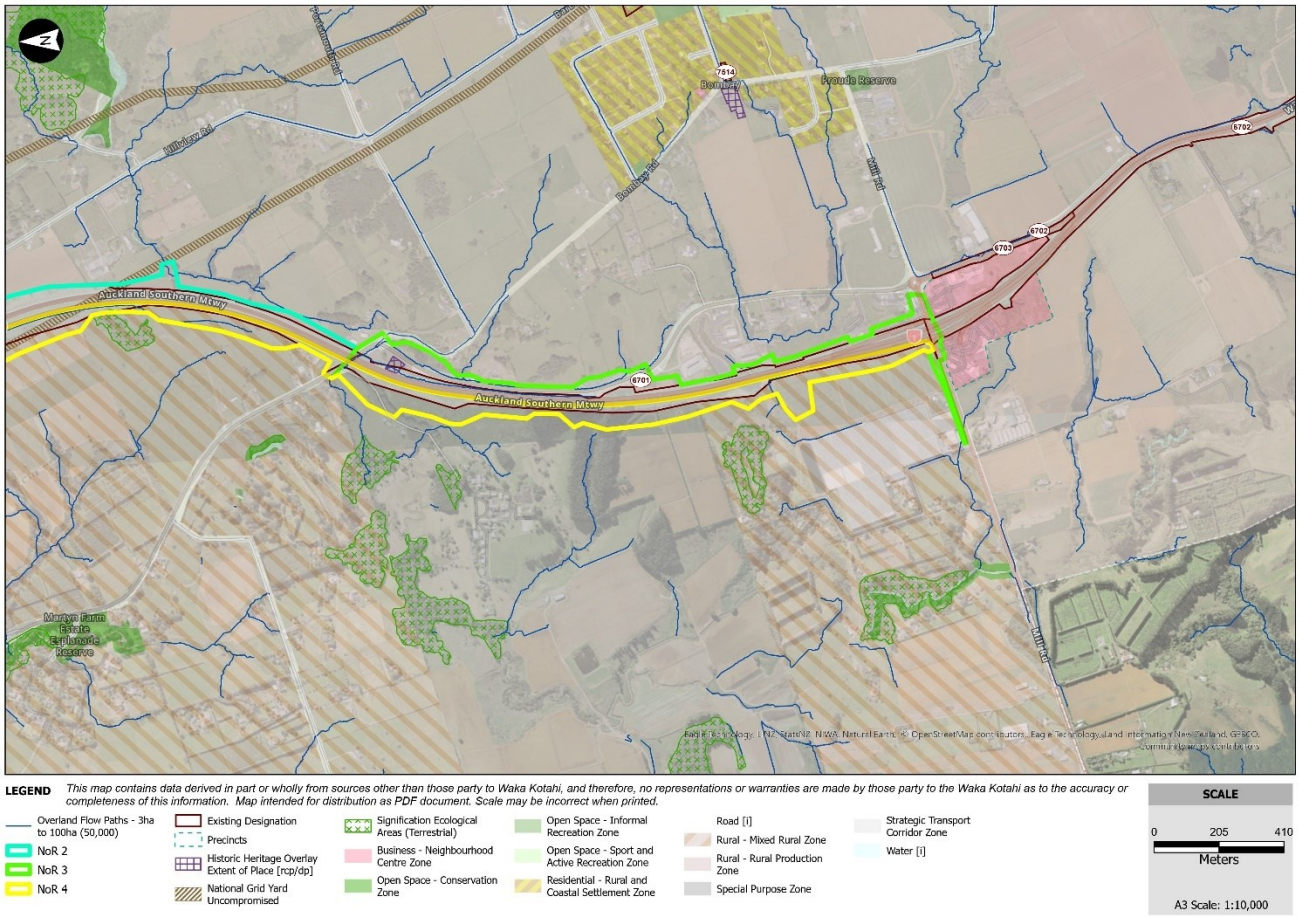
7 STAGE 2 NOR 3 (ALTERATION TO SH1 DESIGNATIONS 6701) AND NOR 4 (NEW SH1 SUP DESIGNATION)

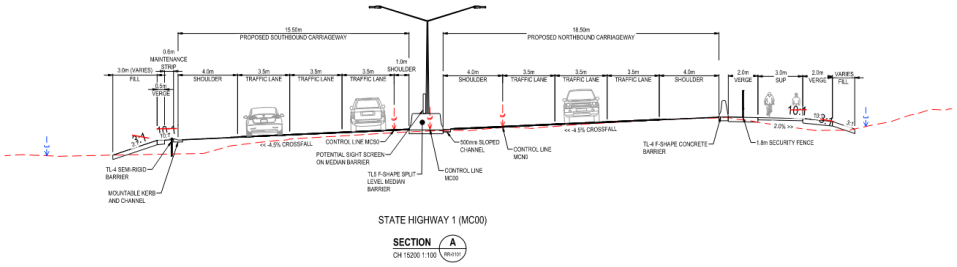
This section assesses the specific freshwater and indigenous biodiversity matters relation to NoR 3: Alterations to the existing SH1 Designations 6701, and NoR 4: Shared User Path Quarry Road to Bombay Interchange.

7.1 Overview and description of works

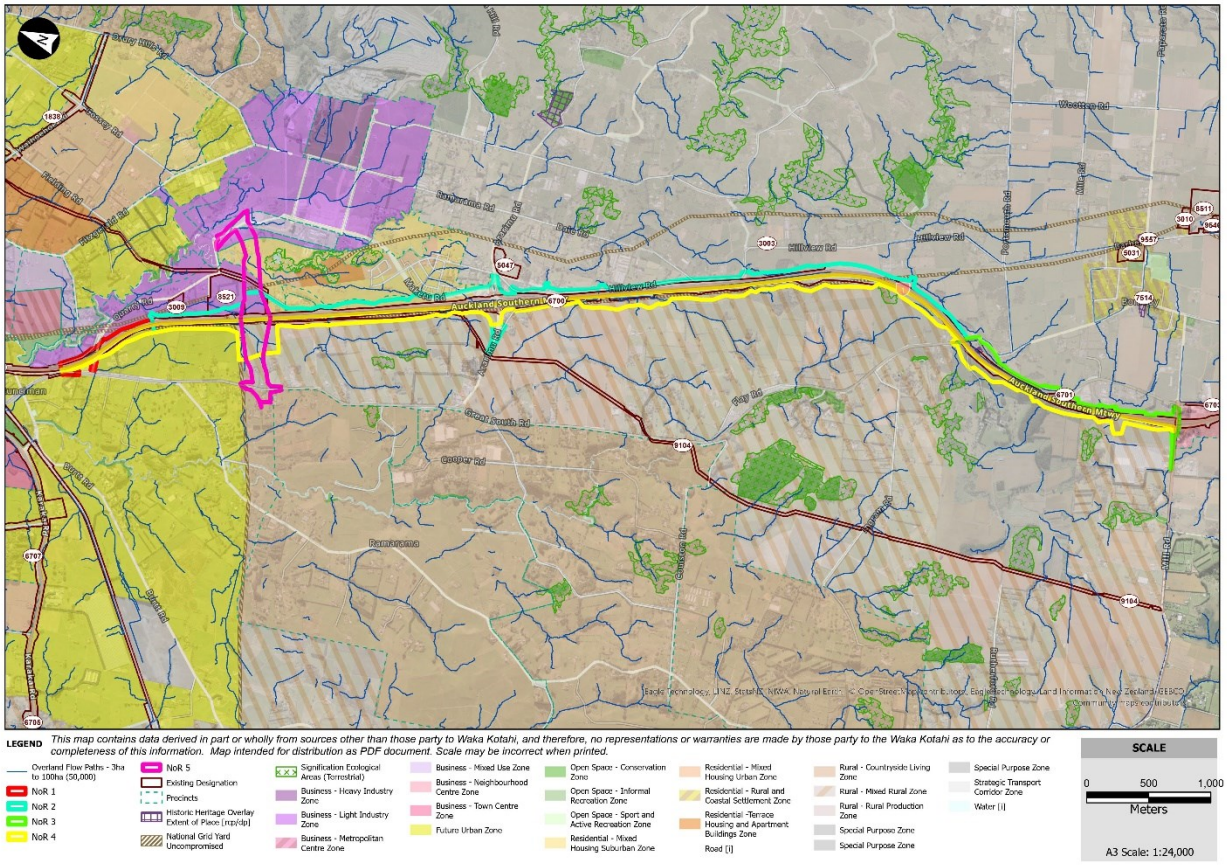
As set out in **Table 7-1** below, the proposed alterations to the existing SH1 Designation 6701 are to provide widening of the existing SH1 corridor and accommodate the future upgrades to the SH1 network.

Table 7-1: Overview of the alteration to SH1 Designation 6701

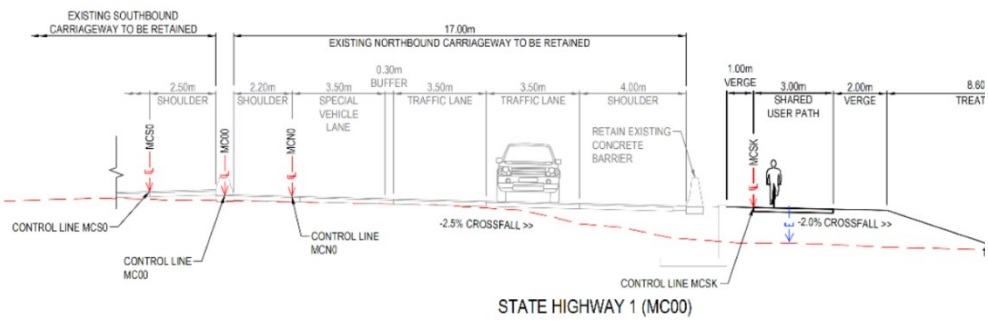
NoR 3 – Alteration to SH1 Designation 6701	
	
Key features	
Overview	• Six general traffic lanes (4.3m shoulders) on State Highway 1. • Safety improvements include upgrading interchanges, wider shoulders, new barriers, and improved lighting along the full extent of the Project.
Structures	• Upgrades to the existing Mill Road/Bombay Interchange • Mill Road over-bridge and abutments • SH1 Great South Road Bridge

Speed Environment	• Design to accommodate 110km/h on State Highway 1
Access Lanes	• Designed to accommodate special vehicle lane within the 4m shoulder
Intersections	• Bombay Interchange – northbound signals • Mill Road Bridge – altering both abutments to allow realignment of the road beneath Bombay Interchange
Stormwater Infrastructure	• Swales and wetland treatment train (100% treatment of impervious surfaces and full-scale wetland)
Typical cross sections	

NoR 4 – Construction, operation and maintenance of a new SUP



Key features

Overview	▪ Requires a new designation between 200m north of Quarry Road to 600m south of the existing Mill Road/Bombay Interchanges, with some locations overlapping the existing SH1 Designations 6706, 6700 and 6701. ▪ 3.0m wide SUP continuing from 200m north Quarry Road to 600m south of the existing Bombay/Mill Road Interchange. ▪ Located on the western side of the motorway.
Structures	▪ Tie-ins to all new and upgraded motorway interchange (ie. Drury South, Ramarama and Bombay) ▪ New bridge at Great South Road
Speed Environment	▪ N/A
Access Lanes	▪ N/A
Intersections	▪ Grade separated tie-in at all interchanges
Stormwater Infrastructure	▪ Swales and wetland treatment train (100% treatment of impervious surfaces and full scale wetland)
Typical cross sections	

7.2 Existing environment

7.2.1 Terrestrial habitats and fauna

NoR 3 and 4 transitions through a mixed rural zone (west) and a rural – rural production zone to the east (AUP). A special purpose zone (School Zone) is also located to the west of SH1, within the ZOI. Present day habitats are therefore largely limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 7-2. These habitats are mapped in Figure 7-1 and Figure 7-2.

Table 7-2: Vegetation types present within and directly adjacent to the Project Area (NoR 3 and 4), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	Comprising shelterbelts, roadside vegetation and disturbed riparian areas.
Exotic forest	EF	N/A	Located in between Great South Road and Bombay Road.

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Planted vegetation	PL.1	N/A	Native vegetation restoration planting along SH 1, and a wetland
	PL.3	N/A	Amenity planting
Treeland	TL.3	N/A	Planted *Eucalyptus* spp. and *Pinus* spp. within and outside the NoR footprint.
TBC – Native/exotic trees	TBC - N/ET	TBC	Mature native trees outside the NoR footprint, east of SH1. This ecosystem will be classified pending the outcome of site verification.
TBC – Native/exotic scrubs	TBC - N/ES	TBC	Scrub vegetation identified within and outside the NoR footprint, west of SH1. This ecosystem will be classified pending the outcome of site verification
Kahikatea, pukatea forest	WF8	Critically Endangered	Mature forest vegetation located outside the western portion of the NoR footprint. Forest canopy dominated by pukatea (*Laurelia novae-zelandiae*) and kahikatea (*Dacrycarpus dacrydioides*). Gorse and eucalypt scrub present along the outer forest edge. Pukatea is prevalent in the gully which transitions WF8 to WF9.
Taraire, tawa, podocarp forest	WF9	Endangered	Mature forest vegetation located outside the western portion of the NoR footprint. Dominated by native tree species such as pūriri (*Vitex lucens*), taraire (*Beilschmiedia tarairi*), tawa (*Beilschmiedia tawa*), tōtara (*Podocarpus totara*), kahikatea, pukatea, rewarewa (*Knightia excelsa*), ponga (*Cyathea dealbata*) and nīkau (*Rhopalostylis sapida*). Gorse and eucalypt scrub present along the outer forest edge. Pukatea is prevalent in the gully which transitions WF8 to WF9.

Potentially present fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink and potentially other species; and
- Common, non-threatened native bird species.

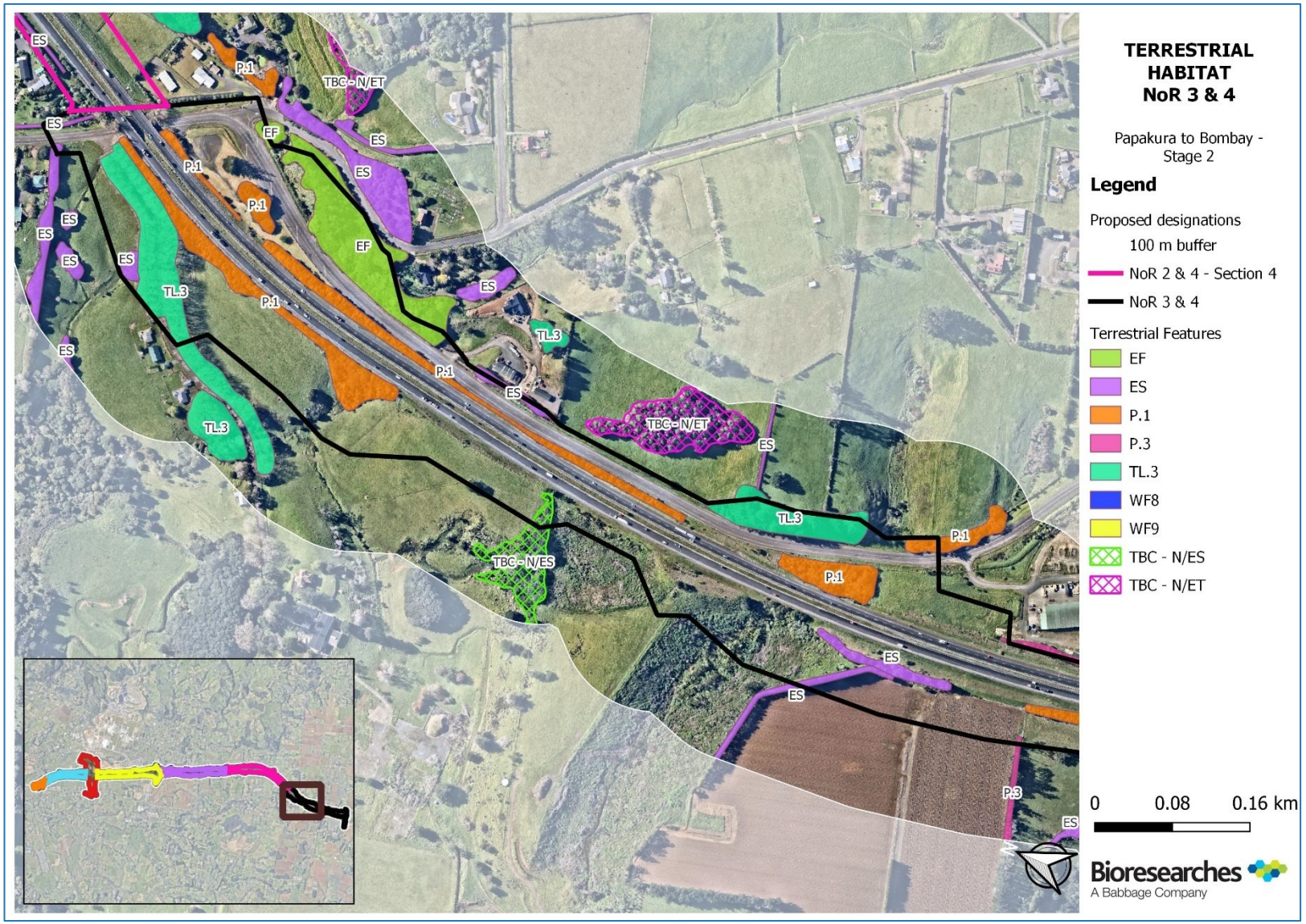


Figure 7-1: Potential terrestrial habitats associated with the northern portion of the proposed NoR 3 and 4.

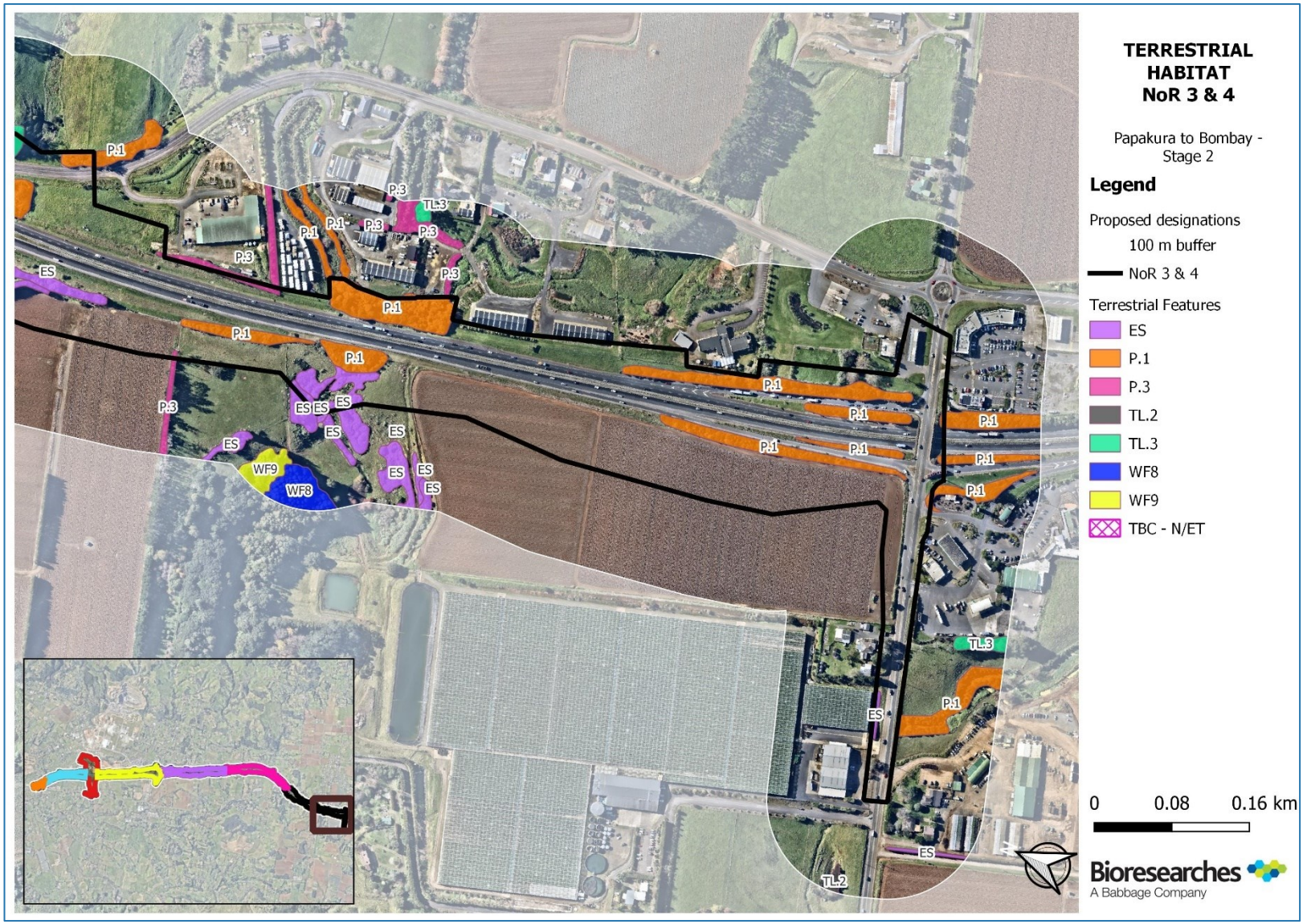


Figure 7-2: Potential terrestrial habitats associated with the southern portion of the proposed NoR 3 and 4.

7.2.1.1.1 Terrestrial ecological value

Table 7-3 presents the ecological value for the terrestrial habitats identified within NoR 3 and 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 7-3: Ecological values of terrestrial habitats within the ZOI of NoR 3 and 4.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
ES	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
EF	Low – this habitat is highly modified with very low indigenous representation.	High – not likely to support any Threatened or At Risk species bird or lizard species, there is potential that the vegetation margins are used as long-tailed bat flight paths.	Low – habitat has very low diversity.	Low - Whilst these areas may provide some foraging habitat for common, non-threatened bird species, due to their small, fragmented nature they are unlikely to support copper skink. Are much more susceptible to edge effects and weed incursion.	**Moderate**
PL.1	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
PL.3	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
TL.3	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has low diversity and other than copper skink does not provide habitat for other sensitive species.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
TBC - N/ET	Low – this habitat is highly modified with low indigenous representation.	High – not likely to support any Threatened or At Risk species bird or lizard species, there is potential that the vegetation margins are used as long-tailed bat flight paths.	Low – habitat has very low diversity.	Low - Whilst these areas may provide some foraging habitat for common, non-threatened bird species, due to their small, fragmented nature they are unlikely to support copper skink. Are much more susceptible to edge effects and weed incursion.	**Low**
TBC - N/ES	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
WF8	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	High – not likely to support any Threatened or At Risk bird or lizard species, but there is potential that the vegetation margins are used as long-tailed bat flight paths. This forest ecosystem is designated as Critically Endangered.	Low - while indigenous species dominate, they lack the diversity and structure expected of a naturally occurring ecosystem.	High – the forest provides some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	**High**
WF9	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	High – not likely to support any Threatened or At Risk bird or lizard species, but there is potential that the vegetation margins are used as long-tailed bat flight paths. This forest ecosystem is designated as Endangered.	Low - while indigenous species dominate, they lack the diversity and structure expected of a naturally occurring ecosystem.	High – the forest provides some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	**High**

Table 7-4 presents the ecological values for the fauna identified within the ZOI of NoR 3 and 4.

Table 7-4: Ecological values of fauna within the ZOI of NoR 3 and 4.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	PL.1 – riparian margins	Threatened – Nationally Critical	Very High
Native Lizards – copper skink	PL.1 – riparian margins	At Risk – Declining	High
Native Birds – Spotless crake	EW and WL19 Wetland habitats	At Risk – Declining species.	**High**
Native Birds – common, Not Threatened species only	All habitats identified in Table 7-2.	Not Threatened	Low

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series

7.2.2 Freshwater habitats – Streams

Six stream branches were identified within 100 m of the designation boundary, of which four of these were within the NoR 3 and 4 footprint. These streams are mapped in Figure 7-3 and Figure 7-4; and described in Table 7-5.

Table 7-5: Summary of streams associated with NoR 3 and 4.

Stream	Classification	Site verified?	Brief description
Ngaakooroa Stream Tributary C	Intermittent	No	A total length of approximately 231 m reach of intermittent stream is located in the ZOI, of which approximately 25 m is located within the Section 5 footprint. Given the surrounding agricultural land uses, it's likely that this stream is dominated by exotic aquatic species and features typical pasture grasses along its banks. The stream banks lack any shrub or tree vegetation.
Ngaakooroa Stream Tributary D	Intermittent	No	A total length of approximately 204 m reach of intermittent stream is located in the ZOI, of which approximately 82 m is located within the Section 5 footprint. This stream originates to the east of the SH1, and drains via multiple culvert crossings underneath SH1, to discharge into the Ngaakooroa Stream (located outside the ZOI). This stream lacks the presence of mature trees along its embankments, but shrubs (likely exotic) are scattered along its length Considering the surrounding rural land uses, the stream channel is expected to be incised, with limited hydrological heterogeneity. Longfin eel (At Risk – Declining) has been recorded in the stream catchment (downstream of this stream reach). As there are several culvert crossings within this stream reach, longfin eel is not expected in this stream.
Ngaakooroa Stream Tributary E	Intermittent	No	An approximately 230 m length intermittent stream is located outside the western boundary of the NoR footprint, which discharges into Stream Tributary D. The stream embankments are devoid of any shrubs and trees. It's likely that exotic pasture grasses and macrophytes dominate the stream channel.

Stream	Classification	Site verified?	Brief description
Ngaakooroa Stream Tributary F	Intermittent	No	A total length of approximately 198 m reach of intermittent stream is located in the ZOI, of which approximately 92 m is located within the NoR footprint. This stream originates to the east of the SH1, and drains via multiple culvert crossings underneath SH1, to discharge into the Ngaakooroa Stream (located outside the ZOI). The upstream reach is well shaded with what is likely exotic scrub. The downstream reach drains through an area of cleared vegetation (used to be a pine forest, which was felled in c. 2022). This has reduced the effective shading and organic inputs to the stream. The stream is expected to have low hydrological heterogeneity. Longfin eel (At Risk – Declining) has been recorded in the stream catchment (downstream of this stream reach). As there are several culvert crossings within this stream reach, longfin eel is not expected in this stream.
Ngaakooroa Stream Tributary G	Intermittent	No	A total length of approximately 356 m of intermittent stream branches is located in the ZOI, of which approximately 211 m is located within the NoR footprint. This stream originates to the east of the SH1, and drains via a culvert crossing underneath SH1. Light industrial development surrounds the upstream reaches of this stream. The embankments of these reaches have been partially replanted with native vegetation species, while others remain devoid of any bankside vegetation. The downstream reach (west of SH1) is surrounded by exotic scrub (likely woolly nightshade). The stream is expected to have low hydrological heterogeneity. Longfin eel (At Risk – Declining) has been recorded in the stream catchment (downstream of this stream reach). As there are several culvert crossings within this stream reach, longfin eel is not expected in this stream.
Ngaakooroa Stream Tributary H	Permanent	No	This stream is situated outside the NoR footprint, to the south thereof. It extends for approximately 194 m within the ZOI. However, it's important to note that the proposed designation comes in very close proximity to this stream, specifically south of Mill Road. Mill Road crosses this stream via a culvert crossing. The embankment of this stream appears to have been replanted in 2019, with mānuka, kānuka, and cabbage trees. The stream is expected to have low hydrological heterogeneity. Longfin eel (At Risk – Declining) has been recorded in the stream catchment (downstream of this stream reach). There are several culvert crossings within this stream reach, longfin eel is not expected in this stream. 

Figure 7-3: Potential freshwater habitats associated with the northern portion of the proposed NoR 3 and 4.

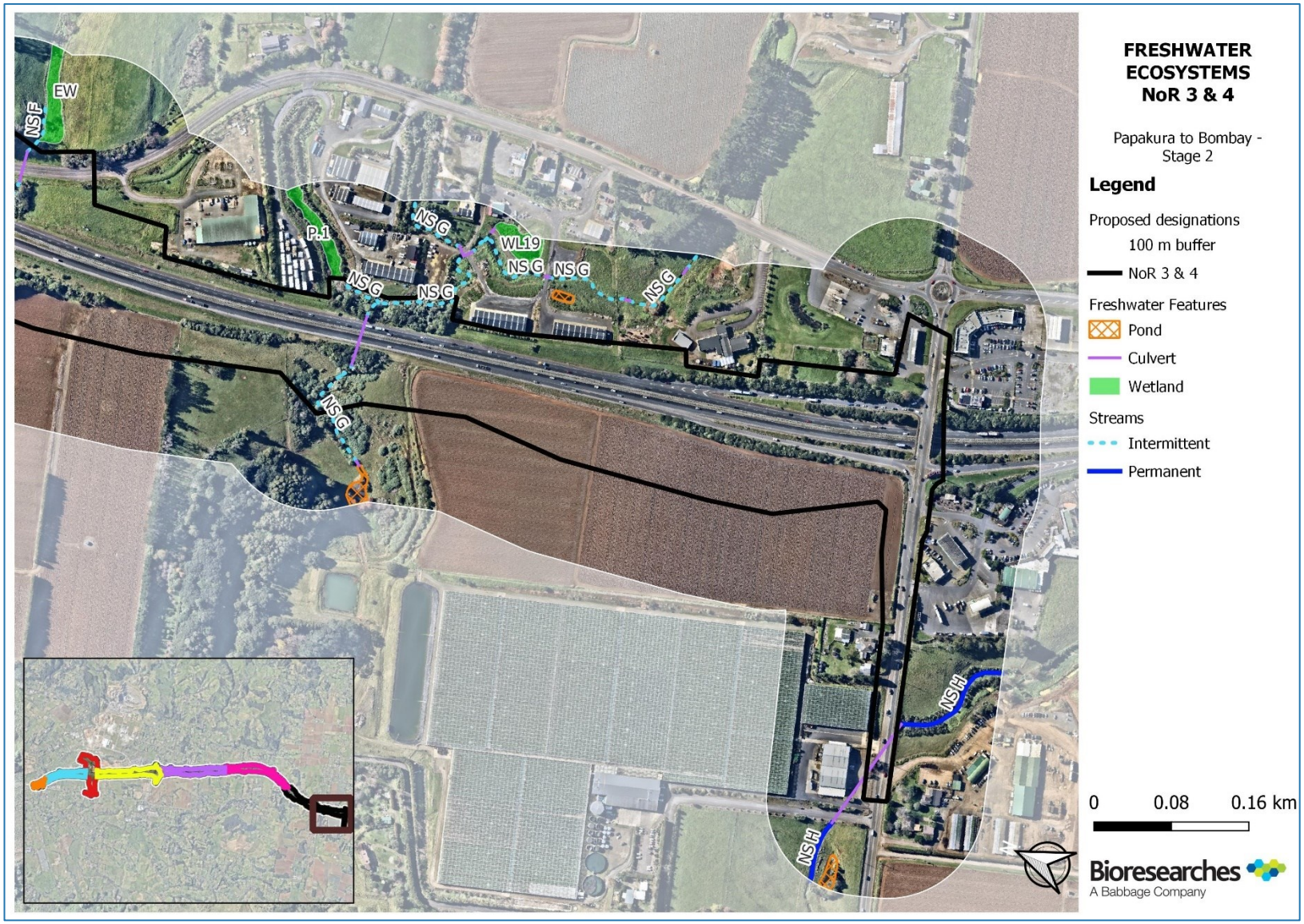


Figure 7-4: Potential freshwater habitats associated with the southern portion of the proposed NoR 3 and 4.

7.2.2.1.1 Freshwater ecological value – Streams

Table 7-6 presents the ecological value for the freshwater habitats identified within NoR 3 and 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 7-6: Ecological values of streams within the ZOI of NoR 3 and 4.

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Ngaakooroa Stream Tributary C	Low – Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	**Low**
Ngaakooroa Stream Tributary D	Low – Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	**Low**
Ngaakooroa Stream Tributary E	Low – Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	**Low**
Ngaakooroa Stream Tributary F	Low – Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	**Low**
Ngaakooroa Stream Tributary G	Moderate – instream habitat highly modified, with moderately modified riparian zone.	Low – no 'At Risk' or 'Threatened' species present	Low – highly modified	Moderate – stream, with permanent flow.	**Moderate**
Ngaakooroa Stream Tributary H	Moderate - instream habitat highly modified, with moderately modified riparian zone.	Low – no 'At Risk' or 'Threatened' species present	Low – highly modified	Moderate - stream, with permanent flow.	**Moderate**

7.2.3 Freshwater habitats – Wetlands

Six wetlands were identified during the desktop study. These wetlands are described in Table 7-7 and depicted in Figure 7-3 and Figure 7-4.

Table 7-7: Wetlands associated with NoR 3 and 4.

Wetland	NES:F Classification	Classification process	Description
Exotic wetland	TBC	Desktop	A small portion of this wetland is intersected by the western boundary of the NoR footprint. Likely dominated by exotic rushes (such as soft rush).
Exotic wetland	Natural inland wetland	Desktop (Previously verified by Bioresearches, 2022)	A small portion of this wetland is intersected by the eastern boundary of the NoR footprint. 
Exotic wetland	TBC	Desktop	Located outside the NoR footprint, in the western portion of the ZOI, and discharges into Ngaakooroa Stream Tributary E. Likely dominated by exotic rushes (such as soft rush).
Exotic wetland	TBC	Desktop	Located outside the NoR footprint, in the western portion of the ZOI, and discharges into Ngaakooroa Stream Tributary E. Likely dominated by exotic rushes (such as soft rush).
Exotic wetland	TBC	Desktop	A small section is located within the eastern boundary of the NoR footprint, and discharges into Ngaakooroa Stream Tributary F. 
Raupō wetland	Natural inland wetland	Desktop (Previously verified by Bioresearches, 2022)	Located outside the NoR footprint, in the eastern portion of the ZOI, located to the east of and discharges into Ngaakooroa Stream Tributary G. 

7.2.3.1.1 Freshwater ecological value – Wetlands

Table 7-8 presents the ecological value for the wetland habitats identified within NoR 3 and 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 7-8: Ecological values of wetlands within the ZOI of NoR 3 and 4.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Exotic wetland	Low – appears from desktop to be a wetland formed in a highly modified watercourse.	Low – Unlikely to contain habitat for anything other than common, non-threatened species.	Low – largely uniform habitat	Low – highly modified wetland in a local environment with multiple wetlands which have retained their features.	**Low**
Raupō wetland	Moderate – whilst the wetland retains most of its hydrological functioning, its flora has been modified.	Moderate – the raupō reedland is an endangered habitat, however this is interspersed with large pockets of exotic wetland vegetation.	Moderate – the wetland retains some of its original diversity.	Moderate – reduced due to the highly modified catchment.	**Moderate**

7.3 Future environment

Zoning within the ZOI of Stage 2 NoR 3 and 4 is a combination of rural- mixed rural zone (to the west) and rural- rural production zone to the east of SH1. It is expected that these areas will continue to be utilised for agriculture and horticultural purposes over the next 10 years.

7.4 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

This section assesses the ecological effects of activities which relate to District Plan matters under the AUP. Refer to the 'Future Environment' Section for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

Freshwater habitats are considered a Regional Plan matter, no effects assessment thereof is provided in this report. Should regional resource consent be required, this will be separately sought.

7.4.1 Assessment of construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to district matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to Appendix B for a breakdown of Regional versus District Plan vegetation); and
- Disturbance and displacement of native birds and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. Appendix A provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

7.4.1.1 Terrestrial Vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors.

The effects of the removal of this vegetation are assessed below in Table 7-9.

Table 7-9: Effects of vegetation removal for terrestrial habitats associated with NoR 3 and 4

Vegetation type	Alpha-numeric code*	Ecological Value	Magnitude of effect	Level of effect prior to impact management	Impact management and residual level of effect	Management of residual effects
Exotic scrub	ES	Negligible	Very Low	Negligible	Not required	N/A
Exotic forest	EF	Negligible	Very Low	Negligible	Not required	N/A
Planted vegetation	P.1	Negligible	Very Low	Negligible	Not required	N/A
	P.3	Negligible	Very Low	Negligible	Not required	N/A
Treeland	TL.3	Negligible	Very Low	Negligible	Not required	N/A
TBC – Native/exotic trees	TBC – N/ET	Negligible	Very Low	Negligible	Not required	N/A
TBC – Native/exotic scrubs	TBC – N/ES	Negligible	Very Low	Negligible	Not required	N/A
Pūriri forest	WF7	High	Low	Low	Not required	N/A
Kahikatea, pukatea forest	WF8	High	Low	Low	Not required	N/A

7.4.1.2 Bats

Long-tailed bats (very high ecological value) may utilise the stream corridors for foraging or as flight paths, which means they may fly over the NoR at the stream crossing locations at night (although bats have not been recorded from surveys and are considered unlikely to be present). Vegetation within the road corridor is not considered likely to provide roosting or foraging habitat.

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging or moving along the stream corridors. There are no trees suitable for bats to roost in within the ZOI of the Project and consequently noise and vibration is not considered to be an issue, and mortality or injury to bats or loss of foraging habitat has not been considered.

The effects of the works upon bats are described below in Table 7-10.

Table 7-10: Assessment of ecological effects encountered during construction for bats.

Effect	Disturbance and displacement of bats crossing the NoR as they use streams as a flight corridor
Magnitude of effect	Where the Project is situated adjacent to a light industrial area, night-time work and subsequent noise generated by the Project is likely to occur infrequently. Where the Project is situated in rural areas, noise generated by the project is likely to occur more frequently. As the Project area is already lit with street lighting and as the main southern connection to and from Auckland, with continuous traffic, including heavy trucks, the night-time noises and lighting generated from the Project area are not expected to have more than a Low magnitude of effect on bats; if present.
Level of effect prior to impact management	**Moderate**
Impact management and residual level of effect	Surveys should be completed prior to construction commencing to confirm bat presence. If bats are identified to be present, then a Bat Management Plan should be implemented. This plan incorporates mitigation measures such as reduction of light spill and works at night near bat habitats, and siting of compounds and laydown areas away from bat habitats. The post mitigation level of effect can be reduced to **Negligible**.
Management of residual effects	Not required

7.4.1.3 Native Birds

Indigenous birds including both the Not Threatened bird species and the At Risk wetland bird species may be displaced from nearby habitats due to construction activities. In addition, Not Threatened birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are described below in Table 7-11.

Table 7-11: Assessment of ecological effects encountered during construction for birds.

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Magnitude of effect	Adjacent habitats are periodically used by birds. Although birds present are likely to be habituated to a level of disturbance due to existing proximity to the motorway and urban environments in which they are found, the magnitude of effect is expected to be Low, as habitat availability is poor quality and very limited relative to the surrounding environment.	There is a reasonable probability that native birds utilise these trees for nesting, however habitat quality is poor, being predominantly exotic, narrow, isolated strips of vegetation. The magnitude of effect is expected to be **Low**.
Level of effect prior to impact management	**Very Low** for Not Threatened bird species. **Low** for TAR species.	**Low**

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Impact management and residual level of effect	Pre-construction bird surveys should be undertaken to determine if Spotless Crake and other wetland bird species are present. If At risk or Threatened wetland birds are present, a Wetland Bird Management Plan should be developed which could include the following management controls: Where practicable, construction works should commence prior to the breeding season/s of the wetland birds identified as present; to discourage bird nesting. Prior to any works beginning a nesting bird survey should be undertaken of wetland areas within a 50 m radius of the works footprint. If nesting birds are detected, then a 20 m buffer surrounding the nest should be clearly demarcated and works should not be completed within this buffer until birds have fledged. Where practicable, works should be set back from wetland edges by at least a 10 m buffer. Light spillage from construction areas should be minimised as far as practicable.	Under the Wildlife Act 1953, impact management measures will be required to prevent killing or injuring native birds during tree felling. This should include scheduling tree felling and vegetation removal activities outside of the bird nesting season (which is September to February, inclusive), or undertaking pre-clearance inspections to ensure nesting birds are not present.
Management of residual effects	Not required	Not required

7.4.1.4 Lizards

Lizards are not expected to be present within any of the District Plan vegetation to be removed (vegetation to be removed is expected to be limited to existing planted road side vegetation). Consequently, effects are limited to the potential displacement of lizards from adjacent habitats.

The effects of the works upon lizards are described below in Table 7-12.

Table 7-12: Assessment of ecological effects encountered during construction for lizards.

Effect	Disturbance and displacement of lizards due to construction activities
Magnitude of effect	The magnitude of effect is assessed as **Negligible** due to unlikelihood of lizard disturbance due to construction related noise and vibration.
Level of effect prior to impact management	Low
Impact management and residual level of effect	Not required
Management of residual effects	Not required

7.4.2 Operational effects – terrestrial ecology

The Project involves the widening of the SH1 and a shared use path. The future environment is a mix of urban and rural. The stream corridors and existing habitats associated with these are highly likely to remain as they have significant protections under current legislation.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

7.4.2.1 Bats

Potential operational impacts to bats include:

- Loss of habitat connectivity through the presence of the upgraded roadway, and impacts of lighting spillage which may impact behaviour of both bats and insects (their prey). This is considered to have a low magnitude of effect, over and above the existing motorway environment and consequently a moderate level of effect and therefore is discussed further in Table 7-13; and
- Vehicle strike causing injury or mortality. This is considered to have a very low likelihood of occurring, as bats are not considered likely to be using potential habitats within the NoR. Consequently, the magnitude of effect is considered to be negligible, and therefore has a low level of effect. Effects management is not required.

As the habitats adjacent to the Project area do not provide roosting habitat for bats and are not expected to develop to provide this within 10 years (when the Project is expected to begin), impacts on roosting bats have not been considered.

Table 7-13: Assessment of ecological effects encountered during operation for bats.

Effect	Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting
Magnitude of effect	The habitat is already fragmented by the presence of the existing motorway, which is lit at night with high traffic movement, and already generates vehicle noise. In addition, bats are unlikely to frequently visit the Project area. Consequently, the magnitude of effects is considered to be **Low**, and therefore the level of effect is **Moderate**.
Level of effect prior to impact management	**Moderate**
Impact management and residual level of effect	If bats are identified to be present during pre-construction surveys, then a Bat Management Plan should be implemented. This plan incorporate mitigation measures such as reduction of light spill near bat habitats, and planting of supplementary trees within the riparian corridors which will in time increase the canopy height of the plantings and aim to retain connectivity as the local area intensifies further. The post mitigation level of effect can be reduced to **Negligible**.
Management of residual effects	Not required

7.4.2.2 Native Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the Project. However, as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low**, and consequently the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for At Risk birds.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently and is unlikely to occur with greater frequency than current conditions. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for At Risk birds.

Impact management is therefore not required for operational effects to birds.

7.4.2.3 Lizards

The Project works are not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **low**, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

7.4.3 Conclusions

Ecological effects assessed as moderate or greater include:

- Moderate level of effect to bats during construction may occur due to disturbance to bats utilising the streams which the NoR crosses as flight corridors;
- Moderate level of effect to At Risk birds may occur due to disturbance to birds nesting in adjacent habitats; and
- Moderate level of effect to bats during operation may occur due to fragmentation of habitat and impacts of lighting and noise.

Effects management (implementation of a Bat Management Plan, Lizard Management Plan and a Bird Management Plan) reduces these effects to **Negligible** for disturbance to bats, **Negligible** for disturbance to lizards and **Low** for disturbance to At Risk birds and habitat fragmentation for bats.

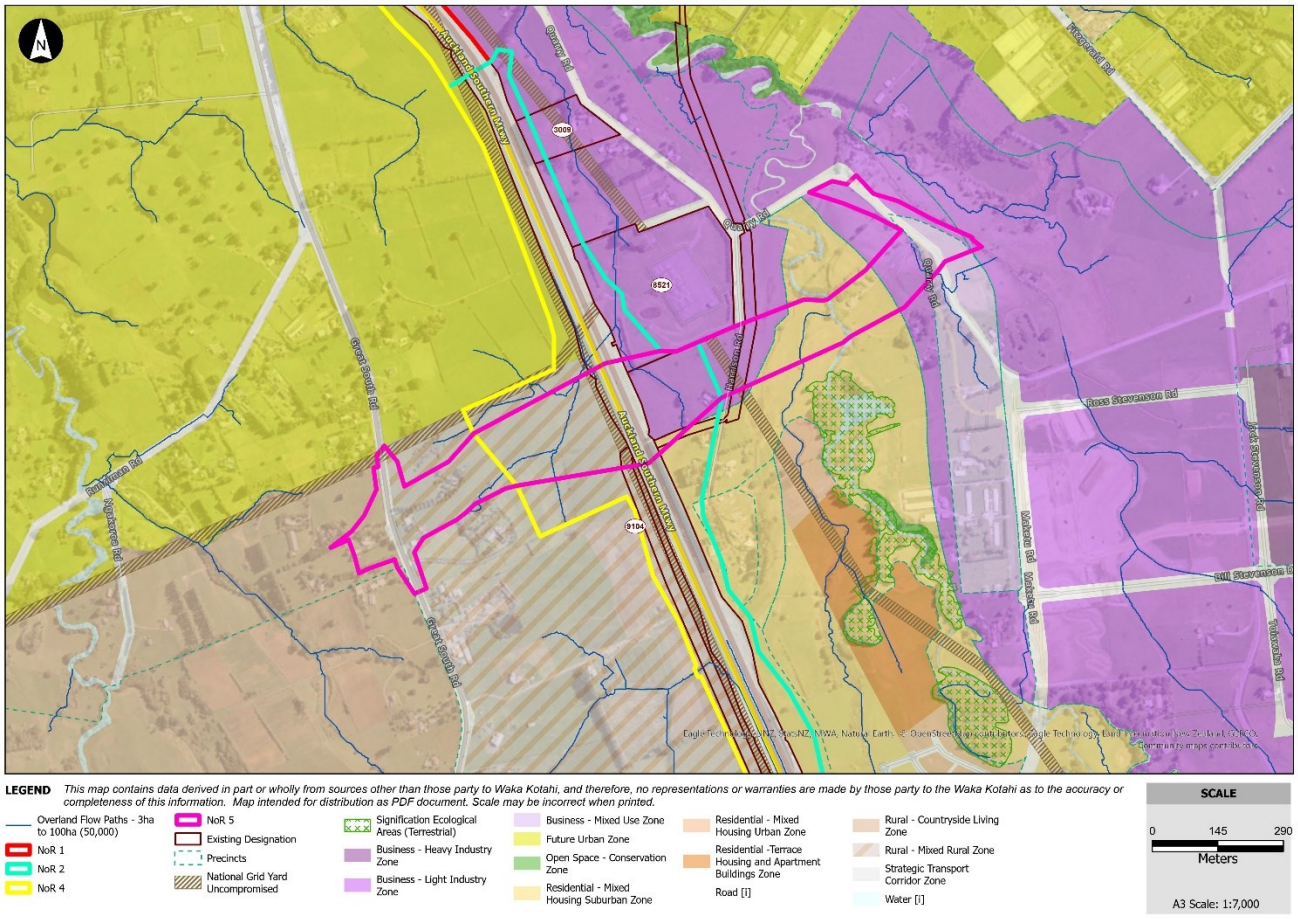
8 STAGE 2 NOR 5 (DRURY SOUTH LINK ROAD)

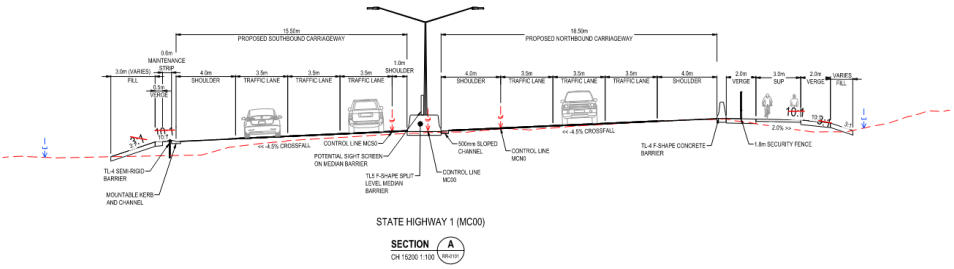
This section assesses the specific freshwater and indigenous biodiversity matters relation to NoR 5: Drury South Link Road

8.1 Overview and description of works

As set out in Table 8-1 below, the proposed designation to accommodate the construction, operation, and maintenances of a new link road between Maketu Road and Great South Road.

Table 8-1: Overview of the Drury South Interchange Connections

NoR 5 – Drury South Interchange Connections	
	
Key features	
Overview	▪ New link roads to the adjacent network (Maketu Road and Great South Road) to tie-into the proposed Drury South Interchange. ▪ Four traffic lanes, cycle lanes and footpaths on either side.
Structures	▪ Raised viaduct across the Hinagaia reserve area.
Speed Environment	▪ N/A
Access Lanes	▪ Accommodation for a special vehicle lane or bus lane within the 4m shoulder
Intersections	▪ Signalised intersection at Maketu Road

	▪ Round-about intersection tie-in to Great South Road
Stormwater Infrastructure	▪ Swales and wetland treatment train (100% treatment of impervious surfaces and full scale wetland)
Typical cross sections	

8.2 Existing environment

8.2.1 Terrestrial habitats and fauna – NoR 5

NoR 5 transitions through light industry and mixed rural zones (AUP). Present day habitats are therefore largely limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 8-2.

Table 8-2 Vegetation types present within and directly adjacent to the Project Area (NoR 5), classified according to Singers et al. (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	Comprising shelterbelts and roadside vegetation.
Planted vegetation	PL.1	N/A	Restoration planting along SH 1, the newly diverted Hingaia Stream Tributary E/Roslyn Stream, Hingaia Stream Tributary D/Harrison Stream and the Hingaia Stream.
	PL.3	N/A	Amenity planting surrounding Transpower substation property.
Exotic dominated treeland	TL.3	N/A	Primarily planted *Eucalyptus* spp.; within and outside the most western extent of NoR 5 footprint.
Kahikatea, pukatea forest	WF8	Critically Endangered	Mature native forest, intersected by the most eastern NoR 5 footprint. This habitat type is SEA (SEA_T_5280). According to Auckland Council, this is a riparian forest on a lowland alluvial terrace which comprises two disjunct areas of kahikatea and totara dominance. Titoki is common throughout the forest along with typical pasture weeds species along the embankments of the Hingaia Stream. This forest type is depleted in the district.

Potentially present fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink; and
- Common, non-threatened native bird species.

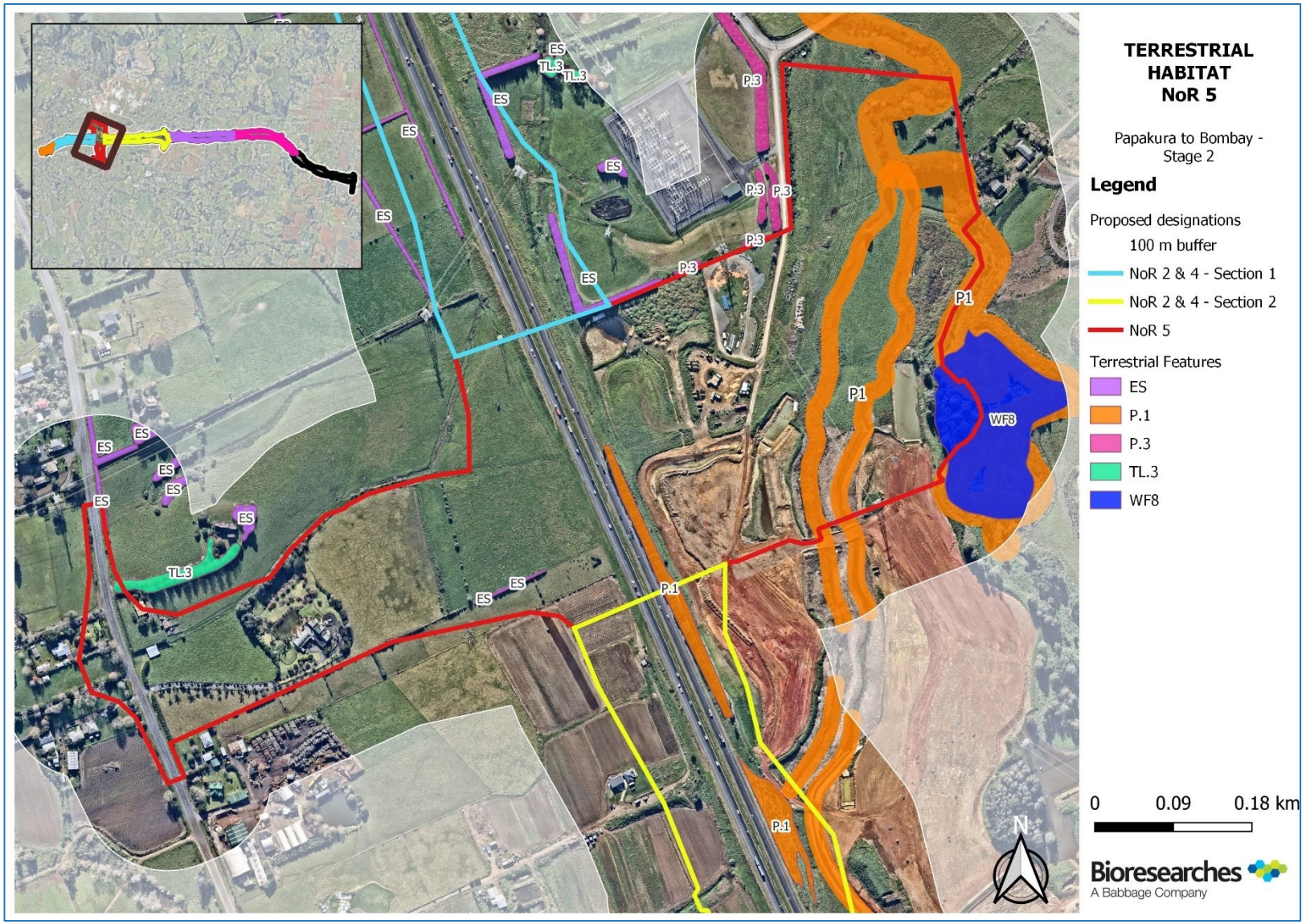


Figure 8-1: Potential terrestrial habitats associated with the northern portion of the proposed NoR 5.

8.2.2 Terrestrial ecological value – NoR 5

Table 8-3 presents the ecological value for the terrestrial habitats identified within NoR 5. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 8-3 Ecological values of terrestrial habitats within the ZOI of NoR 5.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
ES	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
TL.3	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has low diversity and other than copper skink does not provide habitat for other sensitive species.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
PL.1	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
PL.3	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
WF8	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	High – not likely to support any Threatened or At Risk bird or lizard species, but there is potential that the vegetation margins are used as long-tailed bat flight paths. Forest ecosystem type is classified as Critically Endangered.	Low – while indigenous species dominate, they lack the diversity and structure expected of a naturally occurring ecosystem.	High – the forest provides some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	**High**

Table 8-4 presents the ecological values for the fauna identified within the ZOI of NoR 5.

Table 8-4 Ecological values of fauna within the ZOI of NoR 5.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	PL.1 – riparian margins	Threatened - Nationally Critical	Very High
Native Lizards – copper skink	PL.1 – riparian margins	At Risk - Declining	High
Native Birds – Spotless crake	EW and WL19 Wetland habitats	At Risk – Declining species.	High
Native Birds – Grey duck and New Zealand dabchick	Pond habitats	Confirmed Threatened - Nationally Vulnerable and Threatened - Nationally Increasing species.	High
Native Birds – common, Not Threatened species only	ES, TL.3, Pl.1, PL.3 and WF8 habitats	Not Threatened	Low

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series

8.2.3 Freshwater habitats – Streams of NoR 5

Four stream branches were identified within 100 m of the designation boundary and within the NoR 5 footprint. These streams are mapped in Figure 8-2; and described in Table 8-5.

Table 8-5 Summary of streams associated with NoR 5

Stream	Classification	Site verified?	Brief description
Hingaia Stream	Permanent	No	The Hingaia Stream is located within the NoR footprint, along the most eastern boundary.
Hingaia Stream Tributary D (also referred to as the 'Harrison Stream' (Boffa Miskell, 2018))	Permanent	Only upstream reach field verified	Detailed description is provided in Table 6-16.
Hingaia Stream Tributary E (also referred to as the 'Roslyn Stream' (Boffa Miskell, 2018))	Permanent	No	Drury South Limited has obtained Resource Consent for streamworks for the Drury South Project. These consents will enable development in accordance with the Drury South Residential and Industrial Precincts under the AUP. This development will reclaim streams. This stream (Roslyn Stream) is a newly diverted stream which runs along SH 1 to the west of the proposed development. The purpose of this diversion is to realign the stream to permit land development, while maintaining open stream channels with ecological and flow conveyance values. This stream ties in with the Hingaia Stream. As part of the Stream Environmental Compensation Plan (Boffa Miskell, 2018), a 20 m riparian buffer (10 m on each embankment) will be established along this stream.
Hingaia Stream Tributary C	Intermittent	Yes	Detailed description is provided in Table 6-14

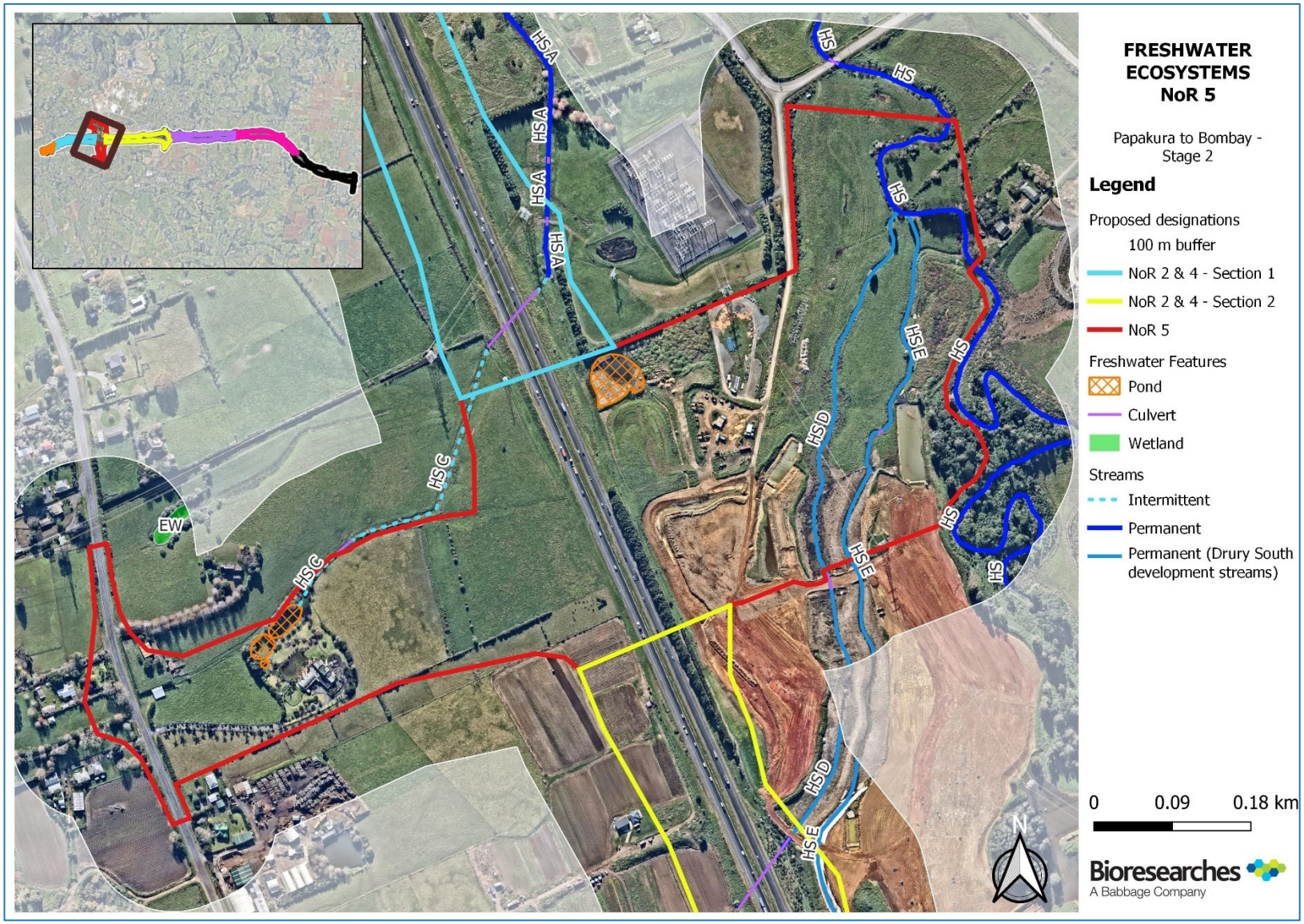


Figure 8-2 Potential freshwater habitats associated with the northern portion of the proposed NoR 5

8.2.4 Freshwater ecological value – Streams of NoR 5

Table 8-6: Ecological values of streams within the ZOI of NoR 5 presents the ecological value for the freshwater habitats identified within NoR 5. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 8-6: Ecological values of streams within the ZOI of NoR 5

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Hingaia Stream	Moderate - Riparian zone has been highly modified by human activities. However, in some places the planted margins are regenerating and recovering. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime from stormwater inputs and the stormwater dam below.	Moderate – At risk declining longfin eel present within the catchment.	High – the stream and riparian margins collectively form a habitat gradient which is uncommon within the local agricultural environment. The stream is modified by the presence of ponds and culvert crossings.	High – permanently flowing stream	High
Hingaia Stream Tributary D (also referred to as the 'Harrison Stream' (Boffa Miskell, 2018))	Currently undergoing riparian yard restoration. As such, no accurate ecological value assessment could be undertaken. Nonetheless, it is expected that the overall ecological value will be moderate, which is an improvement to the ecological value prior to any restoration.				Moderate
Hingaia Stream Tributary E (also referred to as the 'Roslyn Stream' (Boffa Miskell, 2018))	Currently being diverted and restored. As such, no accurate ecological value assessment could be undertaken. Nonetheless, it is expected that the overall ecological value will be moderate, which is an improvement to the ecological value prior to any restoration.				Moderate
Hingaia Stream Tributary C	Moderate - Riparian zone has been highly modified by human activities. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime.	Moderate – At risk declining longfin eel are present within the catchment.	Low – Highly modified stream with no connectivity to upstream habitats.	Low – likely to only be seasonally wet.	**Moderate**

8.2.5 Freshwater habitats – Wetlands

A single wetland identified during the desktop study. This wetland is described in Table 8-7 and depicted in Figure 8-2.

Table 8-7 Wetlands associated with NoR 5

Wetland	NES:F Classification	Classification process	Description
Exotic wetland	TBC	Desktop	Located outside the NoR 5 footprint, in the western portion of the ZOI. Likely dominated by exotic sedges (such as soft rush).

8.2.6 Freshwater ecological value – Wetlands of NoR 5

Table 8-8 presents the ecological value for the wetland habitats identified within NoR 5. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 8-8 Ecological values of wetlands within the ZOI of NoR 5.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Exotic wetland	Low – appears from desktop to be a wetland formed in a highly modified watercourse.	Low - Unlikely to contain habitat for anything other than common, non-threatened species.	Low – largely uniform habitat	Low – highly modified wetland in a local environment with multiple wetlands which have retained their features.	**Low**

8.3 Future environment

Zoning within the ZOI of Stage 2 NoR 5 is a combination of light industry and mixed rural zones. It is expected that these areas will continue to be utilised for the intended zoned purposes over the next 10 years.

8.4 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

This section assesses the ecological effects of activities which relate to District Plan matters under the AUP. Refer to the 'Future Environment' Section for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

Freshwater habitats are considered a Regional Plan matter, no effects assessment thereof is provided in this report. Should regional resource consent be required, this will be separately sought.

8.4.1 Assessment of construction effects - terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to district matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to Appendix B for a breakdown of Regional versus District Plan vegetation); and
- Disturbance and displacement of native birds and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. Appendix A provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

8.4.1.1 Terrestrial Vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors.

The effects of the removal of this vegetation are assessed below in Table 8-9.

Table 8-9 Effects of vegetation removal for terrestrial habitats associated with NoR 5.

Vegetation type	Alpha-numeric code*	Ecological Value	Magnitude of effect	Level of effect prior to impact management	Impact management and residual level of effect	Management of residual effects
Exotic scrub	ES	Negligible	Very Low	Negligible	Not required	N/A
Planted vegetation	P.1	Negligible	Very Low	Negligible	Not required	N/A
	P.3	Negligible	Very Low	Negligible	Not required	N/A
Treeland	TL.3	Negligible	Very Low	Negligible	Not required	N/A
Kahikatea, pukatea forest	WF8	High	Low*	Low*	Not required	N/A

*Assuming that the designation will avoid this habitat unit.

8.4.1.2 Bats

Long-tailed bats (very high ecological value) may utilise the stream corridors for foraging or as flight paths, which means they may fly over the NoR at the stream crossing locations at night (although bats have not been recorded from surveying and are considered unlikely to be present). Vegetation within the road corridor is not considered likely to provide roosting or foraging habitat.

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging or moving along the stream corridors. There are no trees suitable for bats to roost in within the ZOI of the Project and consequently noise and vibration is not considered to be an issue, and mortality or injury to bats or loss of foraging habitat has not been considered.

The effects of the works upon bats are described below in Table 8-10.

Table 8-10: Assessment of ecological effects encountered during construction for bats.

Effect	Disturbance and displacement of bats crossing the NoR as they use streams as a flight corridor
Magnitude of effect	Where the Project is situated adjacent to a light industrial area, night-time work and subsequent noise generated by the Project is likely to occur infrequently. Where the Project is situated in rural areas, noise generated by the project is likely to occur more frequently. As the Project area is already lit with street lighting and as the main southern connection to and from Auckland, with continuous traffic, including heavy trucks, the night-time noises and lighting generated from the Project area are not expected to have more than a Low magnitude of effect on bats; if present.
Level of effect prior to impact management	**Moderate**
Impact management and residual level of effect	Surveys should be completed prior to construction commencing to confirm bat presence. If bats are identified to be present, then a Bat Management Plan should be implemented. This plan incorporates mitigation measures such as reduction of light spill and works at night near bat habitats, and siting of compounds and laydown areas away from bat habitats. The post mitigation level of effect can be reduced to **Negligible**.
Management of residual effects	Not required

8.4.1.3 Native Birds

Indigenous birds including both the Not Threatened bird species and the At Risk wetland bird species may be displaced from nearby habitats due to construction activities. In addition, Not Threatened birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are described below in Table 8-11.

Table 8-11: Assessment of ecological effects encountered during construction for birds

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Magnitude of effect	Adjacent habitats are definitely periodically used by birds. Although birds present are likely habituated to a level of disturbance already due to the proximity to the motorway and urban environments in which they are found, the magnitude of effect is expected to be High, especially as nest abandonment could result in the death of birds.	There is a reasonable probability that native birds utilise these trees for nesting. The magnitude of effect is expected to be **Moderate**.
Level of effect prior to impact management	**Very Low** for Not Threatened bird species. **Low** for TAR species.	**Low**

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Impact management and residual level of effect	Pre-construction bird surveys should be undertaken to determine if Spotless Crake, New Zealand Dabchick, Grey Duck and other wetland bird species are present. If At risk or Threatened wetland birds are present, a Wetland Bird Management Plan should be developed which could include the following management controls: Where practicable, construction works should commence prior to the breeding season/s of the wetland birds identified as present; in order to discourage bird nesting. Prior to any works beginning a nesting bird survey should be undertaken of wetland areas within a 50 m radius of the works footprint. If nesting birds are detected, then a 20 m buffer surrounding the nest should be clearly demarcated and works should not be completed within this buffer until birds have fledged. Where practicable, works should be set back from wetland edges by at least a 10 m buffer. Light spillage from construction areas should be minimised as far as practicable.	Under the Wildlife Act 1953, impact management measures will be required to prevent killing or injuring native birds during tree felling. This should include scheduling tree felling and vegetation removal activities outside of the bird nesting season (which is September to February, inclusive), or undertaking pre-clearance inspections to ensure nesting birds are not present.
Management of residual effects	Not required	Not required

8.4.1.4 Lizards

Lizards are not expected to be present within any of the District Plan vegetation to be removed. Consequently, effects are limited to the potential displacement of lizards from adjacent habitats.

The effects of the works upon lizards are described below in Table 8-12.

Table 8-12: Assessment of ecological effects encountered during construction for lizards

Effect	Disturbance and displacement of lizards due to construction activities
Magnitude of effect	The magnitude of effect is assessed as **Negligible** due to unlikelihood of lizard disturbance due to construction related noise and vibration.
Level of effect prior to impact management	Low
Impact management and residual level of effect	Not required
Management of residual effects	Not required

8.4.2 Operational effects – terrestrial ecology

The Project involves the Drury South interchange to SH1. The future environment is a mix of urban (east) and rural (west). Once the stream habitats to the east are established and planted under the existing consents (Drury South Precincts development), all the stream corridors and existing habitats associated with these are highly likely to remain as they have significant protections under current legislation.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

8.4.2.1 Bats

Potential operational impacts to bats include:

- Loss of habitat connectivity through the presence of the interchange and impacts of lighting spillage which may impact behaviour of both bats and insects (their prey). This is considered to have a low magnitude of effect, over and above the consented urban environment and consequently a moderate level of effect and therefore is discussed further in Table 8-13; and
- Vehicle strike causing injury or mortality. This is considered to have a very low likelihood of occurring, as bats are not considered likely to be using potential habitats within the NoR. Consequently, the magnitude of effect is considered to be negligible, and therefore has a low level of effect. Effects management is not required.

As the habitats adjacent to the Project area do not provide roosting habitat for bats and are not expected to develop to provide this within 10 years (when the Project is expected to begin), impacts on roosting bats have not been considered.

Table 8-13: Assessment of ecological effects encountered during operation for bats

Effect	Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting
Magnitude of effect	The habitat is already fragmented by the presence of the existing motorway, which is lit at night with high traffic movement, and already generates vehicle noise. In addition, bats are unlikely to frequently visit the Project area. Consequently, the magnitude of effects is considered to be **Low**, and therefore the level of effect is **Moderate**.
Level of effect prior to impact management	**Moderate**
Impact management and residual level of effect	If bats are identified to be present during pre-construction surveys, then a Bat Management Plan should be implemented. This plan incorporate mitigation measures such as reduction of light spill near bat habitats, and planting of supplementary trees within the riparian corridors which will in time increase the canopy height of the plantings and aim to retain connectivity as the local area intensifies further. The post mitigation level of effect can be reduced to **Negligible**.
Management of residual effects	Not required

8.4.2.2 Native Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the Project. However, as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low**, and consequently the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for At Risk birds.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently and is unlikely to occur with greater frequency than current conditions. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for At Risk birds.

Impact management is therefore not required for operational effects to birds.

8.4.2.3 Lizards

The Project works are not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **low**, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

8.4.3 Conclusions

Ecological effects assessed as moderate or greater include:

- Moderate level of effect to bats during construction may occur due to disturbance to bats utilising the streams which the NoR crosses as flight corridors;
- Moderate level of effect to At Risk birds may occur due to disturbance to birds nesting in adjacent habitats; and
- Moderate level of effect to bats during operation may occur due to fragmentation of habitat and impacts of lighting and noise.

Effects management (implementation of a Bat Management Plan, Lizard Management Plan and a Bird Management Plan) reduces these effects to **Negligible** for disturbance to bats, **Negligible** for disturbance to lizards and **Low** for disturbance to At Risk birds and habitat fragmentation for bats.

9 OVERALL STAGE 2 NORS

This section assesses common or general ecological matters across the entire Stage 2 corridor (i.e. all five NoRs). This section also recommends measures to avoid, remedy, or mitigate actual or potential adverse effects.

9.1 Positive ecology effects

NZTA projects can potentially offer opportunities or undertake works to support national indigenous biodiversity strategic outcomes and contribute to national targets. Degraded areas and/or depauperate biodiversity areas especially provide opportunities for NZTA to enhance biodiversity and align with regional and local priorities.

Positive terrestrial ecology effects could be achieved through mitigation enhancement or restoration[22] of terrestrial and wetland habitats where ecological integrity is currently compromised through weed infestation. In addition, native restoration planting will occur on roadsides which will in time provide habitat for native fauna and assist in providing a native plant seed source in the local area which will eventually lead to the growth of native plants in other areas. Furthermore, the exotic vegetation along SH1 to be removed often provides very little ecological function. This vegetation will be replaced with native species that would provide indigenous resources for native fauna and contribute to local native seed sources. This initiative aligns with the NZ Biodiversity Strategy goals (Goal 12.6.1, and potentially 12.6.3 and 12.6.3 pending final designs) (DOC, 2020)[23], of which the objective is to manage natural resources in a sustainable manner. Goal 12.6.1 specifically aims for native vegetation planting to be a standard practice along transport corridors and other areas. Additionally, by establishing native vegetation this will promote the objectives of the National Adaptation Plan (MfE, 202224), as healthy and diverse ecosystems can adjust more effectively to climate threats. This approach is also in line with Outcome 1 of the Te Mana o te Taiao – Aotearoa New Zealand Biodiversity Strategy (**ANZBS**) 2020, aiming to maintain and/or restore the health, integrity, and connectivity of ecosystems, including in human-dominated areas. The initiative to enhance biodiversity in areas with no/low ecological values, by reintroducing suitable indigenous vegetation within a transport corridor, protecting and maintaining it, and creating weed-free areas along the state highway to buffer high-value ecological areas, is consistent with the NPS-IB, particularly Policy 8, 10, and 14.

Streams within the Project area are frequently affected by stormwater inputs (from the existing SH1), and the Project would allow for an increase in the number of ‘green infrastructure’ features such as stormwater wetlands, which will improve water quality of stormwater generated by the existing roadway before it enters the waterways (which is in support of ANZBS Strategy Outcome 3). In addition, stream crossings where culverts are to be upgraded or lengthened will be improved so that fish passage is provided. By protecting and maintaining the physical connection/link between ecological domains (i.e. terrestrial and freshwater), is in line with the NPS-IB, particularly Policy 13 to 16.

Opportunities within the immediate landscape of the Project include enhancing indigenous biodiversity values within the riparian margins of the various stream crossings identified.

9.2 Assessment of construction effects

Table 9-1 to Table 9-4 provide summaries of ecological effects on a district level during the construction phase without any mitigation measures in place. In cases where the assessed effect level is **Moderate** or higher, then mitigation has been developed.

[22] **Restoration** means (as per NPS-IB) the active intervention and management of modified or degraded habitats, ecosystems, landforms, and landscapes in order to maintain or reinstate indigenous natural character, ecological and physical processes, and cultural and visual qualities, and may include enhancement activities.
[23] Department of Conservation. 2020. Te Mana o Te Taiao - Aotearoa New Zealand Biodiversity Strategy 2020.
[24] Ministry for the Environment. 2022. Aotearoa New Zealand’s first national adaptation plan. Wellington. Ministry for the Environment.

Table 9-1: Summary of ecological effects during construction prior to mitigation for district plan trees

Construction - Terrestrial vegetation (district plan)	
NoR	**Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)**
NoR 1 and 4	Very Low
NoR 2 and 4 – Section 1	Very Low
NoR 2 and 4 – Section 2	Very Low
NoR 2 and 4 - Section 3	Very Low
NoR 2 and 4 - Section 4	Very low – should the SEA be avoided
NoR 3 and 4	Very Low
NoR 5	Very low – should the SEA be avoided

Table 9-2: Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats			
NoR	**Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)**	**Loss of foraging habitat due to vegetation removal - District plan only**	**Kill or injure individual bats due to vegetation removal - District plan only**
NoR 1	Low	N/A	N/A
NoR 2 and 4 – Section 1	Low	N/A	N/A
NoR 2 and 4 – Section 2	Low	N/A	N/A
NoR 2 and 4 - Section 3	Low	N/A	N/A
NoR 2 and 4 - Section 4	Moderate	N/A	N/A
NoR 3 and 4	Moderate	N/A	N/A
NoR 5	Moderate	N/A	N/A

Table 9-3: Summary of ecological effects during construction prior to mitigation for native birds

Construction - Birds		
NoR	**Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) - Non-TAR**	**Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds**
NoR 1	Very Low	Low
NoR 2 and 4 – Section 1	Very Low for Not Threatened bird species. Low for TAR species.	Low
NoR 2 and 4 – Section 2		
NoR 2 and 4 - Section 3		
NoR 2 and 4 - Section 4		

NoR 3 and 4	Very Low for Not Threatened bird species. Low for TAR species.	Low
NoR 5	Very Low for Not Threatened bird species. Low for TAR species.	Low

Table 9-4: Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)
NoR 1	Low
NoR 2 and 4 – Section 1	Low
NoR 2 and 4 – Section 2	
NoR 2 and 4 - Section 3	
NoR 2 and 4 - Section 4	
NoR 3 and 4	Low
NoR 5	Low

9.3 Recommended measures to avoid, remedy or mitigate construction effects

Construction effect mitigation measures will include:

- A Lizard Management Plan (**LMP**): Details of the LMP will be dependent on the lizard habitat present during the construction phase. It is expected to include activities such as reassessment or surveys of lizard habitats prior to construction, the placement of compounds and laydown areas, identification of relocation sites and the determination of timing and methods for capturing and relocating lizards. Considering that there may be a time lag between when the construction occurs and when its full ecological effects are detectable on lizard communities, the lizard management plan may recommend additional effects management measures for affected lizards, such as undertaking habitat enhancement, pest control and ongoing monitoring. The triggers to undertake these measures will be commensurate with the number of lizards relocated.

- A Bat Management Plan (**BMP**): Details of the BMP will be dependent on the bat habitat present during the construction phase. The likely activities will involve conducting surveys of bat habitat before construction is commenced, positioning compounds and laydown areas to steer clear of bat habitat, designing lighting systems to minimise light levels and prevent light spill from construction areas, and enforcing restrictions on night works in proximity to bat habitats.

- Native bird management (as per Section 9.3): Considerations for bird management will include conducting a pre-construction bird survey (specifically at wetland and pond habitats) to confirm the absence of Threatened or At Risk (**TAR**) species and to provide guidance in case such species are found. This guidance may involve avoiding construction activities during the bird breeding seasons, which typically spans from September to February, nesting bird surveys, and where practicable, works set back from wetland edge.

- A Restoration Planting Plan (**RPP**): Details of the RPP will depend on vegetation and fauna habitat present at the time of construction, and is likely to include identification of strategic revegetation to buffer and restore habitats, and potentially offset or compensate for high vegetation and / or fauna habitat values.

9.4 Assessment of operational effects

Table 9-5 to Table 9-7 provide summaries of the operational effects related to district plan matters caused by the road, which may result in disturbance or loss in connectivity for bats, birds and lizards. In cases where the level of effects has been assessed as **Moderate** or higher, mitigation measures have been formulated.

The residual level of effect for operational effects are considered Low or Very Low.

Table 9-5: Summary of ecological effects during operation prior to mitigation for bats

Operation - Bats		
NoR	Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting	Kill or injuring - vehicle strike
NoR 1	Very Low	N/A
NoR 2 and 4 – Section 1	Moderate	Low
NoR 2 and 4 – Section 2		
NoR 2 and 4 - Section 3		
NoR 2 and 4 - Section 4		
NoR 3 and 4	Moderate	Low
NoR 5	Moderate	Low

Table 9-6: Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds			
NoR	**Disturbance - presence of the road**	**Loss in connectivity - presence of the road**	**Kill or injuring - vehicle strike**
NoR 1	Very Low		Very Low
NoR 2 and 4 – Section 1	Very Low		Very Low
NoR 2 and 4 – Section 2			
NoR 2 and 4 - Section 3			
NoR 2 and 4 - Section 4			
NoR 3 and 4	Very Low		Very Low
NoR 5	Very Low		Very Low

Table 9-7: Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards			
NoR	**Disturbance - presence of the road**	**Loss in connectivity - presence of the road**	**Kill or injuring - vehicle strike**
NoR 1	Low		Very Low
NoR 2 and 4 – Section 1	Low		Very Low
NoR 2 and 4 – Section 2			
NoR 2 and 4 - Section 3			
NoR 2 and 4 - Section 4			
NoR 3 and 4	Low		Very Low
NoR 5	Low		Very Low

9.5 Recommended measures to avoid, remedy or mitigate operational effects

To address operational effects, mitigation measures will involve the implementation of a BMP. The BMP will include buffer planting alongside road corridors linked to stream crossings[25] and the design of appropriate lighting at strategic points along the road (stream crossings).

9.6 Cumulative effects

The EIANZ Guidelines (2018) emphasize that an assessment of ecological effects for a project should extend beyond considering only the direct impacts within the Project area. In line with these guidelines, the proposed designation, when combined with future urban development (external projects) along specific sections of the designation, and the potential implications of a changing climate, poses a cumulative effect. It's important to note that addressing this cumulative effect may not necessarily demand mitigation measures from the standpoint of a singular project.

9.6.1 Cumulative impacts to native fauna

Mobile native fauna species are anticipated to inhabit the Project area and its broader surroundings. Given the predominantly rural nature of the current setting, native faunas are expected to be more sensitive to disturbance. While these species may adapt to disruptions like noise, light, and vibration associated with transport corridors, the gradual and cumulative alterations in habitat due to ongoing urbanization could deter nesting and roosting, potentially compromising the long-term viability of native fauna. Notably, long-tailed bats, known for their heightened sensitivity to disturbance, will necessitate targeted mitigation efforts in coordination with the broader urban development as the future infrastructure develops.

The Project area, in isolation, does not pose a direct risk to native bird species; however, the broader context is considered. According to Adams *et al.* (2021)[26], artificial light is prevalent in urban environments and has known or suspected impacts on birds. Nocturnal birds are prone to gathering around artificial light sources, increasing the risk of collisions with illuminated structures due to attraction and/or disorientation. Light-based deterrents can repel birds, and artificial light may alter birds' perceptions of habitat quality, leading to selection or avoidance of illuminated areas.

[25] The extent of buffer planting is not specifically defined in this report as the requirements may change in the future. For instance, presently, stream corridors may lack buffer planting or have immature plantings, which could change overtime. The mandate to establish buffer planting and/or preserve existing trees that serve the purpose of buffer planting is expected to encompass the region between the road embankment and the designation boundary, extending a minimum of 10 m on both sides of stream crossings. It's important to note that buffer planting can also be implemented on the road embankments.

[26] Adams, C.A., Fernández-Juricic, E., Bayne, E.M. et al. 2021. Effects of artificial light on bird movement and distribution: a systematic map. Environ Evid 10, 37 (2021). https://doi.org/10.1186/s13750-021-00246-8

Terrestrial birds can also be impacted by artificial light at night due to disruption of their behaviours, such as altering breeding seasons (Dominoni *et al.*, 2013)[27], circadian rhythms (de Jong *et al.*, 2016)[28] and singing behaviours (Kempenaers *et al.*, 2010)[29]. In addition to birds, recent research on long-tailed bats indicates that this species avoids artificial light. Schamhart *et al.* (2023)[30] found that the detection rates of long-tailed bats declined in the presence of artificial light (LED floodlights).

Transport corridors can function as barriers to faunal movement (Jones et al., 2019)[31], impacting migratory species and leading to habitat fragmentation (Innes *et al.*, 2022)[32]. This fragmentation can result in decreased genetic diversity, population declines, and alterations to community structure. While an individual designation might be assessed with a "Low" effect, the cumulative impact of habitat fragmentation should be considered comprehensively, especially given ongoing urban development.

Developments should recognize the vulnerability and resilience of the receiving environment, acknowledging the cumulative effects stemming from various developments within the Project Area. As urban areas expand and transport infrastructure develops, collaboration among transport providers, consenting authorities (such as Auckland Council), and developers is crucial to evaluating the combined effects of lighting. Mitigation measures at a landscape scale could include the establishment of vegetated (including dark) corridors, wildlife-friendly lighting designs, wildlife crossings, and vegetated buffers to safeguard sensitive habitats and fauna.

9.6.2 Cumulative effects to vegetation

Habitat degradation from ongoing cumulative removal of low value vegetation (which does not necessarily require impact management under EIANZ Guidelines) should be considered at a landscape scale by the consenting authorities in the wider regional context to prevent a decline in biodiversity and changes to ecosystem function and services.

The Manukau ecological district, which this project falls within, is highly modified from its original forested state with only 3% of native vegetation remaining (Lindsay *et al*. 2009). As a result of this, remnant indigenous vegetation, as well as exotic vegetation, plays a significant role in providing biodiversity values, habitat for fauna and ecosystem services to the area. With little original vegetation remaining any additional loss has a greater proportional impact than loss occurring in areas with greater remnant vegetation coverage. Therefore, even small areas of vegetation clearance are significant to the overall ecological function of the district. Within the context of significant cumulative deforestation mature trees are particularly important as the ecological role that they play cannot be replaced with new restoration plantings, which will take decades to reach a similar size.

[27] Dominoni, D., Quetting, M., & Partecke, J. (2013). Artificial light at night advances avian reproductive physiology. Proceedings of the Royal Society B: Biological Sciences, 280(1756), 20123017.
[28] de Jong, M., Jeninga, L., Ouyang, J. Q., van Oers, K., Spoelstra, K., & Visser, M. E. (2016). Dose-dependent responses of avian daily rhythms to artificial light at night. Physiology & Behavior, 155, 172-179.
[29] Kempenaers, B., Borgström, P., Loës, P., Schlicht, E., & Valcu, M. (2010). Artificial night lighting affects dawn song, extra-pair siring success, and lay date in songbirds. *Current biology*, *20*(19), 1735-1739.
[30] Schamhart, T., Browne, C., Borkin, K. M., Ling, N., Pattemore, D. E., & Tempero, G. W. (2023). Detection rates of long-tailed bats (Chalinolobus tuberculatus) decline in the presence of artificial light. New Zealand Journal of Zoology, 1-11.
[31] Jones, C., Borkin, K., & Smith, D. (2019). Roads and wildlife: the need for evidence-based decisions; New Zealand bats as a case study. New Zealand Journal of Ecology, 43(2), 3376.
[32] Innes, J., Miskelly, C. M., Armstrong, D. P., Fitzgerald, N., Parker, K. A., & Stone, Z. L. (2022). Movements and habitat connectivity of New Zealand forest birds. New Zealand Journal of Ecology, 46(2), 1-21.

10 CONCLUSION

Several ecological values are associated with the proposed NoR for Stage 2 of the Papakura to Bombay Project. This includes indigenous biodiversity, such as native habitat units, and freshwater values such as streams and wetlands. It is recommended that additional site investigations be undertaken to assess to potential presence of native bats and lizards within the Project Area, specifically prior to the commencement of construction activities.

Based on the ecological baseline assessment, the ecological value of these features various between Negligible to Moderate.

This report details the district matter ecological effects during construction and operation of the Project. Overall, the construction phase effects to district plan ecological matters will be low to moderate. Where the level of effect was assessed to be moderate, mitigation has been developed. The construction phase effects to district plan ecological matters will be low to moderate. Suitable mitigation has been developed to those effects determined to be moderate.

The residual level of effect for construction and operational effects to district plan ecological matters are considered Low or Very Low.

APPENDICES

APPENDIX A – ASSESSMENT STANDARDS

A1: Tables below details the justification of how ecological value was assigned, utilising the EIANZ guidelines but also includes recommendations from the Waka Kothai Ecological Impact Assessment Guidelines.

Table 0-1: Criteria for assigning ecological value to terrestrial habitats, based on NZTA EIA guidelines and the EIANZ guidelines.

NZTA EIA guideline	EIANZ guidelines & application throughout the report
Ecological value can be assessed at a range of scales, such as local, regional and, national. For example, a particular ecosystem may be locally common but is poorly represented nationally (or vice versa). The ecologist needs to justify why they chose the scale they did and what would happen had a different spatial scale been selected.	The ecological value assigned to an area or species considers the zone of influence (ZOI) of the project (refer to Section 3.1.4 for more details), based on how different species use their environment. The ecological value assessment for terrestrial habitats within the Project area was conducted on a landscape scale. This approach was taken to account for habitat degradation resulting from the ongoing cumulative removal of low-value vegetation, which, under the EIANZ Guidelines, may not necessarily require impact management. The objective is to prevent a decline in biodiversity and mitigate changes to ecosystem function and services. Any considerations for a different assessment scale are noted within the relevant sections of this report.
The EcIA should reflect the underlying importance of local (ecological district) settings, while taking into account some or all of the national priorities and tools such as Land Environments of New Zealand, Manaaki Whenua Landcare Research's Naturally Uncommon Ecosystems factsheets and the New Zealand Threat Classification System (**NZTCS**).	Considered as part of the Rarity/Distinctiveness matter/criteria of the EIANZ guideline. None of the identified ecosystems are considered 'naturally uncommon' by the Land Environments of New Zealand, Manaaki Whenua Landcare Research's Naturally Uncommon Ecosystems factsheets. Threat classifications for areas/species are reported upon in the relevant sections, and considered as part of the ecological value assessment.
To assist in determining value to terrestrial sites consider using DOC Guidelines for assessing significant ecological values.	Use was made of five criteria listed by the EIANZ guideline to be considered when assigning ecological value of an area or species. These criteria predominantly correspond to criteria set out by the DOC guidelines. Considering the lack of naturally uncommon ecosystems or very high valued ecosystems within the ZOI, the EIANZ criteria for assigning ecological values to ecosystems are considered sufficient for this assessment.
Degraded naturally occurring indigenous vegetation/ecosystems can have high value, particularly if they are representative of original vegetation/ecosystem types. Natural areas in degraded ecological districts (less than 20% indigenous cover remaining) may be the best/only examples of their type left nationally or regionally in an ecological district.	Considered as part of the Representativeness matter/criteria of the EIANZ guideline.
Should highly mobile indigenous fauna be present, identify how they could use the site.	Although not specified under a matter/criteria of the EIANZ guidelines, this was considered and described for each of the identified indigenous fauna.
Value of habitat dominated by introduced species, including weeds, cannot be discounted. In more modified landscapes, they may provide habitat for threatened/at risk (TAR) species.	Considered as part of the Rarity/distinctiveness matter/criteria of the EIANZ guideline.

Table 0-2: Criteria for assigning ecological value to terrestrial habitats, based on NZTA EIA guidelines and the EIANZ guidelines.

NZTA EIA guideline	EIANZ guidelines & application throughout the report
Contextual information about distribution and abundance of a species population is fundamental in determining value in the EcIA when using the NZTCS. For example, a species that is common locally may be declining nationally or mainland populations may be rare while large numbers are present on offshore islands.	Considered as part of the diversity and pattern and rarity/distinctiveness matter/criteria of the EIANZ guideline.
A species' value from a local, regional and national context should be established.	Considered as part of the rarity/distinctiveness matter/criteria of the EIANZ guideline.
Understanding the reason for a species' threat status (that is, the qualifiers) under the NZTCS is important in assessing its value in the local context.	Considered as part of the rarity/distinctiveness matter/criteria of the EIANZ guideline. Additional information to explain the threat classification of some species is also provided in the relevant sections.
DOC and some regional councils are starting to develop lists of regionally threatened species and some regional and district plans already refer to these in the ecological significance criteria.	
Species (both exotic and native) may be important for non-ecological reasons and should be considered in the relevant assessment rather than in the EcIA, for example gamebirds and recreational/social assessments.	Not applicable, as non some species was identified within the ZOI.

A2: Ecological Impact Assessment guidelines - Environmental Institute of Australia and New Zealand (EIANZ)

The ecological assessments undertaken for the Papakura to Bombay Notices of Requirement generally follow Ecological Impact Assessment guidelines for use in New Zealand (**EcIAG**) published by EIANZ[33] (Roper-Lindsay *et al.* 2018[34]). The EcIAGs provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent and consistent. The EcIAG framework is generally used in impact assessments in New Zealand as good practice.

The EcIAGs provide a three-step process for undertaking terrestrial assessments as follows:

Step 1: Assess the **value** of the area, taking into consideration species (Table 0-3 and Table 0-4) and other attributes of importance for vegetation or habitats to assign an overall ecological value (Table 0-5)

Step 2: Determine the **magnitude** of effect (Table 0-6). This step also includes consideration of the timescale and permanence of the effect, whereby temporary (< 25 years) and long-term (substantial improvement after 25 years) effects are distinguished from permanent (beyond the span of a human generation) effects.

Step 3: Evaluate the overall severity or **level of effect** using a matrix (
Table 0-7) of the ecological value and magnitude of effect.

That analysis then leads to an effects management regime comparable to the level of adverse ecological effect using the mitigation hierarchy to end with an overall outcome for ecological values that demonstrably results in no greater than minor, or preferably, a net improvement (Net Environmental Gain).

[33] Environmental Institute of Australia and New Zealand
[34] Roper-Lindsay, J.; Fuller, SA.; Hooson, S.; Sanders, MD.; Ussher, GT. 2018. Ecological Impact Assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

Fauna considered in this report include all those that are protected by the Wildlife Act (1953), including lizards, birds and long-tailed bats. Particular consideration was given where species with a conservation status of nationally 'At Risk' or higher have the potential to be present.

Table 0-3: Factors to be considered in assigning value to species (Roper-Lindsay et al. 2018)

Determining factors	Value
Nationally threatened species, found in the ZOI either permanently or seasonally	Very High
Species listed as 'At Risk' – declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of 'At Risk' found in the ZOI (Zone of Interest) either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

Table 0-4: Attributes to be considered when assigning ecological value or importance to a site or area of vegetation / habitat / community (as per Table 4 of Roper-Lindsay et al. 2018).

Matters	Attributes to be considered
Representativeness	*Criteria for representative vegetation:* • Typical structure and composition; • Indigenous species dominate; and • Expected species and tiers are present. *Criteria for representative vegetation:* • Species assemblages that are typical of the habitat; and • Indigenous species that occur in most of the guilds expected for the habitat type.
Rarity/ distinctiveness	*Criteria for rare/distinctive vegetation and habitats:* • Naturally uncommon or induced scarcity; • Amount of habitat or vegetation remaining; • Distinctive ecological features; and • National Priority for Protection. *Criteria for rare/distinctive species of species assemblages:* • Habitat supporting nationally threatened or At-Risk species, or locally uncommon species; • Regional or national distribution limits of species or communities; • Unusual species or assemblages; and • Endemism.
Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity; • Biogeographical considerations- pattern, complexity; and • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation.
Ecological context	• Site history and local environment conditions which have influenced the development of habitats and communities; • The essential characteristics that determine an ecosystems integrity, form, functioning and resilience (from 'intrinsic value' as defined in RMA); • Size, shape and buffering; • Condition and sensitivity to change; • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material; and • Species role in ecosystem functioning - high level, key species identification, habitat as proxy.

Table 0-5: Assigning ecological value (Roper-Lindsay et al. 2018)

Value	Description
Very High	Area rates High for three or all of the four assessment matters. Likely to be nationally important and recognised as such.
High	Area rates High for two of the assessment matters. Moderate and Low for the remainder, or Area rates High for one of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter. Moderate and Low for the remainder, or area rates Moderate for two or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for three matters and Moderate, Low or Very Low for remainder.

Table 0-6: Criteria matrix for describing magnitude of effects (Roper-Lindsay et al. 2018)

Magnitude	Description
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element / feature.
High	Major loss or major alteration to key elements/ features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element / feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element / feature.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances/patterns; AND/OR Having a minor effect on the known population or range of the element / feature.
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the “no change” situation; AND/OR Having a negligible effect on the known population or range of the element / feature.

Table 0-7: Criteria matrix for describing level of effects (Roper-Lindsay et al. 2018)

Ecological Value → Magnitude ↓	Very High	High	Moderate	Low	Negligible
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

A3: Ecological Impact Assessment guidelines – NZTA NZ Transport Agency

The relevance of specific EcIA components to the environmental screen (ES), preliminary technical assessment (PTA) and detailed EcIA (as mentioned in Section 3.1.2) are indicated in the table below, as extracted from NZTA's ecological impact assessment guidelines. The following text provides more detail on these components. The ecologist should be familiar with these considerations early in the project, however, the level of effort can be adjusted depending on the business case stage and/or complexity of project.

Table 0-8: Relevance of specific EcIA components to the environmental screen (ES), preliminary technical assessment (PTA) and detailed EcIA.

EcIA component	Environmental screen	Preliminary technical assessment	Detailed EcIA
Scoping	Yes	Yes. ES helps inform scope	Yes. Scoping is usually iterative with previous assessments informing the next
Desktop studies	Yes. Key method for assessment at this stage	Yes	Potentially. Further information may come from consultation that had not been done in early stages
Site investigations/ surveys	Possibly – there may be site walk over surveys but mostly will be reliant in desktop information	Site walk over. Possibly more detailed investigations should there be a reasonable chance of vegetation, ecosystem or species and/or their habitat with moderate or greater value	Yes
Detailed site investigations	Unlikely but potentially for high-risk projects	Possibly – for high-risk projects	Yes, but not always for low-risk projects
Valuing ecological features	Yes – limited to ecological features gained in desktop	Yes – desktop	Yes – detailed
Assessing ecological effects	Yes – high level	Yes – high-moderate level	Yes – detailed
Effects management	Yes. Greater opportunity to flag high biodiversity values to avoid	Yes. Greater opportunity to flag high biodiversity values to avoid	Yes – detailed

Scoping

Scoping is the process that sets out the extent of the EcIA, ensuring it includes details of the scale and significance of the effects the project may have on ecological features. It determines the ecological issues to be addressed, the methods and resources to be used, and establishes the study area and timeframes for surveys and assessments.

- Scoping is part of an iterative process, with information gathered in one project phase used to inform the requirements for assessment of the next.
- Scoping should begin as early as possible to ensure there is sufficient time to adequately inform the EcIA process. The ecologist needs to use their knowledge and experience to judge the resources required to complete an adequate and effective EcIA.
- For NZTA projects, the ES is used early in project development to provide a coarse indication of ecological risks and opportunities (section 4.1). This informs the scope of any PTA required, and the PTA provides the scope for the detailed EcIA.
- Ecological information may be available from the benefits selection process that could help inform the EcIA scope (section 1.4.1). The ecologist needs to confirm with the NZTA project manager whether biodiversity measures have been selected for the project for benefits management and if they have been, be provided with relevant information.
- Early engagement with partners and stakeholders can assist with the scoping process (2.4).
- Knowledge gaps needing to be addressed and fieldwork requirements (including methods, timescales and seasonal considerations) should be scoped as early as possible to factor in potential programme constraints (D3).
- The ecologist (often in consultation with the consents planner) should address any national and regional biodiversity guidance or policy documents where relevant (for example National priorities for protection of indigenous biodiversity on private land).

Desktop studies

The initial step to describe the existing/baseline environment is undertaking a desktop investigation. Refer to EIANZ (2018) for a list of resources/databases, which are also inline with the resources/databases provided in Section 3.2.1.

Site investigations/surveys

- Initial site investigations are usually walkover surveys, which are most useful for characterising ecological features in general and identifying whether more detailed survey effort is required.
- Initial investigations should be designed to support future survey and monitoring efforts, for example data may inform the following: presence (or likely absence) of an ecological feature, effect of the project on an ecological feature, and/or success of effects management package.
- Spatial and temporal limits of surveys need to be established. This will help provide an ecological baseline for accurate prediction of the effects of the project, feed into effects management, and present a clear rationale for the work involved.
- The ecologist should note any challenges and constraints to designing the survey, for example ‘No suitable control site’, and document as far as possible how these challenges have been addressed.
- A biostatistician may be useful to advise on the sampling effort needed to address the objectives of the survey programme and address challenge around species-level analysis, which can be difficult.
- The ecologist is to inform the project team as early as possible when:

- a particular species requires repeat surveys at different times of the year to understand seasonal changes/how they are using the landscape, such as coastal waders
- more than one year of data is needed to gain a higher degree of confidence in the accuracy of the baseline or to understand the seasonal/inter-annual variability in the data.

- Site visits should be timed for the best chance of detecting species present. Influencing factors can include the season, time of day, moon phase, tide, precipitation, and temperature.
- Site investigations need to consider programme planning factors.
- Where it is likely that offset/compensation is required, then surveys to identify and value potential receiving sites should be included the scope of site investigations. In addition, further assistance from the project team may be required in regard to offset planning logistics, such as private landowner negotiations.
- The scope of surveys should incorporate appropriate survey methods to support different types and timing of statutory applications (resource consent (regional plan matters) and/or NOR (district plan matters), including WAA applications) while at the same time providing enough information to guide design decisions and future consenting 'red flags'.

Further investigations, which might take the form of a 'ground-truthing' exercise, may be necessary to check the data and baseline are still accurate. This can happen in the event that there is a lengthy delay (years) between when ecological investigations are carried out and when the project actually commences.

Valuing ecological features

While EIANZ provides a set of criteria to determine the value of ecological features, the ecologist needs to also assess them against criteria from the relevant regional or district plan. The ecologist needs to be transparent with their assessment of value and use of criteria. Should the value rating be different between the EIANZ guidance and statutory direction, the highest value rating is to be used in the EcIA to direct effects management. This will provide more certainty that appropriate/ sufficient effects management will be implemented and greater change it will result in no net loss and ideally net gain.

Refer to Sections 3.2.2.2 and 3.2.2.3, which details aspects to consider when assigning ecological values to areas and species.

Assessing ecological effects

Assessing effects on ecological features occurs through various phases of a NZTA project. The coarser level of assessment from the initial phase is built upon and refined in the next phase. When using EIANZ to determine the level of effect, considerations with the EIANZ guidelines are to be applied.

Effects must be assessed in the context of the predicted ecological baseline conditions within the ZOI throughout the lifetime of the project.

Further considerations include:

- The ecologist should be aware of road edge-effects on ecosystems research (i.e. Simcock *et al.* 2022[35]).
- The timeframe of expected ecological effects may overlap and happen at different rates after construction begins.
- Ecologists should assess the project effects at several spatial and temporal scales and then identify which ones they prefer and why. This ensures transparency for decision makers who can then clearly see what the consequences of the ecologist's spatial/temporal decisions are.
- Liaise with other technical disciplines to fully understand what the biophysical changes are and how they could affect ecological features, for example changes in hydrology or lighting change.
- Effects must be assessed and presented separately for the construction and operation/maintenance phases of a project.
- There is often a time lag between when the construction occurs and when its full ecological effects are detectable. This needs to be considered in survey and monitoring programmes.
- Consider the effects of road development and climatic change. Some ecological communities, for example, will not be able to shift or adapt due to barriers caused by roads (for example marsh communities).
- There may be cumulative effects. Cumulative effects can be different in nature, larger in magnitude, greater in significance, longer lasting and/or greater in extent than any individual effect.
- Should potential cumulative effects of a project be considered significant the ecologist should flag this to the consents planner. An example of this might be the cumulative effects of habitat removal by several projects within a local area that adds up to a larger effect than the individual project effects.

[35] Simcock, R., Innes, J., Samarasinghe, O., Lambie, S., Peterson, P., Glen, A., & Faville, N. (2022). Road edge-effects on ecosystems: A review of international and New Zealand literature, an assessment method for New Zealand roads, and recommended actions (Waka Kotahi NZ Transport Agency research report 692)

APPENDIX B – REGIONAL AND DISTRICT CONSENTING MATTERS

Table 0-9: Ecological features associated with Regional and District Plan matters. Ticks (✓) indicate provisions associated with this report. Crosses (X) indicate provisions excluded from assessment in this report.

Ecological feature	Activity	Ecological Effect	AUP: District Plan provisions	AUP 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
	Construction activities (Noise, light, dust etc.)	Disturbance and displacement of individuals (existing)	✓		X

Ecological feature	Activity	Ecological Effect	AUP: District Plan provisions	AUP Regional Plan provisions	Wildlife Act (1953)
	Reclamation/culverting/other structures e.g., bank armouring	Permanent loss/modification of habitat/ecosystem		X	
Freshwater habitat – wetland or stream (including riparian margins)	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
	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

Ecological feature	Activity	Ecological Effect	AUP: District Plan provisions	AUP Regional Plan provisions	Wildlife Act (1953)
	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 C – BIRD DESKTOP STUDY RESULTS

Table 0-10: Native avifauna identified during the desktop study, with corresponding conservation status (Robertson et al., 2021).

Common name	Scientific name	Threat classification (Robertson *et al.*, 2021)	Observation source	Potentially present	Habitat description
kōtuku / white heron	*Ardea modesta*	Threatened - Nationally Critical	New Zealand Bird Atlas		Coastal (non-breeding season)
Caspian tern	*Hydroprogne caspia*	Threatened - Nationally Vulnerable	New Zealand Bird Atlas		Coastal
pārera / grey duck	*Anas superciliosa*	Threatened - Nationally Vulnerable	New Zealand Bird Atlas	✓	Ponds
New Zealand dabchick	*Poliocephalus rufopectus*	Threatened - Nationally Increasing	New Zealand Bird Atlas	✓	Ponds
wrybill	*Anarhynchus frontalis*	Threatened - Nationally Increasing	New Zealand Bird Atlas		Coastal
banded rail	*Gallirallus philippensis assimilis*	At Risk - Declining	New Zealand Bird Atlas		Coastal
eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk - Declining	New Zealand Bird Atlas		Coastal
lesser knot	*Calidris canutus rogersi*	At Risk - Declining	New Zealand Bird Atlas		Coastal
New Zealand pipit	*Anthus novaeseelandiae novaeseelandiae*	At Risk - Declining	New Zealand Bird Atlas	✓	Pasture
red-billed gull	*Larus novaehollandiae scopulinus*	At Risk - Declining	New Zealand Bird Atlas		Coastal
South Island pied oystercatcher	*Haematopus finschi*	At Risk - Declining	New Zealand Bird Atlas		Coastal
spotless crake	*Porzana tabuensis tabuensis*	At Risk - Declining	New Zealand Bird Atlas	✓	Wetland
white-fronted tern	*Sterna striata striata*	At Risk - Declining	New Zealand Bird Atlas		Coastal
black shag	*Phalacrocorax carbo novaehollandiae*	At Risk - Relict	New Zealand Bird Atlas		Coastal
little black shag	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	New Zealand Bird Atlas		Coastal and freshwater
royal spoonbill	*Platalea regia*	At Risk - Naturally Uncommon	New Zealand Bird Atlas		Coastal
New Zealand falcon / Kārearea	*Falco novaeseelandiae*	At Risk - Recovering	New Zealand Bird Atlas		Forest
kākā / North Island kākā	*Nestor meridionalis septentrionalis*	At Risk - Recovering	New Zealand Bird Atlas, iNaturalist		Forest
variable oystercatcher	*Haematopus unicolor*	At Risk - Recovering	New Zealand Bird Atlas		Coastal
Australasian shoveler	*Anas rhynchotis*	Not Threatened	New Zealand Bird Atlas		Ponds and Wetlands
black swan	*Cygnus atratus*	Not Threatened	New Zealand Bird Atlas		Ponds
grey teal	*Anas gracilis*	Not Threatened	New Zealand Bird Atlas	✓	Ponds
kāhu / Australasian harrier	*Circus approximans*	Not Threatened	New Zealand Bird Atlas, iNaturalist	✓	Farmland/ Wetlands/ Coastal

Common name	Scientific name	Threat classification (Robertson *et al.*, 2021)	Observation source	Potentially present	Habitat description
karoro / southern black-backed gull	*Larus dominicanus dominicanus*	Not Threatened	New Zealand Bird Atlas		Coastal
kererū / New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist	✓	Forest
kōtare / New Zealand kingfisher	*Todiramphus sanctus vagans*	Not Threatened	New Zealand Bird Atlas	✓	Forest/ Urban/ Farmland
North Island fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	New Zealand Bird Atlas	✓	Forest
pīpīwharauroa / shining cuckoo	*Chrysococcyx lucidus lucidus*	Not Threatened	New Zealand Bird Atlas	✓	Forest
poaka / pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened	New Zealand Bird Atlas	✓	Coastal
pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	New Zealand Bird Atlas	✓	Farmland / wetland
pūtangitangi / paradise shelduck	*Tadorna variegata*	Not Threatened	New Zealand Bird Atlas	✓	Farmland / ponds
riroriro / grey warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas, iNaturalist	✓	Forest / urban / farmland
ruru / morepork	*Ninox novaeseelandiae novaeseelandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist	✓	Forest / urban / farmland
spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	New Zealand Bird Atlas	✓	Urban / farmland
tauhou / silvereye	*Zosterops lateralis lateralis*	Not Threatened	New Zealand Bird Atlas	✓	Forest / urban / farmland
tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist	✓	Forest / urban / farmland
welcome swallow	*Hirundo neoxena neoxena*	Not Threatened	New Zealand Bird Atlas	✓	Urban / farmland
white-faced heron	*Egretta novaehollandiae*	Not Threatened	New Zealand Bird Atlas	✓	Urban / farmland / coastal
little egret	*Egretta garzetta immaculata*	Non-resident Native - Vagrant	New Zealand Bird Atlas		Farmland / coastal
little pied shag	*Phalacrocorax melanoleucos melanoleucos*	Non-resident Native - Vagrant	New Zealand Bird Atlas		Coastal and freshwater

Table 0-11: Habitat assessment for threatened or at-risk bird species. Table 0-11

Common name	Threat classification (Robertson *et al.*, 2021)	Potential habitat
kōtuku / white heron	Threatened - Nationally Critical	Kōtuku occasionally visit freshwater wetlands (Adams, 2013), however they are rare visitors to the Manukau Harbour and highly unlikely to utilise the wetlands within the project area due to their small size. Consequently, they have not been considered further.
pārera / grey duck	Threatened - Nationally Vulnerable	Individuals of this species within urban environments are almost always hybrids with introduced mallard ducks (*Anas superciliosa*), which are not a threatened species (Williams, 2013). However, several reports of grey ducks have been reported north of the project, near Karaka by well-known birders. Pārera are unlikely to be present within the project area but have been precautionarily included.
New Zealand dabchick	Threatened - Nationally Increasing	Dabchick generally requires areas of open water with wetland habitats on the periphery (Szabo, 2022). However, they can also occur on farmland ponds, with sightings in nearby Papakura. This habitat is not considered to be present within the ZOI of the Project and consequently dabchick have not been considered further.
New Zealand pipit	At Risk - Declining	Pipit often are present within rural areas. It is possible therefore that they are present within the ZOI of NoR 2 & 4 (sections 1-4), 3 & 4, and 5.
red-billed gull	At Risk - Declining	Red-billed gull are highly mobile and do occasionally spend time foraging in more urbanised areas, either for food scraps, or in large open areas such as sports pitches (Mills, 2013). They may be sporadically present within any NoR but are highly mobile and disturbance tolerant and consequently are not assessed further.
spotless crake	At Risk - Declining	Spotless crakes occur and breed in freshwater wetland dominated by dense emergent vegetation (particularly raupō) throughout the North Island (Fitzgerald, 2013). It is possible they may utilise the wetlands/streams within NoR 3 & 4.
little black shag	At Risk - Naturally Uncommon	May frequent streams and wetlands for foraging, such as those in NoR 5
kākā / 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). At best they may use the project area as a movement corridor but due to a lack of foraging habitat are unlikely to utilise the project area for more.
pied shag	At Risk - Recovering	May frequent streams and wetlands for foraging, such as those in NoR 5

APPENDIX D – RAPID HABITAT ASSESSMENT SCORING SHEET

Table 0-12. Rapid habitat assessment scoring sheet

Habitat parameter	Condition category										SCORE
1. Deposited sediment	*The percentage of the stream bed covered by fine sediment.*										
	0	*5*	*10*	*15*	*20*	*30*	*40*	*50*	*60*	*≥ 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
2. Invertebrate habitat diversity	*The number of different substrate types such as boulders, cobbles, gravel, sand, wood, leaves, root mats, macrophytes, periphyton. Presence of interstitial space score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
3. Invertebrate habitat abundance	*The percentage of substrate favourable for EPT colonisation, for example flowing water over gravel-cobbles clear of filamentous algae/macrophytes.*										
	95	*75*	*70*	*60*	*50*	*40*	*30*	*25*	*15*	*5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
4. Fish cover diversity	*The number of different substrate types such as woody debris, root mats, undercut banks, overhanging/encroaching vegetation, macrophytes, boulders, cobbles. Presence of substrates providing spatial complexity score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
5. Fish cover abundance	*The percentage of fish cover available.*										
	95	*75*	*60*	*50*	*40*	*30*	*20*	*10*	*5*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
6. Hydraulic heterogeneity	*The number of of hydraulic components such as pool, riffle, fast run, slow run, rapid, cascade/waterfall, turbulance, backwater. Presence of deep pools score higher.*										
	≥ 5	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
7. Bank erosion	*The percentage of the stream bank recently/actively eroding due to scouring at the water line, slumping of the bank or stock pugging.*										
Left bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
Right bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
8. Bank vegetation	*The maturity, diversity and naturalness of bank vegetation.*										
Left bank AND Right bank	*Mature native trees with diverse and intact understorey*		*Regenerating native or flaxes/sedges/tussock > dense exotic*			*Mature shrubs, sparse tree cover > young exotic, long grass*			*Heavily grazed or mown grass > bare/impervious ground.*		
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
9. Riparian width	*The width (m) of the riparian buffer constrained by vegetation, fence or other structure(s).*										
Left bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
Right bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
10. Riparian shade	*The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).*										
	≥ 90	*80*	*70*	*60*	*50*	*40*	*25*	*15*	*10*	*≤ 5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
TOTAL	(Sum of parameters 1-10)										

APPENDIX E – SEA'S PRESENT WITHIN 2 KM OF THE PROJECT AREA

Table 0-13. SEAs located within 2 km of the Project area.

Significant Ecological Area	Distance from Project area (km)	Criteria met for classification as SEA*	NoR(s) within 2 km
SEA_T_1175	1.75	1, 2	NoR 5
SEA_T_1183	0.69	4	NoR 2 and 4 – Section 4
SEA_T_215	0.94	1, 2, 3	NoR 2 and 4 – Section 3
SEA_T_4363	1.9	1, 2	NoR 2 and 4 – Section 3
SEA_T_4364	1.88	1, 2	NoR 2 and 4 – Section 3
SEA_T_4366	1.5	1, 2	NoR 3
SEA_T_4367	1.5	1, 2	NoR 3 & 4
SEA_T_4368	1.5	1, 2	NoR 3
SEA_T_4370	1.9	1, 2	NoR 3
SEA_T_4371	1.9	1, 2	NoR 3
SEA_T_4372	1.9	1	NoR 3
SEA_T_4387	1.2	1	NoR 3
SEA_T_4388	1.5	1, 4	NoR 3
SEA_T_4389	1.9	1	NoR 3
SEA_T_4464	0.6	1	NoR 3
SEA_T_4500	1.4	2	NoR 2 and 4 – Section 3
SEA_T_4501	0.42	1, 2, 3	NoR 2 and 4 – Section 3
SEA_T_4505	0.78	1, 2, 3	NoR 2 and 4 – Section 4
SEA_T_4506	0.06	1	NoR 3
SEA_T_4508	1.4	1	NoR 3
SEA_T_4511	0.38	1, 2, 3	NoR 2 and 4 – Section 4
SEA_T_4512	0.49	2	NoR 2 and 4 – Section 4
SEA_T_4513	Within designation footprint	1, 2	NoR 2 and 4 – Section 4
SEA_T_4514	0.28	2	NoR 2 and 4 – Section 4
SEA_T_5280	Within designation footprint	1, 2	NoR 5
SEA_T_5295	0.95	1, 4	NoR 3
SEA_T_530	1.49	2, 4	NoR 2 and 4 – Section 1
SEA_T_530b	0.93	2	NoR 2 and 4 – Section 1
SEA_T_5332	1.2	1, 2, 4	NoR 2 and 4 – Section 4
SEA_T_5333	1.6	1, 2, 4	NoR 2 and 4 – Section 4

Significant Ecological Area	Distance from Project area (km)	Criteria met for classification as SEA*	NoR(s) within 2 km
SEA_T_5346	1.3	1, 2, 3, 4	NoR 2 and 4 – Section 3
SEA_T_5348	1.8	1, 2, 3, 4	NoR 2 and 4 – Section 3
SEA_T_5573	1.3	3, 4	NoR 2 and 4 – Section 4
SEA_T_78	0.3	1, 2	NoR 2 and 4 – Section 2
SEA_T_79	0.29	1, 2, 3	NoR 2 and 4 – Section 2
SEA_T_80	0.24	1, 2	NoR 2 and 4 – Section 2
SEA_T_81	0.67	1, 2	NoR 2 and 4 – Section 2
SEA_T_85	0.09	2, 4	NoR 3
SEA_T_86	0.13	1, 2	NoR 3
SEA-M1-29b	1.4 Upper reaches of Drury Creek	Within the upper tidal reaches of Drury Creek there are a variety of marshes, grading from mangroves through to extensive areas of jointed rush-dominated saltmarsh, to freshwater vegetation in response to salinity changes. Migration pathway between marine and freshwater habitats.	NoR 2 and 4 – Section 1
SEA-M2-29a	1.8 Drury Creeks and intertidal habitats	This area 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. Healthy areas of mangroves grow in the shelter of the Whangamaire Stream, and Drury and Whangapouri Creeks and in the southern half of the Whangapouri Creek are notable 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 for pied stilt	NoR 2 and 4 – Section 1

* Classification codes are as follows:
1 = Representativeness
2 = Threat status and rarity
3 = Diversity
4 = Stepping-stones, migration pathways and buffers
5 = Unique or distinctiveness

Full classification criteria are provided in Appendix F

APPENDIX F – TERRESTRIAL SEA CLASSIFICATION CRITERIA

Below are the four factors used when assessing if terrestrial vegetation meets the criteria for classification as an SEA. These criteria are from Schedule 3 of the AUP OP.
Factors:

1) REPRESENTATIVENESS
   Sub-factor:
   (a) It is an example of an indigenous ecosystem (including both mature and successional stages), that contributes to the inclusion of at least 10% of the natural extent[36] of each of Auckland's original ecosystem types[37] in each ecological district of Auckland (starting with the largest, most natural and intact, most geographically spread) and reflecting the environmental gradients of the region, and is characteristic or typical of the natural ecosystem diversity of the ecological district and/or Auckland.

2) THREAT STATUS AND RARITY
   Sub-factors:
   (a) It is an indigenous habitat, community or ecosystem that occurs naturally in Auckland and has been assessed (using the IUCN threat classification system) to be threatened, based on evidence and expert advice (including Holdaway *et al*. Status assessment of NZ naturally uncommon ecosystems[38]).
   (b) It is a habitat that supports occurrences of a plant, animal or fungi that has been assessed by the Department of Conservation and determined to have a national conservation status of threatened or at risk;
      i. or it is assessed as having a regional threatened conservation status including Regionally Critical, Endangered and Vulnerable and Serious and Gradual Decline.
   (c) It is indigenous vegetation that occurs in Land Environments New Zealand Category IV where less than 20% remains.
   (d) It is any indigenous vegetation or habitat of indigenous fauna that occurs within an indigenous wetland or dune ecosystem.
   (e) It is a habitat that supports an occurrence of a plant, animal or fungi that is locally rare; or
      it has been assessed by the Department of Conservation and determined to have a national conservation status of Naturally Uncommon, Range Restricted or Relict.

3) DIVERSITY
   Sub-factors:
   (a) It is any indigenous vegetation that extends across at least one environmental gradient resulting in a sequence that supports more than one indigenous habitat, community or ecosystem type e.g., an indigenous estuary to an indigenous freshwater wetland.
   (b) It supports the expected indigenous ecosystem diversity for the habitat(s).
   (c) It is an indigenous habitat type that supports a typical species richness or species assemblage for its type.

[36] "Natural extent" is intended to mean a combination of our understanding of the historic pre-human diversity, distribution and extent of ecosystems in Auckland and what we would expect this to be given past and current environmental drivers.
[37] The Department of Conservation's ecosystem classification system described over 135 ecosystems in New Zealand (Singers and Rogers in press). Of these 35 ecosystems are known to have occurred in Auckland and these are what is meant by original ecosystems. They include the more recent indigenous dominated shrub and scrublands that have evolved as a result of human modification of the landscape.
[38] Status Assessment of New Zealand's Naturally Uncommon Ecosystems, ROBERT J. HOLDAWAY, SUSAN K. WISER and PETER A. WILLIAMS. Conservation Biology. Volume 26, Issue 4, pages 619–629, August 2012

4) STEPPING-STONES, MIGRATION PATHWAYS AND BUFFERS

Sub-factors:

(a) It is an example of an indigenous ecosystem, or habitat of indigenous fauna that is used by any native species permanently or intermittently for an essential part of their life cycle (e.g., known to facilitate the movement of indigenous species across the landscape, haul-out site for marine mammals) and therefore makes an important contribution to the resilience and ecological integrity of surrounding areas.

(b) It is an example of an ecosystem, indigenous vegetation or habitat of indigenous fauna, that is immediately adjacent to, and provides protection for, indigenous biodiversity in an existing protected natural area (established for the purposes of biodiversity protection); or

   i. it is an area identified as significant under the 'threat status and rarity' or 'uniqueness' factor. This includes areas of vegetation (that may be native or exotic) that buffer a known significant site. It does not include buffers to the buffers.

c) It is part of a network of sites that cumulatively provide important habitat for indigenous fauna or when aggregated make an important contribution to the provision of a particular ecosystem in the landscape.

d) It is a site which makes an important contribution to the resilience and ecological integrity of surrounding areas.

5) UNIQUENESS OR DISTINCTIVENESS

Sub-factors:

(a) It is habitat for a plant, animal or fungi that is endemic to the Auckland region (i.e., not found anywhere else).

(b) It is an indigenous ecosystem that is endemic to the Auckland region or supports ecological assemblages, structural forms or unusual combinations of species that are endemic to the Auckland region.

(c) It is an indigenous ecosystem or a habitat that supports occurrences of a plant, animal or fungi that are near-endemic (i.e., where the only other occurrence(s) is within 100 km of the council boundary).

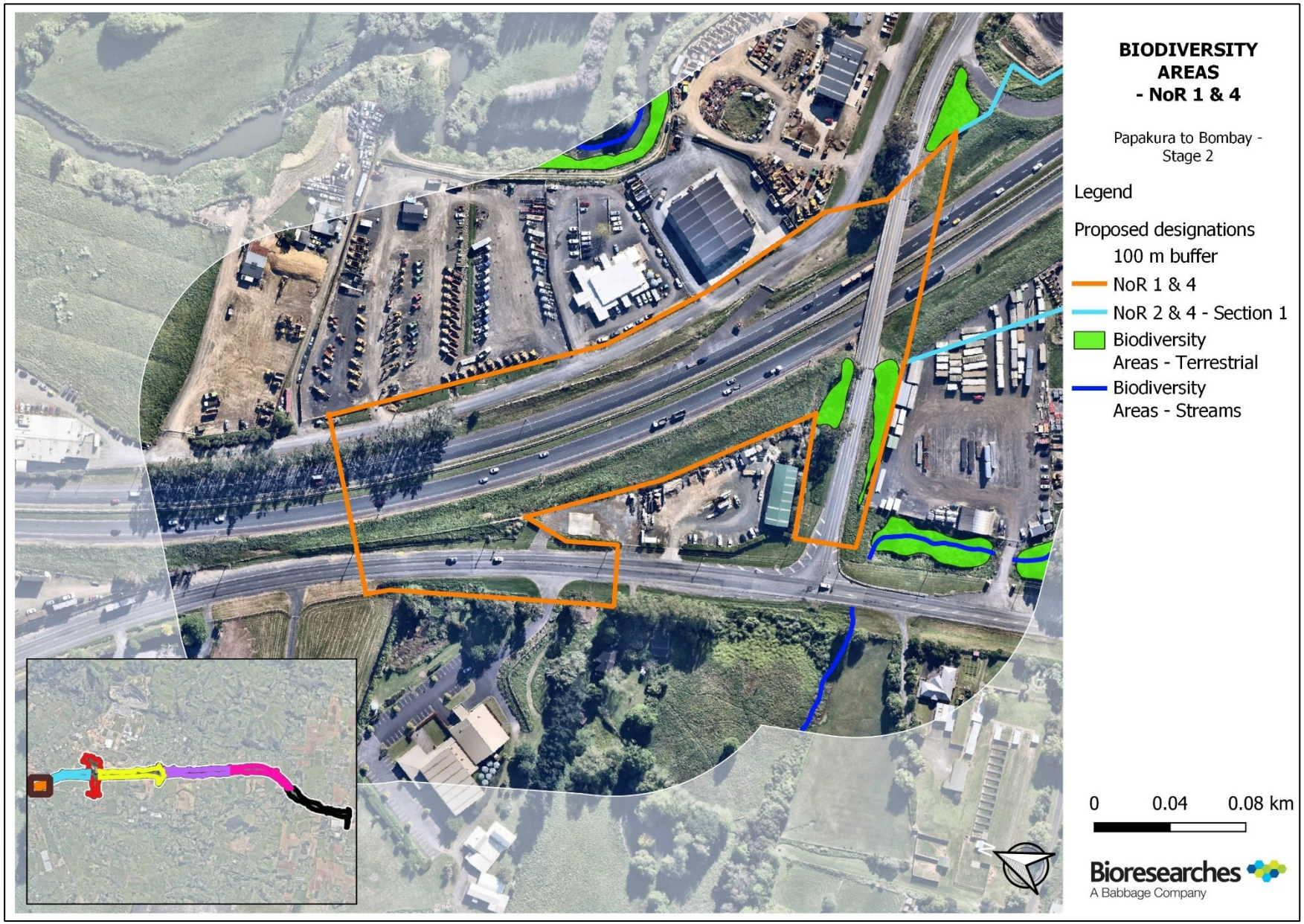
(d) It is a habitat that supports occurrences of a plant, animal or fungi that is the type locality for that taxon.

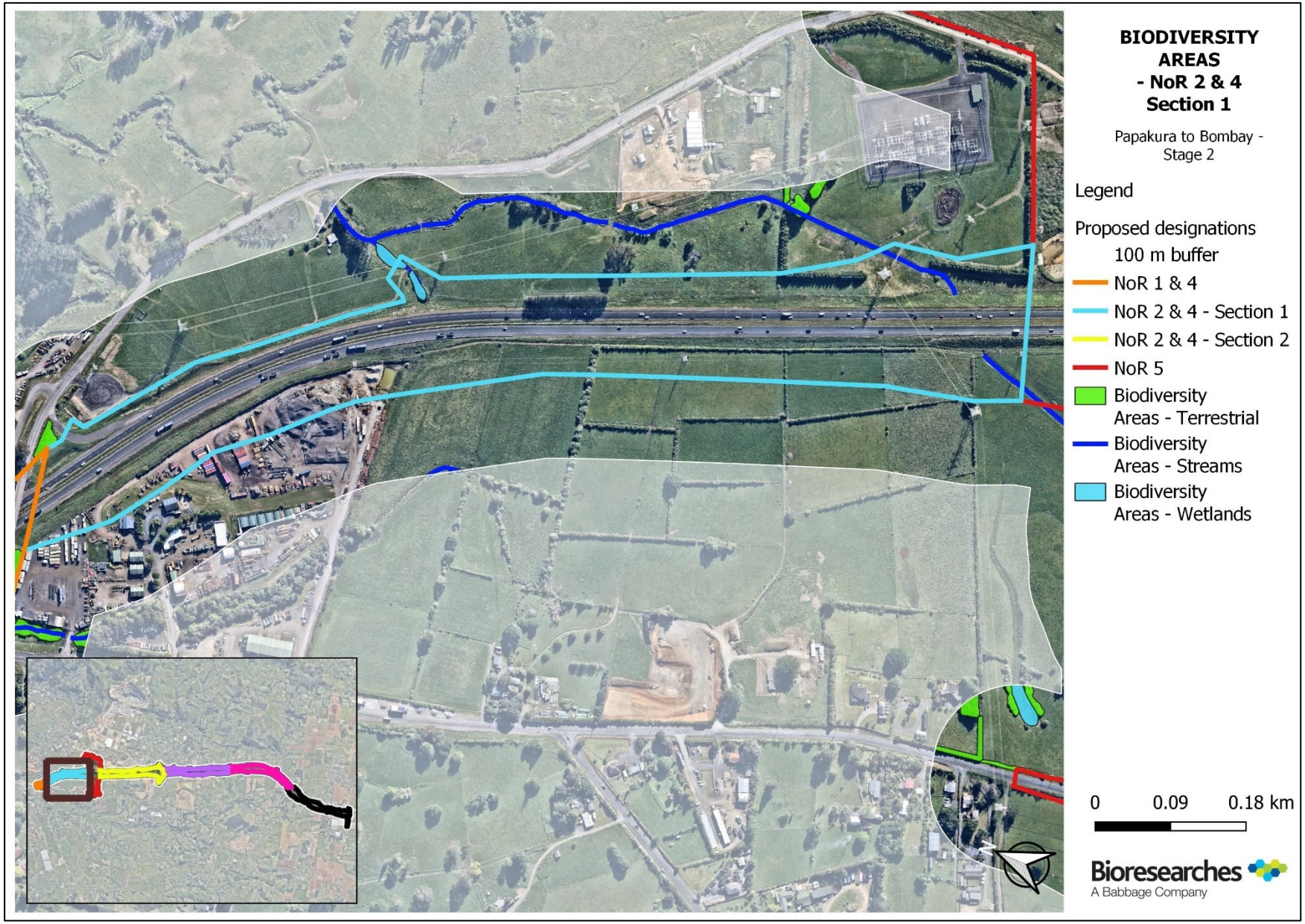
(e) It is important as an intact sequence or outstanding condition in the region.

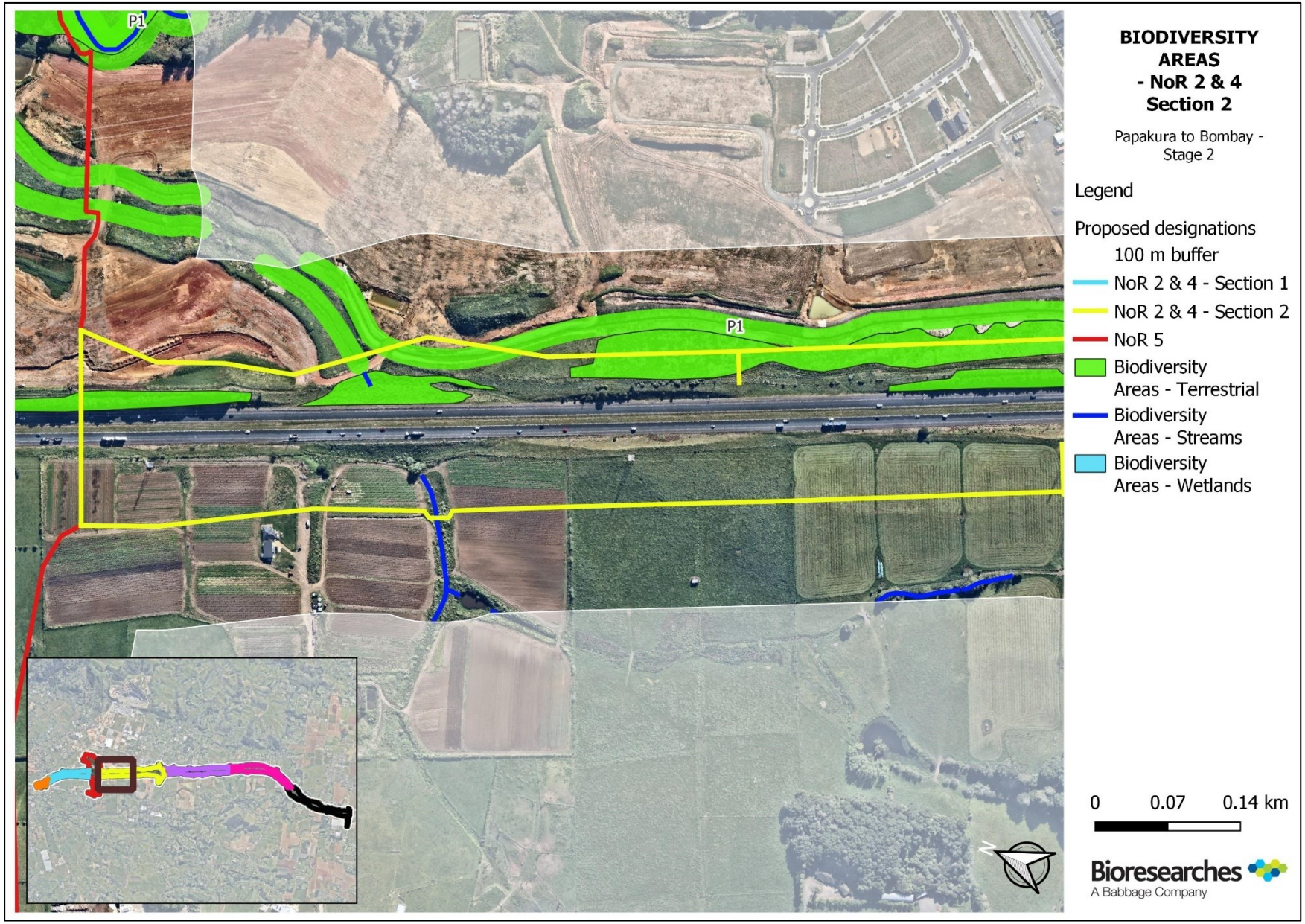
(f) It is a habitat that supports occurrences of a plant, animal or fungi that is the largest specimen or largest population of the indigenous species in Auckland or New Zealand.

(g) It is a habitat that supports occurrences of a plant, animal or fungi that are at (or near) their national distributional limit.

APPENDIX G – BIODIVERSITY AREAS




BIODIVERSITY AREAS
- NoR 2 & 4
Section 1
Papakura to Bombay - Stage 2
Legend
Proposed designations
100 m buffer
NoR 1 & 4
NoR 2 & 4 - Section 1
NoR 2 & 4 - Section 2
NoR 5
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.09
0.18 km
Bioresearches
A Babbage Company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P1
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Papakura to Bombay - Stage 2
Legend
Proposed designations
100 m buffer
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NoR 2 & 4 - Section 2
NoR 5
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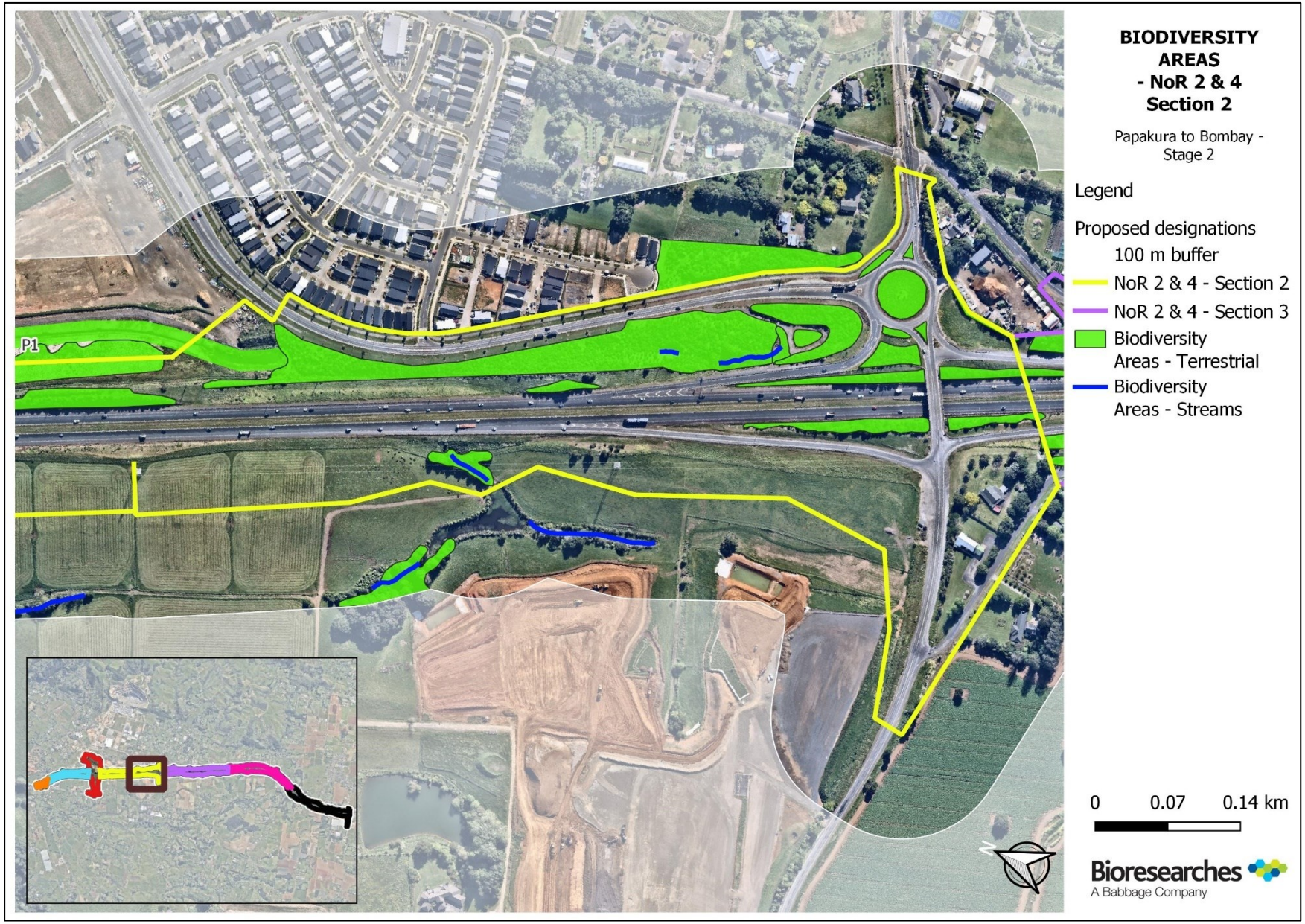
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.07
0.14 km
Bioresearches
A Babbage Company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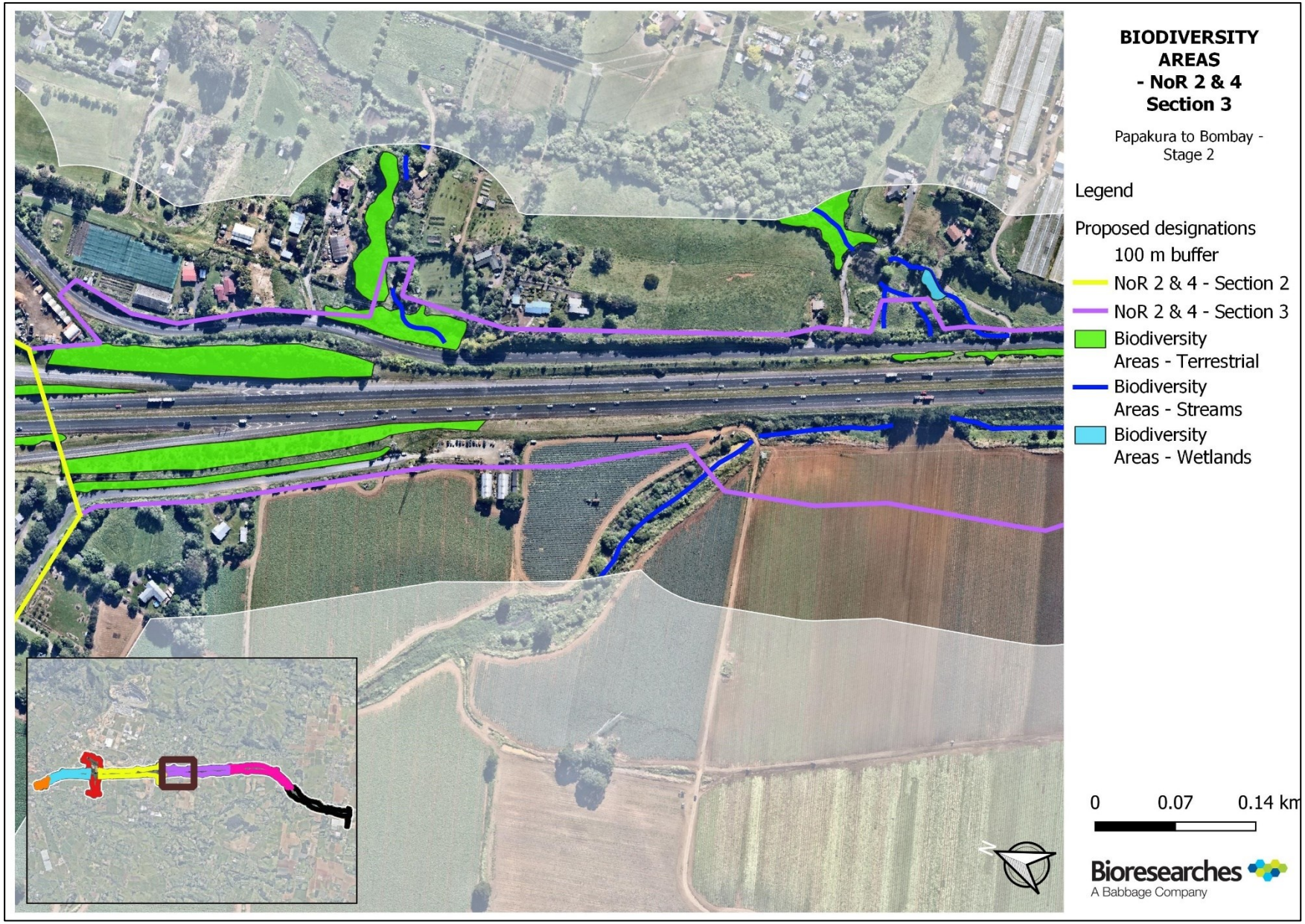
BIODIVERSITY AREAS
- NoR 2 & 4
Section 2
Papakura to Bombay - Stage 2
Legend
Proposed designations
100 m buffer
NoR 2 & 4 - Section 2
NoR 2 & 4 - Section 3
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
0
0.07
0.14 km
Bioresearches
A Babbage Company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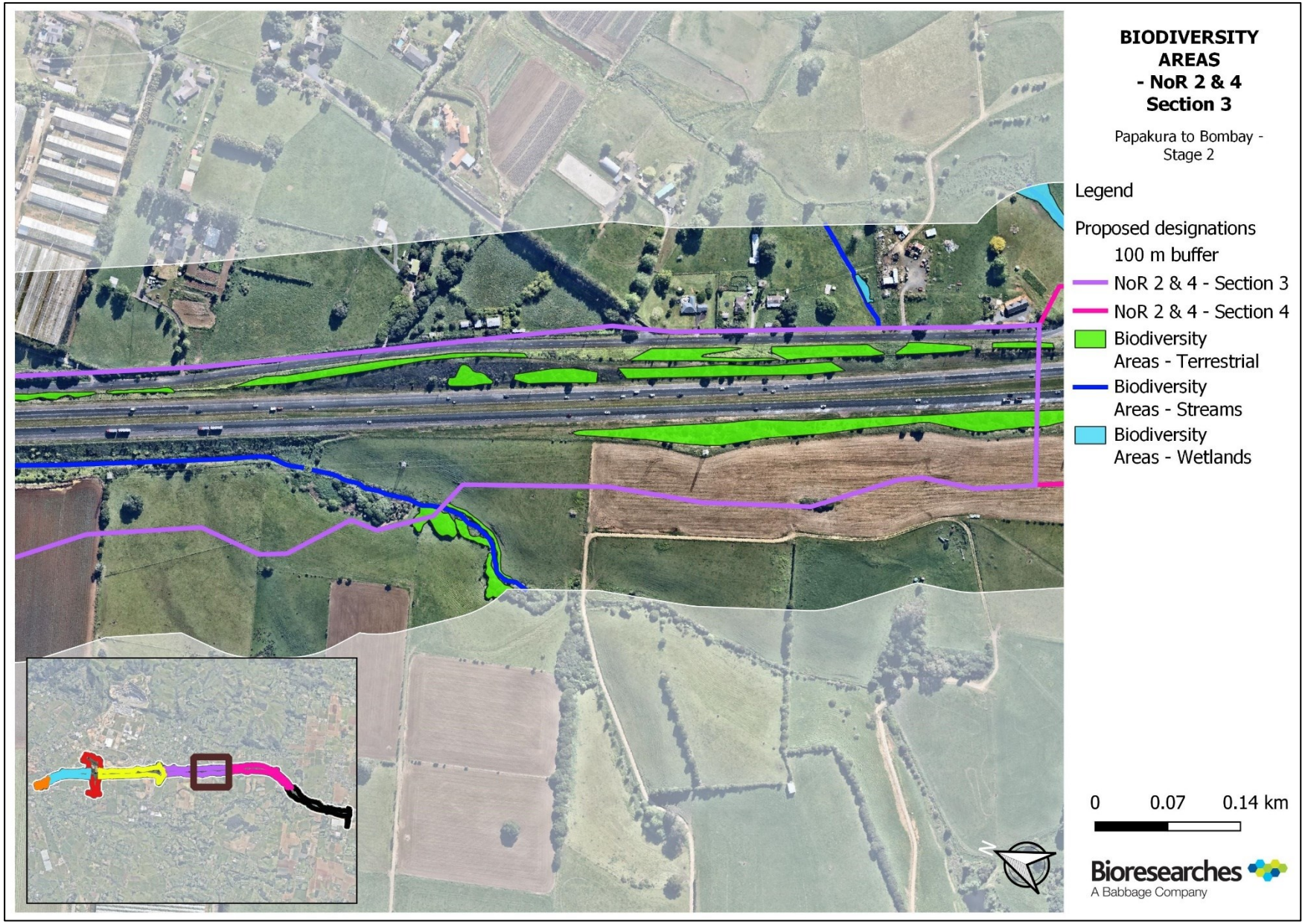
Papakura to Bombay - Stage 2
Legend
Proposed designations
100 m buffer
NoR 2 & 4 - Section 2
NoR 2 & 4 - Section 3
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.07
0.14 km
Bioresearches
A Babbage Company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Section 3
Papakura to Bombay - Stage 2
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NoR 2 & 4 - Section 4
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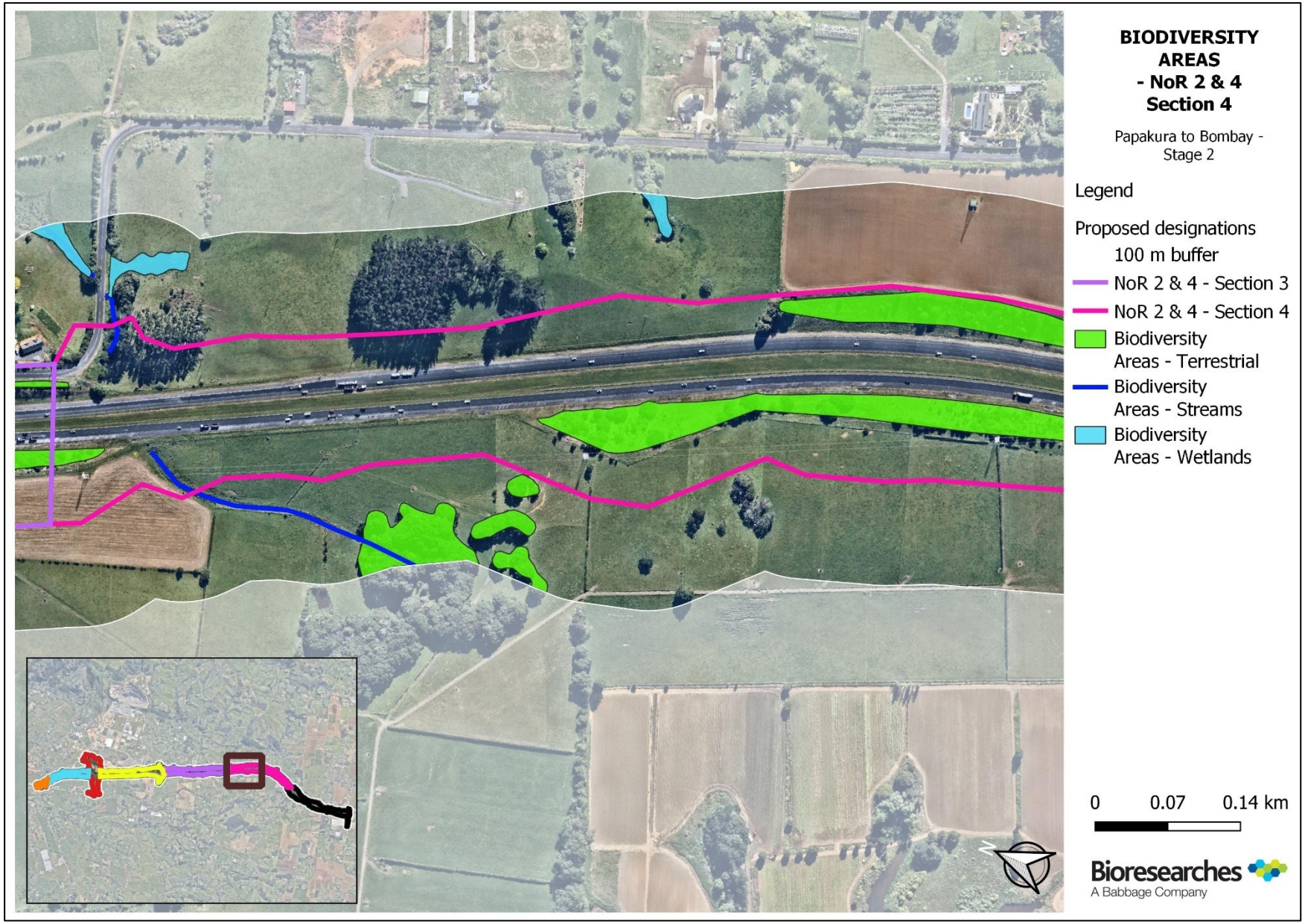
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.07
0.14 km
Bioresearches
A Babbage Company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Proposed designations
100 m buffer
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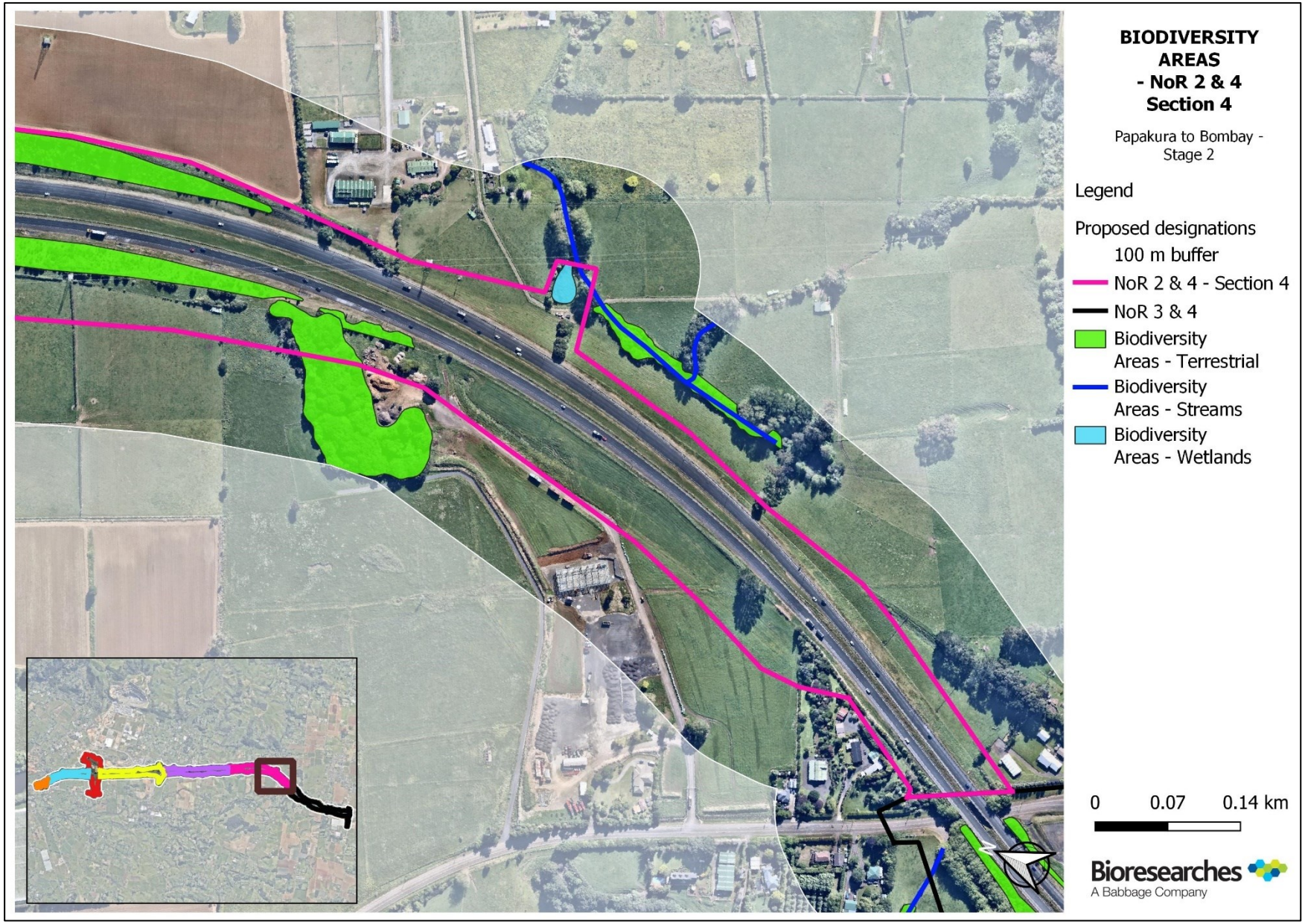
NoR 2 & 4 - Section 4
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.07
0.14 km
Bioresearches
A Babbage Company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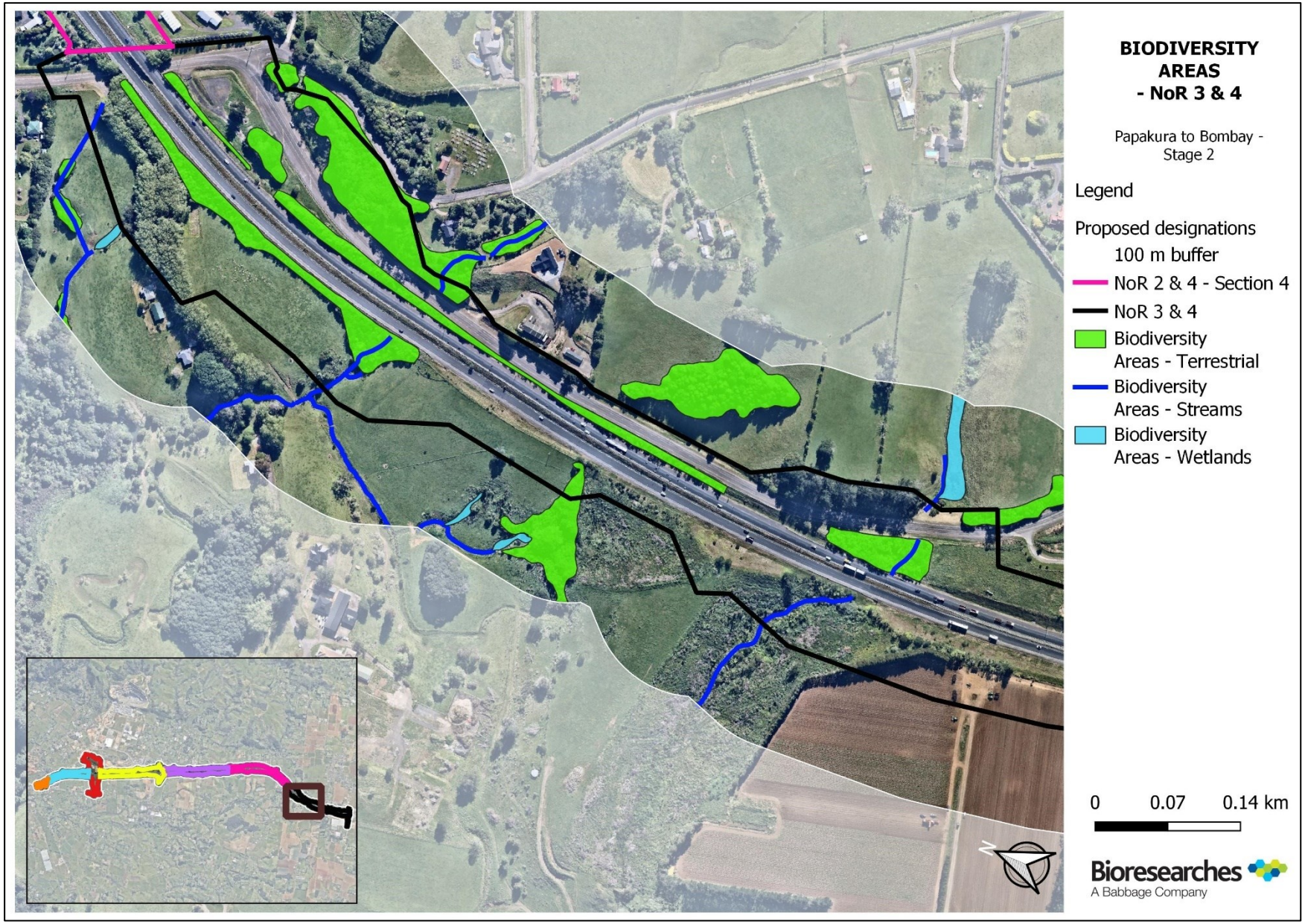
Papakura to Bombay - Stage 2
Legend
Proposed designations
100 m buffer
NoR 2 & 4 - Section 4
NoR 3 & 4
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.07
0.14 km
Bioresearches
A Babbage Company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Papakura to Bombay - Stage 2
Legend
Proposed designations
100 m buffer
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NoR 3 & 4
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
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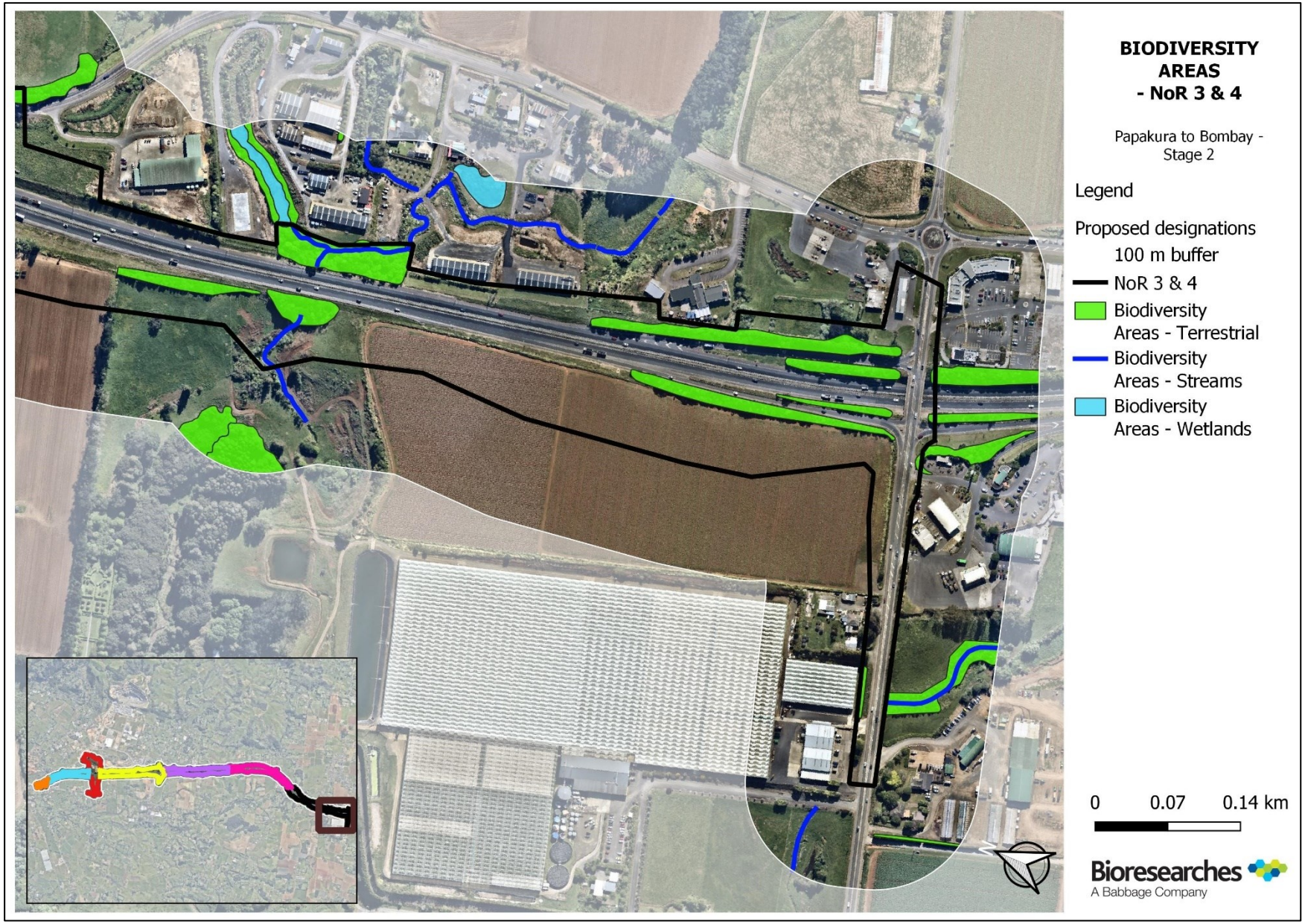
0.14 km
Bioresearches
A Babbage Company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Papakura to Bombay - Stage 2
Legend
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100 m buffer
NoR 3 & 4
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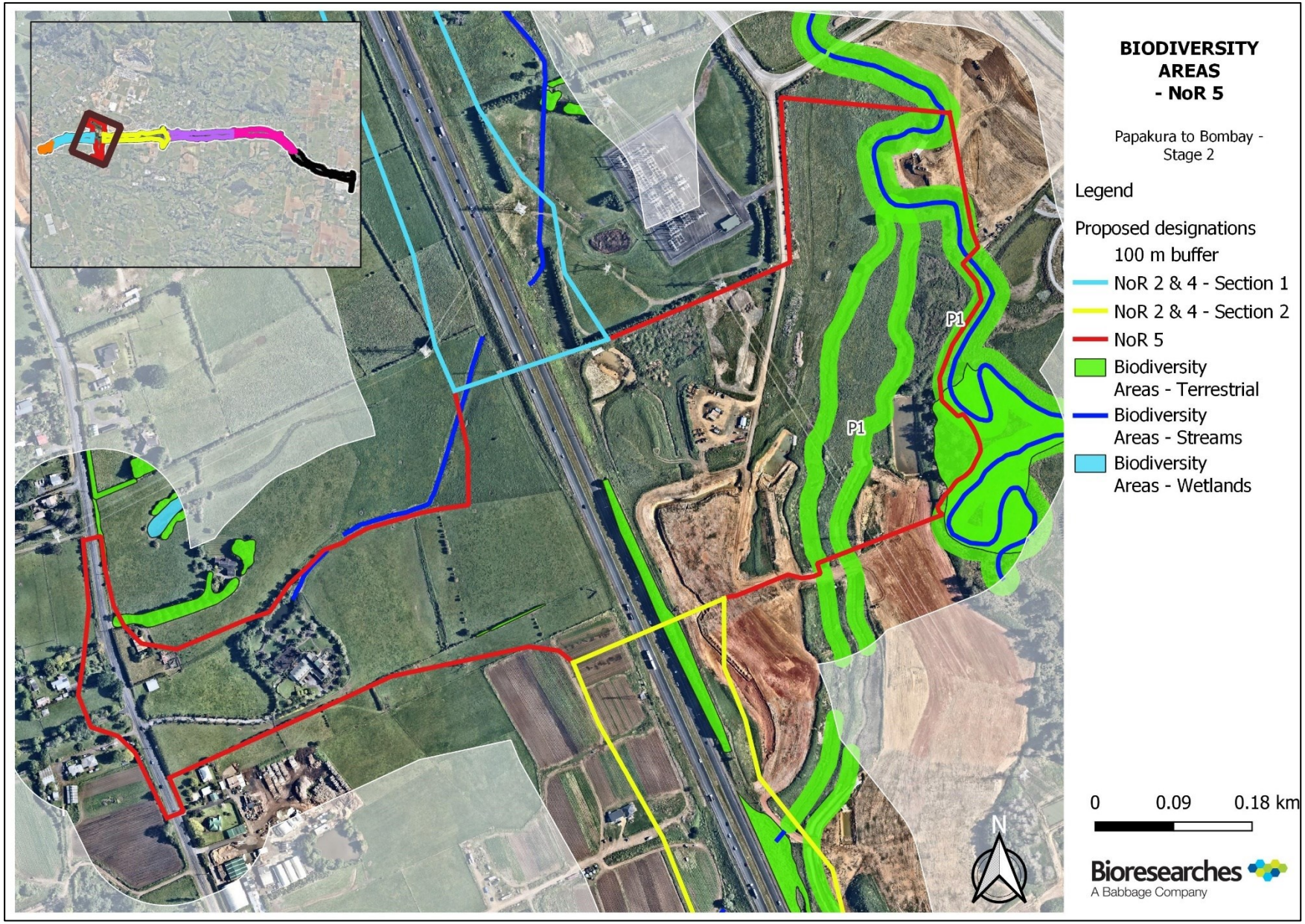
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
0
0.07
0.14 km
Bioresearches
A Babbage Company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Legend
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100 m buffer
NoR 2 & 4 - Section 1
NoR 2 & 4 - Section 2
NoR 5
Biodiversity Areas - Terrestrial
Biodiversity Areas - Streams
Biodiversity Areas - Wetlands
P1
P1
N
0
0.09
0.18 km
Bioresearches
A Babbage Company

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