5. CONSTRUCTION OF THE PROJECT

Overview

This chapter provides an overview of key construction activities and is a basis for the assessment of environmental effects in Part G. Staging strategies have been developed to minimise the disruption and duration of construction.

There are a range of construction effects assessed in Part G of the AEE and within the technical reports, appended in Volume 3, with recommended mitigation measures included in these reports. The most significant construction effects requiring mitigation relate to earthworks, traffic management, the operation of SH1, general amenity effects on nearby properties relating to noise, vibration and dust. Also, there are works relating to land purchase and construction compounds.

Construction is expected to take between three and four years and will be carried out concurrently at several locations along the Project alignment. There is an overall philosophy to construct local road connections early in order to maintain local connectivity and minimise disruption during construction.

Initial enabling construction activities involve shifting of boundary lines, relocation of businesses and other property related effects, temporary and permanent property access, temporary road connections, and modification to utilities including high voltage transmission lines. Early works will also involve establishing an estimated four construction site compounds and smaller satellite compounds at interchange and bridge locations.

Construction related activity will be contained within the designation boundaries and relate to site clearing, establishing traffic management (including on roads outside the designated areas), constructing and maintaining sediment controls, earthworks, building of retaining and bridge structures, storm water devices, intersection upgrades, pavement surfacing, landscaping and related road furniture.

5.1. Introduction

This chapter contains high level information about the construction of the Project. Construction of the Project is influenced by a number of factors, including:

- designation and resource consent conditions;
- the detailed engineering design for the Project;
- construction duration and target completion date;
- procurement method adopted for construction of the Project;
- resource constraints that may arise as a result of the re-build effort following the Christchurch earthquake events;
- construction methodology;
- technology adopted for construction; and
- existing traffic demands at the time of construction.

This chapter is intended to provide sufficient detail on the anticipated construction activities to assess their potential environmental effects and to identify any necessary measures to avoid, remedy or mitigate those effects, where appropriate. It is recognised that once the contract for the Project has been awarded and a contractor is in place, the construction methodology will be further refined and developed. This will be undertaken within the scope of the designation and consent conditions which will be in place to manage the environmental effects of the construction activities. As such, this chapter should be considered as a guide to the likely construction activities, noting that the construction methodology and details may change.

Construction management plans supporting an overarching CEMP, a draft of which is contained in Volume 4, will be secured by conditions on the designations and consents and to ensure all mitigation measures are implemented as required. Should a contractor wish to undertake construction activities in a manner which is not authorised by the consents held, appropriate authorisations would need to be obtained at that time.

5.2. Early construction activities

5.2.1. Relocation of significant businesses

There are several significant businesses that are directly affected by the proposed Project works. The NZTA's property agents have already commenced discussions with these businesses and it is expected that they will have been relocated and/or any modifications will be completed prior to physical works commencing.

5.2.2. Local road connections

Main South Road rear access roads and property access

The majority of businesses and land owners along the MSRFL section have indicated during consultation they would like the proposed rear access roads on both sides of Main South Road to be built in advance of the main physical works contract. This will allow the affected properties to be re-orientated to the new road locations and be fully operational prior to the construction of MSRFL. The existing Main South Road accesses will be closed off, providing the contractor with a clear workspace and simpler traffic management, resulting in overall efficiency and cost savings. Access will be provided to each affected property off the new rear access roads.

Waterholes Road access to Southern Woods Nursery

A new road is proposed to access the land that becomes "landlocked" north of the Southern Woods Nursery as a result of the new CSM2 / Main South Road connection. The accessway extends from Waterholes Road running adjacent to the CSM2 alignment before veering south towards the Southern Woods Nursery and linking into an existing easement. This new connection will be constructed early to maintain access to these rear properties during the construction period.

5.2.3. Site compounds

There are four key locations proposed for site compounds, all within the proposed designation, which are outlined as follows:

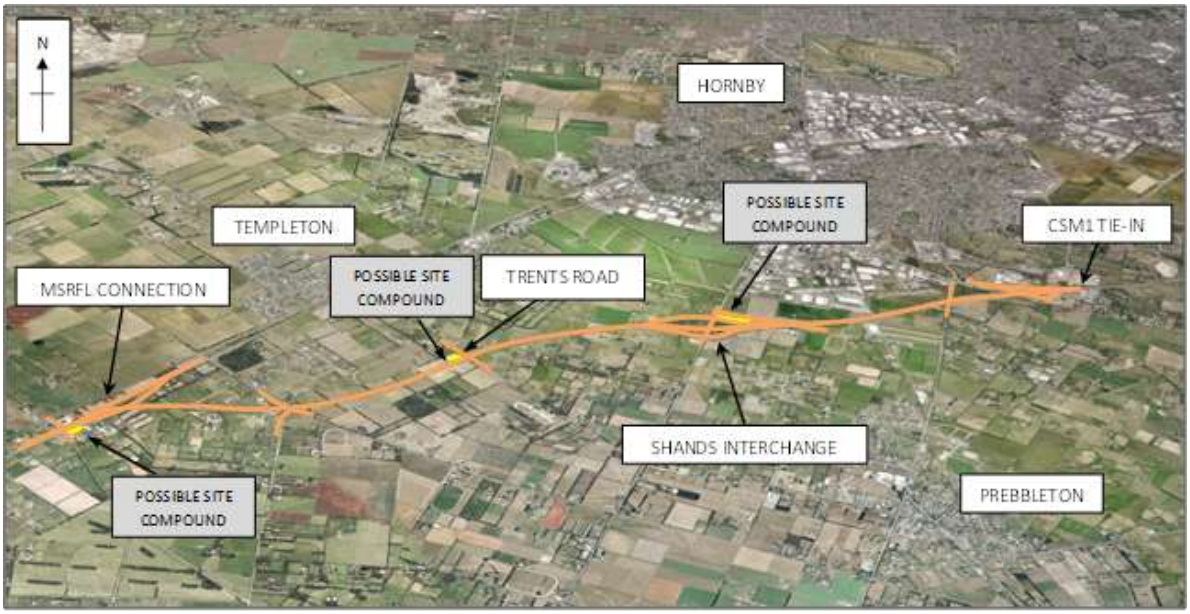
- east of the CSM2 / Robinsons Road, utilising the existing Evergreen Nursery facilities once it is vacated[54];
- north eastern corner of the Marshs / Shands intersection, in the space between the intersection and the proposed on ramp;
- inside the proposed parclo arrangement at Weedons Interchange; and
- near Trents Road.

The locations of the site compounds are presented in Figure 26 and Figure 27.

Figure 26: MSRFL available main site compound location

[54] Evergreen Nursery will be a total purchase so the contractor could use the garden centre building as the main project office.

Figure 27: CSM2 available main site compound locations



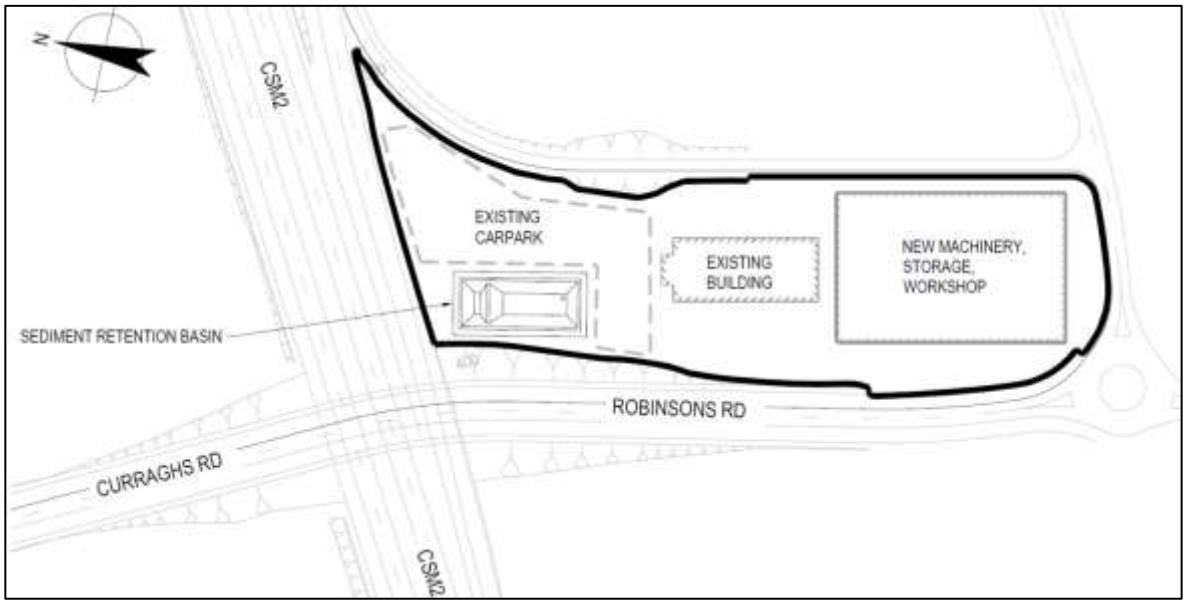
Additional smaller satellite compounds may be required by the contractor and have been shown at each interchange or bridge location.

The main site compound will contain features commonly associated with construction facilities, including:

- temporary site buildings;
- material laydown areas;
- workers' office and workshop accommodation;
- plant and equipment maintenance facilities;
- refuelling facilities;
- wheel washing and cleaning facilities;
- car parking; and
- plant and equipment storage areas.

An indicative layout for a main site compound is presented in Figure 28.

Figure 28: Indicative main site compound arrangement



Site compounds will be specifically designed prior to their establishment, in order to provide for the appropriate management of stormwater. This will involve the following elements:

- Perimeter bunds to prevent clean water run on from areas outside of the compound area and to prevent dirty water runoff from site compound onto adjacent land;
- Stormwater runoff within the compound is to be collected and treated prior to discharge to ground; and
- Fuel / chemical storage tanks will be bunded to a minimum of 110% of the storage tank volume to provide full containment in the event of a spill. Rainwater collected within the bunded area will be removed by vacuum truck and disposed of to an approved discharge facility.

5.2.4. Traffic management

Construction of the Project involves road closures, traffic management, diversions and periods of lowered speed limits on some roads, all of which have the potential to cause inconvenience to road users and residents. A Draft Construction Traffic Management Plan (CTMP) is contained within Volume 4 (Management Plans) detailing traffic management methodologies and mitigation measures to be adopted for the Project during construction.

The CTMP, when finalised by the contractor, will detail the traffic control activities, the impacts on pedestrians, cyclists, residents, businesses, public transport, and general traffic and typical mitigation measures that will be considered in the development of Site Specific Traffic Management Plans (SSTMP) and in the general management of Project construction. A SSTMP will be required for each of the work areas to maintain public road safety and minimise the disruption of the construction activities on motorists, and to provide a safe working environment for the contractors.

The extent of construction traffic is dependent on the phase of works. The majority of construction vehicle movements are expected to be to/from quarries located in areas to the west of Main South Road. Construction vehicles will therefore access Main South Road from the west, predominantly from Weedons Road, Dawsons Road or Curraghs Road. The specific route is dependent on the location of the site works. While the majority of construction movements will be via the roads specified above, other alternatives will be required for some sections. For example, for works on MSRFL west of Weedons Road where access is expected to be via a left turn at Hoskyns Road north of Rolleston.

Access to the Project from the city will be predominantly via Shands Road and Halswell Junction Road for the eastern end of the Project. Construction traffic travelling through Templeton will be encouraged to remain on Main South Road, rather than utilising Jones Road. The SSTMPs will detail the acceptable routes for construction vehicles and the expected frequency of heavy commercial vehicle movements. Any required mitigation measures will also be assessed and detailed in the SSTMPs. Construction related truck drivers are to be briefed on the appropriate routes and made aware of sensitive areas and points of high pedestrian and cycle usage.

Construction traffic movements through certain intersections and roads, at locations to be agreed with the Road Controlling Authorities, will be restricted at am and pm peak periods to reduce the impact of construction vehicles. In these instances, alternative routes will be established or the timing of construction movements adapted to maintain capacity. These restrictions will be detailed in the SSTMPs.

5.2.5. Alteration of services

Transpower 66 kV transmission lines

Transpower currently operate two main transmission lines within the Project area being:

- a 220kV line that runs in a northwest to southeast direction, passing to the north of the Shands/Marshs intersection and north of the Prebbleton Township; and
- a 66kV line that runs north/south, generally parallel and to the west of Shands Road. This 66kV line passes under the alignment of the 220kV line approximately 200 m north of the Shands Road/Marshs Road intersection.

The proposed CSM2 alignment passes under the 220kV line just south of Marshs Road and under the 66kV line just to the west of Shands Road. The standard clearance envelope is not achieved where CSM2 passes under the 66kV line. Transpower is currently undertaking a study for the modification of these lines to achieve the required clearance standards. The preferred option is to raise one, possibly two, of the existing towers, one of which may also require minor relocation to achieve horizontal and vertical clearances.

The preferred solution will be identified when the Project advances to detailed design. Any modifications to these 66 kV lines will be undertaken prior to the construction of CSM2 in that area. This will provide the contractor with a clear and safe working space during the construction of the Shands Road interchange.

Orion utilities

Throughout the Project area, electricity distribution assets are owned and operated by Orion (excluding the transmission lines note above). Numerous overhead and underground lines will be affected by the Project. Necessary modifications to the Orion infrastructure will be carried out prior to the main alignment works, as this will allow a more efficient and construction environment during construction.

Telstra Clear and Chorus utilities

Telecommunications assets within the Project area are owned by Telstra Clear and Chorus. Several underground fibre optic cables will be affected by the Project. Necessary modifications to the telecommunications infrastructure will be carried out prior to the main alignment construction starting.

5.2.6. Erosion and sediment control

Erosion and sediment control will be installed prior to bulk earthworks and will be maintained throughout the duration of the construction works to ensure protection of the downstream receiving environment from the adverse effects of sediment from the work area.

An Erosion and Sediment Control Plan (ESCP) will be prepared by the contractor as part of the CEMP. A draft ESCP is included in Volume 4 of the application documents. The principle behind the ESCP is to control erosion across the construction site, to manage any sediment-laden stormwater runoff and prevent unacceptable discharges of sediment into the receiving environment. As the receiving environment is groundwater, the protection of the groundwater aquifer is also required.

Typical erosion and sediment control mitigation measures to be implemented in advance of bulk earthworks are as follows:

- for fill areas, a ditch with a silt fence will be constructed at the bottom of the embankment to catch and contain unsuitable runoff from the earthworks;
- for areas in cut, a channel will be formed at the side of the road to collect run-off from the embankments;
- stabilise/roughen the surface of embankments with mulch, a weed mat and landscape planting to reduce erosion and assist with dust control;
- the sediment from the main alignment will be collected by the permanent swales which will initially be excavated to approximately 200mm above the final level. Temporary bunding will be provided at 100m intervals along the swale to slow the flow and allow sediment to settle to the bottom. Shortly before completion of the Project, the swales will be cleaned and cut to their final level;
- decanting earthbunds will be installed at soak pit locations to protect soak pits; and
- material stockpiles will be at nominated locations or the contractor has to assess the effects of runoff of alternative locations.

All sediment and erosion control measures will be inspected on a regular basis and following any significant rainfall event. The ESCP is a "live" document, and should be reviewed and updated where necessary if any measure is not achieving its intended purpose.

The options for disposal of stormwater runoff during construction are limited by the absence of surface water disposal points. Key issues which require management in the ESCP are:

- control of stormwater and isolating runoff from the stockwater network;
- keeping clean water separate from sediment laden construction runoff;
- protecting adjacent landowners from surface discharge from the construction runoff;
- minimising sediment leaving the site; and
- disposal of excess water to land.

Sediment retention devices are proposed throughout the construction phase of the Project, including decanting earth bunds, swales with bunding, sediment retention ponds and silt fencing.

Temporary soakage solutions will be used to dispose of runoff from the site. Regular positioning of soak pits along the construction corridor will be undertaken to minimise the risk of discharges from the site. Sediment retention basins will be used at sites where soak pits are required for prolonged periods. This will allow waterborne sediment to settle out prior to disposal, thus limiting the need for regular cleaning and/or replacement of the soak pits.

More details regarding erosion and sediment control measures for the Project are contained within Volume 4 (Management Plans) which includes the draft ESCP (SEMP002).

5.2.7. Stockwater race modifications

Modifications will be required to the existing stockwater race network, where stockwater races are being decommissioned or diverted. These will be constructed early to provide a clear working site and to separate the construction sites from surface waters.

5.2.8. Water

Water will be required for a number of construction activities, including:

- dust suppression;
- earthworks supply (moisture conditioning for engineered fill construction);
- pavement works;
- concrete and aggregate production (placement and curing);
- irrigation for landscaping to establish a vegetation cover; and
- vehicle tyre wash to prevent tracking of sediment on roads.

Water will be sourced from existing local wells and/or brought to site by water truck. There is also the possibility of taking water from the stockwater races, subject to SDC approval and any resource consents required for this.

The peak water demand (typically full scale construction occurring during the summer months) has been estimated at 2,500m^3 per day. The volume of water required will be reduced during periods of wet weather. This water needs to be readily available across the construction site.

The contractor will obtain sufficient water supply for construction of the Project. At this stage it is not desirable to confine the contractor to a particular source. Should the chosen source(s) require additional resource consents, then the contractor will be required to obtain these directly from ECan.

5.2.9. Noise and vibration

The most effective way to control construction noise and vibration is through good on-site management. A draft Construction Noise and Vibration Management Plan (CNVMP) has been prepared for the Project and is contained within Volume 4 (Management Plans). This plan includes information required by NZS 6803:1999 Acoustics – Construction Noise, such as:

- general construction practices, management and mitigation;
- noise management and mitigation measures specific to activities and/or receiving environments;
- monitoring and reporting requirements;
- procedures for handling complaints; and
- procedures for review of the CNVMP throughout the Project.

The CNVMP will be implemented on site for each specific area of work. Construction noise management schedules will be prepared for each area of work once details of construction equipment and locations have been confirmed.

Where compliance with the relevant construction noise criteria in NZS6803:1999 cannot be achieved with the implementation of practicable management and onsite mitigation, a Site Specific Noise Management Plan (SSNMP) will be developed in communication with the affected residents and relevant Council. A SSNMP will set out specific conditions relating to a defined activity in a pre-determined location and be relevant for that activity only. Generally, SSNMPs are developed for activities that have been identified as likely to exceed the Project noise criteria, prior to commencement, and onsite mitigation is not practicable. This may apply to activities such as the bridge beam placement which is proposed to occur during night-time in order to avoid daytime road closures of local main roads.

Table 10 outlines the plant and machinery likely to be required during construction activities which will produce noise emissions.

Table 10: Plant and machinery involved in construction activities

Construction Activity	Plant and Machinery likely to be required
Topsoil Stripping	Motor-scraper, excavator, trucks and water carts.

Construction Activity	Plant and Machinery likely to be required
General Earthworks	Large excavators, spreaders, rollers/compactors, trucks and water carts.
Bridge foundations	Excavators, steel sheet piling, rollers/compactors, pile drivers for bored concrete piles and driven steel piles, truck movements.
Bridge Construction	Mobile cranes, truck movements, concrete pumping
Pavement Construction	Spreader machine, grader, paving machine, vibratory roller, truck movements and water carts.
Electricity Network Utilities	Mobile cranes and jointing methods

5.2.10. Dust

The most effective way to control construction dust is through good on-site management. A draft Air Quality Management Plan (AQMP) has been produced for the Project and is contained within Volume 4 (Management Plans).

The AQMP will be implemented on site for each area of construction work, to manage the following potential sources of dust and other air contaminant discharges associated with the construction phase of the Project:

- dust from roads and access areas generated by trucks and other mobile machinery movements during dry and windy conditions;
- excavation and disturbance of dry material;
- loading and unloading of dusty materials to and from trucks;
- smoke and odour from diesel-engine machinery and truck exhausts; and
- stockpiling of materials including material placement and removal.

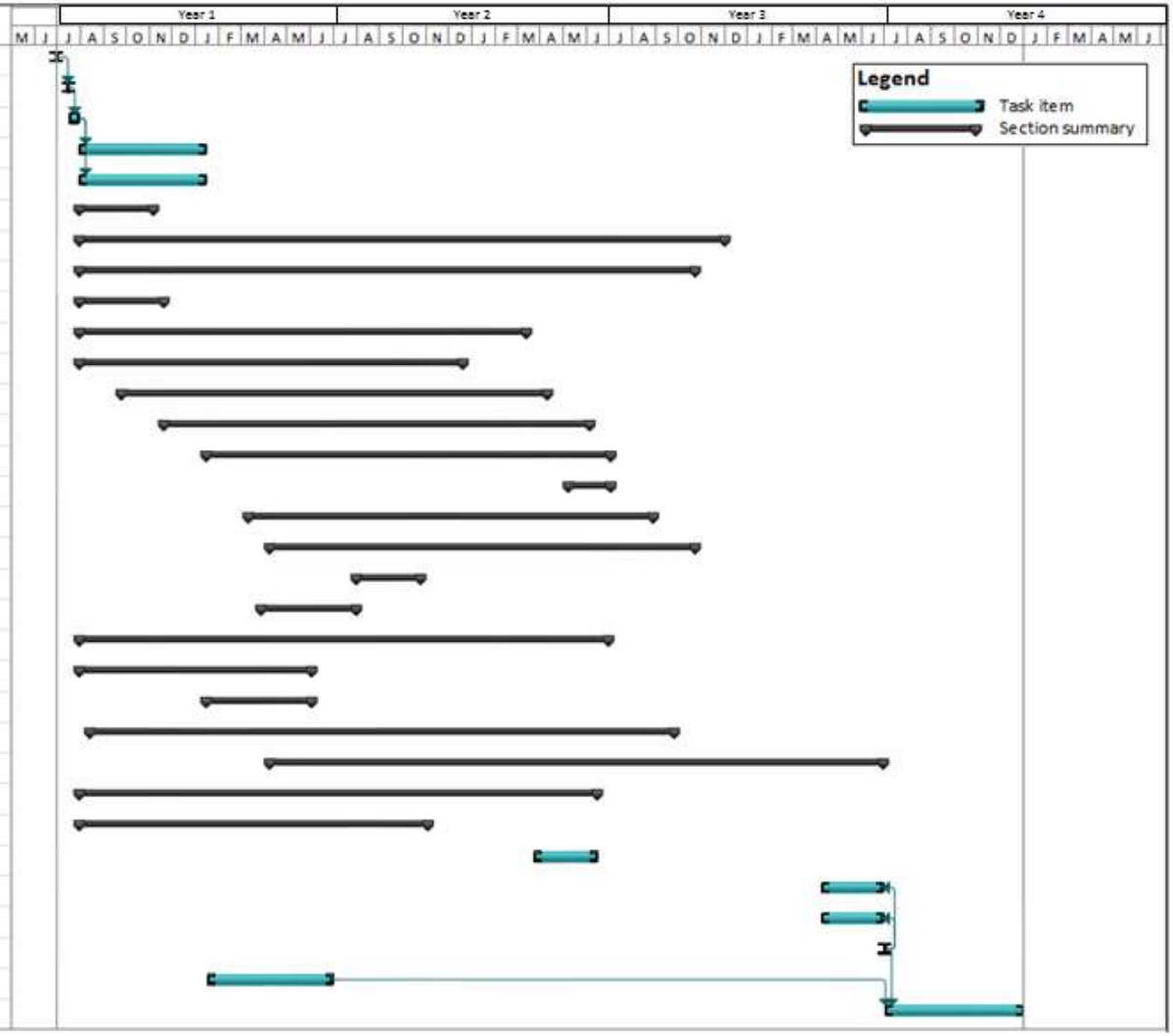
Chapter 18, the air quality effects assessment, contains a detailed list of the proposed mitigation measures to be adopted for this Project.

5.3. Construction programme

An indicative construction programme has been developed to inform the AEE, which is provided in Figure 29. Construction of the Project will take three to four years and will be carried out simultaneously at several locations along the Project alignment.

Figure 29: Indicative construction programme

ID	Task Name	Duration
1	Award of construction contract	1 day
2	Site possession	1 day
3	Stand down period	10 days
4	Site Clearance	120 days
5	Erosion and Sediment control	120 days
6	**Site Compound**	**70 days**
9	**Utilities**	**611 days**
30	**Local Road Connections**	**582 days**
31	**John Patterson Drive**	**80 days**
35	**Halswell Junction Road**	**422 days**
44	**Springs Road**	**362 days**
51	**Marshs Road**	**402 days**
59	**Shands Road**	**402 days**
67	**Trents Road**	**382 days**
74	**Blakes Road**	**40 days**
76	**Waterholes Road**	**382 days**
85	**Weedons Road**	**402 days**
92	**Levi Road**	**61 days**
96	**Weedons Ross / Jones Road roundabout**	**90 days**
98	**Robinsons / Curraghs Road**	**501 days**
109	**Western Rear Access Road**	**220 days**
112	**Eastern Rear Access Road**	**100 days**
115	**CSM2 Alignment**	**552 days**
121	**MSRFL Alignment**	**581 days**
130	**Stormwater**	**490 days**
131	**Stormwater Ponds**	**330 days**
136	Overland flow soakpits	60 days
137	Lighting	60 days
138	Barriers	60 days
139	Open CSM2 and MSRFL	1 day
140	Construct Waterholes / Dawsons roundabout	120 days
141	Risk / Contingency	130 days



5.4. General construction activities

5.4.1. Earthworks

The Project will generate approximately 405,000m^3 of excavated (cut) material (excluding topsoil) with approximately 320,000m^3 of this cut material suitable to be placed for fill embankments. Approximately 1,035,000m^3 of fill will be required for the Project of which approximately 715,000m^3 will be imported fill, approximately 300,000m³ of topsoil will be stripped and stockpiled for reuse on site, as appropriate.

Imported fill

The imported fill will be sourced from local quarries or rivers (Waimakariri/Selwyn) or from suitable screened demolition material resulting from the recent Christchurch earthquakes, if economically viable.

Cut slopes

Cut slopes will be minimal, generally up to 2.9m in height with shallow cut slopes of 4h:1v. The only exception will be the Robinsons Curraghs link which passes under Main South Road in a 7m deep cutting. Cut material will be excavated mechanically and will be stockpiled or loaded directly onto trucks to be transported for use elsewhere on the Project.

Fill embankments

The fill embankment slopes, typically up to 8m in height (to a maximum of 10.5m high), will be formed from materials sourced from cuttings but predominately from imported fill.

Surplus material and topsoil

There will be approximately 85,000m³ of excavated material that is deemed unsuitable for construction. For the most part, this material can be disposed of on site, reducing haulage distances. There is sufficient capacity within the site to accommodate the currently identified volume of waste fill material although the NZTA may also choose to use some of the fill for one or more of its other projects in the region.

All topsoil will be removed and stockpiled. Some topsoil will be re-used within the Project area. There is expected to be excess topsoil which will be available for re-use elsewhere.

5.4.2. Bridges and retaining walls

The Project will involve the construction of nine bridges and associated retaining walls for the interchanges, overpasses and underpasses. Bridge components such as steel and precast concrete deck beams, will be manufactured in a controlled environment at an off-site facility. Other components such as columns and deck topping slabs will be cast in-situ using local ready mixed concrete providers.

The bridge foundation piles will be either bored concrete or driven steel sections. The Design Philosophy Report (Technical Report 1, Volume 3) has full details of the materials required for the proposed bridge structures.

5.4.3. Pavement and surfacing

The proposed materials for the CSM2 and MSRFL mainline pavement are an Open Grade Porous Asphalt (OGPA) or Stone Mastic Asphalt (SMA) surfacing over a foamed bitumen stabilised base, which in turn overlays a sub-base. The depth of the sub-base material varies at different locations. The pavement for the local roads has still to be determined; however the surfacing is likely to be chip seal.

The sub-base and base layer granular materials will be imported to site by trucks and laid by a grader and roller compacted to the required levels. The base layer will utilise specialist equipment to modify the material to create the foamed bitumen layer. The asphalt surfacing material will be delivered to site by trucks and laid by a paving machine.

One main alignment carriageway will be utilised as a haul route through the site after the sub-base material has been laid. The other carriageway can be completed to seal to enable immediate protection of the pavement layers. Following completion of all earthworks, the haul route will be paved and surfaced.

5.5. Site specific construction

This section outlines the Project in five sectors and discusses the construction activities that will be undertaken in each sector, anticipated sequencing of construction activities and management of these activities. An overview of traffic sequencing details for each sector is provided in Chapter 8 of the Assessment of Traffic and Transportation Effects (Technical Report 2).

5.5.1. Sector 1 - Weedons Road Interchange and Main South Road Four Laning

This sector is located between chainage 1350 (south end of existing passing lanes) and 5900 (south of Robinsons Road intersection), and includes Weedons Road interchange and 4.55km of the Main South Road mainline.

Construction activity overview

Early works include the Main South Road rear western and eastern property access routes and relocation or protection of electricity and telecommunication services. This will enable the closing of property access onto Main South Road, to facilitate the upgrade of this existing state highway.

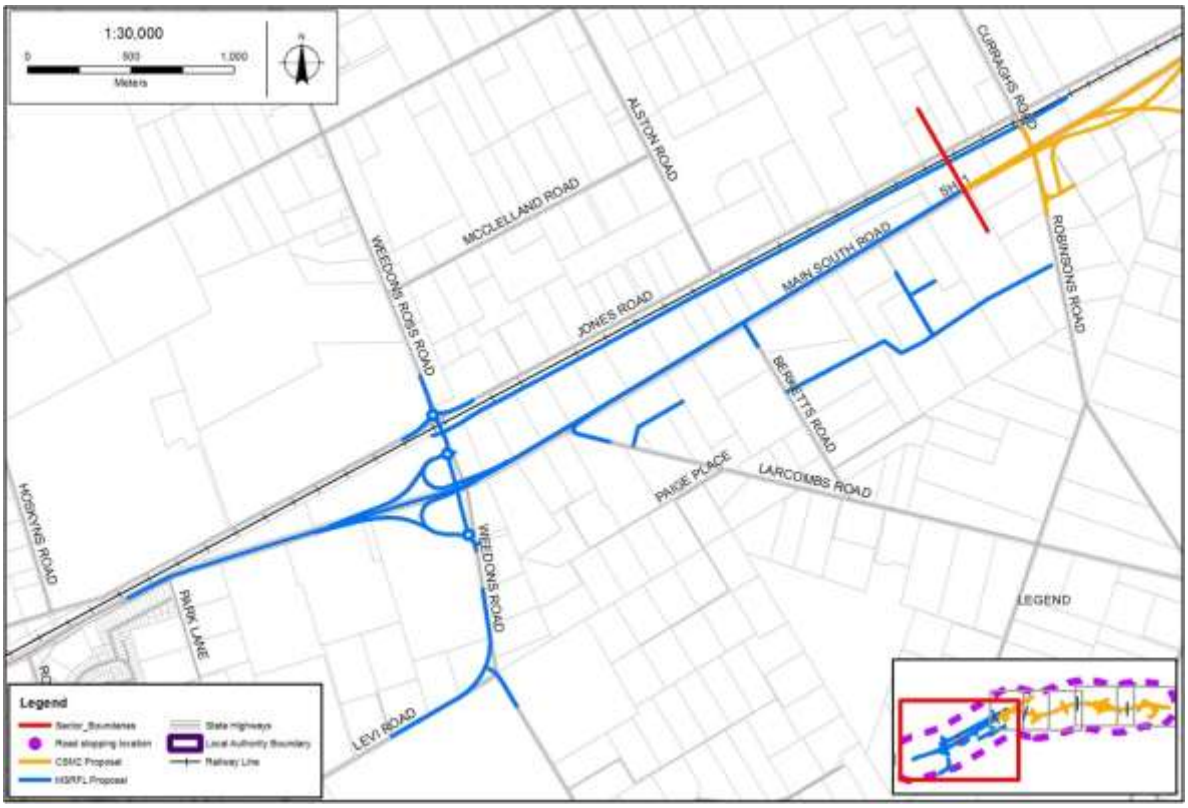
There is land available within the footprint of the Weedons interchange for a potential site compound location, if the contractor needs this.

Construction of the Jones Road/Weedons Ross Road intersection will be undertaken early to provide a secure detour route when part of Weedons Ross Road is closed later in the Project. The improved intersection works at Weedons Road/Levi Road can also be undertaken at this time.

The Weedons Road underpass and embankments are being constructed off-line from the existing Weedons Road alignment enabling access to existing dwellings. This will be followed by construction of the on and off-ramps to complete the interchange.

The widening of the Main South Road west (future northbound) carriageway will be constructed at the same time as the interchange before moving over to reconstruct the existing carriageway (future southbound lanes), which will include the interchange tie-ins to Main South Road. Incorporated in the east carriageway works will be restricted access to Larcombs Road (left turns in only) and Berketts Road (left in and left out turns). This will be followed by construction/installation of roadside infrastructure, including lighting, road side barriers and signage.

Figure 30: Extent of Sector 1



Weedons Road underpass

Construction of the four span Weedons Road underpass will involve reinforced concrete spread footing foundations, abutments, columns and cross-head construction. The double hollow core deck beams will be manufactured off site in a precast concrete construction yard and then transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Temporary traffic management

The following traffic management will be utilised:

- the western (northbound) carriageway of Main South Road will be constructed allowing traffic to remain on the existing carriageway. Traffic will then be moved over to the new carriageway to upgrade the existing carriageway;
- Berketts Road will be closed during its reconstruction with vehicle access diverted to Larcombs Road. The opposite will apply when undertaking the works at Larcombs Road with alternative property access provided where necessary; and
- Bridge beam placement may proceed under night-time closures due to day-time traffic volumes on Main South Road. The traffic detour will utilise Jones Road; and
- close Weedons Ross Road between the access to the Digga-link property, on the corner of Main South Road and Weedons Ross Road, and the western property rear access road to allow the construction of the northern interchange roundabout. The traffic detour will utilise Jones Road.

Erosion and sediment control

The general mitigation measures stated in 5.2.6 will apply for this sector.

Stockwater races and siphons

Stockwater race modification includes:

- the piping of the open stockwater ditch on the eastern side of Main South Road;
- increasing the capacity of stockwater race and associated culvert adjacent to Weedons Ross Road, to compensate for the decommissioning of the stockwater race 200m north of Weedons Ross Road; and
- maintaining overland flow capacity and land drainage function of the stockwater races by installation of siphons to convey flows under the MSRFL carriageway.

Service relocations

A number of existing services require relocation or protection as follows:

- undergrounding/relocation of the Orion 66kV overhead lines and 11kV underground lines in the vicinity of the substation located on Weedons Ross Rd adjacent to the railway corridor;
- undergrounding/relocation of Orion 11kV overhead lines that currently run along the eastern side of Main South Road from Park Lane to Waterholes Road and also along Jones Road; and
- protection and/or relocation of Telstra Clear underground fibre optic cables

5.5.2. Sector 2 - Robinsons Road / Curraghs Road/ Dawsons Road

This sector, between chainage 0 and 1500 (CSM2), includes Robinsons Road overpass, Main South Road (Main South Road)/CSM2 interchange, Main South Road/Dawsons Rd intersection and 1.5km of the CSM2 mainline.

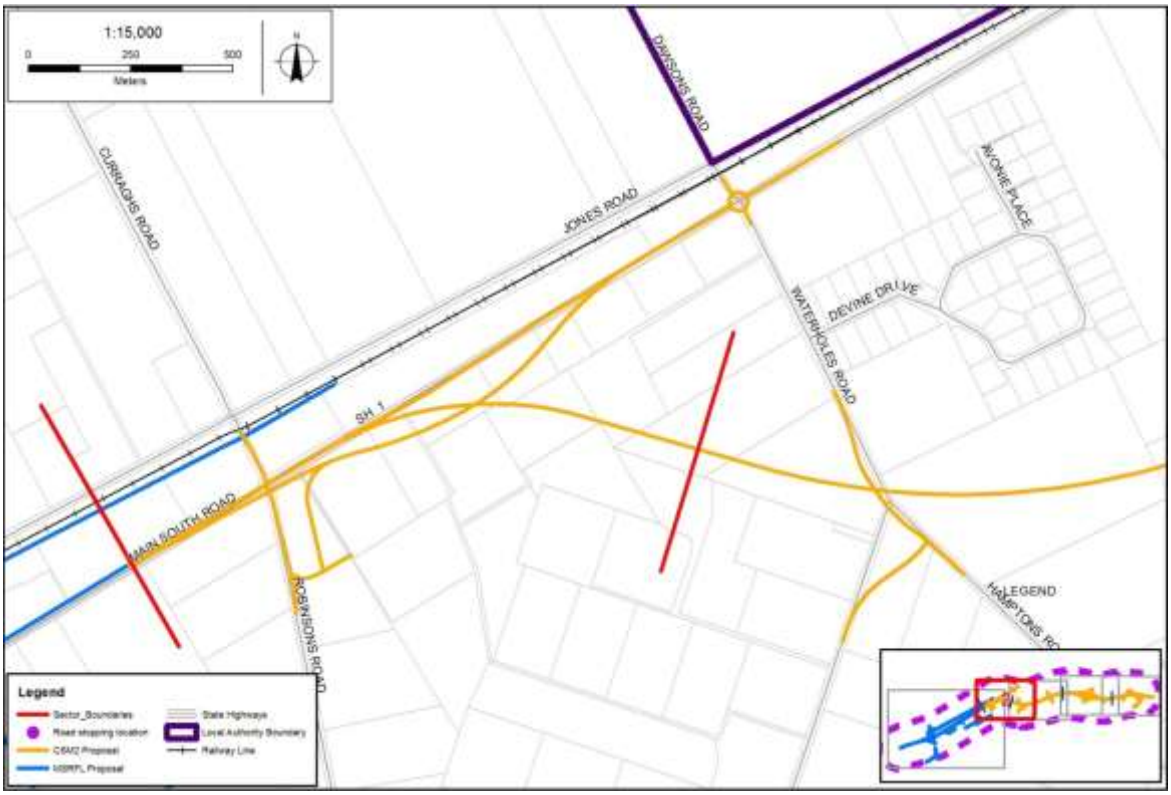
Construction activity overview

Early works include the relocation or protection of electricity and telecommunication services. There is land available northeast of CSM2 and Robinsons Road for a potential site compound location, if the contractor requires this.

Initial work will include the construction of alternative access arrangements, via Robinsons Road, to properties on the eastern side of Main South Road and construction of a new land drainage culvert, which will enable construction of the SH1 Southbound On-Ramp Bridge to be undertaken. The construction of the new Main South Road/Dawsons Road roundabout will be undertaken at this time also, to provide a safe crossing of Main South Road.

The Robinsons Road overpass will be then constructed in two stages in conjunction with the widening and reconstruction of Main South Road. The main motorway alignment, which is generally at-grade, will commence at this time, followed by construction/installation of roadside infrastructure, including lighting, road side barriers and signage.

Figure 31: Extent of Sector 2



Robinsons Road overpass

Construction of the single span overpass will be undertaken in two stages, with the south half first followed by the north half. The abutments comprise a reinforced concrete footing supported on top of vertical mechanically stabilised earth retaining walls. The double hollow core deck beams

will be transported to site and placed in position followed by construction of the in-situ concrete topping slab.

SH1 southbound on-ramp bridge

Construction of the four span bridge will involve reinforced concrete spread footing foundations, abutments, columns and cross-head construction. The steel I-girder deck beams will be transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Temporary traffic management

The following construction traffic sequencing will be utilised:

- Robinsons Road overpass will be constructed in two parts. This will initially require closure of Robinsons Road between the new roundabout and Main South Road (for construction of the southern half of the bridge) and then closure of Robinsons Road between the new roundabout and Jones Road (for construction of the northern half of the bridge). Traffic will use Waterholes Road as the diversion route;
- diversion of all Main South Road traffic to the SH1 Southbound On-Ramp, which would be used for two-way traffic, will be necessary to enable construction of the Robinsons Road overpass and tie-in between CSM2 and Main South Road;
- the earlier works will enable the motorway overpass to be completed with associated traffic management at its tie in with Main South Road; and
- the new roundabout at Main South Road/ Dawsons Road can be built on line with standard traffic management in place.

Erosion and sediment control

In addition to the general mitigation measures stated in 5.2.6, it will be necessary during construction to pump out surface water from the cutting at Robinsons Road overbridge to the proposed sediment retention basin at the south east corner of Robinsons Road and Main South Road.

Stockwater races and siphons

Modification includes:

- diversion of existing stockwater race to the north east of the new roundabout at Main South Road/Dawsons Road;
- diversion of the existing stockwater race at chainage 780 under Main South Road, CSM2 and SH1 Southbound On-Ramp Bridge via a siphon;
- diversion of the existing stockwater race at chainage 370 further west of Robinsons Road; and
- the instllation of a series of siphons early in the construction sequence to maintain the passage of overland flow under the proposed carriageway.

Service relocations

A number of existing services require relocation or protection as follows:

- undergrounding/relocation of Orion 11kV overhead lines that currently run along the eastern side of Main South Road from Park Lane to Waterholes Road and also both sides of Waterholes Road/Hamptons Road; and
- protection and/or relocation of Chorus underground fibre optic cables running under CSM2 at chainage 700.

5.5.3. Sector 3 - Waterholes to Blakes

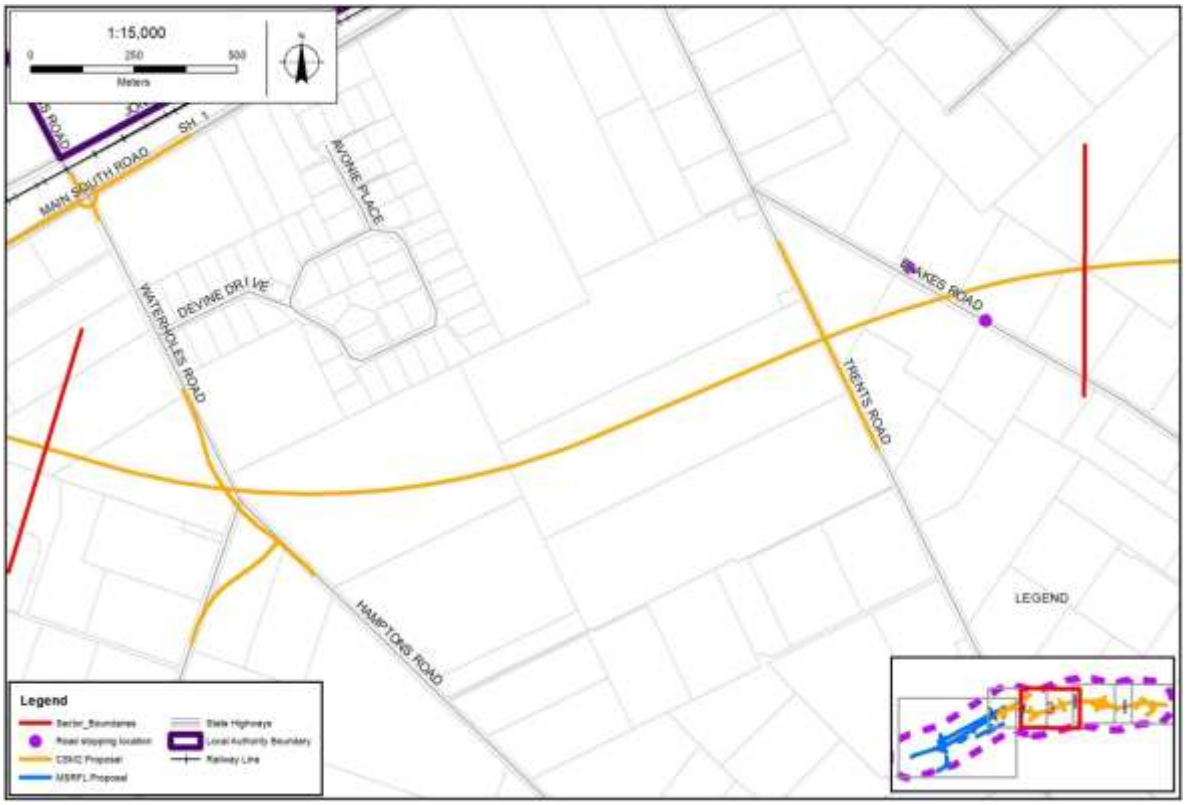
This greenfields sector, between chainage 1500 and 4200, includes the Waterholes Road underpass, Trents Road underpass, the closure of Blakes Road and 2.7km of the CSM2 main alignment.

Construction activity overview

Early works include the relocation or protection of electricity and telecommunication services and construction of the access road from Waterholes Road through to Southern Woods (required before two driveways are closed where CSM2 merges with Main South Road). A site compound location could be constructed west of Trents Road, north of CSM2, if the contractor requires

The construction of the embankments and bridges of Waterholes Road and Trents Road will be undertaken first followed by the main motorway alignment, which is generally at-grade. After completion of the Trents Road underpass, the infrastructure will be put in place to terminate Blakes Road either side of CSM2, which will then enable construction of the motorway mainline to be undertaken at this location. This will be followed by construction/installation of roadside infrastructure, including lighting, road side barriers and signage.

Figure 32: Extent of Sector 3



Waterholes Road underpass

Construction of the four span underpass will involve reinforced concrete spread footing foundations, abutments, columns and cross-head construction. The double hollow core deck beams will be transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Trents Road underpass

Construction of the three span underpass will involve reinforced concrete spread footing foundations, abutments, columns and cross-head construction. The double hollow core deck beams will be transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Temporary traffic management

As this is a greenfields sector, temporary traffic management requirements are limited to the local road crossing points. The following construction traffic sequencing will be utilised:

- a temporary road will be constructed to the west of Waterholes Road / Hamptons Road, including an intersection with the existing Waterholes Road, which will enable construction of the embankments and bridge to be undertaken;

- a temporary road will be required to the east of Trents Road, which will divert to the section of Blakes Road north of the CSM2 alignment, providing uninterrupted access to construct Trents Road bridge and northern embankment and
- bridge beam placement may proceed under night-time closures due to the volume of daytime traffic using both Waterholes Road and Trents Road.

Erosion and sediment control

The general mitigation measures stated in 5.2.6 will apply for this sector.

Stockwater races and siphons

Modification includes:

- relocation of the stockwater race along Trents Road to the east to keep it clear of the new embankments;
- new westbound and eastbound connections, along the southern side of CSM2, are required to connect with the existing stockwater races at chainage 3100 and along Blakes Road. Siphon piped crossings are required under CSM2, Trents Road and Blakes Road;
- the decommissioned stockwater race along Blakes Road, to the north of CSM2, is to be retained to act as a land drainage function during heavy rain;
- diversion of the stockwater race along the east side of Waterholes Road will be required to keep it clear of the new embankments, which will include a siphon piped crossing of CSM2; and
- the instllation of a series of siphons early in the construction sequence to maintain the passage of overland flow under the proposed carriageway.

Service relocations

Existing services require relocation or protection as follows:

- relocating Orion 11kV overhead lines at Trents Road and Blakes Road; and
- protection and/or relocation of Chorus underground fibre optic cables running NE-SE under Trents Road.

5.5.4. Sector 4 - Shands Road Interchange and Marshs Road

This sector, between chainage 4200 and 6600, includes the Shands Road interchange, Marshs Road underpass and 2.4km of the CSM2 mainline.

Construction activity overview

Early works includes the relocation and protection of electricity and telecommunication services, including the lifting of the existing Transpower 66kV overhead transmission lines at the interchange to provide the necessary clearance envelope. The realignment of the Hornby Industrial Rail Line including an eastern turnout at the eastern end of this section will also be required. A site compound is available to be constructed on the southeast corner of the Marshs

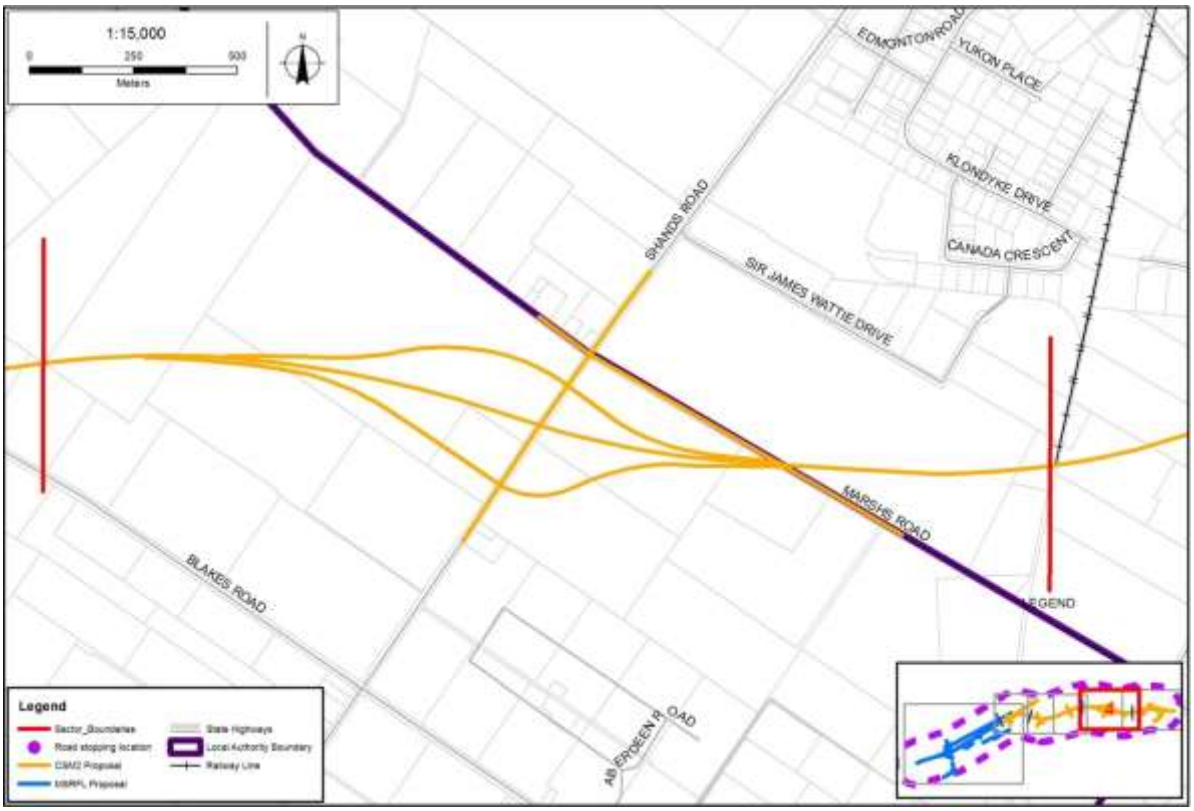
Road / Shands Road intersection, in the space between the intersection and the proposed on-ramp.

The construction of the embankments and bridges at Shands Road and Marshs Road will be undertaken first followed by the main motorway alignment and the on and off-ramps, which are generally at-grade. This will be followed by construction/installation of roadside infrastructure, including lighting, road side barriers and signage.

The installation and commissioning of traffic signals at three intersections will occur at the existing Shands Road/Marshs Road, proposed Shands Rd/eastbound off-ramp/eastbound on-ramp, and proposed Shands Rd/westbound off-ramp/westbound on-ramp.

The commercial vehicle inspection unit (CVIU) facility, including a weigh station and parking/ inspection area, will be constructed at the southeast corner of the Marshs Road/Shands Road intersection nearing the completion of the Project, or independently to it.

Figure 33: Extent of Sector 4



Shands Road underpass

Construction of the three span underpass will involve piled foundations, reinforced concrete abutments, columns and cross-head construction. The double hollow core deck beams will be manufactured off site in a precast concrete construction yard and then transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Marshs Road underpass

Construction of the four span bridge will involve piled foundations, reinforced concrete abutments, columns and cross-head construction. The steel I-girder deck beams will be transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Temporary traffic management

The following construction traffic sequencing will be utilised:

- temporary roads can be constructed to the west of Shands Road and to the southwest of Marshs Road to enable construction of the bridges and embankments on these two local roads; and
- bridge beam placement may proceed under night-time closures due to the volume of daytime traffic using both Shands Road and Marshs Road.

Erosion and sediment control

The general mitigation measures stated in 5.2.6 will apply for this sector.

Stockwater races and temporary stormwater management

Modifications are:

- diversion of the existing stockwater race further north of Marshs Road, to be clear of the bridge embankments, which will include a piped crossing under CSM2, the capacity of which will need to consider the land drainage function too; and
- installation of a number of additional siphons to be constructed early in the construction sequence to maintain land drainage.

Service relocations

Specific existing services require relocation or protection as follows:

- lifting the existing Transpower 66kV overhead transmission lines at the interchange;
- relocating 11kV overhead line at Marshs Rd and 33kV overhead line along Shands Rd; and
- protecting and/or relocating Chorus underground fibre optic cables running north east to south east through the interchange.

5.5.5. Sector 5 - Springs Road / Halswell Junction Road

This sector, between chainage 6600 and 8600, includes the tie-in with CSM1, Halswell Junction Road interchange, Springs Road underpass and 2km of the CSM2 mainline. The John Paterson Drive realignment is also within this sector.

Construction activity overview

Early works include the relocation or protection of electricity and telecommunication services.

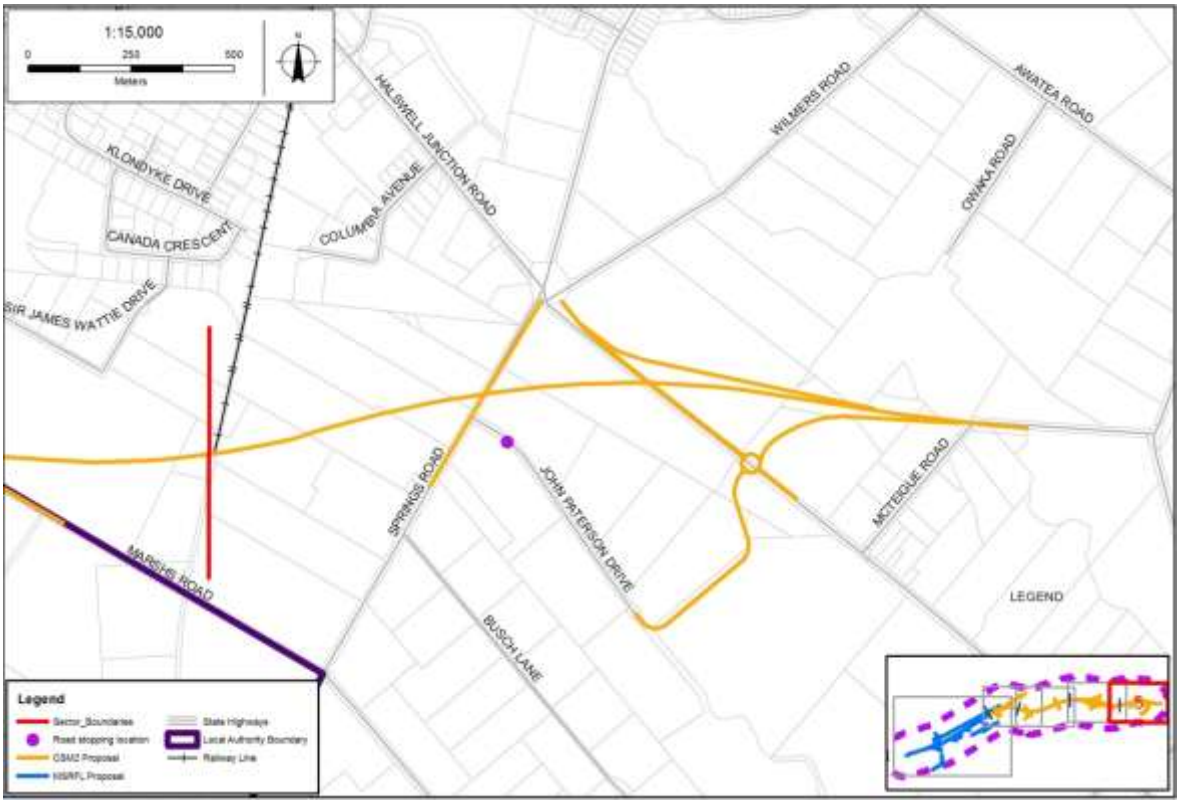
Initial works will involve the construction of three stormwater retention ponds in the vicinity of Halswell Junction Road interchange. Two of these will be either side of the Halswell Junction Road westbound off–ramp with a pipe connecting them. The third pond (Maize Maze Pond) is located at the south west corner of CSM2 and Halswell Junction Road. After the new ponds are operational, part of the existing CSM1 Mushroom pond will be filled in to enable the construction of the Halswell Junction Road eastbound on-ramp later in the Project.

Following construction of the Halswell Junction Road westbound off-ramp, the realignment of John Paterson Drive and deconstruction of the existing CSM1/Halswell Junction Road roundabout, the embankments and bridges along Halswell Junction Road and Springs Road can be constructed.

During this time the construction of the mainline motorway, which is generally at-grade, together with the Halswell Junction Road eastbound on-ramp will commence. This will be followed by construction/installation of roadside infrastructure, including lighting, road side barriers and signage.

The construction of a remote shared cycleway/footpath (an extension of the CSM1 route at the Owaka subway), continuing west along the CSM2 alignment, passing under Halswell Junction Road and Springs Road and connecting to Little River Rail Trail, can be undertaken during the main motorway alignment works.

Figure 34: Extent of Sector 5



Springs Road underpass

Construction of the four span underpass will involve piled foundations, reinforced concrete abutments, columns and cross-head construction. The double hollow core deck beams will be manufactured off site in a precast concrete construction yard and then transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Halswell Junction Road underpass

Construction of the four span underpass will involve piled foundations, reinforced concrete abutments, columns and cross-head construction. The double hollow core deck beams will be manufactured off site in a precast concrete construction yard and then transported to site and placed in position followed by construction of the in-situ concrete topping slab.

Temporary traffic management

The following construction traffic sequencing will be utilised[55]:

- the new Halswell Junction Road off-ramp will be constructed as two lanes for two-way traffic, together with the removal of the existing Halswell Junction Road roundabout and construction of the new Halswell Junction Road roundabout. Traffic will be diverted to and from CSM1 via the new roundabout and off-ramp. John Paterson

[55] Further detail is provided in section 8.8 of Technical Report 2, appended in Volume 3.

Drive will be connected through to the new roundabout on Halswell Junction Road, with residents initially using the existing alignment to continue accessing Springs Road;

- implementing temporary traffic diversion routes to the west of Halswell Junction Road and Springs Road, around the site of the new bridges and approach embankments. At the same time the John Paterson Drive connection on Springs Road will be terminated and the traffic directed to use the new alignment;
- after completion of the bridges and associated road works, the traffic will be routed back to Halswell Junction Road and Springs Road. The westbound off-ramp will be reconfigured from the temporary two-way traffic flow to one-way flow; and
- bridge beam placement will proceed under night-time closures due to the volume of daytime traffic using both Springs Road and Halswell Junction Road.

Erosion and sediment control

In addition to the general mitigation measures stated in 5.2.6 the construction of part of the Maize Maze pond will be required as temporary sediment control for the Halswell Junction Road embankment construction and temporary diversion road runoff. It will also compensate for the loss of the Mushroom first flush (east) basin.

Land drainage races

A permanent diversion of the existing land drainage race around the south side of CSM2, including a new siphon piped crossing under Springs Road, is to be constructed.

The existing Montgomery's Drain will be re-aligned along the north side of CSM2 and piped to the open swale between Wilmers Quarry and Owaka Basin. An overflow from Owaka basin to Montgomery's Drain is to be constructed under Halswell Junction Road. Further drainage works will be required early in the construction sequence to maintain the land drainage function of the various waterways, drainage races and overland flow paths.

Service relocations

Specific existing services require relocation or protection as follows:

- relocating 11kV overhead lines at Springs Rd and Halswell Junction Road; and
- protecting and/or relocating Chorus underground fibre optic cables.