APPENDIX D

Waitarere Beach Road Curves Project
Erosion and Sediment Control Plan

Prepared for The New Zealand Transport Agency

November 2015

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BUILDING A BETTER WORLD

QUALITY STATEMENT

PROJECT MANAGER	PROJECT TECHNICAL LEAD
Jon England	Phil Peet

PREPARED BY		
Stephen Molineux		09/07/2015
CHECKED BY		
Grant Shearer/Steve Kerr		09/07/2015
REVIEWED BY		
Nick Keenan		09/07/2015
APPROVED FOR ISSUE BY		
Jon England		09/07/2015

WELLINGTON
Level 14, 80 The Terrace,
Wellington 6011, New Zealand

TEL +64 4 381 6700, FAX +64 4 381 6739

REVISION SCHEDULE

Rev No	Date	Description	Signature or Typed Name (documentation on file).			
			Prepared by	Checked by	Reviewed by	Approved by
A		For consent application	S.Molineux	GS	NK	SK
B	09/09/15	Receive NZTA feedback	S.Molineux	GS	NK	SA
C	18/11/15	Revised Option	S.Molineux	NK	NK	SA

CONTENTS

APPENDICES

1 Introduction

This document has been prepared as a summary of the controls required during the construction stage for the Waitarere Beach Road Curves project (The Project) and to support the a Notice of Requirement and resource consent application. A location plan showing the proposed reconfiguration is included in Appendix A.

The drainage and geometric design for the Project is currently in the preliminary design phase. The erosion and sediment control plan (ESCP) measures proposed in this report are to be reviewed prior to construction.

Adopting the design approach set out in this report will avoid or mitigate the adverse effects of sediment and erosion during the construction phase of the Project.

1.1 Site Description

The Project is part of the North of Otaki to north of Levin section of the Wellington Northern Corridor Roads of National Significance (RoNS) programme. The Project area is approximately 7 km north of the centre of Levin.

The disturbed area over the worksite is approximately 12.2 hectares in total. While much of the Project area is relatively flat and previously used for livestock or crops, there are also several sand dunes located mainly between Paeroa Road and Waitarere Beach Road. The predominant surface geology is sand and peat (See Appendix C, Volume 2, in the notice of requirements documentation).

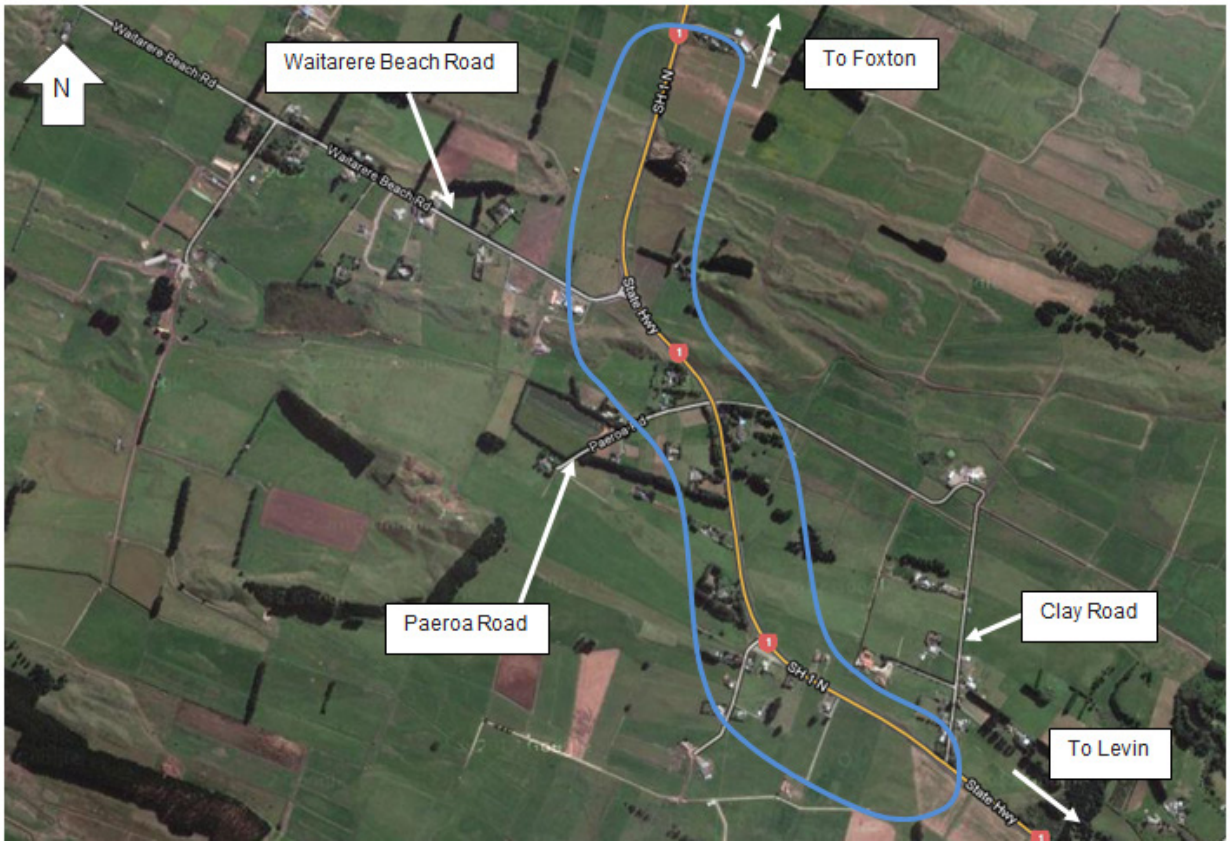

Figure 1-1: Project Area location plan (excludes Poroutawhao School Area)

1.2 ESCP Objectives and Description

The objectives of the ESCP are to achieve the proposed road improvements in this section of State Highway 1 (SH1) whilst safeguarding the downstream receiving environments by appropriately managing the potential the effects of land disturbance activities such as increased sediments in rainfall runoff during the construction phase.

The proposed changes in the road environment include:

- Replacing the three existing curves with two curves;
- Increasing the radii of the curves to improve the alignment of the road;
- Widening the highway cross section to provide a median strip and wider shoulders (tapering in to connect to the sections of highway outside the project area);
- Providing a wire rope median barrier within the median strip;
- Providing wire rope barriers on the outer edge of the hard shoulder (this does not include across private accessways);
- Improving the layout of, and visibility at, the Waitarere Beach Road/SH1 intersection;
- Improving the layout of, and visibility at, the Clay Road/SH1 intersection; and
- Closing the Paeroa Road intersection with SH1, and connecting Paeroa Road by a parallel road to a new intersection with SH1 further to the south, at the curve north of the Huia Marae access.

The Project area includes earthworks in the vicinity of Poroutawhao School, where minor road widening is proposed.

The Project will require significant earthworks due to the undulating topography. Improvements to the stormwater management will also be made with roadside swales and stormwater retention ponds at key locations and the installation of new culverts for the realigned sections and the upgrade of existing culverts where the existing SH1 alignment will be retained. The preliminary phase drainage design is provided in the stormwater design report in Appendix C of Volume II, and the drainage layout and other plans in Volume III of the Notice of Requirement documentation.

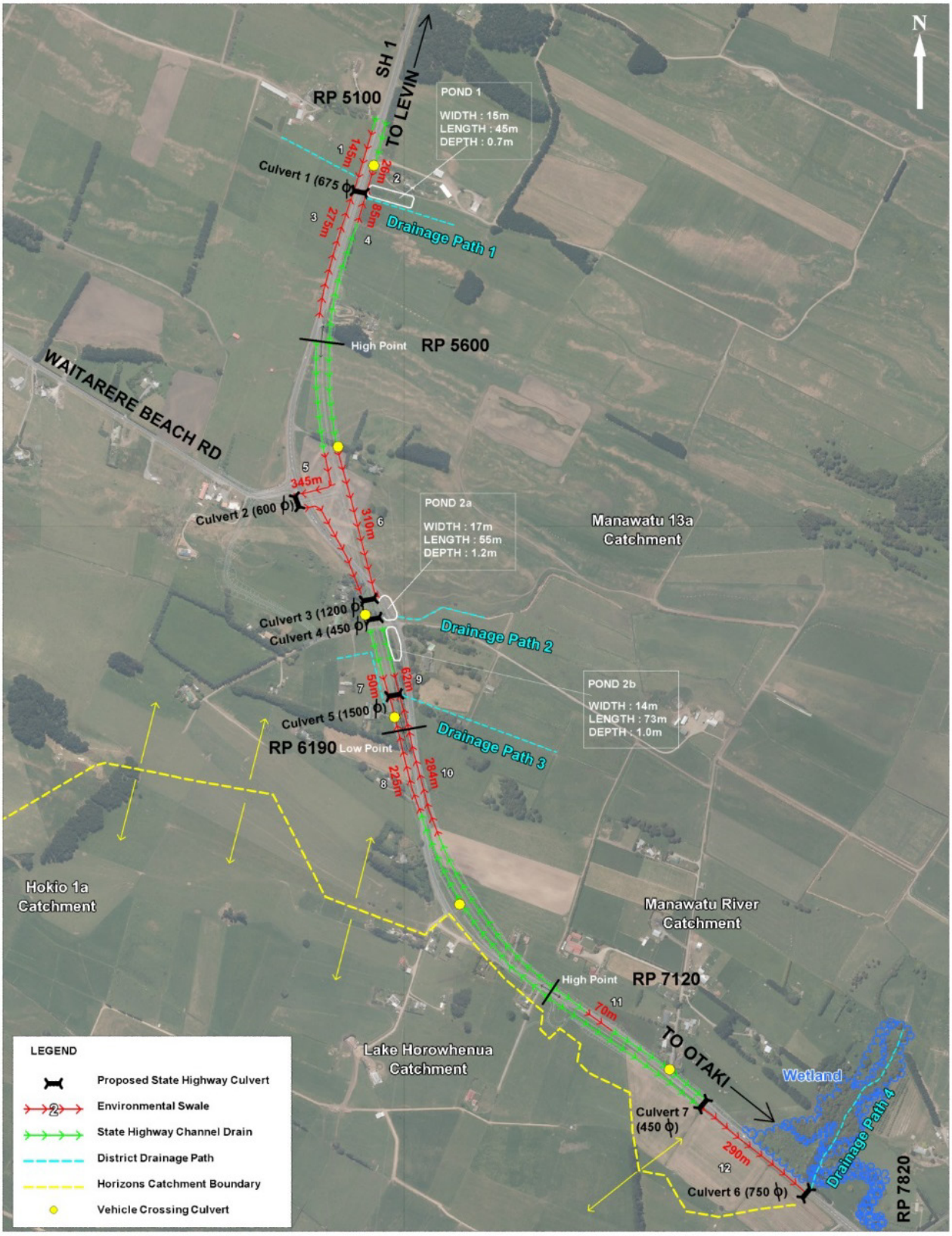

Figure 1-2: Preliminary Phase, Drainage Design Summary as at September 2015

1.3 Approach

The Horizons Regional Council erosion and sediment control measures refer to the Greater Wellington Regional Council (GWRC) document entitled 'Erosion and Sediment Control Guidelines for the Wellington Region (2002)' (hereafter referred to as "the Guidelines")[1]. This ESCP has been developed with reference to the standard details, approaches and objectives within the Guidelines.

The proposed control measures consist of runoff diversion channels, silt fences and sediment retention ponds. The proposed measures are dictated by the area and topography of the disturbed area.

The sediment control measures outlined in this document indicate a potential workable plan. The final or exact location and size of the sediment and erosion control measures will be confirmed prior to construction once a contractor has been appointed and the construction methodology has been finalised.

Controls are expected to be reviewed and improved by the contractor according to the soil conditions present on site and the proposed construction methodology. Additional or alternative measures may need to be considered as more detailed information is made available.

All erosion and sediment control measures will require on-going maintenance throughout the construction period and should be monitored and inspected during and after significant rainfall events. All sediments collected by the sediment control structures should be disposed of at an approved location. The locations of the proposed sediment control measures are shown on the 'Sediment Control Layout Plan' (C450) in Appendix A.

1.4 Receiving Environments

The natural Manawatu surface water hydrology is complex and dynamic. The landform has been shaped by wind and flooding processes, as well as extensive human modification with the locality's conversion into pastoral farming. The drainage and watercourses in the area are dominated by the grid pattern of farm drains. The low lying peat areas are affected by rises in the water table which results in ponding at various times[2].

The Waitarere Curves project area straddles the high ground between two main catchments and this is identified in Horizon's One Plan Surface Water Management Zones and Sub-zones[3] These catchments are "Mana_13a" and "Hoki_1a" and are shown in Figure 1-3. The drains and streams in the project area within Mana_13a eventually flow through a network of farms drains and modified streams to the Manawatu River and those within Hoki-1a flow through farm drains and modified streams to Lake Horowhenua.

The watercourses or streams that are affected by the project work are shown in Figure 1-4 to Figure 1-7. The southern end of the project re-joins the existing State Highway adjacent to a remnant wetland area identified as Drainage Path 4. ESCP measures have been considered to protect this wetland receiving environment.

The ecological assessment undertaken for the Project shows the receiving environment has native fish and potentially lizard life forms in the immediate area (see Appendix G in Volume 2 of the Notice of Requirement documentation).

[1] See definition of ESCP, Glossary, Horizons One Plan, 2014

[2] Horowhenua District Plan. Section 2.

[3] Schedule A of Manawatu Whanganui Regional Plan ('The One Plan').

Figure 1-3: Drainage paths and catchment areas

Table 1-1: Summary of the primary streams and drains

#	Chainage	Flow Condition	Description
Drainage path 1	5240	Dry	Artificial dug drain. Small swale upstream (west) of SH1 widening to a wider drain east of SH1 (refer to Figure 1-4). Non-stable bed and banks
Drainage path 2	6160	Dry U/S Flowing D/S	Artificial dug drain upstream (west) of SH1. Natural stream downstream of SH1 (refer to Figure 1-5). Non-stable bed and banks
Drainage path 3	6240	Flowing	Modified natural stream through farmland upstream and downstream (refer to Figure 1-6). Non-stable bed and banks
Drainage path 4	7820	Flowing	Modified natural stream through Kahikatea swamp forest (refer to Figure 1-7). It is considered to be stable bed and banks

Figure 1-4: Drainage path 1: downstream of Section 1 – northern extent of project

Figure 1-5: Drainage path 2: downstream of Section 2 –north of Paeroa Rd/SH1 intersection

Figure 1-6: Drainage path 3: downstream of Section 3 –south of Paeroa Rd/SH1 intersection

Figure 1-7: Drainage path 4: Wetland downstream of Section 4 – southern extent of project (outside project boundary)

2 Earthworks Methodology

2.1 Programming

The works are to take place on SH1 and therefore maintaining the traffic flow along the highway is critically important. Accordingly, it is expected that the appointed contractor will construct the greenfield sections (those areas outside the SH1 corridor) of the realignment first. In this way disruption to the existing highway traffic will be minimised (though temporary speed restrictions and temporary traffic management measures will be necessary). The greenfield sections account for the majority of the project length, other than at the tie-backs to the existing highway at either end of the works, and two crossings of the existing highway.

It is expected that the appointed contractor's strategy for undertaking the works at the project extents will involve reducing the width of traffic lanes temporarily to allow half the width of the works to be constructed whilst traffic uses the other half of the road. The traffic should be switched over to the other lane when half of the lane width is completed and allow the remaining half to be completed. This approach may include the construction of temporary road alignments within the designation as required to move vehicles safely around construction zones.

Due to the need to maintain traffic flows through the site, there will be times where traffic is transporting sediment outside of the area of works. The contractor will monitor this and undertake appropriate cleaning as required.

2.2 Earthworks Volumes and Stockpiling

The earthworks for this project will involve moving in the order of a total of 151,000 m^3 of material, based on a computer generated 3D roading model of the project works. The material to be moved is estimated as follows:

- Topsoil stripping (cut): 17,000 m^3.
- Cut to fill: 33,000 m^3.
- Cut to waste: 90,000 m^3.
- Imported material: 11,000 m^3.

It is expected that a number of stockpiles will be required as part of the earthworks. Stockpile locations are yet to be determined. The contractor will outline appropriate erosion and sediment controls for these stockpiles once the locations are confirmed. It is expected each stockpile should be surrounded with a silt fence and/or bund, and hydro seeded or covered with mulch where appropriate.

Generally, stockpiles should be located in flat open areas away from open water courses, overland flowpaths, wetlands and existing vegetation. The ecological assessments will identify any particular areas that are likely to be important to local wildlife and hence become areas or locations to avoid the placement of stockpiles. The height and shape of the stockpiles will be considered to minimise risks of instability, dust generation, and poor vegetation take, where required.

2.3 Establishment of the ESCP

The initial establishment of the ESCP will be undertaken before heavy construction commences. The installation of all ESCP measures will likely be staged over the course of construction as appropriate to the work methodology. In particular, minimising dust and potential dune 'blow out' will be necessary in the sandy and windy environment, and additional control measures are likely to be required including placement of straw mulch and water carts to dampen dust, depending upon the soil conditions uncovered and the construction timing.

All permanent works, which are likely to be constructed early in the programme, may need to be protected from sediment laden flows by placing additional control measures to separate these areas from areas yet to be stabilised.

The contractor is likely to need to construct two culverts prior to undertaking the bulk roading earthworks. The culverts requiring forward installation are located at either end of catchment zone 7 as identified on drawing C450 in Appendix A. Installation of these culverts will allow clean water flow paths to be maintained through the worksite and live traffic flows on SH1. This avoids the requirement for attenuation or over-pumping at these locations. Super silt fences will be installed within the stream bed downstream of the culvert during installations.

3 Erosion and Sediment Control Measures

The following section describes the types of erosion and sediment control measures most likely to be relevant to this project. Further details are provided in sections 4 and 5 of the Guidelines.

3.1 Runoff Diversion Channel

The runoff from the earthworks area can be collected by a contour drain, which in turn drains into a diversion channel to collect the sediment-laden flows and channel them into sediment retention ponds as shown in Appendix A

Runoff diversion channels are expected to be typically constructed to have an overall width of 3m, a base width of 1, side slopes of 1 in 3 and a depth of 0.61m, unless otherwise indicated on the layout plan. Generally, channels should be designed to provide a freeboard of 300mm for channel gradients of 1 in 500 and steeper. The channels will be formed either by excavation of the channel alone or by forming a bund on an existing slope. Where slopes exceed 2% or where excessive erosion is present the channel will be stabilised using geofabric and benched slopes.

All channels are to be designed to an AEP (annual exceedance probability) of 5% with a longitudinal fall of 1:500m and a Mannings coefficient of 0.04. For details on runoff coefficients and catchment flows refer to Appendix C, Volume 2 of the Notice of Requirement documentation.

In events larger than a 5% AEP storm event, the freeboard allowance within channels will convey the additional flow to the sediment retention ponds. It is expected that the additional flow will cause the sediment retention ponds to overflow via their emergency spillways and discharge sediment laden material into the surrounding environment. This occurrence is, by definition, rare, and of low probability over the duration of the works. Such a large, rare, event is not expected to be catered for with the ESCP measures proposed here. Figure 4-1 shows an indicative basic cross section of the channel (Figure 1 in the Guidelines).

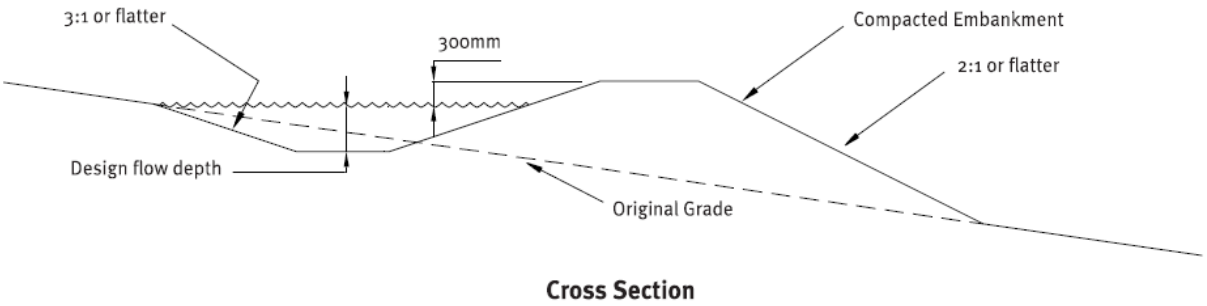

Figure 3-1: Runoff Diversion Channel Detail (Figure 1 in the Guidelines)

3.2 Clean Water Diversion Bund

Runoff from the catchments adjacent to the working area is to be diverted by a clean water diversion bund, to allow the clean water flows to be separated from the sediment laden flows inside the works area and therefore not require treatment in a sediment retention pond.

All clean water diversion bunds should be constructed to a height that will provide adequate capacity for the catchment runoff and a freeboard of 300mm for gradients of 1 in 500 and steeper. As with the runoff diversion channels, stabilisation will be required for all slopes over 2% gradient. Figure 3-2 below shows an indicative cross section of the clean water diversion bund (Figure 2 in The Guidelines).

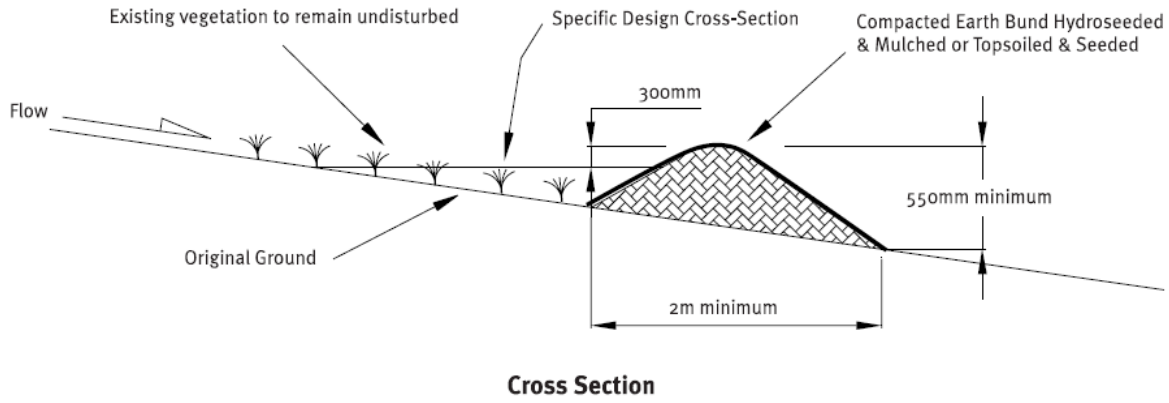

Figure 3-2: Clean Water Diversion Bund Detail (Figure 2 in the Guidelines)

3.3 Contour Drain

The runoff from within the earthworks area may need to be collected by a contour drain to collect the sediment-laden flows and direct them towards the diversion channels. While no contour drains have been specified these may need to be implemented as part of the ongoing sediment control review the contractor will be regularly undertaking.

All contour drains will be constructed to have a maximum gradient of 2%. The channels will be constructed by excavating the drain and forming a small bund on the downhill edge of the drain.

The method of channel construction and appropriateness of location will be confirmed on site during construction. Figure 3-3 below shows an indicative cross section of the channel or bund.

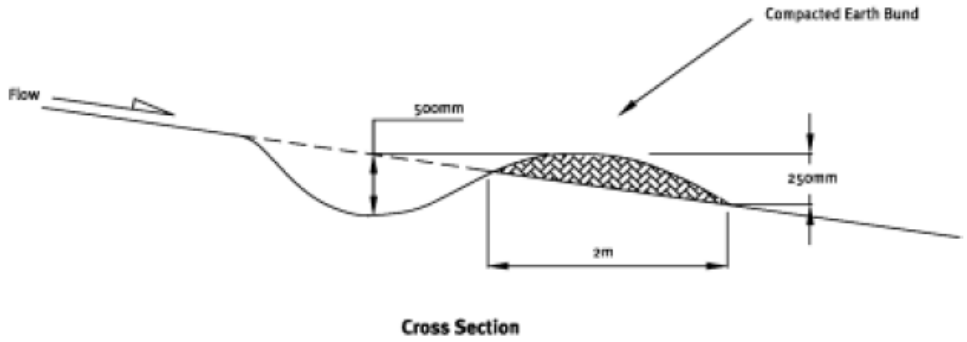

Figure 3-3: Runoff Diversion Channel and Runoff Diversion Bund Detail (Figure 3 in the Guidelines)

3.4 Silt Fences

Silt fences will be erected in appropriate locations to reduce sediment from catchment runoff within the project construction area. This will filter the majority of the water borne particles and debris from the runoff. Silt fence post spacing and catchment size will be determined in accordance with Figure 20 in the Guidelines. A typical cross section is shown in Figure 3-4.

Silt fences will be installed at the boundary of the earthworks areas where the natural runoff from the area does not flow towards the sediment retention pond or where runoff diversion bunds are unviable.

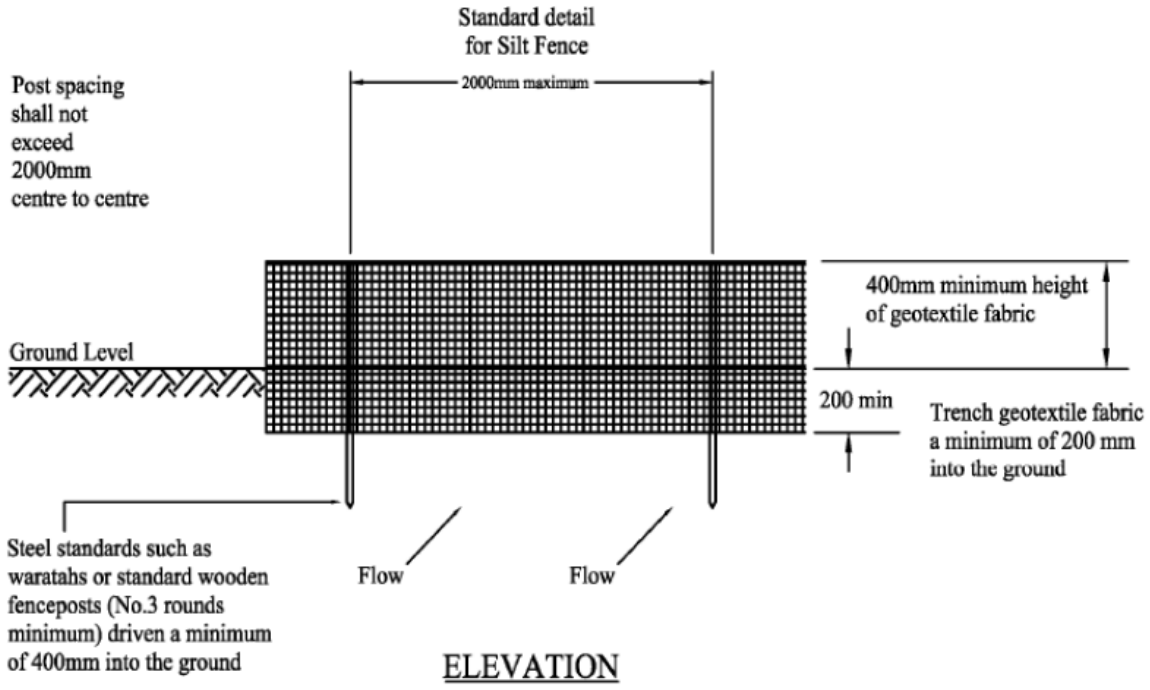

Figure 3-4: Silt Fence Standard Detail
(Figure 20 in the Guidelines)

3.5 Sediment Retention Ponds

Sediment retention ponds will be constructed to treat sediment-laden runoff for all catchments greater than 0.3 hectares. The ponds will be sized according to the associated catchment area.

Sediment retention ponds will include a sediment forebay area separated from the main pond by a timber weir level spreader. The outlet should consist of a floating T-bar dewatering device and the pipework should discharge to a nearby watercourse. An emergency spillway approximately 4m wide protected by a pinned needle geotextile will also be required. A typical sediment retention pond detail is shown in Figure 3-5 (Figure 12 in the Guidelines).

Discharge from the sediment retention ponds should be visually monitored by the Contractor daily and periodically by the Engineer. Should the discharge be deemed inordinately cloudy or miscoloured the sediment retention pond sizing will be reviewed and additional measures including flocculation considered.

It is estimated that approximately six sediment retention ponds may be required to treat runoff. The retention ponds and pond forebay areas for each pond have been sized according to the contributing catchment area (200m^3 per ha) and assumes a slope under 10%. The pond sizing methodology will be reviewed by the contractor onsite once soil conditions are known. Indicative pond dimensions are shown in Table 3-1.

Table 3-1: Sediment Retention Pond Details

Retention Pond number	Catchment Size (ha)	Pond size (m^3)	Pond Dimensions
1	0.79	160	6 x 18 x 1.5m
2	0.83	165	6 x 18 x 1.5m
3	2.27	450	10 x 30 x 1.5m
4	2.28	450	10 x 30 x 1.5m
5	1.43	285	10 x 20 x 1.5m
6	2.71	540	12 x 30 x 1.5m

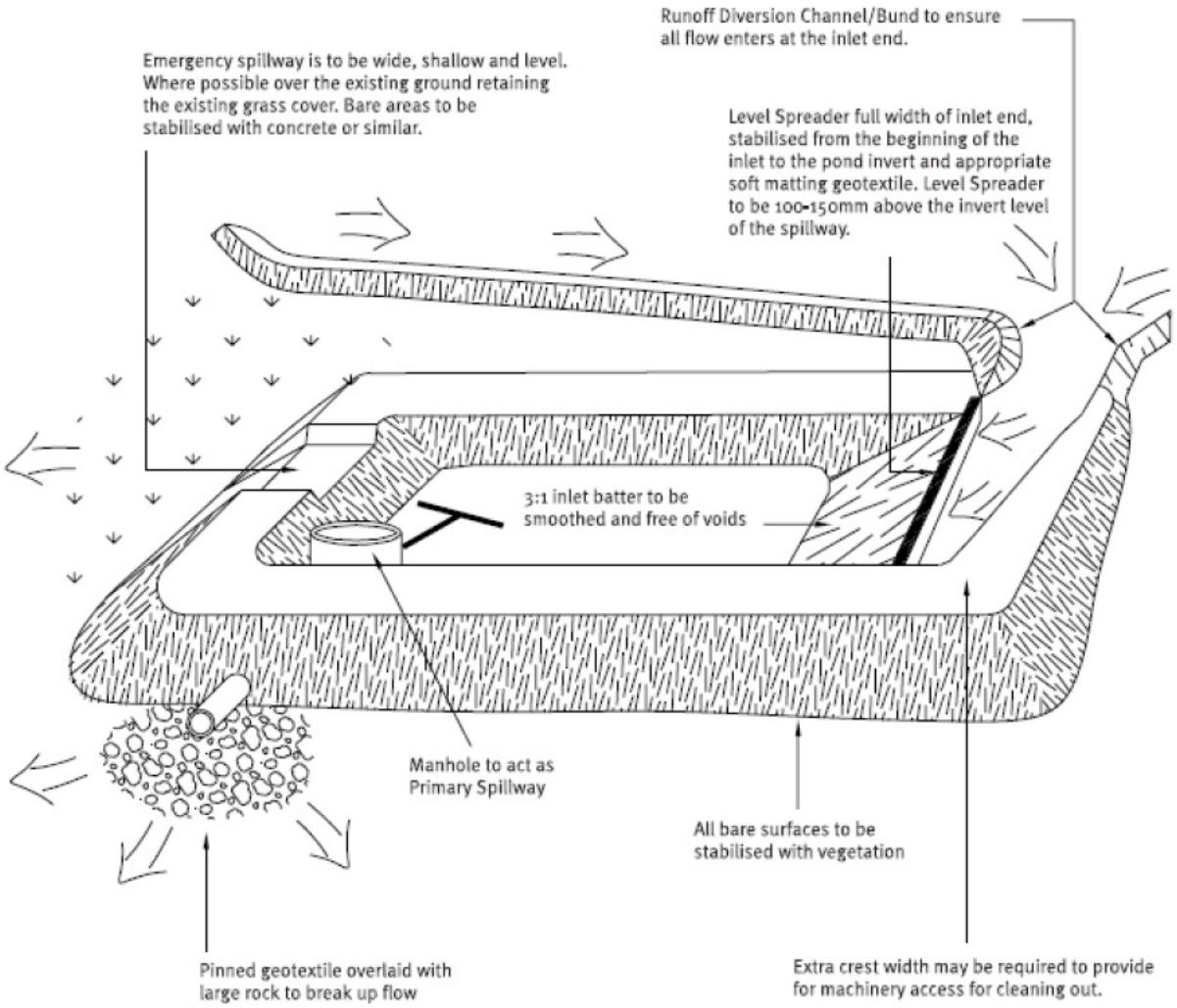

Figure 3-5: Sediment Retention Pond Typical Detail (Figure 12 in 'The Guidelines')

3.6 Stabilisation

Mulching is to be used as a supplementary control in conjunction with other sediment control measures. Only straw or aged wood chip is considered acceptable mulching material.

4 Conclusions

The preliminary design phase erosion and sediment control measures outlined within this report will need to be aligned with the final detailed design phase outputs of the project.

Also, this ESCP should be reviewed, updated and implemented by the appointed Contractor at the start of the works contract, in accordance with any resource consent requirements.

Appendix A: Sediment Control Plan Drawings

DO NOT SCALE – IF IN DOUBT, ASK

ORIGINAL SIZE A1

CATCHMENT A
AREA = 0.47Ha

POND 1 = 162m³
6m x 18m x 1.5m DEEP

EXTENT OF WORKS

CATCHMENT 1
AREA = 0.302Ha

CATCHMENT 2
AREA = 0.304Ha

CATCHMENT 3
AREA = 0.495Ha

POND 2 = 162m³
6m x 18m x 1.5m DEEP

CATCHMENT 4
AREA = 0.528Ha

CLEAN FLOW BUND
TO BE INDICATIVELY
0.8m IN HEIGHT

CATCHMENT B
AREA = 19.62Ha

CATCHMENT C
AREA = 9.41Ha

CATCHMENT 5
AREA = 2.263Ha

POND 3 = 450m³
10m x 30m x 1.5m DEEP

CLEAN FLOW BUND TO
BE 0.75m IN HEIGHT

CATCHMENT D
AREA = 10.48Ha

CATCHMENT 6
AREA = 0.525Ha

SUPER SILT FENCE

JOIN
REFER

CATCHMENT 7
AREA = 0.830Ha

LINE
BELOW

CATCHMENT E
AREA = 1.24Ha

CATCHMENT 5A
AREA = 1.38Ha

DESIGNATION BOUNDARY

STATE HIGHWAY 1

WAITARERE BEACH ROAD

PAEROA RD

NOTES:

1. ALL CLEAN FLOW DIVERSION BUNDS TO BE INDICATIVELY 0.61m HEIGHT PROVIDING A CAPACITY OF 0.1m³/s UNLESS OTHERWISE STATED ON THE DRAWING.
2. ALL CONTROLS TO BE CONSTRUCTED AS PER GREATER WELLINGTON EROSION SEDIMENT CONTROL GUIDELINES 2002.
3. ALL RUNOFF DIVERSION CHANNELS TO BE INDICATIVELY 0.55m DEEP, PROVIDING A CAPACITY OF 0.15m³/s.
4. SEDIMENT PONDS ARE TO BE CONSTRUCTED WITH FOREBAYS 10% OF THE TOTAL POND SIZE.

LINE
ABOVE

POND 4 = 450m³
10m x 30m x 1.5m DEEP

JOIN
REFER

CONTRACTOR TO INSTALL
CULVERT AS INDICATED IN
DRAINAGE DESIGN
DRAWINGS PRIOR TO
BULK EARTHWORKS

CATCHMENT 8
AREA = 0.597Ha

SILT FENCE TO BE
LOCATED ON TOP OF BUND

POND 5 = 285m³
10m x 20m x 1.5m DEEP

CATCHMENT F
AREA = 11.68Ha

CLEAN FLOW BUND TO
BE INDICATIVELY
0.75m IN HEIGHT

CATCHMENT 9
AREA = 2.279Ha

CATCHMENT G
AREA = 4.4Ha

CATCHMENT H
AREA = 2.86Ha

EXTENT OF WORKS

POND 6 = 420m³
8m x 35m x 1.5m DEEP

CATCHMENT 10
AREA = 2.71Ha

DESIGNATION BOUNDARY

STATE HIGHWAY 1

LEGEND:

- CATCHMENT BOUNDARIES
- EXISTING STREAM CHANNEL
- CLEAN WATER DIVERSION
- RUNOFF DIVERSION
- SILT FENCE
- SEDIMENT RETENTION POND

SCALE 1:2000 @ A1

SCALE 1:4000 @ A3

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
B		PJC	JP	PP	11/15
A	FOR CONSULTATION	PJC	JP	JP	09/15

SURVEYED	LIDAR & Aerial Photos	04/14
DESIGNED	Stephen Molineux	06/15
DRAWN	Jim Hunt	06/15
CAD REVIEW		
DESIGN CHECK		
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

MWH

Client: NZ TRANSPORT AGENCY WAKA KOTAHI

WAITARERE BEACH ROAD
CURVES PROJECT

SEDIMENTATION CONTROL
LAYOUT PLAN

Status Stamp: **FOR CONSENT**

Date Stamp: **12/11/2015**

Scales: 1:2000 @ A1, 1:4000 @ A3

Drawing No.: 80500902-04-0853-C450

Rev.: B

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Appendix B: Calculations

Cleanflow Drains

20 Year storm event

old numbering	Number	Pervious Area	C	Tc	I (mm/hr)	Q (m3/s)	Bund height (m)
2	A	0.47	0.15	10	69.6	0.01	0.55
3	B	19.62	0.15	30	40	0.33	0.8
5	C	9.41	0.15	20	49.2	0.19	0.75
6	D	10.48	0.15	20	49.2	0.22	0.75
7	E	1.24	0.15	10	69.6	0.04	0.55
8	F	11.68	0.15	20	49.2	0.24	0.75
10	G	4.4	0.15	20	49.2	0.09	0.61
12	H	2.86	0.15	10	69.6	0.08	0.61

Runoff Diversion Bund

Catchment	Pervious Area	C	Tc	I (mm/hr)	Q (m3/s)	Bund height (m)
1	0.302	0.3	10	69.6	0.02	0.55
2	0.304	0.3	10	69.6	0.02	0.55
3	0.495	0.3	10	69.6	0.03	0.55
4	0.528	0.3	10	69.6	0.03	0.55
5	2.263	0.3	10	69.6	0.13	0.55
5a	1.38	0.3	10	69.6	0.08	0.55
6	0.525	0.3	10	69.6	0.03	0.55
7	0.83	0.3	10	69.6	0.05	0.55
8	0.597	0.3	10	69.6	0.03	0.55
9	2.279	0.3	10	69.6	0.13	0.55
10	2.71	0.3	10	69.6	0.16	0.55

Sediment Retention pond

Cv=0.4

Pond	Contributing Catchment Areas	Catchment	pond size required (m3)	Pond Dimensions
1	1, 3	0.797	159.4	6 x 18 x 1.5m
2	2,4	0.832	166.4	6 x 18 x 1.5m
3	5	2.263	452.6	10 x 30 x 1.5m
4	9	2.279	455.8	10 x 30 x 1.5m
5	7,8	1.427	285.4	10 x 20 x 1.5m
6	10	2.71	542	12 x 30 x 1.5m