# PART C: DESCRIPTION OF THE PROJECT

## 4. PROJECT DESCRIPTION

**Overview**

Main South Road will be four laned from just north of the intersection of SH1 and Park Lane at Rolleston. This four-laning continues northwest on SH1 for approximately 4.5km to a new interchange which will connect State Highway 1 with CSM2 just north of Robinsons Road. MSRFL will consist of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Rd will provide full access on and off the Main South Road for property access. Access at Berketts and Larcombs Road intersections will be modified due to the new median and all private accesses will be transferred to new rear access roads running parallel to Main South Road.

The CSM2 section of the Project will extend from SH1 at Robinsons Road for 8.4 km linking with the CSM1 at Halswell Junction Road. The road will be a motorway standard comprising of four lanes, with two lanes in each direction, a median and a barrier that will separate oncoming traffic and provide for safety. Access to CSM2 will be available from Main South Road and the merger with CSM1 and the interchanges at Shands Road and Halswell Junction Road, enabling the efficient and safe flow of traffic. There will be the choice to avoid entering CSM2 at Robinsons Road and to remain on Main South Road. At seven places along the motorway, the local road will pass over the State highway to maintain existing connectivity for the State highway (Main South Road) and local roads (Hamptons/Waterholes, Trents, Shands, Marshs, Springs and Halswell Junction Roads). In addition, Robinsons Road will pass under CSM2.

Upon completion, CSM2 will be numbered State Highway 76 (“SH76”). The Project is shown on the plans included in Volume 5 – Plan Set, which contains the drawing sets for the applications. The Plan set has been split for MSRFL (Set A) and CSM2 (Set B) for ease of reference. These should be viewed in conjunction with this section of the AEE.

### 4.1. Introduction

This chapter outlines a description of the Project,including:

- the design objectives;
- traffic services;
- road alignment;
- interchanges, connections and bridges;
- predicted traffic volumes and flows;
- pavements and surfaces;
- walkways and cycleways;
- noise attenuation;

- stormwater design, treatment and management;
- urban design and landscaping; and
- transmission lines.

The construction phase of the Project is outlined in Chapter 5 of this AEE.

## 4.2. Design objectives

The Project is to be constructed to expressway standard on MSRFL and motorway standard on CSM2. Expressway standard is achieved by four-laning with a dividing median and limiting access to the two existing intersections at Berketts Road and Larcombs Road only, with direct private property access removed from Main South Road and alternate rear access provided. Motorway standard is achieved by a four lane median divided arterial road with no property access or intersections. Access onto the motorway is provided by the interchanges. The Project will ensure the motorway network in Christchurch is upgraded to cope with the future demands that growth and development in the city will place on infrastructure.

The design philosophy for the Project is outlined below:

- land take required is minimised - land take and the number of land owners affected is minimised through appropriate road cross-sections, interchange forms, and stormwater treatments;
- effects on adjacent residents are minimised (access, noise and visual elements);
- effects on the environment are minimised (stormwater, noise and landscaping);
- connectivity of existing infrastructure is maintained including local roads, property accesses, walking and cycling routes, and stockwater races;
- all elements of the Project are designed to the relevant design standards including the NZTA's RoNS design standards and guidelines;
- route security is provided for including recognition of secondary routes, design to standards, especially relating to stormwater (flooding) and structures (seismic effects), and the setting of the designation footprint;
- construction and maintenance costs are minimised; and
- continuity with CSM1 including cross-sectional widths, pavement and structure types, levels of accessibility, and landscaping and visual approach to design.

Along with the above philosophy, the Project design has been driven by the traffic modelling results and the receiving environment, particularly the existing flat terrain of the Canterbury plains and existing and proposed subdivisions and residences. For further information about the design philosophy refer to Technical Report 1 (Design Philosophy Statement) in Volume 3 of the application documents.

### 4.2.1. Road geometric design

The geometric design standards for this Project are based on the following standards and guidelines:

- the NZTA's Roads of National Significance (RoNS) Design Standards and Guidelines;
- the NZTA State Highway Geometric Design Manual (Draft);
- Austroads suite of road design standards; and
- Christchurch City Council Construction Standard Specification.

The RoNS geometric Design Standards specify the minimum desirable measurements for 110km/h and 100km/h curves.

The main topography of the Project terrain is predominately flat land, with most of the area covering rural land. The road has been designed at or near grade, to avoid significant visual effects of an elevated motorway and to allow disposal of stormwater above groundwater levels. The alignment of the motorway will bypass the built up areas of Templeton and Hornby, as well as avoiding the residential subdivisions at Claremont and Aberdeen. Further information on the vertical and horizontal alignment is provided in Chapter 7 (Consideration of Alternatives).

### 4.2.2. Design speed

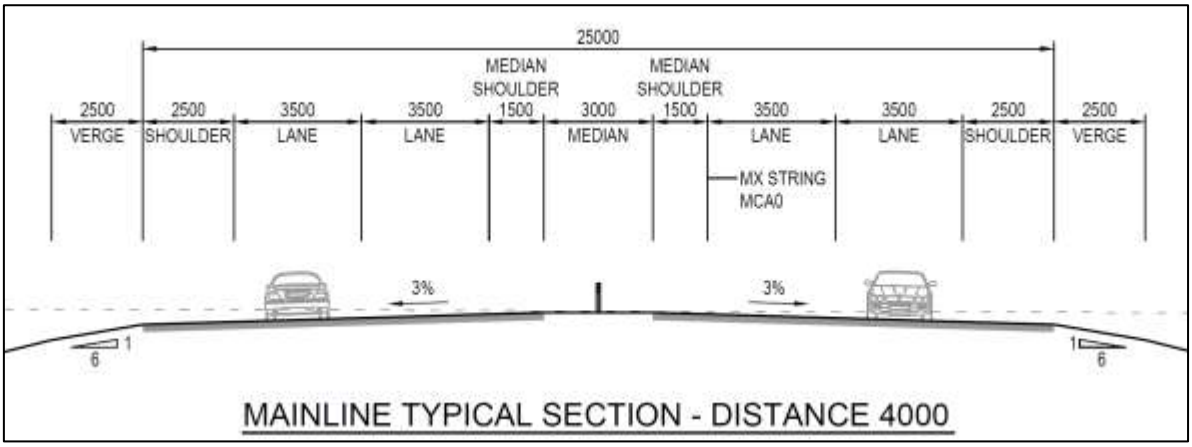
A design speed of 100km/hr has been adopted for MSRFL from the existing two-lane section, just north of Rolleston to the proposed tie-in to the CSM2 interchange. A design speed of 110km/hr has been adopted for CSM2 from the Main South Road SH1 interchange intersection to the tie-in to CSM1, east of Springs Road/Halswell Junction Road.

### 4.2.3. Typical cross sections and lane widths

The typical MSRFL and CSM2 cross section has been designed to current standards and will achieve consistency with CSM1, comprising the following components equating to a carriageway width of 25m (inclusive of the central median but exclusive of verge and swales):

- 2.5m wide outside shoulder;
- four x 3.5m wide traffic lanes;
- 1.5m wide inner shoulder; and
- 3.0m wide central median (inclusive of wire rope barrier).

**Figure 14: Typical Cross Section**



The wider cross section, including swales, is shown in the Typical Cross Section Scheme Plans appended in Volume 5.

### 4.2.4. Property access

Residential and commercial properties occupy both sides of MSRFL. With the construction of the four-laning and central median with barrier, accesses will be restricted for all properties with current access to Main South Road. It is proposed to close all private access onto MSRFL where access onto other roads is available or can be provided. Along the west side of MSRFL a new local rear access alongside the western property boundaries will be provided, running parallel with the Main Trunk Railway Line, between Weedons Ross Road and Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Lane and private rights of way.

Residential and commercial properties will be purchased in whole or part which are directly along the CSM2 alignment. Affected accesses will be modified where required.

A list of the properties required in part of full for the Project is included in Appendix B and are illustrated on the land requirement plans in Volume 5.

### 4.2.5. Intersections

The Project will require changes in priority, relocation, or new provisions for intersections due to the MSRFL and CSM2 alignments. These will include improvements to Weedons Road / Weedons Ross Road, Larcombs Road, Berketts Road, Dawsons Road / Waterholes Road, Waterholes Road / Hamptons Road, Shands Road / Marshs Road, Halswell Junction Road and John Paterson Drive. The layout and lane configuration of these intersections are generally indicated on Layout Plans, 62236-A-C020 to C014, and 62236-B-C020 to C038 in Volume 5 and will be finalised during the detailed design phase following consenting. Options to enhance the safety and efficiency of these intersections include restrictions to left in/left out, priority “T” intersections, traffic signals and roundabouts.

### 4.2.6. Vehicle tracking and over-dimensional route

MSRFL and CSM2 (SH76) will be “over dimensional” and “overweight” permit routes. The required 10.5 m wide x 6.1 m high over dimensional envelope has been allowed for, with an additional 1m lateral clearance, as per the requirements that have been put in place for the CSM1 alignment. Median island signal poles (and potentially overhead masts) may need to be collapsible to allow for continuity of the “over dimensional” route.

Tracking paths have been undertaken on heavy vehicle turning movements to check there is adequate room provided. A minimum 600 mm additional clearance has been allowed to the tracking path to cater for driver error or misjudgement. The design vehicle is the RTS 18 m long quad rear axle semi-trailer, as this provides the worst case tracking path out of the heavy vehicle group.

## 4.3. Traffic services

Traffic services include the following features:

- permanent road signs;
- road lighting;
- road markings;
- barrier protection;
- traffic signals; and
- a Commercial Vehicle Inspection Unit (outlined in section 4.14).

The precise design and location of traffic services that will be in place when the Project opens will be confirmed in the detailed design phase and will be in accordance with all required standards that apply at the time of construction. Throughout the life of the road, it is anticipated that traffic services will be renewed and upgraded as required, ensuring the long term serviceability and safety of the road.

### 4.3.1. Signs

When it initially opens the Project will incorporate signage required for traffic safety purposes, throughout the alignment, as shown on the signage drawings A-C501 to 508 and B-C501 to 517. Gantries are proposed at chainage 5800 (MSRFL) and chainage 380 and 780 (CSM2). Design of all road signs and markings will be in accordance with the following standards, taking into account any updates to these standards:

- The Manual of Traffic Signs and Markings (MOTSAM); and
- Land Transport Rule: Traffic Control Devices.

### 4.3.2. Lighting

Lighting is proposed in accordance with the relevant New Zealand standard for road lighting, AS/NZS 1158.1.1 Lighting for roads and public spaces - Vehicular traffic (Category V) lighting - Performance and design requirements. As the Project is in a semi-rural environment, full lighting of the motorway and Main South Road is not proposed. Throughout the alignment, the minimum gap in lighting is 300m. In some sections, no lighting is required to meet V3[46], for example on MSRFL, chainage 3900 to 5800 and CSM2 chainage 1400 to 4200. The V3 standard will generally be applied to all lengths of the alignment and all connections, underpasses and interchanges. The following specific sections of the proposed lighting design are noted:

- MSRFL: Berketts intersection – intersection flag lighting will be used;
- CSM2: Hamptons and Trents overbridge – no lighting required however ducting will be installed for future use; and

[46] This will require an average luminance level no less than 0.75 candela per square metre, with an overall uniformity (minimum-to-average) to be above 0.33; a longitudinal uniformity to be above 0.3; a Threshold Increment (T.I. for glare control) below 20%; and a minimum Illuminance for intersections and other specified locations to be above 7.5 lux.

- CSM2: Waterholes and Hamptons Road intersections – isolated lit section to comply with subcategory V4[47].

Lighting of adjoining local SDC and CCC roads will also be carried out at Jones, Levi, Weedons, Shands, Marshs, Springs, Halswell Junction and John Paterson Drive, and the unnamed industrial road adjacent to the railway. Lighting of local roads will comply with V3 or V4 as appropriate.

The Little River Trail extension is proposed to be lit to comply with lighting subcategory P3[48]. All underpasses will be lit to comply with subcategory P10[49].

Lighting will be designed as part of the detailed design stage, and is the focus of Technical Report 19, located in Volume 3.

### 4.3.3. Barriers

Vehicle barriers will be provided along all centre medians to separate oncoming traffic, along roadsides where there are hazards such as trees or irrigation waterways and on all bridges.

All barrier protection will comply with the appropriate versions of the following standards when they are designed and constructed:

- The NZTA 'Safe Systems' memorandum, 2012.
- The Transit NZ M/23:2000 Guide for Road Safety Barrier Systems;
- NZS 3114:1987 Concrete Surface Finishes;
- AS/NZS 3845:1999 Road Safety Barrier Systems;
- The NCHRP Report 350 – Recommended Procedures for the Safety and Performance Evaluation of Highway Features (NCHRP 350);
- The State Highway Geometric Design Manual (SHGDM); and
- The Transit NZ Bridge Manual, September 2004 Revision.

New barriers for the Project will typically be:

- Central median - Test Level 4 (TL4) wire rope barrier;
- Roadside - TL4 nu-guard W-section; and
- Bridges and approaches - TL4 concrete 'F-Shape' edge barrier.

### 4.3.4. Traffic signal design standards

The traffic signal design is to be based on the following standards:

[47] will require an average luminance level no less than 0.5 candela per square metre, with an overall uniformity (minimum-to-average) to be above 0.33; a longitudinal uniformity to be above 0.3; a Threshold Increment (T.I. for glare control) below 20%; and a minimum Illuminance for intersections and other specified locations to be above 5 lux.

[48] will require an average horizontal illuminance level no less than 1.3 lux, with a minimum horizontal point illuminance of 0.22 lux, an overall uniformity (maximum to average illuminance) to be less than 10, and a minimum vertical illuminance of 0.22 lux.

[49] will require an average horizontal illuminance level no less than 35 lux, with a minimum horizontal point illuminance of 17.5 lux, an overall uniformity (maximum to average illuminance) to be less than 10, and a minimum vertical illuminance of 17.5 lux.

- Austroads Guide to Road Design – Part 4a: Unsignalised and Signalised Intersections;
- Austroads Guide to Traffic Management – Part 9: Traffic Operations;
- RTS 14 Guidelines for Installing Pedestrian Facilities for People with Visual Impairment;
- Signals New Zealand User Group (SNUG) National Traffic Signal Specification; and
- The NZTA (Transit's) Standard Signal Layout Draughting Guide Drawing 1/ 1061/ 140/ 8104/ Sheet 1/ Rev 0.

There are currently no existing traffic signal facilities within the existing Main South Road alignment or the roads which will intersect with CSM2. This Project includes three signalised intersections at interchange points; one at the existing Shands Road / Marshs Road intersection, one at the proposed Shands Rd / Eastbound Off Ramp/ Eastbound on ramp intersection and one further south on Shands Road at the proposed intersection of Shands Rd / Westbound Off Ramp/ Westbound on ramp.

The design preference is not to have traffic signals south of Marshs Road in order to retain the rural environment. Further traffic modelling at the detailed design phase will determine the most suitable treatment. The traffic signal design for each option will be developed along with the detailed intersection layouts in consultation with CCC and SDC.

### 4.4. Road alignment

The road alignment will be approximately 4.5km (MSRFL) and 8.4km (CSM2) long and the following general approach is proposed:

- four lanes (two lanes in each direction with a median and barrier dividing oncoming lanes);
- new full grade separated interchange at Weedons Road;
- new roundabout at Weedons Ross / Jones Road;
- left in only intersection at Main South Road / Larcombs Road;
- left in and left out intersection at Main South Road / Berketts Road;
- intersection at Weedons / Levi Road;
- rear access provision on Main South Road to provide full alternative access for properties with Main South Road frontage (both east and west of Main South Road);
- grade separated overpass at Robinsons Road;
- construction of a grade separated Y-junction (overpass) with Main South Road near Robinsons Road;
- roundabout intersection at Dawsons/Waterholes Road;
- closure of part of Blakes Road where it currently crosses CSM2 and conversion to two cul-de-sacs;
- grade separated underpasses at Springs Road, Marshs Road, Trents Road, and Waterholes Road;
- new full grade separated interchange at Shands Road;

- realignment of John Paterson Drive to connect with Halswell Junction Road off-ramp roundabout; and
- new grade separated underpass at Halswell Junction Road with east facing on and off ramps linking to CSM1.

The alignment has been designed at grade. The majority of the Project is within SDC boundaries. The section north of Marshs Road is within the CCC boundary. Further information about the vertical and horizontal positioning of the road alignment can be found in Chapter 7 (Consideration of Alternatives).

The interchanges and connections are described below.

## 4.5. Interchanges, local connections and bridges

The key interchanges, intersections and local road connections proposed for the Project are:

- Weedons Road interchange;
- Weedons Ross / Jones Roads roundabout;
- Weedons / Levi Roads intersection;
- Main South Road / Larcombs Road intersection;
- Main South Road / Berketts Road intersection;
- Main South Road back access;
- Robinsons / Curraghs Road overpass;
- Dawsons / Waterholes Road roundabout;
- CSM and Main South Road connection;
- Waterholes Road underpass (motorway under local road);
- Trents Road underpass;
- Shands Road interchange;
- Marshs Road underpass;
- Springs Road underpass;
- Halswell Junction Road underpass; and
- Halswell Junction Road interchange.

These proposed intersections and local connections are listed in order of location, from the south-western most end of the motorway alignment (MSRFL) continuing north-east just past the Springs and Halswell Junction Roads roundabout (where the CSM2 and CSM1 alignments merge). These interchanges, underpasses (motorway under local road), overpasses (motorway over local road) and bridge structures are described in more detail below.

### 4.5.1. Weedons Road interchange

It is proposed to construct a grade separated interchange at Weedons Road. This will enable Weedons Ross / Weedons Road to pass over Main South Road with exit and entry loops to cater for traffic in both directions. The southbound exit ramp loop is designed for the slowing of traffic

with a design speed of 50 km/h, ready to join Weedons Road via the roundabout. The northbound entry ramp loop is slightly wider to cater for the increasing speeds of traffic joining the motorway. Both ramp terminal intersections will be controlled by dual-laned roundabouts.

Main South Road remains at grade throughout the interchange. Weedons Road and has adopted a 60km/h design speed. This is considered adequate as the roundabouts at each end reduce speeds through the site. The maximum vertical grade along Weedons Road is 6.8 percent.

**Figure 15: Weedons Road interchange photo simulation**

*Weedons Road interchange bridge structure*

The Weedons Road underpass is the only bridge structure which spans over the new MSRFL alignment. The bridge is not directly connected to Main South Road but the approach roads to the structure link back into the motorway on-ramps and off-ramps.

The proposed bridge abutments and piers are skewed with respect to the centreline of the bridge at an angle of approximately 83 degrees. The bridge is a four span bridge with the internal skewed span lengths of 22 m and the end spans of 20 m. The central pier is located in the middle of SH1 with rigid barriers either side. The two outer piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 15.3 m to the outer edge of the footpath. This provides for a carriageway width of 10 m, 2 x 2.0 m wide footpaths, 2 x 0.4 m wide rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure consists of 12 x 0.9 m deep precast prestressed concrete double hollow core ("DHC") units. An in-situ topping concrete of 180 mm minimum thickness at either edge of the deck forms the raised footpath. A surfacing course will overlay the DHC units across the width of the road carriageway.

The three piers comprise of three 1000 mm diameter columns on top of 18 m x 6 m x 1.2 m thick spread footings. The pier crossheads provide seating for the DHC units. The abutments comprise of a 1.8 m wide spread footing. A 250 mm thick, 3 m long settlement slab is provided to minimise post-construction differential settlement.

The vertical clearance from the underside of the Weedons Road bridge structure to the Main South Road surface is at least 6.1 m to allow for over-dimensional vehicles.

### 4.5.2. Weedons Ross Road / Jones Road roundabout

The construction of the Weedons interchange will promote Jones Road as the main access route into the proposed Rolleston Izone industrial area. The consequent increase in traffic demand, in particular heavy vehicles which will be generated by the Izone, necessitates an upgrade of the intersection at Weedons Ross Road and Jones Road.

The design proposes construction of a large diameter dual lane roundabout. In consideration of the close proximity to the Main Trunk Line, the roundabout has been shifted to the west to meet minimum separation distances from the level crossing.

The roundabout design allows for a minimum 32 m separation between the centre of rail track to the limit line for straight and right turn traffic entering the roundabout. For left-turning traffic, a free left turn has been provided for the dominant traffic movement and HGV's heading south on Jones Road to the Izone. It is noted that the ability to widen on the eastern approach is constrained by the existing sub-station on the southern side.

### 4.5.3. Weedons Road / Levi Road intersection

Levi Road currently intersects Weedons Road at a priority controlled T junction, approximately 1 km east of the proposed Weedons interchange. With the construction of the new interchange, Levi Road will be promoted as the primary access into the Rolleston township, relieving pressure through the lights on SH1.

It is therefore proposed to change the current intersection priority from Weedons Road to Levi Road to allow free-flow movements to and from Rolleston. This will involve realignment of the current intersection approaches, to introduce an 80 km/h design speed curve.

### 4.5.4. Main South Road / Larcombs Road intersection

Larcombs Road currently intersects Main South Road at an oblique angle, which restricts driver visibility and promotes high speed left turns from Larcombs Road into the major traffic movement on SH1. For safety reasons, it is proposed that the Larcombs Road intersection with Main South Road be left in only. The proposed layout includes a left turn deceleration lane to enable left turning traffic to move clear of high speed southbound traffic on Main South Road, and left turn only onto Larcombs Road.

### 4.5.5. Main South Road / Berketts Road intersection

The Berketts Road / Main South Road intersection also presents safety issues and in order to enhance safety and improve driver sight distance, it is proposed to change this intersection to left in / left out only. The proposed layout includes a left turn deceleration lane to enable left turning traffic to move clear of high speed southbound traffic on Main South Road, and a left turn acceleration lane onto Main South Road.

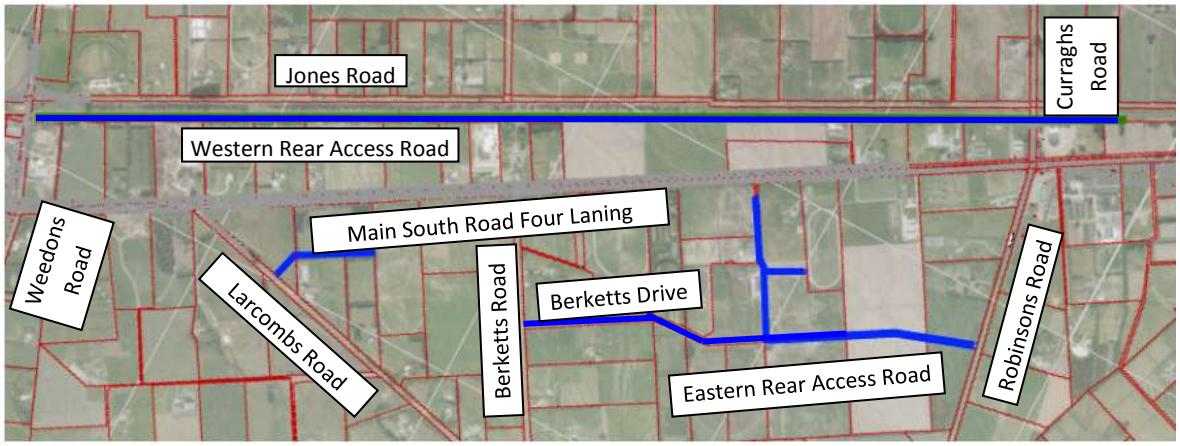
### 4.5.6. MSRFL rear accesses

A local access road is included as part of the Project running adjacent to and on the eastern side of the rail corridor between Weedons Ross Road and Curraghs Road and to 250m north of Curraghs Road. This road is proposed to provide rear access to all western properties with existing access fronting Main South Road along this section.

The preliminary design for the western side rear access involves a 17m road reserve to allow for a 7m carriageway and 5m either side for drainage, services and batter slopes. This rear access road is predominantly situated on a mixture of Crown owned KiwiRail land and private land.

Rear access for private access is also included for properties on the east side of Main South Road. Access will be provided off Larcombs Road and a rear access road will join Berketts Drive to Robinsons Road. Rear access provides both safety and efficiency benefits by the introduction of alternative access for these properties which allow closure of private access onto Main South Road. All rear roads will be constructed prior to the removal of any State highway access.

**Figure 16: MSRFL rear access roads (shown in blue)**




### 4.5.7. CSM2 / Main South Road connection

The Main South Road and CSM2 connection is located just north of Curraghs and Robinsons Roads. At this junction the northbound Main South Road alignment forks – with CSM2 to the east; and continues northwards along SH1 (Main South Road) before merging with the southbound lanes south of the SH1 Dawsons / Waterholes intersection.

Figure 17: MSRFL / CSM2 connection - Robinsons Road overpass photo simulation

The Main South Road southbound alignment is at grade until it approaches the CSM2 alignment, where the southbound lane diverges from the northbound lane and climbs over the CSM2 alignment at a maximum grade of 4 percent. This flyover provides southbound access onto the CSM2 alignment from Main South Road.

The southbound alignment ties back in with the northbound lane as it crosses the Robinsons / Curraghs intersection. The Robinsons Road / Curraghs Road overpass enables traffic to drive under SH1 along Robinsons Road and connect with Curraghs Road. This overpass and its structural details are described further below.

An exit lane has been included on the southbound lane of Main South Road to provide access to adjacent properties that will have their present access severed by the motorway alignment. The exit lane will also link to the local road network via a new roundabout with Robinsons Road.

A design speed of 100 km/h has been adopted for both the northbound and southbound lanes of Main South Road.

*CSM2 / Main South Road connection bridge structure*

This flyover is a four span bridge with two internal span lengths of 42m and end spans of 3m. The proposed bridge abutments and piers are in line with the centreline of the bridge. The bridge however is skewed at an angle of approximately 45 degrees to the CSM2 proposed alignment. The central pier is located in the middle of the motorway with rigid barriers either side. The two outer piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 13.05m to the outer edge face of the footpath. This provides for a carriageway width of 10m, 1 x. 2.0m wide footpath, 2 x 0.4m wide rigid barriers and allowance for

a pedestrian handrail at the southern edge of the deck. Each span of the structure comprises four Steel I-girders with an in situ topping slab. The I-girders are typically 1800mm deep with 500mm wide top and bottom flanges. The in situ deck topping is a constant concrete thickness of 250mm. A surfacing course will overlay the deck across the width of the roadway.

The central pier comprises of a single 1500mm diameter column on top of a 9m x 7.5m x 1.5m thick spread footing, the outer piers consist of 2 x 1250mm diameter concrete columns on top of 17m x 6.5m x 1.5m spread footings. For the central pier the I-girders are cast integral with the pier crosshead whilst the end pier, crossheads provide seating for the I-girders. The abutments comprise a 2.75m wide spread footing. The overall height of the abutment from the top of the deck to the underside of the footing is approximately 3.0m. A 250mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

The vertical clearance from the underside of the Main South Road southbound structure to the CSM2 road surface below is at least 6.0 m to allow for over-dimensional vehicles. This criteria is similar to that adopted on CSM1.

The maximum height above ground for the CSM2 / Main South Road connection bridge structure is 11.5m.

### 4.5.8. Robinsons / Curraghs Road overpass

A link has been provided between Robinsons and Curraghs Road passing underneath the State highway to improve the connectivity with the local road network.

The maximum vertical grade of the road passing beneath the motorway is eight percent on the western side. This maximises the length of flat grade (about 50m) leading into the at-grade rail crossing. The bridge structure at Robinsons/Curraghs Road is required to carry the motorway over the road and to allow vehicular access beneath the motorway.

A 60km/h design speed has been adopted for the link primarily to allow the road to safely tie into the existing railway crossing on the western side near Jones Road.

*Robinsons / Curraghs Road overpass bridge structure*

The proposed bridge abutments are skewed with respect to the centreline of the bridge at an angle of approximately 82 degrees. The single span bridge spans 24m between the abutment centrelines. The abutments are located on top of mechanically stabilised earth walls.

The overall deck width is 45.8m to the outer edge of the bridge girders. This provides for a carriageway width of approximately 40m with TL4 w-section flexible barriers on either side of the bridge. The structure consists of 40 x 0.9m deep precast prestressed concrete double hollow core (DHC) units. An in-situ topping concrete of 200 mm minimum thickness at either edge of the deck forms the raised kerb slab. A surfacing course will overlay the DHC units across the width of the road carriageway.

The abutments comprise an 1800mm wide reinforced concrete footing supported on top of vertical mechanically stabilised earth retaining walls. The footing has an upstand beam and the overall height of the abutment is 1700mm. A 250mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

A 4.9m minimum vertical clearance has been adopted under the bridge structure to cater for standard legal road vehicles.

### 4.5.9. Main South Road / Dawsons Road / Waterholes Road intersection

A new roundabout is to be constructed at the Main South Road / Dawsons Road / Waterholes Road intersection to allow safe access to the Claremont subdivision and provide a "U" turn facility for traffic from the south.

### 4.5.10. Waterholes Road underpass

Where the CSM2 alignment crosses Waterholes Road, an underpass is proposed to enable traffic on Waterholes Road to pass over the CSM2 before tying back into the existing Waterholes Road. The southern leg of Waterholes Road intersects with a slightly realigned Hamptons Road intersection about 150m south of the CSM2 underpass. This minor realignment is intended to increase safety at this intersection.

**Figure 18: Waterholes Road underpass photo simulation**

The reverse curves of the CSM2 horizontal alignment have been designed to allow the new Waterholes Road connection and associated structures to be built off-line, while minimising the impact on private property and accesses.

The maximum vertical grade along Waterholes Road is 6.2 percent. An 80km/h design speed has been adopted for where Waterholes Road passes over CSM2. This is considered adequate based on the rural environment and reasonably low traffic volumes.

*Waterholes Road underpass bridge structure*

This bridge spans over the new CSM2 alignment linking the northern end of Waterholes Road to the southern end. The structure is not connected to the motorway and therefore there are no on-ramps or off-ramps.

The proposed bridge abutments and piers are skewed with respect to the centreline of the bridge at an angle between 43 degrees and 55 degrees. The bridge consists of four skewed span lengths of 24m. The central pier is located in the middle of the motorway with rigid barriers either side. The two outer piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 15.3m to the outer edge face of the footpath. This provides for a carriageway width of 10m, 2 x 2.0m wide footpaths, 2 x 0.4m wide rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure consists of 12 x 0.9m deep precast prestressed concrete DHC units. An in-situ topping concrete of 180mm minimum thickness at either edge of the deck forms the raised footpath. A surfacing course will overlay the DHC units across the width of the roadway.

The three piers comprise of three 1000mm diameter columns on top of 20m x 6m x 1.2m thick spread footings. The pier crossheads provide seating for the DHC units. The abutments comprise of a 1.8m wide spread footing. A 250mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

The maximum height above ground for the Waterholes Road bridge structure is 9.5m.

### 4.5.11. Trents Road underpass

An underpass is proposed where CSM2 crosses Trents Road. This will enable local traffic on Trents Road to pass over the CSM2 alignment. Nearby, Blakes Road will become two cul-de-sac roads. Blakes Road through traffic will be diverted onto Trents Road.

Figure 19: Trents Road underpass photo simulation

The reverse curves of the CSM2 horizontal alignment have been designed to allow the new connection and associated structures to be built off-line, while minimising the impact on private property and accesses.

The maximum vertical grade along Trents Road is 6.3 %. An 80km/h design speed has been adopted. This is considered adequate based on the rural environment and reasonably low traffic volumes. There are no side roads or accesses over this section of Trents Road.

*Trents Road underpass bridge structure*

The Trents Road underpass spans over the new CSM2 alignment linking the north western end of Trents Road to the southern eastern end. The bridge is not connected to the motorway and therefore there are no on-ramps or off-ramps.

The proposed bridge abutments and piers are skewed with respect to the centreline of the bridge at an angle of approximately 87 degrees. The bridge is a three span bridge with an internal skewed span length of 30m and skewed end spans of 27m. The two piers are positioned clear of the back face of the edge barriers.

The overall deck width is 15.3m to the outer edge face of the footpath. This provides for a carriageway width of 10m, 2 x 2.0m wide footpaths, 2 x 0.4m wide rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure comprises six precast pre-stressed concrete “Super Tee” beams with an in situ topping slab. The precast “Super Tee” beams are 1225mm deep and 2400mm wide across the top flanges. The in situ deck topping concrete thickness is a minimum of 200mm. A surfacing course will overlay the deck across the width of the roadway.

The two piers comprise of two 1000mm diameter columns on top of 14.5m x 5m x 1.2m thick spread footings. The pier crossheads provide seating for the "Super Tee" beams. The abutments comprise of a 2.0m wide spread footing. The overall height of the abutment from the top of the deck to the underside of the footing is approximately 5.0 m. A 250 mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

The maximum height above ground for the Trents Road bridge structure is 9.5m.

### 4.5.12. Shands Road interchange and Marshs Road underpass

The connections proposed at this section of the motorway include a typical diamond interchange at Shands Road and an underpass beneath Marshs Road. In addition there are traffic signals proposed at the intersection of Shands and Marshs Roads.

The full grade-separated interchange at Shands Road south of Marshs Road will allow drivers to turn left and right, or go straight ahead from any direction. Shands Road is proposed to retain its existing straight alignment; thus maximising the visibility to the ramp intersections with Shands Road. The four-ramp terminal intersections at this interchange will be controlled by traffic signals.

The maximum vertical grade along Shands Road is 6.4 percent. CSM2 remains at grade throughout the interchange with Shands Road. A 60km/h design speed has been adopted.

**Figure 20: Shands Road interchange and Marshs Road underpass photo simulation**

To the east of the Shands Road interchange, the Marshs Road underpass will enable traffic to pass over the CSM2 alignment. Marshs Road will retain a straight horizontal alignment as it passes over the CSM2 alignment. The on and off-ramps are designed to comply with the NZTA's motorway drawing M1 (Standard Exit and Entrance Details) from the MOTSAM manual.

The maximum vertical grade along Marshs Road is 6.6 percent. A design speed of 80km/h has been adopted for Marshs Road underpass due to the relatively close proximity to the Shands Road interchange.

*Shands Road underpass and Marshs Road underpass bridge structures*

The Shands Road bridge structure spans over the new CSM2 alignment linking the north eastern end of Shands Road to the south western end. The bridge is not directly connected to the new motorway but the approach roads to the structure link back into the motorway on-ramps and off-ramps.

The proposed bridge abutments and piers are skewed with respect to the centreline of the bridge at an angle of approximately 70 degrees. The bridge is a three span bridge with an internal skewed span length of 30m and end spans of 27m. The two piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 22.6m to the outer edge face of the footpaths. This provides for a carriageway width of 17.3m, 2 x 2.0m wide footpaths, 2 x 0.4m wide rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure comprises nine precast pre-stressed concrete “Super Tee” beams with an in situ topping slab. The precast “Super Tee” beams are 1225mm deep and 2400mm wide across the top flanges. The in situ deck topping concrete thickness is 200mm. A surfacing course will overlay the deck across the width of the roadway.

The two piers comprise of three 1000mm diameter columns on top of 22m x 5m x 1.1m thick pile caps. Each pile cap is supported by 48 x 14m long driven piles. The piles are founded in the competent Riccarton gravels. The pier crossheads provide seating for the “Super Tee” beams. The abutments comprise of a 2.75m wide capping beam which have 30 x 20m long driven piles piled down to competent Riccarton gravels. The overall height of the abutment from the top of the deck to the underside of the footing is approximately 4.0m. A 250mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

The Marshs Road Underpass spans over the new CSM2 alignment linking the north western end of Marshs Road to the south eastern end. The bridge is not connected to the motorway and therefore there are no on-ramps or off-ramps.

The proposed bridge abutments and piers are in line with the centreline of the bridge. The bridge however is skewed at an angle of approximately 45 degrees to the motorway. The bridge is a four span bridge with the internal span lengths of 48m and 54m and the end spans of 40m. The central pier is located in the middle of the motorway with rigid barriers either side. The two outer piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 15.3m to the outer edge face of the footpath. This provides for a carriageway width of 10m, 2 x 2.0m wide footpaths, 2 x 0.4m wide rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure comprises four

Steel I-girders with an in situ topping slab. The I-girders are typically 2400mm deep with 500mm wide top and bottom flanges. The in situ deck topping is a thickness is 250mm. A surfacing course will overlay the deck across the width of the roadway.

The central pier comprises of a single 1500mm diameter column on top of 10m x 8.75m x 1.6m thick pile caps. The outer piers consist of 2 x 1250 mm diameter concrete columns on top of 16.25m x 7.5m x 1.4m pile caps. The pile caps are supported by 18m long 310UC 118 driven piles. The piles are founded in the competent Riccarton gravels. For the central pier the I-girders are cast into the pier crosshead whilst the end pier crossheads provide seating for the I-girders. The abutments comprise of a 2.75m wide capping beam which have 20m long 310UC 118 driven piles piled down to competent Riccarton gravels. The overall height of the abutment from the top of the deck to the underside of the footing is approximately 3.8m. A 250mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

The maximum height above ground for the Shands Road and Marshs Road bridge structures is 8.5m.

### 4.5.13. Springs Road underpass

An underpass is proposed where CSM2 crosses Springs Road. This will allow local traffic and cyclists to drive / cycle over the CSM2 alignment. It is proposed to realign John Paterson Drive on the southern side of Springs Road, and to connect John Paterson Drive into the off-ramp roundabout on Halswell Junction Road.

**Figure 21: Springs Road underpass photo simulation[50]**

[50] This photosimulation shows an earlier design. The John Paterson Drive link to Springs Road has now been realigned to Halswell Junction Road. Refer to the Plan Set for the correct design details.

The maximum vertical grade along Springs Road is 6 percent. A design speed of 80km/h has been adopted. This is considered adequate based on the peri-urban environment and nearby Springs Road roundabout.

*Springs Road underpass bridge structure*

The Springs Road underpass spans over the new CSM2 alignment linking the north eastern end of Springs Road to the southern western end. The proposed bridge abutments and piers are skewed with respect to the centreline of the bridge at an angle of 44 degrees and 53 degrees. The bridge consists of four skewed span lengths of 20m. The central pier is located in the middle of the motorway with rigid barriers either side. The two outer piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 15.3m to the outer edge face of the footpath. This provides for a carriageway width of 10m, 2 x 2.0m wide footpaths, 2 x 0.4m wide rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure consists of 12 x 0.9m deep precast prestressed concrete DHC units. An in-situ topping concrete of 180 mm minimum thickness at either edge of the deck forms the raised footpath. A surfacing course will overlay the DHC units across the width of the road carriageway.

The three piers comprise of three 900mm diameter columns on top of 21m x 5m x 1.1m thick pile caps. Each pile cap is supported by 36 x 18m long driven piles. The piles are founded in the competent Riccarton gravels. The pier crossheads provide seating for the DHC units. The abutments comprise of a 2.75m wide capping beam which have 22 x 24m long driven piles piled down to competent Riccarton gravels. The overall height of the abutment from the top of the deck to the underside of the footing is approximately 2.5m. A 250 mm thick, 3m long settlement slab is provided to minimise post-construction differential settlement.

The maximum height above ground for the Springs Road bridge structure is 9m.

### 4.5.14. Halswell Junction Road underpass

To the east of the existing Springs Road roundabout, an underpass is proposed for the CSM2 alignment to traverse beneath Halswell Junction Road. Halswell Junction Road will retain a straight horizontal alignment as it passes over the CSM2 alignment.

Figure 22: Halswell Junction Road underpass photo simulation[51]

Halswell Junction Road grades down to the existing road level about 100m prior to the Springs Road roundabout. The maximum vertical grade along Halswell Junction Road is 6.4 percent.

The proposed design allows for east facing ramps connecting from CSM2 into Halswell Junction Road. These ramps provide full access for all vehicles. The on-ramp commences 100m east of the Springs Road roundabout with a typical lane diverge, merging into the CSM2 alignment with typical 2 percent motorway on-ramp geometry. The off-ramp is a standard 8 percent motorway exit, connecting into a new Halswell Junction Road roundabout. The off ramp is generally at ground level; however the on ramp requires to grade up slightly to match the Halswell Junction Road embankment, before it can diverge horizontally. The maximum vertical grade along the on-ramp is five percent.

A design speed of 80km/h has been adopted due to the relatively close proximity of the Springs Road roundabout and proposed off ramp roundabout. There is potential for the design speed to be reduced here, as the roundabouts either side of the underpass will create speed thresholds and the anticipated speed environment would be in the vicinity of 60km/h to 70km/h.

*Halswell Junction Road underpass bridge structure*

The Halswell Junction Road underpass spans over the new CSM2 alignment linking the north western end of Halswell Junction Road to the south eastern end.

The proposed bridge abutments and piers are skewed with respect to the centreline of the bridge at an angle of approximately 37 degrees. The bridge consists of four equal skewed span lengths of

[51] This photosimulation shows an earlier design. The John Paterson Drive link to Halswell Junction Road is not shown. Refer to the Plan Set for the correct design details.

25m. The central pier is located in the middle of the motorway with rigid barriers either side. The two outer piers are positioned clear of the back face of the edge barriers at the shoulders of the road.

The overall deck width is 23.2m to the outer edge of the bridge. This provides for a carriageway width of 20m, 1 x 2.0m wide footpath, 2 x rigid barriers and allowance for pedestrian handrails at the outer edges of the deck. Each span of the structure consists of 20 x 0.9m deep precast prestressed concrete DHC units. An in-situ topping concrete of 180mm minimum thickness at one edge of the deck forms the raised footpath. A surfacing course will overlay the DHC units across the width of the roadway.

The three piers comprise of five 900mm diameter columns on top of 37.5m x 5m x 1.1m thick pile caps. Each pile cap is supported by 60 x 18m long 310UC 118 driven piles. The piles are founded in the competent Riccarton gravels. The pier crossheads provide seating for the DHC units. The abutments comprise of a 2.75m wide capping beam which have 40 x 24m long 310UC 118 driven piles piled down to competent Riccarton gravels. The overall height of the abutment from the top of the deck to the underside of the footing is approximately 2.5m. A 450mm thick, 6m long approach slab is provided to assist in resisting longitudinal loads from the structure.

The maximum height above ground for the Halswell Junction Road bridge structure is 9.5m.

## 4.6. Hornby Industrial Line rail siding

The proposed CSM2 alignment passes across the existing KiwiRail rail corridor (Hornby Industrial Line) that is used for shunting trains into the Watties factory. The rail corridor is approximately 10m wide but only extends as far south as the Preshes Investments Ltd property at 303 Marshs Road (Lot 2, DP397092). This provides adequate length for the train to shunt the wagons back up the track into the Watties area. To enable CSM2 to remain at-grade, it is proposed to turn the rail tracks out to the east on a curve clear of CSM2, catering for the shunting of carriages into Watties. KiwiRail accepts this is a workable solution and that the rail line will end at CSM2.

KiwiRail has indicated that it has no intention of extending the rail line further south and it is currently not nor will it in future be used for commuter rail. KiwiRail and the NZTA will enter into a formal agreement (a Deed of Grant) to enable the NZTA to pass across the corridor. If, in the future, a rail extension to Prebbleton was justified, any associated upgrade works for the rail to pass across CSM2 would be undertaken by the NZTA.

## 4.7. Traffic volumes and flow

### 4.7.1. Overview

The Project will contribute to the CSM and improve traffic flow from Rolleston to the Port.

The CSM2 section will provide a direct, motorway standard, connection between the end of CSM1 at Springs Road and Main South Road at Robinsons Road. It is forecast that a significant volume of

traffic will use the CSM2, relieving roads such as Main South Road through Hornby and Templeton and Halswell Junction Road which would otherwise remain heavily congested.

With the reduction in traffic volumes on these alternative routes to the CSM2, intersection delays are forecast to decrease significantly, as are link travel times. Significant benefits in terms of improved levels of service are forecast following the construction of CSM combined with MSRFL. The completion of the Weedons Road interchange will provide alternative access into the Rolleston residential area and the Izone industrial hub via Levi Road and Jones Road respectively. MSRFL

The key impacts on traffic movements which are forecast to occur following the completion of the MSRFL part of the Project are as follows:

- increase in traffic volume along Weedons Ross Road. This is due to the new interchange at Weedons Road. For the 2041 evening peak hour, this diversion is in the order of 300 vehicles;
- increase in traffic volume along Levi Road. This is due to the new interchange at Weedons Road;
- reduction in traffic volumes along Jones Road between Templeton (Kirk Road) and Weedons Ross Road and on Selwyn Road from Rolleston due to rerouting onto the upgraded Main South Road; and
- significant increased traffic on Main South Road between Rolleston and CSM2 interchange.

The Main South Road/Weedons Road intersection has been identified to be of high importance due to the location of the junction in relation to Rolleston and the Izone development, traffic from which will travel through this intersection to access the CSM and Rolleston.

### 4.7.2. CSM2

North of the CSM2 and Main South Road Interchange there will be a large drop in traffic volumes on Main South Road and Halswell Junction Road, as vehicles reroute onto CSM2. This reflects the attractiveness of the CSM2, which along with CSM1 provides a faster and shorter route and increased capacity through to Brougham Street.

There will be increased volumes along the CSM1 and CSM2 between the Curletts Road interchange and Main South Road and a decrease in traffic on Shands Road, as vehicles remain on the CSM2 rather than head to the southern side of Rolleston. On Brougham Street, capacity constraints reduce attractiveness, so Brougham Street is forecast to experience a smaller increase in traffic than for CSM1, which connects to it.

Around the western end of CSM1, traffic volumes on Halswell Junction Road northwest of Springs Road are expected to drop significantly, since CSM2 will provide a more efficient connection south. On Halswell Junction Road, east of Springs Road there is likely to be an increase in traffic volumes, as the reduction in congestion around the end of CSM1 will be aliviated by CSM2, making travelling through here relatively more attractive.

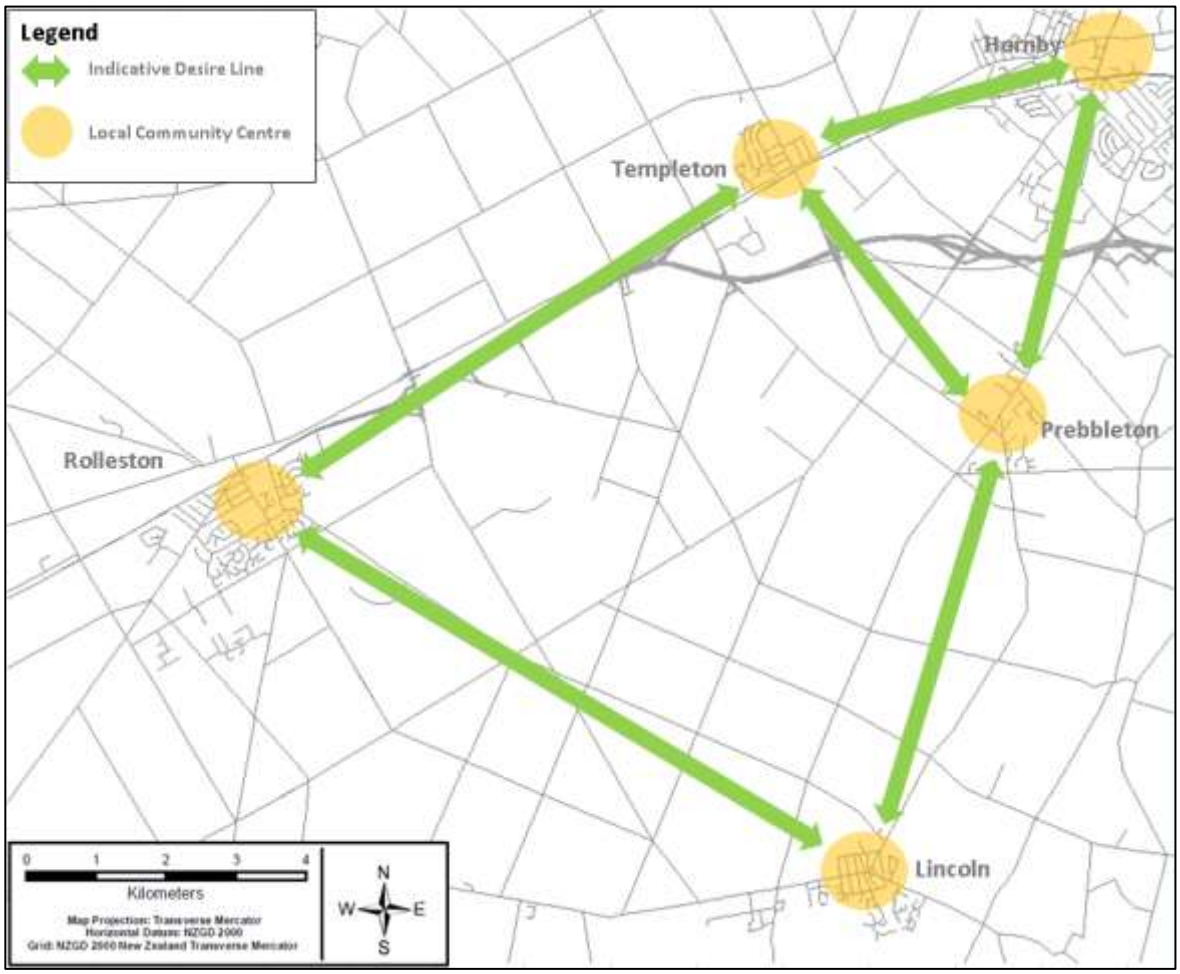
Marshs Road and Shands Road (south of the Shands Road interchange) are both expected to see higher volumes as traffic uses those roads to access the CSM. The new interchange on Shands Road will draw traffic from the parallel Springs Road routing from Lincoln, enabling access to the motorway without having to travel through Prebbleton or the Halswell Junction Road/ Springs Road roundabout.

### 4.8. Walkways and cycleways

Walking demand in the Project area is generally limited to local trips within the local community centres (Rolleston, Prebbleton, Lincoln, Templeton and Hornby). The distances between these centres discourages pedestrian activity, leaving cycling as the most preferred active mode.

For cyclists, trips are expected to be either within the local community centres, between these centres or are recreational trips on facilities such as the Little River Rail Trail. These are shown in Figure 23, with the Little River Rail Trail connecting Hornby, Prebbleton and Lincoln, and continuing southwards. Apart from the Rail Trail, there are currently no specific cycle facilities on routes serving these identified "desire lines".

**Figure 23: Desire lines**



Specific provision for walking and cycling facilities on Main South Road is not supported by the safety audit carried out for the Project, however the NZTA accept that the Main South Road section can be used by cyclists as it will not be designated as a motorway. It is noted that there are alternative preferred cycling routes available on parallel routes via the new rear access road to the west and Jones Road[52].

Subject to the outcome of any consultation, the NZTA currently intends to request the Governor General to declare CSM2 a motorway under section 71 of the Government Roading Powers Act 1989. As such, cyclists and pedestrians will not be able to use the CSM2 section of the Project. Provisions for cyclists and pedestrians have been included in the Project, where possible, in the local roads, intersections and bridges.

Underpasses at the following locations will provide access and connectivity for walkers and cyclists on the road bridges:

- Weedons Road;
- Main South Road connection bridge;
- Hamptons Road/ Waterholes Road;
- Trents Road;
- Shands Road;
- Marshs Road;
- Springs Road; and
- Halswell Junction Road.

On the above listed crossings, cyclists will be accommodated at the road shoulder incorporated as part of the road design, however as foot traffic is expected to be very low, it is anticipated that cyclists may also use the footpaths when using the bridges.

A width of 3.5 metres to 4.0 metres has been allowed for dedicated pedestrian and cycle facilities on all bridges. Two metre wide footpaths are proposed on both sides of the Weedons Road overbridge, Hamptons/Waterholes Road overbridge, Shands Road overbridge, Springs Road overbridge and Halswell Road overbridge. The Trents Road and Marshs Road overbridge will have a 3.5m shared facility for cyclists and pedestrians. The bridge footpaths/shared facilities will be confirmed at the detailed design phase.

Where considered necessary, pedestrian crossing phases will be provided for at the signalised intersection options.

### 4.8.1. Marshs Road and Little River Rail Trail

A shared use walking and cycling facility is proposed as part of the Project, which has been developed through a series of workshops with SDC and CCC. The facility links the CSM1 shared use path currently under construction and the Little River Rail Trail.

[52] The SDC has agreed with the NZTA that the alternative routes are preferable for cyclists and pedestrians than Main South Road.

Currently the Little River Rail Trail runs down Shands Road from Hornby, crossing over the proposed motorway before turning onto Marshs Road and then following the rail corridor to Prebbleton. When completed, the Little River Rail Trail will provide a cycle route from Hornby to Little River. The 3.5km section of the route between Shands Road and Prebbleton was opened in 2009 and the 7km section from Prebbleton to Lincoln was opened in 2006. The final sections of the trail linking Lincoln to Motukarara are currently under construction by the Rail Trail Trust. The Rail Trail is typically 3m wide and provides a shared use commuter and leisure facility for pedestrians and cyclists.

The proposed cycle link involves an extension from the CSM1 route at the Owaka subway. This is proposed to continue west along CSM2 to the south of the alignment within the new designation. The path would pass under the bridges at Halswell Junction Road and Springs Road and utilise the disused section of rail corridor to Marshs Road, whereupon it connects with the existing Little River Rail Trail. The proposed route alignment (highlighted in light blue) is shown in Figure 24.

The Marshs Road section of the existing Little River Rail Trail will be maintained from Shands Road and the signalised intersection associated with the Shands Road interchange will facilitate a cyclist crossing from Marshs Road to Shands Road. This maintains connectivity for cyclists to Hornby via Shands Road.

**Figure 24: Proposed alignment of shared use path and locations of potential changes**


### 4.8.2. Other opportunities

The Selwyn District Council's Walking and Cycling Strategy identifies the potential for a cycling corridor along Jones Road, connecting Rolleston to Hornby. It is recognised that the western rear

access road proposed as part of this Project could serve as part of this cycling corridor, with the advantage of reduced traffic volumes and a lower speed environment when compared with Jones Road. Provision or contribution towards this cycling corridor is not proposed to be constructed as part of this Project however, and it is a matter for SDC to address.

### 4.9. Pavements and surfacing

The pavement design for MSRFL involves strengthening of the existing pavement to cater for the design traffic, and the installation of new pavement to accommodate the additional two lanes. The final pavement design will be confirmed in the detailed design phase.

The final design of the pavement for the CSM2 section will also be carried out during the detailed design phase of the Project. The design will be based on the requirements in the NZTA Supplement to Austroads (NZTA 2007), particularly in relation to the standard for a modified aggregate base to reduce the risk of rutting. It is proposed to match the pavement construction methodology to that of the CSM1, ensuring continuity and durability where possible.

A foamed bitumen basecourse has been selected and pavement surfacing of Open Graded Porous Asphalt (OGPA) is proposed for the majority of the main alignment for maintenance purposes, as well as its properties of noise reduction and surface water reduction. There will be areas where the more durable Stone Mastic Asphalt (SMA) surfacing will be used, including on the approaches to interchanges (on and off ramps), at intersections and some underpasses. The majority of the extent of local roads within the Project will be surfaced with standard chip seal, with SMA utilised at intersections and some overpasses. The proposed pavement treatments for the Project are illustrated on Drawings 62236-A-C250 to 253 and 62236-B-C250 to 255 (the pavement drawings in Volume 5).

### 4.10. Noise attenuation

Along Main South Road, 1.8m high acoustic fences are proposed for several properties (1528 Main South Road, 95 Berketts Road and 1213 Main South Road) to mitigate noise effects along this section of the alignment.

Noise mitigation for the new motorway (CSM2) will include the use of low noise road surface (OGPA) and acoustic fences in certain isolated areas. For a section of Springs Road that is impacted by the Project, mitigation will involve using OGPA surface on the local road bridge southern approach, and a 1.8m high acoustic fence will be built along the road boundary at 312 Springs Road. The assessment of noise and details of proposed noise mitigation measures is contained in Chapter 16 of this report and in Technical Report 8, appended in Volume 3 of this application.

The low noise road surface areas (OGPA) are illustrated on Drawings 62236-A-C250 to 253 and 62236-B-C250 to 255 (the pavement drawings in Volume 5).

## 4.11. Stormwater design, stormwater treatment and flood management

The operational drainage and stormwater treatment design for the Project has been driven by two key requirements:

- ensuring that stormwater does not inhibit the safe and effective operation of the Project; and
- ensuring that the potential adverse environmental effects associated with stormwater are mitigated.

### 4.11.1. Stormwater design

A design groundwater level was established for the Project, using historical data, local current data, and allowances for the Central Plains Water Enhancement Scheme (CPWES). An allowance of 1m between the designed groundwater level, and the bottom of the land disposal layer that is specified in the NRRP, means surface water can be treated prior to it mixing with groundwater.

The proposed stormwater collection and treatment system will cater for a total rainfall depth of 140.7mm for MSRFL, and 158.4mm for CSM2, for the 24 hour duration 100 year Annual Recurrence Interval (ARI) event. Utilisation of the total storm detention will ensure that spilling into Upper Knights Stream in the Halswell catchment, via Montgomery's Drain, will only occur in extreme rainfall and/ or groundwater events where dilution will be significant.

Surface water will be dealt with differently in the MSRFL and CSM2 alignments. Main South Road and the adjacent rail embankment have impediments to overland flows, and they have little stormwater infrastructure in place. The widening of Main South Road will have little impact on the current behaviour of the catchment. Therefore, isolated soak pits in the low lying areas are proposed, with allowances for potential over topping.

For the CSM2 section at low points in the topography of the area, overland flows will pass underneath the motorway using a series of siphons designed to a 100 year ARI event. Bunds will protect the roadside swales and dispersal points. The additional disposal areas at locations of concentrated overland flows will provide protection to the road against flooding. In locations where overland flow siphons will be impractical (given length or geometric constraints) "surface water soakage areas" have been proposed to accommodate overland flow. These are required around the Shands Road and Weedons Ross Road interchanges and are illustrated on the Drainage Layout drawings in Volume 5.

Stockwater races will be passed under the motorway via a siphon system, typically measuring between 300mm and 450mm. In addition to the water supply function of the races they have a secondary function of being used for land drainage. Thus at each crossing a larger diameter siphon will be required to convey the storm flows under the project alignment. This second siphon will provide for the ability to carry out maintenance on the primary stockwater race siphon.

The proposed alignment is typically at or near grade, allowing for the disposal of stormwater above design groundwater levels. This minimises the depth of stormwater crossings and stockwater race siphons, and minimises the risk of road closure due to flooding. The elevation of the design groundwater level limits the depth at which the vertical alignment can be dropped into a trench.

The swales have been designed in general accordance with the NZTA Stormwater Treatment Standard for State Highway Infrastructure (May 2010). Overflow from one swale to the next will be prevented via low bunds immediately downstream of the soak pit entry points. Two detention basins are required at the CSM1 end due to low percolation rates and high groundwater levels. Where these detention basins are situated coincides with the groundwater protection area, and as such first flush basins are proposed to treat stormwater prior to disposal to land.

A variable design disposal rate was applied along the alignment to account for changes in ground condition, generally increasing with distance from the city. These design disposal rates allow a disposal footprint to be calculated for a required design outflow, i.e. flow out of the soak pit or detention basin.

The Robinsons Road overpass will be at an inverted level, which could mean that, without mitigation the road might be flooded every 3 to 4 years, for a period of between weeks to a month or more (based on ECan data). Proposed mitigation measures to address this issue are a pumping system, piping the adjacent stockwater race (to ensure separation to the excavation), bunding, and installation of pavement that is better suited to submergence. An alternative option of allowing the local road to flood occasionally is also available.

CSM1 stormwater infrastructure will be impacted by CSM2, most notably:

- construction of the southbound off-ramp will partially fill the Lee Pond; and
- construction of the northbound on-ramp will require backfill of less than one tenth of the CSM1 'Mushroom Pond'.

To ensure the CSM1 system still operates as intended, allowances for modifications to this infrastructure have been made in the design of CSM2 to integrate stormwater treatment. With the Lee Pond, a small proportion of the existing alignment will now drain to the new Ramp Pond. For the Mushroom Pond, the remaining 90% of the pond will be sufficient to service the Halswell Junction Road roundabout and associated impervious areas. The on-ramp and CSM1 contributing areas will be diverted to the new "Maize Maze" pond which will be designed to have the capacity to capture this shortfall.

#### 4.11.2. Stormwater treatment

The proposed method of stormwater treatment will be via a series of grass filter strips (verge edge and swale batter), swales, first flush basins and infiltration devices. Stormwater methods were designed using the following guides:

- Canterbury Natural Resources Regional Plan ("NRRP");

- the NZTA Stormwater Treatment Standard for State Highway Infrastructure (2010);
- Christchurch City Council Waterways and Wetlands Drainage Guide (Parts A and B), 2003 (revision to design rainfall guidance in 2010);
- Selwyn District Council Engineering Code of Practice July 2010;
- Auckland Regional Council, Technical Publication No 10 (TP10) Stormwater Management Devices Design Guideline. Auckland. 2003;
- Ministry for the Environment, Climate Change effects and impacts assessment. A guidance manual for Local Government in New Zealand. (Prepared by the New Zealand Climate Change Office, 2008); and
- Facility for Advanced Water Biofiltration, Monash University, Stormwater Biofiltration Systems, Adoption Guidelines: Planning, Design and Practical Implementation, Version 1, June 2009.

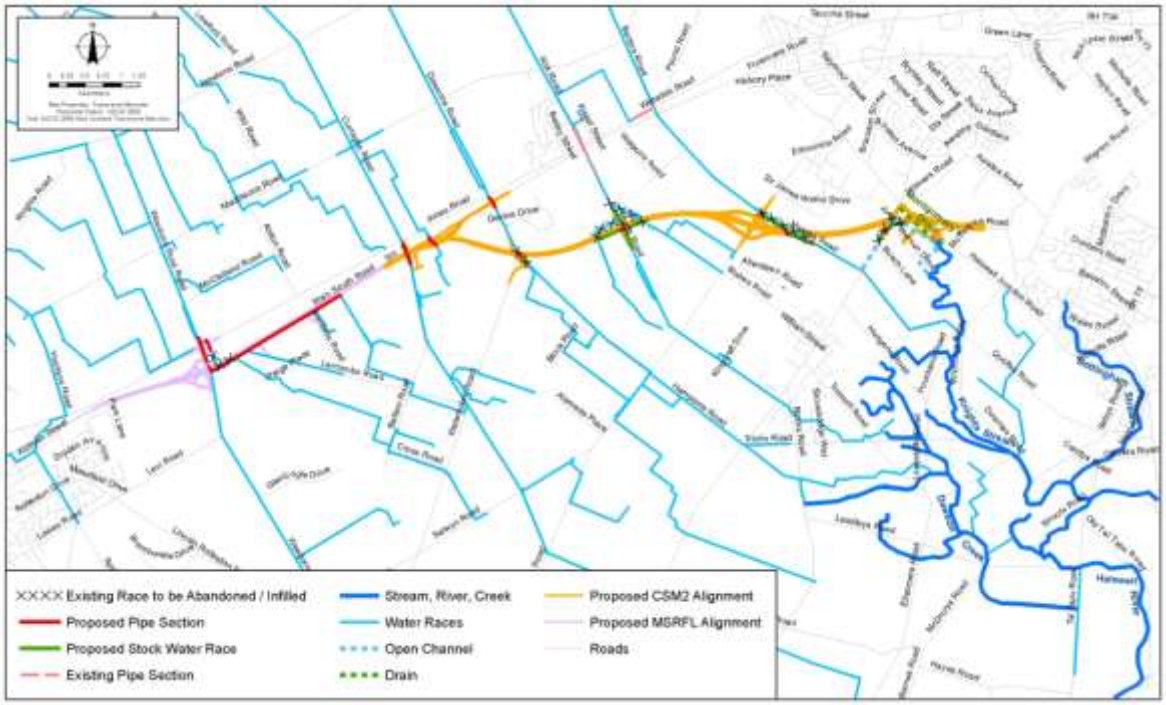
The various components of the stormwater and drainage system have been designed for the 100 year ARI. This standard is set in the NZTA Stormwater Treatment Standard for State Highway Infrastructure. This standard is appropriate for this Project, as the vast majority of the stormwater collection and treatment system will be constructed below the existing ground level, limiting the ability to 'spill' out of the system in large events.

The 100 year ARI standard exceeds the requirements of the CCC Waterways, Wetlands and Drainage Guide, the SDC Engineering Code of Practice and the NZ Building Code. Events in excess of this ARI have the potential to cause flooding upstream of the State highway and of the State highway itself.

### 4.11.3. Diversion of water races

Nine existing stockwater races cross the proposed alignment and various measures are required in conjunction with construction of the Project, particularly in relation to the CSM2 alignment. In addition, a 2.1km section of race which runs alongside Main South Road will be piped. These are illustrated in Figure 25 below.

Figure 25: Proposed diversions of stockwater races




Where stockwater races pass under the State highway, a siphon system will be constructed, with pipes typically measuring between 300mm and 450mm being utilised. In addition to the water supply function of the races they have a secondary function of being used for land drainage. Thus at each crossing two conduits will be required. A smaller pipe to convey the normal race flows and a large conduit to convey the storm flows under the Project alignment plus allow for maintenance of the smaller pipe.

In other cases, stockwater races will be diverted to allow for the construction of embankments and to reduce the number of siphons. These diversions will be fully lined to prevent water loss. This rationalisation of the stockwater race network will limit the number of piped crossings beneath the Project, reducing the risk of upstream flooding and minimising the on-going maintenance of the system.

The existing stockwater races at Weedons Ross and Weedons Road crosses Jones Road SIMT rail and SH1. Upgrades will be required to pipe stockwater race flows under Jones SIMT rail and SH1 to take race water and be suitable for its modified land drainage function. This pipe will also feed the “Digga-Link” race branch to feed the Larcombs and Berketts branches by means of a new 2.1 km pipe to be laid parallel with SH1.

The existing stockwater race on the west side of Robinsons / Curraghs Road will be piped below SH1 and continue flowing south on the other side. Minor realignment will be required to bypass the embankments required for the intersection construction. The function of the race can be maintained.

The existing stockwater race at the intersection to be formed between SH1 and CSM2 at chainage 800m will also be piped below the proposed CSM2 alignments. The function of the race can be maintained.

A minor realignment will be required to bypass the Waterholes Road roundabout and for intersection construction.

The existing stockwater race at the proposed Waterholes Road and SH1 will be piped under the new interchange. Further down Waterholes Road and at the SH1 underpass at chainage 1950m, the race will be piped below the proposed CSM2 alignment and realigned to suit the extents of the proposed embankments for the underpass. The function of the race will be maintained.

There is an existing stockwater race flowing south on the east side of Trents Road and one on the west side of Blakes Road. Trents Road will cross CSM2 by means of an underpass and modifications to the Trents Road stockwater race will be required as part of these works. It is proposed to realign the race along the bottom of the eastern embankment of Trents Road that will form the underpass. The stockwater race will pass below CSM2 and continue on in the new alignment until the proposed embankment ends, allowing the race to recommence its original alignment.

An existing branch departs the main stockwater race and heads west off Trents Road at chainage 250 before turning south, crossing the proposed CSM2 alignment at chainage 3100m. This branch connection point will be removed as part of the underpass works, and it is proposed that this branch be infilled or a soak pit be placed downstream of the final race user. This will reduce the requirement for a stockwater race crossing at chainage 3100m. The branch will recommence on the south side of the CSM2 alignment, picking up a new branch that will come from the realigned stockwater race on the western side of the Trents Road underpass.

It is proposed that the stockwater race on the south side of Blakes Road will continue but with reduced capacity and will terminate at a soakhole beside the CSM2 alignment. The overland flow / land drainage function of the race will continue and an inverted siphon under the CSM2 will allow this overland flow to continue down Blakes Road.

At Marshs Road the existing stockwater race will terminate and Shands Road and will become a land drainage race. The existing race is to be re-aligned to the toe of the new Marshs Road embankment and piped by siphon under CSM2.

Further changes to stockwater race / land drainage races are proposed at Springs Road and to the alignment of Montgomery's Drain at Halswell Junction Road.

At the John Paterson Drive extension the race is realigned along the western embankment of the extension.

The proposed rationalisation of the stockwater race network will reduce the maintenance burden of the scheme and minimise flooding risks to the Project and adjacent property owners. It will be implemented in accordance with the construction staging for the Project.

Only very brief shut downs of the races will occur to allow the new connections to be made. The new alignments will be constructed by excavating trenches, thrust piping or installing culverts. For thrust piped or excavated sections, once the alignment is completed the upstream connection will be made during which time a shutdown of the race may be required. Race shut offs would require the upstream junction to be closed off, leaving water flowing down only one of the races at a junction. This would allow the connection to occur and the closure or decommissioning of the upstream end of the existing alignment. Once the connection has been made, the new alignment can be used and supply will recommence.

For culverted sections of the alignment along MSRFL, over-pumping of the section in construction will be employed to maintain supply. A shut down would only be required for the final connection of the culvert. Shut downs are expected to be in the order of eight hours, but will not exceed 36 hours.

The Selwyn District Council Water Race Bylaw 2008 controls the shutdown periods of the water races. The Selwyn District Council Policy Manual (policy W117) includes a time limit for planned management of the system, limiting this to 36 hours. As stated above it is expected that all alterations and changes would be able to be carried out within eight hours which is well within the normal 36 hour shutdown period allowed by the Policy. The NZTA will seek approval from SDC for this.

Realignments and piping of water races are to occur on the land parcels listed in Table 9. All of the affected races are on land within the designation (and proposed to be acquired for the Project) and/or is on land already purchased by the Crown.

**Table 9: Land parcels where works are required to pipe and realign water races**

| Property acquisition reference | Owner | Legal Description | | Title Ref |
|---|---|---|---|---|
| MSRFL | | | | |
| 118 | MacLee Holdings Limited | Pt Lot 3 | DP 25904 | CB8B/713 |
| 154 | Timargo Holdings Limited | Lot 2 | DP 25718 | CB7D/15 |
| CSM2 | | | | |
| 2 | Her Majesty the Queen | Lot 2 | DP 81942 | CB47B/504 |
| 16 | Her Majesty the Queen | Lot 1 | DP 408618 | 431405 |
| 18 | Emma Joy Steel Michael Joseph Sweeney | Lot 2 | DP 408618 | 431404 |
| 19 | Her Majesty the Queen | Lot 3 | DP 408618 | 431406 |
| 20 | Her Majesty the Queen | Lot 1 | DP 19955 | CB760/91 |
| 22 | Her Majesty the Queen | Lot 1 | DP 322541 | 89932 |
| 23 | Her Majesty the Queen | Lot 2 | DP 340332 | 165870 |
| 44 | Calder Stewart Industries Limited | Lot 1 | DP 397092 | 387248 |

| Property acquisition reference | Owner | Legal Description | | Title Ref |
|---|---|---|---|---|
| MSRFL | | | | |
| 49 | Her Majesty the Queen | Pt | RS 1480 | CB493/44 |
| 50 | Her Majesty the Queen | Pt | RS 1480 | NZG1972p497 |
| 54 | Richard John Sissons<br>Carolyn Beverley Sissons | Lot 1 | DP 318764 | 73541 |
| 59 | Her Majesty the Queen | Lot 3 | DP 307041 | 27368 |
| 66 | Her Majesty the Queen | Lot 1 | DP 19825 | CB756/94 |
| 67 | Grant Phillip England<br>Halie Sharleen Kellaway | Lot 8 | DP 318764 | 73548 |
| 103 | Templeton Investments Limited | Lot 2 | DP 18353 | CB667/57 |
| 129 | Godfried Maria Louise van Tulder<br>Sandra Kay van Tulder<br>Philip Robert Haunui Royal | Pt Lot 2 | DP 82599 | CB47D/144 |
| 171 | Gary John Cross<br>Gerard Joseph Twaites | Lot 1 | DP 406023 | 421093 |
| 172 | The Selwyn District Council | Section 2 | SO 435267 | 544078 |
| 178 | Martin Richard Harcourt<br>Aiko Harcourt<br>Peter Ian Cullen | Lot 4 | DP 318764 | 73544 |
| 179 | Fulton Hogan Land Development | Lot 2 | DP 3256 | CB759/44 |
| 181 | Kiwi Rail | Main South Line | | NA |

Water supply will not be meaningfully disrupted to any other users outside of land required by the NZTA for the Project as a result of the realignment works. Therefore no other water race users will be affected.

### 4.11.4. Groundwater intervention

The majority of the Project has sufficient clearance from groundwater as not to be impacted by the groundwater level and seasonal variations thereof. The Central Plains Water Enhancement Scheme (CPWES) has now been consented and is part of the "existing environment" for planning purposes. There is a 4 m and 1 m predicted rise in the groundwater from the effects of the CPWES at the south and north ends of CSM2 respectively.

At the CSM2 ponds at Halswell Junction Road (Maize Maze and Ramp ponds) and the CCC ponds (Halswell Junction Road ponds and Owaka Basin), the future groundwater highs have the potential to impact upon pond performance. As such, a primary intervention strategy of controlled release of water collected in the stormwater ponds to Montgomery's Drain is proposed. A second

intervention strategy is proposed to intercept rising groundwater and to convey these flows by a gravity pipe and to discharge this flow to Upper Knights Stream.

At the Robinsons Road overpass, the future groundwater high level is predicted to flood the pavement for shorter periods of days to a month every few years. As such an intervention strategy to pump groundwater is potentially required to maintain an open road. Alternatively, the local road which passes under the State highway may be closed at times, when flooded. Local road diversions will be used in this situation.

### 4.12. Urban design and landscaping

The design and landscaping of the Project will follow the design principles in the NZTA Urban Design Policy (2007), and aims to ensure that:

- roads fit in sensitively with the landform and the built, natural and community environments through which they pass;
- all systems of movement along and across the corridor are integrated into the design of State highway projects with good connections and access to the communities;
- the design contributes to the quality of public space and to the road user's experience; and
- the design is generally consistent with the parkway appearance of CSM1 so it can be extended through to Main South Road.

The CSM2 alignment is considered to form a logical extension to the Christchurch urban limit between Springs Road and Shands Road. The motorway, in conjunction with Marshs Road, Halswell Junction Road and Upper Knights Stream Corridor, provide a robust urban limit.

The alignment is of a gentle curvilinear nature and the landscaping for the Project is in line with the NZTA's Environmental, Urban Design and Landscape Masterplan for CSM[53]. Landscaping has been designed with the possible views of the Port Hills and Southern Alps in mind.

The main objectives regarding the landscaping design of the Project are to:

- mitigate the visual effects of the Project;
- integrate with the planting and landscaping already in place at CSM1;
- retain open views to Port Hills and Southern Alps where possible; and
- develop site specific landscape treatment that complements any noise mitigation measures.

Landscape planting was chosen in order to be in keeping with the surrounding rural environment, and the historic native plantings of the area. Continuing with the CSM1 plantings, the focus is on the interchange embankments, amenity plantings, visual and noise mitigation plantings, and stormwater plantings.

[53] NZTA, 2011, Environmental, Urban Design and Landscape Masterplan for CSM

Walkway and cycleway links are included and safety sightlines, setbacks and Crime Prevention through Environmental Design (CPTED) provisions. The grassed median will be consistent throughout the Project, and will link with CSM1 near the Halswell Junction underpass.

### 4.13. Transmission lines

Two lines of Transpower pylons intersect just north of the proposed Shands Road / Marshs Road interchange and require modification as a result of the Project, in order to ensure safe clearances.

Realignment / strengthening of existing transmission lines is proposed to facilitate the proposed alignment. It is likely that one or two towers along the Islington-Springston A (ISL-SPN A) 66 kV transmission line will be increased in height and/ or relocated to provide the required ground and road crossing clearances required under the New Zealand Electrical Code of Practice for Electrical Safe Distances (NZECP 34:2001).

Discussions with Transpower to confirm the exact modifications required to these lines are on-going.

### 4.14. Commercial Vehicle Inspection Unit (CVIU)

There has been a request from the NZ Police to include a Commercial Vehicle Inspection Unit (CVIU) facility as part of the Project in the vicinity of Halswell Junction Road. The CSM2 weigh station would include a weigh bridge catering for 25 m long vehicles with room for parking, inspection and unloading, and would also allow for drink driver testing. NZ Police would like the facility to be able to capture both northbound and southbound movements, with the potential need for associated variable message board signage to direct traffic. Overweight vehicle infrastructure is being planned and coordinated within the Greater Christchurch area. Further liaison between the NZ Police and the NZTA is required to confirm the ideal location, funding and operational details of this CVIU facility.