Belfast to Pegasus Motorway & Woodend Bypass Pre-implementation and MSQA Professional Services

Design Statement

NZ Transport Agency (NZTA)

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1 Introduction

This Design Statement provides a high-level overview of the design philosophy, key structures, and other design elements of the State Highway 1 North Canterbury—Woodend Bypass Project (Belfast to Pegasus) (the Project). It includes commentary on where the design has been refined from the earlier scheme design phase which supported the designation process (2013-2015).

This report provides technical support to the Assessment of Effects on the Environment (AEE) for applications made by the New Zealand Transport Agency Waka Kotahi (NZTA) under the Fast-Track Approvals Act 2024 (FTAA).

1.1 Expert witness statement

While this is not a matter before the Environment Court, the authors of this report have each read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 ('Code'). The authors have each complied with the Code in the preparation of this report.

The data, information, facts and assumptions the authors have each considered as part of this report are set out in this report. The reasons for the conclusions of the report are also set out in this report. Unless stated otherwise, this report is within each of the authors' expertise and the authors have not omitted to consider material facts known to them that might alter or detract from the opinions expressed.

1.2 Applicability statement

We understand and agree that NZTA will submit this report as part of an application under the Fast-Track Approvals Act 2024 and the appointed panel will use this report for the purpose of assessing that application.

2 Background

The Project is a vital initiative led by NZTA, aimed at enhancing transport capacity and connectivity in the rapidly growing northern region of Christchurch. Recognized as a Road of National Significance (RoNS), this project is critical for supporting both local community needs and the national economy by facilitating the movement of goods and people along this essential freight route.

The key objectives of the Project are:

- **Improve Travel Time and Reliability:** The Project aims to enhance travel time and reliability between Lineside Road and Pegasus, increasing the efficiency and productivity of the transport network. This enhancement will ensure smoother traffic flow and reduce delays, benefiting both local commuters and freight transport.
- **Reduce Severance and Improve Accessibility**: By reducing severance, the Project seeks to improve accessibility to social, cultural and economic opportunities for local communities. This objective is crucial as it enables residents to connect more effectively with essential services, employment opportunities, and recreational facilities.
- **Improve Safety of the Transport Network**: A core focus of the Project is to improve the safety of the transport network by minimizing exposure to crash risks and reducing the number of deaths and serious injuries. This aligns with national priorities for transport safety and aims to create a more secure environment for all road users.

3 Description of Design

3.1 General

In accordance with the RoNS Standardised Design, the Project will incorporate best practices in roadway design.

Overall, the Project is a circa 11km four-lane motorway extension of SH1 north of Christchurch, running south of SH1/SH71 Lineside Road interchange and finishing just north of Pegasus. The Project will upgrade the current motorway from two lanes to four lanes between Lineside Road and Williams Street and extend the four lanes via the Woodend Bypass to Pegasus. At Pegasus the state highway will continue as a two-lane overbridge (one lane in each direction), connecting with the existing state highway heading further north.

In the northbound direction, at the southern extent of the Project, the design ties in 100m south of Lineside Road, where the existing motorway merges from two to one lane and ties back into the existing SH1 740m north of Pegasus. The total length in the northbound direction is 9.6km.

In the southbound direction, at the northern extent, the design ties in 740m north of Pegasus of Lineside Road and extends 800m south of Lineside Road, allowing for a tie-in for the additional lane southbound at Kaiapoi Bridge. The total length in the southbound direction is 11.1km

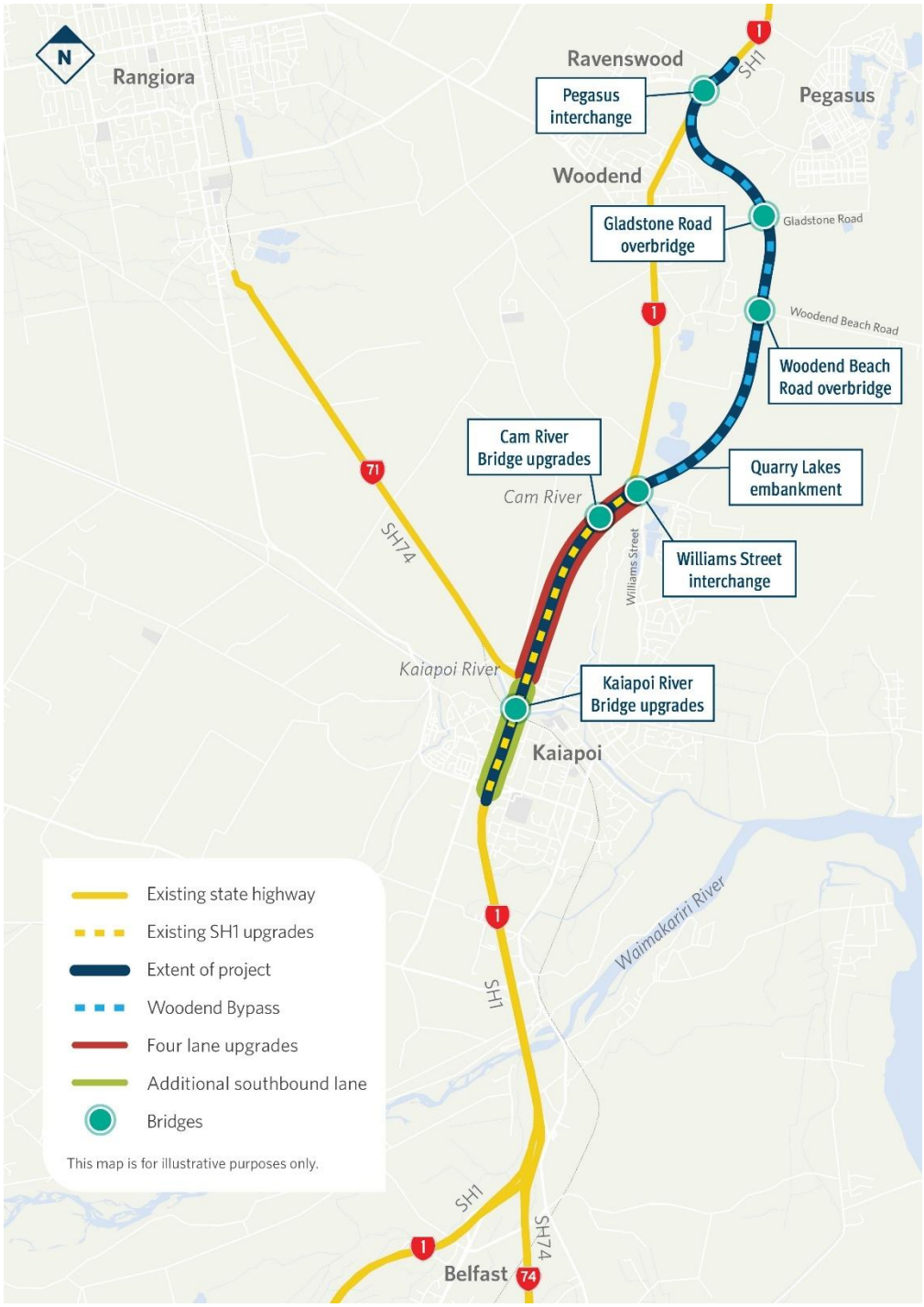

Figure 3-1 – Project Scope Extent

The design is fully within Waimakariri District, and we have maintained close collaboration with the Waimakariri District Council throughout its development. In particular, we have worked closely on local road connectivity, such as at Williams Street and Bod Robertson Drive/Pegasus Boulevard, active mode connections and coordination with their services, including stormwater, water supply, wastewater, and utilities.

3.2 Design Description

The design has been developed to a 30% Detailed Design level, which includes:

- Overall alignment based on topographical surveys, establishing the horizontal and vertical profiles, lane widths, shoulders, medians, emergency bay locations, active mode connections, and intersection forms.

- Confirmation of preferred geotechnical and structural approaches for key elements, broadly fixing structural footprints while allowing for further optimisation and detailed design. This includes preliminary noise wall locations, with final designs yet to be confirmed.
- Flood and stormwater management approach confirmed, with the broad location and type of infrastructure identified to mitigate affects. While culvert locations, stream diversions and pond locations are identified, the detailing of the stormwater infrastructure is still subject to optimisation as detailing is developed, and space requirements refined.
- Initial design of surface features such as barriers, streetlights, traffic signals, intelligent transport systems (ITS), signage, noise walls and property access have been developed conceptually alongside the 30% design, but these details are still in development and subject to optimisation.

This design statement reflects the 30% design drawings that have been prepared supporting the FTAA applications (GAs) as outlined below:

- General arrangement plans – which provide the overall 2D layout along the alignment, including proposed stormwater infrastructure and some surface details such as barriers, streetlights,
- Plan and Longitudinal Sections – which illustrate the levels along the main alignment with respect to the existing ground surface, including additional longitudinal plans for elements off the main alignment (e.g., at on-ramps, off-ramps, and crossed roads)
- Typical Cross Sections – At a range of locations along the alignment with respect to the existing ground level.
- Stormwater features – culvert locations, stream diversions, pond locations

3.3 Structures and Geotechnical

In total, the structural design consists of five new bridges, strengthening of one existing bridge, rearrangement of an existing bridge, three new major culverts, and an extension of an existing major culvert. All of the new bridge abutments will have ground improvements such as stone columns or rigid inclusions. The Cam River Crossing Bridge is the only structure with piled foundations. Ramped approaches to the bridges are to have sloped embankment sides throughout, with the exception of constrained areas, such as south of the Williams Street Overbridge and both sides of the Pegasus Interchange Overbridge, which will use retaining walls to hold the approaches. Each of the key structural components is outlined below:

3.3.1 Kaiapoi Bridge

The Kaiapoi River and Rail Bridge is a preexisting dual deck structure, supported on shared piers, commissioned in 1970. The structure carries SH1 across the Kaiapoi River. The southbound carriageway of the structure will be widened with an additional lane on the median side of the deck to improve the traffic safety of road users merging and demerging with traffic between Lineside Road and Ohoka Road.

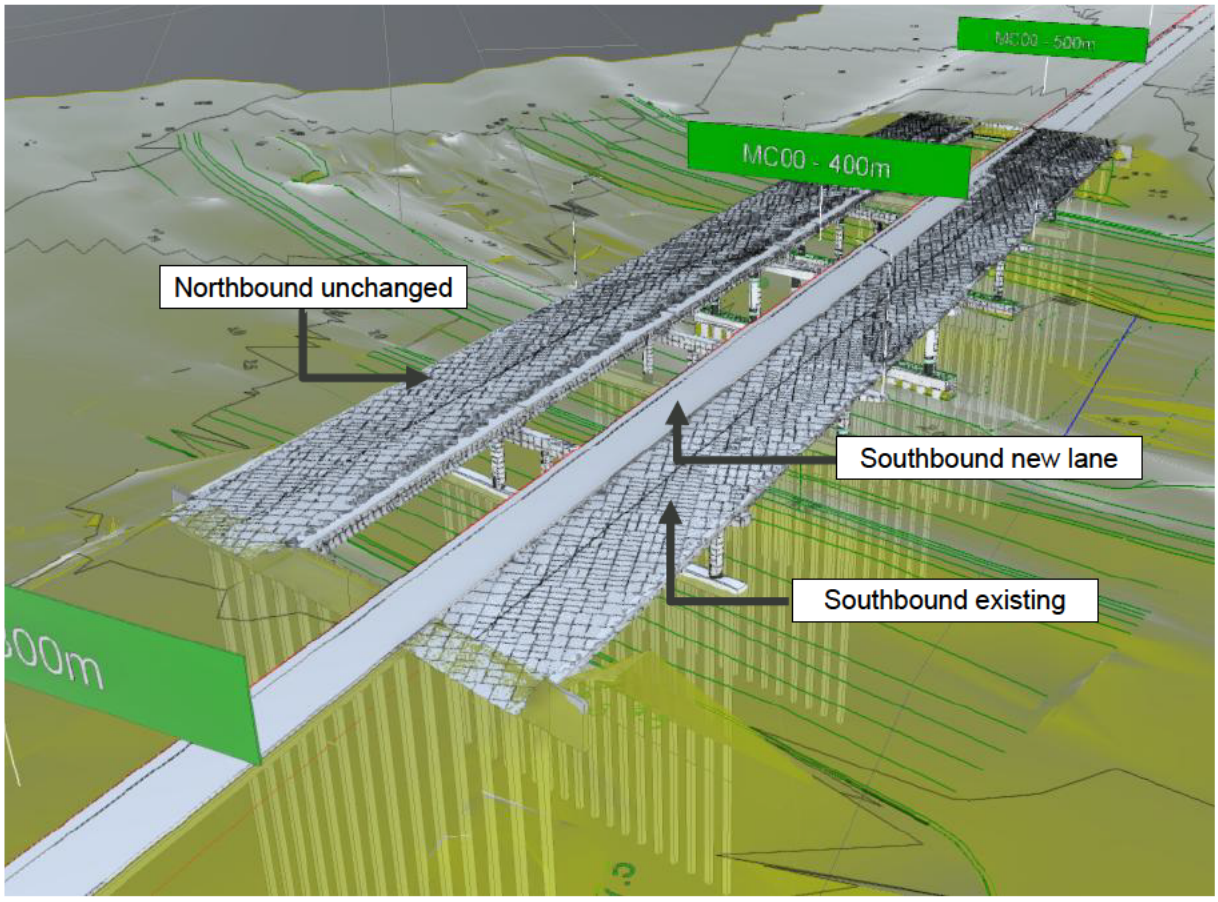

Figure 3-2 – 3D Illustration of Kaiapoi Bridge Design

3.3.2 Cam River Crossing

The Cam River Crossing is located at the point of divergence between the existing SH1 alignment and the new alignment, which will form a key part of the new State Highway. A new bridge structure is required at this location to carry the projected traffic volumes and lane arrangements across the Cam River. The existing bridge will be repurposed as the northbound off-ramp, while a new bridge will be constructed adjacent carrying the main SH1 northbound and southbound lanes, as well as a southbound on-ramp.

The new bridge comprises a single discrete structure constructed on concrete piled foundations, carrying the four-lane main alignment and one southbound on-ramp. The new 5-lane bridge will have a total width of 28m and span of 37m. 3m long settlement slabs will be located beneath both approaches to the bridge. The deck will be surfaced with a standard bridge deck road surfacing layer. The layout arrangement is outlined in the figures below.

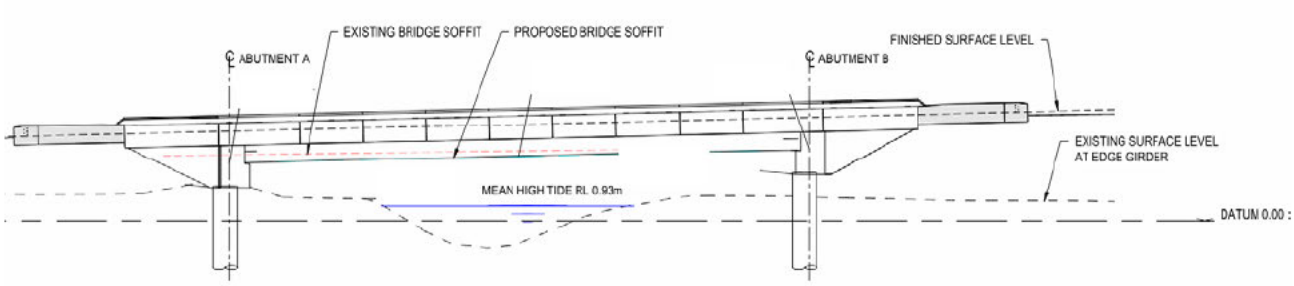

Figure 3-3 – Vertical View of Cam River Bridge Design

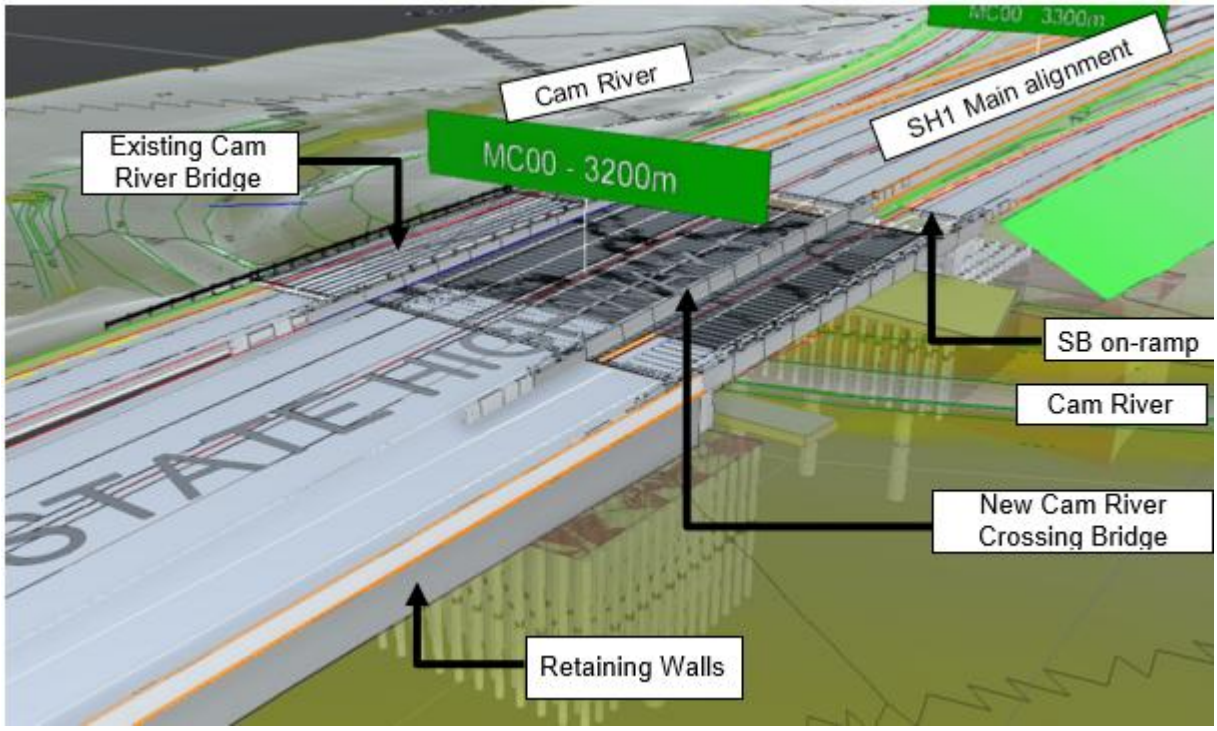

Figure 3-4 – Illustration of Cam River Bridge Design

3.3.3 Williams Street Overbridge

The structure will be located where the proposed Williams Street alignment and proposed SH1 intersect. The bridge runs from southwest to northeast. The new SH1 alignment will have ramped approaches leading up to the bridge from either side. The southern approach will have a retaining wall to the eastern side, located between the main alignment and a southbound on-ramp, while all other ramped approach sides will have sloped embankments. The ramped approach to the southwest interacts with the Cam River Crossing Structures, while the approaches to the northeast cross the Quarry Lake region.

The bridge deck will be an in-situ concrete slab and precast beam composite section. The deck edges will have TL5 concrete rigid barriers. The deck will be surfaced with a standard bridge deck road surfacing layer. Concrete integral abutment beams will be located at each end at the top of MSE abutment walls. The total bridge structural footprint will be approx. 29m by 22m.

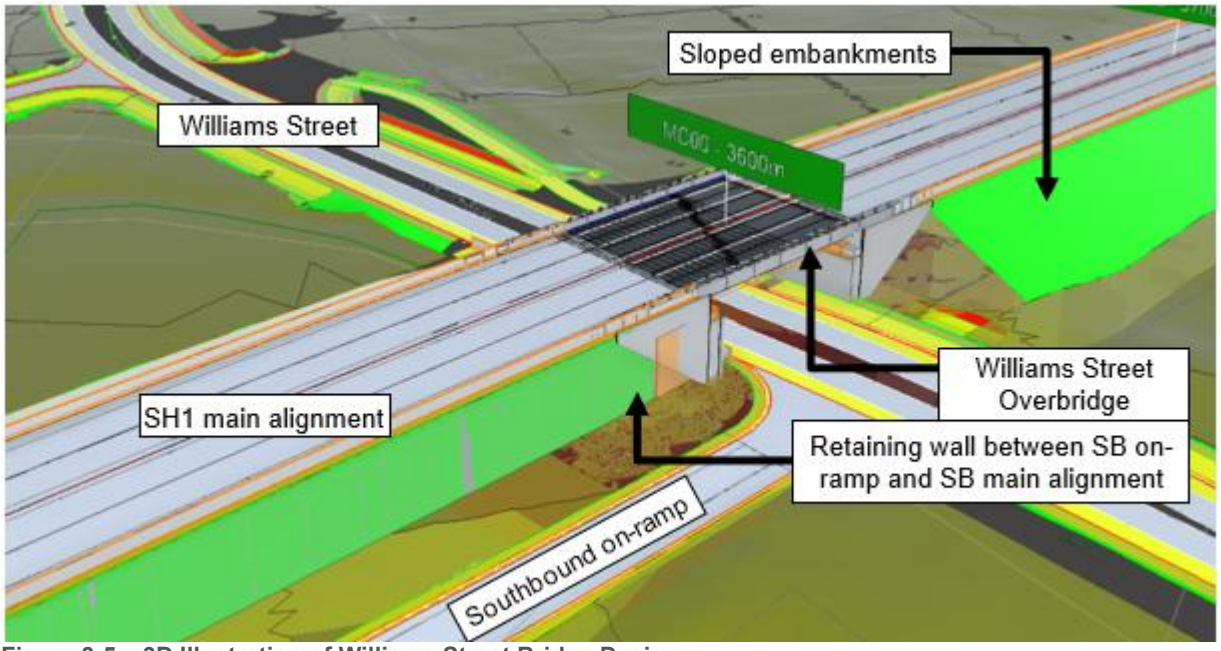

Figure 3-5 – 3D Illustration of Williams Street Bridge Design

3.3.4 Quarry Lakes Crossing

North of Williams Street the design needs to cross existing quarry lakes. A causeway was selected as the preferred structure at this location, compared to a bridge, as it provides a much more economical solution. The proposed embankment comprises a causeway that passes through both east and west lakes as shown in the following figure. Reclamation of the lakes to form the embankment is part of early works which are authorised separately.

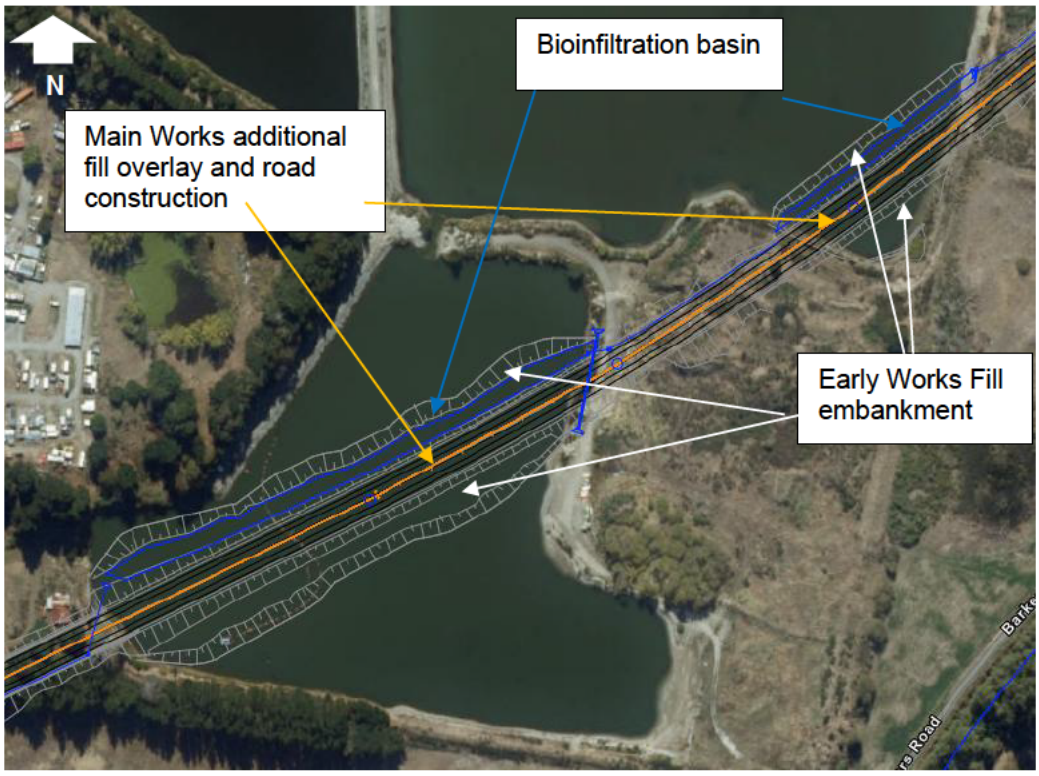

Figure 3-6 – Plan of Quarry Lake Crossing

The previously constructed embankment (authorised through early works) will be subject to ground improvement by dynamic compaction. The following figure shows the fill placed as part of early works in orange. The embankment will need to be overfilled laterally, to enable dynamic compaction of the underlying 1V:3H slopes. The overfilled slopes essentially become sacrificial shoulders that may be displaced under seismic loading without affecting the permanent embankment. The overlying road formation will contain 3 layers of geogrid (Miragrid GX 200/50 or similar).

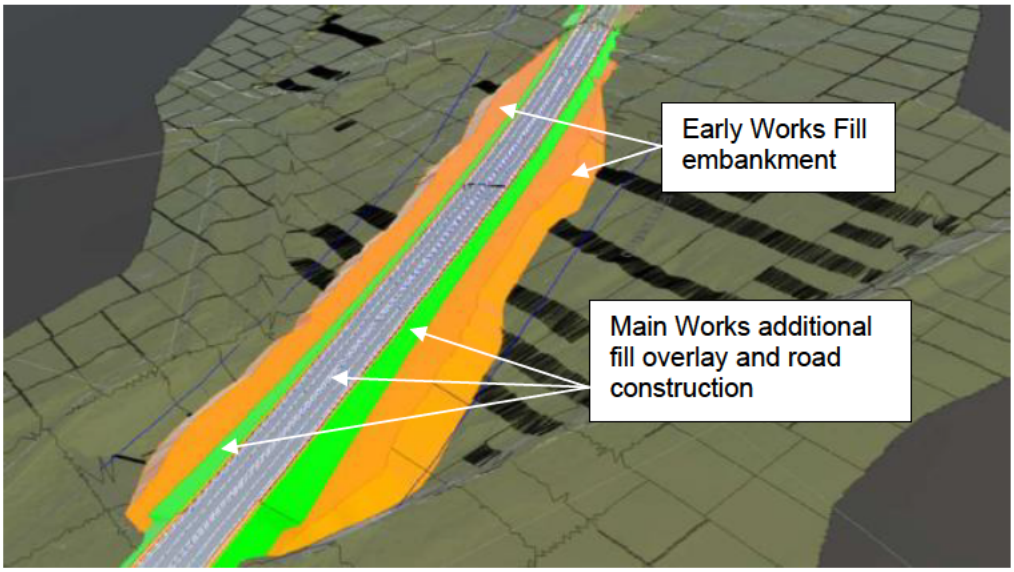

Figure 3-7 – 3D Illustration of Quarry Lake Crossing

A south-east remnant waterbody (circa.2.5 ha) will be backfilled and constructed as a wetland created through the partial reclamation of the quarry lakes for the new alignment. A further description of these works is provided in the Construction Method Statement.

3.3.5 Woodend Beach Road Underpass

A structure at Woodend Beach Road, will carry a locally realigned Woodend Beach Road, a local road, over the proposed SH1 alignment, achieving a safe, unobstructed, high speed road network. The bridge runs from East to West. The structure will be located offline to the south of the existing Woodend Beach Road alignment and proposed State Highway 1 intersect. The new road alignment will have approach embankments leading up to the bridge from either side.

The bridge deck will be an in-situ concrete slab and precast beam composite section. The deck edges will have TL5 concrete rigid barriers. The deck will be surfaced with a standard bridge deck road surfacing layer. Concrete integral abutment beams will be located at each end at the top of MSE abutment walls. The total bridge structural footprint will be approx. 35m by 16m.

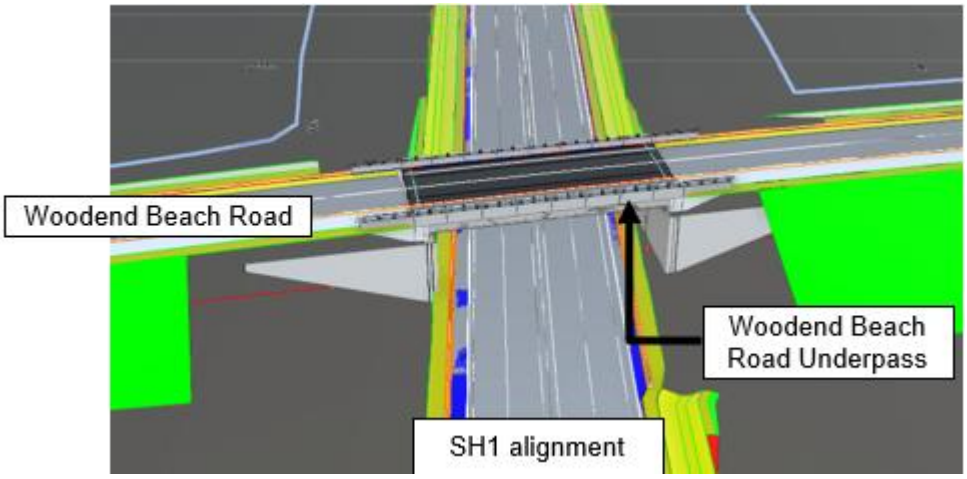

Figure 3-8 – 3D Illustration of Woodend Road Underpass

3.3.6 Gladstone Road Underpass

Similar to Woodend Beach Road, a structure is also required at Gladstone Road, to cross over SH1. The bridge runs from East to West. The bridge construction is to be completed online, requiring a temporary road diversion during construction.

The new Gladstone Road alignment will have approach embankments leading up to the bridge from either side. The bridge deck will be an in-situ concrete slab and precast beam composite section. The deck edges will have TL5 concrete rigid barriers. Concrete integral abutment beams will be located at each end at the top of MSE abutment walls. Starting at the centreline of the carriageway, there will be a 3% crossfall sloping down to both edges of the bridge deck for drainage purposes. The total bridge structural footprint will be approx. 38m by 16m.

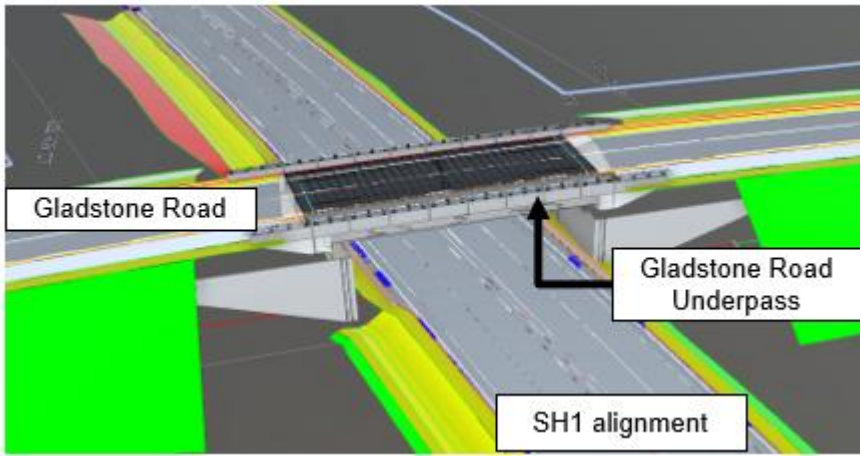

Figure 3-9 – 3D Illustration of Gladstone Road Underpass

3.3.7 Pegasus Interchange Overbridge

The current Pegasus Boulevard, Bob Robertson Drive and State Highway 1 intersection is to be upgraded to a full diamond interchange to achieve a safe, reliable, efficient road network. The bridge runs from North to South. The existing local roads under the bridge are to be modified to enable safe and efficient connections to SH1 on and off ramps, while allowing east-west through traffic.

SH1 will have approach ramps leading up to the bridge from either side. Both sides of the approach ramps will have retaining walls separating the Main alignment grade from the on and off ramps.

The bridge deck will be an in-situ concrete slab and precast beam composite section. A levelling course will overlay the deck across the width of the roadway. The deck edges will have TL5 concrete rigid barriers. Concrete integral abutment beams will be located at each end at the top of MSE abutment walls. The total bridge structural footprint will be approximately 34m by 17m.

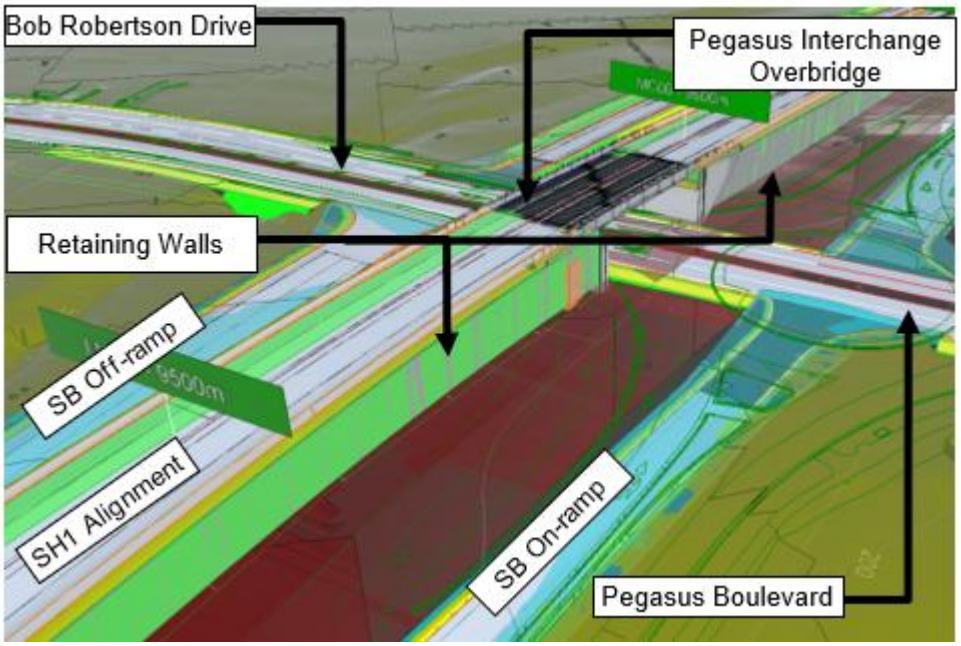

Figure 3-10 – 3D Illustration of Pegasus Interchange

The on and off ramps will be connected to the east-west local roads, Pegasus Boulevard and Bob Robertson Drive, via signalised intersections as illustrated in the following figure.

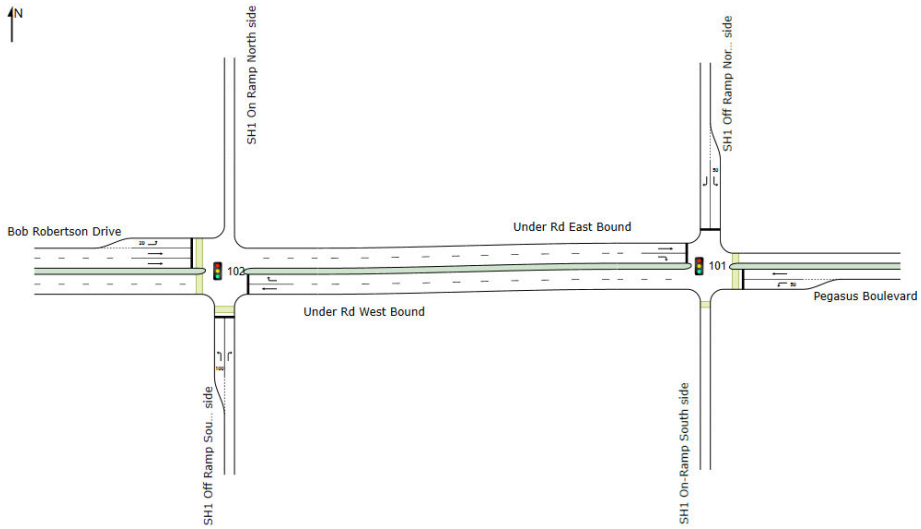

Figure 3-11 – Layout Plan of Bob Robertson Drive and Pegasus Boulevard connections at Pegasus Interchange

3.3.8 Major culverts

Major culverts (culvert >3.4m^2) are proposed at three locations:

- Across SH1 north of Bob Robertson Drive, conveying the Taranaki Stream,
- South of Pegasus intersection conveying Waihora Creek,
- Between Woodend Beach Road and the quarry lake, conveying McIntosh's drain.

In addition, the existing culvert on Bob Robertson Drive at Taranaki Stream will be extended to provide for the final corridor width and 3m shared used path.

Further details on these major culverts and others are provided in a separate Stormwater and Flooding Report.

3.3.9 Noise Barriers

Noise walls are being proposed to mitigate noise impacts in the surrounding residential areas. Preliminary noise modelling has been undertaken to determine the potential location and extent of these, which indicates up to 3km (total on both sides) of noise barriers may be required at various locations along the alignment. The preferred design for the noise barriers is still being refined but will consist of one of the following options:

1. A timber or steel/concrete fence at ground level at the edge of the alignment
2. A small earth bund (e.g 1m high with 2:1 slopes), set outside of the proposed swales with a timber or steel & concrete fence at the crest
3. An earth bund (e.g 2m high with 2:1 slopes) set beyond the swales.

3.4 Geometrics

- **Cross Sections:** While the cross-section details vary throughout, for SH1 the typical cross section (as per RoNS v3 Draft for 2+2 Road up to 100km/h) provides for a 18.5m barrier to barrier width, comprising 1.5m median, 3.5m lanes and 1.5m shoulder.

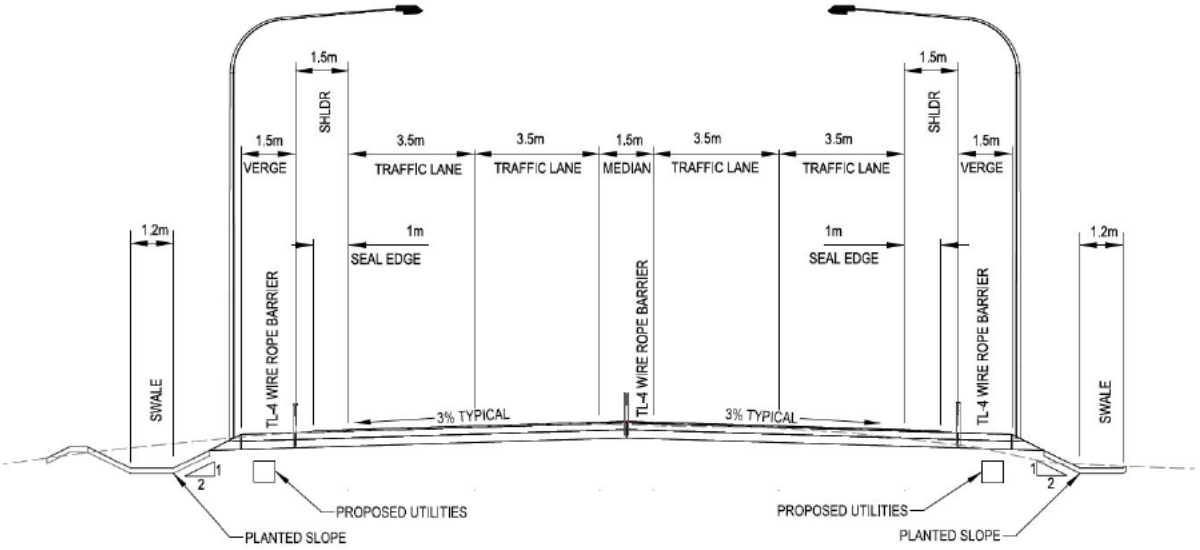

Figure 3-12 – Typical Cross Section of SH1 Main Alignment

- **Design Speed:** From the southern extent of the Project, the posted / design speed of 100km/h is to be used to align to the speed environment to the south of the Project. This is reduced to 80km/h just south of Pegasus Interchange, to minimise the footprint and earthworks of the interchange and to interface with the 80km/h posted speed limit to the north of the Project extent. On the side roads there is a variety of speeds as outlined in the following table. While these design speeds still need to be ratified, including those on the side roads through WDC, they form the basis of the 30% design and should these be altered, the design will be adjusted accordingly.

Table 3-1 – Proposed Design Speeds

Roads	Existing Posted Speed	Proposed New Posted Speed/ Design Speed
State Highway 1	100km/h (Ohoka Road to south of Williams Street) 80km/h (south of Williams Street to Woodend Beach Road) 50km/h (Woodend Beach Road to south of Pegasus Interchange)	100km/h (Lineside Road to south of Pegasus Interchange)
	70km/h (south of Pegasus Interchange to Wards Road) 80km/h Northwards	80km/h (south of Pegasus northwards)
Pegasus Boulevard	70km/h	50km/h
Bob Robertson Drive	50km/h	50km/h
Gladstone Road	60km/h	60km/h
Woodend Beach Road	80km/h	80km/h
Williams Street	80km/h	60km/h
Garlick Street	50km/h	50km/h

- **Barriers:** Road safety barriers will be provided in the median, on the edge of the main alignment and on the edge of ramps at interchanges. TL-4 wire rope safety barriers will be used, wherever feasible as the first preference, with rigid and semi-rigid systems only used where specifically required. The preference will be to avoid placing roadside hazards within the deflection and rollover envelopes of the wire rope system. Where this cannot reasonably be avoided, more rigid barrier systems will be considered such as around bridge abutments and signage or tolling gantries.
- **Stopping Bays:** The inclusion of 1.5m shoulders throughout the State Highway design necessitates the incorporation of stopping bays, which will serve a dual purpose as both emergency bays and maintenance bays. The bays are approx. 60m in length and 4m wide and are provided in both directions aligned with VMS and CCTV locations.

3.5 Active Modes

- **Bob Robertson Drive – Pegasus Boulevard:** The Project includes a 3m wide shared path on the south side connecting Ravenswood to Pegasus across Taranaki Stream and under the new Pegasus bridge (Figure 3-13).
- **Kaiapoi to Ravenswood cycleway:** Waimakariri District Council have a current proposal to develop a cycleway from Kaiapoi to Ravenswood. The Project interfaces with this cycleway in two locations, at Williams Street and at Garlick Street, where shared paths connections have been allowed for within the design. At Garlick Street (Figure 3-14) a shared path is provided on the west side to connect to the existing SH1 and at Williams Street a 3m shared path is proposed on the northern side of Williams Street to connect to Lees Road (Figure 3-17) and.
- **East West Connectors:** Shared paths are also prosed on the south side of Woodend Beach Road (Figure 3-15) and Gladstone Road (Figure 3-16) overpasses to provide an active mode connection east-west across the bypass.
- **Arohatia te Awa path:** The Arohatia te Awa path is a potential path planned by WDC to follow the southern side of Cam River, extending under the Cam River bridge (Figure 3-18). While this path is not included in the Project design, a suitable space has been allocated to allow the head height and width of the path when constructed in the future. This path is only in concept stage hence the timing of design and construction if this is currently unknown.

Figures illustrating each of these shared path connections is provided on the following page from Figure 3-13 to Figure 3-18. These snips are from the 30% design drawings, hence the north point varies across the figures in line with the plans, with the shared paths illustrated in yellow.

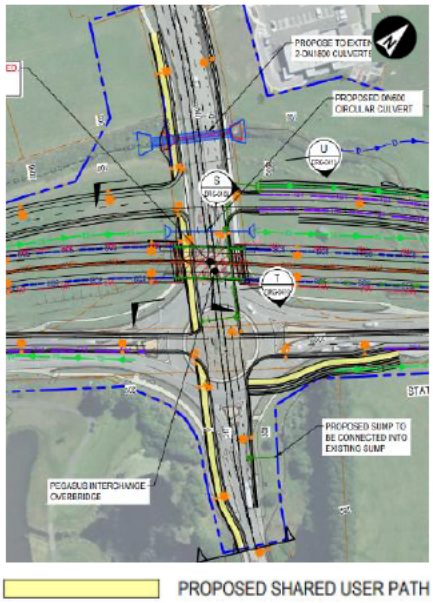

Figure 3-13 – Shared path at Pegasus Interchange

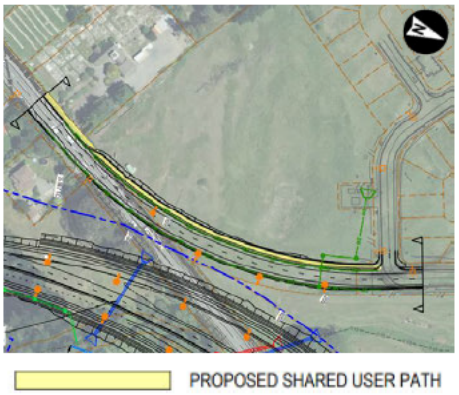

Figure 3-14 – Shared path at Garlic Street

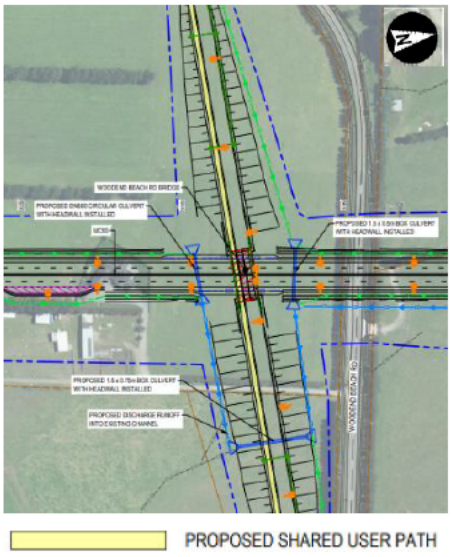

Figure 3-15 – Shared path at Woodend Beach Road

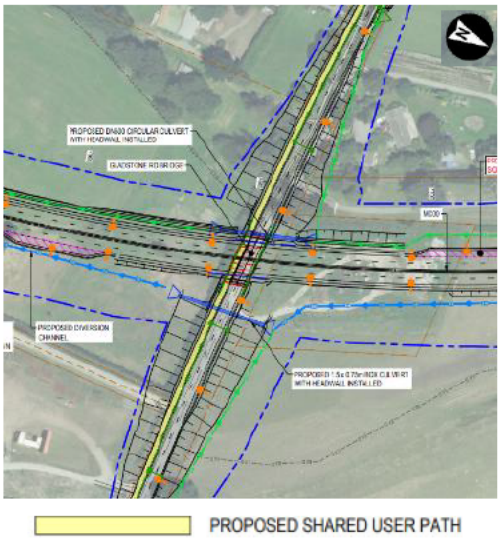

Figure 3-16 – Shared path at Gladstone Road

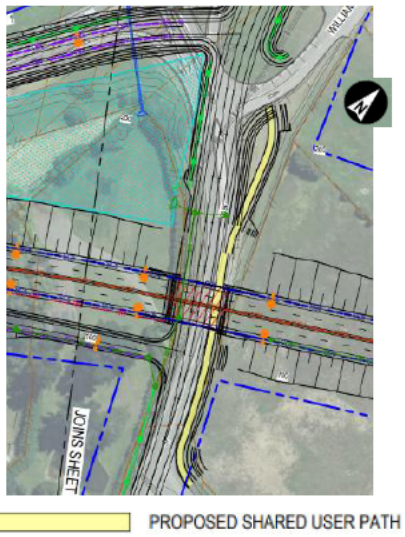

Figure 3-17 – Shared path at Williams Street

Figure 3-18 – Future proposed Arohatia te Awa shared path

3.6 Intersections

- **Traffic Signals:** A new signalised diamond interchange is proposed at the SH1 / Bob Robertson Drive / Pegasus Boulevard intersection (Pegasus Interchange). The traffic signals at the interchange will be controlled by a single traffic signal controller, as the northbound / southbound ramp intersections are in close proximity to each other and will operate as one signalised intersection.
- **Priority Intersections:** Williams Street intersects in two T-junctions with the SH1, at the off ramp and on ramp. Both intersections are proposed as priority-controlled intersections with a posted speed limit of 60km/hr on Williams Street. This configuration will optimise traffic flow, reduce delays and achieve better safety outcomes, while aligning with the future function assessment that defines this section as a peri-urban road.

3.7 Intelligent Transport Systems (ITS)

- **Operational Visibility**: Pan Tilt and Zoom (PTZ) CCTV cameras will be installed at regular intervals along the corridor between the Lineside Road and Pegasus Boulevard interchanges to provide comprehensive coverage. Fixed cameras will also be installed at these locations, mounted on the same supporting columns as the PTZ cameras. All cameras will be mounted on 15m hinged poles designed for easy maintenance and to minimize downtime.
- **Road User Information:** Variable Message Signs (VMS) are proposed to provide real-time journey information to road users, enhancing their travel experience and decision-making. VMS will be installed on SH1 in both northbound and southbound directions, as well as on the local road network approaching the Lineside Road, Williams Street, and Pegasus Boulevard interchanges. A VMS for southbound traffic will be located north of the Pegasus Interchange, outside the project area.
- **Traffic Monitoring:** Traffic monitoring systems will be strategically placed to capture traffic volumes, vehicle classifications, and speeds. These systems will cover all on-ramps, off-ramps, and lanes along the SH1 main alignment within the Project area, ensuring comprehensive monitoring of all traffic movements.
- **Communication Connections**: Communication infrastructure is essential for seamless data exchange between ITS devices and central management systems at NZTA and WTOC, enabling real-time monitoring and control. This will be achieved via a dedicated fibre optic backbone cable routed along the eastern side of the corridor from Pegasus Boulevard to Lineside Road. The backbone connects to third-party providers (e.g., Enable, One NZ, or Chorus) at both ends, enhancing network resilience and redundancy.

3.8 Utilities

The existing infrastructure within the Project corridor is owned and operated by several individual utility companies including Waimakariri District Council (WDC), Chorus, EonFibre (Vodafone), MainPower, Transpower, GASCO, Enable and Land Information New Zealand (LINZ). The design includes the relocation of a number of these existing utilities, to manage conflicts with the new geometry and structures. In addition, some future proofing is being considered as outlined below:

- **Bypass:** Space proofing for the length of the bypass to enable MainPower to later retrofit a new 66kV line. (Note a 66KV line requires sufficient space for a minimum 2x2 trench)
- **Woodend Beach Road:** WDC have requested that the design allows for future proofing of a new watermain along Woodend Beach Road. There is currently no watermain along Woodend Beach Road, instead the community at Woodend Beach currently draw from their local water supply source but are having issues with poor water quality. Providing a watermain connection along Woodend Beach Road would enable them to connect to the Woodend Town supply improving water supply quality for the beachside community.

- **Gladstone Beach Road:** WDC have requested that the design also allow for future proofing of a new (additional) watermain and wastewater along Gladstone Beach Road:
  - There is an existing wastewater pipe along Gladstone Beach Road which connects the wider community to the wastewater treatment plant and outfall. However, as the demand from the surrounding area increases with further development zoned, more wastewater capacity is anticipated and hence there is a desire to consider future proofing for this within the design by providing for an additional wastewater pipe at this location.
  - While there is also an existing watermain along Gladstone Road, an additional pipe would provide for additional water supply demand expected in the future.
- **Pegasus Interchange:** WDC are also considering space proofing for a future additional watermain and wastewater line, east west beneath Pegasus Interchange, to serve future anticipated growth in the wider area.

These future proofing requests may come in the form of simply setting width aside, installing ducting only or installing the infrastructure itself, with details on this future proofing still being confirmed.

3.9 Local Roads

The Project includes works on the following connecting local roads, which will be designed at the interfaces to tie-in with existing geometry with the following existing road:

- Williams Street
- Woodend Beach Road
- Gladstone Road
- Bob Robertson Drive
- Pegasus Boulevard

In addition, at Garlick Street a new arterial road will form an Urban Connector (under the future One Network Framework) connecting the State Highway to Bob Robertson Drive.

3.10 Private Accessways

As part of the Project, 12 private driveways are affected and will be realigned as part of the construction works, including access to properties off Main North Road, Gladstone Road, Woodend Beach Road and Fullers Road. The final location of these driveways are to be negotiated with the property owner.

3.11 Fences

Permanent fences are intended to define land boundaries, both public and private, at the completion of the Project works. Fences will be provided to ensure the security and protection of the main corridor, stormwater management devices, and planting areas.

3.12 Lighting

The design provides for lighting across the full length of the corridor to provide a safe, well-lit environment for all road users, including drivers, cyclists, and pedestrians.

3.13 Pavement

A 25-year design traffic loading has been adopted for the main alignment, resulting in a RoNS Type 5 pavement design which comprises of the following layers:

- 40 mm Epoxy Porous Asphalt (EPA) 7 (on a tack coat)
- 160 mm Asphalt Concrete 20 (AC20)
- 230 mm All Passing 65 (AP65)
- Upper Subgrade (or SIL) California Bearing Ratio (CBR) 10+
- Subgrade (Designed as Required)

Where existing pavements are being widened, the existing pavement must also adhere to the requirements of the RoNS Standardised Designs document.

3.14 Stormwater

The stormwater design comprises the following components:

- Stormwater drainage – effective collection and conveyance of stormwater runoff from new and existing pavement areas;
- Cross drainage – management and conveyance of stormwater runoff generated upstream and outside of the Project footprint;
- Stormwater treatment – water quality treatment measures; and
- Bridge scour assessment and design.

Further details outlining the stormwater design components are outlined in a separate Stormwater and Flooding Report to support the AEE.

3.15 Urban and Landscape Design

Urban and landscape design comprises the following components:

- Roadscape elements - to achieve a motorway that provides a quality road user experience i.e. framing the direction of views, vegetation groupings, integration of culturally significant art or design.
- Signage and wayfinding - to achieve a motorway that provides a legible road user experience.
- Landscape planting – grassed areas, planted slopes / embankments, riparian planting, visual screen planting, high amenity planting for key areas, ecological connection, habitat creation, alongside the opportunity to use taonga species, mahinga kai, and the protection of waterways as appropriate.

Further details outlining the urban and landscape design components are outlined in a separate memo.

4 Comparison to Designated Scheme Design

The design generally aligns with the scheme design supporting the designation phase, with the exception of Pegasus Interchange and Cam River.

4.1 Pegasus Interchange

4.1.1 Form of Intersection

In 2013, as part of the scheme design that informed the Project's designation, an upgraded double-lane roundabout was proposed for the intersection. However, traffic modelling[1] carried out in 2024 as part of the investment case found the roundabout would not perform adequately with updated traffic forecasts. It also raised safety concerns for pedestrians and cyclists crossing SH1. Ongoing growth in housing and commercial development, especially in the Ravenwood area, is expected to increase traffic demand on Bob Robertson Drive beyond the roundabout's capacity

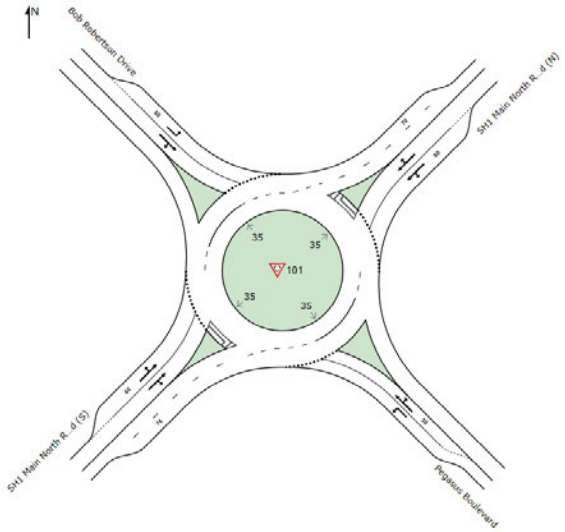

Figure 4-1 – Previously Proposed Pegasus Roundabout Layout

As a result, a new grade separated interchange layout, was proposed connecting the four-lane motorway to a two lane over bridge with lane drop and lane gain via on and off ramps. The intersection is controlled with a signalised diamond interchange.

A key feature of the new design is the introduction of shared user paths and crossings, which will link Pegasus town with Ravenswood. The shared user connection will establish a primary route along the southern side of Pegasus Boulevard/Bob Robertson Drive, with road crossings to the northern side at the Pegasus signalised interchange, connecting to adjacent land use and bus stops.

The current design would accommodate over-dimension vehicle access at Pegasus and William Street, encouraging heavy vehicles to utilise SH1 and the Woodend Bypass. This shift aims to reduce traffic congestion within the Woodend township.

4.1.2 Culvert and Stream Diversion

The interchange design at this location has also impacted the Taranaki Stream alignment.

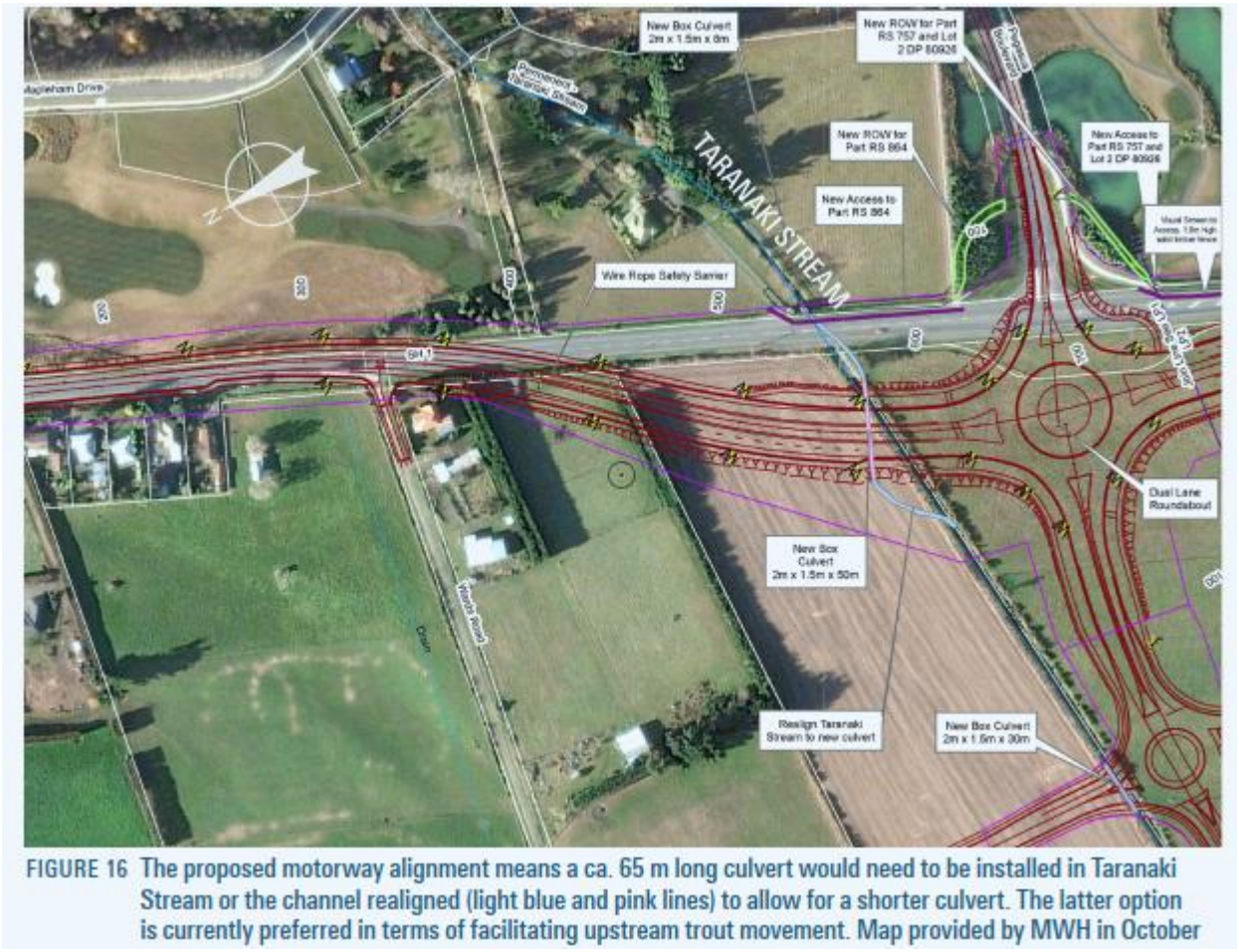

FIGURE 16 The proposed motorway alignment means a ca. 65 m long culvert would need to be installed in Taranaki Stream or the channel realigned (light blue and pink lines) to allow for a shorter culvert. The latter option is currently preferred in terms of facilitating upstream trout movement. Map provided by MWH in October

Figure 4-2 – 2013 Scheme Design at Pegasus

The previous scheme required a new culvert and diversion of the Taranaki Stream. The realignment also included daylighting of the culverted section under the existing highway.

The need for realignment and a new culvert is unchanged with the new scheme. However, to accommodate the additional lanes of the new interchange, the new culvert will be considerably longer (in the order of 85m) than the previous scheme.

It is also noted that significant modification and realignment of the Taranaki and Waihora streams has since occurred with development of Ravenswood. A portion of the Waihora Stream has been diverted into the Taranaki Stream and both channels have been realigned through to the existing Taranaki culvert.

The Wiahora Culvert and Stream Realignment are Consistent with the Original Scheme.

4.2 Cam River Crossing

At Cam River Bridge the 2013 scheme design assumed a northbound off-ramp, southbound on-ramp and a four-lane main alignment. In terms of construction the 2013 scheme design plans indicate the existing bridge is retained as the new off ramp and **two new bridges** be constructed to form the southbound on-ramp and a four-lane main alignment.

While this general layout has been retained, the bridge construction to achieve this layout has been optimised. While the existing bridge will remain, repurposed as the northbound off-ramp, **only one new bridge** will be constructed, adjacent carrying the main SH1 northbound and southbound lanes, as well as a southbound on-ramp.

This approach minimises construction activity at Cam River, provides an easier constructable solution in regard to managing traffic during construction and provides economic benefits.

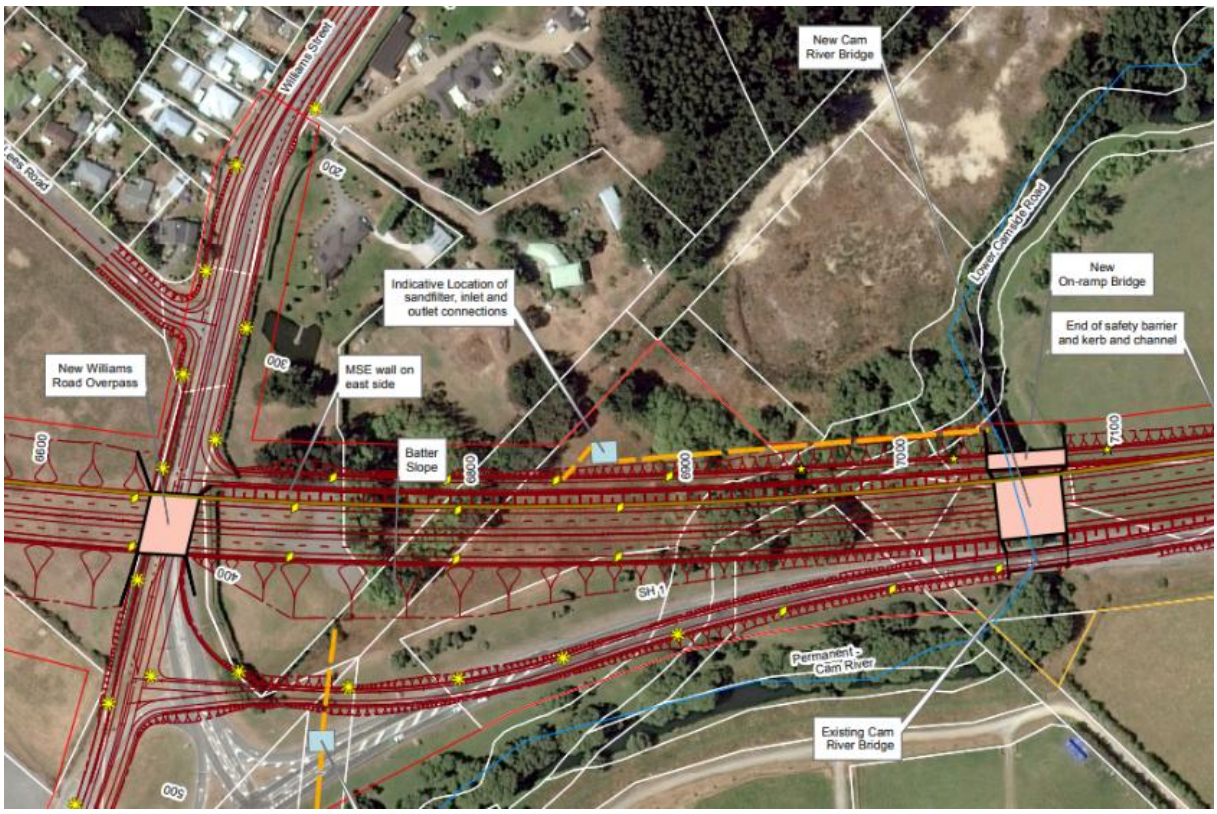

Figure 4-3 – 2013 Scheme Design at Cam River Bridge

In terms of the stormwater approach at this location, the reliance on high maintenance filtration treatment devices has been replaced with a nature based passive stormwater system which utilises available space between the main alignment and the northbound off ramp for a landscaped bioretention basin. Stormwater from the main alignment and ramps north of the Cam Bridge, and a portion of Williams Street will be directed to the bioretention basin for treatment before discharging to the adjacent Cam River.

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