
PART E: CONSIDERATION OF ALTERNATIVES**7. CONSIDERATION OF ALTERNATIVES****Overview**

Under section 171(1)(b) of the RMA, a requiring authority needs to consider alternative sites, routes and methods of undertaking a work when lodging a NoR if it does not have an interest in the land sufficient for undertaking the work or the work is likely to have a significant adverse effect on the environment. The RMA also requires an applicant to consider alternative methods and locations for resource consents relating to any activity that may have significant adverse effects on the environment or, when an activity involves the discharge of a contaminant, alternative methods of discharge need to be considered.

This chapter outlines the alternatives that were identified and assessed as part of the process to determine the selected alignment and design for MSRFL and CSM2. During the development of the Project there have been three general stages in option assessment; the CRETS work (2002 – 2007); a scoping investigation for each of MSRFL and CSM2 to investigate and narrow down various options; and the Scheme Assessment phase to identify a preferred option for the Project.

The NZTA's assessment of alternatives demonstrates that, in developing the proposed route, the NZTA has considered:

- the alignment, design, and methodology for the Project;
- alternative routes (as appropriate);
- alternative alignments and interchanges/connections to the wider transport network;
- alternative designs and measures to avoid, remedy and mitigate identified adverse effects on the environment; and
- alternative methods of discharge.

The assessment process applied was highly iterative, and involved on-going refinement of the Project on the basis of information derived from desk top studies, field work, community and stakeholder consultation and detailed technical investigations. The process was also informed by the requirements of Part 2 of the RMA, the objectives of the NZTA and relevant national and regional policy directives. The process therefore satisfies the requirements of section 171 and Schedule 4 of the RMA.

7.1. Introduction

This chapter provides a summary of the key aspects of alternatives considered in the development of the Project. It outlines the historical development of the Project and option evaluation process undertaken to arrive at the preferred option for the two main components, consisting of:

- the configuration of the four-laning of Main South Road from CSM2 to Rolleston (MSRFL); and
- the alignment of CSM2.

During the development of the Project there have been three general stages in option assessment:

1. the CRETS study to define the general scope and form of corridor improvements;
2. the two scoping investigations for MSRFL and CSM2 to investigate and narrow down various options; and
3. the Scheme Assessment phase to identify a preferred option.

Stage one of the Scheme Assessment phase was focussed on fundamental road alignment options and the mapping of key environmental constraints from published information such as district and regional plans. Following the selection of a preferred option, the environmental assessments were carried out. Changes to the road alignment and options at this stage were carried out. In particular, consideration was given to the stormwater design, noise impacts and landscaping design.

7.2. Statutory requirement to consider alternatives

Under the RMA, a consideration of alternative sites, routes and methods is required in relation to some aspects of the Project.

The Fourth Schedule of the RMA requires an AEE to include possible alternative locations or methods for undertaking the activity to be described where it is likely that an activity will result in any significant adverse effect on the environment (Schedule 4 clause 1 (b)).

In relation to discharge permit applications, section 105 of the RMA requires regard to be had to various matters including “any possible alternative methods of discharge, including discharge into any other receiving environment”.

In relation to NoRs, section 171 (1)(b) requires particular regard to be given to whether adequate consideration has been given to alternative sites, routes and methods of undertaking the work.

Further, section 16 of the RMA requires a “best practicable option” to be adopted in relation to noise, and this implies consideration of options to mitigate noise is required.

7.3. Historical context

As discussed in Chapter 2, the concept for the CSM dates back to the early 1960s through the work of the Christchurch Regional Planning Authority, including the Christchurch Master Transportation Plan released in 1962⁵⁸. Staged development of the motorway commenced during the 1970s, with the first stage involving the SH75 Curletts Road link between Halswell Road and Yaldhurst, which opened in 1979. The second stage involved the section from Curletts Road to

⁵⁸Christchurch Regional Planning Authority. Christchurch Master Transportation Plan. 1962.

Brougham Street which opened in 1981. This was originally to be a four lane motorway all the way through to Main South Road, west of Halswell Junction Road but was reduced in scope just prior to construction as a result of funding constraints.

In the early 1980s, the remaining unbuilt length of the motorway route was redesignated and generally followed the alignment developed in the original 1960s plan, but with a significantly reduced designation width and a termination point with SH1 just south of Templeton. Further modifications in 1994 saw the CSM2 designation uplifted and the termination point shifted to the western end of Halswell Junction Road, as per the current form of the CSM presently under construction.

The next studies to specifically address the development of CSM did not occur until the 1990s, and these studies focused on what is now recognised as CSM1. These studies led to the construction of CSM1 commencing in 2010.

No significant studies investigating the CSM extension beyond the current proposal to Halswell Junction Road were completed until the CRETS study was commissioned in 2002. This study identified possible CSM2 routes and the need for four-laning Main South Road to Rolleston as part of an integrated transport strategy for southwest Christchurch.

Further detail on the historic development of the Christchurch Southern Motorway was provided in Chapter 2. It is within this strategic context that the consideration of alternatives for the current Project fits.

7.4. Assessment of alternative options

7.4.1. Christchurch Rolleston and Environs Transportation Study (CRETS) (2002 – 2007)

In 2002, Transit New Zealand, Selwyn District Council, Christchurch City Council, Environment Canterbury and the Christchurch International Airport Ltd jointly commissioned a study to investigate the long-term transport needs for areas south and west of Christchurch and develop a transport strategy to accommodate the anticipated urban growth and associated travel demand in the study area.

The objective, as stated in the terms of reference was⁵⁹:

“The study of transportation requirements in the Christchurch to Rolleston broad area is seen as a key component in the planning for the development of the roading network to the west and south of Christchurch for the ensuing 25 year period.

The key output of the study is the identification, justification and reporting of a strategy that details the most appropriate stages for the progression of improvement projects that will achieve an ideal roading network to satisfy projected demands.”

⁵⁹Christchurch, Rolleston and Environs Transportation Study. Transport Strategy Final Report. September 2007.

The CRETS study was completed over five years between 2002 and 2007 and involved the production of five major reports including:

- Model Validation Report, April 2005;
- Identification of Potential Problem Areas Report, April 2005;
- Issues and Options Identification Report, April 2005;
- Options Analysis Report, December 2005; and
- Transport Strategy Report. This was completed in two stages; the first draft formed the basis of the 2006 public consultation documents and the Transport Strategy Final Report was released in September 2007.

The CRETS study included two full rounds of public consultation. The first phase of consultation was undertaken between February and June 2002 and helped identify transport-related issues that were then considered in the study. The second phase of consultation was undertaken between September and November 2006 and was designed to obtain feedback on the Draft Transport Strategy. The feedback gained was used in preparing the Final Transport Strategy.

Of particular relevance to this Project, key matters raised in the study brief as specific issues to be addressed included the treatment of SH1 between Hornby and Burnham and the location of the Southern Motorway Extension beyond that proposal. It was identified early on that both of these issues were inter-related, as traffic will divert from SH1 to the future Southern Motorway Extension.

These two specific issues were again highlighted in the initial phase of consultation and supported by the preliminary technical performance analysis where potential problem areas were identified on the SH1 corridor between Hornby and Rolleston, as well as Halswell Junction Road between Springs Road and SH1. The main issues were grouped around the conflicting function of the route, route safety, link volumes and intersection delays and the associated level of service. Essentially, the existing SH1 was identified as not being of a sufficient standard to carry the additional traffic (predicted to increase in the order of 75% by 2021). Furthermore, analysis determined that due to the limited catchments of a passenger rail based service utilising the Main South Line, it would not have a significant effect on the growth in private vehicle traffic and upgrade of the roading network would still be required.

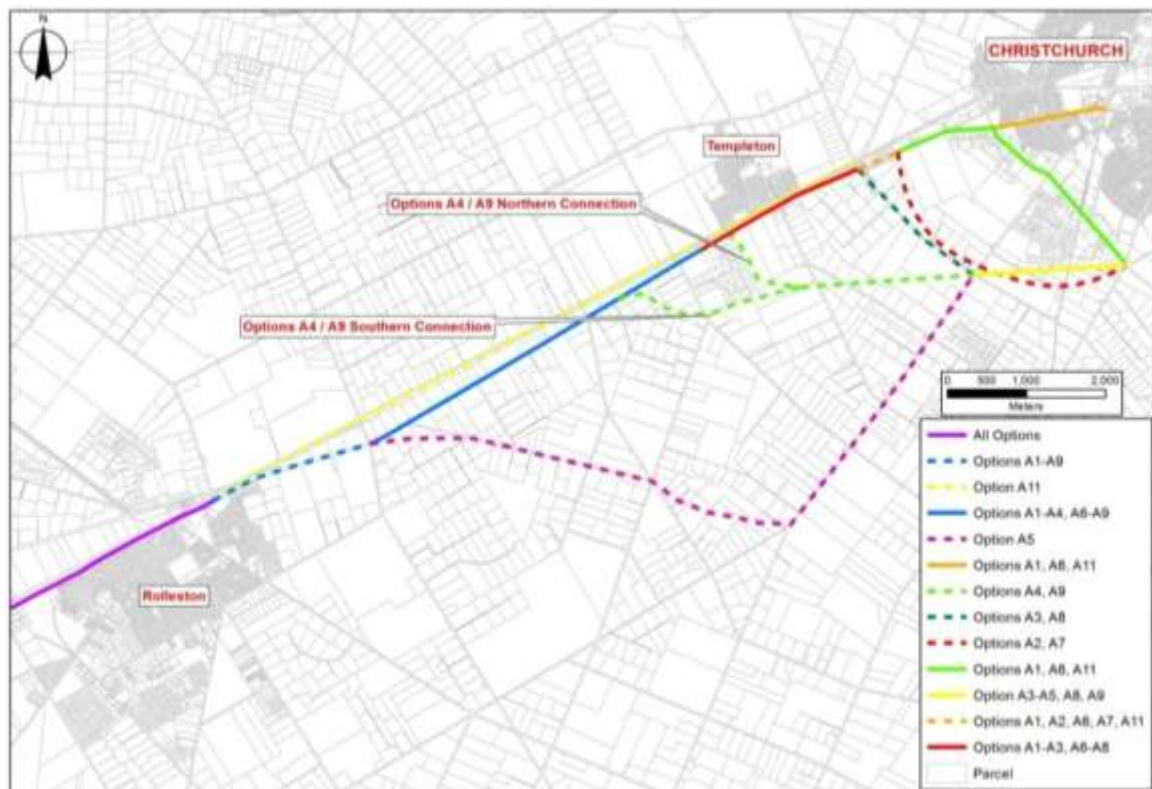
In response to these issues, CRETS developed a number of options along the SH1 corridor and improving the connection of the Southern Motorway Extension. These included four-laning the existing highway, five different route alignments for a connection between CSM1 and SH1, and two upgrade standards for SH1 (80 km/h with access at intersections and 100 km/h with a higher standard of access at intersections). A further option to upgrade Jones Road as a supplementary route was also identified. The full list of the options assessed are set out in Table 12 and illustrated on Figure 35. Private land would be required for all options.

Table 12: CRETS Project options

CRETS Project options	
Option	Description
A1	Four lane SH1 and Halswell Junction Road. Roundabouts at major rural intersections and signals at major urban intersections. SH1 80km/h.
A2	Four lane SH1 and a new link between Halswell Junction Road and Marshs Road. Roundabouts at major rural intersections and signals at major urban intersections. SH1 80km/h.
A3	Four lane SH1 and Marshs Road. Roundabouts at major rural intersections and signals at major urban intersections. SH1 80km/h.
A4	Four lane SH1 and a new link from Springs Road/Halswell Junction Road intersection to SH1 south of Templeton. Roundabouts and interchanges at major rural intersections. SH1 80km/h.
A5	Two lane Christchurch Southern Motorway Extension from Springs/Halswell Junction Road intersection to SH1/Weedons Road intersection using Shands Road and Larcombs Road. Roundabouts and interchanges at major rural intersections. SH1 100 km/h.
A6	Four lane SH1 and Halswell Junction Road (as per Option A1). Interchanges at major rural intersections and signals at major urban intersections. SH1 100km/h.
A6a	Four lane SH1 and two lane Halswell Junction Road. Interchanges at major rural intersections and signals at major urban intersections. SH1 100km/h.
A7	Four lane SH1 and new link between Halswell Junction Road and Marshs Road (as per Option A2). Interchanges at major rural intersections and signals at major urban intersections. SH1 100km/h.
A8	Four lane SH1 and Marshs Road (as per option A3). Interchanges at major rural intersections and signals at major urban intersections. SH1 100km/h.
A8a	Four lane SH1 and two lane Marshs Road. Interchanges at major rural intersections and signals at major urban intersections. SH1 100km/h.
A9	Four lane SH1 and a new link from Springs Road/Halswell Junction Road intersection to SH1 south of Templeton (as per A4). Interchanges at major rural intersections. SH1 100km/h.
A9a	Four lane SH1 and new two lane link from Springs Road/Halswell Junction Roads intersection to SH1 south of Templeton. Interchanges at major rural intersections. SH1 100km/h.

CRETS Project options	
Option	Description
A11	Upgrade Jones Road between Hoskyns Road and Barbers Road. Four lane SH1 north of Barbers Road and four lane Halswell Junction Road. Priority control at rural intersections and signals at major urban intersections. SH1 100km/h.

Figure 35: CRETS Southern Motorway Extension options considered



Options analysis

The options were subject to a first order analysis against three criteria, including social and environmental effects, transportation effectiveness and economic efficiency.

Options A1 to A4 were rejected on the grounds that the 80 km/h upgrade standards and greater access availability at intersections are not in keeping with the function of a national arterial route. The proposed at grade intersections would result in increased delays and decreased mobility for through traffic and were not considered to be sustainable in the long term.

Option A5 was not carried forward due to its low transportation effectiveness rating. The low effectiveness rating is associated with the option not addressing the conflicting function of the SH1 route, not addressing the low level of service and not addressing the safety concerns of the route.

Option A6 was shown to be not economically viable and Option A7 was assessed to have significant environmental effects in an area popular for lifestyle blocks. Both options would also not address the high traffic volumes through Templeton.

Option A11 was dismissed on the basis of a low transportation effectiveness rating and a BCR of less than 1.0. To function as a supplementary route to SH1, it would also require traffic to cross the railway line twice with associated safety concerns. The promotion of Jones Road would also encourage larger traffic volumes through developed areas where there are low current volumes and was therefore considered unlikely to meet community amenity expectations.

The key recommendation of the first order analysis was:

- that Options A8 and A9 and their variations A8a and A9a be taken forward for further analysis as part of an 'Initial Package of Works'.

Initial Package of Works

The Initial Package of Works covered the Southern Motorway Extension and several other independent road network improvement options within the study area. This package was built from options that best work towards an ideal staged, sustainable long term roading network and for this reason, Option A9 was initially chosen over Option A8. Option A8 would also add significant traffic to the Marshs Road and the Islington/ Templeton areas, and had a lower BCR compared to Option A9. It was later determined that extending the CSM to SH1 south of Templeton results in lower travel times and distances, than upgrading SH1 through Templeton to four lanes.

The Initial Package of Works therefore involved the Southern Motorway Extension to SH1 south of Templeton (just north of Dawsons Road) and four-laning SH1 from the intersection with the future extension to Rolleston. A number of variations to the initial package were also tested, with those of direct relevance to this Project including:

- removal of the CSM interchange at Springs Road/ Halswell Junction Road;
- realignment of the southern end of the CSM extension to connect to SH1 south of Dawsons Road to avoid the new subdivision at Claremont; and
- removal of the Option A9 alignment and replacement with Option A8.

The key findings (specific to the Project) noted in the conclusions of the option analysis work⁶⁰ included:

- that the interchange at the intersection of Springs Road/Halswell Junction Road and the Southern Motorway Extension be removed, as connectivity to the Southern Motorway Extension could be provided via existing routes;
- that an interchange should be provided at the intersection of Shands Road and the CSM Extension to provide access from Rolleston, the south of Lincoln, and southern portions of the Hornby Industrial Area;

⁶⁰Summarised from the Christchurch, Rolleston and Environs Transportation Study. Options Analysis Report. December 2005

- that the intersection of SH1 and the CSM Extension should be south of Dawsons Road, in the form of a high speed interchange;
- that SH1 from the CSM Extension connection to Rolleston be four laned;
- that all intersections of side roads and SH1 between the CSM Extension connection and Weedons Road be closed or converted to left in left out to be consistent with the function of SH1; and
- that an interchange be constructed at the intersection of SH1 and Weedons Road and that the intersections of SH1 and Rolleston Drive North and Hoskyns Road be converted to left in left out.

CRETS Final Transport Study 2007

SH1 four-laning and the Southern Motorway Extension from Rolleston were included as a medium term project in the CRETS Final Transport Strategy which was released in September 2007. The analysis showed that this component of the strategy was effective at addressing many of the issues raised including:

- providing capacity for the projected future traffic volumes whilst enabling the highway to provide its function of mobility in the hierarchy;
- significantly decreasing traffic volumes on SH1 through Hornby, Islington and Templeton;
- significantly decreasing traffic on Halswell Junction Road west of Springs Road;
- increased safety as a result of lower traffic volumes on SH1 north of the CSM2 connection and median divided four lane and intersection improvement on the southern section;
- safer movements across SH1 with an interchange at Weedons;
- improved access to industrial areas to the north of Rolleston via Jones Road and the Weedons interchange, along with improved access to the Rolleston residential areas south of SH1 via Weedons Road, Levi Road and Lowes Road and the Weedons interchange; and
- provision of a key access corridor from the south, for increased traffic between Christchurch and Rolleston and strategic traffic travelling to and from Christchurch City and the Port of Lyttelton.

7.4.2. Principal MSRFL options identified

Overview

The MSRFL investigation process involved the following general stages of investigation:

- establish the general scheme defined in the Project scope;
 - first round of public consultation;
 - development of options and comparative option evaluation for scoping report;
 - second round of public consultation;
 - draft Scheme Assessment;
 - option refinement; and
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- final Scheme Assessment.

The Project scope defined the MSRFL scheme as:

- upgrade two lane Main South Road to four lanes median separated from the CSM2 junction near Robinsons Road to south of Weedons Road at Rolleston;
- full grade separated interchange at Weedons Road; and
- other road and property access to be left in/left out only.

The NZTA presented these key features of the Project to the community during the first round of consultation in October 2010. The consultation newsletter indicated that additional land was likely to be required for road improvements, but that it was yet to be decided whether adjoining land would be required on both sides of the existing SH1, or whether land would be required from only one side.

MSRFL Scoping Report

The MSRFL Scoping Report was completed in December 2010. The scoping study investigated four-laning options based on widening the existing Main South Road alignment. These options were developed using a 42.5m wide cross section, adopted from the CSM1 Project currently under construction (for consistency, it was proposed to retain this cross-section through CSM2 and MSRFL).

Options were initially identified and examined by dividing the Main South Road into three discrete sections, described as follows:

- Main South Road North – CSM2/ Robinsons Road to Weedons Road/ Weedons Ross Road;
- Weedons Interchange; and
- Main South Road South – Weedons Road/ Weedons Ross Road to Hoskyns Road.

Options assessment

An options assessment workshop was held in December 2010. The purpose of this assessment was to complete a comparative evaluation of the identified Main South Road widening and Weedons interchange options, and to identify a preferred solution to take forward into the detailed scheme assessment and present at the second round of consultation.

The workshop was attended by selected consultants engaged by the NZTA representing relevant engineering and environmental disciplines.

The options were evaluated under five main criteria:

- cost;
 - engineering;
 - transport network;
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- physical environmental impacts; and
- social environmental impacts.

The evaluation indicated that there were no major differentiators between options. Social impacts, other than those relating to direct property effects, were evaluated as low through the initial social screening process. Initial desktop investigations also did not identify any significant environmental impacts that could not be avoided, remedied or mitigated.

The preferred option for carrying forward to the scheme assessment stage was recommended as comprising:

- Main South Road North – widening to the west on the basis that the existing widening designation is on the west side of Main South Road and it would lessen the impact of local road intersection upgrades on the east side;
- Weedons Interchange – the partial cloverleaf design as it has the least impact on neighbouring properties to the north. It also has lesser environmental impact and a slightly better traffic performance than the diamond options; and
- Main South Road South – a slightly narrower cross section to fit within the existing road reserve as it avoids land purchase and has the least impact on neighbouring property.

7.4.3. Principal CSM2 options identified

*Christchurch Southern Motorway Extension Stage 2 Strategic Study*⁶¹

In 2008, the NZTA commissioned the SH73 Christchurch Southern Motorway Extension Stage 2 Strategic Study. This was part of the Southern Corridor Package, one of three corridors in the wider Christchurch area (also including the Northern and Western Corridors).

The Strategic Study recognised earlier work from CRETS and investigations through Stage 1 of the CSM specimen design that *“the upgraded Halswell Junction Road will only provide an interim transport solution and that a second extension of the Southern Motorway westward beyond Halswell Junction Road is required to provide an adequate level of service beyond 2021. In particular the Springs Road/ Halswell Junction Road roundabout could reach capacity before 2016 with Halswell Junction Road reaching capacity by 2018.”*

Four main alignment options were considered in the study extending from SH1 near Waterholes Road to the Halswell Junction Road intersection with Springs Road (tying in to CSM1). There was some flexibility at the tie in point at the western end (i.e. to the south of Templeton and the north of Rolleston). The options investigated were (Figure 36):

- Option 1 (blue route);
- Option 2 (orange route);
- Option 3 (red route); and

⁶¹ Christchurch Southern Motorway Extension Stage 2 Strategic Study, Opus International Consultants Ltd, 2008

- Option 4 (green route).

It is noted that a fifth alignment, Option 3.1, is also shown. This is an earlier development of Option 3, but was modified to reduce the impact on the Aberdeen subdivision.

Figure 36: CSM2 Strategic Study options considered



Option 1 (blue route)

Option 1 would involve the construction of a 6.1 km motorway extension from SH1 immediately south-west of Templeton, crossing immediately north of the Blakes Road/Trents Road intersection. It then continues south-east over the Marshs Road/Shands Road intersection. It then ties into the CSM1 duplication (currently under construction at grade) after a series of left and right hand turns and after crossing the railway line. The alignment would be elevated over the railway line, Springs Road and Halswell Junction Road, and be located in a cutting under Trents Road.

Option 2 (orange route)

Option 2 was most similar to the alignment advocated in CRETS, however between Trents Road and the Shands Road/Marshs Road intersection, the alignment is moved south to minimise its impact on a large parcel of Greenfield business land (labelled CB9). It would involve the construction of a 7.8 km motorway extension that commences from SH1 approximately 1 km south of Waterholes Road. The route would pass slightly to the north of the Waterholes/Hamptons Road intersection, then crossing Trents Road to the south of the Blakes/Trents Road intersection and continuing towards the Shands/Marshs Road intersection from where it follows a very similar alignment to Option 1.

Option 3 (red route)

This option was developed to reduce the impacts of the alignment on the existing Claremont subdivision, as well as the significant block of Greenfield Business land (CB9) east of the Shands Road/Marshs Road intersection. Starting approximately 1 km south of Waterholes Road, Option 3 is similar to Option 2, until it reaches Hamptons Road where it moves further to the east. The alignment then travels under Trents Road, before cutting across Blakes Road and heading for Shands Road. The option then curves across Marshs Road before crossing the railway line via an overpass and remaining elevated over Springs Road and Halswell Junction Road before connecting with CSM1.

The red route relocates the proposed interchange at the Shands/Marshs Road intersection further to the south-east of this intersection to minimise the relocation requirements for power pylons in the vicinity of the alignment. As part of this interchange, Shands Road would go over the motorway, whilst the on and off ramps would be located to avoid the Aberdeen subdivision.

Option 4 (green route)

Option 4 was developed after community consultation, and resulted in an alignment that focused land take on properties that were unavoidably affected by the proposed motorway extension. It was similar to Option 3, commencing at the same point, however diverting to the west just east of Hamptons Road and crossing both Trents Road and Blakes Road further north. It avoids impacts on large tracts of developable land (Greenfield business land) and crosses Shands Road just south of its intersection with Marshs Road, before continuing towards and over the railway line and remaining elevated over Springs Road and Halswell Junction Road prior to connecting with CSM1.

Option screening process

Before being subjected to a full options analysis, the four options were put through a preliminary screening process. This process considered five key parameters; property, existing infrastructure, geotechnical, environmental impact and design standards. The preliminary screening led to Option 1 being eliminated as it had a significant impact on the Claremont residential subdivision and a large parcel of land west of the railway line that could potentially be developed for industrial purposes. The existence of the Claremont residential subdivision would also have knock on effects in terms of design standards, with the horizontal curvature being compromised at the south-west end of the option where it ties into SH1. In addition, there were concerns about the severance effect the motorway would have between Claremont and the Templeton community.

Options analysis

Options 2, 3 and 4 were carried forward to a full option analysis. This analysis was undertaken from a technical (constraints and opportunities) perspective, as well as broadly against the targets and objectives of the LTMA and the NZTS where there would be sufficient difference between the options. The parameters for the full analysis were similar to those used in the preliminary

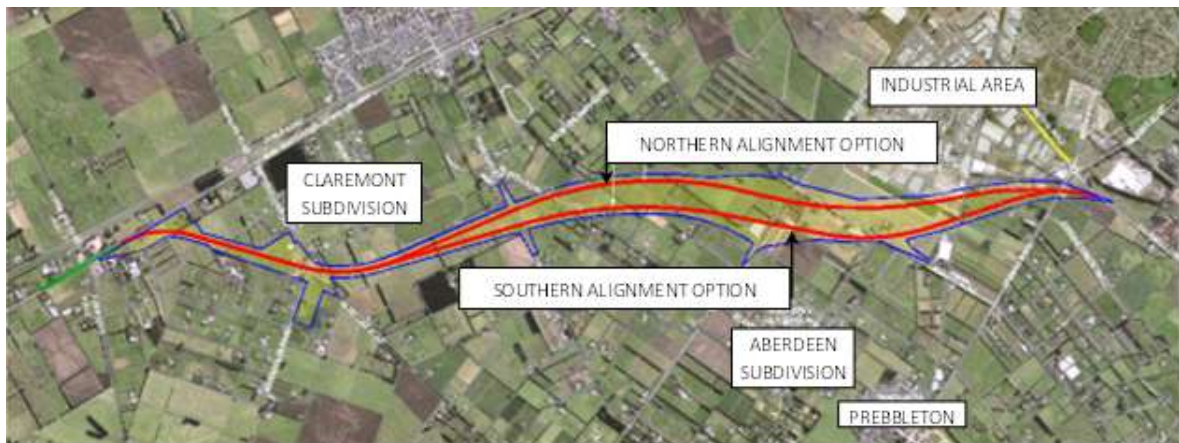
screening exercise however with a further parameter added; community connectivity/access and mobility, including road connectivity, road closures, pedestrian and cycle links and local access.

As a result of the options analysis, Options 3 and 4 were recommended to be taken forward for further investigation in the Scheme Assessment stage. This was on the basis of:

- Option 2 having a greater impact on the Claremont Subdivision, potential industrial land west of the railway line, adjacent properties and their access and greater impact on existing power poles. The route was also less desirable from a design standards perspective in that it had a more winding alignment;
- Options 3 and 4 offered a better route in terms of geometry and minimising the impacts on the Claremont Subdivision, the large parcel of Greenfield business land west of the railway line and the power pylons in the vicinity of the Shands Road/Marshs Road intersection;
- Option 3 maximises the land available for industrial development in the Shands Road/Marshs Road/ Springs Road/Halswell Junction Road block; and
- Option 4 reduces impact on existing businesses and new buildings and increases separation from the Aberdeen subdivision.

Option 3 forms the southern alignment and Option 4 the northern alignment, as indicated below in Figure 37. The NZTA presented these options to the community during the first round of consultation for this stage of the Project in October 2010.

Figure 37: CSM2 study corridor



Feedback from the first round of consultation identified a preference for the northern alignment. Based on this, a 'best fit' option, referred to as Option A, was developed within the study corridor with a design philosophy of locating the alignment as far north as possible in light of the following key constraints:

- Tie in with Main South Road – this was reviewed in some detail and several alternative locations were investigated, including tying in north of the Claremont Subdivision, and further south towards Larcombs Road;

- Claremont Subdivision and Trents Winery – the Claremont Subdivision and heritage building located at Trents Winery are key constraints to the north and south of the motorway alignment respectively;
- Shands Road interchange – locating a full interchange at Shands Road incorporating the intersection of Marshs Road and Shands Road;
- Transpower high voltage (220 kV) transmission lines and towers around the Shands Road/ Marshs Road area;
- Hornby Industrial Railway Line – reconfiguring the industrial rail line north of Marshs Road to allow shunting/access into the existing industrial area;
- Greenfield business land – land owned by Calder Stewart Ltd south of James Wattie Drive is identified in PC1 to the RPS as greenfield business land; and
- Springs Road and Halswell Junction Road underpass - the CSM2 alignment is generally at ground level. Springs Road and Halswell Junction Road need to safely grade over CSM2 and tie into the existing CSM1 Halswell Junction Road/Springs Road roundabout.

7.5. Selection of alignment

7.5.1. Selection of the MSRFL alignment

The MSRFL scoping study developed four-laning options based on widening the existing Main South Road alignment. These options were developed using the same cross section as CSM1. In recognition of the change in road environment, widening options were examined by dividing the Project into two sections north and south of the proposed interchange at Weedons Road.

On the northern section between CSM2 and the Weedons interchange, the existing road reserve is 20m wide, with an additional 10 m wide strip of designated land on the western side. A single preferred option widening to the west was carried forward into the scheme assessment phase, with a proposed 42.5m wide cross-section.

On the southern section between the Weedons interchange and Rolleston, the existing road reserve is wider at 40m to accommodate the passing lanes provided in both directions. An option was therefore identified to keep within the existing 40m wide road reserve and avoid any land purchase requirements. This was recommended as the single preferred option for adoption in the scheme assessment phase.

In response to feedback from the first round of consultation, consideration was also given to an alternative route for MSRFL that utilised widening of the existing rail corridor adjacent to Jones Road. However, this option was discounted due to the following issues:

- significant difficulties designing side road intersections in such close proximity to the railway line, due to the need to either provide at grade crossings or potentially needing to provide additional bridges across the rail line;
- difficulties with integrating the alignment with CSM2 at Robinsons Road but more particularly at Hoskyns Road/Rolleston Drive; and
- safety concerns over the lights from trains at night being on the “wrong” side of opposing traffic creating potential confusion.

On this basis the preferred option of widening to the west and the partial cloverleaf interchange at Weedons Road was carried forward and recommended in the draft Scheme Assessment Report.

The design process following submission of the draft Scheme Assessment Report was then focused on responding to safety concerns raised by a safety audit. The most significant design changes resulting from the safety audit include:

- development of rear access roads on western and eastern sides of Main South Road;
- removal of all direct property access onto Main South Road between Robinsons Road and Weedons Road;
- improving the geometry of the Weedons Road interchange and Jones Road roundabout ; and
- Provision of a roundabout at the Main South Road / Dawsons / Waterholes intersection to facilitate “U” turns for traffic from the south.

7.5.2. CSM2 alignment

Scheme Assessment

The scheme assessment phase for the Project commenced in 2010. The scope included both MSRFL and CSM2.

The CSM2 alignment investigations were broadly defined by the corridor recommended in the 2009 Strategic Study, with Option 3 forming the southern extent and Option 4 the northern boundary. The selected preferred alignment is based on a “best fit” option, which was developed with the philosophy of pushing the alignment as far north as possible.

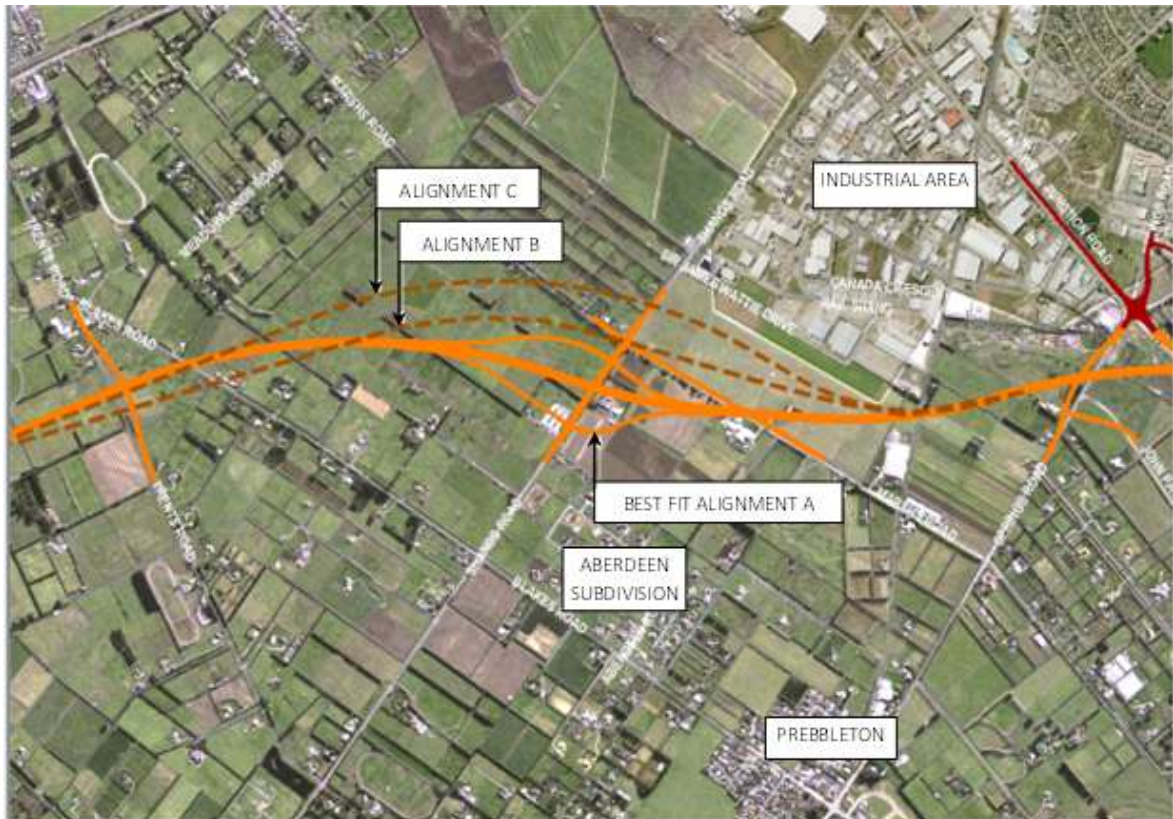
The ‘best fit’ alignment is presented in Figure 38.

Figure 38: CSM2 ‘best fit’ alignment (Option A)



The first round of consultation also identified support for an alternative alignment further north of Marshs Road to increase the separation from the Aberdeen residential subdivision. As a result, two additional alignments, referred to as Option B and C, were developed that passed across Shands Road further to the north. These are presented below in Figure 39.

Figure 39: CSM2 alternative northerly alignments (Option B and C)



Option B was then discounted from further consideration due to the following disadvantages:

- a significant embankment (approximately 8 m in height) would be required for CSM2 to pass over the Shands/Marshs intersection, resulting in a large footprint and potential visual effects;
- a complex bridge structure would be required to span over a large traffic signal controlled intersection;
- the option would have a direct impact on the Transpower high voltage (220kV) transmission lines and towers. Several meetings were held with Transpower to discuss this option. Transpower was very concerned with the likely relocation of a key anchor pylon that acts as a change in direction for the 220kV overhead cables. Transpower considered there would be a high risk of power outages associated with the relocation of the anchor pylon and strongly advised against this option; and
- significant severance of greenfield business land labelled 'CB9' north of Marshs Road identified on Map 1 of Proposed Change 1 to the RPS as future industrial land (this is also known as the Plan Change 54 land).

As a result of the design issues identified with Option B, a more northerly Option C was developed. The advantages of this option relative to Option B were:

- the alignment avoids the 220 kV transmission lines;
- the alignment would require a simpler bridge structure at the Shands Road interchange; and

- it allows the motorway to remain at-grade with Shands Road passing over the top.

Along with the best fit Option A, the alternative northerly Option C was carried forward into an option assessment.

Options assessment

An options assessment workshop was held by the NZTA with its consultants in May 2011. The purpose of this assessment was to complete a comparative evaluation of the two alignment options and identify a preferred alignment to take forward into the detailed scheme assessment and present at the second round of consultation.

The workshop was attended by staff from the NZTA, the NZTA's lawyers (Chapman Tripp) and selected consultants engaged by the NZTA representing relevant engineering and environmental disciplines.

The two alignment options A and C were assessed against the following evaluation criteria:

- cost;
- engineering;
- accessibility;
- physical environmental impacts;
- social environmental impacts; and
- strategic alignment.

The options assessment highlighted that the most significant differences between the two alignments was with respect to property cost and the strategic alignment with regional policy.

The more northerly Option C route bisected a large block of Greenfield business land identified in PC1 of the RPS (the PC54 land). It was assessed that a total purchase of the business land would be required for this option.

While property costs for the 'best fit' alignment are not insignificant, the Option A alignment would only require partial purchase of the business land. The overall difference compared to Option C was therefore very significant, estimated in the order of \$14 million to \$34 million lower.

Therefore on the basis of cost and being consistent with the strategic land use policy outlined in the RPS, the 'best fit' Option A was selected as the preferred alignment. From an environmental point of view, it was noted that the more northerly Option C was preferable in regards to visual, community and residential amenity parameters, but it was assessed that any adverse impacts associated with Option A could be adequately mitigated.

Draft Scheme Assessment Report

A draft scheme assessment report (SAR) was issued for MSRFL and CSM2 in October 2011. During the preparation of this report, the traffic modelling highlighted future capacity issues on Main

South Road south of Templeton. This will be exacerbated by the introduction of CSM2, in particular delays and queuing associated with the compression of the three lanes of traffic travelling southbound on CSM2 and Main South Road into a single lane. For these reasons, it was recommended that the four-laning of Main South Road should be progressed simultaneously with CSM2, and be opened before or at the same time. As a result of the SAR findings, the Project therefore now combines both MSRFL and CSM2.

7.5.3. Vertical alignment

The CSM2 Strategic Study originally proposed a vertical alignment based on raising the motorway at the eastern end to future proof passing over the Hornby Industrial Rail Line. The majority of the remaining length of motorway was proposed in cut to provide a balance of cut and fill material.

Elevating the motorway was not considered to be practical given the increased environmental effects on the surrounding area, including noise, landscape and visual impacts. A raised motorway would also lead to a significant increase in construction costs associated with structures and substantial embankments.

Following groundwater analysis and considerations regarding discharge into Montgomery's Drain and Upper Knights Stream, the option of placing the whole Project into a trench had a series of problems, potential conflicts and a lack of ability to discharge Project runoff to groundwater. The existing record of groundwater highs had predicted a groundwater table at around 4m below existing surface level at Halswell Junction Road. Further to this, the impacts of the Central Plains Water Enhancement Scheme (CPWES) are projected to raise the groundwater in the area. KiwiRail has also agreed to allow the motorway to pass across the rail corridor at-grade. This is on the basis that the rail line is reconfigured to allow a shunting line so that trains can remain on the western side of CSM2 to access into the existing industrial area.

Overall the proposed alignment is typically at or near grade to allow the disposal of stormwater above design groundwater levels, minimise the depth of stormwater crossings and stockwater race siphons, and minimise the risk of road closure due to flooding. The elevation of the design groundwater level limits the depth to which the vertical alignment can be placed into a trench. Allowing for cross fall across the CSM2, a verge, swale and soak pit, the design disposal layer is typically 1-2 m above the design groundwater level.

In order to maintain connectivity to existing infrastructure, stockwater races, side roads and other local access, maintaining the existing vertical profile (at-grade) on the MSRFL section of carriageway was selected early on.

7.6. Interchanges

The Project includes interchanges at the following locations:

- Weedons Road/ Weedons Ross Road;
- CSM2/Main South Road connection;

- Shands Road; and
- Halswell Junction Road.

Details of the options considered at each of these locations are provided below.

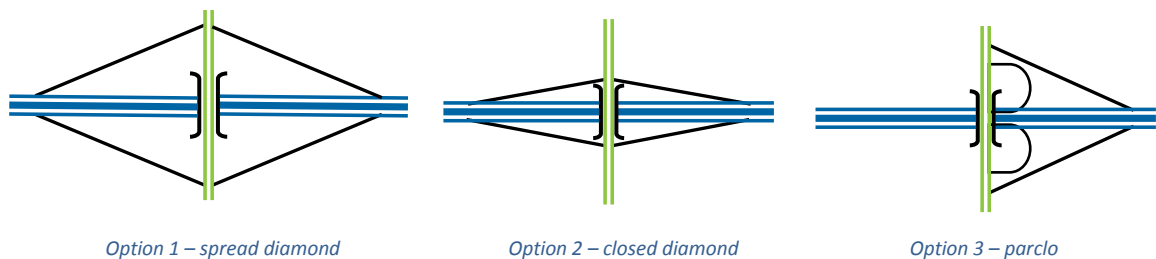
7.6.1. Weedons Road interchange

In CRETS, the construction of a full interchange at Weedons was recommended as a key component of the MSRFL Project. This was on the basis of the interchange functioning as the main access point into Rolleston (via Levi Road) and the Izone (via Jones Road) with the existing Weedons and Weedons Ross Road route becoming a district arterial between West Melton and Lincoln. This approach is supported by both the NZTA and the SDC.

At scoping stage, three interchange configurations were identified. All options maintained the highway alignment at-grade with Weedons Ross / Weedons Road crossing overhead via an elevated bridge structure. The options are listed below with schematics presented in:

- spread diamond layout with conventional on and off ramps;
- closed diamond layout with more closely spaced ramp terminal intersections requiring the ramps to be raised on embankments; and
- partial cloverleaf (parclo), with loop off-ramps and conventional diagonal on-ramps confined to the southern side of the interchange only.

Figure 40: Weedons interchange diagrams



The scoping evaluation process considered each option against five main criteria, including project costs, engineering considerations, transport network impacts, physical environmental impacts and social environmental impacts. The evaluation showed no major differentiators in the first three criteria, but the parclo option was preferred on the basis of having the least impact on property relative to both diamond options and having a less prominent elevated structure than the closed diamond.

As a result of considering the above, only the single option for a parclo interchange has been carried forward. In terms of the parclo ramp terminal intersections, the preliminary traffic modelling identified that an acceptable operational performance could be achieved using two lane roundabouts. There are three roundabouts proposed along Weedons Road to assist with entry/exit from the motorway and improve local road connectivity. Roundabouts are supported by SDC and are the preferred form of control from a safety perspective. For these reasons that design has been confirmed.

7.6.2. Main South Road / CSM2 connection

The Main South Road and CSM2 connection is located on the northern side of the intersection of Robinsons and Curraghs Road. The design philosophy is for the CSM to remain at-grade and function as the primary route in the form of a Y-layout.

Just south of the interchange, the two northbound lanes on Main South Road will deviate on a large radius right hand curve to form the start of CSM2. A third outside northbound lane (northbound off-ramp) will continue straight to merge back into the existing Main South Road south of the intersection with Dawsons and Waterholes Road. In the southbound direction, Main South Road is proposed to diverge on a left hand curve to pass over the top of the CSM2 alignment, before merging back into the Main South Road alignment south (southbound on-ramp) of the Robinsons/ Curraghs Road intersection.

An option for an exit lane has also 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.

During the scheme development stage, a U-turn facility between the northbound off-ramp and southbound on-ramp was also considered as part of the Y-interchange option. However, this was later discounted after it was raised as a concern in the road safety audit. An alternative option for the U-turn movement is now proposed by installing a roundabout further north at the SH1 intersection with Dawsons and Waterholes Road.

Only one option for the interchange layout described above (the parclo interchange) was carried forward.

7.6.3. Shands Road interchange

A full grade separated interchange is proposed at Shands Road to provide access from Rolleston, Prebbleton and southern portions of the Hornby industrial area. High traffic volumes and safety considerations have ruled out any at-grade intersection option at this location.

The CRETS Study and CSM2 Strategic Study recommended a diamond layout as being the only interchange form that was practical at this location. This had been primarily focused on the motorway alignment passing south of Marshs Road. For the purpose of sensitivity testing, the traffic model was also run for interchange locations passing over and north of Marshs Road. This testing demonstrated that at a strategic level, the location of the Shands Road interchange relative to Marshs Road would have no significant impact on traffic patterns in the immediate vicinity.

Given the close spacing of the Shands Road / Marshs Road intersection to the northbound ramps, traffic signals were considered to be the only practical solution for the ramp terminal intersections. Traffic signals provide a greater ability to control, synchronise and co-ordinate movements, and detailed micro-simulation modelling has demonstrated that an acceptable

operating performance can be achieved. The signals also offer a better form of control for pedestrians and cyclists using the Shands and Marshs Road section of the Little River Rail Trail.

A further sub-option for a tighter closed diamond layout was also considered to provide increased spacing from Marshs Road, as well as moving the southern ramp terminal intersection further away from the Aberdeen subdivision. However, this would require the ramps to be raised on substantial embankments including the construction of elevated ramp terminal intersections and therefore, the option was discounted from further investigations. On this basis, only one option involving a spread diamond with traffic signal control was progressed.

7.6.4. Halswell Junction Road interchange

The CRETS study did not favour a direct motorway connection around Springs and Halswell Junction Road. This was on the basis that the CSM2/ Shands Road interchange should be the primary connection in this vicinity to access the motorway from the Hornby industrial estate and local road network. The strategic upgrade of Shands Road to become a district arterial and function as an alternative route to SH1 between Rolleston and Christchurch was an additional factor in favour of an interchange at Shands Road.

Full connectivity at Halswell Junction Road could also have the effect of promoting more traffic to use Springs Road with potential level of service problems and associated amenity issues from increased traffic volumes through Prebbleton Township.

The motorway options presented in the first consultation newsletter in October 2010 did not include an interchange at Halswell Junction Road. This generated a lot of feedback, including CCC requesting consideration of local road connectivity at this location. The CSM2 Strategic Study also identified that east facing freight ramps should be considered at Springs Road to enable Heavy Commercial Vehicles (HCVs) generated by adjacent industrial areas to quickly and efficiently access CSM, Lyttelton Port and Christchurch City.

Based on the above, the following three interchange options were identified at Halswell Junction Road:

- Option 1 – eastward facing ramps for all traffic;
- Option 2 – no connections - all movements on and off the motorway would be via the Shands Road interchange or would utilise the local network; and
- Option 3 – eastward facing ramps for commercial vehicles only. This was as per Option 1, but the ramps would be restricted to freight and passenger transport.

These three options were taken forward for further evaluation in the scheme assessment stage.

7.7. John Paterson Drive

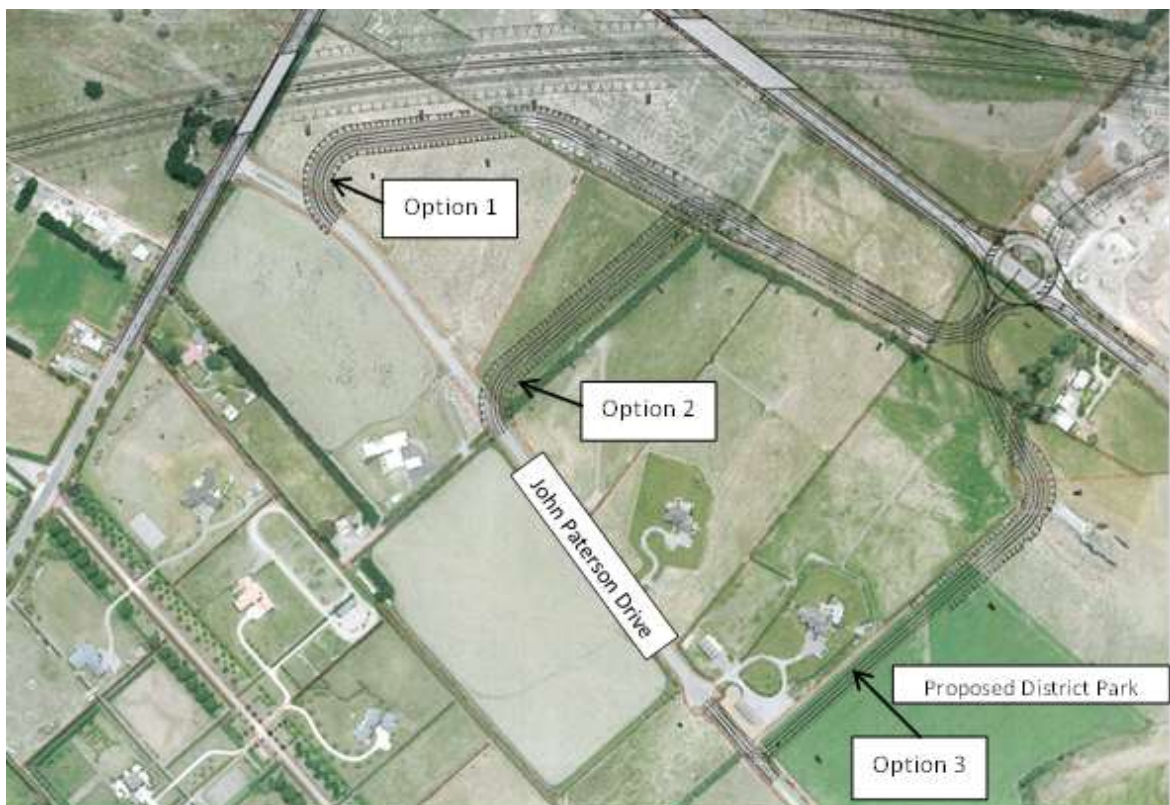
John Paterson Drive currently forms a priority T intersection with Springs Road approximately 300 m south of Halswell Junction Road. This is at the location of the proposed CSM2/ Springs Road underpass where Springs Road will grade over the new motorway.

The initial option considered was for a minor realignment of John Paterson Drive to connect into the southern side of the Springs Road embankment. Due to the close proximity to the embankment structure, an alternative concept was also identified for a more major realignment of John Paterson Drive to connect into the motorway off-ramp roundabout on Halswell Junction Road.

The road safety audit raised the initial design option as a concern and it was subsequently eliminated. Further discussion of the alternative concept for a Halswell Junction Road off-ramp connection was undertaken with stakeholders, with the following three options identified for consideration, as presented in Figure 41.

- Option 1 - utilising the existing John Paterson Drive and realigning the western end;
- Option 2 - realigning the existing John Paterson Drive to pass west of the shelterbelt located midway along the existing road; and
- Option 3 - extending John Paterson Drive further east before running north along the future District Park boundary identified in the adjacent Fulton Hogan plan change. The road would then veer back west to tie into the off-ramp roundabout.

Figure 41: John Paterson Drive options



Further consideration has led to a strong preference for the third option due to the following advantages:

- it will provide good access to a proposed District park and for residents of John Paterson Drive;

- the alignment allows for future connectivity to the Fulton Hogan subdivision immediately to the east;
- it has the shortest length of the three options considered; and
- it requires minimal land take from just one John Paterson Drive land owner.

On this basis, the third option has been adopted.

7.8. CSM2 local road crossings

The proposed CSM2 alignment crosses the local roads listed below. An outline of the options considered at each crossing is provided in the sections that follow:

- Robinsons/ Curraghs Road;
- Waterholes Road;
- Trents Road;
- Blakes Road;
- Marshs Road;
- Springs Road; and
- Halswell Junction Road.

With the exception of Robinsons/ Curraghs Road and Blakes Road, it is proposed to construct underpasses at each location to carry the local road over the new motorway.

7.8.1. Robinsons / Curraghs Road

Robinsons Road and Curraghs Road form a priority crossroads intersection with SH1 on the southern side of the proposed connection between CSM2 and Main South Road. Both are local roads running between Ellesmere Road and SH73.

Given the close proximity to the CSM2 and Main South Road interface, the initial option was to partially close the intersection with consideration to restricting movements to left-hand turns in and out. However, there were safety implications identified with this option related to the design of adequate merge and diverge areas so close to the interchange.

The first round of consultation raised local road connectivity concerns as a key issue amongst the directly affected land owners and community. A further option was therefore considered for Robinsons and Curraghs Road to pass underneath the highway, thereby maintaining a local road connection at this location. This received positive feedback during the second round of consultation and was therefore adopted.

An underpass (local road over the motorway) was considered for this connection. However this was not possible as the proximity of the railway line to the immediate north of the MSRFL alignment and the required mainline vertical clearance meant that the grade required for the western bridge approach would have been too steep.

7.8.2. Waterholes Road

Waterholes Road is a local road in the Selwyn network providing a link from Springston to Main South Road south of Templeton. The CSM2 alignment crosses Waterholes Road near its intersection with Hamptons Road. It is proposed to modify Waterholes Road with a reverse curve alignment to allow the bridge structure to be built offline⁶², whilst also minimising impact on adjacent private property and accesses. A minor realignment of the existing Waterholes Road/Hamptons Road intersection is also required to increase the separation from the new bridge structure.

7.8.3. Blakes Road and Trents Road

Trents Road is classified as a collector road in the Selwyn network and provides an important community link between Prebbleton and Templeton. The initial scheme design was for an offline bridge solution to minimise impact on adjacent properties. However, this design was later discounted following the road safety audit when concerns were raised about the introduction of reverse curves on the Trents Road approaches. Therefore, the confirmed option was for a direct route over the motorway.

CSM2 crosses Blakes Road just south of its intersection with Trents Road. Blakes Road is proposed to be closed either side of the motorway to become two cul-de-sac roads. No other alternatives have been considered given the low traffic demand and the nearby availability of Trents Road as an alternative route for Blakes Road. The skewed alignment across Blakes Road would also mean a significant cost to keep the road open. Closing Blakes Road has received support from the local community and is endorsed by SDC.

7.8.4. Halswell Junction Road, Springs Road and Marshs Road

Marshs Road, Springs Road and Halswell Junction Road will all have an important function in the modified road network, and it was considered important to maintain connectivity across the proposed motorway for all three roads.

Marshs Road passes over the CSM2 alignment just to the east of the Shands Road interchange. An online structure⁶³ can be accommodated without significant property impacts, so an offline solution was not considered at this location.

Springs Road will cross over the new motorway approximately 300 m west of Halswell Junction Road. An offline design was initially considered for the new structure to improve constructability and provide increased distance grading down the approach to the Halswell Junction Road intersection. However, this option was later eliminated following significant concerns raised in the road safety audit for a reverse curve alignment at this location. The option for a straight alignment has therefore been adopted in the Project.

⁶² An offline structure means that the structure is located off the existing road alignment, meaning that the entire construction of the structure can take place while keeping the existing road open.

⁶³ An online structure means that the structure is located on the existing road alignment.

Halswell Junction Road crosses CSM2 to the east of the existing Springs Road roundabout, approximately half way between this intersection and the proposed off ramp roundabout. Given the relatively close spacing of these intersections, in order to retain the straight horizontal alignment as it passes over the motorway, the online structure was taken forward.

Alternative bridge solutions around Springs Road / Halswell Junction Road

Further options around the Springs Road / Halswell Junction Road area were considered during the earlier stages of scheme development. These were based around the philosophy of removing the requirement for a bridge structure on Halswell Junction Road and re-routing this traffic between Springs Road and the CSM2 off-ramp. The existing roundabout at the Springs Road / Halswell Junction Road intersection would remain, but the south-eastern leg would be replaced by an on-ramp to CSM1. Alternatives included maintaining the motorway at grade or elevating it over Springs Road, as can be seen in the sketches presented in Figure 42 and Figure 43 below.

Figure 42: Sketch of alternative layout at Springs Road/ Halswell - main alignment at-grade

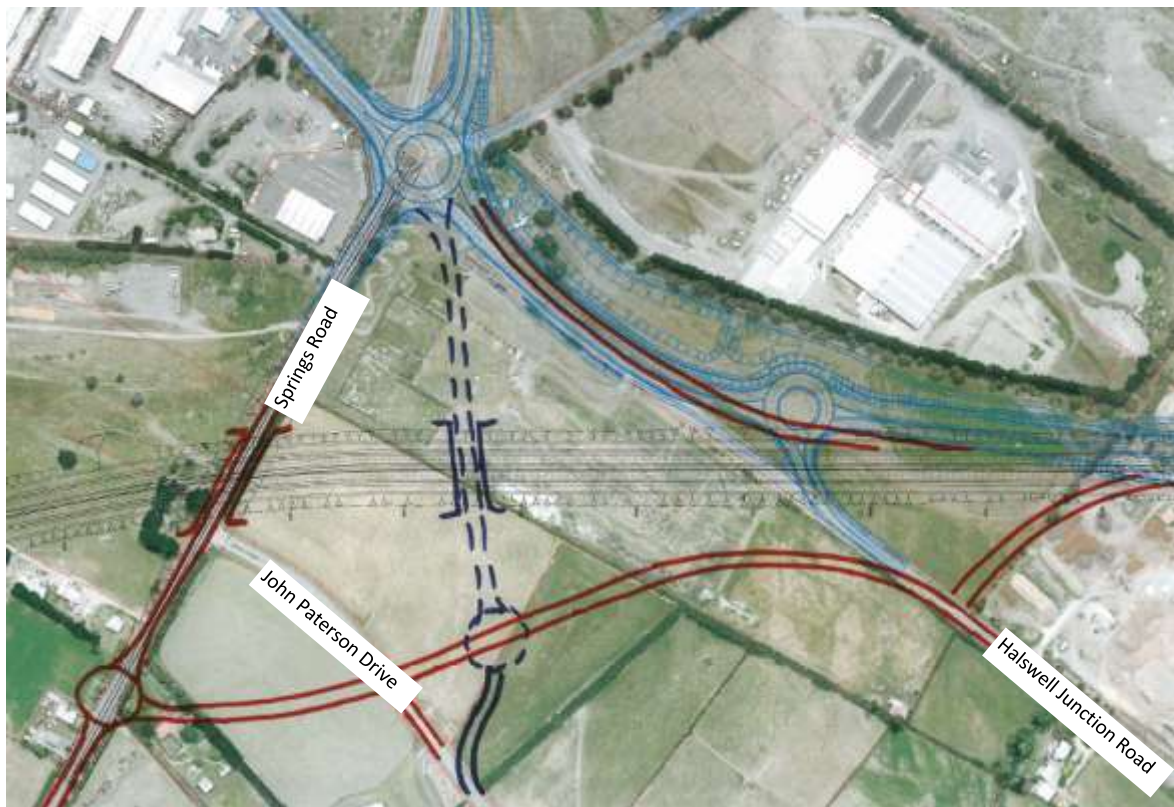
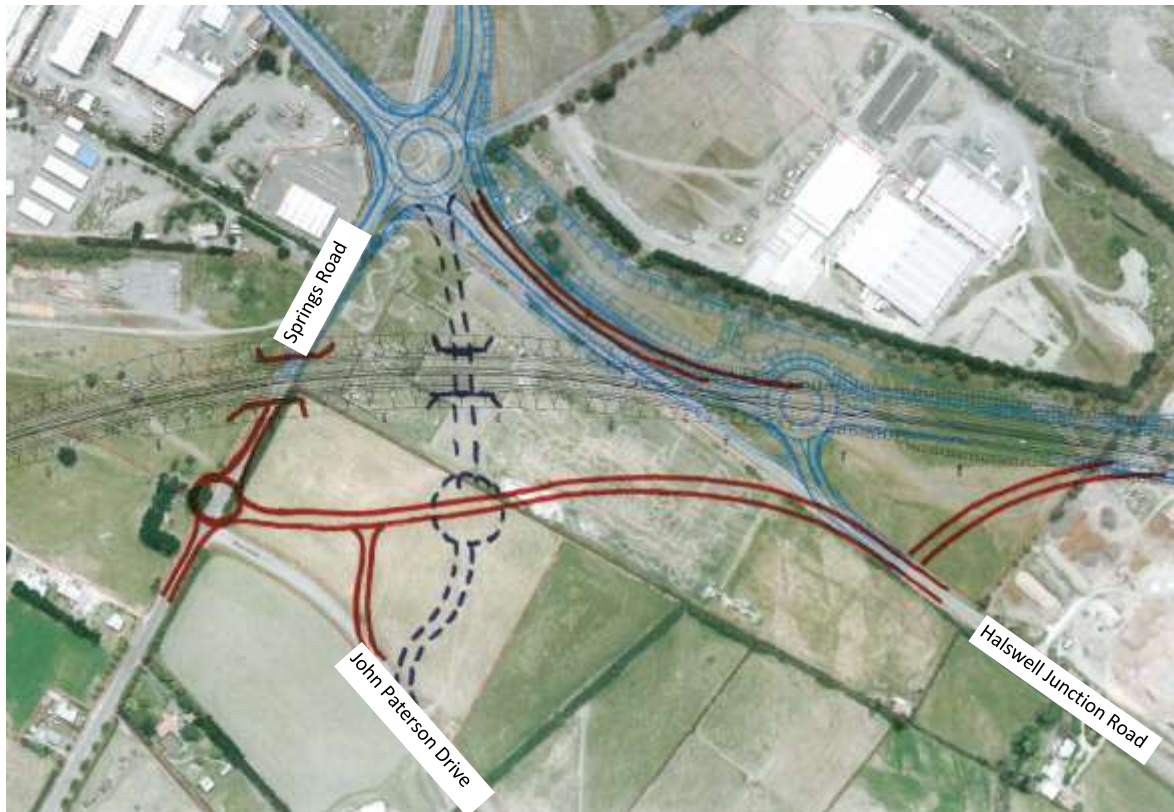


Figure 43: Sketch of alternative layout at Springs Road/ Halswell - main alignment elevated



This arrangement would introduce an obvious disadvantage for commercial vehicles travelling to the Hornby industrial area. Instead of travelling directly up Halswell Junction Road, they would be required to use a more circuitous route. Compared to the preferred option, most traffic movements would also have to negotiate an additional roundabout.

An assessment of the likely intersection performance for the alternative layout indicated that the roundabouts would operate satisfactorily with the motorway ramps restricted to freight only movements. However, the ramps opened to all traffic would result in a serious deterioration in performance at the “new” Springs Road / Halswell Junction Road intersection. Significant delays were predicted on the Springs Road southern approach during the morning peak period giving an overall level of service (LoS) of F⁶⁴.

At the “existing” Springs Road / Halswell Junction Road roundabout, more long delays were predicted for the traffic approaching on the western leg of Halswell Junction Road during both the morning and evening peak periods. The overall intersection level of service was LoS E and D respectively, but the Halswell Junction Road approach was operating at LoS F in both periods.

⁶⁴ For road sections, the calculation of the level of service is dependent on the type of road being assessed, with different criteria applied to multi-lane motorways and expressways, rural highways and urban roads. Level of service is a measure describing the operational conditions within a traffic stream, based on service measures such as speed, freedom to manoeuvre, traffic interruptions, and comfort and convenience. Six LoS are defined, using the letters from A to F, with LoS A representing the best operating conditions and LoS F the worst.

7.9. Main South Road intersections

There are three existing intersections on Main South Road within the extent of the Project:

- Larcombs Road;
- Berketts Road; and
- Dawsons Road/ Waterholes Road.

Details of the options considered at each of these crossings are provided below.

7.9.1. Larcombs and Berketts Road

Larcombs Road and Berketts Road are both priority T intersections located on the eastern side of the alignment. The scoping investigations were based on retaining the intersections, but restricting the access to left hand in and out movements as a result of the central median barrier on Main South Road.

This concept was carried through to the scheme design for Berketts Road, with the proposed layout including the provision of a segregated left turn deceleration lane to enable left turning traffic to move clear of high speed southbound traffic on Main South Road. An associated flush painted island is also proposed to improve lane discipline on the highway approach.

For Larcombs Road, access has been further restricted to left turns in only. Initially left turn out movements were allowed for, but the proximity of the Weedons interchange does not provide sufficient separation for a left turn acceleration lane with respect to the off-ramp for southbound traffic. Consideration was given to realigning the Larcombs Road approach to increase the separation to the exit ramp, however the desired separation could still not be achieved within the land available. Moving Larcombs Road further north would also begin to impact on Berketts Road.

Later during the scheme development stage, the road safety audit raised the idea of fully closing both intersections to fulfil the function of Main South Road as a strategic road with no access except for grade separation. This was met with considerable opposition from local landowners, businesses and also SDC. Therefore, the scheme has maintained a degree of access to/from these side roads.

7.9.2. Dawsons Road / Waterholes Road

Discussions with directly affected landowners around the CSM2 connection with Main South Road identified demand for a U-turn movement close to the interchange. The original proposed layout for the CSM2 / Main South Road connection therefore included a U-turn facility between the northbound off-ramp and southbound on-ramp.

This facility was raised as a concern in the road safety audits, which suggested considering an alternative option for providing the U-turn movement further north by installing a roundabout at the Main South Road intersection with Dawsons and Waterholes Road. The intersection is

currently a priority controlled cross roads layout and a roundabout would also offer additional advantages by allowing safer side road access.

The inclusion of the roundabout at this location will also function as a threshold for northbound traffic approaching Templeton. In the southbound direction, it will signify the transition from the built-up Templeton area into the higher speed rural environment.

The single proposed option is for a large diameter, dual laned roundabout suitable for a high speed environment. A single lane roundabout was also considered, but was discounted in preference of providing a more sustainable, long term solution.

7.10. Weedons intersections

7.10.1. Weedons Ross Road / Jones Road

The construction of the Weedons interchange promotes Jones Road as the main access route into the Rolleston industrial area. The consequent increase in traffic demand (assuming the eventual removal of traffic signals at Rolleston), in particular heavy vehicles generated by the Izone, necessitates an upgrade of the intersection.

Three options were identified during the scoping stage including:

- maintaining existing priority control;
- changing the priority to Jones Road; and
- a roundabout.

Traffic modelling analysis demonstrated that maintaining the existing layout was only sustainable in the short term, with capacity problems and large queues forming on Jones Road by 2026. A change in priority from Weedons Ross Road to Jones Road would increase the design life of the intersection, but capacity issues would emerge by 2041.

On this basis, the single option of a roundabout was adopted for the scheme design. Traffic modelling has confirmed the requirement for a large diameter, dual lane layout. A free left turn lane for the dominant traffic movement heading south on Jones Road to the Izone was initially considered, however this was later discounted due to concerns raised in the road safety audit.

7.10.2. Weedons Road / Levi Road

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.

During the scoping stage investigations, traffic modelling was undertaken to test the future performance of the intersection for the following three options:

- maintaining existing priority control;
 - adding turning lanes; and
-

- changing the priority to Levi Road.

Similar to the Weedons Ross Road / Jones Road intersection (and assuming the eventual removal of traffic signals in Rolleston), the existing layout was only shown to be sustainable in the short term, with large queues forming on Levi Road by 2026. The addition of slip lanes on the Levi Road approach improves the design life of the intersection, but delays would start to increase by 2041.

Modelling of the alternative option to change the priority from Weedons Road to Levi Road highlighted a significantly improved intersection performance. The change of control also supports the promotion of Levi Road as the primary access into the Rolleston residential area. This option was therefore adopted.

7.11. Main South Road rear access roads

There are numerous property accesses located along the State highway frontage varying from residential accesses to commercial business accesses. The vast majority of these are located on the 3.2 km section of Main South Road between the intersections of Weedons / Weedons Ross Road and Robinsons / Curraghs Road.

With the introduction of a central median to divide opposing lanes, all property accesses along the four-laning corridor would be restricted to left-hand turns in and out. The dividing median is proposed to reduce the crash rate and crash severity from right turning movements and head on collisions, which are typically higher on four lane highways.

One of the key issues raised during consultation was the effects of a left in / left out arrangement on property users. Right turning vehicles will essentially have to travel to the nearest interchange and make a legal U-turn manoeuvre. The scoping stage investigations raised potential measures to mitigate the effects of this including:

- U-turn slots;
- new centrally located link road between SH1 and Jones Road; and
- rear access roads.

There are significant safety concerns with U-turn arrangements in high speed environments. Any new centrally located link road would also require a new level crossing over the railway line and would also introduce a new intersection to the highway. On this basis, these two options were discounted and the scheme investigations focused on the provision of rear access roads.

In addition, various options were identified for rear access roads on both the western and eastern side of the Main South Road alignment before the final solutions were selected.

7.12. Hornby rail siding

The Hornby Industrial Line runs from the Main Trunk Line at Carmen Road heading in a southerly direction across Halswell Junction Road to just north of Marshs Road. The proposed CSM2 alignment passes across the southern end of this rail corridor, which is currently used for shunting

trains into the Watties factory. To enable CSM2 to remain at-grade whilst continuing to cater for the shunting of carriages into Watties allowing the trains to remain on the west side of CSM2, it is proposed to turn out the rail tracks.

Two options were considered including a western turnout and an eastern turnout, which were presented to KiwiRail in February 2011. KiwiRail confirmed that both options appeared feasible and that the turnout to the west would cost less but the eastern turnout may provide more development opportunities. On this basis, the eastern turnout has been taken forward.

KiwiRail has advised it has no intention of extending the railway line further south for future commuter rail purposes or similar. However, KiwiRail initially stated that the rail corridor would not be sold, and that it would expect a Deed of Grant would be required for 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 as per the NZTA's obligations under the Deed of Grant Agreement. Subsequent discussions with KiwiRail have indicated that the NZTA purchase of the affected section of railway corridor is an alternative option that could be explored.

7.13. Walking and cycling facilities

A preliminary concept for a shared use walking and cycling facility has been identified for the Project. This has been developed through a series of workshops with SDC and CCC and has primarily focused on providing a link between the CSM1 shared use path currently under construction and the Little River Rail Trail.

In collaboration with the key stakeholders, the proposed option involves an extension from the CSM1 route terminus at the Owaka subway, continuing west along the CSM2 alignment and within the new motorway designation to the south. The path would then pass under bridges at Halswell Junction Road and Springs Road before continuing along the disused section of rail corridor to Marshs Road, whereupon it connects with the existing Little River Rail Trail. The proposed cycle route alignments were presented previously in Figure 24.

A second link is also provided on the southern side of Halswell Junction Road to the new CSM2 west bound off-ramp roundabout to create a link with the shared use cycle way where it passed along the CSM2 alignment. In addition, a third link is shown, from the Owaka subway to Halswell Junction Road. This link is being built as part of CSM1, and will remain in place after CSM2 is completed. Access for cyclists across the new roundabout on Halswell Junction Road will be provided based on current standards.

The existing Marshs Road section of the Little River Rail Trail will be retained 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 to Hornby via Shands Road.

The option of walking and cycling facilities along Springs Road and Halswell Junction Road (in the vicinity of the bridges) has been discounted, due to safety concerns.

7.13.1. Provision for pedestrians and cyclists at bridge structures

The new motorway scheme includes the construction of eight bridges to maintain local road connections across the motorway alignment. Various combinations were considered, but key stakeholders (CCC and SDC) agreed to a practical approach in providing for pedestrians and cyclists at the bridge structures, described as follows:

- Halswell Junction Road underpass – provide on-road shoulders for confident cyclists, 2m wide separated footpath will be provided either side of the road carriageway;
- Springs Road underpass – provide on-road shoulders for confident cyclists, 2m wide separated footpath will be provided either side of the road carriageway;
- Marshs Road underpass – provide a shared use path on the southern approach. The width of the route is to be ascertained during the detailed design phase, with provision for a barrier separating cyclists from traffic to be included. No footpath is required on the northern side of the bridge;
- Shands Road underpass – provide on-road shoulders for confident cyclists, 2m wide separated footpath will be provided either side of the road carriageway;
- Trents Road underpass – provide (subject to agreement with SDC) a shared use path on the north-eastern side of the bridge. The width of the route is to be ascertained during the detailed design phase, with provision for a barrier separating cyclists from traffic to be included. No footpath is required on the south-western side of the bridge;
- Hamptons Road / Waterholes Road underpass – provide on-road shoulders for confident cyclists, 2m wide separated footpaths will be provided either side of the road carriageway;
- Main South Road underpass – provide on-road shoulders for confident cyclists; and
- Robinson Road overpass – provide on-road shoulders for confident cyclists, 2m wide separated footpaths will be provided either side of the road carriageway.

The actual arrangements are flexible and can be finalised during detailed design within the design envelope of the bridges.

7.13.2. Main South Road

Several options were considered to provide safe, comfortable, direct and attractive facilities for pedestrians and cyclists travelling along or across the Main South Road corridor. The options identified were:

- using the shoulder along the State highway;
- using the rear access road on the western side of Main South Road; and
- using Jones Road.

The first option is to provide access along the Main South Road corridor for cyclists. The number of accessways along the corridor will be greatly reduced as a result of the proposed MSRFL scheme, with only Larcombs Road and Berketts Road intersecting this section of the route. A 2.5 m wide sealed shoulder is provided along the extent of Main South Road and this would provide a coherent and direct route for cycle trips. However, this option is not recommended from a safety perspective.

The second option is to provide a cycle route along the western rear access road. The lower speed environment and reduced traffic flow could make this attractive for less confident cyclists. However, by itself, it does not provide a coherent, safe or direct route option and still requires the use of either Main South Road or Jones Road north of Curraghs Road and south of Weedons Ross Road.

The third option is for the development of a cycle route utilising Jones Road, which is identified in the SDC Walking and Cycling Strategy. This could be in the form of widened seal on the carriageway. This a less desirable option due to the higher speed environment and higher volume of through traffic relative to the rear access route. This route would be considered more comfortable and attractive to some cyclists due to the reduced traffic flows (relative to Main South Road), but would not be as direct or coherent as Main South Road.

Pedestrian provision will be more limited along Main South Road. However, the primary pedestrian access should be catered for by using the Robinsons /Curraghs Road underpass and Weedons Road / Weedons Ross Road overbridge. There will also be the option for pedestrians to cross Main South Road at each of the key intersections north of CSM2 including Waterholes Road, Trents Road and Barbers Road.

Ultimately the provision of a walking and cycling facility within the Main South Road corridor is a decision for SDC which needs to reflect the objectives and targets outlined in its Walking and Cycling Strategy. These facilities have not specifically been included as part of this Project, as cycling connectivity in Selwyn is accepted by SDC as being a council commitment, separate to this Project.

7.14. Stormwater

This section provides a summary of the various options for stormwater management. A detailed discussion is presented in Technical Report 3, Volume 3.

7.14.1. Discharge of surface water runoff

Options considered for conveyance and discharge of runoff included:

- kerb and channelling with sumps and piped conveyance system; and
- grassed swales and steep sided open channels.

Given the rural environment, the availability of land and water quality objectives, swales were selected as the preferred option. Swales are a low cost and effective treatment solution. They

also provide storage of stormwater prior to discharge to land. Steep sided open channels were disregarded due to road safety considerations.

Kerb and channelling has been proposed on ramps, structures and on the Project infrastructure around Halswell Junction Road due to the limited depth between the edge of seal and historical groundwater highs. Typically structures will drain to swales to provide treatment prior to disposal.

Disposal to land was considered the only viable option for disposing of stormwater for the Project. Options, such as constructing a piped discharge network to discharge to the Selwyn River and/or Halswell River and/or pumping, were discounted due to the significant costs of such a system. Pumping options were only considered in very rare instances where other solutions were not possible, such as adjacent to Robinsons Road. Conveying runoff to ponds and dedicated larger disposal fields was considered but rejected due to having to designate and purchase larger blocks of land to accommodate these features. The preferred option for regular soakage devices was selected due to increased redundancy and reduced land take.

7.14.2. Stormwater treatment

The treatment of stormwater is required by the NRRP in areas mapped as less than 6 m depth to groundwater. Collection and treatment in swales was considered an acceptable methodology and is typically used throughout the region. The methods set out in the NRRP are prescriptive to achieve a permitted activity status. Virtually the entire Project complies with the NRRP permitted activity rules regarding stormwater treatment and disposal.

Proprietary stormwater treatment devices have not been considered due to high cost and high maintenance requirements.

7.14.3. Treatment of stockwater races

Nine existing stockwater races cross the proposed alignment and will be piped as part of the Project. The vertical grade of the Project was determined early in the design sequence and shifting of the alignment to accommodate open channel flow of the stockwater races was neither practical nor cost effective. A range of alternative options were considered including: closure, part closure, pumping and realignment. Overall the function of the race network must be maintained thus wider closures were not considered. The stockwater races also have a dual function of providing land drainage during heavy rain and providing environmental flows to the Halswell River.

Closing sections of some individual races and /or rerouting races has been considered where it can minimise the number of stockwater siphons. An alternative supply is available to service those customers affected if the race can be reconnected downstream. Pumping was discounted on the grounds of cost and reliability.

Along Main South Road, retention of the existing stockwater race as an open channel has been considered as an alternative to a 2km section of piping between Weedons Rd and the point where

the stockwater race alignment leaves Main South Road. This was investigated to determine whether the loss of aquatic habitat could be avoided.

In order to retain the stockwater race in its current alignment as an open channel, the typical cross section of the road would need amending by installing a wire rope safety fence along the eastern road edge, along with adjustments to the road shoulder and drainage swale design also being required.

There were a number of potential issues identified with retaining this section of stockwater race as it required the road alignment to move to the west and would have resulted in a relatively short length of road with an unacceptable weaving alignment. The wire rope safety fence is more of a hazard to vehicles compared with clear run-out zones and a requirement to steepen the back face of the drainage swale would result in less permeable surface area and therefore less stormwater treatment.

The lengths where this alternative option could be achieved without purchasing land on the eastern side of Main South Road was limited, as detailed below in Table 13.

Table 13: Potential for stockwater race retention

Section No.	Chainage (project running distance in metres)	Length	Comments
1	3100 – 3200	100m	The carriageway is wider at this point to accommodate the southbound exit ramp at Weedons Interchange. A wire rope safety fence is already proposed to accommodate the additional road width and piping this section is necessary because of the interchange.
2	3200 – 3600	400m	There is potential to retain the existing stockwater race.
3	3600 – 3900	300m	A deceleration lane is required into Larcombs Rd and piping this section is therefore necessary.
4	3900 – 4200	300m	There is potential to retain the existing stockwater race.
5	4200 – 4950	750m	A deceleration and acceleration lane is required into Berketts Rd so piping this section is therefore necessary.
6	4950 - 5150	200m	There is potential to retain the existing stockwater race.

Sections 2 and 6 are within the proposed location of the back slope of the swale. If the road and swale were moved to the west, there would be insufficient width of earth remaining between the swale and stockwater race to ensure suitable slope stability, which risks the possibility of the stockwater race side wall collapsing. There is sufficient width of earth along Section 4 to enable it to remain without risking collapse (a distance of approximately 300 metres).

It is considered that only Section 4 could be retained without compromising the proposed MSRFL alignment. However, it is considered impractical and ineffective in terms of aquatic habitat values to retain such a short section of open channel, so this option has been dismissed also.

7.14.4. Overland flow paths

The Project crosses approximately 12 overland flow paths in addition to the stockwater race flow paths set out above. Options to deal with these included:

- ignoring the overland flow path and making the assumption that soakage would prevail. If soakage does not prevail, the overland flow generated in the upstream catchment would discharge to the highway drainage network. Should the highway drainage network then be overwhelmed, it would spill over the Project area centreline and fill the downhill swale before continuing as overland flow downstream of the Project alignment but not necessarily in the same location. This option was rejected as it would require detailed engineering and a full topographical survey to ascertain the extent of flooding and the effects on this and other flow paths downstream of the Project area;
- allowing overland flow to enter the Project drainage swale. This option was rejected because of potential overloading of the highway drainage system. Flows to the Project would be intercepted upstream of the Project and passed beneath in an inverted siphon; and
- pumping and storage options were ruled out because of cost and maintenance and the increase in designation area and its associated land take required to store the necessary volumes.

The preferred solution varies with existing function. Along CSM2, the preferred solution is to bund against the potential overland flow paths and convey the floodwater beneath the Project using siphon arrangements. Along MSRFL the overland flow paths do not typically pass through / beneath SH1 and have the potential to flood the upstream landowners. Protection of the drainage system via earth bunds and shallow timber flood walls was preferred over reshaping of the existing land and wider flood bunds due to land constraints.

7.14.5. Construction phase stormwater discharges

The Draft ESCP (SEMP002) included in Volume 4 of the application documents, sets out a 'toolbox approach' to management of construction discharges, through the proposed application of various erosion and sediment control devices. The tools available for the management of

construction phase stormwater discharges include clean water diversion drains, earth bunds, silt fences, swales, sediment retention ponds, soak pits, surface roughening of embankments and chemical flocculation to assist in the settlement of sediment in ponds.

All of these options will be available to the contractor (as required) within the structure of the final ESCP and this forms the consideration of alternatives for managing the construction phase stormwater discharges.

7.14.6. De-watering

The Project involves potential dewatering at two locations. The dewatering involves lowering of groundwater, which will possibly rise in the future due to groundwater mounding effects unrelated to this Project. The potential dewatering is at the stormwater treatment ponds adjacent to Halswell Junction Road and the Robinsons Road overpass, where the local road passes under the motorway.

The alternatives available to the dewatering option proposed for the Halswell Junction Road ponds within this application are:

- Direct more runoff to surface water and less to groundwater at Halswell Junction Road - the stormwater system could be designed to discharge more runoff directly to surface water with less directed to groundwater via pond seepage. Additional storage facilities (and a larger designation area) would also be required to offset the reduced volume of storage in the unlined ponds caused by high groundwater levels above the pond floors. Additional and more regular discharge to surface water (via surface raceways or subsurface pipe lines eventually to Upper Knights Stream) would be needed to offset the reduced infiltration rates from the unlined ponds where gravity drainage would be significantly curtailed by groundwater levels above the pond floors. In addition, the lined ponds would have to be redesigned to allow for groundwater levels above pond floors to reduce the risk of liner lifting.
- Raise CSM2 at Halswell Junction Road - raising CSM2 by 1 m to 2 m would allow for construction of the unlined ponds at Halswell Junction Road to be raised by a corresponding amount allowing for a greater depth to water. This alternative is probably the highest capital cost of the listed options, but it may allow for operation of the stormwater management system with a minimum of operational costs and pond storage volumes would not be limited by high groundwater levels. However, raising the road would potentially lead to additional visual and noise effects and a greater land requirement for the Project.

The alternatives available to the dewatering option proposed for Robinsons Road where it is potentially affected by future groundwater levels are:

- Raising the level of Robinson Road beneath the Robinson Road overpass - raising the level of the low point of Robinsons Road beneath the overpass by 1 m to 2 m would allow for water levels to be higher than those assessed with less risk of flooding. The utility of the road would be reduced however, as taller vehicles could not use the road if over height. The roadway would be available for use by the lower-height vehicles during wet periods when a deeper roadway would be flooded.

- Raise CSM2 above the Robinson Road overpass - raising CSM2 by 1 to 2 m would allow Robinsons Road to be raised by a corresponding amount without the limitation of the lower clearance described above. However, raising CSM2 would potentially lead to additional visual and noise effects and a greater land requirement for the Project.
- Allow Robinsons Road to flood - building the Robinson Road overpass and CSM2 as planned may result in flooding of Robinsons Road when groundwater levels are high and large rainfall events occur. The depth to water, recurrence interval and duration of such flooding events cannot be accurately predicted at this stage. However, the water level assessment indicates that water levels are likely to be above 37.4 mRL 5 % of the time and above 36.3 mRL 10 % of the time. The duration of the flooding will not be known until the future, as it depends on the extent of groundwater mounding effects arising from the implementation of the Central Plains Water Enhancement Scheme, as well as the timing and uptake of this scheme.

In relation to the third option for addressing the groundwater effects at Robinsons Road, it is noted that while the NZTA has proposed dewatering at Robinsons Road and discharge to the nearby stockwater race (for consenting purposes), it also proposes to retain the option of allowing Robinsons Road to flood, where it passes under CSM2. Alternative routes are available to minimise effects on local traffic movements. The NZTA will work with the SDC to determine the preferred approach when (and if) the future groundwater effects arise.

7.15. Air

The Draft Construction Air Quality Management Plan (SEMP001) included in Volume 4 of the application documents, sets out a 'toolbox approach' to management of construction phase air discharges (i.e. dust), through the proposed application of various management techniques. The alternatives available for the management of construction phase air discharges are also set out in Section 18.6 of this AEE.

7.16. Noise

A number of noise mitigation options have been evaluated by the Project team under the Best Practicable Option (BPO) guidance provided by the applicable noise standard NZS 6806:2010. The assessment matters included, but were not limited to, noise reduction, visual impact, safety, planning and cost. For this Project, a workshop was held which was attended by the Project team. Each mitigation option was progressed in order that the BPO could be determined. Of the noise mitigation options that were presented at the workshop, a number of bunds and barriers were immediately identified as not being necessary owing to the intended Crown purchase of the properties they were designed to protect.

Each sector assessment is set out in Chapter 17 of this AEE and contains a summary of all noise mitigation options considered and a description of the selected mitigation option.