Memo

16 April 2013

To: Chris Fern
From: Gregor McLean– Environmental Consultant
Subject: Dry Creek Cleanfill – Erosion and Sediment Control Plan

Nature of Review

1 I have reviewed the following document supplied by Greater Wellington Regional Council:


Erosion and Sediment Control

2 The purpose of the Erosion and Sediment Control Plan (ESCP) is intended:

‘as providing a realistic and feasible methodology from which the anticipated environmental effects on the environment of these activities can be identified’.

3 It is intended that the ESCP submitted (September 2012) provides enough detail at the consent stage to demonstrate that the effects will be less than minor from potential sediment discharges over the lifetime of the project.

4 The ESCP acknowledges that consent conditions will require the submission of a Cleanfill Management Plan (CMP) which would incorporate and confirm:

- Indicative staging;
- Day to day management;
• Indicative location of expected topsoil and any fill stockpiles;
• Indicative rehabilitation details
• Plans, location and design of erosion and sediment controls; and
• Details of the expected water quality monitoring programme.

5 It is also acknowledged that in addition to the CMP an Annual Management Plan (AMP) would be submitted to Council which would provide more specific details of staging, the ESCP and rehabilitation for the upcoming 12 months.

6 The ESCP indicates that the erosion and sediment control devices will be sized in accordance with GWRC ESC Guidelines.

Stage 1

7 Stage 1 of the works is associated with the installation of the access road, including a cut to fill earthwork operation at the interface of the site and State Highway 58 (SH58).

8 Topsoil will be stripped from the footprint of works and stockpiled for future reinstatement and rehabilitation. The location of the stockpiles is proposed to be determined through the AMP process.

9 Cut to fill earthworks will be undertaken along the length of the access road. Any excess cut will be placed as fill. The location of the fill has not been identified.

10 Minor drainage works are required in the base of a gully the access road crosses.

11 Erosion and sediment control will consist of sediment laden diversions directing sediment laden flows to four sediment retention ponds (SRP 1 – 4).
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<th>Catchment (ha)</th>
<th>Min Vol (m$^3$)</th>
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No cleanwater diversions are proposed.

**Stage 2**

12 Stage 2 of the works is associated with the installation of the shear key, toe of fill and piping a portion of a tributary.

13 The installation of the shear key involves working across the tributary. A stream works methodology has been proposed involving either dam and pump or dam and divert to ensure that the works are undertaken in a ‘dry’ environment. These works are to be undertaken over a two week period. Any sediment laden water will be pumped to SRP4. On completion of works it is proposed that the stream will be diverted to its original channel or the culvert installed as per later stages of work.

14 It is proposed that 280m of stream will be piped to allow for the first lift of the cleanfiling. The construction methodology will involve the installation of the pipe in an ‘offline’ location, however there will be locations where this cannot be achieved and either a dam and pump or dam and divert methodology will be utilised to ensure that the works are undertaken in a ‘dry’ environment.

15 A cleanwater diversion channel (overland flow path) will be constructed on the western extent of works to take flows from the upper gully.
The toe fill will be constructed with low grade granular fill which is to be sourced either offsite or from an onsite borrow area located within the fill footprint and independently managed from an ESC perspective.

The toe fill will have a 2:1 batter slope with reverse slope benches established as the toe fill increases. Progressive stabilisation of the toe face will be undertaken. All sediment laden water is to discharge to SRP4.

On completion of the toe bund, filling will occur over an area of 5ha. It is proposed that topsoil will be stripped and stockpiled on the edge of the fill area for later respreading. The access road will be lifted as the fill level increases.

The surface of the fill will be sloped to the south west to facilitate surface water draining to the back of the fill. It is proposed that any sediment laden water will discharge to additional SRP’s or rock ‘chimney drains’. The chimney drains will be connected to the pipe network manholes and drainage through the fill.

Stage 3

Stage 3 involves further filling from RL 142 – 158 and the extension of the pipe and drainage network. The works will be undertaken in a number of stages that are independent from each other.

The culvert will be extended by a further 80m following the same methodology proposed during Stage 2.

The cleanwater diversion channel (overland flow path) on the western extent of works will be extended to take flows from the upper gully.

The filling will involve the raising of the toe bund, following the same methodology previously proposed and revisions to the access road to provide an established tip head.
Stage 4

24 Stage 4 is a replication of Stage 3 involving further filling from RL 158 – 190 (It is noted that the fill increases to RL200 at the head of the gully), the extension of the pipe and drainage network and the establishment of a new stream channel around the fill footprint.

25 The culvert will be extended by a further 400m following the same methodology proposed during Stages 2 and 3.

26 The filling will involve the raising of the toe bund, following the same methodology previously proposed

27 A new stream channel will be constructed around the fill footprint as detailed within the Stormwater Assessment Report.

Winter Works

28 Works are proposed to be undertaken year round with no winter restrictions proposed.

Monitoring

29 A range of monitoring is proposed. Device monitoring will consist of visual inspections including qualitative monitoring of the following:

   o The integrity and effectiveness of all erosion and sediment control devices;
   
   o Activities onsite;
   
   o General site conditions and other activities occurring within the catchment;
   
   o General status of the receiving environment.
30 It is proposed that a condition of consent require that the discharges from the site shall not result in an increase in the median turbidity or suspended solids level over any 3 month period of greater than 33% compared to upstream water quality.

31 Baseline monitoring will be undertaken for pH, turbidity and suspended solids over a period of six months prior to the filling operation. Sampling is based on manual grab samples monthly and within 24 hours after a storm event of 15mm in any 24 hour period recorded through the daily reading of an onsite rain gauge.

32 Works monitoring, including for pH, turbidity and suspended solids will be undertaken during the filling operation. Sampling is based on manual grab samples for a minimum of two months when discharges are occurring from the SRP’s and within 24 hours after a storm event of 15mm in any 24 hour period recorded through the daily reading of an onsite rain gauge. The sample locations have been determined but not identified on plans.

33 It is proposed to report the monitoring within the AMP.

34 Comments

35 The ESCP provides little in the way of the ESC’s design detail other than the sizing of three sediment retention ponds (SRP 1, 2 and 4). Design details of the sediment laden and cleanwater diversions have not been provided. This is not considered to be a major concern as regardless of the size they can be installed.

36 The ESCP does not show any cleanwater diversions other than the channel (overland flow path) on the western extent of the site. It would appear that additional cleanwater diversions are required to ensure that catchments to devices are not compromised.

37 The drainage systems (culverts and underfill drainage) need to be considered from an ESC perspective. The installation methodology has been detailed in principle and is considered appropriate. Design details and plans should be provided of the drainage systems to ensure that the proposal meets GWRC ESC Design guidelines.
Furthermore, in my experience, underfill drainage can have high sediment loads for the initial period after installation and I have in the past suggested that these be directed to sediment control measures for treatment.

The filling methodology suggests that other SRP’s will be established at the back of the fill as required. Although in principle this is supported, the ability to discharge from the SRP’s would be inhibited unless they discharge to the drainage systems. At this stage no details have been provided. In my opinion further consideration needs to be given to how the sediment laden runoff from the fill surface is to be treated and discharged.

I do not believe that the rock chimney drains would provide adequate treatment for sediment laden runoff. I believe the rock chimney drains are required as part of any sound engineering solution to ensure stability of the fill. Discharging sediment laden water to these drains would potentially affect their integrity and would also result in uncontrolled sediment discharges to the receiving environment.

The use of chemical flocculants to improve treatment efficiencies of sediment control devices is considered industry best practice. Given the sensitivity of the receiving environment to sediment discharges (Porirua Harbour) and the duration of cleanfilling, flocculation of the site’s sediment control devices needs to be implemented.

The staging of cleanfilling is supported. Staging is essentially a risk management approach whereby limiting the exposed area limits the potential for sediment generation, and therefore sediment yield and transport off site. Staging reduces the risk of large scale, one-off erosion events causing significant detrimental effects.

The proposed staging is essentially enabling works, shear key and toe construction and then 5ha of cleanfilling at any one time. No winter restrictions are considered to be appropriate by the applicant. It is acknowledged that during winter months cleanfills are more active than summer months, however winter restrictions should be considered.

Baseline monitoring will be undertaken for pH, turbidity and suspended solids over a period of six months prior to the filling operation. Sampling is based on manual grab
samples monthly and within 24 hours after a storm event of 15mm in any 24-hour period recorded through the daily reading of an onsite rain gauge. I am of the opinion that the grab sampling and the timing of sampling would not provide much in the way of baseline knowledge. In other significant projects freshwater ecologists have suggested a minimum of two years of baseline monitoring (both automated and grab sampling) to ensure that baseline conditions are adequately identified. Furthermore other parameters such as sediment deposition and aquatic macroinvertebrates may also need to be considered. It would also be useful to have the points of monitoring plotted on a plan.

44 Construction water sampling is based on manual grab samples for a minimum of two months when discharges are occurring from the SRP’s and within 24 hours after a storm event of 15mm in any 24-hour period recorded through the daily reading of an onsite rain gauge. Taking a sample within 24 hours after the rain event has been recorded may not provide a representative sample of discharges from the devices. Consideration should be given to manual vs automated monitoring. The same concerns in terms of parameters as above apply.

45 The visual qualitative monitoring is loose in terms of what the monitoring entails, other than visual inspections. I am of the opinion that checklists would be required to provide a more robust qualitative assessment and would assist the applicant/operator.

46 The proposed consent conditions require discharges from the site, after reasonable mixing, to avoid the following effects:

- A median increase in turbidity of greater than 33% over any 3 months;

- A median increase in suspended solids of greater than 33% over any 3 months;

- pH to be outside the range of 6 – 9;
Consipiscuous oil, grease, films, scums, foams, floatable or suspended materials, colour change, odour, rendering of freshwater unsuitable for consumption by farm animals.

The conditions around suspended solids and turbidity require further thought regarding how this is monitored (as per comments above) and the correlation to effects, and its appropriateness as a consent condition. It is understood that these conditions are not acceptable with regard to GWRC water quality standards.

The pH range of 6 – 9 should be 5.8 – 8.5 as per recent consent conditions by GWRC, if this is to be used as a threshold.

The proposed monitoring programme is considered by the applicant to be adaptive management. Adaptive management enables a ‘plan-do-check-act’ approach to be undertaken whereby the ongoing monitoring and reporting that is proposed creates a continuous feedback loop from the effects being created. This allows for the most appropriate solution to be utilised or change of method made for any particular environmental effect. Adaptive management requires the following components:

- Clear Objectives
- Objectives linked to consent conditions
- Feedback and review loop
- Process, triggers and actions
- Good baseline knowledge
- Setting of triggers
- Identification of remedial actions
o Effective monitoring

o Implementation of remedial actions

o Continued monitoring

50 The above components were reiterated through the Board of Enquiry hearing on the Transmission Gully project. It is considered the approach proposed does not cover the above components.

51 It would also be useful to have cross and long sections of the cleanfill, to better understand the nature of filling and the interface with the existing ground levels.

Section 92 response – dated 8 April 2013

I comment based on the S92 question and answer provided by Winstones

52 The ESCP does not include a Universal Soil Loss Equation (USLE) and states that staging of works, control around in stream works and proposed environmental monitoring make this assessment not relevant. Given the scale of the proposal, duration of consent, and sensitive receiving environment please provide a USLE assessment for all stages of construction to demonstrate that proposed erosion sediment control measures are appropriate and provide a comparison between pre construction and during construction estimate of sediment yields.

53 I generally agree with the response provide in that the Universal Soil Loss Equation (USLE) will identify higher risk areas within the site. The higher risk areas of the site are generally associated with the steeper slopes and in this case the streamworks. The USLE should not be used to determine the effects of the site.

54 The ESCP does not propose mandatory chemical treatment (floculation) of SRP’s discharges as a primary treatment measure. Please provide a detailed assessment of treatment efficiencies and anticipated water quality to be discharged from all sediment
control devices. Please also discuss why you consider chemical treatment is not required as a primary measure.

55 As discussed by the applicant the ESC devices have been designed in accordance with GWRC guidelines and chemical treatment has not been discounted and may be utilised if determined necessary. The Porirua Harbour, comprising the Onepoto Arm and the Pauatahanui Inlet, is considered by Porirua City Council and community as the centrepiece of the City. The Harbour is the largest estuary system in the lower North Island. As well as having a nationally significant wildlife area, the estuary has cultural, recreational, economic (transport), and other wildlife habitat values. In this regard I still firmly believe that chemical flocculation should be mandatory.

56 Sediment retention ponds at the back of the fill surface have been proposed for Stage 2. Please provide details as to where treated water from these devices will discharge to.

57 I have not reviewed the letter from Harrison Greierson dated 27 November 2012 which the applicant refers to as confirming that discharging water to the underfill drainage is suitable. The key issues with this approach are the capacity of the underfill drainage in relation to the discharge rates from the SRP’s and the type of underfill drainage (perforated or non-perforated).

58 Chimney drains have been proposed to collect surface water from areas of the cleanfill, and discharge into the drainage network below. Please provide a detailed assessment and supporting plans to demonstrate all water collected by chimney drains will be suitably treated.

59 The applicant states that the chimney drains are effectively drainage paths based on filtration through the media to the central drainage system. They are currently used on the existing Dry Creek Cleanfill. I do not believe that the rock chimney drains would provide adequate treatment for sediment laden runoff as controls based on filtration block up rapidly and are difficult to maintain.
60 Please confirm that all water discharging from the site will discharge via the 1800mm culvert underneath State Highway 58. If there are any other outlet/discharge structures please provide detailed showing their locations, and the catchment areas for each structure.

61 As per the applicants response.

62 What sized rainfall event are the sediment retention ponds been designed to? (e.g. 1 in 2 year event)

63 The applicant response advises that the SRP’s are sized per the GWRC guidelines which allow for the 100 year rain event to discharge via the emergency spillway. It is noted that when SRP’s overtop the sediment removal efficiency will drop. Where receiving environments are noted as sensitive to sediment related effects larger sizing of SRP’s have been considered. For example for the Bral Cleanfill (Auckland) which discharges to the Okura Estuary SRP’s were required to be sized to 8% of the contributing catchment (800m$^3$ per hectare). This sizing was imposed through the appeal process. It was considered that to ensure that the residual sediment discharged from the site and the sites controls would not have an adverse effect on the receiving environment, larger ponds and treatment of a larger range of storms would assist in this regard. This was supported by technical work undertaken by NIWA for the applicant and agreed with by ARC officers acting under delegated authority through the appeal process.

64 Please provide an assessment of the anticipated volume of stormwater runoff from the site during rainfall events with return periods of 2, 5 and 25 years.

65 As I have not reviewed the Harrison Grierson report I cannot provide comment in this regard.

66 Given the sensitivity of the receiving environment and ongoing nature of works have you considered over designing all sediment retention ponds as a contingency measure
to cope for larger rainfall events? Have you considered designing the ponds for a 5% contributing catchment rather than the recommended 3%?

67 The applicant states that the SRP sizing (3%) is based on the accepted best practice approach and endorsed by the GWRC guideline. Increasing the size of SRP’s as noted in Para 63 would provide treatment of a larger range of storms, not necessarily increasing the efficiency of the device. There are however examples as noted where this has been imposed as a result of sensitive receiving environments. I agree that in some instances there are difficulties to construct larger devices due to site constraints.

68 Please provide an assessment of the potential adverse ecological effects of sediment discharges and potential reduction in water quality of the Pauatahanui Stream. Please also include an assessment of the cumulative effects of sediment discharges on the Pauatahanui Stream from the construction and operation of the proposed cleanfill.

69 I have not reviewed the Assessment of Effects on Stream Ecology (as I understand this is being undertaken by Keith Hammil). Baseline monitoring will be undertaken for pH, turbidity and suspended solids over a period of six months prior to the filling operation. It is understood however that this six month period coincides with the proposed enabling works. The comments in Para 43 are considered still relevant.

70 Why has 33% has been chosen as an acceptable change in turbidity in the Pauatahanui Stream after reasonable mixing? Please provide an assessment of the potential effects, including cumulative effects, on instream ecology as a result of a 33% increase in turbidity.

71 I have not reviewed the Assessment of Effects on Stream Ecology (as I understand this is being undertaken by Keith Hammil). Comment should be sought from Keith in this regard,

72 Please quantify and assess the cumulative effects of sediment discharges on the receiving environment from the operation of the proposed cleanfill.
73 Please refer to the Para 70 above.

74 *Please propose an appropriate mixing zone for the discharges into the Pauatahanui Stream. Please discuss what adverse effects are likely to occur to aquatic life within the proposed mixing zone as a result of the proposed discharges.*

75 Reasonable mixing is a term used in the Resource Management Act. To define reasonable mixing there are a number of reports\(^1\) that have been produced.

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**What matters need to be considered when deciding on “reasonable” mixing?**

- Reasonable mixing may be said to have occurred when the management objectives of the receiving water are not compromised by the non-compliance zone.
- This will require an assessment of the size and location of the non-compliance zone, and the conditions within it.
- Generally
  - the size of the non-compliance zone should be minimised
  - any adverse effects should be confined to the non-compliance zone
  - any adverse effects within the non-compliance zone should be minor
- If the predicted impact of the discharge is not consistent with the classification objectives, the consent application should be declined. The discharger should:
  - alter the location of the discharge, the quality of the effluent, or the mixing characteristics of the outfall; or
  - seek a variation to the classification.

The potential effects on aquatic ecology have been discussed in the Assessment of Effects on Stream Ecology.

76 *Please provide details in the ESCP of how the erosion and sediment control measures will be monitored during the construction and operation of the cleanfill. Will device efficiency monitoring be undertaken? If not, why not? Also describe what measures will be taken if the devices are assessed as not performing adequately.*

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\(^1\) Resource Management Ideas Number 10, “Reasonable Mixing” – A discussion on reasonable mixing in water quality management, NIWA Ecosystems and Ministry for the Environment, August 1994
The ESCP proposes an ‘adaptive management’ approach to erosion and sediment control. However, it is not clear from the ESCP how the adaptive management approach will work in practice. One concern is that there are no quantifiable or measurable triggers proposed and actions in response to triggers being reached. Please provide more information about the adaptive management approach, including proposed trigger points and proposed mitigation measures/actions to be taken if triggers are reached.

The application relies on an adaptive management approach to dealing with sediment discharges, however, it is unclear as to what ‘environmental bottom line’ will be applied (i.e. at what point adverse effects ecological effects that have not been adequately avoided, remedied or mitigated would arise). Please provide details of the environmental bottom line that will be applied, how that will be measured, what measures will be implemented to ensure that bottom line is not breached, and an assessment of the adverse effects up to that point.

The above three question were answered by the applicant under generally one response. No efficiency monitoring is proposed as it is proposed to measure water quality to determine appropriate adverse effects triggers.

The applicant states that the Annual Management Plan (AMP) process will be informed by the annual ecological survey. The ESCP principles outline the approach that is to be taken with respect to monitoring. If effect triggers are breached, a full review of the ESC measure and methodologies will occur. My comments Para 49 are still considered relevant. It is noted however that I have not reviewed the Assessment of Effects on Stream Ecology.

In relation to Questions 16 and 17 my position is as per my initial comments. Noting that the response from the applicant states that the six month baseline monitoring period will effectively be ongoing as the fill progresses.

In relation to Question 18 and 19 my position is as per my initial comments.
Gregor McLean
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Reviewed By:
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International Erosion Control Association (Australasia)