5. LANDSCAPE OUTCOMES

5. LANDSCAPE OUTCOMES

DESIGN STATEMENT

The landscape form, ecology and land uses across the Moir Hill and Hīkauae Creek Sector encompasses the widest spectrum of contexts along the entire motorway alignment. High value streams in the north and south of this sector contrast with the monotype and less visually diverse forestry areas in the centre.

Landscape outcomes in this sector have been given careful consideration, and a number of elements have influenced the approach. The overall landscaping design has focused to deliver multiple outcomes to support ecology, restore existing land use patterns, and help connect landscapes by filling in gaps between existing features. The central part of this sector has few landscape features (other than steep hills), there is little native bush and the current landuse (forestry) is cyclic in nature. As a consequence, achievement of landscape outcomes in the centre of this sector may be less visible to motorway users and surrounding landowners.

The central sector includes steep hills and rock faces, which will become landscape features. Road users are likely to see very little of the roadside fill treatments on steeper slopes, or only be able to discern landscape planting at the top of rock cuts from a distance due to the height above the motorway. Landscape planting on steep hills and rock faces will be challenging for vegetation growth and for ongoing maintenance such as weed control. Both the planting challenges and lack of visibility has had some influence on the choice of hydro-seeded grass slopes over landscape or terrestrial ecology planting in these areas. Whilst the use of hydro-seed grass is less preferred in terms of the ULDF outcomes, other considered options are less preferable (such as re-instating exotic forest). Similarly any attempts to introduce landscape or mitigation planting is at risk of isolating road users from the landscape and creating insular pockets in an otherwise stitched together landscape of forestry production. The landscape strategy focusses attention on high value areas to enhance these landscapes treatments. In areas of lower value and where less viable, hydro-seeded grass will be used [ULDF Section 3.2].

The highway intersects a number of streams in this sector and uses culverts to maintain water flows. Large culverts at the Te Awa Hīkauae (southern end) and the Mahurangi River East Branch (northern end) and will have some impacts on terrestrial ecology species, however, where possible, planting and landscape treatments have been brought closer to the alignment to encourage avian species to bridge across the highway. All culverts provide for fish passage and utilise baffles and/or spat ropes to aid connectivity for aquatic species.

The southern and northern ends of this sector are excellent examples of where the terrestrial mitigation planting, stream mitigation planting and landscape planting are used in combination to stitch the landscape together with existing ecology. Planting compliments and merges with existing vegetation to create ecological links and stepping stones to reduce distances between suitable habitats as well as making larger contiguous patches. Users will travel though the landscape rather than merely along a motorway corridor [ULDF Section 5].

5.1 NATURAL FEATURES

The motorway is designed to have a low overall alignment, creating a road that better fits within the existing contours and local features. This sector is a productive landscape, consisting of pasture and pine plantation and characterised by the steep terrain [ULDF section 5.2].

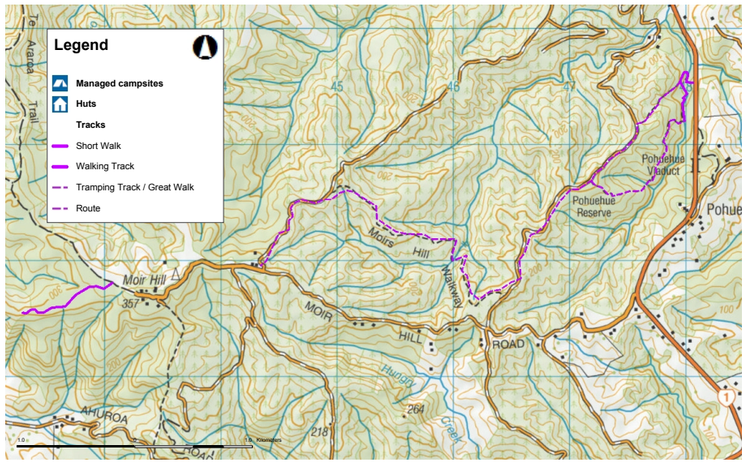
5.2 HUMAN LANDMARKS

Te Tapuwae o Kahumatamomoe will be the primary human landmark in this sector. The bridge has been designed to respond to the significance of its setting and to facilitate the design of the high level local road connection along the route of Kahumatamomoe. This bridge (section 5.4) symbolises the traditional route used by ancestors [ULDF section 5.1].

5.3 LOCAL CONNECTIVITY

The bridge connecting Moir Hill Road provides residents, businesses and visitors with continual connectivity on the local road network. There are three prominent tracks in this sector; Te Araroa, the Waterfall Track and Moirs Hill Walkway. Te Araroa is well separated and unaffected by the Project and the well-used ‘Waterfall Track’ which is largely unaffected by the alignment and will continue to be accessed from the existing SH1. The Moir Hill Walkway climbs through native bush and the track emerges onto a forestry road that connects with Moir Hill Road. This upper part of the forestry track will be severed by the new motorway.

The NZTA have completed consultation with the New Zealand Walking Access Commission and the Department of Conservation. The current walkway is severed by the motorway; and reinstatement includes a 1.8m wide footpath over the bridge and a connecting footpath on Moir Hill Road either side of the bridge [ULDF section 5.3]. The remaining sections will not be reinstated as the Department of Conservation has confirmed that reinstatement is not necessary [D70AB].



Moirs Hill Walkway Map[2]

5.4 LOCAL BRIDGES OVER THE MOTORWAY

Te Tapuwae o Kahumatamomoe is the only public bridge over the motorway for the entire alignment. It is located near the highest point in the route traversing the motorway approximately 20m above the motorway carriageway. The bridge will have an attractive appearance with a slender bridge deck, long span clean lines, refined details, simple structural junctions and an elegant arc on the underside.

The bridge has no piers and a long span which maximises openness and landscape views from the bridge over the route of Kahumatamomoe. The surrounding landscaping has been designed to complement the bridge to ‘stitch the landscape together’ at the same height, and below the bridge. The bridge will be prominent and visually consistent with the 'family of bridges' on the Project – specifically fitting with the visual language of the Okahu and Pūhoi bridges, using steel girders and a simple tectonic of just two parts – a floating deck with carefully considered edge barrier and a below-deck superstructure.

The bridges have been designed by a multi-disciplinary team with specialist bridge architects working alongside structural engineers, the construction team and urban and landscape designers to create an integrated outcome. Throughout, the ULDF requirements for an understated, refined and minimalist aesthetic, and an elegant appearance have been key drivers. The bridge follows the ridgeline to create an organic effect. The bridge arrangement, both horizontally and vertically, is a natural response to the underlying geographic conditions. The bridge vertical alignment, abutment heights and configuration are a natural and desirable outcome of the geometric drivers of the road. The slope, location, length and components of the bridge sit naturally within the wider landscape context, reinforcing the broader visual ridge line and side slopes.

The bridge geometry connects it to the broader topographic context and underlying geometric conditions. The road geometry has been developed to best fit the rolling ridge line, the horizontal approach and the departure angles of the road.

Te Tapuwae o Kahumatamomoe has adopted slender bridge decks for the span lengths adopted; in this way the bridges along the corridor are consistent and deck soffit lines are uniform. Edge barriers are consistent across the family of bridges, incorporating precast down-stands to provide clean lines on elevation and to hide services. Te Tapuwae o Kahumatamomoe will maintain the connectivity of Moir Hill Road for local road users, including pedestrians and cyclists.

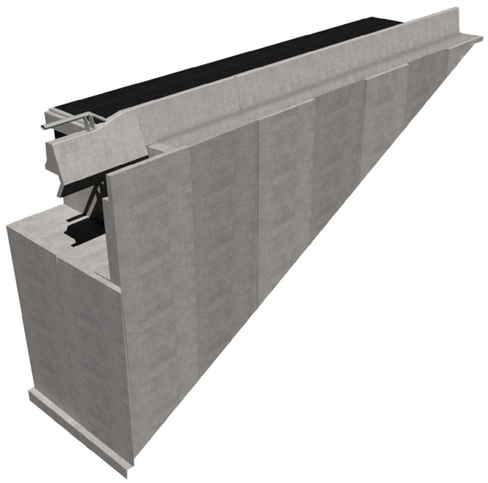
Te Tapuwae o Kahumatamomoe will be acknowledged using patterns on the inside of the bridge, which will be visible to Moir Hill Road users as they cross (refer to plans in section 7). Te Tapuwae o Kahumatamomoe marks the division between the Pūhoi and Mahurangi catchments and this will be acknowledged with patterns under the bridge structure [D36(a)].

The bridge is comprised of three basic elements. The first and primary component is a gently curved structure formed with steel sections. These are shaped to create the visual appearance of an arched structure which implies a wider and more dynamic span and suggestive of spanning over a cut in the land. This gently curved form gives a greater sense of space and length than a simple straight structure.

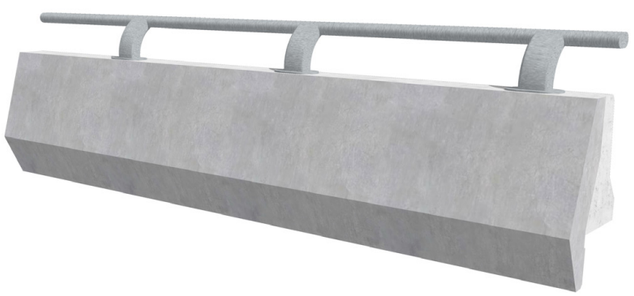
[1] nztramper.com [2] Department of Conservation

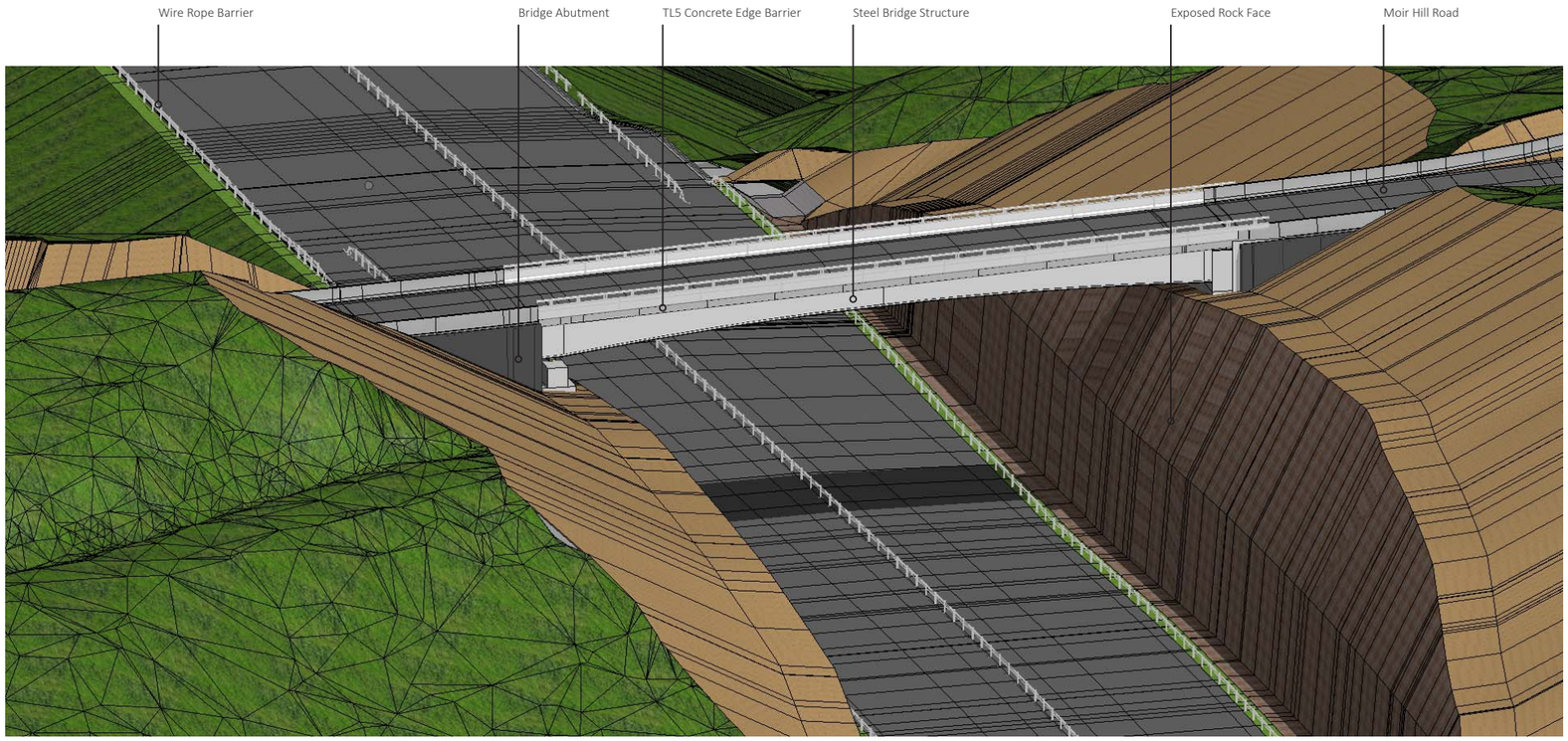
The second key design element of the bridge is the concrete barrier which sits at the outer edge of the bridge deck, overhanging the bridge superstructure. This barrier is visually identical to the barriers on the Pūhoi and Ōkahu bridges for consistency and to reinforce the 'family of bridges' approach. The barriers are designed with a simple horizontal hip that provides visual balance to the visible edge of the bridge structure and to reduce the apparent height of the barrier by breaking down the surface into upper and lower faces. The upper two thirds of the outer face of the barrier is angled upwards to better catch sunlight, while the lower third is angled downwards to provide a face that will largely be in shadow. The bridge barrier will merge with the roadside barrier as it meets the road on either side of the bridge so that the horizontal line of the top of the concrete barrier will be continuous, leading the eye across the span and abutments to the road barriers.

Bridge Barrier Transition Design

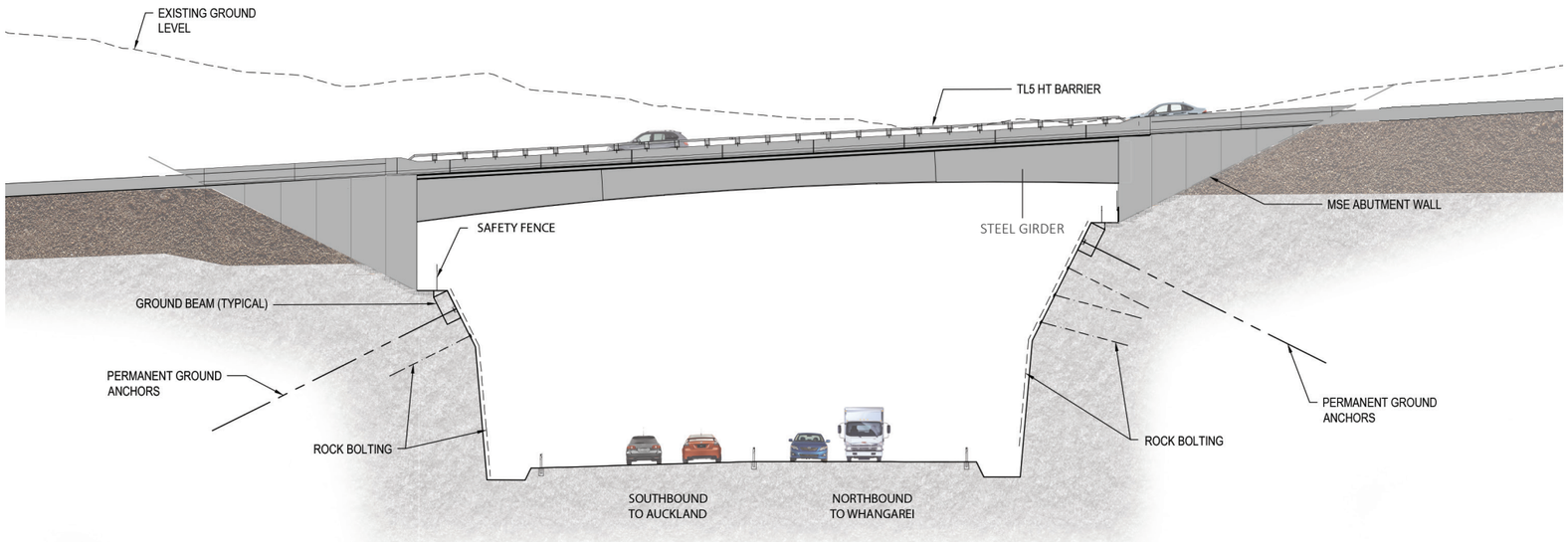


Bridge Barrier Design





Indicative Impression of Te Tapuwae o Kahumatamomoe



Te Tapuwae o Kahumatamomoe Elevation

The final elements are the abutments on either side of the bridge. These are large elements and form shoulders which support the superstructure and deck above. The materiality of the bridge has been conceived of very simply. The main span has a steel superstructure which is treated in a white silver metallic finish while the barrier above has a light concrete finish. To contrast this, the abutment either side are treated in a dark exposed aggregate concrete finish to suggest they are part of the landscape in which the superstructure spans between. The form of the bridge and its materiality is designed to be appear light on the landscape. The bridge will be seen primarily in profile and against the sky as motorists move underneath it. The gently curving form is a simple yet elegant move and underlines the spirit and principles of the Project.

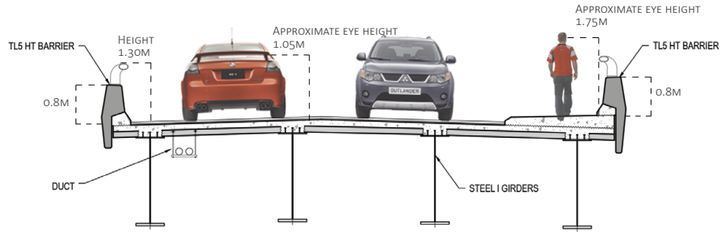
Concrete edge barriers on Te Tapuwae o Kahumatamomoe will be extended 40m on the approach side of the bridge to visually anchor the span to the abutments. The line of the top of the concrete bridge barrier will be extended into the approach barrier as a recessed groove in the external face, providing a consistent top of barrier line across both bridge and approaches. Fences will run along the tops of the bridge abutment walls and underneath the bridge for safety

The key feature of the bridge is its height above the motorway. This however, hinders the use of an intricate pattern as it will not be visible to the motorway user. Alternative options include wording or design on the inside face of the barrier, which will be more visible to the local road traveller. Environmentally and structurally friendly permanent graffiti resistant protective coatings will be applied to all new structural elements, concrete barriers (both sides and top) and urban design features:

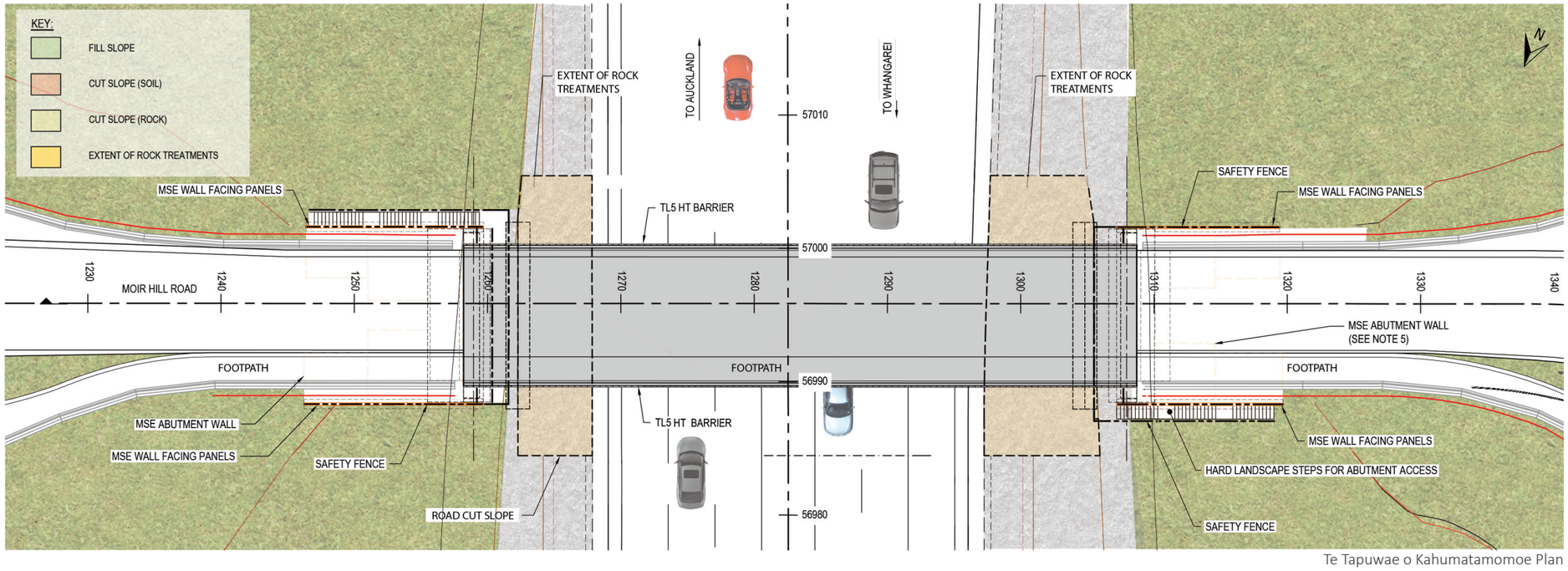
- 1.2m from an accessible top edge;
- 2.7m above adjacent ground level or base level; and
- 1.5m horizontally from an accessible substructure element.

Steel components that are accessible will be protected by an anti-graffiti top coat, which will allow removal of the graffiti without damaging the corrosion protection system [D36(a)] [ULDF section 5.4].

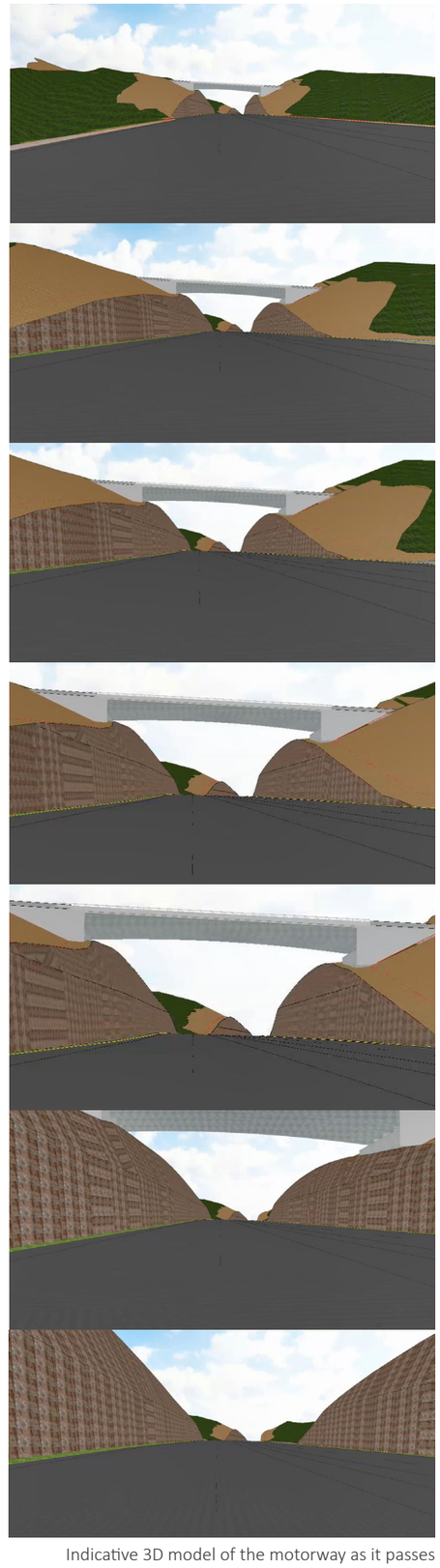
Te Tapuwae o Kahumatamomoe Section



The barrier design and barrier height to be used optimises views from Te Tapuwae o Kahumatamomoe for both vehicle occupants and pedestrians.



Te Tapuwae o Kahumatamomoe Plan



Indicative 3D model of the motorway as it passes under Te Tapuwae o Kahumatamomoe

5.5 STREAMS

The ULDF stream guidelines include:

- Enhancing habitat and ecological connectivity
- Accentuating the streams as features visually
- Preferring the use of bridges to culverts for wildlife connection
- Softening culvert appearance
- Maximising connectivity of streams, wetland, coastal, terrestrial
- Restoring past biodiversity and mahinga kai
- Using riparian (relating to banks of rivers and wetlands) and margin species indigenous to the area
- Merging the riparian planting required by specific conditions into the overall landscape concept [D36(c)]

New roads inherently result in ecological impacts, both during construction and on an on-going basis from operation and maintenance. Te Awa Hīkauae, Mahurangi River and associated tributaries in this sector are important ecologically, so mitigating and avoiding damage to the stream, its tributaries and instream fauna is a high priority. ULDF principles and consent conditions direct the mitigation of stream and culvert enhancements, riparian planting, wetland mitigation and terrestrial planting areas.

Several streams traverse the Moir Hill and Hīkauae Creek Sector including small high gradient tributaries and larger lowland watercourses. The Mahurangi River Right Branch and Te Awa Hīkauae are significant streams within the Sector. Both streams and their associated tributaries provide favourable aquatic habitat for fish and macroinvertebrates. The diversity of native fish species (such as longfin eel, inanga and redfin bully) present, including nationally 'At Risk' species in these streams, is indicative of high-quality habitat and ecological function.

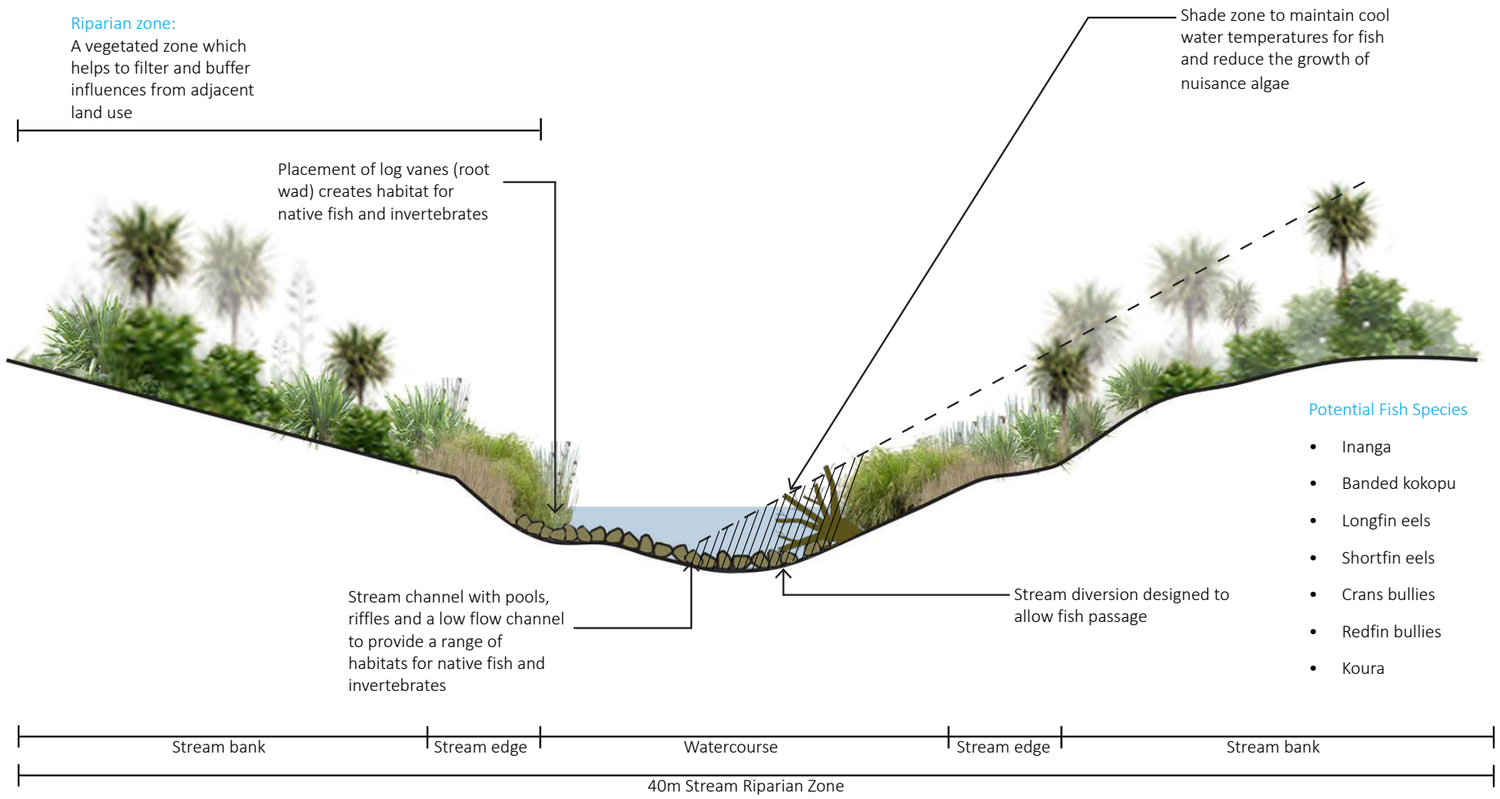
Fish species within the Mahurangi and Hīkauae catchments include the species shown in the Stream Mitigation image. Stream diversions have been designed to allow fish to migrate upstream providing a connection between lower and upper catchments while also enhancing instream habitat for native fish and invertebrates. Where necessary, stream diversions provide low flow channels to allow fish passage when water depth is very low and a pool/riffle sequence (a rocky/shallow area, where the water movement is uneven) to provide resting pools for migrating fish. The stream diversion on the Mahurangi River includes pools, riffles and rootwads (a group of tree roots adjacent to or in a stream), to provide a range of habitat types for native fish and invertebrates.

Mitigation and Restoration

Where culverts are used, the design is guided by the ULDF:

- Incorporate fish passage, where required [RC50-51]
- Plant indigenous shrub vegetation on fill embankments to soften the appearance of culverts and access tracks
- Extend riparian planting onto the fill embankments at culvert crossings. Use low species near the top of fill embankments to maintain views from the motorway, grading to taller species toward the base of the embankment
- Replant stream margins upstream and downstream of culverts for biophysical and visual reasons

Stream Mitigation (Diversion Type 2)



Prior to culverting or diverting a stream, fish rescue is undertaken, whereby fish, as well as kōura and kakahi, are captured and relocated downstream. This minimises any immediate loss of native fauna in the impacted area. Culverts and diversions have been designed to allow fish passage as detailed in the culvert section. Planting around culverts will merge with the re-vegetated stream margins to naturalise the appearance of the culverts. These measures are in place so that no net loss of biodiversity occurs as a result of the new motorway alignment. Pre- and post-monitoring of streams will be undertaken to assess the effectiveness of the mitigation measures so environmental standards are met [D36(c)]. Restoration is undertaken on a nearby stream often upstream or downstream of the road alignment to offset or make-up for the ecological loss associated with the culverting or diversion of the original stream.

Resource consent conditions applied to the Project so that terrestrial and freshwater impacts are appropriately mitigated. Stream mitigation includes riparian planting, enhancement of fish passage and stream diversion enhancements. Mitigation will be merged into the overall landscape concept [D36(c)].

The primary method of stream mitigation is riparian planting, meaning the planting of vegetation alongside streams within the designation. Riparian planting provides a buffer zone between the land and water, filtering and reducing the impacts of adjacent landuse on the stream. Riparian vegetation, being indigenous to the areas, improves the ecological function of watercourses by providing shade, reducing stream temperatures and the growth of nuisance algae. This achieves the ULDF stream outcomes. Woody debris and organic matter associated with the riparian vegetation will improve habitat quality and provide a food source for aquatic insects (macroinvertebrates) which in turn provides a food source for native fish. The riparian planting will visually accentuate the streams as landscape features.

Suitable sites for mitigation have been identified, focusing particularly on streams that are close to the areas affected by the Project and close to existing vegetation, which will help in re-seeding and colonisation processes. Sites have also been selected to improve connections between streams and other habitat types, including estuaries, wetlands and terrestrial habitats such as existing fragments of mature native forest [ULDF section 5.5].

5.6 CULVERTS

Culverts are the primary method of conveying existing stream and watercourse flows beneath the motorway alignment.

A ULDF aims to minimise culvert lengths and stream encroachments. The number of culverts is based on the number of watercourses under the motorway alignment and accordingly dictate road form and safety. The motorway design now slightly increases culvert lengths at certain localities, and minimises culvert lengths in other locations. Because some culverts are utilised instead of bridges the total number and length of culverts has been increased. Effects of this have been minimised by steeping batter slopes where practicable. The integrated stormwater management system for the motorway incorporates the stormwater conveyance and treatment infrastructure with the surrounding landscape and maintains linkages and connectivity of the natural watercourses and environments either side of the motorway. Encroachment into waterways is minimised by making the fill embankments as steep as prudent where in proximity to streams.

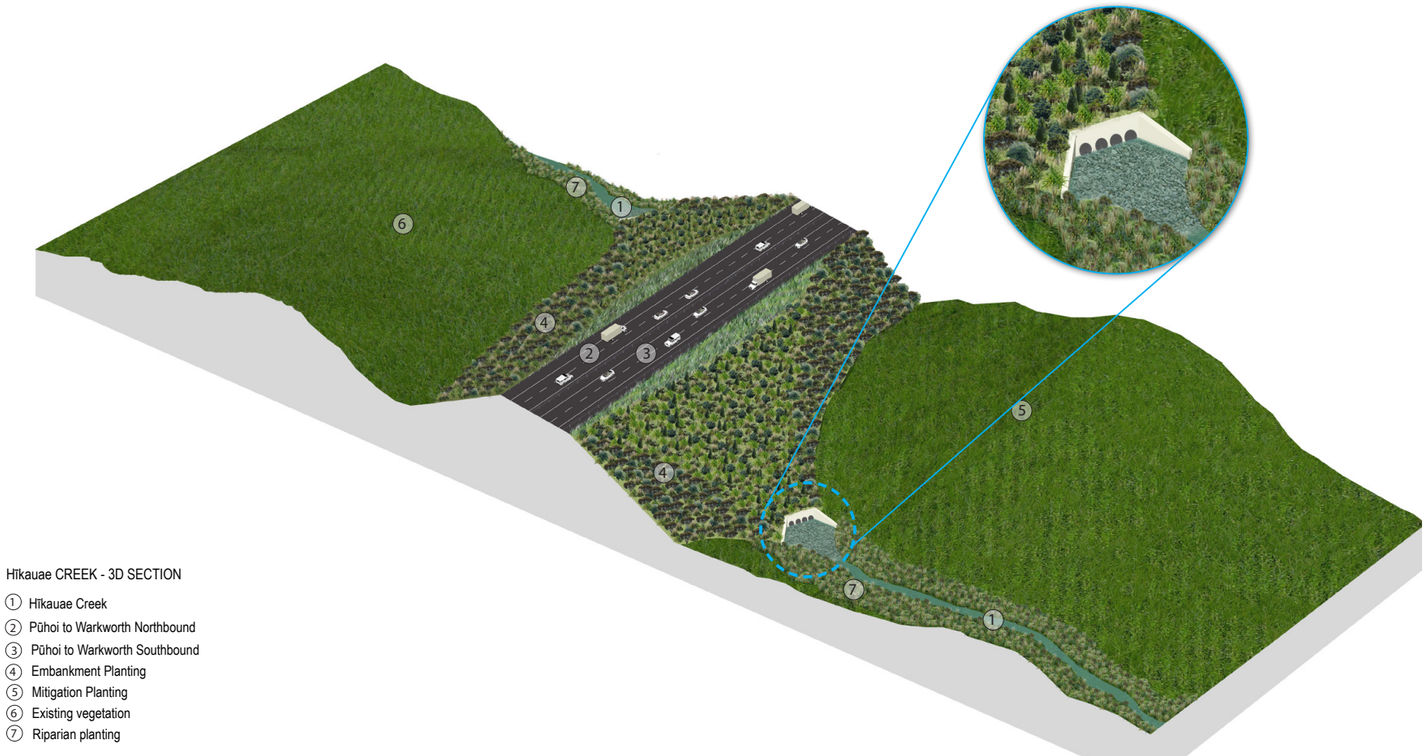
Perched (elevated outlets) and steep culverts can inhibit fish movement along waterways. Design requirements include provisions to facilitate fish passage within all culverted streams, such as the installation of spat rope or spoiler baffles. Many native fish species, such as inanga, banded kokopu, longfin eel, shortfin eel, redfin bully and kōura, require connectivity between upstream and downstream habitat to complete their lifecycle. The installation of fish passage allows fish to move between the downstream and upstream habitat.

The fish species found in this sector have a range of climbing abilities (from poor climbers to good climbers). Baffles in culverts provide access for swimming species.

Native riparian vegetation will be planted at selected culvert inlets and outlets, both to provide a naturalised appearance and to enhance the reinstated or modified stream areas. The stream margins of these culverts will be planted with harakeke and small shrubs to provide shade over the primary channel, while larger species of trees will be planted to provide shade over pools or at bends. Such riparian planting will reduce erosion, help regulate the water temperature and increase organic matter deposition into streams. The environmental changes will increase the habitat quality for native freshwater animals [D36(c)].

The culverts will be provided with robust and resilient inlet and outlet structures. The culvert design incorporates energy dissipation and erosion control devices to minimise the occurrence of bed scour and bank erosion in receiving environments [D36(a)]. Where required, the culverts also include a high-level secondary inlet riser to provide an alternative flow path into the culvert to mitigate the effects of blockage of the primary inlet.

The use of culverts in Hīkauae, Schedewys and Perry Road is an alternative to the ULDF, which anticipated a bridge at these locations. Additional landscaping will be planted on the embankments and along the stream margins. The significant benefit form a shift to a culvert from a bridge is a considerable lowering of the alignment, thus supporting a more naturalised land form, reduced earthwork volumes and fewer visually dominating structures along the alignment supporting the outcome of a highway that recedes into the background. This will also provide an improved view for residents at Perry Road and Schedewys. It is acknowledged that there are impacts from the culverting of the creek, and the design provides for enhancement of the landscape either side to promote continuity and a visual as well as physical stitch. Ecological values that are lost through culverting are replaced with mitigation [RC58] [ULDF section 5.6].



Hīkauae CREEK - 3D SECTION

1. Hīkauae Creek
2. Pūhoi to Warkworth Northbound
3. Pūhoi to Warkworth Southbound
4. Embankment Planting
5. Mitigation Planting
6. Existing vegetation
7. Riparian planting

Te Awa Hīkauae 3D Section showing planting and culvert connection to Hīkauae Creek

5.7 TE AWA HĪKAUAE CULVERT

The motorway alignment crosses Te Awa Hīkauae; the motorway will be supported by an embankment and a culvert will carry Te Awa Hīkauae waters below. The ULDF anticipates a bridge structure at the point where it intersects Te Awa Hīkauae for its elegance and the ability to stitch the landscape together (amongst other outcomes).

The alignment of the motorway through this area has been carefully considered and balanced against the ULDF outcomes. The use of a fill embankment at this location has enabled the motorway to achieve a much lower alignment across all sectors. An embankment does not detract from the key outcome of a clean uncluttered highway, and supports a range of other outcomes, in particular an aesthetically clean margin (un-interrupted by concrete bridge barriers), and green margins where the landscape has been stitched to the edge of the motorway. Perhaps most significantly, the culvert lowers the statement of the highway on the landscape, making it less prominent and noticeable. The motorway embankment at Te Awa Hīkauae is approximately 25m high; this height is required to achieve the road geometry and will balance the cut and fill earthworks volume to reduce the overall earthworks required and facilitate views over the creek to the east. Some views will be feasible looking west. The embankment will be constructed to have a gradient of 2 horizontal to 1 vertical (2H:1V). This is the steepest gradient practical given the type of earth fill found within the earthworks area of the Project, which does not require retaining structures. The length of the culvert has been minimised, given the geotechnical constraints and improve ecological outcomes.

The culvert, designed by a stormwater engineer with input from the ecologist and Hōkai Nuku, maintains stream integrity by allowing connectivity between the open upstream and downstream sections. In terms of ecological function the culvert is a less preferable option to an open stream, however, aspects in the design have been incorporated to mitigate these impacts. This includes; provision for fish passage via baffles, rip rap providing a low flow channel to allow fish passage and upstream and downstream riparian planting. The culvert will be partially inset below the stream bed to provide consistent flow for fish species to easily enter and pass through the culvert. The stream channel will be slightly diverted from the original stream channel, with the planting at either end of the culvert providing visual stitching together of the landscape, in addition to its ecological function. The streams and riparian margin areas, specifically around the downstream area, will be rehabilitated with a long area of stream bank riparian margin planting, providing; shade, temperature control and habitat. The nearest soil disposal area is approximately 1km from the culvert and earthworks are well separated from the enhancement areas where possible, to avoid any conflict with this high value stream restoration area. Earthworks around Te Awa Hīkauae culvert will be configured to provide as-natural-as-possible final contours so the stream appears to be in an untouched landscape, again achieving the stitched together appearance (in combination with the planting) [ULDF section 3.2].

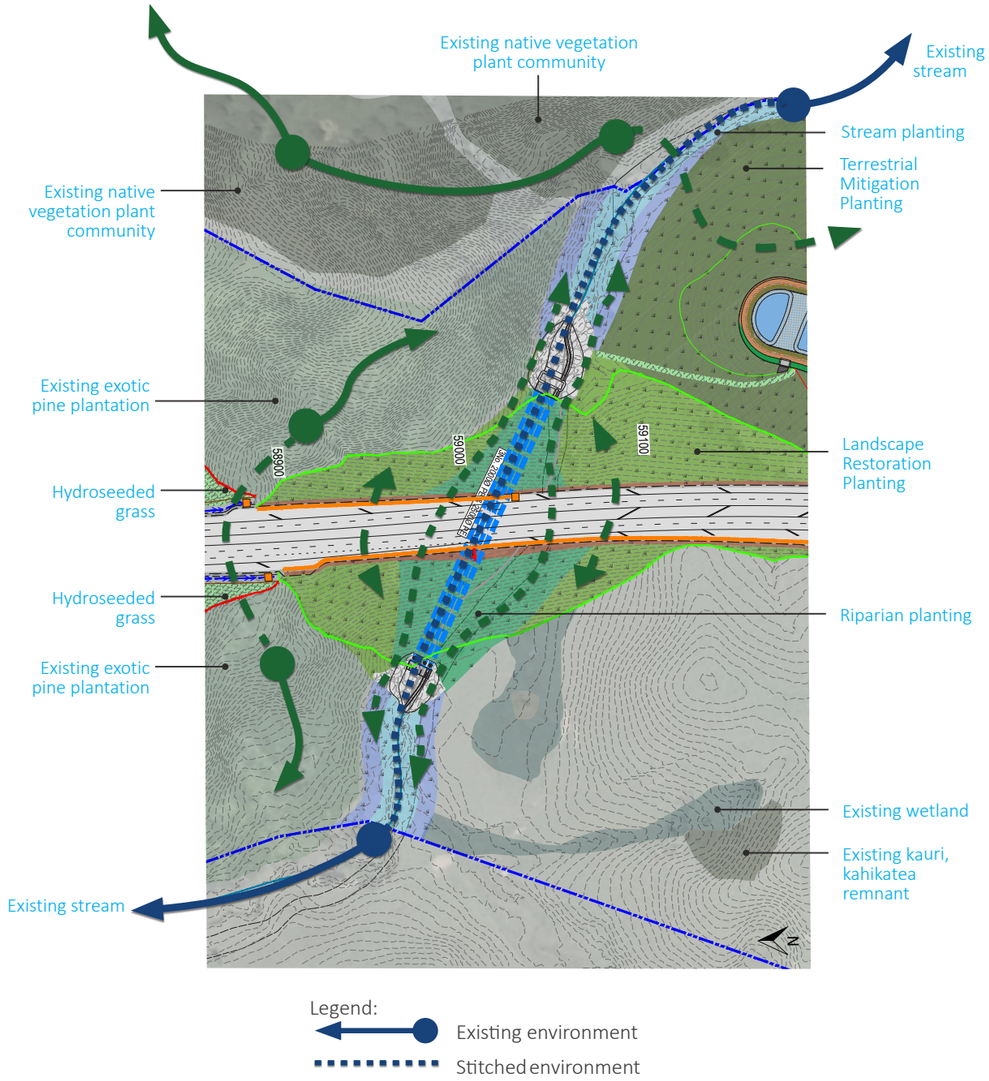


Diagram demonstrating how the landscape is stitched together to maintain the integrity of Hīkauae creek

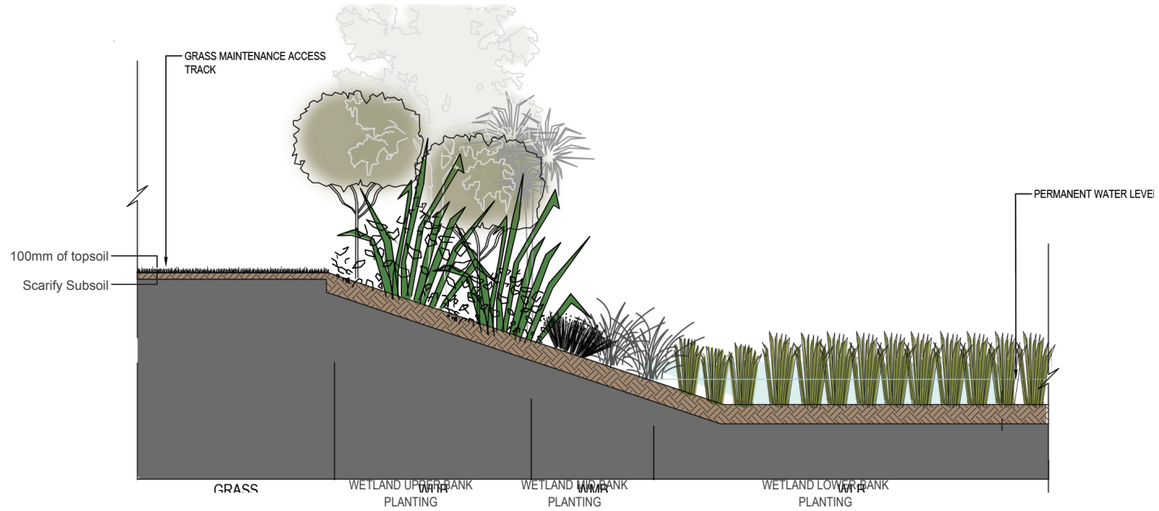
5.8 STORMWATER WETLANDS

The four Moir Hill and Hīkauae Creek Sector stormwater wetlands perform the important function of treating road runoff to remove suspended solids before the water is discharged into the receiving environment. New wetlands will mitigate any loss of existing natural wetlands [D60]. While primarily functional, the wetlands have been landscaped to have a natural appearance and conform to the local landform. The outside geometry of the wetlands have been curved and shaped to fit the existing terrain.

The planted areas immediately surrounding the wetlands will include both landscape and ecological mitigation planting to both treat the water flows running off the road surface of the new motorway and to contribute to the ecological environment. This integrates the engineered wetlands into the overall Project landscape planting to act as one continuous system. The plants that will fill the wetland have been selected on the basis that they will both contribute to the filtering of the water, grow well in wet conditions and for their use in cultural harvest. Riparian and margin vegetation heights and foliage texture is varied in each water zone within each wetland to optimise their natural appearance.

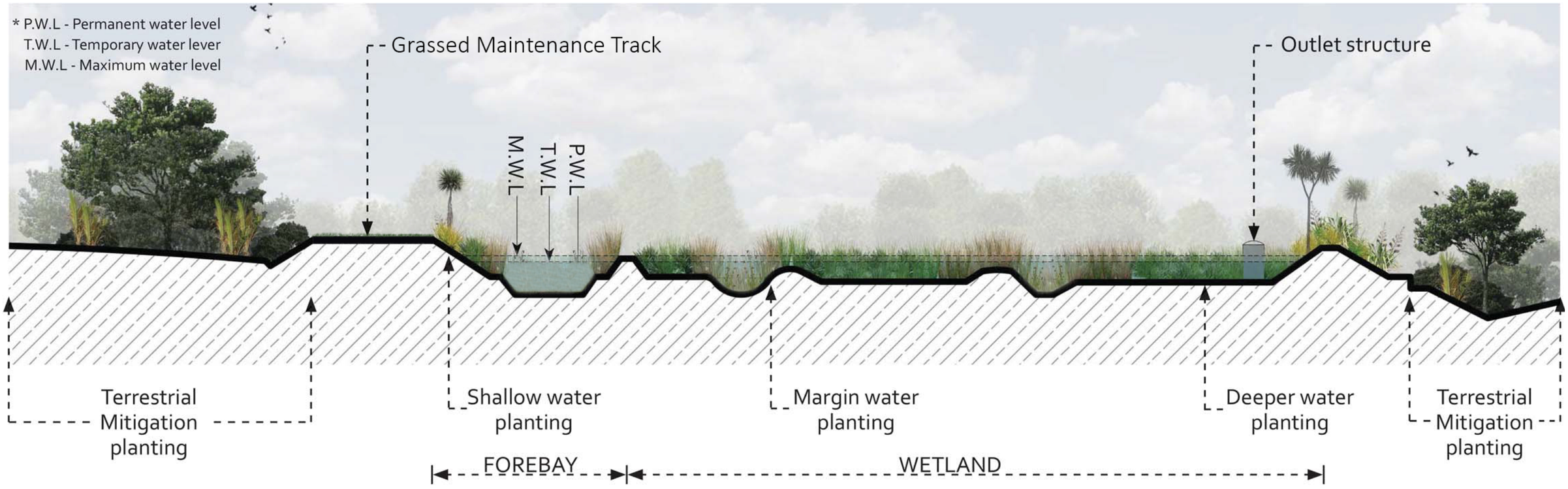
The provision of shallow vegetated wetland edges provides a natural transition from the side of the wetlands to the batter slopes and wider upslope and down slope landscaping to appear similar to natural land contours and soften the engineering. The wetlands are set against a back-drop of terrestrial mitigation planting to contribute to the wetlands naturalised appearance.

A grassed maintenance track is provided around one side of each wetland to access outfall infrastructure and removes the need for a wide flat bench all the way around the wetland. Gated or chained entry to the maintenance tracks will deter unauthorized access. The maintenance access alongside the wetland and the lay down area will be grassed rather than metalled so as to better blend into the surrounding environment. Sediment traps in the rock cut areas and a sedimentation forebay will minimise the maintenance requirements on the wider wetland areas [D36(a)] [D36(c)] [ULDF section 5.7].



Typical Wetland Bank Cross Section (refer to Section 8 for plant mixes)

Structure of a Stormwater Wetland



Stormwater Wetland Mid-Bank Planting (WMB)


Apodasmia similis


Carex lessoniana


Cyperus ustulatus

Stormwater Wetland Lower Bank Planting (WLP)


Baumea articulata


Bolboschoenus fluviatills


Juncus gregiflorus


Typha orientalis


Schoenoplectus tabermaemontani

Stormwater Wetland Upper Bank Planting (WUB)


Coprosma propinqua


Cordyline australis


Dacrycarpus dacrydioides


Leptospermum scoparium


Cortaderia splendens


Phormium tenax


Schefflera digitata


Sophora tetraptera


Syzygium maire

Rock Borrow Section (Refer Section 7 Sector Plans for the Location of the Rock Borrow)

1 Inlet

Water runoff is received via the inlet pipe. Rock riprap disperses the energy of the water slowing it down as it enters the sedimentation forebay.

2 Sedimentation Forebay

The forebay is designed to allow the water to slow and the sediment to fall to the bottom.

3 Littoral Shelf

Wetland plant species are planted on the littoral shelf. The plants take up nutrients in the water as well as trapping sediment.

4 Outlet Pipe (Scruffy Dome)

After treatment water leaves the wetland via the outlet pipe. A scruffy dome is used to trap debris.

5 Emergency Outflow

The emergency out flow allows water to exit the wetland after an extreme heavy rain flow.

6 Maintenance Access Track

This track allows for maintenance vehicles and crews to perform maintenance on the wetland.

7 Grass Maintenance Track

This track allows for maintenance vehicles and crews to perform maintenance on the wetland.

8 Landscape Planting

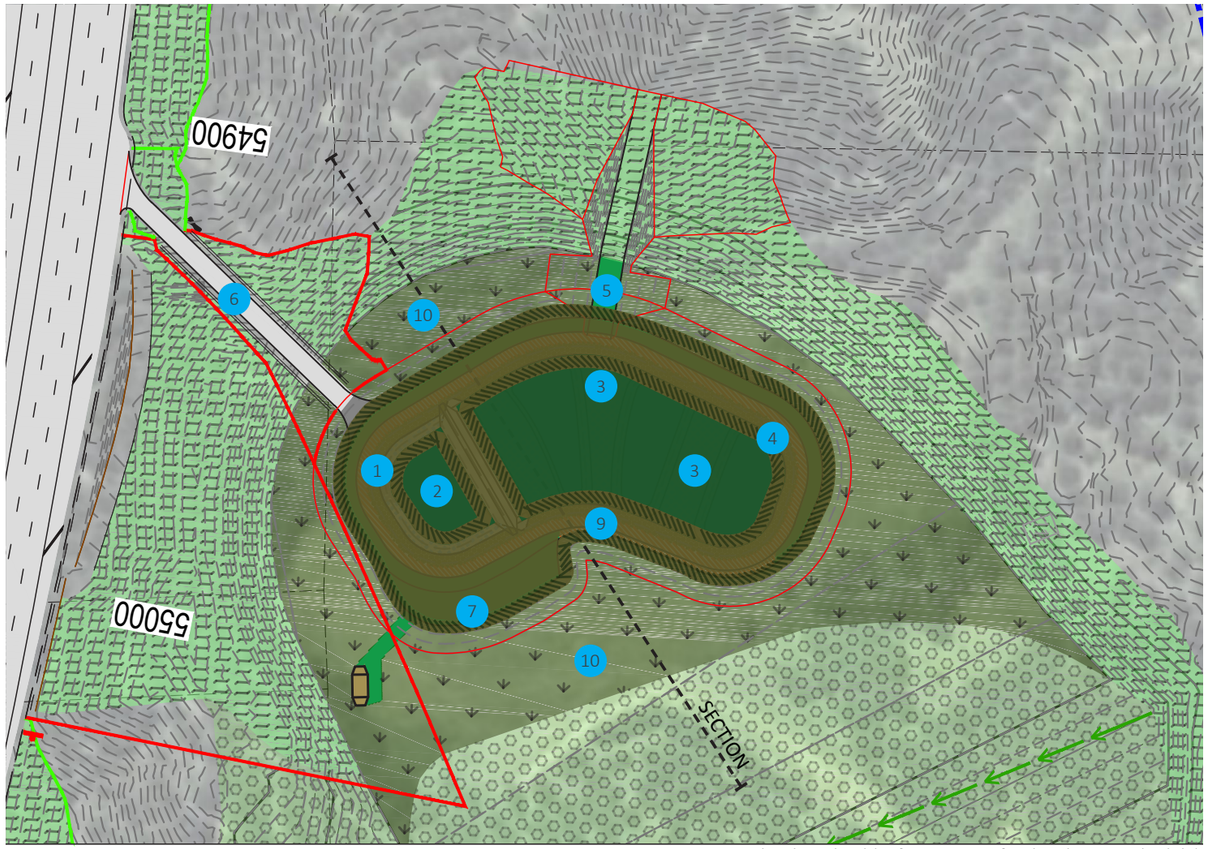
Refer to section 8 for plant species.

9 Wetland Bank Planting

Plant species that live in swamp like conditions. Refer to section 8 for plant species.

10 Terrestrial Mitigation Planting

Refer to section 8 for plant species.



Naturalised Wetland (Refer Section 8 for the Planting Schedule)

Drop of Water

Road

Water falls on the road and flows into a conveyance swale. Contaminants present on the road will be picked up and conveyed by the water.

Conveyance Swale and Sediment Trap

The conveyance swale on each side of the road is designed to capture and slow the flow of water. Sediment traps are incorporated and designed to collect sediment washed off the rock cuts. The water is diverted to stormwater wetlands.

Stormwater Wetland

Engineered wetlands are shallow vegetated ponds that filter stormwater runoff, slow flows and help control regular flooding downstream. They are formed to look like natural wetlands and provide habitat for wildlife. These wetlands remove sediments, nutrients and contaminants from incoming stormwater before discharging to stormwater systems or waterways.

Stream with Mitigation Planting

The stream mitigation planting is designed to provide; erosion protection, shading of water to provide for fish and invertebrate habitat, fish passage, increased biodiversity and integration with natural waterways/streams and improved landscape amenity. The majority of permanent streams within the designation will receive stream mitigation planting. In many cases, this will uplift and restore the current state of waterways.

Existing Stream

Water is released into the existing streams outside of the designation or without mitigation planting.

5.9 ROCK BORROW AND SOIL DISPOSAL AREAS

The earthworks footprint and extent includes areas where excess soil is deposited and re-contoured (soil disposal areas) as well as areas where rock required for construction in other areas is removed from (borrow areas) [D37] [ULDF section 5.8].

5.10 ROCK BORROW AREA

In order to provide suitable rock material for Project construction, a rock borrow is to be established in the Central Sector. The location was chosen due to the proximity to large fill sites and where the majority of the earthworks is to occur. The rock in this area is close to the surface and is easy to access, while out of general public view during construction.

Following construction completion, the rock borrow will be naturalised as much as possible, as shown in the sector plans included in Section 7. The permanent design for the rock borrow includes the following main features:

- Cut slopes of 1H:1V in the unweathered rock and 2H:1V in the overlying residual soils
- Soil backfill in the base of the rock borrow to at a minimum provide a 1% fall for drainage and to provide a minimum of 100mm of soil cover for hydro-seeding
- If excess soil in the vicinity requires disposal, backfill at a maximum slope of 5H:1V may be included in the base of the borrow pit. This backfill would only be limited by the available volume
- Hydro-seeding

It is noted that the design presented will only be able to be confirmed during construction when the actual excavation extents and volume of soil for backfilling are known [D36(c)] [D37].

5.11 SOIL DISPOSAL

Soil disposal areas are sites where the unsuitable soil is deposited in locations along the sector, these areas have been selected to minimise impacts. These are identified in the sector plans in section 7.

Soil disposal sites that do not infill a gully, will be contained by an earth bund. The final slope gradients will be no greater than 5H:1V and will be generally compacted to achieve a minimum undrained shear strength of 40kPa. Soil disposal sites will be shaped to create a naturalised transition where it meets the existing topography, some shaping and contouring will occur on the slopes but some uniformity will remain.

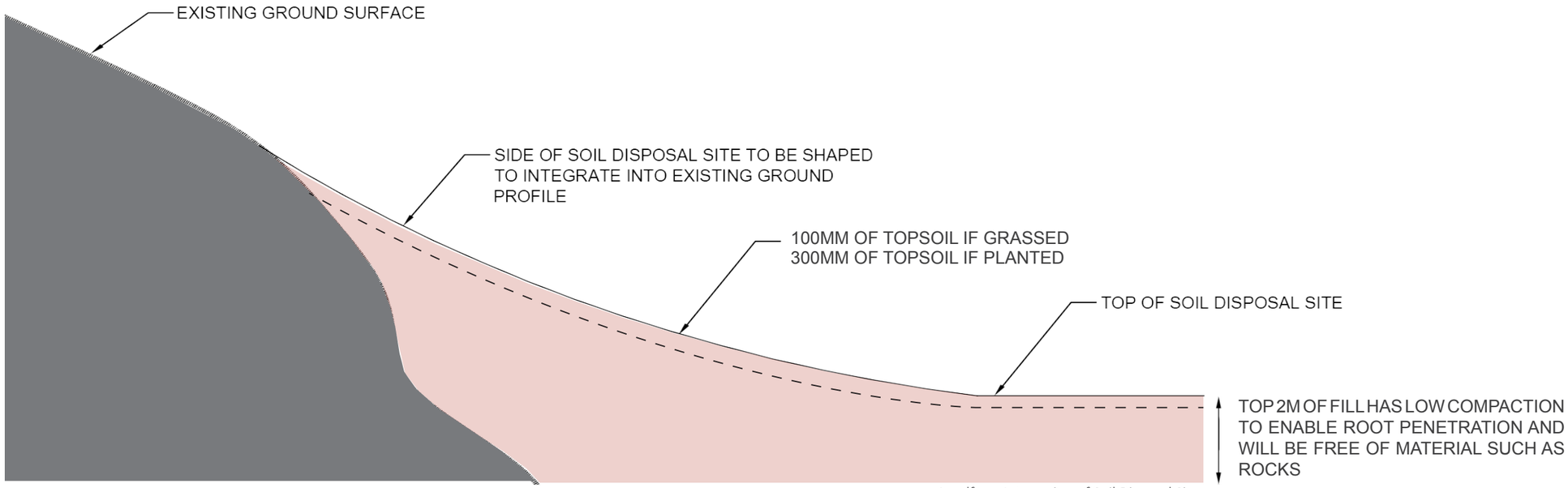
Planting will be used to soften the interfaces between these modified areas and adjacent unmodified areas (more gentle batters are utilised in soil disposal areas to provide adequate slope stability).

There are three soil disposal sites in the Central Sector, these are identified on the sector plans in Section 7 as Soil Disposal Sites.

The soil disposal site at chainage 55600 will fill an existing gully with excess material not utlilised for motorway construction. The final contour and landscape form of the soil disposal will be led by the existing landform, although typically up to an elevation of RL140m.

The soil disposal site at chainage 53600 is located in an area of moderately steep terrain. The slopes of the soil disposal site are designed to maintain stability without needing any drainage within the compacted fill. Subsoil drainage will be provided beneath the structural bund and within the filled gullies.

The soil disposal site at chainage 57200 will utilise existing gullies to fill with excess soil. A structural fill bund is required on the southern side of the gully to contain the material. This bund will be formed at a batter slope of 1V:2H matching the main motorway embankment slopes [D36(c)] [D37] [ULDF section 5.8].



Landform Integration of Soil Disposal Sites

Totara Trees Carrying Green Mistletoe

5.12 VEGETATION

"Specifying native plant species based on an understanding of the existing native vegetation to improve biodiversity values, increase connectivity with surrounding native bush areas, provide wildlife corridors and provide food and habitat for native wildlife found within the designation"

The design has been refined to reduce or avoid impacts on existing vegetation, where practical. The following specific vegetation within this sector has been identified to be retained, protected or reducing impact on [D36] [D53]:

- Tōtara trees carrying green mistletoe (*Ileostylus micranthus*) within the designation in the vicinity of land to the west of the intersection of SH1 and Mahurangi East Road
- The vegetation on the eastern boundary of the designation within Lot 7 DP 113847 (87 Perry Road Warkworth 0983) and Lot 8 DP 113848 (83 Perry Road Warkworth 0983) to prevent access to areas of native vegetation within these Lots during construction
- Native orchid plants of the genus *Danhatchia,* as identified by a suitably qualified botanist, within the designation on Lot 1 DP 321568 (1509 State Highway 1 Warkworth)
- The existing row of poplar trees will be retained, as possible, along the designation boundary as it runs between the fish farm and stormwater pond planting (refer section 7). Additional poplars will be planted in the vicinity, to soften views of the viaduct from the Perry Road area

Existing Stream Vegetation

5.13 PLANTING

The landscape and ecological mitigation planting will [D76]:

- Marry planting with adjacent existing vegetation
- Seek to continue vegetation patterns on both sides
- Seek to bring adjacent land use close to the motorway
- Plant boldly in scale to landscape – broad patterns
- Use dominant mix of pioneer species of the area
- Plant to accentuate topography
- Plant material will be eco-sourced where possible, in accordance with P39 Specification for landscape treatments [D27]
- Configure planting to soften views from residents
- Reinstate and enhance wildlife corridors
- Repair edges of vegetation with dense planting
- Native landscape planting in areas where indigenous forest is cleared to stitch landscape
- Be consistent with the P39 Specification planting standard [D27]
- Identify vegetation to be retained, protected
- Implement kauri dieback management protocols [D63-D63D]
- Consider open-ground forestry methodology
- Planting for safe maintenance

Seven wire post and batten fences will be used to provide stock proofing for terrestrial mitigation areas. Fencing that reflects final property boundaries will be confirmed with private land owners at a later date. Fencing may be used to demarcate adjacent land uses, such as where adjacent bush areas exist and for maintenance and access requirements [ULDF section 5.9].

Ecological Mitigation and Landscape Restoration Planting

The ecological mitigation planting has been developed by the ecology, landscape and urban design and planning teams with input from Hōkai Nuku, particularly around the placement of terrestrial mitigation planting. The Landscape Restoration Planting integrates with the Ecological Mitigation Planting and is a fundamental requirement of the ULDF (refer to the planting schedules in section 8 for specific species and planting mix information). These are considered on a Project wide basis, and tie together ecological outcomes, alongside landscape design considerations. This integration has been achieved through [D36(c)] [D37]:

- The species selection for the terrestrial ecological mitigation planting and the landscape restoration planting is largely the same. Differences necessarily occur where less robust species specified by the ecology team are not suitable to planting on engineered batters
- Both the landscape and the terrestrial ecological mitigation planting strategies utilise a two stage planting method. This strategy sees these planting areas receive almost identical planting of faster growing native species predominates at initial planting (spacing and ground preparation is necessarily different). Then, three years later, receive enrichment planting of larger, slower growing tree species which will have better growth and survival rates with the initial planting creating better sheltered growing conditions
- Coordinating the spatial arrangement of plants. Generally, the landscape planting is confined to cut or fill slopes adjacent to areas of ecological mitigation planting. Additionally, some potential opportunities in specific locations are being considered for ecological mitigation to be integrated with landscape planting. These locations are opportunities to stitch vegetation across the motorway. This strategy also allows some terrestrial mitigation planting to collar stormwater wetlands to tie back to adjacent streams and the motorway planting
- Wildlife corridors have been developed and enhanced along the alignment in locations where it has been considered most beneficial by ecologists. In the Moir Hill and Hīkauae sector, these are provided on both sides of the alignment around the Perry Road area (chainage 52850 – 53500 on western side of alignment; chainage 52850 – 53550 on eastern side). The mitigation planting and landscape restoration planting in this area connects existing mature and regenerating native forest patches in this area with the new planting to provide native forested habitat and corridors for native wildlife [D36]. It is accepted that grassed areas are not contributing to the enhancement of wildlife corridors, nor so, the adjacent land cover of predominantly pine plantation. However, in general, the grass treatments have been used in areas that have been determined to have lesser ecological value such as areas where catchments have been heavily modified, (e.g. for farming)
- All planting in this sector is native and chosen to be suitable to the environment that it will be planted in to ensure the best chance of success. Planting will be undertaken as early as possible, subject to plant and topsoil sourcing in areas which will not be impacted by construction activities. In areas where construction will occur (such as cut and fill areas) planting will occur later, once we can be certain the plants will not be damaged

Riparian vegetation

5.14 ECOLOGICAL MITIGATION PLANTING TYPES

Ecological mitigation planting can be divided into terrestrial (general forest species), riparian (stream) and wetland mitigation planting as well as the kānuka/mānuka terrestrial mitigation planting on some soil disposal sites which offer opportunities to "stitch" across the motorway [D36(c)] [D37]. Refer to the planting schedules in section 8 for specific species and planting mix information.

Terrestrial (general forest species) Mitigation Planting (MPT)

The ecological terrestrial mitigation planting has been designed in response to designation condition D59 which sets parameters for the mitigation of eight canopy species including pūriri, taraire, tōtara, kahikatea, kauri, rimu, rewarewa and tanekaha lost during the Project (refer to Section 8). This list of species matches those most commonly found in the area aiding in matching the existing vegetation retained with the planting composition, and stitching the landscape across the new road.

The requirement to achieve an equivalent basal area of tree species after 20 years of growth has been taken into consideration when proposing plant numbers and planting areas for the landscape and ecological design. Mitigation planting areas shall be maximised within areas of natural ground in order to achieve and maximise growth rates to achieve the basal area required after 20 years [D36(c)] [D37].

Early successional species will be planted to support and enhance establishment of canopy species.

Riparian (stream) Mitigation Planting (MPSE)

The stream ecological mitigation planting has been designed in response to RC58 in particular. The conditions set out the level of improvement required in riparian edges in order to offset the ecological value losses for those streams compromised by the Project. Species used in this planting include those commonly found in local streams [D36(c)] [D37].

Wetland Ecological Mitigation Planting (WMP)

Wetland mitigation planting to offset existing wetlands lost during construction will be offset at a ratio of 1:1, meaning each square metre of lost wetland will be replaced with a square metre of new wetland planting. There is an important distinction to be made between wetland mitigation planting and stormwater wetland planting. Wetland mitigation planting is for areas of existing wetland that require improvement through planting. Stormwater wetland planting is planting to engineered wetlands [D36(c)] [D37].

Kahikatea in fruit

5.15 LANDSCAPE PLANTING TYPES

Landscape Restoration Planting (PLR)

The landscape restoration planting occurs on construction disturbance areas and predominantly on 2:1 fill slopes and more often than not adjacent to areas of ecological mitigation planting, to stitch together new vegetation with existing vegetation on either side of the motorway [ULDF section 3.2]. In locations where no planting will occur, the landscape treatment will either be hydro-seeded grass or pasture grass. Other than slight adjustments for design development around slope extents, there are no significant changes to the extent of landscape restoration planting.

Amenity Road Edge Planting (ARE)

This planting is used in front of the landscape restoration planting mix and is dominated by low growing hardy plant species. Low growing species are used to preserve driver sightlines. The very edge of the road tends to present the most difficult growing conditions, particularly on fill embankments, so hardy drought and exposure tolerant species are used to minimise weed growth and weed spraying.

Amenity Riparian Planting (ARP)

This is used only in one location within this sector, at the fill embankment/culvert location at Te Awa Hīkauae (Ch59000). This planting is designed to acknowledge and signify Te Awa Hīkauae through the planting and uses riparian plant species that cope in the difficult growing conditions of the engineered slopes.

5.16 STORMWATER WETLAND PLANTING TYPES

Stormwater planting is designed to thrive in wet conditions and naturalises the appearance of the stormwater wetlands.

Example of a hydroseeded fill slope

5.17 HYDROSEEDING (GCU) AND (GFL)

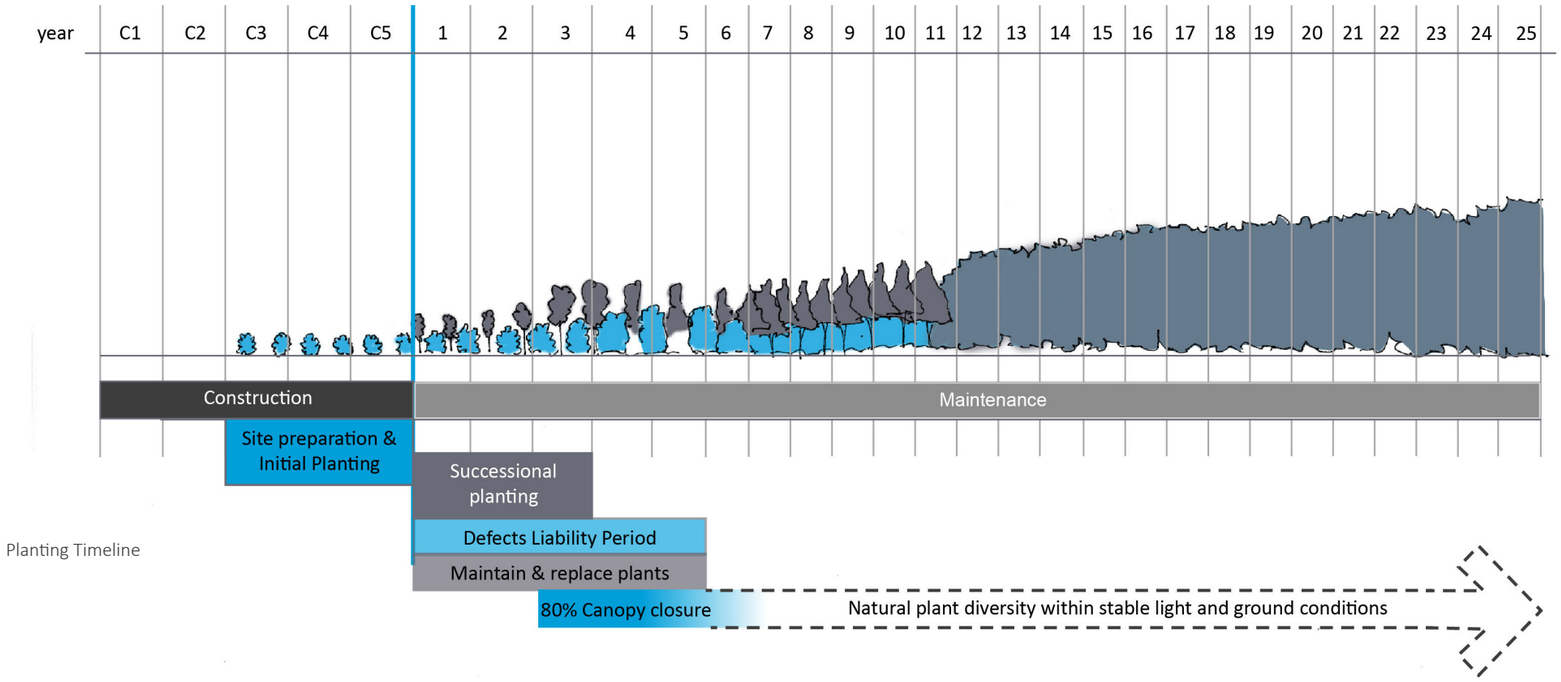
Hydroseeding is a planting process that uses a mix of grass seed and a growing emulsion sprayed onto a bed of topsoil, from which grass grows. The dominance of grass through this sector is due to its ability to grow in an area of low ecological value, on a thin layer of topsoil, surrounded by pine forests (there are few existing native plant communities near the designation boundary). The hydroseeded grass will create links or 'stitches' across the motorway.

The design approach has been to focus valuable landscape restoration and ecological mitigation planting in locations with high ecological values (such as near Te Awa Hīkauae around chainage 59000 and 59100) to provide a more comprehensive landscape stitch using native plant communities in these areas.

Landscape stitching between areas of lower ecological value has simpler landscape solutions, such as grass (refer to the stitch diagram on page 11). Much of the grass will not be visible to road users as it will be elevated above rock cuts or below the motorway level on fill slopes. This will allow views from the road out to the landscape, which contributes to the road user experience along the alignment.

One of the more significant fill slopes in this area (located at chainage 54700) will be hydroseeded (refer section 4.9). This fill slope is located amidst scattered pine forest and is considered to possess a lower degree of ecological value and offers less in terms of visual enhancement compared with other areas in the alignment. The stream in close vicinity will have stream mitigation planting.

The ULDF adopts a strategy of leaving large cuts as either bare rock or with ground cover vegetation where such planting is likely to sustainably grow. Many central sector areas use hydroseeding to provide vegetation coverage on challenging terrain and soil conditions while also seeking a low maintenance outcome. The maintenance of hydro-seeded grassed areas will include the application of pre-emergent herbicide at the establishment phase to prevent weeds developing from an existing seed source in the soil and spot spraying thereafter, to keep pine seedlings, gorse, pampas and other weed species under control. Use of a pre-emergent herbicide and establishment of thick grass cover will reduce weed competition and ongoing spot spraying maintenance [D36(c)]. Maintenance also includes trimming as required to reduce any potential fire hazard.



Planting Timeline

5.18 SUCCESSION PLANTING STRATEGY

A two stage planting method has been developed by the landscape architect and ecologist to enable the integration of the landscape work with the ecological mitigation planting. It mimics the natural process of plant succession, increasing plant survivability.

Stage 1 (initial planting)

- Introduce plants including core pioneer species such as Kānuka, Toetoe and Mānuka which will establish quickly and provide shelter and shade for Stage 2 planting
- Existing vegetation in the surrounding farms, streams and the adjacent road side plantings all include a high proportion of Mānuka so this species has a proven durability in this location in the motorway conditions
- Mānuka and Toetoe and to a lesser degree Kānuka are often associated with colonising disturbed sites which also demonstrates their robust nature and advantages as colonising species
- These species are often found in a range of moisture levels in streams and in exposed ridge areas so are very visible in the region
- These species will cope as well with cut and fill batters because the most robust species appropriate to the ecological district have been specified

Stage 2 (enrichment planting)

- Introduced no later than 3 years after the initial planting so as not to be 'out-competed' for light and water. Plant species include various large canopy trees that will grow through and support the pioneer species. In the long term, the Stage 2 species will become the dominant feature of the planting. The colonisation and establishment process will build up organic matter in the soil which will support the growing vegetation mass. Planting mixes will be designed to suit the various planting conditions and micro climates that they will be introduced to, for example tōtara dominant mixes to fill ridge areas and kahikatea in wet conditions

This two stage method supports whole of life considerations for landscape, which also include selection of plants and planting methodology that allow for effective growth and for plant longevity [D36(c)] [D36A] [D59].

Condition D36A and the ULDF suggests considering open-ground forestry as a methodology for plant sourcing. This has been considered and adopted for some ecological planting areas, however in general, nursery plants will be utilised. Nursery stock is considered better for program coordination in terms of construction and timing of landscape works, and nursery stock is provided with a guaranteed quality, including providing huge numbers of plants at specified sizes on time. The open-ground forestry method does not provide certainty of when plants will be available to replant or how fast they will grow, and plants grown in the ground are harder to successfully move due to root sensitivity. Specifically, canopy species do not typically thrive after root disturbances. The open-ground forestry methodology requires large land areas to grow the plants; due to the large volume of plants needed, this would be inefficient.

5.19 SPECIES SELECTION

The landscape and ecological mitigation planting for the Project specifies native species found in the Rodney Ecological District to:

- Integrate the landscape planting with the various types of ecological mitigation planting (terrestrial mitigation large tree species are stipulated in the ecology consent requirements) to enhance the biodiversity and habitat linkages between existing and new vegetation
- Use of native species known to thrive in the various environments of the central zone including canopy (canopy enrichment) and coloniser (starting crop) species. This is further defined for topography (valley and ridge locations)
- Strengthen the visual landscape patterns of the natural landscape features including existing vegetation and in particular following natural vegetation patterns to stitch patterns and habitats across the motorway (such as the remnant stand of kauri forest near Perry Road and the Mahurangi Stream)
- Form the basis of a plant palette which is being developed with Hōkai Nuku to highlight the cultural footprint of local Iwi at certain locations along the route.
- Integrate stormwater treatment wetlands into the wider landscape through the landscaping and mitigation planting around them, as well as connecting them to the motorway planting along the route

All plants will be good quality nursery stock. Depending on availability, plants propagated from eco-seed sourced within the Rodney Ecological District will be used. Hardy species known to thrive in the local climate and conditions, which cater for the range of soils, aspect, elevation and exposure within the Project have been selected. These robust plants, with a planting design which will endeavour to reflect natural distribution are expected to be successful.

The intention of the project is to procure eco-sourced material for all planting. All species included within the planting plan are able to be eco-sourced from the Rodney Ecological District. There may be circumstances where volume of plants required or lack of suitable stock may force some material to be sourced from elsewhere. All Wetland species will be eco-sourced as per consent condition D60.

Where there will be no planting, the landscape treatment will be hydro-seeded grass. Many grassed areas will generally not be visible to road users, as it will be used in locations such as above rock cuts or below the road level on fill slopes. Refer to Section 8 for plant schedules [D36(c)].

5.20 MULCH

Site-won or imported mulch to be used will be clean and free of sawdust, dirt, phytoxins, pathogens and weed species (including chip from willow, poplar or any other adventive weed species). Mulch will not be used in areas of Mitigation Planting - Wetland, Mitigation Planting - Terrestrial, Mitigation Planting - Stream Edge (see Section 7) or in swales and areas below the stormwater wetland permanent water level. In areas that are steeper than 2:1, mulch is expected to slip down the slope, and biodegradable geotextile fabric will be used instead.

5.21 TOPSOIL AND SURFACE TREATMENT

Topsoil will be carefully stockpiled to retain its organic integrity and will meet the requirements of the NZTA P39 Landscape Standard Specification for Highway Landscaping.

Topsoiling of fill or cut batters will occur in selected locations on the batters in order to provide a layer of higher quality soil above the engineered fill or cuts, which will increase plant growth success. For the majority of the Sector, 100mm of topsoil is used on the cut or fill batters with hydro-seeding. Topsoiling for planting, comprise 300mm thickness of topsoil on selected cut and fill batters at the northern extents of this Sector, near Perry Road as well as at the southern extent near Hīkauae. Scarification (the process of etching the ground to create non uniform surfaces to support root penetration and seed capture) of the slopes will occur. This is with the exception of the crest of fill slopes in the vicinity of the barrier posts in order to maintain the required thickness of engineered fill to provide passive support to the posts [D36(c)].

5.22 SUBSOIL DRAINAGE

Subsoil drainage is located under the footprint of each of the fill areas. With the exception of fill site at chainage 52200, subsoil drainage will consist of “gully drains” at the base of major gullies where significant groundwater flows are expected or observed, together with a network of subsoil drains at regular spacing underneath the fill footprint. Subsoil drainage networks will be set out along ephemeral channels and the final layout of any subsoil drainage will be determined during construction, after topsoil stripping and gully cleaning has occurred, based on observed ground and groundwater conditions and access constraints. Subsoil drainage will generally be buried beneath the fill embankments and on cut batters, and will not be visible, except for small concrete surrounds at the outlets. Bored drains (50-100mm in diameter) may be installed at various levels within the soil and rock cuts. These are expected to be only required at isolated locations and at relatively wide spacings. Due to their small size and spacing, these will be relatively unobtrusive to the motorist.

Site Type	Landscape Treatments	Topsoil Depth Required
Soil disposal sites	Planted Hydroseeded grass	300mm 100mm
2:1 cut/fill batters	Planted Hydroseeded grass	300mm 100mm
3:1 or shallower cut/fill batters (Handed back to adjacent property owner)	Grassed with pasture grass seed	100mm
Stormwater wetlands	Planted	300mm
Swales and stream diversions	Planted Grassed Rock lined	300mm 100mm 0mm
Rock cuts	Rock fall mesh	0mm
Stream, wetland and terrestrial mitigation	Planted	Planted into existing ground

5.23 CONSTRUCTION YARDS

A separate construction phase ULDSP has been prepared for the construction yard located off Moir Hill Road as shown in the Section 7 sector plans.

Upon completion of the motorway construction, the construction yard will be removed and rehabilitated with hydroseeded grass, to the general condition of the pre-Project state. This approach provides flexibility for future use of the area [D36(c)] [D38] [D70] [ULDF section 5.10].

5.24 ECOLOGICAL MITIGATION

To achieve ecological outcomes and comply with the Designation Conditions (refer to Section 1.3), ecologists have determined the habitat types and the nationally threatened and at-risk species within the Project area:

Terrestrial and wetland ecology

- Exotic forest (mainly pine plantation)

Long-tailed bats, North Island (NI) fernbird, NZ pipit, kauri Snail and land snail

- Mature native forest (mainly podocarp/broadleaf/kauri)

Long-tailed bats, Auckland green gecko, forest gecko, NI fernbird, ornate skink, Hochstetter's frog, kauri snail, land snail, green mistletoe, taraire orchid

- Native shrub-lands

Long-tailed bats, Auckland green gecko, forest gecko, NI fernbird, ornate skink, Hochstetter's frog

- Freshwater wetlands

Spotless crake, marsh crake, Australasian bittern

- Short haired plume grass

Aquatic freshwater ecology

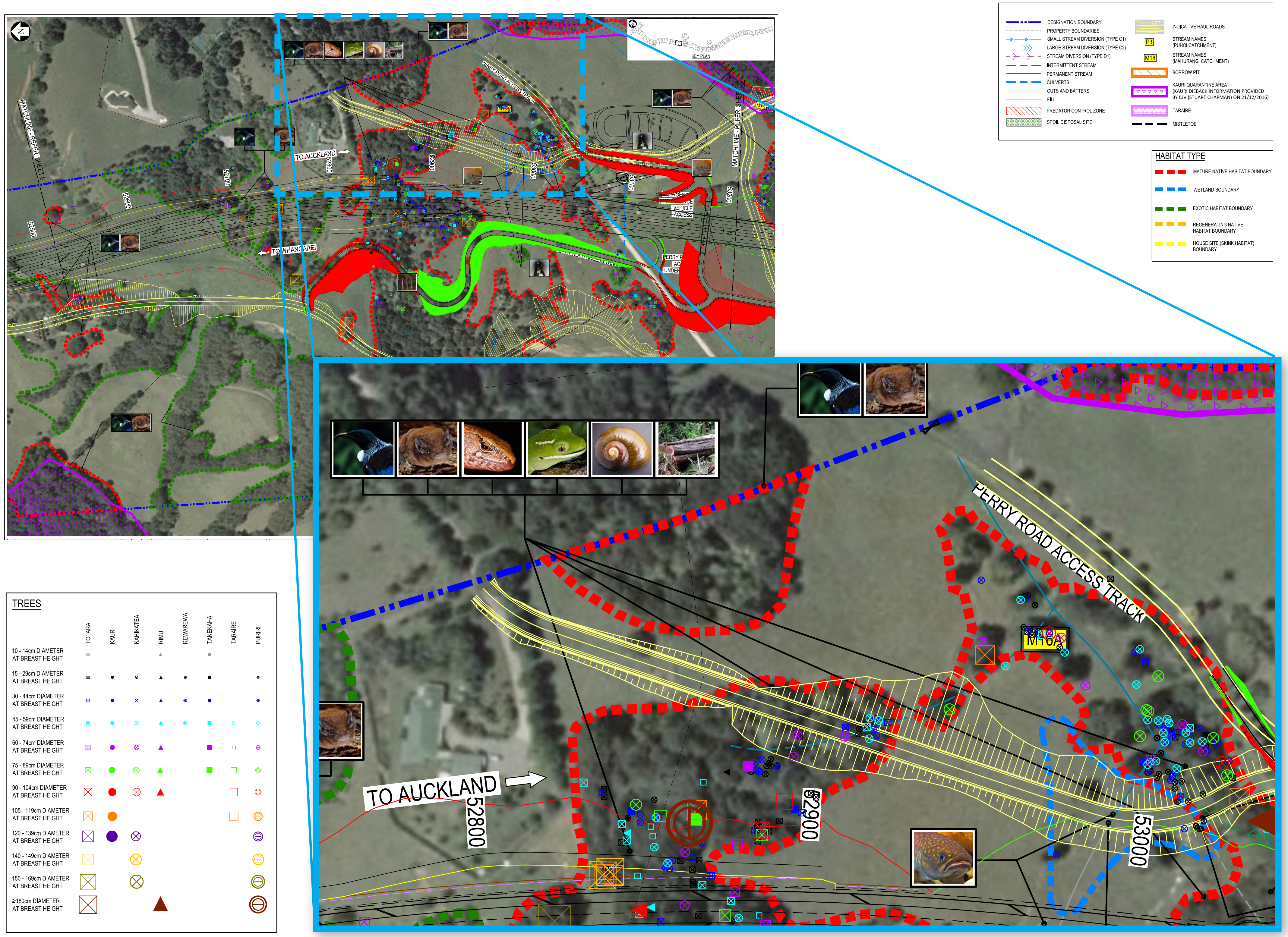
- Permanent streams

Longfin eel, inanga, red-fin bully, kākahi (freshwater mussel)

- Intermittent streams

Longfin eel, inanga, red-fin bully

The images to the right are an extract from the Project's Ecological Constraints Map. These have been included to demonstrate that sensitive species have been identified throughout the alignment by a team of ecologists, who have also determined the appropriate mitigation responses. Details of the Project wide mitigation types are listed below [D36(c)].



MITIGATION TYPE:

VEGETATION CLEARANCE RESTRICTION FOR BATS
REMOVAL OF TREES > 25cm DIAMETER AT BREAST HEIGHT (DBH) IN THESE AREAS IS TO BE RESTRICTED TO THE PERIOD 14 FEBRUARY - 1 MAY TO AVOID OR MINIMIZE EFFECTS ON ROOSTING LONG-TAILED BATS (DESIGNATION CONDITION D44).
ON THE NIGHT PRIOR TO CLEARANCE OF ANY POTENTIAL ROOSTING SITES, A SUITABLY QUALIFIED ECOLOGIST SHALL SURVEY THE RELEVANT AREA FOR ANY ACTIVE ROOSTING SITES. THE REQUIRING AUTHORITY SHALL LEAVE STANDING ANY TREE IDENTIFIED AS AN ACTIVE ROOSTING SITE, UNTIL THE ROOSTING SITE IS CONFIRMED TO BE VACANT BY THE SUITABLY QUALIFIED EXPERT (DESIGNATION CONDITION D45).

VEGETATION CLEARANCE RESTRICTION FOR BIRDS
NO REMOVAL OF VEGETATION IS PERMITTED BETWEEN SEPTEMBER AND DECEMBER INCLUSIVE TO MINIMISE EFFECTS ON NESTING NATIVE BIRDS - DESIGNATION CONDITION D42D)

FERNBIRD SURVEY
IMMEDIATELY PRIOR TO CONSTRUCTION A SUITABLY QUALIFIED ECOLOGIST SHALL CHECK LIKELY AREAS OF FERNBIRD HABTIAT WITHIN THE DESIGNATION IN THE VICINITY OF THE OKAHU INLET.

WETLAND BIRD SURVEY
IMMEDIATELY PRIOR TO CONSTRUCTION A SUITABLY QUALIFIED ECOLOGIST SHALL CHECK LIKELY HABITATS FOR THREATENED OR AT RISK BIRDS

SKINK SALVAGING
A SUITABLY QUALIFIED ECOLOGIST IS REQUIRED TO SALVAGE AND RELOCATE NATIVE SKINKS. THIS WILL REQUIRE:

- ECOLOGISTS TO DEPLOY REPTILE SHELTERS AT LEAST 3 MONTHS PRIOR TO VEGETATION CLEARANCE/HABITAT LOSS.
- ECOLOGISTS TO CHECK REPTILE SHELTERS AND MANUAL SEARCHING ON A WEEKLY BASIS BEGINNING 1 MONTH PRIOR TO HABITAT LOSS (I.E. A TOTAL OF 4 CHECKS).
- ECOLOGISTS TO BRIEF CONTRACTORS IMMEDIATELY PRIOR TO CONSTRUCTION VEGETATION CLEARANCE/EARTHWORKS (SAME DAY), ON SITE-SPECIFIC CONSTRUCTION-ASSISTED SALVAGE PROTOCOL, WHICH MAY INVOLVE:
  - THE USE OF DIGGERS TO MOVE LARGE COVER OBJECTS THAT CAN BE SEARCHED (I.E. LARGE LOGS OR TREE STUMPS)
  - THE USE OF A MULCHING HEAD ON LOW STATURE VEGETATION (TO BETTER ENABLE SKINK CAPTURE)

GECKO SALVAGING
A SUITABLY QUALIFIED ECOLOGIST IS REQUIRED TO SALVAGE AND RELOCATE NATIONALLY 'AT RISK' GECKOS. THIS WILL REQUIRE:

- ECOLOGISTS TO UNDERTAKE NOCTURNAL SEARCHING (SPOTLIGHTING) FOR GECKOS IN THE FOREST CANOPY PRIOR TO CONSTRUCTION
- VEGETATION CLEARANCE CONTRACTORS TO STOCKPILE DE-LIMBED VEGETATION IMMEDIATELY ADJACENT TO REMAINING NATIVE FOREST. VEGETATION MUST BE LEFT IN-SITU FOR AT LEAST 1 MONTH PRIOR TO MULCHING (BUT IDEALLY SHOULD BE LEFT INDEFINITELY).

HOCHSTETTER'S FROG SALVAGING
A SUITABLY QUALIFIED ECOLOGIST IS REQUIRED TO SURVEY, AND IF PRESENT, SALVAGE AND RELOCATE, NATIONALLY 'AT RISK' HOCHSTETTER'S. THIS WILL REQUIRE ECOLOGISTS TO UNDERTAKE MANUAL SEARCHING FOR HOCHSTETTER'S FROG PRIOR TO VEGETATION CLEARANCE IN AREAS WHERE HOCHSTETTER'S FROGS ARE PRESENT.

SNAIL SALVAGING
A SUITABLY QUALIFIED ECOLOGIST IS REQUIRED TO SALVAGE AND RELOCATE NATIONALLY 'AT RISK' SNAILS. THIS WILL REQUIRE ECOLOGISTS TO UNDERTAKE NOCTURNAL SEARCHING (SPOTLIGHTING) FOR NATIVE SNAILS PRIOR TO VEGETATION CLEARANCE

FENCING TO PROTECT SIGNIFICANT VEGETATION
FENCING TO PROTECT SIGNIFICANT NATIVE VEGETATION FROM CONSTRUCTION ACTIVITIES

SHORT HAIRED PLUME GRASS SALVAGING
A SUITABLY QUALIFIED BOTANIST IS REQUIRED TO SALVAGE AND RELOCATE THE NATIONALLY 'AT RISK' SHORT HAIRED PLUME GRASS PRIOR TO CONSTRUCTION ACTIVITIES

FRESHWATER ECOLOGY MONITORING
ECOLOGISTS TO UNDERTAKE PRE-CULVERT INSTALLATION FISH MONITORING BETWEEN 1 SEPTEMBER AND 31 DECEMBER PRIOR TO THE INSTALMENT OF CULVERT.
ECOLOGISTS TO UNDERTAKE POST-CULVERT INSTALLATION FISH BETWEEN 1 SEPTEMBER AND 31 DECEMBER.

FISH SALVAGING
CONSTRUCTION TEAM ARE REQUIRED TO NOTIFY THE FRESHWATER ECOLOGY LEAD 30 DAYS PRIOR TO THE COMMENCEMENT OF WORKS IN A WATERCOURSE TO ENSURE FISH SALVAGE AND RELOCATION CAN BEEN COMPLETED PRIOR TO ANY INSTREAM WORKS. WORKS IN A WATERCOURSE SHOULD NOT COMMENCE BETWEEN 1 SEPTEMBER AND 30 NOVEMBER. FOR SUBSEQUENT YEARS, WORK DURING THIS PERIOD SHOULD BE AVOIDED AS FAR AS PRACTICABLE.

LOG AND STUMP SALVAGING
SELECTIVE DEPLOYMENT OF NATIVE LOGS AND STUMPS TO ECOLOGICAL MITIGATION SITES
ECOLOGISTS (IN CONSULTATION WITH IWI) TO BRIEF VEGETATION CLEARANCE CONTRACTORS ON WHICH LOGS AND STUMPS WILL NEED TO BE DEPLOYED TO MITIGATION SITES.

FISH PASSAGE
FISH PASSAGE REQUIREMENTS TO BE DETERMINED FOR TEMPORARY & PERMANENT CULVERTS. CONSTRUCTION TEAM TO ENSURE THAT FISH PASSAGE REQUIREMENTS ARE INCLUDED IN CULVERT INSTALLATION WHERE REQUIRED.

GREEN MISTLETOE PROTECTION
A SUITABLY QUALIFIED BOTANIST IS REQUIRED TO IDENTIFY AND MONITOR 'NATIONALLY THREATENED DECLING/REGIONALLY CRITICALLY THREATENED' GREEN MISTLETOE FOR DUST PROTECTION MEASURES PRIOR TO AND DURING CONSTRUCTION ACTIVITIES.

TARAIRE ORCHID PROTECTION
A SUITABLY QUALIFIED BOTANIST IS REQUIRED TO IDENTIFY AND FLAG THE BASE OF ANY 'AT RISK' NATIVE ORCHIDS TO PREVENT REMOVAL OR DAMAGE.