified in the past for agriculture activities and private properties, with almost all original vegetation cleared and replaced with exotic species. Streams within the catchment have been highly modified by adjacent agricultural practices in the past. Most streams are unfenced and lacking suitable vegetation cover. Where intact indigenous habitats remain within the zone of influence of the Project these have largely been classified as terrestrial SEAs under the AUPOiP. No SEAs occur within the Project area.

The AUPOiP zoning/overlay identifies the majority of the existing rural landscape as FUZ including residential and industrial areas. This future urban land will therefore largely undergo a significant change from rural to urban over the next couple of decades. Urbanisation will result in more noise and higher light levels that could affect any remaining indigenous fauna. However, it is assumed that in a future urbanised scenario, stream corridors and areas of indigenous vegetation, such remnant stands of regenerating native forest (pūriri forest (WF7.3) and Kahikatea forest MF4) adjacent to the project, will generally be retained. It is therefore considered that in a future scenario, many ecological features of value such as vegetated stream corridors will remain.

The existing environment is a largely rural landscape dominated by exotic grass, exotic scrub and mature exotic trees. Although generally of low value to native wildlife, the habitats still remain largely permeable to the movement of mobile native species and may support Not Threatened species of bird and lizard. However, once urban development occurs, these low value habitats and the potential connectivity they provide will largely be lost. Any remaining native wildlife is therefore likely to be concentrated and more dependent on the remaining stream corridors, as ecological permeability throughout the FUZ will have been reduced. Therefore, retained stream corridors will become increasingly important for native wildlife to remain viable and relatively their value will become more important in a future scenario.

Ecological Effects and Impact Management

The Project will impact mainly exotic terrestrial vegetation types of **Negligible** or **Low** value (regional and district vegetation). Although of **Low** value botanically these features have been considered for their potential to support common, Threatened and At Risk native fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was considered to be **Very low** or **Low** and therefore no specific impact management has been recommended for these matters. Some **Moderate** value ecological features have been identified (as they relate to district plan matters):

- Forest birds – A small stand of regenerating pūriri forest (WF7.3) partially within the Project Area and kahikatea forest (MF4) occurs directly adjacent to the Project Area. Based on desktop records, it is possible that the threatened forest bird, the North Island kākā, may use this habitat sporadically for foraging.
- Herpetofauna – At Risk – Declining Ornate skink (along with Not Threatened copper skink) are potentially present in rural and urban forests, grasslands and shrublands, in low scrub and sedges when habitat is connected to suitable native forest (such as the aforementioned).

However, the magnitude of effects and overall level of effects from the construction and operation of the Project on these **Moderate** value features was considered to be **Low,** so impact management was not required.

Stream and wetland impacts have been considered as part of design and future resource consent considerations. Where possible streams and wetland habitat were avoided as part of the options assessment, route refinement and initial design phase of the Project. However, two permanent and one intermittent stream and two exotic wetland areas will be crossed by the Project. These habitats are generally highly modified, however the Ōtūwairoa Creek was considered to be of **High** ecological value due to its retained hydrological and biological function. The two permanent streams will be bridged (the bridge over Mangapū Stream will replace existing twin culverts), and the intermittent streams may be realigned in part and existing culverts extended. Impact management will therefore be required as part of future consent processes to mitigate for the loss of stream and wetland hydrological function and ecological value. There are opportunities to accommodate any future compensation / offset requirements, beyond the Project footprint within land required within the designation boundary for construction.

Conclusion

Most habitats and species likely to occur within the Project Area are generally modified, exotic, are of **Low** ecological value and are likely to support Not Threatened native species of birds and lizards which have adapted to an already modified landscape. The Project level of effects on these habitats and species are also generally **Low** and therefore specific impact management has not been recommended (excluding Wildlife Act compliance). In a future scenario, where urbanisation is likely to have further modified these habitats, it is likely that any remaining native species will generally be restricted to retained stream corridors and wetlands. Stream corridors and remaining vegetation will therefore be of greater importance for native wildlife in a future environment and the Project should focus on the retention and enhancement of these areas to maintain ecological integrity across the landscape.

The future viability of At Risk Declining species within the Project Area will be dependent on the quality of catchment wide mitigation within the stream network (e.g. the Ōtūwairoa Stream and Mangapū Stream corridors). Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species and may even be improved for some species. Pre-construction surveys to confirm a change in ecological value are not required because there are no ecological features effected by the Project within the Project Area that result in a **Moderate** or higher level of ecological effect (as they relate to district plan matters).

It is considered that future resource consent requirements can be adequately managed in a future consent process. Where possible the proposed alignment has minimised effects on streams, wetlands, terrestrial habitats and species of value.

Table 1 summarises the ecological values, magnitude of operational and construction effects and subsequent level of effect for each ecological feature for NoR D5.

Table 1 Ecological values, magnitude of effect and level of effects summary table for district plan matters only for NoR D1, D2, D3, D4 and D5

			Construction prior to Impact Management		Construction with Impact Management		Operation prior to Impact Management		Operation with Impact Management	
NoR	Feature	Value	Magnitude of Effect	Level of Effect	Magnitude	Level of Effect	Magnitude	Level of Effect	Magnitude	Level of Effect
NoR D1	Terrestrial habitat (district matters)	Low	Negligible	Very low						
	Bats	Low	Low	Very Low			Low	Low		
	Birds – coastal wetland	High	Moderate	**High**	Low	Low	Low	**Low**		
	Birds – forest	Low	Low	Very Low			Low	Very Low		
	Birds – freshwater wetland	High	Low	Low			Negligible	Very Low		
	Herpetofauna	Low					Low	Very Low		
NoR D2	Terrestrial habitat (district matters)	Low	Low	Very low						
	Bats	Low	Low	Very Low			Low	Low		
	Birds – coastal wetland	High	Moderate	**High**	Low	Low	Low	**Low**		
	Birds – forest	Low	Low	Very Low			Low	Very Low		
	Birds – freshwater wetland	Moderate	Low	Low			Negligible	Very Low		
	Herpetofauna	Low					Low	Very Low		

			Construction prior to Impact Management		Construction with Impact Management		Operation prior to Impact Management		Operation with Impact Management	
NoR	**Feature**	**Value**	**Magnitude of Effect**	**Level of Effect**	**Magnitude**	**Level of Effect**	**Magnitude**	**Level of Effect**	**Magnitude**	**Level of Effect**
NoR D3	Terrestrial habitat (district matters)	Low	Negligible	Very low						
	Bats	Negligible	n/a	Negligible			n/a	Negligible		
	Birds – forest	Low	Low	Very Low			Low	Very Low		
	Herpetofauna	Low					Low	Very Low		
NoR D4	Terrestrial habitat (district matters)	Negligible	Low	Very low						
	Bats	Low	Low	Very Low			Low	Low		
	Birds – forest	Moderate/ Low	Low	Low/Very low			Low	Low/Very low		
	Birds – freshwater wetland	Moderate	Low	Low			Low	Low		
	Herpetofauna	Moderate	Low	Low			Low	Low		
NoR D5	Terrestrial habitat (district matters)	Low	Low	Very low						
	Bats	Low	Low	Very Low			Low	Low		
	Birds – forest	Moderate/ Low	Low	Low/Very low			Low	Low/Very low		
	Herpetofauna	Moderate	Low	Low			Low	Low		

Bold = Moderate or above Level of Effect and therefore requires impact management

3 Introduction

This report has been prepared for the Drury Arterial Network Notices of Requirement (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi) (the “Drury Package”). The NoRs are to designate land for future strategic transport corridors as part of the Supporting Growth Programme to enable the future construction, operation and maintenance of transport infrastructure in the Drury-Ōpāheke area of Auckland.

The Auckland Council Drury-Ōpāheke structure plan area is expected to grow over the next 30 years and is estimated to provide about 22,000 houses and about 12,000 jobs with a population of about 60,000. The Drury Package will provide route protection for the local arterials, which include walking, cycling and public transport (including the Frequent Transit Network (FTN)), needed to support the expected growth in Drury. This report assesses the ecological effects of the proposed Projects, that together comprise the Drury Package, as shown in Figure 1.

Table 2 Drury Package: Notices of Requirement and Projects

Notice	Project
NoR D1	Alteration to NZ Transport Agency designation 6707 – State Highway 22 (SH22) Upgrade
NoR D2	Jesmond to Waihoehoe West FTN Upgrade
NoR D3	Waihoehoe Road East Upgrade
NoR D4	Ōpāheke North-South FTN Arterial
NoR D5	Ponga Road and Ōpāheke Road Upgrade

The Drury Package has been developed through an alternatives assessment. Corridor alternatives and route refinements were assessed by a multi-disciplinary team against a programme wide Multi-Criteria Assessment. This assessment phase was completed in February 2020, and further design changes have been adopted through the Assessment of Environmental Effects (AEE) process for the Drury Package, in response to a range of construction and environmental considerations.

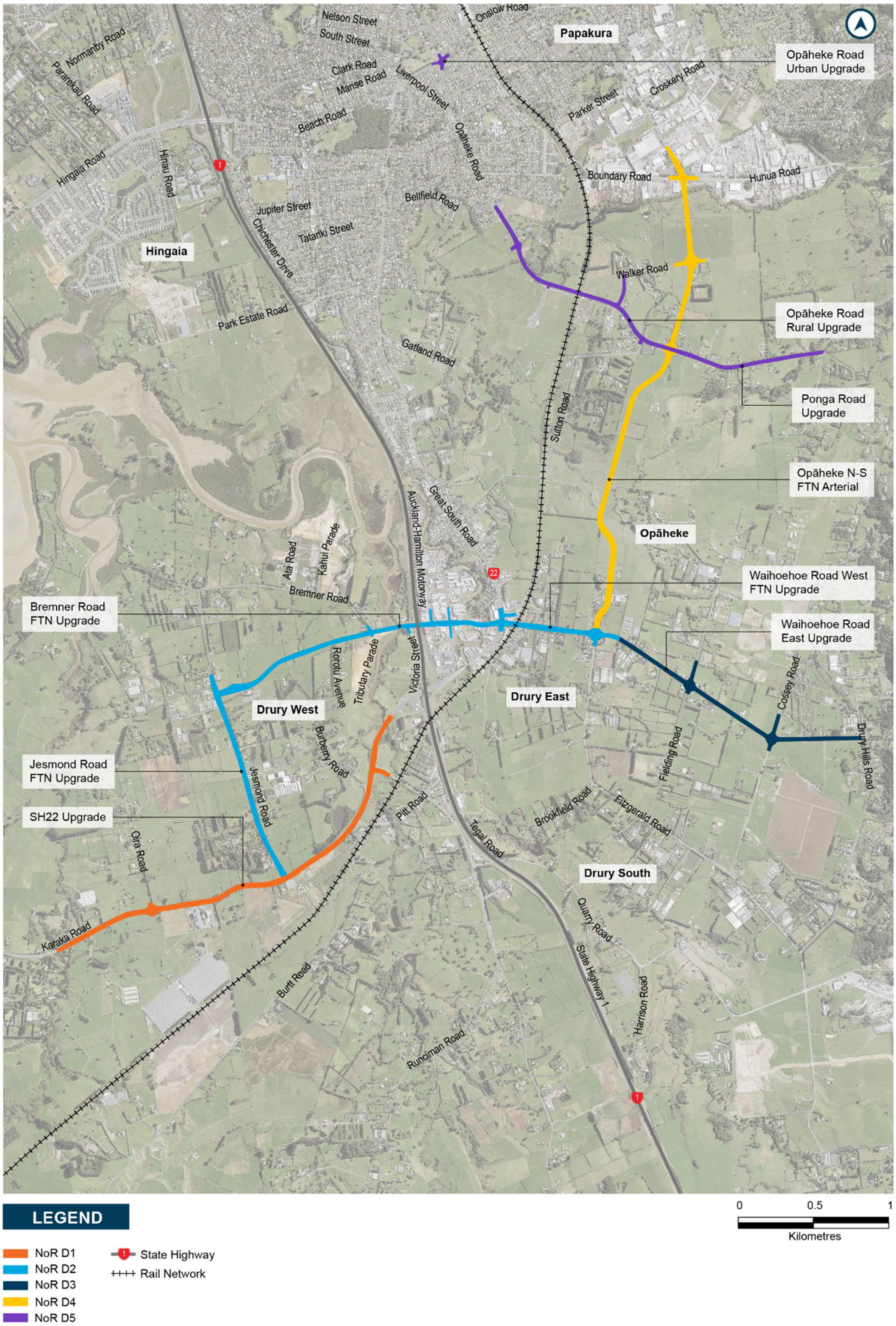

Figure 1 Drury Package Projects and Notices of Requirement

3.1 Background

Auckland is New Zealand's largest city, home to approximately 1.65 million people. In 2017, Auckland attracted 36,800 new residents; more than the rest of the country combined. The Auckland Plan 2050 – Development Strategy signals that Auckland could grow by 720,000 people to reach 2.4 million over the next 30 years. This will generate demand for more than 400,000 additional homes and require land for 270,000 more jobs.[1] Most of this growth will go into existing urban areas. However, around a third will go into future urban zone (FUZ) as identified in the Auckland Unitary Plan: Operative in Part (AUPOIP). The FUZ areas are "greenfields", that is, generally rural land identified to be urbanised over time.

The Supporting Growth Programme is a collaboration between AT and Waka Kotahi to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years.

AT and Waka Kotahi have partnered with Auckland Council, Manawhenua and KiwiRail Holdings Limited (KiwiRail) and are working closely with stakeholders and the community to develop the strategic transport network to support Auckland's growth areas.

The key objective of the Supporting Growth Programme is to protect land for future implementation of the required strategic transport corridors/infrastructure. As a form of route protection, designations will identify and appropriately protect the land necessary to enable the future construction, operation and maintenance of these required transport corridors/infrastructure. A designation is important as it provides certainty for the Requiring Authority that it can implement the work. It also provides property owners, businesses and the community with increased certainty regarding future infrastructure, so they can make informed decisions (if confirmed it will be identified in the AUPOIP). It can also significantly reduce long-term costs for local and central government and enable more effective land use and transport outcomes.

3.2 Drury Package

The Drury Package proposes an arterial network to support the expected future growth in Drury-Ōpāheke. The Drury Package comprises five separate projects which together form the Drury Arterial Network. The network includes provision for general traffic, walking and cycling, and frequent public transport. Overall, the Drury Package aims to improve connectivity within and through the Drury-Ōpāheke area, providing high quality, safe and attractive transport environments.

Each Project within the Drury Package will be designated separately as follows:

- **NoR D1:** Alteration to Waka Kotahi NZ Transport Agency designation 6707 – State Highway 22 (SH22) Upgrade
- **NoR D2:** Jesmond to Waihoehoe West FTN Upgrade
- **NoR D3:** Waihoehoe Road East Upgrade
- **NoR D4:** Ōpāheke North-South FTN Arterial (Ōpāheke N-S FTN Arterial)
- **NoR D5:** Ponga Road and Ōpāheke Road Upgrade

[1] Draft Auckland Plan 2050 Development Strategy: https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/development-strategy/future-auckland/Pages/what-auckland-look-like-future.aspx

3.3 Purpose and Scope of this Report

This report provides an assessment of potential ecological effects associated with the construction, and operation of the Drury Package. This assessment has been prepared to inform the AEE for the NoRs.

The purpose of this report is to:

- Identify and describe the existing and likely future environment;
- Identify and describe the actual and potential ecological effects of the Projects;
- Recommend measures as appropriate to avoid, remedy or mitigate potential adverse ecological effects (including any conditions/management plan required); and
- Present an overall conclusion of the level of potential adverse ecological effects of each of the Projects after recommended measures are implemented.

The key matters addressed in this report are as follows:

- Description of the Projects as they relate to ecology;
- Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
- Identification and description of the existing and likely future environment;
- Description of the actual and potential positive effects of each Project;
- Description of the actual and potential adverse ecological effects of operation of each Project;
- Description of the actual and potential adverse ecological effects of construction of each Project;
- Recommended measures to avoid, remedy or mitigate potential adverse ecological effects (including any conditions/management plan required); and
- Overall conclusion of the level of potential adverse ecological effects of each of the Projects after recommended measures are implemented.

3.4 Report Structure

An Ecological Impact Assessment (EcIA) has been completed in accordance with the Environment Institute of Australia and New Zealand (EIANZ) Guidelines (Roper-Lindsay *et al.* 2018) for each of the five NoRs. Each assessment includes the following assessment stages for ecological effects relating to district plan matters:

- Ecological value;
- Magnitude of effect;
- Level of effects;
- Impact management; and
- Residual effects.

Table 3 provides an outline of where each of these sections are located within this report.

Table 3 EcIA layout; with references to the relevant report sections

NoR	EcIA Section	Section Reference		
		Pre-construction/Baseline	**Construction**	**Operation**
NoR D1	Ecological Value	6.2.4		
	Magnitude of Effect		6.3.1.2	6.3.2.2
	Level of Effects		6.3.1.3	6.3.2.3
	Impact Management		6.3.1.4	6.3.1.4
	Residual Effects		6.3.1.5	6.3.1.5
NoR D2	Ecological Value	7.2.4		
	Magnitude of Effect		7.3.1.2	7.3.2.2
	Level of Effects		7.3.1.3	7.3.2.3
	Impact Management		7.3.1.4	7.3.1.4
	Residual Effects		7.3.1.5	7.3.1.5
NoR D3	Ecological Value	8.2.4		
	Magnitude of Effect		8.3.1.2	8.3.2.2
	Level of Effects		8.3.1.3	8.3.2.3
	Impact Management		n/a	n/a
	Residual Effects		n/a	n/a
NoR D4	Ecological Value	9.2.4		
	Magnitude of Effect		9.3.1.2	9.3.2.2
	Level of Effects		9.3.1.3	9.3.2.3
	Impact Management		n/a	n/a
	Residual Effects		n/a	n/a
NoR D5	Ecological Value	10.2.4		
	Magnitude of Effect		10.3.1.2	10.3.2.2
	Level of Effects		10.3.1.3	10.3.2.3
	Impact Management		n/a	n/a
	Residual Effects		n/a	n/a

Further details relating to how each assessment stage is completed in regard to the EIANZ Guidelines are provided in Appendix 3.

Regional plan matters have also been identified for each NoR and are discussed to the extent these matters informed design, options assessment and the proposed designation footprint. Regional matters, along with any requirements under the Freshwater NES, will otherwise be addressed as part of future consenting processes. See Section 4.1.2 for further details on how regional plan matters have been considered, and section 4.2.1 for further details on how the Freshwater NES has been considered. Appendix 1 lists potential ecological effects from Project activities and splits these accordingly as to whether they are regional, or district plan matters.

3.5 Preparation for this Report

A number of external reports were reviewed for the desktop assessment of the report. This list is presented in Section 5.2.

Information from the Stormwater and Flooding Report (Marais & Seyb, 2020) and Arborist Report (Webb, 2020) was also used to inform this report.

A number of field survey site visits were undertaken between December 2019 and March 2020 to inform this EcIA. See Section 5.3 for survey details. A number of Project workshops were also attended which included discussions around ecology. These are listed below:

- AEE Project Team briefing and site visit – 03 March 2020
- Auckland Council – phone conference – ecology methodology and scope – 23 March 2020
- AEE Technical Report Findings Workshop– phone conference – 15 and 16 April 2020
- As and when required, expert advice was provided by Peer Reviewers Gerry Kessels, Bluewattle Ecology and Matt Baber Alliance Ecology.

4 Assessment Criteria

4.1 Statutory Context

4.1.1 Notice of Requirement

This assessment has been prepared to support the NoRs for the Drury Package. Section 171 of the Resource Management Act 1991 (RMA) sets out the matters that must be considered in making a recommendation on a NoR. This includes consideration of the actual or potential effects on the environment of allowing the requirement, with particular regard to:

- Any relevant provisions of a national policy statement, the NZCPS, and the AUPOiP (in terms of the regional policy statement and regional/district plan provisions);
- Whether adequate consideration has been given to alternative sites, routes or methods of undertaking the work;
- Whether the work and designation are reasonably necessary for achieving the objectives of the requiring authority for which the designation is sought; and
- Any other matter the territorial authority considers reasonably necessary.

Sections 175 and 176 of the RMA set out the legal effect of a designation, which, once confirmed, must be included in a District Plan as if it is a rule, and removes the requirement for a district resource consent in terms of section 9(3) of the RMA.[2] Essentially a designation is therefore a land use or district planning mechanism.

Accordingly, when assessing the actual or potential effects on the environment of allowing the requirement in terms of section 171 of the RMA, the assessment of effects on the environment has been limited to matters that would trigger a district plan consent requirement. Where regional plan consenting requirements are triggered, these will not be authorised by the designation, and will require further regional consents. In order to demonstrate the jurisdictional split between regional and district plan matters, a table is included in Appendix 1, which identifies the potential ecological effects of the construction and operation of the Projects, and whether these are regional, or district plan matters under the AUP OiP. As can be seen from that table, a number of ecological matters are regulated by the regional provisions of the AUP OiP.

Similarly, where consenting requirements under the Freshwater NES are triggered, these will not be authorised by the designation, and additional Freshwater NES consents may be required in the future. Further detail regarding the Freshwater NES is set out in section 4.2.1 below.

4.1.2 Regional Resource Consents

No regional resource consents are currently being sought for the proposed Drury Package. Although regional consents are not being sought, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree as part of this report to inform design, options assessment and the proposed designation footprint. This has included the identification of any areas of significant value or habitats, for the purposes of design and alignment

[2] The underlying district plan provisions only apply if the land is not being used for its designated purpose (section 176(2) of the RMA).

decisions along with future resource consent requirements. This information is presented in each NoR section.

However, while ecological effects in respect of regional matters have been considered for these limited purposes, a detailed assessment of regional plan matters, and the mitigation required is not proposed to be undertaken at this NoR phase as it will be the subject of a subsequent future consenting process.

4.2 Relevant Standards and Guidelines

A list of relevant legislation, policy, plans and strategies for this assessment are presented below (refer to Appendix 2 for further detail):

- Resource Management Act 1991;
- Wildlife Act 1953;
- Freshwater Fisheries Regulations 1983;
- National Policy Statement for Freshwater Management 2020;
- New Zealand Coastal Policy Statement 2010;
- AUPOiP;
- New Zealand's Fish Passage Guidelines For structures up to four metres 2018; and
- EcIA Ecological Institute of Australia and New Zealand (EIANZ) guidelines for use in New Zealand: Terrestrial and freshwater ecosystems (Roper Lindsay *et al.*, 2018). Hereafter referred to as the 'EIANZ Guidelines'.

4.2.1 Freshwater NES

The Freshwater NES came into effect on 3 September 2020 and contains consent requirements for the construction of specified infrastructure involving vegetation clearance and works within certain natural wetlands and streams. The application of these consent requirements will need to be considered as part of the future consenting process for the Projects. Generally, the alignment and design refinement process for each proposed designation has sought to avoid or minimise impacts on high value natural wetlands and streams. There will be further opportunities to minimise any impacts during the detailed design of the Projects.

5 Assessment Methodology

Chapter Summary

This EcIA was undertaken following the EIANZ Guidelines. This process aims to identify, quantify and evaluate the potential impacts and effects of each of the Projects on ecosystems and their component species and habitats (ecological features). The full methodology is described in Appendix 3. The key outcome of the assessment methodology was to establish an ecological baseline for each of the Project Areas.

A desktop study was completed to identify records of indigenous species and habitats that could be present within the ZOI of each Projects. A site walkover was then undertaken to assess the nature and quality of the terrestrial and freshwater habitat within the ZOI of each of the Projects, and whether the habitats could support indigenous species such as lizards. A bat presence / absence survey was completed using ABMs; and bird surveys were undertaken through incidental records, point count and acoustic monitoring, where appropriate. Streams were classified as permanent, intermittent and ephemeral, and stream surveys were completed using the Rapid Habitat Assessment (RHA) methodology.

5.1 Project Area and Zone of Influence

Project Area has been used within this report as a term to describe the area that is located within the designation footprint for a specific NoR.

The Zone of Influence (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. ZOI is used throughout this report to describe the impacts of the Project (construction and operation) on adjacent or connected terrestrial, freshwater and wetland habitats and associated native species. For example, all Significant Ecological Area's (SEA's) within 2 km of each Project Area has been included in the desktop review, along with their connectivity to each Project Area. This is to ensure that important habitat within the wider landscape has been taken into consideration and can be used to inform the potential for flora and fauna to be present within each of the Project Areas and also whether the Project ZOI extends out to these SEA's.

The ZOI of the Project on different species differs depending on how they use their environment e.g. mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Projects and this was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or dispersal ability within each of the Project Areas, varying search distances were used depending on the species context. The size of this search area is stated alongside any species or habitat records identified within the relevant sections of this report. ZOI is also relevant to habitats, as indirect impacts on the receiving environment such as sedimentation of waterbodies could affect habitats far beyond the Project Area. Similarly, habitats which require permanent or intermittent inundation such as floodplain and kahikatea forest could be negatively impacted by changes to hydrology as a result of Project design.

It should be noted that presence within the ZOI of a Project does not necessarily mean the ecological feature will be impacted by the Project.

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 of each of the five Projects.

The sources of information that were reviewed to determine the likelihood of a species or habitat occurring within or adjacent to each of the Project Areas included:

- AECOM (2019a) Habitat Survey Report – SH1 Papakura Interchange to Drury Interchange;
- AECOM (2019b) Wetland and Coastal Bird Survey Report – SH1 Papakura Interchange to Drury Interchange;
- Auckland Council (2015) Assessment Report Ōtūwairoa Creek Catchment;
- Auckland Council (2017) Drury Structure Plan Ecology Assessment;
- Auckland Council (2017) Oira Catchment Watercourse Assessment Report;
- Auckland Council (2018) Hingaia Stream Catchment Watercourse Assessment Report (Draft);
- Auckland Council (2019) Ecology Assessment: constraints and opportunities report Pukekohe-Paerata Structure Plan;
- Auckland Council (2019) Drury – Ōpāheke Structure Plan;
- Auckland Council Geomaps[3];
- Auckland Regional Council (2004) Awhitu and Mānukau Ecological Districts: Indigenous Vegetation Survey, Volume 1;
- Department of Conservation (DOC) Bioweb records[4];
- Department of Conservation Threat Classification Series[5];
- Ecological Regions and Districts of New Zealand (McEwen, 1987);
- iNaturalist records[6], records within approximately 5km radius from each NoR. GPS coordinates are ‘obscured’ for Threatened species which may affect the accuracy of records within the study area;
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers *et al.*, 2017);
- Morphum Environmental (2018) Ngakoroa Catchment Watercourse Assessment Report
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database;
- New Zealand Bird Atlas eBird database[7]; recorded within 10 km^2 grid squares. Results from grid square AE69, positioned over the Drury area; and
- RMA Ecology Ltd, (2017) Auranga B1 Private Plan Change, Drury, Stage B1 Ecology Values Assessment.

[3] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[4] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

[5] 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/

[6] https://www.inaturalist.org/

[7] https://ebird.org/atlasnz/home

5.3 Site Investigations

5.3.1 Habitats

5.3.1.1 Terrestrial Habitat

Site walkovers were undertaken between December 2019 and March 2020[8] by experienced ecologists; to map and describe the habitats[9] present within and adjacent to the Project areas of each of the five NoRs. Habitats were classified into ecosystem type based on those described in Singers *et al.* (2017). The habitats were also assessed as to their potential to support indigenous fauna, including birds, bats and lizards.

Habitat assessment focused on areas of potentially significant value, such as habitat that was identified as a SEA, classified as forest habitat on Auckland Council's Geomaps – Ecosystems Current Extent (Singers *et al.,* 2017) or appears to be wetland or forest habitat based on aerial photos and during site investigation. Species records from relevant literature and biodiversity databases were utilised to focus search efforts on certain areas within the Project areas.

For terrestrial habitats, the vegetation was visually assessed during the site visits in order to classify it in alignment with the vegetation/ecosystem types described for the Auckland Region by Singers *et al.* (2017). Broad indigenous vegetation communities were mapped on recent aerial photography and incorporated into the Project's GIS database. 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 survey work also included searches for any rare or threatened plant species, previously recoded within the Project Areas. Common plant names are predominantly used within this report; refer to Appendix 6 for botanical names. Maps showing the vegetation cover along the Project alignment are provided in Appendix 7.

5.3.1.2 Freshwater Habitat

Freshwater assessments 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). The surveys were undertaken to ground truth GIS stream locations and give an indication of stream ecological value to inform Project design and future resource consent requirements. This methodology takes into account that the NoRs are for a proposed future transport network where the future environment is likely to change prior to construction. Therefore, the Stream Ecological Valuation (SEV) survey method (Quinn *et al.* 2011) was not completed at this stage of the Project and will not be required until each Project within the Drury Package seeks resource consents in the future. Macroinvertebrate and fish surveys were not undertaken as part of this assessment for the same reasons, although NIWA fish records (Franklin *et al.*, 2018) were used to inform potential ecological value of streams.

[8] These were suspended by the Covid-19 Level Four lockdown period and will be resumed where possible at a later date.

[9] Ecosystem codes from Singers *et al.* (2017) were used.

5.3.1.2.1 Stream Classification

During the site walkovers detailed above, all streams within the five Project Areas 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 and Wadhwa (2009), which are presented in Table 4. Any additional streams observed during site walkovers were also classified.

Table 4 Stream classification criteria (Storey and Wadhwa, 2009).

Criteria	Definition
Permanent stream	
1	Evidence of continuous flow
Intermittent or ephemeral stream*	
1	Evidence of natural pools
2	Well defined banks and bed
3	Retains surface water present more than 48 hours after a rain event
4	Rooted terrestrial vegetation not established across channel
5	Organic debris from flooding present on floodplain
6	Evidence of substrate sorting, including scour and deposition
*If three or more of the six assessment criteria can be met with confidence, the watercourse is considered intermittent. If at least three criteria cannot be met, the watercourse is considered ephemeral.	

The results of the stream classification were used to inform the ‘ecological context’ and ‘rarity/distinctiveness’ aspects of the freshwater ecology value assessment.

Specifically, the hydroperiod (period when wet throughout the year) was used as a proxy for the ecological context and presence of pools was used as a proxy for rarity/distinctiveness when assessing the ecological value of the different stream types. The value allocated for ecological context and rarity/distinctiveness is shown in Table 5.

Table 5 Value allocation based on hydroperiod and the pools from the stream classification

Ecological Value	Ecological Context (Hydroperiod)	Diversity and Pattern (Pools)
High	Permanent	Not applicable
Medium	Intermittent (order 2 and up)	Not applicable
Low	Intermittent (order 1 and 0)	Present
Very Low	Ephemeral	Absent

5.3.1.2.2 National Rapid Habitat Assessment

The RHA Protocols were completed on all streams present within each NoR which were classified as permanent or intermittent (Section 5.3.1.2.1). The overall condition of a stream was determined by allocating a score / value between 1 to 10 for 10 parameters (e.g. deposited sediment and fish cover). The total scores provide an RHA Habitat Quality Score (HQS) between 10 and 100.

Effective interpretation of the HQSs generated by the application of the RHA Protocol requires comparison to reference stream conditions. Reference streams must be of the same stream type as the survey site. In heavily transformed catchments, access to suitable reference sites are limited. This limitation is further exacerbated when reference conditions need to be determined for several streams with different characteristics (geomorphological and hydrological differences). In the context of this limitation, theoretical reference stream conditions were constructed for surveyed streams based on the River Environment Classification (REC) (Snelder *et al.*, 2004). Appendix 4 includes a full description of the application of the REC for constructing stream reference conditions, including limitations of the use of this method.

The results from the RHA Protocol informed two specific aspects (matters) of the aquatic ecology value assessment:

(i) 'representativeness' based in the degree of riparian modification; and

(ii) 'diversity and pattern' based in the observed diversity and abundance of instream habitat (Section 5.3.1.2.1).

Similarly, stream order, obtained from the REC, informed the stream order value allocation under 'ecological context' also outlined in Table 6.

Table 6 Value allocation based on representativeness and the level of instream habitat diversity from the RHA scores

Ecological Value	Ecological Context (Representativeness)	Diversity and Pattern (Level of diversity)	Stream Order
High	90-100% relative to reference	90-100% Instream RHA score	Order 4 and higher
Medium	70-90% relative to reference	70-90% Instream RHA score	Order 2 and 3
Low	50-70% relative to reference	50-70% Instream RHA score	Order 1
Very Low	<50% relative to reference	<50% Instream RHA score	Zero order

5.3.1.3 Wetland Habitat

Potential wetland habitat areas were identified by experienced ecologists based on Auckland Council Geomaps contours and the presence of wetland vegetation on aerial maps. These areas were then ground truthed during the site walkover; and areas which appeared to support wetland species were mapped and described.

The areas were described as wetland based upon the presence of wetland plant species (Clarkson, 2013), however no specific assessment or delineation methodology was used. In addition, the surveys were carried out in drought conditions, which may have influenced the visual appearance of some wetlands. This methodology was considered suitable for the purposes of this report, taking into account that the NoRs are for a proposed future transport network where the future environment is likely to change prior to construction. Therefore, a full Wetland Condition Survey was not completed at this stage of the Projects and will not be required until resource consents are sought for each Project in the future.

Wetlands were assessed based on the RMA definition of a wetland[10] and classified into ecosystem type based on those described in Singers *et al.* (2017). If the habitat present met this definition, it was then assessed as to its natural character, such as the composition of indigenous and exotic wetland species and evidence of modification, such as drainage and grazing and pugging by livestock. Wetlands were considered natural based on evidence of natural seeps or where wide flat basins occurred.

The information was then used to give an ecological value to the wetland based on overall condition assessed during the time of survey.

5.3.2 Fauna Species

Incidental observations of any native species seen during site walkover were recorded. For lizard species, this included incidental searches of natural/artificial refugia, such as turning over logs/wood/corrugated iron on the ground. For fish, this included observations within streams whilst collecting other freshwater data. In addition, for bats and birds, more detailed survey techniques were used, which are detailed below in Sections 5.3.2.1 and 5.3.2.2.

5.3.2.1 Bats

5.3.2.1.1 ABM survey

To determine the presence or likely absence of bats in the Project Areas, 22 ABMs (20 SM4BAT FS; and 2 Song Meter ZC; all with SMM-U2 microphones) were deployed across the Drury Package Project Areas; in pre-determined[11] locations where long-tailed bats were most likely to be foraging such as in mature tree vegetation and along stream corridors (Borkin & Parsons, 2009; O'Donnell *et al.*, 2006). The locations of these ABMs are illustrated in Appendix 7, Figure SGA-EX-DL-002.

ABMs were deployed in two separate survey sessions by experienced ecologists. The first (Session 1) was completed within the bat maternity period (December / January / February) and the second (Session 2) within the bat mating season (March – May). The intent of surveying in two sessions was to cover any potential changes in bat activity patterns between the maternity and mating seasons.

When deployed, ABMs were pre-set to start recording 60 minutes before sunset, and cease recording 60 minutes after sunrise (a 'night'). Each ABM was left in-situ for at-least 14 nights with suitable

[10] "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"

[11] Locations were identified and mapped prior to beginning the field surveys; using GIS viewing software.

weather conditions[12]. Weather conditions were monitored through the NIWA Cliflo website[13]; to ensure that conditions were considered suitable for bats to be active (Sedgeley, 2012). This weather information, and the exact dates of survey at each ABM location are presented in Appendix 5.

ABM data was analysed using Kaleidoscope Pro Software by experienced ecologists. This method allows for easy recognition of bat calls, and allows the viewer to distinguish different call types, including foraging (feeding buzzes) and social calls.

5.3.2.1.2 Survey limitations

Session 1 of the ABM surveys started in late December 2019; however, access to private property was not available until March 2020. Due to these access restrictions for Session 1, not all of the pre-determined survey locations were able to be utilised, and instead, alternative survey locations were identified on public land and road reserves, as close as possible to the original survey site.

Where a Session 2 survey was to be completed in a location where the initial Session 1 survey had been completed at an alternative (lower quality) survey location; if access became available to the original survey location on private property, the Session 2 survey utilised the original location (with higher habitat quality) rather than repeat surveying at the lower-quality alternative location.

Due to the Covid 19 Level 4 lockdown, Session 2 was extended by 6 weeks as several devices (B17, B19, B22 and B34) were left out over the lockdown period. There was also one technical failure where an ABM (B4) did not record during Session 1, however this location was covered during Session 2.

5.3.2.2 Birds

5.3.2.2.1 Coastal and freshwater wetland birds

Bird surveys, in the form of point counts, acoustic and transect surveys were carried out for coastal wetland and freshwater wetland birds by experienced ecologists. Each point count lasted 30 minutes. A Konus 20-60X100 Spotting Scope was used for the Point Count surveys. All coastal wetland and freshwater wetland birds, seen or heard within 200 m of these locations were recorded.

Intact coastal and freshwater wetland vegetation types provide potential habitat for a range of native bird species. Shags and gull species feed and roost in open areas and are best surveyed through visual assessment. However due to the dense vegetation associated with wetland habitat and cryptic nature of some bird species, acoustic survey techniques are more appropriate. The range of survey techniques aims to optimise potential survey success for all species likely to be present.

Two DOC AR4 acoustic recorders (ARs) were deployed at Bird Survey D1B2 (NoR D1) and Bird Survey D2B2 (NoR D2) (Appendix 7 Figure SGA-EX-DL-003) between 27 February and 23 March

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[12] 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. Unsuitable weather conditions are those where;

- Air temperatures drop below 10°C overnight; and/or
- Mean overnight wind speed exceeds 20km/h; and/or
- Maximum overnight wind gust exceeds 60km/h; and / or
- Persistent heavy rainfall occurs through the night.

[13] https://cliflo.niwa.co.nz/

2020. The ARs protocol was set to ‘Acoustic Low’ sound recording suitable for lower pitched bird calls such as wetland and coastal species. The ARs were left to record for 25 consecutive days, recording 3 hours of acoustic data each morning, either side of sunrise and 3 hours each evening either side of sunset to maximise detection of calls of crepuscular (most active during twilight) species of wetland and coastal species. The specific times the ARs were recording between 0600 hr – 0900 hr and 1800-2100 hr NZST. The acoustic recorders record all audible sounds for the period programmed. The sound files were analysed using Raven Pro software, developed by Cornell Lab of Ornithology Bioacoustics Research Programme. Calls were classified on the basis of their audible characteristics and by comparison of spectrograms.

The AR at Bird Survey Site 1 (NoR D1) failed to record and due to the Covid 19 lockdown, a repeat survey at this location was not possible. Therefore, at this location only, a 100 m wetland bird transect was undertaken in suitable habitat for inconspicuous wetland birds. The location of this transect is depicted in Figure SGA-EX-DL-003 (Appendix 7). Two playback walks were carried out along the transect. The first survey was carried out at the end of the breeding season (March) and the second survey when birds are likely to be starting to establish territory prior to breeding (May). A tech.inc wireless speaker was used to play recorded calls for banded rail, spotless crake and fernbird along the transects. The playback lures were used to elicit a territorial response from resident birds with any observed or heard behaviour recorded. Additionally, field signs such as footprints/feathers were also recorded.

The majority of the bird surveys were completed between February and March 2020, which is considered to be a suitable time of year to undertake surveys as it coincides with the end of the breeding season for resident birds. It is also during the period when long-distance summer migrants will still be present and when winter migrants from the South Island will be arriving. Therefore, the survey was undertaken during a period when the majority of expected species would be present.

5.3.2.2.2 Forest birds

Five Minute Bird Count (5MBC) surveys were undertaken for forest bird species within vegetated habitat of high ecological value by experienced ecologists. 5MBC is a standardised method of survey for forest species and includes recording all birds seen or heard within the allotted time. In addition, incidental observations were made for forest bird species, during other field surveys. The 5MBCs were carried out in accordance with the standard methodology described in Dawson and Bull (1975).

6 NoR D1: Alteration to Designation 6707 – State Highway 22 Upgrade

Chapter Summary

Desktop studies and site investigations for terrestrial, freshwater and wetland habitats and native species (bats, birds and lizards) were undertaken within and adjacent to the Project Area to identify their ecological value.

The Project will impact a range of exotic vegetation types of **Negligible** to **Low** value (regional and district). Although of **Low** value botanically, these features were considered for their potential to support Threatened and At Risk fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was considered to be **Low** and therefore no specific impact management has been recommended for these matters.

The Ngakoroa Stream corridor and associated wetlands within and adjacent to the Project Area have been highlighted for their potential importance to support a range of Threatened and At Risk coastal and wetland bird species. As such the replacement of the existing Ngakoroa Bridge could potentially cause noise, vibration and light disturbance during construction and operation to breeding birds such as banded rail, fernbird and spotless crake. Construction effects from disturbance of coastal birds was considered to have a **Moderate** level of ecological effect, while operational disturbance effects are **Low** (assuming the lighting and road design does not change (or in fact improves) noise and lighting effects. A Bird Management Plan is recommended to reduce the potential adverse effects of construction from **Moderate** to **Low**. Impact management requirements would include programming noisy works near the Ngakoroa Stream to avoid the bird breeding season (September – February) where practicable, pre-construction nesting bird surveys and mitigating construction lighting and noise/vibration disturbance.

The proposed alignment has minimised effects on streams, wetlands and terrestrial habitats of value. This includes the expansion of the Ngakoroa Bridge to the south of the existing road corridor to avoid **Very high** value wetland habitat within the SEA_T_530b.

Indicative impact management relating to future regional consent requirements has also been highlighted for completeness. It is considered that any potential effects of the Project on ecological features, such as streams and wetlands, can be adequately managed in any future consent processes and any requirement for offset/compensation can be accommodated within the proposed designation boundary.

6.1 Project Description

6.1.1 Project Overview

The State Highway 22 (SH22) Upgrade (NoR D1) consists of the widening of SH22 to a four-lane arterial with separated walking and cycling facilities (the Project). The Project extends approximately 3.08km from the State Highway 1 (SH1) Drury Interchange in the east, and the extent of the FUZ between Woodlyn Drive and Oira Road in the west. The intersections at Jesmond Road and Great South Road will be signalised and a roundabout is proposed at Oira Road. An overview of the concept design is provided in Figure 2.

As the surrounding area is urbanised over time and alternative routes are implemented (particularly the proposed Pukekohe Expressway), the function of SH22 will change from a rural state highway to provide an appropriate urban arterial connecting the growth areas of Drury West to the wider network and centres, including providing a frequent transport bus network. This is likely to include a reduction in the speed limit to 50kph. SH22 will improve future connectivity to the proposed Drury West train station which currently forms part of the New Zealand Upgrade Programme (NZUP) project.

Figure 2 Overview of SH22 Upgrade (showing location only, refer design drawings)

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade include the following:

- Widening of SH22 from its current general width of 20 m to enable a 30 m wide four-lane road with separated walking and cycling facilities
- Localised widening around the existing intersections to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Demolition and reconstruction of the existing Ngakoroa Stream Bridge
- Proposed new and extended culverts
- Three proposed stormwater wetlands
- Batter slopes and retaining to enable widening of the corridor, and associated cut and fill activities
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring

6.1.2 Project Features

The widening of the SH22 corridor will require the demolition and replacement of the existing SH22 Ngakoroa Bridge over Ngakoroa Stream. The new 3-span bridge will accommodate four lanes of traffic, separated pedestrian paths and cycle paths on both sides. During construction, a 20 m wide temporary accessway will be required next to the bridge footprint to allow for the temporary staging for construction and dismantling. The extended bridge footprint will require vegetation removal. This will include exotic vegetation but also may impact high value indigenous vegetation within the adjacent SEA. A site compound will be located adjacent to the eastern side of the existing Ngakoroa Bridge.

The surrounding environment is highly modified with original indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. The remaining road corridor crosses mainly small, low order streams which have been highly modified by previous road construction and adjacent agricultural practices in the past. Stream crossing methods will include extension to existing culverts as well as the bridge crossing described above. Vegetation removal will be required to facilitate the road widening; however, this is generally low value exotic species associated with private properties.

6.2 Ecological Baseline and Likely Future Environment

This section presents the findings of the desktop study (which includes a review of the documents listed in Section 5.1 and site investigations for all of the habitats and species (‘ecological features’) present within the Project Area. Based on this information, an ecological value has been calculated for each ecological feature. The likely future environment in regard to these ecological features during construction of the Project is discussed in Section 6.2.4.

6.2.1 Historical Ecological Context

The Project Area is located within the Mānukau Ecological District, which encompasses the Mānukau Harbour and the surrounding coastal lowlands. The district has a warm, humid climate with mild winters. Soils throughout the district range from poorly drained to well drained, dependent on landform and the presence of localised volcanic areas (McEwen, 1987).

Most of the district was originally forested (Singers et el, 2017). Original forest types were generally dependent on the landform and soils on which it grew:

- Flat lowland areas associated with stream and floodplains were dominated by kahikatea, pukatea forest (WF8[14]);
- The surrounding rolling hillslopes, gullies and ridges were dominated by taraire, tawa, podocarp forest (WF9); and
- The coastal wetland areas were dominated by mangrove forest and scrub (SA1).

Only 1.6% of the entire Mānukau Ecological District has native vegetation of any type remaining. Freshwater wetlands have been particularly affected, with over a 96% reduction in extent throughout the ecological district (Auckland Regional Council, 2004). 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 Mānukau Ecological District are well below these levels. The only significant area of natural landscape remaining in the Mānukau Ecological District are the unmodified coastal habitats of the Mānukau Harbour. Any remaining examples of original forests or wetlands, or any regenerating native vegetation that is developing into vegetation that once clothed the district, therefore needs to be considered as important.

6.2.2 Habitats

6.2.2.1 Terrestrial Habitats

6.2.2.1.1 Desktop Review

The present-day terrestrial habitats within the Project Area are dominated by agricultural land. Where natural habitat remains, the AUP OiP has mapped and classified habitats as terrestrial or marine SEAs. SEAs which occur within 2 km of the Project Area, are presented and described in Table 7 and are shown in Appendix 7 Figure SGA-EX-DL-004.1. A distance of 2 km was selected as potential ZOI for adverse effects of the Project depending on the potential receiving environment and the habitats and species present with a SEA.

SEA_T_530, SEA_T_530b, SEA_M1-29b and SEA_M2-29a are presented as several distinct SEA units in Table 7, however, they should be considered as a continuum following the transition of the Ngakoroa Stream mouth from freshwater to saline dominated habitats. The SEAs include a narrow fringe of terrestrial riparian vegetation transitioning through freshwater influenced wetlands into increasingly saline influenced habitat. Freshwater habitats are described further in Section 6.2.2.2 and wetlands in Section 6.2.2.3.

[14] Habitat codes are from Singers *et al.* (2017) and Singer & Rogers (2014) and have been identified by Auckland Council as occurring in the Auckland region

Table 7 Significant Ecological Areas present within 2 km of the Project Area (NoR D1)

SEA	Distance from Project Area (km)	SEA Description
SEA_T_530b	0.0	Coastal and riparian wetland vegetation associated with the Ngakoroa Stream. Habitat for threatened bird species, including pied oystercatcher and Caspian tern; and the rare plant species kaikōmako.
SEA_T_530	0.5	Terrestrial coastal and riparian edge vegetation along the inner Drury Creek and Ngakoroa Stream mouth. The remnant coastal scrub includes records for threatened plant species, including mingimingi and native oxtongue, and declining fish species īnanga. Also, habitat for rare plant species including korokio, kaikōmako and small-leaved kōwhai. This SEA is a buffer for adjoining SEA_M1-29b.
SEA_M1-29b	0.5	A wetland system within the upper tidal reaches of Drury Creek; which grades from freshwater vegetation, through rush-dominated saltmarshes to mangrove habitat; forming an important migration pathway for many native freshwater fish species.
SEA_M2-29a	0.9	Intertidal habitat; ranging from sandy mud flats, to current-exposed rocky reefs and a variety of saline vegetation. Areas of mangroves grow in Whangamaire Stream, and Drury and Whangapouri Creeks. In southern areas of Whangapouri Creek are eelgrass beds. Drury Creek is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Wading bird roosting area, including important area for pied stilt.
SEA_T_4516	1.9	Mangrove forest and scrub habitat which grades into Saltmarsh – Sea rush oioi habitat.
SEA_T_545	2.0	A highly representative site, containing over 10% of the critically endangered pūriri forest remaining within the Drury Ecological District.

6.2.2.1.2 Site Investigations

The Project Area is dominated by exotic ecosystems such as exotic grassland, and exotic amenity planting with small areas of exotic scrub, exotic wetlands, exotic treeland and exotic forest. For completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 6.2.2.3.

Terrestrial habitats are highly modified and dominated by exotic species. However, small areas of native or mixed exotic species occur with areas of planted native vegetation and within exotic wetland areas. These habitats retain a greater ecological function and have the potential to support a greater number of native species. The only intact indigenous habitat within or adjacent to the Project was classified according to Singers *et al.* (2017) as native wetland raupō reedland (WL19) and forms part of SEA_T_530b (Table 7). This wetland is dominated by purua grass along the main branch of the Ngakoroa Stream and raupō dominated within the adjacent unnamed tributary of the Ngakoroa Stream. The wetland has regional conservation status and is listed as Endangered by Singers *et al.* (2017). Table 8 presents the vegetation types, identified within and directly adjacent to the Project Area. These are also mapped in Appendix 7, Figures SGA -EC-DL-008.01 and SGA -EC-DL-008.02.

Table 8 Vegetation types present within and directly adjacent to the Project Area (NoR D1), classified according to Singers *et al.* (2017).

Vegetation Type	Alphanumeric Code*	Regional IUCN Conservation status*	Description of habitat
Exotic Grassland	EG	N/A	Grassland dominated by exotic species. This includes pasture, sport pitches, gardens and parks.
Brownfield (includes cropland)	BF	N/A	Strictly speaking according to Singers *et al.* (2017) this definition includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites.
Exotic Scrub	ES	N/A	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along stream and roadside corridors. Dominant species include gorse, woolly nightshade and privet species.
Exotic Forest	EF	N/A	Forest vegetation with >50% cover of exotic species in the canopy. This includes stands of exotic deciduous and conifer species.
Exotic Wetland	EW	N/A	Highly modified wetland system dominated by exotic plant species such as willow weed and soft rush.
Treeland	TL.3	N/A	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. This includes tree lined streams, gardens and mature trees within amenity plantings and shelter belts.
Planted Vegetation	PL.1	N/A	Native restoration plantings with <50% exotic biomass. Planted native scrub and forest <20 years old or wetland <10 years old.
	PL.3	N/A	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species.
Native Wetland	WL19	Endangered	Raupō reedland. In this case, dominated by purua grass. Present alongside the Ngakoroa Stream.
Open Water	OW	N/A	Open bodies of water, including ponds.

* = information from Singers *et al.* (2017).

6.2.2.1.3 Ecological Value

The terrestrial habitats within the Project Area are dominated by exotic grasslands, which is of **Negligible** ecological value (as assessed in accordance with the EIANZ Guidelines – refer to Appendix 3 for detailed threshold criteria). Most other vegetation types within NoR D1 are planted exotic habitat or self-seeded habitats such as scrub and treeland. These habitats are considered to be of **Low** ecological value due to their low botanical diversity and predominance of weed species (Table 9). In addition, as they are all exotic habitat types, no threat classification has been provided by Singers *et al.* (2017).

Low value habitat does not however, necessarily mean a vegetation type provides 'no value' habitat, as it may provide some value in terms of ecosystem function, such as bank stability and stream shading, or may provide habitat utilised by common, Not Threatened native species such as native birds and copper skink.

Table 9: Terrestrial habitat values for the Project Area (NoR D1)

Habitat Description	Alphanumeric Code (Singers*et al.*, 2017)	Value based on EIANZ Guidelines
Brownfield (includes cropland)	BF	Negligible
Exotic Forest	EF	Low
Exotic Grassland	EG	Negligible
Exotic Scrub	ES	Low
Planted Exotic and Amenity Vegetation	PL.3	Low
Exotic Treeland	TL.3	Low

6.2.2.2 Freshwater Habitat

6.2.2.2.1 Desktop Review

Auckland Council Geomaps' 'Named Streams' layer indicates that there are three named streams present which are intersected by, or flow immediately adjacent to the Project Area, namely Oira Creek, Ngakoroa Stream and an unnamed tributary of the Ngakoroa Stream. These are depicted in Appendix 7 SGA-EX-DL-005.1.

Auckland Council commissioned the following Catchment Watercourse Assessment Reports which included stream catchment locations within the Project Area:

- Ngakoroa Catchment (Surrey *et al.*, 2018); and
- Oira Catchment (Kane-Sanderson *et al.*, 2017).

These reports provide baseline information on the existing condition of waterways, stream ecological health (including stream classification), wetland habitat assessment and selected representative SEV and macroinvertebrate surveys. Table 10 provides an overview of information collected from these surveys. The data within these catchment reports covers the entire catchment and they are not specific to the sections of streams impacted by the Project.

Table 10 Desktop summary from Auckland Council Catchment Watercourse Assessment Reports for affected catchments within the Project Area (NoR D1)

Catchment effected	Summary	SEV	MCI
Oira Creek (Kane-Sanderson *et al.*, 2017)	The Oira Creek catchment is a soft-bottomed system which flows through a highly modified rural, agricultural landscape from Pukekohe in the south to Pahurehure Inlet (Mānukau Harbour) in the north. Stream characteristics reflect the agricultural nature of the catchment with limited riparian vegetation, low stream shading, lack of stream fencing and bank erosion.	SEV scores calculated for the catchment ranged from 0.267 to 0.573, giving functional values between 'low' to 'moderate'.	MCI scores ranged from 53.67 – 65.71. Overall MCI scores were poor.
Ngakoroa Stream **(Surrey *et al.*, 2018)**	The Ngakoroa catchment is a soft-bottomed system which flows through a highly modified rural, agricultural landscape from the Bombay Hills in the south to the Drury Creek and then the Pahurehure Inlet (Mānukau Harbour) in the north. Due to the gentle topography of the area, the catchment is characterised by low order, low energy systems connected to large wetland areas. Historical vegetation clearance has resulted in only small, fragmented pockets of native vegetation remaining.	SEV scores calculated for the catchment ranged from 0.360 to 0.719, giving functional value of 'moderate'.	MCI scores ranged from 46 – 80. Overall MCI scores ranged from poor to fair.

6.2.2.2.2 Site Investigations

All streams within or directly adjacent to the Project Area were numbered, classified as permanent, intermittent or ephemeral according to Storey and Wadhwa (2009) (Table 4) and mapped (Appendix 7 SGA-EC-DL-010.01 to SGA-EC-DL-010.05). An RHA was completed for all permanent and intermittent streams within or directly adjacent to the Project Area. As the Ngakoroa is tidally influenced at D1S7, an RHA assessment was unsuitable and the assessment and value is based on observed and reference stream data. The RHA scores are presented for instream habitat (instream habitat diversity, quality and quantity) and for riparian habitat (erosion, shade and buffering).

Of the seven stream branches identified within or directly adjacent to the Project Area, three were assessed as permanent and four were classified as intermittent. The results of the stream classification and RHA values are presented in Table 11.

All streams were representative of degraded systems. Primarily, this is due to historical indigenous vegetation clearance which has been compounded by agricultural practices. Degradation includes grazing and pugging by livestock or ploughing of arable land, leading to erosion and sediment control issues and nutrient runoff. This degradation of riparian vegetation and increased nutrient inputs has also led to loss of bank stability, reduced shading and the proliferation of exotic macrophytes within many streams. Additionally, some streams have been physically altered, through dredging, reclamation and/or drainage of associated wetlands and/or channelisation.

Details on corresponding RHA scores for reference stream types are also presented in Table 11 alongside the relevant stream sites. The observed instream RHA scores for sites D1.S1, D1.S3 and D1.S4 were relatively consistent or higher than their reference stream types. This may be due to the following:

- The method applied in predicting reference scores may underestimate instream habitat diversity. Refer to Appendix 4 for details on the assumptions and limitations for the predicted reference scores;
- Under present day conditions, instream habitat may be more diverse and abundant relative to reference conditions due to channel modification and/or increased flows (effluent discharge, irrigation return flows etc.);
- The diversity and abundance of instream habitat may have been overestimated during the field assessment.

Riparian habitat scores ranged from very large differences between observed and reference scores (D1.S2) to moderate differences (D1.S3 and D1.S6). The scores reflect the instream and riparian habitat scores for six streams linked to the Project.

Table 11 Instream, riparian and combined RHA scores for the Project Area (NoR D1)

Site Name	D1S1		D1S2		D1S3	D1S4		D1S5	D1S6	D1S7**	
Stream Name	Oira Creek	Ref. Stream Type WD/HS/1/LG	Ngakoroa Stream Tributary	Ref. Stream Type WD/SS/1/MG	Ngakoroa Stream Tributary	Ngakoroa Stream Tributary	Ref. Stream Type WW/SS/1/LG	Ngakoroa Stream	Ngakoroa Stream Tributary	Ngakoroa Stream	Ref. Stream Type WW/HS/4/LG
Classification	Permanent		Intermittent		Intermittent	Intermittent		Permanent	Intermittent	Permanent	
Instream Score %	51.7	55.0	10.0	41.7	26.7	68.3	35.0	56.7	23.3	80.0	80.0
Riparian %	52.5	100.0	10.0	97.5	75.0	62.5	97.5	57.5	65.0	85.0	85.0
Combined RHA Score %	52.0*	73.0	10.0	64.0	46.0*	66.0*	60.0	57.0	40.0	82.0	82.0

* Stream scores were relatively consistent or higher than their reference stream types.

**The Ngakoroa stream at this location is tidally influenced and therefore RHA assessment was not applicable at this location. The assessment is therefore based on observed and modelled criteria.

6.2.2.2.3 Ecological Value

The aquatic ecological value assessments for the respective sites are outlined in Table 12 for the Project. The assessment applied components presented within this report including: stream classification (hydroperiod and presence of pools), RHA (riparian and instream habitat representation, diversity), REC classification (stream order) and species of conservation importance, to assess the four matters (Representativeness, Rarity, Diversity and pattern, Ecological Context) outlined within the EIANZ Guidelines. A precautionary approach was taken regarding the occurrence of fish species of conservation significance for all the intermittent and permanent streams within the Project Area identified during site surveys. As such, a high value descriptor was assigned for 'Rarity' to qualifying streams, specifically for the likely occurrence of longfin eel and īnanga (At Risk - Declining). SEV surveys will be required when the Project seeks resource consent. This will include fish survey which will allow for a more accurate assessment of rarity for the value assessment.

Table 12 Aquatic ecology value assessment for the Project Area (NoR D1)

Site Name	D1S1	D1S2	D1S3	D1S4	D1S5	D1S6	D1S7
Representativeness	Very low	Very low	Medium	Low	Medium	Medium	Medium
Rarity	High	High	High	High	High	High	High
Diversity and pattern	Low	Very low	Very low	Low	Medium	Medium	Medium
Ecological context	Low	Low	Low	Low	High	High	High
Ecological Value	Moderate	Low	Moderate	Moderate	High	High	High

6.2.2.3 Wetland Habitat

6.2.2.3.1 Desktop Review

A Habitat Survey Report completed by AECOM (2019a) classified the coastal wetland within the mouth of the Ngakoroa Stream, as oioi restiad rushland/reedland. These upper intertidal zone wetlands (WL10) are described by Singers *et al.* (2017) as being characterised by abundant oioi, and locally areas of *Machaerina* and *Bolboschoenus* spp., kuta, lake clubrush, raupō or harakeke.

Surrey *et al.* (2018) assessed the habitat of the Ngakoroa Stream mouth near the SH22 Ngakoroa Bridge. This report describes the wetland as being native wetland species dominated by raupō and *Bolboschoenus* spp., as well as significant areas of exotic weed dominated wetlands, adversely affected by livestock access. Figure 3 depicts the natural wetlands associated with the Ngakoroa Stream and adjacent unnamed tributary to the north and west of the existing SH22 road corridor.

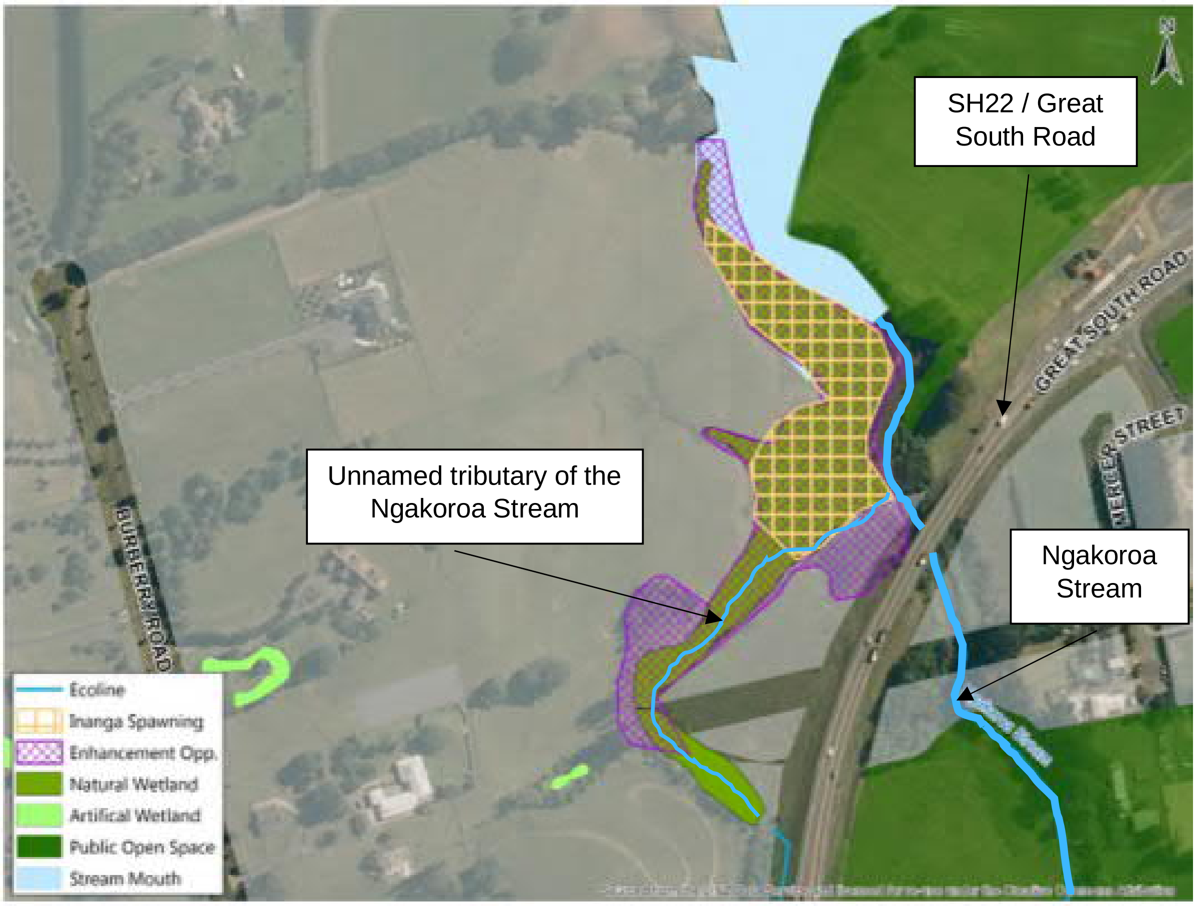


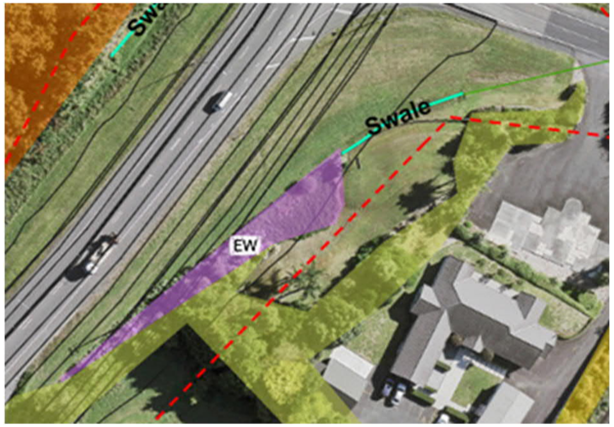
Figure 3 Wetlands habitat surrounding the Ngakoroa stream mouth (Surrey et al, 2018)

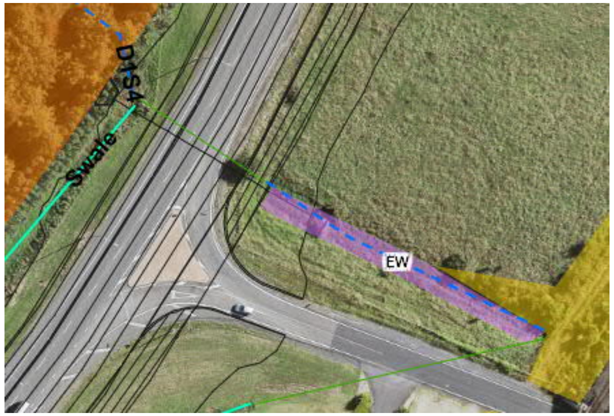
6.2.2.3.2 Site Investigations

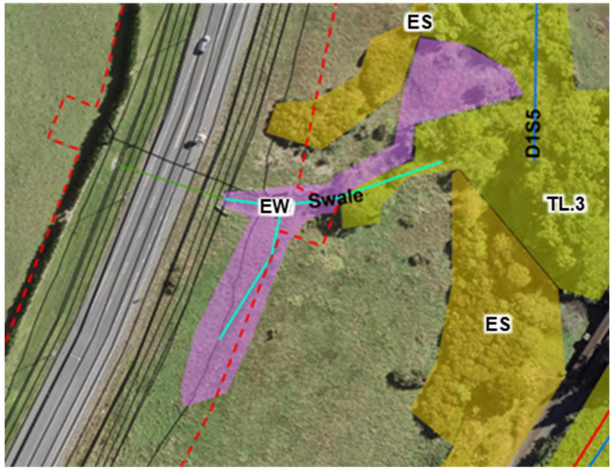
Wetland habitat was present within the and adjacent to Project Area as defined in Section 5.3.1.3. The majority of wetlands identified were classified as highly modified, exotic wetlands (EW) (Singers *et al.*, 2017). However, the wetland complex associated with the Ngakoroa Stream retains areas of intact, native species dominated wetland. Part of this wetland habitat is within the Project Area and may be temporarily effected as it will be partially used for a construction staging area. Table 13 below describes the wetland habitats present within the Project Area with drawings SGA-EC-DL-010.01 to SGA-EC-DL-010.05 presented in Appendix 7.

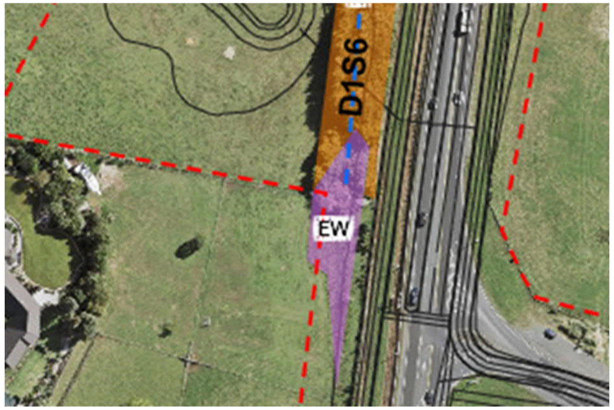
Table 13 Wetland habitats within and adjacent to the Project Area (NoR D1)

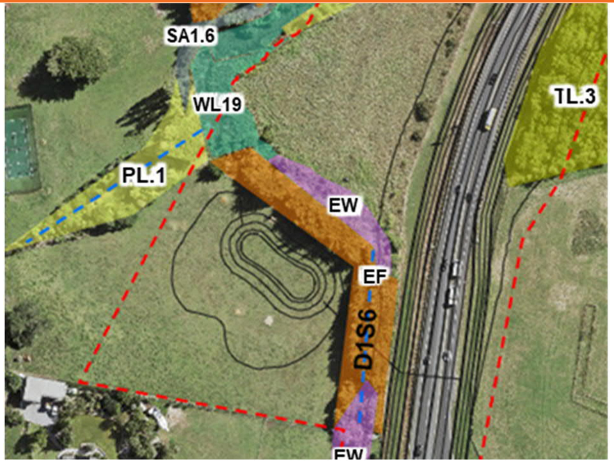
Site Name and Location	Description	Photograph of Habitat
D1W1 	Mapped and described as Open Water (OW) (Singers *et al.*, 2017). This feature is an enclosed depression without channel inflow or outflow. Under normal conditions this area is a naturally formed pond (OW) – this meets the RMA definition of a wetland i.e. 'intermittently wet area, shallow water and land water margins'. The water level fluctuates through the year and as the edges of the pond dry out during summer and it becomes seasonally dominated by pasture grass species. This habitat is modified, unfenced and grazed by livestock. Original (native) vegetation has therefore been cleared and the surrounding paddock has been reseeded with pasture grasses. The extent and dominance of pasture grass fluctuates with the water level. Vegetation cover is sparse due to the variable water table and wetland plant species did not dominate at the time of the assessment. This included sparse cover of exotic facultative wetland plant species such as willow weed (Clarkson, 2013).	

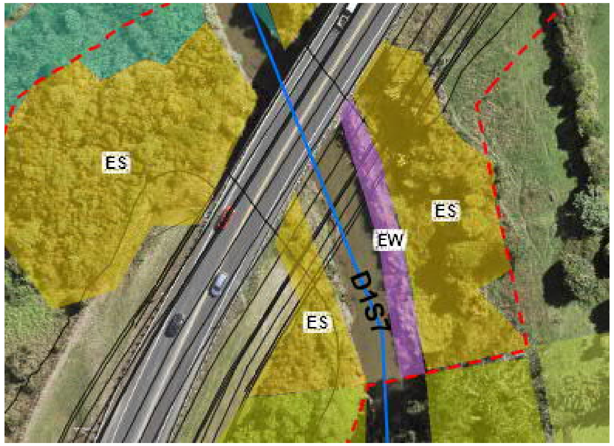
Site Name and Location	Description	Photograph of Habitat
D1W2 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Exotic arum lily and creeping buttercup occur throughout. D1W2 meets the RMA definition of a wetland as a permanently wet and unchanneledseep (where ground water reaches the surface but does not form a channel), and supports plants adapted to wet conditions. The lower wetland (silted pond) is dominated by native swamp millet an obligate wetland species. The upper section of the seep has been planted with native facultative wetland harakeke (flax) and exotic facultative wetland plant species such as crack willow and taro also occur (Clarkson, 2013). The existing SH22 road embankment has likely filled some of the original wetland and old aerials indicate that the adjoining property previously dug the area out into a small artificial pond, which has more recently silted up (likely affected by untreated stormwater runoff from the existing SH22) and now only retains a small area of standing water. An artificial drainage swale and culvert have also contributed to modification of this wetland.	 

Site Name and Location	Description	Photograph of Habitat
D1W3  	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. The vegetation includes obligate wetland plant species such as fools water cress and is dominated by facultative wetland plant species such as willow weed and soft rush (Clarkson, 2013). This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, that support plants that are adapted to wet conditions. This feature is a modified / realigned intermittent stream which drains the artificial pond off Burberry Road. The 1942 aerials indicate that prior to creation of the artificial pond the intermittent stream (D1S4) was part of a more extensive wetland area either side of the exiting SH22 road, which was also connected to D1W2. The diverted exiting flowpath is culverted under the existing SH22, straightened and widened. This new watercourse has an undefined channel where wetland conditions have developed and seasonal intermittent flow. As the flowpath is unfenced and grazed it is also affected by pugging from livestock and siltation from stormwater runoff. Livestock pugging may have exacerbated poor drainage, subsequently contributing to the formation of wetland conditions.	

Site Name and Location	Description	Photograph of Habitat
D1W4  	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. This feature meets the RMA definition of a wetland as it includespermanently or intermittently wet areas, that support plants that are adapted to wet conditions. These wet areas form modified realigned and straightened depressions with predominantly lateral flow path. This wetland has a mixed assemblage of native and exotic species, including native obligate wetland species such as slender spike rush and swamp millet and exotic fools water cress. Facultative wetland species include exotic soft rush and willow weed (Clarkson, 2013). The existing channel is artificially deepened, realigned and channelised. As the wetland features are unfenced and grazed it is affected by pugging from livestock and siltation from stormwater runoff. This has led to siltation and the modification of pre-existing wetland conditions.	 

Site Name and Location	Description	Photograph of Habitat
D1W5 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. This feature meets the RMA definition of a wetland as it includes intermittently wet areas, that support plants that are adapted to wet conditions. Dominated by exotic facultative wetland species such as soft rush (Clarkson, 2013). The extent of the wetland is consistent with the valley bottom floor, fed by lateral flow within the catchment and the adjacent constructed SH22 road embankment. The area may have been altered by historic realignment of the Ngakoroa Stream and the construction of the existing SH22 embankments. Beyond its mapped extent, this wetland drains into a channel described as intermittent stream D1S6 and then into a wider wetland area, described as D1W6.	
D1W6	The upper section of this wetland is mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. The lower section of the wetland is described as native Raupō reedland (WL19). There is a transition between the two areas rather than a defined line as shown on the mapping extent. The exotic wetland area is dominated by facultative wetland species such as reed canary grass, native flax and planted exotic bald cypress. The native Raupō reedland is dominated by obligate wetland species including swamp millet and raupo (Clarkson, 2013).	

Site Name and Location	Description	Photograph of Habitat
	This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, that support plants that are adapted to wet conditions. The 1942 aerial indicates that this area was the original channel of the Ngakoroa Stream before it was realigned to its current location. This wetland has developed as the old channel has gradually silted up. There is no obvious channel or flow within D1W6 however the small intermittent steam (D1S6) drains into this wetland. Raupō reedland has a regional threat classification Endangered (Singers *et al.*, 2017). Although this wetland is within the Project Area, it is outside the construction footprint. It is assumed that the native habitat can be avoided and retained during construction.	
D1W7	Estuarine wetland associated with the mouth of the Ngakoroa Stream. Mapped and described as raupō reedland (WL19) (Endangered, IUCN) (Singers *et al.*, 2017). Forms part of SEA_T_530b (refer Section 6.2.2.1.1). This feature meets the RMA definition of a wetland as it includes permanently wet areas and shallow water on the land water margin, which supports a natural ecosystem of plants that are adapted to wet conditions. The habitat is dominated by obligate wetland species, including a mix of native raupō and purua grass. Other obligate native species	

Site Name and Location	Description	Photograph of Habitat
	include oioi, swamp millet and saltmarsh ribbonwood (Clarkson, 2013). The 1942 aerial indicate natural wetland extending beyond their current extent. Historical reclamation associated with SH22 construction has reduced their area to their current extent. Part of the wetland is located within the construction staging area of the Project Area and may be temporarily affected by construction works (see Section 6.1).	
D1W8 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Obligate wetland plants include raupō, purua grass and swamp millet (Clarkson, 2013). Terrestrial plant species have started to invade this wetland including, pampas grass, blackberry and kikuyu grass. The area is described as riparian wetlands, in the upper estuarine zone, with tidal influence, which are regularly inundated by the associated stream, during high tide. This feature meets the RMA definition of a wetland as it includes permanently wet areas on the land water margin, that suoport a natural ecosystem of plants adapted to wet conditions.	

Site Name and Location	Description	Photograph of Habitat
	The 1942 aerial indicates that this area was once part of a wider wetland complex surrounded by the meandering Ngakoroa stream. The Ngakoroa Stream has since been realigned and straightened to its current position cutting of the old meander bend (now D1W7). The existing wetland habitat has therefore been altered by the formation of a new channel and the current exotic wetland occurs along the new Ngakoroa channel (D1S7).	

6.2.2.3.3 Ecological Value

Wetland habitats present within the Project Area include many areas of exotic wetland, dominated by exotic plant species, severely degraded through factors such as vegetation removal, artificial drainage and grazing and pugging from livestock. Although specific habitat assessments of wetland condition were not undertaken in these areas, this preliminary assessment has identified that the ecological value of these exotic wetlands is **Moderate,** taking into consideration the overall reduction in wetland habitat across the Mānukau Ecological District (a 96% loss in area (Auckland Regional Council, 2004)); in particular in lowland areas adjacent to the Mānukau Harbour (a 99.6% loss in area (Lindsay *et al.* 2009)) and the retained ecological functionality of these systems for attenuation of stormwater and excess nutrient removal.

There are two wetlands (D1W6 and D1W7) that includes raupō reedland which is an endangered indigenous wetland habitat (WL19 (Singers *et al.*, 2017)). Wetland D1W6 is predominantly exotic but includes a small portion of raupō reedland habitat that is of **Very high** ecological value, however it is not directly impacted by the Project. Wetland D1W7 is considered to be a fully functional indigenous wetland, providing habitat for native flora and fauna species. This includes threatened bird species such as the South Island pied oystercatcher and Caspian tern; and regionally threatened plant kaikōmako. At Risk – Declining banded rail has also been recorded within 0.5 km of this location. Part of wetland D1W7 is located within the construction staging area of the Project Area and may be temporarily affected by construction works. The ecological value of Wetland D1W7 is considered to be **Very high**.

6.2.3 Species

6.2.3.1 Bats

6.2.3.1.1 Desktop Review

DOC records; unpublished AECOM records and one additional anecdotal record by G. Kessels (Personal Communication) confirm the presence of long-tailed bats within 10 km of the Project Area. Although none are located directly within the footprint of the Project, as a highly mobile species there is potential for bats to frequent any suitable habitat within the designation boundary. The conservation status of this species is ‘Nationally Critical’ (O’Donnell *et al.*, 2017). The records within 10 km of the Project Area (Appendix 7; Drawing SGA-EX-DL-006) include:

- 5.6 km to the north-west on Kopuhinahinga Island in the Pahurehure Inlet.
- 5.3 km to the south-west, near the SH22 intersection with Glenbrook Road
- 5.6 km to the east in the foothills of the Hunua Ranges.
- 4.2 km to the south within Coulthards Scenic Reserve near Paerata (Unpublished records from AECOM of long-tailed bats); and
- 5.3 km to the south west, within the Paerata Scenic Reserve (Unpublished records from AECOM of long-tailed bats).

Further afield, there are multiple records confirming the presence of long-tailed bats within the Hunua Ranges and within farmland between Waiuku and Patumahoe.

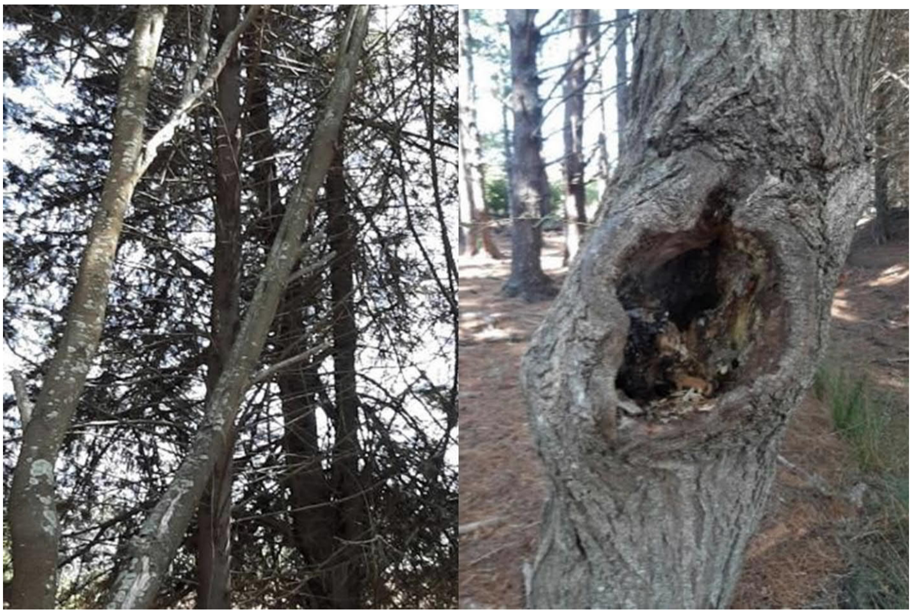
6.2.3.1.2 Site Investigations

6.2.3.1.2.1 Bat habitat

The results of the site walkovers indicate that the Project Area provides potential habitat features which would be suitable for use by foraging and commuting indigenous long-tailed bats, despite bats not being detected within the area to date (refer to Section 6.2.3.1.2.2). These habitat features may include:

- Tree-lined stream corridors;
- Stands of mature trees, both native and exotic; and
- Shelterbelts.

Additionally, mature trees of a range of species (e.g. willow; poplar, pine) with suitable roosting features were identified within and adjacent to the Project Area. Suitable roost features that were identified included cracks and/or rot holes in tree trunks and branches, and loose, peeling bark, and cavities suitable for bats to potentially roost within (Figure 4). Appendix 7 SGA-EC-DL-012.01 highlights potential habitat corridors within and adjacent to the Project Area.



Willow and Tasmanian blackwood trees within exotic forest stand next to SH22. Loose bark and trunk cavities are potentially suitable for roosting bats.

Figure 4 Examples of potential bat roost features within the Project Area

6.2.3.1.2.2 ABM Survey

Due to the large home ranges of bats and interconnectedness of bat habitat and ABM survey locations between all five Project Areas, the results of the bat surveys have been presented collectively.

A summary of the ABM surveys is presented in Appendix 5 and ABM locations are presented in Appendix 7 SGA-EX-DL-002. Data was collected for at least one Session for all ABM sites, with nine locations collecting data for both Sessions (1 and 2). Analysis of the ABM data did not identify any bat activity within the ZOI of the Projects. These results suggest that bats are not frequent visitors to the Project Area during their mating and breeding seasons. However, as the desktop assessment suggests (Section 5.3.2.1), bats are highly mobile and have been recorded within 4.5 km of the Project Area.

6.2.3.1.3 Ecological Value

The ABM surveys did not find any evidence of long-tailed bat (Threatened – Nationally Critical) activity at survey locations. However, there is some suitable habitat within the Project Area (refer to Section 6.2.3.1.1) and bats are known to be present within the wider Hunua-Drury-Pukekohe landscape (refer to Section 6.2.3.1). As such, it is possible that bats may be present in the wider landscape but an infrequent visitor to the Project Area, since they were not detected in the surveys associated with this assessment. On this basis, the ecological value of bat habitat within the Project Area is considered to be **Low**.

6.2.3.2 Birds

6.2.3.2.1 Desktop Review

Records of native bird species identified within 5 km of the Project Area are collated in Appendix 8, Table 111. However, because many records do not include a specific location, a map was not produced of individual bird records.

Of the nationally listed At Risk or Threatened species recorded in the literature search, most were coastal wetland or freshwater wetland bird species, with two forest bird species also recorded within 5 km of the Project Area. Of the coastal wetland species, the waders such as wrybill, pied oystercatcher and bar-tailed godwits are likely to forage within the intertidal mudflats and saltmarsh habitats associated with the SEA-M Significant Ecological Area (Marine) in the Drury Creek and Pahurehure Inlet. The gull, shag and tern species are likely to frequent the inner estuary around Drury Creek and the Ngakoroa Stream for foraging but are unlikely to breed within the Project area. Banded rail, spotless crake and fernbird have been recorded within 5km away within the Pahurehure Inlet. The wetlands throughout the Pahurehure Inlet, Drury Creek and Ngakoroa Stream mouth provide suitable foraging and breeding habitat (WL10 Oioi, restiad rushland/ reedland) for these species. They therefore could be resident and potentially breeding within or directly adjacent to the Project Area.

6.2.3.2.2 Site Investigations

Four bird surveys were undertaken at two locations associated with the Project Area and are summarised in Table 15. The AR recorder failed at Bird Survey Site D1B2 and a repeat survey was not possible due to the Covid 19 lockdown. Instead two playback walks were carried out along a transect at this location.

Table 14 Bird survey sites and method

Bird Survey Site #	Description	Survey method	Date(s)
D1B1	Burberry Rd (approximately 100 m from the Project Area) – Open water habitat in the form of an artificial pond, some small areas of *Machaerina* sedgeland (WL11) on the margins, with planted exotic treeland adjacent.	Point count	26 February 2020
D1B2	Adjacent to SH22 at the Ngakoroa Stream Bridge – upper estuarine zone tidally influenced, where freshwater and coastal wetlands interact.	Point count	26 February 2020
		Transect	19 March 2020 12 May 2020

No notable birds were recorded during the transect walk, the full results of each point count survey are provided in Appendix 8; with a summary of the native species recorded during the point surveys presented in Table 15. Locations of the point surveys are depicted in Appendix 7; Figure SGA-EX-DL-003.1. No 5MBC surveys were undertaken within the Project Area.

Figure 5 shows the D1B1 bird survey location, looking across the artificial pond located at property No. 6 Burberry Road. Habitats include a thin strip of *Machaerina* sedgeland (WL11) on the margins, with planted exotic treeland. This pond is adjacent to the Project Area (approximately 100m). Figure 5also shows D1B2 bird survey location looking across the Ngakoroa stream and tributary at high tide, directly adjacent to the SH22 bridge crossing. The area is part of SEA_T_530b estuarine wetland and includes a mix of raupō, purua grass, oioi, swamp millet and saltmarsh ribbonwood. The area provides high value habitat for coastal wetland and freshwater wetland birds species. This area is within and adjacent to the Project Area and will have temporary construction and staging works at this location.

Figure SGA-EX-DL-013.1 in Appendix 7 highlights the extent of high value wetland bird habitat, within and adjacent to the Project Area, identified along the Ngakoroa Stream corridor.

D1B1 – Artificial pond at No.6 Burberry Rd

D1B2 – Ngakoroa Stream, SEA_T_530b estuarine wetland habitat (the streetlights visible on the left of the picture show the proximity to the existing SH22 bridge)

Figure 5 Coastal wetland and freshwater wetland bird habitat

Table 15 Summarised bird survey results indicating presence

Location of Survey	Common Name	Scientific Name	Conservation status*	Frequency (seen or heard)
D1B1	Swamp harrier	*Circus approximans*	NT	2
	Black shag	*Phalacrocorax carbo*	AR-NU	1
	Little black shag	*Phalacrocorax sulcirostris*	AR-R	4
	Paradise shelduck	*Tadorna variegata*	NT	114
	New Zealand dabchick	*Poliocephalus rufopectus*	AR-R	1
D1B2	Swamp harrier	*Circus approximans*	NT	1
	Pūkeko	*Porphyrio melanotus*	NT	6
	Pied shag	*Phalacrocorax varius*	NT	1
	Sacred kingfisher (kōtare)	*Todiramphus sanctus*	NT	1
	Caspian tern**	*Hydroprogne caspia*	NT	1

Notes:
* = conservation status information from Robertson *et al.* (2016)
** = incidental observation seen outside of bird survey timing
NT = Not Threatened
AR-NU = At Risk – Naturally Uncommon
AR-R = At Risk – Recovering

6.2.3.2.3 Ecological Value

The desktop study and site investigations identified 12 At Risk and three Threatened species of coastal wetland or freshwater wetland bird species and two species of At Risk forest bird within the 5 km desktop search associated with the Project Area. However, many of these species are highly mobile, utilising large areas and are not likely to be effected by the Project based on the importance of the habitat within and adjacent to the Project Area for their pattern and use of habitat or life stage. This information is summarised in Table 16 and discussed in further detail below.

Of the At Risk forest bird species recorded, the At Risk – Recovering kōkako is a forest specialist with a known population in the Hunua Ranges, 10 km to the east. Kōkako do not readily disperse, and no suitable forest habitat occurs within the Project Area. Similarly, the At Risk – Recovering kākā is also a forest specialist but is known to disperse to seasonally available food sources such as pine plantations or other exotic treescapes, particularly in winter. There is limited suitable forest habitat or pine plantations within or adjacent to the Project Area, as such these two forest species are unlikely to occur and have not been considered further in the assessment of NoR D1. Only common, Not Threatened forest bird species are likely to be present within or adjacent to the Project Area.

Of the coastal wetland or freshwater wetland bird species, multiple At Risk or Threatened species were recorded during site investigations and in the desktop assessment within the 5 km desktop search associated with the Project Area. Of these species, the key migratory wading bird species such as At Risk – Declining bar-tailed godwit, At Risk – Declining South Island pied oystercatcher and Threatened – Nationally Critical wrybill depend on intertidal wetlands habitats within Drury Creek and the wider Mānukau Harbour for foraging (Veitch & Habracken, 1999) and also require suitable high tide roosts locations which may include sandspits, beaches and coastal grassland. High tide roost requirements for wading birds include short vegetation, with >50 m visibility and minimal disturbance from stock or human activity (Gillies *et al.* 2014). Suitable roosting and foraging habitat for these species would be within SEA-M2-29a approximately 2 km from the Project Area. Known roost sites include Pollock Spit, Airport (Wiroa Island) and Puhinui Reserve (>10 km from the Project Area) (Garten *et al*, 2018). The habitat directly within or adjacent to the Project Area would therefore be considered largely unsuitable for these wading birds due to existing human disturbance and lack of suitable habitat for these species.

The South Island pied oystercatcher (At Risk – Declining) are more likely to utilise less specific roost locations, such as grazed pasture or grass sports pitches. Their potential occurrence within Drury sports pitches is likely the reason for the recorded presence of this species (see Appendix 8, Table 111) within SEA_T_530b, directly adjacent to the Project Area.

The freshwater lake at bird survey site D1B1 and open water within the Ngakoroa Stream (bird survey site D1B2) provides potential foraging habitat for some shag, gull and tern species (Table 16). The shag species have the potential to breed and roost within the local area on suitable trees or exposed platforms. However, no nesting or roosting sites were observed within or adjacent to the Project Area and no potentially suitable features were identified. Three shag species were observed foraging in the Ngakoroa Stream and crossing under/over the existing SH22 bridge, indicating their habituation to noise and disturbance levels. The gull and tern species (see Table 16) breed in exposed coastal cliffs and sandspits and therefore no suitable breeding habitat occurs within or adjacent to the Project Area for these species. Notably, Caspian terns were observed foraging along the Ngakoroa Stream at high tide and crossed over the existing SH22, indicating their habituation to existing noise and disturbance levels (see Appendix 8, Table 111).

New Zealand dabchick (At Risk – Recovering) were observed on the freshwater pond at bird survey site D1B1 Burberry Rd. The thin strip of *Machaerina* sedgeland (WL11) on the margins, could potentially provide adequate breeding habitat for this species. Spotless crake could also be present within this habitat. This pond is adjacent to the Project Area (approximately 25 m) and buffered by a strip of exotic trees.

In summary, the only At Risk species that are likely to be resident and breeding within or directly adjacent to the Project Area are the At Risk – Declining banded rail, spotless crake and fernbird. It is likely that these species are resident (or have the potential to occur in the future), utilising both the coastal and freshwater wetland habitats near the Ngakoroa Stream and/or the freshwater habitat near bird survey site D1B1, which is adjacent to the Project Area.

Table 16 Threatened and At Risk bird species identified from desktop and site investigations, the habitat suitability and likelihood of occurrence within and adjacent to the Project Area (NoR D1)

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al*, 2013)	Habitat suitability	Pattern in habitat use or life stage
Black-billed gull	Threatened – Nationally Critical	Breeding range largely restricted to Southland. Breeding habitat includes lakes, major rivers (mostly braided) and occasionally farmland; outside of breeding season is more often present in estuaries & coastal areas (McClellan & Habraken, 2013).	Rare visitor. No suitable breeding habitat and suboptimal foraging or roosting.	Foraging only
Wrybill	Threatened – Nationally Vulnerable	Breeding range restricted to the South Island. Winter range in the northern north island where they feed on inter-tidal mudflats in harbours and estuaries. High-water roosts are usually near foraging areas, on shell banks and beaches; occasionally on pasture. The Mānukau Harbour is a key winter-feeding area for the population (Dowding, 2013).	Rare visitor. No suitable breeding habitat and suboptimal foraging or roosting. Key habitat within the wider Mānukau Harbour.	Foraging only
Caspian tern	Threatened – Nationally Vulnerable	Breed habitat includes open coastal shellbanks and sandspits and occasionally in similar habitat inland. No breeding and foraging habitat includes sheltered bays and harbours of the main islands (Fitzgerald, 2013).	No suitable breeding habitat. Small numbers of Caspian terns are known to regularly frequent the Ngakoroa Stream for foraging during high tide.	Foraging only

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al*, 2013)	Habitat suitability	Pattern in habitat use or life stage
Banded rail*	At Risk – Declining	Resident and breeding in the northern north Island. They nest at ground level with rush and reed habitat. Foraging in mangroves and saltmarshes within estuaries (Bellingham, 2013).	Known breeding habitat within the Ngakoroa Stream estuary and Drury Stream wetlands.	Breeding, roosting and foraging
Red-billed gull	At Risk – Declining	Breeding habitat includes sea cliffs and sandy/ rocky shores throughout New Zealand. They forage and disperse widely in coastal areas. They are also commonly found in towns, scavenging on human refuse (Mills, 2013).	No suitable breeding habitat. Likely to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
South Island pied oystercatcher	At Risk – Declining	Breeding range largely restricted to the South Island. Their winter range includes the northern north island where they feed on inter-tidal mudflats in harbours and estuaries, the also frequent wet pasture in coastal areas (Sagar, 2013).	No suitable breeding habitat. Suboptimal foraging or roosting habitat within adjoining grazed paddocks and sports pitches. Presence currently impacted by ongoing (and future) disturbance from live zoned Auranga Development and human disturbance within Drury sports pitches.	Foraging only, but may occasionally roost in the Drury sports pitches
White-fronted tern	At Risk – Declining	Breeding habitat includes sea cliffs and sandy/ rocky shores throughout New Zealand. They forage and disperse widely in coastal areas (Mills, 2013).	No suitable breeding habitat and suboptimal foraging or roosting. Key habitat within the Drury Creek and wider Mānukau Harbour.	Foraging only

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al*, 2013)	Habitat suitability	Pattern in habitat use or life stage
Black shag	At Risk – Naturally Uncommon	Breeding habitat includes trees overhanging water, coastal cliffs and headlands, and on artificial structures throughout New Zealand. They occur and forage widely, in coastal waters, estuaries, harbours, rivers, streams, lakes and ponds (Powlesland, 2013).	No suitable breeding or roosting trees identified. Known to regularly frequent the Ngakoroa Stream estuary habitat for foraging. Also recorded within the large artificial pond at bird survey site 3.	Foraging only
New Zealand dabchick*	At Risk – Recovering	Occurs throughout the north island on freshwater lakes and ponds. Breeding on small shallow ponds with dense vegetation. Non-breeding birds flock on more open freshwater bodies (Szabo, 2013).	Recorded foraging within the large artificial pond at survey site D1B1. May also breed at this location.	Foraging, breeding and roosting
North Island kākā	At Risk – Recovering	Kākā are rare to uncommon in native forest on the mainland, with strongholds on pest free offshore island. Kākā however disperse widely during winter and regularly visit forest fragments and pine plantations in the Auckland area (Moorhouse, 2013).	Rare visitor. No suitable breeding or foraging habitat.	Movement corridor
Little black shag	At Risk – Naturally uncommon	Little black shags occur in most freshwater and coastal habitats throughout the north island. Nest are usually within trees overhanging freshwater (Armitage, 2013).	No suitable breeding or roosting trees identified. Known to regularly frequent the Ngakoroa Stream estuary habitat for foraging. Also recorded within the large artificial pond at Bird Survey Site D1B1.	Foraging only

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al*, 2013)	Habitat suitability	Pattern in habitat use or life stage
Pied shag	At Risk – Recovering	Pied shags mainly forage along the coast but also within estuaries, and occasionally freshwater areas. Nest are usually within trees along coastal cliffs (Powlesland, 2013).	No suitable breeding or roosting trees identified. Known to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
Royal spoonbill	At Risk – Naturally uncommon	Occurs and breeds in a wide range of freshwater and coastal habitat throughout New Zealand (Szabo, 2013).	Likely to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
Spotless crake*	At Risk – Declining	Occur and breed in freshwater wetland dominated by dense emergent vegetation particularly raupō throughout the North Island (Fitzgerald, 2013).	No records in the local area however suitable raupō reedland habitat occurs within the unnamed tributary of the Ngakoroa D1W6 and D1W7.	Breeding, roosting and foraging
North Island fernbird*	At Risk – Declining	Occur and breed in dense freshwater and coastal wetland vegetation throughout New Zealand (Miskelly, 2013).	No records in the local area however suitable in the coastal and freshwater wetlands associated with the Ngakoroa in D1W6 and D1W7.	Breeding, roosting and foraging

*At Risk species most likely to be resident and/or breeding within or adjacent to the Project Area

For the Project Area, an overall assessment on the ecological value of various bird habitats (coastal wetland, forest and freshwater wetland) present within or adjacent to the Project Area, taking into account habitat representativeness, rarity/distinctiveness, diversity/pattern and ecological context (life stage), in accordance with the EIANZ Guidelines, was completed. Due to the large variance in habitat within the Project Area, birds have been split into three groups to provide an overall value assessment based on habitat preference ('coastal wetland', 'forest' and 'freshwater wetland').

As the aquatic habitats available for birds generally scored lower for habitat representativeness, diversity/pattern and ecological context, the score for rarity/distinctiveness of the species present was an important factor in the overall value of the habitat for bird species, as presence of a species with a conservation status of 'At Risk – Declining' or 'Threatened' immediately triggers a **High** overall ecological value rating (as per the EIANZ Guidelines).

The habitat within and adjacent to the Project Area was considered to be of **Low** ecological value for 'forest' birds, as this habitat is most likely to support a range of common Not Threatened species, with no At Risk or Threatened species present. For 'coastal wetland' and 'freshwater wetland' birds, the presence of At Risk – Declining species triggers a **High** score for ecological value for both of these habitats. This in part reflects that the Ngakoroa Stream wetlands are a continuum, with many of these species occurring throughout the coastal and freshwater interface.

The corresponding ecological habitat value for bird species is subsequently presented in Table 17.

Table 17 Overall ecological value of bird habitat (for coastal wetland; forest; and freshwater wetland birds) within and adjacent to the Project Area (NoR D1)

Bird Type	Coastal wetland	Forest	Freshwater wetland
Ecological Value	High	Low	High

6.2.3.3 Herpetofauna

6.2.3.3.1 Desktop Review

Seven native lizard species are known to occur within the Mānukau District (Ecogecko, 2014) (Table 18). In general, the Drury area is poorly surveyed for lizards and therefore a 10 km search area was used to review of the DOC Bioweb database, Auckland Council records, and the iNaturalist website. Most native lizards require indigenous habitat or surrogate habitat adjacent to contiguous forest habitat area. Based on the desktop habitat assessment, there is likely to be a complete absence of suitable habitat within the Project Area for most indigenous lizard species. The Not Threatened copper skink is however widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record is 3 km from the Project. It is therefore highly likely to occur within and adjacent to the Project Area.

Table 18 Indigenous lizard species records within the Mānukau District

Common Name	Latin Name	Threat Class (Hitchmough *et al.*, 2016)	Record source	Likelihood of presence
Pacific gecko	*Dactylocnemis pacificus*	At Risk – Relict	DOC	Unlikely
Elegant gecko	*Naultinus elegans*	At Risk – Declining	Auckland Council	Unlikely
Forest gecko	*Mokopirakau granulatus*	At Risk – Declining	iNaturalist	Unlikely
Copper Skink	*Oligosoma aeneum*	Not Threatened	DOC	Likely
Ornate skink	*Oligosoma ornatum*	At Risk – Declining	DOC	Unlikely
Shore skink	*Oligosoma smithi*	At Risk – Naturally Uncommon	DOC	Unlikely
Moko skink	*Oligosoma moko*	At Risk – Relict	DOC	Unlikely

It is highly unlikely that native frog species would occur within the Project Area, due to lack of suitable habitat. The only native frog species present within the Auckland Region is the Hochstetter's frog, the closest known records of which occur > 10 km away in the Hunua Ranges to the east of the Project Area. However, Hochstetter's frogs do not disperse readily and require damp areas within native forest habitat (or occasionally in exotic plantation) to survive (van Winkel *et al.* 2018). Hochstetter's frogs have not been considered further for the Project, due to the lack of a potential source population and absence of suitable habitat.

6.2.3.3.2 Site Investigations

During the site investigations, no indigenous lizards or frogs were identified as incidental observations. However, the introduced plague skink was identified across the Project Area.

The desktop study identified that it was possible that copper skink (Not Threatened) were potentially present within the Project Area. Habitat availability for this species was confirmed during the site walkovers and includes exotic forest edge, exotic scrub and rank grassland habitats. These areas are known to act as 'surrogate habitats' in the absence of suitable native vegetation, for this species in the Auckland region (van Winkel, Baling & Hitchmough, 2018). No other suitable habitat for native At Risk lizards was found.

6.2.3.3.3 Ecological Value

It is highly likely that the Non Threatened and commonly occurring copper skink could be present throughout the Project Area, in a wide variety of native and exotic habitats. It is unlikely that any other native lizard species are present. As such, the ecological value of the habitat for lizards is considered to be **Low**.

6.2.3.4 Fish

6.2.3.4.1 Desktop Review

The NIWA freshwater fish database and Auckland Council Catchment Assessment Reports (Surrey *et al.*, 2018 and Kane-Sanderson *et al.*, 2017) were reviewed for fish records within stream catchments affected by the Project (Table 19). Of the fish recorded, two species are īnanga and longfin eel are classed as 'At Risk – Declining'. Dunn *et al.* (2017) and Surrey *et al.* (2018) identified the wetland habitat adjacent to the Ngakoroa Bridge as potential īnanga spawning habitat (Figure 3).

Table 19 Freshwater fish species recorded within the catchments affected by the Project (NoR D1)

Stream	Species (shading indicates presence)									
	Īnanga	Longfin eel	Banded kokopu	Common bully	Common smelt	Crans bully	Shortfin eel	Freshwater mussel	Koura	Unidentified eel
Conservation status*	At Risk – Declining		Not Threatened							**
Ngakoroa Stream (and tributaries)	U	U	U	U	U	U	D		U	
Oira Creek	U		U				U			U

Notes:
U = record from upstream of the NoR
D = record from downstream of the NoR
* = fish species conservation statuses from Dunn *et al.* (2017); invertebrates (i.e. Koura) from Grainger *et al.* (2013).
** = conservation status could be either Not Threatened (if shortfin eel) or At Risk – Declining (if longfin eel).

6.2.3.4.2 Site Investigations

During site walkovers, streams were visually checked for presence of any native fish species. No dedicated fish surveys were undertaken as this will be undertaken as part of a future resource consent phase. An unidentified eel (*Anguilla* sp.) was observed in a tributary of the Ngakoroa Stream, outside the Project Area. Other sightings included pest fish species (koi carp and mosquitofish).

6.2.3.4.3 Ecological Value

Although no fish records were identified within the Project Area, At Risk species have been recorded within the wider catchment, and as migratory species, they will pass through the Ngakoroa stream mouth and its tributaries associated with the Project Area. Additionally, extensive areas of potential īnanga spawning habitat was identified see Figure 3, directly adjacent to the Project Area with SEA_T_530b, indicating the potential importance of this catchment for native fish species (Surrey *et al*, 2018).

It is considered that the streams within the Project Area would have **High** ecological value for native freshwater fish species.

6.2.4 Summary of ecological value

Table 20 summarises the ecological values within and adjacent to the Project Area, presented in Sections 6.2.1 and 6.2.3. Of the three major habitat groupings, native wetland habitat and freshwater habitats have the highest ecological value. Of the species groupings, coastal and freshwater wetland birds and fish are ranked as having the highest ecological values, taking into account the high likelihood that species with elevated conservation statuses from these groups may be present within and adjacent to the NoR footprint.

Table 20 Summary of ecological values for ecological features within and adjacent to the Project Area relating to the Project (NoR D1)

Ecological Feature		Ecological Value
Terrestrial Habitat		Low
Freshwater Habitat	D1S2	Low
	D1S1, D1S3, D1S4	Moderate
	Ngakoroa Stream and tributaries – D1S5, D1S6 D1S7	High
Indigenous Wetland Habitat (Ngakoroa Stream) D1W6 and D1W7		Very high
Exotic Wetland Habitat		Moderate
Bats		Low
Birds	Coastal wetland	High
	Forest	Low
	Freshwater wetland	High
Herpetofauna		Low
Fish		High

6.2.5 Likely Future Environment

This section has been prepared to provide some context to how the assessment of ecological effects of the Project construction and operation (Section 6.3) has been undertaken in regards to the changing baseline or likely future environment of the areas within and surrounding the Project Area.

The existing landscape surrounding the Project Area is dominated by rural landuse with some business and council owned open space. The AUPOiP zoning/overlay identifies the land adjacent to the Project Area as FUZ and open space (recreation/conservation land). The future urban land will undergo a significant change from rural to urban over the next couple of decades. The AUPOiP generally protects areas of ecological value that are identified in overlays or open space zones, such as ‘open space – Conservation Zone’ and SEA areas, which includes areas such as the Ngakoroa Reserve to the south of SH22 and Ngakoroa Stream to the north of SH22 (respectively).

The assessment carried out as part of this EcIA has not identified any additional habitat areas that would meet the criteria for SEAs under the AUPOiP. However, the current SEA (SEA_T_530b) at

Ngakoroa Stream has some high value habitat beyond its current boundaries based on actual habitats observed. This includes indigenous wetland habitat within and adjacent to the Project Area, mapped and described as raupō reedland (WL19) which extends outside SEA_T_530b, within the wetland described as D1W6.

Additionally, protection and enhancement of biodiversity is proposed through the Drury – Ōpāheke Structure Plan (Auckland Council, 2019). In the Structure Plan a 'Blue Green Network' (Appendix 7,

Figure 30) is proposed which seeks to provide contiguous ecological linkages, connecting significant terrestrial and marine ecological areas through restored riparian margins 10-20 m wide. This places greater emphasis on the protection and enhancement of existing watercourses and areas of significant natural value, requiring these areas to be accommodated within the future urban environment. Although the Structure Plan does not hold any formal statutory weight and may change, it is likely that there will be an expectation that future development will be consistent with the proposed blue green network.

In light of this context, it is assumed that in a future urbanised scenario, permanent streams, wetlands and areas of indigenous vegetation will generally be avoided by development and retained. It is also assumed that stormwater design will be integrated into the proposed 'Blue Green Network' and sediment and pollutants will be controlled at source. For example, if riparian habitat restoration is implemented appropriately, it is considered that in a future scenario many of the features of value could be similar to existing, or in some cases, enhanced.

The majority of native species assessed within this report are generally adaptable to human modified environments and therefore it is possible that despite the potentially negative implications of urbanisation (disturbance, habitat loss and fragmentation) these species may remain, where suitable habitat is retained. However, as the urban landscape becomes less permeable to wildlife the viability of these species will become increasingly dependent on the quality of catchment wide mitigation within the Project Area and surrounding FUZ.

Due to the uncertainty involved with retention of ecological value in a future urbanised environment a pre-construction wetland bird survey area (Appendix 11) has been identified. The area includes the ecological features within and adjacent to the Project Area where the Project level of effects has been assessed as **Moderate** or higher (as determined in the Assessment of Ecological Effects section of this EcIA, refer Section 7.3). Any ecological features identified within the pre-construction wetland bird survey area will be resurveyed at the same time as resource consent approvals are sought in order to revaluate changes in ecological value. This will confirm if ecological values have been retained and whether there are any subsequent changes to the Project level of effects (in accordance with the EIANZ Guidelines, refer Table 107 in Appendix 3) on any ecological feature identified in the area. If the level of effect from the Project on the ecological feature identified within the area remains at **Moderate** or higher, then the impact management measures identified within this EcIA will be retained or additional measures (if required) will be developed in accordance with the EIANZ Guidelines. If, as a result of the resurvey, the ecological value of the ecological feature reduces and subsequently the level of effect from the Project, to **Low** or less, then impact management measures proposed in this EcIA should be re-evaluated in accordance with the EIANZ Guidelines.

6.3 Assessment of Ecological Effects and Impact Management Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

As discussed in Section 4.1, this assessment has been prepared to support NoR D1 and has been undertaken in the context of the ecological baseline and the likely future environment that has been described in Section 6.2.When assessing the actual or potential ecological effects of allowing the Project, this assessment has been limited to matters that would trigger district plan consent requirements and is presented in Section 6.3.1 and 6.3.2 below. Where regional and/or Freshwater NES consenting requirements are triggered, these will not be authorised by the designation, and will require further consents. In order to demonstrate the jurisdictional split between regional and district plan matters, we have included a table as Appendix 1 which identifies the potential ecological effects of the construction and operation of the Projects, and whether these are regional, or district plan matters under the AUP OiP.

Although regional/Freshwater NES consents are not being sought at this time, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree as part of this report to inform design, options assessment and the proposed designation footprint. For regional matters, this has included the identification of any areas of significant value or habitats for the purposes of design and alignment decisions along with identification of future resource consent requirements. This information is presented in Section 6.4– Design and Resource Consent Considerations.

6.3.1 Assessment of Construction Effects

6.3.1.1 Summary of Potential Construction Effects, Prior to Impact Management

The proposed construction activities have the potential to cause impacts on ecological features within and adjacent to the Project Area, without impact management.

Potential construction effects that relate to district plan matters are presented in Appendix 1**,** and are summarised below:

- Vegetation removal (that triggers district plan controls) leading to the permanent loss of terrestrial habitats;
- Construction activities causing light, noise and vibration leading to the disturbance and displacement of indigenous fauna.

6.3.1.2 Magnitude of Construction Effects

The magnitude of construction effects listed above on impacted ecological features (Section 6.2.3.4.2) are discussed in the following sections (Section 6.3.1.2.1 and 6.3.1.2.2).

6.3.1.2.1 Habitats

6.3.1.2.1.1 Terrestrial Habitat

Section 6.2.2.1 describes all habitat types present within the Project Area. The Project Arboriculture report (Webb, 2020) identifies the vegetation within the Project Area that is the subject of district plan controls e.g. within the existing road space or open space and therefore considered a relevant district plan matter for inclusion in this assessment of effects. Construction effects have been assessed in relation to district plan vegetation and relates to the loss of permanent habitat for native fauna (e.g. bats, birds and lizards). Compliance with the Wildlife Act (1953) relating to the unintentional killing, injuring or disturbing of native fauna (e.g. bats, birds and lizards) has also been considered for these trees.

For NoR D1 there are no trees/vegetation identified within the Project Area that are subject to district plan controls that will be removed due to the Project. One location has been identified at the southern end of the Drury Sports Complex, adjacent to the Ngakoroa Bridge, and part of SEA_T_530. A group of Eucalyptus and Black wattle trees (DP197) will require protection during construction and a Tree Management Plan implemented prior to commencement of construction. The location of this site can be found in the Arboricultural report Appendix 3, Figure A3-02, while information on the vegetation type, age, value is further detailed in Appendix 1 Table 1 of the report.

There are no trees/vegetation subject to district plan controls that will be impacted by the Project, as such the magnitude of effects is considered to be **Negligible.**

6.3.1.2.2 Species

6.3.1.2.2.1 Bats

Bats have not been detected within the Project Area during field surveys or from the review of existing databases and literature. However, potentially suitable habitat has been identified for long-tailed bats within the Project Area, including vegetated stream corridors and exotic trees. Long-tailed bats have previously been recorded outside of the Project Area (within 6 km) and therefore given the large home range of this species, and suitability of habitat, they could potentially occur with the Project Area (see Section 6.2.3.1).

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. It is currently planned that a site compound will be located adjacent to the Ngakoroa Stream which could be used as commuting corridor by bats. 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. However, the existing SH22 bridge has streetlighting installed (LED bulbs) and therefore any bats utilising this corridor are likely to be habituated to light disturbance. Despite this, where practicable light spill from construction compounds into the Ngakoroa Stream should be minimised as bat behaviour may be altered by additional artificial lighting.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. At present, bat roosts have not been confirmed within the designation boundary, but mature trees that could be used as roosts are known to be present within the Project Area.

Bats have not been detected within or adjacent to the Project Area and this assessment is based upon habitat potential and desktop records. It is considered unlikely that construction activities would result in the disturbance or displacement of individuals or their roosts because they are likely infrequent visitors to the area. As such, the magnitude of effect on bats is considered to be **Low.**

6.3.1.2.2.2 Birds

Noise, vibration and lighting disturbance caused by construction activities could displace indigenous birds from suitable nesting and foraging habitat adjacent to the Project Area, particularly where sensitive At Risk – Declining species occur within adjacent wetlands.

As there are three distinct areas of habitat types (coastal wetland, freshwater wetland and forest) supporting different communities of birds within and adjacent to the Project Area, the magnitude of effect on bird species has been broken down as follows:

Coastal wetland bird habitat:

Many of the coastal bird species which occur or are likely to occur within the Ngakoroa Stream wetlands adjacent to the Project Area are Threatened or At Risk species. Habitats used by these birds include the open water, intertidal mudflats and coastal wetland habitats. The majority of coastal and wetland birds such as gull, shag and tern species use the stream corridor for foraging but have no known breeding habitat or specific roost sites. However, the WL19 Raupo reedland (wetland D1W7) directly adjacent to the Project Area including the construction works area, provide **Very high** value habitat for banded rail, fern bird and spotless crake, which may use these areas for foraging and breeding.

Figure 6 identifies the temporary construction works area including the proposed site compound and bridge laydown area (red), two bridge construction areas (yellow) and the new bridge construction (blue). These areas are directly adjacent to WL19 raupō reedland habitat (wetland D1W7), which has been highlighted as potential habitat for breeding banded rail fern bird and spotless crake. The habitat directly within the bridge construction footprint is suboptimal due to the existing road infrastructure and therefore birds are unlikely to nest at this location. Therefore, direct killing and loss of habitat should be avoidable. However high value habitat does occur directly adjacent to the bridge staging area and the construction compound. The disturbance caused by construction noise, vibration and lighting directly adjacent to breeding habitat has the potential to impact the breeding success of these At Risk species and could lead to indirect death caused by nest abandonment.

The location of these facilities is largely unavoidable as an all-weather construction yard will be required for bridge construction and staging will be required from both sides of the bridge. The construction compound will house a bridge construction satellite office, construction plant, equipment and materials. Access to the site will be via the State Highway, and will allow for heavy construction vehicle access, such as concrete trucks, transporters, delivery trucks, and cranes. Typically, a 20 m wide temporary accessway will be required next to the bridge footprint to allow for the temporary staging, including the construction and dismantling of existing and new bridges. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight.

Existing buffer vegetation, such as Exotic Wetland, Exotic Scrub and Planted Vegetation (see Figure 6) occurs within the Project Area. Although the exotic vegetation is unsuitable for breeding At Risk – Declining wetland birds, these habitats buffer suitable adjacent habitat from construction activities. Where practicable, e.g. along the boundary of the site compound and stockpile / laydown areas, there is an opportunity to retain these vegetation buffers during construction by creating wetland setback buffers. Where removal of buffer vegetation is unavoidable, e.g. bridge staging areas, this should be reinstated and restore following construction, with native wetland and coastal scrub planting.

Background noise and lighting is likely to increase with urbanisation of the FUZ areas surrounding the Ngakoroa Stream. However, construction disturbance to breeding birds is localised to areas of the stream adjacent to the bridge and is considered to be a key concern. Birds are sensitive to disturbance from light, noise and vibration, which can cause displacement and nest abandonment if construction were to coincide with the breeding season. Overall, the magnitude of effect of the Project on the coastal habitat used by the local bird population within the immediate vicinity of the Ngakoroa

Stream is considered to be **Moderate**. This is based upon the regional importance of some of the affected bird species, the relative frequency of construction effects and the reasonable likelihood of those effects to occur on the local coastal wetland bird population.

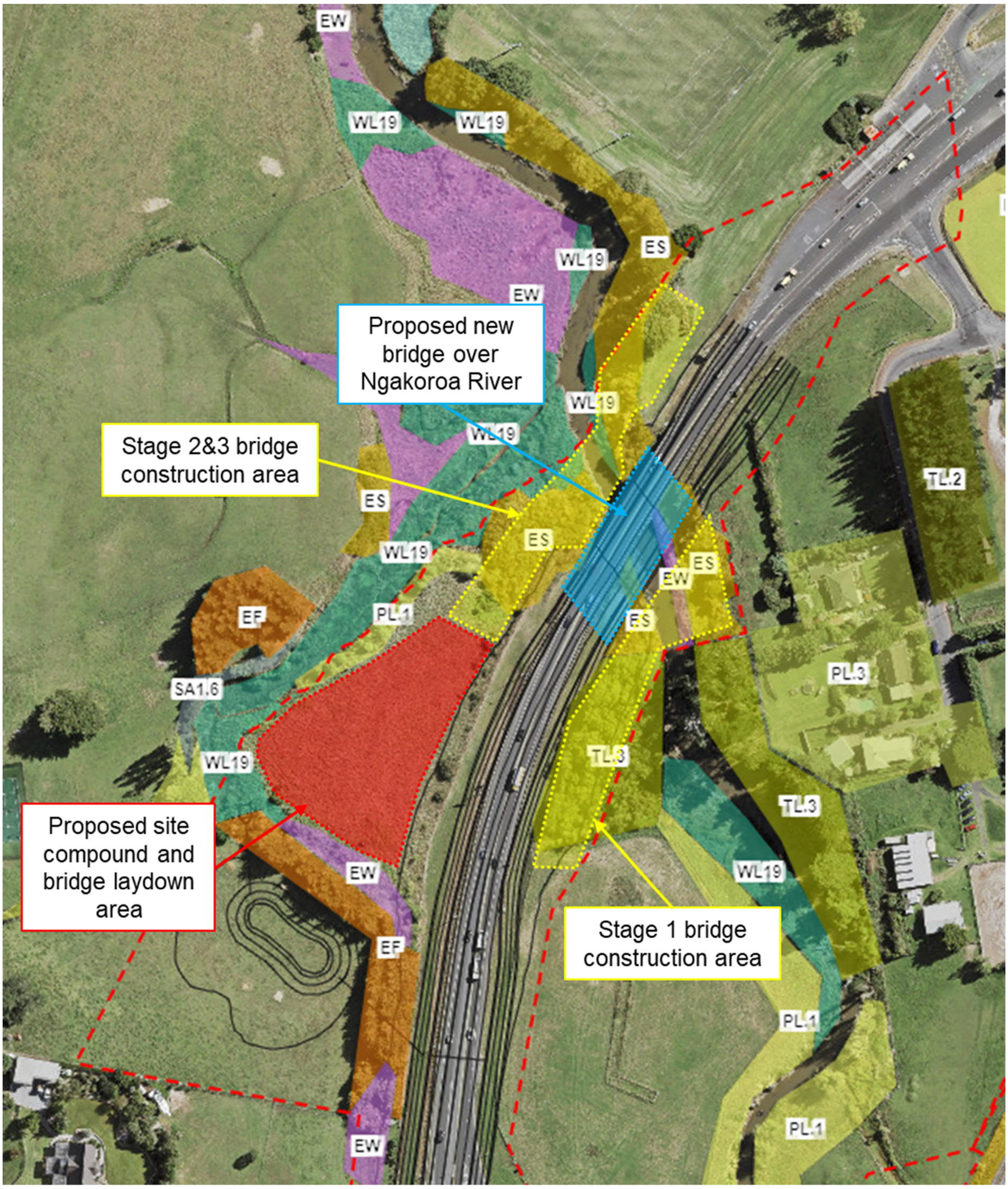


Figure 6 shows the WL19 Raupo Redland/wetland D1W7 (potential breeding habitat for coastal wetland birds) relative to the required temporary construction works area including, site compound and bridge laydown area (red), stage 1, 2 and 3 bridge construction areas (yellow) and the new bridge (blue).

Freshwater wetland bird habitat:

New Zealand dabchick (At Risk- Recovering) have been observed and may breed in the artificial pond at 6 Burberry Road (bird survey Site D1B1, Appendix 7, Drawing SGA-EX-DL-003.1) adjacent to the Project Area (20 m at its closest point). The habitat at this location for freshwater birds is therefore considered to be **High** value. Construction effects relating to noise, vibration and light from the Project are far enough away and separated by a buffer of planted trees for the magnitude of effects to be considered as **Low**.

Forest bird habitat:

The birds which occur in the remainder of the Project Area are common in the local area (modified agricultural land and exotic habitats) and habitat is considered to be of **Low** ecological value. They are adapted to human modified environments and suitable foraging habitat of equal quality will remain adjacent to the Project Area during construction. Therefore, the magnitude of effects from the Project construction activities on the local forest bird population is considered to be **Low**.

6.3.1.3 Level of Ecological Effects – Construction

In accordance with EIANZ Guidelines the level of ecological effects from the construction of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the Project construction.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern. The Project will also need to comply with the Wildlife Act 1953 if applicable.

Table 21 below summarises the overall level of ecological effects for each key ecological feature and fauna group related to the Project before impact management is applied. Section 6.3.1.4 addresses the impact management measures required to minimise any residual effects associated with construction activities.

Table 21 Summary of potential ecological effects (prior to impact management) during construction based on ecological value and magnitude of the effect

Ecological Feature	Ecological Value	Magnitude of Construction Effects	Level of Ecological Effect (prior to impact management)
Terrestrial habitat – district matters	Low	Low	Low
Bats	Low	Low	Very Low
Birds – coastal wetland	High	Moderate	High
Birds – forest	Low	Low	Very Low
Birds – freshwater wetland	High	Low	Low

The assessment identified that the level of ecological effects from the construction of the Project on the majority of ecological features are **Very Low** or **Low,** with the exception costal wetland birds, where the level of effect is **High**. In accordance with the EIANZ Guidelines impact management measures are proposed for those effects **Moderate** and above and as such impact management is required for the Project construction effects on coastal wetland birds.

6.3.1.4 Impact Management – Construction

6.3.1.4.1 Coastal wetland birds

This section identifies recommended impact management measures to ensure that the Project reduces the potential magnitude of construction effects on coastal wetland birds and their habitats, to **Low**.

The wetland habitats (associated with coastal wetland birds) within and adjacent to the Project Area, specifically wetland D1W7 associated with the Ngakoroa Stream (Figure 6) are included as part of the pre-construction wetland bird survey area (identified in Appendix 11). It is recommended that this location should be resurveyed at the same time as resource consent approvals are sought in order to confirm the ecological value identified has been retained and mitigation measures detailed in this section are still required.

If the wetland bird survey and assessment confirm that the Project will or may have a moderate or greater level of ecological effect on Threatened or At Risk Wetland birds without impact management, construction activities and compounds will be planned so as to reduce noise, vibration and light effects on Threatened or At-Risk coastal wetland birds. The following management controls are recommended to form the basis of a Bird Management Plan (BMP).

- Where practicable, construction works should commence prior to the bird breeding season (September to February) in order to discourage bird nesting.
- Prior to any construction works (including establishment of site yards) taking place within a 50m radius of the Ngakoroa wetlands a nesting bird survey of Threatened or At-Risk wetland birds should be undertaken by a suitably qualified and experienced person (SQEP). Surveys should be repeated at the beginning of each bird breeding season and following periods of construction inactivity .
- protection and buffer measures if nesting Threatened or At-Risk Wetland birds are identified within 50m of any construction area (including laydown areas). This could include:
    A. a 20 m buffer area around the nest location and retaining vegetation. The buffer areas should be demarcated where necessary to protect birds from encroachment. This might include the use of marker poles, tape and signage;
    B. monitoring of the nesting Threatened or At-Risk wetland birds by a Suitably Qualified and Experienced Person. Construction works within the 20m nesting buffer areas should not occur until the Threatened or At-Risk wetland birds have fledged from the nest location (approximately 30 days from egg laying to fledging) as confirmed by a Suitably Qualified and Experienced Person; and
    C. minimising the disturbance from the works if construction works are required within 50 m of a nest, as advised by a Suitably Qualified and Experienced Person;
- Where practicable, a 10m wetland setback shall be created between the edge of the Ngakoroa Stream wetlands and the construction area (along the edge of the stockpile/laydown area). This should be achieved by retaining existing vegetation and/or

additional planting with native coastal forest/riparian/wetland species (as appropriate). Signage or marker poles shall also be used to clearly delineate the wetland area to prevent encroachment.

- Any light spill from construction areas into the Ngakoroa Stream wetlands should be minimised as far as practicable.

The BMP should be consistent with any ecological management measures to be undertaken in compliance with conditions of any regional resource consents granted for the Project.

If the impact management detailed above were implemented, it is considered that the magnitude of construction effects from the Project on coastal wetland birds within and adjacent to the wetlands associated with the Ngakoroa Stream within and adjacent to the Project Area could be reduced to **Low**.

6.3.1.4.2 Wildlife Act Compliance

The district plan trees (refer Section 6.3.1.2.1.1) should be assessed for bird, bat and lizard presence prior to removal and management controls put in place to ensure compliance with the Wildlife Act 1953.

6.3.1.5 Residual Effects – Construction

The assessment identified that construction ecological effects on birds and their habitat within wetlands associated with the Ngakoroa Stream within and adjacent to the Project Area could be **High** during construction, prior to impact management. Therefore, in accordance with EIANZ Guidelines impact management measures were developed (Section 6.3.1.4). Table 22 presents the residual ecological effects after impact management has been applied for coastal wetland birds for construction effects from the Project. The table shows that the residual level of ecological effects on birds are **Low** after impact management has been applied.

Table 22 Summary of ecological effects based on ecological value and magnitude of effects during construction, with impact management

Ecological Considerations	Ecological Value	Magnitude of the Effects	Level of Ecological Effect (with impact management)
Birds – coastal wetland	High	Low	Low

6.3.2 Assessment of Operational Effects

6.3.2.1 Summary of Potential Operational Effects, Prior to Impact Management

The Project involves the upgrading of an existing road from two lanes to four and although some impacts may increase from the current baseline, many operational effects such as fragmentation, noise and lighting are likely to be pre-existing. These changes will be considered when assessing the magnitude of effects on potentially already impacted ecological features or species that may have habituated to the existing road.

In general, potential operational effects from the Project that relate to district plan matters are presented in Appendix 1, and are summarised below.

- Loss in connectivity to indigenous fauna (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The magnitude of these operational effects is discussed in Section 6.3.2.2.

6.3.2.2 Magnitude of Operational Effects

6.3.2.2.1 Bats

Although bats themselves have not been detected during surveys, suitable habitat has been identified for long-tailed bats along vegetated stream corridors which cross the Project Area.

It is known that the loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat. Noise and vibration are likely to be reduced from the existing baseline due to improved bridge design and reduced speed limits along the upgraded road. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. Any bats currently utilising the Ngakoroa Stream are likely to be habituated to existing light levels and may already avoid the existing road corridor. The final Project lighting design (to be confirmed at detailed design) is likely to include the use of LEDs (light emitting diodes) which without mitigation could increase the levels of light within and adjacent to the Project Area. LED lighting is already present in some areas such as the Ngakoroa bridge. Where practicable and taking safety into consideration, it is recommended that lighting is minimised along the Ngakoroa Stream corridor. This could be achieved by removing tall lighting columns where the Project crosses the stream corridor. Low/ground level lighting for pedestrian safety could be maintained as required. Background noise and lighting is likely to increase with urbanisation of the FUZ areas surrounding the Ngakoroa Stream, as such maintaining dark corridors will become increasingly important for wildlife, helping to reduce habitat fragmentation minimising alterations to behavioural patterns.

As bats have not been recorded within or adjacent to the Project Area, it is considered unlikely that the operation of the Project would result in the disturbance or displacement of individuals or their roosts. As such, the magnitude of effect on bats is considered to be **Low**. It is recommended that ABM surveys are repeated along potentially high value habitat areas such as the Ngakoroa Stream prior to regional consent applications. If at a later stage, bats are found to be present within or adjacent to the Project Area, the magnitude of effects could increase, and more specific impact management would be required.

6.3.2.2.2 Birds

The operational impacts from the Project on birds are similar to those described in Section 6.3.1.2.2.1 for bats. Birds could be displaced as a result of light spill and noise during operation and habitats fragmented where the Project crosses habitat corridors. However, as the Project is an upgrade to existing infrastructure, impacts such as fragmentation and disturbance already exist.

Noise and vibration are likely to be reduced from the existing baseline due to improved bridge design and reduced speed limits along the upgraded road. Any coastal wetlands birds currently utilising the Ngakoroa are potentially habituated to existing light levels and may already avoid the existing road corridor. The final Project lighting design (to be confirmed at detailed design) is likely to include the use of LEDs (light emitting diode) which without mitigation could increase the levels of light within and adjacent to the Project Area. LED lighting is already present in some areas such as the Ngakoroa bridge. Where practicable and taking safety into consideration, it is recommended that lighting is minimised along the Ngakoroa stream corridor. This could be achieved by removing tall lighting columns where the Project crosses the stream corridor. Low/ground level lighting for pedestrian safety could be maintained as required. Background noise and lighting is likely to increase with urbanisation of the FUZ areas surrounding the Ngakoroa Stream, as such maintaining dark corridors will become increasingly important for wildlife, helping to reduce habitat fragmentation and minimising alterations to behavioural patterns.

As operational effects from the road are likely to reduce in regard to noise and vibration and assuming that the future operational lighting effects are designed to ensure the effects on coastal birds do not change (or preferably, are improved), then the magnitude of operational effects from the Project operation is considered to be **Low.** Where practicable lighting along stream corridors should be minimised as described above, to reduce overall impact on coastal wetland birds.

Forest bird habitat is limited to **Low** value exotic vegetation within and adjacent to the Project Area. The species present are common, Not Threatened adapted to use habitats modified by humans. As such, the magnitude of effects from the Project is considered to be **Low**.

New Zealand dabchick (At Risk- Recovering) have been observed and may breed in the artificial pond at bird survey site D1B1 adjacent to the Project Area. Noise and vibration are likely to be reduced from the existing baseline due to reduced speed limits along the upgraded road. Similarly, it is assumed that the future operational lighting effects are designed to ensure the effects on these birds do not change (or preferably, are improved). In addition, retaining the buffer of existing trees between this habitat and the Project Area will minimise overall disturbance. The magnitude of operational effects is therefore considered to be **Negligible**.

6.3.2.2.3 Herpetofauna

Records of At Risk indigenous lizard have been identified in the wider landscape, beyond the Projects ZOI, but no suitable habitat was found within the Project Area for these species. However, suitable 'surrogate' habitat (exotic scrub, exotic forest edge and rank grassland) was identified within the Project Area which could potentially support native copper skink (Not Threatened).

Native lizards require vegetated corridors (such as riparian stream corridors) to facilitate natural dispersal. The Project is upgrading existing roads and bridges and therefore is not considered to create any additional barriers to movement or dispersal of lizards. During detailed design/resource consent, opportunities should be sought to enhance/retain vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

Native lizards are likely to be habituated to existing disturbance such as noise, vibration and lighting and design should ensure that this will not increase for the operation of the Project. It is considered that the magnitude of operational Project effects on indigenous lizards would be **Low**, without impact management.

6.3.2.3 Level of Ecological Effects – Operation

In accordance with EIANZ Guidelines (Roper-Lindsay *et al.* 2018) the level of ecological effects from the operation of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the operation of the Project.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern; Table 23 summarises the potential ecological effects of the Project during operation.

Table 23 Summary of potential ecological effects (prior to impact management) during operation based on ecological value and magnitude of the impacts.

Ecological Feature	Ecological Value	Magnitude of Operational Effects	Level of Ecological Effect (prior to impact management)
Bats	Low	Low	Very low
Birds – coastal wetland	High	Low	Low
Birds – forest	Low	Low	Very low
Birds – freshwater wetland	High	Negligible	Very low
Herpetofauna	Low	Low	Very low

The assessment identified that the level of ecological effects from the operation of the Project on all of the ecological features were **Very low** or **Low**. In accordance with the EIANZ Guidelines impact management measures would only be proposed where effects are **Moderate** and above and as such impact management measures are not required for the Project operational effects.

6.3.3 Cumulative Effects

As stated in the EIANZ Guidelines, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native birds.

Almost all original native habitat within and adjacent to the Project Area has been removed due to historical land use change. As such, the types of fauna generally remaining within the habitats are Not Threatened native or exotic species, which are generally adaptable to modified environments. Common Not Threatened native species like copper skink, are considered very likely to occur within these modified, low value habitats (e.g. rank grass, scrub) within the Project Area. The ongoing long-term incremental loss of low value habitat may however cause detrimental effects on local populations of 'common' species, which within a project specific context would not normally require impact management under the EIANZ Guidelines. As low value habitats are likely to be altered by the Project and by other external projects (surrounding development), the risk of significant habitat degradation for Not Threatened species such as copper skink is likely to be cumulative and must be considered in the wider regional context.

Many mobile native fauna species have wide ranging and complex habitat requirements, such that small, incremental changes in habitat quantity or quality could have unforeseen adverse effects on their ability to persist in the landscape over time. Historical vegetation clearance (loss of buffer vegetation) and wetland drainage (fragmentation) have also made the landscape more vulnerable to such cumulative effects, as issues become more acute. District Plan matters relating to disturbance (such as lighting, noise and vibration) may not adversely affect crepuscular species such as coastal wetland birds in the short term, as they become habituated. However, potential gradual incremental changes in habitat, caused by surrounding urbanisation, such as increased light spill into the high value wetland areas, could, discourage nesting and therefore reduce viability of native fauna persisting over time.

All developments within the Drury-Ōpāheke Structure Plan area should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Structure Plan area and its catchments.

If the developments (including this Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced, and the buffering effect of riparian habitat restoration could reduce disturbance (e.g. lighting from surrounding urbanisation). The opportunity to enhance stream corridors through riparian planting has been highlighted within the Drury-Ōpāheke Structure Plan and it is anticipated that this will be reflected within future Plan Changes. This Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

6.3.4 Summary and Conclusions

Ecological features were assessed for their potential to be adversely affected by the construction and operation of the Project relating to district plan matters. The construction and operation of the Project were assessed to have a **Negligible** or **Low** level of effect on the majority of relevant habitat (terrestrial – district plan only) and fauna species and therefore no specific impact management was recommended. However, the indigenous wetland habitat (D1W7 and D1W6) within and directly adjacent to the Project Area has been highlighted for its potential importance to support a range of Threatened and At Risk coastal and wetland bird species. There is potential that during construction of the Project, the disturbance (noise, vibration and light) caused by activities within the construction areas and during the replacement of the existing Ngakoroa Bridge could impact breeding birds such as banded rail, fernbird and spotless crake. A Bird Management Plan is therefore recommended to reduce the potential adverse level of effect of construction from **Moderate** to **Low**. Impact management requirements would include programming noisy works to avoid the bird breeding season (September – February) where practicable, pre-construction nesting bird surveys and mitigating construction lighting and noise/vibration disturbance. Wetland habitats identified in the pre-construction wetland bird survey area (Appendix 11) will be resurveyed at the same time as resource consent approvals are sought in order to revaluate changes in ecological value for coastal wetland birds. This will confirm if ecological values have been retained and will confirm the required impact management measures required.

The Ngakoroa Stream has been identified as the main corridor of ecological value associated with the Project Area due to retained high value native wetlands and its potential to support At Risk Declining coastal wetland birds. In a future scenario when the surrounding environment is likely to be urbanised, the importance of stream corridors will be even more important as the urban environment becomes less permeable to the natural movement of native species. These areas should be prioritised for retention and enhancement in line with Structure Plan recommendations for the ‘Blue-green network’.

6.4 Design and Resource Consent Considerations

Although resource consents are not being sought for the Project at this time, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree to inform design, options assessment and the proposed designation footprint of NoR D1. The outcome of this analysis is presented below. This includes the identification of any ecological features of value for the purposes of design and alignment decisions and to identify future consenting requirements.

In terms of regional matters, a full list of potential regional consent matters is included in Appendix 1, but in summary these relate to:

- Effects of vegetation removal on terrestrial habitats – rural zones, riparian margins, coastal areas, SEA’s;
- Effects of vegetation removal on fauna (bats, birds, lizards) behaviour and their roosts/nests
- Effects on streams and wetlands;
- Earthworks effects – weed dispersal and sediment discharge

Ecological effects and associated impact management relating to district plan matters that are the focus of this assessment for the Project, have been presented in Appendix 1.

The Freshwater NES came into effect on 3 September 2020 and contains consent requirements for the construction of specified infrastructure involving vegetation clearance and works within certain natural wetlands and streams. Our preliminary view is that there may be wetlands within the Project Area that meet the definition of "natural wetland" and therefore discretionary consent under the Freshwater NES may be required for these works. The application of these consent requirements will need to be considered further as part of the future consenting process for the Projects. Delineation of these wetlands for the purposes of the Freshwater NES will require further site investigations and soil sampling to inform the detailed design of the Project. Generally, the alignment and design refinement process for each proposed designation has sought to avoid or minimise impacts on high value natural wetlands and streams. There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects.

Some potential effects of the Project (i.e. killing or harming) on individual specifically listed fauna and their nests/roosts are covered by the Wildlife Act 1953. For completeness these are recorded in the sections below where they align with regional consent vegetation removal effects.

6.4.1 Terrestrial Habitat

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 indigenous fauna (bats, birds and lizards). This includes vegetation subject to both regional and district plan controls (Appendix 1). Loss of vegetation that is subject to district plan controls is discussed in Section 6.3.1.2.1.1. The amounts and types of terrestrial habitat and vegetation (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 24.

Table 24 Potential area of permanent terrestrial habitat loss within the Project Area (NoR D1)

Habitat Type	Habitat Code	Potential area to be lost (ha)	Bat habitat loss (ha)	Bird habitat loss (ha)	Threatened lizard habitat loss (ha)
Brownfield	BF	0.83	N/A	N/A	N/A
Exotic Forest	EF	0.10	0.10	0.10	0
Exotic Scrubland	ES	0.54	N/A	0.54	0
Exotic Wetland	EW	0.11	0.11	0.11	0
Open Water	OW	0.01	0.01	0.01	0
Amenity Planted vegetation	PL.3	0.62	N/A	0.62	0
Treeland	TL.3	0.67	0.67	0.67	0
Total		2.94	0.89	2.05	0

The terrestrial habitats to be lost (temporary and permanent) are predominantly comprised of exotic vegetation which are of **Low** ecological value. Small areas of high value native wetland (Raupō reedland) will be temporarily impacted by the bridge staging area (see Figure 6). Some of these habitat areas are likely to provide valuable habitat to native fauna, this is discussed in Sections 6.4.1.1 to 6.4.1.3 below.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys should be undertaken to inform an EcIA (in line with the EIANZ Guidelines, which will be used to support the resource consent applications) and should include any impact management requirements.

6.4.1.1 Bat habitat

Bats were not found to be present within the Project Area. However, given the potential Project impacts from vegetation removal and the conservation status (Nationally Critical) of bats, the effect on bats should be re-evaluated as part of the subsequent resource consent phase, prior to construction. Repeat ABM surveys could be carried out to support this process. Potential vegetation of value for future assessment of potential bat foraging and roosting habitat, has been highlighted in Appendix 7, Drawing SGA-EC-DL-012.01. This includes vegetated stream corridors with mature trees along the Ngakoroa Stream and Oira Creek

As the Project moves into the detailed design and regional resource consent phase, landscape design could incorporate the 'Blue Green Network' within the Project Area (Appendix 7,

Figure 30). This mitigation could include the protection of mature trees (exotic and native) with bat roost potential and retention of riparian vegetation along stream corridors, particularly at bridge crossing points or where transport corridors bisect mature vegetation, as well as bespoke low-lumination artificial lighting regimes near key known habitats. As a gleaning species long-tailed bats fly at canopy height commuting and foraging along forest edges and stream corridors (Borkin & Parsons, 2009; O'Donnell *et al.*, 2006). Where this canopy is maintained and/or enhanced to a height >4.3 m (max height for standard vehicles) (NZ Transport Agency, 2019) above the vehicle deck, bats are likely to maintain a safe distance from moving traffic and therefore avoid any adverse interaction with the transport corridor. Suitable vegetation (native or exotic) of this height, acts as bat 'hop-over' vegetation and could be retained and enhanced where possible in areas where potential commuting corridors could occur within the Project Area (Appendix 7, Drawing SGA-EC-DL-012.01).

6.4.1.2 Bird habitat

Suitable habitat for At-risk and Threatened species of wetland birds occur within and adjacent to the Project Area. Minimal temporary vegetation clearance within coastal wetland areas (wetland D1W71) will be required for bridge construction only (refer Figure 6).

Suitable breeding and foraging habitat occur for At Risk-Declining birds - North Island fernbird, banded rail and spotless crake, and their presence within and adjacent to the Project Area should be assessed as part of the subsequent resource consent process prior to construction.

If vegetation removal is required within the indigenous wetland habitat (WL19 Raupō Reedland) during the breeding season, it is likely that a Wildlife Permit under the Wildlife Act 1953 would be required due to potential disturbance effects.

Not Threatened indigenous forest birds are likely within the Project Area. Vegetation clearance required for construction could result in the loss of approximately 1.91 ha of Not Threatened indigenous bird habitat, including exotic forest and planted vegetation. Although of **Low** value any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

6.4.1.3 Herpetofauna habitat

Indigenous Copper skink (Not Threatened) are likely to be present within exotic vegetation impacted by the Project. There is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953. To mitigate habitat removal, methods can be developed during the future resource consent process to minimise any such effects. This could include, lizard salvage and potentially habitat replacement as appropriate. Further detail on these matters is presented in Appendix 10 Resource Consent – Lizard Management.

6.4.2 Freshwater Habitat

6.4.2.1 Streams

The construction of the Project will cross two existing streams (D1.S4 and D1.S7). D1.S4 is an intermittent stream which has been culverted under the existing SH22 road. An additional 4.6 m of stream loss (13.8 m^2) will be required to accommodate the Project works. The stream crossing over D1.S7 will be bridged and therefore no additional stream loss will occur. Stream D1.S1, D1.S3, D1.S5 and D1.S6 are directly adjacent to the Project Area, however it is assumed that these features can be avoided, and no stream loss will occur at these locations. The predicted permanent and intermittent stream loss for the Project along with possible avoidance or enhancement opportunities is presented Table 25, and streams are mapped in Appendix 7, Drawing SGA-EC-DL-010.01 to SGA-EX-DL-010.05. These calculations will require re-evaluation as part of the future regional consent process, however opportunities for compensation/offset have been identified within the Project Area. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features.

Table 25 Potential stream loss (permanent and intermittent) within the Project Area (NoR D1)

Stream number*	Stream type	Wetted Width of stream (m)**	Bank Width (m)	Estimated Length to be lost (m)**	Loss (m^2)	Notes
D1.S1	Permanent	4	10	N/A	N/A	Existing box culverts, outside of designation boundary.
D1.S3	Intermittent	1.5	4	N/A	N/A	Minor potential impact. As part of detailed design, retaining structures could be considered to avoid direct impacts
D1.S4	Intermittent	1	3	4.6	10	Existing alignment, highly modified and channelised. Opportunity for enhancement.
D1.S5	Permanent	5	23	N/A	N/A	Minor potential impact. As part of detailed design, retaining structures could be considered to avoid direct impacts
D1.S6	Intermittent	1	3	N/A	N/A	Minor potential impact. As part of detailed design, retaining structures could be considered to avoid direct impacts Modified and channelised, opportunity for enhancement.
D1.S7	Permanent, tidally influenced	14	38	N/A	N/A	Bridged. Opportunity for enhancement.
Total Loss	**Permanent**			N/A	N/A	
	Intermittent			4.6	10	

Notes:
* = refer to SGA-EC-DL-010.01 to SGA-EC-DL-010.05 in Appendix 7 for stream locations.
** = Assessments were carried out in drought conditions when it was difficult to accurately delineate stream width. Therefore, widths and areas are indicative

During the detailed design phase, stream crossing plans (i.e. bridge or culvert) will be confirmed. However, it is considered highly likely (based on the indicative design for the Project) that at least some of the streams will be culverted, resulting in a loss of instream and riparian habitat and therefore impact management will be required. Under a future regional consent for earthworks, impact management would also be required to ensure sediment discharge to streams is controlled appropriately.

6.4.2.2 Wetland Habitat

Construction of the Project could result in the loss of several small areas of exotic wetland, which are unavoidable as they occur along the existing SH22 road corridor. It is assumed that impacts on ecologically significant indigenous wetland habitat can be avoided at detailed design stage as these areas are beyond the construction footprint but are likely to be within the temporary construction area. The manner in which exotic wetlands are affected will be confirmed at the detailed design stage of the Project, however it is likely that some will be culverted or reclaimed (based on the current design for the Project), resulting in a loss of wetland habitat and vegetation. Additionally, hydrological inputs to wetlands can also be affected by Project activities such as embankments and culverts altering flow regimes. Wetland loss is presented for the Project in Table 26 and mapped on Appendix 7, Drawings SGA-EC-DL-010.01 to SGA-EC-DL-010.05.

Table 26 Wetland loss within the Project Area (NoR D1)

Site Name*	Type**	Wetland size (m^2)***	Indicative area of impact/potential loss (subject to detailed design) (m^2)***	Notes
D1W1	Open Water (OW)	1,400	200	Could potentially be avoided during detailed design. Minor impact to edge of habitat. Wetland mitigation/offset may be required.
D1W2	Exotic Wetland (EW)	400	400	Wetland mitigation/offset may be required.
D1W3	Exotic Wetland (EW)	350	60	Minor impact to edge of habitat. Wetland mitigation/offset may be required.
D1W4	Exotic Wetland (EW)	2,600	300	Minor impact to edge of habitat. Wetland mitigation/offset may be required.
D1W5	Exotic Wetland (EW)	750	200	Wetland mitigation/offset may be required.
D1W6	Exotic Wetland (EW)	500	80	Minor impact to edge of habitat. Directly adjacent to construction laydown area. Wetland setback required to buffer habitat.
D1W7	Raupō reedland (WL19)	400	0^	No direct loss, however, a small area is located within the construction staging area so there will be temporary impacts during construction. Should be rehabilitated /enhanced following construction.
D1W8	Exotic Wetland (EW)	250	80	Mitigation/wetland offset may be required.
Total area		6,650	1,320	

Notes:
* = refer to SGA-EC-DL-010.01 to SGA-EC-DL-010.05 in Appendix 7 for wetland locations.
^ = no direct loss of vegetation but will be used as construction lay down area so may be some temporary loss.
** = as classified in Singer *et al.*, 2017
*** = Assessments were carried out in drought conditions when it was difficult to accurately delineate wetland sizes. Therefore, areas are indicative.

A number of stream and wetland locations were identified during the indicative and detailed business case process, route refinement and optioneering assessments and initial design phases, and the design has been altered to minimise stream/wetland impacts. This has been partially guided by the ecological value assessment of streams and wetlands undertaken in Sections 6.2.2.2.3 and 6.2.2.3.3.

Table 25 details the estimated stream loss to be approximately 10 m^2 and Table 26 details the estimated wetland loss to be approximately 1,320 m^2 as a result of Project works. Potential future recommendations are presented within the tables for further detailed design changes that could be adopted to avoid and reduce impacts.

As the design develops and regional and/or Freshwater NES resource consent applications are prepared, it is anticipated that an assessment of the effects on freshwater/wetland habitat will be undertaken and more detailed information collected on freshwater habitat classifications, along with the ecological value of streams and wetlands using the SEV stream survey method and Wetland Condition Index (Clarkson *et al.*, 2004) surveys (respectively).

At the detailed design stage, options to avoid or reduce the level of impact (including hydrological effects) to stream and wetlands can be considered e.g. bridges, reduction of embankments, reduction in the length of culverts, type of culvert etc. Where stream or wetland loss is unavoidable, an ecological effects assessment should be undertaken to determine if mitigation/offsetting is required. Offset requirements should be calculated using accounting systems such as the Environmental Compensation Ratio (ECR) used for streams in the Auckland region.

Final ECR calculations will require SEV surveys to assess stream value and effects and to inform the potential requirement for stream compensation. However, potential compensation has been estimated on a preliminary basis using an ECR of 3:1[15] of stream restoration: stream loss. Assuming further avoidance is not possible, for the Project this would equate to intermittent stream compensation of approximately 30 m^2. Subject to detailed design assessment, the area of potential wetland loss is currently estimated to be 1,320 m^2. Assuming a similar compensation ratio of 3:1, approximately 3,960 m^2 of wetland offset would be required.

The proposed designation boundary for the Project Area extends beyond the construction footprint. This is due to construction area requirements, such as stream works which typically extend 20 m past the permanent work area upstream and 15 m downstream. Additionally, a 6 m access track will be required for construction access and larger areas will be required to accommodate stormwater wetlands, construction laydown, stockpile and site compounds. These requirements may change depending on the final design and scope of works, terrain and topography, however these large areas beyond the construction footprint provide opportunity to accommodate any future requirement for wetland or stream compensation/ offset within the proposed designation boundary.

Broad mitigation recommendations for stream/wetland compensation/offset opportunities should be tailored to address impacts on streams and wetlands resulting from the Project as the detailed design advances. Where possible this mitigation will be incorporated within the designation boundary.

6.4.2.3 Fish

Fish surveys were not undertaken as part of the field investigations for the NoR, however NIWA freshwater fish database and Auckland Council Catchment Assessment Reports were reviewed and

[15] Considered to be an average estimate of ECR's in the Auckland Region.

highlighted the likely presence of a number of At Risk and Not Threatened native fish species within streams within the Project Area (Table 19).

It is anticipated that existing culverts on D1S4 will be extended. These have been identified as a potential existing barrier to fish passage (Appendix 7, Drawing SGA-EC-DL-010.01 to SGA-EC-DL-010.05). SEV surveys undertaken during the resource consent phase of the Project will identify if native fish are present and if there is suitable upstream habitat. If so, the culvert extension may cause habitat fragmentation and loss of spawning habitat for native fish. In addition, fish may be killed or injured during culvert installation/extension within the stream.

If required, culvert design considerations should allow for fish passage. In addition, fish recovery and translocation would be required as part of the future resource consents for the Project.

To minimise disturbance to fish, instream works in sensitive reaches of affected streams should be timed to avoid key fish migration and spawning periods (March – August) for Īnanga and other Galaxiidae species which are known to be present within the Ngakoroa catchment. These restrictions are likely to apply where any instream works required for bridge construction are required on the Ngakoroa Stream.

6.4.3 Positive Effects/Future Opportunities

Positive ecological effects are currently anticipated as a result of the Project and further positive outcomes and enhancement opportunities should continue to be developed during detailed design. If implemented, these are currently likely to include:

- The ability for future Project landscape planting to tie into the proposed vegetated corridors anticipated by the Drury -Ōpāheke Structure Plan, Blue-Green Network. Opportunities at specific locations have been outlined in the Project Assessment of Landscape and Visual Effects report;
- Net increase in green infrastructure and associated habitats within the Project Area associated with street trees, berm and stormwater plantings and planted stormwater wetlands. The Project Assessment of Landscape and Visual Effects report outlines recommendations to ensure ecological enhancement opportunities are capitalised upon at these locations.
- There are stream and wetland enhancement opportunities identified within Table 25 and Table 26. Where possible this could be incorporated within the existing designation boundary, beyond the construction footprint.
- Enhance vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

6.4.4 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native fish.

Almost all-original native habitat within, and adjacent to the Project Area has been removed due to historical land use change. As the existing environment is highly modified, the specific Project impacts discussed within this report have been minimal and adverse effects have largely been avoided. However, historical vegetation clearance and wetland drainage have made the landscape more vulnerable to cumulative effects relating to regional consenting considerations including:

- Greater risk of flooding and stormwater runoff. Without treatment and mitigation, the Oira Stream and Ngakoroa Stream and wider Drury Creek and Pahurehure Inlet would be the ultimate receiving environment for treated stormwater from the Project.
- Erosion and sediment control issues during construction could lead to further habitat degradation and adverse impacts on the downstream receiving environments. For example, sedimentation in the Drury Creek and Pahurehure Inlet could lead to the gradual spread of mangroves, at the expense of saltmarsh and open mudflat habitats;
- Cumulative stream loss and vegetation clearance have a high impact on catchments ecological function, water quality, hydrology and the native fauna that use these habitats (i.e. īnanga spawning habitat, eels etc.). Consideration of a riparian habitat function and bankside setback need to be considered in the wider catchment context.

If developments (including the Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced. This opportunity has been highlighted within the Drury-Ōpāheke Structure Plan and is anticipated to be reflected in future Plan Changes. The Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

6.4.5 Conclusion

Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features within or adjacent to the Project Area, for which future consents will be required, can be adequately managed in any future consent processes.

The proposed alignment to date has minimised effects on streams, wetlands and terrestrial habitats of value. This includes the expansion of the Ngakoroa Bridge to the south of the existing road corridor to avoid high value wetland habitat within SEA_T_530b.

A review of the surrounding catchment highlights that there is potentially available stream or wetland habitat for offset/compensation within the proposed designation boundary if that is required.

7 NoR D2: Jesmond to Waihoehoe West FTN Upgrade

Chapter Summary

Desktop studies and site investigations for terrestrial, freshwater and wetland habitats and native species (bats, birds and lizards) were undertaken within and adjacent to the Project Area to identify their ecological value.

The Project will impact a range exotic vegetation types of **Negligible** to **Low** value (regional and district). Although of **Low** value botanically, these features were considered for their potential to support Threatened and At Risk fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was considered to be **Low** and therefore no specific impact management has been recommended for these matters.

The Ngakoroa Stream corridor and associated wetlands within and adjacent to the Project Area have been highlighted for their potential importance to support a range of Threatened and At Risk coastal and wetland bird species. As such the replacement of the existing Bremner Road bridge could potentially cause noise, vibration and light disturbance during construction to breeding birds such as banded rail, spotless crake and fernbird, if present at the time of construction. A Bird Management Plan is recommended to reduce the potential adverse effects of construction from **Moderate** to **Low**. Impact management requirements would include programming noisy works to avoid the bird breeding season (September – February) where practicable, pre-construction nesting bird surveys and mitigating construction

lighting and noise/vibration disturbance. The proposed alignment has minimised effects on streams, wetlands and terrestrial habitats of value. This includes the expansion of the Bremner Bridge to the south of the existing road corridor to avoid direct impacts on **High** value saltmarsh habitat within SEA-M1-29b. Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features, such as streams and wetlands, can be adequately managed in any future consent processes and any requirement for offset/compensation can be accommodated within the proposed designation boundary.

7.1 Project Description

The Jesmond to Waihoehoe West FTN Project (NoR D2) includes, an approximately 4.1km long four-lane FTN arterial route along Jesmond Road, through a new greenfields link between Jesmond Road and the existing Bremner Road, Bremner Road, Norrie Road and Waihoehoe Road West. It primarily involves upgrading and widening existing transport corridors with the exception of the new link between Jesmond Road and the existing Bremner Road and the new bridge connection over Hingaia Stream. The functional intent of the Project is to provide an appropriate urban arterial connecting the growth areas of Drury West to the wider network and centres, including providing a frequent transport bus network. Generally, a 30 m wide transport corridor will be provided with two general traffic lanes, two bus lanes and separated walking and cycling facilities on both sides of the road corridor. The urban arterials will have a likely speed limit of 50 kph.

For assessment purposes, the Project has been separated into three sections, as shown in Figure 7, including:

- Jesmond Road FTN Upgrade;
- Bremner Road FTN Upgrade (including the Jesmond to Bremner link through the Auranga Development, Bremner Road and Norrie Road); and
- Waihoehoe Road West FTN Upgrade including the Great South Road intersection.

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade common to each Project section include the following:

- A typically 30 m wide road with four lanes and separated walking and cycling facilities
- Localised widening around the existing intersections to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Batter slopes and retaining to enable widening of the corridor and/or wetland construction, and associated cut and fill activities
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring.

Further details of each Project section are provided below.

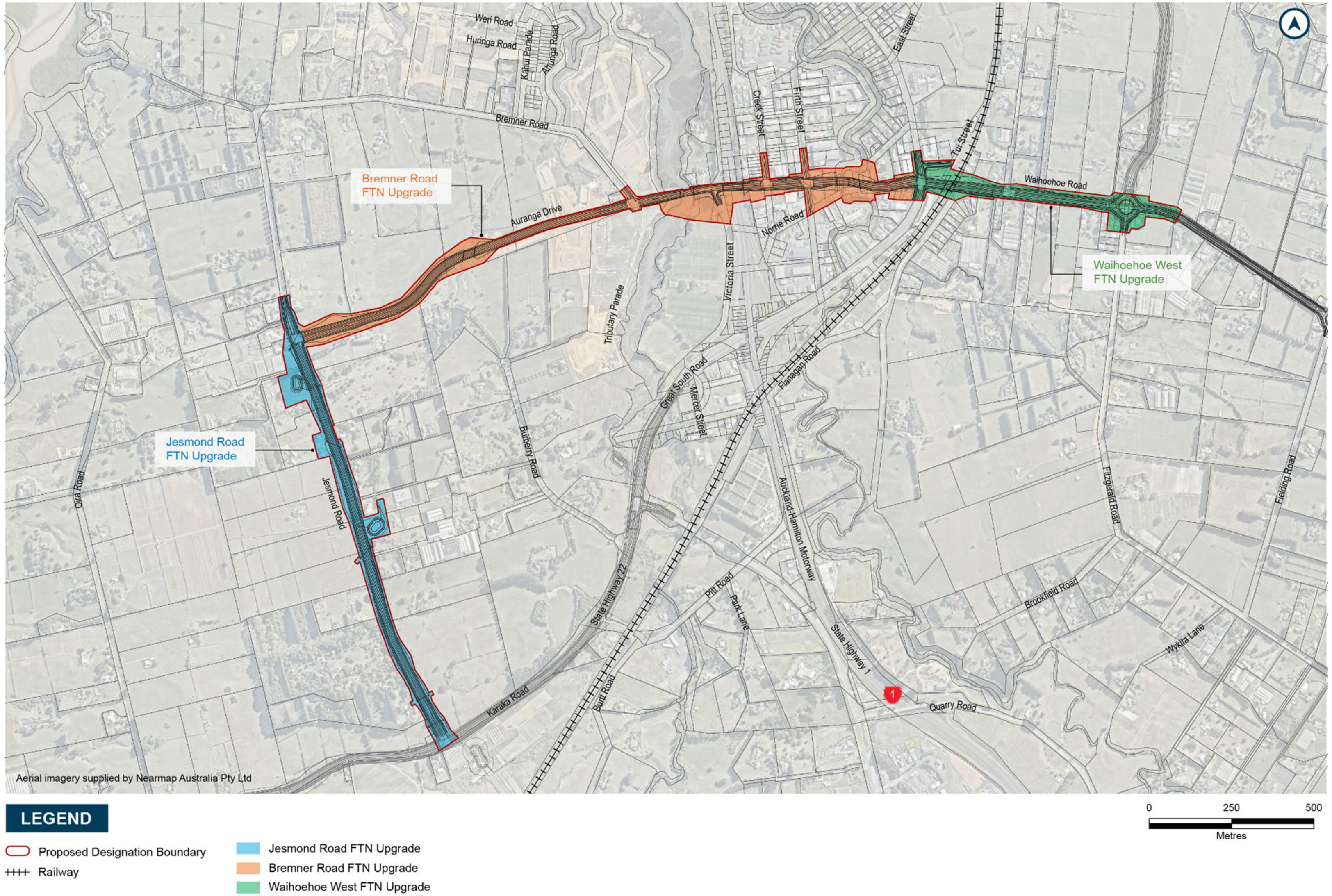


Figure 7 Overview of NoR D2

7.1.1 Jesmond Road Section

7.1.1.1 Section Overview

The Jesmond Road corridor provides greater accessibility via a north-south link that connects Bremner Road to the proposed Drury West Station and town centre, forming a key public transport and active mode spine through Drury West.

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

In addition to those listed above, the key features of the Jesmond Road section include:

- Signalised intersections at SH22 and the new Jesmond to Bremner Link
- New and extended pipe culverts for cross drainage
- Two stormwater wetlands

Figure 8 Overview of Jesmond Road Section of the FTN Upgrade (showing location only, refer design drawings)

7.1.1.2 Specific Features of this section

The surrounding environment is highly modified with original indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. The Project crosses a number of existing small low order streams which have been culverted and modified by historic road construction and adjacent agricultural activity. The widening of the existing Jesmond Road corridor will require additional stream loss where existing culverts are extended. Vegetation removal will be required to facilitate the road widening; however, this is generally low value exotic vegetation associated with private properties.

7.1.2 Bremner Road FTN Upgrade Section

7.1.2.1 Section Overview

The Bremner Road FTN Upgrade section extends from Jesmond Road in the west, approximately 1.98km to the end of Norrie Road in the east. This section involves the construction of a new road from Jesmond Road to the existing Bremner Road referred to as the “Jesmond to Bremner Link” and widening, and direct connection via a new bridge over Hingaia Stream, of Bremner Road and Norrie Road to enable the four-lane FTN arterial. The functional intent of this section provides greater east-west accessibility that connects Jesmond Road to Great South Road and town centre, forming a key public transport and active mode spine.

An overview of the concept design is provided in Figure 9.

In addition to those listed above, the key features of the Bremner Road FTN Upgrade section include:

- Signalised intersections on Bremner Road with Auranga Road 1, Creek Street and Firth Street
- Between Jesmond and Bremner Roads (Jesmond to Bremner Link):
    - A new road from Jesmond Road to an unnamed stream at the Auranga Development.
    - Forming of two additional lanes for the FTN within the Auranga “Road 1” from the unnamed stream to Bremner Road)
- A new bridge over an unnamed stream within the Jesmond to Bremner Link
- Widening of the two existing bridges crossing Ngakoroa Stream and SH1. These two bridges are proposed to be reconstructed in the near future as part of the SH1 widening by the Papakura to Bombay Waka Kotahi Project which forms part of the New Zealand Upgrade Programme .
- A new bridge connection from Bremner Road to Norrie Road across Hingaia Stream
- Removal of Norrie Road Bridge and closure of Norrie Road west
- Removal of access to Bremner Road from Creek Street (south)

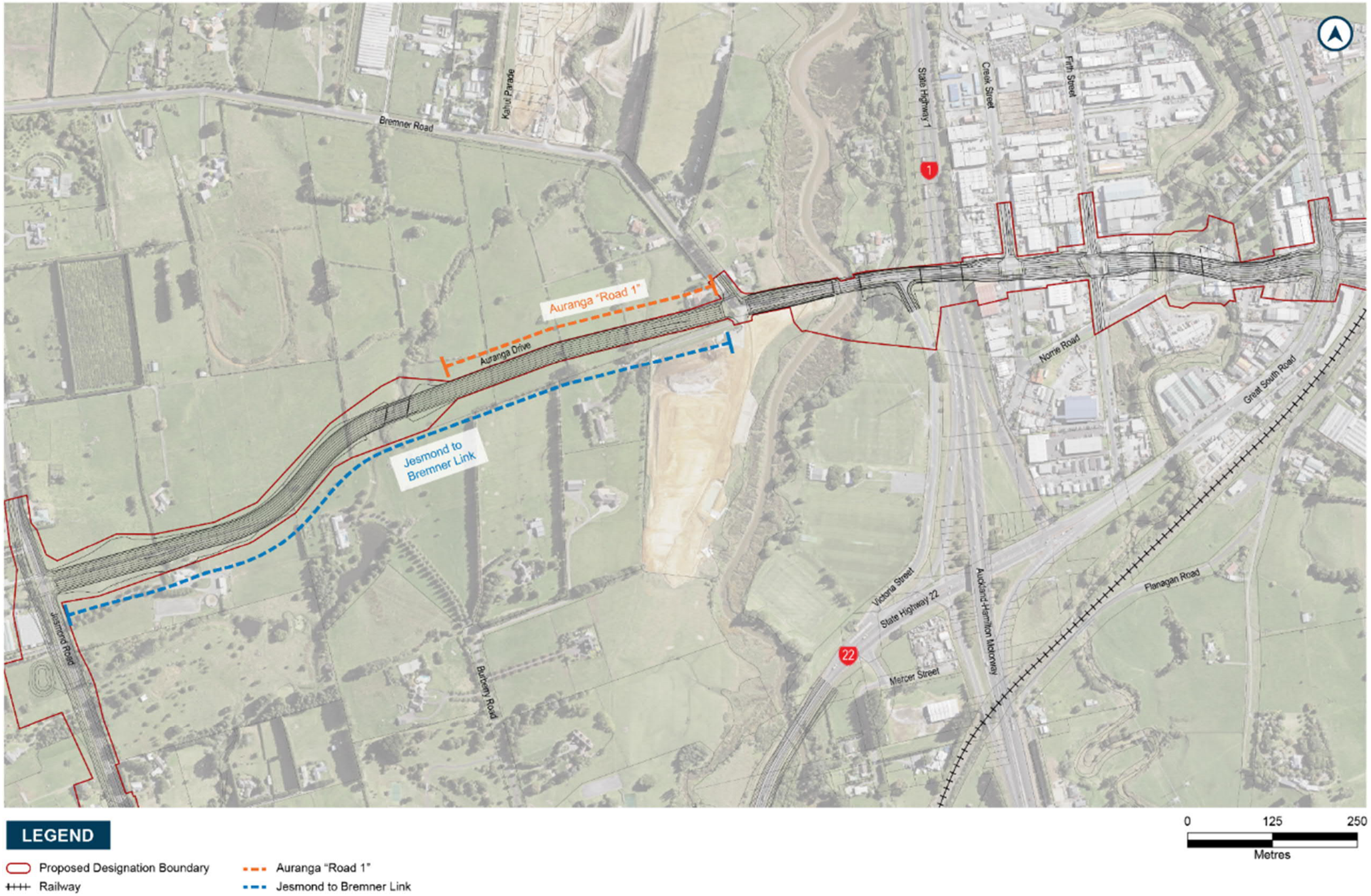


Figure 9 Overview of Bremner Road FTN Upgrade (showing location only, refer design drawings)

7.1.2.1 Specific Features of this section

The widening of the existing Bremner Road section will require the demolition and replacement of the existing Jesmond Bridge over the Ngakoroa Stream, and the Norrie Road Bridge over the Hingaia Stream. The new bridge structures will accommodate four lanes of traffic and pedestrian and cycling facilities. During construction, a 20 m wide temporary accessway will be required next to the bridge footprint to allow for the temporary staging of construction and dismantling. The extended bridge footprint will require vegetation removal, which includes exotic vegetation, and may also impact high value indigenous vegetation within the adjacent SEA habitats, either side of the Bremner Road bridge.

The surrounding environment is highly modified with original indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. The new Bremner Link Road section will bridge across an unnamed tributary of the Ngakoroa stream. This stream has been modified by adjacent agricultural practices in the past. Vegetation removal will be required to facilitate the road widening; however, this is generally low value exotic species associated with private properties

7.1.3 Waihoehoe Road West FTN Upgrade Section

7.1.3.1 Section Overview

The Waihoehoe Road West FTN Upgrade section extends from Great South Road in the west, approximately 800m east to just past Fitzgerald Road in the east and involves widening the existing two-lane rural road to enable the four-lane FTN arterial. The functional intent for the section provides a strategic east-west link between strategic north-south and east-west corridors (Norrie Road, Great South Road and the Ōpāheke N-S FTN Arterial) that connects Waihoehoe Road to the Drury Central Station (and associated park and ride facilities) and town centre, forming a key public transport and active mode spine through Drury West. An overview of the concept design is provided in Figure 10.

In addition to those listed above, the key features of the Waihoehoe Road West FTN Upgrade section include:

- Realignment of Tūī Street to Great South Road
- Upgraded and signalised intersection at Great South Road
- Reconstruction of the bridge crossing the NIMT rail line

Relocation of the Waikato 1 watermain. The point of re-location to be agreed with Watercare at future detailed design.

Figure 10 Overview of Waihoehoe Road West Section (showing location only, refer design drawing)

7.1.3.2 Specific Features of this Section

The surrounding environment is highly modified with original indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. The widening of the existing Waihoehoe Road corridor to four lanes will require exotic vegetation removal along the Project Area. There are no stream crossing through this section of the project.

7.2 Ecological Baseline and Likely Future Environment

This section presents the finding of the desktop study which includes a review of the documents listed in Section 5.1 and site investigations for all of the habitats and species ('ecological features') present within the Project Area. Based on this information, an ecological value has been identified for each ecological feature. The likely future environment in regard to these ecological features during construction of the Project is discussed in Section 7.2.4.

7.2.1 Historical Ecological Context

The Project Area is located within the Mānukau Ecological District, which encompasses the Mānukau Harbour and the surrounding coastal lowlands. The district has a warm, humid climate with mild winters. Soils throughout the district range from poorly drained to well drained, dependent on landform and the presence of localised volcanic areas (McEwen, 1987).

Most of the district was originally forested (Singers *et al.,* 2017). Original forest types were generally dependent on the landform and soils on which it grew:

- Flat lowland areas associated with stream and floodplains were dominated by kahikatea, pukatea forest (WF8[16]);
- The surrounding rolling hillslopes, gullies and ridges were dominated by taraire, tawa, podocarp forest (WF9); and
- The coastal wetland areas were dominated by mangrove forest and scrub (SA1).

Only 1.6% of the entire Mānukau Ecological District has native vegetation of any type remaining (Auckland Regional Council, 2004). Freshwater wetlands have been particularly affected, with over a 96% reduction in extent throughout the ecological district (Auckland Regional Council, 2004). 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 Mānukau Ecological District are well below these levels. The only significant area of natural landscape remaining is the Mānukau Ecological District are the unmodified coastal wetlands of the Mānukau Harbour. Any remaining examples of original forests or wetlands, or any regenerating native vegetation that is developing into vegetation that once clothed the district therefore needs to be considered as significant.

7.2.2 Habitats

7.2.2.1 Terrestrial Habitat

7.2.2.1.1 Desktop Review

Auckland Council Geomaps aerial imagery shows that the original forest within the Project Area has been cleared and that the present-day terrestrial habitats are dominated by agricultural land. Where there are natural habitats remaining within the ZOI of the Project, these have been delineated as either terrestrial or marine SEAs. The AUP has mapped and scheduled two SEAs within or directly adjacent to the Project Area, including SEA_T_530b and SEA_M1-29b. SEAs which occur within 2 km of the Project Area are presented and described in Table 27 and are shown in Appendix 7, Drawing SGA-EX-DL-004.2. A conservative distance of 2 km was selected as the potential ZOI for adverse effects of the Project, but this is dependent on the potential receiving environment and the habitats and species present with a SEA.

SEA_T_530, SEA_T_530b, SEA_M1-29b and SEA_M2-29a are presented as several distinct SEA units in Table 32, however, they should be considered as a continuum following the transition of the Ngakoroa Stream mouth from freshwater to saline dominated habitats. The SEAs include a narrow fringe of terrestrial riparian vegetation transitioning through freshwater influenced wetlands into increasingly saline influenced habitat. Freshwater habitats are described further in Section 7.2.2.1.2 and wetlands in Section 7.2.2.2.2.

[16] Habitat codes are from Singers *et al.* (2017) and Singer and Rogers (2014) and have been identified by Auckland Council as occurring in the Auckland region

Table 27 Significant Ecological Areas present within 2 km of the Project (NoR D2)

SEA	Distance from Project Area (km)	SEA Description
SEA_T_530b	0.0	Coastal and riparian wetland vegetation associated with the Ngakoroa Stream. Habitat for Threatened bird species, including pied oystercatcher and Caspian tern; and the rare plant species kaikōmako.
SEA_M1-29b	0.0	A wetland system within the upper tidal reaches of Drury Creek; which grades from freshwater vegetation, through rush-dominated saltmarshes to mangrove (*Avicennia marina* subsp. *australasica*) habitat; forming an important migration pathway for many native freshwater fish species.
SEA_T_530	0.03	Terrestrial coastal and riparian edge vegetation along the inner Drury Creek and Ngakoroa Stream mouth. The remnant coastal scrub includes records for Threatened plant species, including mingimingi and native oxtongue, and declining fish species īnanga. Also, habitat for rare plant species including korokio, kaikōmako and small-leaved kōwhai. This SEA is a buffer for adjoining SEA_M1-29b.
SEA_T_545	1.3	Critically endangered pūriri forest (WF7)
SEA_M2-29a	1.6	Intertidal habitat; ranging from sandy mud flats, to current-exposed rocky reefs and a variety of saline vegetation. Areas of mangroves grow in Whangamaire Stream, and Drury and Whangapouri Creeks. In southern areas of Whangapouri Creek are eelgrass beds. Drury Creek is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Wading bird roosting area, including important area for pied stilt.
SEA_T_4561	1.7	Habitat for rare plant species kaikōmako, and a migration pathway for migrant species.
SEA_T_5323	1.7	Critically endangered kahikatea forest (MF4) and pūriri forest (WF7). Habitat for Threatened fish species, including longfin eel, torrent fish and īnanga, as well as koura. Threatened plant species including pirata, or green mistletoe, and swamp maire are also found. This SEA is a buffer to a protected area and has high habitat diversity, including forest ecosystems such as pūriri forest (WF7), Taraire, tawa podocarp forest (WF9), Kauri, podocarp, broadleaved, beech forest (WF12), Tawa kohekohe rewarewa, hīnau podocarp forest (WF13), kahikatea forest (MF4) and Rimu, tōwai forest (MF24), and regenerating ecosystems including Kanuka scrub/forest (VS2) and Broadleaved species scrub/forest (VS5).
SEA_T_1173	1.8	Vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13), which is a migration pathway for migrant species.
SEA_T_4562	1.8	Endangered taraire, tawa, podocarp forest (WF9) and kānuka scrub forest (VS2), which is a migration pathway for migrant species
SEA_T_1175	1.9	Critically endangered kahikatea forest (MF4)

7.2.2.1.2 Site Investigation

The Project Area is dominated by exotic ecosystems such as exotic grassland, and exotic amenity planting with small areas of exotic wetland, exotic scrub, exotic treeland and exotic forest. For completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 7.2.2.3

Terrestrial habitats are highly modified and dominated by exotic species. However, small areas of native or mixed exotic species occur with areas of planted native vegetation and within exotic wetland areas (for completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 8.2.2.3). These habitats retain a greater ecological function and have the potential to support a greater number of native species. The only intact indigenous habitat within or adjacent to the Project Area was classified according to Singers *et al.* (2017) as indigenous wetland habitat, Oioi restiad rushland/reedland (WL10). This wetland has regional conservation status listed as Endangered by Singers *et al.*, (2017) and is currently mapped and largely coincident with SEA_T_530b which is within and adjacent to the Project Area. Table 28 presents the vegetation types, identified within and directly adjacent to the Project Area, these are mapped in Appendix 7, Drawings SGA -EC-DL-008.03 – SGA -EC-DL-008.05 .

Table 28 Vegetation types present within and directly adjacent to the Project Area (NoR D2), classified according to Singers *et al.* (2017)

Section	Vegetation Types	Alphanumeric Code*	Regional IUCN threat status*	Description
Jesmond Road	Exotic Grassland	EG	N/A	Grassland dominated by exotic species. This includes pasture, sport pitches, gardens and parks.
	Exotic Wetland	EW	N/A	Highly modified wetland system, dominated by exotic plant species such as willow weed and soft rush.
	Open Water	OW	N/A	Open bodies of freshwater, including ponds.
	Treeland	TL.3	N/A	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. This includes tree lined streams, gardens and mature trees within amenity plantings and shelter belts.
	Planted Vegetation variant	PL.3	N/A	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species.
Bremner Road	Brownfield (includes cropland)	BF	N/A	Strictly speaking according to Singers *et al.* (2017) this definition includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended

Section	Vegetation Types	Alphanumeric Code*	Regional IUCN threat status*	Description
				to include bared ground associated with cropland, market gardens and construction sites.
	Oioi, restiad rushland/ reedland wetland	WL10	Endangered	Oioi restiad rushland/reedland. This is present along the banks of the Ngakoroa Stream, adjacent to the existing Bremner Rd – Ngakoroa Stream bridge.
	Treeland	TL.3	N/A	Treeland – Tree canopy cover 20 -80%, this is present as amenity plantings and is a mix of native and exotic species.
	Exotic Scrub	ES	N/A	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. Generally growing along stream and roadside corridors. Dominant species include gorse, woolly nightshade and privet species.
	Planted Native Vegetation	PL.1	N/A	Native plantings on the west bank of the Ngakoroa Stream.
Waihoehoe Road West	Planted Vegetation	PL.3	N/A	Exotic amenity plantings. This includes parks and gardens and roadside vegetation dominated by exotic species.
	Exotic Grassland	EG	N/A	Grassland dominated by exotic species. This includes pasture, sport pitches, gardens and parks.
	Brownfield (includes cropland)	BF	N/A	Strictly speaking according to Singers *et al.* (2017) this definition includes industrial hard standing concrete and unmanaged bare ground. For the purposes of mapping this has been extended to include bared ground associated with cropland, market gardens and construction sites.

* = information from Singers *et al.*, 2017

7.2.2.1.3 Ecological Value

The terrestrial habitats within the Project Area are dominated by exotic grasslands, which is of negligible ecological value (as assessed in accordance with the EIANZ Guidelines – refer to Appendix 3 for detailed threshold criteria). Most other vegetation types within the Project Area are planted exotic habitat or self-seeded habitats such as scrub and treeland. These habitats are considered to be of **Low** ecological value due to their low botanical diversity and predominance of weed species.

Low value habitat does not however, necessarily mean a vegetation type provides 'no value' habitat as it may provide some value in terms of ecosystem function, such as, bank stability and stream shading, or may provide habitat utilised by common, Not Threatened native species such as native birds and copper skink.

The Project Area also includes areas of **Moderate** ecological value, such as planted native vegetation which has greater ecological function and the potential to support a wider diversity of native fauna and flora. These habitat types are also given greater value due to their potential in the long term. For example, native planted vegetation can mature into native forest.

Table 29 Terrestrial habitat values for the Project (NoR D2)

*Information from Singers *et al.* (2017).

Section	Habitat Description	Alphanumeric Code*	Regional IUCN conservation status*	Value based on EIANZ Guidelines
Jesmond Road	Exotic Grassland	EG	NA	Negligible
	Open Water	OW	NA	Low
	Planted Exotic and Amenity Vegetation	PL.3	NA	Low
	Exotic Treeland	TL.3	NA	Low
Bremner Road	Brownfield (includes cropland)	BF	NA	Negligible
	Exotic Scrub	ES	NA	Low
	Exotic Treeland	TL.3	NA	Low
	Planted Native Vegetation	PL.1	NA	Moderate
Waihoehoe Road West	Brownfield (includes cropland)	BF	NA	Negligible
	Exotic Grassland	EG	NA	Negligible
	Planted Exotic and Amenity Vegetation	PL.3	NA	Low

7.2.2.2 Freshwater Habitat

7.2.2.2.1 Desktop Review

Auckland Council Geomaps layer ('Named Streams') indicate that there are a total of four permanent named streams present which are crossed by, or flow immediately adjacent to the Project Area. These are listed in Table 30 and depicted in Appendix 7 SGA-EX-DL-005.2.

Table 30 Streams present within or adjacent to the Project Area (NoR D2)

Relevant section of the Project	Stream Name
Jesmond Rd section	Two unnamed tributaries of Ngakoroa Stream
Bremner Rd section	Unnamed tributary of Ngakoroa Stream
	Ngakoroa Stream
	Hingaia Stream
Waihoehoe Rd West Section	None

Auckland Council commissioned the following Catchment Watercourse Assessment Reports which includes stream catchments within the Project Area:

- Hingaia Catchment (Spyksma *et al.* 2018); and
- Ngakoroa Catchment (Surrey *et al.* 2018).

These reports provide baseline information on the existing condition of waterways, stream ecological health, (including stream classification), wetland habitat assessment and selected SEV and macroinvertebrate surveys. Table 31 provides an overview of information collected from these surveys that is relevant to streams within the Project Area. The data within these catchment reports covers the entire catchment and they are not specific to the sections of stream impacted by the Project.

Table 31 Desktop summary from Auckland Council Catchment Watercourse Assessment Reports for affected catchments within the Project Area (NoR D2)

Catchment effected	Summary	SEV	MCI
Ngakoroa Stream (Surrey *et al.* 2018)	The Ngakoroa catchment is a soft-bottomed system which flows through a highly modified rural, agricultural landscape from the Bombay Hills in the south to the Drury Creek and then the Pahurehure Inlet (Mānukau Harbour) in the north. Due to the gentle topography of the area, the catchment is characterised by low order, low energy systems connected to large wetland areas. Historical vegetation clearance has resulted in only small, fragmented pockets of native vegetation remaining.	SEV scores calculated for the catchment ranged from 0.360 to 0.719, giving a functional value of 'moderate'.	MCI scores ranged from 46 – 80. Overall MCI scores ranged from Poor to Fair.

Catchment effected	Summary	SEV	MCI
Hingaia Stream (Spyksma *et al.* 2018)	The Hingaia catchment is a hard-bottomed system which flows through a rural catchment used intensively for agricultural purposes, with some well vegetated gullies found in the eastern hill country. The stream channels typically had steep banks, prone to erosion. Historical vegetation clearance has resulted in low riparian vegetation and shading.	SEV scores calculated for the catchment ranged from 0.32 to 0.83, giving a functional value of 'low' to 'high'.	MCI scores ranged from 67.1 – 128.75 Overall MCI scores ranged from Poor to Excellent.

7.2.2.2.2 Site Investigation

All streams within the Project Area were numbered, classified (permanent, intermittent or ephemeral) according to Table 4 and mapped (Appendix 7, Drawings SGA-EC-DL-010.06 – SGA-EC-DL-010.11). A RHA was completed for all permanent and intermittent streams within the Project Area. The RHA scores are presented for instream habitat (instream habitat diversity, quality and quantity) and for riparian habitat (erosion, shade and buffering).

Four permanent and three intermittent streams were identified. Access restrictions prevented surveys to D2.S6 and D2.S7, however a suitable surrogate location was surveyed downstream for D2.S6. From recent aerial photograph it appears that D2.S7 has been removed or diverted to accommodate development within the Auranga development. The Ngakoroa Stream (D2.S8) is tidal at the survey location so was not suitable for an RHA. The results of the stream classification and RHA values for surveyed streams are presented in Table 31. Details on corresponding RHA scores for reference stream types are also presented in Table 31 .

All streams were representative of degraded systems. Primarily, this is due to historical indigenous vegetation clearance which has then been compounded by agricultural practices. Degradation includes grazing and pugging by livestock or ploughing of arable land, leading to erosion and sediment control issues and nutrient runoff. This degradation of riparian vegetation and increased nutrient inputs has also led to loss of bank stability, reduced shading and the proliferation of exotic macrophytes within the streams. Additionally, many streams have been physically altered, through dredging, reclamation and/or drainage of associated wetlands and/or channelization.

All streams reflect a moderate digression from reference instream habitat conditions and a moderate to large digression from reference riparian features. Site D2.S9, specifically measured a substantial loss in habitat features compared to its expected reference stream type. However, its relative size, permanent flow and residual habitat remains important features within this urbanised section of the catchment.

Table 32 Instream, riparian and combined RHA scores for the Project (NoR D2)

NoR Section	Jesmond Road					Bremner Road					
Site Name	**D2.S2**	**Ref. Stream Type WD/SS/1/MG**	**D2.S3**	**D2.S5**	**Ref. Stream Type WD/HS/1/LG**	**D2.S6***	**D2.S7****	**Ref. Stream Type WW/VA/1/LG**	**D2.S8*****	**D2.S9**	**Ref. Stream Type WW/HS/4/LG**
Stream Name	**Ngakoroa Stream Tributary**		**Ngakoroa Stream Tributary**	**Drury Creek Tributary**		**Drury Creek Tributary**	**Drury Creek Tributary**		**Ngakoroa Stream**	**Hingaia Stream**	
Classification	**Intermittent**		**Intermittent**	**Permanent**		**Permanent**	**Intermittent**		**Permanent**	**Permanent**	
Instream Score %	11.7	41.7	23.3	33.3	55.0	11.7	N/A	55.0	N/A	20.0	80.0
Riparian Score%	40.0	97.5	42.5	30.0	100.0	35	N/A	100.0	N/A	25.0	85.0
Combined RHA Score %	23.0	64.0	31.0	32.0	73.0	21	N/A	73.0	N/A	22.0	82.0

* = Stream not surveyed at specified location due to access restriction. Quoted survey information is from a surrogate downstream location approximately 350m downstream.

** = Stream not surveyed; stream has been altered by the Auranga development.

*** = Stream is tidal at this location and therefore was not suitable for an RHA

7.2.2.2.3 Ecological Value

The aquatic ecological value assessments for the respective sites are outlined in Table 33 for the Project Area. The assessment applied components presented within this report including: stream classification (hydroperiod and presence of pools), RHA (riparian and instream habitat representation, diversity), REC classification (stream order) and species of conservation importance, to assess the four matters (Representativeness, Rarity, Diversity and pattern, Ecological context) outlined within the EIANZ Guidelines. A precautionary approach was taken regarding the occurrence of fish species of conservation significance for all the intermittent and permanent streams within the Project Area identified during site surveys. As such, a high value descriptor was assigned for ‘Rarity’ to qualifying streams, specifically for the likely occurrence of longfin eel and īnanga (At Risk- Declining). SEV surveys will be required when the Project seeks resource consent. This will include fish surveys and will allow for a more accurate assessment of rarity for the value assessment.

Table 33 Aquatic ecology value assessment for the Project (NoR D2)

NoR Section	Jesmond Road			Bremner Road				Waihoehoe Road West
Site Name	D2.S2	D2.S3	D2.S5	D2.S6	D2.S7	D2.S8	D2.S9	N/A no streams present
Representa-tiveness	Very low	Very low	Very low	Very low	N/A	Very high	Very low	
Rarity	High	High	High	High	N/A	High	High	
Diversity and pattern	Very low	Very low	Very low	Very low	N/A	High	Medium	
Ecological context	Low	Low	Medium	Low	N/A	High	High	
Ecological Value	Low	Low	Moderate	Low	N/A	Very high*	Moderate	

Note:
*RHA was not undertaken because of streams tidal nature. Conservatively, because it is considered to be a high value stream, the reference stream RHA data was used to inform Ecological Value.

7.2.2.3 Wetland Habitat

7.2.2.3.1 Desktop Review

Auckland Council Geomaps layers indicate that the wetland habitats present within and adjacent to the Project Area are associated with the Bremner Road Bridge section, within the riparian zone of the Ngakoroa Stream, consisting of upper intertidal zone wetlands (SA1.3). This habitat is characterised by abundant oioi, and local areas of *Machaerina* and *Bolboschoenus* spp., kuta, lake clubrush, raupō and harakeke (Singers *et al.*, 2017).

AECOM (2019a) completed wetland habitat surveys of the Ngakoroa wetlands between the SH1 Ōtūwairoa Creek road bridge and Bremner Bridge. This survey identified sea rush and oioi upper estuarine zone habitat (SA1.3) north of the Bremner Bridge and oioi restiad rushland reedland habitat (WL10) to the south of Bremner Bridge crossing (Figure 11).

This area is adjacent to the Project Area where the existing road bridge will be replaced.

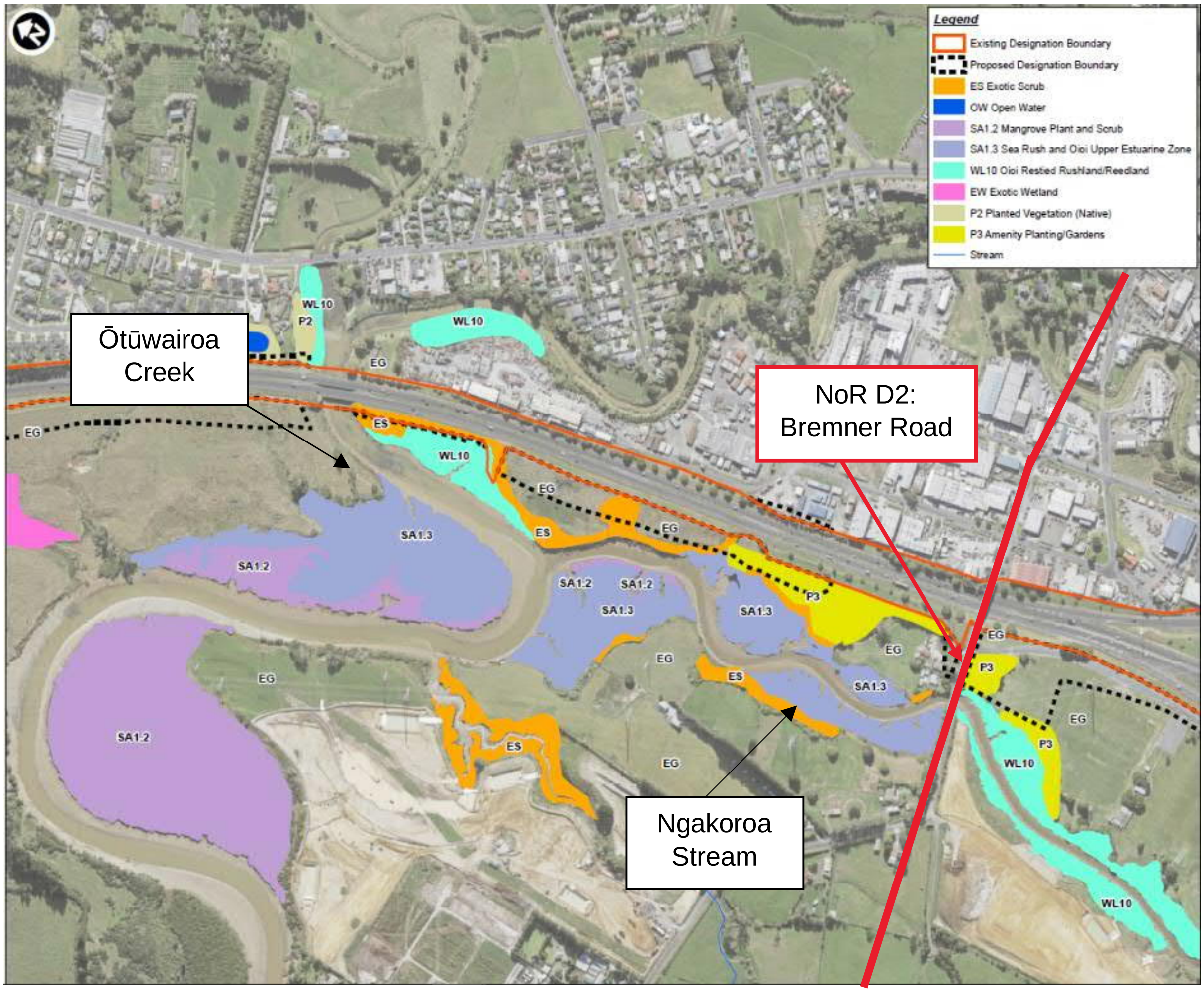


Figure 11 Habitat Survey Map Ngakoroa Stream (AECOM, 2019) and proximity to the Project Area (NoR D2): Bremner Road (FTN)

Surrey *et al.* (2018) assessed the wetland habitat associated with an unnamed tributary of the Ngakoroa Stream adjacent to Jesmond Road. This has been described as artificial wetland and includes a stream with a series of eight online farm ponds. Figure 12 depicts the freshwater features described as artificial wetland associated with the stream.

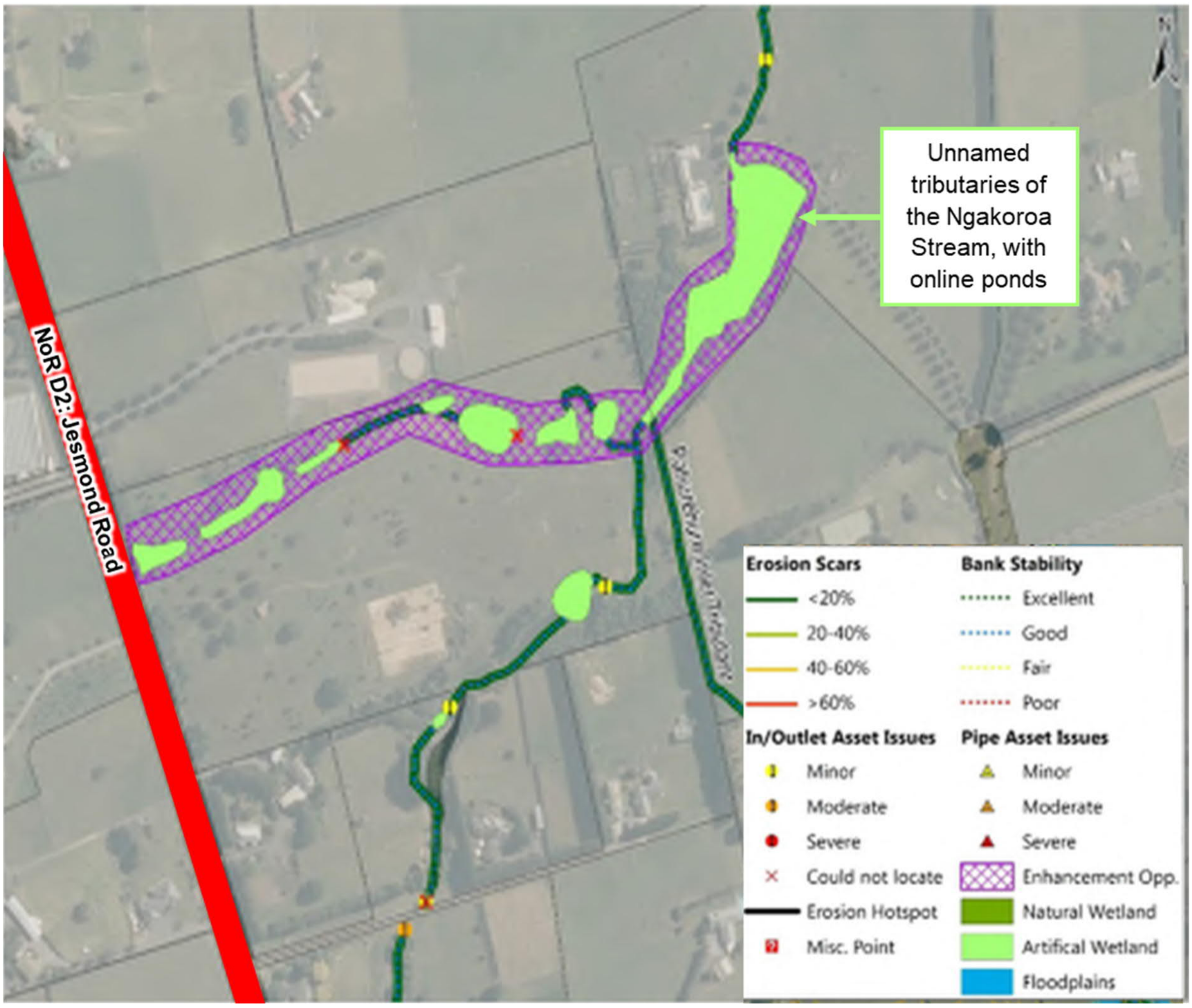


Figure 12 Freshwater stream survey map of unnamed tributary of the Ngakoroa Stream, with on stream ponds, described as artificial wetlands. Figure adapted from Morphum (2018).

7.2.2.3.2 Site Investigation

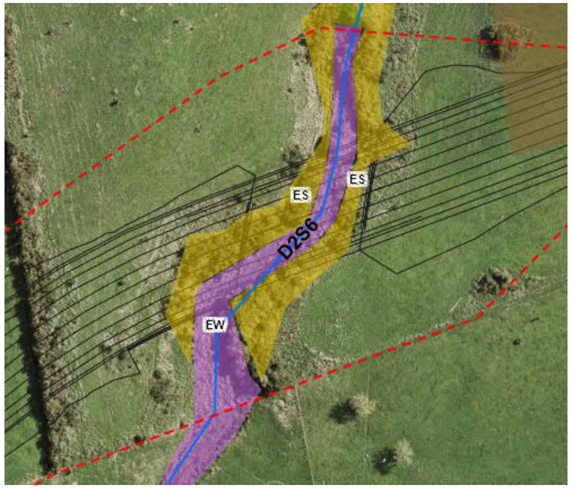
Wetland habitat was present within and adjacent to the Project Area as defined in Section 5.3.1.3. The majority of wetlands within the Project Area were mapped and described as highly modified, exotic wetlands (EW) (Singers *et al.* 2017). However, the wetland complex associated with the Ngakoroa Stream (D2W5) retains extensive areas of intact native species dominated wetland. Although not within the design footprint this location is within the Project Area and therefore construction effects may need to be managed. Table 34 below describes the wetland habitats present for both exotic and indigenous within and adjacent to the Project Area with drawings SGA-EC-DL-010.06 to SGA-EC-DL-010.11 presented in Appendix 7.

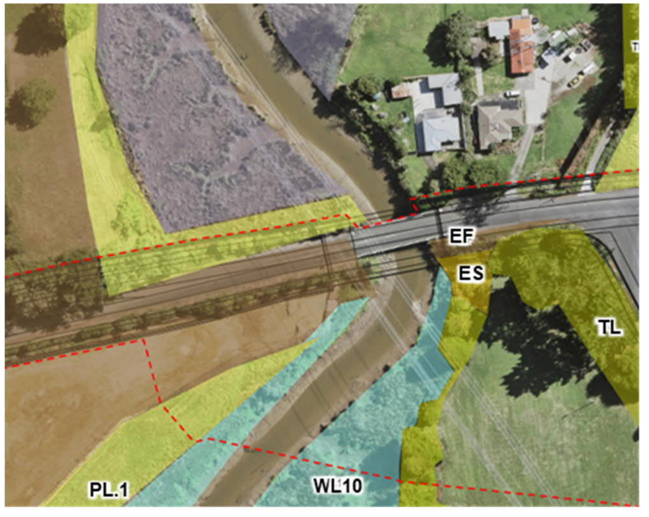
Table 34 Wetland habitats within and adjacent to the Project Area (NoR D2)

Site Name and Location	Description	Photograph of Habitat
Jesmond Road		
D2W1 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) including soft rush and willow weed (Clarkson, 2013). The feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants adapted to wet conditions. This wetland is a shallow depression with likely permanent saturation and intermittent inundation. The topographical setting is consistent with a valley head seep. The feature is unchannelised but has outflow through an existing culvert under Jesmond Road, when water levels are high. It is likely that the obstruction caused by the existing Jesmond Road may have increased the extent of the wetland. This habitat is modified, unfenced, and grazed by livestock.	

Site Name and Location	Description	Photograph of Habitat
D2W2  	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) including soft rush and willow weed (Clarkson, 2013). The feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas that supports plants adapted to wet conditions. This wetland forms a valley bottom wetland, which is unchannelised and expressed by wetland vegetation which is hydrologically maintained through a combination of hillslope (lateral) and upland (longitudinal) soil and surface water flows. It forms a linear feature, where intermittent flows also occur and are described as Stream D2S3. The obstruction caused by the existing Jesmond Road may have increased the extent of this feature, causing intermittent inundation.	

Site Name and Location	Description	Photograph of Habitat
D2W3 	Mapped and described as Open Water (OW) and Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Within the standing water obligate wetland species dominate such as parrots feather and fools water cress. On the water's edge facultative wetland species dominate including willow weed and soft rush. D2W3 meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. This feature is a series of on-stream farm ponds associated with permanent stream D2S5, which flows from west to east and is culverted under the existing Jesmond Road. Upslope wetlands have developed due to poor drainage around the ponds. The 1942 aerial image, indicates no obvious wetland features (other than the stream channel D2S5), however the landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. The obstruction caused by the existing Jesmond Road and damned ponds have likely increased the extent of this feature, causing intermittent inundation.	

Site Name and Location	Description	Photograph of Habitat
Bremner Road		
D2W4  	Not surveyed, due to access restrictions.Assessed from adjacent property. Upstream farm ponds limit flow through this area during summer drought conditions. Assessment based on downstream conditions which are assumed to be similar. Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) including soft rush and willow weed. This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, that support plants that are adapted to wet conditions. The 1942 aerial indicates a wide channel with dense (potentially wetland vegetation). This wetland appears to still be intact, with a wide gully bottom dominated by wetland vegetation. Based on current aerials there appears to be some culverts downstream which may be impeding natural flow along the permanent stream D2S6, resulting in some modification of natural wetland features. Additionally, as the stream is unfenced and grazed it is likely to be affected by pugging from livestock and siltation from stormwater runoff. The obstruction caused by the existing culverts and damned ponds may have increased or decreased the original extent of this feature. However, the landscape position is consistent with valley bottom	

Site Name and Location	Description	Photograph of Habitat
	flow accumulation, likely to naturally support wetland conditions.	
D2W5 	Intact native estuarine wetland associated with the mouth of the Ngakoroa Stream (D2S8). Mapped and described as Sea rush and oioi upper estuarine zone (SA1.3) (Least Concern, IUCN) to the north of Bremner Bridge and Oioi restiad rushland/reedland (WL10) (Endangered, IUCN) to the south of Bremner Bridge (Singers *et al.*, 2017). Forms part of SEA_T_530b (refer Section 6.2.2.1.1). This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, shallow water, on the land water margin, that support a natural ecosystem of plants adapted to wet conditions. The habitat is dominated by obligate wetland species, including a mix of raupō and purua grass. Others Obligate native species include oioi, swamp millet and saltmarsh ribbonwood. The 1942 aerial indicate natural wetland beyond their current extent. Historical reclamation associated with Bremner road construction has reduced the wetland area to the current extent. Part of the wetland is located within the construction staging area of the Project Area and may be temporarily affected by construction works.	

7.2.2.3.3 Ecological Value

Wetland habitats present within the Project Area include many areas of exotic wetland, dominated by exotic plant species, degraded through factors such as vegetation removal, artificial drainage and grazing and pugging from livestock (Section 7.2.2.3.2). Although specific habitat assessments of wetland condition were not undertaken in these areas, this preliminary assessment has identified that the ecological value of these exotic wetlands is **Moderate,** taking into consideration the overall reduction in wetland habitat across the Auckland region and the retained ecological functionality of these systems for attenuation of stormwater and excess nutrient removal.

Two areas of intact indigenous wetland habitat types were identified within and directly adjacent to the Project Area. These areas occur either side of the Bremner Road bridge crossing of the Ngakoroa Stream. Although direct impacts such as permanent loss of this habitat is likely to be avoidable, temporary construction works may directly or indirectly affect this habitat as it occurs within the construction staging and laydown areas. These wetland areas are considered to be functional indigenous wetland, providing habitat for native flora and fauna species. Table 35 provides information on the ecological value of these wetland habitats.

Table 35 Ecological value of indigenous wetland habitat within and directly adjacent to the Project Area (NoR D2): Bremner Road Section

Site Name	Wetland Habitats Present & Regional IUCN Conservation status*	Other details	Ecological Value
D2W5	WL10 – Oioi, restiad rushland/ reedland **Endangered** Occurs on the southern side of the Bremner Road Bridge	**SEA_T_530b** habitat for Threatened bird species South Island pied oystercatcher & Caspian tern; and Regionally Threatened plant kaikōmako. Banded rail also recorded within 0.5km of location.	**Very High**
D2W5	SA1.3 Sea Rush and Oioi Upper Estuarine Zone **Least Concern** Occurs on the northern side of the Bremner Road Bridge	**SEA-M1-29b** A wetland system within the upper tidal reaches of Drury Creek; which grades from freshwater vegetation, through rush-dominated saltmarshes to mangrove (*Avicennia marina* subsp. *australasica*) habitat; forming an important migration pathway for many native freshwater fish species. Banded rail also recorded within 0.5km of location.	**Moderate**

* = Information from Singers *et al.* (2017).

7.2.3 Species

7.2.3.1 Bats

7.2.3.1.1 Desktop Review

DOC records; unpublished AECOM records, and one additional anecdotal record by G. Kessels (Personal Communication) confirm the presence of long-tailed bats within 10 km of the Project Area. Although no records are located directly within the Project Area; as a highly mobile species there is potential for bats to frequent any suitable habitat within the designation boundary. The conservation status of this species is 'Nationally Critical' (O'Donnell *et al.*, 2017). The records within 10 km of the Project Area (Appendix 7; Drawing SGA-EX-DL-006) include:

- 4.9 km to the north-west on Kopuhinahinga Island in the Pahurehure Inlet.
- 5.3 km to the south-west, near the SH22 intersection with Glenbrook Road
- 4.1 km to the east in the foothills of the Hunua Ranges.
- 5.1 km to the south within Coulthards Scenic Reserve near Paerata (Unpublished records from AECOM of long-tailed bats); and
- 6.5 km to the south west, within the Paerata Scenic Reserve (Unpublished records from AECOM of long-tailed bats).

Further afield, there are multiple records within the Hunua Ranges and within farmland between Waiuku and Patumahoe. There are no records of bats directly within the Project Area.

7.2.3.1.2 Site Investigation

7.2.3.1.2.1 Bat habitat

Mature trees of a range of species (e.g. willow; poplar, pine) with suitable roosting features were identified within and adjacent to the Project Area. Suitable roost features that were identified included cracks and/or rot holes in tree trunks and branches, and loose, peeling bark, with cavities potentially suitable for roosting bats. Appendix 7 SGA-EC-DL-012.01 highlights key habitat corridors within and adjacent to the Project Area.

Mature pines in Drury Sports Pitch. Branch splits and branch fold potentially suitable for roosting bats.

Figure 13 Examples of potential bat roost features within the Project Area

7.2.3.1.2.2 ABM Survey

Due to the large home ranges of bats and interconnectedness of bat habitat and ABM survey locations within the Project Areas, bat survey results have been presented collectively.

A summary of the ABM surveys is presented in Appendix 5 and ABM locations are presented in Appendix 7 SGA-EX-DL-002. Data was collected for at least one survey session for all ABM sites, with nine locations collecting data for both survey sessions (1 and 2). Analysis of the ABM data did not identify any bat activity within the Project ZOI. These results suggest that bats are not frequent visitors to the area during their mating and breeding seasons. However, as the desktop assessment suggests (Section 7.2.3.1.1), bats are highly mobile and have been recorded within 4 km of the Project Area.

7.2.3.1.3 Ecological Value

The ABM surveys did not find any evidence of long-tailed bat (Threatened – Nationally Critical) activity at survey locations. However, there is some suitable habitat within some of the Project Area (refer to Section 7.2.3.1.1 above) and bats are known to be present within the wider Hunua-Drury-Pukekohe landscape (refer to Section 6.2.3.1). As such, it is possible that bats may be present in the wider landscape but an infrequent visitor to the Project Area, since they were not detected in the surveys associated with this assessment. On this basis, the ecological value of bat habitat within the Project Area is considered to be **Low**.

7.2.3.2 Birds

7.2.3.2.1 Desktop Review

Records of native bird species identified within a 5 km radius of the Project Area, are collated into Appendix 8, Table 116. As many records do not include a specific location, a map was not produced for individual bird records.

Of the nationally listed At Risk or Threatened species recorded in the desktop assessment, most were coastal wetland or freshwater wetland bird species with two forest bird species also recorded within 5 km of the Project Area. Of the coastal wetland species, the waders such as wrybill (Threatened – Nationally Vulnerable), South Island pied oystercatcher (At Risk - Declining) and bar-tailed godwits (At Risk - Declining) are likely to forage within the intertidal mudflats and saltmarsh habitats. This habitat occurs within the Marine SEA, (SEA_M2-29a and SEA_M2-29w1) in the Drury Creek and Pahurehure Inlet approximately 1 – 5 km from the Project Area. The gull, shag and tern species are likely to frequent the inner estuary around Drury Creek and the Ngakoroa Stream (within the Project Area) for foraging but are unlikely to breed within the Project Area.

Banded rail, spotless crake and fernbird (all At Risk - Declining) have been recorded 5km away within the Pahurehure Inlet. The wetlands throughout the Pahurehure Inlet, Drury Creek and Ngakoroa Stream mouth provide suitable foraging and breeding habitat (WL10 Oioi, restiad rushland/ reedland and SA1.3 Sea Rush and Oioi Upper Estuarine Zone) for these species. They therefore could be resident and potentially breeding within or directly adjacent to the Project Area.

Of the At Risk forest bird species recorded, the North Island kokako (At Risk - Recovering) is a forest specialist with a known population in the Hunua Ranges, 10 km to the east of the Project Area. Similarly, the North Island kākā (At Risk - Recovering) is also a forest specialist but is known to disperse to seasonally available food sources, particularly in winter. Given the type of habitat present within the Project Area neither of these species are likely to be present and are therefore excluded from further mention for this Project.

7.2.3.2.2 Site Investigations

Three bird surveys in the form of point counts were completed, one at the artificial wetlands on Jesmond Road (Bird Survey Site D2B1) Figure 14, and two (one low and one high tide count) at the Bremner Bridge (Bird Survey Site D2B2), Figure 15. Survey summaries are shown in Table 36 These locations are depicted in Appendix 7, Drawing SGA-EX-DL-003.2.

Table 36 Bird survey sites and method

Bird Survey Site #	Description	Survey method	Date(s)
D2B1	Artificial wetland created by multiple on-stream farm ponds.	Point count	12th May 2020
D2B2	Bremner Rd Bridge – oioi, raupō reedland and saltmarsh ribbon wood, intertidal with freshwater influence.	Point count x2	20th March 2020

A summary of the native species recorded during the surveys is presented in Table 37. Full results of each survey are provided in Appendix 8, Table 112. Appendix 7 Figure SGA-EX-DL-013.2 highlights the high value wetland bird habitat, identified along the Ngakoroa Stream corridor.

Figure 14 shows the view looking across the artificial farm ponds and wetlands, from Bird Survey Site D2B1 directly adjacent to the Jesmond Road widening. This habitat consists of a series of on-line farm ponds, with multiple small dams along a stream. This has created artificial wetlands, which are unfenced and grazed by livestock. The area provides potential habitat for At Risk species such as spotless crake (At Risk - Declining) and New Zealand dabchick (At Risk - Recovering). However due to grazing pressure natural wetland vegetation cover is absent, significantly reducing the suitability for these species.

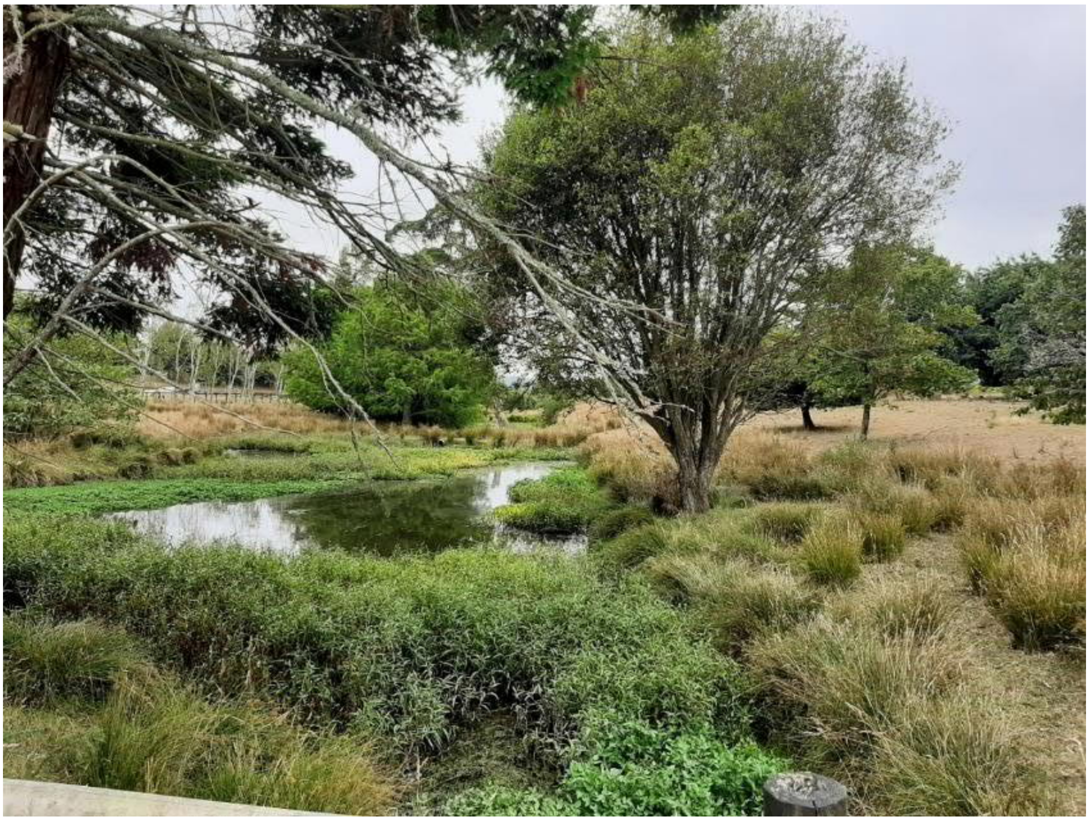


Figure 14 Bird Survey Site D1B1

Figure 15 shows the view from the eastern bank looking west across the Ngakoroa Stream, directly south of Bremner Bridge (Bird survey Site D2B2). Figure 15 shows the survey site at high tide, where the new Bremner Road bridge replacement will be built. The area is part of SEA_T_530b estuarine wetland and includes a mix of raupō, purua grass, oioi, swamp millet and saltmarsh ribbonwood. Although not recorded at the time of survey, this area may provide suitable habitat for coastal wetland and freshwater wetland birds species such as banded rail, fernbird and spotless crake. As can been seen from the picture, recent works on the new footbridge has altered the wetland habitat directly adjacent to the existing bridge, however high value habitat remains within several metres, directly adjacent to the proposed new bridge construction footprint.

Figure 15 Bird Survey Site D2B2

Table 37 Summarised bird survey results

Bird Survey Site #	Common Name	Scientific Name	Conservation status*	Frequency
D2B1	Pied shag	*Phalacrocorax varius*	NT	3
	Pūkeko	*Porphyrio melanotus*	NT	10
D2B2	Mallard	*Anas platyrhynchos*	Int.	4
	Pūkeko	*Porphyrio melanotus*	NT	2
	Swamp harrier	*Circus approximans*	NT	1

Notes:
* = conservation status information from Robertson *et al.* (2016).

- NT = Not Threatened
- Int. = Introduced

In addition, an AR was used at Bird Survey Site D2B2 on the Ngakoroa Stream which recorded calls from eight native species and a range of non-native species. Summarised results of the native species recorded are listed in Table 38, with full results in Appendix 7, Table 117.

Table 38 Bird species recorded using the acoustic recorder at the Ngakoroa Stream Bird Survey Site 2 (D2B2)

Common name	Latin Name	Conservation status*	Frequency
Pūkeko	*Porphyrio melanotus*	NT	489
Spur-winged plover	*Vanellus miles*	NT	346
Grey warbler	*Gerygone igata*	NT	97
Sacred kingfisher (kōtare)	*Todiramphus sanctus*	NT	40
Silvereye	*Zosterops lateralis*	NT	6
Tūī	*Prosthemadera novaeseelandiae*	NT	3
Swamp harrier	*Circus approximans*	NT	2
Welcome swallow	*Hirundo neoxena*	NT	2

Notes:
* = conservation status information from Robertson *et al.* (2016).NT = Not Threatened

7.2.3.2.3 Ecological Value

The desktop study identified a number of At Risk and Threatened species of coastal wetland or freshwater wetland bird species, and two species of At Risk forest bird within the wider landscape associated with the Project. However, many of these species are highly mobile, utilising large areas and are not likely to be directly affected by the Project. Only Not Threatened bird species were recorded from the site investigations. Table 39 below summarises the list of Threatened and At Risk bird species and indicates the importance of the habitat within and adjacent to the Project Area for their pattern and use of habitat or life stage

Of the At Risk forest bird species recorded, the At Risk – Recovering North Island kōkako is a forest specialist with a known population in the Hunua Ranges, 10 km to the east of the Project Area. Kōkako do not readily disperse into non-forested habitat, and no suitable forest habitat occurs within the Project Area. Similarly, the At Risk – Recovering North Island kākā is also a forest specialist, however, it is known to disperse to seasonally available food sources such as pine plantations, particularly in winter.

Other than the stand of mature pine trees on the right bank of the Ngakoroa Bridge, there is no suitable forest habitat or pine plantations with the Project Area where these forest species are likely to occur. Kākā could potentially utilise the large pines as a night roost or for feeding, but this is an isolated stand in an otherwise unsuitable landscape. Therefore, kākā would be unlikely to occur within the Project Area and have not been considered further in the assessment of the Project.

Of the coastal wetland or freshwater wetland bird species, multiple At Risk or Threatened species were recorded during desktop assessment within 5 km search area of the Project. Of these species the key migratory wading bird species such as the At Risk – Declining Bar-tailed godwit, At Risk – Declining South Island Pied oystercatcher and Threatened – Nationally Critical Wrybill depend on intertidal wetlands habitats within Drury Creek and the wider Mānukau Harbour for foraging and also require suitable high tide roosts locations which may include sandspits, beaches and coastal grassland. High tide roost requirements for wading birds include short vegetation, with >50 m visibility and minimal disturbance from stock or human activity (Gillies *et al.* 2014). Suitable roosting and foraging habitat for these species would be within SEA-M2-29a approximately 1 km from the Project Area. Known roost sites include Pollock Spit, Airport (Wiroa Island) and Puhinui Reserve (>10 km from the Project Area) (Garten *et al*, 2018). The habitat within or adjacent to the Project Area would therefore generally be considered largely unsuitable for wading birds.

The South Island Pied oystercatcher (At Risk – Declining) are however more likely to utilise less specific roost locations, such as grazed pasture or grass sports pitches. Their potential occurrence within Drury sports pitches is likely the reason for the recorded presence of this species (Table 27) within SEA_T_530b, which are directly adjacent to the Project Area. Due to high levels of noise and disturbance from recreation use and existing traffic, these sports pitches would be considered suboptimal and may only be used infrequently by these birds as a high tide roost.

The open water within the Ngakoroa Stream (Bird Survey Site D2B2) provides potential foraging habitat for the shag, gull and tern species listed in Table 39. The shag species have the potential to breed and roost within the local area on suitable trees or exposed platforms. However, no nesting or roosting sites were observed within or adjacent to the Project Area and no potentially suitable features were identified. Three shag species were observed foraging in the Ngakoroa Stream and crossed under/over the existing Bremner bridge, indicating their habituation to noise and disturbance levels. The gull and tern species breed in exposed coastal cliffs and sandspits and therefore no suitable breeding habitat occurs for these species, within the Project Area. Notably, Caspian terns (Threatened – Nationally Vulnerable) were also observed incidentally foraging along the Ngakoroa Stream at high tide and crossed over the existing Bremner Bridge, indicating their habituation to existing noise and disturbance levels (See Appendix 8, Table 111).

Banded rail, fernbird and spotless crake (all At Risk- Declining) are the only species likely to occur within or directly adjacent to the Project Area where the Project crosses the Ngakoroa Stream wetlands. Wetland values have been degraded near the existing bridge, reducing the nesting coastal wetland birds within the Project footprint, however high value suitable habitat remains directly adjacent to the Project Area

The At Risk – Recovering New Zealand dabchick and At Risk – Declining spotless crake were not recorded during the survey of the artificial wetlands adjacent to Jesmond Road. As the wetlands are degraded with little habitat cover and are impacted by grazing animals, they are unlikely to support breeding individuals, therefore the value of these wetlands is diminished. Although these species may utilise the habitat for foraging, there is no suitable breeding habitat within the Project Area.

Table 39 Presence of suitable habitat for threatened bird species the Project Area (NoR D2)

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al.*, 2013)	Habitat suitability the Project Area	Pattern in habitat use or life stage
Black-billed gull	Threatened – Nationally Critical	Breeding range largely restricted to Southland. Breeding habitat includes lakes, major rivers (mostly braided) and occasionally farmland; outside of breeding season is more often	Rare visitor. No suitable breeding habitat and suboptimal foraging or roosting.	Foraging only

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al.*, 2013)	Habitat suitability the Project Area	Pattern in habitat use or life stage
		present in estuaries & coastal areas (McClellan & Habraken, 2013).		
Wrybill	Threatened – Nationally Vulnerable	Breeding range restricted to the South Island. Winter range in the northern north island where they feed on inter-tidal mudflats in harbours and estuaries. High-water roosts are usually near foraging areas, on shell banks and beaches; occasionally on pasture. The Mānukau Harbour is a key winter-feeding area for the population (Dowding, 2013).	Rare visitor. No suitable breeding habitat and suboptimal foraging or roosting. Key habitat within the Drury Creek and wider Mānukau Harbour.	Foraging only
Caspian tern	Threatened – Nationally Vulnerable	Breed habitat includes open coastal shellbanks and sandspits and occasionally in similar habitat inland. No breeding, and foraging habitat includes sheltered bays and harbours of the main islands (Fitzgerald, 2013).	No suitable breeding habitat. Small numbers of Caspian terns are known to regularly frequent the Ngakoroa Stream for foraging during high tide.	Foraging only
Banded rail*	At Risk – Declining	Resident and breeding in the northern north Island. They nest at ground level with rush and reed habitat. Foraging in mangroves and saltmarshes within estuaries (Bellingham, 2013).	Known breeding habitat within the Ngakoroa Stream estuary and Drury Creek wetlands.	Breeding, roosting and foraging
Red-billed gull	At Risk – Declining	Breeding habitat includes sea cliffs and sandy/ rocky shores throughout New Zealand. They forage and disperse widely in coastal areas. They are also commonly found in towns, scavenging on human refuse (Mills, 2013).	No suitable breeding habitat. Likely to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
South Island pied oystercatcher	At Risk – Declining	Breeding range largely restricted to the South Island. Their winter range includes the northern north island where they feed on inter-tidal mudflats in harbours and estuaries, the also frequent wet pasture in coastal areas (Sagar, 2013).	No suitable breeding habitat. Suboptimal foraging or roosting habitat within adjoining grazed paddocks and sports pitches. Presence currently impacted by ongoing (and	Foraging only

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al.*, 2013)	Habitat suitability the Project Area	Pattern in habitat use or life stage
			future) disturbance from live zoned Auranga Development and human disturbance within Drury sports pitches.	
White-fronted tern	At Risk – Declining	Breeding habitat includes sea cliffs and sandy/ rocky shores throughout New Zealand. They forage and disperse widely in coastal areas (Mills, 2013).	No suitable breeding habitat and suboptimal foraging or roosting. Key habitat within the Drury Creek and wider Mānukau Harbour.	Foraging only
Black shag	At Risk – Naturally Uncommon	Breeding habitat includes trees overhanging water, coastal cliffs and headlands, and on artificial structures throughout New Zealand. They occur and forage widely, in coastal waters, estuaries, harbours, rivers, streams, lakes and ponds (Powlesland, 2013).	No suitable breeding or roosting trees identified. Known to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
New Zealand dabchick	At Risk – Recovering	Occurs throughout the north island on freshwater lakes and ponds. Breeding on small shallow ponds with dense vegetation. Non-breeding birds flock on more open freshwater bodies (Szabo, 2013).	Likely to occur on the online ponds associated with the artificial wetland east of Jesmond Road. Due to lack of dense vegetation (caused by grazing livestock), they are unlikely to breed in these ponds.	Foraging, and roosting
North Island kākā	At Risk – Recovering	Kākā are rare to uncommon in native forest on the mainland, with strongholds on a pest free offshore island. Kākā however disperse widely during winter and regularly visit forest fragments and pine plantations in the Auckland area (Moorhouse, 2013).	Rare visitor. No suitable breeding or foraging habitat.	Foraging only
Little black shag	At Risk – Naturally uncommon	Little black shags occur in most freshwater and coastal habitats throughout the north island. Nest are	No suitable breeding or roosting trees identified. Known	Foraging only

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online Bellingham *et al.*, 2013)	Habitat suitability the Project Area	Pattern in habitat use or life stage
		usually within trees overhanging freshwater (Armitage, 2013).	to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	
Pied shag	At Risk – Recovering	Pied shags mainly forage along the coast but also within estuaries, and occasionally freshwater areas. Nest are usually within trees along coastal cliffs (Powlesland, 2013).	No suitable breeding or roosting trees identified. Known to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
Royal spoonbill	At Risk – Naturally uncommon	Occurs and breeds in a wide range of freshwater and coastal habitat throughout New Zealand (Szabo, 2013).	Likely to regularly frequent the Ngakoroa Stream estuary habitat for foraging.	Foraging only
Spotless crake	At Risk – Declining	Occur and breed in freshwater wetland dominated by dense emergent vegetation particularly raupō throughout the North Island (Fitzgerald, 2013).	No records in the local area however suitable habitat occurs within the Project Area	Roosting and foraging
Fernbird*	At Risk – Declining	Occur and breed in dense freshwater and coastal wetland vegetation throughout New Zealand (Miskelly, 2013).	No records in the local area however suitable habitat occurs within the Project Area	Breeding, roosting and foraging

Note:
*At Risk species most likely to be resident and/or breeding within Ngakoroa Stream wetlands (D1D2)

For the Project, an overall assessment on the ecological value of various bird habitats (coastal wetland, forest and freshwater wetland) present within the Project Area was considered in regard to the four matters outlined within the EIANZ guidelines including habitat representativeness, distinctiveness, diversity/pattern and ecological context. Bird species have been grouped to provide an overall value assessment based on habitat preference (coastal wetland, forest and freshwater wetland).

The habitat within and adjacent to the Project Area was considered to be of **Low** ecological value for ‘forest’ birds, as this habitat is most likely to support a range of common Not Threatened species, with no At Risk or Threatened species present. For coastal wetland and freshwater wetland birds, the presence of potentially breeding At Risk – Declining species triggers a **High** score for ecological value for coastal wetland habitats and **Moderate** ecological value for the degraded, artificial freshwater wetlands, where breeding is unlikely. The corresponding ecological habitat value for bird species is subsequently presented in Table 40.

Table 40 Overall ecological value of bird habitat (coastal, forest and freshwater) the Project Area (NoR D2)

Ecological value for bird habitat		
Coastal wetland	Forest	Freshwater wetland
High	Low	Moderate

7.2.3.3 Herpetofauna

7.2.3.3.1 Desktop Review

Seven native lizard species are known to occur within the Mānukau District (Ecogecko, 2014) (Table 41). In general, the Drury area is poorly surveyed for lizards and therefore a 10 km search area was used to review the DOC Bioweb database, Auckland Council records, and the iNaturalist website. Most native lizards require indigenous habitat or surrogate habitat adjacent to contiguous forest habitat area. Based on the desktop habitat assessment, there is likely to be a complete absence of suitable habitat for most indigenous lizard species within the Project Area. The Not Threatened copper skink is however widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record for copper skink are within 4 km from the Project Area and therefore it is highly likely they will occur within the Project Area.

Table 41 Indigenous lizard species records within the Mānukau District

Common Name	Latin Name	Threat Class (Hitchmough *et al.*, 2016)	Closest record source
Pacific gecko	*Dactylocnemis pacificus*	At Risk – Relict	DOC
Elegant gecko	*Naultinus elegans*	At Risk – Declining	Auckland Council
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining	iNaturalist
Copper Skink	*Oligosoma aeneum*	Not Threatened	DOC
Ornate skink	*Oligosoma ornatum*	At Risk – Declining	DOC
Shore skink	*Oligosoma smithi*	At Risk – Naturally Uncommon	DOC
Moko skink	*Oligosoma moko*	At Risk – Relict	DOC

It is highly unlikely that native frog species would occur the Project Area, due to lack of suitable habitat. The only native frog species present within the Auckland Region is the Hochstetter's frog, the closest known records of which occur > 10 km away in the Hunua Ranges to the east of the Project Area. However, Hochstetter's frogs do not disperse readily and require damp areas within native forest habitat (or occasionally in exotic plantation) to survive (van Winkel *et al.* 2018). Hochstetter's frogs have not been considered further for the Project, due to the lack of a potential source population and absence of suitable habitat.

7.2.3.3.2 Site Investigations

During the site investigations, no indigenous lizards or frogs were identified as incidental observations. However, the introduced plague skink was identified across the Project Area.

The desktop study identified that it was possible that copper skink (Not Threatened) were potentially present within the Project Area. Habitat availability for these species was confirmed during the site walkovers and included fragmented / modified forest edges, scrub and rank grassland habitats. These areas are known to act as ('surrogate habitats') in Auckland (van Winkel, Baling & Hitchmough, 2018). No other suitable habitat for native At Risk lizards was found.

7.2.3.3.3 Ecological Value

It is highly likely that the Not Threatened and commonly occurring copper skink could be present throughout the Project Area, in a wide variety of native and exotic habitats. It is unlikely that any other native lizard species are present. As such, the ecological value of the habitat for lizards is considered to be **Low**.

7.2.3.4 Fish

7.2.3.4.1 Desktop Review

The NIWA freshwater fish database and Auckland Council Catchment Assessment Reports (Spyksma *et al.* 2018 and Surrey *et al.* 2018) were reviewed for fish records within stream catchments affected by the Project (Table 42). Of the species recorded as present, two had 'At Risk – Declining' conservation statuses: īnanga and longfin eel (Dunn *et al.* (2017).

Table 42 Freshwater fish species recorded within the catchments effected by the Project (NoR D2)

NoR D2 Section	Stream	Species (shading indicates presence)									
		Īnanga	Longfin eel	Banded kokopu	Common bully	Common smelt	Crans bully	Shortfin eel	Freshwater mussel	Koura	Unidentified eel
Conservation status*		At Risk – Declining		Not Threatened							**
Jesmond Road	Ngakoroa Stream (and tributaries)	U	U	U	U	U	U	D		U	U
Bremner Road	Ngakoroa Stream (and tributaries)	U	U	U	U	U	U	D		U	U
	Hingaia Stream	U	U	U				U	D	D	D
	Maketu Stream		D			D					
Waihoehoe Road West	No Streams										

Notes:
U = record from upstream of the NoR
D = record from downstream of the NoR
* = fish species conservation statuses from Dunn *et al.* (2017); invertebrates (i.e. Koura) from Grainger *et al.* (2013).
** = conservation status could be either Not Threatened (if shortfin eel) or At Risk – Declining (if longfin eel).

7.2.3.4.2 Site Investigations

During site walkovers , streams were visually checked for the presence of any native fish species. No dedicated fish surveys were undertaken as this will be undertaken during SEV survey, required as part of future resource consent application. An unidentified eel was observed in a tributary of the Ngakoroa Stream. Other sightings included pest fish species (koi carp and mosquitofish).

The freshwater ecological value assessment took a precautionary approach, due to the likely presence of the species of conservation significance, and considered these species as being present for the assessment of intermittent and permanent streams identified during site surveys (Section 7.2.2.2.2). A 'high value' descriptor was assigned to qualifying streams specifically for the likely occurrence of longfin eel and īnanga (At Risk- Declining).

7.2.3.4.3 Ecological Value

Although no fish records were identified within the Project Area, At Risk species have been recorded within the wider catchment and as migratory species they will pass through the Ngakoroa, Hingaia Streams and their tributaries within the Project Area. Fish records indicated the presence of fish species with a threat status of 'At Risk – Declining' (longfin eel and/or īnanga) in stream catchments associated with the Jesmond and Bremner Road sections of the Project (the Waihoehoe Road West section does not cross any streams).

It is therefore considered that the Project Area (Jesmond and Bremner Road sections) would have **High** ecological value for native freshwater fish species.

7.2.4 Summary of Ecological Value for the Project

Table 43 summarises the ecological values presented in Sections 7.2.2 to 7.2.3.

Of the three major habitat groupings, native wetland habitat has the highest ecological value. Of the species groupings, coastal and wetland birds and fish are ranked as having the highest ecological values, taking into account the conservation statuses of some species likely to occur within the NoR.

Table 43 Summary of ecological values for ecological feature for the Project Area (NoR D2)

Ecological Feature	Ecological Value		
	Jesmond Rd	Bremner Rd	Waihoehoe Rd West
Terrestrial Habitat – exotic grass, exotic treeland, planted exotic and exotic scrub	Low	Low	Low
Terrestrial Habitat – native/planted vegetation	n/a	Moderate	n/a
Freshwater Habitat	D2.S2, D2.S3 – Low D2.S5 – Moderate	D2.S6 – Low D2.S8 – Very High D2.S9 – Moderate	n/a
Wetland Habitat (Ngakoroa Stream) – WL10 Oioi, restiad rushland/ reedland wetland and	n/a	Very high and Moderate	n/a

Ecological Feature	Ecological Value		
	Jesmond Rd	Bremner Rd	Waihoehoe Rd West
SA1.3 Sea Rush and Oioi Upper Estuarine Zone			
Wetland Habitat (Exotic)	Moderate	Moderate	n/a
Bats	Low	Low	Low
Birds–coastal and wetland	n/a	High	n/a
Birds – freshwater	Moderate	n/a	n/a
Birds – forest	Low	Low	Low
Herpetofauna	Low	Low	Low
Fish	High	High	n/a

7.2.5 Likely Future Environment

This section has been prepared to provide some context to how the assessment of ecological effects of the Project construction and operation (Section 7.3) has been undertaken in regard to the changing baseline or likely future environment of the areas within and surrounding the Project Area.

The existing landscape surrounding the Project Area is dominated by rural landuse with light industrial landuse dominating the existing Bremner Road Section. The AUPOiP zoning/overlay identifies the land adjacent to the Project Area as existing, developed live zoned are and future urban area, much of which is already being developed as part of the Auranga development. The future urban land will undergo a significant change from historically rural to urban over the next couple of decades. The AUPOiP only protects areas of value that are identified in overlays, such as 'open space – Conservation Zone' and SEA areas, which includes terrestrial/marine SEA's to the north and south of Bremner Bridge. A DoC administered Drury Conservation Area, is also located adjacent to SH1, north of Bremner Road.

Additionally, protection and enhancement of biodiversity is proposed through the Drury – Ōpāheke Structure Plan (Auckland Council, 2019). In the Structure Plan a 'Blue Green Network' (Appendix 7, Figure 30) is proposed which seeks to provide contiguous ecological linkages, connecting significant terrestrial and marine ecological areas through restored riparian margins 10-20 m wide. This places greater emphasis on the protection and enhancement of existing watercourses and areas of significant natural value, requiring these areas to be accommodated within the future urban environment. Although the Structure Plan does not hold any formal statutory weight and may change, it is likely that there will be an expectation that future development will be consistent with the proposed blue green network.

In light of this context, it is assumed that in a future urbanised scenario, permanent streams, wetlands and areas of indigenous vegetation will generally be avoided by development and retained. It is also assumed that stormwater design will be integrated into the proposed 'Blue Green Network' and sediment and pollutants will be controlled at source. For example, if riparian habitat restoration is implemented appropriately, it is considered that in a future scenario many of the features of value could be similar to existing, or in some cases, enhanced.

The majority of native species assessed within this report are generally adaptable to human modified environments and therefore it is possible that despite the potentially negative implications of urbanisation (disturbance, habitat loss and fragmentation) these species may remain, where suitable habitat is retained. However, as the urban landscape becomes less permeable to wildlife the viability of these species will become increasingly dependent on the quality of catchment wide mitigation within the Project Area and surrounding FUZ.

Due to the uncertainty involved with retention of ecological value in a future urbanised environment a pre-construction wetland bird survey area (Appendix 11) has been identified. The area includes the ecological within and adjacent to the Project Area where the Project level of effects has been assessed as **Moderate** or higher (as determined in the Assessment of Ecological Effects section of this EcIA, refer Section 7.3). Any ecological features identified within the pre-construction wetyland bird survey area will be resurveyed at the same time as resource consent approvals are sought in order to revaluate changes in ecological value. This will confirm if ecological values have been retained and whether there are any subsequent changes to the Project level of effects (in accordance with the EIANZ Guidelines, refer Table 107 in Appendix 3) on any ecological feature identified in the area. If the level of effect from the Project on the ecological feature listed within the schedule remains at **Moderate** or higher, then the impact management measures identified within this EcIA will be retained or additional measures (if required) will be developed in accordance with the EIANZ Guidelines. If as a result of the resurvey the ecological value of the ecological feature reduces and subsequently the level of effect from the Project, to **Low** or less, then impact management measures proposed in this EcIA should be re-evaluated in accordance with the EIANZ Guidelines.

7.3 Assessment of Ecological Effects and Impact Management Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

As discussed in Section 4.1, this assessment has been prepared to support NoR D2 and has been undertaken in the context of the ecological baseline and the likely future environment that has been described in Section 7.2. When assessing the actual or potential ecological effects of allowing the Project, this assessment has been limited to matters that would trigger a district plan consent requirement and is presented in Section 7.3.1 and 7.3.2 below.

Where regional and/or Freshwater NES consenting requirements are triggered, these will not be authorised by the designation, and will require further consents. In order to demonstrate the jurisdictional split between regional and district plan matters, we have included a table as Appendix 1 which identifies the potential ecological effects of the construction and operation of the Projects, and whether these are regional, or district plan matters under the AUP OiP.

Although regional consents/Freshwater NES are not being sought at this time, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree as part of this report to inform design, options assessment and the proposed designation footprint. For regional matters, this has included the identification of any areas of significant value or habitats for the purposes of design and alignment decisions along with identification of future resource consent requirements. This information is presented in Section 7.4 – Design and Resource Consent Considerations.

7.3.1 Assessment of Construction Effects

7.3.1.1 Summary of Potential Construction Effects, Prior to Impact Management

The proposed construction activities have the potential to cause impacts on ecological features within or adjacent to the Project Area, without impact management.

Potential construction effects that relate to district plan matters are presented in Appendix 1**,** and are summarised below:

- Vegetation removal (that triggers district plan controls) leading to the permanent loss of terrestrial habitats;
- Construction activities causing light, noise and vibration leading to the disturbance and displacement of indigenous fauna.

7.3.1.2 Magnitude of Construction Effects

The magnitude of construction effects listed above on impacted ecological features (Section 7.2) are discussed in the following sections (Section 7.3.1.2.1 and 7.3.1.2.2).

7.3.1.2.1 Habitats

7.3.1.2.1.1 Terrestrial Habitat

Section 7.2.2 describes all habitat types present within the Project Area. The Project Arboriculture report (Webb, 2020) identifies the vegetation within the Project Area that is the subject of district plan controls e.g. within the existing road space or open space and therefore considered a relevant district plan matter for inclusion in this assessment of effects. Construction effects have been assessed in relation to district plan vegetation and relates to the loss of permanent habitat for native fauna (e.g. bats, birds and lizards). Compliance with the Wildlife Act (1953) relating to the unintentional killing, injuring or disturbing of native fauna (e.g. bats, birds and lizards) has also been considered.

For NoR D2 the following trees/vegetation were identified within the Project Area that are subject to district plan controls and will be removed due to the Project (the location of these sites can be found in the Arboricultural report Appendix 3, while information on the vegetation type, age, value is further detailed in Appendix 1 of the report):

- A group of eight large pine trees (identified as DP41 within the Arborist Report) located at the northern end of the Drury Sports Complex and adjacent to the Bremner Bridge. These trees are mature, and are currently preventing erosion and reducing stormwater in the area The life expectancy of these trees is 10-20 years. The pine trees have been identified as Treeland (TL) within this EcIA (refer Table 28).
- A group of pink oak, American sweet gum and Yunnan poplar trees (identified as DP43 within the Arborist Report) located at the northern end of the Drury Sports Complex. These trees have been identified as Treeland (TL) within this EcIA (refer Table 28).
- A group of English oak trees (identified as DP44 within the Arborist Report) growing either side of the motorway embankments either side of the Bremner Bridge. These exotic trees have not been classified within this EcIA due to their small numbers.
- Two silver birch trees (identified as DP46 within the Arborist Report) located in the road reserve of Bremner Road, outside 69 Creek Street, Drury. These exotic trees have not been classified within this EcIA due to their small numbers.

- A group of white willow and Yunnan poplar trees (identified as DP49 within the Arborist Report) located on Cameron Road, Drury. These trees were identified as Treeland (TL.3) within this EcIA (refer Table 28)
- A group of Mexican fan palm (identified as DP53 within the Arborist Report) located in the road reserve on Cameron Road, Drury. These trees were identified among exotic grassland (EG) within this EcIA (refer Table 28).

For NoR D2, the following trees/vegetation were identified within the Project Area that are subject to district plan controls and will not be removed; but may be affected due to the Project.

- A shelterbelt of Japanese cedar (identified as DP27 within the Arborist Report) located adjacent to Aroha Cottage, 201 Jesmond Road. These trees are subject to District Plan rules surrounding vegetation on Historic places. The cedar trees have been identified as Planted vegetation (PL.3) within this EcIA (refer Table 28).
- A group of trees, including pin oak, American sweet gum and manna ash (identified as DP42 within the Arborist Report) located at the northern end of the Drury Sports Complex, and adjacent to the Ngakoroa Stream. These trees have been identified as treeland (TL) within this EcIA (refer Table 28).
- Two melia trees (identified as DP45 within the Arborist Report) located outside 11 Creek Street, Drury. These exotic trees have not been classified within this EcIA due to their small numbers.
- A single American arborvitae (identified as DP50 within the Arborist Report) located in the road reserve outside St John's Church and a single Sitka spruce (identified as DP51) and a single Japanese cedar (identified as DP52) located in the heritage places zone outside the Church. These trees are identified in an area of exotic grass (EG) within this EcIA (refer Table 28).
- A group of English oak tree (identified as DP54 within the Arborist Report) located in the road reserve of Waihoehoe Road. These trees have been identified among exotic grass (EG) within this EcIA (refer Table 28).

With the exception of the large pine trees in the Drury sports reserve (DP41), the majority of district plan trees/vegetation detailed above are young or isolated and exotic, albeit they do provide important vegetated habitat in a predominantly urban landscape for fauna and the support of ecosystem services. The Project Assessment of Landscape and Visual Effects report identifies that there will be a net increase in green infrastructure and associated habitats within the Project Area as a result of the Project, including street trees, berm and stormwater plantings and planted stormwater wetlands. This is considered to be embedded mitigation. Overall, the vegetation being removed is considered to be of **Low** ecological value botanically but could provide potential habitat for common native birds and lizards and potentially bats. Bat presence has not been confirmed from Project surveys, however, bats have been recorded in desktop records within 4 km of the Project in the Hunua Ranges. Although the habitats are considered to be of **Low** value for bats, the potential presence of roosting bats during removal should not be discounted in the Pine trees to be removed from the Drury Sports Reserve (DP41) as the trees at this location have been identified to have moderate bat roost potential and would require management under the Wildlife Act (1953). There is also the potential for all trees that they could contain nesting native birds that could be killed or injured during removal and would also require management under the Wildlife Act (1953). Similarly, any trees with unmanaged ground cover (not mown or grazed grass i.e. rank grass, shrubs or dense leaflitter) could support native copper skink that could be killed or injured during removal and would also require management under the Wildlife Act (1953).

Overall, the scale and type of district plan vegetation habitat loss is not substantial and can be replaced in the short term. As such the magnitude of effect is considered to be **Low.**

7.3.1.2.2 Species

7.3.1.2.2.1 Bats

Bats have not been detected within the Project Area during field surveys or from the review of existing databases and literature. However, potentially suitable habitat has been identified for long-tailed bats within the Project Area, including vegetated stream corridors and exotic trees. Long-tailed bats have previously been recorded outside of the Project Area (within 4 km) and therefore given the large home range of this species, and suitability of habitat, they could potentially occur within the Project Area (see Section 7.2.3.1). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. It is currently planned that a site compound will be located adjacent to the Ngakoroa Stream which could be used as commuting corridor by bats. 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. However, the existing Bremner Road bridge over the Ngakoroa has streetlighting installed and therefore any bats utilising this corridor are likely to be habituated to light disturbance. Despite this, light spill from construction compounds into the Ngakoroa Stream should be minimised where practical.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. At present, bat roosts have not been confirmed within the designation boundary, but mature trees that could be used as roosts are known to be present within the Project Area.

Bats have not been detected within or adjacent to the Project Area and therefore this assessment is based upon habitat potential and desktop records. It is considered unlikely that construction activities would result in the disturbance or displacement of individuals or their roosts because they are likely infrequent visitors to the area. As such, the magnitude of effect on bats is considered to be **Low**.

7.3.1.2.2.2 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Project Area.

As there are three distinct areas of habitat types (coastal wetland, freshwater wetland and forest) supporting three different communities of birds the Project Area, the magnitude of effect on bird species has been broken down as follows:

Coastal wetland bird habitat:

Many of the coastal bird species which occur or are likely to occur within the Ngakoroa Stream wetlands adjacent to the Project Area are Threatened or At Risk species. Habitats used by these birds include the open water, intertidal mudflats and coastal wetland habitats. The majority of coastal and wetland birds such as gull, shag and tern species use the stream corridor for foraging but have no known breeding habitat or specific roost sites. However, the Sea rush and oioi upper estuarine zone (SA1.3) and Oioi restiad rushland/reedland (WL10) directly adjacent to the Project Area provides **High** value habitat for banded rail, fern bird and spotless crake (all At Risk - Declining), which may use these areas for foraging and breeding. Figure 16 identifies the proposed bridge site lay down areas (red) and bridge footprint (blue) in relation to the high value bird habitat. The habitat directly within the construction footprint is suboptimal due to the existing road infrastructure and recent degradation due to surrounding development, and birds are unlikely to nest within the Project Area. Therefore, direct killing and loss of habitat should be avoidable. Temporary bridge staging is however likely to encroach into high value habitat and therefore potential impacts will need to be managed to avoid adverse effects. The disturbance caused by construction noise, vibration and lighting directly adjacent to breeding habitat also has the potential to impact the breeding success of these At Risk species and could lead to indirect death caused by nest abandonment.

The locations of the proposed bridge site lay-down areas are largely unavoidable as an all-weather construction yard will be required for bridge construction and staging will be required on the southern side of the bridge. The construction compound will house a bridge construction satellite office construction plant, equipment and materials. Typically, a 20 m wide temporary accessway will be required next to the bridge footprint to allow for the temporary staging, including the construction and dismantling of existing and new bridges. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight.

Existing buffer vegetation, such as Exotic Scrub (ES), Exotic Treeland (TL.3) and Planted Vegetation (PL.1) (see Figure 16) occur within the Project Area. Although the vegetation is unsuitable for breeding At Risk – Declining wetland birds, these habitats buffer suitable adjacent habitat from existing disturbance and will also buffer disturbance from construction if retained. Where practicable, e.g. along the both banks of the Ngakoroa, there is an opportunity to retain these vegetation buffers during construction by creating wetland setback buffers. Where removal of buffer vegetation is unavoidable, e.g. bridge staging areas, this should be reinstated and restore following construction, with native wetland and coastal scrub planting.

Background noise and lighting is likely to increase with urbanisation of the FUZ areas surrounding the Ngakoroa Stream. However, construction disturbance to breeding birds is localised to areas of the stream adjacent to the bridge and is considered to be a key concern. Birds are sensitive to disturbance from light, noise and vibration, which can cause displacement and nest abandonment if construction were to coincide with the breeding season. Overall, the magnitude of effect of the Project on the coastal habitat used by the local bird population within the immediate vicinity of the Ngakoroa Stream is considered to be **Moderate**. This is based upon the regional importance of some of the affected bird species, the relative frequency of construction effects and the reasonable likelihood of those effects to occur on the local coastal wetland bird population.

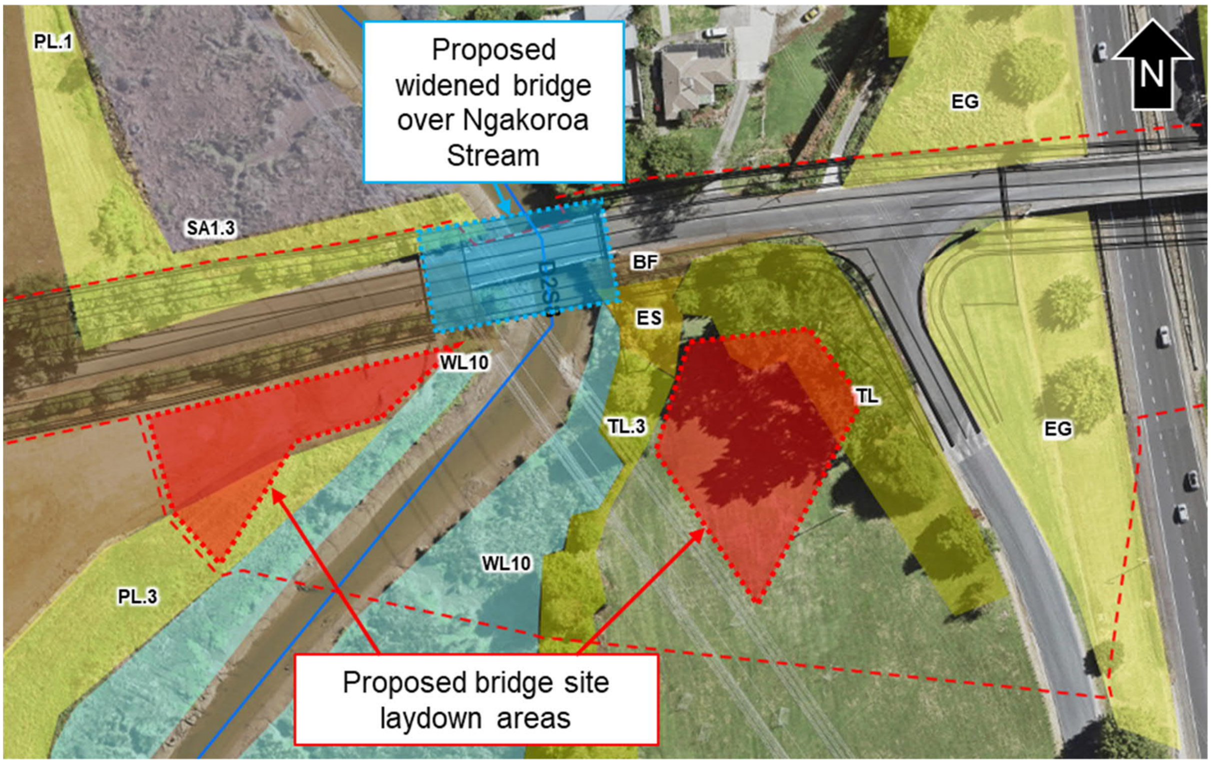


Figure 16 Showing the Sea rush and oioi upper estuarine zone (SA1.3) to the north of Bremner Bridge and Oioi restiad rushland/reedland (WL10) to the south. The new bridge footprint is highlighted in blue crossing the Ngakoroa Stream the proposed bridge site laydown areas highlighted in red. 20 m wide temporary staging areas will likely be required either side of the bridge, which could cause temporary impacts to coastal wetland bird habitat

Freshwater wetland bird habitat:

Although not observed at the time of survey New Zealand dabchick (At Risk- Recovering) and spotless crake (At Risk – Declining) may use the online ponds directly adjacent to Jesmond Road for foraging habitat (Figure 12). They are unlikely to breed at this locality due to lack of suitable vegetation, caused by livestock grazing. Construction effects including noise, vibration and light may temporarily displace these species in habitat adjacent to the road, however given the availability of contiguous habitat that will not be affected by the Project activities, the magnitude of effects is considered to be **Low**.

Forest bird habitat:

The birds which occur in the remainder of the Project Area are common in the local area (modified agricultural land, exotic vegetation and exotic wetland) and habitat is considered to be of **Low** ecological value. They are adapted to human modified environments, and suitable foraging habitat of equal or better quality will remain adjacent to the Project Area during construction. Therefore, the magnitude of effects from the Project on the local bird population is considered to be **Low.**

7.3.1.3 Level of Ecological Effects – Construction

In accordance with EIANZ Guidelines the level of ecological effects from the construction of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the Project construction.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern. The Project will also need to comply with the Wildlife Act 1953 if applicable. Table 44 below summarises the overall level of ecological effects for each key ecological feature and fauna group related to the Project before impact management is applied. Section 7.3.1.4 addresses the impact management measures required to minimise any residual effects associated with construction activities.

Table 44 Summary of potential ecological effects (prior to impact management) during construction based on ecological value and magnitude of the effect

Ecological Feature	Ecological Value	Magnitude of Construction Effects	Level of Ecological Effect (prior to impact management)
Terrestrial habitat – district matters	Low	Low	Very low
Bats	Low	Low	Very low
Birds – coastal wetland	High	Moderate	High
Birds – forest habitat	Low	Low	Very low
Birds – Freshwater wetland	Moderate	Low	Low

The assessment identified that the level of ecological effects from the construction of the Project on the majority of ecological features are **Very low** or **Low** with the exception of coastal wetland birds, where the level of effect is **High**. In accordance with the EIANZ Guidelines impact management measures are proposed for those effects **Moderate** and above and as such mitigation is required for the Project construction effects on coastal wetland birds.

7.3.1.4 Impact Management – Construction

7.3.1.4.1 Coastal wetland birds

This section identifies recommended impact management measures to ensure that the Project reduces the potential magnitude of construction effects on coastal wetland birds and their habitats to **Low**.

The wetland habitats (associated with coastal wetland birds) within and adjacent to the Project Area, specifically wetland D2W5 associated with the Ngakoroa Stream (Figure 16 and Appendix 7, Drawing SGA-EX-DL-004.2) are included as part of the pre-construction wetland bird survey area (identified in

Appendix 11). It is recommended that this location should be resurveyed at the same time as resource consent approvals are sought in order to confirm the ecological value identified has been retained and mitigation measures detailed in this section are still required.

If the wetland bird survey and assessment confirm that the Project will or may have a moderate or greater level of ecological effect on Threatened or At Risk wetland birds without impact management (specifically wetland D2W5 associated with the Ngakoroa Stream (Figure 16 and Appendix 7, Drawing SGA-EX-DL-004)), construction activities and compounds will be planned so as to reduce noise, vibration and light effects on Threatened or At-Risk wetland birds. The following management controls are recommended to form the basis of a BMP.

- Where practicable, construction works should commence prior to the bird breeding season (September to February) in order to discourage bird nesting.
- Prior to any construction works (including establishment of site yards) taking place within a 50m radius of the Ngakoroa wetlands a nesting bird survey of Threatened or At-Risk wetland birds should be undertaken by a suitably qualified and experienced person (SQEP). Surveys should be repeated at the beginning of each bird breeding season and following periods of construction inactivity .
- Protection and buffer measures if nesting Threatened or At-Risk wetland birds are identified within 50 m of any construction area (including laydown areas). This could include:

    D. a 20 m buffer area around the nest location and retaining vegetation. The buffer areas should be demarcated where necessary to protect birds from encroachment. This might include the use of marker poles, tape and signage;

    E. monitoring of the nesting Threatened or At-Risk wetland birds by a Suitably Qualified and Experienced Person. Construction works within the 20m nesting buffer areas should not occur until the Threatened or At-Risk wetland birds have fledged from the nest location (approximately 30 days from egg laying to fledging) as confirmed by a Suitably Qualified and Experienced Person; and

    F. minimising the disturbance from the works if construction works are required within 50 m of a nest, as advised by a Suitably Qualified and Experienced Person;

  A.

- Where practicable, a 10 m wetland setback shall be created between the edge of the Ngakoroa Stream wetlands and the construction area (along the edge of the stockpile/laydown area). This should be achieved by retaining existing vegetation and/or additional planting with native coastal forest/riparian/wetland species (as appropriate). Signage or marker poles shall also be used to clearly delineate the wetland area to prevent encroachment.
- Any light spill from construction areas into the Ngakoroa Stream wetlands should be minimised as far as practicable.

The BMP should be consistent with any ecological management measures to be undertaken in compliance with conditions of any regional resource consents granted for the Project.

If the impact management detailed above were implemented, it is considered that the magnitude of construction effects from the Project on coastal wetland birds within and adjacent to the Project Area could be reduced to **Low**.

7.3.1.4.2 Wildlife Act Compliance

The district plan trees (refer Section 7.2.2.1) should be assessed for bird, bat and lizard presence prior to removal and management controls put in place to ensure compliance with the Wildlife Act 1953. Pine trees with moderate bat roost potential have been identified at the Drury Sports Pitch and will be removed to accommodate the construction of the Project. These trees are subject to district plan provisions and as such are relevant to this assessment. The trees are considered to be of **Low** ecological value and bat presence has not been confirmed. However, bats have been recorded in desktop records within 4 km of the Project in the Hunua Ranges. A Tree Removal Protocol (refer example in Appendix 9) should be implemented prior to removal of these trees to ensure compliance with the Wildlife Act 1953.

7.3.1.5 Residual Effects – Construction

The assessment identified that construction ecological effects on birds and their habitat within wetlands associated with the Ngakoroa Stream within and adjacent to the Project Area could be **High** during construction, prior to impact management. Therefore, in accordance with EIANZ Guidelines impact management measures were developed (Section 7.3.1.4). Table 45 presents the residual ecological effects after impact management has been applied for coastal wetland birds for construction effects from the Project. The table shows that the residual level of ecological effects on birds are **Low** after impact management has been applied.

Table 45 Summary of ecological effects based on ecological value and magnitude of effects during construction, with impact management

Ecological Considerations	Ecological Value	Magnitude of the Effects	Level of Ecological Effect
Birds – coastal wetland	High	Low	Low

7.3.2 Assessment of Operational Effects

7.3.2.1 Summary of Potential Operational Effects, Prior to Impact Management

The Project involves the upgrading of an existing road from two lanes to four and although some impacts may increase from the current baseline, many operational effects such as, fragmentation and noise and lighting are likely to be pre-existing. These changes will be considered when assessing the magnitude of effects on potentially already impacted ecological features or species that have habituated to the existing road. In general, potential operational effects from the Project that relate to district plan matters are presented in Appendix 1, and are summarised below.

- Loss in connectivity to indigenous fauna (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The magnitude of these operational effects is discussed in Section 7.3.2.2.

7.3.2.2 Magnitude of Operational Effects

7.3.2.2.1 Bats

Although bats themselves have not been detected during surveys, suitable habitat has been identified for long-tailed bats along vegetated stream corridors which cross the Project Area.

It is known that the loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat. Noise and vibration are likely to be reduced from the existing baseline due to improved bridge design and reduced speed limits along the upgraded road. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The existing road is lit with LED lighting columns at stream crossing points e.g. Bremner Bridge . Any bats currently utilising the Ngakoroa Stream will most likely be habituated to existing light levels and may already avoid the existing road corridor. Where practicable and taking safety into consideration, it is recommended that lighting is minimised along the Ngakoroa Stream corridor. This could be achieved by removing tall lighting columns where the Project crosses the stream corridor. Low/ground level lighting for pedestrian safety could be maintained as required. Background noise and lighting is likely to increase with urbanisation of the FUZ areas surrounding the Ngakoroa Stream, as such maintaining dark corridors will become increasingly important for wildlife, helping to reduce habitat fragmentation minimising alterations to behavioural patterns.

As bats have not been recorded within or adjacent to the Project Area, it is considered unlikely that the operation of the Project would result in the disturbance or displacement of individuals or their roosts. As such, the magnitude of effect on bats is considered to be **Low**. It is recommended that ABM surveys are repeated along potentially high value habitat areas such as the Ngakoroa Stream prior to regional consent applications. If at a later stage, bats are found to be present within or adjacent to the Project Area, the magnitude of effects could increase, and more specific impact management would be required.

7.3.2.2.2 Birds

The operational impacts from the Project on birds are similar to those described in Section 7.3.1.2.2.1 for bats.

Noise and vibration are likely to be reduced from the existing baseline due to improved bridge design and reduced speed limits along the upgraded road. The existing road is lit with LED lighting columns over the stream crossing points e.g. Bremner Bridge. Any coastal wetlands birds currently utilising the Ngakoroa stream may be habituated to existing light levels and may already avoid the existing road corridor. Where practicable and taking safety into consideration, it is recommended that lighting is minimised along the Ngakoroa Stream corridor. This could be achieved by removing tall lighting columns where the project crosses the stream corridor. Low/ground level lighting for pedestrian safety could be maintained as required. Background noise and lighting is likely to increase with urbanisation of the FUZ areas surrounding the Ngakoroa Stream, as such maintaining dark corridors will become increasingly important for wildlife, helping to reduce habitat fragmentation and minimising alterations to behavioural patterns.

As operational effects from the road are likely to reduce in regard to noise and vibration and assuming that the future operational lighting effects are designed to ensure the effects on coastal birds do not change (or preferably, are improved), then the magnitude of operational effects from the Project operation is considered to be **Low.** Where practicable lighting along stream corridors should be minimised as described above, to reduce overall impact on coastal wetland birds.

Forest bird habitat is limited to **Low** value exotic vegetation within and adjacent to the Project Area. The species present are common, Not Threatened adapted to use habitats modified by humans. As such, the magnitude of effects from the Project is considered to be **Low**.

Although not recorded at the time of survey At Risk New Zealand dabchick (At Risk – Recovering) and spotless crake (At Risk – Declining) may forage in the artificial ponds at bird survey site D2B1 adjacent to the Project Area (Jesmond Road). Jesmond road is currently unlit, and noise and vibration is likely to increase from the existing baseline along the upgraded road. Direct impacts on habitat for these species will be avoided. Although, birds may be locally displaced due to increased disturbance the habitat adjacent to the Project is unsuitable for key life stages such as breeding and suitable foraging habitat is available further downstream. Where practicable retaining or replanting the buffer of existing trees between this habitat and the Project will minimise overall disturbance. The magnitude of operational effects is therefore considered to be **Low**.

7.3.2.2.3 Herpetofauna

Records of At Risk indigenous lizard have been identified in the wider landscape, beyond the Projects ZOI, but no suitable habitat was found within the Project Area for these species. Suitable ‘surrogate’ habitat (exotic scrub, exotic forest edge and rank grassland) was identified within the Project Area which could potentially support native (Not Threatened) copper skink.

Native lizards require vegetated corridors (such as riparian stream corridors) to facilitate natural dispersal. The Project generally includes upgrading existing roads and bridges with a new road proposed to the west of Auranga Road 1 within the Jesmond to Bremner link. Within this section a bridge is proposed over the unnamed stream which will maintain connectivity for these species where suitable habitat is retained. Therefore the Project is not considered to create any additional barriers to movement or dispersal of lizards. During detailed design/resource consent, opportunities should be sought to enhance/retain vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

Native lizards are likely to be habituated to existing disturbance such as noise, vibration and lighting and design should ensure that this will not increase for the operation of the Project. It is considered that the magnitude of operational Project effects on indigenous lizards would be **Low**, without impact management.

7.3.2.3 Level of Ecological Effects – Operation

In accordance with EIANZ Guidelines (Roper-Lindsay *et al.* 2018) the level of ecological effects from the operation of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the operation of the Project.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern. Table 46 summarises the potential ecological effects of the Project during operation.

Table 46 Summary of potential ecological effects (prior to impact management) during operation based on ecological value and magnitude of the impacts

Ecological Feature	Ecological Value	Magnitude of Operational Effects	Level of Ecological Effect (prior to impact management)
Bats	Low	Low	Very low
Birds – coastal Wetland	High	Low	Low
Birds – forest	Low	Low	Very low
Birds – Freshwater wetland	Moderate	Negligible	Very Low
Herpetofauna	Low	Low	Very low

The assessment identified that the level of ecological effects from the operation of the Project on all ecological features were **Very low** or **Low** In accordance with the EIANZ Guidelines impact management measures would only be proposed where effects are **Moderate** and above and as such impact management measures are not required for the Project operational effects.

7.3.3 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native birds.

Almost all original native habitat within and adjacent to the Project Area has been removed due to historical land use change. As such, the types of fauna generally remaining within the habitats are Not Threatened native or exotic species, which are generally adaptable to modified environments. Common Not Threatened native species like copper skink, are considered very likely to occur within these modified, low value habitats (e.g. rank grass, scrub) within the Project Area. The ongoing long-term incremental loss of low value habitat may however cause detrimental effects on local populations of 'common' species, which within a project specific context would not normally require impact management under the EIANZ Guidelines. As low value habitats are likely to be altered by the Project and by other external projects (surrounding development), the risk of significant habitat degradation for Not Threatened species such as copper skink is likely to be cumulative and must be considered in the wider regional context.

Many mobile native fauna species have wide ranging and complex habitat requirements, such that small, incremental changes in habitat quantity or quality could have unforeseen adverse effects on their ability to persist in the landscape over time. Historical vegetation clearance (loss of buffer vegetation) and wetland drainage (fragmentation) have also made the landscape more vulnerable to such cumulative effects, as issues become more acute. District Plan matters relating to disturbance (such as lighting, noise and vibration) may not adversely affect crepuscular species such as coastal wetland birds in the short term, as they become habituated. However, potential gradual incremental changes in habitat, caused by surrounding urbanisation, such as increased light spill into the high value wetland areas, could, discourage nesting and therefore reduce viability of native fauna persisting over time.

All developments within the Drury-Ōpāheke Structure Plan area should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Structure Plan area and its catchments.

If the developments (including this Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced, and the buffering effect of riparian habitat restoration could reduce disturbance (e.g. Lighting from surrounding urbanisation). The opportunity to enhance stream corridors through riparian planting has been highlighted within the Drury-Ōpāheke Structure Plan and it is anticipated that this will be reflected within future Plan Changes. This Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could potentially remediate cumulative effects in the long term.

7.3.4 Summary and Conclusions

Ecological features were assessed for their potential to be adversely affected by the construction and operation of the Project relating to district plan matters. The majority of relevant habitat (terrestrial – district plan only) and fauna species (bats, birds and lizards) were assessed to be of **Negligible** or **Low** level of effect from the construction and operation of the Project and therefore no specific impact management was recommended. However, the indigenous wetland habitat (D2W5) within and directly adjacent to the Project Area has been highlighted for its potential importance to support a range of Threatened and At Risk coastal and wetland bird species. There is potential that during construction of the Project, the disturbance (noise, vibration and light) caused by activities within the construction areas and during the replacement of the existing Bremner Bridge could impact breeding birds such as banded rail, fernbird and spotless crake. A Bird Management Plan is therefore recommended to reduce the potential adverse level of effects of construction from **Moderate** to **Low**. Impact management requirements would include programming noisy works to avoid the bird breeding season (September – February) where practicable, pre-construction nesting bird surveys and mitigating construction lighting and noise/vibration disturbance. Wetland habitats identified in the pre-construction wetland bird survey area (Appendix 11) will be resurveyed at the same time as resource consent approvals are sought in order to revaluate changes in ecological value for coastal wetland birds. This will confirm if ecological values have been retained and will confirm the required impact management measures required.

The Ngakoroa Stream has been identified as the main corridor of ecological value associated with the Project Area due to retained high value native wetlands and its potential to support At Risk Declining coastal wetland birds. In a future scenario when the surrounding environment is likely to be urbanised, the importance of stream corridors will be even more important as the urban environment becomes less permeable to the natural movement of native species. These areas should be prioritised for retention and enhancement in line with Structure Plan recommendations for the ‘Blue-green network’.

7.4 Design and Resource Consent Considerations

Although resource consents are not being sought for the Project at this time, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree to inform design, options assessment and the proposed designation footprint of NoR D2. The outcome of this analysis is presented below. This includes the identification of any ecological features of value for the purposes of design and alignment decisions, and to identify future consenting requirements.

In terms of regional matters, a full list of potential regional consent matters is included in Appendix 1, but in summary these relate to:

- Effects of vegetation removal on terrestrial habitats – rural zones, riparian margins, coastal areas, SEA's;
- Effects of vegetation removal on fauna (bats, birds, lizards) behaviour and their roosts/nests;
- Effects on streams and wetlands;
- Earthworks effects – weed dispersal and sediment discharge

Ecological effects and associated impact management relating to district plan matters that are the focus of this assessment for the Project, have been presented in Appendix 1.

The Freshwater NES came into effect on 3 September 2020 and contains consent requirements for the construction of specified infrastructure involving vegetation clearance and works within certain natural wetlands and streams. Our preliminary view is that there may be wetlands within the Project Area that meet the definition of "natural wetland" and therefore discretionary consent under the Freshwater NES may be required for these works. The application of these consent requirements will need to be considered further as part of the future consenting process for the Projects. Delineation of these wetlands for the purposes of the Freshwater NES will require further site investigations and soil sampling to inform the detailed design of the Project. Generally, the alignment and design refinement process for each proposed designation has sought to avoid or minimise impacts on high value natural wetlands and streams. There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects.

Some potential effects of the Project (i.e. killing or harming) on individual specifically listed fauna and their nests/roosts are covered by the Wildlife Act 1953. For completeness, these are recorded in the section below where they align with regional consent vegetation removal effects.

7.4.1 Terrestrial Habitat

Construction of the Project will result in temporary and permanent loss of vegetation within the Project Areas, including suitable habitat that is potentially being used by indigenous fauna (bats, birds and lizards). This includes vegetation subject to both a regional and a district plan controls (Appendix 1). Loss of vegetation that is subject to district plan controls is discussed in Section 7.3.1.2.1.1. The amounts and types of terrestrial habitat and vegetation (including habitat used by indigenous fauna) that could be lost as a result of the Project is presented in Table 47.

Table 47 Potential area of permanent terrestrial habitat loss within the Project Area

Habitat Type	Habitat Code	Potential area to be lost (ha)	Bat habitat loss (ha)	Bird habitat loss (ha)	Lizard habitat loss (ha)
Brown Field	BF	1.69	N/A	N/A	N/A
Exotic Grassland	EG	0.08	N/A	N/A	N/A
Exotic Scrub	ES	0.15	N/A	0.15	0.15
Planted Vegetation	PL.1	0.06	N/A	0.08	0.08
Exotic Wetland	EW	0.00			
Open Water	OW	0.08			
Amenity Planted vegetation	PL.3	0.51	N/A	0.48	0.48
Treeland	TL.3	0.33	0.33	0.33	0.33
Total		**4.23**	**0.33**	**1.04**	**1.04**

The terrestrial habitats to be lost (temporary and permanent) are predominantly comprised of exotic vegetation which are of **Low** ecological value. Small areas of high value native wetland (Raupō reedland) will also be temporarily impacted by the bridge staging area (see Figure 16). Some of these habitat areas are likely to provide valuable habitat to native fauna, as discussed in sections 7.4.1.1 to 7.4.1.3 below.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys should be undertaken to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support the resource consent application and should include any impact management requirements.

7.4.1.1 Bat habitat

Bats were not found to be present the Project Area. However, given the potential Project impacts from vegetation removal and the conservation status (Nationally Critical) of bats, the presence of bats and potential effect of the Project should be re-evaluated as part of the subsequent resource consent phase, prior to construction. Repeat ABM surveys should be carried out to support this process. Potential vegetation of value for future assessment of potential bat foraging and roosting habitat, has been highlighted in Appendix 7, Drawing SGA-EC-DL-012.01. This includes vegetated stream corridors with mature trees along the Ngakoroa Stream. As the Project moves into the resource consent phase, landscape design should incorporate the 'Blue Green Network' within the Project Area (Appendix 7, Figure 30). This mitigation should include the protection of mature trees (exotic and native) with bat roost potential where possible and retention of riparian vegetation along stream corridors, particularly at bridge crossing points or where transport corridors bisect mature vegetation, as well as bespoke low-lumination artificial lighting regimes near key known habitats. As a gleaning species, long-tailed bats fly at canopy height commuting and foraging along forest edges and stream corridors (Borkin & Parsons, 2009; O'Donnell *et al.*, 2006). Where this canopy is maintained and/or enhanced to a height >4.3 m (max height for standard vehicles) (NZ Transport Agency, 2019) above the vehicle deck, bats are likely to maintain a safe distance from moving traffic and therefore avoid any adverse interaction with the transport corridor. Suitable vegetation (native or exotic) of this height, acts as bat 'hop-over' vegetation and could be retained and enhanced where possible in areas where potential commuting corridors could occur within the Project Area (Appendix 7, Drawing SGA-EC-DL-012.01).

7.4.1.2 Bird habitat

Suitable habitat for At-risk and Threatened species of wetland birds occur within and adjacent to the Project Area. Subject to detailed design approximately 0.35 m^2 of native Oioi restiad rushland/reedland (WL10) within wetland D2W5 within the Ngakoroa wetland stream corridor will be permanently removed for the Project. This habitat could be used by coastal wetland bird species such as banded rail, spotless crake and fernbird which uses adjacent native wetlands habitat all year round, including for breeding. Minimal temporary vegetation clearance within coastal wetland areas will also be required for bridge construction (refer Figure 16). Presence of these species within and adjacent to the Project Area should be assessed as part of the subsequent resource consent process prior to construction.

If vegetation removal is required within the indigenous wetland habitat Oioi restiad rushland/reedland (WL10) during the breeding season, a Wildlife Permit under the Wildlife Act 1953 may be required due to potential disturbance effects.

Not Threatened indigenous forest birds are likely within the Project Area. Vegetation clearance required for construction could result in the loss of approximately 1.23 ha of Not Threatened indigenous bird habitat, including exotic treeland and planted vegetation. Although of **Low** value any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

7.4.1.3 Herpetofauna habitat

Indigenous Copper skink (Not Threatened) are likely to be present within exotic vegetation impacted by the Project. There is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953. To mitigate habitat removal, methods can be developed during the future resource consent process to minimise any such effects. This could include, lizard salvage and potentially habitat replacement as appropriate. Further detail on these matters is presented in Appendix 10 Resource Consent – Lizard Management.

7.4.2 Freshwater Habitat

7.4.2.1 Streams

The construction of the Project could result in stream crossings over four permanent and three intermittent streams and a total stream loss of 136 m^2 of permanent stream and 81 m^2 of intermittent stream. The stream crossing over D2.S6, D2.S8 and D2.S9 will be bridged and therefore no additional stream loss will occur. Permanent and intermittent stream loss for the Project along with possible avoidance or enhancement opportunities is summarised in Table 48 and streams are mapped in Appendix 7, Drawing SGA-EX-DL-005.2. These calculations will require re-evaluation as part of the future regional consent process, however opportunities for compensation/offset have been identified within the Project Area. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features.

Table 48 Potential stream loss (permanent and intermittent) the Project Area (NoR D2)

Stream number *	Stream type	Wetted Width of stream (m)**	Bank width (m)	Length to be lost (m)	Loss (m^2)**	Notes
D2.S2	Intermittent	NA	NA	NA	NA	Section already culverted. Opportunity for daylighting within designation boundary, beyond construction footprint.
D2.S3	Intermittent	0.5	3	27	80	Stream is culverted downstream of this location. Opportunity for daylighting within designation boundary, beyond construction footprint.
D2.S5	Permanent	0.25	2	68	150	Existing stream is highly modified and channelised. Opportunity for realignment and enhancement within designation boundary.
D2.S6	Permanent	Not assessed	8	NA	NA	New Bridge crossing
D2.S7	Intermittent	NA	2	NA	NA	Already modified by the Auranga development.
D2.S8	Permanent	16	25	NA	NA	Bremner Bridge replacement.
D2.S9	Permanent	5	25	NA	NA	New bridge crossing to replace Norrie Bridge.
Total	**Permanent**			68	150	
	Intermittent			27	80	
Grand Total				95	230	

Notes:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.06, to SGA-EC-DL-010.11
** = Assessments were carried out in drought conditions when it was difficult to accurately delineate stream width. Therefore, widths and areas are indicative

During the detailed design phase, stream crossing plans (i.e. bridge or culvert) will be confirmed. However, it is considered highly likely (based on the indicative design for the Project) that at least some of the streams will be culverted, resulting in a loss of instream and riparian habitat and therefore impact management will be required. Under a future regional consent for earthworks, impact management would also be required to ensure sediment discharge to streams is controlled appropriately.

7.4.2.2 Wetland Habitat

Construction of the Project could result in the loss of several small areas of exotic wetland, which are largely unavoidable as they occur along the existing Jesmond road corridor. It is assumed that impacts on ecologically significant indigenous wetland habitat can largely be avoided at detailed design stage, as a small area is within the construction footprint and a small area is within the temporary construction area. The manner in which exotic wetlands are affected will be confirmed at the detailed design stage of the Project, however it is likely that some will be culverted or reclaimed (based on the current design for the Project), resulting in a loss of wetland habitat and vegetation. Additionally, hydrological inputs to wetlands can also be affected by Project activities such as embankments and culverts altering flow regimes. Wetland loss is presented for the Project in Table 49, and mapped on in Appendix 7, Drawings SGA-EC-DL-010.06 to SGA-EC-DL-010.11.

Table 49 Indicative wetland loss within the Project Area (NoR D2)

Site name*	Type**	Wetland size (m^2)***	Indicative area of impact/potential loss (subject to detailed design) (m^2)***	Notes
D2W1	Exotic Wetland (EW)	1,100	70	Wetland offset may be required.
D2W2	Exotic Wetland (EW)	500	70	Wetland offset may be required.
D2W3	Exotic Wetland (EW)	2,100	40	Wetland offset may be required.
D2W4	Exotic Wetland (EW)	1,400	420	Wetland offset may be required. Loss could be reduced by bridging where practicable.
D2W5	Oioi restiad rushland/reedland (WL10)	13,000	1	Wetland offset may be required.
Total area		18,100	601	

Notes:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.06 to SGA-EC-DL-010.11.
** = as classified in Singers*et al.*, 2017
*** = Assessments were carried out in drought conditions when it was difficult to accurately delineate wetland sizes. Therefore, areas are indicative.

A number of stream and wetland locations were identified during the indicative and detailed business cases process, route refinement and optioneering assessments and initial design phases and the design has been altered to minimise stream/wetland impacts. This has been partially guided by the ecological value assessment of streams and wetlands undertaken in Section 7.4.2.1 and 7.4.2.2.

Table 48 details the estimated stream loss (230 m^2) and Table 49 details estimated wetland loss (601 m^2) which will occur as a result of the Project works.

As the design develops and regional resource consent applications are prepared, it is anticipated that an assessment of the effects on freshwater/wetland habitat will be undertaken and more detailed information collected on freshwater habitat classifications, along with the ecological value of streams and wetlands using the SEV stream survey method and Wetland Condition Index (Clarkson *et al.*, 2004) surveys (respectively).

At the detailed design stage, options to avoid or reduce the level of impact (including hydrological effects) to stream and wetlands can be considered e.g. bridges, reduction of embankments, reduction in the length of culverts, type of culvert etc. Where stream or wetland loss is unavoidable, an ecological effects assessment should be undertaken to determine if mitigation/offsetting is required. Offset requirements should be calculated using accounting systems such as the Environmental Compensation Ratio (ECR) used for streams in the Auckland region.

Effects management will require SEV surveys to assess stream value and effects and to inform the potential requirement for stream compensation. However, potential compensation has been estimated on a preliminary basis using an ECR of 3:1[17] of stream restoration: stream loss. Assuming further avoidance is not possible, for the Project this would equate to intermittent stream compensation of approximately 240 m^2, and permanent stream compensation of 450 m^2. Subject to detailed design assessment, the area of potential wetland loss is currently estimated to be 601 m^2. Assuming a similar compensation ratio of 3:1, approximately 1,803 m^2 of wetland offset would be required.

The proposed designation boundary for the Project Area extends beyond the construction footprint. This is due to construction area requirements, such as stream works which typically extend 20 m past the permanent work area upstream and 15 m downstream. Additionally, a 6 m access track will be required for construction access and larger areas will be required to accommodate stormwater wetlands, construction laydown, stockpile and site compounds. These requirements may change depending on the final design and scope of works, terrain and topography, however these large areas beyond the construction footprint provide opportunity to accommodate any future requirement for wetland or stream compensation/ offset within the proposed designation boundary.

Broad mitigation recommendations for stream/wetland compensation/offset opportunities should be tailored to address impacts on streams and wetlands resulting from the Project as the detailed design advances. Where possible this mitigation will be incorporated within the designation boundary.

7.4.2.3 Fish

Fish surveys were not undertaken as part of the field investigations for the NoR, however NIWA freshwater fish database and Auckland Council Catchment Assessment Reports were reviewed and highlighted the likely presence of a number of At Risk and Not Threatened native fish species within streams within the Project Area (Table 42).

Although not confirmed it is considered likely that a number of streams and/or wetlands will be culverted or reclaimed. A number of these streams are already culverted at the location of current roads and have been identified as a potential barrier to fish passage (Appendix 7, Drawing SGA-EC-DL-010.06 to SGA-EC-DL-010.11). SEV surveys undertaken during the resource consent phase of the Project will identify if native fish are present within streams/wetlands and if there is suitable upstream habitat. If so, the Project could potentially result in a loss of upstream instream/wetland and

[17] Considered to be an average estimate of ECR's in the Auckland Region.

riparian habitat and potentially cause habitat fragmentation and loss of spawning habitat for native fish. In addition, fish may be killed or injured during culvert installation/extension within the stream.

If required, culvert design considerations should allow for fish passage. In addition, fish recovery and translocation would be required as part of the future resource consents for the Project.

To minimise disturbance to fish, instream works in sensitive reaches such as the Ngakoroa and Hingaia streams should be timed to avoid key fish migration and spawning periods (March – August) for Īnanga and other Galaxiidae species which are known to be present within the catchment. These restrictions are likely to apply where any instream works are required for bridge construction such as piling.

7.4.3 Positive effects/ Future Opportunities

Positive ecological effects are currently anticipated as a result of the Project and further positive outcomes and enhancement opportunities should continue to be developed during detailed design. If implemented, these are currently likely to include:

- The ability for future Project landscape planting to tie into the proposed vegetated corridors anticipated by the Drury -Ōpāheke Structure Plan, Blue-Green Network. Opportunities at specific locations have been outlined in the Project Assessment of Landscape and Visual Effects report;
- Net increase in green infrastructure and associated habitats within the Project Area associated with street trees, berm and stormwater plantings and planted stormwater wetlands. The Project Assessment of Landscape and Visual Effects report outlines recommendations to ensure ecological enhancement opportunities are capitalised upon at these locations.
- There are stream and wetland enhancement opportunities identified within Table 48 and Table 49. Where possible this could be incorporated within the existing designation boundary, beyond the construction footprint.
- Enhance vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

7.4.4 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native fish.

Almost all-original native habitat within, and adjacent to the Project Area has been removed due to historical land use change. As the existing environment is highly modified, the specific Project impacts discussed within this report have been minimal and adverse effects have largely been avoided. However, historical vegetation clearance and wetland drainage have made the landscape more vulnerable to cumulative effects relating to regional consenting considerations including:

- Greater risk of flooding and stormwater runoff. Without treatment and mitigation, the, Hingaia Stream and Ngakoroa Stream and wider Drury Creek and Pahurehure Inlet would be the ultimate receiving environment for treated stormwater from the Project.
- Erosion and sediment control issues during construction could lead to further habitat degradation and adverse impacts on the downstream receiving environments. For example, sedimentation in the Drury Creek and Pahurehure Inlet could lead to the gradual spread of mangroves, at the expense of saltmarsh and open mudflat habitats;
- Cumulative stream loss and vegetation clearance have a high impact on catchments ecological function, water quality, hydrology and the native fauna that use these habitats (i.e. īnanga spawning habitat, eels etc). Consideration of a riparian habitat function and bankside setback need to be considered in the wider catchment context.

If developments, the (including the Project) and external developments contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced. This opportunity has been highlighted within the Drury-Ōpāheke Structure Plan and is anticipated to be reflected in future Plan Changes. The Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could potentially remediate cumulative effects in the long term.

7.4.5 Conclusion

Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features within or adjacent to the Project Area, for which future regional and/or Freshwater NES consent will be required, can be adequately managed in any future consent processes.

The proposed alignment to date has minimised effects on streams, wetlands and terrestrial habitats of value.

A review of the surrounding catchment highlights that there is potentially available stream or wetland habitat for offset/compensation within the designation boundary if this is required.

8 NoR D3: Waihoehoe Road East Upgrade

Chapter Summary
Desktop studies and site investigations for terrestrial, freshwater and wetland habitats and native species (bats, birds and lizards) were undertaken within and adjacent to the Project Area to identify their ecological value. The Project will impact a range **Negligible** to **Low** value terrestrial exotic habitat types (regional and district vegetation). Although of **Low** value botanically these features were considered for their potential to support common, Threatened and At Risk native fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was however considered to be **Negligible** to **Very low** and therefore no specific impact management has been suggested for these matters. The proposed alignment to date has minimised effects on streams, wetlands and terrestrial habitats of value. Based on survey work undertaken to date, it is considered that any Project effects on ecological features such as streams and wetlands can be adequately managed in any future consent processes and any requirement for offset/compensation can be accommodated within the proposed designation boundary.

8.1 Project Description

8.1.1 Project Overview

The Waihoehoe Road East Upgrade (NoR D3) consists of the widening of Waihoehoe Road to a two-lane arterial with walking and cycling facilities from the proposed intersection with Ōpāheke North-South FTN Arterial in the west, to Drury Hills Road in the east. The functional intent of the Project is to provide strategic east-west connectivity between the strategic north-south corridors (Great South Road, the Ōpāheke N-S FTN Upgrade (NoR D4) and Mill Road), providing multi-modal access to the wider network for the planned growth area as well as providing access to the existing Drury township and proposed rail station (an NZUP project).

The eastern extent of the Project will tie into the future Mill Road corridor which forms a separate NZUP project. The intersection with Ōpāheke North-South is proposed to be signalised, but this work forms part of NoR D2 . Roundabouts are proposed at the intersections with Appleby Road and Cossey Road. The road will be an urban arterial with a likely reduced speed limit of 50kph. An overview of the proposed design is provided in Figure 17.

Figure 17 Overview of Waihoehoe Road East Upgrade (showing location only, refer design drawings)

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade include the following:

- Widening of Waihoehoe Road from its current general width of 20m to enable a 24m wide two-lane cross-section including separated walking and cycling facilities
- Localised widening around the existing intersections to accommodate for the two proposed roundabouts
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, the re-grade of driveways and construction traffic manoeuvring.

8.1.2 Project Features

The surrounding environment is highly modified with indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. The widening of the Waihoehoe Road east corridor will require additional land take. The footprint will require vegetation removal throughout the construction area. There is only one impacted stream along the proposed alignment.

8.2 Ecological Baseline and Likely Future Environment

This section presents the finding of the desktop study which includes a review of the documents listed in Section 5.1 and site investigations for all of the habitats and species ('ecological features') present within the Project Area. Based on this information, an ecological value has been identified for each ecological feature. The likely future environment in regard to these ecological features is discussed in Section 8.2.4.

8.2.1 Historical Ecological Context

The Project Area is located within the Mānukau Ecological District, which encompasses the Mānukau Harbour and the surrounding low-altitude land. The district has a warm, humid climate with mild winters. Soils throughout the district range from poorly drained to well drained, dependent on landform and the presence of localised volcanic areas (McEwen, 1987).

- Most of the district was originally forested. Original forest types were generally dependent on the landform and soils on which it grew (Singers *et al.*, 2017):
- On free draining soils, pūriri forest (WF7[18]) was present;
- On lowland, poor draining areas, kahikatea, pukatea forest (WF8) grew; and
- In volcanic areas, from gullies to hillslopes and ridges, taraire, tawa, podocarp forest (WF9) was present.

Only 1.6% of the entire Mānukau Ecological District has native vegetation of any type remaining (Auckland Regional Council, 2004). Freshwater wetlands have been particularly affected, with over a 96% reduction in extent throughout the ecological district (Auckland Regional Council, 2004). 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 Mānukau Ecological District are well below these levels. The only significant area of natural landscape remaining is the Mānukau Ecological District (ED) are the unmodified coastal of the Mānukau Harbour. Any remaining examples of original forests or wetlands, or any regenerating native vegetation that is developing into vegetation that once clothed the ED therefore needs to be considered as likely significant.

8.2.2 Habitats

8.2.2.1 Terrestrial Habitat

8.2.2.1.1 Desktop Review

Auckland Council Geomaps aerial imagery shows that the original forest within the Project Area has been largely cleared and that the present-day terrestrial habitats are dominated by agricultural land. Where there are natural habitats remaining the AUP OiP has mapped and classified remaining significant indigenous habitats as either terrestrial or marine SEAs. There are no SEAs within the Project Area. A conservative distance of 2 km was selected as the potential ZOI for adverse effects of the Project, but this is dependent on the potential receiving environment and the habitats and species present with a SEA.

[18] Habitat codes are from Singers *et al.* (2017) and Singer and Rogers (2014) and have been identified by Auckland Council as occurring in the Auckland region.

Where SEAs are present within 2 km of the proposed designation for NoR D3, a description of the habitat remaining is presented below in Table 7. A map of SEAs relative to the Project Area is also provided in Appendix 7, Drawing SGA-EX-DL-004.3.

No remaining native forest occurs within the Project Area and no SEAs occur within or directly adjacent to the Project.

Table 50 Significant Ecological Areas present within 2 km of the Project Area (NoR D3)

SEA	Distance from Project Area (km)	SEA Description
SEA_T_1175	0.1	Critically endangered kahikatea forest (MF4). Other forest ecosystems including Taraire, tawa, podocarp forest WF9.
SEA_T_5323	0.1	Critically endangered kahikatea forest (MF4) and pūriri forest (WF7). Habitat to Threatened fish species, including longfin eel, torrentfish and īnanga, as well as koura. Also found are Threatened plant species including pirata, or green mistletoe and swamp maire. This SEA is a buffer to a protected area and has high habitat diversity, housing forest ecosystems including WF7, WF9, WF12, WF13, MF4 and MF24, and regenerating ecosystems including VS2 and VS5.
SEA_T_1173	0.8	Vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13), which is a migration pathway for migrant species.
SEA_T_1174	0.8	Vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13), which is a migration pathway for migrant species.
SEA_T_4561	1.1	Habitat for rare plant species kaikōmako, and a migration pathway for migrant species.
SEA_T_1172	1.2	Critically endangered kahikatea forest (MF4).
SEA_T_4562	1.4	Endangered taraire, tawa, podocarp forest (WF9) and kānuka scrub forest (VS2), which is a migration pathway for migrant species.
SEA_T_530	1.5	Terrestrial coastal and riparian edge vegetation along the inner Drury Creek and Ngakoroa Stream mouth. The remnant coastal scrub includes records for Threatened plant species, including mingimingi and native oxtongue and declining fish species īnanga. Also, habitat for rare plant species including korokio, kaikōmako and small-leaved kōwhai. This SEA is a buffer for adjoining SEA_M1-29b.
SEA_T_530b	1.5	Coastal and riparian wetland vegetation associated with the Ngakoroa Stream. Habitat for Threatened bird species, including pied oystercatcher and Caspian tern; and the rare plant species kaikōmako.
SEA_M1-29b	1.5	A wetland system within the upper tidal reaches of Drury Creek; which grades from freshwater vegetation, through rush-dominated saltmarshes to mangrove habitat; forming an important migration pathway for many native freshwater fish species.
SEA_T_4563	1.6	Endangered taraire, tawa, podocarp forest (WF9) and endangered kauri, podocarp, broadleaved, beech forest (WF12), which is a migration pathway for migrant species.

SEA_T_545	1.7	Critically endangered pūriri forest (WF7).
SEA_T_77	1.7	Critically endangered kahikatea-pukatea forest (WF8).
SEA_M2-29a	1.7	Intertidal habitat; ranging from sandy mud flats, to current-exposed rocky reefs and a variety of saline vegetation. Areas of mangroves grow in Whangamaire Stream, and Drury and Whangapouri Creeks. In southern areas of Whangapouri Creek are eelgrass beds. Drury Creek is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Wading bird roosting area, including important area for pied stilt.

8.2.2.1.2 Site Investigations

The Project Area is dominated by exotic grassland and amenity planting (gardens and parks), treeland and exotic planted vegetation. For completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 8.2.2.3. All the habitats observed are highly modified and dominated by exotic species. Table 8 presents the vegetation types, identified within and directly adjacent to the Project Area, these are mapped in Appendix 7, Drawings SGA -EC-DL-008.01 and SGA -EC-DL-008.02. Due to the exotic nature of these habitats, none have been assigned a conservation status in Singers *et al.* (2017).

Table 51 Vegetation types present within and directly adjacent to the Project Area (NoR D3), classified according to Singers *et al.* (2017)

Vegetation Types	Alphanumeric Code (Singers *et al.*, 2017)	Description
Exotic Grassland	EG	Grassland dominated by exotic species. This includes pasture and gardens.
Planted vegetation	PL.3	Native and/or amenity plantings. This includes garden areas within this NoR.
Exotic Wetland	EW	Highly modified wetland system, now dominated by exotic plant species such as willow weed and soft rush.
Treeland	TL.3	Tree canopy cover 20-80%: <25% native with exotic tree cover dominant. This includes orchards, tree lined streams, gardens and mature trees within amenity plantings and shelter belts.

8.2.2.1.3 Ecological Value

The terrestrial habitats within the Project Area are dominated by exotic grasslands, which is of negligible ecological value (as assessed in accordance with EIANZ Guidelines – refer to Appendix 3 for detailed threshold criteria). Most other vegetation types across the NoR are planted exotic habitat. These habitats are considered to be of **Low** ecological value due to their low botanical diversity and predominance of weed species.

Low value habitat does not however, necessarily mean a vegetation type provides 'no value' habitat as it may provide some value in terms of ecosystem function, such as, bank stability and stream shading, or may provide habitat utilised by common, Non Threatened native species such as native birds and copper skink.

Table 52 Terrestrial habitat values for the Project (NoR D3)

Habitat Description	Alphanumeric Code*	Regional IUCN conservation status*	Value based on EIANZ Guidelines
Exotic Grassland	EG	N/A	Negligible
Planted amenity vegetation	PL.3	N/A	Low
Exotic treeland	TL.3	N/A	Low

* = Information from Singers *et al.* (2017)

8.2.2.2 Freshwater Habitat

8.2.2.2.1 Desktop Review

Auckland Council Geomaps layers ('Named Streams') indicates that there are three overland flow paths, which will be intersected by the upgrade on Waihoehoe Road and tie ins with Appleby Road and Cossey Road . Two of which are small tributaries of the Waihoehoe Stream (part of the Ōtūwairoa Creek catchment) and one which is a tributary of the Hingaia Stream (Appendix 7, Drawing SGA-EX-DL-005.3).

Auckland Council commissioned the Hingaia Catchment (Spyksma *et al.* 2018b) and Ōtūwairoa Creek catchment (Ingley *et al.,* 2015) Watercourse Assessment Reports which includes stream catchment locations within the Project Area. This report provides baseline information on the existing condition of waterways, stream ecological health, including stream classification, wetland habitat assessment and selected representative SEV and macroinvertebrate surveys. Table 53 provides an overview of information collected from this survey. The data within this catchment reports covers the entire catchment and is not specific to the sections of stream impacted by the Project.

Table 53 Desktop summary from Auckland Council Catchment Watercourse Assessment Reports for effected catchments within the Project Area (NoR D3)

Catchment effected	Summary	SEV	MCI
Hingaia Stream (Spyksma *et al.* 2018b)	The Hingaia catchment is a hard-bottomed system which flows through a rural catchment used intensively for agricultural purposes, with some well vegetated gullies found in the eastern hill country. The stream channels typically had steep banks, prone to erosion. Historical vegetation clearance has resulted in low riparian vegetation and shading.	SEV scores calculated for the catchment ranged from 0.32 to 0.83, giving functional value of 'low' to 'high'.	MCI scores ranged from 67.1 – 128.75 Overall MCI scores ranged from Poor to Excellent.

Catchment effected	Summary	SEV	MCI
Ōtūwairoa Creek (Ingley *et al.,* 2015)	Ōtūwairoa Creek is drained by four main watercourses, Ōtūwairoa Creek, Waipokapū Stream, Waihoehoe Stream, and Mangapū Stream. These discharge via Ōtūwairoa Creek to the upper Pahurehure Inlet of the Mānukau Harbour. The catchment is largely soft-bottomed and flows through a highly modified rural landscape, however the upper catchment in the eastern hill country, is dominated by indigenous forest. The Ōtūwairoa Creek section is largely urbanised where it flows through Papakura.	SEV scores calculated for the catchment ranged from 0.406 to 0.853, giving functional value of 'moderate' to 'high'	MCI scores ranged from 68.24– 125.44. Overall MCI scores ranged from poor to excellent.

8.2.2.2.2 Site Investigations

The unnamed tributaries of the Hingaia Stream and Waihoehoe Stream within the Project Area were numbered (D3.S1 – D3.S3), classified as intermittent or ephemeral and mapped (Appendix 7, Drawing SGA-EX-DL-005.3). D3.S1 and D3.S2 are both ephemeral and in part within existing culverts so no RHA assessment was possible for these sections. An RHA was completed for the section of D3.S3 which is intermittent and not already culverted under the existing Waihoehoe Road. The RHA score is presented for instream habitat (instream habitat diversity, quality and quantity) and for riparian habitat (erosion, shade and buffering).

The results of the stream classification and RHA value (including the reference site) are presented in Table 54. Stream D3.S3 has been highly modified by adjacent agricultural practice. The catchment area for this small stream was likely originally a wetland with no obvious overland flowpath. The wetland has however been drained and reclaimed for agriculture and a farm drain now forms the source of this intermittent stream. This artificial farm drain therefore has low ecological value. The instream and riparian habitat measured a large difference relative to the reference stream type although this difference was more pronounced for the instream habitat features.

Table 54 Instream, riparian and combined RHA scores for the Project Area (NoR D3) and associated reference stream

Site Name	D3S3	
Stream Name	Waihoehoe Stream Tributary	Reference Stream Type WD/VA/1/LG
Classification	Intermittent	
Instream Score %	13.3	55
Riparian Score%	35	100
Combined RHA Score %	22	73

8.2.2.2.3 Ecological Value

The aquatic ecological value assessments for the one stream (D3.S3) surveyed are outlined in Table 55. The assessment applied components presented within this the report including: stream classification (hydroperiod and presence of pools), RHA (riparian and instream habitat representation, diversity), REC classification (stream order) and species of conservation importance, to assess the four matters (Representativeness, Rarity, Diversity and pattern, Ecological context) outlined within the EIANZ Guidelines. A precautionary approach was taken regarding the occurrence of fish species of conservation significance for all streams within the Project Area identified during site surveys. As such, a high value descriptor was assigned for 'Rarity' to qualifying streams, specifically for the likely occurrence of longfin eel and īnanga (At Risk- Declining). SEV surveys will be required when the Project seeks resource consent. This will include fish surveys which will allow for a more accurate assessment of rarity for the value assessment. Stream D3.S3 was highly modified and with the main streambed dredged and channelised into a farm drain, it is then culverted under the existing road.

Table 55 Aquatic ecology value assessment for the Project (NoR D3)

Site Name	D3.S3
Representativeness	Very low
Rarity	High
Diversity and pattern	Very low
Ecological context	Low
Ecological Value	Low

8.2.2.3 Wetland Habitat

8.2.2.3.1 Desktop Review

No wetland habitat was identified during the desktop assessment for the Project.

8.2.2.3.2 Site Investigations

Wetland habitat was present within the Project Area as defined in Section 5.3.1.3. The wetland present was mapped and described as a highly modified, exotic wetland (EW) (Singers *et al.,* 2017) and is described in Table 56.

Table 56 Wetland habitats within the Project Area (NoR D3)

Site Name and Location	Description	Photograph of Habitat
D3W1 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.,* 2017) as species present are >50% exotic. Facultative wetland species are common and include willow weed and soft rush. This wetland feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas that supports plants that are adapted to wet conditions. The 1942 aerial indicates no obvious flow path, however more recent aerials indicate intermittent ponding and likely permanently wet conditions. It is possible that the obstruction caused by the existing Appleby Road may have increased the extent of the wetland. However, drainage channels along Appleby Road have also likely lowered the watertable and have potentially reduced the wetland extent. The landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. This habitat is modified, unfenced and is grazed by livestock. Original (native) vegetation has therefore been cleared and the surrounding paddock has been reseeded with pasture grasses.	

8.2.2.3.3 Ecological Value

Wetland habitat present within the Project Area included one area of exotic wetland, dominated by exotic plant species and severely degraded through factors such as vegetation removal, artificial drainage and grazing and pugging from livestock. Although specific habitat assessments of wetland condition were not undertaken in these areas, this preliminary assessment has identified that the ecological value of this exotic wetlands is **Moderate,** taking into consideration the overall reduction in wetland habitat across the Auckland region and the retained ecological functionality of these systems for attenuation of stormwater and excess nutrient removal.

8.2.3 Species

8.2.3.1 Bats

8.2.3.1.1 Desktop Review

DOC records; unpublished AECOM records, and one additional anecdotal record by G. Kessels (Personal Communication) confirm the presence of long-tailed bats within 10 km of the Project Area. Although no records are located directly within the Project Area; as a highly mobile species there is potential for bats to frequent any suitable habitat within the designation boundary. The conservation status of this species is ‘Nationally Critical’ (O’Donnell *et al.*, 2017). The records within 10 km of the Project Area (Appendix 7; Drawing SGA-EX-DL-006) include:

- 6.3 km to the north-west on Kopuhinahinga Island in the Pahurehure Inlet.
- 8.2 km to the south-west, near the SH22 intersection with Glenbrook Road
- 2.5 km to the east in the foothills of the Hunua Ranges.
- 7.5 km to the south within Coulthards Scenic Reserve near Paerata (Unpublished records from AECOM of long-tailed bats); and
- 9.3 km to the south west, within the Paerata Scenic Reserve (Unpublished records from AECOM of long-tailed bats).

Further afield, there are multiple records within the Hunua Ranges and within farmland between Waiuku and Patumahoe.

8.2.3.1.2 Site Investigations

8.2.3.1.2.1 Bat habitat

No habitat features suitable for use by foraging and commuting indigenous long-tailed bats or mature trees with suitable roosting features were identified within or adjacent to the Project Area.

8.2.3.1.2.2 ABM Survey

Due to the large home ranges of bats and interconnectedness of bat habitat and ABM survey locations between the Project Areas , the results of the bat surveys have been presented collectively in Sections 6.2.3.1.2.1 and 6.2.3.1.2.2.

A summary of the ABM surveys are presented in Appendix 5 and ABM locations are presented in Appendix 7 SGA-EX-DL-002. Data was collected for at least one Session for all ABM sites, with nine locations collecting data for both Sessions (1 and 2). Analysis of the ABM data did not identify any bat activity within the ZOI of the five Projects. These results suggest that bats are not frequent visitors to the area within any of the five NoRs during their mating and breeding seasons. However, as the desktop assessment suggests (Section 5.3.2.1), bats are highly mobile and have been recorded within 4.5km of the Project Area.

8.2.3.1.3 Ecological Value

The ABM surveys did not find any evidence of long-tailed bat (Threatened – Nationally Critical) activity at survey locations, and there is no suitable bat habitat such as mature trees and vegetated stream corridors within the Project Area. As such, it is considered that the ecological value of bat habitat within the Project Area is **Negligible.**

8.2.3.2 Birds

8.2.3.2.1 Desktop Review

All records of native species, for which suitable habitat types were identified within the Project Area are collated into Appendix 8, Table 113. However, because many records do not include a specific location, a map was not produced of individual bird records.

Of the nationally listed At Risk or Threatened species recorded, most were coastal or freshwater bird species. As there is no suitable habitat for these species within the Project Area, records for these species were excluded as their potential for presence was considered highly unlikely.

Of the At Risk forest bird species recorded, the North Island kōkako (At Risk - Recovering) is a forest specialist with a known population in the Hunua Ranges, 10km to the east of the Project Area. Similarly, the North Island kākā (At Risk - Recovering) is also a forest specialist but is known to disperse to seasonally available food sources, particularly in winter. Given the type of habitat present within the Project Area neither of these species are likely to be present and are therefore excluded from further mention for this project.

8.2.3.2.2 Site Investigations

Bird surveys were not completed within the Project Area because no suitable habitat was present.

8.2.3.2.3 Ecological Value

No suitable habitat exists for Threatened or At Risk species identified in Table 113 (Appendix 8). However, common, Not Threatened, native forest species will use the surrogate habitat (exotic vegetation) present within the Project Area for breeding and foraging. It is considered that the ecological value of bird habitat for forest species within the Project Area is **Low**.

8.2.3.3 Herpetofauna

8.2.3.3.1 Desktop Review

Seven native lizard species are known to occur within the Mānukau District (Ecogecko, 2014). In general, the Drury area is poorly surveyed for lizards and therefore a 10 km search area was used to review the DOC Bioweb database, Auckland Council records, and the iNaturalist website. Most native lizards require indigenous habitat or surrogate habitat adjacent to contiguous forest habitat area. Based on the desktop habitat assessment, there is likely to be a complete absence of suitable habitat for most indigenous lizard species within the Project Area. The Not Threatened copper skink is however widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. It is therefore highly likely to occur within and adjacent to the Project Area.

Table 57 Indigenous lizard species records within the Mānukau District

Common Name	Latin Name	Threat Class (Hitchmough *et al.,* 2016)	Record source	Likelihood of presence
Pacific gecko	*Dactylocnemis pacificus*	At Risk – Relict	DOC	Unlikely
Elegant gecko	*Naultinus elegans*	At Risk – Declining	Auckland Council	Unlikely
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining	iNaturalist	Unlikely
Copper Skink	*Oligosoma aeneum*	Not Threatened	DOC	Likely
Ornate skink	*Oligosoma ornatum*	At Risk – Declining	DOC	Unlikely
Shore skink	*Oligosoma smithi*	At Risk – Naturally Uncommon	DOC	Unlikely
Moko skink	*Oligosoma moko*	At Risk – Relict	DOC	Unlikely

It is highly unlikely that native frog species would occur within the Project Area, due to lack of suitable habitat. The only native frog species present within the Auckland Region is the Hochstetter's frog, the closest known records of which occur > 10 km away in the Hunua Ranges to the east of the Project Area. However, Hochstetter's frogs do not disperse readily and require damp areas within native forest habitat (or occasionally in exotic plantation) to survive (van Winkel *et al.* 2018). Hochstetter's frogs have not been considered further for the Project, due to the lack of a potential source population and absence of suitable habitat.

8.2.3.3.2 Site Investigations

During the site investigations, no indigenous lizards or frogs were identified as incidental observations. However, the introduced plague skink was identified within the Project Area.

The desktop study identified that it was possible that copper skink (Not Threatened) were potentially present within the Project Area. Habitat availability for these species was confirmed during the site walkovers and included, planted vegetation and rank grassland habitats associated with private gardens and roadside vegetation. These areas are known to act as ('surrogate habitats') in Auckland (van Winkel, Baling & Hitchmough, 2018). No other suitable habitat for native lizards was found.

8.2.3.3.3 Ecological Value

It is considered highly likely that the Not Threatened and commonly occurring copper skink could be present throughout the Project Area, within planted vegetation and rank grassland. Habitat for other native species is not present. As such, the ecological value of the habitat for lizards is considered to be **Low**.

8.2.3.4 Fish

8.2.3.4.1 Desktop Review

The NIWA freshwater fish database and Auckland Council Catchment Assessment Reports (Spyksma *et al.et al.* 2018b) was reviewed for fish records within stream catchments affected by the Project

(Table 58). Of the species recorded as present, two had ‘At Risk – Declining’ conservation statuses: īnanga and longfin eel (Dunn *et al.* (2017)).

Table 58 Freshwater fish species recorded within the catchment effected by the Project (NoR D3)

NoR	Stream	Species (shading indicates presence)									
		Īnanga	Longfin eel	Banded kokopu	Common bully	Common smelt	Crans bully	Shortfin eel	Freshwater mussel	Koura	Unidentified eel
Conservation status*		At Risk – Declining		Not Threatened							**
NoR D3	Hingaia Stream	U	U	U				U	D	D	D
	Waihoehoe Stream		D						D	D	

Notes:
U = record from upstream of the NoR
D = record from downstream of the NoR
* = fish species conservation statuses from Dunn *et al.* (2017); invertebrates (i.e. Koura) from Grainger *et al.* (2013).
** = conservation status could be either Not Threatened (if shortfin eel) or At Risk – Declining (if longfin eel).

8.2.3.4.2 Site Investigations

During site walkover, streams were visually checked for presence of any native fish species No dedicated fish surveys were undertaken as this will be undertaken as part of future resource consent phase. The freshwater ecological value assessment took a precautionary approach and included the occurrence of species of conservation significance for the intermittent stream identified during site surveys (Section 8.2.2.2.2). A high value descriptor was assigned to qualifying streams specifically for the potential occurrence of longfin eel (At Risk- Declining).

8.2.3.4.3 Ecological Value

The only stream present within the Project Area is a **Low** value intermittent stream which is unlikely to provide suitable fish habitat. The ecological value for native freshwater fish species is considered to be **Low**.

8.2.4 Summary of ecological value

Table 20 summarises the ecological values within and adjacent to the Project, presented in Sections 8.2.2 and 8.2.3 .

Table 59 Summary of ecological values within and adjacent to the Project Area (NoR D3)

Ecological Feature	Ecological Value
Terrestrial Habitat	Low
Freshwater Habitat	Low

Ecological Feature	Ecological Value
Wetland Habitat (Exotic)	Moderate
Bats	Negligible
Birds – forest/wetland	Low
Herpetofauna	Low
Fish	Low

8.2.5 Likely Future Environment

This section has been prepared to provide some context to how the assessment of ecological effects of the Project construction and operation (Section 8.3) has been undertaken in regard to the changing baseline or likely future environment of the areas within and surrounding the Project Area.

The existing landscape surrounding the Project Area is rural. The AUPOiP zoning/overlay identifies the land adjacent to the Project Area as FUZ. The future urban land will undergo a significant change from rural to urban over the next couple of decades. The AUPOiP generally protects areas of ecological value that are identified in overlays, such as ‘open space – Conservation Zone’ land and SEA areas, which do not occur within the NoR D3 designation. The assessment carried out as part of this EcIA has not identified any additional habitats that would meet the criteria for SEAs under the AUPOiP.

Ecological protection and enhancement of biodiversity is proposed through the Drury – Ōpāheke Structure Plan (Auckland Council, 2019). In the Structure Plan a ‘Blue Green Network’ (Appendix 7, Figure 30) is proposed which seeks to provide contiguous ecological linkages, connecting significant terrestrial and marine ecological areas through restored riparian margins 10-20 m wide. This places greater emphasis on the protection and enhancement of existing watercourses and areas of significant natural value, requiring these areas to be accommodated within the future urban environment. Although the Structure Plan does not hold any formal statutory weight and may change, it is likely that there will an expectation that future development will be consistent with the proposed blue green network.

In light of this context, it is assumed that in a future urbanised scenario, permanent stream and wetlands will generally be avoided by development and retained. It is also assumed that stormwater design will be integrated into the proposed ‘Blue Green Network’ and sediment and pollutants will be controlled at source. For example, if riparian habitat restoration is implemented appropriately, it is considered that in a future scenario many of the features of value could be similar to existing, or in some cases, enhanced.

The majority of native species assessed within this report are generally adaptable to human modified environments and therefore it is possible that despite the potentially negative implications of urbanisation (disturbance, habitat loss and fragmentation) these species may remain, where suitable habitat is retained. However, as the urban landscape becomes less permeable to wildlife the viability of these species will become increasingly dependent on the quality of catchment wide mitigation within the Project Area and surrounding FUZ.

Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species. Pre-construction surveys to confirm a change in ecological value are not required because there are no ecological features effected by the Project within the Project Area that result in a **Moderate** or higher level of ecological effect (as they relate to district plan matters).

8.3 Assessment of Ecological Effects and Impact Management Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

As discussed in Section 4.1, this assessment has been prepared to support the NoR D3 and has been undertaken in the context of the ecological baseline and the likely future environment that's has been described in Section 8.2. When assessing the actual or potential ecological effects of allowing the Project, this assessment has been limited to matters that would trigger a district plan consent requirement and presented in Section 8.3.1 and 8.3.2 below.

Where regional and/or Freshwater NES consenting requirements are triggered, these will not be authorised by the designation, and will require further consents. In order to demonstrate the jurisdictional split between regional and district plan matters, we have included a table as Appendix 1 which identifies the potential ecological effects of the construction and operation of the Projects, and whether these are regional, or district plan matters under the AUP OiP.

Although regional/Freshwater NES consents are not being sought at this stage, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree as part of this report to inform design, options assessment and the proposed designation footprint. For regional matters, this has included the identification of any areas of significant value or habitats for the purposes of design and alignment decisions along with identification of future resource consent requirements This information is presented in Section 8.4 – Design and Resource Consent Considerations.

8.3.1 Assessment of Construction Effects

8.3.1.1 Summary of Potential Construction Effects, Prior to Impact Management

The proposed construction activities have the potential to cause impacts on ecological features of value within or adjacent to the Project Area, without impact management.

Potential construction effects that relate to district plan matters are presented in Appendix 1**,** and are summarised below:

- Vegetation removal (that triggers to district plan controls) leading to the permanent loss of terrestrial habitats;
- Construction activities causing light, noise and vibration leading to the disturbance and displacement of indigenous fauna.

8.3.1.2 Magnitude of Construction Effects

The magnitude of construction effects listed above on impacted ecological features (Section 8.2) are discussed in the following sections (Section 8.3.1.2.1 and 8.3.1.2.2).

8.3.1.2.1 Habitats

8.3.1.2.1.1 Terrestrial Habitat

Section 8.2.2.1 describes all habitat types present within the Project Area. The Project Arboricultural report identifies the vegetation that is district plan related e.g. within the existing road space and therefore considered a district plan matter for inclusion in this assessment of effects.

For NoR D3 there are no trees/vegetation identified within the Project Area that are subject to district plan controls that will be removed due to the Project, as such the magnitude of effects is considered to be **Negligible.**

8.3.1.2.2 Species

8.3.1.2.2.1 Bats

There is no suitable habitat for long-tailed bats in the Project Area and bat presence was not detected during surveys. As such the magnitude of effect from construction is not relevant for consideration as part of this effects assessment.

8.3.1.2.2.2 Birds

Noise, vibration and lighting disturbance caused by construction activities could displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Project Area.

The birds which occur in the Project Area are common in the local area (which comprises agricultural land and private gardens). They are adapted to human modified environments, and suitable foraging habitat of equal or better quality will remain adjacent to the Project Area during construction. Therefore, the magnitude of effects from the Project construction activities on the local bird population is considered to be **Low**.

8.3.1.3 Level of Ecological Effects – Construction

In accordance with EIANZ Guidelines the level of ecological effects from the construction of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the Project construction.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern. The Project will also need to comply with the Wildlife Act 1953. Table 60 below summarises the overall level of ecological effects for each key ecological feature and fauna group related to the Project before impact management is applied.

Table 60 Summary of potential ecological effects (prior to impact management) during construction based on ecological value and magnitude of the effect

Ecological Feature	Ecological Value	Magnitude of Construction Effects	Level of Ecological Effect (prior to impact management)
Terrestrial habitat – district matters	Low	Low	Very Low

Ecological Feature	Ecological Value	Magnitude of Construction Effects	Level of Ecological Effect (prior to impact management)
Bats	Negligible	N/a	Negligible
Birds – forest	Low	Low	Very Low

The assessment identified that the level of ecological effects from the construction of the Project were **Negligible** or **Very low** on the ecological features identified. In accordance with the EIANZ Guidelines impact management measures are only proposed for those effects **Moderate** and above and as such impact management is not required for the Project construction effects.

8.3.2 Assessment of Operational Effects

8.3.2.1 Summary of Potential Operational Effects, Prior to Impact Management

The Project involves the widening of an existing road by 4 m for walking and cycling. No additional vehicle lanes are being added. Although some impacts may increase from the current baseline (i.e. street lighting), many operational effects such as, fragmentation and noise are likely to be pre-existing. These changes will be considered when assessing the magnitude of effects on potentially already impacted ecological features or species that have habituated to the existing road.

In general, potential operational effects from the Project that relate to district plan matters are presented in Appendix 1, and are summarised below.

- Loss in connectivity to indigenous fauna (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The magnitude of these operational effects is discussed in Section 8.3.2.2.

8.3.2.2 Magnitude of Operational Effects

8.3.2.2.1 Bats

There is no suitable habitat for long-tailed bats in the Project Area and bat presence was not detected during surveys. As such the magnitude of effects from operation of the Project is not relevant for consideration as part of this effects' assessment.

8.3.2.2.2 Birds

Birds are unlikely to be disturbed or habitat fragmented from Project operations, that is an increase from baseline.

Suitable habitat for common native forest birds include planted vegetation associated with private gardens, within and adjacent to the Project Area. The species present are those species which have adapted to use habitats modified by humans and as such, the magnitude of effects from the Project are considered to be **Low**.

8.3.2.2.3 Herpetofauna

There is no suitable habitat for Threatened indigenous lizard species within or adjacent to the Project Area. There is the potential that copper skink (Not Threatened) are present within suitable 'surrogate' habitat (planted vegetation and rank grassland) within the Project Area.

Native lizards require vegetated corridors (such as riparian stream corridors) to facilitate natural dispersal. The Project is upgrading existing roads and culverts and therefore is not considered to create any additional barriers to movement or dispersal of lizards. During detailed design/resource consent, opportunities should be sought to enhance/retain vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity. Native lizards are likely to be habituated to existing disturbance such as noise, vibration and lighting and design should ensure that this will not increase for the operation of the Project. It is considered that the magnitude of operational Project effects would be **Low**, without impact management.

8.3.2.3 Level of Ecological Effects – Operation

In accordance with EIANZ Guidelines (Roper-Lindsay *et al.* 2018) the level of ecological effects from the operation of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the operation of the Project.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern. Table 61 summarises the potential ecological effects of the Project during operation.

Table 61 Summary of potential ecological effects (prior to impact management) during operation based on ecological value and magnitude of the impacts

Ecological Feature	Ecological Value	Magnitude of Operational Effects	Level of Ecological Effect (prior to impact management)
Bats	Negligible	N/a	Negligible
Birds – forest habitat	Low	Low	Very low
Herpetofauna	Low	Low	Very low

The assessment identified that the level of ecological effects from the operation of the Project an all ecological features was **Negligible** or **Very low**. In accordance with the EIANZ Guidelines impact management measures are proposed for those effects **Moderate** and above and as such impact management is not required for the Project's operational effects.

8.3.3 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native birds.

All original native habitat within, and adjacent to the Project Area has been removed due to historical land use change. As such, the types of fauna generally remaining within the habitats are Not Threatened native or exotic species, which are generally adaptable to modified environments. Common Not Threatened native species like copper skink, are considered very likely to occur within these modified, low value habitats (e.g. rank grass, scrub) within the Project Area. The ongoing long-term incremental loss of low value habitat may however cause detrimental effects on local populations of 'common' species, which within a project specific context would not normally require impact management under the EIANZ Guidelines. As low value habitats are likely to be altered by the Project and by other external projects (surrounding development), the risk of significant habitat degradation for Not Threatened species such as copper skink is likely to be cumulative and must be considered in the wider regional context.

All developments within the Drury-Ōpāheke Structure Plan area should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Structure Plan area and its catchments.

If the developments (including this Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced. This opportunity to enhance stream corridors through riparian planting has been highlighted within the Drury-Ōpāheke Structure Plan and it is anticipated that this will be reflected within future plan changes. This Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

8.3.4 Summary and Conclusions

Ecological features were assessed for their potential to be adversely affected from the construction and operation of the Project relating to district plan matters. All of the relevant habitat (terrestrial – district plan only) and fauna species (bats, birds and lizards) were assessed to be of **Negligible** or **Low** level of effect from the construction and operation of the Project and therefore no specific impact management has been recommended.

In a future scenario when the surrounding environment is likely to be urbanised, the importance of stream corridors will be even more important as the urban environment becomes less permeable to the natural movement of native species. Habitats of value are limited within the Project Area however in a future environment any remaining mature exotic vegetation, stream corridors and wetland areas may retain habitat for Not Threatened birds and lizards. These areas should be prioritised for retention and enhancement in line with Structure Plan recommendations for the 'Blue-green network'.

8.4 Design and Resource Consent Considerations

Although resource consents are not being sought for the Project at this stage, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree to inform design, options assessment and the proposed designation footprint of NoR D3. The outcome of this analysis is presented below. This includes the identification of any ecological features of value for the purposes of design and alignment decisions and to identify future consenting requirements.

In terms of regional matters, a full list of potential regional consent matters is included in Appendix 1, but in summary these relate to:

- Effects of vegetation removal on terrestrial habitats – rural zones, riparian margins, coastal areas, SEA's;
- Effects of vegetation removal on fauna (bats, birds, lizards) behaviour and their roosts/nests;
- Effects on streams and wetlands; and
- Earthworks effects – weed dispersal and sediment discharge

Ecological effects and associated impact management relating to district plan matters that are the focus of this assessment for the Project, have been presented in Section 8.3.1.

The Freshwater NES came into effect on 3 September 2020 and contains consent requirements for the construction of specified infrastructure involving vegetation clearance and works within certain natural wetlands and streams. Our preliminary view is that there may be wetlands within the Project Area that meet the definition of "natural wetland" and therefore discretionary consent under the Freshwater NES may be required for these works. The application of these consent requirements will need to be considered further as part of the future consenting process for the Projects. Delineation of these wetlands for the purposes of the Freshwater NES will require further site investigations and soil sampling to inform the detailed design of the Project. Generally, the alignment and design refinement process for each proposed designation has sought to avoid or minimise impacts on high value natural wetlands and streams. There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects.

Some potential effects of the Project (i.e. killing or harming) on individual specifically listed fauna and their nests/roosts is covered by the Wildlife Act 1953. For completeness these are recorded in the section below where they align with regional consent vegetation removal effects.

8.4.1 Terrestrial Habitat

Construction of the Project would result in temporary and permanent loss of vegetation within the Project Area, including suitable habitat that is potentially used by indigenous fauna (birds and lizards). This includes vegetation that is both a regional and a district plan matter (Appendix 1). Loss of district plan vegetation is discussed in Section 8.3.1.2.1.1. The amounts and types of terrestrial habitat and vegetation (including habitat used by indigenous fauna) to be lost as a result of the Project (District and Regional) is presented in Table 62.

Table 62 Potential area of permanent terrestrial habitat loss within the Project Area

Habitat Type	Habitat Code	Potential area to be lost (ha)	Bird habitat loss (ha)
Exotic Forest	EF	0.04	0.04
Exotic Wetland	EW	0.01	0.01
Planted amenity vegetation	PL.3	0.51	0.51
Exotic Treeland	TL.3	0.3	0.3
Total		0.86	0.86

The terrestrial habitats to be lost (temporary and permanent) are predominantly comprised of exotic vegetation which are of **Low** ecological value. However some of these provide valuable habitat to native fauna and this is discussed in Sections 8.4.1.1 to 8.4.1.3 below.

As the design develops and resource consent applications are prepared, more detailed habitat (such as SEV and Wetland Condition Index) and fauna surveys should be undertaken as required, to inform an EcIA (in line with the EIANZ Guidelines, which will be used to support the resource consent applications and should include any impact management requirements.

8.4.1.1 Bat habitat

Bats were not found to be present within the Project Area and no suitable bat habitat is considered to be present.

8.4.1.2 Bird habitat

The Project Area is likely to contain Not Threatened indigenous forest bird habitat, such as planted vegetation and treeland. Vegetation clearance required for construction could result in the loss of approximately 0.83 ha habitat, including stream branches and wetlands that could be used by these species and may affect nesting/breeding and feeding behaviour.

Impacts on birds through habitat removal would be managed through timing of vegetation clearance and habitat replacement. Although of low value any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

8.4.1.3 Herpetofauna habitat

Indigenous Copper skink (Not Threatened) are likely to be present within exotic vegetation impacted by the Project. There is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953. To mitigate habitat removal, methods can be developed during the future resource consent process to minimise any such effects. This could include, lizard salvage and potentially habitat replacement as appropriate. Further detail on these matters is presented in Appendix 10 Resource Consent – Lizard Management.

8.4.2 Freshwater Habitat

8.4.2.1 Streams

The construction of The Project could result in stream loss over one intermittent stream with a total stream loss of 4.8 m^2. This information is detailed in Table 63 and mapped in Appendix 7, Drawing SGA-EC-DL-010.12 to SGA-EC-DL-010.14. D3.S3 has been modified and degraded and is largely culverted through the Project Area. Where possible culverted sections beyond the immediate footprint of the Project should be daylighted and restored that are within the designation boundary.

Table 63 Potential stream loss within the Project Area (NoR D3)

Stream number*	Stream type	Wetted width of stream (m)**	Bank width (m)	Length to be lost (m)	Loss (m^2)**	>30m stream loss?	Notes
D3.S3	Intermittent	0.5	1	4.8	5	No	Existing culvert extension. The existing stream is culverted through private property. There is an opportunity to daylight the section beyond the culvert required.
Total Loss	**Permanent**			**NA**	**NA**		
	Intermittent			**4.8**	**5**		

Notes:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.12 to SGA-EC-DL-010.14
** = Assessments were carried out in drought conditions when it was difficult to accurately delineate stream width. Therefore, widths and areas are indicative

During the detailed design phase, culvert design will be confirmed. It is considered highly likely (based on the indicative design for the Project) that the stream will be culverted, resulting in a loss of instream and riparian habitat, and therefore impact management will be required. Under a future regional consent for earthworks, impact management would also be required to ensure sediment discharge to streams is controlled appropriately

8.4.2.2 Wetland Habitat

Construction of the Project could result in the partial loss of an exotic wetland. The manner in which the wetland is affected will be confirmed at the detailed design stage of the Project, however it is likely that some culverting or reclamation will occur, resulting in a loss of wetland habitat. Hydrological inputs to the wetland could also be affected by Project such as embankments and culverts altering flow regimes. Potential wetland loss is presented for the Project in Table 64, and mapped in Appendix 7, Drawings SGA-EC-DL-010.12 to SGA-EC-DL-010.14.

Table 64 Potential wetland loss for the Project

Site name*	Type**	Wetland size (m^2)***	Indicative area of impact/potential loss (subject to detailed design) (m^2)***	Notes
D3W1	Exotic Wetland (EW)	100	60	Wetland offset required.
Total		**100**	**60**	

Notes:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.12 to SGA-EC-DL-010.14
** = as classified in Singers *et al.*, 2017
*** = Assessments were carried out in drought conditions when it was difficult to accurately delineate wetland sizes. Therefore, areas are indicative.

One intermittent stream and one wetland location have been identified during the indicative and detailed business case process, route refinement and optioneering assessments and initial design phases and the design has been altered to minimise stream/wetland impacts. This has been partially guided by the ecological value assessment of streams and wetlands undertaken in Section 8.2.2.2.3 and 0 .

Table 63 details the estimated stream loss to be approximately 5 m^2 and Table 64 details estimated wetland loss to be approximately 60 m^2 as a result of the Project. As the design develops and regional and/or Freshwater NES resource consents applications are prepared, it is anticipated that an assessment of the effects on freshwater/wetland habitat will be undertaken and more detailed information collected on freshwater habitat classifications, along with the ecological value of streams and wetlands using the SEV stream survey method and Wetland Condition Index (Clarkson *et al.*, 2004) surveys (respectively).

At the detailed design stage, options to avoid or reduce the level of impact (including hydrological effects) to stream and wetlands can be considered e.g. bridges, reduction of embankments, reduction in the length of culverts, type of culvert etc. Where stream or wetland loss is unavoidable, an ecological effects assessment should be undertaken to determine if impact management is required.

Final ECR calculations will require SEV surveys to assess stream value and effects and to inform the potential requirement for stream compensation. However, potential compensation has been estimated on a preliminary basis using an ECR of 3:1[19] of stream restoration: stream loss. Assuming further avoidance is not possible, for the Project this would equate to intermittent stream compensation of approximately 15 m^2. Subject to detailed design assessment, the total area of potential wetland loss is currently estimated to be 60 m^2. Assuming a similar compensation ratio of 3:1, approximately 180 m^2 of wetland compensation could be required.

The proposed designation boundary for the Project Area extends beyond the construction footprint. This is due to construction area requirements, such as stream works which typically extend 20 m past the permanent works area upstream and 15 m down-stream. Additionally, a 6 m access track will also be required for construction access and larger areas will be required to accommodate stormwater wetlands, construction laydown, stockpile and site compounds. These requirements may change depending on the final design and scope of works, terrain and topography, however these large areas beyond the construction footprint provide opportunity to accommodate any future requirement for wetland or stream compensation/ offset within the proposed designation boundary.

Broad mitigation recommendations for stream/wetland compensation/offset opportunities should be tailored to address impacts on streams and wetlands resulting from the Project as the detailed design advances. Where possible this mitigation will be incorporated within the designation boundary.

8.4.2.3 Fish

Fish surveys were not undertaken as part of the field investigations for the NoR, however NIWA freshwater fish database and Auckland Council Catchment Assessment Reports were reviewed and highlighted the likely presence of a number of At Risk and Not Threatened native fish species within streams within the Project Area (Table 58).

It is anticipated that existing culverts on D3.S3 will be extended. The existing culvert has been identified as a potential barrier to fish passage (Appendix 7, Drawings SGA-EC-DL-010.12 to SGA-

[19] Considered to be an average estimate of ECR's in the Auckland Region.

EC-DL-010.14) and therefore habitat is likely to be fragmented and potentially unsuitable for fish SEV surveys required for the resource consent phase of the Project will identify if native fish are present within streams/wetlands and if there is suitable upstream habitat. If so, the Project could potentially result in a loss of upstream instream/wetland and riparian habitat and potentially cause habitat fragmentation. In addition, fish may be killed or injured during culvert installation/extension within the stream.

If required, culvert design considerations should allow for fish passage. In addition, fish recovery and translocation would be required as part of the future resource consents for the Project.

To minimise disturbance to fish, any instream works in intermittent streams should occur during the summer months when the stream is likely to be dry and fish are likely to be absent.

8.4.3 Positive effects/ Future Opportunities

Positive ecological effects are currently anticipated as a result of the Project and further positive outcomes and enhancement opportunities should continue to be developed during detailed design. If implemented, these are currently likely to include:

- The ability for future Project landscape planting to tie into the proposed vegetated corridors anticipated by the Drury -Ōpāheke Structure Plan, Blue-Green Network. Opportunities at specific locations have been outlined in the Project Assessment of Landscape and Visual Effects report;
- Net increase in green infrastructure and associated habitats within the Project Area associated with street trees, berm and stormwater plantings and planted stormwater wetlands. The Project Assessment of Landscape and Visual Effects report outlines recommendations to ensure ecological enhancement opportunities are capitalised upon at these locations.
- There are stream and wetland enhancement opportunities identified within Table 63 and Table 64. Where possible this could be incorporated within the existing designation boundary, beyond the construction footprint.
- Enhance vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

8.4.4 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native fish.

Almost all-original native habitat within and adjacent to the Project Area has been removed due to historical land use change. As the existing environment is highly modified, the specific Project impacts discussed within this report have been minimal and adverse effects have largely been avoided.

However, historical vegetation clearance and wetland drainage have made the landscape more vulnerable to cumulative effects relating to regional consenting considerations including:

- Greater risk of flooding and stormwater runoff. Without treatment and mitigation, the Waihoehoe Stream, Hingaia Stream and wider Drury Creek and Pahurehure Inlet would be the ultimate receiving environment for treated stormwater from the Project.
- Erosion and sediment control issues during construction could lead to further habitat degradation and adverse impacts on the downstream receiving environments. For example, sedimentation in the Drury Creek and Pahurehure Inlet could lead to the gradual spread of mangroves, at the expense of saltmarsh and open mudflat habitats;
- Cumulative stream loss and vegetation clearance have a high impact on catchments ecological function, water quality, hydrology and the native fauna that use these habitats (i.e. īnanga spawning habitat, eels etc). Consideration of a riparian habitat function and bankside setback need to be considered in the wider catchment context.

If developments, the (including the Project) and external developments contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced. This opportunity has been highlighted within the Drury-Ōpāheke Structure Plan and is anticipated to be reflected in future Plan Changes. This plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could potentially remediate cumulative effects in the long term.

8.4.5 Conclusion

Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features within or adjacent to the Project Area, for which future regional and/or Freshwater NES consent will be required, can be adequately managed in any future consent processes.

The proposed alignment to date has minimised effects on streams, wetlands and terrestrial habitats of value.

A review of the surrounding catchment highlights that there is potentially available stream or wetland habitat for offset/compensation within he proposed designation boundary if that is required.

9 NoR D4: Ōpāheke North-South FTN Arterial

Chapter Summary

Desktop studies and site investigations for terrestrial, freshwater and wetland habitats and native species (bats, birds and lizards) were undertaken within and adjacent to the Project Area to identify their ecological value.

The Project will impact upon mainly exotic terrestrial vegetation types of **Negligible** or **Low** value (regional and district vegetation). Although of Low value botanically, these features have been considered for their potential to support common, Threatened and At Risk native fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was considered to be **Very low** or **Low** and therefore no specific impact management has been recommended for these matters. Some **Moderate** value ecological features have been identified (as they relate to district plan matters):

- Forest birds – A Kahikatea stand (Critically Endangered) adjacent to the Project Area has potential for At Risk – Recovering kākā,
- Freshwater wetland birds – artificial wetlands (D4W1) there is potential for At Risk wetland bird species (New Zealand dabchick and Spotless Crake) to be present (although not breeding).
- Herpetofauna – At Risk – Declining Ornate skink (along with Not Threatened copper skink) are potentially present in rural and urban forests, grasslands and shrublands, in low scrub and sedges when habitat is connected to suitable native forest.

The magnitude of effects and overall level of effects from the construction and operation of the Project on these features was considered to be **Low** so impact management is not required.

The proposed alignment has minimised effects on streams, wetlands and terrestrial habitats of value. This includes the avoidance of several small stands of Indigenous kahikatea forest associated with the Waihoehoe Stream floodplain. Although direct impacts on this forest type have been avoided, as the project is directly adjacent to this forest habitat type impact management may be required to prevent indirect effects such as hydrological change caused by embankments and culverts.

Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features , such as streams and wetlands, can be adequately managed in any future consent processes and any requirement for offset/compensation could potentially be accommodated within the proposed designation boundary.

9.1 Project Description

9.1.1 Project Overview

The Ōpāheke North-South FTN Arterial is a new 30 m wide four-lane FTN arterial with separated walking and cycling facilities between Hunua Road in the north and Waihoehoe Road in the south. The road will be an urban arterial with a likely speed limit of 50 kph. The functional intent of the Project from a transport perspective is to increase connectivity and provide for good people-movement and public transport function through the FUZ. The Project will also support SH1, Great South Road and the proposed Mill Road corridor by providing a new corridor which will cater more to local north-south trips in Drury.

The road traverses greenfields zoned FUZ, crossing approximately seven streams (or tributaries of streams) and areas of flood plain, providing a new north-south connection between Drury and Papakura. The intersection with Hunua/Boundary Roads will be signalised, and roundabouts are proposed at Ōpāheke Road / Ponga Road, Walker Road and Waihoehoe Road. The intersection at

Waihoehoe Road is not included in this project extent (it is included within NoR D2). An overview of the proposed design is provided in Figure 18.

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposal include the following:

- A new road to enable a 30 m wide four-lane cross section including bus lanes and separate walking and cycling facilities
- Localised widening around intersections with existing roads to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Proposed new culverts
- Four proposed stormwater wetlands
- Two proposed bridges over Waipokapū Stream (approximately 120 m) and Waihoehoe Stream and floodplain (approximately 265 m)
- Batter slopes and retaining to enable construction of the corridor, and associated cut and fill activities
- Vegetation removal
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring.

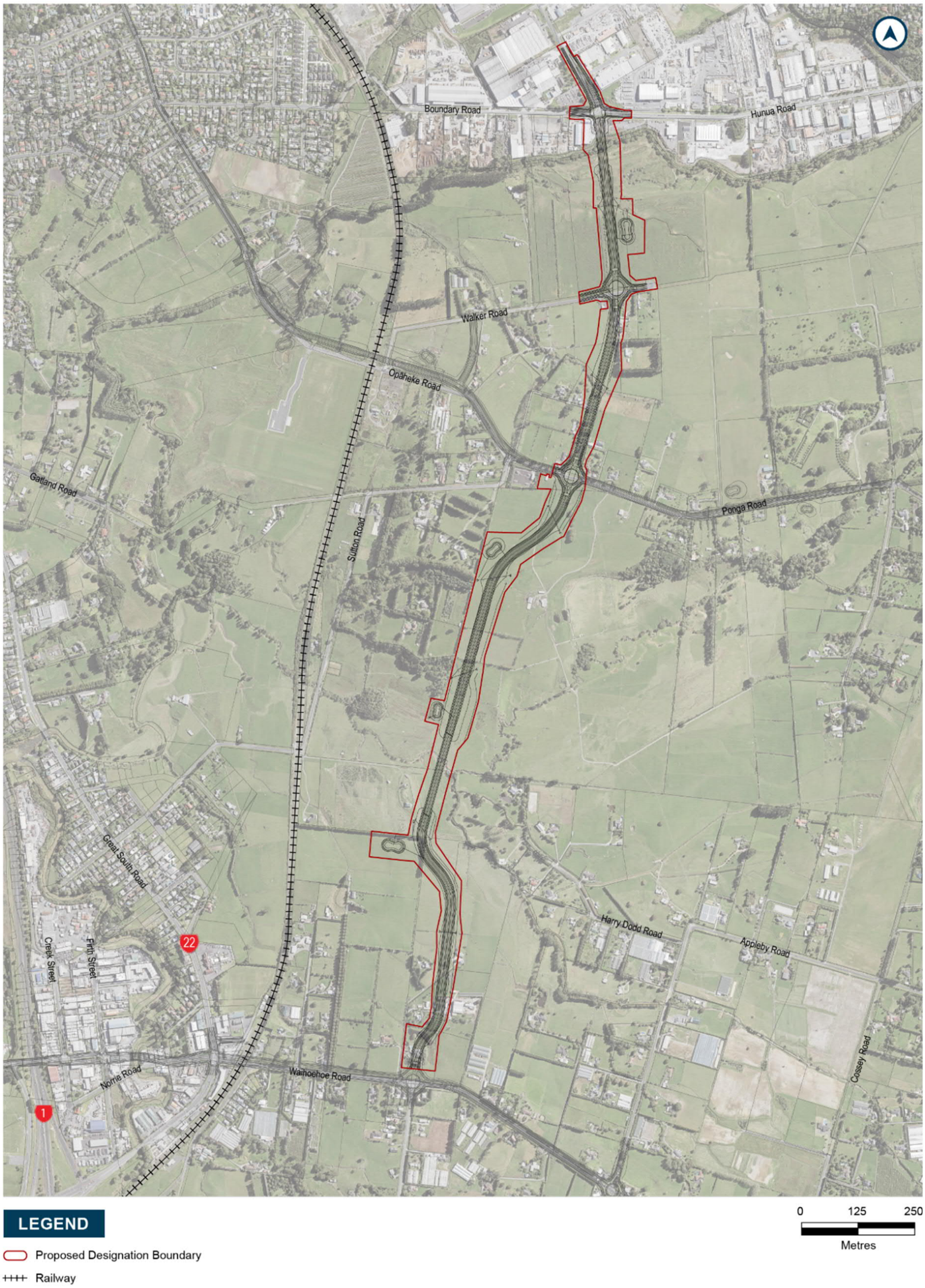


Figure 18 Overview of Ōpāheke N-S FTN Arterial (showing location only, refer design drawings)

9.1.2 Project Features

The new Ōpāheke North-South Road is generally located in greenfield area. Three new bridge structures will accommodate four lanes of traffic, including bus lanes and separated pedestrian cycle facilities. The proposed Project crosses a number of small streams and wetland areas which have been highly modified by agricultural practices in the past. The Project footprint will result in stream loss where culverts are installed, and some areas of vegetation removal will be required across the construction area.

The Waihoehoe Stream crossing is the most significant ecological feature in the Project Area. This stream corridor is part of a large floodplain area that would originally have been dominated by floodplain forest habitat prior to clearance for agriculture. The surrounding environment is highly modified with the majority of original indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. Either side of the proposed 245 m long Waihoehoe Bridge there are several small stands of secondary regenerating native forest within private properties. These areas have been actively avoided by the project and are outside the Project designation boundary. Although fragmented and not within SEAs, these areas have greater potential to support high value native species than the surrounding exotic vegetation. These areas contribute to the importance of the Waihoehoe stream corridor for the movement of native species. and therefore, it is important to ensure that connectivity is maintained along this floodplain corridor.

The Waipokapū Stream crossing and its associated floodplain also form a significant ecological feature within the Project area. The original indigenous vegetation has been removed and replaced with exotic vegetation associated with farms and private properties. Although exotic, the willow dominated treeland habitat associated with Waipokapū Stream contributes to the greater ecological value of this stream corridor, providing shading and stabilising banks against erosion. The retained floodplain wetlands, although cleared of original vegetation contribute to the importance of the Waipokapū Stream corridor for retained natural hydrological function and the movement of native species.

9.2 Ecological Baseline and Likely Future Environment

This section presents the findings of the desktop study (which includes a review of the documents listed in Section 5.1) and site investigations for all of the habitats and species ('ecological features') present within the Project Area. Based upon this information, an ecological value has been calculated for each ecological feature. The likely future environment in regard to these ecological features when the Project is constructed is discussed in Section 9.2.3.

9.2.1 Historical Ecological Context

the Project Area lies within the Mānukau Ecological District, which encompasses the Mānukau Harbour and the surrounding low-altitude land. The district has a warm, humid climate with mild winters. Soils throughout the district range from poorly drained to well drained, dependent on landform and the presence of localised volcanic areas (McEwen, 1987).

Most of the district was originally forested (Singers *et al.*, 2017). Original forest types were generally dependent on the landform and soils on which it grew:

- On free draining soils, pūriri forest (WF7[20]) was present; and
- On lowland, poor draining areas, kahikatea, pukatea forest (WF8) dominated.

Only 1.6% of the entire Mānukau Ecological District has native vegetation of any type remaining. Freshwater wetlands have been particularly affected, with over a 96% reduction in extent throughout the ecological district (Auckland Regional Council, 2004). 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 Mānukau Ecological District are well below these levels. The only significant area of natural landscape remaining is the Mānukau Ecological District are the unmodified coastal of the Mānukau Harbour. Any remaining examples of original forests or wetlands, or any regenerating native vegetation that is developing into vegetation that once clothed the district therefore needs to be considered as likely significant.

9.2.2 Habitats

9.2.2.1 Terrestrial Habitat

9.2.2.1.1 Desktop Review

Auckland Council Geomaps aerial imagery shows that throughout the Project Area, the original forest has been largely cleared and that the present-day terrestrial habitats are dominated by agricultural land.

Where intact natural habitat remains the AUP OiP has mapped and classified habitats as terrestrial SEAs. There are no SEAs within the Project Area. Where SEAs are present within 2 km of the Project Area, a description of the habitat remaining is presented below in Table 65. A map of SEAs relative to the Project Area is also provided in Appendix 7 Figure SGA-EX-DL-004.4. For completeness, terrestrial and marine SEA’s are presented. A conservative distance of 2 km was selected as the potential ZOI for adverse effects of the Project, but this is dependent on the potential receiving environment and the habitats and species present with a SEA.

Singers *et al.* (2017) notes that all of the Auckland region’s forest ecosystems are threatened to varying degrees. These include flood-plain kahikatea forests (MF4) which is present directly adjacent to the Project Area.

Table 65 Significant Ecological Areas present within 2 km of the Project Area (NoR D4)

SEA Name	Distance from Project Area (km)	SEA Description
SEA_T_77	0.2	Critically endangered kahikatea-pukatea forest (WF8).
SEA_T_545	0.6	Critically endangered pūriri forest (WF7).

[20] Habitat codes are from Singers *et al.* (2017) and Singer and Rogers (2014) and have been identified by Auckland Council as occurring in the Auckland region

SEA Name	Distance from Project Area (km)	SEA Description
SEA_T_5277	0.6	High habitat diversity, including endangered taraire, tawa, podocarp forest (WF9), vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13) and kānuka scrub forest (VS2). Habitat for the Threatened fish species longfin eel, and Threatened plant species including willowherb and fireweed. Also, habitat to rare plant species carmine rātā. This SEA is a buffer to a protected area.
SEA_M1-29b	1.0	A wetland system within the upper tidal reaches of Drury Creek; which grades from freshwater vegetation, through rush-dominated saltmarshes to mangrove habitat; forming an important migration pathway for many native freshwater fish species.
SEA_T_530	1.0	Habitat for Threatened plant species including mingimingi and *Picris burbidgeae*, and declining fish species īnanga. Also, habitat for rare plant species including korokio, kaikōmako and small-leaved kōwhai. This area is a buffer for a protected area and also buffers SEA_M1-29b.
SEA_T_7032	1.1	Habitat for nationally Threatened species, elegant gecko (Naultinus elegans), and has a diverse habitat including endangered taraire, tawa, podocarp forest (WF9), and kānuka scrub forest (VS2).
SEA_T_4361	1.2	Critically endangered pūriri forest (WF7), including kānuka scrub forest (VS2).
SEA_T_530b	1.2	Habitat for Threatened bird species, including pied oystercatcher and Caspian tern; and rare plant species kaikōmako.
SEA_M2-29a	1.2	Intertidal habitat; ranging from sandy mud flats, to current-exposed rocky reefs and a variety of saline vegetation. Areas of mangroves grow in Whangamaire Stream, and Drury and Whangapouri Creeks. In southern areas of Whangapouri Creek are eelgrass beds. Drury Creek is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Wading bird roosting area, including important area for pied stilt.
SEA_T_4562	1.5	Endangered taraire, tawa, podocarp forest (WF9) and kānuka scrub forest (VS2), which is a migration pathway for migrant species.
SEA_T_5430	1.6	Endangered taraire, tawa, podocarp forest (WF9) and endangered kauri, podocarp, broadleaved forest (WF11), including kānuka scrub forest (VS2). This SEA is a buffer for a protected area.
SEA_T_7033	1.6	Endangered taraire, tawa, podocarp forest (WF9), including kānuka scrub forest (VS2).
SEA_T_4362	1.7	Critically endangered pūriri forest (WF7), habitat for naturally uncommon plant species Danhatchia orchid.
SEA_T_4561	1.7	Habitat for rare plant species kaikōmako, and a migration pathway for migrant species.
SEA_T_5248	1.8	Critically endangered pūriri forest (WF7), habitat to rare plant species including Danhatchia orchid, kapuka and carmine rātā.
SEA_T_5323	1.8	Critically endangered kahikatea forest (MF4) and puriri forest (WF7). Habitat to Threatened fish species, including longfin eel, torrentfish and

SEA Name	Distance from Project Area (km)	SEA Description
		īnanga, as well as koura. Also found are Threatened plant species including pirata, or green mistletoe, and swamp maire. This SEA is a buffer to a protected area and has high habitat diversity, housing forest ecosystems including WF7, WF9, WF12, WF13, MF4 and MF24, and regenerating ecosystems including VS2 and VS5.
SEA_T_1173	1.9	Vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13), which is a migration pathway for migrant species.
SEA_T_1175	2.0	Critically endangered kahikatea forest (MF4).
SEA_T_409	2.0	Critically endangered kahikatea forest (MF4). Habitat for Threatened fish species longfin eel and rare plant species kaikōmako.

9.2.2.1.2 Site Investigations

The Project Area is dominated by exotic grassland and amenity planting (gardens and parks) with small areas of exotic forest, exotic scrub, wetlands, treeland and remnant forest fragments (Table 66). For completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 9.2.2.3.

Terrestrial habitats are highly modified and dominated by exotic species. However, small areas of native or mixed exotic vegetation occur within areas of planted native and exotic wetland habitat (for completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 9.2.2.3). These habitats retain a greater ecological function and have the potential to support a greater number of native species. The only indigenous habitat within the ZOI of the Project, was classified according to Singers *et al.* (2017) as Kahikatea Forest (MF4) and occurs in scattered patches along the Waihoehoe Stream with the closest stand directly adjacent to the Project Area along its western boundary. This habitat has a regional threat classification status of Critically Endangered in the Auckland Region (Singers *et al.*, 2017). Table 66 presents the vegetation types, identified within and directly adjacent to the Project Area. These are also mapped in Appendix 7, Figures SGA -EC-DL-008.01 and SGA -EC-DL-008.02

Table 66 Vegetation types present within and directly adjacent to the Project Area (NoR D4), classified according to Singers *et al.* (2017)

Vegetation Types	Alphanumeric Code*	Regional IUCN Conservation status	Description
Open Water	OW	N/A	Open bodies of water, including ponds.
Exotic Wetland	EW	N/A	Highly modified wetland system, now dominated by exotic plant species.
Exotic Scrub	ES	N/A	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species.

Vegetation Types	Alphanumeric Code*	Regional IUCN Conservation status	Description
Planted Vegetation	PL.1	N/A	Native restoration plantings with <50% exotic biomass. Planted native scrub and forest <20 years old.
	PL.3	N/A	Native and exotic plantings, which are limited to gardens throughout this NoR.
Exotic Grassland	EG	N/A	Grassland dominated by exotic species. Minimal cover/biomass from plants in any other vegetation tier. Grassland areas are predominantly areas of pasture.
Exotic Forest	EF	N/A	Forest vegetation with >50% cover of exotic species in the canopy.
Treeland	TL3	N/A	Exotic-dominated: <25% native with exotic tree cover dominant. This also includes areas of orchards, gardens, amenity plantings etc. Some areas of this include potential ornate skink habitat.
Kahikatea Forest	MF4	Critically Endangered	Remnant secondary stands of regenerating Kahikatea forest outside of the proposed designation boundaries. This small remnant stand of secondary regenerating native forest habitat has been impacted by grazing of livestock, preventing native understorey regeneration. Native tree species include kowhai, tōtara, cabbage tree and rewarewa.

* = from Singers *et al.* (2017).

9.2.2.1.3 Ecological Value

The terrestrial habitats within the Project Area are dominated by exotic grasslands, which is of **Negligible** ecological value (as assessed in accordance with the EIANZ Guidelines – refer Appendix 3 for detailed threshold criteria). Most other vegetation types across the Project Area are planted exotic habitat or self-seeded habitats such as scrub and treeland. These habitats are considered to be of **Low** ecological value (

Table 67) due to their low botanical diversity and predominance of weed species.

Low value habitat does not however, necessarily mean a vegetation type provides ‘no value’ habitat as it may provide some value in terms of ecosystem function, such as, bank stability and stream shading, or may provide habitat utilised by common, Non Threatened native species such as native birds and copper skink.

The Project Area also includes areas of **Moderate** ecological value such as planted native vegetation. Although isolated, these habitats have greater ecological function and therefore greater potential to support a wider diversity of native fauna and flora. These habitat types are also given greater value due to their potential in the long term. For example, native planted vegetation can mature into native forest.

A small stand kahikatea forest (MF4) occurs directly adjacent to the Project Area (Figure 19). It was identified through the options assessment for the Project and has actively been avoided during design. With a Regional IUCN threat status: Critically Endangered this remnant secondary stand of regenerating kahikatea forest is a small fragment of a once much greater floodplain forest associated with the Waihoehoe floodplain. Although dominated by Kahikatea, other native tree species include kowhai, tōtara, cabbage tree and rewarewa. This habitat is currently threatened by lowering of the water table due to artificial drainage, grazing by livestock and fragmentation which have led to weed invasion and competition with native and non-native species. Grazing by livestock has prevented natural regeneration of native understory and without protection from grazing the habitat will likely continue to degrade. Although degraded, this small forest has a greater potential to support a diverse range of native flora and fauna and is considered to be of **Very High** ecological value.

Figure 19 MF4 Kahikatea forest habitat adjacent to the Project Area

Table 67 Terrestrial habitat values for the Project (includes Kahikatea forest, directly adjacent to the Project Area)

Habitat Description	Alphanumeric Code (Singers *et al*., 2017)	Regional IUCN conservation status*	Value based on EIANZ Guidelines
Exotic Grassland	EG	NA	Negligible
Kahikatea Forest**	MF4	Critically Endangered	Very High
Planted Native Vegetation	PL.1	NA	Moderate
Planted Amenity vegetation	PL.3	NA	Low
Exotic treeland	TL.3	NA	Low

* = Information from Singers *et al.* (2017).

**Outside the Project Area but within the Project ZOI

9.2.2.2 Freshwater Habitat

9.2.2.2.1 Desktop Review

Auckland Council Geomaps layer ('Named Streams') indicates that there is a total of five permanent streams present which are crossed by, the Project Area. These include Waihoehoe Stream, Ōtūwairoa Creek tributary, Mangapū Stream Stream, Waipokapū Stream tributary and Waipokapū Stream. These are depicted in Appendix 7, Drawings SGA-EC-DL-010.15 to SGA-EC-DL-010.19.

Auckland Council commissioned Catchment Watercourse Assessment Reports for streams, including those streams within the wider Ōtūwairoa Creek catchment (Ingley *et al.,* 2015). This report provides baseline information on the existing condition of waterways, stream ecological health, including stream classification, wetland habitat assessment and selected representative SEV and macroinvertebrate surveys. Table 68 provides an overview of information collected from these surveys. The data within these catchment reports covers the entire catchment and are not specific to the sections of stream impacted by the Project.

Table 68 Desktop summary from Auckland Council Catchment Watercourse Assessment Reports for catchments within the Project Area

Catchment effected	Summary	SEV	MCI
Ōtūwairoa Creek (Ingley *et al.*, 2015)	Ōtūwairoa Creek is drained by four main watercourses, Ōtūwairoa Creek, Waipokapū Stream, Waihoehoe Stream, and Mangapū Stream. These discharge via Ōtūwairoa Creek to the upper Pahurehure Inlet of the Mānukau Harbour. The catchment is largely soft -bottomed and flows through a highly modified rural landscape, however the upper catchment in the eastern hill country, is dominated by indigenous forest. The Ōtūwairoa Creek section is largely urbanised where it flows through Papakura.	SEV scores calculated for the catchment ranged from 0.406 to 0.853, giving functional value of 'moderate' to 'high'	MCI scores ranged from 68.24– 125.44. Overall MCI scores ranged from poor to excellent.

9.2.2.2.2 Site Investigations

All streams within the Project Area were numbered, classified (permanent, intermittent or ephemeral) (Table 5) and mapped (Appendix 7, SGA-EC-DL-010.15 to SGA-EC-DL-010.19). An RHA was completed for all permanent and intermittent streams within the Project Area. The RHA scores are presented for instream habitat (instream habitat diversity, quality and quantity) and for riparian habitat (erosion, shade and buffering).

Eight streams were identified and assessed within the Project Area. Six were assessed as intermittent and two were permanent. The results of the stream classification and RHA values are presented in Table 69. Details on corresponding RHA scores for reference stream types are also presented in Table 69.

With the exception of the Waipokapū Stream (D4.S3) , all streams were representative of degraded systems. Primarily, this is due to historical indigenous vegetation clearance which has then been compounded by agricultural practices. Degradation includes grazing and pugging by livestock or ploughing of arable land, leading to erosion and sediment control issues and nutrient runoff. This degradation of riparian vegetation and increased nutrient inputs has also led to loss of bank stability, reduced shading and the proliferation of exotic macrophytes within the streams. Additionally, many streams have been physically altered, through dredging, reclamation and/or drainage of associated wetlands and/or channelization.

Site D4.S1, D4.S4, D4.S6, D4.S9 and D4.S10 measured low instream and riparian representation relative to its reference stream type. Site D4.S11 retains a moderate representation of its reference type in terms of habitat diversity and abundances, while site D4.S12 scored notably lower relatively to the same reference type. Site D4.S13 is highly representative of its reference stream type and generally measured very high instream habitat diversity, despite dominance of exotic willow treeland habitat along the stream corridor.

Table 69 Instream, riparian and combined RHA scores for the Project (NoR D4)

Site Name	D4.S1	D4.S4		D4.S6		D4.S9	D4.S10[21]		D4.S11	D4.S12		D4.S13	
Stream Name	Ōtūwairoa Creek Tributary	Ōtūwairoa Stream Tributary	Ref. Stream Type WW/HS/2/LG	Waipokapū Stream	Ref. Stream Type WW/SS/4/LG	Ōtūwairoa Creek Tributary	Ōtūwairoa Creek Tributary	Ref. Stream Type WD/VA/1/LG	Waipokapū Stream Tributary	Waipokapū Stream Tributary	Ref. Stream Type WW/SS/1/LG	Waipokapū Stream	Ref. Stream Type WW/SS/3/LG
Classification	**Intermit-tent**	**Intermit-tent**		**Perman-ent**		**Intermit-tent**	**Intermit-tent**		**Intermit-tent**	**Intermit-tent**		**Perman-ent**	
Instream Score %	25.0	10	60.0	31.7	63.3	11.7	11.7	55	25.0	16.7	35.0	85	50.0
Riparian Score%	32.5	20	95.0	37.5	82.5	32.5	32.5	100	70	25	97.5	77.5	87.5
Combined RHA Score %	28	14	74.0	34	71	20	20	73	43	20	60.0	82	65.0

[21] The scoring of this stream is based off an assessment of the same stretch of stream, D4S9

9.2.2.2.3 Ecological Value

The aquatic ecological value assessments for the respective sites are outlined in Table 12 for the Project. The assessment applied components presented within this report including: stream classification (hydroperiod and presence of pools), RHA (riparian and instream habitat representation, diversity), REC classification (stream order) and species of conservation importance, to assess the four matters (Representativeness, Rarity, Diversity and pattern, Ecological context) outlined within the EIANZ Guidelines. A precautionary approach was taken regarding the occurrence of fish species of conservation significance for all the intermittent and permanent streams within the Project Area identified during site surveys. As such, a high value descriptor was assigned for 'Rarity' to qualifying streams, specifically for the likely occurrence of longfin eel and īnanga (At Risk- Declining). SEV surveys will be required when the Project seeks resource consent. This will include fish survey which will allow for a more accurate assessment of rarity for the value assessment.

Table 70 Aquatic ecology value assessment for the Project (NoR D4)

Site Name	D4.S1	D4.S4	D4.S6	D4.S9	D4.S10	D4.S11	D4.S12	D4.S13
Representativeness	Very low	Very low	Low	Very low	Very low	Medium	Very low	High
Rarity	High	High	High	High	High	High	High	High
Diversity and pattern	Very low	Very low	Low	Very low	Very low	Medium	Very low	High
Ecological context	Low	Moderate	High	Moderate	Moderate	Low	Low	High
Ecological Value	Low	Moderate	Moderate	Moderate	Moderate[22]	Moderate	Low	Very high

9.2.2.3 Wetland Habitat

9.2.2.3.1 Desktop Review

No wetland habitat was identified during the desktop assessment for the Project. However, the lower reaches of the Waihoehoe Stream, Ōtūwairoa Creek, Mangapū Stream and Waipokapū Stream are part of a large floodplain system which periodically floods. Although, the majority of indigenous vegetation has been cleared and the ground drained, there is likely to be remnant wetland areas associated with this catchment (Ingley *et al.*, 2015).

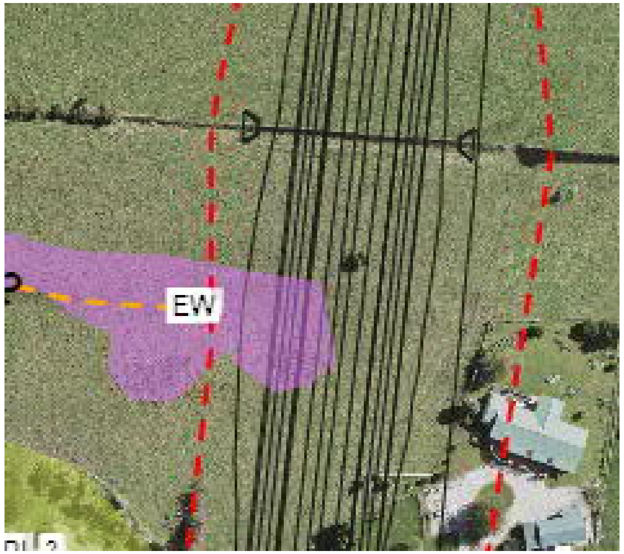
[22] The scoring of this stream is based off the assessment of the same stretch of stream, D4S9

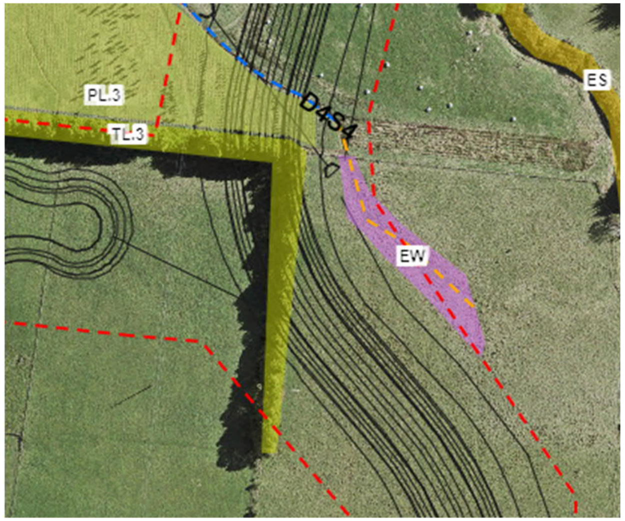
9.2.2.3.2 Site Investigations

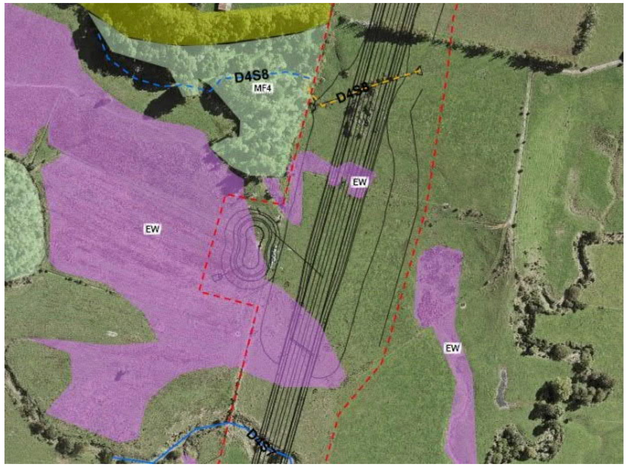
Wetland habitat was present within and adjacent to the Project Area as defined in Section 5.3.1.3. The wetland present was mapped and described as highly modified, exotic wetlands (EW) (Singers *et al.* 2017) and is described in Table 56. Table 13 below describe the wetland habitats present within and adjacent to the Project Area with drawings SGA-EC-DL-010.15 to SGA-EC-DL-010.19 presented in Appendix 7.

Table 71 Wetland habitats within and adjacent to the Project Area (NoR D4)

Site Name and Location	Description	Photograph of Habitat
D4W1 	Mapped and described as Open Water (OW) and Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Within the standing water obligate wetland species dominate such as parrots feather and fools water cress. On the water's edge facultative wetland species dominate including willow weed and soft rush. There is also a small stand of planted native wetland species including cabbage tree, kahikatea, flax and kanuka. The feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. The 1942 aerial indicates no obvious wetland features and therefore the wetland extent has likely been extended due to the construction of an on-stream farm	 

Site Name and Location	Description	Photograph of Habitat
	pond on an intermittent stream (Stream D4S1). The landscape position is however consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. These wetlands are unfenced and grazed by livestock.	
D4W2 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) include soft rush and willow weed. this feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants adapted to wet conditions. This wetland is associated with the ephemeral flow path (Stream D4S2). The 1942 aerial indicates no obvious wetland features; however, the landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. Additionally, as the flow path is unfenced and grazed it is affected by pugging from livestock and	

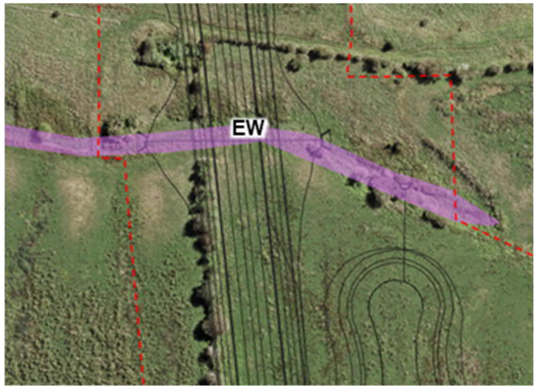
Site Name and Location	Description	Photograph of Habitat
	siltation from stormwater runoff. This has led to siltation which has also contributed to wetland conditions in the channel.	
D4W3  	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species are common but do not dominate, include soft rush and willow weed. Further assessment would be required to confirm if this area would meet wetland criteria. This feature is likely to meet the RMA definition of a wetland as it includes intermittently wet areas, that support plants that are adapted to wet conditions. This is a floodplain area associated with intermittent/ephemeral flow path (Stream D4S4) and the Waihoehoe Stream. As there is no obvious channel and facultative wetland species occur it is potentially best described as a wetland. However, this area has been modified for agriculture with original vegetation removed, land drainage and reseeded with improved pasture grasses. Wetland delineation may therefore require further investigation. Additionally, as the flow path is unfenced and	

Site Name and Location	Description	Photograph of Habitat
	grazed it is affected by pugging from livestock and siltation from stormwater runoff. The 1942 aerial indicates no obvious wetland vegetation however this area was already converted to agriculture at this time.	
D4W4 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) include soft rush and willow weed. This feature meets the RMA definition of a wetland as it includes intermittently wet areas, or shallow water that support plants adapted to wet conditions. This is a floodplain area associated with Waihoehoe Stream (D4S7). This area has been modified for agriculture but due to intermitently wet conditions is dominated by facultative wetland species. Land drainage and reseeding may have reduced wetland extent in some instances and therefore further survey may be required to delineate this area accurately. This habitat was unfenced and grazed by livestock. The 1942 aerial showsdense vegetation associated with the	

Site Name and Location	Description	Photograph of Habitat
	Waihoehoe Stream, which may indicate native floodplain wetland vegetation. However this area was already being converted to agriculture (along with associated land drainage and lowering of the water table) at this time and therefore, the extent of wetlands in the area are therefore inconclusive based on old aerials.However, the adjacent regenerating stands of kaihatea forest (MF4), indicates that this area was once part of a larger seasonally inundated floodplain forest.	

Site Name and Location	Description	Photograph of Habitat
D4W5 	Surveyed from the roadside due to access restrictions. Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) including soft rush and willow weed. This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that supports plants that are adapted to wet conditions. The extent of the wetland is expressed by wetland vegetation which is hydrologically maintained through a combination of hillslope (lateral) and upland (longitudinal) soil- and surface water flows. The 1942 aerial indicates that this wetland was likely channelised, which has potentially reduced its extent. The landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. The system has intermittent flow associated with D4S9; however, this has also been obstructed by a series of small dams/fords which have created	 

Site Name and Location	Description	Photograph of Habitat
	increased ponding in some locations. The extreme northern end of the wetland has a wider basin which may indicate the original extent of this modified system. This upper section is consistent with a valley head seep.	
D4W6 	Mapped and described as Open Water (OW) and Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Within the standing water obligate wetland species dominate such as parrots feather and fools water cress. On the water's edge facultative wetland species dominate including willow weed and soft rush. Planted trees surround the area of open water with mixed native and exotics including cabbage tree and flax, and exotic species such as crack willow and magnolia. This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. The 1942 aerial image indicates no obvious wetland features (other than the stream channel D4S11).	 

Site Name and Location	Description	Photograph of Habitat
	However, since the on-stream ponds have been created, upslope wetlands have developed potentially due to poor drainage around the ponds and therefore the expression of wetness may have been extended. The landscape position is however consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. Additionally, as the flow path is unfenced and grazed it is affected by pugging from livestock and siltation from stormwater runoff.	
D4W7  	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Obligate wetland species, parrots feather is present and facultative wetland species dominate (>50%) include soft rush and willow weed. This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. The wetlands present are a combination of hillslope (lateral) and upland (longitudinal) soil and	

Site Name and Location	Description	Photograph of Habitat
	surface water flows. The landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions. The system has intermittent flow associated with D4S12; however, this has also been obstructed by a series of small dams/fords which have created increased ponding in some locations. As the wetland is unfenced and grazed it is also affected by pugging from livestock and siltation from stormwater runoff. This has led to the modification of wetland conditions in the channel which remains permanently wet year-round.	
D4W8	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) and include Edgar's rush (native), soft rush and willow weed. Habitat is however variable with some areas wetter or drier, further survey may be required to delineate the wetland extent accurately. This feature meets the RMA definition of a wetland as it includes	

Site Name and Location	Description	Photograph of Habitat
	permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. This is modified floodplain wetland associated with the floodplain of the Waipokapū Stream (D4S13) which is inundated intermittently during flood events. The 1942 aerials indicate that these wetland areas are oxbow lake depressions which originate from old, cut of stream meanders of the Waipokapū stream. The existing stream now running further north. This area has been highly modified for agriculture with original vegetation removed, land drainage and reseeded with improved pasture grasses. Wetland delineation may therefore require further investigation.	

9.2.2.3.3 Ecological Value

Wetland habitats present within the Project Area includes areas of exotic wetland, dominated by exotic plant species, highly degraded through factors such as natural vegetation removal, artificial drainage and grazing and pugging from livestock. Although specific habitat assessments such as wetland condition assessment, were not undertaken in these areas, this preliminary assessment has identified that the ecological value of these exotic wetlands is **Moderate,** taking into consideration the overall reduction in wetland habitat across the Auckland region and the retained ecological functionality of these systems for attenuation of stormwater and excess nutrient removal.

9.2.3 Species

9.2.3.1 Bats

9.2.3.1.1 Desktop Review

DOC records; unpublished AECOM records, and one additional anecdotal record by G. Kessels (Personal Communication) confirm the presence of long-tailed bats within 10 km of the Project Area. Although no records are located directly within the Project Area; as a highly mobile species there is potential for bats to frequent any suitable habitat within the designation boundary. The conservation status of this species is 'Nationally Critical' (O'Donnell *et al.*, 2017). The records within 10 km of the Project Area (Appendix 7; Drawing SGA-EX-DL-006) include:

- 5.1 km to the west on Kopuhinahinga Island in the Pahurehure Inlet.
- 7.8 km to the south-west, near the SH22 intersection with Glenbrook Road
- 4.3 km to the east in the foothills of the Hunua Ranges.
- 7.5 km to the south west, within Coulthards Scenic Reserve near Paerata (Unpublished records from AECOM of long-tailed bats);
- 9.1 km to the south west, within the Paerata Scenic Reserve (Unpublished records from AECOM of long-tailed bats); and
- 9.3 km to the north, near the northern end of Mill Road and its intersection with Redoubt Road.

Further afield, there are multiple records within the Hunua Ranges and within farmland between Waiuku and Patumahoe.

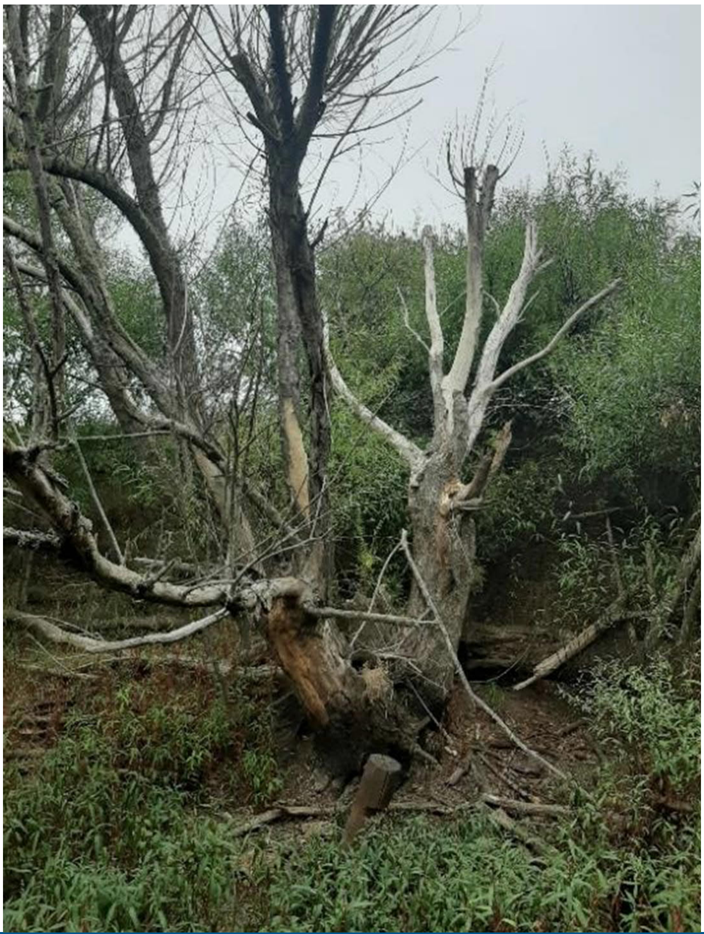
9.2.3.1.2 Site Investigations

9.2.3.1.2.1 Bat Habitat

The results of the site walkovers indicate that the Project Area contains potential habitat features which would be suitable for use by foraging and commuting indigenous long-tailed bats, despite bats not being detected within the area to date (refer to Section 6.2.3.1.2.2). These habitat features may include:

- Tree-lined stream corridors;
- Stands of mature trees, both native and exotic; and
- Shelterbelts.

Additionally, mature trees of a range of species (e.g. willow, poplar and oak) with suitable roosting features were identified within and adjacent to the Project Area. Suitable roost features that were identified included cracks and/or rot holes in tree trunks and branches, and loose, peeling bark, with cavities suitable for bats to potentially roost within (Figure 4). Appendix 7, Drawing SGA-EC-DL-012.01 highlights key habitat corridors within and adjacent to the Project Area.



Standing dead wood along Waipokapū Stream. Loose bark and branch cavities suitable for roosting bats.

Figure 20 Bat habitat present within the Project Area (NoR D4)

9.2.3.1.2.2 ABM Survey

Due to the large home ranges of bats and interconnectedness of bat habitat and ABM survey locations within the Project Areas, bat survey results have been presented collectively.

A summary of the ABM surveys are presented in Appendix 5 and ABM locations are presented in Appendix 7 SGA-EX-DL-002. Data was collected for at least one Session for all ABM sites, with nine locations collecting data for both Sessions (1 and 2). Analysis of the ABM data did not identify any bat activity within the ZOI of the Project. These results suggest that bats are not frequent visitors to the area within any during their mating and breeding seasons. However, as the desktop assessment suggests (Section 5.3.2.1), bats are highly mobile and have been recorded within 3km of the Project Area.

9.2.3.1.3 Ecological Value

The ABM surveys did not find any evidence of long-tailed bat (Threatened – Nationally Critical) activity at survey locations. However, there is some suitable habitat within some of the Project Area (refer Section 9.2.3.1.2) and bats are known to be present within the wider Hunua-Drury-Pukekohe landscape (9.2.3.1). As such, it is possible that bats may be present in the wider landscape but an infrequent visitor to the Project Area, since they were not detected in the surveys associated with this assessment.

On this basis, the ecological value of bat habitat throughout the Project Area is considered to be Low.

9.2.3.2 Birds

9.2.3.2.1 Desktop Review

Records of native bird species identified within 5 km of the Project Area, are collated in Appendix 8, Table 114. However, because many records do not include a specific location, a map was not produced of individual bird records.

Of the nationally listed At Risk or Threatened species recorded, most were coastal or freshwater bird species. As there is no suitable coastal or wetland habitat for these species within the Project Area, records these species were excluded as their potential for presence was considered highly unlikely.

Of the At Risk forest bird species recorded, the North Island kōkako (At Risk - Recovering) is a forest specialist with a known population in the Hunua Ranges, 10 km to the east. Any dispersing birds would be restricted to native forest habitat in the foothills of the Hunua Ranges to the east of the Project Area, and highly unlikely to ever visit habitat within the Project Area. They have therefore been excluded from further assessment within the Project Area. The North Island kākā (At Risk - Recovering) is also a forest specialist; but is known to disperse to seasonally available food sources, for foraging, particularly in winter. Therefore, it is considered kākā may frequent the scattered remnant forest patches of kahikatea directly adjacent to the Project Area.

9.2.3.2.2 Site Investigations

One Point Count bird survey was carried out adjacent to an artificial pond associated with the D4W1 wetlands (Figure 21), near the proposed roundabout junction with Waihoehoe Road (Bird Survey Site D4B1); and one 5MBC was carried out within a native kahikatea forest patch adjacent to the Project Area (Bird Survey Site D4B2 (Figure 21), see Drawing SGA-EX-DL-003.3 in Appendix 7 for locations).

Summarised results of these surveys are presented in Table 72, with full results in Appendix 8, Table 116.

D4B1

D4B2

Figure 21 Bird survey site D4B1 located on artificial pond within the Project Area and bird survey site D4B2 located within kahikatea forest adjacent to the Project Area.

Table 72 Summarised bird survey results indicating presence

Type and Location of Survey	Common Name	Scientific Name	Conservation status*	Frequency
Point Count **Bird Survey Site D4S1** **Artificial pond**	Mallard	*Anas platyrhynchos*	Int.	24
	White faced heron	*Egretta novaehollandiae*	NT	1
	Pūkeko	*Porphyrio melanotus*	NT	2
	Spur-winged plover	*Vanellus miles*	NT	2
5MBC **Bird Survey Site D4S2** **Treeland with kōwhai, tōtara, kahikatea, tree privet, tarata, barberry, Chinese privet, blackberry.**	New Zealand fantail	*Rhipidura fuliginosa*	NT	3
	Pūkeko	*Porphyrio melanotus*	NT	6
	Common myna	*Acridotheres tristis*	Int.	2
	Song thrush	*Turdus philomelos*	Int.	1
	Grey warbler	*Gerygone igata*	NT	1
	Chaffinch	*Fringilla coelebs*	Int.	2
	Silvereye	*Zosterops lateralis*	NT	20

Notes:
* = conservation status information from Robertson *et al.* (2016).
NT = Not Threatened
Int. = Introduced

9.2.3.2.3 Ecological Value

Only common native and introduced bird species where identified during the bird surveys, however the habitat was also assessed for its potential suitability to support Threatened and At Risk species. The At Risk – Recovering North Island kākā is a forest specialist but is known to disperse to seasonally available food sources such as remnant stand of native forest and pine plantations, particularly in winter. The kākā therefore may occasionally frequent the stands of native forest adjacent to the Project Area for seasonal foraging.

The At Risk – Recovering New Zealand dabchick and At Risk – Declining spotless crake were not recorded during the survey of the artificial pond associated with D4W1 (see **Table 71**), within the Project Area. As the wetlands are degraded and impacted by grazing animals, they are unlikely to support breeding individuals, therefore the value of these wetlands is diminished. Although these species may utilise the habitat for foraging, breeding habitat is suboptimal within the Project Area.

Table 73 below summarises the list of Threatened and At Risk bird species that may occur and indicates suitable habitat within or directly adjacent to the Project Area for each species.

Table 73 Presence of suitable habitat for key bird species within or directly adjacent to the Project Area

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online)	Suitable habitat within the Project Area
New Zealand dabchick	At Risk – Recovering	Occurs throughout the north island on freshwater lakes and ponds. Breeding on small shallow ponds with dense vegetation. Non-breeding birds flock on more open freshwater bodies (Szabo, 2013).	Likely only present sporadically/incidentally rather than making regular use of habitat present. Artificial ponds are unfenced and grazed by livestock, reducing habitat suitability for breeding.
Spotless crake	At Risk – Declining	Occurs throughout the north island on freshwater wetlands, dominated by dense emergent vegetation. Breeding wetlands with dense vegetation such as raupō (Fitzgerald, 2013).	Likely to be present sporadically/incidentally rather than making regular use of habitat present. Artificial ponds are unfenced and grazed by livestock, significantly reducing habitat suitability for breeding.
North Island kākā	At Risk – Recovering	Kākā are rare to uncommon in native forest on the mainland, with strongholds on pest free offshore island. Kākā however disperse widely during winter and regularly visit forest fragments and pine plantations in the Auckland area (Moorhouse, 2013).	Likely only present sporadically during winter foraging, rather than making regular use of habitat present. No suitable breeding habitat.

For the Project Area the ecological value of various bird habitat (forest and freshwater) present was considered in regard to the four matters outlined within the EIANZ Guidelines – Representativeness, Distinctiveness (including presence of Threatened or At Risk species), Diversity/pattern and Ecological context. The corresponding ecological habitat value (forest and freshwater) is presented in Table 74.

Table 74 Overall ecological value of bird habitat (forest and freshwater) within and adjacent to the Project Area (NoR D4)

NoR	Ecological value for bird habitats	
	Forest	**Freshwater wetland (D4W1)**
NoR D4	Moderate – Kahikatea forest adjacent to the Project Area (bird survey site D4B2) Low – remainder of the Project Area	Moderate

9.2.3.3 Herpetofauna

9.2.3.3.1 Desktop Review

Seven native lizard species are known to occur within the Mānukau District (Ecogecko, 2014) (Table 75). In general, the Drury area is poorly surveyed for lizards and therefore a 10 km buffer was used to review the DOC Bioweb database, Auckland Council records, and the iNaturalist website.

Most native lizards require indigenous habitat or surrogate habitat adjacent to contiguous native forest habitat area. Based on the desktop habitat assessment, there are several remnant stands of suitable native forest adjacent to the Project Area which may provide habitat for native lizard species listed within Table 75, however no suitable habitat for habitat was found within the Project Area suitable for Threatened or At Risk lizard species. The Not Threatened copper skink is however widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record is 500 m from the Project. It is therefore highly likely to occur within or adjacent to the Project area.

Table 75 Indigenous lizard species records within Mānukau District

Common Name	Latin Name	Threat Class (Hitchmough *et al.*, 2016)	Closest record source	Likelihood of presence within or adjacent to project area
Pacific gecko	*Dactylocnemis pacificus*	At Risk – Relict	DOC	Unlikely
Elegant gecko	*Naultinus elegans*	At Risk – Declining	Auckland Council	Unlikely
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining	iNaturalist	Unlikely
Copper Skink	*Oligosoma aeneum*	Not Threatened	DOC	Likely
Ornate skink	*Oligosoma ornatum*	At Risk – Declining	DOC	Possible
Shore skink	*Oligosoma smithi*	At Risk – Naturally Uncommon	DOC	Unlikely
Moko skink	*Oligosoma moko*	At Risk – Relict	DOC	Unlikely

It is highly unlikely that native frog species would occur within the Project Area, due to lack of suitable habitat. The only native frog species present within the Auckland Region is the Hochstetter's frog, the closest known records of which occur > 10 km away in the Hunua Ranges to the east of the Project Area.

However, Hochstetter's frogs do not disperse readily and require damp areas within native forest habitat (or occasionally in exotic plantation) to survive (van Winkel *et al.* 2018). Hochstetter's frogs have not been considered further for the Project, due to the lack of a potential source population and absence of suitable habitat.

9.2.3.3.2 Site Investigations

During the site investigations, no indigenous lizards or frogs were identified as incidental observations. However, the introduced plague skink was identified across the Project Area. Much of the habitat within the Project Area was identified as suitable for copper skink, such as planted vegetation, treeland (Figure 22), and areas of rank grassland. These areas are known to act as 'surrogate habitats' for this species in the Auckland region (van Winkel, Baling & Hitchmough, 2018). Additionally, potentially suitable habitat was identified for ornate skink. Ornate skinks occur in forests, grasslands and shrublands and often persist in rural and urban areas, when habitat is connected to suitable native forest. The vegetated stream corridors of the Waipokapū Stream and Waihoehoe Stream potentially provide suitable habitat corridors between stands of more continuous indigenous vegetation found beyond the Project Area.

Elegant gecko, Pacific gecko, moko skink and forest gecko have all been recorded within 20 km of the Project Area, within more contiguous forest habitat to the east of the Project Area. As there is no suitable intact indigenous habitat within the Project area it is highly unlikely that these species would persist.

Based on known habitat preference and habitat suitability, the skink species listed in Table 76 are therefore the only native herpetofauna species likely to, or having the potential to occur within and / or directly adjacent to NoR D4 to the Project Area.

Table 76 Native lizard species likely to be present within or directly adjacent to the Project Area (NoR D4)

Species	Conservation status (Hitchmough *et al.*, 2015)	Habitat Required (information from van Winkel *et al.*, 2017)	Habitat Present Within Project Area	Likelihood of presence
Copper skink	Not Threatened	A generalist, occurring in grassland, dry scrubland, closed forest and managed agricultural land and gardens (including urban gardens).	Yes	Highly likely within designation boundary
Ornate skink	At Risk – Declining	Forests, grasslands and shrublands, in low scrub and sedges. Persists in rural and urban areas, when habitat is connected to suitable native forest.	Yes	Likely along vegetated stream corridors and within suitable adjacent habitat.

Figure 22 Example of dense rank grass, scrub and treeland habitat within the Project Area, along the Waipokapū Stream corridor, providing a potentially suitable corridor for native ornate skink.

9.2.3.3.3 Ecological Value

It is highly likely that the Not- Threatened copper skink could be present through much of the Project Area in a wide variety of native and exotic habitats. In addition, there is suitable habitat within the Project area for At Risk – Declining ornate skink; although the likelihood of this species being present is lower due to their often-patchy distribution. Potentially suitable habitat occurs within the Project Area and these lizard species are likely to disperse within potential existing and future habitat corridors. As such the ecological value for lizard habitat within the Project Area is considered to be **Moderate**.

9.2.3.4 Fish

9.2.3.4.1 Desktop Review

The NIWA freshwater fish database and Auckland Council Catchment Assessment Reports (Ingley *et al.* 2015) were reviewed for fish records within stream catchments affected by the Project (Table 77). Of the species recorded as present, two had 'At Risk – Declining' conservation statuses: īnanga and longfin eel (Dunn *et al.* (2017)).

Table 77 Freshwater fish species recorded within the catchments effected by the Project

NoR	Stream	Species (orange shading indicates presence)									
		Īnanga	Longfin eel	Banded kokopu	Common bully	Common smelt	Crans bully	Shortfin eel	Freshwater mussel	Koura	Unidentified eel
Conservation status*		At Risk – Declining		Not Threatened							**
Ōpāheke North South FTN Arterial	Waipokapū Stream	U	U	U				U		U	
	Mangapū Stream		D	D			D	D	D		
	Waihoehoe Stream		D						D	D	

Notes:
U = record from upstream of the NoR
D = record from downstream of the NoR
* = fish species conservation statuses from Dunn *et al.* (2017); invertebrates (i.e. Koura) from Grainger *et al.* (2013).
** = conservation status could be either Not Threatened (if shortfin eel) or At Risk – Declining (if longfin eel).

9.2.3.4.2 Site Investigations

During the site walkover, streams were visually checked for the presence of any native fish species. An unidentified bully (*Gobiomorphus* sp.) was seen in Waihoehoe Stream. Other sightings included pest fish species mosquitofish. No dedicated fish surveys were undertaken as this will be carried out during SEV survey, required as part of a future resource consent application. The freshwater ecological value assessment took a precautionary approach and included the occurrence of species of conservation significance for all the intermittent and permanent streams identified during site surveys (Section 9.2.2.2). A high value descriptor was assigned to qualifying streams specifically for the likely occurrence of longfin eel and īnanga (At Risk- Declining).

9.2.3.4.3 Ecological Value

Although no fish records where identified within the Project Area boundary, At Risk species have been recorded within the wider catchment. Fish records indicated the presence of fish species with a conservation status of 'At Risk – Declining' (longfin eel and/or īnanga) within the Project Area.

It is considered that the streams within the Project Area would have **High** ecological value for native freshwater fish species.

9.2.4 Summary of ecological value for the Project (NoR D4)

Table 78 summarises the ecological values within and adjacent to the Project area, presented in Sections 9.2.2 and 9.2.3. Of the three major habitat groupings, the native forest habitat has the highest value, though as it occurs outside the project area it will not be directly affected. native wetland habitat and freshwater habitats have the highest ecological value. Waipokapū Stream (D4.S13) has also be highlight for its high value habitat. The majority of other ecological features have been given a Moderate value, indicating that the habitats are degraded or suboptimal but may retain some value for native species such as ornate skink or freshwater and forest birds. The extensive wetland areas are a notable example of moderate value habitat which occurs at several locations across the Project area.

Table 78 Summary of ecological values within and adjacent to the Project

Ecological Feature	Ecological Value
Terrestrial Habitat – exotic grassland, exotic treeland and planted amenity vegetation	Negligible and Low
Terrestrial Habitat – Planted native vegetation	Moderate
Terrestrial Habitat – Kahikatea Forest**	Very high
Freshwater Habitat	D4.S1, D4.S12 – Low D4.S4, D4.S6, D4.S9, D4.S10, D4.S11 – Moderate D4.S13 – Very high
Wetland Habitat	Moderate
Bats	Low
Birds – forest	Kahikatea forest adjacent to the Project Area – Moderate** Remainder of the Project Area – Low
Birds – freshwater (wetland D4W1)	Moderate
Herpetofauna	Moderate
Fish	High

** beyond the Project area but within the ZOI

9.2.5 Likely Future Environment

This section has been prepared to provide some context to how the assessment of ecological effects of the Project construction and operation (Section 9.3) has been undertaken in regards to the changing baseline or likely future environment of the areas within and surrounding the Project Area.

The existing landscape surrounding the Project Area is dominated by rural landuse with some light and heavy industry towards its northern junction with Boundary Road. The AUPOiP zoning/overlay identifies the land adjacent to the Project Area as FUZ, open space (conservation land) and heavy industrial. The future urban land will largely undergo a significant change from rural to urban over the next couple of decades. The AUPOiP only protects areas of ecological value that are protected by overlays, such as 'open space – Conservation Zone', which includes Waipokapū Stream esplanade reserve along the Northern bank of Waipokapū Stream, and SEA areas of which there are none in the Project Area.

The kahikatea forest directly adjacent to the designation boundary and within the ZOI of the Project is considered to be of **Very high** ecological value. This area has been actively avoided by the Project and is outside the Project designation boundary. One stand is identified as a group of notable trees in the AUPOiP which could be considered suitable for SEA or covenant in the future. Although fragmented and not within SEAs, these areas have greater potential to support high value native species than the surrounding exotic vegetation. These areas contribute to the importance of the Waihoehoe Sstream corridor for the movement of native species. Therefore, it is important to ensure that connectivity is maintained along this floodplain corridor.

Additionally, protection and enhancement of biodiversity is proposed through the Drury – Ōpāheke Structure Plan (Auckland Council, 2019). In the Structure Plan a 'Blue Green Network' (Appendix 7, Figure 30) is proposed which seeks to provide contiguous ecological linkages, connecting significant terrestrial and marine ecological areas through restored riparian margins 10-20 m wide. This places greater emphasis on the protection and enhancement of existing watercourses and areas of significant natural value, requiring these areas to be accommodated within the future urban environment. Although the Structure Plan does not hold any formal statutory weight and may change, it is likely that there will be expectation that future development will be consistent with the proposed blue green network.

In light of this context, it is assumed that in a future urbanised scenario, permanent streams, wetlands and areas of indigenous vegetation will generally be avoided by development and retained. It is also assumed that stormwater design will be integrated into the proposed 'Blue Green Network' and sediment and pollutants will be controlled at source. For example, if riparian habitat restoration is implemented appropriately, it is considered that in a future scenario many of the features of value could be similar to existing, or in some cases, enhanced.

The majority of native species assessed within this report are generally adaptable to human modified environments and therefore it is possible that despite the potentially negative implications of urbanisation (disturbance, habitat loss and fragmentation) these species may remain, where suitable habitat is retained. However, as the urban landscape becomes less permeable to wildlife the viability of these species will become increasingly dependent on the quality of catchment wide mitigation within the Project Area and surrounding FUZ.

Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species and may even be improved for some species Pre-construction surveys to confirm a change in ecological value are not required because there are no ecological features effected by the Project within the Project Area that result in a **Moderate** or higher level of ecological effect (as they relate to district plan matters).

9.3 Assessment of Ecological Effects and Impact Management Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

As discussed in Section 4.1, this assessment has been prepared to support the NoR D4 and has been undertaken in the context of the ecological baseline and the likely future environment that has been described in Section 9.2. When assessing the actual or potential ecological effects of allowing the Project, this assessment has been limited to matters that would trigger a district plan consent requirement and presented in Section 9.3.1 and 9.3.2 below.

Where regional and/or Freshwater NES consenting requirements are triggered, these will not be authorised by the designation, and will require further consents. In order to demonstrate the jurisdictional split between regional and district plan matters, we have included a table as Appendix 1 which identifies the potential ecological effects of the construction and operation of the Projects, and whether these are regional, or district plan matters under the AUP OiP.

Although regional/Freshwater NES consents are not being sought at this stage, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree as part of this report to inform design, options assessment and the proposed designation footprint. For regional matters, this has included the identification of any areas of significant value or habitats for the purposes of design and alignment decisions along with identification of future resource consent requirements. This information is presented in Section 9.4 – Design and Resource Consent Considerations.

9.3.1 Assessment of Construction Effects

9.3.1.1 Summary of Potential Construction Effects, Prior to Impact Management

The proposed construction activities have the potential to cause impacts on ecological features of value within and adjacent to the Project Area, without impact management.

Potential construction effects that relate to district plan matters are presented in Appendix 1**,** and are summarised below:

- Vegetation removal (that triggers district plan controls) leading to the permanent loss of terrestrial habitats; and
- Construction activities causing light, noise and vibration leading to the disturbance and displacement of indigenous fauna.

9.3.1.2 Magnitude of Construction Effects

The magnitude of construction effects (prior to impact management) listed above on impacted ecological features (Section 9.2) are discussed in the following sections (Section 9.3.1.2.1 and 9.3.1.2.2).

9.3.1.2.1 Habitats

9.3.1.2.1.1 Terrestrial Habitat

Section 9.2.2.1 describes all habitat types present within the Project Area. The Project Arboricultural report identifies the vegetation that is district plan related e.g. within the existing road space and therefore considered a district plan matter for inclusion in this assessment of effects.

For NoR D4 there are no trees/vegetation identified within the Project Area that are subject to district plan controls that will be removed due to the Project, as such the magnitude of effects is considered to be **Negligible.**

9.3.1.2.2 Species

9.3.1.2.2.1 Bats

Bats have not been detected within the Project Area during field surveys or from the review of existing databases and literature. However, potentially suitable habitat has been identified for long-tailed bats within the Project Area, including vegetated stream corridors and exotic trees. Long-tailed bats have previously been recorded outside of the Project Area (within 4 km) and therefore given the large home range of this species, and suitability of habitat, they could potentially occur within the Project Area (see Section 9.2.3.1. During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. It is currently planned that a site compound will be located adjacent to the Waipokapū Stream and Waihoehoe Stream, which could be used as commuting corridor by bats. 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. As the Project crosses greenfield, the Project Area is currently unlit. Where practicable light spill from construction compounds into the stream corridors should be minimised as bat behaviour may be altered by additional artificial lighting. Where possible stream corridors should be retained as dark corridors to minimise impacts on nocturnal species.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. At present bat roosts have not be confirmed within the designation boundary, but mature trees that could be used as roosts are known to be present. The willow trees along the Waipokapū Stream, for example, provide potentially suitable roost locations for bats.

Bats have not been detected within or adjacent to the Project Area and this assessment is based upon habitat potential and desktop records. It is considered unlikely that construction activities would result in the disturbance or displacement of individuals or their roosts because they are likely infrequent visitors to the area. As such, the magnitude of effect on bats is considered to be **Low**.

9.3.1.2.2.2 Birds

Noise, vibration and lighting disturbance caused by construction activities could potentially displace indigenous birds from suitable nesting and foraging habitat adjacent to the Project area.

As there are two distinct areas of habitat types supporting two different communities of birds within the Project Area, the magnitude of effect on bird species has been broken into two sections – forest bird and freshwater wetland bird.

Forest bird habitat:

The forest birds which occur within the ZOI of the Project are common in the local area (modified agricultural land and exotic wetland) and the majority of habitat is considered to be of **Low** ecological value. They are adapted to human modified environments, and suitable foraging habitat of equal or better quality will remain adjacent to the Project area during construction. The stand of native forest potentially suitable for At Risk – Recovering kākā is not considered key habitat and is far enough away from the Project for the magnitude of effects to be considered as **Low**. Overall, the magnitude of effects from the Project construction activities on the local bird population is considered to be **Low**.

Freshwater wetland bird habitat:

New Zealand dabchick (At Risk- Recovering) and spotless crake (At Risk- Declining) may frequent the online pond located at wetland D4W1 (Section 9.2.3.2.2; Table 71). This artificial pond will be removed to accommodate the Project and the surrounding wetland area will largely be retained. New Zealand dabchick or spotless crake were not identified at the time of survey and the habitat for these species is considered suboptimal. Assuming that conditions remain the same, it is assumed that New Zealand dabchick and spotless crake are unlikely to be breeding at this location and therefore, the magnitude of effects is considered to be **Low**. It is however recommended that pre-construction surveys are undertaken at this location, as any significant change in the habitat quality could alter suitability for these species. For example, if the pond was fenced and grazing pressure reduced, this habitat could become more suitable for breeding.

9.3.1.2.2.3 Herpetofauna

Indigenous copper skink (Not Threatened) are likely to be present throughout the Project Area within any suitable surrogate habitat, such as rank grassland, treeland habitat along stream corridors and planted vegetation. There is also the potential for Ornate skink to be present within similar habitat, although, ornate skink are only likely to be found along the key stream corridors where these habitat features are connected to adjacent stands of native forest habitat beyond the Project area.

Noise, vibration and lighting disturbance caused by construction activities could displace indigenous lizards locally during construction, however suitable habitat is present adjacent to the Project Area and therefore the magnitude of effects from the Project on the local lizard population is considered to be **Low**.

9.3.1.3 Level of Ecological Effects – Construction

In accordance with EIANZ Guidelines the level of ecological effects from the construction of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the Project construction.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern; however, the Project will also need to comply with the Wildlife Act 1953 if applicable.

Table 79 below summarised the overall level of ecological effects for each key ecological feature and fauna group related to the Project before impact management is applied. Section 9.3.1.3 addresses the impact management measures required to minimise any residual effects associated with construction.

Table 79 Summary of potential ecological effects (prior to impact management) during construction based on ecological value and magnitude of the effect

Ecological Feature	Ecological Value	Magnitude of Construction Effects	Level of Ecological Effect (prior to impact management)
Terrestrial habitat – district matters	Low	Moderate	Low
Bats	Low	Low	Very low
Birds – forest	Moderate and Low	Low	Low
Birds – freshwater (wetland D4W1)	Moderate	Low	Low
Herpetofauna	Moderate	Low	Low

The assessment identified that the level of ecological effects from the construction of the Project on all ecological features are **Very low** or **Low**. In accordance with the EIANZ Guidelines impact management measures are proposed for those effects **Moderate** and above and as such impact management is not required for the Project's construction effects.

9.3.2 Assessment of Operational Effects

9.3.2.1 Summary of Potential Operational Effects, Prior to Impact Management

The Project involves the construction of a new 30m wide four-lane arterial route through greenfields with separated walking and cycling paths. Currently the greenfield corridor has low levels of fragmentation, noise and lighting and therefore these impacts are likely to change considerably from the existing baseline. These changes will be considered when assessing the magnitude of effects on ecological features or species that would not necessarily be habituated to road infrastructure.

In general, potential operational effects from the Project that relate to district plan matters are presented in Appendix 1, and are summarised below.

- Loss in connectivity to indigenous fauna (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The magnitude of these operational effects is discussed in Section 9.3.2.2.

9.3.2.2 Magnitude of Operational Effects

9.3.2.2.1 Bats

Although bats themselves have not been detected during surveys, suitable habitat has been identified for long-tailed bats along vegetated stream corridors which cross the Project Area.

It is known that the loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The existing green corridor is unlit and would likely have LED lighting columns installed along the full Project area. As the area will be coming increasingly urbanised any bat would be habituated to existing light levels and may already avoid the existing road corridor. However, where practicable and taking safety into consideration, it is recommended that lighting is minimised along stream corridors (Waipokapū Stream and Waihoehoe Stream). This could be achieved by removing tall lighting columns where the project crosses the stream corridor. Low/ground level lighting for pedestrian safety could be maintained as required. Maintaining dark corridors for wildlife will allow for reduced habitat fragmentation and will minimise alteration to behavioural patterns.

As bats have not been recorded within or adjacent to the Project Area, it is considered unlikely that the operation of the Project would result in the disturbance or displacement of individuals or their roosts. As such, the magnitude of effect on bats is considered to be **Low**. It is recommended that ABM surveys are repeated along potentially high value habitat areas such as the Waipokapū Stream and Waihoehoe Stream prior to regional consent applications. If during the resource consent phase of the Project, bats are found to be present within or adjacent to the Project Area, the magnitude of effects would increase, and more specific impact management would be required.

9.3.2.2.2 Birds

The operational impacts from the Project on birds are similar to those described in section 9.3.2.2.1 on bats. Birds could also be displaced as a result of light spill and noise during operation and habitat fragmented where the Project crosses known habitat corridors. Loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bird foraging habitat. As the area will become increasingly urbanised birds may become habituated to existing light levels or may already avoid the proposed road corridor. However, where practicable, low/ground level lighting for pedestrian safety could be used along dark stream corridors to reduce habitat fragmentation and minimise alteration to behavioural patterns. The species present are those species which have adapted to use habitats modified by humans and as such, the magnitude of effects from the Project are considered to be **Low**. New Zealand dabchick (At Risk - Recovering) and spotless crake (At Risk - Declining) may be present at the online pond located at D4W1, which will be removed to accommodate the Project. However, it is considered that the removal of the wetland due to the presence of the road will not cause any loss in connectivity for New Zealand dabchick, as wetland value for the species is low. As such the magnitude of effects are considered to be **Low**.

9.3.2.2.3 Herpetofauna

Indigenous lizard species have been identified in the local area and there is the potential that:

- Copper skink (Not Threatened) could be present within suitable rank grassland, treeland and planted vegetation across the Project Area; and
- Ornate skink could be present within vegetation along key stream corridors (Waipokapū Stream and Waihoehoe Stream). See Drawing SGA-EX-DL-007.1.

Native lizards require vegetated corridors (such as riparian stream corridors) to facilitate natural dispersal. Road and culvert construction could create barriers to the movement and dispersal of lizards along stream and terrestrial vegetated corridors. However, the bridge construction at Waipokapū Stream and Waihoehoe Stream could maintain connectivity for these species where suitable habitat is retained. During detailed design/resource consent, connectivity should be retained for lizards including appropriately vegetated corridors under bridges or include ledges within culverts or under bridges.

As the area will become increasingly urbanised any lizards may become habituated to existing light levels or may avoid the proposed road corridor. However, where practicable, low/ground level lighting for pedestrian safety could be used along dark stream corridors to reduce habitat fragmentation and minimise alteration to behavioural patterns.

Overall, it is considered that the magnitude of operational Project effects on indigenous lizards would be **Low**, without impact management.

9.3.2.3 Level of Ecological Effects – Operation

In accordance with EIANZ Guidelines the level of ecological effects from the operation of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the operation of the Project.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern.

Table 80 summarises the potential ecological effects of the Project during operation.

Table 80 Summary of potential ecological effects (prior to impact management) during operation based on ecological value and magnitude of the impacts

Ecological Feature	Ecological Value	Magnitude of Operational Effects	Level of Ecological Effect (prior to impact management)
Bats	Low	Low	Very low
Birds – forest habitat	Moderate and Low	Low	Low
Birds – freshwater (wetland D4W1)	Moderate	Low	Low
Herpetofauna	Moderate	Low	Low

The assessment identified that the level of ecological effects of the operation of the Project on all ecological features was **Very low** or **Low**. In accordance with the EIANZ Guidelines impact management measures are proposed for those effects **Moderate** and above and as such impact management is not required for the Project operational effects.

9.3.3 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native birds.

Almost all original native habitat within and adjacent to the Project Area has been removed due to historical land use change. As such, the types of fauna generally remaining within the habitats are Not Threatened native or exotic species, which are generally adaptable to modified environments. Common Not Threatened native species like copper skink, are considered very likely to occur within these modified, low value habitats (e.g. rank grass, scrub) within the Project Area. The ongoing long-term incremental loss of low value habitat may however cause detrimental effects on local populations of 'common' species, which within a project specific context would not normally require impact management under the EIANZ Guidelines. As low value habitats are likely to be altered by the Project and by other external projects (surrounding development), the risk of significant habitat degradation for Not Threatened species such as copper skink is likely to be cumulative and must be considered in the wider regional context.

Many native fauna species have wide ranging and complex habitat requirements, such that small, incremental changes in habitat quantity or quality could have unforeseen adverse effects on their ability to persist in the landscape over time. Historical vegetation clearance (loss of buffer vegetation) and wetland drainage (fragmentation) have also made the landscape more vulnerable to such cumulative effects, as issues become more acute. District Plan matters relating to disturbance (such as lighting, noise and vibration) may not adversely affect native lizards in the short term, as they become habituated. However, potential gradual incremental changes in habitat, caused by surrounding urbanisation, such as fragmentation and reduced foraging capacity, could reduce viability of native fauna persisting over time.

All developments within the Drury-Ōpāheke Structure Plan area should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Structure Plan area and its catchments.

If the developments (including this Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced, and the buffering effect of riparian habitat restoration could reduce disturbance (e.g. Lighting from surrounding urbanisation). The opportunity to enhance stream corridors through riparian planting has been highlighted within the Drury-Ōpāheke Structure Plan and it is anticipated that this will be reflected within future Plan Changes. This Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

9.3.4 Summary and Conclusions

Ecological features were assessed for their potential to be adversely affected from the construction and operation of the Project relating to district plan matters. All of the relevant habitat (terrestrial – district plan only) and fauna species (bats, birds and lizards) were assessed to be of **Very low** or **Low** level of effect from the construction and operation of the Project and therefore no specific impact management has been recommended.

The Waihoehoe Stream and Waipokapū Stream have been identified as the main corridors of ecological value associated with the Project Area due to retained connectivity for wildlife and associated floodplain wetlands. Additionally, these corridors have the potential to support At Risk Declining species such as ornate skink. In a future scenario when the surrounding environment is likely to be urbanised, the importance of these stream corridors will be even more important as the urban environment becomes less permeable to the natural movement of native species. These areas should be prioritised for retention and enhancement in line with Structure Plan recommendations for the 'Blue-green network'.

9.4 Design and Resource Consent Considerations

Although resource consents are not being sought for the Project at this stage, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree to inform design, options assessment and the proposed designation footprint of the Project. The outcome of this analysis is presented below. This includes the identification of any ecological features of value for the purposes of design and alignment decisions and to identify future consenting requirements.

In terms of regional matters, a full list of potential regional consent matters is included in Appendix 1, but in summary these relate to:

- Effects of vegetation removal on terrestrial habitats – rural zones, riparian margins, coastal areas, SEA's;
- Effects of vegetation removal on fauna (bats, birds, lizards) behaviour and their roosts/nests
- Effects on streams and wetlands; and
- Earthworks effects – weed dispersal and sediment discharge.

Ecological effects and associated impact management relating to district plan matters that are the focus of this assessment for the Project have been presented in Appendix 1.

The Freshwater NES came into effect on 3 September 2020 and contains consent requirements for the construction of specified infrastructure involving vegetation clearance and works within certain natural wetlands and streams. Our preliminary view is that there may be wetlands within the Project Area that meet the definition of "natural wetland" and therefore discretionary consent under the Freshwater NES may be required for these works. The application of these consent requirements will need to be considered further as part of the future consenting process for the Projects. Delineation of these wetlands for the purposes of the Freshwater NES will require further site investigations and soil sampling to inform the detailed design of the Project. Generally, the alignment and design refinement process for each proposed designation has sought to avoid or minimise impacts on high value natural wetlands and streams. There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects.

Some potential effects of the Project (i.e. killing or harming) on individual specifically listed fauna and their nests/roosts is covered by the Wildlife Act 1953. For completeness these are discussed in the section below as they are aligned with regional consent vegetation removal effects.

9.4.1 Terrestrial Habitat

Construction of the Project would result in temporary and permanent loss of vegetation within the Project Area, including suitable habitat that is potentially used by indigenous fauna (bats, birds and lizards). This includes vegetation that is both a regional and a district plan matter (Appendix 1). Loss of district plan vegetation is discussed in Section 9.3.1.2.1.1 The amounts and types of terrestrial habitat and vegetation (including habitat used by indigenous fauna) to be lost as a result of the Project (district and regional) is presented in Table 81. Given the wide extent of copper skink habitat, only habitat suitable for the At Risk lizard species is presented.

Table 81 Potential area of permanent terrestrial habitat loss within the Project Area

Habitat Type	Habitat Code	Potential area to be lost (ha)	Bat habitat loss (ha)	Bird habitat loss (ha)	Lizard habitat loss (ha)
Exotic Grassland	EG	0.06	N/A	N/A	N/A
Exotic Wetland	EW	0.8	0.8	0.8	N/A
Open Water	OW	0.1	0.1	0.1	N/A
Planted Vegetation	PL.1	0.09	N/A	0.09	0.09
	PL.3	0.3	N/A	0.3	0.3
Treeland	TL.3	0.4	0.4	0.4	0.4
Total		**1.8**	**1.3**	**1.7**	**0.8**

The terrestrial habitats to be lost (temporary and permanent) are predominantly comprised of exotic vegetation which are of **Low** ecological value. However some of these provide valuable habitat to native fauna and this is discussed in Sections 9.4.1.1 to 9.4.1.3 below.

A small stand kahikatea forest (MF4) with a Regional IUCN threat status: Critically Endangered, occurs adjacent to the Project Area. This area has been actively avoided through options assessment and design and is not directly impacted by the Project. During the detailed design phase, continued consideration should be given to protecting this habitat from the adverse impacts of the Project such as modification to hydrological regimes (flooding).

As the design develops and resource consent applications are prepared, more detailed habitat (such as SEV and Wetland Condition Index) and fauna surveys should be undertaken as required to inform an EcIA (in line with the EIANZ Guidelines) and should include any required impact management requirements.

9.4.1.1 Bat habitat

Bats were not found to be present within the Project Area. However, given the potential Project impacts from vegetation removal and the conservation status (Nationally Critical) of bats, the presence of bats and potential effect of the Project should be re-evaluated as part of the subsequent resource consent phase, prior to construction. As appropriate repeat ABM surveys should be carried out to support this process. Potential vegetation of value for future assessment of potential bat foraging and roosting habitat, has been highlighted in Appendix 7, Drawing SGA-EX-DL-012.1. This includes vegetated stream corridors with mature trees along the Waipokapū Stream and Waihoehoe Stream. As the Project moves into the resource consent phase, the Project landscape design should incorporate the ‘Blue Green Network’ within the Project Area (Appendix 7, Figure 30). Key aspects of this mitigation should include the protection of mature trees (exotic and native) with bat roost potential where possible and retention of riparian vegetation along stream corridors, particularly at bridge crossing points or where transport corridors bisect mature vegetation, as well as bespoke low-lumination artificial lighting regimes near key known habitats. As a gleaning species long-tailed bats fly at canopy height commuting and foraging along forest edges and stream corridors (Borkin & Parsons, 2009; O’Donnell *et al.*, 2006). Where this canopy is maintained and/or enhanced to a height >4.3 m (max height for standard vehicles) (NZ Transport Agency, 2019) above the vehicle deck, bats are likely to maintain a safe distance from moving traffic and therefore avoid any adverse interaction with the transport corridor. Suitable vegetation (native or exotic) of this height, can act as bat 'hop-over' vegetation and could be retained and enhanced where possible in areas where potential commuting corridors could occur within the Project Area (Appendix 7, Drawing SGA-EX-DL-012.1).

9.4.1.2 Bird habitat

The Project Area is likely to contain Not Threatened indigenous forest and freshwater wetland birds. There is also potential that At Risk bird species such as New Zealand dabchick and spotless crake will utilise artificial ponds present within the Project Area and their presence should be re-assessed prior to construction.

Vegetation clearance required for construction could result in the loss of approximately 1.75 ha of Not Threatened indigenous bird habitat, including exotic treeland and planted vegetation. Although of low value any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

9.4.1.3 Herpetofauna habitat

Indigenous lizard species have been identified beyond the Project Area and there is the potential that:

- Copper skink (Not Threatened) could be present any areas of long (rank) grassland, exotic treeland and planted vegetation within the Project Area; and
- Ornate skink, (At Risk – Declining) could also be present within suitable habitat corridors along the Waipokapū Stream and Waihoehoe Stream, within the Project Area within

It was estimated that approximately 1.75 ha of lizard habitat (associated with ornate (and copper) skink only) could be lost as a result of vegetation clearance. Potential habitat for At Risk lizards has been highlighted in Appendix 7, Drawing SGA-EX-DL-007.1.

There is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink or ornate skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953. To mitigate habitat removal, methods can be developed during the future resource consent process to minimise any such effects. This could include, lizard salvage and potentially habitat replacement as appropriate. Further detail on these matters is presented in Appendix 10 Resource Consent – Lizard Management.

9.4.2 Freshwater Habitat

9.4.2.1 Streams

The Project will cross two permanent and six intermittent streams. As both permanent streams will be bridged, no permanent stream loss will occur. It is proposed that intermittent stream D4.S11 will be bridged, and all other streams will be culverted, leading to 863 m^2 of intermittent stream loss. This information is presented in Table 82 and impacted stream are shown in Appendix 7, Drawing SGA-EX-DL-005.4.

These calculations will require re-evaluation as part of the future regional consent process, however opportunities for compensation/offset have been identified within the Project Area.

Table 82 Potential stream loss (permanent and intermittent) within the Project Area (NoR D4)

Stream number*	Stream type	Wetted width of stream (m)**	Bank Width (m)	Length to be lost (m)	Loss (m^2)**	Notes
D4.S1	Intermittent	0.5	3	N/A	N/A	Opportunity to remove existing on-line pond.
D4.S4	Intermittent	0.5	1	62	60	Existing stream is highly modified and channelised.
D4.S6	Permanent	1	2	N/A	N/A	Avoided. Bridge proposed.
D4.S9	Intermittent	1	4	79	300	Large amount of stream loss, bridging or other design changes could reduce loss.
D4.S10	Intermittent	0.5	3	56	150	Large amount of stream loss. Realignment could reduce overall loss.
D4.S11	Intermittent	0.5	3	61	200	Bridge proposed
D4.S12	Intermittent	0.5	2	67	150	Large amount of stream loss, bridging or other design changes could reduce loss.
D4.S13	Permanent	3	10	30	300	Bridge proposed
Total Loss	**Permanent**			30	300	
	Intermittent			325	860	

Notes:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.15 to SGA-EC-DL-010.19
** = Assessments were carried out in drought conditions when it was difficult to accurately delineate stream width. Therefore, widths and areas are indicative

During the detailed design phase culvert design will be confirmed. However, it is considered highly likely (based on the indicative design for the Project) that at least some of the streams will be culverted, resulting in a loss of instream and riparian habitat and therefore impact management will be required. Under a future regional consent for earthworks, impact management would also be required to ensure sediment discharge to streams is controlled appropriately.

9.4.2.2 Wetland Habitat

Construction of the Project could result in the loss of exotic wetland habitat. The manner in which wetlands are affected will be confirmed at the detailed design stage of the Project, however it is likely that some will be culverted or reclaimed (based on the indicative design for the Project), resulting in a loss of wetland habitat and vegetation. Additionally, hydrological inputs to the wetlands could also be affected by Project activities such as embankments and culverts altering flow regimes. Potential wetland loss is presented for the Project in Table 83 and wetland habitat affected is mapped on Appendix 7, Drawings SGA-EC-DL-010.15 to SGA-EC-DL-010.19.

Table 83 Wetland loss within the Project Area

Site Name*	Type **	Wetland size (m^2)**	Indicative area of impact/potential loss (m^2) (subject to detailed design)***	Notes
D4W1	Exotic Wetland (EW)	1,800	210	Could potentially be avoided during detailed design. Minor impact to edge of habitat.
D4W2	Exotic Wetland (EW)	1,300	500	Effects can be minimised during detailed design. Future survey prior to resource consent required to determine extent. Wetland offset may be required.
D4W3	Exotic Wetland (EW)	1,200	7	Wetland offset may be required.
D4W4	Exotic Wetland (EW)	38,500	1,000	Wetland offset may be required.
D4W5	Exotic wetland (EW)	2,400	1,300	Wetland offset may be required.
D4W6	Exotic Wetland (EW)	2,000	5	Bridge proposed, likely to be retained. Could potentially be avoided during detailed design. Minor impact to edge of habitat.
D4W7	Exotic Wetland (EW)	6,200	440	Wetland offset may be required. Could be reduced by bridging.
D4W8	Exotic Wetland (EW)	9,100	850	Bridge proposed, likely to be retained.
Total			4,312	

Notes:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.15 to SGA-EC-DL-010.19
** = as classified in Singers*et al.*, 2017
*** = Assessments were carried out in drought conditions when it was difficult to accurately delineate wetland sizes. Therefore, areas are indicative.

Eight stream and eight wetland locations were identified during the indicative and detailed business cases, route refinement, optioneering assessments and design phases, and the design has been altered to minimise stream and wetland impacts. This has been partially guided by the ecological value assessment of streams and wetlands undertaken in Section 9.2.2.2.3 and 9.2.2.3.3.

Table 82 details the estimated intermittent and permanent stream loss (860 m^2 and 300 m^2 respectively) and Table 83 details estimated wetland loss (4,312 m^2) as a result of the Project. As design develops and resource consents are prepared an assessment of the effects on freshwater/wetland habitat will be undertaken and more detailed information collected on freshwater habitat classifications, along with the ecological value of streams and wetlands using the SEV stream survey method and Wetland Condition Index (Clarkson *et al.*, 2004) surveys (respectively).

At the detailed design stage, options to avoid or reduce the level of impact (including hydrological effects) to stream and wetlands could be considered e.g. bridges, reduction of embankments, reduction in the length of culverts, type of culvert etc. Where stream or wetland loss is unavoidable, an ecological assessment should be undertaken to determine if mitigation or offsetting may be required. Offset requirements should be calculated using accounting systems such as the Environmental Compensation Ratio (ECR) used for streams in the Auckland region.

Effects management will require SEV survey results to assess stream value and and effects and to inform the potential requirement for stream compensation. However, potential compensation can be estimated on a preliminary basis using an Environmental compensation Ratio of 3:1[23] of stream restoration: stream loss. Assuming further avoidance is not possible for the Project, this would equate to intermittent compensation of approximately 2,580 m^2; and permanent compensation of approximately 900 m^2. Subject to detailed design assessment, area of potential wetland loss is currently estimated to be 4,312 m^2. Assuming a similar compensation ratio of 3:1, approximately 12,936 m^2 of wetland compensation may be required.

Additionally, a 6 m access track will be required for construction access and larger areas will be required to accommodate stormwater wetlands, construction laydown, stockpile and site compounds. These requirements may change depending on the final design and scope of works, terrain and topography, however these large areas beyond the construction footprint provide opportunity to accommodate any future requirement for wetland or stream compensation/ offset within the proposed designation boundary.

Broad mitigation recommendations for stream/wetland compensation/offset opportunities and should be tailored as the detailed design advances. Where possible this mitigation will be incorporated within the designation boundary.

9.4.2.3 Fish

Fish surveys were not undertaken as part of the field investigations for the NoR, however NIWA freshwater fish database and Auckland Council Catchment Assessment Reports were reviewed and highlighted the likely presence of a number of At Risk and other native fish species within streams within the Project Area (Table 19).

New culverts are proposed for a number of stream locations to facilitate road development. Some potential barriers to fish passage have already been identified (Appendix 7, Drawing SGA-EC-DL-010.15 to SGA-EC-DL-010.19). SEV surveys undertaken during the resource consent phase of the Project will identify if native fish are present and if there is suitable upstream habitat. If so, culvert extensions may cause habitat fragmentation and loss of spawning habitat for native fish. In addition, fish may be killed or injured during culvert installation/extension within the stream.

If required, culvert design considerations should allow for fish passage. In addition, fish recovery and translocation would be required as part of the future resource consents for the Project.

To minimise disturbance to fish, instream works in sensitive reaches such as the Waipokapū Stream and Waihoehoe Stream should be timed to avoid key fish migration and spawning periods (March – August) for Īnanga and other Galaxiidae species which are known to be present within the catchment. These restrictions are likely to apply where any instream works are required for bridge construction such as piling.

[23] Considered to be an average estimate of ECR’s in the Auckland Region.

9.4.3 Positive effects/ Future Opportunities

Positive ecological effects are currently anticipated as a result of the Project and further positive outcomes and enhancement opportunities should continue to be developed during detailed design. If implemented, these are currently likely to include:

- The ability for future Project landscape planting to tie into the proposed vegetated corridors anticipated by the Drury -Ōpāheke Structure Plan, Blue-Green Network. Opportunities at specific locations have been outlined in the Project Assessment of Landscape and Visual Effects report;
- Net increase in green infrastructure and associated habitats within the Project Area associated with street trees, berm and stormwater plantings and planted stormwater wetlands. The Project Assessment of Landscape and Visual Effects report outlines recommendations to ensure ecological enhancement opportunities are capitalised upon at these locations.
- There are stream and wetland enhancement opportunities identified within Table 82 and Table 83. Where possible this could be incorporated within the existing designation boundary, beyond the construction footprint.
- Enhance vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

9.4.4 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native fish.

Almost all-original native habitat within and adjacent to the Project Area has been removed due to historical land use change. As the existing environment is highly modified, the specific Project impacts discussed within this report have been minimal and adverse effects have largely been avoided. However, historical vegetation clearance and wetland drainage have made the landscape more vulnerable to cumulative effects relating to regional consenting considerations including:

- Greater risk of flooding and stormwater runoff. Without treatment and mitigation, the Waipokapū Stream, Waihoehoe Stream, and wider Drury Creek and Pahurehure Inlet would be the ultimate receiving environment for treated stormwater from the Project.
- Erosion and sediment control issues during construction could lead to further habitat degradation and adverse impacts on the downstream receiving environments. For example, sedimentation in the Drury Creek and Pahurehure Inlet could lead to the gradual spread of mangroves, at the expense of saltmarsh and open mudflat habitats;
- Cumulative stream loss and vegetation clearance have a high impact on catchments ecological function, water quality, hydrology and the native fauna that use these habitats (i.e. īnanga spawning habitat, eels etc). Consideration of a riparian habitat function and bankside setback need to be considered in the wider catchment context.

If developments (including this Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced. This opportunity has been highlighted within the Drury-Ōpāheke Structure Plan and it is anticipated to be reflected in future Plan Changes. The Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

9.4.5 Conclusion

Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features within or adjacent to the Project Area, for which future regional and/or Freshwater NES consent will be required can be adequately managed in any future consent processes.

The proposed alignment to date has minimised effects on streams, wetlands and terrestrial habitats of value. This includes avoidance of Kahikatea forest associated with the Waihoehoe Stream floodplain.

A review of the surrounding catchment highlights that there is potentially available stream or wetland habitat for offset/compensation within the designation boundary if this is required.

10 NoR D5: Ponga and Ōpāheke Road Upgrade

Chapter Summary

Desktop studies and site investigations for terrestrial, freshwater and wetland habitats and native species (bats, birds and lizards) were undertaken within and adjacent to the Project Area to identify their ecological value.

The Project will impact mainly exotic terrestrial vegetation types of **Negligible** or **Low** value (regional and district vegetation). Although of **Low** value botanically these features have been considered for their potential to support common, Threatened and At Risk native fauna species such as bats, birds and lizards. The ecological effects of the construction and operation of the Project within this habitat for these species was considered to be **Very low** or **Low** and therefore no specific impact management has been recommended for these matters. Some **Moderate** value ecological features have been identified (as they relate to district plan matters):

- Forest birds – A small stand of regenerating pūriri forest (WF7.3) partially within the Project Area and kahikatea forest (MF4) occurs directly adjacent to the Project Area. Based on desktop records, it is possible that the At Risk - Declining forest bird, the North Island kākā, may use this habitat sporadically for foraging.
- Herpetofauna – At Risk – Declining Ornate skink (along with Not Threatened copper skink) are potentially present in rural and urban forests, grasslands and shrublands, in low scrub and sedges when habitat is connected to suitable native forest (such as the aforementioned).

The magnitude of effects and overall level of effects from the construction and operation of the Project on these features was considered to be **Low**, so impact management is not required.

The proposed alignment has minimised effects on streams, wetlands and terrestrial habitats of value. Based on survey work undertaken to date, it is considered that any Project effects on ecological features such as streams and wetlands can be adequately managed in any future consent processes and any requirement for offset/compensation can be accommodated within the proposed designation boundary.

10.1 Project Description

As the Drury-Ōpāheke area is urbanised it is proposed to upgrade a 4.15km section of Ponga Road and Ōpāheke Road, from Great South Road in the north, to Jack Paterson Road and the future Mill Road corridor (which forms a separate NZUP project) in the southeast, to a two-lane arterial with separated walking and cycling facilities. The functional intent of the Project is a multimodal corridor that provides access to the proposed Mill Road corridor, FUZ in Papakura and employment areas to the north. The Project has been separated into three sections (as shown in Figure 23):

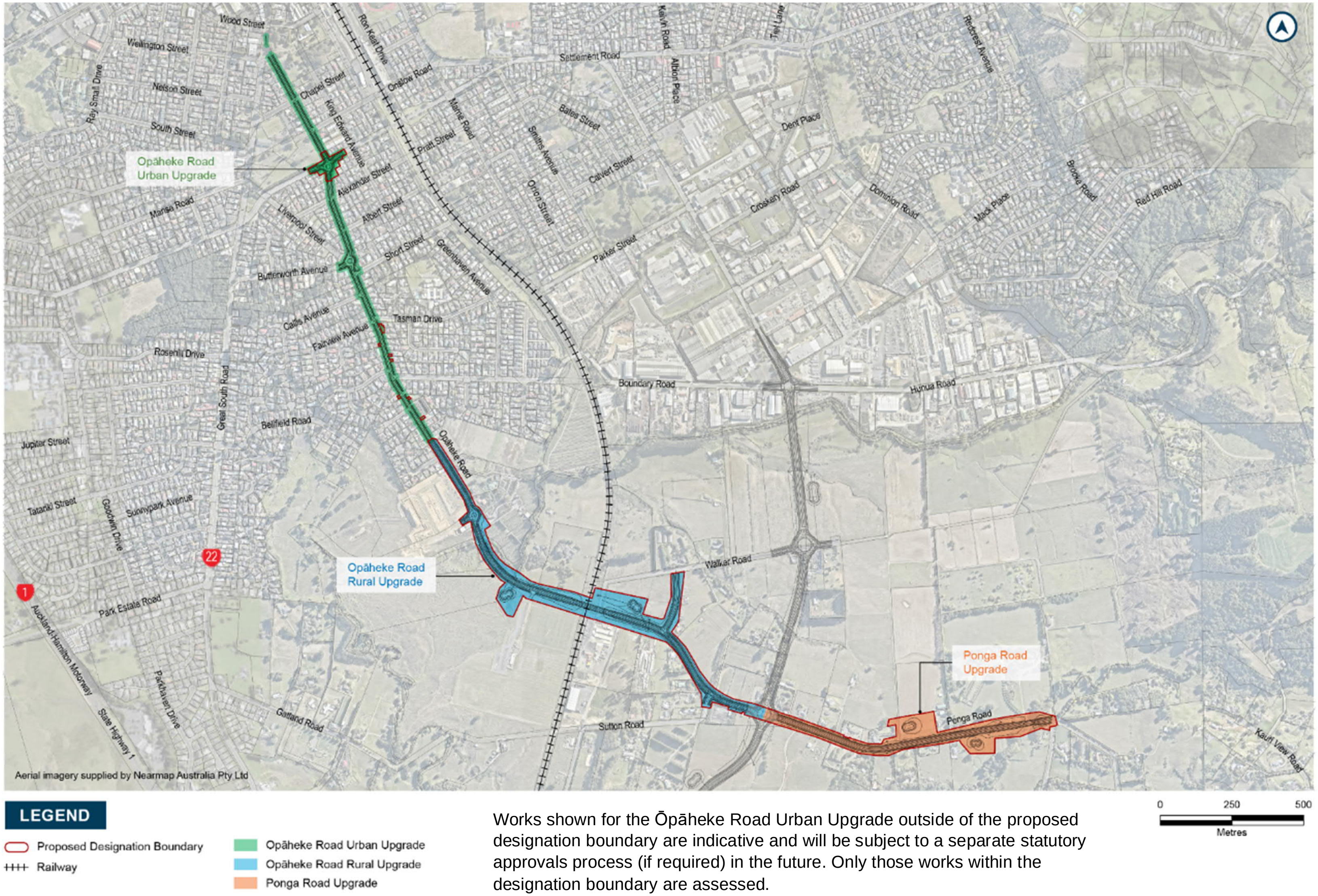
- Ponga Road Upgrade: from Ōpāheke Road to Jack Paterson Road
- Ōpāheke Road Rural Upgrade: from the northern extent of the FUZ to Ponga Road
- Ōpāheke Road Urban Upgrade: north of the FUZ
    - While the overall plan for the urban area of Ōpāheke Road is to upgrade the walking and cycling facilities from Ōpāheke Road Rural Upgrade in the south to Great South Road, Papakura in the north, generally, the upgrade can fit within the existing road reserve, therefore only the areas affecting land outside the existing road reserve are proposed to be designated.

For the Ponga Road and the Ōpāheke Road Rural upgrade sections it is proposed to widen the existing roads to 24m two-lane urban arterials with separated walking and cycling facilities. As the Ōpāheke Road urban section is an existing and constrained urban environment, it is proposed to upgrade the existing road to a 20m two-lane urban arterial with separated walking and cycling facilities.

The indicative alignment has been prepared for assessment purposes, and to indicate what the final design of the Project may look like. The final alignment will be refined and confirmed at the detailed design stage. Key features of the proposed upgrade common to each Project section include the following:

- A typically 24m or 20m wide road with two lanes and separated walking and cycling facilities
- Likely posted speed of 50kph
- Localised widening around the existing intersections to accommodate for vehicle stacking and tie-ins and walking and cycling facilities/crossings
- Batter slopes and retaining to enable widening of the corridor and/or wetland construction, and associated cut and fill activities
- Vegetation removal along the existing road corridor
- Areas identified for construction related activities including site compounds, construction laydown, bridge works area, the re-grade of driveways and construction traffic manoeuvring

Further details of each Project section are provided below.



Works shown for the Ōpāheke Road Urban Upgrade outside of the proposed designation boundary are indicative and will be subject to a separate statutory approvals process (if required) in the future. Only those works within the designation boundary are assessed.

Figure 23 Overview of NoR D5

10.1.1 Ponga Road Upgrade Section

10.1.1.1 Section Overview

The Ponga Road Upgrade section is a 1km long upgrade extending from the proposed intersection with Ōpāheke North-South FTN Arterial in the west, to Jack Paterson Road in the east. In the future Ponga Road will tie into the proposed Mill Road corridor which forms a separate NZUP project. An overview of the concept design is provided in Figure 24.

Figure 24 Overview of Ponga Road Upgrade Section

In addition to those listed above, the key features of the Ponga Road Upgrade section include:

- Roundabout tying into the proposed Ōpāheke N-S FTN Arterial (NoR D4) and Ōpāheke Road Rural Upgrade section
- A bridge over Mangapū Stream
- Extension of existing pipe culverts
- Two stormwater wetlands.

10.1.1.2 Specific Features of this section

The Ponga Road Upgrade is currently an existing two-lane road (Ponga Road). The surrounding environment of The Project Area is highly modified with the majority of original indigenous vegetation removed and replaced with exotic vegetation associated with farms and private properties. Towards the eastern end of Ponga Road there are several small stands of secondary, regenerating native forest within private property either side of Ponga Road These areas have been actively avoided by the project and are outside the Project designation boundary. Although fragmented and not within

SEAs, these fragments do have greater potential to support high value native species than the surrounding exotic vegetation. Additionally, these areas contribute to the importance of the Mangapū Stream corridor for the movement of native species.

The road crosses a number of existing small streams which have been culverted and highly modified by existing road development and adjacent agricultural practices. The Project will require additional stream loss where the existing culverts occur; and vegetation removal the within construction area.

The Mangapū Stream crossing is this most significant ecological feature in the Project Area. This stream corridor is part of a large floodplain area that would originally have been dominated by floodplain forest habitat prior to clearance for agriculture, however, this stream corridor is currently constrained by culverts on the existing Ponga Road but will be upgraded to a bridge crossing as part of the proposed Project. This will improve the connectivity of the stream crossing for native fauna species such as fish and lizards.

10.1.2 Ōpāheke Road Rural Upgrade section

10.1.2.1 Section Overview

It is proposed to widen, and realign a portion of, the existing road within the Ōpāheke Road Rural Upgrade section to a 24m urban arterial. The Ōpāheke Road Rural Upgrade section extends 1.6km from the extent of the FUZ in the north to Ponga Road in the south. An overview of the concept design is provided in Figure 25.

Figure 25 Overview of Ōpāheke Road Rural Upgrade (showing location only, refer design drawings)

In addition to those listed above, the key features of the Ōpāheke Road Rural Upgrade section include:

- Roundabouts at Bellfield Estate and Ōpāheke N-S FTN Arterial / Ponga Road
- Realignment of a section of Ōpāheke Road and grade separation of the NIMT to avoid the Waikato 1 watermain and Ōpāheke Sports Fields and to allow the bridge to be constructed offline
- New road connection to Walker Road (and closure of a section of the existing Ōpāheke Road – replaced by the new NIMT bridge)
- Two walking and cycling bridges adjoining each side of the existing Ōtūwairoa Stream road bridge
- Two stormwater wetlands. One is an extension of an existing wetland located within Ōpāheke Reserve.

10.1.2.2 Specific Features of this section

The widening of the Ōpāheke Road will occur largely within an existing road corridor or directly adjacent to the existing road corridor. The area is predominantly farmland, with some areas of amenity plantings and gardens present. vegetation removal will occur throughout the construction area. The road crosses a number of existing small streams which have been culverted or bridged. These streams are highly modified from existing road construction and adjacent agricultural practices. The widening will require additional stream loss where existing culverts are to be lengthened.

The Ōtūwairoa Creek crossing and its associated floodplain within Council-owned Ōpāheke Reserve are the most significant ecological features within the Project Area. The original indigenous vegetation has been removed and replaced with exotic vegetation associated with farms and private properties. Although largely exotic, the treeland habitat associated with the Ōtūwairoa Creek contributes to the greater ecological value of this stream corridor and the retained connection to the natural floodplain contributes to the importance of the Ōtūwairoa Creek corridor for retained natural hodological function and the movement of native species.

Stormwater wetlands will attenuate peak flows and prevent adverse runoff to the receiving environment (Ōtūwairoa Creek) once the road is operational.

10.1.3 Ōpāheke Road Urban Upgrade section

10.1.3.1 Section Overview

While the overall plan for the urban area of Ōpāheke Road is to upgrade the walking and cycling facilities from Ōpāheke Road Rural Upgrade in the south to Great South Road, Papakura in the north, only the areas affecting land outside the existing road reserve are proposed to be designated and assessed as part of this assessment. The Ōpāheke Road Urban Upgrade section of NoR D5 includes the regrading of nine driveways along Ōpāheke Road and the upgrade of the Ōpāheke Road / Settlement Road intersection to a roundabout. An overview of the proposed designation areas is provided in Figure 26.

The key features of the Ōpāheke Road Urban Upgrade section include:

- Upgrade of the Ōpāheke Road / Settlement Road intersection to a roundabout to provide for separated walking and cycling facilities, including crossing facilities
- Re-grade of nine driveways.

Figure 26 Overview of Ōpāheke Road Urban Section

10.1.3.2 Specific Features of this section

The Ōpāheke Road urban upgrades will occur in an urban setting. The area is largely residential, with the exception of a Central Park and a Papakura Cemetery, located at the western end of the Project Area. This setting will be retained following construction. There are no streams or wetlands within the Ōpāheke Road urban section. Terrestrial habitats to be affected include amenity plantings (gardens and planted trees.

10.2 Ecological Baseline and Likely Future Environment

This section presents the findings of the desktop study (which includes a review of the documents listed in Section 5.1) and site investigations for all of the habitats and species ('ecological features') present within the Project Area. Based upon this information, an ecological value has been calculated for each ecological feature. The likely future environment in regard to these ecological features when the Project is constructed is discussed in Section 9.2.3.

10.2.1 Historical Ecological Context

The Project Area is located within the Mānukau Ecological District, which encompasses the Mānukau Harbour and the surrounding low-altitude land. The district has a warm, humid climate with mild winters. Soils throughout the district range from poorly drained to well drained, dependent on landform and the presence of localised volcanic areas (McEwen, 1987).

Most of the district was originally forested (Singers *et al.*, 2017). Original forest types were generally dependent on the landform and soils on which it grew:

- On free draining soils, pūriri forest (WF7[24]) was present; and
- On lowland, poor draining areas, kahikatea, pukatea forest (WF8) dominated.

Only 1.6% of the entire Mānukau Ecological District has native vegetation of any type remaining. Freshwater wetlands have been particularly affected, with over a 96% reduction in extent throughout the ecological district (Auckland Regional Council, 2004). 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 Mānukau Ecological District are well below these levels. The only significant area of natural landscape remaining is the Mānukau Ecological District are the unmodified coastal of the Mānukau Harbour. Any remaining examples of original forests or wetlands, or any regenerating native vegetation that is developing into vegetation that once clothed the district therefore needs to be considered as significant.

10.2.2 Habitats

10.2.2.1 Terrestrial Habitat

10.2.2.1.1 Desktop Review

Auckland Council Geomaps aerial imagery shows that throughout the Project Area, the original forest has been largely cleared and that the present-day terrestrial habitats are dominated by agricultural land. Where there are natural habitats remaining, these have been delineated as either terrestrial or marine SEAs. There are no SEAs within the Project Area. SEAs which occur within 2 km of the Project Area, are presented and described in Table 7 and are shown in Appendix 7 Figure SGA-EX-DL-004.5.

Singers *et al.* (2017) note that all of the Auckland Region's forest ecosystems are threatened to varying degrees. These include swamp and flood-plain kahikatea forests (WF8, MF4) and pūriri forest (WF7). Of these forest types the pūriri forest (WF7) is present within the Project Area and kahikatea forest (MF4) occurs directly adjacent to the Project Area.

[24] Habitat codes are from Singers *et al.* (2017) and Singer and Rogers (2014) and have been identified by Auckland Council as occurring in the Auckland region

Table 84 Significant Ecological Areas present within 2 km of the Project Area (NoR D5)

SEA	Distance from Project Area (km)	SEA description
SEA_T_77	0.1	Critically endangered kahikatea-pukatea forest (WF8)
SEA_T_7032	0.4	Habitat for Nationally Threatened species, elegant gecko, and has a diverse habitat including endangered taraire, tawa, podocarp forest (WF9), and kānuka scrub forest (VS2).
SEA_T_545	0.6	Critically endangered pūriri forest (WF7)
SEA_T_4362	0.7	Critically endangered pūriri forest (WF7), habitat for naturally uncommon plant species Danhatchia orchid.
SEA_T_5430	0.7	Endangered taraire, tawa, podocarp forest (WF9) and endangered kauri, podocarp, broadleaved forest (WF11), including kānuka scrub forest (VS2). Significant ecological area is a buffer for a protected area.
SEA_T_4562	0.8	Endangered taraire, tawa, podocarp forest (WF9) and kānuka scrub forest (VS2), which is a migration pathway for migrant species
SEA_T_5248	0.8	Critically endangered pūriri forest (WF7), habitat to rare plant species including Danhatchia orchid, kapuka and carmine rātā.
SEA_T_7033	0.8	Endangered taraire, tawa, podocarp forest (WF9), including kānuka scrub forest (VS2).
SEA_T_5323	1.1	Critically endangered kahikatea forest (MF4) and puriri forest (WF7). Habitat to Threatened fish species, including longfin eel, torrentfish and īnanga, as well as koura. Also found are Threatened plant species including pirata, or green mistletoe, and swamp maire. This significant ecological area is a buffer to a protected area and has high habitat diversity, housing forest ecosystems including WF7, WF9, WF12, WF13, MF4 and MF24, and regenerating ecosystems including VS2 and VS5.
SEA_T_5277	1.2	High habitat diversity, including endangered taraire, tawa, podocarp forest (WF9), vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13) and kānuka scrub forest (VS2). Habitat for the At Risk fish species longfin eel, and Threatened plant species including willowherb and fireweed. Also, habitat to rare plant species carmine rātā. This significant ecological area is a buffer to a protected area.
SEA_T_4561	1.3	Habitat for rare plant species kaikōmako, and a migration pathway for migrant species.
SEA_T_530	1.5	Habitat for Threatened plant species including mingimingi and *Picris burbidgeae,* and declining fish species īnanga. Also, habitat for rare plant species including korokio, kaikōmako and small-leaved kōwhai. This area is a buffer for a protected area and also buffers adjoining SEA_M1-29b.

SEA	Distance from Project Area (km)	SEA description
SEA_T_4563	1.6	Endangered taraire, tawa, podocarp forest (WF9) and endangered kauri, podocarp, broadleaved, beech forest (WF12), which is a migration pathway for migrant species.
SEA_M1-29b	1.6	A wetland system within the upper tidal reaches of Drury Creek; which grades from freshwater vegetation, through rush-dominated saltmarshes to mangrove habitat; forming an important migration pathway for many native freshwater fish species.
SEA_M2-29a	1.6	Intertidal habitat; ranging from sandy mud flats, to current-exposed rocky reefs and a variety of saline vegetation. Areas of mangroves grow in Whangamaire Stream, and Drury and Whangapouri Creeks. In southern areas of Whangapouri Creek are eelgrass beds. Drury Creek is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Wading bird roosting area, including important area for pied stilt.
SEA_T_1173	1.7	Vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13), which is a migration pathway for migrant species.
SEA_T_409	1.7	Critically endangered kahikatea forest (MF4). Habitat for Threatened fish species longfin eel (Anguilla dieffenbachii) and rare plant species kaikōmako.
SEA_T_1172	1.9	Critically endangered kahikatea forest (MF4)
SEA_T_1174	1.9	Vulnerable tawa, kohekohe, rewarewa, hīnau, podocarp forest (WF13), which is a migration pathway for migrant species.
SEA_T_4361	1.9	Critically endangered pūriri forest (WF7), including kānuka scrub forest (VS2).
SEA_T_5289	2.0	High habitat diversity, including critically endangered kahikatea forest (MF4); endangered kauri forest (WF10), kānuka scrub/forest (VS2), taraire, tawa, podocarp forest (WF9), and kauri, podocarp, broadleaved, beech forest (WF12). At-risk long-finned eel and koura are present, as well as regionally Threatened kaikōmako. In addition, the kahikatea forest accounts for over 10% of the extent of this forest type within the Mānukau Ecological District.
SEA_T_544	2.0	A threatened ecosystem type which supports Threatened species.

10.2.2.1.2 Site Investigations

Within and adjacent to the Project Area habitat is dominated by exotic grassland and amenity planting (gardens and parks) with small areas of exotic forest, exotic scrub, exotic wetlands, treeland and remnant forest fragments (Table 85). For completeness, wetland locations are listed in this section, however, a full description of wetland habitats is provided in Section 10.2.2.3.

Terrestrial habitats are highly modified and dominated by exotic species. However, small areas of native or mixed exotic vegetation occur within areas of planted native and exotic wetland habitat. These habitats retain a greater ecological function and have the potential to support a greater number of native species. The only indigenous habitat found within the Project Area is a small stand of regenerating pūriri forest (WF7.3), additionally kahikatea forest (MF4) occurs directly adjacent to the Project Area (Singers *et al.* (2017).and these habitats both have a regional threat classification status of Critical Endangered in the Auckland Region (Singers *et al.* 2017). The small, remnant stands of secondary regenerating native forest habitat are fragmented and should be prioritised for avoidance and protection within the Project Area. These are also mapped in Appendix 7, Figures SGA-EC-DL-008.10 to SGA-EC-DL-008.12.

Table 85 Vegetation types present within and adjacent to the Project Area (NoR D5), classified according to Singers *et al.* (2017).

Section	Vegetation Type	Alphanumeric Code*	IUCN Regional Conservation status*	Description
Ponga Road	Exotic Grassland	EG	N/A	Grassland dominated by exotic species. Minimal cover/biomass from plants in any other vegetation tier. Grassland areas are predominantly areas of pasture.
	Treeland	TL.3	N/A	Tree-lined stream corridors, gardens and shelterbelts.
	Planted Vegetation	PL.3	N/A	Amenity/garden plantings.
	Kahikatea** Forest	MF4	Critically Endangered	Remnant secondary stands of regenerating Kahikatea forest. Adjacent to the Project Area.
	Pūriri forest on alluvial terraces	WF7.3	Critically Endangered	A semi-mature stand of regenerating native forest. Includes some exotic planted trees. This area has been fenced and has dense understorey regeneration, dominated by native species. The canopy is pūriri dominated but also includes tōtara, karaka and nikau in the understorey.

Section	Vegetation Type	Alphanumeric Code*	IUCN Regional Conservation status*	Description
	Exotic Wetland	EW	N/A	Highly modified wetland system, now dominated by exotic plant species.
	Planted Vegetation	PL.1	N/A	Native restoration plantings with <50% exotic biomass. Planted native scrub and forest <20 years old.
	Exotic Forest	EF	N/A	Oak (*Quercus sp.*) forest
Ōpāheke Road	Brownfield	BF	N/A	Industrial sites and cleared land
	Exotic Grassland	EG	N/A	Grassland dominated by exotic species. Minimal cover/biomass from plants in any other vegetation tier. Grassland areas are predominantly areas of pasture.
	Treeland	TL.3	N/A	Tree-lined stream corridors and shelterbelts
	Exotic Wetland	EW	N/A	Highly modified wetland system, now dominated by exotic plant species.
	Exotic Scrub	ES	N/A	Scrubby, rank vegetation growing on roadsides.
	Planted Vegetation	PL.1	N/A	Planted native scrub and forest <20 years old – limited to small areas adjacent to the road.
		PL.3	N/A	Amenity/garden plantings.

* = Classifications and IUCN conservation status info from Singers *et al.* (2017).
** = located immediately adjacent to the Project Area but not within.

10.2.2.1.3 Ecological Value

The terrestrial habitats within and adjacent to the Project Area (Table 86) are dominated by exotic grasslands or self-seeded exotic habitat such as scrub and treeland, which is of negligible to low ecological value (as assessed in accordance with EIANZ Guidelines – refer to Appendix 3 for detailed threshold criteria). Most other vegetation types across the NoRs are planted exotic habitat or self-seeded habitats such as scrub and treeland. These habitats are considered to be of **Low** ecological value due to their low botanical diversity and predominance of weed species.

Low value habitat does not however, necessarily mean a vegetation type provides ‘no value’ habitat as it may provide some value in terms of ecosystem function, such as, bank stability and stream shading, or may provide habitat utilised by common, Not Threatened native species such as native birds and copper skink.

The Project Area also includes areas of **Moderate** value such as planted native vegetation. Although isolated, these habitats have greater ecological function and therefore greater potential to support a wider diversity of native fauna and flora. These habitat types are also given greater value due to their potential in the long term. For example, native planted vegetation can mature into native forest.

A small stand of Critically Endangered (WF7.3) Pūriri forest occurs partially within the boundary of the Project Area, along its northern boundary (Figure 27, Box 1). The habitat is not proposed to be directly impacted by the road widening and it is recommended that these trees are retained where possible. This secondary stand is a small fragment of a once much greater floodplain terrace forest associated with the Mangapū Stream. Although dominated by puriri, other native tree species include karaka tōtara, rimu and nikau are present. This habitat is currently threatened by fragmentation and edge effects which have led to weed invasion and competition with native and non-native species. Fencing has prevented grazing by livestock, allowing natural regeneration of native understory.

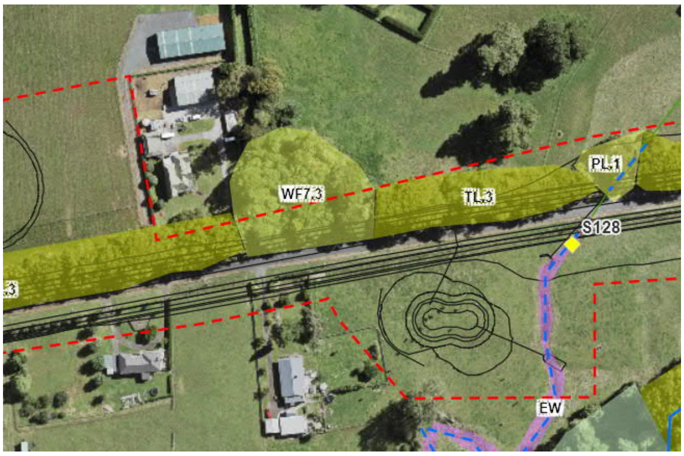
In addition, a secondary stand of kahikatea forest (MF4) (Regional IUCN threat status: Critically Endangered) is adjacent to boundary of the Project Area and is part of a more continuous block of forest associated with SEA_T_77, 500m to the west (Figure 27, Box 2). Although dominated by Kahikatea, other native tree species include kowhai, tōtara, cabbage tree and tītoki. This habitat is currently threatened by lowering of the water table due to artificial drainage, grazing by livestock and fragmentation which have led to weed invasion and competition with native and non-native species.

Both habitats, including the Critically Endangered, (MF4) Kahikatea forest and Critically Endangered (WF7.3) Pūriri forest have the potential to support a diverse range of native flora and fauna and are considered to be of **Very high** ecological value.

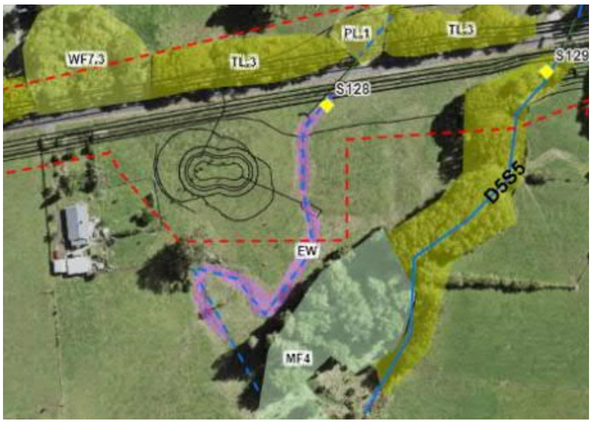
Table 86 Terrestrial habitat values for habitats within or directly adjacent to the Project Area (NoR D5)

* = Habitat Classifications and Conservation status information from Singers *et al.* (2017).

Habitat Description	Alphanumeric Code*	Regional IUCN conservation status*	Value based on EIANZ (2018) guidelines
Exotic Forest	EF	NA	Low
Exotic Grassland	EG	NA	Negligible
Exotic Scrub	ES	NA	Low
Kahikatea Forest	MF4	Critically Endangered	Very high
Planted Native Vegetation	PL.1	NA	Moderate
Pūriri Forest	WF7.3	Critically Endangered	Very high



Box 1. A small stand of Critically Endangered (WF7.3) Pūriri Forest occurs within the Project Area on the northern boundary



Box 2. Secondary stand of kahikatea forest (MF4) (Regional IUCN threat status: Critically Endangered) which is part of a more continuous block of forest associated with SEA_T_77, 500m to the west of the Project Area

Figure 27 Very high value terrestrial habitats present within or adjacent to the Project Area (NoR D5)

10.2.2.2 Freshwater Habitat

10.2.2.2.1 Desktop Review

Auckland Council Geomaps layer ('Named Streams') indicates that there are two permanent streams present which are crossed by the Project. These are listed in Table 87 and depicted in Appendix 7, Drawings SGA-EC-DL-010.20 to SGA-EC-DL-010.25.

Table 87 Streams within or adjacent to the Project Area (NoR D5)

Section	Stream Name
Ponga Rd Section	Mangapū Stream
Ōpāheke Section	Ōtūwairoa Creek

Auckland Council commissioned Catchment Watercourse Assessment Reports including those streams within the wider Ōtūwairoa Creek catchment (Ingley *et al.,* 2015). This report provides baseline information on the existing condition of waterways, stream ecological health, including stream classification, wetland habitat assessment and selected representative SEV and macroinvertebrate surveys. Table 10 provides an overview of information collected from these surveys. The data within these catchment reports covers the entire catchment and are not specific to the sections of stream impacted by the Project.

Table 88 Desktop summary from Auckland Council Catchment Watercourse Assessment Reports for effected catchments within the Project Area (NoR D5)

Catchment effected	Summary	SEV	MCI
Ōtūwairoa Creek (Ingley *et al.,* 2015)	Ōtūwairoa Creek is drained by four main watercourses, Ōtūwairoa Creek, Waipokapū Stream, Waihoehoe Stream, and Mangapū Stream. These discharge via Ōtūwairoa Creek to the upper Pahurehure Inlet of the Mānukau Harbour. The catchment is largely soft-bottomed and flows through a highly modified rural landscape, however the upper catchment in the eastern hill country, is dominated by indigenous forest. The Ōtūwairoa Creek section is largely urbanised where it flows through Papakura.	SEV scores calculated for the catchment ranged from 0.406 to 0.853, giving functional value of 'moderate' to 'high'	MCI scores ranged from 68.24–125.44. Overall MCI scores ranged from poor to excellent.

10.2.2.2.2 Site Investigations

All streams within the Project Area were numbered, classified (permanent, intermittent or ephemeral) (according to Table 4) and mapped (Appendix 7 SGA-EC-DL-010.20 to SGA-EC-DL-010.25). An RHA was completed for all permanent and intermittent streams within the Project Area. The RHA scores are presented for instream habitat (instream habitat diversity, quality and quantity) and for riparian habitat (erosion, shade and buffering).

Four streams were identified and assessed within the Project Area, two permanent and two intermittent systems. D5.S3 was classified as ephemeral and has not been considered further in this assessment. The results of the stream classification and RHA values are presented in Table 89. Details on corresponding RHA scores for reference stream types are also presented in Table 89. All streams were degraded to some degree. Primarily, this is due to historical indigenous vegetation clearance which has then been compounded by agricultural practices. Degradation includes grazing and pugging by livestock or ploughing of arable land, leading to erosion and sediment control issues and nutrient runoff. This degradation of riparian vegetation and increased nutrient inputs has also led to loss of bank stability, reduced shading and the proliferation of exotic macrophytes within the streams. Additionally, many streams have been physically altered, through dredging, reclamation and/or drainage of associated wetlands and/or channelization.

Site D5.S1 and D5.S5 represent relatively large systems with permanent flows. The instream and riparian habitat features of site D5.S1 compare well to its predicted reference stream type while D1.S5 scores higher for instream habitat and relatively low for riparian habitat compare to its predicted reference. Site D5.S2 represent soft bottom low order streams with a low gradient. The instream habitat is moderately representative of its reference stream type, while its riparian habitat is measured to be a very good representation of riparian habitat diversity and cover and abundance. D5.S2 is however highly modified through the Project area, originating as an artificial swale along the roadside and then flowing into an artificially channelised section associated with the existing stormwater wetland within Ōpāheke Reserve. This section has also been recently replanted with native riparian planting which has allowed for its high values for riparian cover. D4.S4 scored relatively low compared to its predicted reference stream for both instream and riparian habitats. D4.S4 in comparison is unfenced and impacted by grazing, leading to lower values for riparian cover.

Table 89 Instream, riparian and combined RHA scores for the Project (NoR D5)

Site Name	D5.S1		D5.S2		D5.S4	D5.S5	
Stream Name	**Ōtūwairoa Creek**	**Ref. Stream Type WW/SS/4/LG**	**Ōtūwairoa Creek Tributary**	**Ref. Stream Type WW/SS/1/LG**	**Mangapū Stream Tributary**	**Mangapū Stream**	**Ref. Stream Type WW/SS/3/MG**
Classification	**Permanent**		**Intermittent**		**Intermittent**	**Permanent**	
Instream Score %	55.0	63.3	23.3	35.0	20	80	56.7
Riparian Score%	67.5	82.5	82.5	97.5	42.5	27.5	87.5
Combined RHA Score %	60.0	71.0	47.0	60.0	29	59	69

10.2.2.2.3 Ecological Value

The aquatic ecological value assessments for the respective sites are outlined in Table 90 for the Project. The assessment applied components presented within this report including stream classification (hydroperiod and presence of pools), RHA (riparian and instream habitat representation, diversity), REC classification (stream order) and species of conservation importance, to assess the four matters (Representativeness, Rarity, Diversity and pattern, Ecological context) outlined within the EIANZ Guidelines. A precautionary approach was taken regarding the occurrence of fish species of conservation significance for all the intermittent and permanent streams within the Project Area identified during site surveys. As such, a high value descriptor was assigned for 'Rarity' to qualifying streams, specifically for the likely occurrence of longfin eel and īnanga (At Risk- Declining). SEV surveys will be required when the Project seeks resource consent. This will include fish surveys, which will allow for a more accurate assessment of rarity for the value assessment.

Table 90 Aquatic ecology value assessment for the Project (NoR D5)

Site Name	D5.S1	D5.S2	D5.S4	D5.S5
Representativeness	Medium	Medium	Low	Very low
Rarity	High	High	High	High
Diversity and pattern	Medium	Very low	Very low	High
Ecological context	High	Low	Moderate	High
Ecological Value	High	Moderate	Moderate	Moderate

10.2.2.3 Wetland Habitat

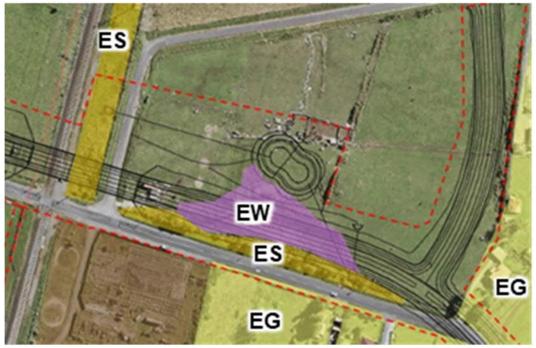
10.2.2.3.1 Desktop Review

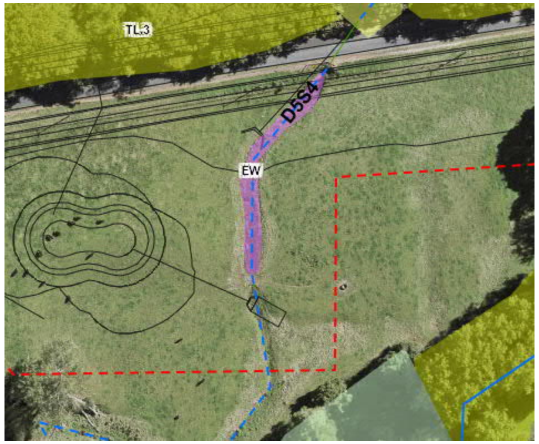
No wetland habitat was identified during the desktop assessment for the Project. However, the lower reaches of the Waihoehoe Stream, Ōtūwairoa Creek, Mangapū Stream and Waipokapū Stream are part of a large floodplain system which periodically floods. Although the majority of indigenous vegetation has been cleared and the ground drained, there is likely to be remnant wetland areas associated with this catchment (Ingley *et al.* 2015).

10.2.2.3.2 Site Investigations

Wetland habitat was present within or adjacent to the Project Area and was defined as described in Section 5.3.1.3. The wetland present was classified as highly modified, exotic wetlands (EW) (Singers *et al.*, 2017). Table 91, below, describes the wetland habitats present within the Project Area, with drawings SGA-EC-DL-010.20 to SGA-EC-DL-010.25 presented in Appendix 7.

Table 91 Wetland habitats within or adjacent to the Project Area (NoR D5)

Site Name and Location	Description	Photograph of Habitat
D5W1 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) and include Edgar's rush (native), soft rush and willow weed. This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. This wetland is a shallow ephemerally flooded depression, which holds water during the wetter winter months but is permanently saturated year-round. This was likely associated with an intermittent flow path that has been partially obstructed by Ōpāheke Road. The landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions, however the wetland areas may have been increased due to obstruction caused by the Ōpāheke Road.	

Site Name and Location	Description	Photograph of Habitat
D5W2 	Mapped and described as Exotic Wetland (EW) vegetation (Singers *et al.*, 2017) as species present are >50% exotic. Facultative wetland species dominate (>50%) including soft rush and willow weed. This feature meets the RMA definition of a wetland as it includes permanently or intermittently wet areas, or shallow water that support plants that are adapted to wet conditions. This wetland has associated intermittent flow described as Stream D5S4. The landscape position is consistent with valley head and valley bottom flow accumulation which has high likelihood of wetlands occurring under natural conditions, however the wetland area may have been increased due to obstruction caused by several small culverts and fords. Also, the stream is unfenced and grazed and is affected by pugging from livestock and siltation from stormwater runoff.	

10.2.2.3.3 Ecological Value

The wetland habitats present within the Project Area includes areas of exotic wetland, dominated by exotic plant species highly degraded through factors such as vegetation removal, artificial drainage and grazing and pugging from livestock. Although specific habitat assessments of wetland condition were not undertaken in these areas, this preliminary assessment has identified that the ecological value of these exotic wetlands is **Moderate,** taking into consideration the overall reduction in wetland habitat across the Auckland region and the retained ecological functionality of these systems for attenuation of stormwater and excess nutrient removal.

10.2.3 Species

10.2.3.1 Bats

10.2.3.1.1 Desktop Review

DOC records; unpublished AECOM records, and one additional anecdotal record by G. Kessels (Personal Communication) confirm the presence of long-tailed bats within 10 km of the Project Area. Although no records are located directly within the Project Area; as a highly mobile species there is potential for bats to frequent any suitable habitat within the designation boundary. The conservation status of this species is 'Nationally Critical' (O'Donnell *et al.*, 2017). The records within 10 km of the Project Area (Appendix 7; Drawing SGA-EX-DL-006) include:

- 3.4 km to the west on Kopuhinahinga Island in the Pahurehure Inlet.
- 9.3 km to the south west, near the SH22 intersection with Glenbrook Road
- 3.5 km to the south east in the foothills of the Hunua Ranges.
- 9.3 km to the south west within Coulthards Scenic Reserve near Paerata (Unpublished records from AECOM of long-tailed bats); and
- 8.3 km to the north, near the northern end of Mill Road and its intersection with Redoubt Road.

Further afield, there are multiple records within the Hunua Ranges and within farmland between Waiuku and Patumahoe. There are no records of bats directly within the Project Area.

10.2.3.1.2 Site Investigations

10.2.3.1.2.1 Bat habitat

The results of the site walkovers indicate that the Project Area provides potential habitat features which would be suitable for use by foraging and commuting indigenous long-tailed bats, despite bats not being detected within the area to date (refer to Section 6.2.3.1.2.2). These habitat features may include:

- Tree-lined stream corridors;
- Stands of mature trees, both native and exotic; and
- Shelterbelts.

Additionally, mature oak trees with suitable roosting features were identified within and adjacent to the Project Area. Suitable roost features that were identified included cracks and/or rot holes in tree trunks and branches, and loose, peeling bark, leaving cavities which bats could potentially roost within (Figure 28). Appendix 7, Drawing SGA-EC-DL-012.01 highlights key habitat corridors and known potential roost trees within and adjacent to the Project Area.

Mature oak trees along Ponga Road. Multiple cracks and rot holes potentially suitable for roosting bats.

Figure 28 Potential bat roost features present within the Project Area (NoR D5)

10.2.3.1.2.2 ABM Survey

Due to the large home ranges of bats and interconnectedness of bat habitat and ABM survey locations within the Project Areas, bat survey results have been presented collectively.

A summary of the ABM surveys is presented in Appendix 5 and ABM locations are presented in Appendix 7 SGA-EX-DL-002. Data was collected for at least one survey session for all ABM sites, with nine locations collecting data for both survey sessions (1 and 2). Analysis of the ABM data did not identify any bat activity within the Project ZOI. These results suggest that bats are not frequent visitors to the area during their mating and breeding seasons. However, as the desktop assessment suggests (Section 10.2.3.1.1), bats are highly mobile and have been recorded within 3 km of the Project Area.

10.2.3.1.3 Ecological Value

The ABM surveys did not find any evidence of long-tailed bat (Threatened – Nationally Critical) activity at survey locations. However, there is some suitable habitat within some of the Project Area (refer to Section 10.2.2.1 above) and bats are known to be present within the wider Hunua-Drury-Pukekohe landscape (refer to Section 6.2.3.1 above). As such, it is possible that bats may be present in the wider landscape but an infrequent visitor to the Project Area, since they were not detected in the surveys associated with this assessment.

On this basis, the ecological value of bat habitat within the Project Area is considered to be **Low.**

10.2.3.2 Birds

10.2.3.2.1 Desktop Review

The habitats present within and adjacent to the Project Area largely consist of exotic vegetation which has been highly modified. Remnant stands of native regenerating forest are small and isolated and are therefore only likely to support small numbers of common native forest species.

All records of native species, for which suitable habitat types were identified within the Project Area, are collated into Appendix 8, Table 115. However, because many records do not include a specific location, a map was not produced of individual bird records.

Of the recorded bird species recorded which are nationally listed as At Risk or Threatened species, most were coastal or freshwater bird species. As there is no suitable habitat for these species within the Project Area, records of these species were excluded as their potential for presence was considered highly unlikely.

Two forest bird species of conservation concern were recorded; the At Risk - Recovering North Island kōkako and the At Risk - Recovering North Island kākā. The kōkako is a forest specialist with a known population in the Hunua Ranges, 10 km to the east. Any dispersing birds would be restricted to native forest habitat in the foothills of the Hunua Ranges to the east of the Project Area and highly unlikely to ever visit forest areas within the Project Area. This species is therefore excluded from further mention for the Project.

The kākā is also a forest specialist; but is known to disperse to seasonally available food sources, particularly in winter; however, isolated stands such as this could not support a breeding population. Therefore, it is considered kākā are highly likely to frequent the scattered remnant forest patches within and directly adjacent to the Project Area.

10.2.3.2.2 Site Investigations

Due to the presence of native forest within the ZOI of the Project a 5MBC was carried out on 12 May 2020, within the stand of pūriri forest directly adjacent to the Project Area (Bird Survey Location D5B1, see Drawing SGA-EX-DL-003.4 in Appendix 7 for location). Summarised results of this survey are presented in Table 92, with full results in Appendix 8, Table 116.

Table 92 Summarised bird survey results indicating presence

Location of Survey	Common Name	Scientific Name	Conservation status*	Frequency
Bird Survey Site D5B1 **Stand of native bush**	Tūī	*Prosthemadera novaeseelandiae*	NT	1
	New Zealand fantail	*Rhipidura fuliginosa*	NT	1
	Silvereye	*Zosterops lateralis*	NT	2
	Common myna	*Acridotheres tristis*	Int.	2
	Australian magpie	*Gymnorhina tibicen*	Int.	1

Notes:
* = conservation status information from Robertson *et al.* (2016).
NT = Not Threatened
Int. = Introduced

10.2.3.2.3 Ecological Value

The desktop study identified the possible presence of one species of At Risk - Declining forest bird, the North Island kākā.

Table 93 below summarises the habitat requirements for this species and indicates suitable habitat within the Project Area which may be suitable.

Table 93 Presence of suitable habitat for At Risk bird species within the Project Area (NoR D5)

Common name	Conservation status (Robertson *et al.* 2017)	Habitat (NZ Birds online)	Suitable habitat within the Project Area
North Island kākā	At Risk – Recovering	Kākā are rare to uncommon in native forest on the mainland, with strongholds on pest free offshore island. However, kākā disperse widely during winter and regularly visit forest fragments and pine plantations in the Auckland area (Moorhouse, 2013).	The remnant stands of native forest (WF4 and WF7.3) may be frequented seasonally for foraging. Likely only present sporadically/incidentally rather than making regular use of habitat present.

Notes:
* = based upon EIANZ Guidelines for assessing ecological value for terrestrial and freshwater species; see Appendix 3 for further detail.

For the Project the ecological value of various bird habitat present was considered in regard to the four matters outlined within the EIANZ Guidelines – Representativeness, Distinctiveness (including presence of threatened species), Diversity/pattern and Ecological context.

As no habitat suitable for At Risk - Declining or Threatened wetland birds was identified within the Project Area., this has not been considered further. A small area of WF7.3 Pūriri forest occurs within the Project Area, additionally kahikatea forest (MF4) occurs directly adjacent to the Project Area. These habitats are small and fragmented, and not large enough to support a large population of forest bird species including kaka. As kaka may only occur sporadically and the habitat is not suitable for key life stages such as breeding, the overall ecological value of this bird habitat within and adjacent to the Project Area is considered **Moderate.**

10.2.3.3 Herpetofauna

10.2.3.3.1 Desktop Review

Seven native lizard species are known to occur within the Mānukau District (Ecogecko, 2014). A review of the DOC Bioweb database, Auckland Council records, and the iNaturalist website identified no records of these species within the Project Area (Table 94).

However, within 5 km of the Project Area, records for three of these species were recorded. Records are either GPS tagged, or ‘obscured’ so that the exact location of Threatened and At Risk species records is hidden. Most native lizards require indigenous habitat or surrogate habitat adjacent to contagious native forest habitat area. Based on the desktop habitat assessment, there are several remnant stands of suitable native forest adjacent to the Project Area which may provide stepping stone habitat for native lizard species listed within Table 94.

Table 94 Indigenous lizard species records within Mānukau District

Common Name	Latin Name	Threat Class (Hitchmough *et al.*, 2016)	Closest record source	Likelihood of occurrence within or adjacent to project area
Pacific gecko	*Dactylocnemis pacificus*	At Risk – Relict	DOC	Unlikely
Elegant gecko	*Naultinus elegans*	At Risk – Declining	Auckland Council	Unlikely
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining	iNaturalist	Unlikely
Copper Skink	*Oligosoma aeneum*	Not Threatened	DOC	Likely
Ornate skink	*Oligosoma ornatum*	At Risk – Declining	DOC	Possible
Shore skink	*Oligosoma smithi*	At Risk – Naturally Uncommon	DOC	Unlikely
Moko skink	*Oligosoma moko*	At Risk – Relict	DOC	Unlikely

It is highly unlikely that native frog species would occur within the Project Area, due to lack of suitable habitat. The only native frog species present within the Auckland Region is the Hochstetter's frog, the closest known records of which occur > 10 km away in the Hunua Ranges to the east of the Project Area.

However, Hochstetter's frogs do not disperse readily and require damp areas within native forest habitat (or occasionally in exotic plantation) to survive (van Winkel *et al.* 2018). Hochstetter's frogs have not been considered further for the Project, due to the lack of a potential source population and absence of suitable habitat.

10.2.3.3.2 Site Investigations

During the site investigations, no indigenous lizards or frogs were identified as incidental observations. However, the introduced plague skink was identified within the Project Area. Much of the habitat within the Project Area was identified as suitable for copper skink, such as fragmented / modified forest edge, scrub and rank grassland habitats (Figure 29). These areas are known to act as 'surrogate habitats' for this species in the Auckland Region (van Winkel, Baling & Hitchmough, 2018).

Elegant gecko, Pacific gecko, forest gecko, and moko skink have been recorded within 20 km of the Project Area, generally in more contiguous forest habitat to the east of the Project Area. Habitat availability for these species was confirmed during the site walkovers and although the patches of native Kahikatea Forest (MF4) and Pūriri Forest (WF7.3) within and directly adjacent to the Project Area are isolated and small, there are documented populations of elegant gecko within SEA_T_7032, which is 0.5 km from the Project Area. The stands of native Kahikatea Forest (MF4) and Pūriri Forest (WF7.3) within and directly adjacent to the Project Area are however isolated and small which may reduce the likelihood of the species listed above being present, particularly geckos, which generally require contiguous habitat corridors.

However, ornate skink occurs in forests, grasslands and shrublands and often persist in rural and urban areas, when habitat is connected to suitable native forest. The vegetated stream corridors of the Mangapū Stream potentially provide suitable habitat corridors between stands of more continuous indigenous vegetation found beyond the Project Area. Additionally, as these areas are fenced, retain a dense understorey and thick leaflitter, habitat suitability for native skink is more likely. It is therefore possible the they occur within the Pūriri Forest (WF7.3) within the Project Area and are likely to occur in the adjacent Kahikatea Forest (MF4).

Based on known habitat preference and habitat suitability the skink and gecko species listed in Table 95 are likely or have the potential to occur within and or directly adjacent to the Project Area.

Table 95 Native lizard species present within the Mānukau Ecological District, and their likelihood of presence within the Project Area (NoR D5)

Species	Conservation status (Hitchmough *et al.,* 2015)	Habitat Required (information from van Winkel *et al.,* 2017)	Habitat Present Within Project Area	Likelihood of presence
Copper skink	Not Threatened	A generalist, occurring in grassland, dry scrubland, closed forest and managed agricultural land and gardens (including urban gardens).	Yes	Records within 0.5 km. Highly likely within designation boundary
Ornate skink	At Risk – Declining	Forests, grasslands and shrublands, in low scrub and sedges. Persists in rural and urban areas, when habitat is connected to suitable native forest.	Yes	Likely along edge of designation boundary, within suitable adjacent habitat.

Native habitat with regenerating understory and thick ground cover, suitable for native skink.

Figure 29 Examples of lizard habitat identified directly adjacent to the Project Area (NoR D5).

10.2.3.3.3 Ecological Value

It is highly likely that the Not- Threatened copper skink could be present through much of the Project Area, within a wide variety of native and exotic habitats. In addition, there is suitable habitat adjacent to the Project Area for many of the native lizards discussed in Section 10.2.3.3.2. The likelihood of each species varies, however if in a future scenario, stream corridors have been restored and enhanced, the likelihood of these species occurring may be significantly improved due to increased habitat connectivity and therefore ability for dispersal from known populations. Although the habitat is currently fragmented and small there is a possibility that At Risk – Declining ornate skink and Not Threatened copper skink may occur within the Project Area. As such the ecological value for lizards within and adjacent to the Project Area is considered to be **Moderate**.

10.2.3.4 Fish

10.2.3.4.1 Desktop Review

The NIWA freshwater fish database and Auckland Council Catchment Assessment Reports (Ingley *et al.,* 2015) were reviewed for fish records within stream catchments affected by the Project (Table 96). Of the species recorded as present, two had ‘At Risk – Declining’ conservation statuses: īnanga and longfin eel (Dunn *et al.,* 2017).

Table 96 Freshwater fish species recorded within catchments effected by the Project (NoR D5)

NoR		Stream	Species (orange shading indicates presence)									
			Īnanga	Longfin eel	Banded kokopu	Common bully	Common smelt	Crans bully	Shortfin eel	Freshwater mussel	Koura	Unidentified eel
Conservation status*			At Risk – Declining		Not Threatened							**
Ponga Road / Ōpāheke Road Upgrade	Ponga Rd Section	Mangapū Stream									D	
	Ōpāheke Section	Ōtūwairoa Creek	U	U	U				U			U
		Waipokapū Stream		U	U			D	U		U	

Notes:
U = record from upstream of the NoR
D = record from downstream of the NoR
* = fish species conservation statuses from Dunn *et al.* (2017); invertebrates (i.e. Koura) from Grainger *et al.* (2013).
** = conservation status could be either Not Threatened (if shortfin eel) or At Risk – Declining (if longfin eel).

10.2.3.4.2 Site Investigations

During the site walkover, streams were visually checked for the presence of any native fish species. Sightings within the Project Area included pest fish species (mosquitofish). No dedicated fish surveys were undertaken as this will be carried out during SEV survey, required as part of a future resource consent application. The freshwater ecological value assessment took a precautionary approach and included the occurrence of species of conservation significance for all the intermittent and permanent streams identified during site surveys (Section 10.2.2.2.2). A high value descriptor was assigned to qualifying streams specifically for the likely occurrence of longfin eel and īnanga (At Risk - Declining).

10.2.3.4.3 Ecological Value

Although no fish records where identified within the Project Area boundary, At Risk species have been recorded within the wider catchment. Fish records indicated the presence of fish species with a conservation status of ‘At Risk – Declining’ (longfin eel and/or īnanga) within the Project Area.

It is considered that the streams within the Project Area would have **High** ecological value for native freshwater fish species.

10.2.4 Summary of ecological value for the Project (NoR D5)

Table 97 summarises the ecological values presented in Sections 10.2.2 to 10.2.3.

Table 97 Summary of ecological values for ecological feature the Project Area (NoR D5)

Ecological Feature	Ecological Value
Terrestrial Habitat – exotic grassland, exotic treeland and planted amenity vegetation	Negligible and Low
Terrestrial Habitat – pūriri forest (WF7)	Very High
Freshwater Habitat	D5.S1 – High D5.S2, D5.S4, D5.S5 – Moderate
Wetland Habitat	Moderate
Bats	Low
Birds – forest	Native forest remnants (WF4 and W7.3) – Moderate Remainder of the Project Area – Low
Herpetofauna	Moderate
Fish	High

10.2.5 Likely Future Environment

This section has been prepared to provide some context to how the assessment of ecological effects of the Project construction and operation (Section 10.3) has been undertaken in regards to the changing baseline or likely future environment of the areas within and surrounding the Project Area.

The existing landscape surrounding the Project Area is dominated by rural landuse. The AUPOiP zoning/overlay identifies the land along the Project Area as FUZ, open space (conservation zone and Recreation Zone) along the Ōtūwairoa Creek esplanade reserve and Ōpāheke Reserve, and residential towards the north of the Project Area. The future urban land will undergo a significant change from rural to urban over the next couple of decades. The AUPOiP only protects areas of ecological value that are protected by overlays, such as 'open space – Conservation Zone', which includes areas such as the Ōtūwairoa Creek esplanade reserve and SEA areas of which there are none in the Project Area.

The assessment carried out as part of this EcIA has identified two small areas of endangered indigenous vegetation within (Pūriri forest (WF7)) and adjacent (kahikatea forest (MF4)) to the Project Area which could be considered suitable for SEA or covenant in the future. Although fragmented and not currently within SEAs, these areas have greater potential to support high value native species than the surrounding exotic vegetation.

Additionally, protection and enhancement of biodiversity is proposed through the Drury – Ōpāheke Structure Plan (Auckland Council, 2019). In the Structure Plan a 'Blue Green Network' (Appendix 7, Figure 30) is proposed which seeks to provide contiguous ecological linkages, connecting significant terrestrial and marine ecological areas through restored riparian margins 10-20 m wide. This places greater emphasis on the protection and enhancement of existing watercourses and areas of significant natural value, requiring these areas to be accommodated within the future urban environment. Although the Structure Plan does not hold any formal statutory weight and may change, it is likely that there will be an expectation that future development will be consistent with the proposed blue green network.

In light of this context, it is assumed that in a future urbanised scenario, permanent stream, wetlands and areas of indigenous vegetation will generally be avoided by development and retained. It is also assumed that stormwater design will be integrated into the proposed ‘Blue Green Network’ and sediment and pollutants will be controlled at source. For example, if riparian habitat restoration is implemented appropriately, it is considered that in a future scenario many of the features of value could be similar or in some cases enhanced.

The majority of native species assessed within this report are generally adaptable to human modified environments and therefore it is possible that despite the potentially negative implications of urbanisation (disturbance, habitat loss and fragmentation) these species may remain, where suitable habitat is retained. However, as the urban landscape becomes less permeable to wildlife the viability of these species will become increasingly dependent on the quality of catchment wide mitigation within the Project Area and surrounding FUZ.

Assuming structure plan recommendations to retain and enhance watercourses are implemented within the Project Area and the surrounding FUZ, the landscape should remain viable for all assessed native species and may even be improved for some species. Pre-construction surveys to confirm a change in ecological value are not required because there are no ecological features effected by the Project within the Project Area that result in a **Moderate** or higher level of ecological effect (as they relate to district plan matters).

10.3 Assessment of Ecological Effects and Impact Management Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

As discussed in Section 4.1, this assessment has been prepared to support the NoR D5 and has been undertaken in the context of the ecological baseline and the likely future environment that has been described in Section 10.2. When assessing the actual or potential ecological effects of allowing NoR D5, this assessment has been limited to matters that would trigger a district plan consent requirement and presented in Section 10.3.1 and 10.3.2 below.

Where regional and/or Freshwater NES consenting requirements are triggered, these will not be authorised by the designation, and will require further consents. In order to demonstrate the split between regional and district plan matters, we have included a table as Appendix 1 which identifies the potential ecological effects of the construction and operation of the Projects, and whether these are regional, or district plan matters under the AUP OiP.

Although regional/Freshwater NES consents are not being sought at this stage, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree as part of this report to inform design, options assessment and the proposed designation footprint. For regional matters this has included the identification of any areas of significant value or habitats for the purposes of design and alignment decisions along with identification of future resource consent requirements. This information is presented in Section 10.4 – Design and Resource Consent Considerations.

10.3.1 Assessment of Construction Effects

10.3.1.1 Summary of Potential Construction Effects, Prior to Impact Management

The proposed construction activities have the potential to cause impacts on ecological features within or adjacent to the Project Area, without impact management.

Potential construction effects that relate to district plan matters are summarised below:

- Vegetation removal (that triggers district plan controls) leading to the permanent loss of terrestrial habitats;
- Construction activities causing light, noise and vibration leading to the disturbance and displacement of indigenous fauna (e.g. bats, lizards and birds).

10.3.1.2 Magnitude of Construction Effects

The magnitude of construction effects listed above on impacted ecological features (Sections 10.2.2 and 10.2.3) are discussed in the following sections (Sections 10.3.1.2.1 and 10.3.1.2.2).

10.3.1.2.1 Habitats

10.3.1.2.1.1 Terrestrial Habitat

Section 10.2.2.1 describes all habitat types present with the Project Area. The Project Arboricultural report identifies the vegetation that is district plan related e.g. within the existing road space and therefore considered a district plan matter for inclusion in this assessment of effects.

Construction effects have been assessed in relation to district plan vegetation and relates to the loss of permanent habitat for native fauna (e.g. bats, birds and lizards). Compliance with the Wildlife Act (1953) relating to the unintentional killing, injuring or disturbing of native fauna (e.g. bats, birds and lizards) has also been considered.

For NoR D5 the following trees/vegetation were identified within the Project Area that are subject to district plan controls and will be removed due to the Project.

- A group of black poplar (identified as DP132 within the Arborist Report) located in the road reserve outside Open Space zoned land on the bank of Slippery Creek and adjacent to the Hays Stream Bridge. These trees are identified as Treeland (TL.3) within this EcIA (refer Table 85). The location of this site can be found in Appendix 3 of the Arboricultural report, Figure A3-08., while information on the vegetation type, age, value is further detailed in Appendix 1 Table 3 of the report.

For NoR D5, the following trees/vegetation were identified within the Project Area that are subject to district plan controls and will not be removed but may be affected due to the Project.

- A group of bald cypress and a group of Japanese cedar (identified as DP130 and DP131 respectively within the Arborist Report) located in the road reserve outside 165 Ōpāheke Road. Due to their small number, these trees have not been classified within this EcIA. The location of these sites can be found in Appendix 3 of the Arboricultural report, Figure A3-08., while information on the vegetation type, age, value is further detailed in Appendix 1 Table 3 of the report.

With the exception of the large black poplar trees in the Open Space zoned land (Ōpāheke Reserve) (DP132), the majority of district plan trees/vegetation detailed above are young and exotic, albeit they do provide important vegetated habitat in a predominantly urban landscape for fauna and the support of ecosystem services. The Project Assessment of Landscape and Visual Effects report identifies that there will be a net increase in green infrastructure and associated habitats within the Project Area as a result of the Project, including street trees, berm and stormwater plantings and planted stormwater wetlands. This is considered to be embedded mitigation. Overall, the vegetation being removed is considered to be of Low ecological value botanically but could provide potential habitat for common native birds and lizards and potentially bats. Bat presence has not been confirmed from Project surveys, however, bats have been recorded in desktop records within 4 km of the Project in the Hunua Ranges. Although the habitats are considered to be of Low value for bats, the potential presence of roosting bats during removal should not be discounted in the black pine trees to be removed from the Ōpāheke Reserve (DP132). The trees at this location have been identified to have low bat roost potential however this may need to be reassessed in the future, to ensure compliance with the Wildlife Act (1953). There is also the potential for all trees that they could contain nesting native birds that could be killed or injured during removal and would also require management under the Wildlife Act (1953). Similarly, any trees with unmanaged ground cover (not mown or grazed grass i.e. rank grass, shrubs or dense leaflitter) could support native copper skink and potentially ornate skink that could be killed or injured during removal and would also require management under the Wildlife Act (1953).

The district plan trees/vegetation detailed above are exotic and therefore of **Low** ecological value botanically but could provide potential habitat for common native birds, lizards and bats. These habitats are common and easily replaced in the short term and as such the magnitude of effect is considered to be **Low.** However, these trees should be assessed for bird, bat and lizard presence prior to removal and management controls put in place to ensure compliance with the Wildlife Act 1953.

10.3.1.2.2 Species

10.3.1.2.2.1 Bats

Bats have not been detected within the Project Area during field surveys or from the review of existing databases and literature. However, potentially suitable habitat has been identified for long-tailed bats within the Project Area, including vegetated stream corridors and exotic trees. Long-tailed bats have previously been recorded outside of the Project Area (within 4 km) and therefore given the large home range of this species, and suitability of habitat, they could potentially occur within the Project Area (see Section 10.2.3.1).

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. It is currently planned that a site compound will be located adjacent to the Mangapū Stream and Waipokapū Stream, which could be used as commuting corridor by bats. 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.

The rural section of the project is currently unlit. Where practicable light spill from construction compounds into the stream corridors should be minimised as bat behaviour may be altered by additional artificial lighting. Where possible stream corridors should be retained as dark corridors to minimise impacts on nocturnal species.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. At present bat roosts have not be confirmed within the designation boundary, but mature trees that could be used as roosts are known to be present. The oak trees along the Ponga Road, for example provide potentially suitable roost locations for bats.

Bats have not been detected within or adjacent to the Project Area and therefore this assessment is based upon habitat potential and desktop records. It is considered unlikely that construction activities would result in the disturbance or displacement of individuals or their roosts because they are likely infrequent visitors to the area. As such, the magnitude of effect on bats is considered to be **Low**.

10.3.1.2.2.2 Birds

Noise, vibration and lighting disturbance caused by construction activities could displace indigenous birds from suitable nesting and foraging habitat within and adjacent to the Project Area.

As described in Section 10.2.3.2.3; the Project Area has **Low** value habitat for forest birds. The majority of birds which occur in the Project Area are common in the local area (modified agricultural land). They are adapted to human modified environments, and suitable foraging habitat of equal or better quality will remain adjacent to the Project Area during construction. The stand of native forest potentially suitable for At Risk – Recovering kākā is not considered to be breeding habitat and is likely to be largely avoided by the Project. Overall, the magnitude of effects from the Project construction activities on the local bird population is considered to be **Low**.

10.3.1.2.2.3 Herpetofauna

Indigenous copper skink (Not Threatened) are likely to be present throughout the Project Area within any suitable surrogate habitat, such as rank grassland, treeland habitat along stream corridors and planted vegetation. There is also the potential for ornate skink to be present within similar habitat, although, ornate skink is only likely to be found along the key stream corridors (Mangapū Stream and Waipokapū Stream) and where these habitat features are connected to adjacent stands of native forest pūriri forest (WF7) and kahikatea forest (MF4). As the key stream corridors with suitable lizard habitat (Mangapū Stream and Waipokapū Stream) will be bridged, the habitat present within the project area will be retained. Although some vegetation clearance may be required to accommodate bridge construction, it is assumed that some riparian habitat will be retained. To manage construction effects some exclusion or salvage may be required prior to construction to ensure compliance with the Wildlife Act 1953.

Noise, vibration and lighting disturbance caused by construction activities could displace indigenous lizards locally during construction, however suitable habitat is present adjacent to the Project Area from suitable habitat adjacent into the Project Area. However, lizards are considered to be sheltered within existing adjacent habitat and therefore the magnitude of effects from the Project on the local lizard population is considered to be **Low**.

10.3.1.3 Level of Ecological Effects – Construction

In accordance with EIANZ Guidelines the level of ecological effects from the construction of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the Project construction.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern; however, the Project will also need to comply with the Wildlife Act 1953 if applicable.

Table 98 below summarised the overall level of ecological effects for each key ecological feature and fauna group related to the Project before impact management is applied.

Table 98 Summary of potential ecological effects (prior to impact management) during construction based on ecological value and magnitude of the effect

Ecological Feature	Ecological Value	Magnitude of Construction Effects	Level of Ecological Effect (prior impact management)
Terrestrial habitat – district matters	Low	Moderate	Low
Bats	Low	Low	Very low
Birds – forest habitat	Moderate and Low	Low	Very Low/Low
Herpetofauna	Moderate	Low	Low

The assessment identified that the level of ecological effects from the construction of the Project on all ecological features are **Very low** to **Low** on different ecological features (Table 98). In accordance with the EIANZ Guidelines impact management measures are proposed for those effects **Moderate** and above and as such impact management is not required for the Project construction effects.

10.3.2 Assessment of Operational Effects

10.3.2.1 Summary of Potential Operational Effects, Prior to Impact Management

The Project involves widening of the existing two lane 20 m wide crossing section to a 24 m wide cross-section to accommodate footpaths and cycleways. Although some impacts may increase from the current baseline, many operational effects such as fragmentation and noise and lighting are likely to be pre-existing. These changes will be considered when assessing the magnitude of effects on potentially already impacted ecological features or species that have habituated to the existing road.

In general, potential operational effects from the Project that relate to district plan matters are presented in Appendix 1, and are summarised below.

- Loss in connectivity to indigenous fauna (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests/roosts (e.g. bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road.

The magnitude of these operational effects is discussed in Section 10.3.2.2.

10.3.2.2 Magnitude of Operational Effects

10.3.2.2.1 Bats

Although bats themselves have not been detected during surveys, suitable habitat has been identified for long-tailed bats along vegetated stream corridors which cross the Project Area.

It is known that the loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bat foraging habitat. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations. The existing rural section of the Project Area is largely unlit and would likely have LED lighting columns installed along the full Project. As the area will be coming increasingly urbanised any bat would be habituated to existing light levels and may already avoid the existing road corridor. However, where practicable and taking safety into consideration, it is recommended that lighting is minimised along stream corridors (Mangapū Stream and Waipokapū Stream). This could be achieved by removing tall lighting columns where the project crosses the stream corridor. Low/ground level lighting for pedestrian safety could be maintained as required. Maintaining dark corridors for wildlife will allow for reduced habitat fragmentation and will minimise alteration to behavioural patterns.

As bats have not been recorded within or adjacent to the Project Area, it is considered unlikely that the operation of the Project would result in the disturbance or displacement of individuals or their roosts. As such, the magnitude of effect on bats is considered to be Low. It is recommended that ABM surveys are repeated along potentially high value habitat areas such as the Mangapū Stream and Waipokapū Stream prior to regional consent applications. If at a later stage, bats are found to be present within or adjacent to the Project , the magnitude of effects would increase, and more specific impact management would be required.

10.3.2.2.2 Birds

The operational impacts from the Project on forest birds (see Section 10.2.3.2.2 for locations and a description), are similar to those on bats. Birds could also be displaced as a result of light spill and noise during operation and habitat fragmented where the Project crosses known habitat corridors. Loss of connectivity through permanent habitat loss and disturbance such as operational noise/vibration and light can lead to an overall reduction in size and quality of bird foraging habitat. As the area will become increasingly urbanised any birds would become habituated to existing light levels or may already avoid the proposed road corridor. However, where practicable, low/ground level lighting for pedestrian safety could be used along dark stream corridors to reduce habitat fragmentation and minimise alteration to behavioural patterns. The species present are those species which have adapted to use habitats modified by humans and as such, the magnitude of effects from the operation of the Project are considered to be Low.

10.3.2.2.3 Herpetofauna

Indigenous lizard species have been identified in the local area and there is the potential that:

- Copper skink (Not Threatened) could be present; and
- Ornate skink, (all At Risk – Declining) could be present within the Project Area e.g. Pūriri Forest (WF7.3) and vegetated stream corridors, where surrogate habitat areas connected to

native forest habitats such as planted and exotic vegetation with dense ground cover and/or log piles.

Native lizards require vegetated corridors (such as riparian stream corridors) to facilitate natural dispersal. The Project is upgrading existing roads and bridges and therefore is not considered to create any additional barriers to movement or dispersal of lizards. During detailed design/resource consent, connectivity should be retained for lizards including appropriately vegetated corridors under bridges or include ledges within culverts or under bridges e.g. Waipokapū Stream. Key areas of focus for improving habitat connectivity should include the crossing of the Mangapū Stream where remnant forest fragments occur that could be used as connecting habitat for native lizards (Appendix 7 Drawing SGA-EX-DL-007.2). The existing culvert over the Mangapū Stream creates a barrier for native lizards. The new bridge structure over Mangapū Stream will provide connection between extensive native forest habitat in the Hunua foothills, with known elegant gecko records in SEA_T_7032, 0.5 km to the east. A new bridge structure would allow for stream bank restoration under the road and allow for lizards to disperse along where vegetated dry passage is incorporated in bridge design. As the existing culvert causes fragmentation for native lizards, an upgrade to a bridge structure would be considered to be of ecological benefit, and connectivity would be improved.

As the area will become increasingly urbanised any lizards may become habituated to existing light levels or may avoid the proposed road corridor. However, where practicable, low/ground level lighting for pedestrian safety could be used along dark stream corridors to reduce habitat fragmentation and minimise alteration to behavioural patterns.

Overall, it is considered that the magnitude of operational Project effects on indigenous lizards would be **Low**, without impact management.

10.3.2.3 Level of Ecological Effects – Operation

In accordance with EIANZ Guidelines (Roper-Lindsay *et al.* 2018) the level of ecological effects from the operation of the Project was determined using the matrix presented in Appendix 3. This matrix considers the magnitude of potential effects and the ecological value of existing natural features to provide an understanding of the level of ecological effects that are likely to occur as a result of the operation of the Project.

EIANZ Guidelines state that **Moderate** to **Very high** levels of effect require avoidance or mitigation. **Very low** to **Low** impacts are normally of lower concern.

Table 99 Summary of potential ecological effects (prior to impact management) during operation based on ecological value and magnitude of the impacts.

Ecological Feature	Ecological Value	Magnitude of Operational Effects	Level of Ecological Effect (prior to impact management)
Bats	Low	Low	Very low
Birds – forest habitat	Moderate and Low	Low	Low and Very low
Herpetofauna	Moderate	Low	Low

The assessment identified that the level of ecological effects of the operation of the Project on all ecological features was **Very low** or **Low** on different ecological features (Table 99).

In accordance with the EIANZ Guidelines (Roper-Lindsay *et al.* 2018) impact management measures are proposed for those effects **Moderate** and above and as such impact management is not required for the Project operational effects.

10.3.3 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native birds.

Almost all original native habitat within and adjacent to the Project Area has been removed due to historical land use change. As such, the types of fauna generally remaining within the habitats are Not Threatened native or exotic species, which are generally adaptable to modified environments. Common Not Threatened native species like copper skink, are considered very likely to occur within these modified, low value habitats (e.g. exotic trees, rank grass, exotic scrub) within the Project Area. The ongoing long-term incremental loss of low value habitat may however cause detrimental effects on local populations of 'common' species, which within a project specific context would not normally require impact management under the EIANZ Guidelines. As low value habitats are likely to be altered by the Project and by other external projects (surrounding development), the risk of significant habitat degradation for Not Threatened species such as copper skink and native birds is likely to be cumulative and must be considered in the wider regional context.

Many native fauna species have wide ranging and complex habitat requirements, such that small, incremental changes in habitat quantity or quality could have unforeseen adverse effects on their ability to persist in the landscape over time. Historical vegetation clearance (loss of buffer vegetation) and wetland drainage (fragmentation) have also made the landscape more vulnerable to such cumulative effects, as issues become more acute. District Plan matters relating to disturbance (such as lighting, noise and vibration) may not adversely affect native lizards in the short term, as they become habituated. However, potential gradual incremental changes in habitat, caused by surrounding urbanisation, such as fragmentation and reduced foraging capacity, could reduce viability of native fauna persisting over time.

All developments within the Drury-Ōpāheke Structure Plan area should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Structure Plan area and its catchments.

If the developments (including this Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced, and the buffering effect of riparian habitat restoration could reduce disturbance (e.g. lighting from surrounding urbanisation). The opportunity to enhance stream corridors through riparian planting has been highlighted within the Drury-Ōpāheke Structure Plan and it is anticipated that this will be reflected within future Plan Changes. This Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

10.3.4 Summary and Conclusions

Ecological features were assessed for their potential to be adversely affected from the construction and operation of the Project relating to district plan matters. The level of effect from the construction and operation of Project was assessed to be **Very low** or **Low** for all of the relevant habitat (terrestrial – district plan only) and fauna species (bats, birds and lizards) and therefore no specific impact management has been recommended.

The Ōtūwairoa Stream and Mangapū Stream have been identified as the main corridors of ecological value associated with the Project Area due to retained connectivity for wildlife and associated floodplain wetlands. Additionally, these corridors have the potential to support At Risk Declining species such as ornate skink. In a future scenario when the surrounding environment is likely to be urbanised, the importance of these stream corridors will be even more important as the urban environment becomes less permeable to the natural movement of native species. These areas should be prioritised for retention and enhancement in line with Structure Plan recommendations for the 'Blue-green network'.

10.4 Design and Resource Consent Considerations

Although resource consents are not being sought for the Project at this stage, ecological effects arising in respect of activities that require regional consents have been considered to a more limited degree to inform design, options assessment and the proposed designation footprint of the Project. The outcome of this analysis is presented below. This includes the identification of any ecological features of value for the purposes of design and alignment decisions and to identify future consenting requirements.

In terms of regional matters, a full list of potential regional consent matters is included in Appendix 1, but in summary these relate to:

- Effects of vegetation removal on terrestrial habitats – rural zones, riparian margins, coastal areas, SEA's;
- Effects of vegetation removal on fauna (bats, birds, lizards) behaviour and their roosts/nests
- Effects on streams and wetlands; and
- Earthworks effects – weed dispersal and sediment discharge.

Ecological effects and associated impact management relating to district plan matters that are the focus of this assessment for the Project, have been presented in Section 10.2.5.

The Freshwater NES came into effect on 3 September 2020 and contains consent requirements for the construction of specified infrastructure involving vegetation clearance and works within certain natural wetlands and streams. Our preliminary view is that there may be wetlands within the Project Area that meet the definition of "natural wetland" and therefore discretionary consent under the Freshwater NES may be required for these works. The application of these consent requirements will need to be considered further as part of the future consenting process for the Projects. Delineation of these wetlands for the purposes of the Freshwater NES will require further site investigations and soil sampling to inform the detailed design of the Project. Generally, the alignment and design refinement process for each proposed designation has sought to avoid or minimise impacts on high value natural wetlands and streams. There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects.

Some potential effects of the Project (i.e. killing or harming) on individual specifically listed fauna and their nests/roosts is covered by the Wildlife Act 1953. For completeness these are discussed in the section below as they are aligned with regional consent vegetation removal effects.

10.4.1 Terrestrial Habitat

Construction of the Project would result in temporary and permanent loss of vegetation within the Project Areas, including suitable habitat that is potentially used by indigenous fauna (bats, birds and lizards). This includes vegetation that is both a regional and a district plan matter (Appendix 1). Loss of district plan vegetation is discussed in Section 10.3.1.2.1.1. The amounts and types of terrestrial habitat and vegetation (including habitat used by indigenous fauna) to be lost as a result of the Project (District and Regional) is presented in Table 100. Given the wide extent of copper skink habitat, only habitat suitable for At Risk lizard species is presented.

Table 100 Potential area of permanent terrestrial habitat loss within the Project Area (NoR D5)

Habitat Type	Habitat Code	Potential area to be lost (ha)	Bat habitat loss (ha)	Bird habitat loss (ha)	Lizard habitat loss (ha)
Brown Field	BF	0.21	N/A	N/A	N/A
Exotic Forest	EF	0.07	0.07	0.07	0.07
Exotic Grassland	EG	0	N/A	N/A	N/A
Exotic Scrubland	ES	0.21	N/A	0.21	0.21
Planted vegetation	PL.1	0.08	0.08	0.08	0.08
Native planted vegetation	PL.3	0.1	0.1	0.1	0.1
Treeland	TL.3	1.01	1.01	1.01	1.01
Pūriri Forest	WF7.3	0	0	0	0
Total		**1.7**	**1.27**	**1.48**	**1.48**

The terrestrial habitats to be lost (temporary and permanent) are predominantly comprised of exotic vegetation which are of **Low** ecological value. However, some of these provide valuable habitat to native fauna and this is discussed in Sections 10.4.1.1 to 10.4.1.3 below.

A small stand of Critically Endangered (WF7.3) Pūriri Forest occurs partially within the boundary of the Project Area, along its northern boundary (Figure 27, Box 1). The edge of this habitat, including dripline and root zone is likely to be impacted by the Project. Where possible detailed design should aim to minimise these impacts. Removal of the trees will require resource consent because of their size and location within the rural zone.

As the design develops and resource consents are prepared, more detailed habitat (such as SEV and Wetland Condition Index) and fauna surveys should be undertaken as required to inform an EcIA (in line with the EIANZ Guidelines) and should include any required impact management requirements.

10.4.1.1 Bat habitat

Bats were not found to be present within the Project Area. However, given the potential Project impacts from vegetation removal and the conservation status (Nationally Critical) of bats, the presence of bats and potential effect of the Project should be re-evaluated as part of the subsequent resource consent phase, prior to construction. As appropriate repeat ABM surveys should be carried out to support this process. Potential vegetation of value for future assessment of potential bat foraging and roosting habitat, has been highlighted in Appendix 7, Drawing SGA-EX-DL-012.01. This includes vegetated stream corridors with mature trees along the Waipokapū Stream and Waihoehoe Stream. As the Project moves into the resource consent phase, the Project landscape design should incorporate the 'Blue Green Network' into the Project Area (Appendix 7, Figure 30). Key aspects of this mitigation should include the protection of mature trees (exotic and native) with bat roost potential where possible and retention of riparian vegetation along stream corridors, particularly at bridge crossing points or where transport corridors bisect mature vegetation, as well as bespoke low-lumination artificial lighting regimes near key known habitats. As a gleaning species long-tailed bats fly at canopy height commuting and foraging along forest edges and stream corridors. Where this canopy is maintained and/or enhanced to a height >4.3 m (max height for standard vehicles) (NZ Transport Agency, 2019) above the vehicle deck, bats are likely to maintain a safe distance from moving traffic and therefore avoid any adverse interaction with the transport corridor. Suitable vegetation (native or exotic) of this height, acts as bat 'hop-over' vegetation and should be retained and enhanced where possible in areas where potential commuting corridors could occur within the Project Area (Appendix 7, Drawing SGA-EX-DL-012.01).

10.4.1.2 Bird habitat

The Project Area is likely to contain Not Threatened indigenous forest birds, with At Risk – Recovering kaka, only likely to occur incidentally. Vegetation clearance required for construction could result in the loss of approximately 1.7 ha habitat, which may affect nesting/breeding and other behaviours. Although of low value, any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

10.4.1.3 Herpetofauna habitat

Indigenous lizard species have been identified in the local area and there is the potential that:

- Copper skink (Not Threatened) could occur throughout the Project Area; and
- Ornate skink (At Risk – Declining) could also be present within suitable habitat corridors along the Waipokapū Stream and Mangapū Stream corridors and in indigenous forest fragments within the Project Area.

It was estimated that approximately 1.7 ha of lizard habitat (associated with ornate (and copper) skink only) could be lost as a result of vegetation clearance.

Site clearance required for construction also has the potential to kill or injure of indigenous lizard species. Potential habitat for At Risk lizards has been highlighted in Appendix 7 Drawing SGA-EX-DL-007.2.

There is therefore the potential that site clearance required for construction could kill or injure indigenous lizard species. Any vegetation clearance where copper skink or ornate skink are likely to occur will need to be managed in accordance with the Wildlife Act 1953. To mitigate habitat removal, methods can be developed during the future resource consent process to minimise any such effects.

This could include, lizard salvage and potentially habitat replacement as appropriate. Further detail on these matters is presented in Appendix 10 Resource Consent – Lizard Management.

10.4.2 Freshwater Habitat

10.4.2.1 Streams

The construction of the Project will cross over two permanent and two intermittent streams with a total loss of 656 m^2 of permanent stream and 161 m^2 of intermittent stream loss. This is presented in Table 101, and impacted streams are shown in Appendix 7, Drawings SGA-EC-DL-010209 to SGA-EC-DL-010.25.

Table 101 Potential stream loss within the Project Area (NoR D5)

Stream loss location number*	Stream type	Wetted width of stream (m)**	Bank Width (m)	Length to be lost (m)	Loss (m^2) ***	Notes
D5.S1	Permanent	4	20	22	450	Bridge proposed
D5.S2	Artificial/Swale	0.25	1	89	100	Existing stream is highly modified and channelised. Realignment could reduce overall loss.
D5.S4	Intermittent	1	2	36	50	Large amount of stream loss, bridging or other design changes could reduce loss.
D5.S5	Permanent	2	8	27	200	Large amount of stream loss, bridging recommended.
Total Loss	**Permanent**			49	650	
	Intermittent			125	150	

Note:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.20 to SGA-EC-DL-010.25
** = Assessments were carried out in drought conditions when it was difficult to accurately delineate stream width. Therefore, widths and areas are indicative

During the detailed design phase culvert design will be confirmed. However, it is considered highly likely (based on the indicative design for the Project) that at least some of the streams will be culverted, resulting in a loss of instream and riparian habitat and therefore impact management will be required. Under a future regional consent for earthworks, impact management would also be required to ensure sediment discharge to streams is controlled appropriately.

10.4.2.2 Wetland Habitat

Construction of the Project could result in the loss of exotic wetland habitat. The manner in which wetlands are affected will be confirmed at the detailed design stage of the Project, however it is likely that the entirety of wetland D5.W1 will be lost, and D5.W2 will be culverted or reclaimed (based on the indicative design for the NoR), resulting in a loss of wetland habitat and vegetation. Additionally, hydrological inputs to wetlands can also be affected by Project activities such as embankments and culverts altering flow regimes. Wetland loss within the Project Area is presented in Table 102, and impacted wetlands are shown in Appendix 7, Drawings SGA-EC-DL-010.20 to SGA-EC-DL-010.25.

Table 102 Indicative wetland loss within the Ponga / Ōpāheke Project Area (NoR D5)

Wetland location number*	Type (Singers *et al.*, 2017)**	Wetland size (m^2)***	Indicative area of impact/potential loss (subject to detailed design) (m^2)***	Notes
D5W1	Exotic Wetland (EW)	3,800	3,400	Wetland offset required.
D5W2	Exotic Wetland (EW)	250	130	Wetland offset required.
Total			3,530	

Note:
* = refer to Appendix 7, Drawings SGA-EC-DL-010.20 to SGA-EC-DL-010.25
** = as classified in Singers *et al.*, 2017
*** = Assessments were carried out in drought conditions when it was difficult to accurately delineate wetland sizes. Therefore, areas are indicative.

A number of stream and wetland locations were identified during the indicative and detailed business cases, route refinement, optioneering assessments and initial design phases and the design has been altered to minimise stream/wetland impacts. This has been partially guided by the ecological value assessment of streams and wetlands undertaken in Sections 10.2.2.2.3 and 10.2.2.3.3.

Table 101 details the estimated stream loss (800 m^2) and Table 102 details estimated wetland loss (3,530 m^2) as a result of the Project. As the design develops and regional and/or Freshwater NES resource consent applications are prepared it is anticipated that an assessment of the effects on freshwater/wetland habitat will be undertaken and more detailed information collected on freshwater habitat classifications, along with the ecological value of streams and wetlands using the SEV stream survey method and Wetland Condition Index (Clarkson *et al.*, 2004) surveys (respectively).

At the detailed design stage, options to avoid or reduce the level of impact (including hydrological effects) to stream and wetlands could be considered e.g. bridges, reduction of embankments, reduction in the length of culverts, type of culvert etc. Where stream or wetland loss is unavoidable, an ecological effects assessment should be undertaken to determine if mitigation or offsetting may be required. Offset requirements should be calculated using accounting systems such as the Environmental Compensation Ratio (ECR) used for streams in the Auckland region.

Final ECR calculations will require SEV surveys to assess stream value and effects and to inform the potential requirement for stream compensation. However, potential compensation has been estimated on a preliminary basis using an ECR of 3:1[25] of stream restoration: stream loss. Assuming further avoidance is not possible for the Project this would equate to intermittent and permanent stream compensation of approximately 450 m^2 and 1,950 m^2 respectively. The area of wetland loss is

[25] Considered to be an average estimate of ECR's in the Auckland Region.

estimated to be 3,530 m^2, and while further assessment is required, assuming a similar compensation ratio of 3:1, approximately 10,590 m^2 of wetland compensation may be required.

Broad mitigation recommendations for stream/wetland compensation/offset opportunities and should be tailored as the detailed design advances. Where possible this mitigation will be incorporated within the designation boundary.

10.4.2.3 Fish

Fish surveys were not undertaken as part of the field investigations for the NoR, however NIWA freshwater fish database and Auckland Council Catchment Assessment Reports were reviewed and highlighted the likely presence of a number of At Risk and other native fish species within streams within the Project Area (Table 19).

Although not confirmed, it is considered likely that some streams will be culverted to facilitate road widening. Some potential barriers to fish passage have already been identified (Appendix 7, Drawing SGA-EC-DL-010.20 to SGA-EC-DL-010.25). SEV surveys undertaken during the resource consent phase of the Project will identify if native fish are present and if there is suitable upstream habitat. If so, culvert extensions may cause habitat fragmentation and loss of spawning habitat for native fish. In addition, fish may be killed or injured during culvert installation/extension within the stream.

If required, culvert design considerations should allow for fish passage. In addition, fish recovery and translocation would be required as part of the future resource consents for the Project.

10.4.3 Positive effects/ Future Opportunities

Positive ecological effects are currently anticipated as a result of the Project and further positive outcomes and enhancement opportunities should continue to be developed during detailed design. If implemented, these are currently likely to include:

- The ability for future Project landscape planting to tie into the proposed vegetated corridors anticipated by the Drury -Ōpāheke Structure Plan, Blue-Green Network. Opportunities at specific locations have been outlined in the Project Assessment of Landscape and Visual Effects report;
- Net increase in green infrastructure and associated habitats within the Project Area associated with street trees, berm and stormwater plantings and planted stormwater wetlands. The Project Assessment of Landscape and Visual Effects report outlines recommendations to ensure ecological enhancement opportunities are capitalised upon at these locations.
- There are stream and wetland enhancement opportunities identified within Table 100 and Table 101. Where possible this could be incorporated within the existing designation boundary, beyond the construction footprint.
- Enhance vegetated corridors under bridges or include ledges within culverts or under bridges to allow for lizard connectivity.

A review of the surrounding catchment highlights that there is potentially available stream or wetland habitat for offset/compensation within the designation boundary if this is required.

10.4.4 Cumulative Effects

As stated in the EIANZ Guidelines 2018, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. For the purposes of the Project it is considered that the Drury-Ōpāheke Structure Plan area and the downstream receiving environment associated with the Drury Creek and Pahurehure Inlet are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native fish.

Almost all-original native habitat within, and adjacent to the Project Area has been removed due to historical land use change. As the existing environment is highly modified, the specific Project impacts discussed within this report have been minimal and adverse effects have largely been avoided. However, historical vegetation clearance and wetland drainage have made the landscape more vulnerable to cumulative effects relating to regional consenting considerations including:

- Greater risk of flooding and stormwater runoff. Without treatment and mitigation, the Ōtūwairoa Stream, Mangapū Stream and wider Drury Creek and Pahurehure Inlet would be the ultimate receiving environment for treated stormwater from the Project.
- Erosion and sediment control issues during construction could lead to further habitat degradation and adverse impacts on the downstream receiving environments. For example, sedimentation in the Drury Creek and Pahurehure Inlet could lead to the gradual spread of mangroves, at the expense of saltmarsh and open mudflat habitats;
- Cumulative stream loss and vegetation clearance have a high impact on catchments ecological function, water quality, hydrology and the native fauna that use these habitats (i.e. īnanga spawning habitat, eels etc). Consideration of a riparian habitat function and bankside setback need to be considered in the wider catchment context.

If developments (including the Project) contribute meaningfully to catchment wide integrated management then ecological connectivity can be enhanced. This opportunity has been highlighted within the Drury-Ōpāheke Structure Plan and is anticipated to be reflected in future Plan Changes. The Structure Plan recognises the potential to reverse historical impacts caused by land conversion to agriculture and where implemented appropriately, could remediate cumulative effects in the long term.

10.4.5 Conclusion

Based on survey work undertaken to date, it is considered that any potential effects of the Project on ecological features within or adjacent to the Project Area, for which future regional and/or Freshwater NES consent will be required can be adequately managed in any future consent processes.

The proposed alignment to date has minimised effects on streams, wetlands and terrestrial habitats of value. This includes avoidance of Kahikatea forest and Pūriri forest associated within and adjacent to the Project Area.

A review of the surrounding catchment highlights that there is potentially available stream or wetland habitat for offset/compensation within the proposed designation boundary if that is required.

11 Conclusions

11.1 Recommendations

At Risk - Declining bird species are likely to be present in the Ngakoroa Stream wetlands directly adjacent to the SH22 and Bremner Road bridge crossings (NoR D1 and NoR D2). Coastal wetland birds at these locations are considered to be of **High** ecological value. Project construction could disturb coastal wetland birds with a potentially **High** level of ecological effect overall. These At Risk – Declining bird species are most vulnerable during the breeding season when disturbance due to construction activity may cause displacement and nest abandonment.

A Bird Management Plan is recommended to manage the potential adverse effects. Impact management requirements would include programming work to avoid the bird breeding season (September – February) and pre-construction nesting bird surveys prior to any vegetation clearance or construction works within 20 m of the riparian margins of the Ngakoroa Stream. Additionally, wetland restoration and riparian planting is recommended to buffer habitat from operational disturbance impacts. It is recommended that this location (identified in Appendix 11) should be resurveyed at the same time as resource consent approvals are sought in order to in order to confirm the ecological value identified has been retained and mitigation measures detailed in this EcIA are still required.

Stream and wetland impacts have been considered as part of design and resource consent considerations. High value streams and wetland have largely been avoided, however some impacts on low/moderate value streams and wetlands will be unavoidable. Offset/compensation will therefore be required to mitigate the cumulative loss of hydrological function and ecological value. This can be accommodated within the proposed designation boundary.

12 References

AECOM (2019a) Habitat Survey Report – SH1 Papakura Interchange to Drury Interchange

AECOM (2019b) Wetland and Coastal Bird Survey Report – SH1 Papakura Interchange to Drury Interchange

Armitage, (2013) [updated 2017] Little black shag. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Auckland Regional Council (2004) Awhitu and Mānukau Ecological Districts: Indigenous Vegetation Survey, Volume 1

Bellingham, M. (2013) Banded rail. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Clapcott, J. E. (2015). National Rapid Habitat Assessment Protocol Development for Streams and Rivers. Prepared for Northland Regional Council. Report Number 2649. Cawthron Institute: Nelson, New Zealand.

Clapcott, J. E. (2013). Rapid habitat assessment workshop. Prepared for Hawkes Bay Regional Council. Cawthron Report No. 2445. Nelson, Cawthron Institute.

Clarkson, B., Sorrell, B., Reeves, P., Champion, P., Partridge, T. & Clarkson, B. (2004). Handbook for Monitoring Wetland Condition – Coordinated Monitoring of New Zealand Wetlands. Revised Edition. doi:10.7931/J2Z60KZ3

Dawson, D.G. & Bull, P.C. (1975). Counting birds in New Zealand forests. *Notornis*, 22, 101–109.

de Lange P.J, Rolfe J.R, Barkla J.W, Courtney S.P, Champion P.D, Perrie L.R, Beadel S.M, Ford K.A, Breitwieser I, Schönberger I, Hindmarsh-Walls R, Heenan P.B and Ladley K. Threat Classification of New Zealand Vascular Plants. New Zealand Threat Classification Series 22. Department of Conservation: Wellington, New Zealand.

Department of Conservation (2019). Tree removal protocol for areas where bats are present. Report Number 5952435. Unpublished report supplied to AECOM via Wildlands Consultants LTD.

Dowding, J.E. (2013) [updated 2017]. Wrybill. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Dunn N.R. *et al.* (2017). Conservation status of New Zealand freshwater fishes New Zealand threat classification series 24 Department of Conservation

Ecogecko (2014). *Lizard Survey Report for the Proposed Upgrade of the Redoubt-Mill Road Corridor.* Ecogecko Consultants Limited.

Fitzgerald, N. (2013) Caspian tern. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Fitzgerald, N. (2013) [updated 2017] Spotless crake. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online.* Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Franklin, P., Gee, E., Baker, C. & Bowie, S. (2018). New Zealand Fish Passage Guidelines. National Institute of Water & Atmospheric Research (NIWA): Hamilton, New Zealand.

Garton C., Lawrie D., Turner B., Templeton L. (2018). 60 years of migratory bird management on the Mānukau.

Gillies, R., Shaw, W., & Mazzieri, F., (2014) Evaluation of Restoration Management Requirements at Miranda – Pukorokoro Wildland Consultants Ltd prepared for Department of Conservation

Grainger, N., Collier, K., Hitchmough, R., Harding, J., Smith, B & Sutherland, D. (2013). Conservation status of New Zealand freshwater invertebrates. New Zealand Threat Classification Series 8. Department of Conservation: Wellington, New Zealand.

Hickford, M. J., Cagnon, M., Schiel, D. R. 2010: Predation, vegetation and habitat-specific survival of terrestrial eggs of a diadromous fish, Galaxias maculatus. Journal of Experimental Marine Biology and ecology 385: 7

Hitchmough R, Barr B, Lettink M, Monks J, Reardon J, Tocher M, van Winkel D , Rolfe J 2016. Conservation status of New Zealand reptiles, 2015: New Zealand Threat Classification Series 17. Wellington, DOC.

Ingley, R., Rieger, A., Magee, J., Reeves, E., Macintosh, K., Lowe, M., Young, D. (2016) Watercourse Assessment Report: Ōtūwairoa Creek Catchment. Morphum Environmental for Auckland Council.

Institute of Lighting Professionals (ILP) and the Bat Conservation Trust (2018). Guidance note 8 bats and artificial lighting. https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/.

Kane-Sanderson, P., Spyksma, A., Bennett, K., Lindgreen, M., Pertziger, F., Bennett, J., Secretin, C. (2017) Oira Catchment Watercourse Assessment Report. 4Sight Consulting and AECOM New Zealand Ltd for Auckland Council.

Lindsay, H., Wild, C. and Byers, S. (2009). Auckland protection strategy: a report to the Nature Heritage Fund Committee. Nature Heritage Fund. Wellington. 85p.

McClellan, R.K., Habraken, A. (2013) [updated 2019] Black-billed gull. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

McEwen (ed.) (1987). Ecological Regions and Districts of New Zealand. Wellington: Department of Conservation.

McGahan, D., Burn, O., and Whyte, D., (2016) Northern Corridor Improvements Assessment of Environmental Effects Aurecon Prepared for NZ Transport Agency.

Mills, J.A. (2013) [updated 2018] Red-billed gull. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Mills, J.A. (2013) White-fronted tern. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Ministry for the Environment (2019). Draft National Policy Statement for Indigenous Biodiversity. ME 1471. Wellington, New Zealand: New Zealand Government.

Miskelly, C.M. (2013) Fernbird. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Moorhouse, R.J. (2013) [updated 2017] Kaka. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

National Pest Control Agencies (2013). Keep it Clean – Machinery hygiene guidelines and logbook to prevent the spread of pests and weeds. National Pest Control Agencies. Wellington, New Zealand. ISBN 978-1-877474-54-5.

NZ Transport Agency (2019). Land Transport Rule Vehicle Dimensions and Mass Amendment Rule 41001/2016/1

Powlesland, R.G. (2013) Black shag. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Powlesland, R.G. (2013) [updated 2017] Pied shag. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Quinn, J., Neale, M. & Storey, R. (2011). Stream Ecological Valuation (SEV): a method for assessing the ecological functions of Auckland streams. Auckland Council technical report, TR2011/009.

Roper-Lindsay, J., Fuller, S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). Ecological impact assessment. EIANZ Guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition. EIANZ Melbourne, Australia.

Sagar, P.M. (2013) South Island Pied Oystercatcher. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Sawyer, J & Stanley, R. (2012). Criteria for the identification of significant ecological areas in Auckland. Auckland, New Zealand: Auckland Council.

Singers, N., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., Hill, K., Andrews, J., Hill, S. & Webb, C. (2017). Indigenous terrestrial and wetland ecosystems of Auckland. Auckland Council: Auckland, New Zealand.

Smith, D., Borkin, K., Jones, C., Lindberg, S., Davies, F. & Eccles, G. (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. Research report 623, 249 p. NZ Transport Agency: Wellington; New Zealand.

Storey, R.G., Neale, M.W., Rowe, D.K., Collier, K.J., Hatton, C., Joy, M.K., Maxted, J. R., Moore, S., Parkyn, S.M., Phillips, N. and Quinn, J.M. (2011) Stream Ecological Valuation (SEV): a method for assessing the ecological function of Auckland streams. Auckland Council Technical Report 2011/009.

Snelder, TH, Biggs B and Weatherhead M (2004). *New Zealand River Environment Classification User Guide*. Ministry for the environment and NIWA. Publication number: ME 1026, ISBN 978047833495.

Snelder, TH, Cattaneo F, Suren AM, Biggs BJF. (2004b). *Is the River Environmental Classification an improvement landscape-scale classification of rivers?* The North American Benthological Society, 2004, 23(3):580-589.

Spyksma, A., Bennett, K., Kane-Sanderson, P., Lindgreen, M., Pertziger, F., Allen, J., Gasson, S and Canal, L. (2018a) Hingaia Stream Catchment Watercourse Assessment Report. 4Sight Consulting and Urban Solutions for Auckland Council. Auckland Council

Spyksma, A., Bennett, K., Kane-Sanderson, P., Lindgreen, M., Pertziger, F., Allen, J., Gasson, S and Canal, L. (2018b) Hingaia Stream Catchment Watercourse Assessment Report. 4Sight Consulting and Urban Solutions for Auckland Council. Auckland Council

Surrey, G., Fredrick, K., Ingley, R., & Rossaak. A., (2018) Watercourse Assessment Report Ngakoroa Catchment, Prepared for Auckland Council by Morphum Environmental Ltd

Szabo, M.J. (2013) [updated 2017] New Zealand dabchick. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online.* Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

Szabo, M.J. (2013) [updated 2017] Royal spoonbill. *In* Miskelly, C.M. (ed.) *New Zealand Birds Online*. Retrieved 30 June 2020 from www.nzbirdsonline.org.nz

van Winkel, D., Baling, M. & Hitchmough, R. (2018). Reptiles and Amphibians of New Zealand. Auckland University Press: Auckland, New Zealand.

Walker, S., Price, R., Rutledge, D. (2008) New Zealand's remaining indigenous cover: recent changes and biodiversity protection needs. Science for Conservation 284. Department of Conservation, Wellington.

Webb, C. (2020). Supporting Growth Alliance – Drury Arboriculture Report.

Appendix 1. Regional and district consent Matters

Table 103 Ecological effects of road infrastructure construction broken down into AUP OiP Regional and district plan matters

Ecological feature	Activity	Ecological Effect	AUPOiP district plan provisions	AUPOiP Regional Plan provisions	Wildlife Act (1953)
Construction					
Terrestrial habitat	Vegetation removal (including trees) outside of roads and public spaces in: a) a rural zone b) riparian margins c) coastal areas d) SEAs This also includes other terrestrial habitat of value identified in the EcIA.	Permanent loss of habitat/ecosystem, fragmentation and edge effects		X	
	Vegetation removal (including trees) in: a) Roads b) Public spaces c) ONFs d) ONLs e) HNCs f) ONCs	Permanent loss of habitat/ecosystem, fragmentation and edge effects	✓		
	Earthworks – leading to invasion of bare earth surfaces with weeds and transfer of weeds (seeds and fragments) between earthworks areas	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity		X	
Bats	Vegetation removal	Roost loss		X	X
	Vegetation removal	Kill or injure individual			X
	Vegetation removal	Loss of foraging habitat		X	
	Construction activities (Noise, light, dust etc.)	Disturbance and displacement to roosts and to individuals (existing)	✓		X
Birds (native)	Vegetation removal	Nest loss		X	X
	Vegetation removal	Kill or injure individual			X
	Vegetation removal	Loss of foraging habitat		X	
	Construction activities (Noise, light, dust etc.)	Disturbance and displacement of roosts and individuals (existing)	✓		X
Herpetofauna (native)	Vegetation removal	Lizard habitat loss		X	
	Vegetation removal	Kill or injure individual			X

Ecological feature	Activity	Ecological Effect	AUPOiP district plan provisions	AUPOiP Regional Plan provisions	Wildlife Act (1953)
	Construction activities (Noise, light, dust etc.)	Disturbance and displacement of individuals (existing)	✓		X
Freshwater habitat – wetland or stream (including riparian margins)	Reclamation/ culverting/other structures e.g. bank armouring	Permanent loss/modification of habitat/ecosystem		X	
	Vegetation removal	Permanent loss of habitat/ecosystem, fragmentation and edge effects		X	
	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		X	
	Diversion, abstraction or bunding of watercourses and water level/ flow/ periodicity changes.	Detrimental effects on habitats including plant composition and fauna		X	
Fish (native)	Reclamation/diversion/other structures e.g. bank armouring	Loss of aquatic habitat		X	
	Reclamation/diversion/ culverting/other structures e.g. bank armouring	Kill or injure individual			X
Operation					
Terrestrial habitat	Presence of the road – use of road edges as dispersal corridors by invasive plant species	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity		X	
	Road maintenance – Increased use of herbicides	Increased weed incursion, unintentional spray of indigenous vegetation		X	
Bats	Vehicle movement	Kill or injure individual			X
	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	✓		X
	Lighting and noise/vibration	Disturbance and displacement of (new and existing) roosts and individuals	✓		X
Birds (native)	Vehicle movement	Kill or injure individual			X

Ecological feature	Activity	Ecological Effect	AUPOiP district plan provisions	AUPOiP Regional Plan provisions	Wildlife Act (1953)
	Presence of the road	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		X
	Lighting and noise/vibration	Disturbance and displacement of (new and existing) nests and individuals	✓		X
Herpetofauna (native)	Vehicle movement	Kill or injure individual			X
	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	✓		X
	Lighting	Disturbance of nocturnal lizard behaviour	✓		X
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		X	
	Presence of bridge	Shading leading to change in ecosystem structure		X	
	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)		X	
	Stormwater discharges – pollutants (such as heavy metals and herbicides).	Permanent degradation of wetland or instream habitat and water quality		X	
Fish (native)	Presence of culvert	Loss of connectivity due to culvert preventing fish passage up and downstream		X	

Appendix 2. Regulatory Assessment

Legislation

Resource Management Act 1991

The purpose of the RMA is to achieve sustainable development of natural and physical resources. Important elements of this are the maintenance of indigenous biodiversity and protection of significant indigenous vegetation and habitats. These elements are given effect in Sections 5, 6 and 7, and Schedule 4 sets out the requirements for effects assessments.

Wildlife Act 1953

The Wildlife Act 1953 provides statutory protection for all indigenous lizard, frog, bat and bird species, and for the control of those species listed in Schedules 1 to 6. This includes a number of invertebrates (terrestrial and freshwater) and marine animals.

Conservation Act 1987

The Conservation Act 1987 provides for the protection of New Zealand's natural and historic resources. This includes protection of resources within public conservation land, including marginal strips and specially protected areas. Part 5B sets out protection for indigenous freshwater fish, including spawning habitat and individuals, and requirements regarding fish translocation.

Freshwater Fisheries Regulations 1983

The Freshwater Fisheries Regulations 1983 describes the legal requirement for the protection of indigenous fish species (Part 10, Clause 70) and additional provisions regarding fish passage (Part 6).

National Policy Statements

National Policy Statement for Freshwater Management 2017

The National Policy Statement for Freshwater Management (MfE 2017) provides national direction for decisions regarding water quality and quantity, and integrated management of land, freshwater and coastal environments under the RMA. The National Policy Statement for Freshwater Management contains national objectives that specify what local authorities, in their governance and management roles, must do to help achieve those objectives and policies.

There is a proposed amendment to this NPS that has not yet been adopted but proposes some changes to these governance and management roles and approaches.

Proposed National Policy Statement for Indigenous Biodiversity 2019

The Proposed National Policy Statement for Indigenous Biodiversity (MfE 2019) provides direction for managing indigenous biodiversity under the RMA. It outlines a system for the management of biodiversity outside of public conservation land.

The Proposed National Policy Statement for Biodiversity has not been formally adopted; however, government agencies are looking to develop a new version of the policy statement.

Auckland Unitary Plan Operative in Part 2016

The AUPOiP sets out the direction and rules for land, water, air and coastal use activities and development in the region and provides measures to protect natural and physical resources.

The AUPOiP became operative in part on 15 November 2015, replacing most district and regional plans in the Auckland Region.

Additional Planning Guidance

New Zealand Biodiversity Strategy

The New Zealand Biodiversity Strategy (DOC and MfE 2000) was prepared in response to the state of decline of New Zealand's indigenous biodiversity and establishes a strategic framework for the conservation, sustainable use and management of New Zealand's biodiversity. This includes indigenous biodiversity and 'important' introduced species.

Protecting our Places

Protecting our Places (DOC & MfE 2007) forms part of a Department of Conservation (DOC) and Ministry for the Environment (MfE) programme and intends to provide a framework for decision making regarding biodiversity management on private land. It is an important document for managing biodiversity under the RMA and its key provisions have been incorporated into the Proposed National Policy Statement for Biodiversity (refer to Sections 3.1.1 and 3.2.2).

It is supported by the 'Statement of National Priorities for protecting rare and threatened indigenous biodiversity on private land' and includes the provision of identifying rare and threatened environments and ecosystems in New Zealand:

- National Priority 1: To protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV), that have 20% or less remaining in indigenous cover.
- National Priority 2: To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.
- National Priority 3: To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.
- National Priority 4: To protect habitats of acutely and chronically threatened indigenous species.

Auckland Conservation Management Strategy 2014 to 2024

The Auckland Conservation Management Strategy (DOC, 2014) describes the conservation values present in Auckland and provides guidance for conservation work in the Auckland region. The purpose of the Auckland Conservation Management Strategy is to implement DOC's general policies and establishes objectives and milestones for integrated management of the region's natural and historic resources. A priority of the strategy is the maintenance and enhancement of ecosystems, habitats and species vulnerable to the adverse effects of human activities.

Auckland Council's Indigenous Biodiversity Strategy 2012

The Council's Indigenous Biodiversity Strategy (Auckland Council 2012) provides an approach for managing indigenous biodiversity in the region and gives guidance for the development of statutory plans, while upholding the Council's statutory obligations to biodiversity under the RMA and the Proposed National Policy Statement for Biodiversity.

It provides objectives and performance measures for:

- Conserving Auckland's indigenous ecosystems;
- The Long-term recovery of threatened species;
- The maintenance and enhancement of ecosystem services;
- Sustaining and protecting cultural values; and

Improving understanding biodiversity, collaboration and implementation of statutory responsibilities.

Appendix 3. Summary of EIANZ Guidelines Methodology

The standard by which this EcIA was undertaken follows the guidelines published by the Environment Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay *et al.* 2018).

The assessment involves the following key stages:

- Scoping;
- Identification of the likely freshwater and terrestrial zone of influence; and
- Identification and evaluation of ecological resources and features likely to be affected (existing environment).
- Identification of the biophysical changes likely to affect valued ecological resources and features and an assessment of whether these biophysical changes are likely to give rise to an adverse ecological impact;
- Refinement of the proposed development to incorporate ecological mitigation measures to avoid, minimise or compensate for any adverse impacts; and
- Assessment of cumulative effects.

The likely zone of influence identified comprises:

- An immediate zone of influence within the Project Area; and
- A wider zone of influence extending to all areas/receptors outside the Project Area that could be affected by the proposed development.

Assigning Ecological Value

Terrestrial and Freshwater habitat

The assessment methodologies used in this EcIA follow the guidelines set by EIANZ (Roper-Lindsay *et al.* 2018) and uses a set of ecological attributes and conservation status to determine overall ecological value.

The ecological values of freshwater systems (riparian vegetation, habitats and species present) potentially impacted by the road widening were assessed against the following attributes:

- Representativeness.
- Rarity or distinctiveness.
- Diversity or pattern.
- Ecological context

These attributes are described in more detail in the EIANZ Guidelines (Roper-Lindsay *et al.* 2018) and differ slightly for terrestrial and freshwater systems. These attributes align with DOC assessment criteria (Davis *et al.* 2016).

The terrestrial and freshwater habitat features recorded during the site investigations were assessed considering each of the attributes. To avoid suppressing potential impacts on individual components, features of interest were subjectively given a rating on a scale of 'Very Low' to 'High' for each attribute and assigned a value in accordance with the description provided in Table 104.

Table 104 Rating system for assessing ecological value of terrestrial and freshwater systems (Roper-Lindsay *et al.* 2018)

Description	Value
Feature rates Very Low for at least three assessment attributes and Low to Moderate for the remaining attribute(s).	Negligible
Feature rates Very Low to Low for most assessment attributes and moderate for one. Limited ecological value other than providing habitat for introduced or tolerant indigenous species.	Low
Feature rates High for one assessment attribute and Low to Moderate for the remainder, OR The Project Area rates Moderate for at least two attributes and Very Low to Low for the rest. Likely to be important at the level of the Ecological District.	Moderate
Feature rates High for at least two assessment attributes and Low to Moderate for the remainder, OR The Project Area rates High for one attribute and Moderate for the rest. Likely to be regionally important.	High
Feature rates High for at least three assessment attributes. Likely to be nationally important.	Very High

Species

Assigning value at the species level considered the threat class of the species considered to be present in areas potentially impacted by the Project (de Lange *et al.* 2018; Dunn *et al.* 2018; Hitchmough *et al.* 2016; O'Donnell *et al.* 2018; Robertson *et al.* 2013; Townsend *et al.* 2008). The ecological value of the species assessed was assigned in accordance with the information outlined in Table 105.

Table 105 Attributes to consider when assessing ecological value of terrestrial and freshwater species (Roper-Lindsay *et al.* 2018; Townsend *et al.* 2008)

Threat Class	Threat Sub-class	Value
Exotic: Introduced and Naturalised	-	Negligible
Indigenous: Common/not threatened	-	Low
Indigenous: Locally uncommon or distinctive species	-	Moderate
Indigenous: At Risk	Naturally uncommon	Moderate

Threat Class	Threat Sub-class	Value
	Relict Recovering	
	Declining	High
Indigenous: Threatened	Nationally Critical Nationally Endangered Nationally Vulnerable	Very High

Assessing the Magnitude of Impacts

The magnitude of impacts is determined by the scale (temporal and spatial) of potential impacts identified and the degree of ecological change that is expected to occur as a result road widening (Roper-Lindsay *et al.* 2018).

Based on the assessor's knowledge and experience, the magnitude of identified impacts on the ecological values within the Project Area and zone of influence were assessed and rated on a scale of 'Negligible' to 'Very High' based on the description provided in Table 106.

Table 106 Criteria for describing the magnitude of effects (Roper-Lindsay *et al.* 2018)

Description	Magnitude
Very slight change from existing conditions. Change barely distinguishable, approximating "no change"; and/or having negligible effect on the known population or range of the feature.	Negligible
Minor shift away from existing conditions. Change arising from the loss/alteration will be discernible, but underlying attributes will be similar to pre-development circumstances; and/or having a minor effect on the known population or range of the feature.	Low
Loss or alteration to one or more key features of the existing condition, such that post-development attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the feature.	Moderate
Major loss or alteration of key features of existing conditions, such that post-development attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the feature.	High
Total loss or very major alteration to key features of existing conditions, such that the post-development attributes will be fundamentally changed and may be lost altogether; and/or loss of a very high proportion of the known population or range of the feature.	Very high

Assessment also considered the temporal scale at which potential impacts were likely to occur:

- Permanent (>25 years).
- Long-term (15-25 years).
- Medium-term (5-15 years).
- Short-term (0-5 years).
- Temporary (during construction)

Assessing the level of effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the magnitude of impacts and the values of impacted ecological features (Roper-Lindsay *et al.* 2018).

Results from the assessment of ecological value and the magnitude of identified impacts were used to determine the level or extent of the overall impacts on identified ecological features within the Project Area and zone of influence using the matrix described in Table 107.

Table 107 Matrix for determining the level of described ecological impacts (Roper-Lindsay *et al.* 2018).

Effect Level		Ecological Value				
		Negligible	**Low**	**Moderate**	**High**	**Very High**
Magnitude of impact	**Positive**	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain
	Negligible	Very Low	Very Low	Very Low	Very Low	Low
	Low	Very Low	Very Low	Low	Low	Moderate
	Moderate	Very Low	Low	Moderate	High	High
	High	Very Low	Low	Moderate	Very High	Very High
	Very High	Low	Moderate	High	Very High	Very High

Results from the matrix were used to determine the type of responses that may be required to mitigate potential direct and indirect impacts within the Project Area and within the zone of influence, considering the following guidelines (Roper-Lindsay *et al.* 2018):

- A ‘Low’ or ‘Very Low’ level of impact is not normally of concern, though design should take measures to minimise potential effects.
- A ‘Moderate’ to ‘High’ level of impact indicates a level of impact that qualifies careful assessment on a case-by-case basis. Such activities could be managed through avoidance (revised design) or appropriate mitigation. Where avoidance is not possible, no net loss of biodiversity values would be appropriate.

A ‘Very High’ level of impact is are unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values would be appropriate.

Appendix 4. RHA Reference Sites Method

The REC classifies individual sections of river networks according to the climate, topography, geology and land cover (Table 108). The REC attributes therefore explicitly consider the drivers of spatial variation within ecological characteristics of rivers and streams and can be applied to predict patterns within instream habitat features (Snelder *et al.*, 2004b). Based on this notion, different RHA metrics have been linked with REC attributes to generate references stream conditions over the extent of the study area (Table 109). As an example, the deposited sediment metric within the RHA for theoretical reference streams were allocated a score of 1 for Soft Sediment and 2 for Alluvium, while higher scores (6 and 7) were allocated for Volcanic, Plutonic and Hard Sedimentary substrates based on expert judgment. For more complex RHA metrics (such as invertebrate and fish habitat diversity), a combination of REC attributes were applied including Climate, Source, Substrate Network position and Valley landform. Low elevation, soft substrate and low gradient streams were allocated a low RHA score for habitat diversity. Conversely, hard substrate, high order and high gradient streams were assigned a higher habitat diversity score.

A limitation in the application of the REC to infer stream habitat diversity and abundance is that smaller scale habitat complicity (i.e. woody debris within a local slope adjustment with more hydraulic diversity) will not be accounted for. Similarly, the RHA Protocol testing measured only moderate predictability between covariables such as invertebrate habitat diversity and hydraulic heterogeneity compared with the REC. The prediction of instream habitat diversity, based on the REC, relied heavily on the relationship between river slope and hydraulic complexity and the covariance of hydraulic complexity and habitat diversity. Therefore, the predicted scoring of habitat diversity carries a low to moderate confidence. Both limitations (inability to account for small-scale habitat complexity and moderate covariance) may result in underestimating the diversity of instream habitat and subsequently influencing the overall RHA score. These limitations were managed in the following way:

- The RHA score were divided into two parts: instream score, and riparian score. The instream score was not compared to the reference state, but directly informed the instream habitat diversity component of the aquatic ecology value assessment (i.e. sites with high instream scores, irrespective of reference scores, were assigned a higher ecological value);
- The comparison between theoretical reference and observed riparian scores informed an assessment of the representativeness within the aquatic ecology value assessment. This was possible as the riparian habitat scores more reliably indicate habitat modification, and the prediction of riparian reference conditions can also be made with a higher degree of confidence.

Table 108 REC attributes (Snelder *et al.*, 2004)

Climate categories	Source	Substrate	Land cover	Network position	Valley landform
Warm extremely wet	Glacial mountain	Alluvium	Bare ground	Low order	High gradient
Warm wet	Mountain	Hard sedimentary	Indigenous forest	Middle order	Medium gradient
Warm dry	Hill	Soft sedimentary	Scrub	High order	Low gradient
Cool extremely wet	Low elevation	Volcanic basic	Tussock	-	-
Cool wet	Lake	Volcanic acidic	Pastoral	-	-
Cool dry	Spring	Plutonics	Exotic forestry	-	-
-	Wetland	Miscellaneous	Urban	-	-
-	Regulated	-	-	-	-

Table 109 RHA metrics and the corresponding REC attribute applied in predicting reference conditions

RHA Metric	REC Attribute
Deposited sediment	Geology
Habitat diversity	Climate, Source, Substrate, Valley landform
Habitat abundance	Network position and River order
Hydraulic heterogeneity	Substrate, Valley landform
Bank erosion	River order
Bank vegetation	NA
Riparian width	NA
Riparian shade	River order

Appendix 5. Bat (ABM) Survey Results

Table 110 ABM survey status

ABM	Survey during Session 1 maternity period (December – February)	Survey during Session 2 mating period (March – May)	ABM Results
B1	Yes	Yes	No bat calls detected
B2	Yes	Yes	
B3	Yes	No	
B4	Technical failure, no recordings available for analysis	Yes	
B5	Yes	No	
B6	Yes	Yes	
B7	Yes	Yes	
B8	Yes	No	
B9	No	Yes	
B17	Yes	Yes	
B18	Yes	No	
B19	Yes	Yes	
B20	Yes	Yes	
B21	Yes	No	
B22	No	Yes	
B23	Yes	No	
B24	Yes	Yes	
B26	Yes	Yes	

B27	No	Yes	
B34	No	Yes	
B43	Yes	No	
B44	No	Yes	
B46	Yes	Yes	

Maternity Period Survey

December

ABM	18-Dec-19	19-Dec-19	20-Dec-19	21-Dec-19	22-Dec-19	23-Dec-19	24-Dec-19	25-Dec-19	26-Dec-19	27-Dec-19	28-Dec-19	29-Dec-19	30-Dec-19	31-Dec-19
B1														
B2														
B3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B4														
B5														
B6														
B7														
B8														
B17														
B18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B19														
B20														
B21														
B22														
B23														
B24														
B26														
B27														
B34														
B43														
B44														
B46	0	0	0	0	0	0	0	0	0	0	0	0	0	0

January

ABM	01-Jan-20	02-Jan-20	03-Jan-20	04-Jan-20	05-Jan-20	06-Jan-20	07-Jan-20	08-Jan-20	09-Jan-20	10-Jan-20	11-Jan-20	12-Jan-20	13-Jan-20	14-Jan-20	15-Jan-20	16-Jan-20	17-Jan-20	18-Jan-20	19-Jan-20	20-Jan-20	21-Jan-20	22-Jan-20	23-Jan-20	24-Jan-20	25-Jan-20	26-Jan-20	27-Jan-20	28-Jan-20	29-Jan-20	30-Jan-20	31-Jan-20
B1				Weather Unsuitable			Weather Unsuitable													0	0	0	0	0	0	0	0	0	0	0	0
B2																					0	0	0	0	0	0	0	0	0	0	0
B3	0	0	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0										
B4																															
B5																					0	0	0	0	0	0	0	0	0	0	0
B6																					0	0	0	0	0	0	0	0	0	0	0
B7																					0	0	0	0	0	0	0	0	0	0	0
B8																							0	0	0	0	0	0	0	0	0
B17																				0	0	0	0	0	0	0	0	0	0	0	0
B18	0	0	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0												
B19																					0	0	0	0	0	0	0	0	0	0	0
B20																					0	0	0	0	0	0	0	0	0	0	0
B21																				0	0	0	0	0	0	0	0	0	0	0	0
B22																															
B23																					0	0	0	0	0	0	0	0	0	0	0
B24																				0	0	0	0	0	0	0	0	0	0	0	0
B26																					0	0	0	0	0	0	0	0	0	0	0
B27																															
B34																															
B43																				0	0	0	0	0	0	0	0	0	0	0	0
B44																															
B46	0	0	0		0	0		0	0	0	0	0	0	0	0	0	0	0	0												

February

ABM	01-Feb-20	02-Feb-20	03-Feb-20	04-Feb-20	05-Feb-20	06-Feb-20	07-Feb-20	08-Feb-20	09-Feb-20	10-Feb-20	11-Feb-20
B1	0	0	0	0	0	0	0	0	0	0	
B2	0	0	0	0	0	0	0	0	0	0	
B3											
B4											
B5	0	0	0	0	0	0	0	0	0	0	
B6	0	0	0	0	0	0	0	0	0	0	
B7	0	0	0	0	0	0	0	0	0	0	
B8	0	0	0	0	0	0	0	0	0	0	
B17	0	0	0	0	0	0	0	0	0	0	
B18											
B19	0	0	0	0	0	0	0	0	0	0	
B20	0	0	0	0	0	0	0	0	0	0	
B21	0	0	0	0	0	0	0	0	0	0	
B22											
B23	0	0	0	0	0	0	0	0	0	0	
B24	0	0	0	0	0	0	0	0	0	0	
B26	0	0	0	0	0	0	0	0	0	0	
B27											
B34											
B43	0	0	0	0	0	0	0	0	0	0	
B44											
B46											

Table legend	
Number in cell e.g. '0'	Number of bat calls recorded that night
X	Number of bat calls not known, as ABM in-situ and not able to be collected for data analysis
Grey fill	No ABM in place on site
Pink fill	Unsuitable weather conditions for ABM analysis
Blue fill	ABM in place and weather suitable

Mating Period Survey

	March																															April
ABM	01-Mar-20	02-Mar-20	03-Mar-20	04-Mar-20	05-Mar-20	06-Mar-20	07-Mar-20	08-Mar-20	09-Mar-20	10-Mar-20	11-Mar-20	12-Mar-20	13-Mar-20	14-Mar-20	15-Mar-20	16-Mar-20	17-Mar-20	18-Mar-20	19-Mar-20	20-Mar-20	21-Mar-20	22-Mar-20	23-Mar-20	24-Mar-20	25-Mar-20	26-Mar-20	27-Mar-20	28-Mar-20	29-Mar-20	30-Mar-20	31-Mar-20	ABM still in situ during lockdown
B1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0												
B2																																
B3																																
B4																																
B5																																
B6					0	0	0	0	0	0	0	0	0	0	0	0	0		0	0												
B7		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0												
B8																																
B17											X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	Yes
B18																																
B19											X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	Yes
B20		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Weather Unsuitable	0	0												
B21																																
B22											X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	Yes
B23																																
B24																																
B26		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0												
B27		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0												
B34																			X	X	X	X	X	X	X	X	X	X	X	X	X	Yes
B43																																
B44		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0												
B46					0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0								

ABM	Survey complete
B1	Yes
B2	Yes
B3	Yes
B4	No
B5	Yes
B6	Yes
B7	Yes
B8	Yes
B17	No
B18	Yes
B19	No
B20	Yes
B21	Yes
B22	No
B23	Yes
B24	Yes
B26	Yes
B27	Yes
B34	No
B43	Yes
B44	Yes
B46	Yes

Table legend	
Number in cell e.g. '0'	Number of bat calls recorded that night
X	Number of bat calls not known, as ABM in-situ and not able to be collected for data analysis
Grey fill	No ABM in place on site
Pink fill	Unsuitable weather conditions for ABM analysis
Blue fill	ABM in place and weather suitable

Appendix 6. Common and Scientific Names for Plant Species Listed in this Report

Table 120 Common and Scientific Names for Plant Species Listed in this Report

Common Name	Scientific Name
Arum lily	*Zantedeschia aethiopica*
Bald cypress	*Taxodium distichum*
Barberry	*Berberis* sp.
Broadleaf, Kāpuka	*Griselinia littoralis*
Bulrush, Raupō	*Typha orientalis*
Blackberry	*Rubus fruticosus*
Carmine rātā, Akakura	*Metrosideros carminea*
Chinese privet	*Ligustrum sinense*
Corokia, Korokio	*Corokia cotoneaster*
Crack willow	*Salix fragilis*
Creeping buttercup	*Ranunculus repens*
Dallas grass	*Paspalum dilatatum*
Danhatchia orchid	*Danhatchia australis*
Eelgrass	*Zostera mulleri*
Fireweed	*Senecio scaberulus*
Flax, Harakeke	*Phormium tenax*
Fools water cress	*Apium nodiflorum*
Gorse	*Ulex europaeus*
Greater bird's-foot-trefoil	*Lotus pedunculatus*
Green mistletoe, Pirata	*Ileostylus micranthus*
Hard beech, Tawhai raunui	*Fuscospora truncata*
Hīnau	*Elaeocarpus dentatus*
Jointed wire rush, Oioi	*Apodasmia similis*
Kahikatea	*Dacrycarpus dacrydioides*
Kaikōmako	*Pennantia corymbosa*
Kauri	*Agathis australis*
Kikuyu grass	*Cenchrus clandestinus*
Kohekohe	*Dysoxylum spectabile*
Kōwhai	*Sophora* spp.
Lake club-rush, Kāpūngāwhā	*Schoenoplectus tabernaemontani*
***Machaerina* spp.**	*Machaerina* spp.

Mangrove, Mānawa	*Avicennia marina subsp. australasica*
Mercer grass	*Paspalum distichum*
Mingimingi	*Coprosma propinqua var. propinqua*
Mountain cabbage tree, Tōī	*Cordyline indivisa*
Oxtongue, Toitako	*Picris burbidgeae*
Parrots feather	*Myriophyllum aquaticum*
Parsley dropwort	*Oenanthe pimpinelloides*
Pine species	*Pinus sp.*
Poplar species	*Populus sp.*
Privet species	*Ligustrum sp.*
Pukatea	*Laurelia novae-zelandiae*
Pūriri	*Vitex lucens*
Purua grass, Rīrīwaka	*Bolboschoenus fluviatilis*
Reed sweet grass	*Glyceria maxima*
Rewarewa	*Knightia excelsa*
Rimu	*Dacrydium cupressinum*
Saltmarsh ribbonwood, Mākaka	*Plagianthus divaricatus*
Sea rush, Wīwī	*Juncus kraussii*
Slender spike sedge	*Eleocharis gracilis*
Small-leaved kōwhai	*Sophora microphylla*
Soft rush, Wīwī	*Juncus effusus*
Southern magnolia	*Magnolia grandiflora*
Swamp maire, Maire tawake	*Syzygium maire*
Swamp millet	*Isachne globosa*
Tall spike sedge, Kuta	*Eleocharis sphacelata*
Taraire	*Beilschmiedia tarairi*
Tarata	*Pittosporum eugenioides*
Tasmanian blackwood	*Acacia melanoxylon*
Tawa	*Beilschmiedia tawa*
Tōwai	*Weinmannia silvicola*
Tree privet	*Ligustrum lucidum*
White tea tree, Kānuka	*Kunzea robusta*
Willow species	*Salix sp.*
Willow weed	*Persicaria maculosa*
Willowherb	*Epilobium nerteroides*
Woolly nightshade	*Solanum mauritianum*

Table 121 Common and Scientific Names for Bird Species Listed in this Report

Common Name	Scientific Name
Banded rail	*Gallirallus philippensis assimilis*
Bar-tailed godwit	*Limosa lapponica baueri*
Black-backed gull	*Larus dominicanus*
Black-billed gull	*Larus bulleri*
Black shag	*Phalacrocorax carbo*
Canada goose	*Branta canadensis*
Caspian tern	*Hydroprogne caspia*
Cattle egret	*Ardea ibis coromanda*
Fantail	*Rhipidura fuliginosa*
Fernbird	*Bowdleria punctata*
Gray teal	*Anas gracilis*
Gray warbler	*Gerygone igata*
Kereru	*Hemiphaga novaehollandiae*
Kotare	*Todiramphus sanctus*
Little black shag	*Phalacrocorax sulcirostris*
Little shag	*Phalacrocorax melanoleucos*
Mallard	*Anas platyrhynchos*
New Zealand dabchick	*Poliocephalus rufopectus*
North Island kākā	*Nestor meridionalis*
North Island kōkako	*Callaeas wilsoni*
Paradise Shellduck	*Tadorna variegata*
Pied shag	*Phalacrocorax varius*
Pied stilt	*Himantopus himantopus*
Pūkeko	*Porphyrio melanotus*
Red-billed gull	*Larus novaehollandiae scopulinus*
Royal spoonbill	*Platalea regia*
Silvereye	*Zosterops lateralis*
South Island Pied oystercatcher	*Haematopus finschi*
Spotless Crake	*Porzana tabuensis*
Spur wing plover	*Vanellus miles*
Swamp harrier	*Circus approximans*

Tūī	*Prosthemadera novaeseelandiae*
Welcome swallow	*Hirundo neoxena*
White faced heron	*Egretta novaehollandiae*
White-fronted tern	*Sterna striata striata*
Wrybill	*Anarhynchus frontalis*

Table 122 Common and Scientific Names for Reptile Species Listed in this Report

Common Name	Scientific Name
Copper Skink	*Oligosoma aeneum*
Elegant gecko	*Naultinus elegans*
Forest gecko	*Mokopirikau granulatus*
Moko skink	*Oligosoma moko*
Ornate skink	*Oligosoma ornatum*
Pacific gecko	*Dactylocnemis pacificus*
Plague skink	*Lampropholis delicata*
Shore skink	*Oligosoma smithi*

Table 123 Common and Scientific Names for Freshwater Fish and Invertebrate Species Listed in this Report

Common Name	Scientific Name
Banded kokopu	*Galaxias fasciatus*
Common bully	*Gobiomorphus cotidianus*
Common smelt	*Retropinna retropinna*
Cran's bully	*Gobiomorphus basalis*
Freshwater crayfish, Koura	*Paranephrops* sp.
Freshwater mussel	*Echyridella menziesii*
Īnanga	*Galaxias maculatus*
Koi carp	*Cyprinus carpio*
Longfin eel	*Anguilla dieffenbachii*
Mosquitofish	*Gambusia affinis*
Shortfin eel	*Anguilla australis*
Torrentfish	*Cheimarrichthys fosteri*
Unidentified bully	*Gobiomorphus* sp.

Table 124 Common and Scientific Names for Amphibian Species Listed in this Report

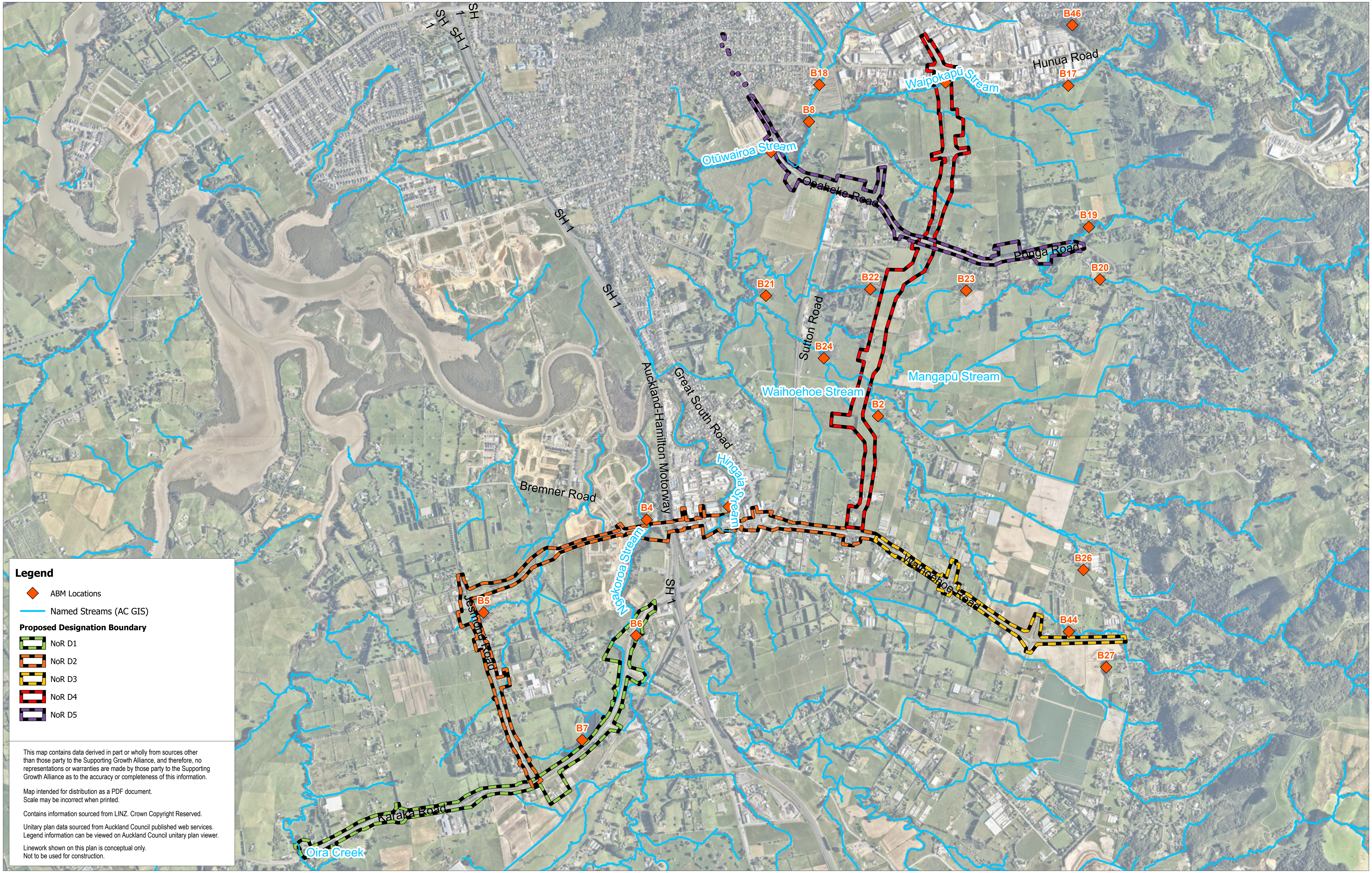
Common Name	Scientific Name
Hochstetter's frog	*Leiopelma hochstetteri*

Table 125 Common and Scientific Names for Mammal Species Listed in this Report

Common Name	Scientific Name
Long-tailed bat	*Chalinolobus tuberculatus*

Appendix 7. Drawings

Figure 30 Drury – Ōpāheke Structure Plan (Auckland Council, 2019) Blue green network map



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Map intended for distribution as a PDF document.
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Unitary plan data sourced from Auckland Council published web services.
Legend information can be viewed on Auckland Council unitary plan viewer.

Linework shown on this plan is conceptual only.
Not to be used for construction.

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

ABM Locations

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-002

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:
Supporting Growth
Bird Survey Locations - NoR D1

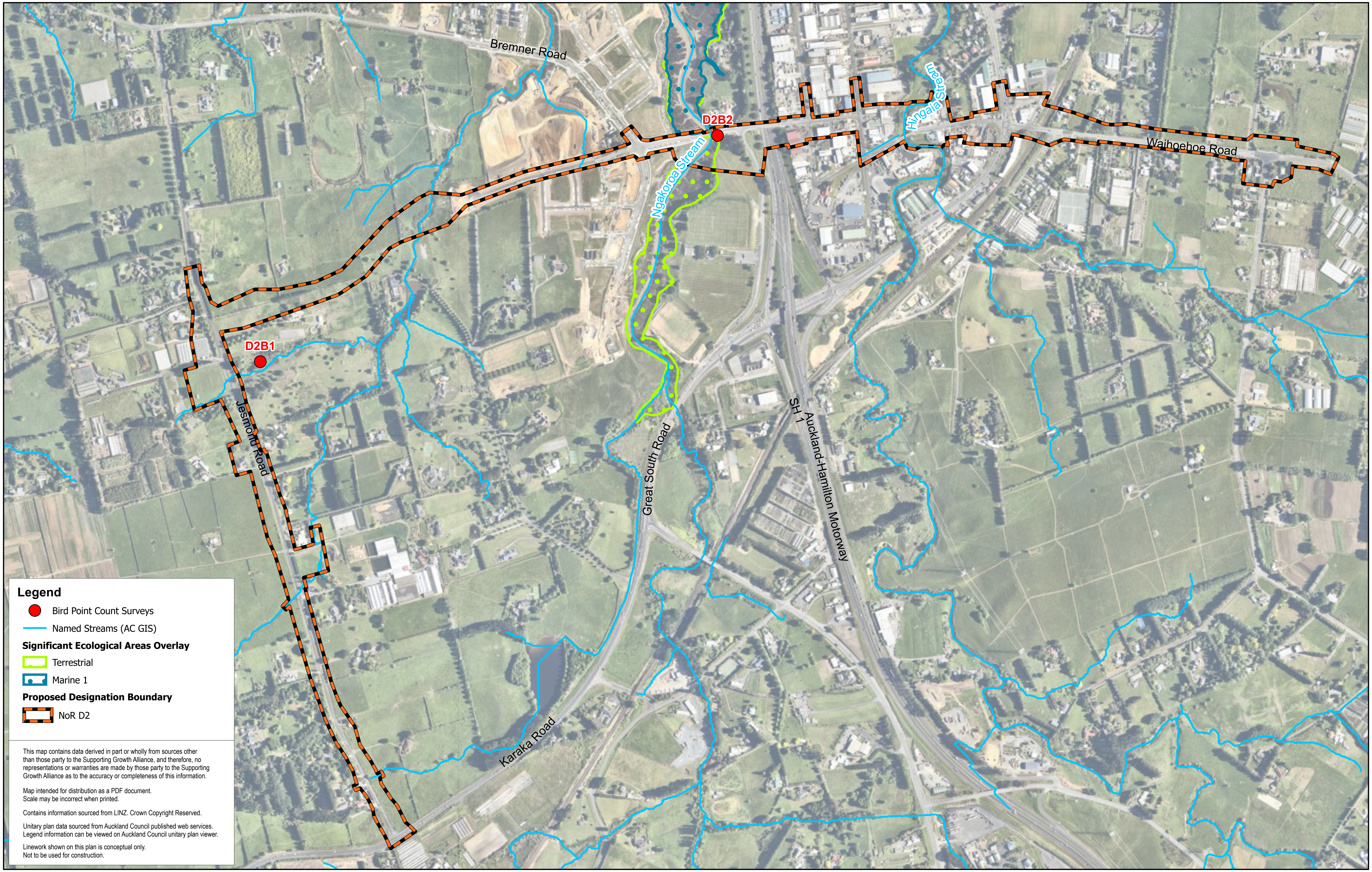
Client: **Supporting Growth**

Project: **Drury Arterial Network**

TE TUPU NGĀTAHI
Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EX-DL-003.1**
Page 1 of 4



Legend

- Bird Point Count Surveys
- Named Streams (AC GIS)

Significant Ecological Areas Overlay

- Terrestrial
- Marine 1

Proposed Designation Boundary

- NoR D2

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Linework shown on this plan is conceptual only.
Not to be used for construction.

Map Scale @ A3: 1:8,000

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title: **Supporting Growth**
Bird Survey Locations - NoR D2

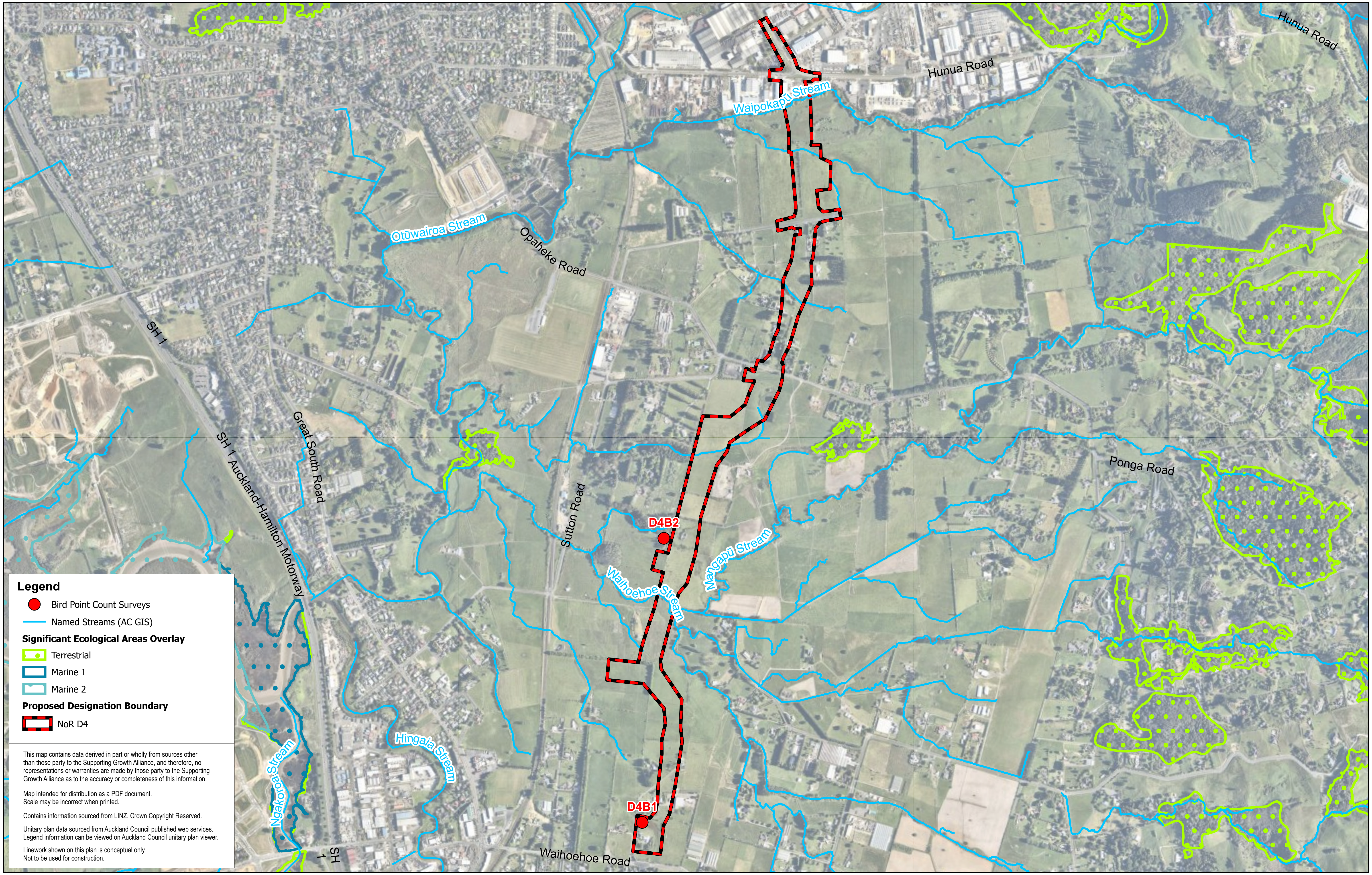
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-003.2



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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Bird Survey Locations - NoR D4

Client: Supporting Growth

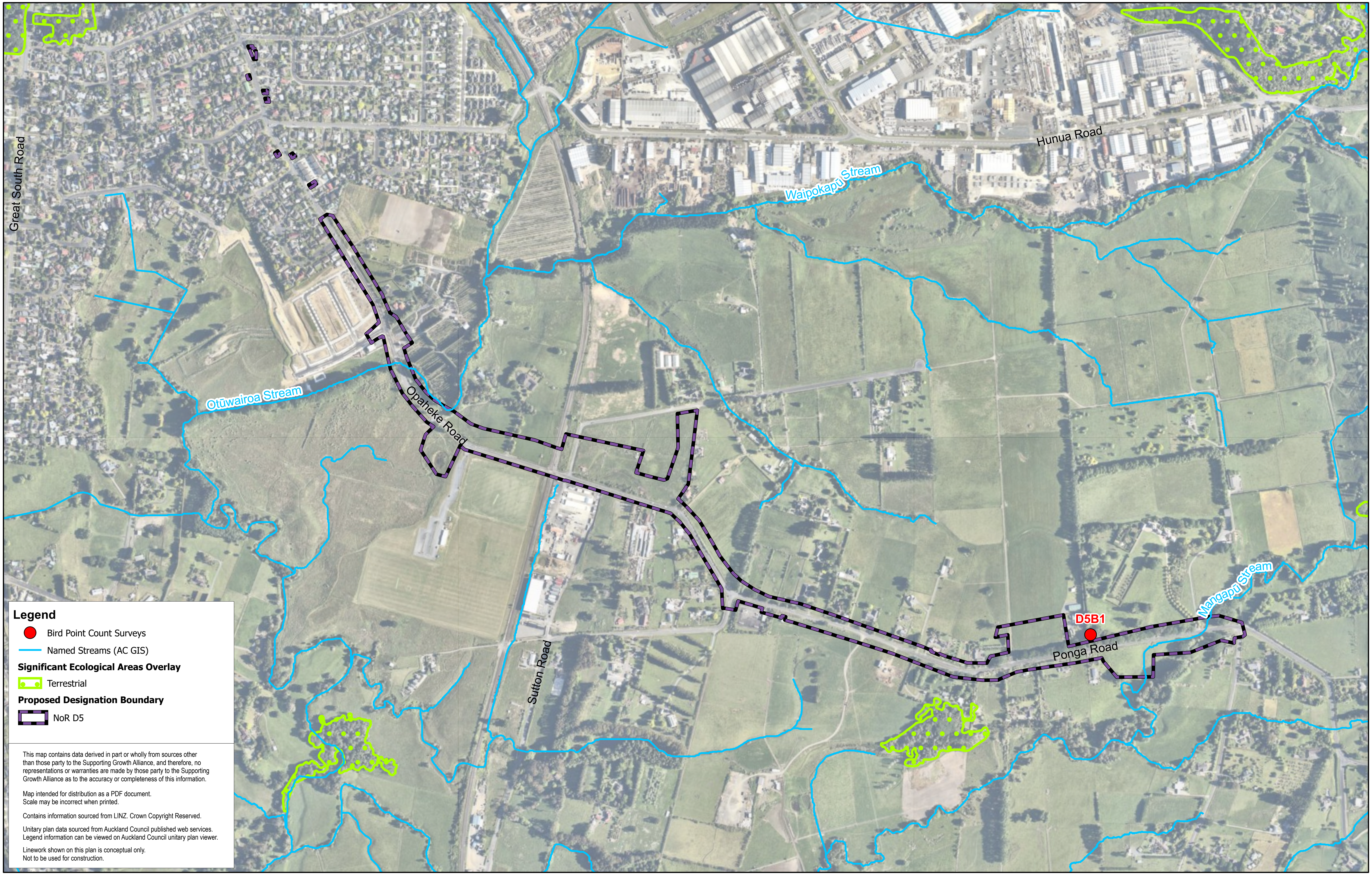
Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-003.3

Page 3 of 4



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Path: C:\Working_Folder\Works\60558831\02_Maps\SGA_Ecology_Figures_1_7.aprx

Name: SGA_Ecology_Figures_1_7

Map Scale @ A3: 1:8,000

0 70 140 280
Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:
Supporting Growth
Bird Survey Locations - NoR D5

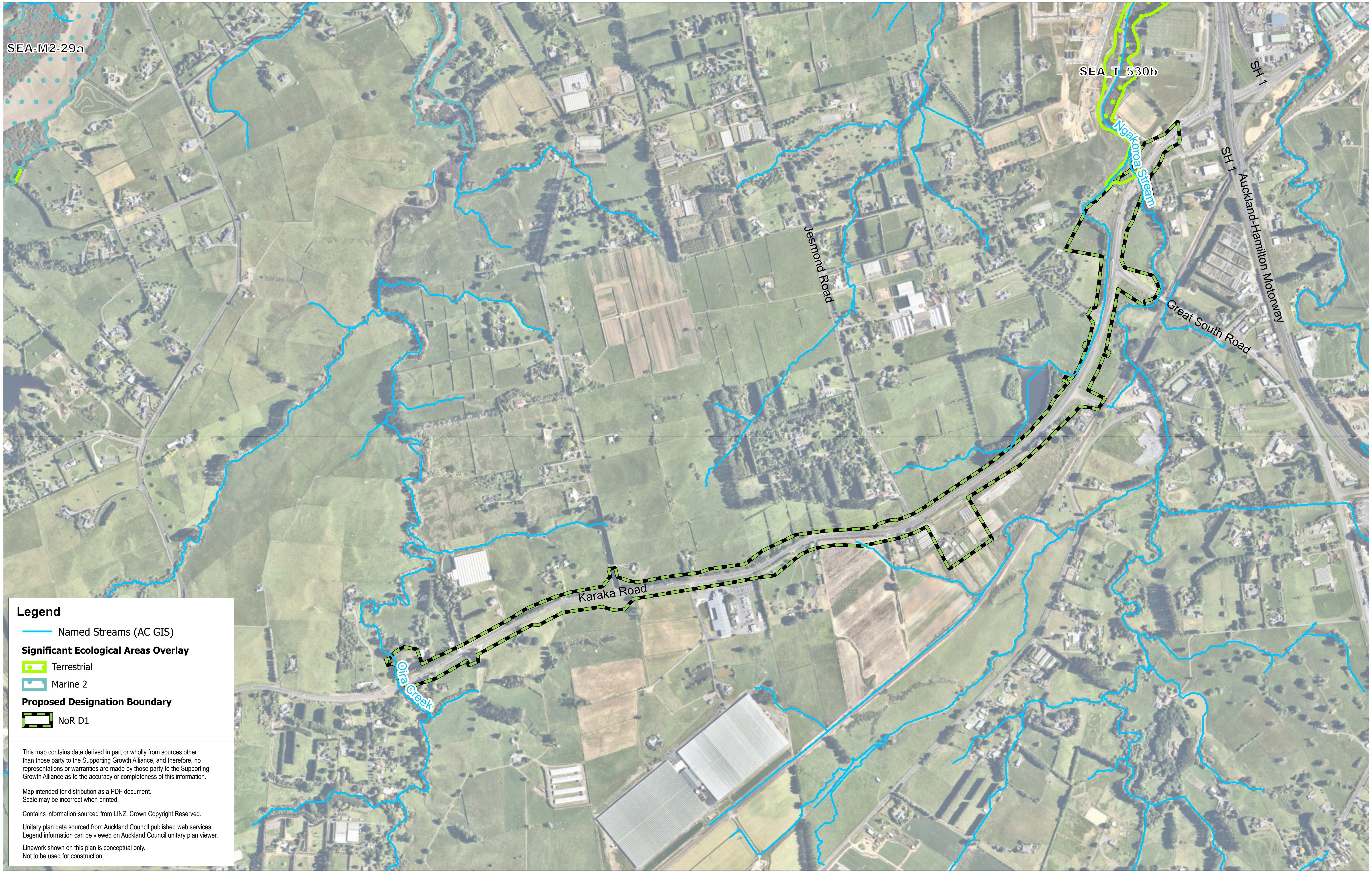
Client: **Supporting Growth**

Project: **Drury Arterial Network**

TE TUPU NGĀTAHI
Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EX-DL-003.4**



Legend

Named Streams (AC GIS)

Significant Ecological Areas Overlay

Terrestrial

Marine 2

Proposed Designation Boundary

NoR D1

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Name: SGA_Ecology_Figures_1_7

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Map Scale @ A3: 1:10,000

0 0.1 0.2 0.4

Kilometres

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

SEA Locations - NoR D1

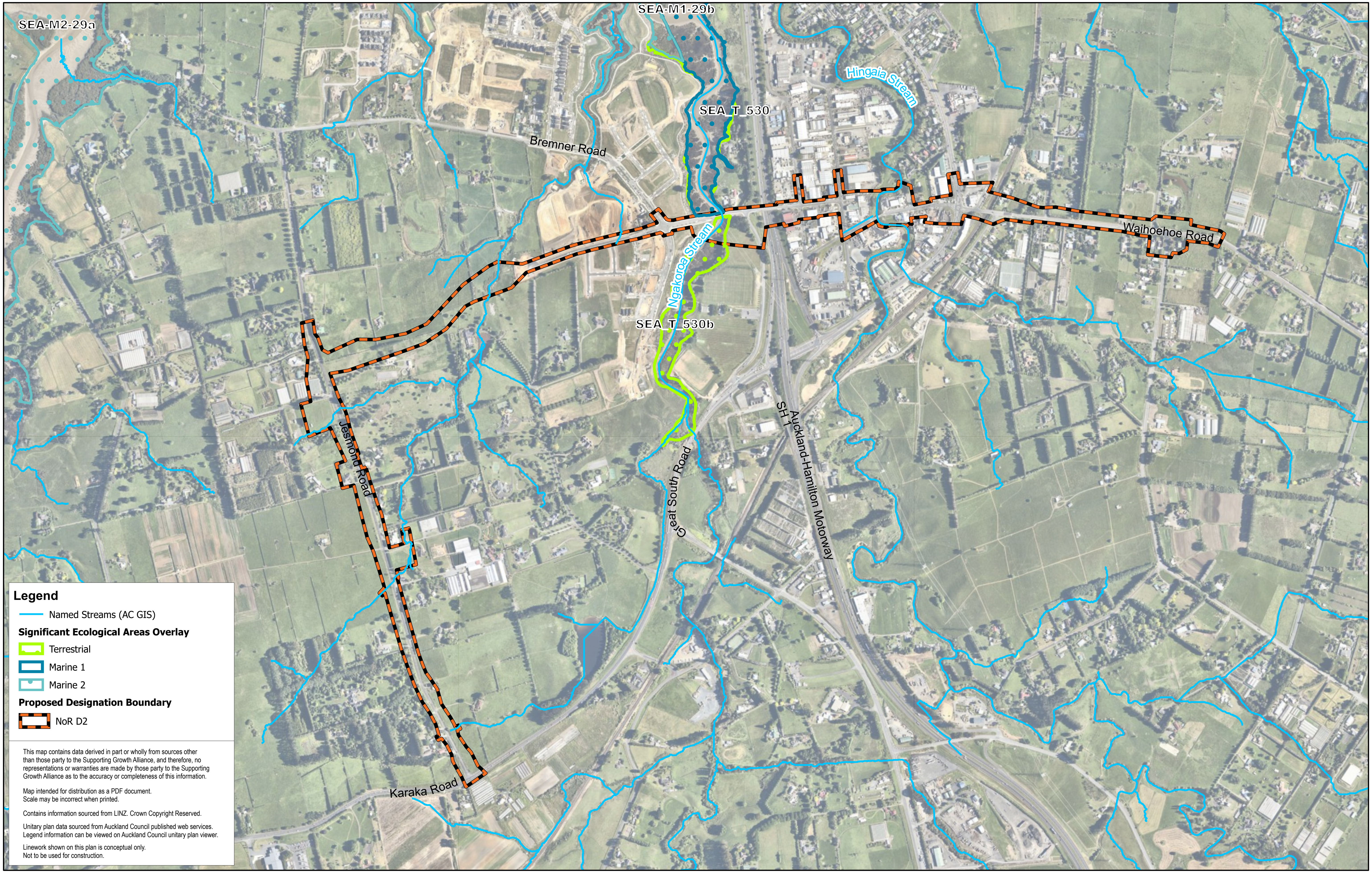
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-004.1



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Name: SGA_Ecology_Figures_1_7

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Map Scale @ A3: 1:10,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title: **Supporting Growth**

SEA Locations - NoR D2

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-004.2

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Name: SGA_Ecology_Figures_1_7

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Map Scale @ A3: 1:10,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

SEA Locations - NoR D3

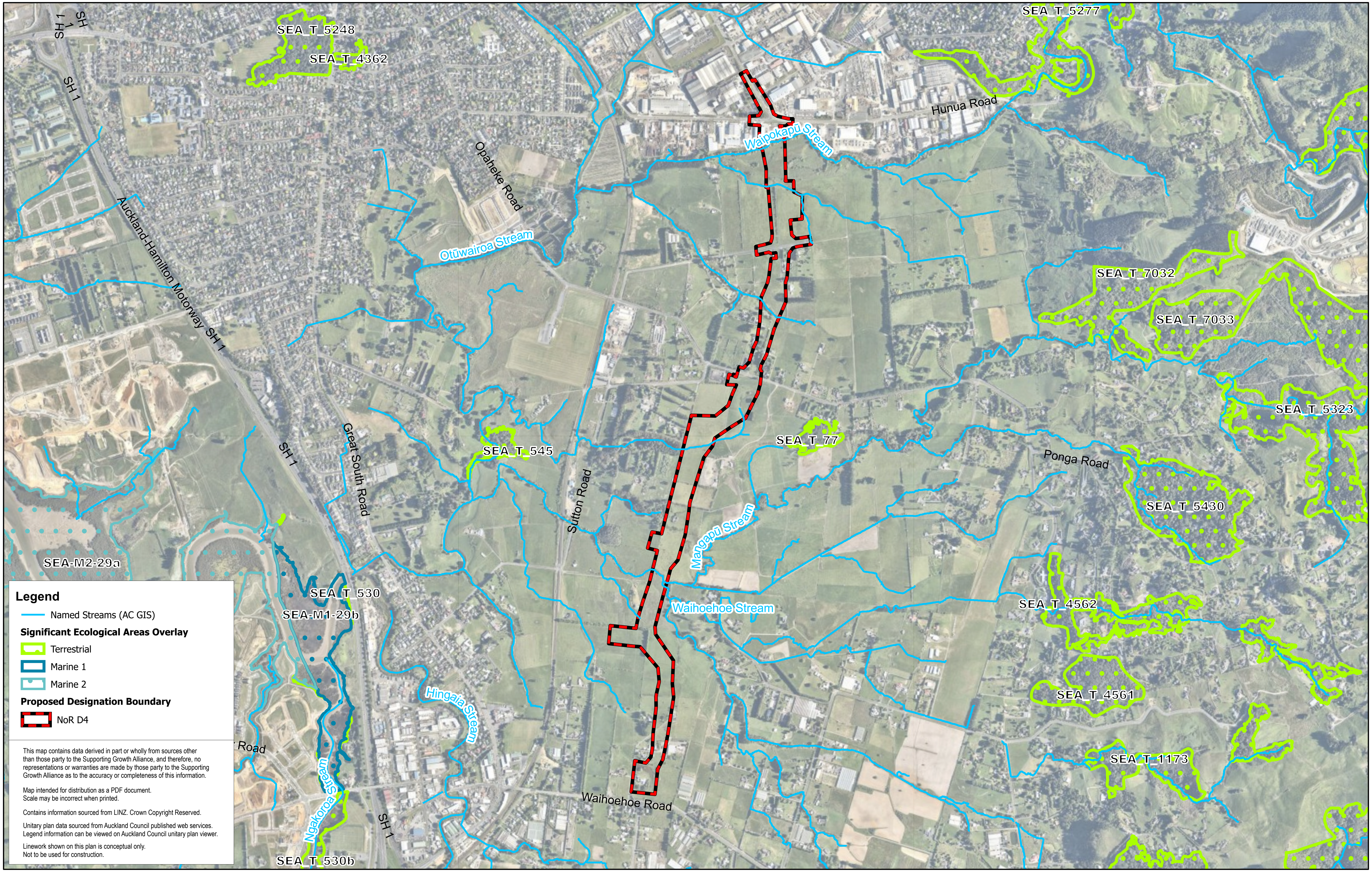
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-004.3



Legend

Named Streams (AC GIS)

Significant Ecological Areas Overlay

Terrestrial

Marine 1

Marine 2

Proposed Designation Boundary

NoR D4

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Kilometres

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Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title: **Supporting Growth**

SEA Locations - NoR D4

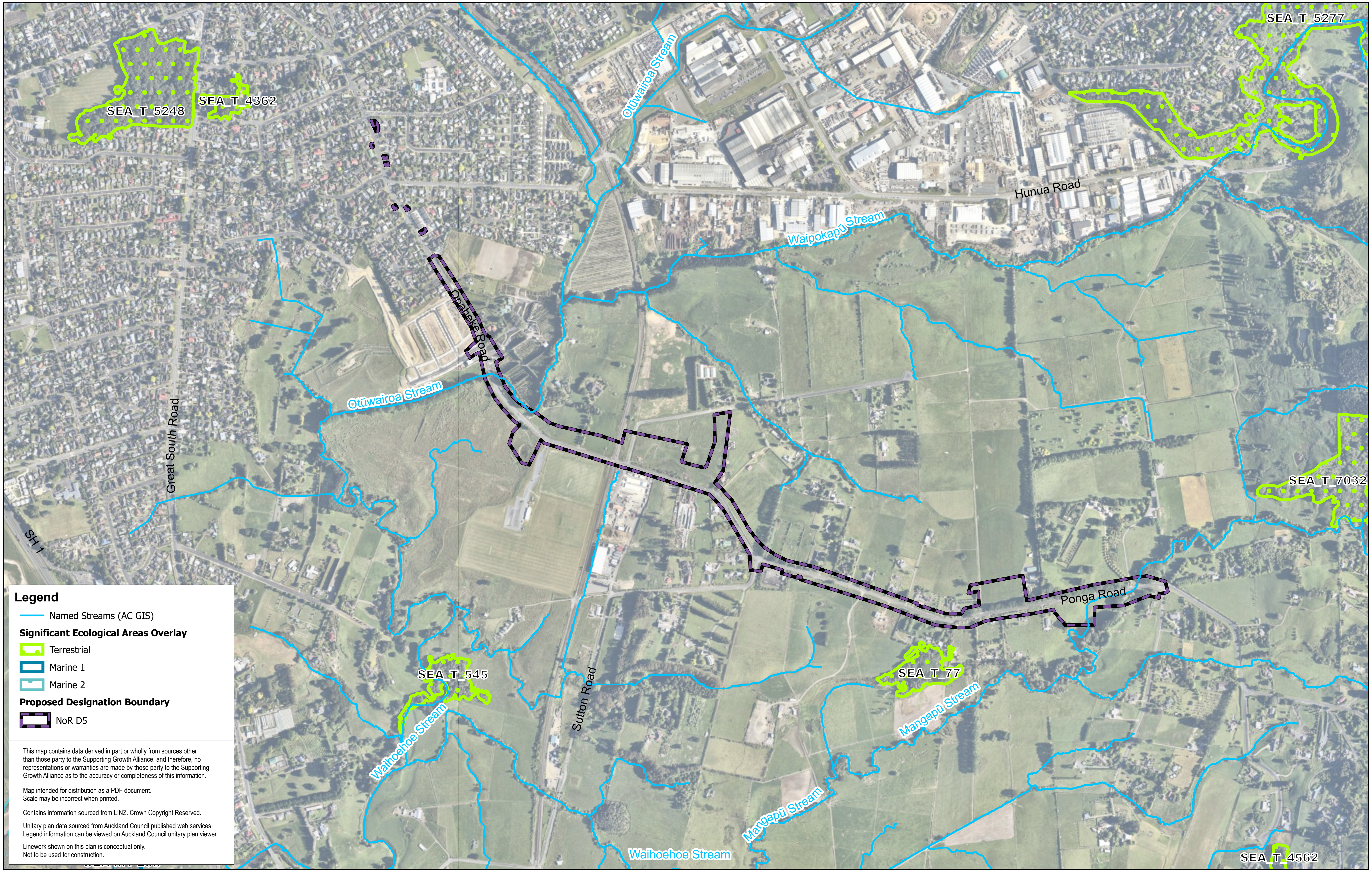
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-004.4



Map Scale @ A3: 1:10,000

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Kilometres

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Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title: **Supporting Growth**

SEA Locations - NoR D5

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-004.5

Page 5 of 5

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Named Streams - NoR D1

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-005.1

Page 1 of 5

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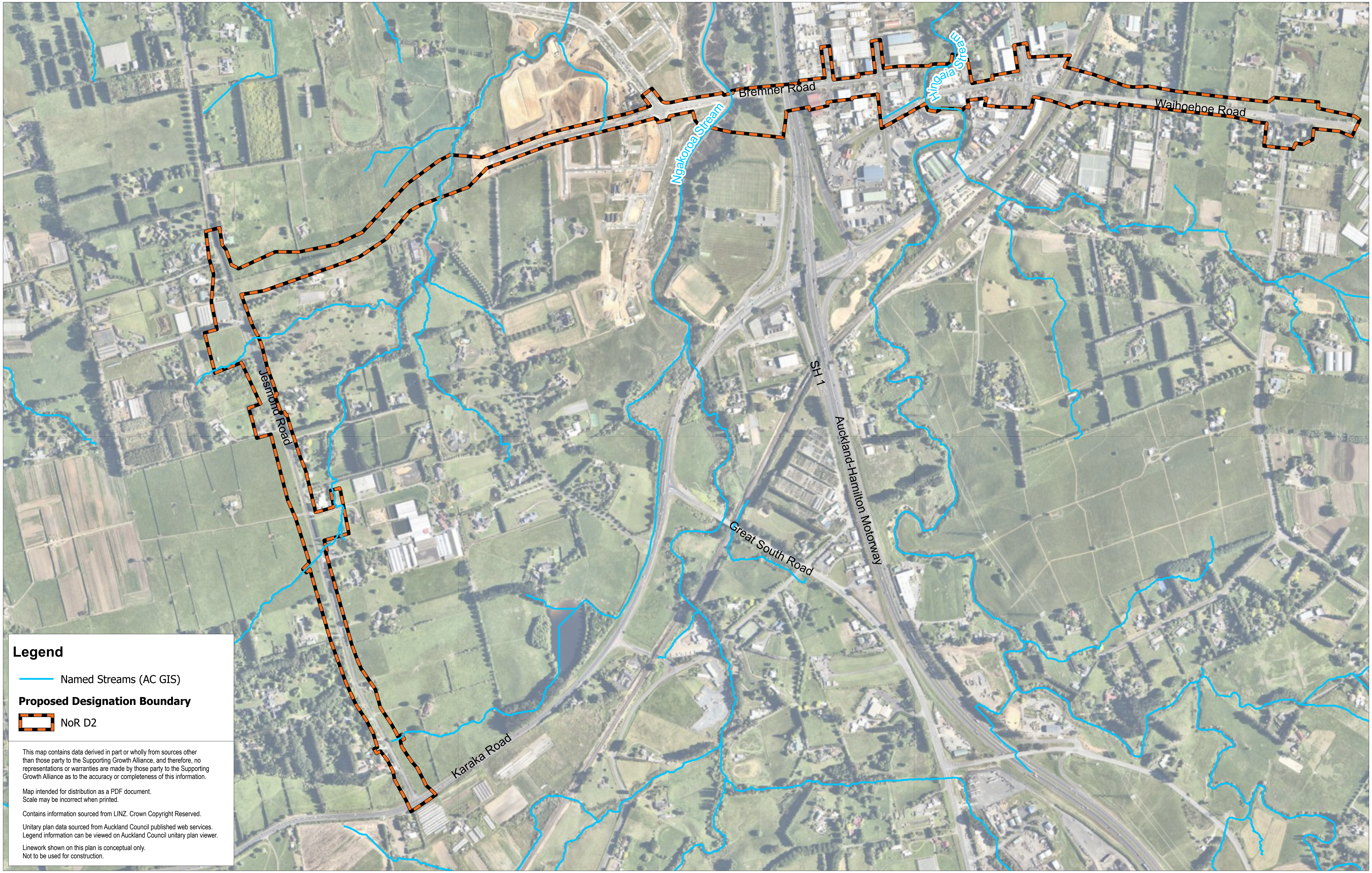

Map Scale @ A3: 1:8,000

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Named Streams - NoR D2

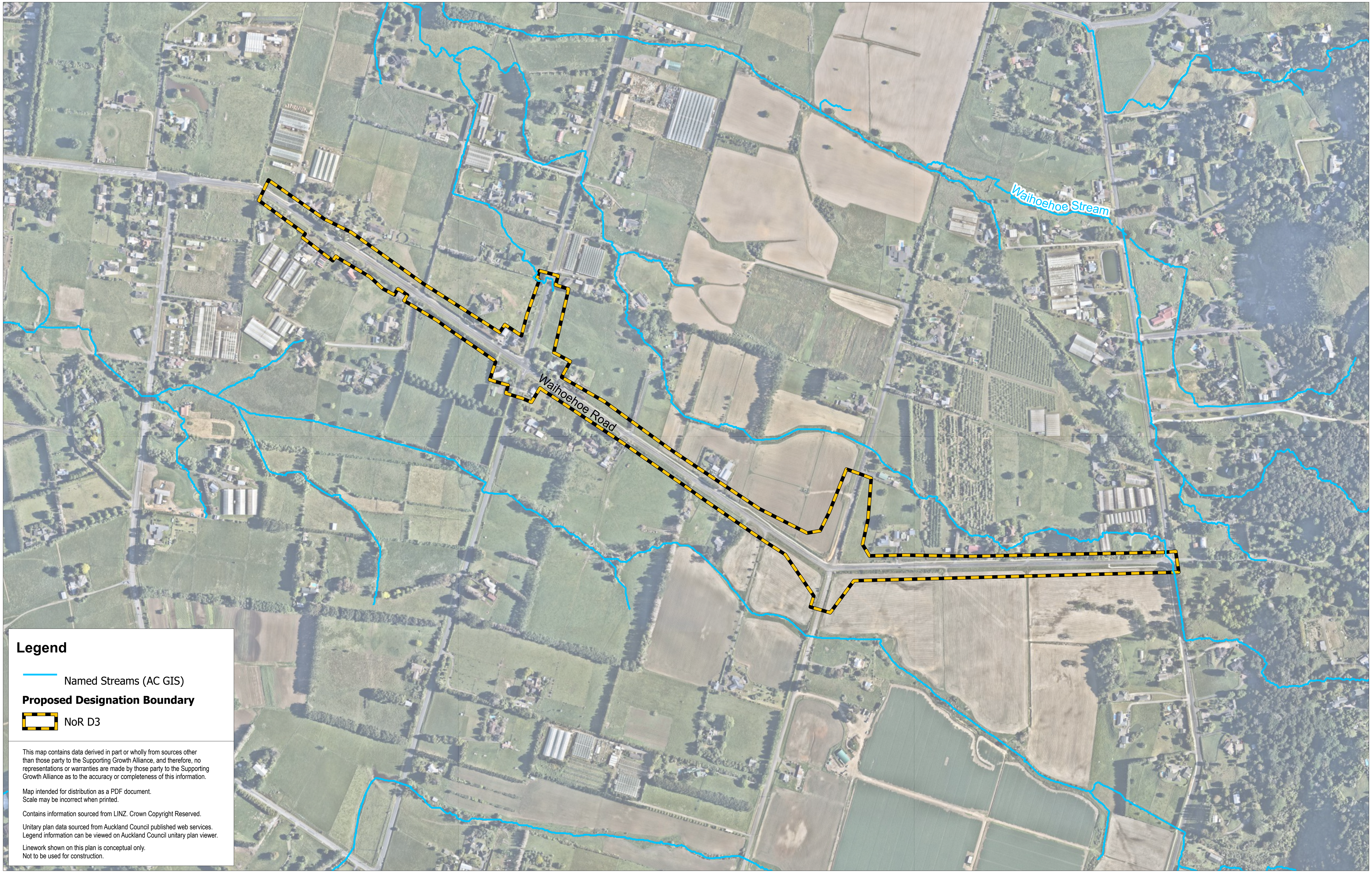
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-005.2



Legend

Named Streams (AC GIS)

Proposed Designation Boundary

NoR D3

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Name: SGA_Ecology_Figures_1_7

Path: C:\Working_Folder\Works\60558831\02_Maps\SGA_Ecology_Figures_1_7.aprx

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Named Streams - NoR D3

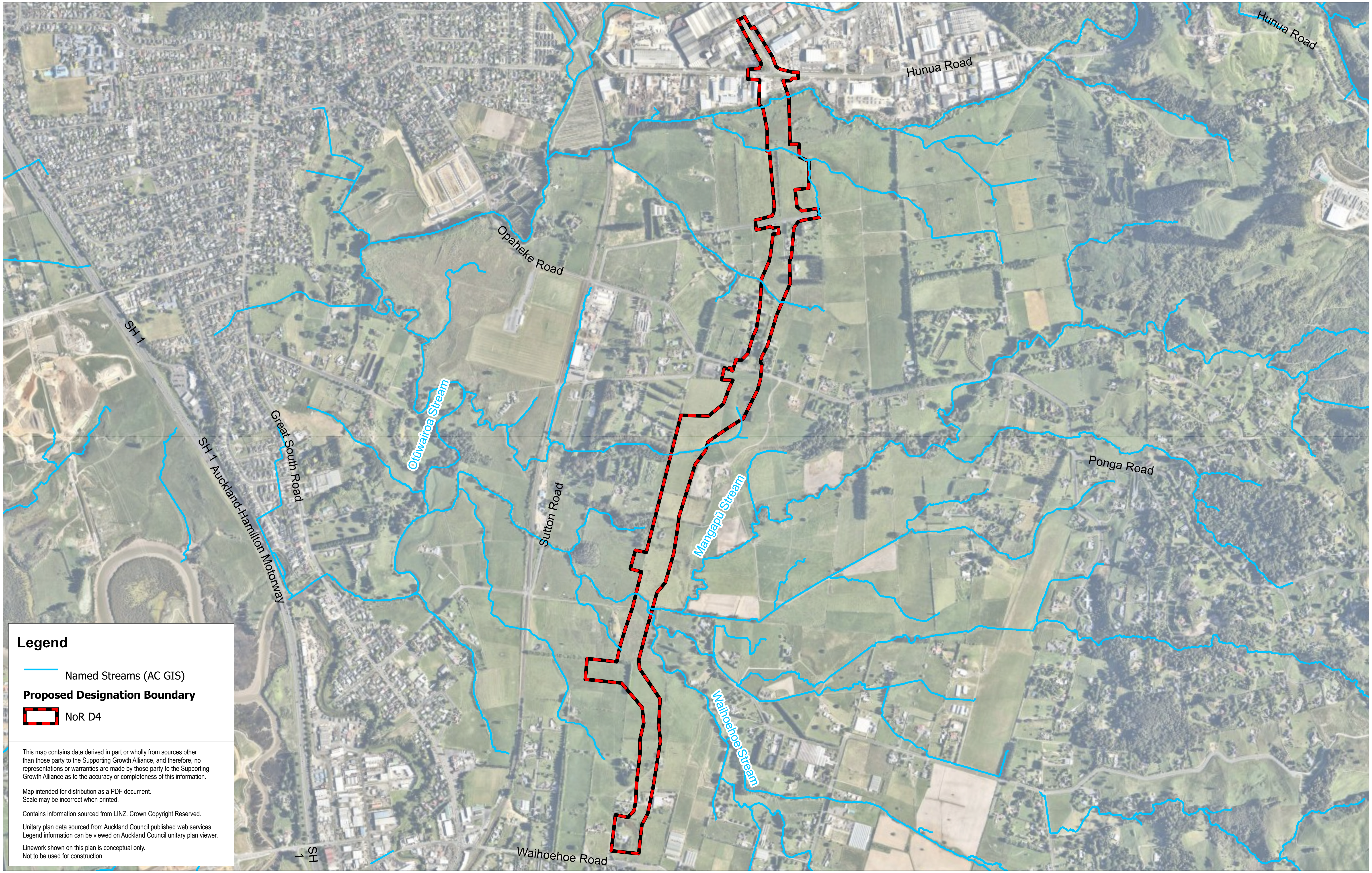
Client: **Supporting Growth**

Project: **Drury Arterial Network**

TE TUPU NGĀTAHI
Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EX-DL-005.3**



Legend

Named Streams (AC GIS)

Proposed Designation Boundary

NoR D4

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Map Scale @ A3: 1:13,000

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Named Streams - NoR D4

Client: Supporting Growth

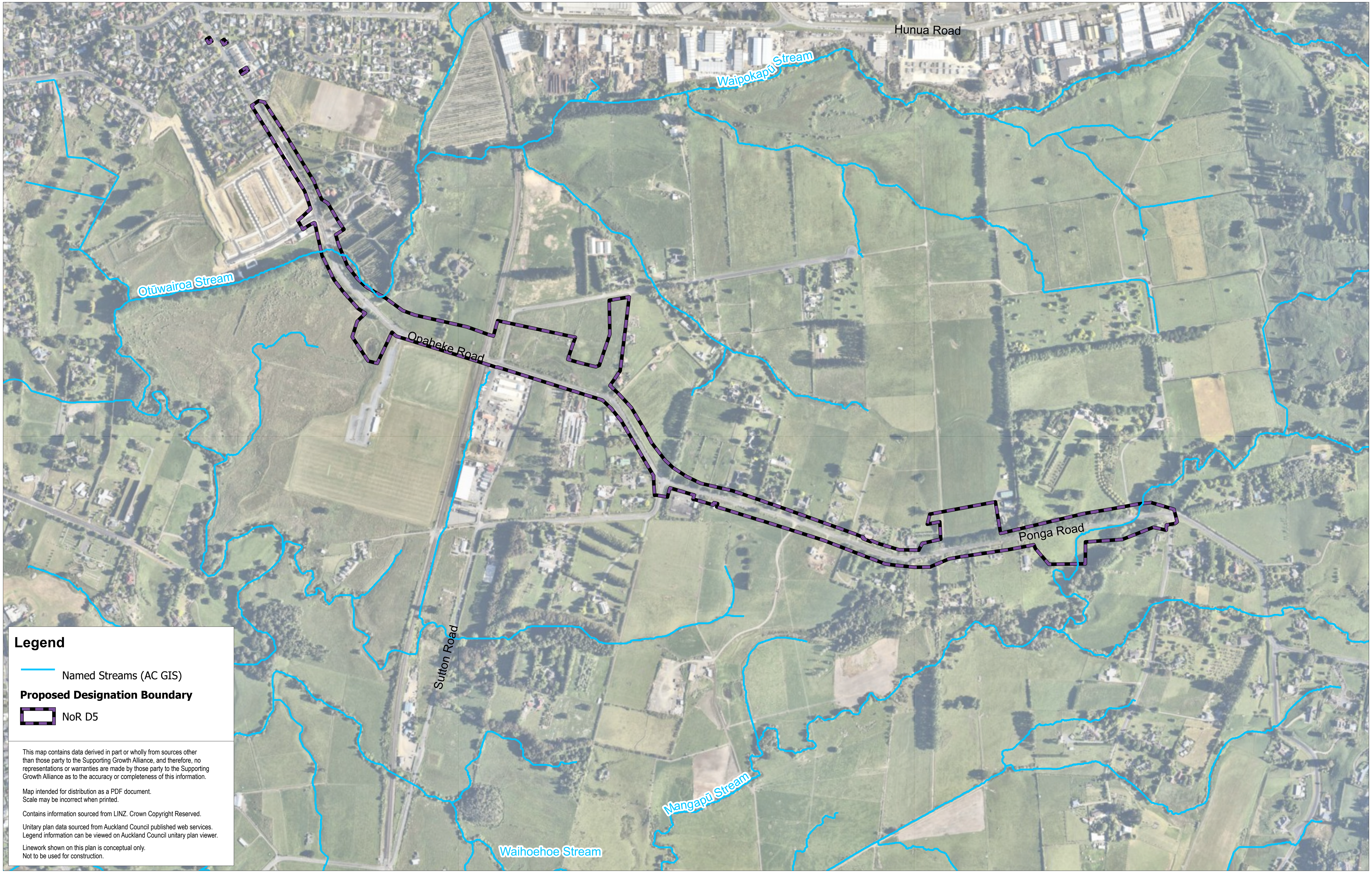
Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-005.4

Page 4 of 5



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Map Scale @ A3: 1:8,000

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Meters

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Named Streams - NoR D5

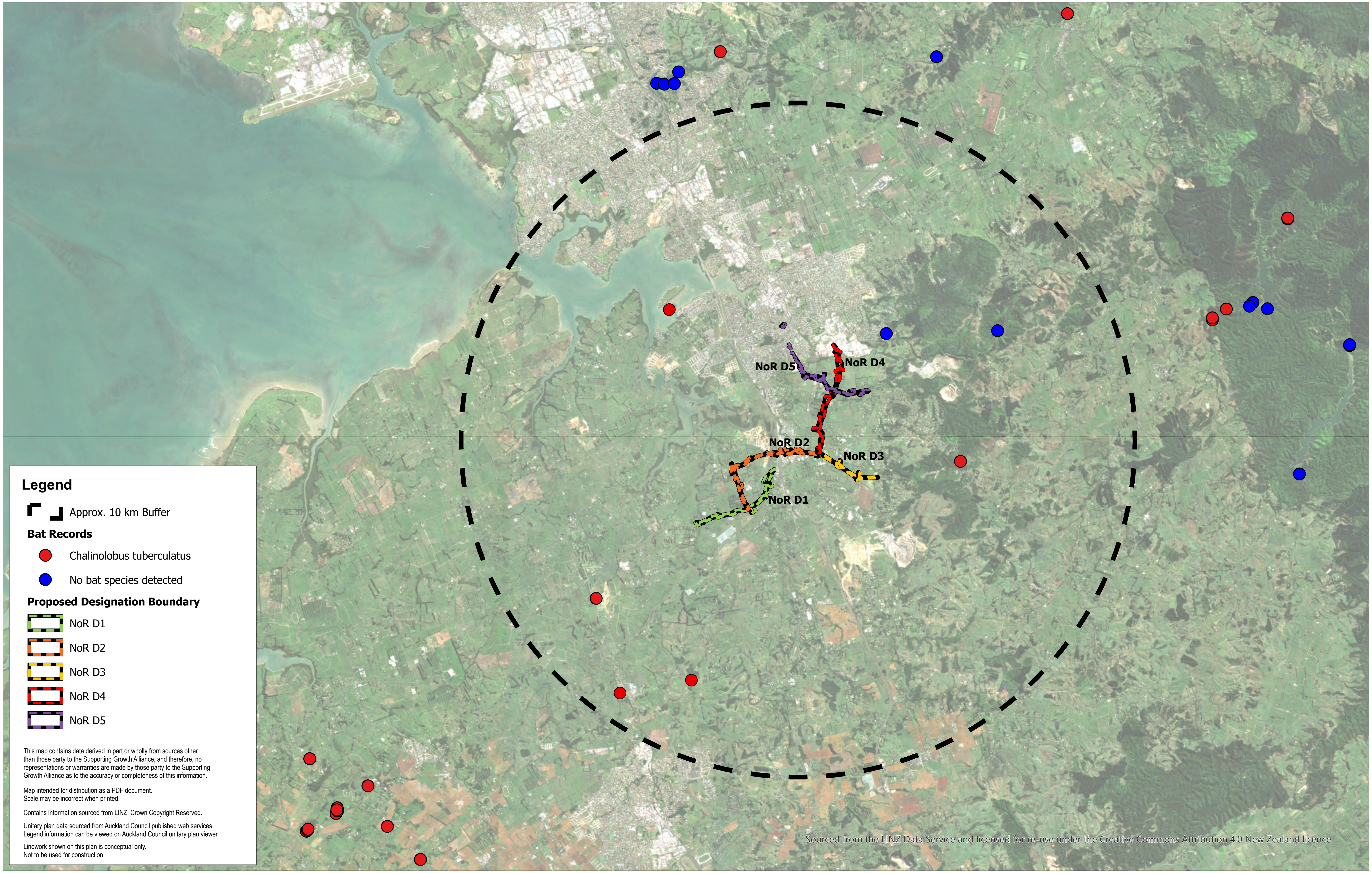
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-005.5



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Map Scale @ A3: 1:100,000

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N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title: **Supporting Growth**

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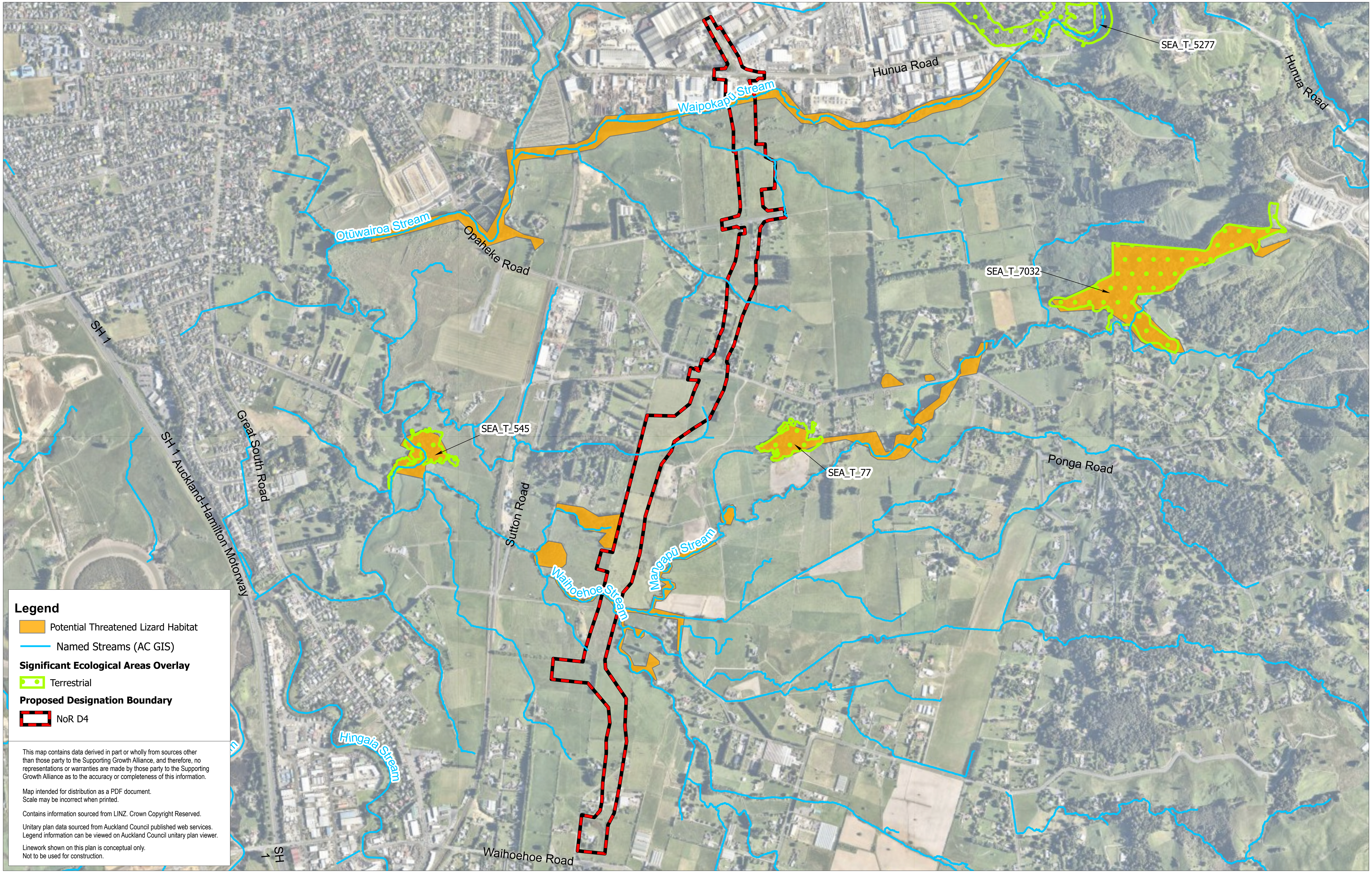
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-006



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Map Scale @ A3: 1:13,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Potential Threatened Lizard Habitat
Within ZOI of NoR D4

Client: **Supporting Growth**

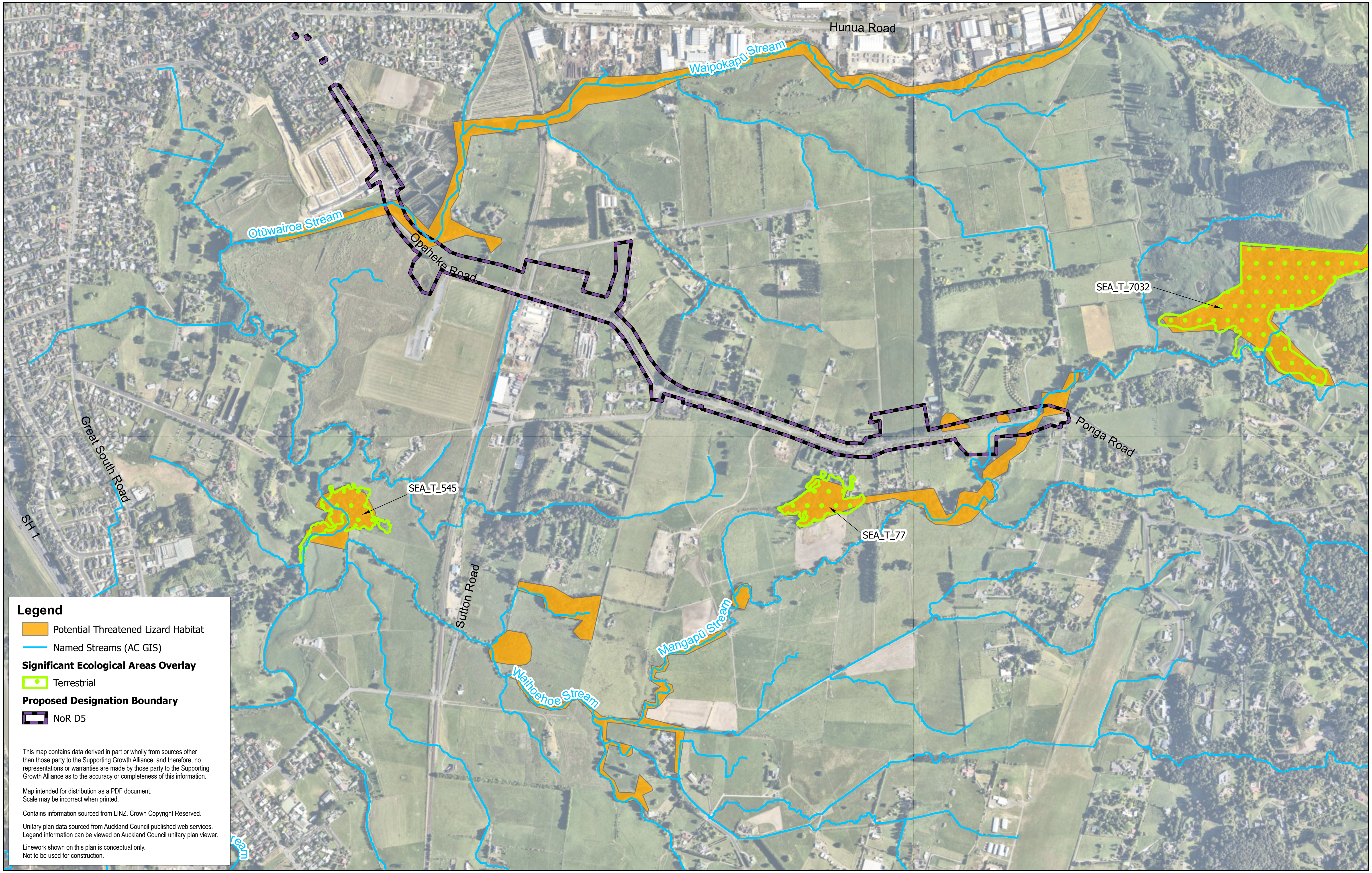
Project: **Drury Arterial Network**

TE TUPU NGĀTAHI
Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EX-DL-007.1**

Page 1 of 2



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Kilometres

N

Revision	Author	Verified	Approved	Date
1	SS	CR	FD	22/12/2020

Title:

Supporting Growth

Potential Threatened Lizard Habitat
Within ZOI of NoR D5

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EX-DL-007.2

Page 2 of 2

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Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

Map Scale @ A3: 1:5,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth
Terrestrial Habitat Mapping

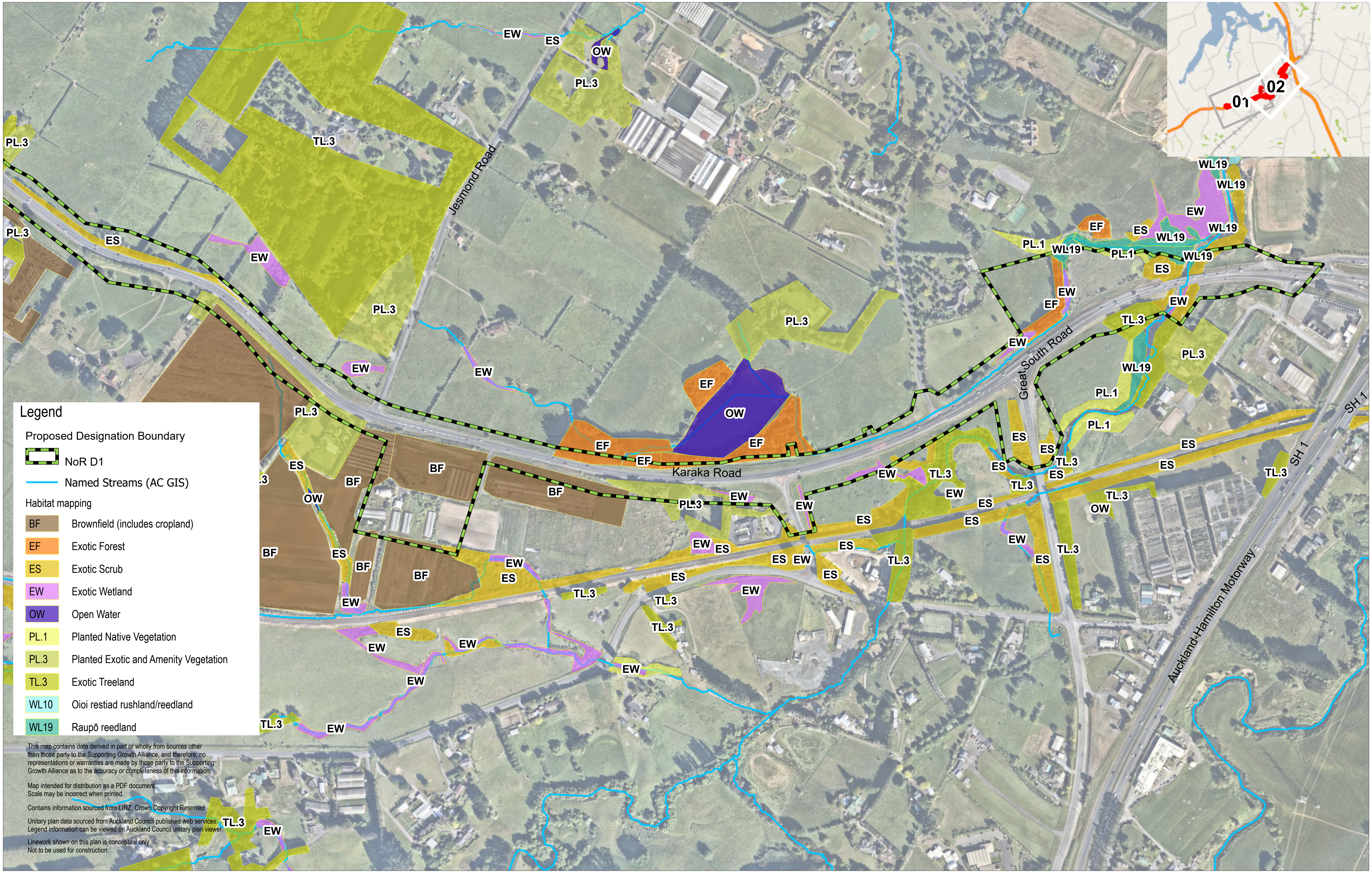
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.01



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Linework shown on this plan is conceptual only.
Not to be used for construction.

Map Scale @ A3: 1:5,000

0 0.04 0.08 0.16
Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth
Terrestrial Habitat Mapping

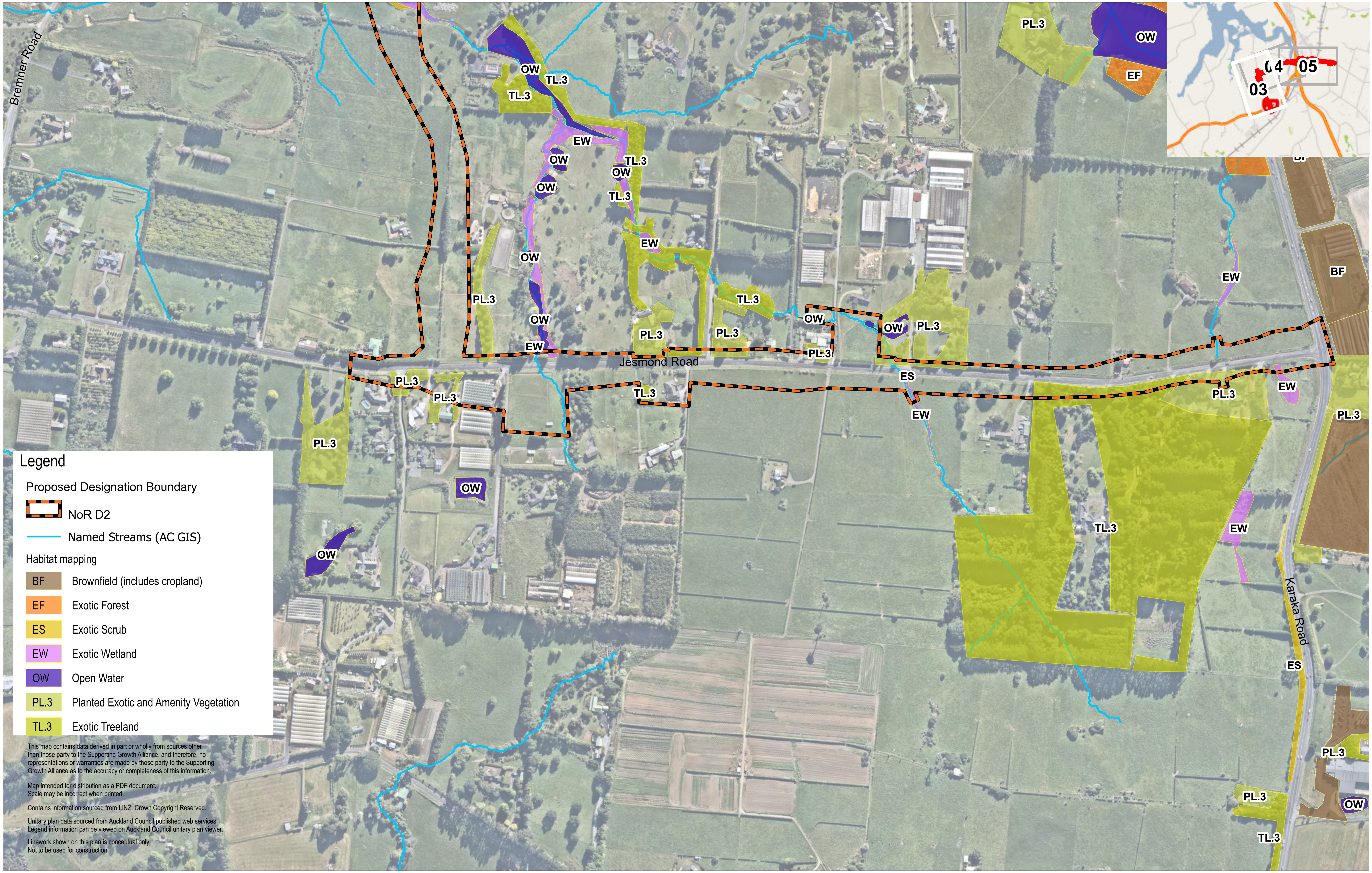
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.02



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Map Scale @ A3: 1:5,000

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Kilometres

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Terrestrial Habitat Mapping

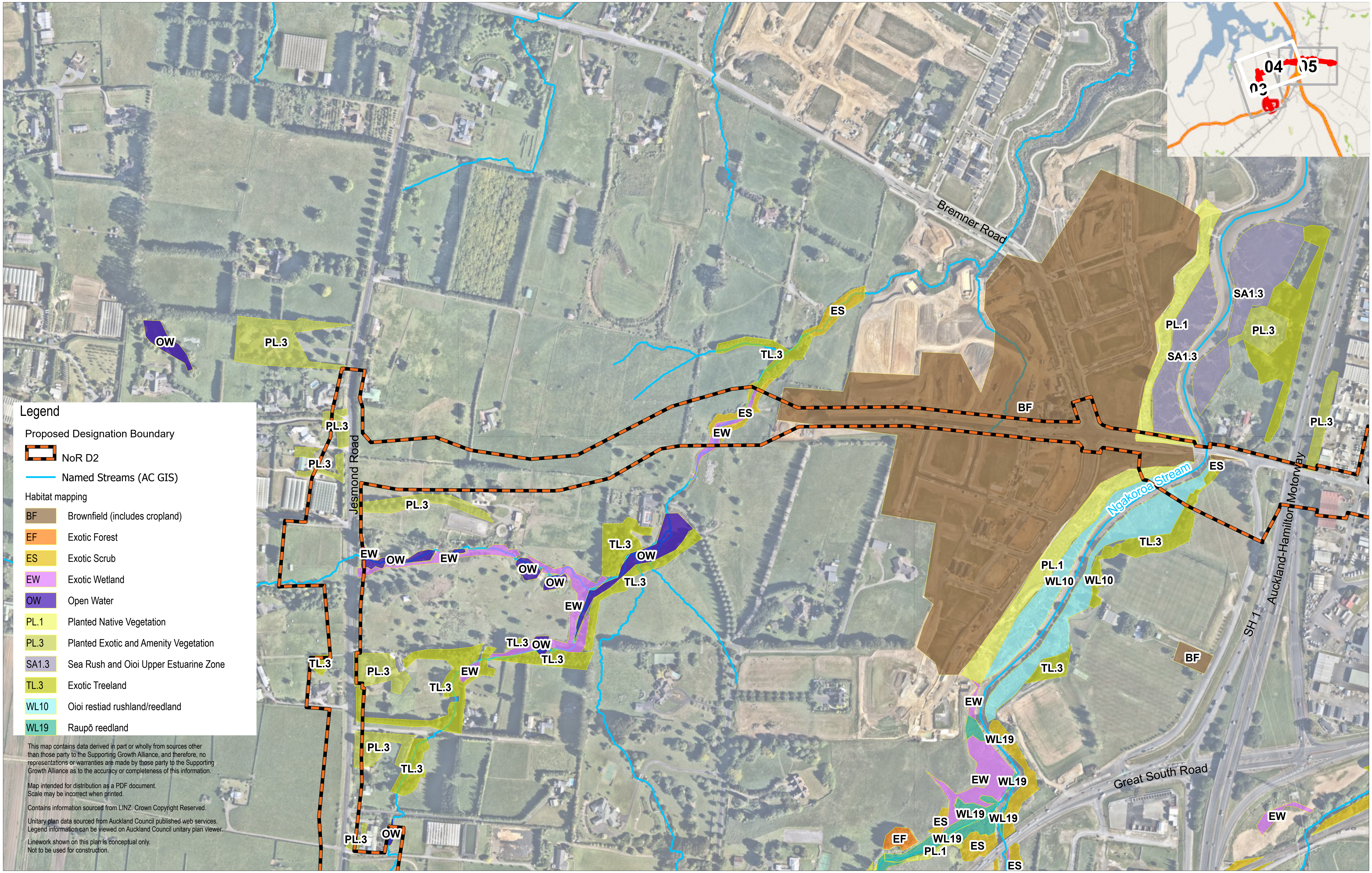
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.03



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Not to be used for construction.

Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

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Map Scale @ A3: 1:5,000

0 0.04 0.08 0.16
Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Terrestrial Habitat Mapping

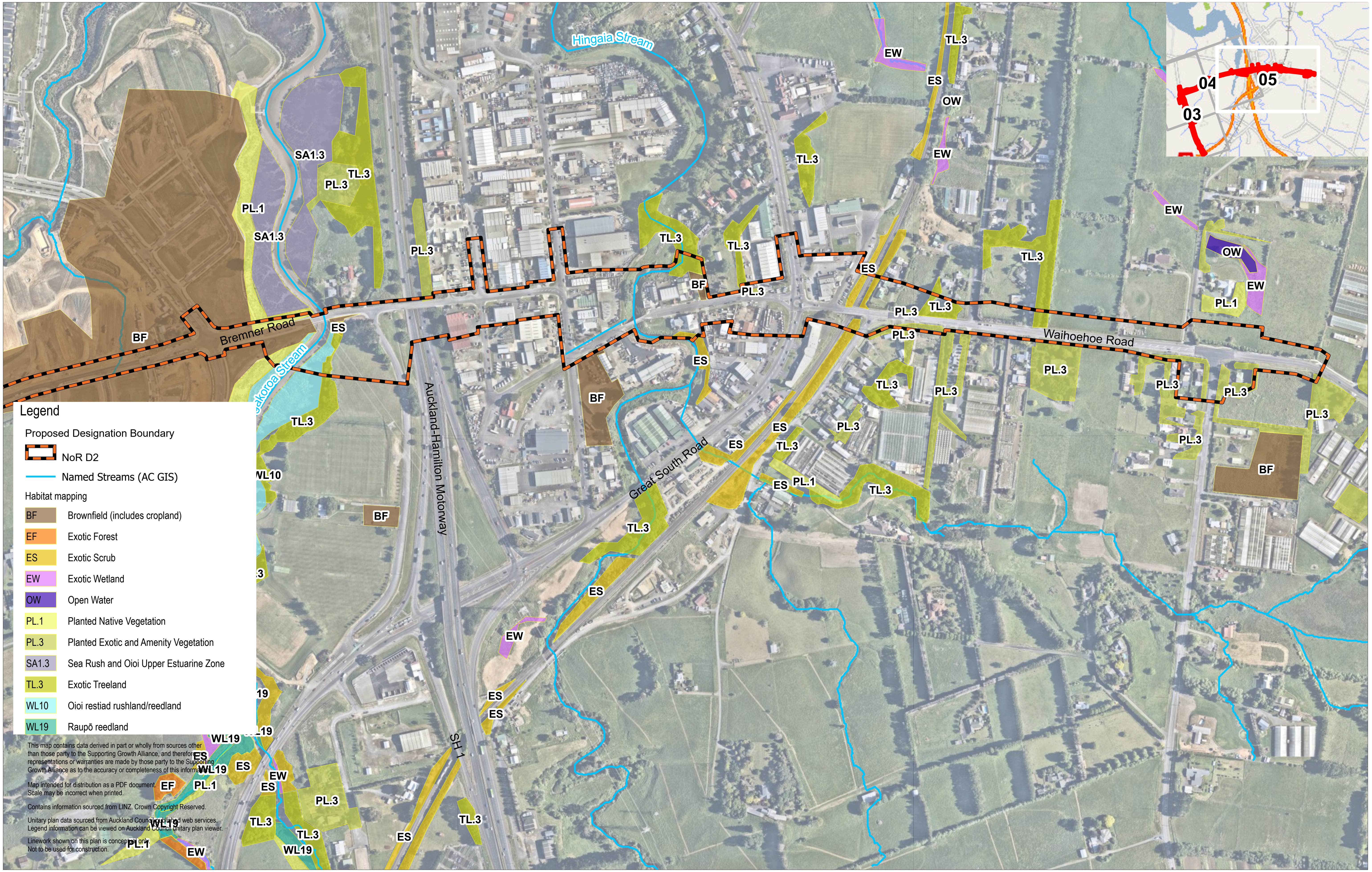
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.04



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Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

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Map Scale @ A3: 1:5,000

0 0.04 0.08 0.16 Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth** Terrestrial Habitat Mapping

FOR INTERNAL PURPOSES ONLY. YET TO BE VERIFIED

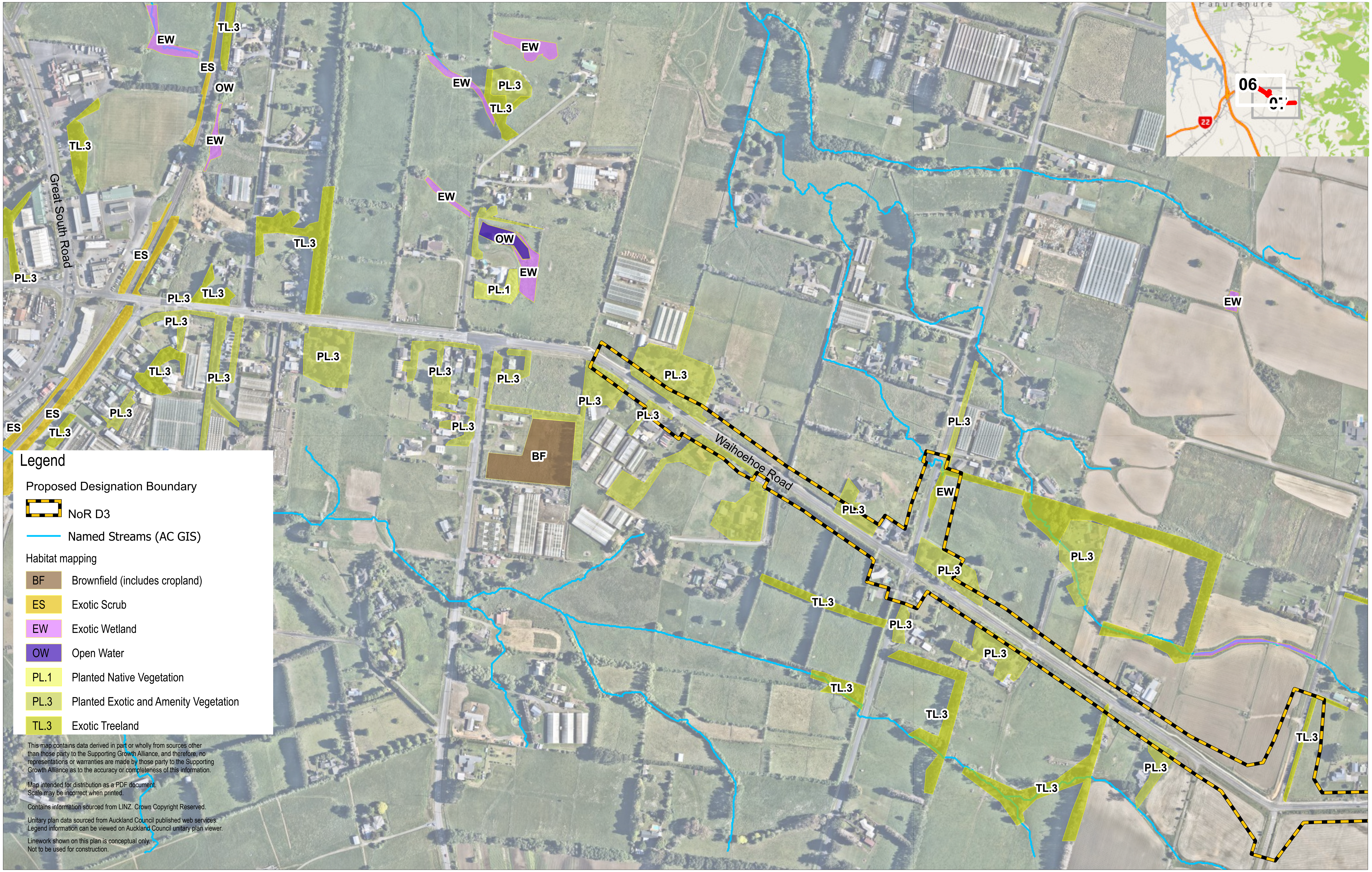
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.05



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Map Scale @ A3: 1:5,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**

Terrestrial Habitat Mapping

FOR INTERNAL PURPOSES ONLY. YET TO BE VERIFIED

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.06

Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

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Map Scale @ A3: 1:5,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Terrestrial Habitat Mapping

FOR INTERNAL PURPOSES ONLY.
YET TO BE VERIFIED

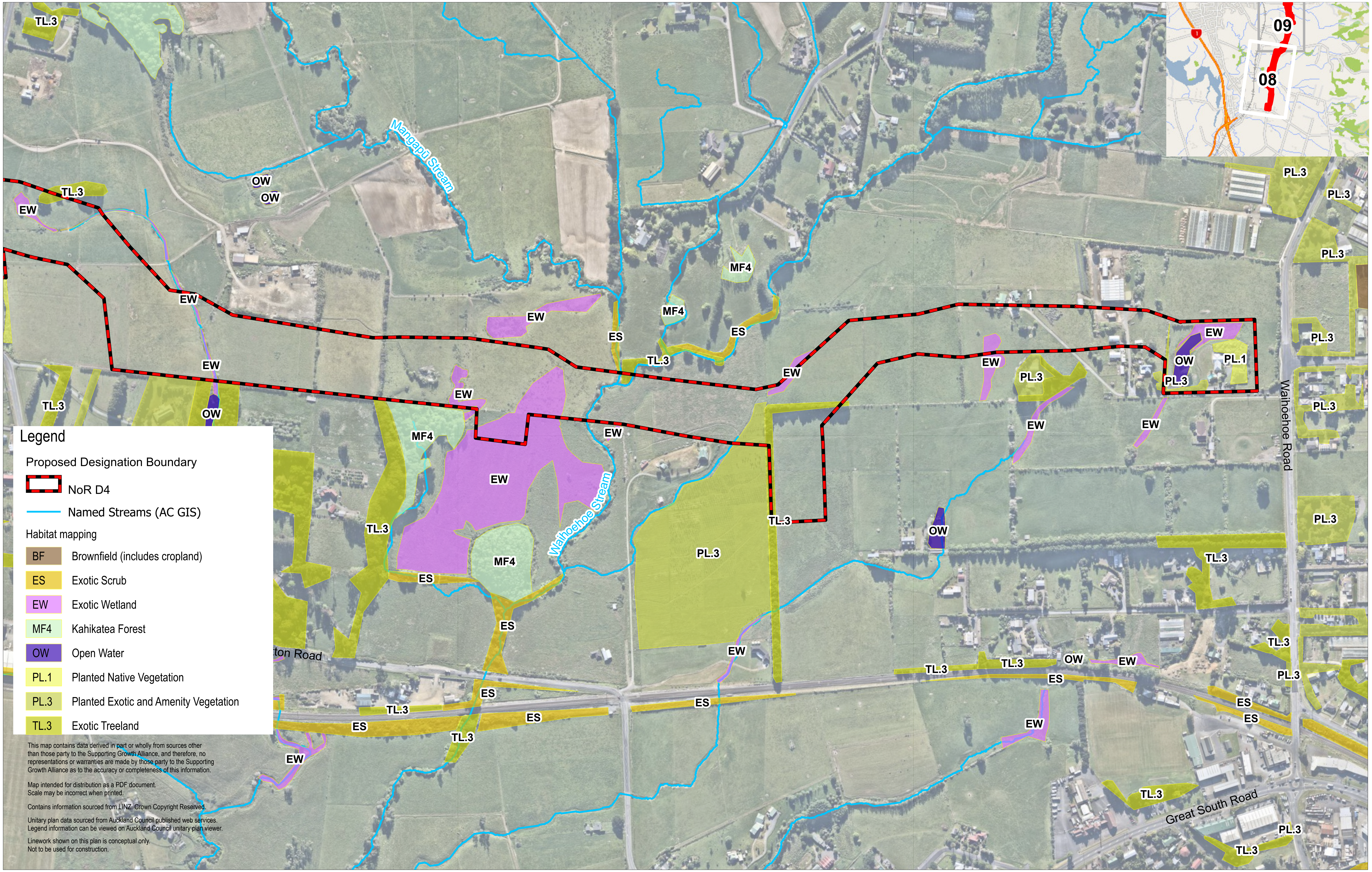
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.07



Map Scale @ A3: 1:5,000

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Terrestrial Habitat Mapping

FOR INTERNAL REVIEW ONLY. YET TO BE VERIFIED

Client: **Supporting Growth**

Project: **Drury Arterial Network**

TE TUPU NGĀTAHI Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EC-DL-008.08**

Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

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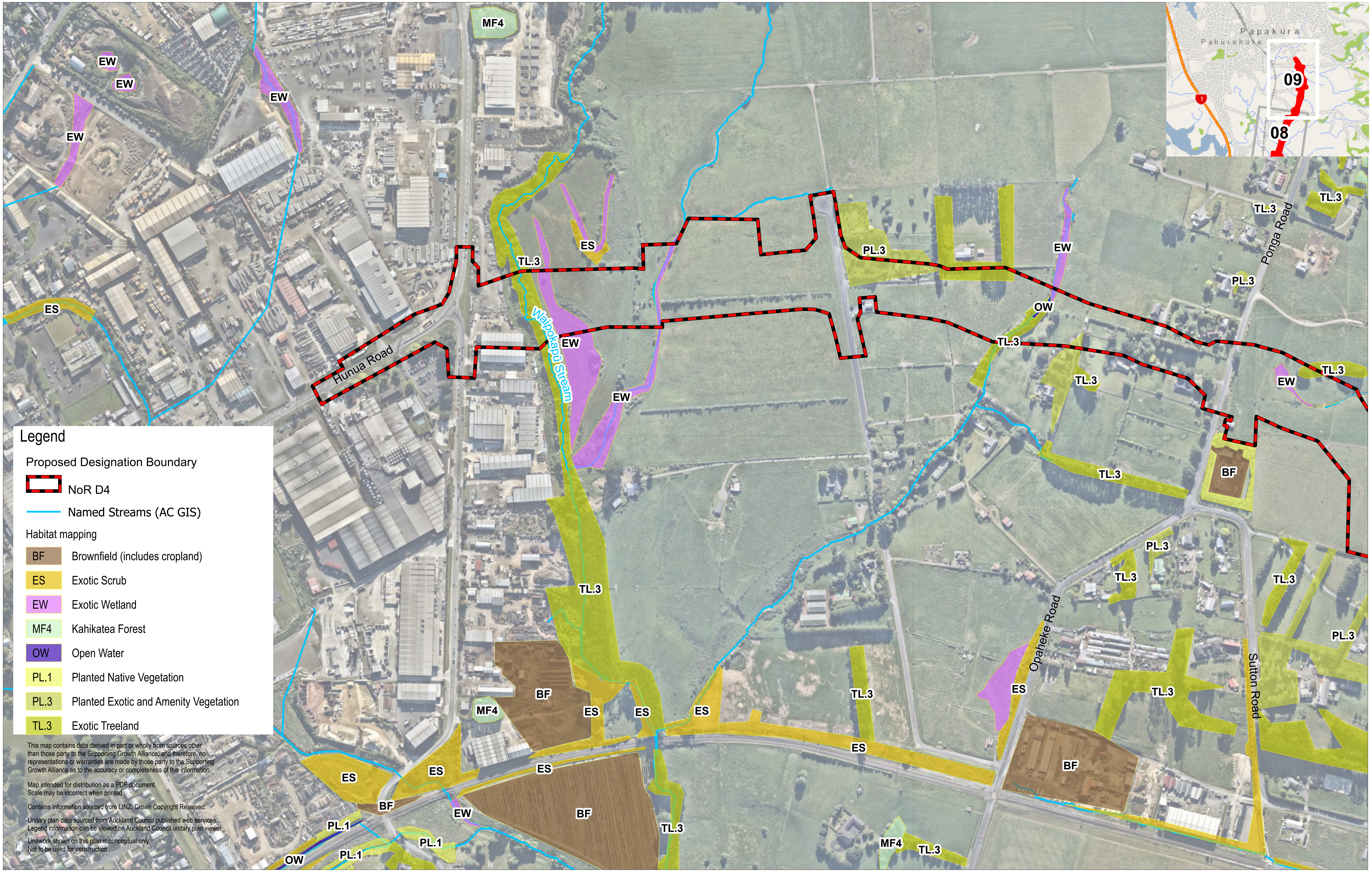

Legend

Proposed Designation Boundary

NoR D4

Named Streams (AC GIS)

Habitat mapping

BF	Brownfield (includes cropland)
ES	Exotic Scrub
EW	Exotic Wetland
MF4	Kahikatea Forest
OW	Open Water
PL.1	Planted Native Vegetation
PL.3	Planted Exotic and Amenity Vegetation
TL.3	Exotic Treeland

Map Scale @ A3: 1:5,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Terrestrial Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.09

Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

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Map Scale @ A3: 1:5,000

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Terrestrial Habitat Mapping

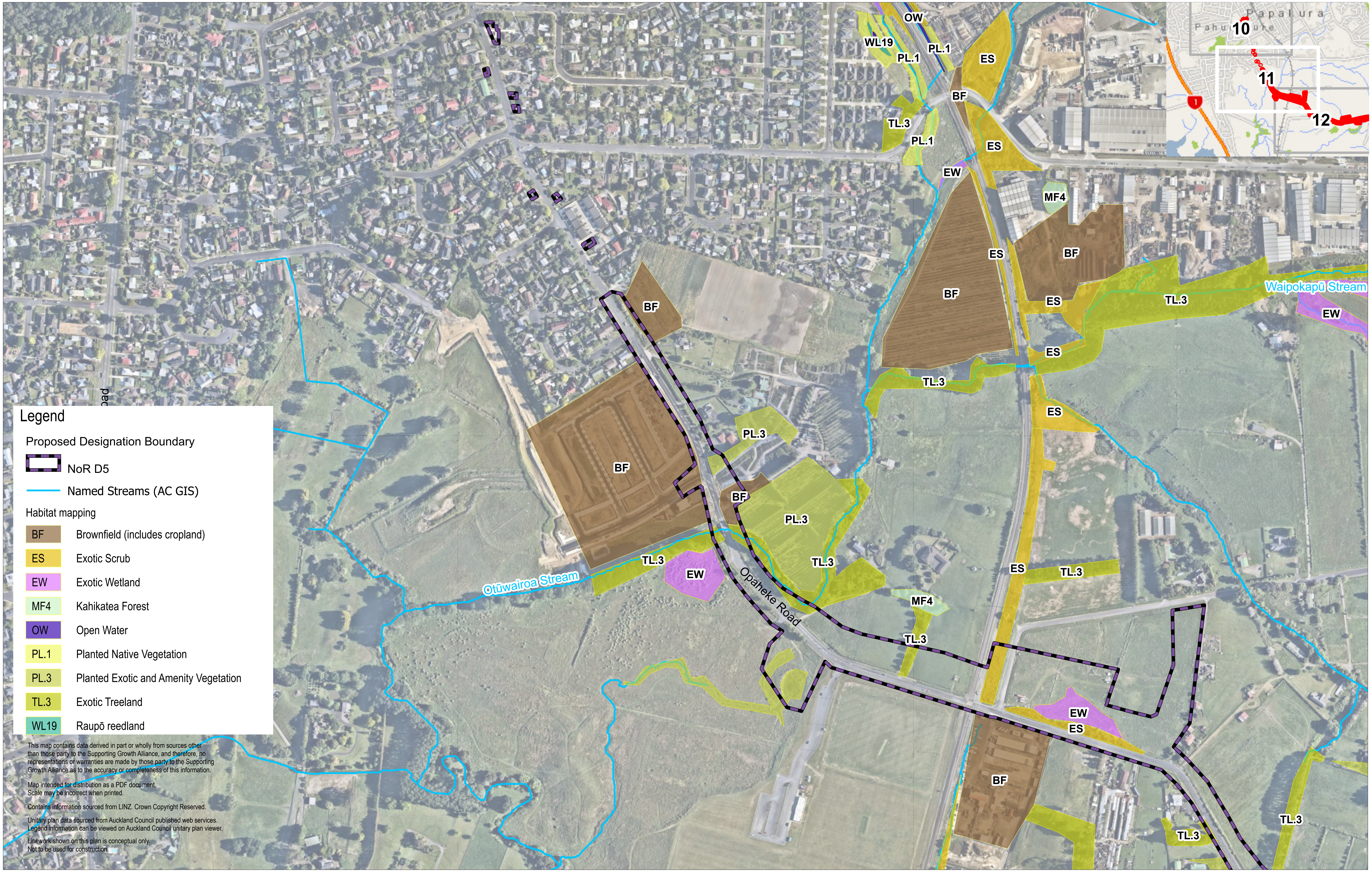
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.10



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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Terrestrial Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-008.11

Name: SGA-EC-DL-008 Terrestrial Habitat Mapping

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_8_13.aprx

Name: SGA-EC-DL-010.1 Freshwater Habitat Mapping - NoR D1

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

Client: **Supporting Growth**

Project: **Drury Arterial Network**

TE TUPU NGĀTAHI
Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EC-DL-010.01**

Name: SGA-EC-DL-010.1 Freshwater Habitat Mapping - NoR D1

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.02

Legend

Proposed Designation Boundary

NoR D1

Partial Barrier to Fish Passage

Stream classification

Intermittent

Ephemeral

Named Streams (AC GIS)

Habitat mapping

EW Exotic Wetland

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Name: SGA-EC-DL-010.1 Freshwater Habitat Mapping - NoR D1

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.03

Name: SGA-EC-DL-010.1 Freshwater Habitat Mapping - NoR D1

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

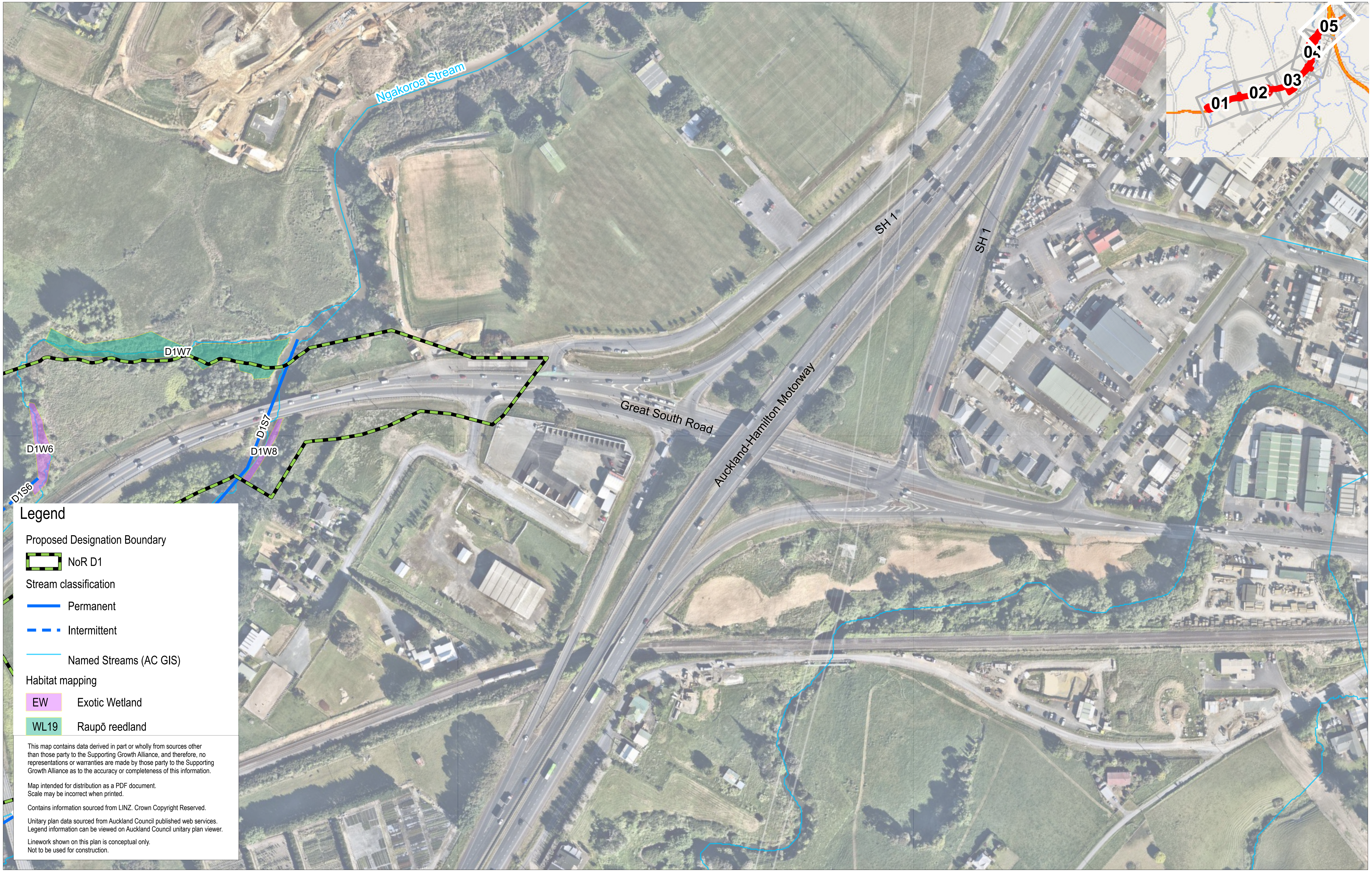
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.04



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Name: SGA-EC-DL-010.1 Freshwater Habitat Mapping - NoR D1

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Map Scale @ A3: 1:2,500

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Kilometres

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:
Supporting Growth
Freshwater and Wetland Habitat Mapping

Client: **Supporting Growth**

Project: **Drury Arterial Network**

TE TUPU NGĀTAHI
Supporting Growth

Discipline: **GIS**

Drawing No: **SGA-EC-DL-010.05**

Name: SGA-EC-DL-010.2 Freshwater Habitat Mapping - NoR D2

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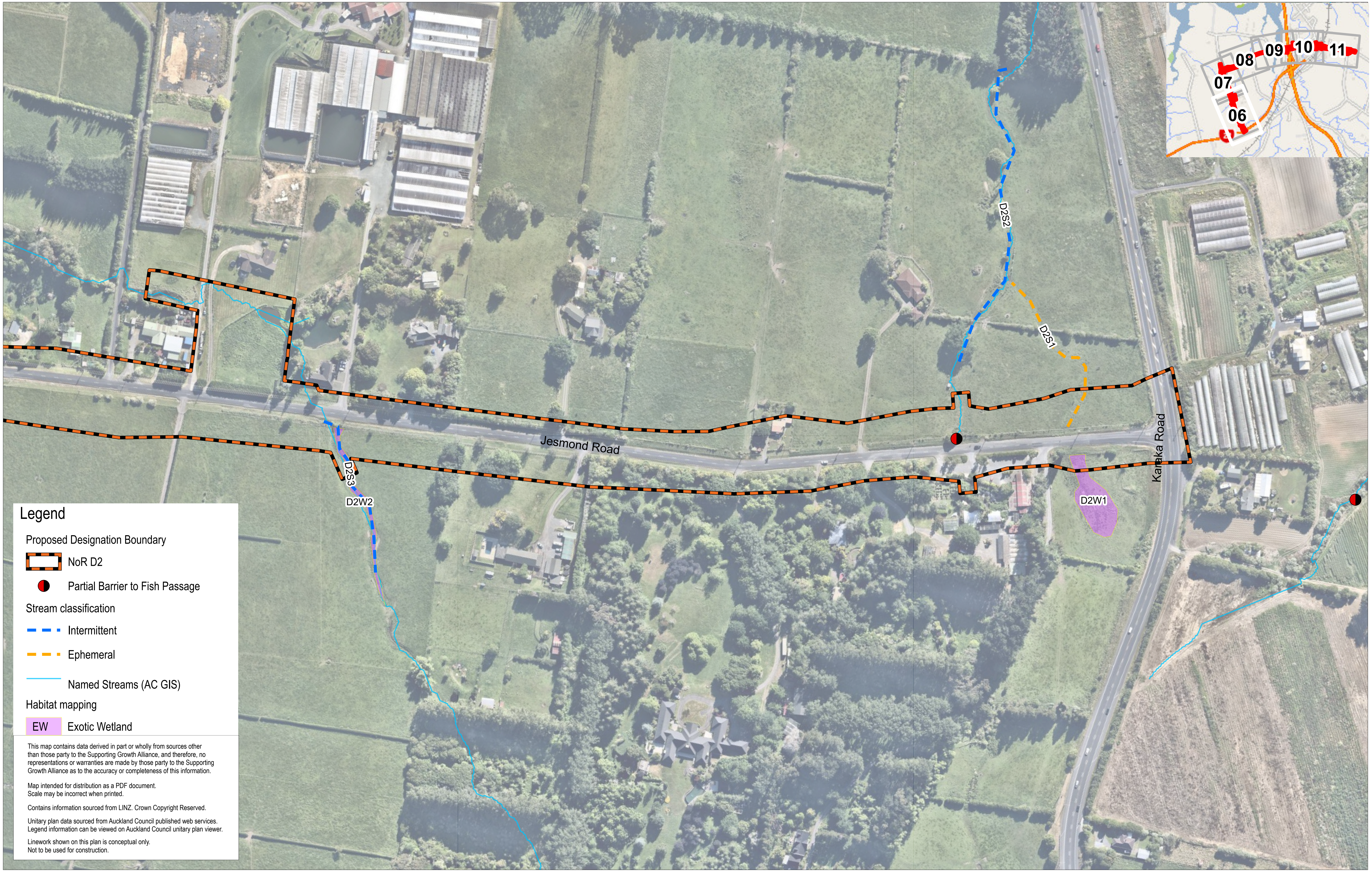

Legend

Proposed Designation Boundary

NoR D2

Partial Barrier to Fish Passage

Stream classification

Intermittent

Ephemeral

Named Streams (AC GIS)

Habitat mapping

EW Exotic Wetland

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Map Scale @ A3: 1:2,500

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Kilometres

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth
Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.06

Name: SGA-EC-DL-010.2 Freshwater Habitat Mapping - NoR D2

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Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

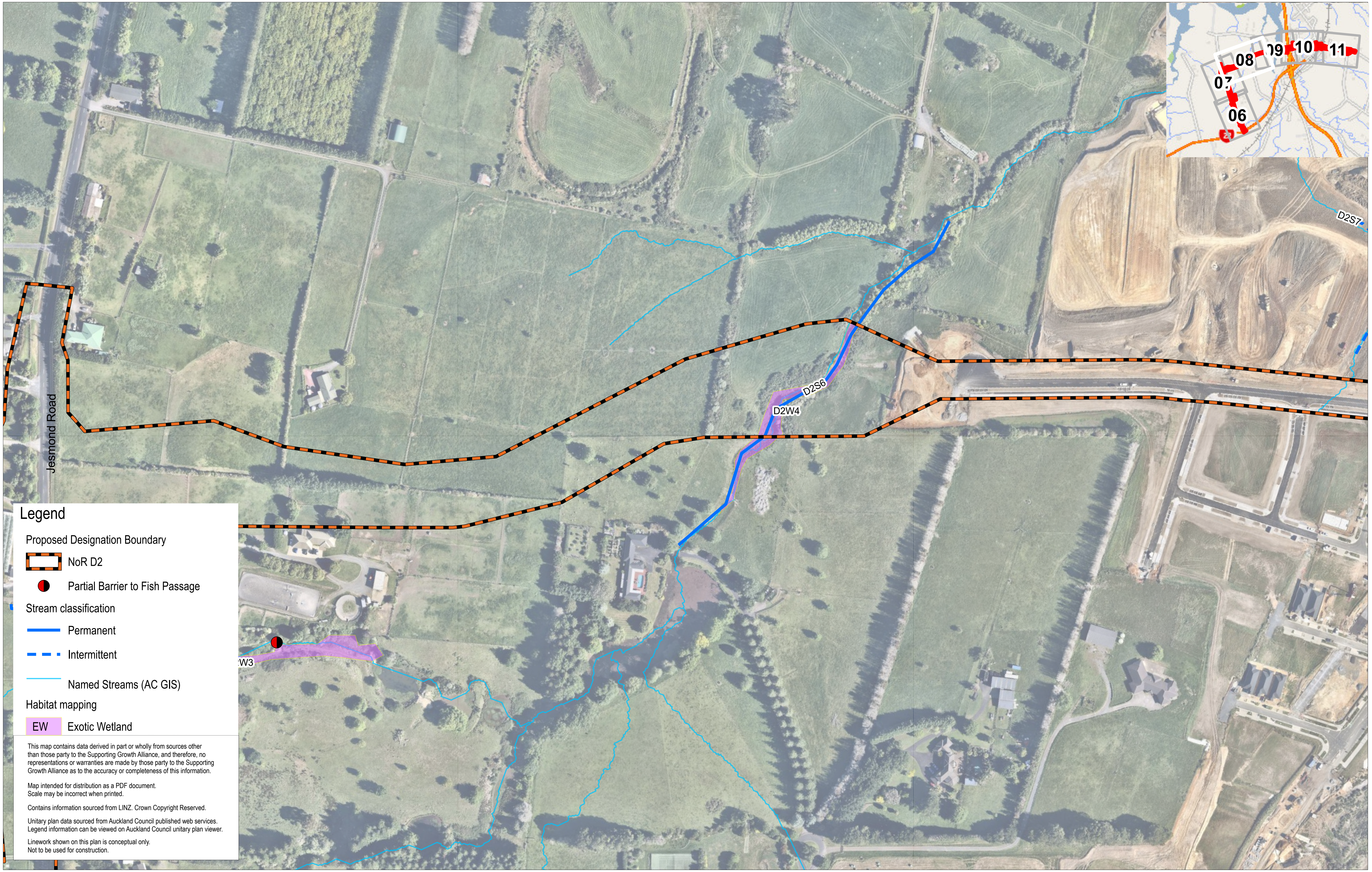
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.07



Name: SGA-EC-DL-010.2 Freshwater Habitat Mapping - NoR D2

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Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

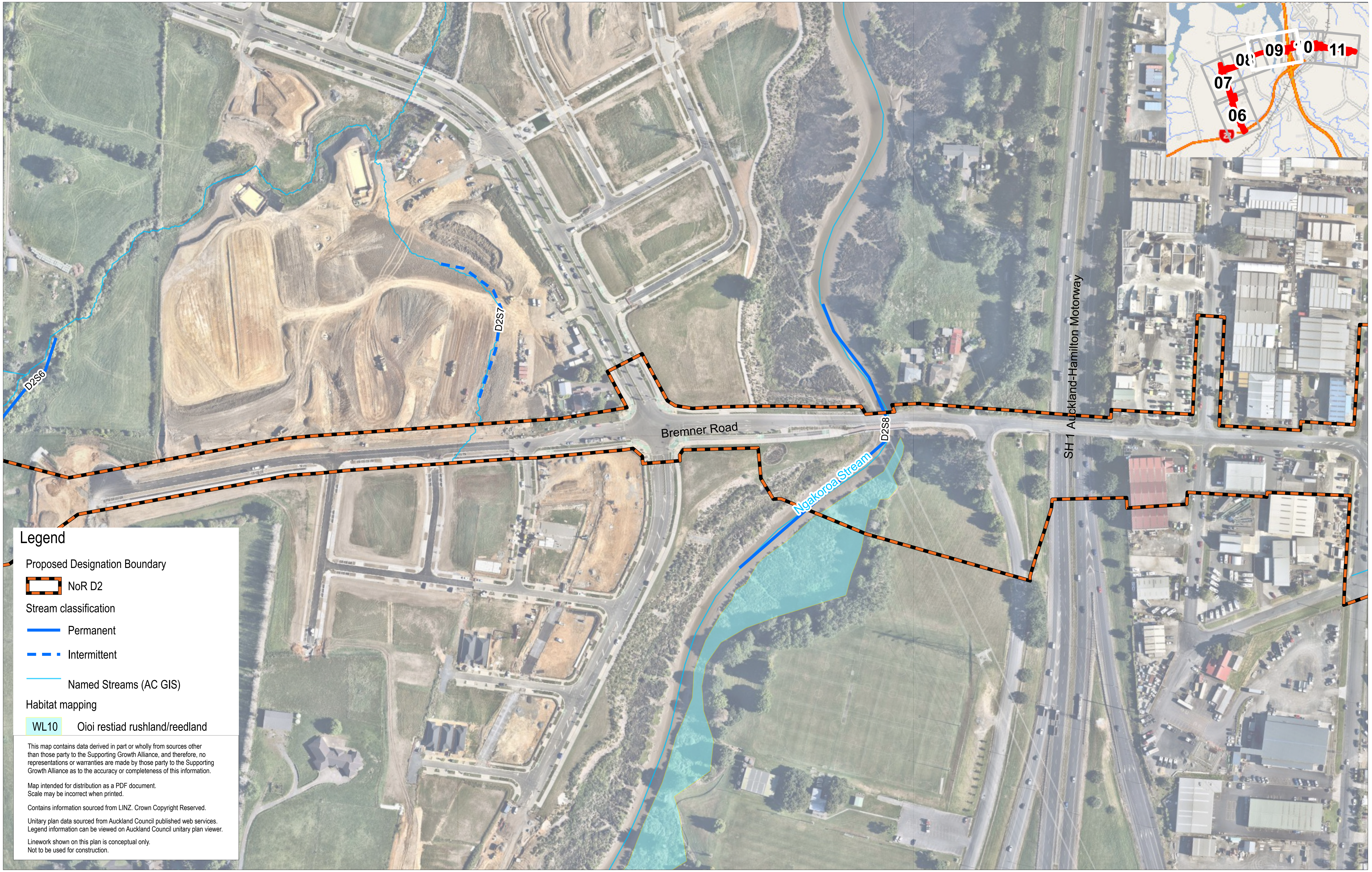
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.08



Legend

Proposed Designation Boundary

NoR D2

Stream classification

Permanent

Intermittent

Named Streams (AC GIS)

Habitat mapping

WL10 Oioi restiad rushland/reedland

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Name: SGA-EC-DL-010.2 Freshwater Habitat Mapping - NoR D2

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

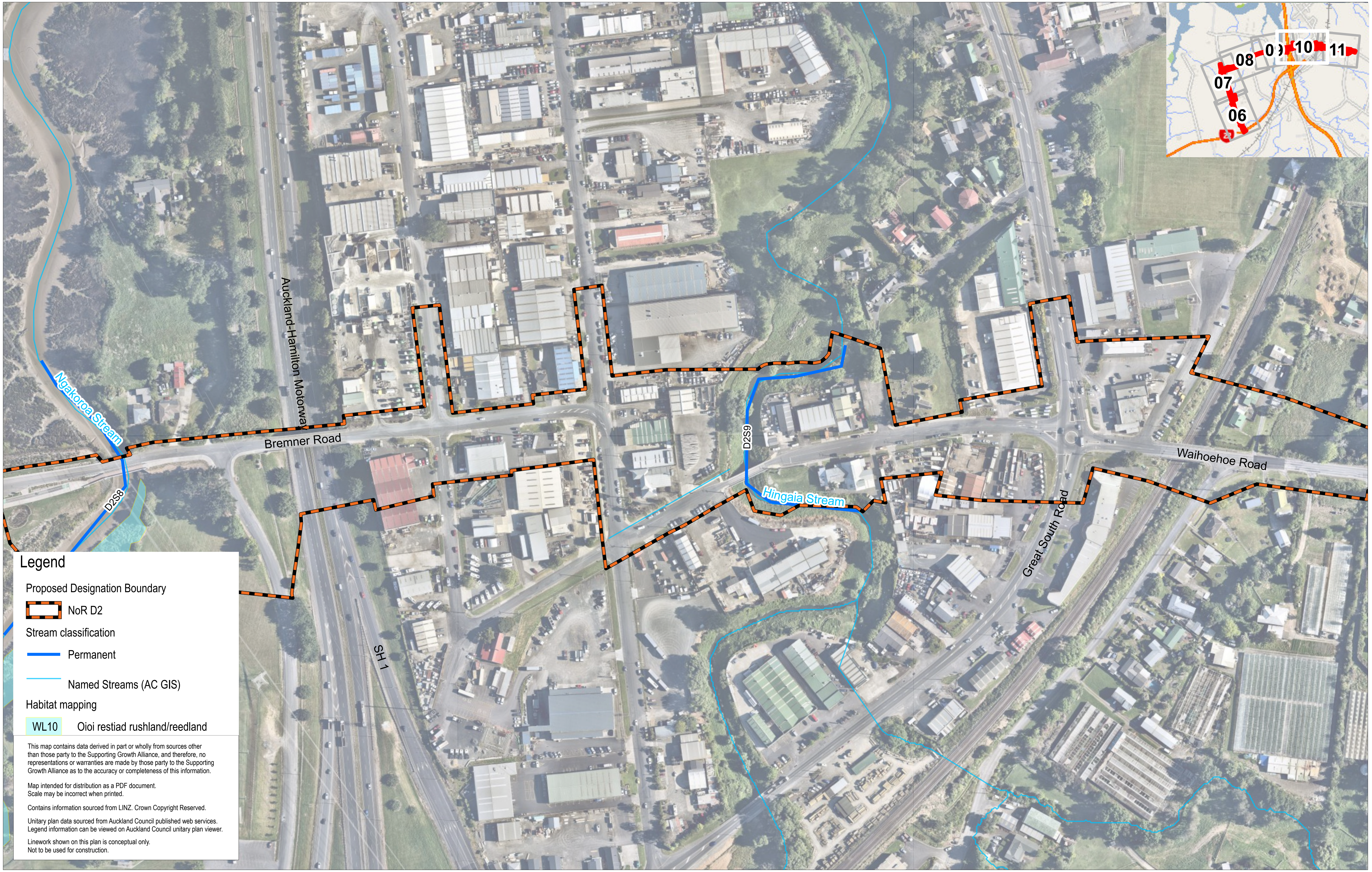
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.09



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Name: SGA-EC-DL-010.2 Freshwater Habitat Mapping - NoR D2

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:
Supporting Growth
Freshwater and Wetland Habitat Mapping

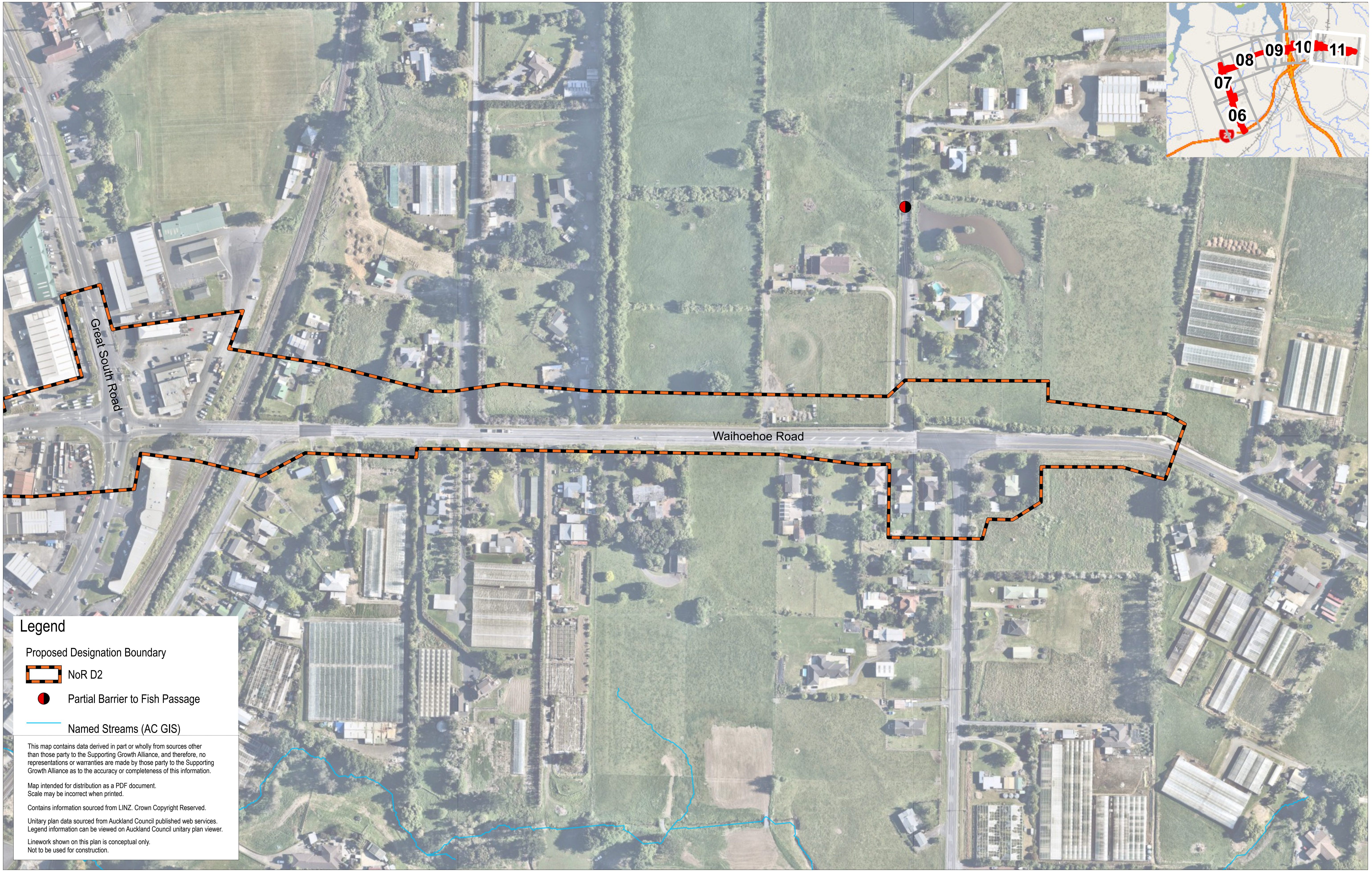
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.10



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Name: SGA-EC-DL-010.2 Freshwater Habitat Mapping - NoR D2

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

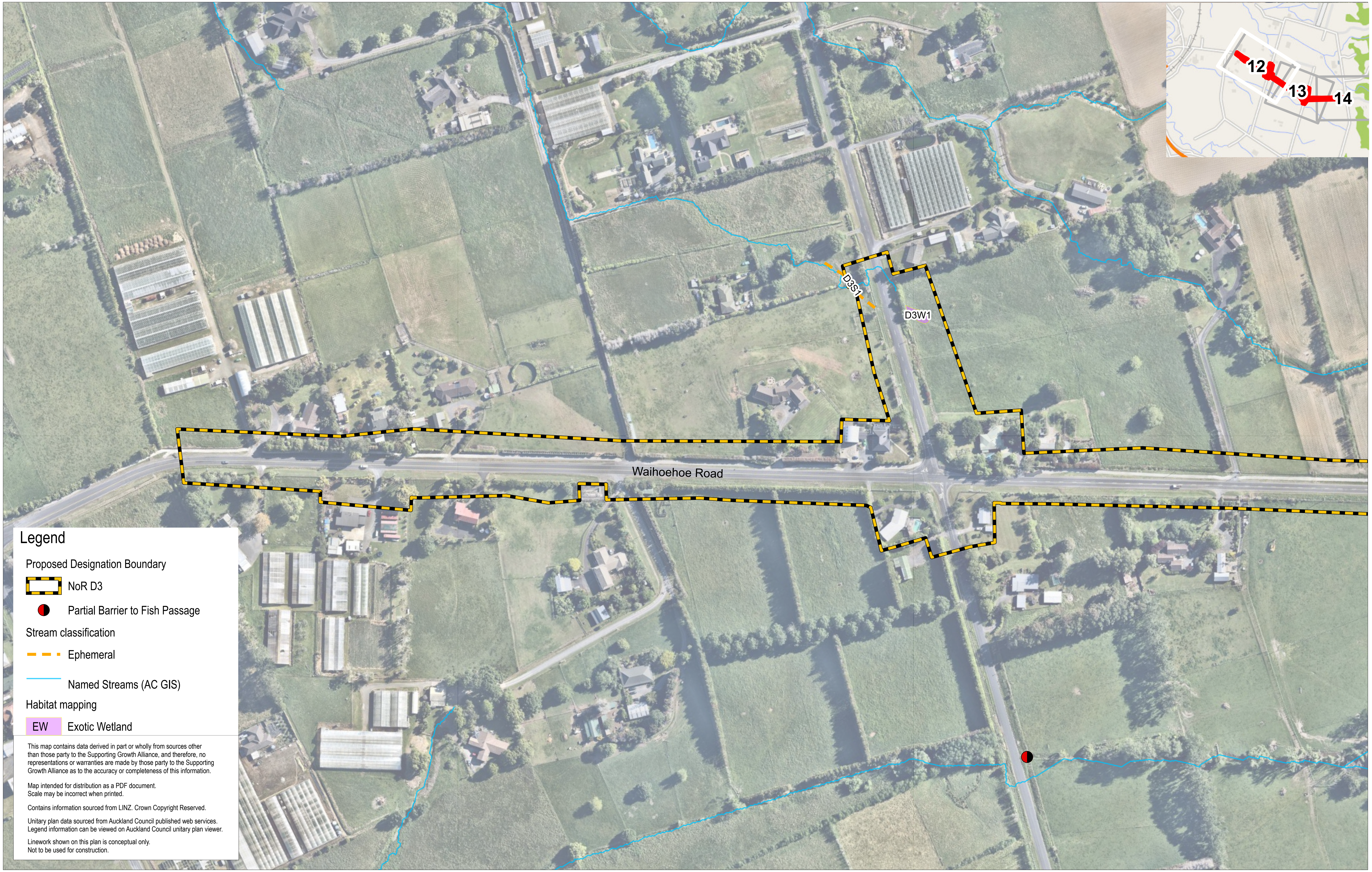
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.11



Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:
Supporting Growth
Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.12

Name: SGA-EC-DL-010.3 Freshwater Habitat Mapping - NoR D3

Path: P:\605X\60588314\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Name: SGA-EC-DL-010.3 Freshwater Habitat Mapping - NoR D3

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.13

Name: SGA-EC-DL-010.3 Freshwater Habitat Mapping - NoR D3

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.14

Name: SGA-EC-DL-010.4 Freshwater Habitat Mapping -NoR D4

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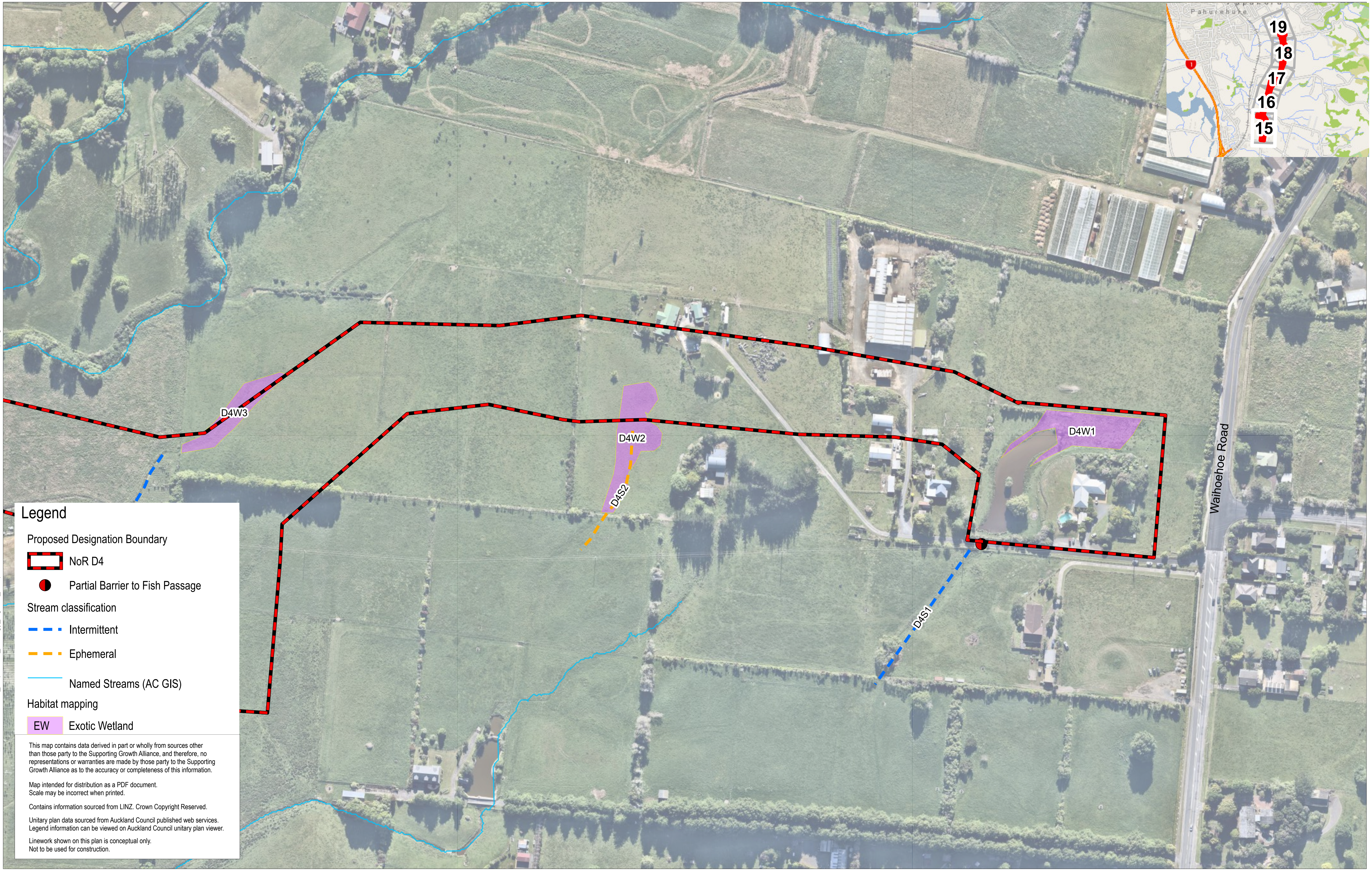

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

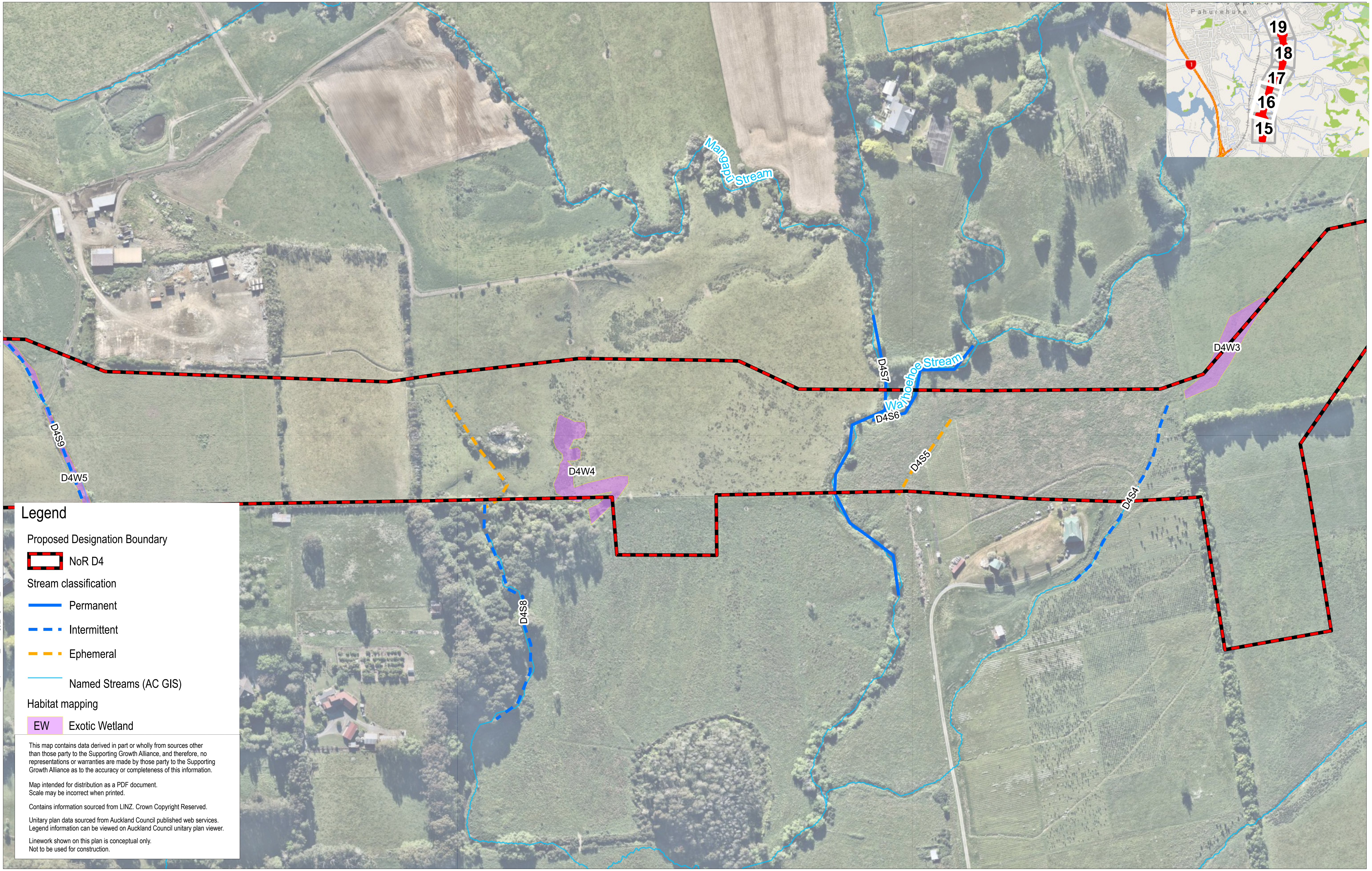
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.15



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Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

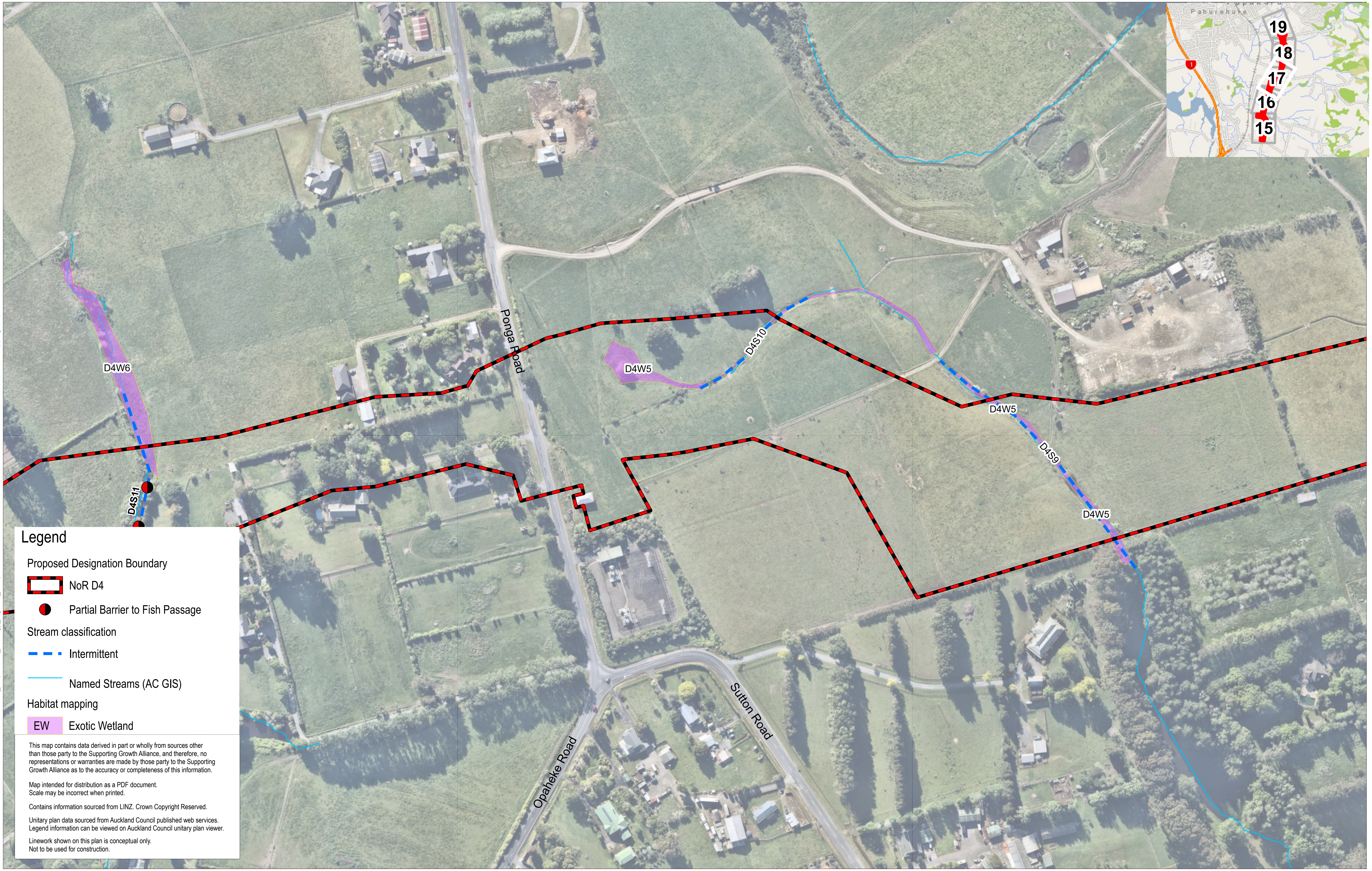
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.16



Legend

Proposed Designation Boundary

NoR D4

Partial Barrier to Fish Passage

Stream classification

Intermittent

Named Streams (AC GIS)

Habitat mapping

EW Exotic Wetland

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Name: SGA-EC-DL-010.4 Freshwater Habitat Mapping -NoR D4

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

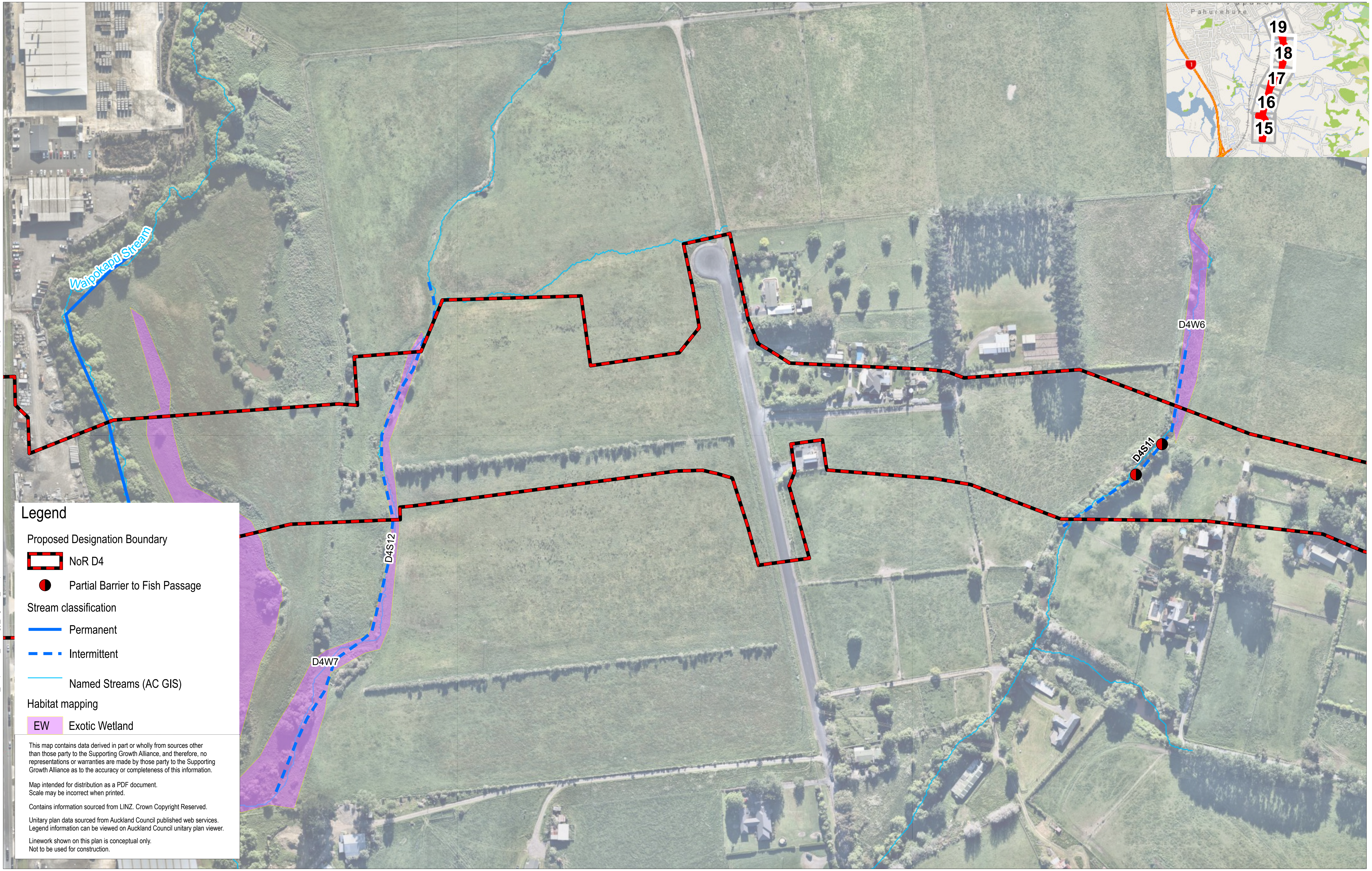
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.17



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Name: SGA-EC-DL-010.4 Freshwater Habitat Mapping -NoR D4

Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.18

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Not to be used for construction.

Name: SGA-EC-DL-010.4 Freshwater Habitat Mapping -NoR D4

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.19

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Name: SGA-EC-DL-010.5 Freshwater Habitat Mapping -NoR D5

Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.20

Name: SGA-EC-DL-010.5 Freshwater Habitat Mapping -NoR D5

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

Freshwater and Wetland Habitat Mapping

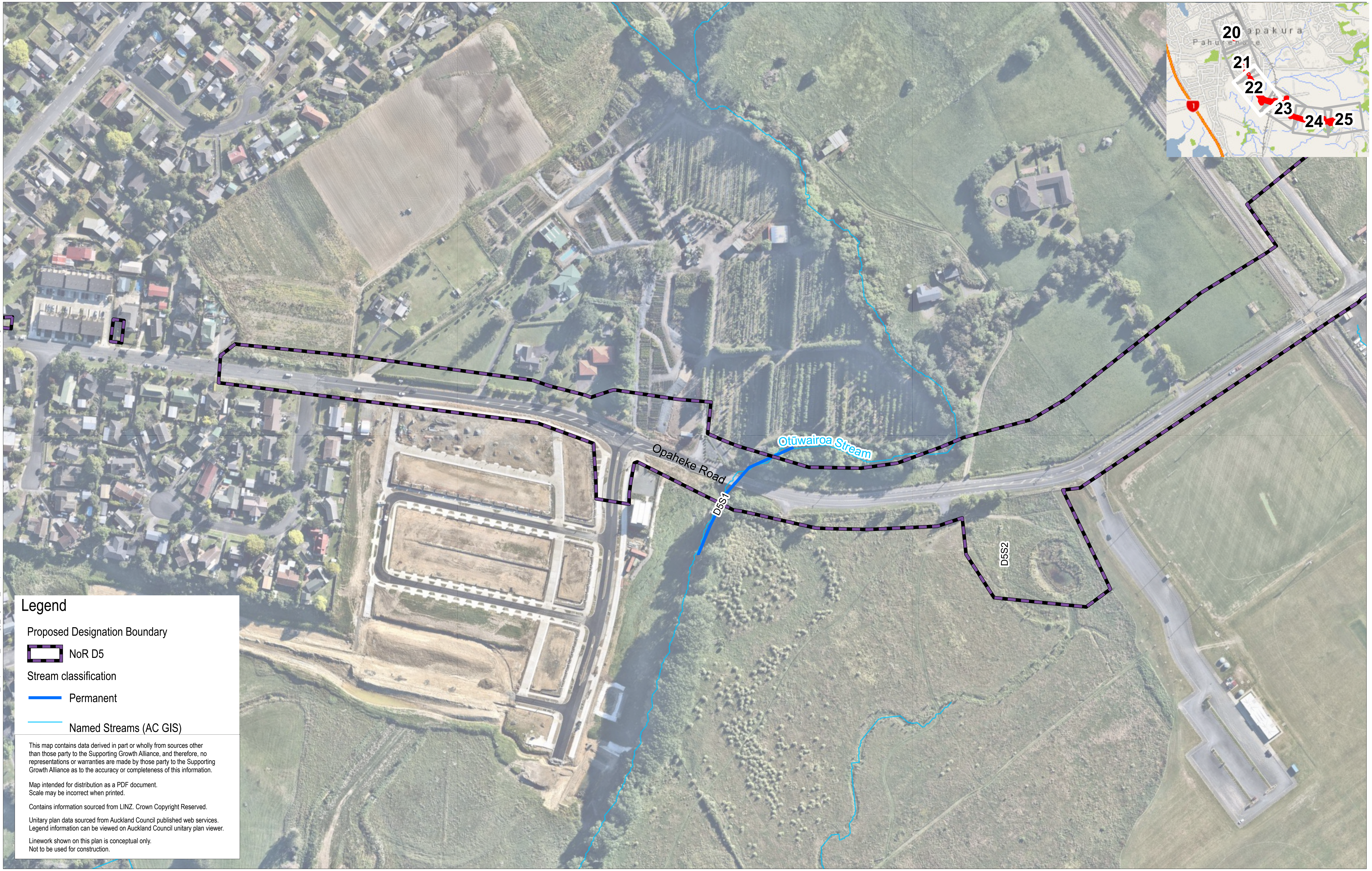
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.21



Legend

Proposed Designation Boundary

NoR D5

Stream classification

Permanent

Named Streams (AC GIS)

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Name: SGA-EC-DL-010.5 Freshwater Habitat Mapping -NoR D5

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Map Scale @ A3: 1:2,500

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Kilometres

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Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:
Supporting Growth
Freshwater and Wetland Habitat Mapping

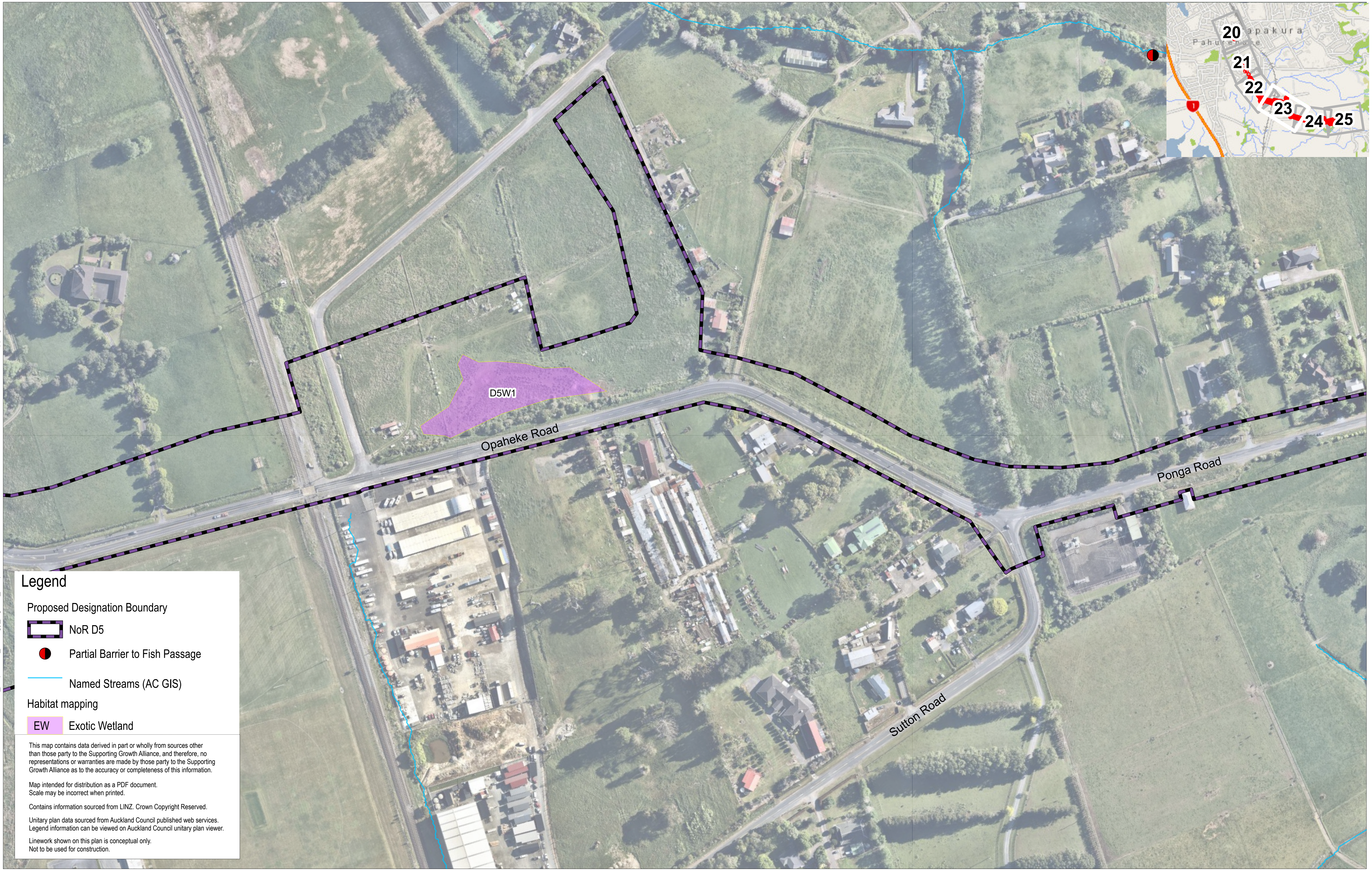
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.22



Legend

Proposed Designation Boundary

NoR D5

Partial Barrier to Fish Passage

Named Streams (AC GIS)

Habitat mapping

EW Exotic Wetland

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_10.aprx

Name: SGA-EC-DL-010.5 Freshwater Habitat Mapping -NoR D5

Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

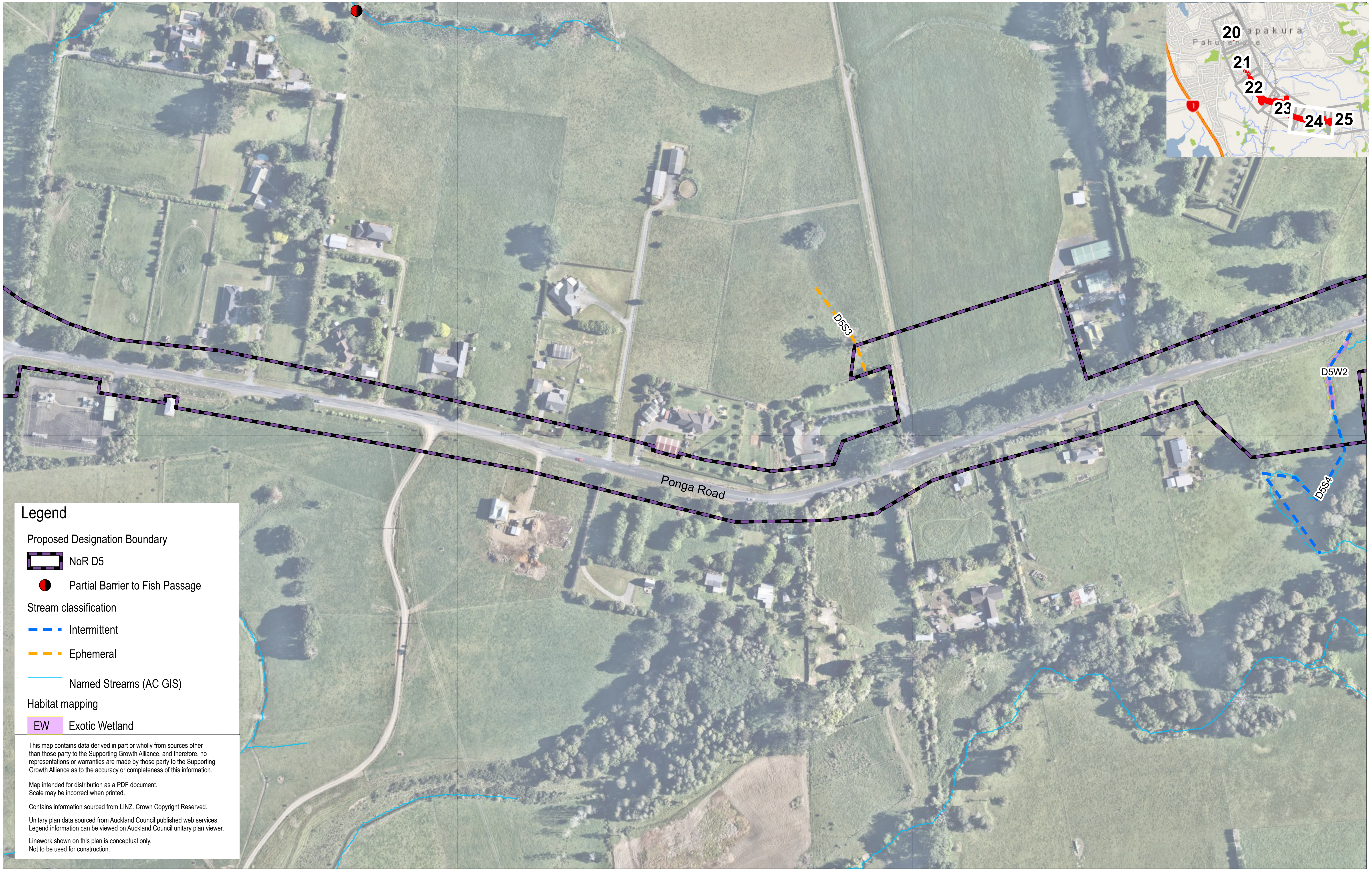
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.23



Name: SGA-EC-DL-010.5 Freshwater Habitat Mapping -NoR D5

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:
Supporting Growth
Freshwater and Wetland Habitat Mapping

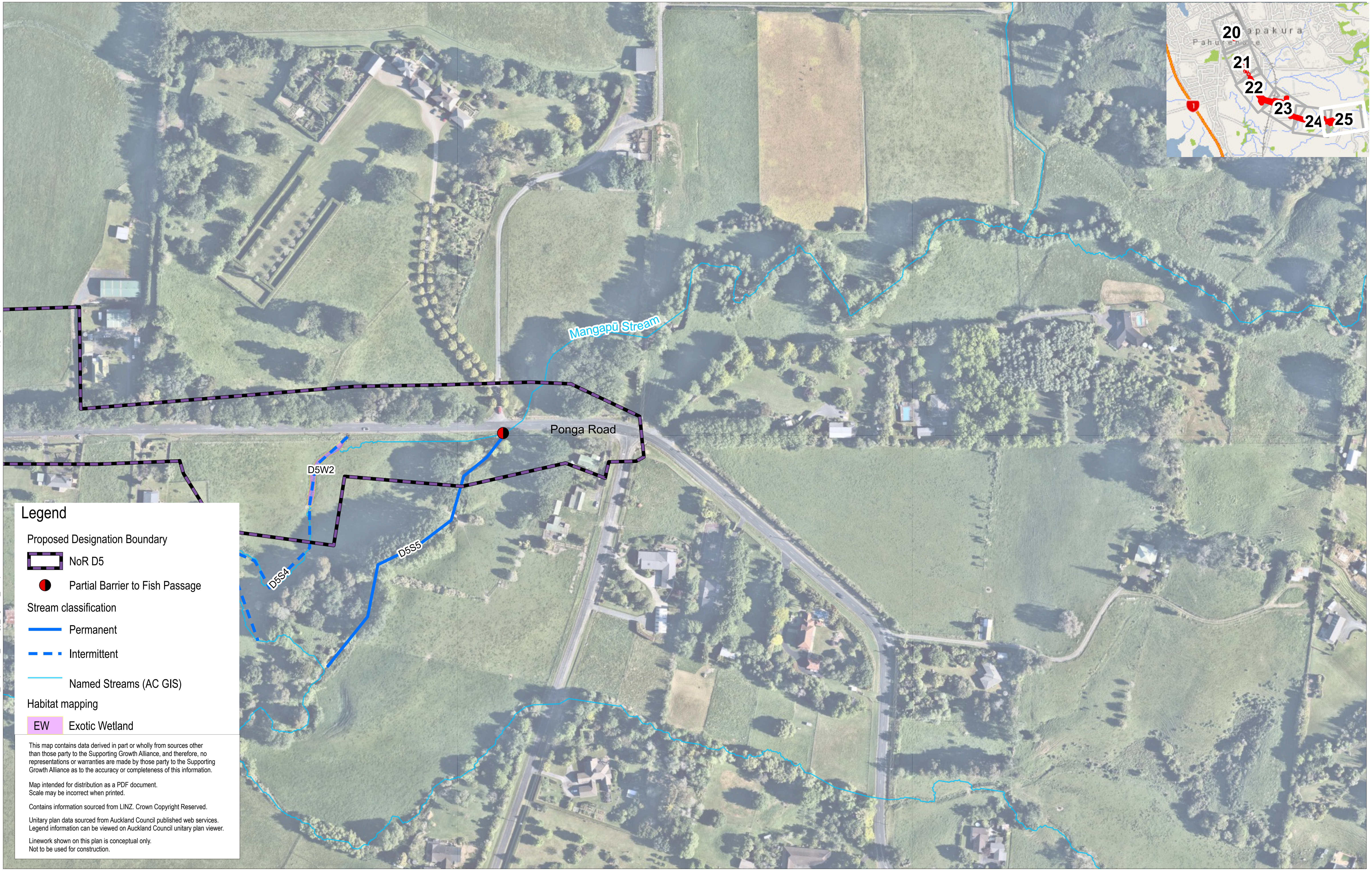
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.24



Name: SGA-EC-DL-010.5 Freshwater Habitat Mapping -NoR D5

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Map Scale @ A3: 1:2,500

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**
Freshwater and Wetland Habitat Mapping

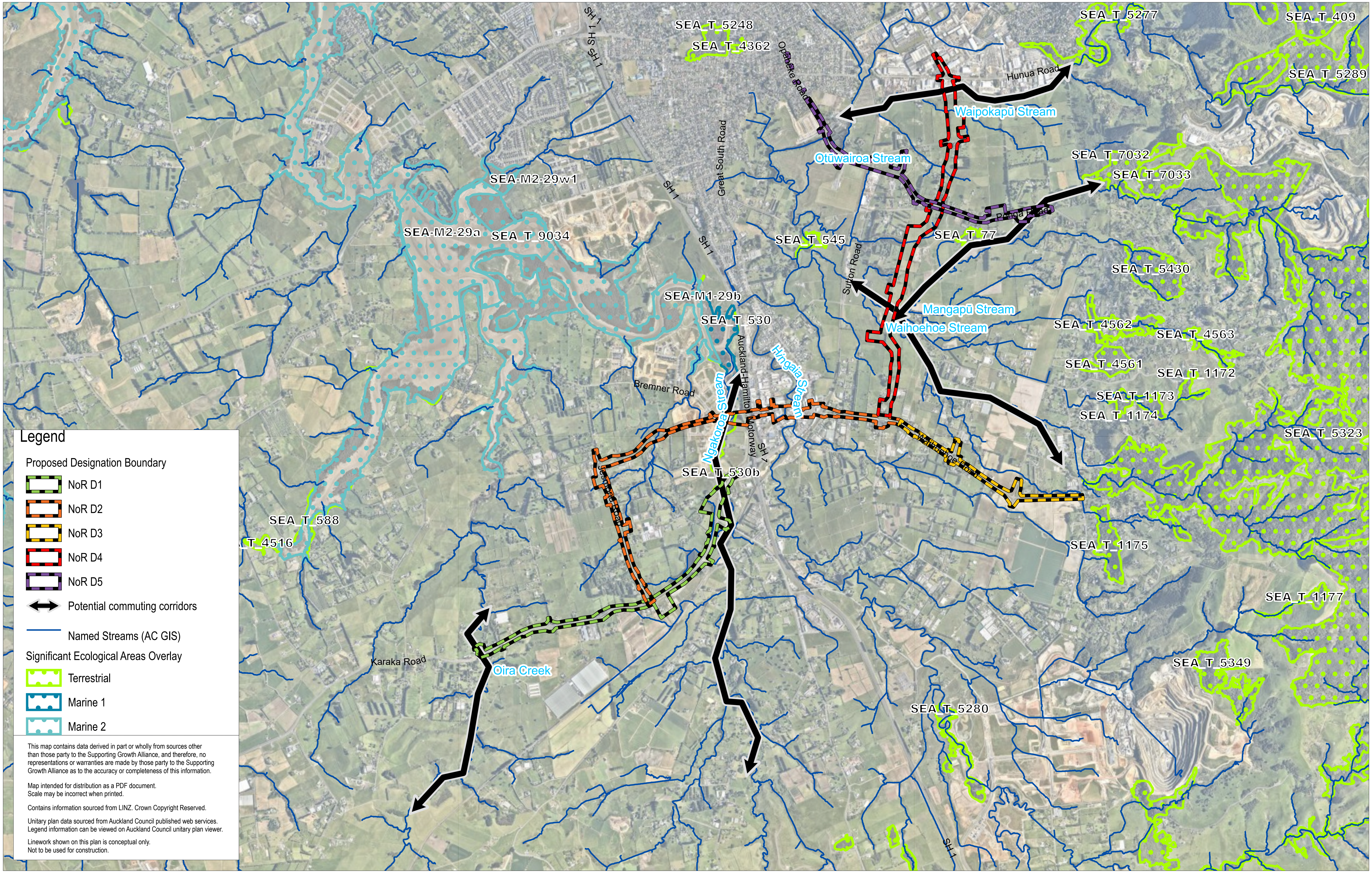
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-010.25



This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.

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Linework shown on this plan is conceptual only. Not to be used for construction.

Name: SGA-EC-DL-012 Bat habitat mapping

Path: P:\60SX\60558314. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_8_13.aprx

Map Scale @ A3: 1:30,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title: **Supporting Growth**

Potential Bat Commuting Corridor

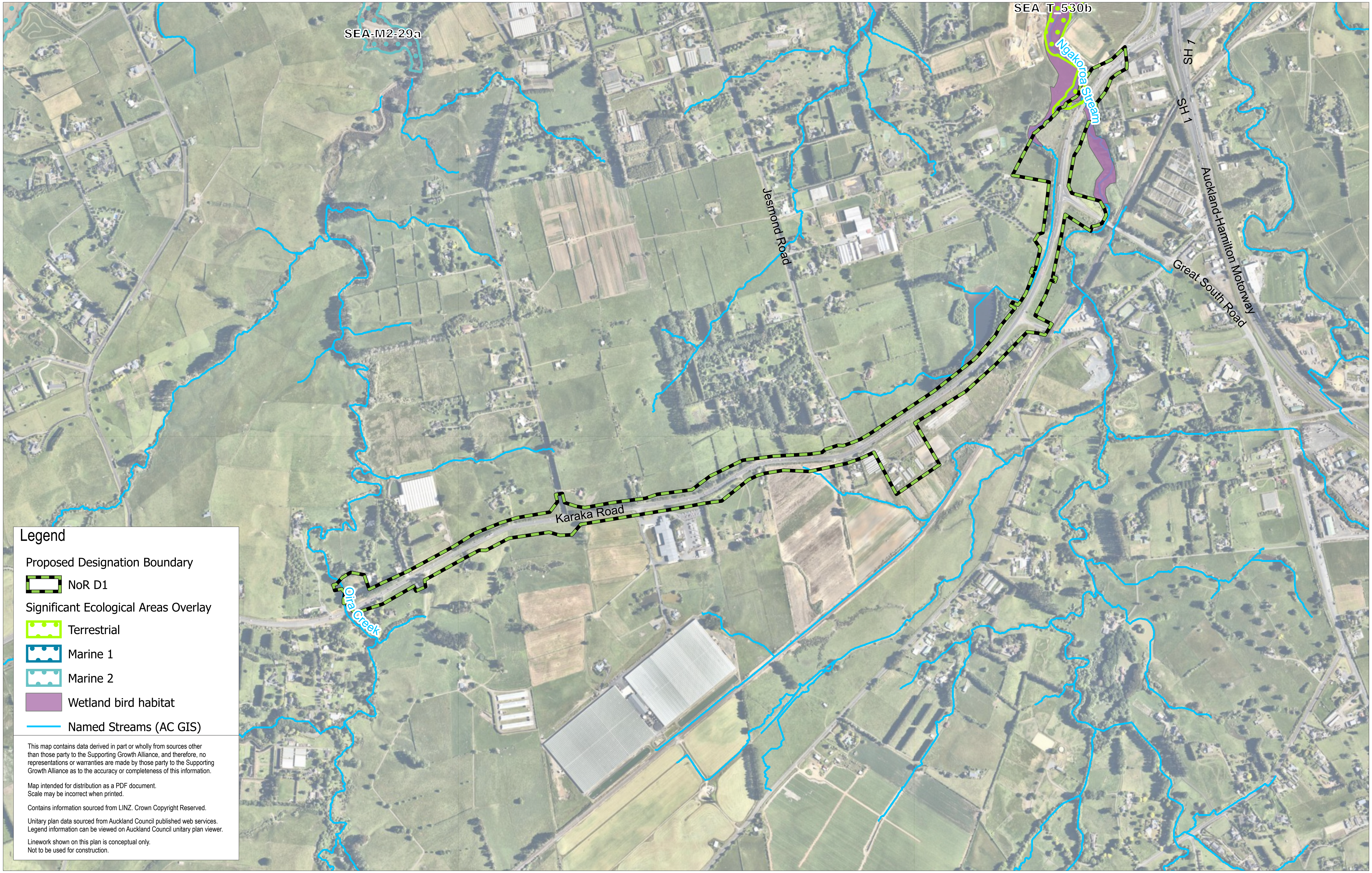
Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-012.01



Name: SGA-EC-DL-013 Wetland bird habitat

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_8_13.aprx

Map Scale @ A3: 1:10,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

ZOI Coastal Wetland Bird Habitat Corridor

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI
Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-013.01

Name: SGA-EC-DL-013 Wetland bird habitat

Path: P:\605X\60558831\4. Tech Work Area\4.99 GIS\02_Maps\SGA_Ecology_Figures_8_13.aprx

Map Scale @ A3: 1:10,000

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Kilometres

N

Revision	Author	Verified	Approved	Date
1	MJB	CR	FD	22/12/2020

Title:

Supporting Growth

ZOI Coastal Wetland Bird Habitat Corridor

Client: Supporting Growth

Project: Drury Arterial Network

TE TUPU NGĀTAHI Supporting Growth

Discipline: GIS

Drawing No: SGA-EC-DL-013.02

Appendix 8. Bird Desktop Review and Survey Results

Table 111 Native bird species recorded within a 5 km radius of the Project Area (NoR D1)

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Banded rail	*Gallirallus philippensis assimilis*	At Risk – Declining	AECOM, 2019 New Zealand Bird Atlas
Bar-tailed godwit	*Limosa lapponica baueri*	At Risk – Declining	New Zealand Bird Atlas, iNaturalist
Black-backed gull	*Larus dominicanus*	Not Threatened	AECOM, 2019 New Zealand Bird Atlas
Black-billed gull	*Larus bulleri*	Threatened – Nationally Critical	New Zealand Bird Atlas
Black shag	*Phalacrocorax carbo*	At Risk – Naturally Uncommon	New Zealand Bird Atlas; AECOM, 2019a
Caspian tern	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	New Zealand Bird Atlas; AECOM, 2019a SEA_T_530
Cattle egret	*Ardea ibis coromanda*	Migrant	New Zealand Bird Atlas
Fantail	*Rhipidura fuliginosa*	Not Threatened	iNaturalist; Auranga Development
Fernbird	*Bowdleria punctata*	At Risk – Declining	eBird
Gray teal	*Anas gracilis*	Not Threatened	New Zealand Bird Atlas
Gray warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas
Kereru	*Hemiphaga novaehollandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas
Kotare	*Todiramphus sanctus*	Not Threatened	Auranga Development, New Zealand Bird Atlas
Little black shag	*Phalacrocorax sulcirostris*	At Risk – Naturally uncommon	iNaturalist, New Zealand Bird Atlas
Little shag	*Phalacrocorax melanoleucos*	Not Threatened	New Zealand Bird Atlas
New Zealand dabchick	*Poliocephalus rufopectus*	At Risk – Recovering	New Zealand Bird Atlas
North Island kākā	*Nestor meridionalis*	At Risk – Recovering	iNaturalist
North Island kōkako	*Callaeas wilsoni*	At Risk – Recovering	iNaturalist
Paradise Shellduck	*Tadorna*	Not Threatened	AECOM, 2019a;

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
	variegata		New Zealand Bird Atlas
Pied shag	*Phalacrocorax varius*	At Risk – Recovering	iNaturalist, AECOM, 2019a, New Zealand Bird Atlas
Pied stilt	*Himantopus himantopus*	Not Threatened	SEA_M2_29a, New Zealand Bird Atlas
Pūkeko	*Porphyrio melanotus*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk – Declining	iNaturalist, New Zealand Bird Atlas
Royal spoonbill	*Platalea regia*	At Risk – Naturally uncommon	iNaturalist, New Zealand Bird Atlas
Silvereye	*Zosterops lateralis*	Not Threatened	New Zealand Bird Atlas
South Island Pied oystercatcher	*Haematopus finschi*	At Risk – Declining	New Zealand Bird Atlas, iNaturalist, SEA_T_530b
Spotless crake	*Porzana tabuensis*	At Risk – Declining	eBird
Spur wing plover	*Vanellus miles*	Not Threatened	Auranga Development
Swamp harrier	*Circus approximans*	Not Threatened	AECOM, 2019a, New Zealand Bird Atlas
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas,
Welcome swallow	*Hirundo neoxena*	Not Threatened	New Zealand Bird Atlas
White faced heron	*Egretta novaehollandiae*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
White-fronted tern	*Sterna striata striata*	At Risk – Declining	New Zealand Bird Atlas
Wrybill	*Anarhynchus frontalis*	Threatened – Nationally Vulnerable	New Zealand Bird Atlas, iNaturalist

Table 112 Native bird species recorded within a 5 km radius of the Project Area (NoR D2)

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Banded rail	*Gallirallus philippensis assimilis*	At Risk – Declining	New Zealand Bird Atlas
Bar-tailed godwit	*Limosa lapponica baueri*	At Risk – Declining	New Zealand Bird Atlas, iNaturalist
Black-backed gull	*Larus dominicanus*	Not Threatened	AECOM, 2019 New Zealand Bird Atlas
Black-billed gull	*Larus bulleri*	Threatened – Nationally Critical	New Zealand Bird Atlas
Black shag	*Phalacrocorax carbo*	At Risk – Naturally Uncommon	New Zealand Bird Atlas; AECOM, 2019a
Caspian tern	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	New Zealand Bird Atlas; AECOM, 2019a SEA_T_530
Cattle egret	*Ardea ibis coromanda*	Migrant	New Zealand Bird Atlas
Fantail	*Rhipidura fuliginosa*	Not Threatened	iNaturalist; Auranga Development
Fernbird	*Bowdleria punctata*	At Risk – Declining	eBird
Gray teal	*Anas gracilis*	Not Threatened	New Zealand Bird Atlas
Gray warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas
Kereru	*Hemiphaga novaehollandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas
Kotare	*Todiramphus sanctus*	Not Threatened	Auranga Development, New Zealand Bird Atlas
Little black shag	*Phalacrocorax sulcirostris*	At Risk – Naturally uncommon	iNaturalist, New Zealand Bird Atlas
Little shag	*Phalacrocorax melanoleucos*	Not Threatened	New Zealand Bird Atlas
New Zealand dabchick	*Poliocephalus rufopectus*	At Risk – Recovering	New Zealand Bird Atlas
North Island kākā	*Nestor meridionalis*	At Risk – Recovering	iNaturalist
North Island kōkako	*Callaeas wilsoni*	At Risk – Recovering	iNaturalist
Paradise Shellduck	*Tadorna variegata*	Not Threatened	AECOM, 2019a; New Zealand Bird Atlas
Pied shag	*Phalacrocorax varius*	At Risk – Recovering	iNaturalist,

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
			AECOM, 2019a, New Zealand Bird Atlas
Pied stilt	*Himantopus himantopus*	Not Threatened	SEA_M2_29a, New Zealand Bird Atlas
Pūkeko	*Porphyrio melanotus*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk – Declining	iNaturalist, New Zealand Bird Atlas
Royal spoonbill	*Platalea regia*	At Risk – Naturally uncommon	iNaturalist, New Zealand Bird Atlas
Silvereye	*Zosterops lateralis*	Not Threatened	New Zealand Bird Atlas
South Island Pied oystercatcher	*Haematopus finschi*	At Risk – Declining	New Zealand Bird Atlas, iNaturalist, SEA_T_530
Spotless crake	*Porzana tabuensis*	At Risk – Declining	eBird
Spur wing plover	*Vanellus miles*	Not Threatened	Auranga Development
Swamp harrier	*Circus approximans*	Not Threatened	AECOM, 2019a, New Zealand Bird Atlas
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas,
Welcome swallow	*Hirundo neoxena*	Not Threatened	New Zealand Bird Atlas
White faced heron	*Egretta novaehollandiae*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
White-fronted tern	*Sterna striata striata*	At Risk – Declining	New Zealand Bird Atlas
Wrybill	*Anarhynchus frontalis*	Threatened – Nationally Vulnerable	New Zealand Bird Atlas, iNaturalist

Table 113 Native bird species recorded within a 5 km radius of the Project Area (NoR D3)

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Fantail	*Rhipidura fuliginosa*	Not Threatened	iNaturalist; Auranga Development
Gray warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Kereru	*Hemiphaga novaehollandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas
Kotare	*Todiramphus sanctus*	Not Threatened	Auranga Development, New Zealand Bird Atlas
North Island kākā	*Nestor meridionalis*	At Risk – Recovering	iNaturalist
Paradise Shellduck	*Tadorna variegata*	Not Threatened	AECOM, 2019a; New Zealand Bird Atlas
Pūkeko	*Porphyrio melanotus*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
Silvereye	*Zosterops lateralis*	Not Threatened	New Zealand Bird Atlas
Spur wing plover	*Vanellus miles*	Not Threatened	Auranga Development
Swamp harrier	*Circus approximans*	Not Threatened	AECOM, 2019a, New Zealand Bird Atlas
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas,
Welcome swallow	*Hirundo neoxena*	Not Threatened	New Zealand Bird Atlas

Table 114 Native bird species recorded within a 5 km radius of the Project Area (NoR D4)

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Black shag	*Phalacrocorax carbo*	At Risk - Naturally Uncommon	New Zealand Bird Atlas; AECOM, 2019a
Fantail	*Rhipidura fuliginosa*	Not Threatened	iNaturalist; Auranga Development
Gray teal	*Anas gracilis*	Not Threatened	New Zealand Bird Atlas
Gray warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas
Kereru	*Hemiphaga novaehollandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas
Kotare	*Todiramphus sanctus*	Not Threatened	Auranga Development, New Zealand Bird Atlas
Little black shag	*Phalacrocorax sulcirostris*	At Risk - Naturally uncommon	iNaturalist, New Zealand Bird Atlas
Little shag	*Phalacrocorax melanoleucos*	Not Threatened	New Zealand Bird Atlas
New Zealand dabchick	*Poliocephalus rufopectus*	At Risk - Recovering	New Zealand Bird Atlas
North Island kākā	*Nestor meridionalis*	At Risk - Recovering	iNaturalist
North Island kōkako	*Callaeas wilsoni*	At Risk - Recovering	iNaturalist

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Paradise Shellduck	*Tadorna variegata*	Not Threatened	AECOM, 2019a; New Zealand Bird Atlas
Pied shag	*Phalacrocorax varius*	At Risk - Recovering	iNaturalist, AECOM, 2019a, New Zealand Bird Atlas
Pūkeko	*Porphyrio melanotus*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
Silvereye	*Zosterops lateralis*	Not Threatened	New Zealand Bird Atlas
Spur wing plover	*Vanellus miles*	Not Threatened	Auranga Development
Swamp harrier	*Circus approximans*	Not Threatened	AECOM, 2019a, New Zealand Bird Atlas
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas,
Welcome swallow	*Hirundo neoxena*	Not Threatened	New Zealand Bird Atlas
White faced heron	*Egretta novaehollandiae*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
Wrybill	*Anarhynchus frontalis*	Threatened - Nationally Vulnerable	New Zealand Bird Atlas, iNaturalist

Table 115 Native bird species recorded within a 5 km radius of the Project Area (NoR D5)

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Fantail	*Rhipidura fuliginosa*	Not Threatened	iNaturalist; Auranga Development
Gray warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas
Kereru	*Hemiphaga novaehollandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas
Kotare	*Todiramphus sanctus*	Not Threatened	Auranga Development, New Zealand Bird Atlas
North Island kākā	*Nestor meridionalis*	At Risk – Recovering	iNaturalist
North Island kōkako	*Callaeas wilsoni*	At Risk – Recovering	iNaturalist
Paradise Shellduck	*Tadorna variegata*	Not Threatened	AECOM, 2019a; New Zealand Bird Atlas
Pūkeko	*Porphyrio melanotus*	Not Threatened	AECOM, 2019a, Auranga Development, New Zealand Bird Atlas
Silvereye	*Zosterops lateralis*	Not Threatened	New Zealand Bird Atlas
Spur wing plover	*Vanellus miles*	Not Threatened	Auranga Development

Common name	Latin Name	Conservation Status (Robertson *et al.* 2017)	Record source
Swamp harrier	*Circus approximans*	Not Threatened	AECOM, 2019a, New Zealand Bird Atlas
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	iNaturalist, New Zealand Bird Atlas,
Welcome swallow	*Hirundo neoxena*	Not Threatened	New Zealand Bird Atlas

Table 116 Full bird point count and 5MBC survey results

Relevant NoR	Bird Survey Site	Location of Survey	Survey Type	Tidal Conditions	Common Name	Scientific Name	Conservation status*	Frequency
State Highway Upgrade (NoR D1)	3	Burberry Rd – Open water habitat in the form of an artificial pond, some small areas of *Machaerina* sedgeland (WL11) on the margins, with planted exotic treeland adjacent.	Point Count	N/A	Swamp harrier	*Circus approximans*	NT	2
					Black shag	*Phalacrocorax carbo*	AR-NU	1
					Little black shag	*Phalacrocorax sulcirostris*	AR-R	4
					Paradise shelduck	*Tadorna variegata*	NT	114
					Mallard	*Anas platyrhynchos*	Int.	200
					Canada goose	*Branta canadensis*	Int.	24
					New Zealand dabchick	*Poliocephalus rufopectus*	AR-R	1
	1	Adjacent to SH22 at Ngakoroa Stream Bridge – Intertidal area with riverine wetlands and mudflats at low tide.	Point Count	Low	Swamp harrier	*Circus approximans*	NT	1
					Pūkeko	*Porphyrio melanotus*	NT	2
					Pied shag	*Phalacrocorax varius*	NT	1
					Mallard	*Anas platyrhynchos*	Int.	10
			Point Count	High	Pūkeko	*Porphyrio melanotus*	NT	4
					Sacred kingfisher	*Todiramphus sanctus*	NT	1
					Mallard	*Anas platyrhynchos*	Int.	5
Jesmond to Waihoehoe West FTN upgrade (NoR D2)	2	Bremner Rd at Ngakoroa Stream Bridge – oioi, raupō reedland and	Point Count	High	Pied shag	*Phalacrocorax varius*	NT	2
					Pūkeko	*Porphyrio melanotus*	NT	6
			Point Count	Low	Pied shag	*Phalacrocorax varius*	NT	4

Relevant NoR	Bird Survey Site	Location of Survey	Survey Type	Tidal Conditions	Common Name	Scientific Name	Conservation status*	Frequency
		saltmarsh ribbon wood, intertidal with freshwater influence.			Pūkeko	*Porphyrio melanotus*	NT	1
	4	Pond	Point Count	N/A	Mallard	*Anas platyrhynchos*	Int.	4
					Pūkeko	*Porphyrio melanotus*	NT	2
					Swamp harrier	*Circus approximans*	NT	1
Ōpāheke North-South FTN Arterial (NoR D4)	6	Water low, vegetation sparse	Point Count	N/A	Mallard	*Anas platyrhynchos*	Int.	24
					White faced heron	*Egretta novaehollandiae*	NT	1
					Pūkeko	*Porphyrio melanotus*	NT	2
					Spur-winged plover	*Vanellus miles*	NT	2
	7	Treeland – kōwhai, tōtara, kahikatea, tree privet, tarata, barberry, Chinese privet, blackberry	5MBC	N/A	New Zealand fantail	*Rhipidura fuliginosa*	NT	3
					Pūkeko	*Porphyrio melanotus*	NT	6
					Common myna	*Acridotheres tristis*	Int.	2
					Song thrush	*Turdus philomelos*	Int.	1
					Grey warbler	*Gerygone igata*	NT	1
					Chaffinch	*Fringilla coelebs*	Int.	2

Relevant NoR	Bird Survey Site	Location of Survey	Survey Type	Tidal Conditions	Common Name	Scientific Name	Conservation status*	Frequency
					Silvereye	*Zosterops lateralis*	NT	20
					Blackbird	*Turdus merula*	Int.	2
Ponga and Ōpāheke Road Upgrade (NoR D5)	5	Native bush	5MBC	N/A	Tūī	*Prosthemadera novaeseelandiae*	NT	1
					New Zealand fantail	*Rhipidura fuliginosa*	NT	1
					Silvereye	*Zosterops lateralis*	NT	2
					Common myna	*Acridotheres tristis*	Int.	2
					Australian magpie	*Gymnorhina tibicen*	Int.	1

Notes:
* = conservation status information from Robertson *et al.* (2016).

- NT = Not Threatened
- AR-NU = At Risk – Naturally Uncommon
- AR-R = At Risk – Recovering
- Int. = Introduced and Naturalised

Table 117 Acoustic Recorder Full Results List – NoR D2

Date	Frequency																	
	Myna	Pūkeko	Spur-winged plover	Mallard	Grey warbler	Australian Magpie	Kingfisher	Song thrush	Blackbird	Greenfinch	Silvereye	Tūī	Chaffinch	Swamp harrier	Welcome swallow	Dunnock	Dove	Other non-native
Conserv-ation Status*	**Int.**	**NT**	**NT**	**Int.**	**NT**	**Int.**	**NT**	**Int.**	**Int.**	**Int.**	**Int.**	**NT**	**Int.**	**NT**	**NT**	**Int.**	**Int.**	**Int.**
27/02/2020	2	9	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0
28/02/2020	49	12	18	2	5	0	1	0	0	0	0	0	0	0	0	1	0	1
29/02/2020	27	11	21	7	2	0	0	0	1	0	0	3	0	0	0	0	0	11
1/03/2020	0	18	29	29	7	0	1	0	2	6	0	0	2	0	1	1	0	20
2/03/2020	7	34	17	14	9	0	0	0	2	1	0	0	0	0	0	0	2	23
3/03/2020	55	27	21	25	4	0	0	0	1	0	0	0	0	0	0	0	0	7
4/03/2020	47	17	5	25	1	0	0	0	0	0	0	0	0	0	0	0	0	11
5/03/2020	32	10	13	23	6	0	0	0	0	0	0	0	1	0	0	0	0	8
6/03/2020	56	14	10	23	6	0	0	0	0	0	0	0	0	0	0	0	0	2
7/03/2020	93	21	25	6	4	15	0	0	0	0	0	0	0	0	0	0	0	0
8/03/2020	57	22	21	42	7	27	0	0	0	0	0	0	0	0	0	0	0	8
9/03/2020	13	8	9	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
10/03/2020	38	25	21	3	7	1	0	0	0	0	0	0	0	0	0	0	0	0
11/03/2020	22	20	13	10	5	0	0	0	0	0	0	0	0	0	0	0	0	0

Date	Frequency																	
	Myna	Pūkeko	Spur-winged plover	Mallard	Grey warbler	Australian Magpie	Kingfisher	Song thrush	Blackbird	Greenfinch	Silvereye	Tūī	Chaffinch	Swamp harrier	Welcome swallow	Dunnock	Dove	Other non-native
12/03/2020	14	18	18	1	9	1	0	0	0	0	0	0	0	0	0	0	0	1
13/03/2020	22	30	13	3	3	5	0	0	0	0	0	0	0	0	1	0	0	0
14/03/2020	29	47	21	9	5	0	2	8	1	0	1	0	0	0	0	0	0	11
15/03/2020	21	25	23	2	3	0	36	0	0	0	0	0	0	2	0	0	0	9
16/03/2020	9	27	16	10	2	0	0	0	0	0	0	0	0	0	0	0	0	3
17/03/2020	1	11	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
18/03/2020	1	25	9	7	2	0	0	0	0	0	0	0	0	0	0	0	0	9
19/03/2020	10	34	16	9	2	0	0	0	0	0	0	0	0	0	0	0	0	2
20/03/2020	10	24	2	21	6	0	0	0	0	0	5	0	0	0	0	0	0	14
Total	**615**	**489**	**346**	**280**	**97**	**49**	**40**	**8**	**7**	**7**	**6**	**3**	**3**	**2**	**2**	**2**	**2**	**143**

Notes:
* = conservation status information from Robertson *et al.* (2016).

- NT = Not Threatened
- Int. = Introduced and Naturalised

Appendix 9. Department of Conservation (2019) Tree Removal Protocol

Tree removal protocol for areas where bats are present

Context

Tree removal protocols have become a standard part of bat management plans for development Projects in areas with bat activity. Ecological consultants are engaged to write and implement tree removal protocols. The Department of Conservation may be involved in assessing these protocols through the RMA process or an application for a Wildlife Act permit. It is useful to have a document that sets out the minimum requirements for tree removal procedures, agreed by DOC's bat experts, for comparison. This will save time when assessing tree removal protocols and ensure consistency.

Purpose

To set out the minimum requirements for tree removal protocols for areas where bats are present.

Intention of the protocol

The intention of the tree removal protocol is, in the first instance, to avoid felling bat roost trees, secondarily to move roost trees, and only if unavoidable, fell roost trees (but only once vacated by bats).

Are bats potentially at risk?

1. Is it a 'bat zone'?	Who can make this assessment?	When?
If, there is appropriate and sufficient evidence collected that there is no bat activity within the area, trees can be felled without developing and implementing a removal protocol.	Evidence must come from an appropriate ecological assessment or study carried out by a qualified person.	Ecological assessments must be undertaken when bats are most active (October 1st to April 30th), with a focus on the breeding period (November to February)

2. Do the trees proposed to be removed have potential bat 3. roost characteristics?	Who can make this assessment?	When?
1. Is the tree >=15 cm dbh (diameter at breast height)? 1. If no, the tree can be removed at any time. 2. If yes, further assessment is required (2)	Anyone who can measure a tree dbh.	Any time
2. On visual inspection from the ground, does the tree have features that indicate roost potential? These features include: • hollows • cavities • knot holes • cracks • flaking bark • epiphytes If no, the tree can be removed at any time under the supervision of an approved bat expert who can identify if a potential bat roost become apparent during the removal process that was not previously observed. In this case, felling must stop until the tree has been further assessed. If yes, further assessment is required to determine if bats roost in the tree (3 or 4).	An approved bat expert	Any time

2. Do the trees proposed to be removed have potential bat 3. roost characteristics?	Who can make this assessment?	When?
If visual inspection from the ground is not possible because the tree is obscured in some way, further assessment is required (3 or 4).		

Do bats roost in the tree?

There are two ways in which a tree can be assessed for bat roosting activity:

- Climbing the tree and inspecting features – this is usually most suitable when there are a small number of trees that are safe to climb and can be visually inspected.
- Using ABMs (Automatic Bat Monitoring devices) to check if bats are present close to the time of tree removal.

Either method can be implemented as in 3 and 4 below:

3. Can a roost be identified on closer inspection when the tree is climbed?	Who can make this assessment?	When
NB: Care must be taken while climbing trees to avoid disturbing, removing or destroying tree features with bat roost potential such as large sections of loose bark or cavities in dead wood.		
a) Do possible roost features observed from the ground still show potential on closer inspection when the tree is climbed? For example: • Cracks, holes and splits may lead to cavities or may be superficial. • A cavity may be wet indicating no potential. • Cobwebs may be across a cavity indicating it is not used. • Other incompatible animals may be occupying the cavity (e.g. rats). If no, the tree can be removed. If yes, further assessment must be done (3.b or 4).	An approved bat expert or an experienced tree-climber (e.g. an arborist) working with an approved bat expert. If the latter, the tree-climber provides information along with photographs or video footage, which the bat expert assesses.	Any time
b) Are potential features being used by roosting bats? • Can bats be seen? • Can bats be heard – either audible squeaking or using a hand-held bat detector listening at 25 (for social calls) and 40 kHz (for echolocation calls? • Is guano present or urine staining? If no, the tree can be removed on the day of the tree inspection following the method in 5. If yes, the following communication procedures shall be implemented: • If bats are sighted or sign detected, the approved bat expert, as soon as possible, shall: i. Call the tree felling supervisor to inform him/her which affected tree(s) cannot be felled due to detection of bat sign. ii. Send an email to the site manager, and a bat expert representing the council and DOC detailing the results of the survey and outlining the measures for protection or relocating the roost tree. • A record (including photos) of any vegetation containing bat roosts shall be kept detailing the size, location and type of tree.	An approved bat expert or an experienced tree-climber (e.g. an arborist) working with an approved bat expert. If the latter, the tree climber provides information along with photographs or video footage, which the bat expert assesses.	Between October 1st and April 30th only

4. Is there bat activity close to trees indicating roosting potential?	Who can make this assessment?	When
NB: Prior to the commencement of surveys, ABMs must be checked for correct operation at a site where bat activity is known to be high. Faulty or suspect ABMs must not be deployed.		

4. Is there bat activity close to trees indicating roosting potential?	Who can make this assessment?	When
3. Is bat activity recorded at any time during two consecutive, valid survey nights proceeding tree felling? 4. Bat activity can be recorded using ABMs or trained observers with handheld detectors. Location of ABMs or observers must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees. 5. 'Valid' survey nights must have the following features: • Begin one hour before official dusk and end one hour after official dawn • Temperature between 10 and 17ºC • Relative humidity > 70 % • Precipitation < 2.5mm in the first 2 hours after dusk • No full moon If no, the tree/s can be removed on the day immediately following the survey nights using the method in 5. If yes, roost features of each tree must be visually assessed via climbing as in 3, or, survey must continue until no bat activity is recorded for two consecutive nights prior to felling.	An approved bat expert	Between October 1st and April 30th only

Tree removal

5. Does the tree have to be removed?	Who can make this assessment?	When
NB: Tree removal must take place on the day of tree inspection or the day immediately following night surveys.		
a) Is the tree known to provide a roost location for bats or has potential to do this? If no, remove as in 5.b. If yes, consider whether any changes can be made to maintain the tree, or consider carefully relocating the tree, or part of the tree, when bats are not present (not detected for two valid survey nights prior), to continue to provide future roosting opportunities. This is particularly important where roosting opportunities are limited. Trees must only be relocated when the following conditions are met during the preceding two nights: • Temperature between 10 and 17ºC • Relative humidity > 70 % • No Precipitation • No full moon Follow 6 should bats appear during tree relocation.	Only under supervision of an approved bat expert.	Between October 1st and April 30th only
b) Is the only option to remove the tree entirely? If no, consider leaving or relocating the tree, revisit 5.a. If yes, the tree can be removed under supervision of an approved bat expert when the following conditions are met during the preceding two nights: • Temperature between 10 and 17ºC • Relative humidity > 70 % • No Precipitation • No full moon Trees must be inspected again for signs of bats once felled and before removing from the site. Follow 6 should bats be detected during tree removal.	Only under supervision of an approved bat expert.	Between October 1st and April 30th only

What if bats are detected during tree relocation or removal?

6. At what stage have bats been detected?	Who can make this assessment?	When
a) Have bats been detected prior to the tree being completely felled? If no, 6.b. If yes, felling must stop, and DOC must be contacted. See 6.c if bats do not fly away or are injured.	Only under supervision of an approved bat expert.	Between October 1st and April 30th only
b) Bats have been detected once the tree has been felled. All further work must stop and DOC must be contacted. Any live bats that are not immediately able to fly away must be collected and placed in cloth bat bags or cloth-lined bat boxes. The felled tree must be thoroughly inspected for further bats. See 6.c if bats do not fly away or are injured, or 6.d if they are dead.	Only under supervision of an approved bat expert.	Between October 1st and April 30th only
c) Do any captured bats have injuries? If no, keep the bat in a secure bat bag in a safe, temperature-controlled environment and release at a safe location close to the site of capture the following evening. If yes, take the bat to a nearby vet to be examined. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The bat expert and vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high. Euthanised bats must be handed to DOC.	Approved bat expert in consultation with vet and DOC.	Between October 1st and April 30th only
d) Dead bats have been found. Dead bats must be handed to DOC.	Approved bat expert	Between October 1st and April 30th only

Appendix 10. Resource Consent Lizard Management

To compensate for this loss of habitat the lizard habitat plantings should be created within the Blue Green network (refer Figure 30, Appendix 7) or other suitable locations within the designation boundary. Copper skink are often found in modified landscapes where habitat structure allows them to avoid predation e.g. dense scrub, long grassland. These areas of habitat should link to existing habitat features where lizards could be present e.g. stream corridors (Appendix 7, Drawings SGA-EX-DL-005.1 to SGA-EX-DL-005.5). These habitats should be enhanced through the placement of log piles which provide lizards with refugia from predators.

Lizard salvage should be undertaken within vegetation identified for clearance in the Project Area, that could provide habitat for copper skink. Not Threatened Copper skink could be present within any dense exotic vegetation or long grass. This is required to ensure that the Project remains legally compliant with the Wildlife Act 1953.

Vegetation clearance can only be undertaken when lizards are active which is typically from October – May (weather dependent).

The LMP should specify the mitigation measures that could be implemented to avoid lizards being injured or killed, however, key aspects that it should cover include:

- The appointment of a herpetologist who holds a region wide Wildlife Authorisation Permit, or is able to apply for a Project specific Wildlife Authorisation Permit;
- The identification of lizard habitat that needs to be cleared;
- The confirmation of the process that should be followed to sensitively destroy the habitat and salvage any lizards within the habitat;
- The identification of a site suitable for the translocation of any lizards salvaged;
- Offset planting for high value habitat loss; and
- The enhancement of the release site to ensure that it is suitable for the animals being released e.g. additional refugia and if appropriate a suitable pest control strategy.

Appendix 11. Pre-Construction Wetland Bird Survey Areas

NoR D1

- **Coastal wetland birds** – Ngakoroa Stream wetlands
- **Freshwater wetland birds** – Ponds at Burberry Road

NoR D2

- **Coastal wetland birds** – Ngakoroa Stream wetlands
- **Freshwater wetland birds** – Ponds at Jesmond Road

NoR D3

- n/a

NoR D4

- n/a

NoR D5

- n/a