INDICATIVE SITE SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN (SSEMP)

Upper Horokiri Stream Focus Area
(from Chainage 6500 to 8500)

This Document, that is in the form of an SSEMP, is one of a number that have been developed for key focus areas along the TG Alignment. The focus areas were chosen to be representative of the range of sites along the route and to have between them the full range of environmental management issues likely to be encountered during construction of the route.

The aims in producing these documents are to:

- Provide confidence in design;
- Provide an indication as to how works can be staged and programmed;
- Assist in assessing effects;
- Assist in developing mitigation strategies; and
- Assist in consultation with stakeholders regarding construction management issues.

The SSEMP for Horokiri specifically explores the following issues:

- Stream diversion, reclamation and formation of new freshwater habitat;
- Culvert installation and fish passage;
- Erosion and sediment control;
- Stormwater treatment;
- Mitigation; and
- General management of environmental issues in a listed stream.

The SSEMPS have been prepared using the best information available and are not intended to be final. They will be refined further during the specimen and detailed design stages and will be to relevant local authority as required by conditions.

July 2011
Version 5. FINAL

1 INTRODUCTION

This SSEMP relates to those construction matters that have potential or actual effects on aspects of the local natural and human environment.

It covers the upgrading of the existing farm access road, establishment of erosion and sediment control structures, installation of culverts, the formation of stream diversion, formation of a four lane highway including cut slopes and batter fills which sidles across steep faces, installation of a variety of stormwater treatment devices, and post construction landscape and mitigation planting. This SSEMP covers a length of alignment of approximately 2.2 kilometres of the upper Horokiri Stream.

Note that the CEMP contains generic details common to the route standard details and methodologies for a range of activities such as diversions, culvert installation, sediment and erosion control, monitoring and mitigation which are not repeated in this SSEMP.

This site specific management plan relates to those matters that are unique to this section of the alignment.

1.1 Consents

The following consents are relevant to this SSEMP

Consent	Condition
Greater Wellington Regional Council	
Porirua City Council	

The following activities relevant to this SSEMP are permitted.

Activity	Rule
Greater Wellington Regional Council	
Porirua City Council	

2 PREPARATION OF DOCUMENT

The draft SSEMP has been prepared by the following people:

Name	Organisation	Role
Peter Ward	NZTA	Project Manager
Mark Edwards	OPUS	Civil & Roading
Stephen Fuller	BML	Ecology
Craig Martell	SKM	Hydrology and Water Quality
Wade Robertson	Isthmus	Landscape

3 CONTACT DETAILS

NZTA

Position	Name	Organisation	Contact Details
Project Engineer			
Project Manager			
Site Supervision			
Site Environmental Management Auditor			
Project Ecologist			

CONTRACTOR

Position	Name	Organisation	Contact Details
Contractors Representative			
Site Supervisor			
Site Safety Supervisor			

4 PLANS

Drawings relevant to this SSEMP are attached and show the location of the proposed works and sediment control structures for Horokiri. The attached drawings are:

B1 General Arrangement Plan
B2 Construction Access Plan
B3 Landscape Plan
B4 Stream Diversion and Wetland
B5 Culvert Design H15
B6 Stormwater and Defender Detail
B7 Long and Cross Sections.

5 ENVIRONMENTAL CONSIDERATIONS

5.1 Erosion & Sediment Control & Stormwater Treatment

The area covered by this SSEMP falls within the wider watershed of Pauatahanui Inlet, the northern arm of Porirua Harbour. This harbour is recognised as nationally significant. It is the ultimate receiving environment for any discharges from site. Considerable care is therefore essential in the management of sediment and contaminants.

5.2 Stream Works

Horokiri stream and its tributaries are listed in the Regional Freshwater Plan, and their regional significance is recognised in the operative Regional Policy Statement. It is considered to be an important habitat for indigenous fish and has a high level of natural character.

There will be a major diversion of the Horokiri Stream in the vicinity of this SSEMP.

- Diversion HD3 at chainage 7150 to 7280

There will be a number of temporary culverts/fords installed in Horokiri Stream. All of these will require consideration of fish passage, and post construction reinstatement (see 7.7.1).

There will be three permanent culverts installed in tributaries of Horokiri Stream. Two of these require provision of fish passage (see 7.7.2).

- Culvert H15 at chainage 7400
- Culvert H16 at chainage 7675

There will be one bridge across Horokiri Stream. Care will be needed during its construction to protect the stream from contaminants and in particular the use of cement (e.g. for bridge construction), as this is toxic to freshwater fauna.

- Bridge 4 at chainage 8540

Care is also required in the management of sediment discharge to this stream.

5.3 Indigenous Fish

Horokiri Stream has a numbers of fish species present, several of which are threatened or at risk (banded kokopu, longfinned eel, and redfinned bully). During construction special attention needs to be paid to the protection of native fish within any section of stream being diverted or culverted.

5.4 Habitats / Flora / At Risk or Threatened plant species

Two sites have been identified within the SSEMP where consent conditions require best endeavours to minimise vegetation loss.

- Horokiri Stream Riparian Bush: Riparian vegetation on slopes below footprint at chainage 6500 to 6800.

A rare wetland plant is present in a wetland on river terraces above Horokiri Stream. A stormwater treatment pond and riparian revegetation is proposed in this area. The extent of the habitat of this plant needs to be identified and protected during construction.

- Horokiri Stream Wetland: Sphagnum wetland in valley floor at chainage 7500 to 7900.

The Horokiri Valley is relatively weed-free. Protocols for washing of earthmoving equipment, and for weed monitoring, are contained within the CEMP.

5.5 Terrestrial Fauna / At Risk or Threatened fauna species

No rare or threatened terrestrial fauna have been identified within this SSEMP site. However, locally important populations of lizards and indigenous invertebrates are present in boulderfield and scree habitat at several sites within the SSEMP area. These locations require confirmation prior to earthworks. Where this habitat lies beneath the construction footprint consent conditions require a capture and translocation process.

5.6 Landscape

There are no significant landscape issues for this SSEMP although the final form and landscape treatment of large cut batters and stabilised earth walls will require specific consideration. The primary mechanisms used include the design of batter slopes and benches; contouring of fill areas; and revegetation of all earth-worked areas.

5.7 Visual

There are no particular visual issues for this SSEMP.

5.8 Social & Amenity

There are no communities directly affected by works within this SSEMP

5.9 Historical & Cultural Sites

There are no known sites of historical interest or cultural significance within the area covered by this SSEMP. Accidental Discovery Protocols are contained within the CEMP.

5.10 Dust

Dust control is necessary to protect transmission lines, to assist with sediment management and stream protection, and to minimise construction effects on indigenous vegetation.

5.11 Noise & Vibration

No particular noise issues have been identified for this SSEMP.

5.12 Traffic

No particular traffic issues have been identified for this SSEMP.

5.13 Utilities

A number of Transpower towers are located within the designation and will need to be moved either in advance of the NZTA's roading project works or as part of the roading works.

5.14 Forestry

There is no exotic forestry within this SSEMP.

5.15 Restricted 'NO GO' Areas

There are no restricted areas within this SSEMP.

5.16 Water Abstraction

No water abstraction from streams is currently proposed within this SSEMP. Harvesting of treated water from sediment ponds for dust management may occur.

6 WORK PROGRAMME

6.1 Staging

The exact timing and construction staging is still to be confirmed. However, generally the construction process includes:

- Access track widening and installation of temporary culverts or other stream crossings.
- Establishment of Erosion and Sediment Control measures.
- Stream diversions including translocation and protection of flora and fauna.
- Enabling works
- Earthworks and construction of Reinforced Soil Embankments (RSEs).
- Bridge construction
- Re-vegetation of exposed earthworks areas (to be undertaken as work areas are completed).
- Pavement Works.
- Removal of Erosion and Sediment Control measures after agreement with GWRC.
- Complete installation of stormwater treatment areas.

6.2 Indicative Programme

This section provides an indication as to how the works can be staged and programmed. The works will be undertaken in a sequential manner from downstream to up, or sequential in time. All stream works will be completed prior to commencement of bulk earth works to form the haul road and main alignment. The haul road will be divided into four one kilometre sections. Two construction teams will be used to construct the haul road and bridges. The programme for the works could be as follows:

No.	Activity	Estimated Duration *	Preceding Activity
	ENABLING WORKS		
	Retire pasture and install new fencing	-	
1	Move Transpower towers	6 weeks	-
2	Install temporary culverts along existing access road	2 weeks	-
3	Upgrade existing access track formation	1 week	1
4	Carry out Stream Diversions in Horokiri Stream	2 weeks	1 & 2
	CONSTRUCTION WORKS		
5	Install culverts within proposed alignment.	3 weeks	1 & 2
6	Initial erosion and sediment control structures	3 weeks	5
7	Bulk earthworks chainage 6500m-8500m	6 weeks	6
8	Construct RSEs and bridges	10 weeks	6
9	Remove temporary culverts along existing track	1 week	8
10	Earthworks stabilisation (Progressively complete)	1 week	7 & 8
11	Pavement and surfacing works chainage 6500m-8500m	4 weeks	7 & 8
12	Remove and rehabilitate temporary sediment ponds	1 week	10 & 11
13	Form stormwater treatment devices	1 week	8
14	Carry out revegetation planting	2 weeks	10 & 11
	POST CONSTRUCTION WORKS		
15	Monitor and maintain revegetation.	Ongoing	All

* Unforeseen circumstances may result in re-programming of the above works. These changes will be discussed as necessary with regulatory authorities.

7 ENABLING WORKS

The following works will be carried out prior to bulk earthworks commencing:

7.1 Site Access

The existing farm access track which follows the valley floor will be used as a temporary construction access road during enabling works. It will require limited earthworks to widen and straighten sections to afford better access for construction plant. The location of these works is shown in SSEMP/B02.

Upgrade of these tracks will require the installation of up to 9 temporary culverts discussed below.

7.2 Traffic

No particular traffic issues have been identified for this SSEMP.

7.3 Noise

No particular noise issues have been identified for this SSEMP.

7.4 Site Clearance / Forestry

Depending upon the nature of the vegetative cover, the vegetation clearance method will vary. For pasture, no vegetation clearance will be undertaken, the grass will be considered to form part of the top soil, which will be removed and stored on site for use in re-vegetation works and mitigation planting. For areas covered in gorse or other shrubby vegetation the vegetation may be treated in the following fashion;

- Bladed off to form a wind row outside of the earthwork area.
- Mulched and then treated as top soil.
- Removed with topsoil to be used to revegetate areas.
- Removed and placed in a pile to decompose.

No forestry clearance is required within this SSEMP.

7.5 Laydown Areas

None proposed within this SSEMP.

7.6 Stockpile Areas

Where practical all topsoil will be stripped and stored separately for use in rehabilitation and revegetation. The top soil will be stored in windrows outside the immediate construction area or in a designated stockpile. The topsoil stockpiles will be established within areas where runoff can be intercepted and discharged away from the stockpiles. The topsoil stockpiles will be no greater than 3m high. The piles will be lightly compacted to reduce the potential for losses from wind erosion. Areas identified for stockpiling are:

- Chainage 6700m to the east of the alignment.
- Chainage 7600m to the east of the alignment.
- Chainage 7800m to the east of the alignment.

These locations are shown in SSEMP/B03.

7.7 Utilities

Within this SSEMP it is anticipated that transmission towers will need to be relocated. They are shown in SSEMP/B01. This work will be carried out by Transpower New Zealand Ltd. The following are identified:

Chainage	Reference	Comments
6900m	T17	Proposed new tower located approx 15m to the east of existing tower 17
7100m	T18	Proposed new tower located approx 20m to the east of existing tower 18

7.8 Fencing

Two sites have been identified for temporary fencing to provide protection during works. They are the Horokiri Stream wetland and Horokiri Stream Riparian Bush.

The location of the fence is to be decided by the Site Environmental Manager and fencing contractor. The fencing will be undertaken prior to any earthworks commencing.

7.9 Species Translocations

7.9.1 Terrestrial Fauna

Capture and translocation of lizards is required in several boulderfield habitats within the SSEMP. This work needs to occur in advance of bulk earthworks. A permit is required together with agreement from the Department of Conservation on appropriate translocations sites.

7.9.2 Fish

Immediately prior to any stream reclamation or diversion process, the section of stream to be reclaimed will be isolated by coffer dams or bunds, and any fish present will be safely captured for translocation by accepted methods as provided in the EMP (Appendix xx).

All fish that are captured will be transferred upstream to the nearest equivalent habitat to limit their exposure to any increased turbidity that is caused during the diversion or culvert installation process.

7.10 Stream Works

Work in the stream is required for the construction of culverts, fords, and stream diversions.

7.10.1 Temporary Stream Crossings

An existing farm access track will be upgraded to aid in enabling works. Within the length of this SSEMP there are 10 informal crossings of the stream. They are shown in SSEMP/B02.

Approx Chainage Main alignment	Comments
6430	Main channel
6570	Eastern tributary
6620	Main channel
7010	Main channel
7050	Main channel
7090	Main channel
7250	Main channel
7420	Main channel
8180	Main channel
8550	Main channel – to be replaced by Bridge 04

In these locations temporary crossings will be installed to reduce impacts of vehicles crossing the stream. These crossings may use temporary culverts or short span bridges. Standard design guidelines for these are [will be] provided in the CEMP. The final crossing method that is chosen for each site will comply with these guidelines.

If a culvert is used, the existing stream will be diverted during installation. The diversion works will be undertaken in accordance with the diversion procedures identified in the Wellington Regional Council's Erosion and Sediment Control Guidelines for the Wellington Region Dated September 2002.

7.10.2 Permanent Culverts

All culverts will be constructed either by installing a diversion around the work area and installing the culvert in the dry channel, or by constructing the culverts adjacent to the stream and then diverting water into the culvert on completion. In steeper catchments the diversion may be done using a pipe. Prior to using a pipe the project ecologist will confirm the use of this method will not adversely affect fish passage.

The locations of all culverts are shown in SSEMP/B01. Design calculations are provided in Technical Report 14. Culvert design for fish passage is shown in SSEMP/B04 and their locations are:

Chainage	Culvert Number	Type Of Fish Passage Treatment
7250	H14	None required
7400	H15	Fish passage design required
7675	H16	Fish passage design required

7.10.3 Diversions

There will be an approximately 130 metre diversion of the Horokiri Stream (HD3) from chainage 7050 to 7850. Details of the diversion are shown in SSEMP/B04.

7.10.4 Diversion Design Guidelines

A series of performance based guidelines have been developed for stream diversions in the Te Puka and Horokiri. These guidelines can be found in the Ecological Mitigation and Monitoring Plan.

The intent of the guidelines is for the new channel (diversion) to mirror, as closely as possible, the existing channels habitat, hydrology and geomorphology including:

- Ideal proportion of habitat types (pool, run, riffle, cascade, chute, waterfall, braid);
- Ideal proportion of substrate types in each habitat type (boulder, cobble, gravel, pebble, sand);
- Ideal water depths in each of the habitat types;
- Ideal total wetted areas in each habitat type; and,
- Maximum allowable water velocities in each of the habitat types.

7.10.5 Fish

Immediately prior to any stream reclamation or diversion process, the section of stream to be reclaimed will be isolated by coffer dams or bunds, and any fish present will be safely captured for translocation by accepted methods as provided in the Ecological Mitigation and Monitoring Plan.

All fish that are captured will be transferred upstream to the nearest equivalent habitat to limit their exposure to any increased turbidity that is caused during the diversion or culvert installation process.

8 CONSTRUCTION WORKS

8.1 Earthworks

During construction the area of earthworks open will be restricted, as much as is practicable, to the road corridor. Construction will be staged to reduce the area of earthworks open concurrently with progressive treatment including revegetation to limit erosion.

Generally, material cut from the western side of the alignment will be moved and placed to form the Reinforced Soil Embankments (RSEs). All surplus material within this section has been identified for re-use on the adjacent sections. It will either be stored at locations specified in 7.9 or transferred to adjacent areas for storage before use.

8.2 Cut & Fill Treatments

The final form and treatment of cut and fill batters has a significant bearing on both landscape and visual effects. In order to reduce the degree of these effects the following actions will be undertaken:

- Benches where practical will be spaced evenly except for the first bench which will be a minimum of 15m above finished road level.
- Faces will be left with a rough surface to facilitate vegetation growth.
- Tops and ends of cuts rounded off to reduce hard edges and potential erosion.
- Soil material will be left on benches to aid revegetation.
- Benches shaped to retain water where not detrimental to slope stability to facilitate vegetation growth.

Both cut and fill batters are to receive final revegetation treatment (see 8.5.2 – Revegetation below) at the earliest possible time following completion of construction provided this timing is conducive to vegetation growth. If the Site Environmental Management Auditor finds that conditions are not acceptable, an interim treatment (hydroseeded grass) will be applied and the final landscape treatment carried out at an appropriate time within the following year.

8.3 Bridges

One bridge is proposed for this SSEMP. Construction will require earthworks on the slopes above the streams being bridged, to allow for construction of piers.

Access roading which sidles across steep slopes will need to be managed to prevent erosion or mass wasting into the stream beds.

Use of concrete for pier construction will need to be managed to prevent cement discharge to the streams.

8.4 Erosion Control Measures

The primary construction methodology for mitigation against sediment release to the environment is targeted erosion control. In the Horokiri area this will involve the development of stepped slopes during earthworks, importing and laying topsoil, mulch or compost blankets, use of sprayed and bound straw mulch or hydro seeding. On steeper slopes rolled erosion control blankets or netting may be used, and if any particularly steep vulnerable slopes are worked, wire blankets or cellular confinement will be used to provide sufficient control.

The initial stage of earthworks primarily focuses on prevention of erosion during stream diversions. The following section describes the provisions for the control of works.

Erosion control in this section will focus on preventing the existing streams from eroding exposed materials during earthworks. Where possible, streams will be diverted during culvert construction so that the potential for erosion is minimised. If this is not possible, a coffer dam will be constructed and the stream will be piped during the culvert construction process. Due to the

steep terrain, care will be taken to make sure diversion or pipe outfalls are at low grades and / or are sufficiently protected so that downstream erosion is minimized.

Once the culvert construction is complete the streams will be directed through the new culverts, which will assist in preventing sedimentation during construction.

The diversion of the Horokiri Stream will be constructed offline from the stream, with a plug left in place until the majority of the diversion is complete. Ngati Toa will be involved in finalising the diversion design and to check the final construction. Once the new stream bed is adequately protected against erosion, the stream will be directed down the new watercourse and the old channel will be inspected for stranded fauna and these transferred to the new channel, plugged and then backfilled.

Clean water diversion bunds will be formed up-gradient of the earthworks areas prior to the bulk cut and fill required in the Horokiri area for road construction. Silt fences will be installed adjacent to each of the small streams.

Additional erosion control measures for the operation of the project include step structures down gradient of each of the culverts. These are intended to reduce the velocity of flow and therefore the erosion potential.

The following summarises the erosion control measures that are proposed to be used:

Approx Chainage	Element	Comment
7225, 7400 & 7650	Offline culvert construction	Where possible culverts will be constructed offline to prevent erosion potential. Once complete streams will be diverted through these culverts to channel water away from the earthworks during construction.
7225, 7400 & 7650	Coffer dam	Where diversions are not possible, coffer dams installed on existing streams while a new culvert is constructed, with water piped across the road alignment.
7050 to 7850	Clean water diversion bunds	Constructed around all aspects of the earthworks site where undisturbed land lies up-gradient. The diversion bunds will lead to existing small watercourses.
7150 - 7280	Stream diversion (HD3)	Create diversion channel with a plug left in place. Once protected against erosion, remove plug and divert watercourse. Dam old channel, clean out and backfill.
7225, 7400 & 7650	Step structures	Installed on the downstream side of the road to reduce velocities and prevent erosion.

8.5 Sediment Control Measures

During the second phase of earthworks, the first sediment diversion bunds / contour drains will be constructed to convey sediment-laden water to treatment devices. These are located in appropriate places down-gradient of small sections of earthworks. The chemically treated sediment retention ponds have been sized on the basis of 3% of the contributing catchment by area (see sediment calculations in the Appendix for further details).

Further chemically treated sediment ponds will be installed as needed, as bulk earthworks commence. Smaller areas will be treated with container sediment tanks (either one or two at each location), or earth decanting bunds, with the addition of flocculent.

During the final phase of work sediment ponds and tanks may need to be repositioned to suit the new contours and changing construction catchments. Sediment controls will remain in place until all earthworks are stabilised. Definitions of “stabilised” will be provided in the CEMP together with standard methodologies.

Indicative locations of these components are shown on SSEMP/B1. Calculations for sediment detention ponds are provided in Technical Report 15.

Chainage	Element	Comment
TBA	Sediment diversion bunds and channels	Installed down gradient of earthworks areas to direct sediment-laden water to silt ponds and sediment tanks
TBA	Silt fences	Installed between small streams and earthworks to prevent sediment laden water or dust entering the watercourses
6950, 7100, 7200,7350, 7450 & 7600	Sediment ponds	Located downstream of each discrete work area / catchment.
TBA	Sediment tanks or earth decanting bunds	Installation of either one- or two-tank systems to treat small volumes of sediment-laden runoff from diversion bunds
6950, 7100, 7200,7350, 7450 & 7600	Chemical treatment control sheds	Installation of chemical treatment sheds, adjacent to and for use in sediment ponds and sediment tanks

8.6 Stormwater Treatment Devices

A constructed wetland has been chosen for the capture and treatment of road runoff within the Horokiri SSEMP area. Due to the constraints of the road in this section it has not been possible to combine the wetland with grassed swale conveyance as part of a treatment train process, as has been done with the other wetlands in the alignment. Details of the wetland and planting treatment are provided in Volume 5. Area calculations are provided in Technical Report 15.

8.7 Revegetation

Following completion of bulk earthworks restoration planting will be carried out as per plan SSEMP/B06. The treatments will be:

Site	Current Vegetation	Method
HK1	Pasture on slopes	Revegetation
HK2	Pasture adjacent to streams	Riparian Planting
HK3	Shrublands and open scrub	Enrichment planting (interplanting)
HK4	Advanced regeneration	Retirement (no planting proposed)

8.8 Water Abstraction

No water abstraction from streams is currently proposed within this SSEMP. Harvesting of treated water from sediment ponds for dust management may occur.

8.9 Quarrying

No aggregate sourcing will occur outside the road footprint within this SSEMP.

8.10 Dust Control

Selections of the following controls are to be deployed as required, on the construction sites.

- Water (water cart irrigation), provides good short term solution. Caution is required to avoid erosion from over application of water. All areas identified as dust sources including roads are to be kept dampened during dry weather periods to minimise public nuisance from windborne dust.
- Chemical adhesive sprays, provide longer term solutions to small areas which aren't able to be treated by water such as hill slopes or long term stock piles.
- Wind fences, are good for small areas and may be appropriate to be used in this location.

- Mechanical treatment, such as slopes rolled with mulch or aggregate provide effective control for wind erosion. However, these can't be used in active work areas, so require careful planning for installation.
- Cover blankets for stock piles.

Where dust control is identified as a specific issue, an investigation by the Construction Supervisor into the cause will be required. When the cause has been identified the specific controls can be applied to the problem area(s).

8.11 Transporting of Materials

There are also risks from the delivery and removal of materials from the sites. All materials transported to and from the sites will need to be assessed for the risk of dust release during transit. Where the load is identified as being a potential dust nuisance such as crushed concrete or topsoil, etc, then the load may need to be covered or dampened down prior to transporting.

Care will also be required to ensure that weeds are not imported with materials such as aggregate or topsoil, or on delivery trucks.

The Construction Supervisor will be responsible for keeping a record of:

- Date and time of movement;
- Transport provider;
- Material moved on and off site;
- Potential for dust release;
- Actions taken to control the material.

9 RE-INSTATEMENT

Re-instatement works will entail the removal of temporary culverts placed along the construction access track. The stream channel will be reinstated to a form that reflects the existing characteristics of the stream on either side of the culvert. This may involve revegetation works as well as topographic correction.

10 TRAINING

Within this SSEMP site, all contractors will receive a full briefing on the environmental considerations including avoidance of NO-GO sites, recognition of habitats of significant species, and timing of ecological and water quality monitoring.

11 MONITORING

The monitoring will be undertaken in accordance with the procedures outlined in the CEMP. Some of the aspects that will monitored in this SSEMP site will be erosion and sediment control devices, freshwater quality, aquatic habitat quality, macro-invertebrate health, fish passage, revegetation success, weeds management.

11.1 Erosion & Sediment Control (ESC) Devices

Performance monitoring of the proposed ESC devices is intended to ensure that they operate as designed and that their performance is maintained over the lifespan of their use on the project.

The discharges from the site works and the proposed treatment devices will enter watercourses throughout the catchments. The following monitoring of the receiving environment is proposed to check whether the effects of the discharges are as anticipated.

Monitoring of erosion and sediment control measures will be, as follows:

Control Measure	Routine Inspection	Wet Weather And Incident Inspections	Inspect For	Performance Measures	Management Action	Reporting
Control and retention of disturbed soil at earthwork sites (Improve Soil Health)	Weekly	During heavy rain (Q10 event) and after all rain	Soil loss Rill erosion Surface water flow pathways	Retention of soil	Rectify any erosion or channel formation Re-grade surface as required	Inspection, outcomes and management action in site log
Provide Short Term Soil Cover	Weekly	When rainfall predicted through weather monitoring. After all rain	Surface water pathways / erosion	Design specifications	Undertake straw mulching Hydro seeding	Inspection, outcomes and management action in site log
Provide Long Term Soil Cover	Weekly	During heavy rain (Q10 event) and after heavy rain (Q10 event)	Damage / erosion Growth of plantings (including gaps)	90% cover or stabilised	Rectify and repair damage to blankets/netting Replant gaps/dieback	Inspection, outcomes and management action in site log
Steep Slope Techniques	Weekly till 90% stabilised (i.e. 90% gassed or equivalent)	During heavy rain (Q10 event) and after heavy rain (Q10 event)	Damage / erosion Growth of plantings (including gaps)	Design specifications	Rectify and repair damage to blankets/netting Replant gaps/dieback	Inspection, outcomes and management action in site log
Clean water diversion bund	Weekly	During heavy rain (Q10 event) and after all rain	Damage / erosion Blockages Sediment build-up	Design specifications	Rectify any damage / erosion or blockages Remove accumulated sediment in diversion channel.	Inspection, outcomes and management action in site log
Rock check dam	Weekly	After all rain	Damage / erosion Blockages Sediment build-up	Design specifications	Rectify any damage / erosion or blockages Remove accumulated sediment behind dams when 50% full	Inspection, outcomes and management action in site log
Pipe drop structure/ flume	Weekly	After all rain	Damage / erosion Blockages	Design specifications	Rectify any damage / erosion or blockages	Inspection, outcomes and management action in site

Control Measure	Routine Inspection	Wet Weather And Incident Inspections	Inspect For	Performance Measures	Management Action	Reporting
						log
'Pinned' Silt socks or gravel check dams	Weekly	During heavy rain (Q10 event) and after heavy rain (Q10 event)	Damage / erosion Sediment build-up	Design specifications	Rectify and damage / erosion or blockages Replace/ repair gaps	Inspection, outcomes and management action in site log
Sediment Retention Pond	Daily	After all rain. During heavy rain (Q10)	Sediment build up	Measure depth of sediment versus pond volume	Remove sediment when 20% full	Inspection, outcomes and management action in site log
			Damage/ Function of the decants/ Level Spreaders / Fore bay	Design Specifications	Rectify any damage / blockages to fore bay	Inspection, outcomes and management action in site log Advise GWRC within 24hrs of significant damage and management actions
Chemical treatment System	Weekly	After all rain. During heavy rain (Q10)	Damage, low dosing supply	Design Specifications	Rectify any damage or blockages. Replace flocculent	Inspection, outcomes and management action in site log
Sediment Fence / Silt Socks	Weekly	After all storm events (Q2-Q10)	Sediment build-up	Measure depth of sediment versus fence height	Remove sediment when 20% of height occupied	Inspection, outcomes and management action in site log
			Damage/ erosion/ water bypass	Design Specifications	Rectify any damage / erosion. Relocate devices to deal with bypass	Inspection, outcomes and management action in site log
Decanting Earth Bund	Weekly	After all rain events During heavy rain (Q10)	Sediment build-up	Measure depth of sediment versus pond volume	Remove sediment when 20% full	Inspection, outcomes and management action in site log
			Damage/ erosion Blockages	Design Specifications	Rectify any damage / erosion or blockages	Inspection, outcomes and management action in site log Advise GWRC within 24hrs of significant damage and management actions

Control Measure	Routine Inspection	Wet Weather And Incident Inspections	Inspect For	Performance Measures	Management Action	Reporting
Stormwater Inlet Protection	Weekly	After all rain	Damage/ erosion Blockages	Design Specifications	Rectify any damage / erosion or blockages	Inspection, outcomes and management action in site log
Works in watercourses	Weekly	After all rain	Visual release of sediment into the water above that envisaged for works	Documented method for works	Investigate source of sediment and rectify works/modify method	Inspection, outcomes and management action in site log

12 REPORTING

No reporting above and beyond the requirements of the CEMP are required for this SSEMP section.

13 APPENDIX - CALCULATIONS

13.1 Earthworks Quantities

EARTHWORKS CATEGORY	AREA (m^2)	QUANTITY (m3)
Earthworks cut from 6500 – 8500m	18,300	673,000
Earthworks structural fill required from 6500 – 8500m	25,000	315,000
Earthworks excess cut from 6500 – 8500m	-	357,000

13.2 Proposed Fill Sites

None proposed within this SSEMP

13.3 Chemically treated Sediment Retention Ponds

The sediment retention pond size has been calculated on the basis of 3% of the contributing catchment (by area), with a further 10% of this storage volume for the fore bay.

Chainage	Catchment Area (Ha)	Pond Size (M^3)	Pond Number	Comments
7600	5630	170	211	1.3m deep, 19m x 47m
7450	5730	175	212	1.3m deep, 20m x 48m
7350	5180	155	213	1.3m deep, 19m x 46m
7200	6860	210	214	1.3m deep, 20m x 51m
7100	6920	210	215	1.3m deep, 20m x 51m
6950	2520	80	216	1.3m deep, 18m x 38m

13.4 Culverts

Calculation summary for culverts are as follows.

Chainage	Pipe Reference	Pipe Diameter (Mm)	Indicative Gradient (M/M)	Catchment (Ha)	Q10 Design Flow (M3/S)	Height Below Pipe Soffit In Q10 (M)	Q100 Design Flow (M3/S)	Height Below Road Level In Q100 (M)
7225	Ho14	600	1 to 50	3	0.30	0.0	0.52	1.2
7400	Ho15	1200	1 to 50	15	1.19	0.2	2.22	0.6
7650	Ho16	1050	1 to 21	15	1.11	0.3	2.10	1.2

13.5 Stormwater Treatment Devices

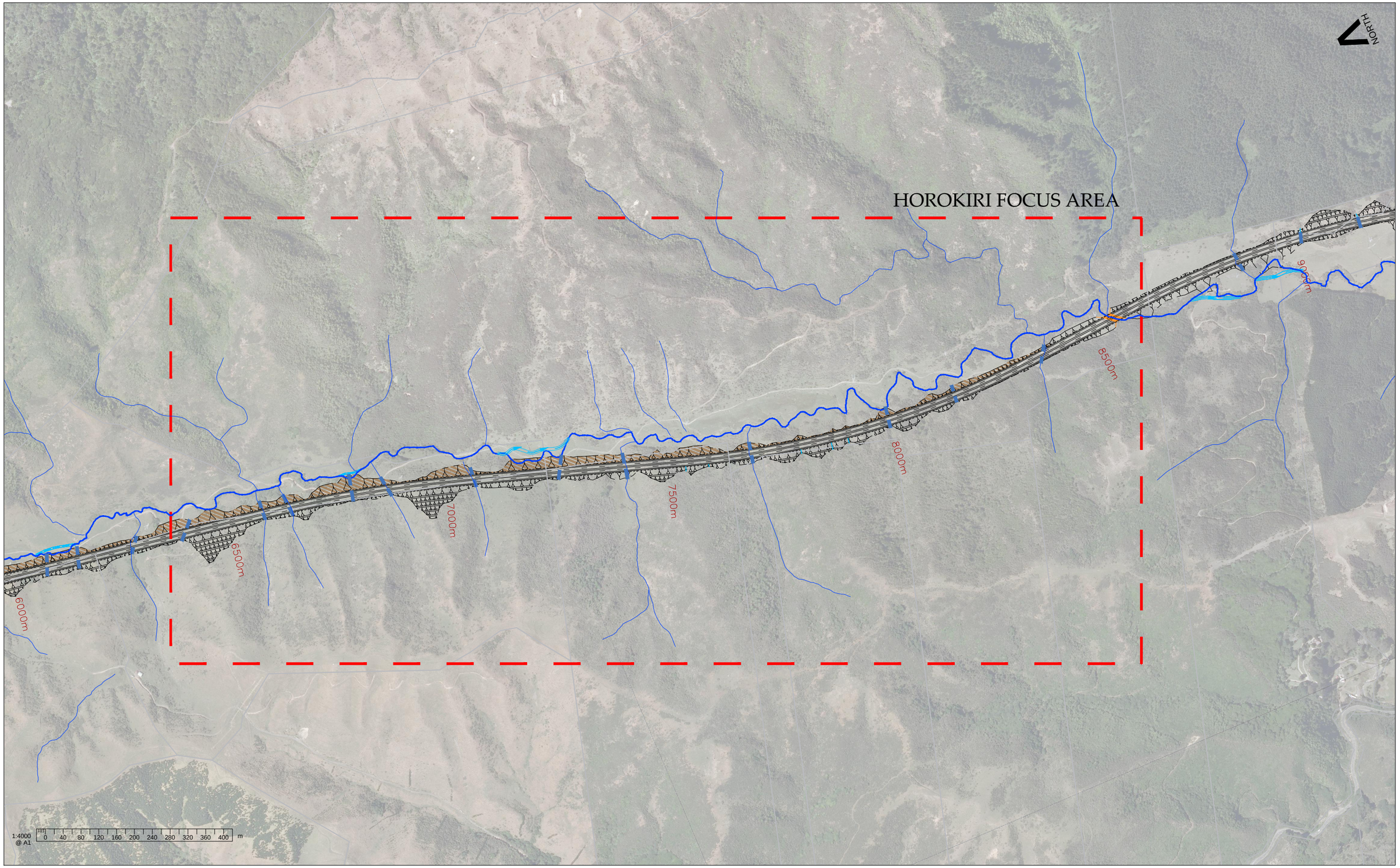
There is one stormwater treatment pond for the capture and treatment of road runoff. The catchment size and size of proposed stormwater treatment devised is as follows:

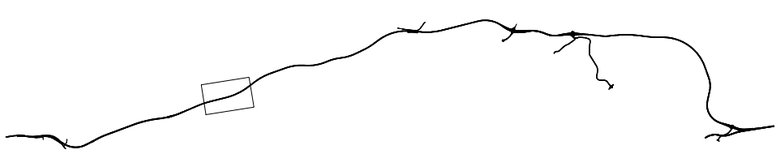
Chainage	Device Number	Catchment Area (Ha)	Type Of Treatment	Comments
5500 to 7550	W4	5.25	Wetland	Surface area of 1980 m2 26m x 78m

13.6 Minimising extent and effects of Earthworks

Since the original designation was put in place, significant design changes have occurred within this section to reduce the construction impacts on the Horokiri Stream. The result is the volume of earthworks cut material has increased and a small reduction in the amount of fill material required. The surplus material within this section has been identified for re use on the adjacent sections.

SAR (Oct 2008)		CONSENTED (Mar 2011)	
CUT	FILL	CUT	FILL
204,000	393,000	673,000	315,000





Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

Title.
Site Environmental Management Plan
Upper Horokiri
General Arrangement Plan

Status. For Consenting

Sheet. No. SSEMP/B1

Version No. A

Plot Date 03.03.2011

NORTH

STOCKPILE AREA

STOCKPILE AREA

PROPOSED WETLAND

STOCKPILE AREA

6500m

7000m

7500m

8000m

8500m

EXISTING ACCESS TRACK

TEMPORARY TRACK FOR CONSTRUCTION

PROPOSED TRACK AFTER CONSTRUCTION

TEMPORARY CULVERTS

1:2500 @ A1

0 40 80 120 160 200 240 m

Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

Title.
Site Environmental Management Plan
Upper Horokiri
Construction Access Plan

Status. For Consenting

Sheet. No. SSEMP/B2

Version No. A

Plot Date 03.03.2011

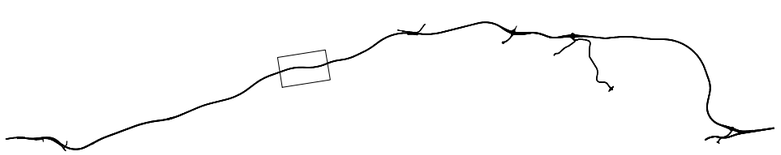
NORTH

15A
16A
17A
18A
6500m
7000m
7500m
8000m
8500m

PLANTING KEY

- AMENITY PLANTING
- TREE GRID - KAHIKATEA
- KANUKA CORRIDOR
- STREAM RESTORATION
- CUT / FILL FACE + FILL SITE VEGETATED
- CUT / FILL FACE + FILL SITE GRASSED
- ENRICHMENT
- RETIREMENT/PROTECTION
- EXISTING DESIGNATION MITIGATION PLANTING
- VISUAL MITIGATION PLANTING

1:2500 @ A1 — 0 40 80 120 160 200 240 m



Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

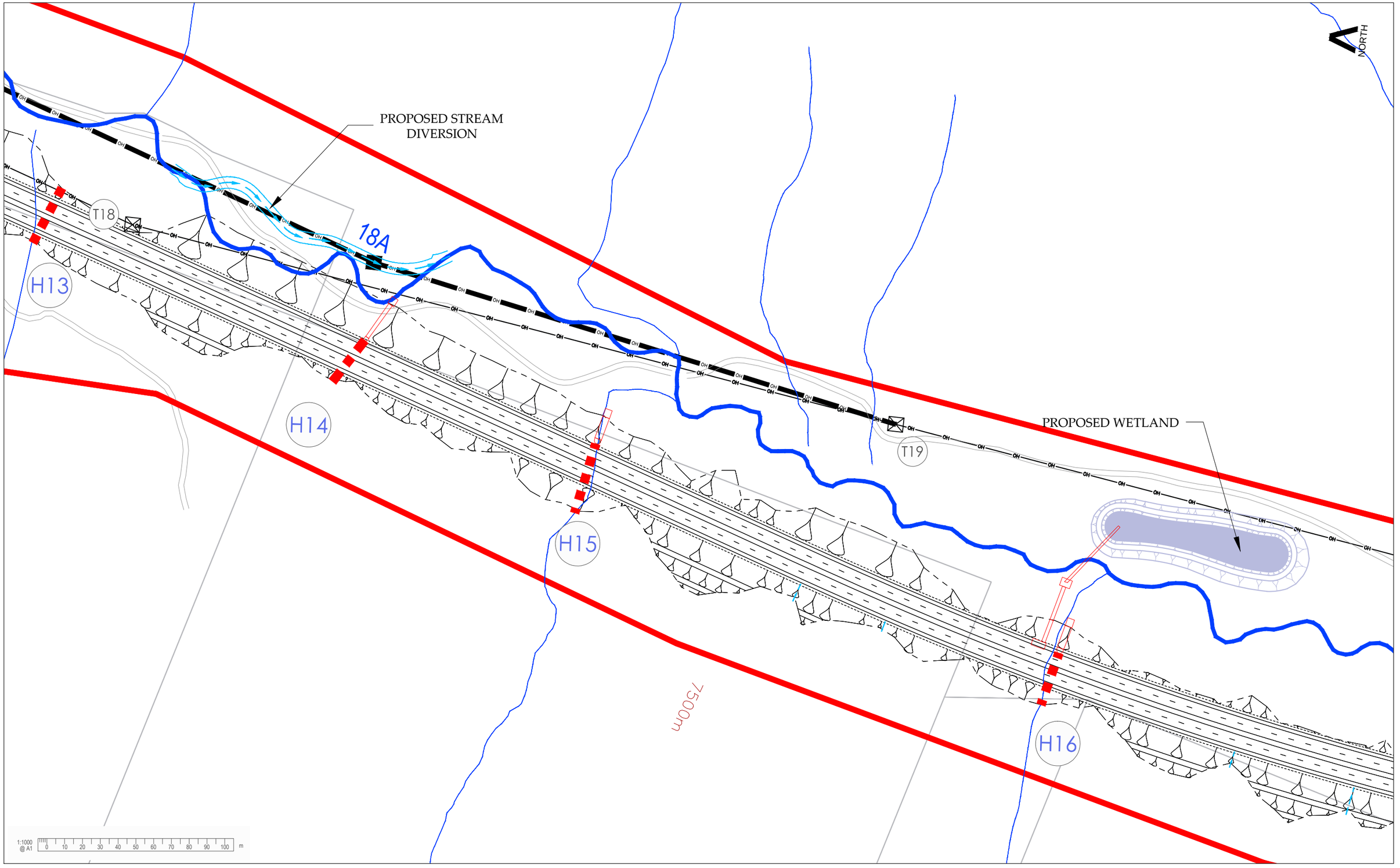
Title.
Site Environmental Management Plan
Upper Horokiri
Landscape Plan

Status. For Consenting

Sheet. No. SSEMP/B3

Version No. A

Plot Date 03.03.2011



Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

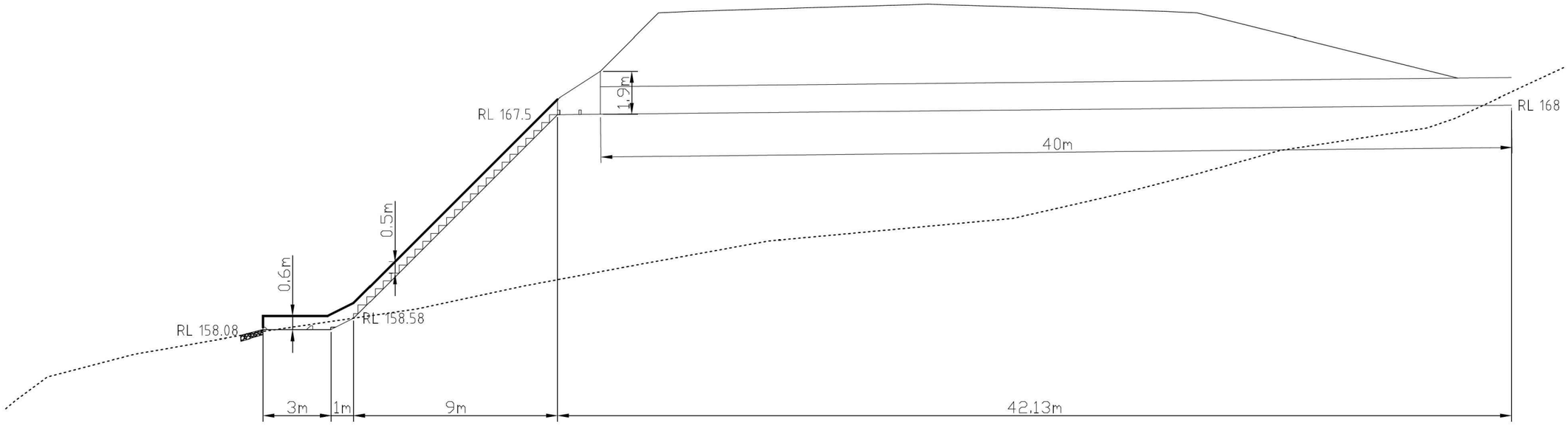
Title.
Site Environmental Management Plan
Upper Horokiri
Stream Diversion & Wetland

Status. For Consenting

Sheet. No. SSEMP/B4

Version No. A

Plot Date 29.07.2011

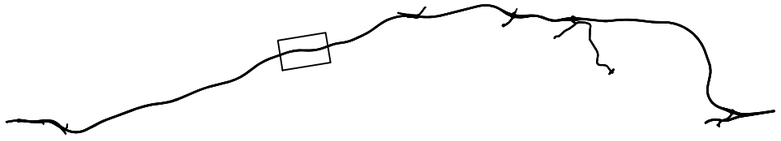


HOROKIRI 15 CULVERT CROSS-SECTION

DESIGN PARAMETERS

CULVERT	LENGTH= 40m SLOPE = 1% DIAMETER = 1200mm Q_{100} = 2.26m^3/s
WINGWALL WITH ENERGY DISSIPATORS	END WIDTH = 4.0m
STEP DROP-DOWN STRUCTURE	OVERALL DROP IN HEIGHT = 9.3m SLOPE = 1:1 CHANNEL WIDTH = 4m STEP HEIGHT = 0.35m STEP LENGTH = 0.35m ENERGY DISSIPATION EFFICIENCY = 82%
TYPE III USBR STILLING BASIN	LENGTH = 3m WIDTH = 4m

1:100 @A1 0 1 2 3 4 5 6 7 8 9 10 m



Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY WAKA KOTAHI

Project. TRANSMISSION GULLY PROJECT

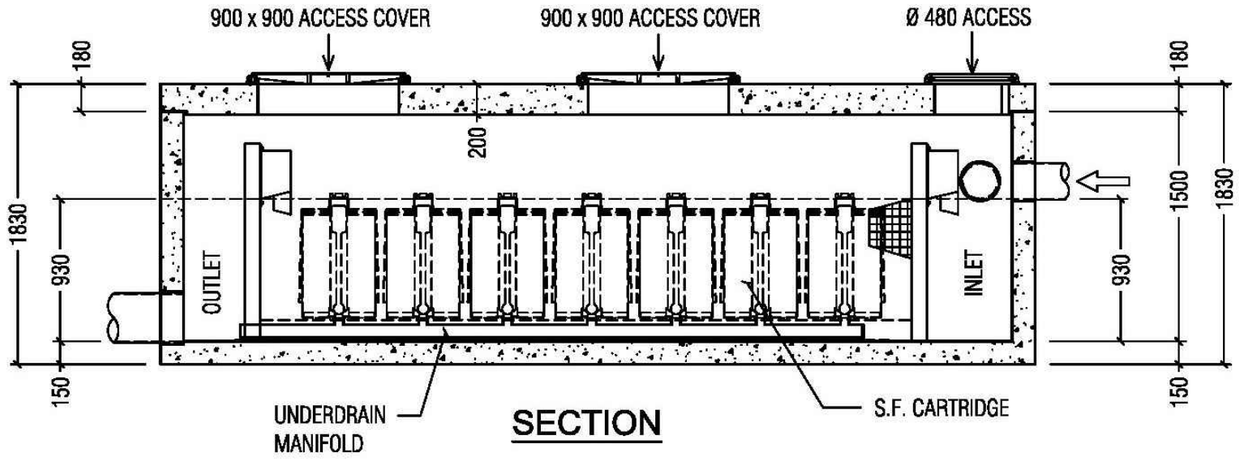
Title. Site Environmental Management Plan
Upper Horokiri
Culvert Design H15

Status. For Consenting

Sheet. No. SSEMP/B6

Version No. A

Plot Date 03.03.2011



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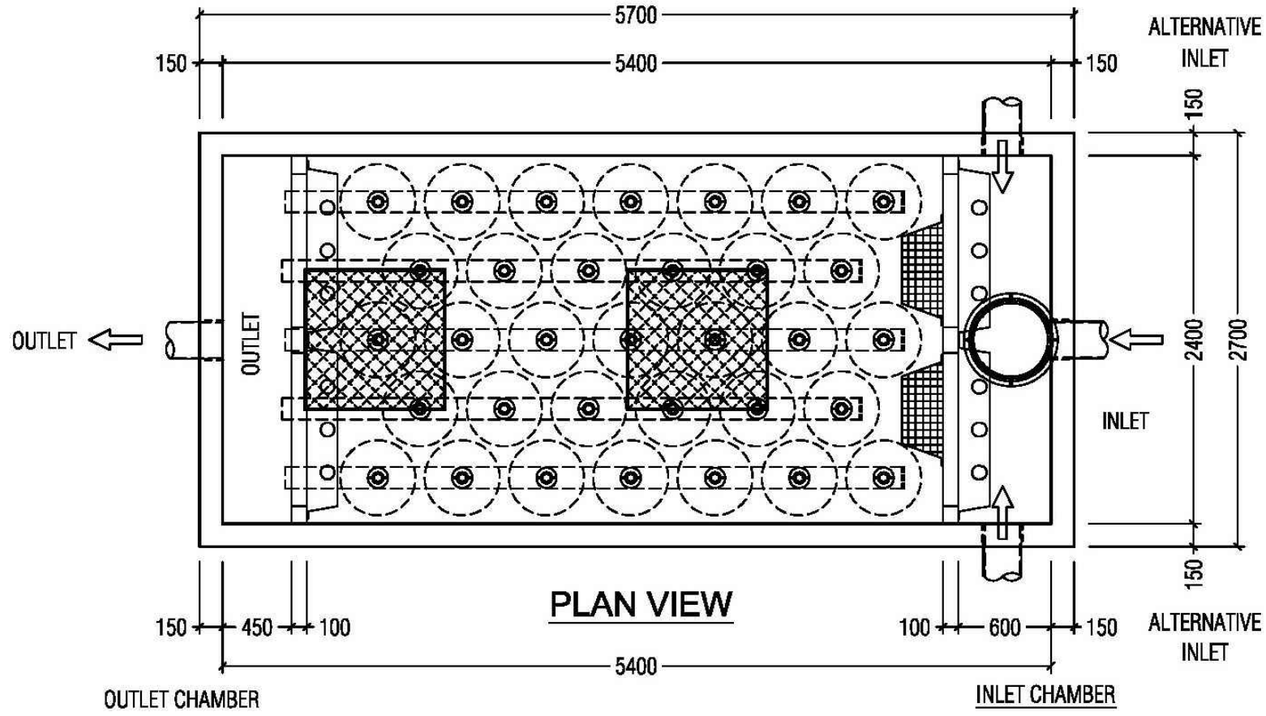
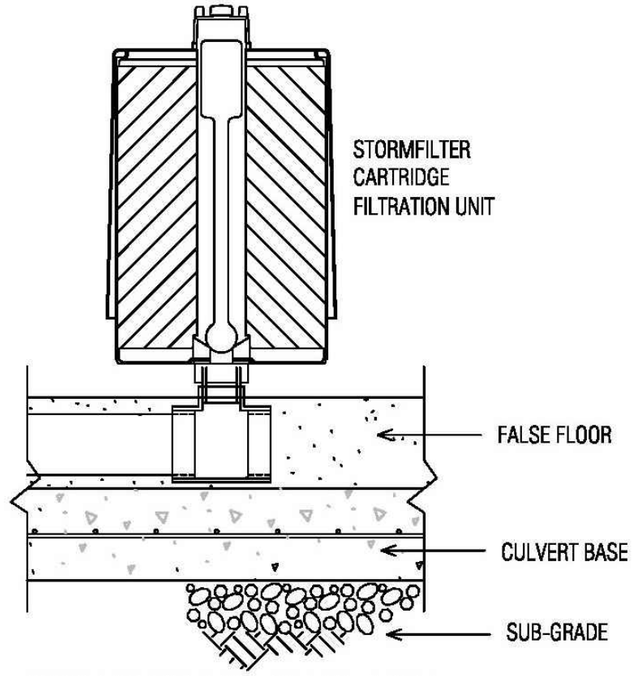


PLAN VIEW



CHAMBER FALSE FLOOR

NOTE

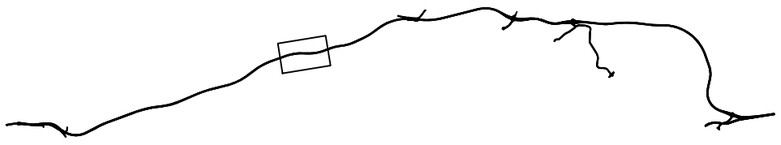
SIZE AND CLASS OF PIPE OR SQUARE KNOCKOUT SIZE TO BE SPECIFIED ON DRAWING BY CLIENT.

ACCESS RISERS TO BE FORMED ON SITE BY CONTRACTOR IF REQUIRED.

CONCRETE CONSTRUCTION TO NZS 3109

DETENTION TANK VOLUME = 1.86m3
MASS OF PIT = 19.7 TONNES
MASS OF LID = 6.8 TONNES

1:20 @ A1 — 0 200 400 600 800 1000 1200 1400 1600 1800 2000 mm



Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

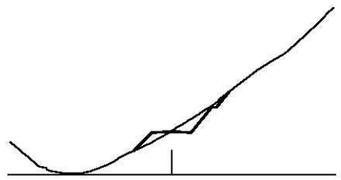
Title.
Site Environmental Management Plan
Upper Horokiri
Stormwater and Defender Detail

Status. For Consenting

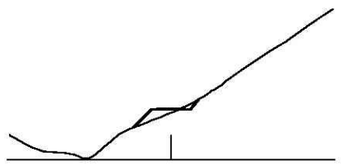
Sheet. No. SSEMP/B7

Version No. A

Plot Date 03.03.2011



6500m



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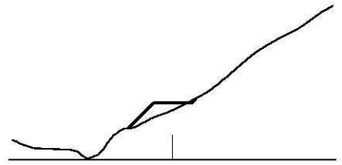

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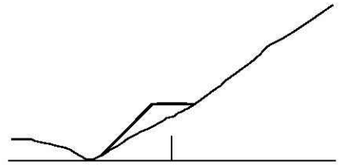

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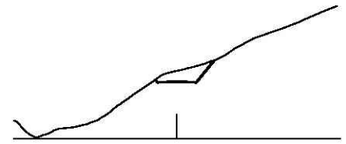

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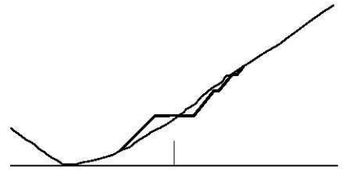

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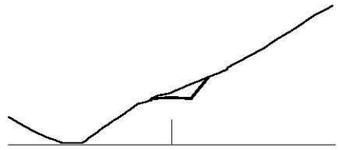

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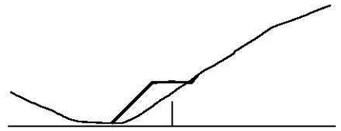
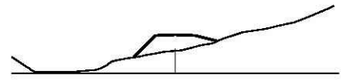


7200m

7300m



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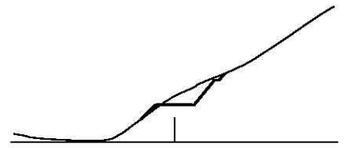

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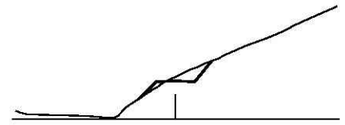

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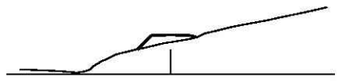

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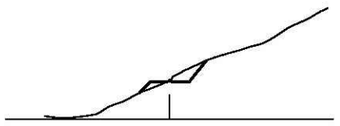

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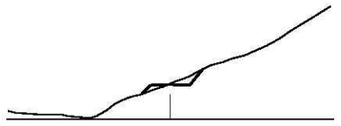

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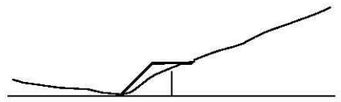

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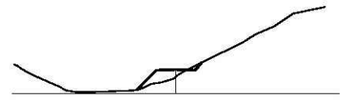

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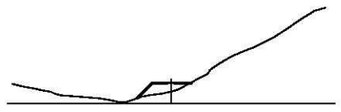

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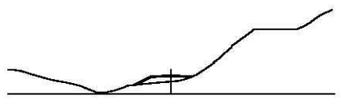

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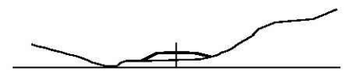

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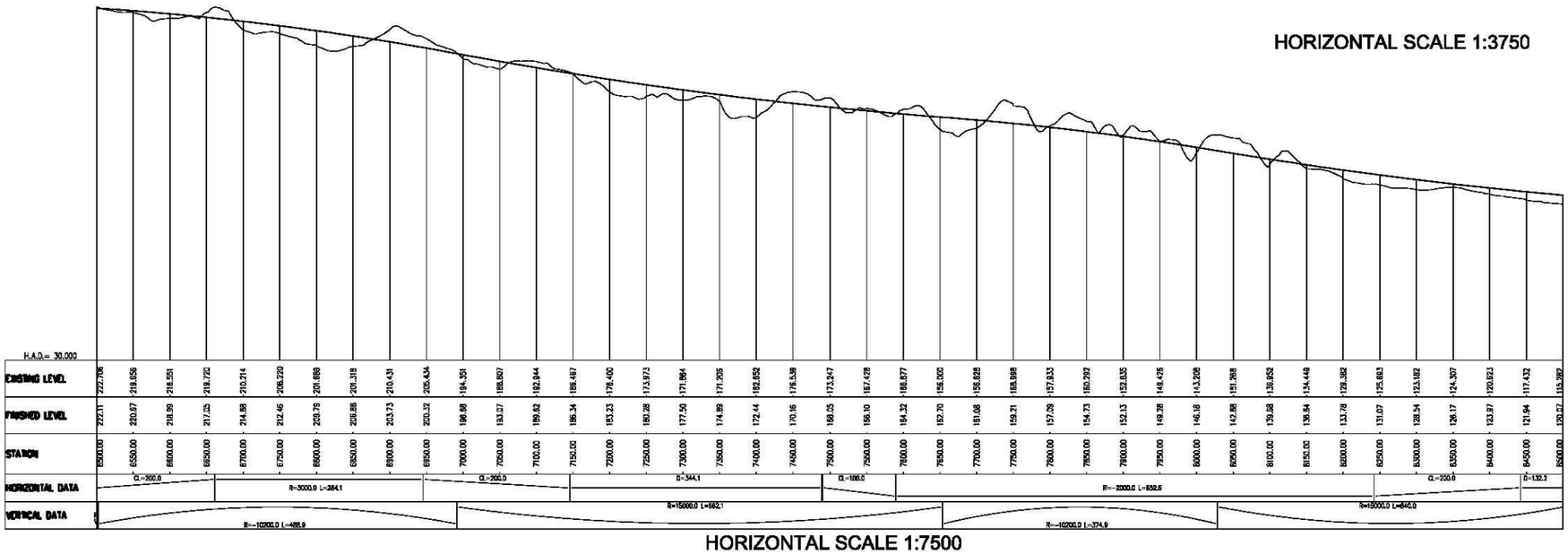

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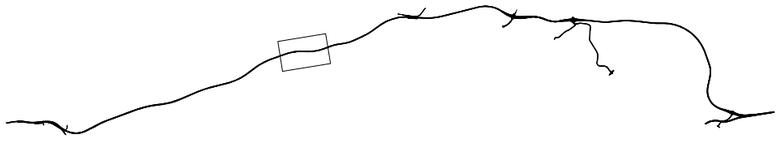

Revision	Amendment	Approved	Date

NZ TRANSPORT AGENCY
WAKA KOTAHI

Project.
TRANSMISSION GULLY PROJECT

Title.
Site Environmental Management Plan
Upper Horokiri
Long and Cross Sections

Status. For Consenting

Sheet. No. SSEMP/B8

Version No. A

Plot Date 03.03.2011