PART H: MITIGATION AND MONITORING

27. MITIGATION & MONITORING

Overview

Where practicable, potential adverse effects have been avoided or reduced through the integrated design process. Potential adverse effects that are not able to be fully avoided will require careful management throughout the construction and operation of the Project. The delivery framework sets out the overall framework in which the Project will be delivered through to commissioning. This discusses where management plans and other key mitigation will occur. The overall management plan framework has two tiers of construction management plans proposed:

- an overarching CEMP; and
- a series of SEMPs (e.g. noise, air quality etc.).

A draft CEMP and drafts of seven topic specific management plans have been prepared and are contained in Volume 4. These provide indicative details about how potential environmental effects will be managed. The management plans also cover proposed environmental monitoring which will be undertaken prior to, during and following construction to monitor potential effects, and provide a mechanism through which additional measures can be implemented during construction and operation if necessary. Some management plans which extend through to the operational phase of the Project are also proposed as conditions of consent.

As a result of the mitigation proposed including that in proposed conditions of the designations and resource consents, it is concluded that the potential adverse effects of the Project will be appropriately avoided, remedied or mitigated.

27.1. Introduction

The assessment of environmental effects in Part G identified a wide range of positive and adverse actual and potential environmental effects predicted to result from the construction and operation of the Project.

While many potential adverse effects have been able to be avoided completely or at least significantly reduced, the effects assessment identified a range of adverse effects that will require remediation and/or mitigation to ensure that they are appropriately managed. This chapter provides a discussion of the environmental management measures proposed to be implemented before, during and after construction, in order to manage potential environmental effects of the Project.

The remainder of this chapter provides the following information:

- the Project delivery framework identifying how conditions and management plans will be implemented through the further (detailed) design and construction phases of the Project;
- the proposed management plan framework; and
- a summary of the measures proposed to adequately manage potential adverse effects.

Where relevant, the proposed mitigation, remediation and monitoring measures summarised here have been included as recommended conditions for the designations and /or resource consents. Suggested conditions are set out in subsequent chapters:

- proposed conditions of the designations (Chapter 30); and
- proposed conditions of the resource consents (Chapter 31).

27.2. Project delivery framework

Key to the future management of effects is the development and implementation of a suite of measures that include conditions, management plans, and monitoring and maintenance. This is referred to as the Project delivery framework. This includes the need to manage areas of environmental sensitivity, to recognise environmental risk issues, and to identify the mechanisms to avoid, remedy or mitigate these actual and potential effects.

This chapter identifies the methods and plans that will be developed by the NZTA (or its nominated contractors/consultants) at the time detailed design and construction occurs, associated monitoring and the processes for verification.

27.2.1. Principles for Project delivery

The following principles form the basis for the development of the plans and conditions that have and will dictate the delivery of the Project, including its construction, operation and maintenance:

- all works are to be undertaken in compliance with current New Zealand standards and legislation;
- the construction and operation of the Project will use the best practicable options to avoid, remedy or mitigate adverse effects;
- an integrated team approach to development of the design and the methods to avoid, remedy or mitigate actual and potential effects means that no one particular discipline is more important than another; and
- each technical specialist, consultant, or contractor involved in the Project has equal responsibility to use best endeavours to avoid, remedy or mitigate adverse effects.

In addition to these principles, the methods used will seek to:

- maintain on-going communication with the local authorities who will be responsible for monitoring and enforcing conditions placed on the designation and resource consents sought;

- maintain strong communication links with the directly affected landowners, Tangata Whenua, key stakeholders, affected landowners and the wider community; and
- mitigate adverse effects during design and construction of the Project through which the above environmental principles will be implemented.

27.2.2. Methods to avoid, remedy or mitigate

The assessment of alternatives (Chapter 7) discussed how the integrated approach to design has already led to the avoidance and mitigation of effects which will result in the best environmental outcome.

The following methods to avoid, remedy and mitigate the remaining actual and potential adverse effects are proposed:

- designation conditions;
- consent conditions; and
- management plans.

Mitigation measures are summarised in this chapter. Section 27.4 sets out actual and potential adverse environmental effects, methods proposed to manage them, and proposed conditions.

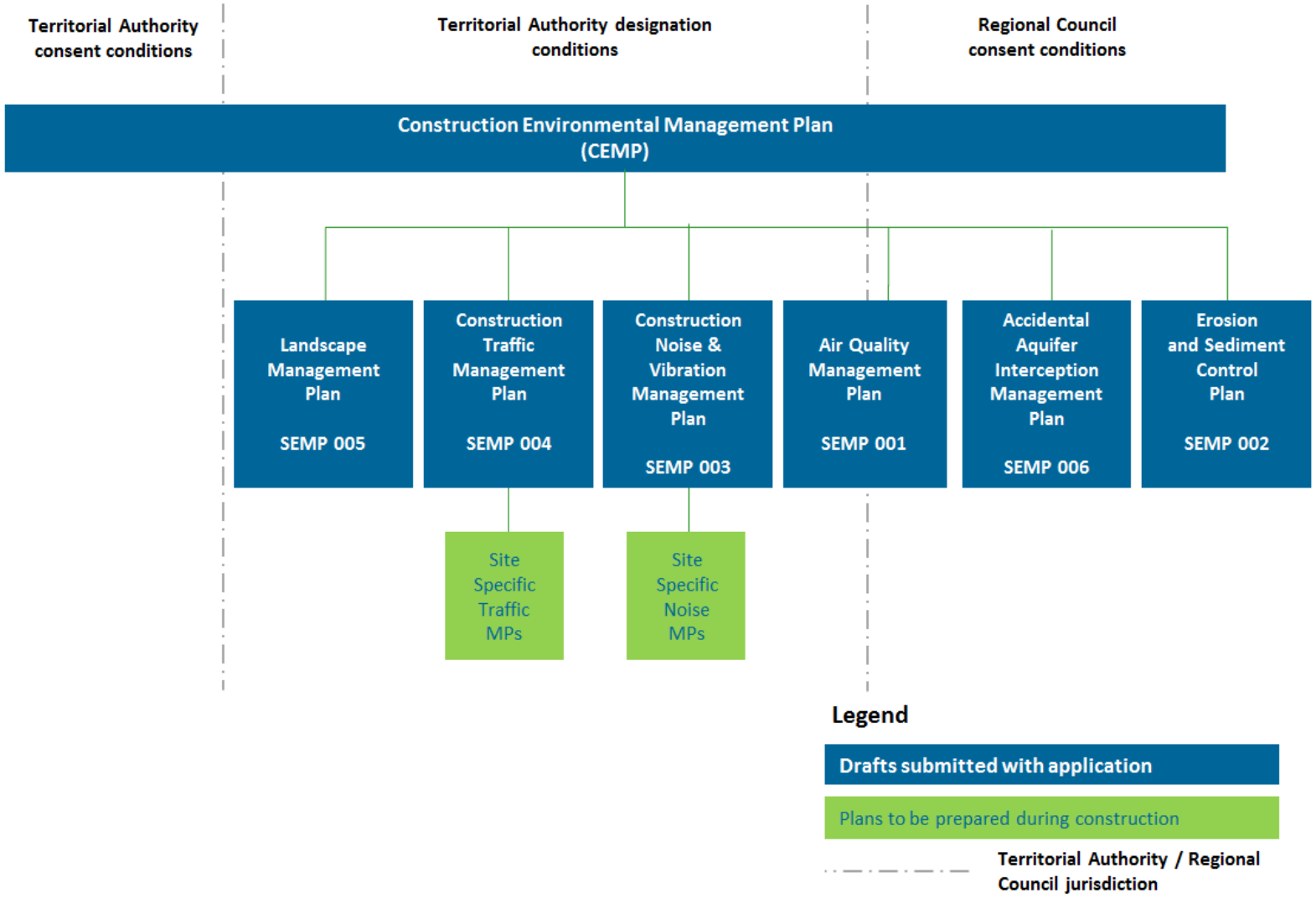
27.3. Management plan framework

The management plan framework for this Project is set out in the draft CEMP, which can be found in Volume 4 of the application documents. The CEMP is the umbrella document for environmental management of the construction phase of the Project. It is supported by a range of Specialised Environmental Management Plans (SEMPs) which are attached as appendices to the CEMP. The following Draft SEMPs have been provided in Volume 4 of the application documents:

- SEMP001 Air Quality Management Plan
- SEMP002 Erosion and Sediment Control Plan
- SEMP003 Construction Noise and Vibration Management Plan
- SEMP004 Construction Traffic Management Plan
- SEMP005 Landscape Management Plan
- SEMP006 Accidental Aquifer Interception Management Plan

In addition to management plans for the construction phase of the Project, there will be management plans for the operational phase of the Project, in particular for the operation and maintenance of stormwater systems. This operational phase management plan is not attached as an appendix to the CEMP. The framework around these management plans is shown in Figure 55.

Figure 55: Management plan framework



27.4. Summary of mitigation, monitoring and other measures to manage adverse effects

A range of mitigation, remediation, management and monitoring measures have been developed for the Project, in order to avoid, remedy or mitigate potential adverse effects. These measures are summarised in Table 41. References to the relevant technical report are provided, where applicable.

Table 41: Proposed mitigation and monitoring

Construction effects
Operational effects

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Traffic and transport				
Increased construction traffic movements of both light vehicles and heavy vehicles are likely to have adverse amenity and safety effects on local roads.	CTMP to outline: appropriate construction sequencing, hours of operations, construction vehicle movements and routes, and use of temporary connection routes. Site specific traffic management plans (SSTMPs) to be prepared for specific locations to control construction vehicle movements and routes.	Monitoring requirements will be specified in the CTMP	Designation: • Finalise and implement CTMP (SEMP 004) – DC.25, DC.26 & DC.28 • Prepare and implement SSTMPs to set out detailed requirements – DC.27 & DC.28.	Technical Report 2

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Removal of direct access to Main South Road for properties on the west and east of the road.	On the western side, access removal will be mitigated by the construction of a rear access road between Weedons Road and Curraghs Road. For properties on the eastern side the existing local road upgrades and an extension of Berketts Drive through to Robinsons Road will be used to provide access. These rear access roads form part of the Project.	N/A	No condition – the rear access roads form part of the Project (shown on the designation plans). The NZTA is required under Government Roading Powers Act to provide an alternative access.	Technical Report 2
Property and land use				
Private land will be required to accommodate the Project alignment, rear access roads and ancillary local road improvements	Private properties will be purchased outright or partially acquired. Property acquisition and compensation will be managed through the Public Works Act.	N/A	No condition. Addressed through Public Works Act	-
Some partial land acquisition may result in land severance or a reduction of land area below a useable size. This may have implications for amenity.	Potential amalgamation of severed land to create titles large enough for effective reuse. Property acquisition and compensation will be managed through the Public Works Act.	N/A	No condition. Addressed through Public Works Act	-

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Provision of alternative access may reduce the net area of existing properties including below the minimum allotment size in the District Plan.	Options for alternative access (for example right of way or road to vest on subdivision) will be considered in the acquisition process. These matters can be considered when the council assesses any future application for right of way or subdivision to facilitate the alternative access.	N/A	No condition. Addressed through Public Works Act.	-
The Project will take land comprising high fertility soil which might otherwise be used for farming purposes. This land use change will be irreversible.	Once construction is complete suitable areas of land will be returned to pasture. During construction, some of the topsoil will be re-used in the Project area. Surplus topsoil will be available for re-use elsewhere.	N/A	Designation: • Require uplift of surplus designation – DC.2	-
Services / network utilities				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
The Project alignment falls within the clearance envelope of a Transpower transmission line.	Clearance will be required to be maintained. The preferred solution will be confirmed at the detailed design stage. Potential solutions include the provision of an additional tower, tensioning of the lines, raising existing towers or undergrounding the lines. This will be undertaken in collaboration with Transpower.	N/A	Designation: • Require compliance with NZECP 34:2001 – DC.34	-
The Project alignment will directly affect some overhead electricity distribution lines.	This infrastructure will be relocated or undergrounded. These enabling works will be carried out prior to construction in consultation with the utility providers. The CEMP shall outline methods to address the safety, integrity and protection of existing network utilities.	N/A	Designation: • Finalise and implement CEMP which shall address network utility works – DC.12 & DC.13	-
Dust from construction activities has the potential to adversely affect electricity infrastructure and rail infrastructure.	AQMP to include measures to adequately manage dust during construction.	Dust monitoring requirements to be specified in the AQMP	Designation: • Finalise and implement AQMP (SEMP 001) – DC.14 & DC.15	-

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Potential for construction to cause damage to telecommunications infrastructure.	This infrastructure will be protected or relocated. These enabling works will be carried out prior to construction in consultation with the utility providers. The CEMP shall outline methods to address the safety, integrity and protection of existing network utilities.	N/A	Designation: • Finalise and implement CEMP which shall address network utility works – DC.12 & DC.13	-
Potential for construction to cause damage to sewer infrastructure.	This infrastructure will be protected and in some cases relocated to improve longer term maintenance accessibility. This will be undertaken in collaboration with the network utility provider. The CEMP shall outline methods to address the safety, integrity and protection of existing network utilities.	N/A	Designation: • Finalise and implement CEMP which shall address network utility works – DC.12 & DC.13	-

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Potential for construction to cause damage to water and stormwater infrastructure.	This infrastructure will be protected and in some cases relocated to improve longer term maintenance accessibility. This will be undertaken in collaboration with the network utility provider. The CEMP shall outline methods to address the safety, integrity and protection of existing network utilities.	N/A	Designation: • Finalise and implement CEMP which shall address network utility works – DC.12 & DC.13	-
During construction, sediment has the potential to enter stockwater races.	ESCP to describe erosion and sediment control measures to be undertaken during construction to manage effects on the quality of water races.	N/A	Regional consent: • Require ESCP to address effects on stockwater races – G.14 & G.15	Technical Report 3 Technical Report 17
Urban form and function				
The Project has no adverse urban design effects.	No mitigation is proposed	N/A	Designation: • Take into account the design principles of the ULDF – DC.31	Technical Report 5
Landscape and visual				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Temporary visual effects resulting from construction activities such as construction yards, laydown areas and equipment.	CEMP to include measures to mitigate areas of soil exposure from earthworks and the length of time exposed will be limited. Vehicle accesses and stockpiled materials will be located to minimise their visual impacts. Landscape Management Plan to include provisions to retain existing vegetation where possible	N/A	Designation: • Finalise and implement CEMP – DC.12 & DC.13 • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30	Technical Report 4 Technical Report 7
Adverse amenity value effects from motorway structures (e.g. interchanges and noise mitigation barriers) and lighting.	Landscape Management Plan to include provisions to retain existing vegetation where possible, replicate existing planting patterns where possible and retain valued view shafts. Planting will be in accordance with the Landscaping Plans with new vegetation planted to provide screening of structures and lighting effects.	N/A	Designation: • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC 30	Technical Report 4 Technical Report 7
The loss of pastoral land will have an effect on rural amenity and character.	Once construction is complete suitable areas of land will be returned to pasture.	N/A	Designation: • Require uplift of surplus designation – DP.2	Technical Report 4 Technical Report 7

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Amenity effects from the removal of planting, such as sections of shelterbelts.	Planting in accordance with Landscaping Plans and Landscape Management Plan which promotes replication of existing planting patterns where possible, limiting vegetation removal and retention of existing planting.	N/A	Designation: • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30	Technical Report 4 Technical Report 7
The proposed swales and stormwater basins may have an adverse visual effect on adjacent properties and travelling public using the motorway.	The stormwater detention basins are designed to be set below grade, surfaced with grass and set back from the carriageway. These will appear as a continuation of the existing rural land.	N/A	No condition. Addressed through design.	Technical Report 4
Lighting				
Construction yard and activity lighting, while temporary, has the potential to cause light spill effects on nearby residents and glare on drivers of vehicles.	The CEMP will manage the potential impacts of temporary lighting during construction. The location of site offices will be carefully considered in relation to nearby residential dwellings. The contractor will be required under the CEMP to use lights that do not produce environmental spill light above that required by relevant standards.	N/A	Designation: • Require CEMP to address effects of construction lighting – DC.12 & DC.13	Technical Report 19

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
There is the potential for intermittent lighting effects from vehicle movements to impact upon existing residents in the vicinity of the motorway.	Potentially affected dwellings will be partially screened from possible lighting effects by landscaping in accordance with Project Landscaping Plans.	N/A	Designation: • Finalise and implement Landscape Management Plan which include Landscaping Plans (SEMP 005) – DC.29 & DC.30	Technical Report 4 Technical Report 19
Lighting installed at intersections and interchanges has the potential to adversely affect residents and vehicle drivers primarily through spill light and glare.	All road lighting has been designed to Standard AS/NZS 1158 to minimise spill light and glare.	N/A	Designation: • Lighting to be designed in accordance with AS/NZS 1158 – DC.35	Technical Report 19
Noise and vibration				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Temporary construction noise and vibration has the potential to cause disturbance to residents and occupiers of commercial properties in close proximity to the Project alignment.	CNVMP to require compliance with construction noise and vibration NZ standards, where practicable. CNVMP to outline measures to mitigate construction noise including hours of operation to be restricted for the use of heavy vehicles and loud construction machinery, or in some instances minimum setback distances from occupied buildings will be employed. Other general mitigation measures for noise and vibration will also be described in accordance with best practice. Further mitigation measures will be investigated where potential exceedance of noise standards has been identified (site specific construction noise management plan in accordance with the CNVMP). Proactive management of community liaison and communications.	Monitoring of noise and vibration as required by NZ standards or CNVMP	Designation: • Finalise and implement CNVMP (SEMP 003) – DC.16 to DC.20 • Appoint Communications Liaison Person – DC.4 • Require Communications Plan – DC.5 • Maintain Feedback Register – DC.38	Technical Report 9

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Operational traffic noise has the potential to cause disturbance to residents and occupiers of commercial properties in close proximity to the Project alignment.	Project design includes traffic noise mitigation where necessary. Methods to be employed are low-noise road surfacing (OGPA), and acoustic fences where necessary. Comprehensive design of the noise control measures will occur during the detailed design stage of the Project.	N/A	Designation: • Require implementation of the preferred mitigation options for road traffic noise (acoustic fencing and low noise road surfacing) – DC.21 to DC.24	Technical Report 8
Air quality				
Dust and fumes generated by earthworks and other construction activities has the potential to adversely affect air quality and amenity for residences within close proximity to the works (within 200m).	AQMP to outline mitigation measures which will include the use of dust suppression, water sprinklers and the stabilisation of areas liable to excessive dust. Stockpiling and spillage will be appropriately managed, as will the use and maintenance of construction vehicles. Access roads and working areas will be constructed from appropriate materials.	An air quality monitoring programme will be implemented to assist the control and management of construction dust discharges. This will be outlined in the AQMP.	Designation: • Finalise and implement AQMP (SEMP 001) – DC.14 & DC.15 Regional resource consent: • Finalise and implement AQMP (SEMP 001) – G.12 & G.13	Technical Report 10
Terrestrial ecology				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Disturbances from construction activities (in conjunction with habitat loss) may lead to lizard mortality or injury.	Survey extent of existing lizard populations. If lizards are present in numbers and locations which puts them at risk during construction a Lizard Management Plan shall be prepared to determine actions to minimise adverse effects, which may include a lizard recovery programme to capture and translocate affected lizard populations.	Monitoring as outlined in the Lizard Management Plan.	Designation: • Undertake lizard monitoring and prepare and implement Lizard Management Plan if required – DC.36	Technical Report 18
Construction activities and particularly heavy machinery presents an opportunity for problem weed species not currently present in the area to become established.	Water blasting of all machinery at a suitable facility prior to entry on site is proposed and weed monitoring.	Landscape Management Plan to outline weed monitoring requirements (monitor construction site over a period of two years to detect introduction of weed species and eradicate if required).	Designation: • Require water blasting of machinery – DC.37 • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30	Technical Report 18

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Bird, lizard and invertebrate habitat will be lost to accommodate on-off ramps and local road connections. The road may also obstruct movement of wildlife and pose a hazard to mobility of some species. This may result in a minor loss of ecological functionality at a local level.	Extensive landscape mitigation measures are proposed. This will include the planting of species that will enhance the ecological value and connectivity at a landscape scale. Restoration planting along the motorway may provide suitable habitats in time for other native wildlife. To minimise the loss of vegetation and damage to surrounding vegetation, the extent of clearance will be carefully managed in the Landscape Management Plan.	Lizard monitoring	Designation: • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30 • Lizard monitoring and prepare and implement Lizard Management Plan if required – DC.36	Technical Report 7 Technical Report 18
Freshwater ecology				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Potential sedimentation and contamination of surface waterways, including stockwater races, from stormwater discharge during construction which may adversely affect ecosystems.	The CEMP will contain comprehensive ESCP which shall outline erosion and sediment control measures to avoid contamination of waterways. The CEMP will include measures to address effects related to potential contamination during construction (e.g. fuelling stations, wash-down facilities and potential spills). All works to carry out diversions of stockwater races shall be completed off line and prior to flows being diverted to the new channel. Disturbed areas adjacent to water races to be stabilised and planted as soon as practicable following completion of works.	Monitoring as outlined in the ESCP.	Regional resource consent: • Finalise and implement CEMP which shall include hazardous substances management procedures – G.10 & G.11 • Finalise and implement ESCP (SEMP 002) – G.14 & G.15 • Diversions undertaken off line and completed prior to flows being diverted to the new channel – D.3 & D.6 • Stabilise adjacent disturbed areas upon completion of works – D.8	Technical Report 17 Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Potential habitat degradation and blockage of fish passage through physical disturbance and temporary closure of stockwater races during construction.	Care will be taken to ensure that construction works do not affect the passage of fish or cause stranding of fish in pools or channels. ESCP will contain measures to prevent sedimentation of waterways. All works to carry out diversions shall be completed off line and prior to flows being diverted to the new channel. All disturbed areas adjacent to water races will be stabilised and planted with suitable riparian margin vegetation.	N/A	Regional resource consent: • Finalise and implement ESCP (SEMP 002) – G.14 & G.15 • Diversions undertaken in a manner to prevent stranding of fish – D.2 & D.5 • Diversions undertaken off line and completed prior to flows being diverted to the new channel - D.3 & D.6 • Stabilise adjacent disturbed areas upon completion of works – D.8	Technical Report 17 Technical Report 7

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Stormwater run-off during operation may contain contaminants that can result in nuisance growths in water races.	Stormwater design will ensure appropriate treatment of stormwater runoff prior to discharge. Careful riparian planting will ensure that sediment and contaminants runoff does not reach the water races. Inspection and maintenance of stormwater treatment systems.	N/A	Designation: • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30 Regional resource consent: • Require treatment of stormwater prior to discharge – DP.8-DP.12. • Design of stormwater systems to meet specific requirements – DP.8 to DP.16 • Inspect and maintain stormwater systems – DP.17 to DP.21	Technical Report 17 Technical Report 7 Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Potential habitat modification as a result of water race piping, realignment and permanent closure.	Culverts will be designed and constructed to provide for fish passage and will not include steep drops or perched sections. During detailed design, provide for the inclusion of light wells, resting areas and baffles along the piped sections to assist with fish passage. Riparian planting will be carried out in consultation with SDC.	N/A	Designation • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30 Regional resource consent: • Design water race diversions to provide for fish passage – D.2	Technical Report 17
Stormwater and groundwater				
Adverse flooding and water quality effects from highway stormwater.	Adopt proposed stormwater design, which provides appropriate protection via the design standard applied in sizing the stormwater infrastructure (100 year return period) and appropriate swale and pond-based treatment, prior to disposal to land.	N/A	Regional resource consent: • Design of stormwater systems to meet specific requirements – DP.8 to DP.16 • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Failure of soak pits leading to progressive failure of individual elements in the Project and negative off corridor effects such as additional surface flooding in the Halswell catchment.	Development of field testing programme to confirm soakage rates of receiving ground should the detailed design vary from rates specified in Technical Report 3. Further full scale field testing at critical locations including sag points. Preparing an Operation and Maintenance Plan during detailed design for soakage devices.	As per Stormwater Operation and Maintenance Plan	Regional resource consent: • Require Stormwater Operation and Maintenance Plan – G.18 • Design of soak pits to meet specific requirements – DP.10	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Concentration of contaminants and sediments in stormwater first flush basins.	Use of specific soil parameters/ media to be used in construction of first flush filter media replacing percolation rates set in NRRP. Regular replacement of soakage filtration media.	Monitoring of soil contamination at disposal sites Monitoring of percolation through soil media to ensure these are similar to design rates	Regional resource consent: • Design of first flush basins to meet specific requirements – DP.11 • Inspection and maintenance of stormwater treatment systems – DP.17 to DP.21 • Monitoring of percolation through soil media – DP.22 • Monitoring of soil contamination at disposal sites – DP.23 & DP.24 • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Failure of stockwater race infrastructure to carry design flows across or adjacent to the Project due to modifications undertaken as part of the Project.	Development of management measures addressing each of the 9 stockwater races during the detailed design stage covering a) on going operation of the supply of water during and post construction, b) passage of flood and land drainage function of the races during and post construction, c) any deviation or alternative route, d) any consequential effect of spill from storm events, e) the construction of deviations to be completed off line before the new deviation is made live, f) limiting the time and occurrence to over pumping to emergency and limited period occasions (e.g. tie ins), g) ensure losses through base of new stockwater race similar to existing to manage overall loss to ground.	Inspect and maintain stockwater race siphons as per the Stormwater Operation and Maintenance Plan	Regional resource consent: • Design diversions of stockwater races to meet specific requirements – D.2 • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Overland flow paths impeded by the Project leading to additional flooding due to modifications made as part of the Project.	Consideration of the overland flow paths that are crossed by the Project alignment during detailed design, covering a) the assessment of interception of these flows on property upstream of the Project, b) the assessment of discharge beyond the Project area, c) how flow paths will be managed during construction, d) operation and maintenance of the siphon structure. Additional flow paths identified by detailed topographical survey will be managed and crossing points identified during the detailed design will be provided.	Inspect and maintain overland flow siphons as per the Stormwater Operation and Maintenance Plan	Regional Resource Consent: • Design overland flows to meet specific requirements relating to afflux – DP.13 • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Failure of individual elements in the stormwater soakage system affects users of the Project or causes negative off corridor effects such as additional surface flooding in the Halswell catchment during events of lesser magnitude than the critical 100 year storm event at Owaka Basin, Ponds adjacent to Meadow Mushrooms and Maize Maze Pond.	• Development of a Stormwater Operation and Maintenance Plan to consider the normal and emergency flow of all the stormwater pond structures in the vicinity. • Inclusion of a liner system that prevents the direct connection of surface water to land in the forebay section of the pond. • The design of the pond shall include a) an ability to receive and store the entire 24 hour 100 year storm runoff from the Project, b) an ability to draw down the level of the pond level following a large rain event and discharge this flow to the Upper Knights Drain or Montgomery's Drain. • A process for the controlled release of water from the Maize Maze Pond to the Halswell River system (including discussion with the ECan and the CCC).	N/A	Regional resource consent: • Design of ponds to meet specific requirements – DP.12 • Require Stormwater Operation and Maintenance Plan – G.18 • Require liaison with CRC and CCC prior to the controlled release of water to the Halswell River system – DP.26	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Robinsons Road overpass may be inundated by groundwater with the CPWES in place.	Design and implementation of the intervention system to lower groundwater levels. Development of a Stormwater Operation and Maintenance Plan for the pumping and disposal system.	Monitoring of groundwater levels at the site to establish the appropriate time for installation and commissioning of primary and secondary groundwater lowering systems.	Regional resource consent: • Require groundwater monitoring and annual reporting – GT.2 & GT.4 • Establish appropriate time for implementation of intervention strategy – GT.6 • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3
Dewatering to lower groundwater levels may have adverse effects on other groundwater users	Dewatering at Halswell Junction Road is gravity based and will not operate at levels lower than present. Dewatering at Robinsons Road overpass is via pumping and gravity. Pumping initiation is set by trigger levels, other wells cone of depression intercepting take will reduce dewatering.	N/A	No condition.	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Dewatering to lower groundwater levels may have adverse effects on the flow within surface waterbodies	Dewatering water will be discharged to water races or directly to Upper Knights Stream	N/A	Regional Resource Consent: • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3
Stormwater discharges may affect water quality of nearby groundwater wells/takes	Install new wells outside the zone of influence or relocate discharge points away from well	N/A	Regional Resource Consent: • Identify affected wells and either relocate discharge points or decommission existing well and install a replacement well – DP.14	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Groundwater mounding beneath the stormwater treatment ponds at Halswell Junction Road will affect the performance of the ponds	Design and implementation of the intervention system to lower groundwater levels	Monitoring of groundwater levels at the site to establish the appropriate time for installation and commissioning of groundwater intervention system.	Regional Resource consent: • Require groundwater monitoring and annual reporting – GT.3 & GT.4 • Outline trigger level for implementation of intervention strategy – GT.5 & GT.7 • Require Stormwater Operation and Maintenance Plan – G.18	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Progressive failure of individual stormwater elements in the Project design due to sediment and erosion effects.	Development of an Erosion and Sediment Control Plan for each work section along the Project covering a) clean and clear water diversions, b) diversion drains for sediment laden runoff, c) use of permanent swales and the ability to rehabilitate the swale to its final purpose during the construction process, e) specific disposal to land soak pits which are not to form part of the final soak pit system, f) methods to prevent discharge of sediment laden water off site or to land, g) cover the issues addressed in other plans such as overland flow path construction, stockwater race construction, existing bores/wells and the works required at each intersection, h) on-going maintenance requirements, i) disestablishment criteria.	Monitoring as required within the ESCP	Regional resource consent: • Finalise and implement ESCP – G.14 & G.15 • Design of erosion and sediment control measures to meet specific requirements – DP.1 • Inspection, maintenance and monitoring of erosion and sediment control measures – DP.4 to DP.6	Technical Report 3

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Effects on groundwater quality from bore installation	Bores to be installed in accordance with good practice. Concrete cap to be installed around well head works. Bore sealed to prevent fluid movement down casing.	N/A	Regional resource consent: • Construct in accordance with the New Zealand Environmental Standard for Drilling of Soil and Rock – BC.1 • Concrete pad constructed around the bore head to prevent leakage and any material or surface water entering the bore or annulus – BC.3 & BC.4 • Sealing of the exterior of each bore – BC.2	N/A
The installation of the pipe outfall in Upper Knights Stream may have effects on ecological and other values within the stream	The pipe shall be installed in dry conditions. The ESCP shall outline measures to prevent sedimentation of the waterway.	N/A	Regional resource consent: • Finalise and implement ESCP (SEMP 002) – G.14 & G.15	N/A

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Use and storage of hazardous substances may affect soil and water quality	The CEMP shall outline measures to avoid, remedy or mitigate the effects of the use and storage of hazardous substances during construction.	N/A	Regional resource consent: • CEMP to include measures to avoid remedy or mitigate effects of hazardous substance storage and use during construction – G.10 & G.11	N/A

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Excavation and deposition over an unconfined/ semi-confined aquifer may affect groundwater quality	Refuelling and fuel storage to be located away from excavation areas. Installation of erosion and sediment control measures around earthworks sites.	N/A	Regional resource consent: • No storage of fuel or refuelling within 50 metres of excavation and requirements for spill kits on site – E.4 & E.5 • Erosion and sediment control to prevent discharge of sediment and contaminants into the excavated land – E.3 • Open excavations that expose groundwater are to be closed with clean fill within 24 hours of the completion of construction – E.6	N/A

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Excavation of material may affect aquifer pressure	Follow procedures of AAIMP regarding sealing of aquifer and controlling flow and pressure. Ensure there is no seepage upon completion of backfilling.	Monitoring as required by AAIMP	Regional resource consent: • Follow procedures of AAIMP if aquifer intercepted – G.16, G.17 & E.1 • Ensure no seepage upon completion of backfilling – E.2	N/A
Natural hazards				
Seismicity in the region carries the risk of elevated PGAs (peak ground acceleration), ground shaking, ground rupture and liquefaction. This may result in displacement or damage at ground level.	The design will adhere to Standards that apply at the time of detailed design. This design standard will mitigate effects on the road and users in a seismic event.	N/A	No condition required. Addressed in design.	Technical Report 11
Flooding from impeded overland flow or failure of the stormwater system.	The design standard for the highway drainage system is the 100 year ARI rainfall event including an allowance for climate change.	N/A	No condition required. Addressed in design.	Technical Reports 3
Contamination				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Contaminant risk to human health and/or ecological values during land disturbance activities, and potential for hazardous materials to be discovered during construction resulting in human health risk (largely for workers).	Site management plan measures included in the CEMP relating to contaminated land risk, and associated monitoring and reporting, including the transport, disposal and tracking of materials taken away in the course of the activity (via the CEMP). If contaminant indictors are discovered in the construction zone, contingency action is included in the CEMP.	Monitoring as specified within the CEMP	SDC and CCC land use consents under Soil NES: • Require CEMP to address contaminated land – CL.7	Technical Report 16
Cultural impacts				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
The Project has the potential to adversely affect unrecorded sites of cultural significance or koiwi remains.	Implementation of the Accidental Discovery Protocol covering the NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast). Adoption of the Ngāi Tahu Koiwi Tāngata Policy 1993.	N/A	Designation: • Require implementation of Accidental Discovery Protocol covering the NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) – DC.32 • Require adoption of Ngāi Tahu Koiwi Tāngata Policy 1993 – DC.33 Regional resource consent: • Require implementation of Accidental Discovery Protocol covering the NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) – G.19 • Require adoption of Ngāi Tahu Koiwi Tāngata Policy 1993 – G.20	-

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
The Project has the potential to adversely affect water quality and aquatic ecological values, which are important to local iwi.	Landscaping of riparian areas and the design for stormwater treatment and management.	N/A	Designation: • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30 • Design stormwater treatment to meet specific requirements – DP.8 to DP.12	Technical Report 7 Technical Report 3
The Project could further erode cultural landmarks.	Installation of interpretation features to inform pedestrian and other non-vehicular users of the area of such things as Ngāi Tahu whānui traditional use of, and on-going relationship with the natural environment.	N/A	No condition required, will be addressed through direct consultation with iwi	-
Archaeology and built heritage				

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
There are no identified sites of archaeological significance affected by the Project. However there is the possibility that such sites have not yet been discovered, or identified.	Measures are proposed to ensure correct protocol is followed in the event of an accidental discovery of potential archaeological material. All contractors involved in earthworks will be briefed on the accidental discovery protocol and will receive training in the recognition of an archaeological site. As a precaution an archaeological authority will be obtained, which is likely to contain conditions relating to on-site briefing and the preparation of a management plan outlining proposed monitoring.	N/A	Designation: • Require implementation of Accidental Discovery Protocol covering the NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) – DC 32 Regional resource consent: • Require implementation of Accidental Discovery Protocol covering the NZTA New Zealand Regions 11 (Canterbury) and 12 (West Coast) – G.19	Technical Report 12
Economic				
Construction activity and traffic will cause temporary negative economic effects on some businesses in localised areas.	Measures to address identified routes and locations are detailed in the CTMP.	N/A	Designation: • Finalise and implement CTMP (SEMP 004) – DC.25 & DC.26	Technical Report 14

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Disruption of current dynamics for passing traffic to be aware of business offerings.	As part of detailed design, directional signs may be used to assist travellers in finding their way to specified economic hubs.	N/A	No condition required. Addressed in detailed design.	Technical Report 14
Social impacts				
Construction noise and vibration will cause disturbance to those living, working and gathering in proximity to the works.	Refer to "Noise and Vibration" above. Proactive management of these social effects will include community liaison and communication management.	Monitoring as required within the CNVMP	Designation: • Finalise and implement CNVMP (SEMP 003) – DC.16 to DC.20 • Require Communications liaison person – DC.4 • Require Communications Plan – DC.5 • Establish Community Liaison Group – DC.6	Technical Report 13 Technical Report 9
Disturbance to human health and nuisance caused by dust produced by construction.	Refer to "Air Quality" above.	As per AQMP	Designation: • Finalise and implement AQMP (SEMP 001) – DC. 14 & DC.15	Technical Report 13 Technical Report 10

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
The use of local roads for construction traffic may cause delays for people accessing community facilities (such as daycare or schools) and increase road safety concerns.	The CTMP will include measures to manage the adverse effects of construction traffic. Communication and liaison processes over the construction period will include parents of school children and other such affected people.	N/A	Designation: • Finalise and implement CTMP (SEMP 004) - DC.25 & DC.26 • Require Communication liaison person – DC.4 • Require Communications Plan – DC.5 • Establish Community Liaison Group – DC.6	Technical Report 13
Visual and amenity effects caused by the motorway and associated interchanges.	Refer to "Landscape and Visual" above.	N/A	Designation: • Finalise and implement Landscape Management Plan (SEMP 005) – DC.29 & DC.30	Technical Report 13 Technical Report 4

Actual or potential adverse environmental effect identified	Mitigation/ management measures	Monitoring	Condition proposed	Report name(s) / reference(s)
Operational noise may have an effect on the health and wellbeing of people living near the alignment.	Project design includes traffic noise mitigation where necessary. Methods to be employed are low-noise road surfacing (OGPA) and acoustic fences where necessary. Comprehensive design of the noise control measures will occur during the detailed design stage of the Project.	N/A	Designation: • Require implementation of the preferred mitigation options for road traffic noise (acoustic fencing and low noise road surfacing) – DC.21 to DC.24	Technical Report 8 Technical Report 10 Technical Report 13