Peka Peka to North Ōtaki Expressway Project

Draft Erosion and Sediment Control Plan

OPUS

NZ TRANSPORT AGENCY
WAKA KOTAHI

Peka Peka to North Ōtaki Expressway Project

Draft Erosion and Sediment Control Plan

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1 Introduction

1.1 Project Description

1.1.1 Expressway Alignment

The Wellington Northern Corridor Road of National Significance (RoNS) runs from Wellington Airport to Levin. The Peka Peka to North Ōtaki Expressway Project (Project) is one of eight sections of the Wellington Northern Corridor RoNS. The location of the Expressway within the Wellington Northern Corridor is illustrated in Figure 1 below.

Figure 1: Location of Peka Peka to North Ōtaki Expressway within the Wellington Northern Corridor RoNS

The New Zealand Transport Agency (NZTA) proposes to designate land and obtain the resource consents to construct, operate and maintain the Expressway. The Project extends from Te Kowhai Road in the south to Taylors Road, just north of Ōtaki, an approximate distance of 13km.

The Expressway will provide for two lanes of traffic in each direction. Connections to local roads, new local roads and access points over the Expressway to maintain safe connectivity between the western and eastern sides of the Expressway are also proposed as part of the Project. There is an additional crossing of the Ōtaki River proposed as part of the Project, along with crossings of other watercourses throughout the Project length.

On completion, it is proposed that the Expressway becomes State Highway 1 (SH1) and that the existing SH1 between Peka Peka and North Ōtaki becomes a local road, allowing for the separation of local and expressway traffic.

1.1.2 North Island Main Trunk (NIMT)

KiwiRail proposes to designate land in the Kapiti Coast District Plan for the construction, operation and maintenance of a realigned section of the North Island Main Trunk (NIMT) Railway through Ōtaki. The realignment of this section of the railway line is required to facilitate construction of the Expressway.

1.2 Purpose of Erosion and Sediment Control Plan

This document forms part of Appendix A to the draft Construction Environmental Management Plan (CEMP) for the Project. The purpose of this Erosion and Sediment Control Plan (E&SCP) is to demonstrate the Erosion and Sediment Control (E&SC) principles and methodologies that will be adopted during the construction phase of this contract to minimise adverse environmental effects due to land disturbing activities. The final version of the CEMP and E&SCP will be developed by the Contractor on award of the physical works contract and prior to construction.

The objectives of this E&SCP can be summarised as follows:

- To support the Resource Consent application;
- To define the appropriate standards and level of service with regards to E&SC adopted for the Project;
- To outline potential environmental impacts associated with earth disturbing activities and the environment;
- To outline forms of erosion, how these may apply to various situations during construction and to summarise best practice E&SC measures to be utilised during construction;
- To define the E&SC principles to be adopted during construction;
- To outline the risk based approach that will be adopted for sediment control;
- To summarise earth moving activities and assess the effect of sediment yield during construction;
- To outline procedures for monitoring of E&SC practices during construction.

The principles outlined in the CEMP and this E&SCP will be used by the Contractor to inform development of Site Specific Environmental Management Plans (SSEMPs), which will detail actual practices and mitigation for site specific work areas, refer to section 1.3 for further details.

This E&SCP is a working document[1] and any changes to the plan will be submitted to the Consenting Authority, Greater Wellington Regional Council for certification, prior to physical works commencing on site.

[1] The CEMP is described as a "working" document in the sense that it may be updated, even after it has been 'finalised' and reviewed by the relevant Councils, so that it remains fit-for-purpose. Any such updates to the

1.3 Indicative Site Specific Environmental Management Plans

As outlined in the CEMP, the SSEMP documents are not just about erosion and sediment control. They bring together the principles of the CEMP and associated sub plans (of which this E&SCP is one sub plan). Figure 2 below outlines the structure of the CEMP and identifies this E&SCP in relation to the CEMP and other Sub Plans.

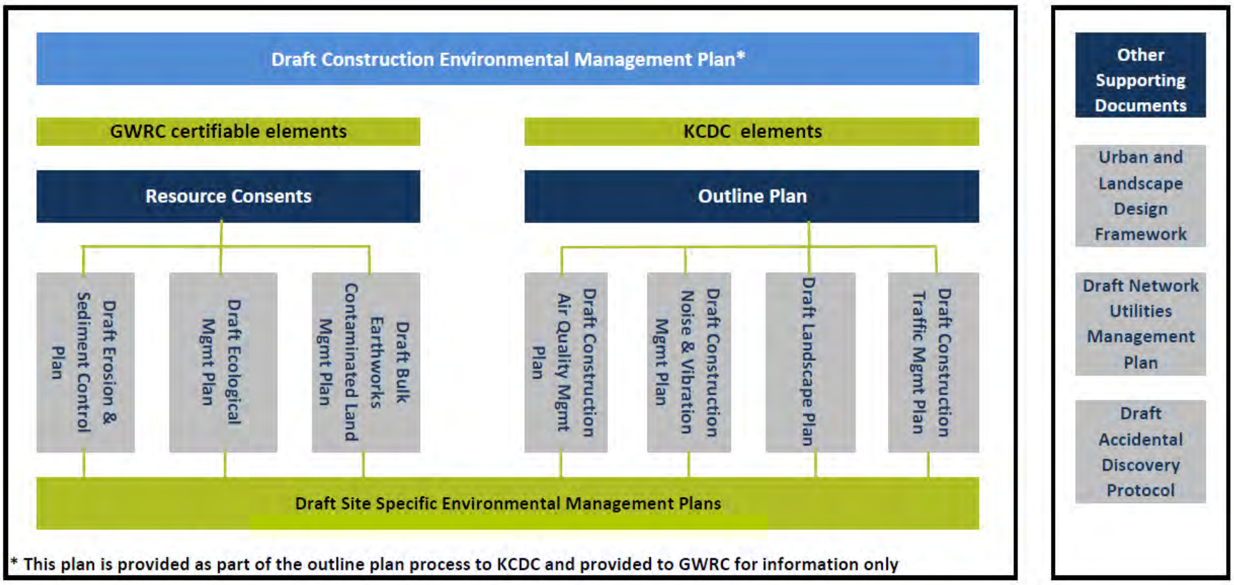

Figure 2: CEMP Structure and Integration of E&SCP

The purpose of the SSEMPs is to demonstrate the application of the methodologies and principles outlined in all the sub plans of the CEMP and provide confidence that the works can be constructed in such a manner as to ensure that environmental matters are appropriately managed.

Two indicative SSEMPs have been prepared for the consenting phase of this Project to demonstrate how the CEMP will be applied during construction. The site specific examples chosen for the indicative SSEMPs are as follows:

- Central Ōtaki: including the Railway Wetland and the Pare-o-Matangi Reserve;
- Mary Crest cut (refer Universal Soil Loss Equation evaluation and section 6.6)

Please note that the above mentioned SSEMP documents are not included as part of this E&SCP. Instead they have been prepared as standalone documents that incorporate the requirements of all of the CEMP sub–plans, not just this E&SCP.

The final SSEMPs will be developed by the Contractor and will be lodged as construction progresses, prior to the commencement of the next stage of work.

document would be limited solely to changes that preserve or enhance, from an environmental point of view, the measures used to address particular effects. "

2 Level of Service and Related Documentation

2.1 Level of Service

The level of service with regards to Erosion and Sediment Control during the construction of the Project is shaped and defined by the following statutory requirements and Regional and Industry best practice guidelines.

2.1.1 Statutory Requirements

- The Resource Management Act (RMA) 1991

The RMA is the primary environmental Act in New Zealand, which establishes the framework of objectives and rules relating to construction related runoff and how this is managed.

2.1.2 Best Practice Guidelines

The effects of erosion and transportation of sediment from areas disturbed by state highway construction can have an adverse effect on downstream receiving environments. Adverse effects from construction related earthworks can be effectively managed within the confines of the construction zone by adopting the principles and practices set out the following Regional and Industry best practice guidelines:

- Erosion and Sediment Control Guidelines for the Wellington Region, Greater Wellington Regional Council, 2002
- Draft Erosion and Sediment Control Standard for State Highway Infrastructure, New Zealand Transport Agency, August 2010.
- Draft Erosion and Sediment Control Field Guide for Contractors, New Zealand Transport Agency, August 2010.

2.1.3 Proposed Level of Service

During construction of the Project, the best practice E&SC measures and principles outlined in the Greater Wellington Regional Council and NZTA draft standard will be adopted to minimise adverse environmental effects. These principles and best practice measures are summarised in section 4 of this report. Section 4 also recognises the performance, applicability and limitations associated with individual erosion and sediment control practices, which can be used to select a suitable management approach for various phases of construction and forms of disturbed areas.

In accordance with the NZTA's Draft Erosion and Sediment Control Standard, this draft E&SCP adopts a risk based management approach for the design of E&SC storage practices. This approach prioritises the sensitivity of receiving environments and adopts design criteria using higher intensity storms for more sensitive receiving systems. This is particularly important when sizing sediment retention ponds, refer to section 5 for more details.

2.2 Related Documentation

The following reference documents are also relevant to this draft E&SCP:

- Regional Freshwater Plan for the Wellington Region, 1999;
- Transit New Zealand Environmental Plan, 2008;
- Technical Report No. 4, Geotechnical Engineering and Geology, September 2012;
- Technical Report No. 5, Construction Methodology Report, August 2012;
- Technical Report No. 10, Assessment of Stormwater Effects, October 2012;
- Technical Report No. 12, Aquatic Ecology Assessment, August 2012.

3 Potential Impact of Earthworks on the Environment

3.1 Existing Ground Conditions

The proposed expressway runs through an area of relatively flat to rolling terrain and is located about 1 km to 2.5 km west of the foothills of the Tararua Range and 3 km to 4 km east of the Te Horo-Ōtaki coastline. The existing geology within the proposed expressway footprint has been assessed in the 'Geotechnical Engineering and Geology' report. The existing geology is illustrated in Figure 2 and summarised below.

- Localised inter-dunal deposits, terrace alluvium, recent alluvium and old beach and dune deposits towards the northern end of the alignment;
- Recent alluvium along the Ōtaki River floodplain and other river or stream locations along the expressway alignment;
- Terrace alluvium from Mary Crest to Ōtaki River; and
- Dune sand, inter-dunal deposits, old beach and dune deposits to the south of Mary Crest.

The composition of the existing ground will determine how susceptible the ground is to the effects of erosion and its potential to generate sediment when the ground becomes disturbed by construction activities. Section 6 of this report addresses potential sediment yield in detail by applying the Universal Soil Loss Equation to assess the potential effects of sediment generation during construction. Refer to section 6 for further details.

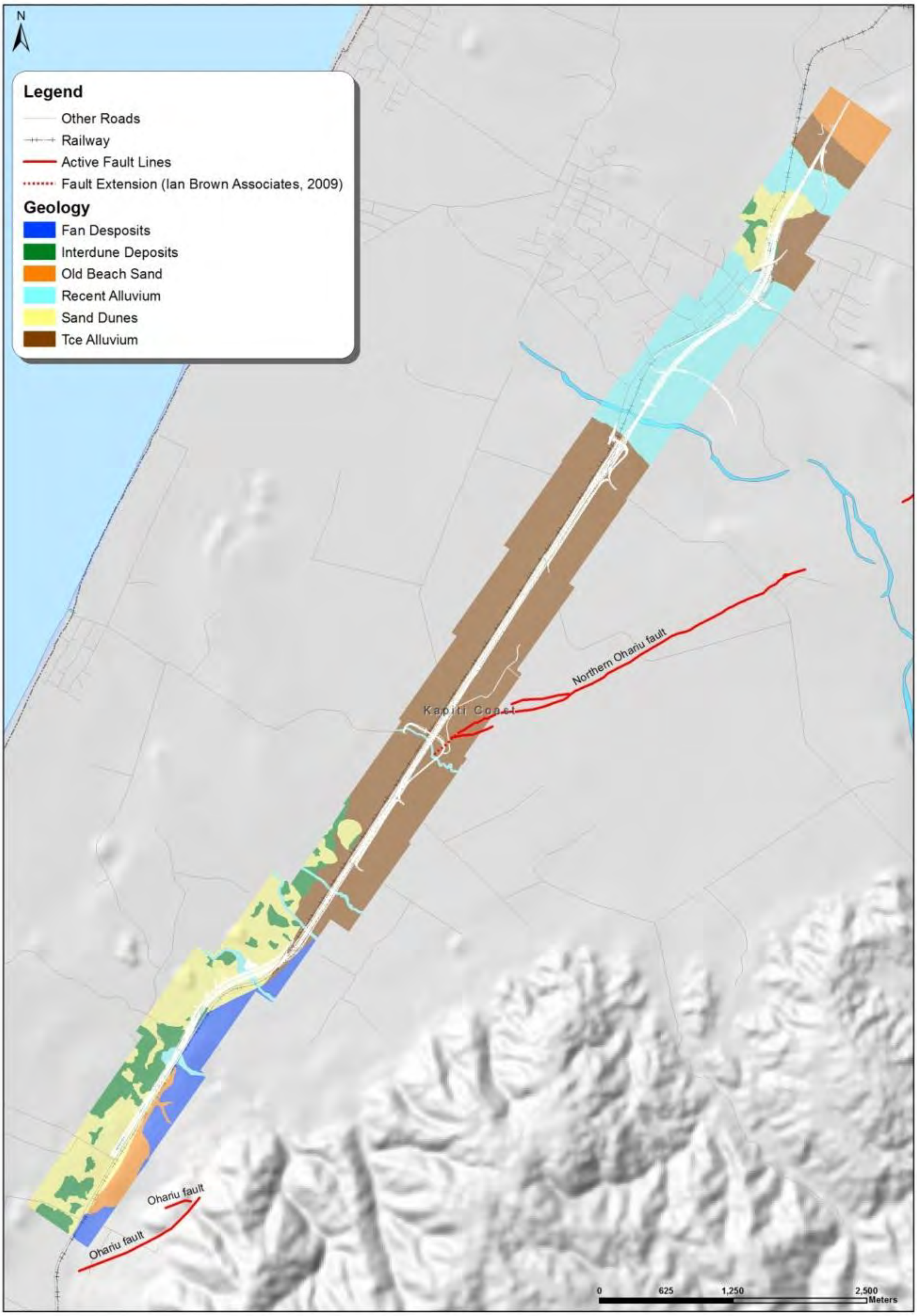

Figure 3: Geology along the Proposed Expressway Alignment

3.2 Waterways of Significance

All watercourses affected by construction will be protected from adverse effects of sediment by applying the principles and practices outlined in this E&SCP.

Technical Report No. 10 "Assessment of Stormwater Effects" identifies three particular waterways that are cited in Greater Wellington Regional Council's (GWRC) Regional Freshwater Plan as having special significance. These waterways are summarised in Table 1 and the locations shown in Figure 4 below:

Waterway	Waterway listed as:
The Ōtaki River	• Containing 'Nationally Threatened Indigenous Fish' (species recorded are: short jawed kokopu, giant kokopu, banded kokopu, and koaro) • Containing 'Important Trout Habitat' • Having 'Important Amenity and Recreational Values'
The Waitohu Stream	• Containing 'Nationally Threatened Indigenous Fish' (species recorded are: brown mudfish)
The Mangaone Stream	• Containing 'Nationally Threatened Indigenous Fish' (species recorded are: short jawed kokopu, koaro, and banded kokopu)

Table 1: Waterways of Significance

Technical Report 12 in Volume 3 contains a more detailed description of waterways.

Figure 4: Location of Waterways of Significance

3.3 Construction Effects on the Environment

Short-term effects on the environment are principally those associated with construction related earthworks. When compared to the process of natural erosion, construction related earthwork activities dramatically increase erosion rates. This is because during earthwork activities, soil particles become detached from the ground surface making them easier to transport via stormwater to the downstream receiving environment. Consequently, if best practice E&SC are not established to mitigate this increase in sediment runoff, one or several of the following adverse environmental effects may occur to the downstream receiving environment:

- Smothering of aquatic life by build-up of sediment in the stream bed;
- Alteration of habitats (e.g. by damaging spawning grounds);
- Abrasive action against aquatic life (e.g. increasing susceptibility to disease);
- Scouring of algae (i.e. stream life food supply);
- Increased turbidity;
- Temperature change (associated with turbidity);
- Reduction in productivity due to increased turbidity and associated decrease in photosynthetic activity;
- Accumulation of contaminants transported by sediments;
- Flow path blockage, increasing susceptibility to flooding and consequent property damage);
- Effects on consumable water for irrigation and stock, etc. (e.g. clogging of pumps;
- Reduced aesthetic value; and
- Dust nuisance from exposed earthwork surfaces.

The generally accepted measure for assessing potential short term increase in sediment during construction is through the application of the Universal Soil Loss Equation (USLE). This exercise has been implemented in section 6 of this report, please refer for further details.

Section 4 of this report outlines the erosion and sediment control management practices and principles that will be adopted for this Project to mitigate the short term effects of erosion and increased sediment during construction. Mitigation measures are particularly important for the receiving environments identified as significant in the Region Plan (refer section 3.2). In such sensitive areas the risk based approach outlined in section 5 will be adopted for sizing of sediment storage devices.

4 Environmental Management Practices

4.1 Key Principles Applied to this Project

Table 2 below broadly outlines the principles and philosophies to be adopted in relation to the provision of erosion and sediment controls during the construction of the Project. Management approaches have been identified for each principle to outline how each principle will be achieved. The E&SC practices that will be adopted during construction are outlined in sections 4.2 and 4.3 of this E&SCP.

Key Principle	Management Approach
1 Minimise Disturbance	**Control Upper Catchment** Isolating the construction site is the best approach to achieve this principle. Water outside of the construction site will not be contaminated by sediment and can be considered as 'clean'. Wherever possible, perimeter controls should be installed to divert the clean upper catchment runoff by interception around the construction area. This limits water running through the construction site, the size of E&SC control required and cost to erect and maintain controls. This may not be possible for concentrated flows such as watercourses.
	Separate Clean from Dirty Water Situations may occur where it is not possible to divert clean upper catchment water around the construction site and clean water may need to flow through the construction site. In such circumstances it's imperative that control practices are installed to separate the clean water from dirty water through the site. This will require careful planning prior to implementation on site.
	Stage Construction Where possible, earthworks will be staged to reduce the total disturbed area exposed at one time. This approach in conjunction with rapid stabilisation through re-vegetation will ensure that disturbed areas are stabilised prior to opening new earthwork areas. This will require careful planning on the part of the Contractor to ensure earthworks operations are staged but not constrained. This Project is likely to be constructed in 4 sections, refer to Construction Methodology Report for Details.
2 Protect Land Surface from Erosion	**Protect Steep Slopes** Where possible clearing of steep slopes will be avoided. Where cut and fill slopes are created through earthwork activities, then consideration will be given to diverting runoff from the top of the slope to prevent clean water mixing with the disturbed slope face. In general slopes will be stabilised through vegetation or erosion matting for erodible sand dunes.
	Stabilisation through Re-vegetation Cut and fill slopes will be stabilised as soon as practicable at key stages through construction. Re-vegetation of slopes will be incorporated into the Contractor's construction programme. The type of vegetation used for re-vegetation has been assessed by our landscape architect and is appropriate to the ground conditions. Refer to the landscaping plans in Appendix A for details.

<table>
<tr><th colspan="2">Key Principle</th><th>Management Approach</th></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Prevent Sediment from Leaving the Construction Site</td><td>Protect Waterbodies
All watercourses in the construction area have been mapped in Technical Report No. 10 ‘Assessment of Stormwater Effects’, refer for details.
Waterbodies such as streams are the downstream receiving environment. As such, all waterbodies will be protected by suitable erosion and sediment control practices from discharges from upstream construction works to prevent sediment laden water entering the downstream environment.</td></tr>
<tr><td>Retention Devices
Sediment retention devices will be utilised for this Project to accommodate sediment discharges from a construction area during storm events. A risk based approach will be adopted to determine the size of the retention device based on the risk associated with the downstream receiving environment.
Chemical flocculants may be used in this Project if standard means of sediment removal are found to be insufficient (although, as described later, in view of the soils involved, this is most unlikely). Flocculants increase the rate at which suspended solids fall out of sediment laden water. This has several advantages including reducing potential sediment discharge after storm events and offers the benefit of smaller higher efficiency retention devices. Specialist input will be sought for dosing of such devices.</td></tr>
<tr><td rowspan="3">4</td><td rowspan="3">Engage Appropriate Personnel</td><td>Appoint Experienced Personnel
Ultimately, it is the Contractor that installs, maintains and decommissions erosion and sediment control practices on site. It is vital that the Contractor is proactive with regards to E&SC’s by planning and responding to the changing requirements during construction. Therefore the Contractor shall appoint suitably trained and experienced personnel to oversee the installation, maintenance and decommissioning of erosion and sediment control practices.</td></tr>
<tr><td>Evolving Plan
Construction will be phased in accordance with the Contractor’s works methodology and construction programme. The requirements for E&SC practices will change at each location during the course of the Project and the Contractor must plan and evolve controls during the course of construction to fully meet the requirements of Resource Consent Conditions.</td></tr>
<tr><td>Inspect, Assess and Adjust
This is necessary to achieve a proactive approach for ensuring that all practices are installed, function correctly and continue to remain appropriate for the current construction activity. Inspection procedures for E&SC practices are outlined in Section 7 of this report.</td></tr>
</table>

Table 2: Key Principles Adopted for Erosion and Sediment Control

4.2 Erosion Control

4.2.1 Forms of Erosion

In relation to the site geology, the fan and alluvium deposits contain high gravel contents and will generally be less prone to the effects of erosion than sand and interdunal (i.e. peat) deposits. However, it is inevitable that erosion will occur to some degree and E&SC practices are required to mitigate the various forms erosion that will occur within the construction area. Table 3 provides a summary of common forms of erosion in order in which they typically occur. The table also provides an indication of where this form of erosion is most likely to occur and should be read in conjunction with Figure 3. Understanding this process will help selection of an appropriate E&SC practice to mitigate the effects of erosion.

Type of Erosion	Cause and Effect	Areas Most Prone
Splash Erosion	This form of erosion occurs when raindrops impact the soil surface. Splash erosion breaks down soil into smaller particles which can then be carried away by stormwater.	• Sand dunes and interdunal deposits south of Te Horo are most prone. • Of less concern in terrace alluvium gravels and fan deposits.
Sheet Erosion	Occurs when the rainfall intensity exceeds ground permeability resulting in overland flow. This results in transportation of loose sediment towards the downstream receiving environment.	• Interdunal deposits south of Te Horo and old (well compacted) dune sand north of Ōtaki will be most prone. • Elsewhere the gravel and sand dominant soils have high permeability, which will help to reduce the effects of sheet erosion.
Rill Erosion	Rill erosion occurs when sheet flow tends to concentrated flow forming narrow rills in the ground surface. This is usually associated with an increase in velocity.	• Areas most prone to this form of erosion are recently formed cut and fill batters. Depending on the energy involved rill erosion could occur in all ground types likely to be encountered, with greater effect in loose sands (sand dunes).
Gully Erosion	Gully erosion could be considered as an intermediately stage of erosion between rill erosion and Channel erosion.	• This form of erosion is most likely to affect areas where concentrated flows occur, for example, at low points, confluences and the toe of fill sites.
Channel Erosion	Channel erosion results from concentrated flows of water where the sides of the channel are subject to scour.	• This form of erosion is most likely to affect areas where concentrated flows occur, for example, at low points, confluences, along watercourse and at culvert inlets and outlets.
Mass Movement	This is the mass movement of soil or rock by gravity induced collapse. This can be induced by increases in pore water pressures or by undercutting of slopes.	• Cut slopes and fill batters. • Existing steep slopes.
Wind Erosion	Wind can cause soil erosion and create dust nuisance by dislodging loose particles from soil.	• Sand dunes and disturbed areas where fine particles have become dislodged through earth disturbing activities.

Table 3: Forms of Erosion and Prone Areas

4.2.2 Proposed Erosion Control Practices

The previous section identifies the likely forms of erosion that can be expected to occur during construction. Depending on ground conditions and the type of storm event, the combined effects of erosion and disturbed land from earthwork activities can result in the mobilisation of large amounts of sediment. It is therefore fundamental to implement appropriate E&SC practices to limit the effects of erosion and the resulting adverse effect on the downstream receiving environment. Table 4 below is an extract from NZTA's Draft Erosion and Sediment Control Standard for State Highway Infrastructure. The table outlines various forms, applicability and limitations of erosion control measures that will be utilised on site to mitigate the effects of erosion.

Erosion Control Practice	Applicability	Limitations
Runoff diversion channels	To divert upstream catchment areas either away from bare soils or to convey sediment laden runoff to sediment storage practices	Limit to channel grades < 2% Limit catchment areas < 2 ha
Contour drains	To intercept and convey overland flow on disturbed areas to reduce overall slope length.	Limit channel grades < 2% Catchment area to each contour drain < 0.5 ha
Slope benches	Where slopes exceed 25%	Limit channel grades < 2% Limit catchment areas < 0.5 ha
Rock check dams	Velocity reduction in channels	Not for use in perennial flow streams. Catchment area < 1 ha
Temporary or permanent seeding	To stabilise the soil and prevent erosion. Can be used on an interim basis prior to final grade being reached	Suitable for any size disturbed area
Hydroseeding	For use on steep slopes or on bunds or batters.	No limitation but primary use would be on difficult sites where reaching certain areas with conventional seeding is difficult.
Mulching with straw or other suitable material	Instant protection of soil from raindrop impact	Needs to be crimped on steeper slopes to prevent sloughing.
Placement of turf	To provide immediate permanent ground cover on critical areas.	No limitation but steeper slopes may require pegs to prevent slippage.
Geosynthetic erosion control blankets	Immediately reduces erosion by coverage and degradable fabric allows seed to pass through the fabric for permanent stabilisation. Permanent fabric can also provide long term erosion protection.	No limitations
Stabilised construction entrance	Use on all access points to a site to prevent those points from becoming a source of sediment.	It is not a sediment removal practice.
Pipe/flume drop structures	Excellent means to get water from the top of a slope to the bottom without causing slope erosion.	Minimum pipe slope of 3% Maximum catchment area of 1 ha
Level spreaders	Converts concentrated flow to dispersed sheet flow to reduce erosion potential.	Downstream slope < 10% Very hard to get exactly flat which is needed to ensure dispersed flow
Phsing of construction	Primarily for larger sites where disturbed areas can be minimised through project staging.	If there is a significant seasonal variation in rainfall, it may be better to work as much of the site as possible prior to the rainy season In general, small sites do not lend themselves to phasing
Surface roughening	To increase surface roughness and reduce velocities of flow down slope.	No limitations

Table 4: Proposed Erosion Controls*[1]

Erosion control practices will be designed in accordance with NZTA's Draft Erosion and Sediment Control Standard for State Highway Infrastructure.

4.3 Sediment Control

4.3.1 Proposed Sediment Control Practices

The adverse effects of increased turbidity associated with sediment laden water have been discussed in section 3.3. The process of erosion (section 4.2.1) in combination with areas disturbed by earthworks can result in stormwater becoming sediment laden as the water passes through the construction site. Sediment control devices will be installed to capture and retain sediment before stormwater leaves the site.

Table 5 below is an extract from NZTA's Draft Erosion and Sediment Control Standard for State Highway Infrastructure. The table outlines various forms of sediment control measures that will be utilised on site to capture sediment. The table outlines various forms, applicability and limitations of sediment control measures that will be utilised on site to capture sediment.

Sediment Control Practice	Applicability	Limitations
Sediment retention pond (no chemical treatment)	For treatment of site runoff in areas where concentrated flow is anticipated or where slopes and flows would overwhelm other practices	For catchment areas > 3,000 m^2
Sediment retention pond (w/chemical treatment)	Same as sediment retention ponds (no chemical treatment)	Same as sediment retention ponds (no chemical treatment)
Silt fence	A barrier of woven geotextile fabric in areas of dispersed sheet flow	Cannot be used in areas where there is concentrated flow Use in areas < 0.5 ha Must be placed on the contour Length of fence is very dependent on catchment slope
Super silt fence	A barrier of woven geotextile fabric that is reinforced with chain link fencing	Capture of runoff that is sheet flow only Use in areas < 1 ha Should be placed on contour Length of fence is very dependent on catchment slope
Straw bale barrier	Should not be used. Straw would be better applied as mulch	Rots too quickly and does not perform as well as silt fence
Storm drain inlet protection	To intercept and filter sediment runoff prior to it entering a reticulated stormwater system	Should never be a primary sediment control practice Extreme care must be taken to ensure that clogging does not cause an unintended overflow
Earth bund	Commonly used with a decanting outlet where the bund functions as a dam to temporarily hold water until the decant discharges it	Catchment area should not exceed 3,000 m^2
Sump/sediment pit	Used to treat sediment from excavated areas such as bridge abutment excavations or for cofferdams	Should only be used where there is not a positive outfall and pumping or suction is needed to dewater

Table 5: Proposed Sediment Controls*[2]

*[1&2] Draft Erosion and Sediment Control Standard for State Highway Infrastructure, NZTA, 2010

4.4 Dust Control

Dust control practices are required to prevent or reduce the movement of dust from disturbed soils through the effects of wind. Water sprinkling will be used on this Project for dust control.

Where possible and, to minimise the impact on water resources, water will be sourced from sediment ponds and decanting earth bunds. However, to ensure adequate supply of water, the use of water bores is being progressed for the Project. To minimise haulage, locations for water take are proposed to be as follows:

- South of Mary Crest;
- In the vicinity of the proposed Te Horo over bridge near Mangaone Stream;
- North of the Otaki River; and
- South of Waitohu Stream.

It is also proposed that the consented bores to be constructed to provide water for construction of the MacKays to Peka Peka project will also be used to provide construction water at the southern end of this project.

Where practical, these bores could also provide water supply to the office/welfare facility in the construction compounds. During drier months and at peak earthworks construction periods it is expected that up to a maximum 300cum per day will be required predominantly for construction purposes and a small amount for office use. This is based upon utilising up to 6 water tankers (5,000-6,000 litre capacity) during peak construction and water take would be spread between the water take locations.

Bore permits for construction and water permits for abstraction are sought for these abstraction wells.

5 Sizing of Sediment Control Devices

5.1 Level of Service for Sediment Retention Devices

For the Project, sediment retention ponds (SRP) and decanting earth bunds (DEB) will be sized in accordance with best practice guidelines. The Greater Wellington Regional Council and the NZTA standard design requirements differ in terms of sizing sediment retention devices and therefore this section considers both design approaches and outlines the proposed design requirements for this Project.

The Greater Wellington Region Council Guidelines (2002) state:

- DEB for areas less than 0.3ha, SRP for areas 0.3ha to 3ha;
- SRP and DEB size**:** Slopes < 10%, to be sized based on 2% of the catchment area;
- SRP and DEB size**:** Slopes > 10%, to be sized based on 3% of the catchment area;
- SRP Volume[2]: 70% of volume as live storage, 30% dead storage.

The NZTA Draft Erosion and Sediment Control Standard for Highway Infrastructure (2010) states:

- DEB for areas less than 0.3ha, SRP for areas 0.3ha to 5ha;
- SRP and DEB size: Based on a risk analysis approach relating to soil conditions, slope, rainfall, ground cover and risk to receiving environment (refer section 5.2 and 5.3 for details).
- SRP Volume[2]: 70% of volume as live storage, 30% dead storage.

The methodology adopted on site for sizing sediment retention devices will be the method that provides the most stringent result. In the first instance, the NZTA risk analysis approach will be used to size sediment retention devices, however, each device will also be sized in terms of the GWRC guidance (i.e. % contributing catchment area) and the largest, most stringent storage volume adopted. This process is summarised in Table 6 below and Figure 5 on page 17.

Sediment Retention Device	Size of Catchment	Sizing Requirements	Live/ Dead Storage	Decant Discharge Rate
DEB	0-0.3 ha	• NZTA risk analysis • check against GWRC 2% or 3% of catchment area • adopt most stringent	100% Live	3l/s/ha (NZTA Chapter 9)
SRP	0.3-3 ha	• NZTA risk analysis • check against GWRC 2% or 3% of catchment area	70% Live 30% Dead	24 hr extended detention stormwater flow if NZTA approach (NZTA Chapter 6)

[2] Dead storage is the component of the SRP volume that does not decant, important for dissipating energy inflows. Live storage is volume of the SRP between the lowest decant and crest of the SRP spillway.

		• adopt most stringent		2l/s/ha if GWRC approach

Table 6: Proposed Design Criteria for Sediment Retention Devices

5.1.1 Chemical Flocculation

If standard means of sediment removal are not sufficient then soil analysis tests, specifically relating to use of flocculation, would be undertaken in order to determine whether flocculation is effective for the soil types present on this Project.

It is noted that flocculation generally works well where the particle size <0.005mm, which is towards the silty clay range of particle sizes. We note that the majority of soil types on this Project consist of gravels and sand, which are likely to contain particles that are too large to be effectively treated by chemical flocculation. Flocculants would probably only be effective in certain areas of the Project where ground conditions generate particles <0.005mm.

5.2 Risk Analysis for Sizing of Sediment Retention Devices

As outlined in the sections above, in the first instance, a risk based approach will be adopted to size sediment control devices. The risk analysis shall be consistent with Chapter 6 of the NZTA's Draft Erosion and Sediment Control Standard for State Highway Infrastructure.

The risk analysis considers risk associated to the downstream receiving system, adopting the principle that storage devices will be sized for higher storm events for more sensitive receiving environments. The NZTA has summarised risk and associated design storm for particular receiving environments as shown in Table 7 below.

Receiving System	Water Quality	Design Risk (%)	Storm to Design For	
			Site disturbance < 6 months	Site disturbance > 6 months
Estuaries	Highest potential effect	99	20-year storm	100-year storm
Streams and Rivers	High potential effect	95	10-year storm	20-year storm
Lakes	Moderate potential effect	90	5 year storm	10-year storm
Harbours	Lower potential effect	80	2-year storm	5-year storm
Open coast	Lower potential effect	75	2-year storm	5-year storm

Table 7: Risk Assessment for Receiving Environment*3

Most of the downstream receiving environments for this Project will fall into the 'Streams and Rivers' category, which would mean that sediment retention devices will be sized to accommodate the 10-yr return storm if construction in a particular area is less than 6 months or 20-yr storm if construction is programmed to last longer than 6 months.

5.3 Design Summary for Sizing of Sediment Control Devices

Figure 5 overleaf is a flow chart extract from the NZTA's Draft Erosion and Sediment Control Standard, which summarises the design process for sediment control devices. This process will be followed when assessing risk and sizing sediment retention devices on this Project.

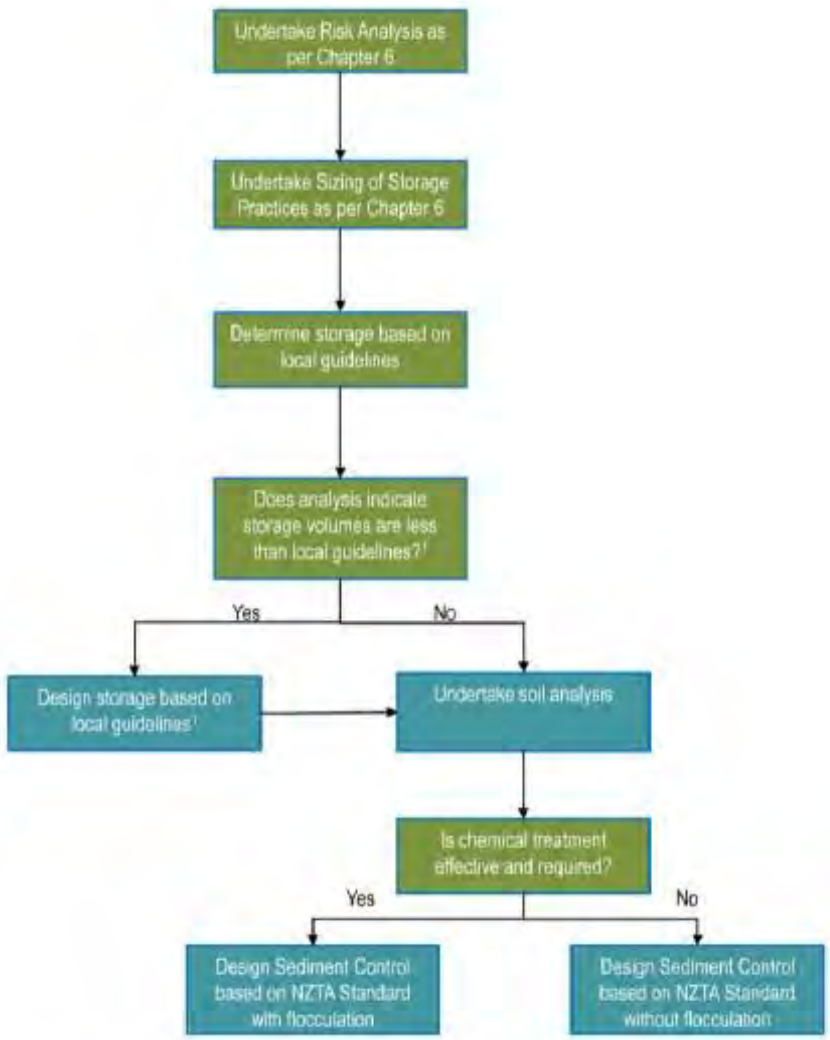

Figure 5: Process for Sizing Sediment Storage Devices*4

The following points provide a summary of the design steps that will be followed when sizing sediment retention devices on this Project. Following these steps will ensure that the design approach is consistent with Figure 5 and the requirements of Chapter 6 in the NZTA's draft standard.

1 – Identify risk associated with receiving environment using Table 7;

2 – Obtain rainfall data (HIRDS or by other means) for 1 hour duration storm for the selected return period;

3 – Determine catchment area (ha) and determine the runoff coefficient based on ground conditions;

4 – Calculate peak flow discharge using Rational Method:

$Q = (C.I.A)/360$ where: Q = Peak discharge (m^3/s)

C = Runoff coefficient (dimensionless)

I = Rainfall intensity (mm/hr) for storm event

A = Catchment area (ha)

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*3&4 Draft Erosion and Sediment Control Standard for State Highway Infrastructure, NZTA, 2010

5 - Calculate storage volume:

$V=QD$ where: V = Total storage volume (m^3)

Q = Peak discharge (m^3/s)

D = Storm duration (3600 seconds, for 1 hr storm duration)

6 - Check volume against GWRC sizing method and adopt largest, most stringent volume.

6 Project Earthworks and Sediment Yield

6.1 Earthworks Summary

The Project involves approximately 800,000m³ of cut-to-fill and 45,000m³ imported fill across four construction sections. Figure 6 provides a graphical representation of the cut/fill comparison for the scheme design and identifies three large cuts at Sta 1000m, 4000m to 5000m and 10,500m, which provide a general balance of materials for the Project. The composition of material from these cuts is discussed in more detail in section 6.3.6. Figure 7 shows the existing and proposed ground profile and complements figure 6 by illustrating areas of cut and fill.

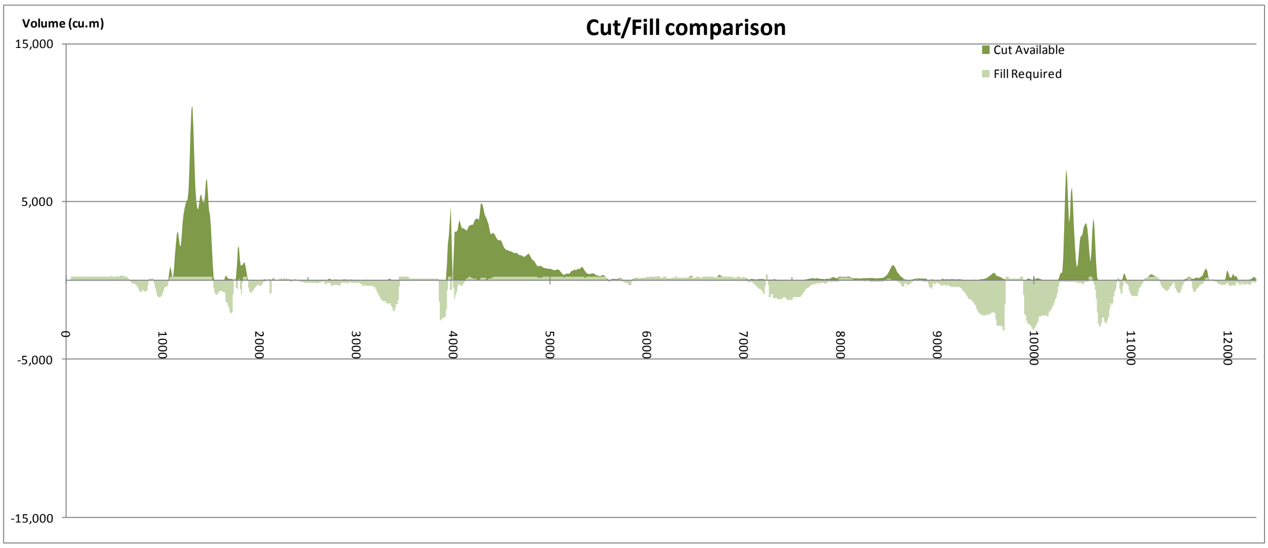


Figure 6: Cut and Fill Comparison

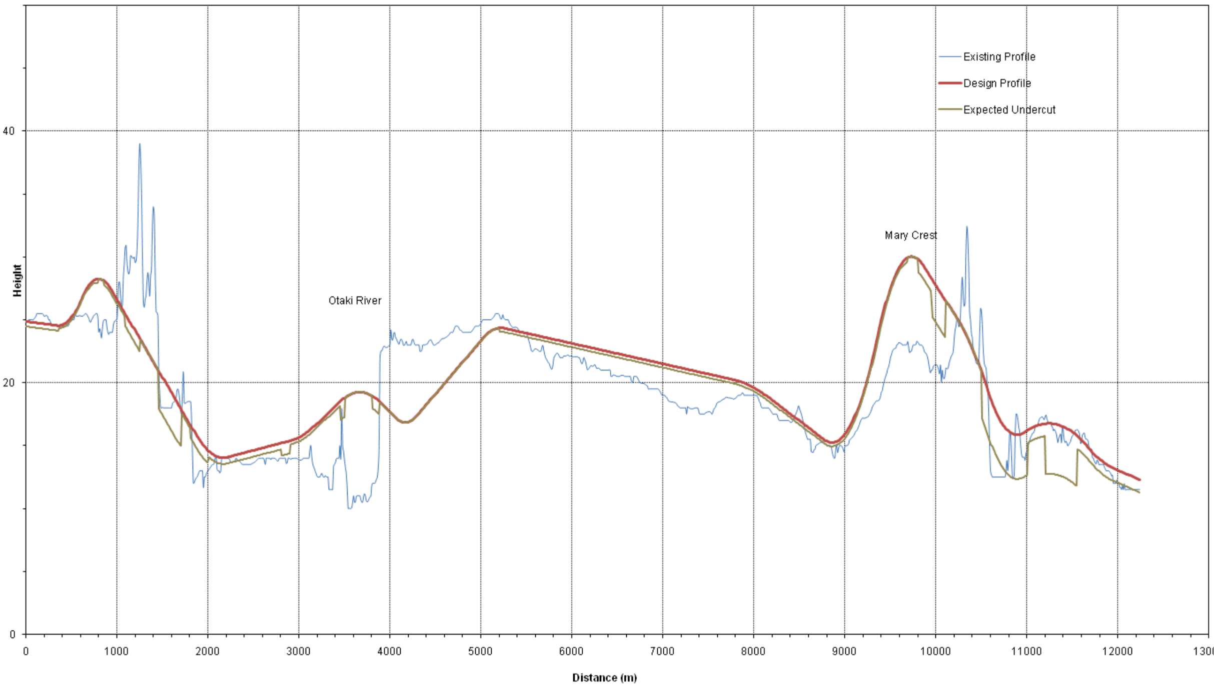


Figure 7: Earthworks Ground Profiles

6.2 Universal Soil Loss Equation

6.2.1 Use of the Universal Soil Loss Equation

The Universal Soil Loss Equation (USLE) has been applied to the disturbed area within each catchment throughout the proposed alignment. The purpose of this exercise is to broadly estimate the potential sediment yield from the Project during construction specifically to help identify any 'hot spots' where particular attention should be made to E&SC practices. The USLE is a comparative tool only and it does not give the actual sediment loss of any particular site. In recognition these limitations, sediment yields with E&SC measures in place will be reported as a range of +/- 25% about the calculated yield value.

The USLE equation is as follows:

$$A = R \times K \times LS \times C \times P \times SDR \times \text{Efficiency}$$

Where:

A = Soil loss (Tonnes/ha/year)

R = Rainfall erosion index (J/ha)

K = Soil erodibility factor (tonnes per unit of J)

LS = Combined slope length (dimensionless)

C = Vegetation cover factor (dimensionless)

P = Erosion control practice factor (dimensionless)

SDR = Sediment delivery ratio (dimensionless)

Efficiency = Assumed efficiently of E&SC's for capture of sediment (dimensionless)

Refer to section 6.3 for the assumptions made for each parameter of the USLE for this Project.

6.2.2 Application of USLE to Peka Peka to Ōtaki Expressway

In principle, the USLE equation has been used as a comparative tool to identify potential sediment 'hot spots' throughout the alignment in order to determine areas of particular focus for E&SC practices during construction. To achieve this outcome in a meaningful way, the following methodology has been followed when applying the USLE to the Project:

1. Identify all natural catchments along the Project length;
2. Within the designation boundary, sub-divide each natural catchment into sub catchments based on ground geology. This is to acknowledge the various ground conditions and so various erodibility rates within the disturbed area on which the USLE calculation is based;
3. To ensure a 'like with like' comparison between the natural sediment yield and construction sediment yield calculations, the same catchment areas have been used for the natural and construction USLE calculations. The assumption that the full width of the proposed

designation will be disturbed is conservative, but recognises that some disturbance to the existing ground outside of the earthworks footprint will be required for haul roads, establishment etc;

4. Select a typical cross section within each sub-catchment on which to base the USLE calculation;
5. Undertake USLE calculations for the natural (existing) scenario for all sub-catchments within the proposed designation;
6. Undertake USLE calculations for the construction phase case for all sub-catchments within the proposed designation. Yield presented as a range (+/- 25%);
7. Compare like with like sediment yields for the natural and construction case to assess the theoretical increase in sediment from the Project site during construction;
8. Compare the additional sediment generated during construction against the natural sediment yield for the whole catchment. This comparison is helpful to gain an appreciation of the potential net increase of sediment in watercourses caused by construction activities in relation to whole catchment sediment generation. Note the USLE equation has not been used to predict natural sediment yields for whole catchments, refer to section 6.5 for details.

6.3 Universal Soil Loss Equation Coefficients

This section summarises the Project specific assumptions made for each of the USLE coefficients used in the sediment yield calculations. These coefficients have been calculated or obtained using the 'Guidelines for Soil and Erosion Control' (Opus), February 2000 and guidance provided by Auckland Regional Council's two day Erosion and Sediment Control workshop.

Refer to Appendix B for further details on each parameter.

6.3.1 R: Rainfall Erosion Index

Base rainfall data was obtained from NIWA's HIRDS for Ōtaki and Peka Peka. Allowance for climate change (of +2°C) has been included in the rainfall figures used, which is a conservative approach considering the relative timescales of construction period and climate change. The maximum 2 year ARI, 6 hour rainfall depth was converted to a rainfall erosion index of (J/ha) as shown below:

$R = 0.00828*1.7*(\text{rainfall depth})^{*2.2}$

$R = 0.00828*1.7*(45.3)^{*2.2} = 61.93$ J/ha

This Rainfall erosion index was used across the whole site.

6.3.2 K: Soil Erodibility Factor

Geological information was obtained from site investigations detailed in Peka Peka to Ōtaki Geotechnical Engineering and Geology Report (Sept 2012). 'K' values were obtained for each material using the 'K' value nomograph and adapted for organic content, rock percentages and metric units. A 'K' value has been determined for each sub catchment based on local geology. Table 8 below summarises the adjusted 'K' values used for the USLE assessment.

Dominant Geology	Final adjusted K value
dune sand with weak silt/sand layer	0.16
dune sand & terrace alluvium	0.07
terrace alluvium (used for all fill sections)	0.03

Table 8: Adjusted 'K' Values

Further assumptions relating to K value:

- At this stage we have assumed that all fill material will be terrace alluvium;
- Any gravel particle greater than 2mm is considered to be rock;
- All organic / peat material (inter dune deposits) will be undercut and removed from site or covered with pre-loading material (sand or gravels).

6.3.3 LS: Combined Slope Length

Each catchment along the Project alignment has been separated into geological sub-catchments to account for the various anticipated soil types along the route.

LS values for the 'natural scenario' are based on the grades of existing ground within each sub catchment. LS values used during 'construction' are based on a typical (representative) design cross section within each sub-catchment, meaning that LS values used for the construction case are based on finished design levels. This assumption is conservative because it will assume the final (i.e. largest) cut and fill batter slopes. Following this assessment of slope grades for the existing and construction scenarios, the LS values used for the USLE assessment have been obtained from the 'LS' values table in the 'Guidelines for Soil and Erosion Control' (Opus) February 2000.

We have assumed that the area within the designation but outside of the road footprint is also disturbed during the construction process (allowance for hauls roads etc.). This has been allowed for by assessing the existing ground slope and length to obtain an LS value. This approach is conservative as it is unlikely that the full width of the designation will be disturbed during construction.

6.3.4 C: Vegetation cover factor

The following 'C' factors have been assumed for this exercise:

- 0.02 for the natural undisturbed catchment as this will be predominantly pastoral land;
- 0.5 for areas within the designation but outside of the road footprint to allow for partial disturbance during construction;
- 1 for areas disturbed during construction.

6.3.5 P: Erosion control practice factor

The following 'P' factors have been assumed for this exercise:

- 1.0 has been used for the existing undisturbed catchment.
- 0.9 for all disturbed areas within the designation allowing for track rolled or irregular surfaces.

6.3.6 SDR: Sediment Delivery Ratio

The USLE makes no allowance for sediment retained on site and therefore we have applied an SDR factor to allow for sediment deposition within the site (i.e. sediment falls out of suspension before it reaches controls or the downstream environment). Auckland Regional Council generally accepts an SDR figure of 0.5 for earthwork sites, with 0.7 for steep slopes. However, this is unique and it is important that the SDR factor is appropriate to the topography and geology for this specific site.

Most of the material on this Project will come from three major cuts as discussed in section 6.1 and shown in Figure 6. The composition of the material from these cuts in broad terms is summarised in Table 9 below:

Station (m)	Silt Content	Sand Content	Gravel Content
1250-1450	5%	55%	40%
3880- 5400	5%		95%
10250-10550	5%	95%	

Table 9: Composition of Material from Main Cuts

The dominant composition of material from the major cuts (and indeed the overall site geological make up) is dune sand and terrace alluvium (gravels) with little silt and clay. Based on this observation particles sizes on site are generally quite large, meaning a large percentage of particles will be too large to remain in suspension and significant amounts of sediment will be deposited. Another effect of this is that we can expect high permeability rates, which will help to reduce the effects of sheet and rill erosion, especially given the relatively flat grades over the length of the Project.

Based on these observations, for this particular site an SDR value of 0.25 has been adopted for USLE calculation.

6.3.7 Efficiency

An efficiency factor of 0.8 has been applied to the USLE calculation, which assumes a very good 80% capture rate within the devices due to the readily settleable nature of the soils.

6.4 Sediment Yield Calculations during Construction

A summary of the USLE calculation for this Project is provided in Table 10 below, outlining theoretical sediment yields per catchment. The complete USLE evaluation calculations, broken down into geology specific sub catchments, are appended to this report in **Appendix A.**

Catchment Reference	Disturbed Area [(1)] (ha)	Natural Yield from Disturbed Area (t/y)	Construction Yield from Disturbed Area with E&SC Measures (t/y)			Increase[(2)] (t/y)
			-25%	Calculated	+25%	
Greenwood	2.63	0.09	0.22	0.30	0.37	0.20
Waitohu	7.83	0.46	5.53	7.37	9.21	6.91
Te Manuao	5.32	0.64	3.02	4.03	5.04	3.39
Mangapouri	10.08	0.86	1.77	2.36	2.95	1.50
Racecourse	3.22	0.08	0.27	0.36	0.45	0.29
Te Roto	4.42	0.11	0.37	0.50	0.62	0.39
Andrews 1	2.36	0.06	0.18	0.24	0.30	0.19
Andrews 2	4.99	0.12	0.38	0.51	0.64	0.39
Ōtaki River	27.93	0.61	3.29	4.39	5.49	3.78
Mangaone	21.98	0.52	2.90	3.87	4.84	3.35
School	4.56	0.11	0.60	0.80	1.00	0.69
Gear	4.64	0.11	0.75	1.00	1.25	0.89
Settlement Heights	1.89	0.04	0.22	0.30	0.37	0.26
Coolen	1.35	0.10	0.24	0.31	0.39	0.22
Avatar	8.51	0.60	2.49	3.32	4.15	2.72
Jewell	9.12	0.65	2.20	2.94	3.67	2.29
Cavallo	7.32	1.69	7.18	9.57	11.96	7.88
Cording	2.99	0.21	0.41	0.55	0.68	0.33
Awatea	2.72	0.19	0.38	0.51	0.64	0.32
Kumototo	2.39	0.17	0.33	0.44	0.55	0.27
Hadfield	5.19	0.37	0.98	1.30	1.63	0.94
Totals	**141.43**	**7.79**	**33.74**	**44.98**	**56.23**	**37.19**

Table 10: USLE Evaluation Summary

(1) Areas quoted are those subject to earthworks (cut, fill and construction activity) and are limited to the proposed designation boundary as sediment control measures will be only be applied to these areas. USLE calculations are limited to the disturbed area.

(2) The increase column is calculated as the difference between the 'calculated' construction yield column and the natural yield column.

For comparative purposes the measure of yield reported in Table 10 is in terms of tonnes per year. Given that construction will be staged (refer Construction Methodology Report) and that disturbed areas within each catchment are unlikely to remain open for a whole year, the figures reported in Table 10 are likely to be conservative.

Table 10 shows that with E&SC's operating at an assumed 80% efficiency, there could potentially be an increase sediment yield from the site during construction. However, in most cases this increase is very small when compared to the natural sediment yield from the whole natural catchment. It is therefore important that the increase during construction is understood in the context of the whole catchment sediment yield in order to assess environmental effects to the downstream receiving environment. This is addressed in section 6.5 below.

It is important that the increase in sediment yield during construction is understood in the context of the whole catchment natural sediment yield in order to assess environmental effects to the downstream receiving environment.

6.5 Comparison of Construction and Natural Catchment Sediment Yields

This section estimates the natural sediment yields for whole catchments along the length of the Project for comparison with construction related sediment yield. It is largely accepted that it is not appropriate to apply the USLE to whole catchments and so an alternative approach to USLE has been adopted to determine theoretical sediment yields for whole catchments along the length of the Project.

6.5.1 Water Resources Explorer New Zealand

The natural catchment suspended sediment yields were estimated using information from Water Resources Explorer New Zealand (WRENZ). The model estimates the suspended sediment yield using an empirical raster-type GIS model which has been calibrated by 233 catchments presented in the paper *Suspended sediment yields from New Zealand rivers* (Hicks *et al.*, 2011). Where there were no values available in the WRENZ model, the yield was estimated from the closest 'similar' catchment.

The calibration dataset for the sediment yield model within WRENZ is based on suspended sediment gaugings and flow records, but also includes data from lake and fiord bed sedimentation studies. The model relates the sediment yield to the spatial integration of the product of a 'driving' factor and a 'supply' factor. The driving factor is $P^{1.7}$, where P is the local mean annual precipitation, and the supply factor depends on an erosion terrain classification that spreads erosion potential by slope and lithology and also to some extent by erosion process.

Of the 233 catchments on which the WRENZ model is calibrated, 148 are located in the North Island. The paper 'Suspended sediment yields from New Zealand rivers' states that for these 148 catchments, the predicted yield differed from the measured yield by 6.5%; that is, the model explained 93.5% of variation in the yield (Hicks et al., 2011). On this basis, we can conclude the model provides a reasonable prediction of sediment yields.

Table 11 below identifies catchment areas and sediment yields for whole natural catchments along the length of the Project. The table also makes a comparison of construction sediment yields and natural sediment yields by reporting the percentage increase in sediment (above the annual natural baseline) in the downstream environment caused by construction.

Catchment Reference	Whole Catchment Area (ha)	Disturbed Area (ha)	A Estimated Whole Catchment Sediment Yield *(WRENZ)* (t/yr)	B Estimated Construction Sediment Yield *(USLE* - Table 10) (t/yr)	% Increase to Natural Sediment Yield [(B/A)*100]
Greenwood	162.7	2.6	90	0.30	0.3
Waitohu	2,324.1	7.8	4,304	7.37	0.2
Te Manuao	35.2	5.3	8.8*	4.03	45.8
Mangapouri	242.0	10.1	60	2.36	3.9
Racecourse	18.8	3.2	4.7*	0.36	7.7
Te Roto	14.3	4.4	3.6*	0.50	13.8
Andrews 1	4.5	2.4	1.1*	0.24	22.0
Andrews 2	5.7	5.0	1.4*	0.51	36.6
Ōtaki River	34,048.4	27.9	171,689	4.39	0.003
Mangaone	2,283.6	22.0	2,644	3.87	0.1
School	177.2	4.6	84*	0.80	1.0
Gear	174.7	4.6	83	1.00	1.2
Settlement Heights	309.0	1.9	182	0.30	0.2
Coolen	7.0	1.3	3.3*	0.31	9.5
Avatar	65.8	8.5	31*	3.32	10.7
Jewell	359.9	9.1	257	2.94	1.1
Cavallo	26.2	7.3	12*	9.57	79.8
Cording	14.2	3.0	6.8*	0.55	8.0
Awatea	225.3	2.7	233	0.51	0.2
Kumototo	66.0	2.4	37*	0.44	1.2
Hadfield	135.0	5.2	75	1.30	1.7
Totals	**40,699.58**	**141.43**	**179,811**	**44.98**	

Table 11: Comparison of Whole Catchment and Construction Sediment Yields

* No values in WRENZ – the yields were scaled from the closest 'similar' catchment.

The above comparison should be interpreted with care, as it involves comparison of results from two quite different, approximate, empirically-based assessment techniques; however the differences in yield are so marked (with the exception of the focus areas discussed in section 6.6) that a compelling argument can still be made that sediment yield resulting from construction will be tiny compared to the natural base flow in the watercourses.

6.6 Focus Area Discussion

As outlined in section 6.2.1, the USLE does not provide exact sediment yields and should not be interpreted as such. The USLE should be used as a comparative tool to identify 'hot spots' in order to better understand catchments that are sensitive to the construction works and where to focus E&SC's.

Table 11 illustrates that providing the principles and practices outlined in this document are followed the likely effects to the three waterways of significance (the Waitohu, Ōtaki River and Mangaone) are considered to be very minor (less than 0.2% increase above existing baseline). However, the table also identifies several hot spots, where particular attention will be required to limit sediment reaching the watercourses. These areas are:

1. Te Manuao; Estimated 46% above baseline
2. Andrews 1: Estimated 22% above baseline
3. Andrews 2: Estimated 37% above baseline
4. Cavallo: Estimated 80% above baseline

It is important to recall that the USLE assessment calculates sediment yield generally due to the effects of sheet and rill erosion. On this basis, the catchments have been identified as being more susceptible these forms of erosion. The following sections briefly review the likely reasons as to why these particular catchments are sensitive to construction effects and considers measures that may be appropriate to mitigate these effects.

6.6.1 Te Manuao Catchment

The likely reasons as to why this catchment is sensitive to construction effects include:

- This catchment is located in one of the three major cuts on this Project.
- The cuts are wide and high, resulting in high 'LS' values being applied in the USLE assessment, leading to higher construction related sediment yield values.
- Ground composition is predominantly dune sand, and a higher erodibility 'K' factor has been applied to the USLE assessment for this ground type, leading to higher construction related sediment yield values.
- The disturbed area is 15% of the total upstream catchment;

The large cut is the main contributing factor for construction related sediment generation in this catchment. Sediment yield could be effectively managed by progressively covering cut slopes in sand dunes with topsoil (and vegetation) and/or geotextile erosion matting. It is also important to isolate cut batters by installing clean water cut off drains, silt fences etc.

6.6.2 Andrews 1 and 2 Catchment

The likely reasons as to why this catchment is sensitive to construction effects include:

- The disturbed area accounts for 73% of the total catchment area. The overall catchment area of 10.2 ha is small, making construction effects more significant for a small catchment.

The high proportion of disturbed area and small catchment is the main contributing factor for construction related sediment generation in this catchment. This can be effectively managed by reducing the effects of sheet and rill erosion by utilising measures outlined in Table 4 of this report. Silt fencing along the toe of the small embankment and contour drains traversing the longitudinal grade of the new road should be effective measures for this particular site.

It is also worth noting that the small catchment sizes mean they are likely to be ephemeral; they are also located in gravels and so are likely to have very high permeability rates. These may be suitable sites to explore the use of soak-away options, thus reducing any discharge to water.

6.6.3 Cavallo Catchment

The likely reasons as to why this catchment is sensitive to construction effects include:

- This catchment is located in one of the three major cuts on this Project.
- The cuts are wide and high, resulting in high 'LS' values being applied in the USLE assessment, leading to higher construction related sediment yield values.
- Ground composition is predominantly dune sand, and a higher erodibility 'K' factor has been applied to the USLE assessment for this ground type, leading to higher construction related sediment yield values.
- The disturbed area is 28% of the total upstream catchment;

As with the Te Manuao catchment, the large cut composed largely of sand dune is the main contributing factor for construction related sediment generation in this catchment. Sediment yield could be effectively managed by utilising contour drains and/or progressively covering cut slopes in sand dunes with topsoil (and vegetation) and/or geotextile erosion matting. It is also important to isolate cut batters by installing clean water cut off drains, silt fences etc.

The USLE assessment has identified the Cavallo catchment as the most sensitive to construction effects. Therefore a SSEMP, outlining construction sequencing and environmental mitigation measures has been developed for this particular site (refer section 1.3).

7 Inspection of Controls during Construction

7.1 Monitoring Approach during Construction

The Greater Wellington Region Council (GWRC) Guidelines for E&SC adopt a best practicable option (BPO) approach with regards to installation and monitoring of E&SC practices. This approach is a practice based standards approach where best management practices (i.e. E&SCs) are applied to minimise sediment yields. The current best practice as outlined in the GWRC and NZTA guidelines will be followed for the installation and maintenance of E&SC's during construction.

In addition to ensuring E&SC's are constructed in accordance with best practice, monitoring of the freshwater environment will be undertaken as outlined below.

7.1.1 Turbidity Monitoring

Turbidity will be used as the sentinel for monitoring construction effects on waterways, and trigger levels for construction effects will be based on turbidity.

The proposed trigger level is a 50% or greater increase in turbidity (as nephelometric turbidity units (NTU)) between upstream and downstream monitoring sites when the downstream turbidity exceeds 5 NTU.

Turbidity monitoring will take place at the following sites:

- The Ōtaki River
- Waitohu Stream
- Mangapouri Stream
- Mangaone Stream
- An intermittent waterway (one of Jewell, Kumototo or Settlement Heights Streams)
- One of either the Te Manuao or Cavallo waterways (during times when water is present)

This monitoring will involve telemetered turbidity sensors and loggers installed, operated and maintained upstream and downstream of the proposed discharge points to the waterways. The proposed locations of the loggers will be included in the Ecological Management Plan (EMP) prior to it being provided to the Environment Manager at GWRC (Manager). The locations of these sites shall be chosen to avoid other potential sources of sediment interfering with the results of monitoring.

The purpose of the turbidity monitoring is to continuously monitor sediment discharges from works areas into the 6 waterways until the relevant earthworks areas are stabilised.

The turbidity data shall be monitored by the consent holder on a daily basis (including weekends and holidays). The continuous telemetered turbidity loggers shall have a rainfall induced alert (alerting a cell phone number) of 7mm/hr so as to ensure the logs are checked where rain events occur. The 7mm/hr alert may be revised as more specific information becomes available, in consultation with the Manager.

Continuous turbidity monitoring will not take place at intermittent waterway (one of Jewell, Kumototo or Settlement Heights Streams)

7.1.2 Pre-construction Turbidity Monitoring

Pre-construction monitoring will be required for 6 months within the Project area to develop turbidity trigger levels against which construction effects can be evaluated as set out in the conditions and the EMP. Turbidity is a useful variable for indicating episodes of elevated suspended sediment associated with earthworks and waterway diversions. The reason for compiling pre-construction turbidity data is to determine the natural range of variation, and to develop statistical correlations between turbidity at sites upstream of the Project area and corresponding sites within the construction areas. By knowing these correlations prior to construction, trigger levels can be defined in terms of turbidity in the construction areas relative to "background" turbidity upstream. Six-month turbidity logger deployments are proposed for the each of the four major waterways in the Project area, Ōtaki River and Waitohu, Mangapouri and Mangaone Streams. The locations of these sites will be included within the EMP prior to it being submitted to the Manager. Comparable turbidity measurements for the remaining, highly intermittent waterways in the Project area are not proposed for two reasons. First, the low frequency of flowing periods means that it would take far longer to compile enough data for robust correlations for the intermittent waterways than for the perennial and near-perennial streams. Second, turbidity in intermittent waterways is strongly affected by the duration of flowing periods and the flow magnitude, which confounds relationships between sites.

7.1.3 Construction-phase Monitoring

Turbidity levels need to be monitored in waterways during the construction phase to ensure that construction activities are not having adverse effects on aquatic ecosystems. This monitoring should take place in phase with construction activities, i.e., when construction is underway near a major waterway, the waterway should be monitored until the construction is complete.

Construction monitoring should be carried out at the Ōtaki River and Waitohu, Mangapouri and Mangaone Streams, at one of the intermittent waterways in the moderate ecological-value class (i.e., Jewell, Kumototo or Settlement Heights Streams) and at either one of either the Te Manuao or Cavallo waterways (during periods when flowing water is present). The intermittent waterways selected for construction monitoring should be the one with the greatest frequency of flow, to facilitate monitoring schedules. The frequencies of flow at these waterways should be determined by visual assessment during the pre-construction phase.

7.2 Best Practice Tools

Suitably qualified and experienced members of the Project team (TPT) will be responsible for E&SCs on site. These individuals will be responsible for developing Site Specific E&SC Plans, E&SC construction supervision, inspections, monitoring (including freshwater), maintenance and decommissioning of practices.

As well as freshwater turbidity monitoring, there are a number of tools which can be adopted during construction to assist in the installation and on-going monitoring of E&SCs. The list below is not exhaustive but outlines the minimum level of service with regards to installation, monitoring and evolution of E&SCs during the construction phase. All of the points below will be undertaken by members of TPT who are suitably qualified and experienced in the field of E&SC.

1. TPT members responsible for E&SC must be conversant with consent conditions, this E&SC plan, best practice guidelines, freshwater monitoring requirements, site geology and areas sensitive to sediment yield generation;

2. TPT will develop and maintain a set of plans that clearly number and show the location of each E&SC practice. This plan will evolve during the course of construction and will be used by the Project team during E&SC practice inspections. A draft set of plans, showing indicative E&SC practices can be found in the Indicative Site Specific Management Plans. Refer to section 1.3 of this report;

3. TPT will monitor and react to weather forecasts. This is extremely important as construction activities may need to be amended or in extreme circumstances stopped to avoid generation of sediment during a weather event. Refer also to section 7.4;

4. TPT will undertake **daily visual inspections** of E&SC practices, refer to section 7.3;

5. TPT will undertake **weekly inspections** and **self-auditing**, refer to section 7.3;

6. TPT will provide regular progress reports to the Client and Consenting Officer with regards to the on-going monitoring and performance of E&SC measures during the course of construction; refer section 7.5 for further details.

7.3 Proposed Inspection Types

7.3.1 Daily Visual Inspections

The visual inspections will function as an early detection tool, with the aim to resolve any problems with E&SC practices before a rainfall event occurs. Much of this will revolve around effective on-going maintenance of E&SC practices. For this to function effectively a proactive culture and approach to monitoring must be adopted by TPT.

Visual inspections of E&SC's in conjunction with freshwater monitoring (refer section 7.1) are likely to be the main form of routine monitoring of E&SC practices on site during normal operations. To ensure that E&SC practices being used on site conform and continue to conform to best practice guidelines, TPT will undertake a daily visual inspection of E&SC practices for each work area. Each inspection will comprise (but is not limited too) the following:

- Visually check that the E&SC practices are appropriate and comply with the methodologies and principles outlined in this E&SC Plan and the Site Specific E&SC Plans;
- Visually check the construction of E&SC practices to confirm that the practice has been constructed in accordance with best practice guidelines;
- Visually check that the E&SC practices are functioning as intended, are fit for purpose and continue to remain so;
- Assess maintenance requirements;

Should any of the above checks identify a defect or issue requiring further action then TPT shall complete the relevant 'E&SC Inspection Checklist' for that particular practice. These checklists are extracts from NZTA Draft Erosion and Sediment Control Field Guide for Contractors and will be used as a quick and easy reference tool to investigate and document any defects with regards to E&SCs. Following this investigation and depending on the severity of the issue, TPT will seek to rectify the problem within the timeframes outlined in section 7.3.2. The E&SC Inspection Checklists are included in **Appendix B** of this report and may be further developed by the Project team during construction.

7.3.2 Weekly Self Auditing

Once a week, TPT will undertake a self-audit of all E&SC practices on site. Self-auditing is a proactive tool that encourages ownership and can instil a sense of pride in TPT with regards to E&SC performance. In general terms, each control will be assessed by TPT and assigned a rating of 1-4, with 1 being best practice and 4 meaning a practice is absent or poorly constructed resulting in an uncontrolled discharge of sediment. The scoring matrix and proposed timeframes in which to rectify the defect are summarised in Table 12.

Rating	Construction/Maintenance	Examples (not exhaustive)
1	Best practice – no further action required.	
2	Minor technical issue with the control device, where the *purpose* of the guidelines/E&SCP/consent conditions has been met. ***Work to be carried out within 7 days***	- No silt fence support - Minor holes in silt fence - Minor discrepancy live/dead storage - Minor lack of volume in DEB's
3	Controls absent or construction of the device is so poor that it leads to/is likely to lead to failure as an efficient erosion/sediment control method. ***Work to be carried out within 3 days***	- No returns in silt fence - Internal pond embankment collapse - Discharge at pond outlet causing erosion - Inappropriate pond volumes - Significant discrepancy between live/dead storage volumes - Flow paths or spillways inadequately stabilised - Diversion channels or bunds inadequately sized - Silt fence not trenched in
4	Controls absent or construction of the device is so poor that it leads to failure as an efficient erosion/sediment control method leading to an uncontrolled sediment discharge ***Work to be carried out immediately***	

Table 12: Self Auditing Rating Matrix

A full version of the proposed self-auditing form can be found in **Appendix C** of this report.

TPT may consider setting Key Performance Indicators (KPI's) for each rating score of the self-auditing matrix. These results will used to ascertain the general performance of E&SC's on site and used for reporting purposes, refer section 7.4.2 for further details.

7.3.3 Flocculants and pH

As outlined earlier in this report, we anticipate that flocculants will not be effective in coarse sand or gravel dominant soils which are found over the majority of this Project. However, where standard means of sediment removal is not sufficient then soil testing will be undertaken where receiving environment sensitivity and sediment yields indicate that this is desirable to confirm the likely effectiveness of chemical flocculants for site-specific soils. Where soil type is appropriate and chemical flocculent is used to aid sediment removal, pH measurements will be taken at the outlet to all dosed E&SC practices to ensure that practices are not overdosed. In accordance with NZTA Draft Erosion and Sediment Control Standard for State Highway Infrastructure, dosing will cease when pH drops below 5.5.

7.4 Weather Events and Remedial/Response Actions

7.4.1 Weather Events

For this Project, a 'severe weather event' may be defined as 7mm of rainfall in a 1 hour period. This may be revised as more specific information becomes available, in consultation with the Manager.

As previously stated, best management practices in conjunction with freshwater monitoring will be used to minimise sediment yields and monitor any potential effects on the aquatic environment. In addition to the routine freshwater monitoring, daily visual inspections and weekly self-auditing, if a severe weather event (>7mm/hr) is forecast, the following actions will be implemented by TPT.

Pre-Weather Event Procedure:

- Visually check controls on site prior to weather event to ensure, as far as practicable, that they will function as intended;
- Depending on site specific circumstances and practices used on site, consider limiting or ceasing earthwork activities to limit land disturbance;
- As far as practicable, stabilise disturbed areas. Such short term measures may include (but are not limited to) track rolling, installing temporary contour drains or silt fences etc. Such practices will help limit the effects of sheet and rill erosion that may occur upstream of decanting earth bunds or sediment retention ponds;
- Photograph critical E&SCs prior to the weather event to document pre weather event condition of E&SCs.

7.4.2 Exceedence of Turbidity Levels

Turbidity trigger levels will be established on the 4 major waterways (Ōtaki River and the Waitohu, Mangapouri and Mangaone streams) following the 6 month pre-construction monitoring set out in section 7.1 above. The pre-construction monitoring will establish baseline turbidity levels on which a trigger level is determined (refer section 7.1 for details of the proposed trigger level)

Should the turbidity monitoring trigger be exceeded the following responses will be implemented:

- within 24hrs of the 50% threshold breach, carry out and record in writing a full audit of the condition of all erosion and sediment control measures within the earthworks area discharging to the monitored waterway;

- remedy any causes on site that may have contributed to the 50% threshold breach as soon as practicable, and record what remedial measures were undertaken;

- notify the Manager by email within 1 working day of the 50% threshold breach, including providing details of the percentage change in turbidity and any remedial measures taken;

- if the NTU threshold remains generally elevated above 50% for more than 48hrs, then macro-invertebrate sampling shall be undertaken following Protocols C1 or C2, as set out in Protocols for Sampling Macro-invertebrates in Wadeable Streams, MfE 2001(for hard and soft-bottomed streams, respectively) within 2 working days at upstream and downstream sites agreed to by the Manager. For known discharge points, these shall be specified in the

EMP prior to it being submitted to the Manager. All laboratory analysis of these samples shall include a full macro-invertebrate count;

- within 10 working days of the collection of the macro-invertebrate samples, a report shall be provided to the Manager which has been prepared by a suitably qualified and experienced aquatic ecologist, and which includes the following:
  - the results of the macro-invertebrate sampling;
  - the causes of the discharge, the response to remedy the cause and measures proposed to avoid a recurrence of this cause;
  - an assessment undertaken by a suitably qualified and experienced aquatic ecologist which details whether the following thresholds have been exceeded:
    - a decline in the Quantitative Macro-invertebrate Community Index (QMCI) score of 1.5 or greater from the corresponding upstream monitoring site or baseline monitoring scores; or
    - a decline of greater than 20% in sensitive invertebrate taxa (in this case taxa with a QMCI score of ≥ 5) compared to the upstream monitoring site or baseline monitoring scores; and
  - mitigation works will be undertaken, which may include raking or other sediment clearance procedure. As part of the report required above the consent holder shall, in consultation with the Manager, detail what mitigation measures are proposed and the timeframes for implementing these. The consent holder shall implement the mitigation measures approved by the Manager. These measures shall be implemented to the Manager's satisfaction and within the timeframe specified by the Manager.

7.4.3 Routine Reporting

TPT will prepare routine weekly environmental performance reports for issue to NZTA and the Consenting Officer. The purpose of these reports is to provide a means of communication between TPT and Consenting Authority with regards to performance of E&SCs on site and compliance with consent conditions. At a minimum, the reports will contain:

- The weekly self-audit form, performance scores and performance against KPI's;
- A summary of any severe weather events that occurred during the week and notification of any exceedence of turbidity trigger levels (refer 7.4.2);
- Checklist sheets completed during the week;

8 Conclusion

This Erosion and Sediment Plan (E&SCP) forms a sub plan of the Construction Environmental Management Plan (CEMP) for the Peka Peka to North Ōtaki Expressway. This E&SCP outlines the level of service, principles, methodologies, E&SC and monitoring practices that will be adopted during the construction phase of this contract to minimise adverse environmental effects due to land disturbing actives. This E&SCP has been complied using best practice E&SC guidelines from Greater Wellington Regional Council and the New Zealand Transport Agency and will remain a live document to meet the evolving demands of E&SC during construction. The final version of the CEMP and this E&SCP will be developed by the Contractor on award of the physical works contract and prior to construction.

The Greater Wellington Region Council (GWRC) Guidelines for E&SC adopt a best practicable option (BPO) approach with regards to installation and monitoring of E&SC practices. This approach is a practice based standards approach where best management practices (i.e. E&SCs) are applied to minimise sediment yields. The current best practice as outlined in the GWRC and NZTA guidelines will be followed for the installation and maintenance of E&SC's during construction.

In addition to ensuring E&SC's are constructed and maintained in accordance with best practice, freshwater monitoring will be implemented at the Ōtaki River, Waitohu, Mangapouri, Mangaone Streams, at one of the intermittent waterways in the moderate ecological-value class (i.e., Jewell, Kumototo or Settlement Heights Streams) and at either one of either the Te Manuao or Cavallo waterways (during periods when flowing water is present).

Turbidity will be used as the sentinel for monitoring construction effects on waterways, and trigger levels for construction effects will be based on turbidity. The proposed trigger level for this Project is a 50% or greater increase in turbidity (as nephelometric turbidity units (NTU)) between upstream and downstream monitoring sites when the downstream turbidity exceeds 5 NTU. Section 7.4.2 of this Draft E&SC Plan outlines the procedures to follow in the event tat a trigger level is exceeded.

This E&SCP makes an assessment of potential sediment yields during construction using the Universal Soil Loss Equation (USLE) for all catchments over the length of the Project. The ULSE is a comparative tool only and it does not give the actual sediment loss of any particular site. It has been applied to broadly estimate the potential sediment yield from the Project during construction and specifically to help identify any sediment yield 'hot spots' where particular attention should be made to E&SC practices.

The parameters (such as K, LS, SDR) used for the USLE evaluation account for site specific soil types encountered along the length of the Project. The soil composition is predominantly composed of sands and gravels and so soil particle sizes are generally large and heavy when compared to that of silt and clay soils. On this basis E&SC retention practices such as decanting earth bunds and sediment retention ponds are expected to perform well on this Project and so an efficiency rating of 80% has been assumed for sediment retention practices; representing a very good capture rate.

To make a meaningful assessment of environmental effects, the estimated sediment yield within each catchment due to construction (calculated via USLE) has been compared to the sediment yield from the entire catchment. It is largely accepted that it is not appropriate to apply the USLE to whole catchments and so the natural catchment suspended sediment yields were estimated using the Water Resources Explorer New Zealand (WRENZ) model. This comparison should be interpreted with extreme care, as it involves comparison of results from two quite different, approximate, empirically-based assessment techniques; however the differences in yield are so marked (with the exception of the focus areas discussed in section 6.6) that a compelling argument can still be made that sediment yield resulting from construction will be tiny compared to the natural base flow in the watercourses.

When the percentage increase of sediment due to construction is assessed against that of the whole catchment, the percentage increase for the three waterways of significance is in the order of:

- 0.2% for the Waitohu catchment;
- 0.003% for the Ōtaki River catchment;
- 0.1% for the Mangaone catchment.

Based on these findings and providing that best practice is followed, the short term effects of land disturbance due to construction on the three waterways of significance is expected to be minor.

The USLE evaluation does however identify catchments that are much more sensitive to the effects of construction. In such locations particular attention will be required to limit sediment reaching the watercourses. The areas sensitive to the effects of construction are summarised below:

- Te Manuao: Estimated 46% above baseline
- Andrews 1: Estimated 22% above baseline
- Andrews 2: Estimated 37% above baseline
- Cavallo: Estimated 80% above baseline

There are three main cuts on the Project and the Te Manuao and Cavallo catchments are both sensitive to construction because they each contain one of these large cuts. The Andrews catchments are sensitive to the effects of construction because the upstream catchment is very small and the disturbed areas account for 73% of the total catchment.

The USLE assessment generally calculates sediment yield due to the effects of sheet and rill erosion. It is therefore possible to focus on these sensitive areas and ensure that E&SC practices are installed to mitigate environmental effects, especially by limiting effects of sheet and rill erosion.

The Cavallo catchment in the Mary Crest area has been identified as being the most sensitive area to the effects of construction. For this reason a Site Specific Environmental Management Plan (SSEMP) has been developed for this particular site. Another SSEMP has been developed for the central Ōtaki area, including the railway wetland and the Pare-o-Matangi reserve.

The SSEMP documents demonstrate the application of the methodologies and principles outlined in this E&SCP and all of the other the sub plans of the CEMP, and provide confidence that the works can be constructed in such a manner as to ensure that environmental matters are appropriately managed. The SSEMP documents have been prepared as standalone documents.

Chemical treatment will deliver little additional benefit, given the predominantly sand/gravel soils, and is not expected to be widely utilised.

Appendix A – Universal Soil Loss Calculations

Peka Peka to North Otaki Expressway Project
USLE Calculation Table for Existing Situation
Nov-12

Catchment		Stn start (m)	Stn finish (m)	Total Catchment Area		Construction footprint		Geology Station (m)			Typical Section Used (m)	Slope %	Maximum Single Slope Length for LS - Value Table (m)	LS - Value	R-Index	C-Factor	P-Factor	K -Factor	SDR	USLE (t/y/ha)	USLE (t/y)	Total USLE (t/y)
				sq.m	ha	Area (sq.m)	Area (ha)	Geology	Stn. from	Stn. to												
1a	Greenwood	0	590	1626742.394	162.67	9848.579	0.98	Old beach & dune deposits	0	350	300 cut	5 to 10	107	2.56	61.93	0.02	1	0.07	0.25	0.06	0.055	0.094
1b	Greenwood					16426.98	1.64	Terrace alluvium	350	590	500 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.039	
2a	Waitohu	590	1250	23240953.05	2324.10	30367.164	3.04	Terrace alluvium	590	750	700 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.072	0.461
2b	Waitohu					3891.045	0.39	Floodplain alluvium	750	800	750 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.009	
2c	Waitohu					4680.519	0.47	Waitohu Stream Bridge	800	860	/	/	/	/	/	/	/	/	/	/	/	
2d	Waitohu					11582.326	1.16	Floodplain alluvium	860	1000	900 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.028	
2e	Waitohu					8004.393	0.80	Dune Sand	1000	1080	1050 cut	5 to 10	107	2.56	61.93	0.02	1	0.16	0.25	0.13	0.102	
2f	Waitohu					19761.48	1.98	Dune sand with weak silt/sand layer	1080	1250	1200 cut	5 to 10	107	2.56	61.93	0.02	1	0.16	0.25	0.13	0.251	
3a	Te Manuoa	1250	1620	352016.919	35.20	27590.595	2.76	Dune sand & terrace alluvium	1250	1450	1300 cut	10 to 20	107	7.64	61.93	0.02	1	0.07	0.25	0.17	0.457	0.638
3b	Te Manuoa					25584.019	2.56	Interdunal deposits (up to 3 m silt/clay)	1450	1620	1600 cut	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.182	
4a	Mangapouri	1620	2120	2419809.349	241.98	15361.831	1.54	Dune sand & terrace alluvium	1620	1700	1700 cut	10 to 20	107	7.64	61.93	0.02	1	0.07	0.25	0.17	0.254	0.860
4b	Mangapouri					15475.28	1.55	Floodplain alluvium (Mangapouri Stream)	1700	1800	1750 cut	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.110	
4c	Mangapouri					39712.91	3.97	Floodplain alluvium	1800	2000	1900 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.282	
4d	Mangapouri					30202.935	3.02	Floodplain alluvium	2000	2120	2050 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.214	
5	Racecourse	2120	2410	188456.481	18.85	32217.822	3.22	Floodplain alluvium	2120	2410	2300 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.077	0.077
6	Te Roto	2410	2800	142970.338	14.30	44202.98	4.42	Floodplain alluvium	2410	2800	2700 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.105	0.105
7a	Andrews 1	2800	2950	45408.071	4.54	14911.047	1.49	Floodplain alluvium (top organic silt)	2800	2900	2850 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.035	0.056
7b						8681.284	0.87	Floodplain alluvium (top organic silt)	2900	2950	2900 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.021	
8	Andrews 2	2950	3130	57404.51	5.74	49894.307	4.99	Floodplain alluvium	2950	3130	2950 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.119	0.119
9a	Otaki	3130	5500	340483682	34048.37	44061	4.41	Floodplain alluvium	3130	3450	3200 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.105	0.609
9b	Otaki					7355.573	0.74	Floodplain alluvium	3450	3500	3450 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.017	
9c	Otaki					23165.059	2.32	Floodplain alluvium	3500	3800	Otaki Bridge	5 to 10	107	/	/	/	/	/	/	/	/	
9d	Otaki					17678.708	1.77	Otaki River Bridge	3800	3880	3850 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.042	
9e	Otaki					180365.748	18.04	Floodplain alluvium	3880	5400	4100 cut	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.429	
9f	Otaki					6695.38	0.67	Terrace alluvium	5400	5500	5450 cut	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.016	

Peka Peka to North Otaki Expressway Project
USLE Calculation Table for Existing Situation
Nov-12

	Catchment	Stn start (m)	Stn finish (m)	Total Catchment Area		Construction footprint		Geology Station (m)			Typical Section Used (m)	Slope %	Maximum Single Slope Length for LS - Value Table (m)	**LS - Value**	**R-Index**	**C-Factor**	**P-Factor**	**K -Factor**	**SDR**	**USLE (t/y/ha)**	**USLE (t/y)**	**Total USLE (t/y)**
				sq.m	ha	Area (sq.m)	Area (ha)	Geology	Stn. from	Stn. to												
10	Mangaone	5500	7720	22836287.89	2283.63	219816.387	21.98	Terrace alluvium	5500	7720	7000 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.523	0.523
11	School	7720	8200	1771826.695	177.18	45602.386	4.56	Terrace alluvium	7720	8200	7750 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.108	0.108
12	Gear	8200	8720	1746907.565	174.69	46352.826	4.64	Terrace alluvium	8200	8720	8500 cut	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.110	0.110
13	Settlement Ht	8720	8980	3089656.009	308.97	18861.798	1.89	Terrace alluvium	8720	8980	8800 fill	5 to 10	107	2.56	61.93	0.02	1	0.03	0.25	0.02	0.045	0.045
14	Coolen	8980	9150	70036.877	7.00	13450.254	1.35	Terrace alluvium	8980	9150	9100 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.095	0.095
15	Avatar	9150	9780	659477.665	65.95	85083.7	8.51	Terrace alluvium	9150	9780	9900 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.604	0.604
16	Jewell	9780	10250	3618718.458	361.87	91228.533	9.12	Terrace alluvium	9780	10250	10000 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.647	0.647
17a	Cavallo	10250	10790	261961.323	26.20	38065.169	3.81	Dune Sand	10250	10550	10450 cut	10 to 20	107	7.64	61.93	0.02	1	0.16	0.25	0.38	1.441	1.690
17b	Cavallo					35136.53	3.51	Interdunal deposits and dune sand (3-4 m peat/silt/clay)	10550	10790	10700 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.249	
18	Cording	10790	11050	141726.475	14.17	29914.327	2.99	Interdunal deposits and dune sand (3-4 m peat/silt/clay)	10790	11050	10900 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.212	0.212
19a	Awatea	11050	11380	2253097.94	225.31	13950.792	1.40	Floodplain alluvium	11050	11200	11100 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.099	0.193
19b	Awatea					13299.047	1.33	Interdunal deposits (up to 4.5 m peat/silt)	11200	11380	11300 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.094	
20a	Kumototo	11380	11780	660070.428	66.01	9107.336	0.91	Interdunal deposits (up to 4.5 m peat/silt)	11380	11500	11500 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.065	0.170
20b	Kumototo					14820.693	1.48	Dune sand with localised interdunal deposits	11500	11780	11600 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.105	
21	Hadfield	11780	12240	1349812.89	134.98	51902.222	5.19	Dune sand with localised interdunal deposits	11980	12240	12000 fill	10 to 20	107	7.64	61.93	0.02	1	0.03	0.25	0.07	0.368	0.368
							141.43													2.44	Total	7.79

Peka Peka to North Otaki Expressway Project
USLE Calculation Table for Construction
Nov-12

Catchment		Stn start (m)	Stn finish (m)	Construction footprint		Existing Geology for Cut Sections	Geology Station (m)		Typical Section Used (m)	Slope %	Maximum Single Slope Length for LS- Value Table (m)	LS - Value	R-index	C-Factor	P-Factor	K -Factor	SDR	Cross Section Width	Percent of Total Cross Section	Slope Area (ha)	USLE (t/y/ha)	USLE (t/y)	- 25 % Total USLE with E&SC (t/y)	Total USLE with E&SC (80%) (t/y)	+ 25% Total USLE with E&SC (t/y)
				Area (sq.m)	Area (ha)		Stn. from	Stn. to																	
1a	Greenwood	0	590	9848.579	0.98	Old beach & dune deposits	0	350	300 cut	0 to 5	12	0.34	61.93	1	0.9	0.07	0.25	15.5	0.37	0.3635	0.33	0.12	0.22	0.295	0.37
										5 to 10	6	0.61	61.93	1	0.9	0.07	0.25	1.5	0.04	0.0352	0.59	0.02			
										10 to 20	0	0	61.93	1	0.9	0.07	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	3	4	61.93	1	0.9	0.07	0.25	5	0.12	0.1172	3.90	0.46			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.07	0.25	20	0.48	0.4690	0.82	0.38			
1b	Greenwood			16426.98	1.64	Terrace alluvium	350	590	500 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	19	0.25	0.4118	0.14	0.06			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	2.5	0.03	0.0542	0.25	0.01			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	3	4	61.93	1	0.9	0.03	0.25	0.3	0.00	0.0065	1.67	0.01			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	54	0.71	1.1703	0.35	0.41			
2a	Waitohu	590	1250	30367.164	3.04	Terrace alluvium	590	750	700 fill	0 to 5	9	0.29	61.93	1	0.9	0.03	0.25	14	0.07	0.2220	0.12	0.03	5.53	7.369	9.21
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	5	0.03	0.0793	0.25	0.02			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	12.5	0.07	0.1982	2.90	0.57			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	160	0.84	2.5372	0.35	0.89			
2b	Waitohu			3891.045	0.39	Floodplain alluvium	750	800	750 fill	0 to 5	9	0.29	61.93	1	0.9	0.03	0.25	14	0.15	0.0595	0.12	0.01			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	5	0.05	0.0212	0.25	0.01			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	11.6	0.13	0.0493	2.90	0.14			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	61	0.67	0.2591	0.35	0.09			
2c	Waitohu			4680.519	0.47	Waitohu Stream Bridge	800	860		0 to 5	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										5 to 10	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	78	1.00	0.4681	0.35	0.16			
2d	Waitohu			11582.326	1.16	Floodplain alluvium	860	1000	900 fill	0 to 5	9	0.29	61.93	1	0.9	0.03	0.25	14	0.15	0.1689	0.12	0.02			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	5	0.05	0.0603	0.25	0.02			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	16	0.17	0.1930	2.90	0.56			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	61	0.64	0.7360	0.35	0.26			
2e	Waitohu			8004.393	0.80	Dune Sand	1000	1080	1050 cut	0 to 5	12	0.34	61.93	1	0.9	0.16	0.25	22	0.22	0.1742	0.76	0.13			
										5 to 10	6	0.61	61.93	1	0.9	0.16	0.25	7	0.07	0.0554	1.36	0.08			
										10 to 20	0	0	61.93	1	0.9	0.16	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.16	0.25	17.1	0.17	0.1354	15.45	2.09			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.16	0.25	55	0.54	0.4355	1.87	0.82			
2f	Waitohu			19761.48	1.98	Dune sand with weak silt/sand layer	1080	1250	1200 cut	0 to 5	12	0.34	61.93	1	0.9	0.16	0.25	26	0.18	0.3580	0.76	0.27			
										5 to 10	6	0.61	61.93	1	0.9	0.16	0.25	7	0.05	0.0964	1.36	0.13			
										10 to 20	0	0	61.93	1	0.9	0.16	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	46	15.51	61.93	1	0.9	0.16	0.25	61.5	0.43	0.8469	34.58	29.29			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.16	0.25	49	0.34	0.6748	1.87	1.26			
3a	Te Manuoa	1250	1620	27590.595	2.76	Dune sand & terrace alluvium	1250	1450	1300 cut	0 to 5	15	0.38	61.93	1	0.9	0.07	0.25	29	0.25	0.6952	0.37	0.26	3.02	4.033	5.04
										5 to 10	6	0.61	61.93	1	0.9	0.07	0.25	7	0.06	0.1678	0.59	0.10			
										10 to 20	0	0	61.93	1	0.9	0.07	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	30	12.66	61.93	1	0.9	0.07	0.25	49.1	0.43	1.1770	12.35	14.53			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.07	0.25	30	0.26	0.7191	2.44	1.75			
3b	Te Manuoa			25584.019	2.56	Interdunal deposits (up to 3 m silt/clay)	1450	1620	1600 fill	0 to 5	15	0.38	61.93	1	0.9	0.03	0.25	29.5	0.19	0.4832	0.16	0.08			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	11.5	0.07	0.1884	0.25	0.05			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	15	8.95	61.93	1	0.9	0.03	0.25	32.2	0.21	0.5274	3.74	1.97			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	83	0.53	1.3595	1.05	1.42			
4a	Mangapouri	1620	2120	15361.831	1.54	Dune sand & terrace alluvium	1620	1700	1750 cut	0 to 5	12	0.34	61.93	1	0.9	0.07	0.25	24	0.15	0.2245	0.33	0.07	1.77	2.359	2.95
										5 to 10	6	0.61	61.93	1	0.9	0.07	0.25	8	0.05	0.0748	0.59	0.04			
										10 to 20	0	0	61.93	1	0.9	0.07	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	18	9.81	61.93	1	0.9	0.07	0.25	32.2	0.20	0.3012	9.57	2.88			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.07	0.25	100	0.61	0.9356	2.44	2.28			
4b	Mangapouri			15475.28	1.55	Floodplain alluvium (Mangapouri Stream)	1700	1800	1750 cut	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	24	0.15	0.2262	0.14	0.03			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.05	0.0754	0.25	0.02			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	18	9.81	61.93	1	0.9	0.03	0.25	32.2	0.20	0.3035	4.10	1.24			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	100	0.61	0.9425	1.05	0.98			
4c	Mangapouri			39712.91	3.97	Floodplain alluvium	1800	2000	2050 fill	0 to 5	15	0.38	61.93	1	0.9	0.03	0.25	55.5	0.48	1.8903	0.16	0.30			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.2384	0.25	0.06			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	16.1	0.14	0.5484	2.90	1.59			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	38	0.33	1.2942	0.35	0.45			
4d	Mangapouri			30202.935	3.02	Floodplain alluvium	2000	2120	2050 fill	0 to 5	15	0.38	61.93	1	0.9	0.03	0.25	55.5	0.48	1.4376	0.16	0.23			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.1813	0.25	0.05			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	16.1	0.14	0.4170	2.90	1.21			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	38	0.33	0.9843	0.35	0.35			
5	Racecourse	2120	2410	32217.822	3.22	Floodplain alluvium	2120	2410		0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.25	0.8034	0.14	0.11	0.27	0.362	0.45
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.1939	0.25	0.05			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	12.3	0.11	0.3407	2.90	0.99			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	68	0.58	1.8838	0.35	0.66			
6	Te Roto	2410	2800	44202.98	4.42	Floodplain alluvium	2410	2800	2700 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.25	1.1022	0.14	0.16	0.37	0.497	0.62
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.2661	0.25	0.07			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	12.3	0.11	0.4675	2.90	1.35			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	68	0.58	2.5845	0.35	0.91			

Peka Peka to North Otaki Expressway Project
USLE Calculation Table for Construction
Nov-12

	Catchment	Stn start (m)	Stn finish (m)	Construction footprint: Area (sq.m)	Construction footprint: Area (ha)	Existing Geology for Cut Sections	Geology Station (m): Stn. from	Geology Station (m): Stn. to	Typical Section Used (m)	Slope %	Maximum Single Slope Length for LS- Value Table (m)	LS - Value	R-index	C-Factor	P-Factor	K -Factor	SDR	Cross Section Width	Percent of Total Cross Section	Slope Area (ha)	USLE (t/y/ha)	USLE (t/y)	- 25 % Total USLE with E&SC (t/y)	Total USLE with E&SC (80%) (t/y)	+ 25% Total USLE with E&SC (t/y)
7a	Andrews 1	2800	2950	14911.047	1.49	Floodplain alluvium (top organic silt)	2800	2900	2900 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.17	0.2585	0.14	0.04	0.18	0.242	0.30
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.04	0.0624	0.25	0.02			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	13.3	0.08	0.1185	2.90	0.34			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	118	0.71	1.0517	0.35	0.37			
7b	Andrews 1			8681.284	0.87	Floodplain alluvium (top organic silt)	2900	2950	2900 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.17	0.1505	0.14	0.02			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.04	0.0363	0.25	0.01			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	13.3	0.08	0.0690	2.90	0.20			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	118	0.71	0.6123	0.35	0.22			
8	Andrews 2	2950	3130	49894.307	4.99	Floodplain alluvium	2950	3130	3100 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.17	0.8649	0.14	0.12	0.38	0.512	0.64
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.04	0.2088	0.25	0.05			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	13.3	0.08	0.3966	2.90	1.15			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	118	0.71	3.5191	0.35	1.24			
9a	Otaki	3130	5500	44061	4.41	Floodplain alluvium (top organic silt)	3130	3450	3200 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	27	0.14	0.6232	0.14	0.09	3.29	4.389	5.49
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.04	0.1616	0.25	0.04			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	17.9	0.09	0.4131	2.90	1.20			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	139	0.73	3.2082	0.35	1.13			
9b	Otaki			7355.573	0.74	Floodplain alluvium	3450	3500	3450 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	21	0.19	0.1434	0.14	0.02			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.0478	0.25	0.01			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	17.7	0.16	0.1209	2.90	0.35			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	62	0.58	0.4234	0.35	0.15			
9c	Otaki			23165.059	2.32	Floodplain alluvium	3500	3800	Otaki Bridge	0 to 5	12		61.93	1	0.9	0.03	0.25								
										5 to 10	6		61.93	1	0.9	0.03	0.25								
										10 to 20	0		61.93	1	0.9	0.03	0.25								
										> 20	9		61.93	1	0.9	0.03	0.25								
									Disturbed ground within designation	5 to 10	46		61.93	0.5	0.9	0.03	0.25								
9d	Otaki			17678.708	1.77	Otaki River Bridge	3800	3880	3850 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	25	0.11	0.1985	0.14	0.03			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.03	0.0556	0.25	0.01			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	15	8.95	61.93	1	0.9	0.03	0.25	26.7	0.12	0.2120	3.74	0.79			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	164	0.74	1.3019	0.35	0.46			
9e	Otaki			180365.748	18.04	Floodplain alluvium	3880	5400	4100 cut	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	41	0.23	4.1545	0.14	0.59			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	14.2	0.08	1.4389	0.25	0.37			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	15	8.95	61.93	1	0.9	0.03	0.25	33.8	0.19	3.4249	3.74	12.81			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	89	0.50	9.0183	0.35	3.17			
9f	Otaki			6695.38	0.67	Terrace alluvium	5400	5500	5450 cut	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	31	0.31	0.2049	0.14	0.03			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.07	0.0463	0.25	0.01			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	12	8.01	61.93	1	0.9	0.03	0.25	27.3	0.27	0.1804	3.35	0.60			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	36	0.36	0.2379	0.35	0.08			
10	Mangaone	5500	7720	219816.387	21.98	Terrace alluvium	5500	7720	7000 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.27	5.8269	0.14	0.83	2.90	3.872	4.84
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	1.4065	0.25	0.36			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	25.4	0.23	5.1036	2.90	14.78			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	48	0.44	9.6446	0.35	3.39			
11	School	5470	8200	45602.386	4.56	Terrace alluvium	7720	8200	7800 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.27	1.2088	0.14	0.17	0.60	0.803	1.00
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.2918	0.25	0.07			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	25.4	0.23	1.0588	2.90	3.07			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	48	0.44	2.0008	0.35	0.70			
12	Gear	8200	8720	46352.826	4.64	Terrace alluvium	8200	8720	8500 cut	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	37	0.30	1.3720	0.14	0.20	0.75	1.000	1.25
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.2596	0.25	0.07			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	39	0.31	1.4462	2.90	4.19			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	42	0.34	1.5575	0.35	0.55			
13	Settlement Ht	8720	8980	18861.798	1.89	Terrace alluvium	8720	8980	8800 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.26	0.4928	0.14	0.07	0.22	0.300	0.37
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.1189	0.25	0.03			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	22	0.20	0.3738	2.90	1.08			
									Disturbed ground within designation	5 to 10	46	1.68	61.93	0.5	0.9	0.03	0.25	53	0.48	0.9006	0.35	0.32			
14	Coolen	8980	9150	13450.254	1.35	Terrace alluvium	8980	9150	9100 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.25	0.3306	0.14	0.05	0.24	0.314	0.39
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.0798	0.25	0.02			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	2	0.02	0.0228	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	26	0.22	0.2964	2.90	0.86			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	54	0.46	0.6155	1.05	0.64			
15	Avatar	9150	9780	85083.7	8.51	Terrace alluvium	9150	9780	9500 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	29	0.24	2.0562	0.14	0.29	2.49	3.322	4.15
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	7	0.06	0.4963	0.25	0.13			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	18	9.81	61.93	1	0.9	0.03	0.25	46	0.38	3.2615	4.10	13.37			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	38	0.32	2.6943	1.05	2.82			
16	Jewell	9780	10250	91228.533	9.12	Terrace alluvium	9780	10250	10000 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	38	0.14	1.2425	0.14	0.18	2.20	2.940	3.67
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.03	0.2616	0.25	0.07			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	18	9.81	61.93	1	0.9	0.03	0.25	65	0.23	2.1254	4.10	8.72			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	168	0.60	5.4933	1.05	5.74			

Peka Peka to North Otaki Expressway Project
USLE Calculation Table for Construction
Nov-12

	Catchment	Stn start (m)	Stn finish (m)	Construction footprint		Geology Station (m)			Typical Section Used (m)	Slope %	Maximum Single Slope Length for LS- Value Table (m)	LS - Value	R-index	C-Factor	P-Factor	K -Factor	SDR	Cross Section Width	Percent of Total Cross Section	Slope Area (ha)	USLE (t/y/ha)	USLE (t/y)	- 25 % Total USLE with E&SC (t/y)	Total USLE with E&SC (80%) (t/y)	+ 25% Total USLE with E&SC (t/y)
				Area (sq.m)	Area (ha)	Existing Geology for Cut Sections	Stn. from	Stn. to																	
17a	Cavallo	10250	10790	38065.169	3.81	Dune Sand	10250	10550	10450 cut	0 to 5	12	0.34	61.93	1	0.9	0.16	0.25	38	0.31	1.1665	0.76	0.88	7.18	9.571	11.96
										5 to 10	6	0.61	61.93	1	0.9	0.16	0.25	8	0.06	0.2456	1.36	0.33			
										10 to 20	0	0	61.93	1	0.9	0.16	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	24	11.32	61.93	1	0.9	0.16	0.25	48	0.39	1.4735	25.24	37.19			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.16	0.25	30	0.24	0.9209	5.57	5.13			
17b	Cavallo			35136.53	3.51	Interdunal deposits and dune sand (3-4 m peat/silt/clay)	10550	10790	10700 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	38	0.27	0.9337	0.14	0.13			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.06	0.1966	0.25	0.05			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	12	8.01	61.93	1	0.9	0.03	0.25	29	0.20	0.7126	3.35	2.39			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	68	0.48	1.6708	1.05	1.75			
18	Cording	10790	11050	29914.327	2.99	Interdunal deposits and dune sand (3-4 m peat/silt/clay)	10790	11050	10900 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	41	0.34	1.0221	0.14	0.15	0.41	0.547	0.68
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.07	0.1994	0.25	0.05			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	12	8.01	61.93	1	0.9	0.03	0.25	12	0.10	0.2991	3.35	1.00			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	59	0.49	1.4708	1.05	1.54			
19a	Awatea	11050	11380	13950.792	1.40	Floodplain alluvium	11050	11200	11100 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	36	0.39	0.5459	0.14	0.08	0.38	0.509	0.64
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.09	0.1213	0.25	0.03			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	12	8.01	61.93	1	0.9	0.03	0.25	14	0.15	0.2123	3.35	0.71			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	34	0.37	0.5156	1.05	0.54			
19b	Awatea			13299.047	1.33	Interdunal deposits (up to 4.5 m peat/silt)	11200	11380	11300 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	36	0.49	0.6558	0.14	0.09			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.11	0.1457	0.25	0.04			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	15	0.21	0.2733	2.90	0.79			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	14	0.19	0.2551	1.05	0.27			
20a	Kumototo	11380	11780	9107.336	0.91	Interdunal deposits (up to 4.5 m peat/silt)	11380	11500	11500 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	36	0.43	0.3903	0.14	0.06	0.33	0.442	0.55
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.10	0.0867	0.25	0.02			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	9	6.93	61.93	1	0.9	0.03	0.25	14	0.17	0.1518	2.90	0.44			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	26	0.31	0.2819	1.05	0.29			
20b	Kumototo			14820.693	1.48	Dune sand with localised interdunal deposits	11500	11780	11800 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	36	0.41	0.6133	0.14	0.09			
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.09	0.1363	0.25	0.03			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	12	8.01	61.93	1	0.9	0.03	0.25	13	0.15	0.2215	3.35	0.74			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	30	0.34	0.5111	1.05	0.53			
21	Hadfield	11780	12240	51902.222	5.19	Dune sand with localised interdunal deposits	11780	12240	12000 fill	0 to 5	12	0.34	61.93	1	0.9	0.03	0.25	36	0.40	2.0994	0.14	0.30	0.98	1.304	1.63
										5 to 10	6	0.61	61.93	1	0.9	0.03	0.25	8	0.09	0.4665	0.25	0.12			
										10 to 20	0	0	61.93	1	0.9	0.03	0.25	0	0.00	0.0000	0.00	0.00			
										> 20	12	8.01	61.93	1	0.9	0.03	0.25	25	0.28	1.4579	3.35	4.88			
									Disturbed ground within designation	10 to 20	46	5	61.93	0.5	0.9	0.03	0.25	20	0.22	1.1663	1.05	1.22			
				Totals:	**141.43**																**Totals:**	**224.90**	**33.74**	**44.98**	**56.23**

Peka Peka to North Otaki Expressway Project
C & P Factors
Nov-12

Assumed C- Factors

	C-Factor
Natural Catchment undisturbed	0.02
Disturbed during construction (road footprint)	1
Disturbed during construction (designation)	0.5

Assumed P - Factors

	P-Factor
Natural Catchment undisturbed	1
Disturbed during construction (road footprint)	0.9
Disturbed during construction (designation)	0.9

Peka Peka to North Otaki Expressway Project
K Factors
Nov-12

Geology	Cut materials				k (nomograph imperial)	Adjusted Organics	Adjusted for Rock Percentages	Adjusted metric (x1.32)
	Clay	Silt	Sand	Gravel				
dune sand with weak silt/sand layer		5%	95%		0.12	0.12	0.12	0.16
dune sand & terrace alluvium		5%	55%	40%	0.15	0.15	0.05	0.07
dune sand & terrace alluvium		5%	45%	50%	0.15	0.15	0.05	0.07
terrace alluvium (used for all fill sections)		5%		95%	0.05	0.05	0.02	0.03

dune sand with weak silt/sand layer
Assume 5% Silt and 95% Sand
0% Rock
No Organics

dune sand & terrace alluvium
Assume 10% Silt and 90% Sand
40/50% Rock
No Organics

terrace alluvium
Assume 100% Silt
95% Rock
No Organics

Peka Peka to North Otaki Expressway Project
R-Index data
Nov-12

High Intensity Rainfall System V3

Depth-Duration-Frequency results (produced on Thursday 25th of October 2012)
Sitename: Peka Peka
Coordinate system: NZTM2000
Easting: 1773557
Northing: 5477762

Rainfall depths (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	7.5	10.4	12.5	17.3	23.1	36.3	48.4	64.4	75.7	83.2
2	0.5	8.1	11.2	13.5	18.7	24.8	38.8	51.5	68.4	80.4	88.4
5	0.2	10.2	14.1	17.1	23.5	30.9	47.7	62.7	82.5	96.9	106.5
10	0.1	11.9	16.5	19.9	27.4	35.8	54.7	71.5	93.3	109.7	120.5
20	0.05	13.8	19.1	23	31.8	41.3	62.4	81	105.1	123.5	135.7
30	0.033	15.1	20.8	25.1	34.6	44.7	67.2	87	112.5	132.2	145.3
40	0.025	16	22.1	26.6	36.7	47.4	70.9	91.5	118	138.7	152.5
50	0.02	16.7	23.1	27.9	38.4	49.5	73.9	95.1	122.5	144	158.2
60	0.017	17.4	24	28.9	39.9	51.3	76.4	98.2	126.3	148.4	163.1
80	0.012	18.4	25.4	30.7	42.4	54.3	80.5	103.3	132.4	155.7	171.1
100	0.01	19.3	26.6	32.1	44.3	56.7	83.9	107.4	137.4	161.5	177.5

Extreme rainfall assessment with climate change

Projected temperature change: 2.0 degree Celsius
Rainfall depths (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	8.7	12	14.3	19.6	26	40.1	53	69.9	81.5	89
2	0.5	9.4	12.9	15.4	21.2	27.9	42.9	56.4	74.3	86.5	94.6
5	0.2	11.8	16.3	19.6	26.8	35	53.5	70	91.4	106.6	116.7
10	0.1	13.8	19.1	22.9	31.5	41	62.1	80.8	105.1	123.1	134.7
20	0.05	16	22.2	26.6	36.7	47.6	71.6	92.8	120.2	141	154.7
30	0.033	17.5	24.1	29.1	40.1	51.9	78	100.9	130.5	152.8	167.7
40	0.025	18.6	25.6	30.9	42.6	55	82.2	106.1	136.9	160.6	176.4
50	0.02	19.4	26.8	32.4	44.5	57.4	85.7	110.3	142.1	167	183.5
60	0.017	20.2	27.8	33.5	46.3	59.5	88.6	113.9	146.5	172.1	189.2
80	0.012	21.3	29.5	35.6	49.2	63	93.4	119.8	153.6	180.6	198.5
100	0.01	22.4	30.9	37.2	51.4	65.8	97.3	124.6	159.4	187.3	205.9

R Index - 50% AEP 6 hour duration

	Depth
Peka Peka	38.8
Otaki	41
Peka Peka plus 2	42.9
Otaki plus 2	45.3

R - Index (metric) : **61.93**

Peka Peka to North Otaki Expressway Project
R-Index data
Nov-12
High Intensity Rainfall System V3

Depth-Duration-Frequency results (produced on Thursday 25th of October 2012)
Sitename: Otaki
Coordinate system: NZTM2000
Easting: 1781986
Northing: 5485584

Rainfall depths (mm)

		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	7.8	10.8	13	18.1	24.2	38.4	51.4	68.9	81.5	90
2	0.5	8.3	11.6	14	19.4	25.9	41	54.8	73.1	86.5	95.5
5	0.2	10.5	14.5	17.6	24.4	32.2	50.2	66.4	87.9	104	114.7
10	0.1	12.1	16.8	20.4	28.3	37.2	57.4	75.5	99.2	117.4	129.6
20	0.05	14	19.4	23.5	32.7	42.7	65.3	85.3	111.5	131.9	145.6
30	0.033	15.2	21.1	25.6	35.5	46.2	70.3	91.5	119.2	141.1	155.7
40	0.025	16.1	22.4	27.1	37.6	48.9	74	96.2	125	147.9	163.2
50	0.02	16.9	23.4	28.4	39.3	51	77.1	99.9	129.6	153.4	169.3
60	0.017	17.5	24.3	29.4	40.8	52.8	79.6	103.1	133.6	158.1	174.4
80	0.012	18.5	25.7	31.2	43.2	55.9	83.8	108.3	140	165.7	182.8
100	0.01	19.4	26.9	32.6	45.2	58.3	87.3	112.6	145.2	171.8	189.6

Extreme rainfall assessment with climate change

Projected temperature change: 2.0 degree Celsius
Rainfall depths (mm)

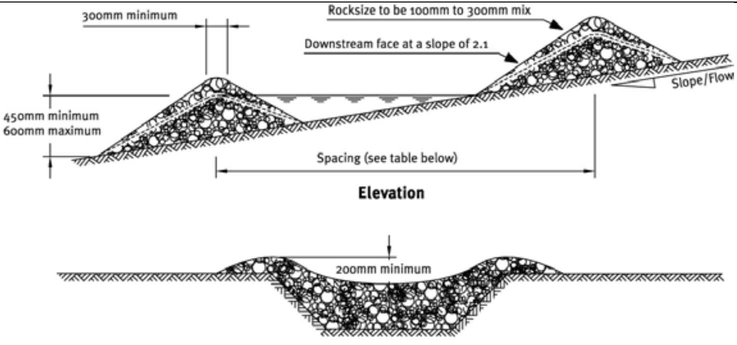
		Duration									
ARI (y)	aep	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.633	9	12.5	14.9	20.5	27.2	42.5	56.3	74.8	87.7	96.3
2	0.5	9.6	13.4	16	22	29.1	45.3	60.1	79.4	93.1	102.2
5	0.2	12.2	16.7	20.2	27.9	36.5	56.3	74.1	97.4	114.4	125.7
10	0.1	14	19.4	23.5	32.5	42.6	65.2	85.3	111.7	131.7	144.9
20	0.05	16.2	22.5	27.2	37.7	49.2	75	97.8	127.6	150.6	166
30	0.033	17.6	24.5	29.7	41.2	53.6	81.5	106.1	138.3	163.1	179.7
40	0.025	18.7	26	31.4	43.6	56.7	85.8	111.6	145	171.3	188.8
50	0.02	19.6	27.1	32.9	45.6	59.2	89.4	115.9	150.3	177.9	196.4
60	0.017	20.3	28.2	34.1	47.3	61.2	92.3	119.6	155	183.4	202.3
80	0.012	21.5	29.8	36.2	50.1	64.8	97.2	125.6	162.4	192.2	212
100	0.01	22.5	31.2	37.8	52.4	67.6	101.3	130.6	168.4	199.3	219.9

Appendix B – Erosion and Sediment Control Inspection Checklists

Erosion and Sediment Control Inspection Checklist

NZ TRANSPORT AGENCY
WAKA KOTAHI

Check List for Check Dams



Standard Rock Check Dam Design

Slope	Spacing (m) Between Dams (450mm centre height)	Spacing (m) Between Dams (600mm centre height)
2% or less	24	30
2% to 4%	12	15
4% to 7%	8	11
7% to 10%	5	6
over 10%	Use Stabilised Channel	Use Stabilised Channel

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

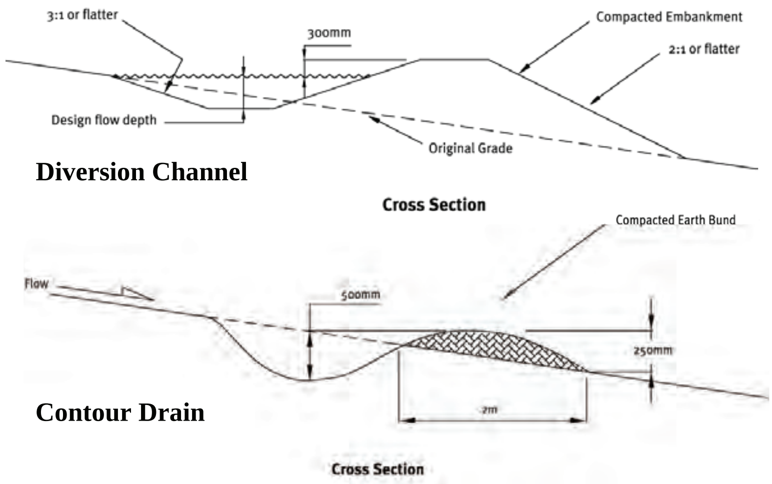
Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Are there spillways in the centre of the check dams to avoid flow outflanking the edges of the dams				
Are they spaced so the toe of upstream dams is at approximately the same elevation as the centre crest of the downstream ones.				
Maintenance				
Have dams been repaired when they have suffered machinery damage?				
Have dams been inspected after rainfall or storms and repairs done as necessary?				
Is there evidence of water outflanking the dams? Is there any scour around the edges or scour between the check dams?				

Sediment accumulation behind the dams should be checked after each significant rain event and removed when depth exceeds 40% of original height.				
Decommissioning				
Remove check dams when no longer needed.				
Do not remove check dams that are protecting grass-lined channels until a complete and sustainable ground cover has been achieved.				
Areas disturbed by the removal process must be seeded, fertilised and protected from erosion.				

NZ TRANSPORT AGENCY
WAKA KOTAHI

Erosion and Sediment Control Inspection Checklist

Check List for Contour Drains and Diversions

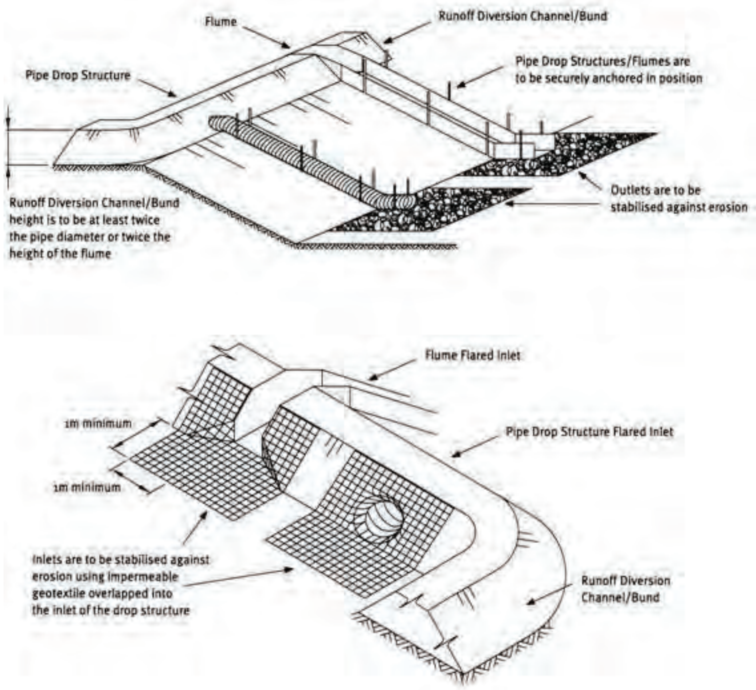


Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Contour drains				
Minimum compacted height is 250 mm				
Minimum depth of 500 mm				
Longitudinal grade < 2% w/out lining				
Catchment area < 0.5 ha				
Parabolic flow area and not V shaped				
Diversion channels and bunds				
Choose a route that avoids trees, services, fence lines or other natural or built features				
Channels shall be trapezoidal or parabolic in shape.				
Internal side slopes no steeper than 3:1 External side slopes no steeper than 2:1				
Bunds shall be well compacted				

Outlets shall be stable and protected as needed				
Diversions shall be stabilised to prevent erosion				
Maintenance				
Contour drains				
Repair or reinstate drains if destroyed by equipment				
Inspect contour drains after rainfall and repair as necessary				
Check outfall for erosion and repair as needed				
Diversion channels and bunds				
Inspect weekly and after every rainfall and repair immediately				
Remove accumulated sediment				
Check inlets and outlets to ensure that these remain scour and erosion free				
Look for low spots where water can pond, formation of tunnel gullies and debris blockage				
Check for stabilisation cover				
Protect bunds from equipment damage				
Decommissioning				
Contour drains				
Spread bunded area and stablise				
Diversion channels and bunds				
Fill in channels and spread bunded area and stabilise				

NZ TRANSPORT AGENCY WAKA KOTAHI	Erosion and Sediment Control Inspection Checklist
Check List for Pipe Drop Structures	

Contractor: Inspector:	Date: Time:	Consent #:	Site:

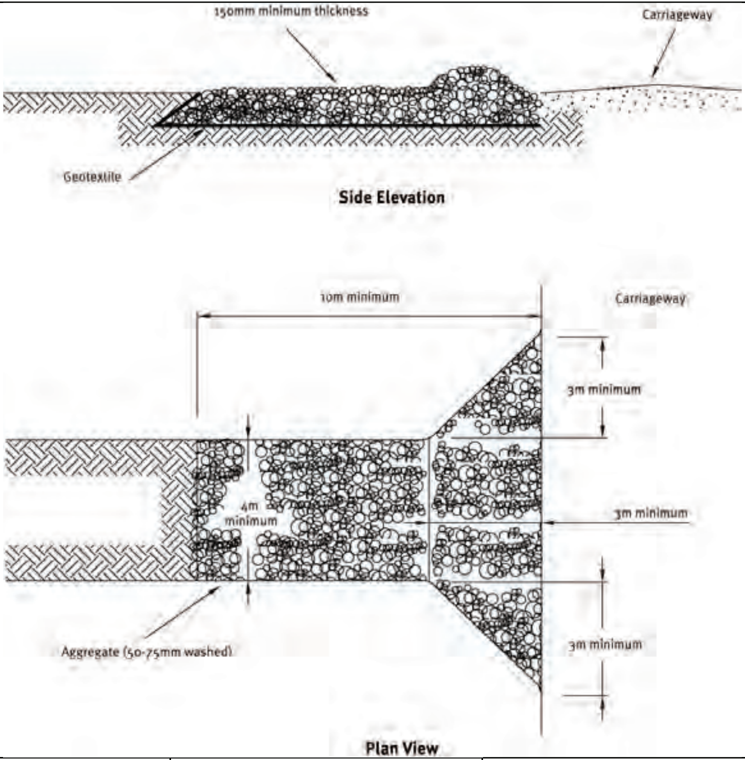
Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Use when slopes > 3:1				
Do not use on slopes < 5:1				
Must be of an impervious material				
Diversion channel or bund must be 2 x height of flume or pipe				
Must have a stabilised entry apron to prevent scour or piping				
Must extend beyond toe of slope with erosion protection at outfall				
Maintenance				
Inspect weekly and after each rain				

Keep the inlet open at all times				
Check for evidence of water bypass, undermining, ponding or overtopping.				
Check for scour at the base of the pipe and repair, protect or reduce flows				
Decommissioning				
When areas draining to the pipe are controlled, all disturbed areas stabilised and permanent stormwater drainage has been installed.				

Erosion and Sediment Control Inspection Checklist

Check List for Stabilised Entranceways



Contractor: Inspector:	Date: Time:	Consent #:	Site:

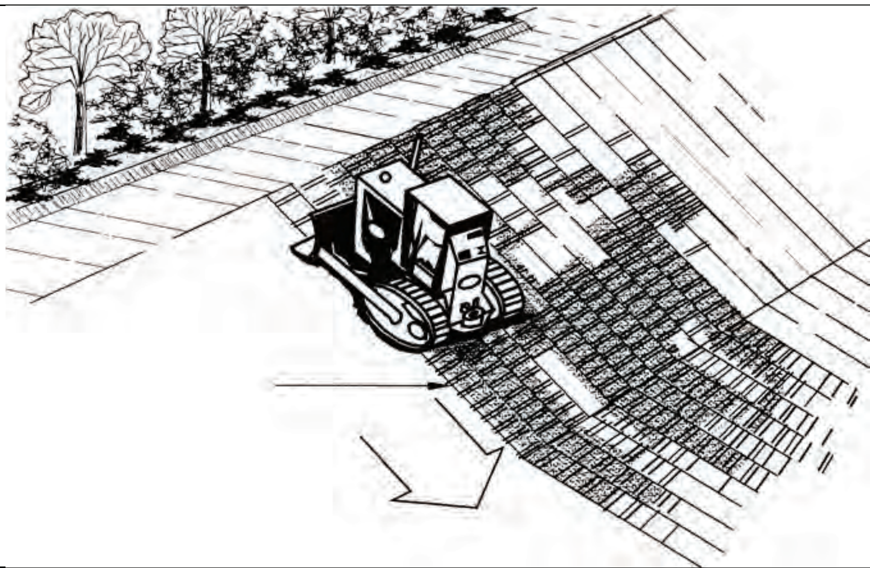
Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Area cleared of unsuitable material and smooth graded				
Geotextile placed over this area ensuring it is properly pinned and overlapped				
At least 10 m of aggregate, 4 m wide and 1.5 x aggregate size in depth. Aggregate 100-105 mm washed aggregate				
Ensure that vehicles cannot bypass the entranceway				
Can be used with a shaker ramp (cattle stops) or with a wheel wash				

Maintenance				
Inspect weekly and after each rain				
Maintain the entranceway to prevent it becoming a source of sediment				
If used with a wheel wash, ensure that this drains to an approved sediment retention practice.				
Decommissioning				
Remove aggregate and geotextile and stabilise. At this point ensure that traffic is kept off of the area				

Erosion and Sediment Control Inspection Checklist

Check List for Surface Roughening



Contractor:	Date:	Consent #:	Site:
Inspector:	Time:		

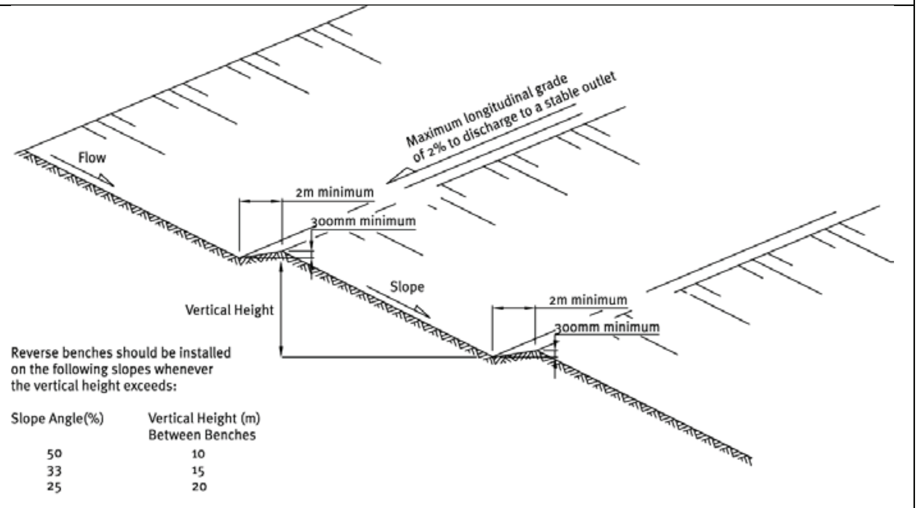
Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Divert water away from the slope face prior to slope roughening				
Fill existing rills before roughening				
Roughening must be done perpendicular to surface water flows				
When track-walking topsoil material, take care not to compact the slope				
Maintenance				
Periodically check the slope for erosion and rework or reseed as necessary				
Decommissioning				
Check slope for any rilling or erosion, topsoil the area and stabilise				

NZ TRANSPORT AGENCY
WAKA KOTAHI

Erosion and Sediment Control Inspection Checklist

Check List for Benched Slopes



Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Are all slopes > 25% and higher than 20 m vertical provided with slope benches				
Are they located as equal as possible apart				
Diversion must be at least 2 m wide and have a reverse slope of 15% and a minimum depth of 0.3 m				
The cross-gradient should be < 2%				
Flow length in bench < 250 m				
Surface water should be diverted away from all cut and fill slopes				
Maintenance				
Repair and reinstate benches when needed				
Check outfalls to ensure that erosion does not occur				
Remove accumulated sediment from the diversion				

Decommissioning				
Check slope and bench area for any rilling or erosion, topsoil and stabilise				

Erosion and Sediment Control Inspection Checklist

Check List for Dust Suppression

Contractor:	Date:	Consent #:	Site:
Inspector:	Time:		

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Has issue been considered at project initiation				
What method of suppression has been selected (water, adhesives, barriers, mulches)				
Maintenance				
Periodically inspect areas to ensure dust is kept to a minimum				
Decommissioning				
Ensure good stabilisation occurs				

Erosion and Sediment Control Inspection Checklist

Check List for Top Soiling and Grass Seeding

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Apply > 100 mm of topsoil				
Apply fertiliser according to manufacturers recommendation				
Apply seed uniformly at the required rate				
Ensure site conditions and time of year are appropriate for germination				
Ensure that site coverage > 80%				
Maintenance				
Check the condition of the topsoil regularly and replace where needed				
Where vegetation establishment is unsatisfactory, seed will need to be reapplied.				
Protect seeded areas from construction traffic or utility construction				
Decommissioning				
Ensure good stabilisation occurs				

Erosion and Sediment Control Inspection Checklist

Check List for Hydroseeding

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Where hydroseeding is used, the manufacturers recommendations shall be followed.				
Maintenance				
Where vegetation requirement is unsatisfactory, the area will require a reapplication of hydroseed				
Protect all re-vegetated areas from construction traffic or utility construction				
Decommissioning				
Ensure good stabilisation occurs				

Erosion and Sediment Control Inspection Checklist

Check List for Mulching

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Straw or hay shall be unrotted material and applied at a rate of 6,000 kg/ha				
If wind is a problem mulch should be either crimped or bound to prevent blowing				
Hydro mulch must contain a minimum of 80% virgin or recycled wood, be in accordance with manufacturers specifications and from 2,200 kg/ha – 2,800 kg/ha and slope length < 150 m				
Wood chip can be applied at rates of 10,000 kg/ha – 13,000 kg/ha				
Maintenance				
Inspect after each rainfall or after strong winds and repair or replace as needed				
Decommissioning				
Ensure good stabilisation occurs				

Erosion and Sediment Control Inspection Checklist

Check List for Turf

Contractor:	Date:	Consent #:	Site:
Inspector:	Time:		

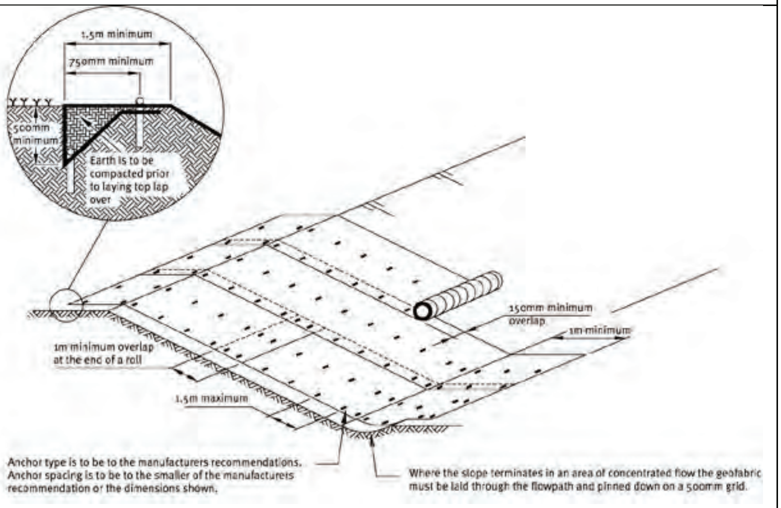
Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Rake soil surface to break crust prior to placing turf				
Irrigate lightly immediately prior to placement during periods of high temperature				
Turf should be laid on the contour, never up and down the slope. Start at the bottom and work up slope				
Butt joints tightly and do not stretch or overlap				
Slopes steeper than 3:1, secure turf to ground with pegs or other means				
Roll and tamp turf immediately to ensure solid contact with ground				
Maintenance				
Water daily during the first week unless there is adequate rainfall				

Check to ensure that turf is firmly rooted. Do not mow until that point				
Apply fertiliser in accordance with specifications				
Decommissioning				
Ensure good stabilisation occurs				

Erosion and Sediment Control Inspection Checklist

Check List for Geotextiles



Contractor: Inspector:	Date: Time:	Consent #:	Site:

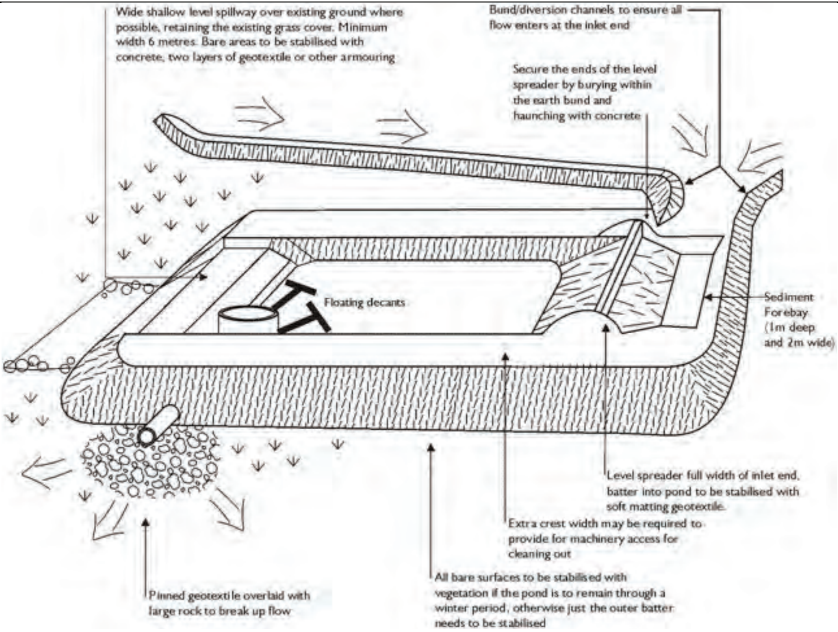
Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Has the site been prepared to ensure complete contact of the blanket or matting with the soil				
Area graded and shaped for installation				
All rocks, clods, vegetation or other obstructions removed				
Seedbed prepared by loosening 50 mm to 75 mm of topsoil				
Area seeded prior to blanket installation unless specified otherwise				
Wire staples, stake pins or wooden stakes have been placed to anchor mats and blankets to the ground. Propoer sized anchoring materials have been used				
On slopes, has the blanket started at the top of the slope and rolled downslope				
Are blanket edges overlapped				

In channels is there an anchor trench >300 mm deep x 150 mm across at the lower end of the project				
Intermittent check slots at 8-10 m intervals				
Are side fabric edges keyed in at least 100 mm deep x 100 mm wide				
Channel fabric begun at the downstream end with upstream geotextile overlapping < 75 mm				
Upstream end keyed in >300 mm x 150 mm wide				
Geotextile anchored securely with appropriate anchors				
Seed and fill turf reinforcement matting with soil if specified				
Maintenance				
Inspected daily and after each rain				
All rills, tears, missing pins or other damage repaired immediately				
Decommissioning				
If geotextile is temporary, remove it and stabilise the area				
If geotextile is permanent, ensure good stabilisation exists				

Erosion and Sediment Control Inspection Checklist

Check List for Sediment Retention Ponds

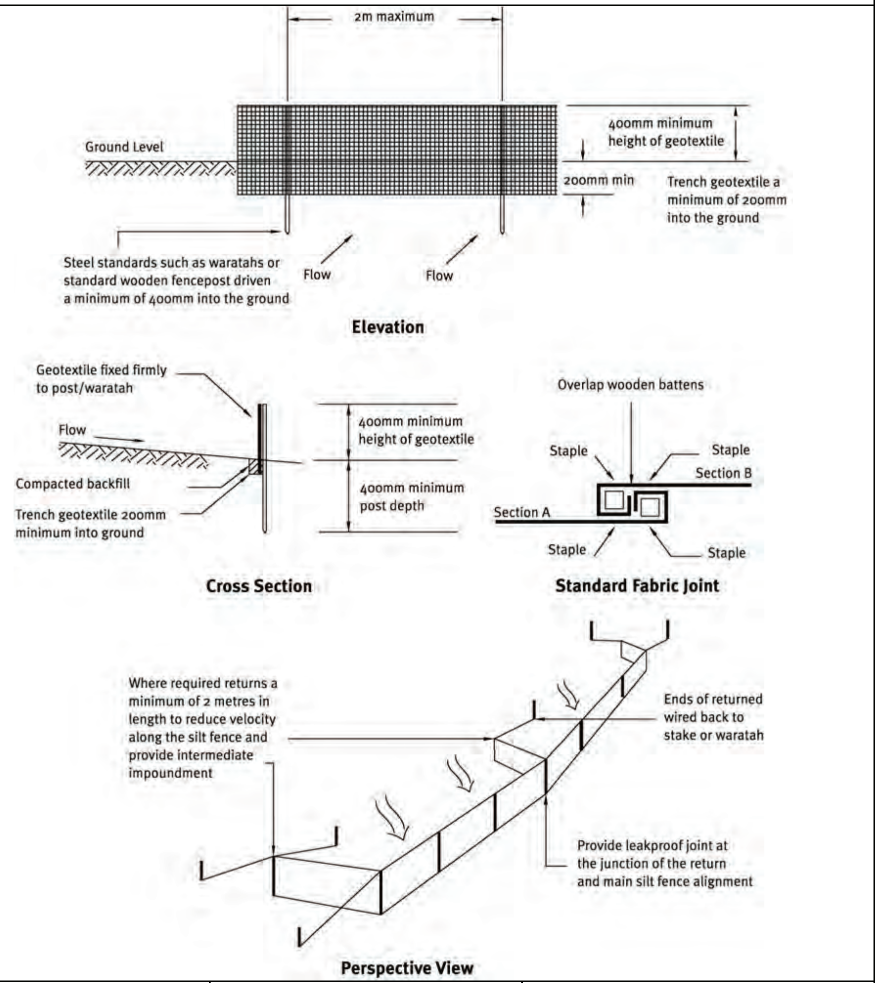


Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Implement sediment control downslope of the proposed sediment retention pond				
Clear areas of proposed fill of topsoil or other suitable material down to competent material.				
If the pond is to be converted to a permanent stormwater management pond ensure that a key trench is constructed				
Use only approved fill material.				
Place and compact fill in layers per the engineering recommendations				
Construct fill embankment 10% higher than the design height to allow for settlement				

Install pipework and anti-seep collars or filter collars during construction of the embankment and ensure good compaction around pipes				
Construct the emergency spillway				
Install and stabilise the level spreader				
Securely attach the decant system to the horizontal pipework. Make all connections watertight. Place any manhole riser on a firm foundation of concrete or compacted soil				
Protect inlet and outlet with fabric				
Install baffles when the pond's length to width ratio < 3:1				
Provide an all weather access track for maintenance				
Check all elevations to ensure proper function and rectify any inaccuracies				
Stabilise both internal and external batters with vegetation and the emergency spillway in accordance with the approved erosion and sediment control plan				
Undertake an As Built assessment at the completion of consruction and rectify any discrepancies with the design				
Maintenance				
Clean out pond before the volume of accumulated sediment reaches 20% of the total pond volume. A staff gauge would assist in this determination				
Clean out ponds with high capacity sludge pumps or with excavators loading the material onto sealed tip trucks to an area that will not discharge sediment off-site				
Clean out forebay after each runoff event if there is any evidence of sediment deposition				
Inspect pond every day and before every forecasted rainfall event				
Inspect for correct operation after every runoff event				
Immediately repair any damage caused by erosion or construction equipment				
Decommissioning				
Install a silt fence or other device downhill from the pond				
Dewater pond				
Remove and correctly dispose of all accumulated sediment				
Backfill the pond and compact soil. Regrade as required				
Stabilise all exposed surfaces				

NZ TRANSPORT AGENCY WAKA KOTAHI	Erosion and Sediment Control Inspection Checklist
Check List for Silt Fence	

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

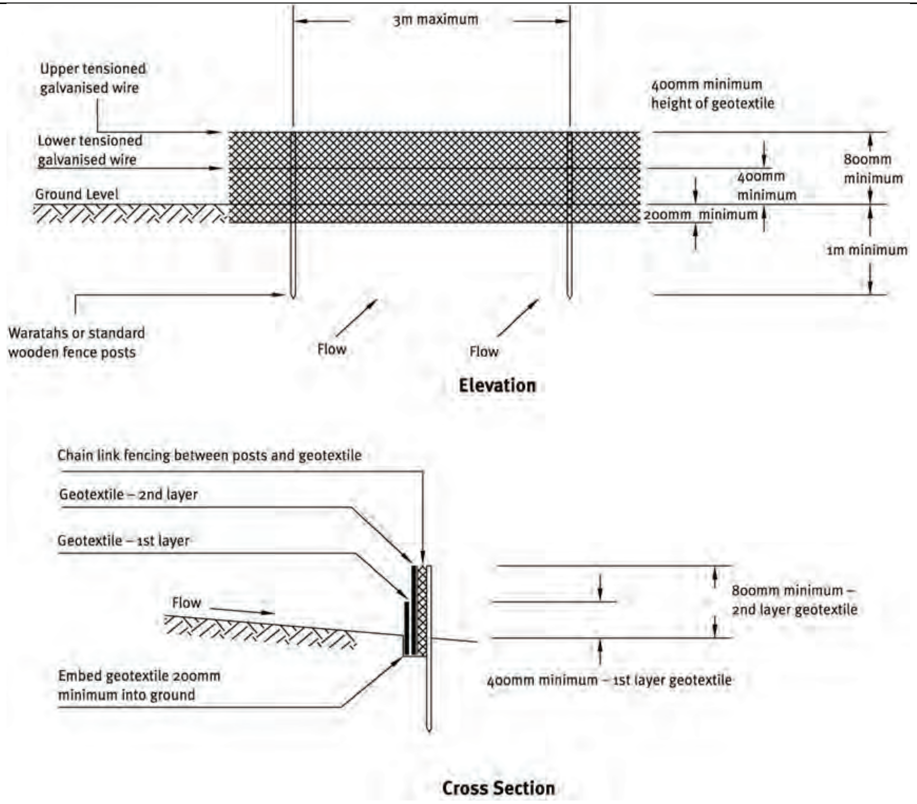
Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Use silt fence material appropriate to the site conditions and in accordance with the manufacturer's specifications				
Always install silt fences along the contour				

Excavate a trench a minimum of 100 mm wide and 200 mm deep along the proposed line of the silt fence				
Use supporting posts of tantalised timber a minimum of 50 mm square or steel waratahs at least 1.5 m length				
Install the support posts/waratahs on the downslope edge of the trench and silt fence fabric on the upslope side of the support posts to the full depth of the trench and then backfill the trench with compacted soil				
Reinforce the top of the silt fence fabric with a support made of high tensile 2.5 mm diameter galvanised wire. Tension the wire using permanent wire streainers attached to angled waratahs at the end of the silt fence				
Where ends of silt fence fabric come together, ensure they are overlapped, folded and stapled/screwed to prevent sediment bypass				
Maintenance				
Inspect silt fences at least once a week and after each rainfall				
Check for damage including rips, tears, bulges in the fabric, broken support wires, loose posts/waratahs, overtopping, outflanking, undercutting and leaking joins in the fabric				
Make any necessary repairs as soon as they are identified				
Remove sediment when bulges occur or when sediment accumulation reaches 50% of the fabric height				
Remove sediment deposits as necessary (prior to 50% level) to continue to allow for adequate sediment storage and reduce pressure on the silt fence				
Dispose of the sediment to an area where sediment cannot be transported downstream				
Decommissioning				
Do not remove silt fence and accumulated sediment until the catchment area has been appropriately stabilised				
Remove and dispose of accumulated sediment				
Backfill trench, regrade and stabilise the disturbed area				

NZ TRANSPORT AGENCY
WAKA KOTAHI

Erosion and Sediment Control Inspection Checklist

Check List for Super Silt Fence



Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

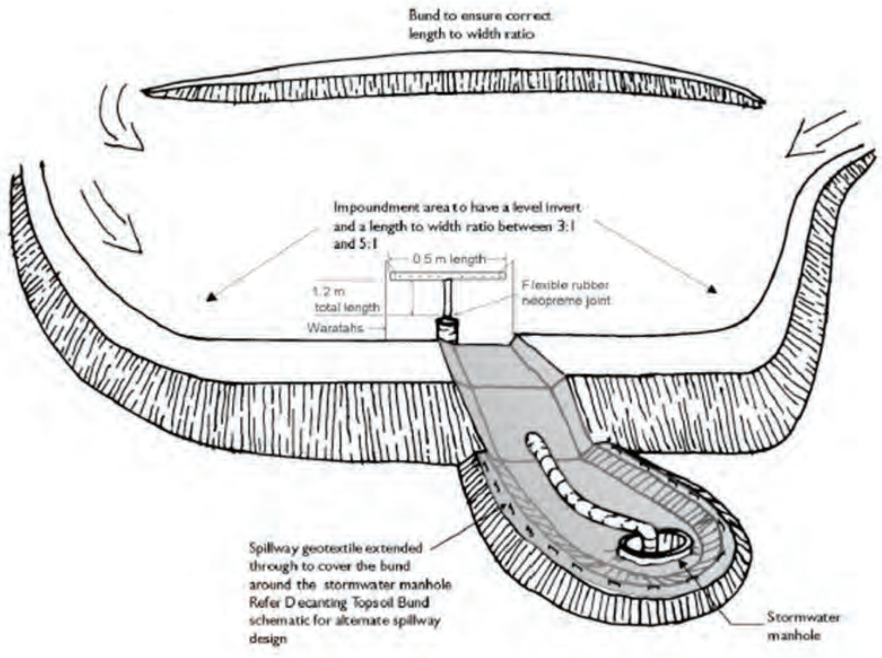
Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Use super silt fence material appropriate to the site conditions and in accordance with the manufacturer's specifications				
Always install super silt fences along the contour				
Excavate a trench a minimum of 100 mm deep along the proposed line of the super silt fence				

Use supporting posts of tantalised timber (No. 3 rounds, No. 2 half rounds) or steel waratahs at least 1.8 m in length				
While there is no need to set the posts in concrete, ensure the 1.8 m long posts are driven in > 1 m				
Install tensioned galvanised wire (2.5 mmHT) at 400 mm and again at 800 mm above ground. Tension the wire using permanent wire strainers attached to angled waratahs at the end of the super silt fence				
Secure chain link fence to the fence posts with wire ties or staples, ensuring the chain link fence goes to the base of the trench				
Fasten two layers of geotextile fabric to the base of the trench (a minimum of 200 mm into the ground) and place compacted backfill back to the original ground level				
When two sections of geotextile fabric adjoin each other, ensure that they are doubled over a minimum of 300 mm, wrapped around a batten and fastened at 75 mm spacings to prevent sediment bypass				
Maintenance				
Inspect fences at least once/week and after each rainfall				
Check for damage including rips, tears, bulges in the fabric, broken support wires, loose posts/waratahs, overtopping, outflanking, undercutting and leaking joins in fabric				
Make repairs as soon as identified				
Remove sediment when bulges occur or when sediment accumulation reaches 50% of the fabric height				
Remove sediment deposits as necessary (prior to 50% level) to continue to allow for adequate sediment storage and reduce pressure on the super silt fence				
Dispose of the sediment to an area where sediment cannot be transported downstream				
Decommissioning				
Do not remove super silt fence and accumulated sediment until the catchment area has been appropriately stabilised				
Remove and dispose of accumulated sediment				
Backfill trench, regrade and stabilise the disturbed area				

NZ TRANSPORT AGENCY
WAKA KOTAHI

Erosion and Sediment Control Inspection Checklist

Check List for Decanting Earth Bund



Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

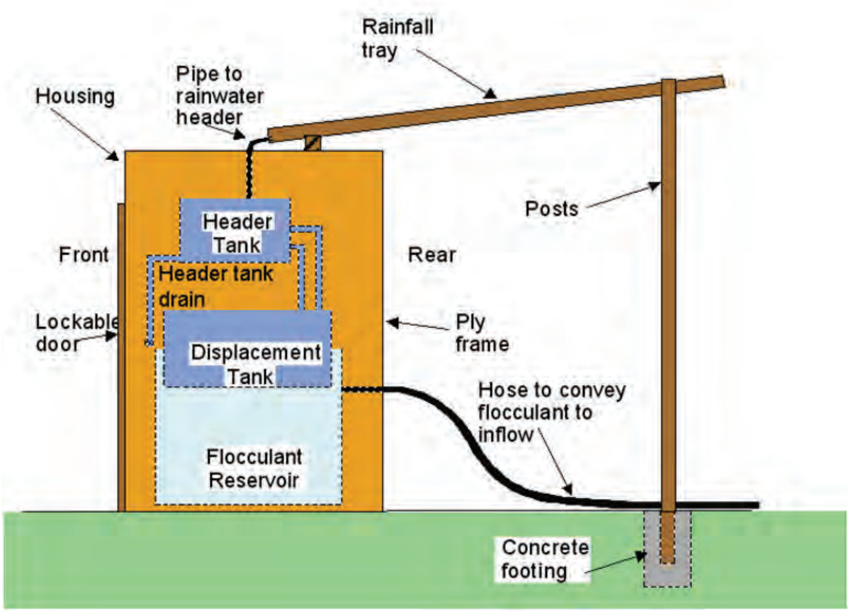
Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Build Decanting Earth Bunds along the contour to obtain required volumes				
Remove all organic/ vegetation before construction				
The Decanting Earth Bund is to be keyed into the existing ground to a minimum depth of 0.3 m				

The Decanting Earth Bund is to be made with a clay-silt mix of suitable moisture content to achieve a reasonable compaction standard (90%). It is considered that this can be achieved, in most instances, by track rolling at 150 - 200 mm lifts. Particular care is required to achieve good compaction around the outlet pipe that passes through the bund to avoid seepage and potential failure				
Install a 150 mm diameter non-perforated outlet pipe through the bund and this is to discharge to a stable erosion proofed area or stormwater system				
A T-Bar decant is attached by way of a standard 100 mm tee joint (glued and screwed). The decant is 100 mm dia. PVC pipe 0.5 metres long with 20 equally spaced holes of 10 mm diameter and fixed firmly to a waratah standard to achieve 3 litres/second/ha of contributing catchment				
A sealed PVC pipe (with endcaps) is placed on top of the decant to provide buoyancy				
Use a flexible thick rubber coupling to provide a connection between the decant arm and the discharge pipe. To provide sufficient flexibility (such as is required for the lower decant arm) install two couplings. Fasten the flexible coupling using strap clamps, glue and screws				
The decant is fastened to two waratahs by way of a nylon cord to the correct height				
Provide an emergency spillway to a stabilised outfall 150 mm above the level of the top of the decanting novacoil pipe. This can be a trapezoidal spillway with a minimum invert length of 2 m which is smooth, has no voids and is lined with a soft needle punched geotextile to the stabilised outfall. Ensure the geotextile is pinned at 0.5m centres				
The emergency spillway is to have a minimum freeboard of 250 mm, i.e. between the invert of the spillway to the lowest point of the top of the bund				
Undertake an As Built assessment at the completion of construction to check against design. If there are discrepancies rectify immediately				
Maintenance				
Inspect decanting earth bunds at least once/week and after each rainfall				

Check for damage including • Spillway • Outlet erosion • Decant or fitting damage • Embankment seepage or along outlet pipe • Blockages to holes in decants				
Make any necessary repairs as soon as identified				
Remove sediment when sediment accumulation reaches 20% of volume				
Dispose of the sediment to an area where sediment cannot be transported downstream				
Decommissioning				
Do not remove Decanting Earth Bund and accumulated sediment until the catchment area has been appropriately stabilised				
Dewater bund area				
Remove and dispose of accumulated sediment				
Remove pipes, fabric and other construction materials				
Backfill, regrade and stabilise the disturbed area				

Erosion and Sediment Control Inspection Checklist

Check List for Flocculation



Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Ensure all components are on site including: • Rainfall catchment tray • Header tank • Displacement tank • Flocculant reservoir tank				
Follow the design approach which provides for sizing of the various elements and pipe sizes. Check that the flocculant volume has been based on site soil testing.				

Rainfall tray shall be constructed and sealed along any joints and be graded at approximately a 10:1 slope with a drain to the header tank at the low end.				
The header tank is installed properly with pipe sizes and elevations done according to plans				
The displacement tank must be of a standard size of approximately 400 L				
The flocculant reservoir tank must be larger than the displacement tank and of sufficient capacity to dose a large storm (generally at least 500 L)				
The flocculant tank outlet shall be a 20 mm hose located at the point that will retain 400 L of floc w/out displacement				
The dosing point of the outlet into the sediment diversion channel should be at least 10 m upstream of the forebay				
Maintenance				
Assess function after every rainfall or during rain events if they are heavy or prolonged				
Service the unit prior to weekends to ensure maximum performance during weekend storms				
The header tank volume needs to be manipulated depending on dry weather. After 3 days lower level 50%, after six days empty the header tank. During the winter, the tank should always have water up to the second level				
When the volume of flocculant in the reservoir tank is insufficient to dose a storm, the displacement tank must be emptied and the flocculant reservoir refilled.				
The size of the rainfall catchment tray needs modification if earthworks alter the extent of the contributing catchment. Also ensure that the tube from the tray does not become clogged				
A contingency plan must be established if there is poor performance or other effects, such as reduced pH				
There must be a consultant available who is qualified to advise on flocculation related issues.				
There must be a spill contingency plan in the event of a PAC spill to prevent it entering water.				
Decommissioning				
Remove all components of the flocculation shed, store for use on another pond				

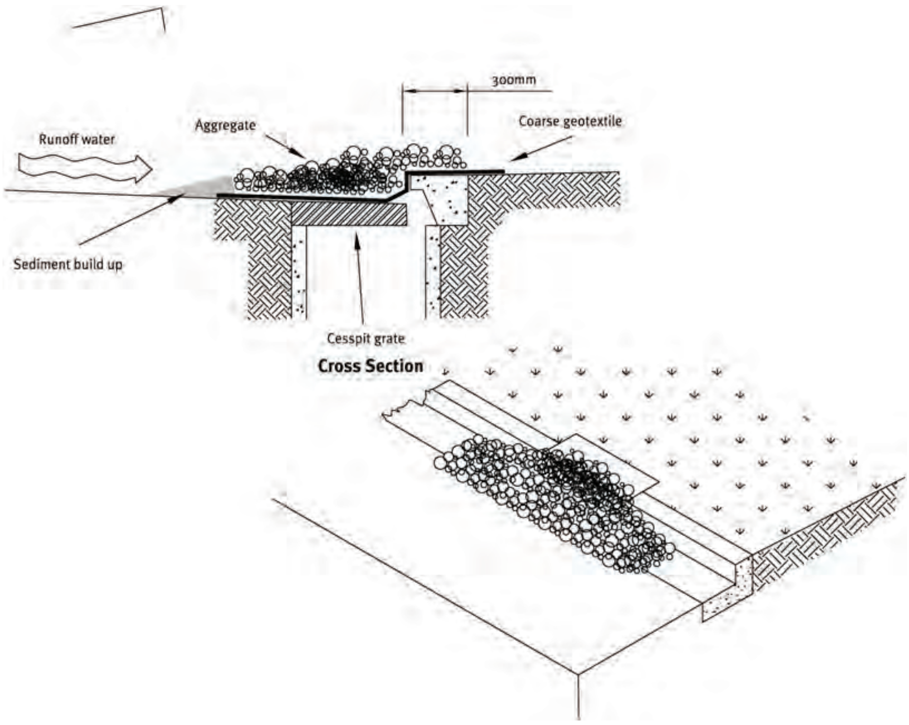
	Erosion and Sediment Control Inspection Checklist
Check List for Dewatering	

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Always dewater the cleaner water at the top first then pump the residual sediment laden water to a tank/truck				
Small volumes of sediment laden water can be pumped to a silt fence or decanting earth bund but do not overwhelm these practices				
Larger volumes can be pumped to a sediment forebay of a sediment retention pond				
Maintenance				
Ensure that the area being pumped to provides effective sediment removal				

Check for any leakage or flow bypass of practices				
Decommissioning				
Remove when the need no longer exists				

NZ TRANSPORT AGENCY WAKA KOTAHI	Erosion and Sediment Control Inspection Checklist
Check List for Stormwater Inlet Protection	

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
General Information				
Do you know what receiving system the project drains into				
Are you aware of local rainfall patterns during various times of the year				
Soil types and erosion potential for site				
Is a copy of the erosion and sediment control plan on site				
Is temporary fencing placed in areas where no construction is to take place				
Construction				
Construction specifications will vary according to the type of inlet protection				
Always ensure an emergency bypass is included on all devices				
Ensure device does not allow water to bypass its intended flow path				
Keep stockpile and loose sediment away from roadside drains				
Maintenance				
Inspect daily and during and after rainfall events				

Beware of blockages and leaks that may affect performance				
Check to see if flows have been diverted away from device and if the diversion caused any damage				
Clean all sediments immediately and repair any problems				
Decommissioning				
Remove and dispose of all accumulated sediments				
Remove control measure, reuse and recycle components				

Erosion and Sediment Control Inspection Checklist

Check List for Non-sediment Contaminants

Contractor: Inspector:	Date: Time:	Consent #:	Site:

Site Inspection of Erosion and Sediment Control Practices

Erosion and Sediment Control Practice	Yes	No	N/A	Corrective Action
Are vehicle and equipment fueling, cleaning and maintenance areas reasonably clean and free of spills, leaks, or any other deleterious material?				
Are vehicle and equipment fueling, cleaning and maintenance activities performed on an impermeable surface in dedicated areas?				
If no, are drip pans used?				
Are dedicated fueling, cleaning, and maintenance areas located at least 15 m away from downstream drainage facilities and watercourses and protected from run-on and runoff?				
Is wash water contained for infiltration/ evaporation and disposed of appropriately?				
Is on-site cleaning limited to washing with water (no soap, soaps substitutes, solvents, or steam)?				
On each day of use, are vehicles and equipment inspected for leaks and if necessary, repaired?				
Are material storage areas and washout areas protected from rainfall and stormwater runoff and located at least 15 m from concentrated flows and downstream receiving environments				
Are all material handling and storage areas clean, organised, free of spills, leaks or any other deleterious material and stocked with appropriate spill response materials.				
Are liquid materials, hazardous materials and hazardous wastes stored in temporary containment areas				

Are bagged and boxed materials stored on pallets				
Are temporary containment areas free of spills and rainwater				
Are temporary containment areas and bagged or boxed materials covered				
Are temporary concrete washout facilities designated and being used?				
Are temporary concrete washout facilities functional for receiving and containing concrete waste and are concrete residues prevented from entering the drainage system?				
Do temporary concrete washout facilities provide sufficient volume and freeboard for planned concrete operations?				
Are concrete wastes, including residues from cutting and grinding, contained and disposed of off-site or in concrete washout facilities?				
Are spills from mobile equipment fueling and maintenance properly contained and cleaned up?				
Is the site free of litter?				
Are trash receptacles provided in the yard, field trailer areas, and at locations where workers congregate for lunch and break periods?				
Is litter from work areas collected and placed in watertight dumpsters?				
Are waste management receptacles free of leaks?				
Are the contents of waste management receptacles properly protected from contact with storm water or from being dislodged by winds?				
Are waste management receptacles filled at or beyond capacity?				

Appendix C – Self Auditing Form

NZ TRANSPORT AGENCY WAKA KOTAHI OPUS		**Erosion & Sediment Control Inspection Notice**	**Site Rating Summary**	**Rating**	**Site Total**
				1 ☺	
				2	
Telephone:				**3**	
e-mail:				**4** ☹	

Site Name: **Date:**

Contract No: **Consent No:** **Time:**

Consultant:

Weather:

Contractor:

Person(s) contacted onsite:

Emailed to:

General Comments:

Site	**Control**	**Rating**	**Comments/ Direction Given:**	**Action Date**	**Closed Out**
			➢		

Rating Criteria – See reverse of Notice

Monitored By:

Position:

Notes:

This Notice is provided as advice with respect to the standard of erosion and sediment controls observed onsite.

Abbreviations:

SF = Silt Fence;
SRP = Sediment Retention Pond;
DEB = Decanting Earth Bund;
TB = Topsoil Bund;
CD = Contour Drain;
CP = Catch pit Protection;
CWD = Clean Water Diversion

Action Times:

Practice Rating	Timeframe for Remedial Action
1	No Action
2	7 Days
3	3 Days
4	Immediate

Erosion & Sediment Control: Guideline to Determining Control Rating

Category/Rating	Construction/Maintenance	Examples (not an exhaustive list)
1	Best practice – no further action required.	
2	Minor technical issue with the control device, where the *purpose* of the guidelines/E&SCP/consent conditions has been met. **Work to be carried out within 7 days**	- No silt fence support - Minor holes in silt fence - Minor discrepancy live/dead storage - Minor lack of volume in DEB's
3	Controls absent or construction of the device is so poor that it leads to/is likely to lead to failure as an efficient erosion/sediment control method. **Work to be carried out within 3 days**	- No returns in silt fence - Internal pond embankment collapse - Discharge at pond outlet causing erosion - Inappropriate pond volumes - Significant discrepancy between live/dead storage volumes - Flow paths or spillways inadequately stabilised - Diversion channels or bunds inadequately sized - Silt fence not trenched in
4	Controls absent or construction of the device is so poor that it leads to failure as an efficient erosion/sediment control method leading to an uncontrolled sediment discharge **Work to be carried out immediately** .	

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