Draft Erosion and Sediment Control Plan

He Ara Kōtahi: Ruha Street Pedestrian and cycle bridge (Option 1B)

Prepared for
Palmerston North City Council

Prepared by
Tonkin & Taylor Ltd

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This Draft Issue has been prepared by T+T based on our understanding of existing site conditions and design concept plans included as Appendix E to the Detailed Business Case prepared by Opus1 and information on anticipated construction methodologies provided by Opus2.

The Contractor is to update the ESCP as required based on the Contractor’s construction methodology.

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2 Email from Peter Kortegaast to Andrea Harris dated 11 October 2016.
1 Background

Palmerston North City Council (PNCC) is undertaking the design and construction of a 6.6 km shared cyclepath and walkway running from Fitzherbert Bridge to Linton Army Camp in Palmerston North, following the left bank of the Manawatu River (referred to as He Ara Kōtahi). The entire area of works principally drains directly to the Manawatu River or to its tributaries.

A new pedestrian and cycle bridge across the Manawatu River is proposed as part of these works and is the subject of this Draft Erosion and Sediment Control Plan (Draft ESCP). The proposed works will enable a secondary crossing downriver from Fitzherbert Bridge.

The Draft ESCP is prepared to demonstrate the approach taken to erosion and sediment control for these works. The plan provides a framework for the management of earthworks to avoid accelerating or causing the generation of sediment, and, where this is not possible effective and efficient treatment.

The Draft ESCP is prepared to support an application for resource consent, based on expected site conditions and method of works. It will require updating based on the appointed Contractor’s construction methodology.

1.1 Objectives

The primary objective for erosion and sediment control is to avoid causing or accelerating erosion and the subsequent generation of sediment.

Where the primary objective is not possible, the secondary objectives are:

- To limit the extent and duration of any erosion or sediment generation;
- The effective and efficient treatment of sediment discharges using regional council accepted erosion and sediment control techniques; and
- To implement an adaptive management strategy which combines routine site auditing with monitoring of the receiving environment.

The structure of the Draft ESCP has been set in accordance with Greater Wellington Regional Council (GWRC’s) guidelines for erosion and sediment control which are the adopted guidelines used by Horizons Regional Council (HRC).

In summary, the draft ESCP covers the following matters:

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<td>Site management, monitoring and reporting</td>
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<td>Reviewing</td>
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<td>9</td>
<td>Site responsibilities</td>
</tr>
</tbody>
</table>

3 Greater Wellington Regional Council (June 2006); Erosion and Sediment Control Guidelines for the Wellington Region
1.2 Project description

Proposed activities for the He Ara Kōtahi Bridge works at Ruha Street will include:

- Tree removal, topsoil stripping and vegetation clearance on both sides of the river banks, up to approximately 1,200 m$^3$ soil disturbance over approximately 1 ha area.
- Construction of a new pedestrian and cycle bridge, which includes two bridge piles within Manawatu River and one bridge pile on the true right hand bank (city side).
- Approximately 3,000 m$^3$ of fill e.g. gravel material with limited fines [fill specification to be confirmed] over approximately 0.8 ha area for the new bridge embankments and widening of the river stop bank on the city side of the river;
- Approximately 6,200 m$^3$ of linear excavations to form connecting shared pathways on both sides of the river;
- Minor upgrades to the road intersection of Dittmer on the city side; and
- Minor shaping earthworks to upgrade the parking area at the end of Dittmer Street.

1.2.1 Anticipated construction programme

The total expected duration of the works is 52 weeks. Earthworks and river bed disturbance works are proposed to be undertaken in the first 25 weeks. Following this (weeks 25 – 35), the bridge deck and rails will be installed with permanent stabilisation activities expected to commence week 35 onwards with:

- Paving of the linear path excavations (weeks 35 – 45); and
- Grass and planting of the new stop bank, bridge embankments and pathway berms (weeks 45 – 52).

This anticipated construction programme will require confirmation once a Contractor is appointed for the works.

2 Principles to minimise effects

The principles for minimising sediment discharges will be as follows:

- Minimise disturbance by staging works;
- Prompt stabilisation of disturbed areas using temporary and permanent techniques as appropriate;
- Use of best practice erosion and sediment control techniques;
- Allowing for the ESCP to evolve in response to experience gained on site or new technologies;
- Ensuring regular inspections and audits of erosion and sediment control measures; and
- Regular planning meetings and updating of plans to suit changing site conditions.
The following sections have been set out to address erosion and sediment control management of:

- Bulk earthworks on the river banks to construct new stop bank, bridge embankments and connecting shared pathways on both sides of the river - see Sections 3-5.
- Works within the river for constructing of two bridge piles located within the river channel – see Section 6.

3 Erosion and sediment control for bulk earthworks

ESC methods and measures which meet the principles set out in Section 2 and are considered appropriate for the proposed works are summarised in Table 3-1. These are discussed in more detail in the sections below.

A sketch demonstrating appropriate ESC measures applied for the bulk earthworks is attached as Appendix B (refer Sketch 1).

The E&SC methods implemented for any given part of the works will be modified and improved in response to detailed design and site conditions as works proceed, and specific E&SC measures will be implemented as required. Specific E&SC will be discussed at site meeting and daily checks will be undertaken by the contractor based on weather conditions.

Table 3-1: Summary of E&SC measures and methods

<table>
<thead>
<tr>
<th>E&amp;SC measures/methods</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive clearing and stripping</td>
<td>To reduce extent of disturbed areas</td>
</tr>
<tr>
<td>Dust control</td>
<td>To avoid generation of nuisance dust emissions</td>
</tr>
<tr>
<td>Decanting Earth Bund (DEB)</td>
<td>For catchments between 500 m² – 3000 m²</td>
</tr>
<tr>
<td>Grit trap</td>
<td>For catchments less than 500 m²</td>
</tr>
<tr>
<td>Silt fences</td>
<td>Where sheeting flows are likely (the cycle way/ shared path or fill embankments)</td>
</tr>
<tr>
<td>Diversion of site run-off</td>
<td>For catchments where site run-off needs to be directed to a DEB or grit trap for treatment prior to discharge.</td>
</tr>
<tr>
<td>Bunds/drain</td>
<td>Where temporary flow diversion is required OR where cause scouring on batter faces is observed.</td>
</tr>
<tr>
<td>Localised surface ponding</td>
<td>Where the existing topography enables ponding of water.</td>
</tr>
</tbody>
</table>

3.1 Commencement

Prior to commencement of work a site meeting will be held with HRC’s compliance and technical team, PNCC and Contractor. The purpose of the meeting is to confirm that all parties confirm method of works and programme, and assist in preparing the final ESCP for certification from HRC, and confirmation of any standing HRC River Management/PNCC asset protection agreements.

3.2 ESC planning

Prior to commencement of works and implementation of any ESC measures, the plan/sketch for each stage will be prepared by appropriately qualified and experienced staff and be submitted to HRC. This will confirm the size and location, and that the device will be built in accordance with the ESCP and the adopted ESC guidelines.
3.3 Stabilised site entrances

The Contractor shall ensure a stabilised area with aggregate is constructed and maintained at all vehicle access entrances to and from the site. These entrances will be built in accordance with the adopted E&SC guidelines, as reproduced below:

Figure 1: Stabilised construction entrance (reproduced from GWRC E&SC guidelines)

3.4 Clearance of vegetation

Vegetation will be cleared at the start of each stage of works. Clearance will comprise the removal of tree roots, flax and/or other vegetation, and the existing topsoil and grass will be maintained such that the surface is considered stabilised.

3.5 Progressive stripping of topsoil and subsequent earthworks

Progressive stripping of topsoil will be undertaken. Stripping will comprise of removing the surface cover and creating an erodible surface. Following stripping, placement of fill material and/or cut excavations will commence.

The Contractor shall ensure that areas stripped do not exceed the design areas of the E&SC measures set out in Table 3-1.

3.6 Dust control

A construction objective will be to ensure there are no nuisance dust emissions from the project site. For the proposed works, dust generated at the site is likely to have the greatest effect on residential properties on the true right hand of the river and vehicles travelling along Dittmer Drive.

To achieve no nuisance dust emissions, the following preventive measures will be used:

- Damping down of potential dust generation areas with water spray;
- Grassing down stockpiles where practicable;
- Ensuring that surfaces are constructed to their final design requirement as quickly as practicable; and
- Controlling vehicle speeds.

On the true right side of the river, source of water for dust control is likely to be from the PNCC water supply. The contractor shall liaise with PNCC and comply with any water supply regulations (to prevent back flow). On the true left side of the river, water will be pumped from the river. Polymer may also be applied as a contingency if required.

Wind conditions may be monitored to assist in daily planning of works to minimise the potential for nuisance dust emissions.

### 3.7 Stockpiling

If required, any stockpiled soil material shall be moved to a designated area at the end of each working day. This area shall be atleast 30 m from the river, and a silt fence will be installed on the river side of the stockpile.

The Contractor shall confirm proposed stockpiling areas, duration of stockpiles, and any associated controls prior to works commencing.

### 3.8 Decanting earth bund

Where possible, site run-off will be directed to a decanting earth bund prior to discharge into the Manawatu River. Decanting earth bunds will serve as the primary treatment for the works. DEBs will be sized by volume to 2-3% of the catchment area. The detail of the DEBs will be as outlined in Auckland Regional guidelines (2016)⁴, reproduced in Detail 2 below:

![Cross-section of Decanting earth bund](image)

*Figure 79: Decanting earth bund*

Where possible, DEB’s will be constructed with a length to width ratio between 3:1 – 5:1, however this may be constrained by site space limitations.

Should the design and implementation of any DEB’s fall outside the guidelines, certification from HRC will be obtained prior to works proceeding.

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⁴ Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region (June 2016), Guideline Document 2016/005
Typically, the outlet structure of these DEBs will comprise of a floating T-Bar dewatering device (decanting arm with anti-seep collar, as shown in Detail 2 above) which discharging to stabilised ground.

Where possible, the discharge end of the pipe will be perforated to disperse flows past the working area to stabilised or undisturbed ground.

3.9 Grit traps

Grit traps may be used to capture and discharge flows for the linear pathway excavations, where the upslope catchment is less than 500 m². Grit traps may either be an excavated pit with a stabilised lip to discharge (as set out in the Waikato Regional Council E&SC guidelines), or a bunded pit with a pipe outlet. Grit traps will typically be between 3-5m³. Where possible if a pipe outlet is used, the discharge end of the pipe will be perforated to disperse flows past the working area to stabilised or undisturbed ground.

If discharges from these grit traps to the Manawatu River are observed to be discoloured, grit traps will be replaced with a DEB sized for 3% of the catchment.

3.10 Localised surface ponding

During construction, there may be areas where localised ponding will occur (e.g. behind the true left embankment, refer Sketch 1). Water will be left to settle undisturbed for as long as practical in these areas. If the area is required to be drained, water will be decanted using a pump and discharged to ground. If the ponded water is discoloured with sediment, it will be pumped to the nearest DEB or grit trap.

3.11 Silt fences

Silt fences may be installed as a treatment measure where sheeting flows are considered likely:

- Toe of fill embankments, where it is not practical to divert flows to a DEB or if significant scour occurs in the embankment following rainfall; and
- Cycleway/shared path, constructed with a cross-fall

Silt fences will be built in accordance with the adopted E&SC guidelines, as reproduced below:

*Detail 3: Silt fence (reproduced from GWRC E&SC guidelines)*

Returns on the silt fences or rock checks may be used where some movement of water parallel to the silt fence may occur.
3.12 Super silt fence

Super silt fences may be installed as a treatment measure to intercept debris, soil and sediment laden run-off. Super silt fences will be used for earth embankment works within 15 m of the river bank, where installation of a grit trap or DEB is not practical.

Silt fences will be built in accordance with the adopted E&SC guidelines, as reproduced below:

![Elevation Diagram](image)

**Elevation**

*Detail 4: Super silt fence (reproduced from GWRC E&SC guidelines)*

3.13 Diversion of site run-off

**Dittmer Drive Intersection:**

Bunds (300 mm minimum height) or shallow drains will be installed to direct water from the intersection to the downstream DEB or grit trap. These bunds (or drains) are likely to be temporary as these surfaces may change as fill operation progresses. Where there is potential for the discharge to result in erosion, drains may be replaced with piping.

**Cycleway/shared pathway:**

In most instances, the cycleway/shared pathway will be constructed with a cross-fall to encourage sheeting of water away from the working area where it can be treated by silt fences. Where this is not possible, bunds (300 mm minimum height) or shallow drains will be installed to direct water to the downstream DEB or grit trap.

Temporary bunds (or drains) may be installed on a daily basis if required, but definitely in advance of rain or if the site is going to be left unattended for more than 24 hours.

3.14 Water control bunds

On completion of the city side stop bank and true left embankment if significant scour is observed following rainfall, a 300 mm high compacted earth bund will be placed along the top of the batter. The purpose of the bund is to prevent any surface flow over the batter face of the fill. The water intercepted by a bund will be directed to the nearest DEB or grit trap.
3.15 Decommissioning

The removal of any erosion or sediment control measure shall only occur after HRC are satisfied that the area serviced by the erosion and sediment control structure has been stabilised (refer section 4 below).

4 Stabilisation

**General definition:** ‘Stabilised’ is defined as inherently resistant to erosion or rendered resistant, such as by the application of base course, rock, polymer, grassing, mulch, or another method. Where hydro seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once 80% vegetative cover has been established, or polymer is applied and visual observations suggest that run-off is clear.

**Specific application:**

Permanent stabilisation works will commence following the construction of the bridge and new road intersection and will comprise:

- Paving and concrete on the shared pathways and new carpark;
- Topsoiling and grass at the pathway berms;
- Planting of the earth embankments and stop bank; and
- Rock armouring at river bank, around each abutment

In some cases, highly compacted granular fill may be rendered resistant to erosion once works are completed. This will be monitored and if evidence of erosion is present, temporary stabilisation may be required if significant scouring following rainfall is observed. This could comprise polymer stabilisation, application of hydroseed and/or a temporary cover of tree mulch.

4.1 Tracking and topsoiling

The placement of topsoil over disturbed areas is an effective way of starting the stabilisation of surfaces and assists with soil moisture retention and breaking up overland flow. The thickness of topsoil will be approximately 100 mm.

Topsoiling will be undertaken when areas are completed to the final design profile.

4.2 Additional methods of stabilisation

Stabilisation is not limited to the methods set out above. Additional methods and technologies may be investigated during the course of works, to improve the effectiveness of stabilisation. Should a new method be proposed, certification will be sought from HRC prior to implementing.

5 Maintenance

Table 5.1 identifies the maintenance requirements for all erosion and sediment control structures, and sediment treatment devices respectively. Maintenance is based on daily inspections or occurs in response to predicted rainfall events or as a result of inspection following rainfall events.

A trigger rainfall event will trigger an inspection to check the condition and continued effectiveness of sediment control measures (refer section 7).
Table 5.1: Maintenance measures for erosion and sediment control devices

<table>
<thead>
<tr>
<th>E&amp;SC measure</th>
<th>Trigger</th>
<th>Maintenance action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary diversion drains</td>
<td>Debris in channel forcing water out of channel</td>
<td>Remove debris</td>
</tr>
<tr>
<td></td>
<td>Scour along edges of cut off channel</td>
<td>Widen cut off channel and extend armour Line channel with geotextile or matting</td>
</tr>
<tr>
<td></td>
<td>Scour in channel</td>
<td>Scour along edges of cut off channel. Widen cut off channel and extend armour Line channel with geotextile or matting</td>
</tr>
<tr>
<td></td>
<td>Scour at outlet</td>
<td>Place armour rock at outlet. Line outlet with geotextile or matting.</td>
</tr>
<tr>
<td>DEB or grit trap discharge pipes</td>
<td>Any build-up of debris in pipe inlet</td>
<td>Remove debris</td>
</tr>
<tr>
<td></td>
<td>Scour at inlet</td>
<td>Protect inlet with geotextile overlain with armour</td>
</tr>
<tr>
<td></td>
<td>Scour around outlet</td>
<td>Place armour to dissipate energy</td>
</tr>
<tr>
<td>DEB/Grit traps</td>
<td>Pond more than 20% full with sediment</td>
<td>Empty pond and remove sediment</td>
</tr>
<tr>
<td></td>
<td>Scouring at discharge point from pond</td>
<td>Place material to dissipate energy from discharge</td>
</tr>
<tr>
<td></td>
<td>Erosion of bund</td>
<td>Armour bund by either placement of geotextile or rock</td>
</tr>
<tr>
<td></td>
<td>Insufficient capacity filling quickly</td>
<td>Enlarge trap or provide additional DEBs</td>
</tr>
<tr>
<td>Silt fence</td>
<td>Fence flapping in wind</td>
<td>Reattach fabric to guide wire and increase number of fabric locks. If required install additional waratahs</td>
</tr>
<tr>
<td></td>
<td>Build-up of sediment greater than 150mm in depth resulting in straining structure</td>
<td>Clean sediment away</td>
</tr>
<tr>
<td></td>
<td>Large rocks distorting fence alignment</td>
<td>Remove rocks</td>
</tr>
<tr>
<td></td>
<td>Bottom of silt fence not properly anchored</td>
<td>Dig fence into ground and use pegs to keep in position</td>
</tr>
<tr>
<td></td>
<td>Under cutting of fence by concentrated flow</td>
<td>Identify options to avoid concentrated flow or replace with grit trap</td>
</tr>
<tr>
<td></td>
<td>Silt fence broken off top wire</td>
<td>Install additional clips on top wire. In very windy locations a netting fence may be required to keep the silt fence in place</td>
</tr>
</tbody>
</table>

### 5.1 Improvements

Section 5 identifies inspections of the sediment control devices that will be undertaken to ensure they are operating correctly and achieving the erosion and sediment control objectives. If the devices are found not to be operating correctly the appropriate response identified in Table 6.2 will be implemented.
Table 5.2: Improvements to treatment devices

<table>
<thead>
<tr>
<th>Treatment device</th>
<th>Problem</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEB/Grit trap</td>
<td>Poor operating performance</td>
<td>Increase capacity of the DEB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduce catchment area by installing another DEB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Place flocculation blocks or similar product in inlet to DEB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve catchment condition e.g. Stabilising as you go</td>
</tr>
<tr>
<td>Silt fence</td>
<td>Poor performance</td>
<td>Replace with super silt fence</td>
</tr>
</tbody>
</table>

6 Erosion and sediment management of riverbed disturbances

6.1 Manawatu River

6.1.1 River situation at project site

The Manawatu River channel at the project site is about 100 m wide with a channel depth ranging from 2 m on the true left side to approximately 4 m on the true right side. The river bed is expected to be gravel dominated. An existing and seasonally exposed gravel shoal is located on the true left bank.

6.1.2 Manawatu River flows

A summary of Manawatu River flows is provided in Table 5.1 below, and indicate:

- Low river flow conditions generally occur January to April inclusive (considered “dry-season”), with a median flow of 43.5 m³/s.
- The annual mean and median flows are 116.6 m³/s and 73.4 m³/s respectively.
- The seasonal distribution of mean monthly flows indicate on average, flows exceed annual mean and median flows in May to October (inclusive), with the highest mean flow of 192 m³/s occurring in July.

Table 5.1: Manawatu River flow summary

<table>
<thead>
<tr>
<th>Condition</th>
<th>Flow (m³/s)</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in 5 year ARI event</td>
<td>2074</td>
<td>As reported in the hydraulic assessment for the proposed bridge⁵</td>
</tr>
<tr>
<td>Mean flow (July to June)</td>
<td>116.6</td>
<td>82 years of data at HRC's Manawatu River monitoring site at Palmerston North (near the Teachers College)⁶</td>
</tr>
<tr>
<td>Median flow (July to June)</td>
<td>73.4</td>
<td></td>
</tr>
<tr>
<td>“Dry season” median flow (Nov – April only)</td>
<td>43.5</td>
<td></td>
</tr>
</tbody>
</table>


6.1.3 Water quality

The desktop ecological assessment\(^7\) looked at existing water quality data collected from the Manawatu River approximately 1 km upstream of the project site and concluded:

*The Manawatu River through Palmerston North is indicated to be characterised by relatively low turbidity (below 10 NTU) and moderate to high visual clarity (mostly between 1 m and 3.5 m) when river discharge is below around 60 m\(^3\)/s. Reduced water clarity (less than 0.5 m) occurs at elevated river discharge, particularly above 100 m\(^3\)/s (refer Figures 1-2 below).*

![Graph showing turbidity vs. river discharge](image1.png)

*Figure 1: Plot showing paired turbidity and instantaneous river discharge data for the HRC monitoring site at Teachers College (monthly data for the period 2010 to 2015 inclusive) [Reproduced from desktop ecological assessment\(^7\)]*

![Graph showing visual clarity vs. river discharge](image2.png)

\(^7\) Liza Inglis (T+T) and Dean Miller (T+T), Memo: Desktop Ecological Assessment: Manawatu River Pedestrian and Cycle Bridge (He Ara Kotahi Bridge), dated 21 October 2016.
6.2 In-River works

The proposed construction methodology includes works within the river channel, and is likely to include:

- Plant (e.g. excavator or crane) to drive two pile casings as far down as possible. The casings are likely to require in situ welding to achieve sufficient depth to reach geotechnically suitable material (inferred to be approximately 30 m);
- Auguring of soil material within the casing once they are in position, before jet vacuming the hole clean (if necessary); and
- Placing a reinforcing steel cage in the casing and pouring concrete to form each pile.

Plant will be demobilised from with-in the river channel at the end of each working day, and any loose sediment or debris will be cleaned off.

Once the piles are constructed, any disturbance of the river bed (if required) will be reinstated to current conditions, after which all plant from within the river channel will demobilise.

To minimise the potential for construction discharges to occur (e.g. sediment, discharge of construction), it is proposed where possible to construct these piles under “dry” conditions.

The preferred method for creating suitable “dry” conditions to carry out these works is discussed below. The final methodology for in-river works is to be developed by the Appointed Contractor.

6.2.1 River diversion (Preferred Option)

An option to create dry working conditions could comprise of using the gravels from the river bed to create a diversion of the river flow (refer Sketch 2A & 2B, Appendix B).

Works could commence on the left bank first, accessing the true left pile location from an existing and seasonally exposed gravel shoal. Works would involve:

1) Local bank modification to allow plant access to the river bed via the existing gravel shoal
2) Local river diversion around the true left pile location using material won from the existing shoal. This would involve creating a bunded area around the pile or creating a larger bund that ties back into the left bank.
3) Pumping out water (as required) from within the bunded area to allow for pile construction in the dry. It is anticipated this water would be suitable to discharge back into the river, after a short period of settling within the bunded area. If this water contains any trace of cement, it will be pumped into a container or tank for off-site disposal.

Works for constructing right pile will commence following the completion of the true left pile, and would involve diverting the river flow from the true right side of the river by:

1) Excavating approximately 2 m to form a deeper river channel through the existing shoal on the true left.
2) Material from the diversion channel excavation may be placed to locally bund or fill the area around the right pile, to create a current main river channel that exists near the right bank.
3) Local bank modification to allow plant access to the river bed from the right bank.

A Diversion Management plan will be prepared for HRC’s approval prior to works commencing, and will set out:
Timing and duration of in-river works;
Locations of plant access to the in-river works;
Specific sizing of diversion channel and associated bunds to suit expected flows;
Hydrological analysis of the effect on the diversion channel on the HRC’s upstream flow monitoring station (at Teacher’s College); and
Proposed practises for any gravel riverbed disturbance works in accordance with section 3.0 of the HRC’s Environmental Code of Practise for River works.

Monitoring and management will be as set out in Section 7 below.

7 Site management

7.1 Timing of works
The anticipated timing of the pile construction works is approximately 8 weeks for each pile (16 weeks in total). We have assumed in-river works (including works to create plant access to the piles) will be up to 20 weeks. Where practicable, works will be done during times of expected lower river flow e.g. between October and April (inclusive), however this will need to be confirmed by the construction programme and sequencing.

Once the seasonal timing of in-river works is confirmed, an appropriate design flow for temporary river diversion or an alternative temporary in-river structure will need to be confirmed using historic median flow data for the months where in-river works will be undertaken.

7.1.1 In-River Winter works
If in-river works occur outside the expected dry season period and where river flows are expected to be in excess of 100 m$^3$/s (i.e. May to September inclusive), a specific management plan for working in the river will be prepared. The winter works management plan will set out:

- Detailed construction methodology, including confirmation of an appropriate method to create “dry” working conditions to undertake the works under higher flow conditions. This may include consideration of alternative methods to the “Preferred Option” discussed above (e.g. a temporary bridge);
- Confirmation of daily monitoring and planning of works to suit river flow conditions;
- Confirmation of a water quality monitoring and reporting plan to assess potential sediment and cement discharges; and
- Confirmation of the flood contingency plan to deal with high flow conditions.

The winter works management plan shall be prepared for HRC approval prior to in-river works commencing anytime between May and September (inclusive).

7.2 Adaptive site management
Adaptive management will be implemented through weekly site visits by the Construction Manager to identify changing site conditions. E&SCP planning meetings will be held while earthworks are occurring (frequency yet to be determined). Proposed changes that may potentially affect the ESCP design will be discussed at these meetings, and changes to the ESCP (if any) will be agreed with HRC prior to implementing.

---

8 HRC (2010), Environmental Code of Practice for River Works
The Manawatu River flow will be monitored on a daily basis through the HRC’s online Environmental portal to assist with daily planning of in-river works to suit the river conditions at the time.

7.3 Rainfall trigger events

The following rainfall events will trigger an inspection to check the condition and continued effectiveness of the sediment control measures, and assess potential effects of works in the river channel:

- 20 mm in a 24 hour period; or
- A rainfall event with an intensity equal to or greater than 6mm/hr.

The rain events will be measured at the HRC Ngahere Park Climate Station (located approximately 2.8 km south of the site).

Water quality monitoring will be undertaken as soon as practicable once a trigger rainfall or trigger flow is measured at the respective locations.

Rain events greater than a 1 in 10 year ARI will be defined as an extreme event. Under these circumstances, control and treatment efficiencies are expected to be significantly reduced.

River flows under a 1 in 5 year ARI event would be considered an extreme event for temporary river diversion or an alternative temporary in-river structure, and evacuation would be required (refer Section 7.5: Flood contingency).

7.4 Water quality monitoring

Visual clarity monitoring (i.e. horizontal sight range of a black disk) will be undertaken to monitor construction related effects on water quality of the Manawatu River, on the same side of the river that works are occurring.

As current water quality data indicates a visual discolouration of the river water could be expected if the river flow exceeds 100 m$^3$/s, regardless of whether works in the river are occurring (refer Figure 2, section 5.1.3), monitoring of water clarity will be undertaken upstream of the project site area and approximately 200 m downstream of furthest site discharge point (to allow for reasonable mixing), to assess the change in clarity due to the works.

Visual clarity monitoring will be undertaken as soon as practicable during daylight hours following a trigger rainfall event.

For the duration of in-river works, daily visual monitoring of Manawatu River will be undertaken 200 m downstream of the works within river channel. A photographic record will be maintained of these inspections.

7.4.1 Water quality assessment

A trigger of >30% change in visual clarity will be adopted to initiate adaptive management actions, which would include:

- Identification of where the exceedance is being generated; and
- Undertaking all practical measures to cease discharge.

If it is not possible to cease discharge, HRC will be notified within 24 hours of the inspection.

---

9 Horizon’s One-Plan defines the length for reasonable mixing as the lower value of 7 x median width of the river or 200 m downstream of the discharge. The width of the Manawatu River is conservatively assumed as 100 m at point of discharge.
If the reason for discolouration cannot be isolated to a specific area within the work site:

- Further discussions with the contractor and/or additional site audits may be required to determine the contributing source (if any); and
- Assessing the appropriateness of existing ESC measures within the catchment.

If a conspicuous discolouration continues to occur on a regular basis:

- Assess if the use of chemical flocculation is appropriate. If required, the flocculation method will comprise of floc blocks placed in the inlet channel prior to its bund inlets. The material safety data sheet is provided as Appendix C. The floc block method has been selected because of ease of storage and use and because it has no residual effect on water pH. A material safety data sheet is included in Appendix C.

  If any chemical treatment other than floc blocks is proposed, a Flocculation Management Plan will be prepared for HRC’s approval prior to its implementation.

7.5 Flooding contingency

All practicable efforts will be undertaken to monitor both forecasted and actual rainfall to identify if heavy rainfall is likely, which would result in potential overtopping of any temporary in-river structures.

HRC’s River Information Services provide automatic river height alerts to assist the Contractor with daily planning. Further information to register for these alerts is provided in Appendix C.

Works may temporarily cease at any time if rainfall conditions and/or weather forecast is not considered suitable.

The Contractor is required to address procedures for heavy rainfall and potential flooding in their Health & Safety Plan, for safely carrying out the works.

In the event of an un-forecasted heavy rainfall, all practicable measures will be taken to cease works and remove loose sediment and/or construction debris from within the river channel, to mitigate the effects of excessive sediment release.

All plant and equipment in the river channel will be mobilised away from the river to a predesignated safe place.

If safe to do so, water quality monitoring downstream of the project site will continue.

Once the rainfall event has ceased and weather conditions are deemed suitable:

- The extent of sediment loss into the downstream environment (if any) will be estimated by visual observation;
- An audit of all devices will be undertaken to identify damage and remedial actions;
- Any disturbed controls or devices will be repaired or replaced as required; and
- Only once control devices are re-instated and operational, earthworks or in-river works may continue.

7.6 Inspections and audits

An audit of the sediment control measures, including temporary in-river measures will be undertaken as a minimum on a weekly basis by a suitably qualified and experienced person (ESC Supervisor) whilst bulk earthworks and in-river works are occurring.

A template to record these weekly audits is provided in Appendix C.
Additional to this, the contractor will be encouraged to inspect the sediment control structures on a daily basis.

7.7 Accidental discovery

While there are no known wāhi tapu or sites of significance within the works area, the Manawatū River is of great importance to iwi. In the unlikely event that archaeological remains, taonga or koiwi are unexpectedly exposed during development work, earthworks should cease in the immediate vicinity while an archaeologist is consulted to establish whether the remains have archaeological and/or iwi significance.

Palmerston North City Council, Horizons Regional Council and Rangitāne o Manawatū shall be advised as soon as practical and site access shall be made available to these parties if it is determined to be required.

If the archaeologist confirms archaeological and/or iwi significant, the area of the site will be defined by the archaeologist and excluded from further disturbance until further notice.

Works may continue outside suspected area.

8 Review and updating

As the construction of the project progresses, additional or modified erosion and sediment control measures may be required to respond to ground conditions, changes in construction activities or experience gained. These measures will be additional to those outlined in the ESCP. Where these additional or modified measures are undertaken they will be discussed, and agreed with HRC prior to implementation.

9 Site responsibilities

A summary of the site roles and responsibilities is set out below in Table 9.1.

Table 9.1: Site roles and responsibility

<table>
<thead>
<tr>
<th>Company</th>
<th>Role</th>
<th>Responsibility</th>
<th>Contact details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palmerston North City Council</td>
<td>Consent holder</td>
<td>Overall responsibility to ensure resource consent conditions and E&amp;SCP requirements are met</td>
<td>TBC</td>
</tr>
<tr>
<td>TBC</td>
<td>Construction Manager</td>
<td>Confirming site works being undertaken in accordance with engineering design and the ESCP. Regular site inspections to employ adaptive management techniques.</td>
<td>TBC</td>
</tr>
<tr>
<td>TBC</td>
<td>ESC Supervisor</td>
<td>ESC planning and preparation of sketches for HRC approval. Regular communication with HRC. Inspections of site. Attendance at relevant construction meetings. Visual monitoring following trigger rainfall.</td>
<td>TBC</td>
</tr>
</tbody>
</table>
10 Applicability

This report has been prepared for the benefit of Palmerston North City Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.
Appendix A: Ruha Street Design B - concept design drawings
Proposed Bridge
SECTION BETWEEN CH: 0.00 AND 320.00
HORIZONTAL SCALE: 1:500 @A1
VERTICAL SCALE 1:500 @A1

NOTES

CONCEPT DESIGN

1:500

Datum R.L. -20.00
PROPOSED LEVEL
EXISTING LEVEL
STATION

28.21
27.70
25.69
25.69
25.88
23.10
20.31
20.29
20.32
20.20
20.26
24.96
26.90
26.63
26.45
25.66
25.09

20.00
0.00
100.00
120.00
140.00
160.00
180.00
200.00
220.00
240.00
260.00
280.00
300.00
320.00

uentes Project No. Sheet. No.
Project
Sheet
Revision
Amendment

200100
5010
0 mm
300 mm

Approved
Revision Date
Amendment

2016-07-11 at 10:32:02 a.m.
P:\projects\5-P0843.01 Manawatu River Pedestrian-Cycle Bridge\Civil\Drawings\5-P0843.01_C.dwg

PALMERSTON NORTH CITY COUNCIL
MANAWATU RIVER PEDESTRIAN/CYCLE BRIDGE
RUHA STREET DESIGN B
BRIDGE LONG SECTION AND GEOTECH BORE LOGS

Original Sheet Size A1
1:500 (A1) 1:1000 (A3)
Appendix B: Erosion and sediment control indicative sketches

- Sketch 1: Erosion and sediment control for bulk earthworks
- Sketch 2: Proposed Method A river diversion for the true - left pile work
- Sketch 3: Proposed Method A river diversion for the true - right pile work
Sketch 1: Erosion and sediment control for bulk earthworks

- Trench (90 m²) for catchment of up to 0.3 m³

- Silt fence at toe, with returns at 10 m intervals

- Silt fence at toe, with returns at 30 m intervals

- Silt fence on the river side of the stockpile

- Grid trap (1.5 m³) for linear path excavation

- Exploded stockpile area (if required)

**NOTES**

1. AERIAL PHOTOGRAPHY: SOURCED FROM LINZ DATA SERVICE https://data.linz.govt.nz AND LICENSED BY PALMERSTON NORTH CITY COUNCIL FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE.

2. LAND PARCELS, CONTOURS: SOURCED FROM PNCC OPEN DATA SERVICE http://data.pncc.opendata.arcgis.com AND LICENSED BY PALMERSTON NORTH CITY COUNCIL FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 3.0 NEW ZEALAND LICENCE.

**Scales**

- Project No. Sheet. No. 5-P0843.01 C13 A1 1:500 (A1) 1:1000 (A3)

**Drawn**

- Q.O'SHAUGHNESSY A.MARTINDALE 2016-07-08

**Designed**

- PALMERSTON NORTH CITY COUNCIL

**Approved**

- WELLINGTON OFFICE

**Approved Date**

- PO BOX 12-003

- WELLINGTON 6144

- NEW ZEALAND

**Plot Date**

- 2016-07-08 at 4:40:02 p.m.
SKETCH 2: Proposed Method A river diversion for the true - left pile work

This sketch has been prepared to indicate approximate locations of works in the river bed only. The actual extent of works is likely to vary depending on site conditions.
SKETCH 3: Proposed Method A river diversion for the right pile work
This sketch has been prepared to indicate approximate locations of works in the river bed only. The actual extent of works is likely to vary depending on site conditions.

Plant access to right pile

Proposed river channel to divert flows

Excavations to deepen the true-left channel

Excavated gravels used to create a bund or causeway to contain all construction discharges (e.g. sediment, cement)

Right pile

True-left pile (complete)
Appendix C: Supplementary information

- Floc Block MSD Sheet
- HRC’s River Information Service
- Contractor’s audit template
Magnasol® AN1

Anionic flocculant block

Description
Magnasol AN1 is an anionic flocculant in the form of a solid block which has been specially designed to dissolve slowly in free flowing water and flocculate the associated suspended solids. Magnasol AN1 is ideally suited for remote locations where electricity is not available. Magnasol AN1 is non toxic to fish and aquatic life allowing the treated water to be discharged to rivers and streams.

Principal uses
Magnasol AN1 has been developed for use in situations where it is not convenient or economic to install makeup equipment and dosing pumps that require electricity and clean water.

Magnasol AN1 has been successful in treating the following applications:
1. Run off water from open cast coal sites and quarries
2. Effluent from small industrial plants
3. Run off water from stock yards and docks
4. Effluent from wheel washing equipment
5. Drainage water from construction sites

Application
Magnasol AN1 has been designed to be placed in a wire basket which is situated in the effluent stream prior to a lagoon/settling pond. The basket containing the Magnasol AN1 should be placed 2–5 metres before the lagoon/settling pond.

As the water stream passes round the Magnasol AN1 block it slowly dissolves. A turbulent zone should be created after the basket to allow contact between the flocculant and the suspended solids.

On entering the lagoon/settling pond the flocculated solids settle and clear water can be discharged or reused.

The dosage of Magnasol AN1 depends on the flow rate; to treat a large water volume it will be necessary to place a number of blocks in the stream. When there is no flow Magnasol AN1 stops dissolving.

Shelf life
2 years from receipt of goods

Shipping & Handling
Magnasol AN1 is manufactured in 3 kg blocks and packed in boxes containing 8 blocks (24 kg). Magnasol AN1 has a low order of toxicity and no special precautions are necessary in handling. The size of the Magnasol blocks are 80 mm depth, 210 mm long and 150 mm wide.
Technical service

Advice and assistance in the running of laboratory and plant tests to select the correct product and determine the best application can be provided by representatives of BASF, who are experienced in mineral processing applications.

Health & Safety

Magnasol AN1 has a low order of oral toxicity and does not present any abnormal handling problems.

Detailed information on handling and any precautions to be observed in the use of the product(s) described in this leaflet can be found in our relevant health and safety information sheet.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

March 2013

BASF SE
Global Mining Solutions
67056 Ludwigshafen, Germany
www.basf.com/miningsolutions
River Information Service

Thank you for registering to receive automated warnings from Horizons Regional Council’s River Information Service. We hope you find the service valuable in managing your flood risk. To help ensure the effectiveness of this service, please take a few minutes to review the attached information. If your contact details or warning preferences have changed, this is your opportunity to let us know.

Please sign and return the attached information within the next month to ensure your river height information is up to date or to advise if you’d like to discontinue your membership to this service.

River height information is available via our Waterline service, accessible by calling toll free 0508 4 FLOOD (0508 435 663) and following the voice prompts.

Alternatively our website www.horizons.govt.nz offers another way to access river height and rainfall information. By using the drop down menu on the right hand side under ‘Check environmental data in your area’, you can see forecasted levels for your chosen site.

For more information on our River Information Service please contact us on toll free 0508 800 800
Below is a list of all the river level recording sites that are currently available. The sites and river heights that you are currently registered for are in bold. **Please circle any additional sites you would like to register for, and cross out any you no longer require warnings.**

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<thead>
<tr>
<th>SITE</th>
<th>RIVER LEVELS (m)</th>
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<tbody>
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<td>Kiwitea at Haynes Line</td>
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<tr>
<td>Makakahi at Hamua</td>
<td>2 2.5 3 4 4.5</td>
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<tr>
<td>Makino at Boness Road</td>
<td>4</td>
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<tr>
<td>Makino at Reid Line</td>
<td>1.5 2.1</td>
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<tr>
<td>Manawatu at Hopelands</td>
<td>4.5 5.5</td>
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<tr>
<td>Manawatu at Moutoa</td>
<td>7 7.5 8.4</td>
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<tr>
<td>Manawatu at Teachers College</td>
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<tr>
<td>Manawatu at Upper Gorge</td>
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<tr>
<td>Manawatu at Weber Road</td>
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<td>Mangahao at Ballance</td>
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<tr>
<td>Mangahao at Kakariki</td>
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<tr>
<td>Mangaone at Milson Line</td>
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<td>Mangaroa at Ohura Town Bridge</td>
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<td>Mangatainoka at Pahiataua Town Bridge</td>
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<td>Mangawhero at Raupiu Road</td>
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<tr>
<td>Matarawa at City Branch</td>
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<tr>
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<td>Ohau at Tokorima</td>
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<td>Ongarue at Taringamotu</td>
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<td>Oroua at Almadale Slackline</td>
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<td>Oroua at Kopane Bridge</td>
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<td>Pohangina at Mais Reach</td>
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<td>Pohangina at Pripiri</td>
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<td>Rangitikei at Mangaweka</td>
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<td>Tamaki Water Supply Weir</td>
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<td>Tiraumea at Ngaturi</td>
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<td>Whangaehu at Aranui</td>
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<tr>
<td>Whangaehu at Kauangaroa</td>
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<tr>
<td>Whanganui at Pipiriki</td>
<td>6 8 10 11 12 13</td>
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</table>

**Step 1**
## Step 2

Please check that your contact details below are correct and update any that require attention.

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<thead>
<tr>
<th>CURRENT INFORMATION</th>
<th>UPDATED INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Name:</td>
</tr>
<tr>
<td>Address:</td>
<td>Address:</td>
</tr>
<tr>
<td>Flood phone number:</td>
<td>Flood phone number:</td>
</tr>
</tbody>
</table>

From an emergency management perspective we are interested in knowing why you register for this service. Please indicate your reason below:

- [ ] Shifting stock
- [ ] General interest
- [ ] Other (please specify)

Protecting assets
- [ ] Protecting people

Did you know we have a quarterly online newsletter that gets sent to residents so they know what Horizons is up to?

- [ ] Please tick here if you would like to receive this newsletter by email.

I/We ........................................................................................................................................... acknowledge that I/we have requested Horizons Regional Council to register us so that I/we will be notified when the height of a certain river within its jurisdiction reaches a specified height. As a result of making this request and Horizons accepting the request, I/we agree that Horizons Regional Council shall not be liable for any damage of any type (including consequential losses) caused as a result of Horizons’ partial or complete failure to provide timely information (or its failure to provide any information) in respect of the height or characteristics of flows within any river or otherwise touching or concerning our notification requirements whether or not that damage is caused directly or indirectly and whether that damage is caused negligently or otherwise.

Dated this (day) .................................................. of (month) .................................................. of (year) ..................................................

Signature: ............................................................................................................................................

## Step 3

Please fill in the following information, fold both pages together and post back to us free of charge.

**CURRENT INFORMATION**

- Name:
- Address:
- Flood phone number:

**UPDATED INFORMATION**

- Name:
- Address:
- Flood phone number:
A site inspection was carried out to monitor erosion and sediment controls installed on site.

**Current Works:**
Cut to fill and cut to waste earthworks to realign...

**Please note:**
This site has been commenced during the previous earthworks season, however was then abandoned for some time. The contractors resumed works recently to complete the project. Erosion and sediment control evident on site are minimal. Installation of erosion and sediment controls or instant stabilisation are recognised as a priority to make this site compliant. Resource consent may be required prior to recommencing earthworks on this site.
Photos.
<table>
<thead>
<tr>
<th>Category/Rating</th>
<th>Construction/Maintenance</th>
<th>Examples (not an exhaustive list)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Best practice – no further action required.</td>
<td>- No silt fence support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Minor holes in silt fence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Minor discrepancy live/dead storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Minor lack of volume in DEB’s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- No as builts provided</td>
</tr>
<tr>
<td>2</td>
<td>Minor technical issue with the control device, where the <em>purpose</em> of the guidelines/E&amp;SCP/consent conditions has been met.</td>
<td>- No returns in silt fence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Short circuiting along outlet pipe of SRP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Internal pond embankment collapse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Discharge at pond outlet causing erosion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Inappropriate pond volumes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Significant discrepancy between live/dead storage volumes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Flow paths or spillways inadequately stabilised</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Diversion channels or bunds inadequately sized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Silt fence not trenched in</td>
</tr>
<tr>
<td>3</td>
<td>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.</td>
<td>- No returns in silt fence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Short circuiting along outlet pipe of SRP</td>
</tr>
<tr>
<td></td>
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<td>- Internal pond embankment collapse</td>
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<td>- Diversion channels or bunds inadequately sized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Silt fence not trenched in</td>
</tr>
<tr>
<td>4</td>
<td>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.</td>
<td>- No returns in silt fence</td>
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<tr>
<td></td>
<td></td>
<td>- Short circuiting along outlet pipe of SRP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Internal pond embankment collapse</td>
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<tr>
<td></td>
<td></td>
<td>- Discharge at pond outlet causing erosion</td>
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<td>- Significant discrepancy between live/dead storage volumes</td>
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<td>- Flow paths or spillways inadequately stabilised</td>
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<tr>
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<td></td>
<td>- Silt fence not trenched in</td>
</tr>
</tbody>
</table>

*Date: 10 August 2010*