B.13 Concept Erosion & Sediment Control Plan

Stantec

Concept Erosion and Sediment Control Plan – Scenic Rim Agricultural Industrial Precinct

Prepared for Kalfresh Pty Ltd

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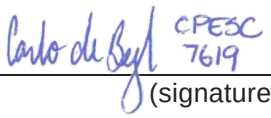
Prepared by  (signature)

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1 Introduction

This concept Erosion and Sediment Control Plan (ESCP) has been prepared on behalf of Kalfresh for the site setup, clearing works, bulk earthworks and site stabilisation to be undertaken as part of the Scenic Rim Agricultural Industrial Precinct (SRAIP) development at Kalbar, Queensland (the subject site).

The concept erosion and sediment control strategy developed for this project has been divided into the following three construction phases as listed below;

- Phase 1 – Clearing and grubbing of the site;
- Phase 2 – Bulk earthworks on site; and
- Phase 3 – Stabilisation of the site.

The aim of this management plan is to provide policies, performance criteria and procedures to minimise the impact of the proposed vegetation clearing and earthworks on the physical and social environment. In particular, the ESC provides monitoring and reporting mechanisms whereby the performance of the works can be measured and that agreed corrective actions are implemented in a timely manner if problems occur.

This ESCP has been prepared with reference to the International Erosion Control Associated (IECA) Australasia *'Best Practice Erosion and Sediment Control (November 2008)'* guidelines, and current local government erosion and sediment control standards and best practice engineering and environmental management.

The measures detailed in the ESCP represent the minimum standards of erosion and sediment control, and dispersive soil management for both the clearing and earthworks phases. All measures are to be supplemented with monitoring and maintenance on site. Additional controls or modifications to work practices may be required to suit the site conditions or construction sequencing as identified through on-site monitoring. While this report provides guidance measures to suit the clearing and earthworks proposed on site, the Contractor is to prepare and maintain ESC plans, in accordance with the IECA guidelines, based upon their chosen methodology and prevailing site conditions. These plans shall be RPEQ / CPESC certified in accordance with local government requirements and kept on site at all times. Plans should be available for inspection in the event of an audit by environmental authorities.

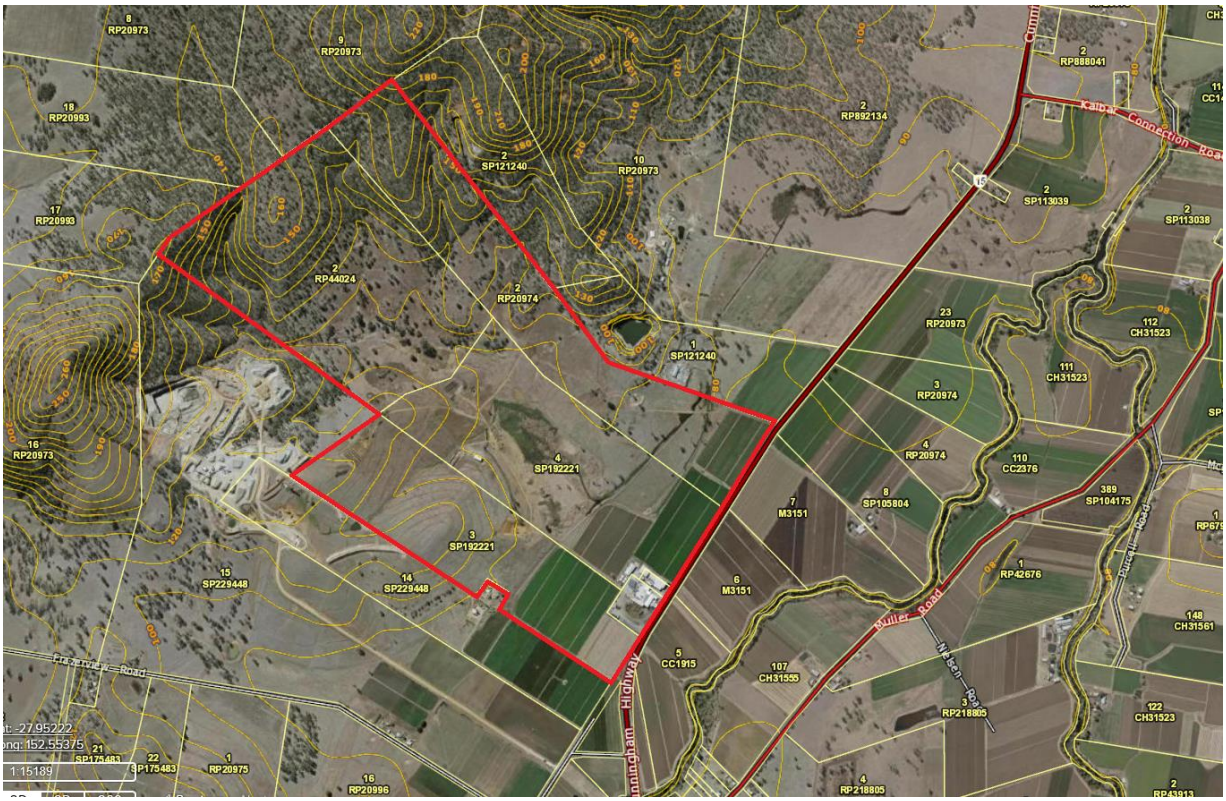
2 Existing and Proposed Site Description

2.1 Existing Site Description

The SRAIP is located at 6206 Cunningham Highway, Kalbar, Queensland, within the Scenic Rim region, approximately 46km South of Ipswich. Figure 1 below present the location of the site.

The site is approximately 250 hectares (ha) of active farmland, with a proposed work extent of approximately 60.6ha as part of this project. Currently the site includes a processing facility and an existing overland flow path bounding the northwest extent of proposed works. The existing overland flow path falls toward the north, eventually contributing to Warrill Creek.

Figure 1: Locality Plan (Source Nearmap)



2.2 Proposed Development Description

This concept ESCP is limited to the clearing works, bulk earthworks and site stabilisation works as part of the interim use works within the SRAIP. The scope of this plan includes activities such as:

- Developing a management strategy for erosion and sediment control and site drainage for the site; and
- Providing a management strategy for water treatment and discharge from site during this interim use phase.

Detailed engineering plans can be found included in Appendix A.

3 Performance Criteria

The performance criteria for the erosion and sediment control strategy to be implemented into the earthworks phase of the project is outlined in the *'State Planning Policy July 2017'* prepared by the Department of Infrastructure, Local Government and Planning (DILGP). These criteria as outlined in Part G Appendix 2 of the State Planning Policy are summarised in the following tables.

Table 1: Part 1 – Construction Phase – Stormwater Management Design Objectives

Issue	Desired Outcome
Drainage Control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2). 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins (part 3).
Erosion Control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior the removal of sediment controls, all site surfaces must be effectively stabilised using methods which will achieve effective short-term stabilisation.
Sediment Control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 m^2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5-8.5).
Litter, hydrocarbons and other contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway Stability and Flood Flow Management	1. Where measures are required to meet post-construction waterway stability objectives (specified in table B, Appendix 2 (State Planning Policy, 2017)), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

Table 2: Part 2 – Construction Phase – Stormwater Management Design Objectives for Temporary Drainage Works

Temporary Drainage Works	Anticipated Operation Design Life and Minimum Design Storm Event		
	< 12 Months	12 - 24 Months	> 24 Months
Drainage Structure	1 in 2 year ARI 39% AEP	1 in 5 year ARI 18% AEP	1 in 10 year ARI 10% AEP
Where located immediately up-slope of an occupied property that would be adversely affected by the failure or overtopping of the structure.	1 in 10 year ARI 10% AEP		
Culvert Crossing	1 in 1 year ARI 63% AEP		

Table 3: Part 3 – Construction Phase – Stormwater Management Design Objectives for Emergency Spillways on Temporary Sediment Basins

Drainage Structure	Anticipated Operation Design Life and Minimum Design Storm Event		
	< 3 Months	3 - 12 Months	> 12 Months
Emergency spillways on temporary sediment basins	1 in 10 year ARI 10% AEP	1 in 20 year ARI 5% AEP	1 in 50 year ARI 2% AEP

Based on the above information, the release criteria for controlled runoff events or pumped discharges from the construction site is to be as shown below in Table 3-4.

Table 4: Discharge Performance Criteria

Parameter	Release Criteria
Waste	No release of waste or litter
Coarse Sediment	No release of coarse sediment
Turbidity	Discharge turbidity (NTU) value shall be less than 50 NTU and/or no greater than 10% above receiving waters immediately downstream of discharge.
Hydrocarbons, Tannins & Paint	No visible trace
Suspended Solids	Discharges shall be < 50 mg/L TSS, or equivalent turbidity as determined by laboratory analysis by correlating turbidity with the suspended solids limit.
pH	6.5 - 8.5, except where and to the extent that, the natural receiving waters lie outside this range.

For the management of sediment basins, the following measures should be undertaken:

- Testing of pH, Total Suspended Solids (TSS) and Turbidity within any temporary sediment basins is to occur prior to any controlled discharges from the site. If the pH or TSS / Turbidity readings are outside the allowable release criteria outlined in Table 4, then further dosing with an appropriate approved coagulant and / or flocculant is required until acceptable levels are reached.
- It is recommended that the Contractor undertake appropriate sampling and testing of the on-site soils to establish a site-specific correlation between TSS concentrations and Turbidity readings. This information would then be used to identify a Turbidity reading that correlates to a TSS concentration equivalent to the allowable release criteria of 50 mg/L. This will assist in the management of the on-site sediment basins by allowing the Contractor to utilise a Turbidity meter to determine when the runoff retained within the basins reaches the allowable release criteria. Sampling and testing for TSS must still be undertaken during de-watering activities to confirm the allowable TSS concentrations are being achieved.
- Prior to the commencement of construction, to improve the efficiency and effectiveness of the flocculation process, it is recommended that the Contractor undertake trial testing to determine appropriate flocculant and / or coagulant types, and dosing rates for the on-site soils. This generally involves conducting soil jar tests of the on-site soils. For the characteristics of various flocculating agents refer to Table 1 in the *'Chemical Coagulants and Flocculants'* fact sheet by IECA, obtainable from the IECA website under the Best Practice Erosion and Sediment Control 'Appendix B - Revision June 2018' section. For details on the soil jar testing procedure, refer to Section 5 of the fact sheet mentioned above.
- Managing the flocculation of the sediment basins should be undertaken using automated dosing systems such as rainfall or flow activated flocking systems. This will allow maximum time for flocculation to occur to assist in reducing the runoff holding times. The effectiveness of the flocculant will determine the actual runoff holding times for each basin. The detailed methods for flocculation and types of flocculants to be used are to be confirmed by the Contractor.
- Managing the flocculation of sediment basins using automated dosing systems such as rainfall or flow activated flocking systems may also improve the devices' effectiveness in higher than design storm rainfall events.
- Testing of the pH, Turbidity and Dissolved Oxygen (DO) of the receiving waters upstream and downstream of the subject is also recommended to assist in identifying if any uncontrolled discharges may be occurring from the site.

Refer to Section 7.3.1 of this report for further information on the management of sediment basins.

4 Available Management Practices

The IECA guidelines outline numerous best practice drainage control, erosion control and sediment control measures that are available to assist with minimising sediment transportation from construction sites.

The tables below outline some of the commonly used control measures considered appropriate for use during the construction phase of the proposed development.

Table 5: Drainage Control Measures

Technique	Typical Use
Catch Drain	To collect and divert sheet flows across a slope or around disturbed / exposed areas.
Flow Diversion Bank / Bund	To divert flows when in-situ soils are dispersive or highly erodible.
Batter Chutes	To convey concentrated flows down steep slopes.
Level Spreaders	To convert minor concentrated flows back to sheet flows.

Table 6: Velocity Control Measures

Technique	Typical Use
Rock Check Dams	Generally used in drains at least 500mm deep, with longitudinal grades of up to 10%. Recommended for locations where it is anticipated that rocks will be removed once suitable grass cover has been established.
Sandbag Check Dam	Recommended for drains less than 500mm deep, with longitudinal grades of up to 10%.
Chute and Channel Linings	Recommended for steep channels where more appropriate to line channel rather than trying to reduce flow velocity. Possible lining materials include grass or turf, rock, erosion control matting or geo-synthetic lining. Allowable flow velocities will dictate the type of lining material that is most appropriate.

Table 7: Erosion Control Measures

Technique	Typical Use
Erosion Control Blankets	For the temporary control of raindrop impact erosion on earth embankments not exposed to concentrated flows.
Light Mulching	For the control of raindrop impact erosion of exposed soils. Suitable for flat or mildly sloping surfaces. Requires appropriate anchoring when placed on steeper slopes. Can assist with seed germination on newly seeded soils. Types of light mulching include hydromulching, temporary seeding and brush mulch.
Heavy Mulching	For the stabilisation of exposed soils that are expected to remain non-vegetated for medium to long periods. Can assist with weed suppression in non-vegetated areas. Types of heavy mulching include bank or woodchip mulch, compost blanket and rock mulch.
Revegetation	For temporary or permanent stabilisation of exposed soils. Methods include turfing, landscaping and temporary seeding.

Table 8: Sediment Control Measures

Technique	Typical Use
High Efficiency Sediment (HES) Basin – Type A or B	Type 1 sediment trap when suitably sized. Best suited to fine grained, poor settling or dispersive soils. Can provide turbidity control when appropriately managed.
Sediment Fence	Type 3 sediment trap. Suitable for all soil types. Two types of sediment fencing material are available; woven fabric or non-woven composite fabric. Non-woven composite fabric type preferred material for fencing adjacent to critical habitats. Not suitable for concentrated flows.
U-Shaped Sediment Trap	Type 3 sediment trap when suitably sized. Suitable for treatment of concentrated flows. Sediment fencing oriented in a U shape with weir.
Filter Sock	Type 2 sediment trap. Suitable for all soil types.

Technique	Typical Use
Sediment Trench	Type 2 or 3 sediment trap when suitably sized. Appropriate for use in long narrow spaces such as at the base of fill batters where space is limited between the toe of batter and property boundary.
Rock Filter Dam	Type 1, 2 or 3 sediment trap when suitably sized. Can be used where there is sufficient space to construct a rock embankment. Primary filter medium is either filter cloth or aggregate. Filter cloth primary filters used where removal of fine grained sediment is critical, however on-going performance is dependent on regular de-silting and replacement of fabric. Aggregate filters are generally used in long-term sediment traps as this type of device is less difficult to de-silt regularly.
Sediment Weir	Type 2 or 3 sediment trap when suitably sized. Can be used as an alternative to a rock filter dam where space is limited.
Construction Entry / Exit Points	Three main types include rock pad areas, vibration grids and wash bays. Rock pad areas are suitable for all soil types. Vibration grids are best suited to sandy soils. For construction near fragile environments, when turbidity control is an issue, or when working with highly cohesive clays then a wash bay is considered the most appropriate.

Control measures other than those techniques listed above may also be appropriate for use within the construction site. Refer to Section 4 of the IECA *'Best Practice Erosion and Sediment Control (November 2008)'* guidelines for comprehensive lists of available drainage control, velocity control, erosion control and sediment control techniques, including the recommended usage of the various measures.

5 Erosion Hazard Assessment

The site setup, clearing works and bulk earthworks to be carried out on the subject site have the potential to increase the level of sediment laden runoff discharging from the site for the duration of the construction phase. Based on this, the following erosion hazard and risk assessments have been undertaken to determine the on-site drainage, erosion and sediment control standards to be adopted for the proposed development of the site.

5.1 Erosion Hazard Assessment

The Erosion Hazard Assessment Form outlined in Table F4 in Appendix F of the IECA guidelines has been adopted for the assessment of the subject site.

Based on the various controlling factors outlined in the hazard assessment, the total score for the assessment of the subject site was 36. As the erosion hazard score for the subject site was greater than the critical score of 17, the following erosion and sediment control plan has been prepared for the proposed development works. A copy of the Erosion Hazard Assessment has been included in Appendix D of this report.

5.2 Drainage Control Standard

The anticipated construction period for the proposed works, where there is likely to be areas of exposed erodible ground, is expected to be less than 12 months. This period would need to be confirmed prior to the commencement of construction to confirm the control standards adopted. Based on a construction period of less than 12 months, a minimum drainage design standard of a 1 in 2-year average recurrence interval (ARI) event should be adopted for any long-term temporary drainage control devices as recommended in Table 4.3.1 – Drainage Design Standard for Temporary Drainage Works of the IECA guidelines and Table 3-2 of this report.

For identified dispersive soils areas, flow diversion bunds / banks should be adopted over cut in catch drains. Where cut in drains are necessary within dispersive soil areas, these catch drains should be adequately lined with a minimum of 150mm of non-dispersive material prior to the installation of other temporary channel linings or check dams.

5.2.1 Clean Water Diversion Drains

For the areas of the works where runoff from external catchments has the potential to enter the disturbed areas of the subject site, it is recommended that where practical stabilised diversion drains / bunds be provided to divert the 'clean' upslope runoff around the proposed disturbed areas and direct these flows towards existing stable flow paths. Based on the anticipated construction period, the clean water diversion drains should be designed to convey the minimum 2-year ARI peak flows of the contributing external local catchments.

5.2.2 Dirty Water Catch Drains

Dirty water catch drains are proposed to be utilised to assist with conveying runoff from the disturbed areas of the site to the proposed sediment control devices, and to assist with managing the maximum length of non-vegetated slopes within these disturbed areas.

As the catch drains are anticipated to be earth lined during initial works, the design criteria for these types of drains is generally to limit channel velocities to 1 m/s, where the catch drains having resultant velocities of greater than 0.6 m/s having check dam velocity controls installed. For catch drains with resultant velocities greater than 1 m/s, in situations where the longitudinal grade of the catch drain exceeds 10%, or in identified dispersive soil areas, it is considered more appropriate to increase the effective scour resistance of the drain. This can be achieved through the placement of a suitable channel liner such as rock, erosion control mats or hydraulically applied erosion control methods suitable for concentrated flow areas.

A Manning's 'n' roughness coefficient of 0.02 to 0.06 may be adopted for the earth lined catch drains based on the drain condition descriptions outlined in Table 5 of the Catch Drain Factsheets in Book 4 of the IECA (2008) guidelines.

5.3 Erosion Risk Based on Average Monthly Rainfall Depth

As outlined above, the works period for the SRAIP bulk earthworks is anticipated to be less than 12 months.

From Table 4.4.6 – Average Monthly Rainfall Depth (mm) for Queensland Towns of the IECA guidelines, the average monthly rainfall depth for the nearby city of Ipswich is shown to range from 31mm to 125mm for the January to December period. Based on Table 4.4.5 – Erosion Risk Rating Based on Average Monthly Rainfall Depth of the IECA guidelines, the subject site is estimated to have a 'low' to 'high' erosion risk rating. Refer to Table 9 below for the monthly erosion risk ratings for the nearby city of Ipswich (refer to Table 4.4.5 extract below).

Table 9: Erosion Risk Based on Monthly Rainfall Depth

Location	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Ipswich (mm)	H (125)	H (116)	M (97)	M (58)	M (47)	M (50)	L (42)	L (31)	L (41)	M (66)	M (76)	H (104)

From Table 4.4.7 of the IECA guidelines, the following best practice land clearing and rehabilitation requirements have been recommended for 'low' to 'extreme' erosion risk ratings.

For a 'low' erosion risk rating:

- Land clearing limited to maximum of eight weeks of work.
- Disturbed soil surfaces stabilised with a minimum 70% cover within 30 days of completion of works within any area of a work site.
- Unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 30 days.

For a 'moderate' erosion risk rating:

- Land clearing limited to maximum of six weeks of work.
- Disturbed soil surfaces stabilised with a minimum 70% cover within 20 days of completion of works within any area of a work site.
- Stage construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 3m vertical increments wherever reasonable and practicable.
- Unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 20 days.

For a 'high' erosion risk rating:

- Land clearing limited to maximum of four weeks of work.
- Disturbed soil surfaces stabilised with a minimum 75% cover within 10 days of completion of works within any area of a work site.
- Stage construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 3m vertical increments wherever reasonable and practicable.
- The use of turf to form grassed surfaces given appropriate consideration.
- Soil stockpiles and unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 10 days.

IECA *'Best Practice Erosion and Sediment Control (November 2008)'* guidelines Table 4.4.7, p4.16

However, for any instream works or works adjacent to the creek, the IECA (2008) guidelines provide an alternative erosion risk rating based on expected daily and average monthly rainfall. Refer to Table 10 below for a summary of Table I10 from the IECA (2008) guidelines.

Table 10: Alternative Erosion Risk Based on Expected Daily and Average Monthly Rainfall

Erosion Risk Rating	Expected 24-hour Rainfall	Average Monthly Rainfall
Very Low	0 to 2mm	0 to 30mm
Low	2+ to 10mm	30+ to 45mm
Moderate	10+ to 25mm	45+ to 100mm
High	25+ to 100mm	100+ to 225mm
Extreme	> 100mm	> 225mm

For any instream works or works adjacent to the creek, the following best practice channel clearing and stabilisation requirements have been recommended from Table I11 of the IECA (2008) guidelines for 'low' to 'extreme' erosion risk ratings.

For a Low erosion risk rating.

- Channel clearing limited to maximum of six weeks of programmed work;
- Disturbed soil surfaces stabilised with a minimum 70% cover within 10 days of completion of works within any constructed drainage channel or waterway; and
- Non-completed channel works are suitably stabilised if exposed, or expected to be exposed, for a period exceeding 30 days.

For a Moderate erosion risk rating.

- Channel clearing limited to maximum of four weeks of programmed work;
- Disturbed soil surfaces stabilised with a minimum 80% cover within 10 days of completion of works within any constructed drainage channel or waterway;
- Appropriate consideration given to the use of rock protection, bio-degradable erosion control mesh or the equivalent, on all erodible stream banks subject to high velocity flows; and
- Non-completed channel works are suitably stabilised if exposed, or expected to be exposed, for a period exceeding 20 days.

For a High erosion risk rating.

- Channel clearing limited to maximum of two weeks of programmed work;
- Disturbed soil surfaces stabilised with a minimum 90% cover within 5 days of completion of works within any constructed drainage channel or waterway;
- Appropriate consideration given to the use of rock protection, bio-degradable erosion control mesh or the equivalent, on all erodible stream banks subject to high velocity flows; and
- Non-completed channel works are suitably stabilised if exposed, or expected to be exposed, for a period exceeding 10 days.

For an Extreme erosion risk rating.

- Channel clearing limited to maximum of one week of programmed work;
- Disturbed soil surfaces stabilised with a minimum 90% cover within 5 days of completion of works within any area of a work site;
- Appropriate consideration given to the use of rock protection, bio-degradable erosion control mesh or the equivalent, on all erodible stream banks subject to high velocity flows; and
- Non-completed channel works are suitably stabilised if exposed, or expected to be exposed, for a period exceeding 5 days.

IECA *'Best Practice Erosion and Sediment Control (November 2008)'* guidelines Table I11, pI.28

Based on the monthly rainfall depth erosion risk information outlined in Table 9 and Table 10 above, it is most desirable that higher risk construction works, such as within or adjacent to the proposed diversion channel, be scheduled to be undertaken during the lower risk months of July, August and September. However, should these works be scheduled for a time period with a higher rainfall depth erosion risk, then an increased use of appropriate erosion control techniques and soil stabilisation measures should be adopted.

5.4 Erosion Risk Based on Estimated Soil Loss Rate

In order to determine the sediment control standards to be adopted for the construction works proposed on-site, the following soil loss assessments were undertaken for the nominated subject site catchments. Refer to Stantec drawing number 510357-008-CI-1023 in Appendix B for the subject site local catchment areas adopted for the soil loss assessment.

Based on the Revised Universal Soil Loss Equation (RUSLE) the predicted soil loss rates have been estimated for each of the disturbed catchment areas located within the subject site. Refer to Appendix F for soil loss calculations and parameters specific to each individual catchment.

Parameters adopted for the RUSLE calculations have been based on the following information. Catchment parameters for the disturbed areas of the subject site were based on the surface contours appropriate to the construction phase as shown on Stantec drawing number 510357-008-CI-1023. The maximum length of exposed slope was limited in line with Table 4.3.2 of the IECA (2008) guidelines. No site-specific geotechnical information was available for the SRAIP. Based on this, a 'K-factor' of 0.052 was adopted across the site. This value includes a 20% increase to allow for the moderate potential for dispersion of the subsoils found on site. For the clearing and grubbing and earthworks phases, a 'C-factor' of 1.0 representing a ground cover of 0% was adopted, with an erosion control practice 'P-factor' of 1.3 adopted for compacted and smooth surfaces. A rainfall erosivity 'R-factor' value of 2858 was adopted based on a 2-year 6-hour rainfall event of approximately 11.5 mm/hr.

For each catchment, the soil losses and catchment areas have been assessed to identify the minimum sediment control standard (i.e. Type 1, 2 or 3) to be adopted based on soil loss erosion risk. Refer Appendix F for the assignment of sediment control type to catchment.

Based on the results of the analysis above, the potential soil losses within the disturbed areas of the subject site have been estimated to range from approximately 32 to 360 tonnes/ha/year for the bulk earthworks phase of the pad areas, and 289 to 629 tonnes/ha/year for the potential borrow pit areas. This classifies the site as having a 'very low' to 'moderate' erosion risk for the pad areas, and a 'moderate' to 'high' erosion risk for the potential borrow pit areas, based on estimated soil loss rates as outlined in Table 4.4.3 of the IECA *'Best Practice Erosion and Sediment Control (2008)'* guidelines.

Given the size of the proposed works area, and the predicted soil loss rates for the subject site, the erosion and sediment control measures outlined in Sections 6 and 7 should be implemented and maintained for the duration of the construction phase of the project.

6 Sediment Control Devices

6.1 Conceptual Sediment Basin Sizing

The expected on site subsoils are likely to be mostly fine and potentially dispersive soils. Based on this, the sediment basins proposed to be incorporated into the construction works have been sized as either Type A or Type B basins. Type A and Type B basins have an automated chemical dosing system installed at the inlet, which categorises this type of basin as a high efficiency sediment (HES) basin. Conceptual sizing of the Type A and Type B sediment basins have been based on the following information.

The minimum settling zone and sediment storage zone volumes for the various basins have been estimated based on the process outlined in Appendix B of the IECA guidelines. The various parameters adopted to estimate the conceptual Type A and Type B settling zone volumes are outlined below.

For the Type A and Type B assessments, a default sediment settlement coefficient (Ks) of 12,000 was adopted from Table B9 and Table B17 in Appendix B of the IECA guidelines, as on-site local data was not available. It is recommended that this value be reviewed once soil jar testing of the on-site soils has been undertaken.

The minimum settling zone depth was calculated in accordance with IECA guidelines to ensure the supernatant flow velocity does not exceed 0.015 m/s, to avoid re-suspension of the settled sediment.

For an ideal sized Type 1 sediment basin, the minimum sediment storage zone volume for the basin is estimated as 30% of the settling zone volume as outlined in Table B6 and Table 16 in Appendix B of the IECA guidelines.

The minimum inlet zone / forebay parameters for the Type A and Type B basins have been estimated based on Step 9 in Appendix B of the IECA guidelines. An inlet zone volume of minimum 10% of the main basin cell has been adopted, with a minimum length of 5 metres and a minimum depth of 1 metre.

Refer to Stantec drawing number 510357-008-CI-1023 (in Appendix B) for the indicative sediment basin locations.

As the sediment basins for proposed works are expected to remain in operation for 3 to 12 months, a 20-year ARI storm has been adopted as the emergency spillway design event based on the information outlined in Table B35 – Recommended design standard for emergency spillways on temporary sediment basins of Appendix B in the IECA guidelines.

As recommended in Appendix B of the IECA guidelines, the crest of the spillway should be at least 0.45m below a basin embankment formed by fill, with the maximum water level over the spillway in a design storm event being at least 0.3m below a basin embankment formed by fill.

Based on this, the preliminary dimensions of the emergency spillways for the various basins were estimated using the broad crested weir formula.

It should be noted that further geotechnical advice should be sought for sediment basin embankments form from fill.

Refer to Appendix B Section B4 to B5 of the IECA *'Best Practice Erosion and Sediment Control (2008)'* guidelines, June 2018 revision, for further information on the construction and maintenance of sediment basins.

6.2 Conceptual Off-line Rock Filter Dam and Sediment Weir Sizing

To assist with minimising sediment transport from the disturbed areas where the installation of ideal sized Type 1 sediment basins was not considered practical, rock filter dams or sediment weirs with aggregate filters are proposed to be incorporated. Refer to Stantec drawing number 510357-008-CI-1023 in Appendix B for the indicative rock filter dam and sediment weir locations.

The conceptual settling pond surface areas for these types of devices should be sized based the contributing 3-month ARI peak flow, and the minimum settling pond surface area per unit inflow rate adopted from Table 1 of the Rock Filter Dam Factsheet from IECA Book 4. The adopted minimum settling pond surface area per unit inflow rate should be selected based on the critical sediment particle size identified through geotechnical investigation of the site.

These devices are generally sized based on the 3-month ARI peak flow filtering through the filter aggregate and the 2 year ARI discharge overtopping the weir. The broad crested weir formula can be used to calculate the weir length and water depth over the weir. These calculations should be reviewed following confirmation of the on-site soil properties.

Where the settling pond width is greater than that of the weir, earth abutments will need to be formed with stable bank slopes. The crest of the earth embankments is to be at least 450mm above the crest of the rock filter dam or sediment weir spillway.

Where practical, the rock filter dams or sediment weirs should be over excavated below the level of the aggregate filter weir invert to increase the runoff holding capacity of the sediment control device. This over excavated storage volume should then be managed similar to a sediment basin, with any runoff trapped within the trench to be sampled and tested for compliance with the site discharge release criteria outlined in Table 4 prior to being pumped from the site.

6.3 Conceptual Channel Works Sediment Control Devices

Instream works are required as part of the construction of the diversion channel around the western side of the proposed development. As these works will involve modifications to the existing channel profile, and are expected to take more than 5 days, an instream erosion and sediment control strategy will need to be developed and maintained. The three main erosion and sediment control strategies to be considered in relation to working within and adjacent to waterways include the following:

- Timing of construction works;
- Isolation of clean water from dirty water; and
- Provision of ground cover.

As outlined above, it is most desirable that these higher risk construction works within the watercourse be scheduled to be undertaken during the lower erosion risk months of July through to September. However, should these works be scheduled for a time period with a higher rainfall depth erosion risk, then an increased use of appropriate erosion control techniques and soil stabilisation measures should be adopted.

Due to the size of the external catchment contributing to the channel works construction areas, and the nature of the channel works proposed, it would not be practical to incorporate an ideal sized Type 1 or Type 2 sediment control device without undertaking additional excavation works within the channel beyond the proposed finished earthworks profile. Therefore, an erosion and sediment control strategy with an increased focus on the application of erosion control techniques and site rehabilitation and limits the duration of soil exposure should be considered. Where practical, the adoption of a construction methodology that allows for the diversion of external low flows would also be beneficial.

Instream erosion and sediment control strategies that should be considered, but not limited to, include the following:

- Prior to commencing significant instream works, clear only enough vegetation to allow access to install the proposed erosion and sediment control devices.
- Once the instream controls are operational, clear and grub only enough area to undertake the earthworks necessary to allow for the staged construction of the proposed diversion channel. These clearing and grubbing works and earthworks within the watercourse should consider the best practice land clearing and rehabilitation requirements for the relevant erosion risk rating as outlined in Table I11 of the IECA *'Best Practice Erosion and Sediment Control (November 2008)'* guidelines and summarised in Section 5.3 of this report.
- If imminent heavy rainfall is forecast prior to the stabilisation of the staged earthworks, then the Contractor should consider temporary stabilisation of the exposed soil areas with a hydraulically applied blanket such as 'GeoSpray' or approved equivalent (suitable for use in concentrated flow areas).

- Where practical, the stabilisation of the exposed earth batter slopes within the watercourse should be staged in maximum 2-3m vertical increments.
- Once the proposed earthworks and batter slopes are adequately stabilised, and the nominated scour protection measures installed, the down slope erosion and sediment control devices can be removed, and these exposed areas adequately stabilised and rehabilitated.

It is proposed to incorporate rock filter dams to assist with minimising sediment transport from the instream construction works areas. Refer to Stantec drawing number 510357-008-CI-1023 in Appendix B for potential indicative instream rock filter dam locations. The suitability of the devices to be incorporated into the watercourses, and the device details should be confirmed on site by the Contractor. Refer to the Instream Rock Filter Dam Factsheet from IECA Book 4 for further information on the recommended materials, installation, maintenance and removal of these types of sediment control devices.

Any temporary barrier works, including installation of rock filter dams, within any identified waterway must also comply with the standards outlined in the *'Accepted development requirements for operational work that is constructing or raising waterway barrier works (3 July 2017)'*, prepared by the Department of Agriculture and Fisheries (DAF).

6.4 Alternative Sediment Control Device Management

Should the incorporation of ideal sized Type 1 sediment control devices, such as sediment basins, as outlined above not be practical, then consideration should be given to, but not limited to, the following:

- Staging the construction works to reduce the area of disturbed soils contributing to the sediment control devices.
- Diverting undisturbed external catchment areas to reduce the catchment contributing to the sediment control devices.
- Standards of erosion control and site rehabilitation to be appropriately increased to compensate for the lower standard of sediment control.
- Consideration given to passive application techniques of flocculants, such as placing ‘Floc Blocks’ (or equivalent) or spreading lime or gypsum within catch drains.
- Incorporate permeable internal baffles, perpendicular to the direction of flow, within any sediment basins constructed to less than the ideal Type 1 size.

7 Construction Phase – Erosion and Sediment Control

7.1 Objective / Target

To control soil erosion on the site and minimise sediment transport to downstream local water courses or road stormwater drainage systems during storm events for the construction phase of the project.

7.2 Compliance Criteria

Refer to Section 3 of this Erosion and Sediment Control Plan.

7.3 Erosion and Sediment Control Strategy

7.3.1 Construction Phase 1 – Site Setup and Clearing Works Phases

The site setup and clearing works phases generally involve activities such as installing appropriate stabilised site access points, establishing site compound areas, and undertaking initial clearing works to allow for the installation of the erosion, drainage and sediment control measures and haul roads.

The erosion, drainage and sediment control techniques to be implemented during site set up and clearing works phases of construction should include, but may not be limited to, the following measures:

- All erosion, sediment and drainage control measures (including construction exits, sediment fencing, check dams etc.) shall be installed and maintained in accordance with the requirements of the IECA *'Best Practice Erosion and Sediment Control (November 2008)'* guidelines, and with this ESCP. All devices should be located within the proposed development site, unless approved with the local authority.
- Install rock pad construction entry / exit devices at the nominated stabilised access points for the construction site. These devices are provided to remove any loose materials from vehicles prior to departure from the site. Additional measures may be required if there is evidence of sediment being carried onto roadways.
- Clearly delineate the area of disturbance and keep all vehicles and building materials within that area. Limit the number of access points to the site, and clearly restrict vehicle and pedestrian access to protected 'no go' areas, such as the retained vegetation areas, using appropriate fencing and signage.
- All reasonable care shall be taken to protect other vegetation from damage during construction. This will involve clearly marking trees to remain and avoiding the compaction of the ground or filling within the dripline of trees to be retained. Where possible retain existing grassed areas to act as buffer zones.
- Clearing and other land disturbing activities must not occur until appropriate erosion, drainage and sediment control measures are implemented. The stripping of topsoil from designated site compound areas, haul roads or areas subject to earthworks or trenching should not occur until the nominated erosion, drainage and sediment control devices have been installed.
- Where practical clearing works should be limited to two (2) metres from the edge of any essential construction activities as outline on the nominated earthworks plans.
- Sediment fencing and perimeter bunds should be appropriately installed along the downslope extent of the proposed disturbed areas, such as at the boundaries with the adjoining properties, waterways and roadways, a minimum of two (2) metres from the expected limit of construction works. These perimeter sediment control devices should be installed prior to commencing significant clearing or construction activities and should be maintained throughout the construction phase of the development.
- Following installation of the downslope boundary sediment fencing and perimeter bunds, and prior to constructing the other nominated sediment control devices, where practical install the 'clean water' diversion drains / bunds along the upslope extents of the construction areas to divert the 'clean' contributing upslope runoff around these disturbed areas. If constructed within dispersive subsoils, these dispersive soils should be treated appropriately, or buried under a layer of non-dispersive soil (minimum 150mm) prior to the placement of the proposed channel

lining. The outlet of the diversion drains / bunds to have scour protection installed to act as an outlet discharge energy dissipater, with a level spreader device provided to disperse the resultant outflows. Permanent and long-term drains and bund walls are to be stabilised with suitable vegetation, rock or other appropriate erosion control methods as soon as possible.

- As discussed in Section 5 of this ESCP, a sediment control standard of incorporating Type 1, Type 2 or Type 3 sediment control devices should be adopted for the various disturbed catchments. These sediment control devices should be established prior to commencing with significant clearing and earthworks, with the area to be excavated to form the sediment control devices stripped of topsoil prior to earthworks commencing.
- Sediment control device embankments and storage areas to be covered by a minimum 150mm thick layer of non-dispersive topsoil. This non-dispersive topsoil layer should be maintained throughout the construction period. For the sediment control device storage areas, this non-dispersive topsoil layer may need be reinstated following any maintenance to remove retained sediment.
- All water trapped within the sediment control devices is to be tested for compliance with the 'Discharge Performance Criteria' outlined in Section 3 of this report. Where the water does not meet these criteria, the water is to be held and treated in accordance with this ESCP. Dosing with an appropriate coagulant and / or flocculant is anticipated to be required to reach acceptable levels of pH and suspended solids. Where sediment basins are adopted, the coagulants and / or flocculants are to be applied to the basin inflows using automated dosing systems such as rainfall or flow activated flocking systems. Where appropriate the Contractor may consider passive application techniques of coagulants and / or flocculants, such as placing 'Floc Blocks' or spreading lime or gypsum within catch drains, to improve the efficiency and effectiveness of the flocculation process. The effectiveness of the flocculant will determine the actual runoff holding times for each sediment control device. The detailed methods for flocculation and types of flocculants to be used are to be confirmed by the Contractor. For the characteristics of various flocculating agents refer to Table 1 in the *'Chemical Coagulants and Flocculants'* fact sheet by IECA, obtainable from the IECA website under the Best Practice Erosion and Sediment Control 'Appendix B - Revision June 2018' section.
- To assist with the performance of any nominated sediment basins, in-line permeable internal baffles can be incorporated across the basin settling zone perpendicular to the direction of flow.
- Sediment basins must operate as wet basins, with the treated runoff to be decanted from the surface of the basins once compliant with the 'Discharge Performance Criteria'. As soon as conditions allow the water level within the basins should be lowered back down to at least the top of the sediment storage zone. This will allow the settling zone volume of the basins to be available for the next rainfall event.
- In the event that the sediment basin cannot be de-watered to re-instate the settling zone volume prior to being surcharged by the following rainfall event, the Contractor must record the occurrence of such an event and report it to Scenic Rim Regional Council. Subject to consultation with and approval from the local authority, alternative operating procedures for the sediment basins may need to be adopted in order to achieve optimum environmental protection.
- Where sediment control devices other than ideal sized Type 1 sediment basins have been proposed, an increased focus on erosion control strategies, such as the spreading of non-dispersive topsoil and mulch or hydraulically applied soil binders or blankets should be adopted. An increased monitoring regime for the devices within these disturbed areas is also recommended to ensure these devices remain operational, and to identify if further control measures may be necessary to meet the conditions of development.
- Mulch berm diversion bunds could be used to capture and convey surface runoff to the nominated sediment traps. These drainage control devices can also be incorporated on site to limit the maximum length of exposed / non-vegetated batters and slopes. The recommended maximum length of exposed area for the nominated catchments should be limited to the lengths as outlined in Table 4.3.2 – Recommended maximum drain, bank and bench spacing on non-vegetated slopes of the IECA guidelines. Where necessary the appropriate velocity control devices or linings should be incorporated into the drainage channels to reduce flow velocity and increase the effective scour resistance of the channels.
- Confirm appropriate locations for cleared material and topsoil stockpiles ensuring that the stockpiles are positioned away from overland flow paths, poor drainage areas or other likely confluences where concentrated flow may cause sediment transportation. Any stockpiles should also be located as far as possible from dwellings and other buildings near the site. Stockpiles are to be located up-slope of an appropriate sediment control device, such as sediment or filter fencing, with a diversion bund or catch drain positioned up-slope to minimise overland flows into the stockpile areas.

The control measures mentioned above and shown on the attached drawings in Appendix B are the anticipated minimum requirements. Should it be deemed necessary from monitoring, the Contractor shall install additional measures to ensure the objectives of this element are met and to minimise the impact of construction activities on the surrounding environment.

The Superintendent may, at their discretion, direct the Contractor to carry out additional controls, as and when required. The Contractor may also at their discretion opt to include additional devices as may be required to ensure compliance with the approvals as they see fit.

The erosion and sediment control measures noted have been provided as a guide for the construction Contractor. It is important to note that construction sequencing and observations made during monitoring may identify the need to modify the details contained herein and on the erosion and sediment control plans. As a result additional measures may be necessary to fulfil the development's approval requirements.

Local consent authorities generally require that suitable erosion, drainage and sediment control measures must be present and available for inspection prior to the pre-start meeting.

The recommended site setup and clearing works phase erosion and sediment control installation sequence for the nominated management measures has been summarised in Table 11 below.

Table 11: Site Setup and Clearing Works Phases – ESC Strategy Installation Sequence

Control Measure	Installed	Removed
Construction entry / exit	Day one	When works are completed, and any temporary haul roads stabilised.
Boundary sediment fencing	Prior to land clearing	After removal of sediment control devices and adequate site stabilisation of contributing upslope area.
Clean water diversion drains / bunds	After installation of boundary sediment fencing / controls.	After stabilisation of down slope construction area.
Sediment basins	Following installation of boundary sediment fencing / controls and prior to land clearing.	After stabilisation of contributing upslope area.
Rock filter dams	Following installation of boundary sediment fencing / controls and prior to land clearing.	After stabilisation of contributing upslope area.
Dirty water catch drains	Following installation of boundary sediment fencing, sediment basins and other nominated sediment control devices, and prior to land clearing.	Catch drains to be retained until adequate site stabilisation of contributing upslope area.
Flow control berms / bunds	Following installation of boundary sediment fencing, sediment control devices, and prior to land clearing.	After stabilisation of contributing upslope area.
Site compound	After installation of boundary sediment fencing / controls	End of interim works.
Mark out stockpile area	Prior to land clearing	Once stockpile area no longer required.

7.3.2 Construction Phases 2 and 3 – Earthworks and Site Stabilisation

The earthworks will involve the works necessary to formalise the interim work areas as outlined on the nominated engineering drawings. The site stabilisation works will involve the works associated with the stabilisation of the extent of work areas, including the decommissioned erosion, drainage and sediment control device areas. Refer to Stantec drawing number 510357-008-CI-1023 in Appendix B for erosion, drainage and sediment control measures to be implemented for construction Phases 2 and 3.

The recommended erosion and sediment control techniques to be implemented during earthworks and site stabilisation should include, but may not be limited to, the following measures:

- The erosion, drainage and sediment control measures installed as part of the site set up and clearing works phase, such as stabilised site access points and boundary sediment controls, shall be maintained where appropriate.
- As the earthworks progresses, a number of the disturbed area catchment boundaries may change. Based on this, the approximate location and minimum size of the sediment control devices may need to be reviewed and amended as necessary.
- Where sediment control devices other than ideal sized Type 1 sediment basins have been proposed, an increased focus on erosion control strategies, such as the spreading of non-dispersive topsoil and mulch or hydraulically applied soil binders or blankets should be adopted. An increased monitoring regime for the devices within these disturbed areas is also recommended to ensure these devices remain operational, and to identify if further control measures may be necessary to meet the conditions of development.
- Where applicable vegetation on the site that is selected to be removed is to be mulched / chipped and reused / applied to cleared areas as an erosion control technique or to form mulch berms. All disturbed regions will be reinstated progressively.
- Emphasis shall be placed on source control of erosion by retaining vegetation for as long as practical and revegetating disturbed areas as soon as possible. It is recommended that the topsoils to be utilised in the revegetation of the disturbed areas be sampled and tested to determine if any deficiencies exist that may impact upon the coverage and health of revegetation achieved.
- The bulk earthworks will be carried out progressively and compacted in stages to prevent large areas of unconsolidated material being present on the site.
- The period of exposure of the earthworks areas should aim to be minimised and vegetation cover will be established as quickly as possible.
- Soil stabilisation measures such as mulching, turf, seeding or other landscaping shall be provided as soon as possible after clearing is completed.
- All erosion, sediment and drainage control devices must be maintained to be fully operational at all times. Worn, damaged or otherwise defective materials and components are to be repaired, refurbished or replaced as they become ineffective for their design purpose.
- All sediment control structures must be operated and maintained in an effective operational condition. These structures must not be allowed to accumulate sediment volumes in excess of forty per cent (40%) sediment storage design capacity. Where sediment basins are used a marker shall be placed within the basin to show the level above which the sediment storage zone design capacity occurs. Materials removed from sediment retention devices must be disposed of in a manner approved by the consent authority that does not cause pollution.
- If it is intended to utilise the sediment basins to collect stormwater runoff for other construction purposes, such as dust control or bulk earthworks, then the sediment basins should be over excavated to cater for the additional reuse storage volume. The sediment basin marker post should also be marked to show the level at which the water surface level must be returned to within the basin prior to a rainfall event to ensure sufficient settling zone volume is available.
- Any chemicals (including coagulants or flocculants) or fuel / oil stored on site shall be stored under cover in a bunded area (above the 100 year ARI peak flood level) or placed sufficiently above ground level to preclude contamination of surface water. The only potential source of contamination of surface water is to be due to erosion of ground surfaces.
- Following 80% stabilisation of the disturbed areas outside of the channel works areas, and 100% stabilisation of the disturbed channel works areas, the temporary sediment control devices and upslope 'clean water' diversion drains / bunds can be removed and the areas rehabilitated and revegetated. The sediment fencing / controls located downslope of the temporary sediment basins or other nominated sediment control device locations should remain in place until these areas have been suitably stabilised.

The control measures mentioned above and shown on the attached drawings in Appendix B are the anticipated minimum requirements. Should it be deemed necessary from monitoring, the Contractor shall install additional measures to ensure the objectives of this element are met and to minimise the impact of construction activities on the surrounding environment.

The Superintendent may, at their discretion, direct the Contractor to carry out additional controls, as and when required. The Contractor may also at their discretion opt to include additional devices as may be required to ensure compliance with the approvals as they see fit.

The erosion, drainage and sediment control measures noted have been provided as a guide for the construction Contractor. It is important to note that construction sequencing and observations made during monitoring may identify the need to modify the details contained herein and on the erosion and sediment control plans. As a result, additional measures may be necessary to fulfil the development's approval requirements.

The recommended earthworks and site stabilisation erosion and sediment control installation sequences for the management measures outlined on Stantec drawing number 510357-008-CI-1023 are summarised in Table 12 below.

Table 12: Earthworks and Site Stabilisation Phases – ESC Strategy Installation Sequence

Control Measure	Reference Drawing	Installed	Removed
Sediment basins	510357-008-CI-1023	Following installation of boundary sediment fencing / controls and prior to land clearing.	After stabilisation of contributing upslope area.
Rock filter dams	510357-008-CI-1023	Following installation of boundary sediment fencing / controls and prior to land clearing.	After stabilisation of contributing upslope area.
Dirty water catch drains	510357-008-CI-1023	Following installation of boundary sediment fencing, sediment basins and other nominated sediment control devices, and prior to land clearing.	Catch drains to be retained until adequate site stabilisation of contributing upslope area.
Internal sediment fencing	510357-008-CI-1023	Prior to clearing upslope areas.	After stabilisation of contributing upslope area.
Flow control berms / bunds	510357-008-CI-1023	Following installation of boundary sediment fencing, sediment control devices, and prior to land clearing.	After stabilisation of contributing upslope area.
Site stabilisation (such as bonded fibre matrix, mulch, hydromulch, turf, topsoil and seeding, landscaping)	510357-008-CI-1023	Following completion of earthworks.	Where possible to become part of permanent site stabilisation.
Stabilisation of sediment basin, stockpile and site compound areas	510357-008-CI-1023	Following removal of sediment basin, site compound and stockpile areas.	Where possible to become part of permanent site stabilisation.

7.4 Management of Dispersive Soils

Should dispersive soils be identified on site during the construction works, the following provides guidance on measures that may be considered (but are not limited to) for the prevention and management of erosion within dispersive soils.

The following guidance has been prepared with reference to the IECA *'Best Practice Erosion and Sediment Control'* guidelines and Ipswich City Council's *'Implementation Guideline No. 28 – Dispersive Soil Management'*.

- Identification and avoidance, if possible, of regions containing dispersive soils.
- Precise re-compaction of soils after completion of disturbances. Geotechnical assessment and advice should be sort from a qualified and experienced engineer in order to determine appropriate compaction measures including optimum moisture content, number of passes, the maximum thickness of compacted layers and the appropriate compaction machinery.
- Avoid allowing rainfall / water to collect and pond on soil surface, or exposed subsoils.
- Avoid stockpiling or spreading dispersive soils.
- Chemical amelioration and / or application of flocculants. Care should be taken to avoid significant changes to pH levels, and in areas where vegetation retention is to occur.

- Where possible, flow diversion banks should be used in lieu of catch drains, reducing the risk of exposing dispersive substrata and concentrating stormwater flows through underlying subsoils. The use of flow diversion banks can reduce the risk of rill erosion by breaking up slope lengths into more manageable drainage areas.
- Utilisation of sand blocks and barriers, where practical.
- Prior to installing vegetation or erosion control measures, dispersive soils should be treated appropriately, or buried under a layer of non-dispersive soil (minimum 150mm, increasing to 250mm on steep slopes).
- The period of soil exposure should be minimised. Avoid exposing dispersive subsoils to rainfall. Consider staging the development, where practical. Areas of dispersive subsoils exposed during construction are to be covered with non-dispersive topsoil as soon as practical.
- In the event that long periods of rainfall or periods of heavy rainfall are predicted, it is recommended that any exposed dispersive subsoils are covered by a layer of non-dispersive topsoil, even if only temporarily for the predicted rainfall event.
- Rainwater tanks should be considered to capture any roof water runoff from construction compounds.
- Captured roof water or surface runoff should be dissipated and spread over as wide an area as possible.
- Where possible, any stormwater to be discharged is to be directed to areas of low erosion risk, and away from dispersive soils.
- Construction details of drainage systems and bank stabilisation works need to demonstrate how soils are to be stabilised and / or covered by a layer of non-dispersive topsoil (minimum 150mm deep).
- Utilisation of geotextile barriers.
- Retention of vegetation for as long as practical and revegetating disturbed areas as soon as possible.
- A layer of non-dispersive topsoil must always be placed over any dispersive subsoil before placement or application of the final surface treatment such as grass seeding and planting, turfing, rock, concrete, rock mattresses or erosion control blankets.
- If trenches are required for services, ensure material used for backfill has been appropriately compacted, treated with gypsum, topsoiled using non-dispersive material and revegetated. Culverts and drains excavated into dispersive subsoils should also be capped with non-dispersive clays mixed with gypsum prior to the placement of topsoil and revegetation. The use of sand blocks may also reduce the risk of tunnelling, where practical.

In most circumstances, the most appropriate management of dispersive soils is to bury the soil under a layer of non-dispersive soil, prior to the application of the final surface treatment. It is recommended a minimum cover of 150mm be applied over the site.

7.5 Wet Weather Preparedness

The Contractor should also consider establishing a wet weather preparedness plan that outlines what erosion, drainage and sediment control measures / actions should be undertaken on site in the event of a predicted rainfall event.

As a guide the Contractor could adopt the expected 24-hour rainfall ranges outlined in Table 13 as triggers for taking action in regards to preparing the site and exposed surfaces for the predicted rainfall.

Table 13: Alternative Erosion Risk Based on Expected Daily and Average Monthly Rainfall

Erosion Risk Rating	Expected 24-hour Rainfall	Average Monthly Rainfall
Very Low	0 to 2mm	0 to 30mm
Low	2+ to 10mm	30+ to 45mm
Moderate	10+ to 25mm	45+ to 100mm
High	25+ to 100mm	100+ to 225mm
Extreme	> 100mm	> 225mm

Erosion, drainage and sediment control techniques and actions that may be undertaken include, but are not limited to, the following measures:

- Review the condition of all erosion, drainage and sediment control devices implemented on site and ensure that these measures are in an effective operational condition prior to the event. Worn, damaged or otherwise defective materials and components are to be repaired or replaced.
- Sediment control devices with accumulated sediment volumes in excess of design capacity should be cleaned out to reinstate the settling and storage zone volumes. Materials removed must be disposed of in a manner approved by the consent authority that does not cause pollution.
- Covering exposed soil surfaces still subject to construction with temporary erosion control techniques such as temporary erosion control blankets or mats, or hydraulically applied blankets. The Contractor should consider retaining a stockpile of erosion control materials on site to ensure measures are readily available as needed.

7.6 Dust Management

The Contractor is responsible for the control of all dust emissions during all earthworks operations.

Dust control techniques and practices may include, but may not be limited to, the following to minimise the movement of dust off-site:

- The pre-clearing of land will be minimised. No vegetation stripping / clearing will occur in situations of high wind.
- All permanent bunds and reshaped areas will be re-vegetated as quickly as possible.
- Stabilisation and re-vegetation of fill areas.
- Stockpiling on-site will be minimised where possible.
- Consider the orientation of temporary stockpiles to minimise the effect of prevailing winds.
- Provision of barrier fence wind breaks.
- Water carts operating as warranted.
- Maintenance of vegetated buffers and / or the implementation of barriers, particularly around stockpile areas.
- Use of shakedown areas for haul trucks leaving the site.
- Minimisation of vehicular movement except for designated traffic routes.

Visual monitoring is to be undertaken throughout the construction phase. Dust monitoring devices may need to be installed where identified through monitoring. The Contractor is to ensure any dust production is kept to a minimum and action taken on any complaints received. If visible dust emissions are observed works to cease immediately until appropriate dust control measures can be put in place.

The Contractor shall maintain a daily record of site conditions and the dust management measures implemented. Complaints by residents are to be recorded in a complaints register.

Depending on the source of the dust the following measures will be implemented:

- Apply water sprays to vegetation.
- Dampen exposed areas.
- Ensure all loaded trucks are covered.
- Increase number of water trucks in operation.
- Cease operations during periods of extreme winds.

7.7 Monitoring

As a minimum the following monitoring should be carried out during the construction phase to confirm compliance as follows:

- Inspection of any disturbed / filled areas for their potential erosion susceptibility and treat in accordance with the practices in the IECA *'Best Practice Erosion and Sediment Control (2008)'* guidelines.
- Regular (at least weekly) inspections of erosion, drainage and sediment control measures. An example weekly inspection checklist is included in Appendix E of this report. These inspections should continue even if no works are occurring on site.
- At least daily during rainfall events. Inspections immediately prior to (within 24 hours) and following (within 18 hours) a rainfall event of sufficient intensity and duration to cause on-site runoff to check condition of control devices and to check for erosion incidence. Where practical

and safe, during each significant intense rainfall event, the turbidity of stormwater runoff exiting the site could be visually checked to ascertain whether the control measures are working effectively.

- In the event that operational works are halted due to unforeseen circumstances, all erosion, drainage and sediment control measures should be inspected to ensure they are intact, operational, and that environmental deterioration does not occur over the 'stop works' period.
- Prior to vacating the site, all soil stockpiles and exposed soil areas should be appropriately covered and adequately stabilised, with the total disturbed area minimised to the greatest extent practicable. In addition, any site conditions that could conceivably degrade over time and result in environmental harm shall be rectified. All erosion, drainage and sediment control devices should be monitored and maintained on a continual basis until work re-commences at the site.
- Inspections must as a minimum check the following:
    - All drainage, erosion and sediment control measures.
    - Occurrences of erosion, scour and excess sediment build up.
    - Presence of construction materials, litter or sediment washed from site.
    - Oil, fuel and chemical storage areas.

7.7.1 Sediment Basins

- Testing of Suspended Solids and pH within any temporary sediment basins is to occur prior to any controlled discharges and at the following frequencies, for the duration of the construction phase:
    - Monthly.
    - Immediately following rain events > 25mm in a 24 hour period.
- If the pH or TSS / Turbidity readings of the trapped runoff are outside the allowable release criteria outlined in Table 4, then further dosing with an appropriate approved coagulant and / or flocculant is required until acceptable levels are reached.
- Where the sediment basin is being utilised as part of the on-site acid sulphate soils management strategy, additional water quality monitoring may be required in order to satisfy the release criteria for stored runoff in accordance with the project acid sulphate soils management plan.

7.7.2 Rock Filter Dams and Sediment Traps

- All rock filter dams and sediment traps are to be checked after each runoff event and any repairs are to be made immediately. Any repairs to upstream and / or downstream of the structure should also be made.
- From full, rock filter dams and sediment traps should discharge over no less than 8 hours. If drainage is too rapid, additional filter aggregate may be required to achieve optimum hydraulic performance. If the flow is reduced to an unacceptable level, the upstream filter medium (aggregate or filter cloth) should be removed and replaced.
- When the collected sediment exceeds 10% of the specified storage volume, remove sediment and restore original sediment storage volume. Sediment and debris are to be disposed in a manner that will not create an erosion or pollution hazard.

7.8 Responsible Person / Organisation

The Contractor is generally the responsible party for all of the above items. This includes compliance with the criteria outlined in Section 3, implementation, monitoring and maintenance of the erosion and sediment control measures, reporting and any corrective action which may result from the non-compliance with the ESCP and conditions of approval.

7.9 Reporting

It is recommended that a weekly check sheet be filled out and monthly reports, including any testing results, be prepared by the Contractor. An example weekly inspection checklist is included in Appendix E of this report. The monthly reports should contain information on the performance of the erosion, drainage and sediment control devices, any water quality monitoring results, and a brief description of the same (including any incidences of non-compliance and corrective actions implemented).

It is recommended that photographs of the implemented erosion, drainage and sediment control measures be taken during the weekly inspections to assist with demonstrating the implementation of the erosion and sediment control plan on site.

Immediate notification of system failure should be made to the Superintendent with significant failures that have the potential to cause environmental harm to be notified to Scenic Rim Regional Council.

7.10 Corrective Action

After any identification of incident or failure, the source / cause is to be immediately located and the following measures implemented where appropriate:

- Build-up of sediment off the site – the material must be collected and disposed of in a manner that will not cause ongoing environmental nuisance or harm. On-site ESC measures should be amended, where appropriate to reduce the risk of further sedimentation.
- Excessive sediment build-up on the site – collect and dispose of material, then amend up-slope drainage and / or erosion control measures as appropriate to reduce the risk of further occurrence.
- Severe or excessive rill erosion – investigate cause, control up-slope water movement, re-profile surface, cover dispersive soils with a minimum 150mm layer of non-dispersive soil, and stabilise with erosion control blankets and vegetation as necessary.
- Off-stream erosion – fill rills, cover dispersive soils with a minimum 150mm layer of non-dispersive soil, vegetate and install velocity control measures including check dams.
- In-stream erosion – consult appropriate hydraulic / waterway consultant for advice.
- Release of construction material from the site – collect and dispose of in a manner that will not cause ongoing environmental nuisance or harm; then inspect litter and waste receptors.
- Poor vegetation growth or soil coverage – confirm adequate condition of topsoil on-site and ameliorate where required. Plant new vegetation and / or mulch as required. Newly planted and previously planted areas may require supplementary watering and replanting.
- Sediment fence failures – replace and monitor more frequently. Regular failures may mean that the sediment fence location, alignment or installation may need to be amended.

Non-compliance with the water quality 'Discharge Performance Criteria', the strategies outlined in the ESCP and / or conditions of approval must be dealt with as soon as practically possible. If there is a breach or infringement of conditions, action will be taken consistent with the nature and seriousness of the breach or infringement. Action may include the following:

- Re-establish erosion control structures if they have failed.
- More intensive implementation of the erosion control measures in accordance with the IECA *'Best Practice Erosion and Sediment Control (2008)'* guidelines, and on advice from a suitably qualified consultant if necessary.
- Issuing of a "stop work notice".
- A notice to comply pending re-inspection of the site.

If the nominated water quality objectives are not met, a suitably qualified consultant is to be notified and an investigation into the cause and source of the pollutants is to be conducted. The appropriate remedial action should then be taken based on the outcomes of the investigation.

7.11 Erosion and Sediment Control Plan Review

The plans and report comprising the erosion and sediment control plan are to be reviewed and updated, as required by the Superintendent, following consultation with the Contractor and Client representative, as and when required. This may be due to changes in construction sequencing and any unforeseen issues that may occur during the construction of the works. No change in the proposed erosion and sediment control devices is to increase the risk of potential environmental harm.

8 References

Department of Infrastructure, Local Government and Planning, *State Planning Policy July 2017*, July 2017, Brisbane, QLD.

International Erosion Control Association of Australasia, *Best Practice Erosion and Sediment Control*, November 2008, Picton, NSW.

International Erosion Control Association (IECA) Australasia *'Appendix B – Sediment basin design and operation'*, June 2018.

Ipswich City Council, *Implementation Guideline No. 28 – Dispersive Soil Management*, May 2016, QLD.

Healthy Land and Water *'Sediment Management on Construction Sites – Complying with the SPP (July 2017) Technical Note for Local Government Development Assessment & Compliance Officers'* (March 2018).

Appendices

Appendix A: Reference Drawings

DATE PLOTTED: 22 February 2023 4:53 PM BY - HUNG TRAN

XREFs: XR-SURVEY, XR-CUTFILL OP2, XR-CONT-EXIST, XR-DSGN OP2, XR-CONT-DSGN OP2a
CAD File: \\Aus5cfs02\data\5103-57\001 - CIVIL ENGINEERING\Drawings\510357-001-CI-1010-1011.dwg

LOT 3
SP192221

LOT 4
SP192221

LOT 2
RP20974

LOT 14
SP229448

LOT 2
SP192221

(PART) 18
63.774 ha

BORROW PIT LOCATION
(GENERALLY IN ACCORDANCE)

BORROW PIT LOCATION
(GENERALLY IN ACCORDANCE)

STAGE 1

STAGE 2

STAGE 3

STAGE 4

19.138 ha

FUTURE CONNECTING ROAD

PROPOSED 20.0m WIDE
ACCESS EASEMENT.

PROPOSED 4.0m WIDE
SERVICES EASEMENT.

PROPOSED 3.0m WIDE
LANDSCAPE EASEMENT

EXISTING TABLE DRAIN TO BE
RE-GRADED TO ENSURE FREE DRAINING

CHANNEL TO BE GRADED
TO ENSURE FREE DRAINING

MC02 (ROAD 2)

MC01(ROAD 1)

CUNNINGHAM HIGHWAY

CTP613.869

CTP653.296

CT673.219

CT574.472

TC554.520

1 Stage 2 — 1.439 ha
2 Stage 2 — 1.374 ha
3 Stage 2 — 0.623 ha
4 Stage 2 — 1.627 ha
5 Stage 2 — 0.832 ha
6 Stage 2 — 0.800 ha
7 Stage 2 — 1.982 ha
8 Stage 2 — 2.107 ha
9 Stage 2 — 6.335 ha
10 Stage 2 — 3.810 ha
11 Stage 3 — 5.120 ha
12 Stage 3 — 2.745 ha
13 Stage 3 — 2.749 ha
14 Stage 3 — 1.001 ha
15 Stage 3 — 1.016 ha
16 Stage 4 — 1.681 ha
17 Stage 4 — 0.700 ha
0.381 ha
5.975 ha

3 / 1016
4 / 1016
2 / 1015
1 / 1015

NORTH

EARTHWORKS

DATE: FRIDAY JAN 20TH 17:00:00 2023
REPORT FILE: L:\5103-57\008 - DETAILED BULK EARTHWORKS\12D\20230125 DESIGN OPT 2 REPORT.rpt

VOLUMES FROM TIN "S EXIST" TO TIN "DESIGN OPT 2"
CUT VOLUMES ARE NEGATIVE
FILL VOLUMES ARE POSITIVE

TOTAL CUT	-488983.712m³
TOTAL FILL	706,054.243m³
IE EXCESS OF FILL OVER CUT	217,070.532m³

NOTE:
1. INDICATED EARTHWORKS VOLUMES ARE NETT AND EXCLUDE BULKING / COMPACTION FACTORS.
2. SPOIL LOCATION FOR EXCESS CUT MATERIAL TO BE ADVISED BY THE SUPERINTENDENT.
3. EARTHWORKS ARE STILL WORKS IN PROGRESS. TO BE CONFIRMED

LEGEND

- PROPOSED PROPERTY BOUNDARY
- PROPOSED NOMINAL KERB LINE
- ROAD CENTRELINE
- PROPOSED CUT
- PROPOSED FILL
- PROPOSED LANDSCAPE EASEMENT
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- OVERLAND FLOW PATH
- PROPOSED CONTOURS (0.25m) — 36.5
- EXISTING CONTOURS (0.5m) — 36.5

EARTHWORKS PLAN

SCALE 1:2000

0 50 100 150 200m
SCALE 1:2000 @A1

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KALFRESH PTY LTD

BULK EARTHWORKS LAYOUT PLAN

Datum	Date	Scale	Size
AHD	3/12/2019	AS SHOWN	A1

Drawing Number	Revision
510357-001-CI-1010	4

Appendix B: Erosion and Sediment Control Plans

EROSION, SEDIMENT AND DRAINAGE CONTROL GENERAL NOTES

1. THE EROSION AND SEDIMENT CONTROL MEASURES IMPLEMENTED ON SITE SHOULD BE INSTALLED AND UTILISED IN ACCORDANCE WITH THE INTERNATIONAL EROSION CONTROL ASSOCIATION (IECA) AUSTRALASIA *'BEST PRACTICE EROSION AND SEDIMENT CONTROL (NOVEMBER 2008)'* GUIDELINES, WITH DETAILS SHOWN ON THE STANDARD DRAWINGS NOTED, AND AS REQUIRED FOR COMPLIANCE WITH THE REQUIREMENTS OF THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN.
2. THE EROSION AND SEDIMENT CONTROL MEASURES SHOWN ON THESE PLANS HAVE BEEN BASED ON A CONSTRUCTION PERIOD OF UP TO 12 MONTHS. SHOULD THE CONSTRUCTION PERIOD EXTEND BEYOND 12 MONTHS THEN THE CONTROL MEASURES PROVIDED SHOULD BE REVIEWED TO CONFIRM IF THE DEVICES REMAIN ADEQUATE.
3. THE CONTROL MEASURES NOTED IN THIS PLAN REPRESENT THE MINIMUM ANTICIPATED STANDARDS OF EROSION AND SEDIMENT CONTROL FOR THE CONSTRUCTION PHASE. ALL MEASURES ARE TO BE SUPPLEMENTED WITH MONITORING AND MAINTENANCE ON SITE. ADDITIONAL CONTROLS OR MODIFICATIONS TO WORK PRACTICES MAY BE REQUIRED TO SUIT THE SITE CONDITIONS OR CONSTRUCTION SEQUENCING AS IDENTIFIED THROUGH ON-SITE MONITORING.
4. SHOULD IT BE DEEMED NECESSARY FROM MONITORING OR WHERE DIRECTED BY THE SUPERINTENDENT, THE CONTRACTOR SHALL INSTALL ADDITIONAL MEASURES TO MINIMISE THE IMPACT OF CONSTRUCTION ACTIVITIES ON THE SURROUNDING ENVIRONMENT.
5. PUBLIC AND WORKPLACE SAFETY ISSUES MUST BE CONSIDERED AND MONITORED FOR EACH DEVICE TO THE SATISFACTION OF LOCAL AUTHORITIES AND INDUSTRY STANDARDS.
6. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING EROSION AND SEDIMENT CONTROL DEVICES TO ACCOMMODATE EARTHWORKS AS REQUIRED. THE LOCATION OF THE EROSION AND SEDIMENT CONTROL DEVICES SHOWN ARE INDICATIVE ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO SPECIFICALLY LOCATE THE CONTROL DEVICES, AND MINIMISE SEDIMENT TRANSPORT DOWNSTREAM DURING ALL STAGES OF CONSTRUCTION, INCLUDING THE MAINTENANCE PERIOD. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE INTENTS OF THESE PLANS AND ANY CONSENT AUTHORITY COMPLIANCE RECOMMENDATIONS ARE COMPLIED WITH.
7. WHERE PRACTICAL ALL AREAS OF THE SITE NOT SUBJECT TO EROSION, CONTAMINATION OR DISTURBANCE MUST HAVE PROVISION FOR ALL RUN-OFF TO BE DIVERTED AWAY FROM THE NOMINATED EROSION AND SEDIMENT CONTROL MEASURES AND FACILITIES, IN A MANNER, WHICH DOES NOT CAUSE SCOURING, OR EROSION.
8. WHERE INDICATED CONTAMINATED RUN-OFF MUST BE DIRECTED TOWARDS A TEMPORARY SEDIMENT CONTROL DEVICE DURING BOTH THE BULK EARTHWORKS PHASE AND CIVIL WORKS PHASE UNTIL 80% OF THE CONTRIBUTING SITE IS ADEQUATELY STABILISED.
9. ALL EROSION AND SEDIMENT CONTROL MEASURES INSTALLED DURING BULK EARTHWORKS ARE TO BE MAINTAINED IN EFFECTIVE OPERATIONAL CONDITION UNTIL THE SITE IS ADEQUATELY STABILISED. THIS INCLUDES MONITORING, REPAIRS AND CLEANING OUT AT REGULAR INTERVALS, AFTER STORM EVENTS, DISTURBANCE BY CONSTRUCTION AND AS DIRECTED BY SUPERINTENDENT ON SITE. THESE STRUCTURES MUST NOT BE ALLOWED TO ACCUMULATE SEDIMENT VOLUMES IN EXCESS OF FORTY PER CENT (40%) SEDIMENT STORAGE DESIGN CAPACITY. WHERE SEDIMENT BASINS ARE USED A MARKER SHALL BE PLACED WITHIN THE BASIN TO SHOW THE LEVEL ABOVE WHICH THE SEDIMENT STORAGE DESIGN CAPACITY OCCURS. MATERIALS REMOVED FROM SEDIMENT RETENTION DEVICES MUST BE DISPOSED OF IN A MANNER APPROVED BY THE CONSENT AUTHORITY THAT DOES NOT CAUSE POLLUTION.
10. WHERE WATER STORAGE IS PROPOSED FOR CONSTRUCTION PURPOSES, IT SHOULD BE PROVIDED OVER AND ABOVE THE MINIMUM NOTED SEDIMENT BASIN SETTLING ZONE AND STORAGE ZONE VOLUMES. WATER LEVELS SHOULD NOT EXTEND INTO THE SETTLING ZONE VOLUME TO ALLOW FOR THIS VOLUME TO BE AVAILABLE FOR THE NEXT RAINFALL EVENT.
11. ACCESS TO THE SITE MUST BE RESTRICTED TO THE NOMINATED STABILISED CONSTRUCTION ENTRANCE / EXITS. ROCK PAD ACCESS POINTS SHALL BE PROVIDED TO HELP SHAKE MUD FROM VEHICLE TYRES. THE NUMBER OF CONSTRUCTION ACCESS POINTS TO BE LIMITED. ADDITIONAL MEASURES TO BE PROVIDED IF EVIDENCE OF SEDIMENT BEING TRANSPORTED ONTO ROADWAYS.
12. ANY DIRT / MATERIALS SPILT OR TRACKED ONTO TMR, COUNCIL OR OTHER EXTERNAL ROADS IS TO BE BROOMED UP AND COLLECTED - NOT WASHED INTO STORMWATER DRAINS OR WATERWAYS.
13. THE CONTRACTOR SHALL ENSURE THE STABILISED SITE ACCESS IS MAINTAINED AND CLEANED OUT REGULARLY AND AS DIRECTED BY THE SUPERINTENDENT ON SITE.
14. RUNOFF RETAINED WITHIN THE SEDIMENT BASINS IS NOT TO BE RELEASED TO THE RECEIVING ENVIRONMENT UNTIL THE SUSPENDED SOLIDS CONCENTRATIONS ARE LESS THAN 50 MILLIGRAMS PER LITRE, AND THE pH OF THE WATER WITHIN THE BASIN IS WITHIN THE 6.5-8.5 RANGE. TESTING OF SUSPENDED SOLIDS AND pH WITHIN ANY TEMPORARY SEDIMENT BASIN IS TO OCCUR PRIOR TO ANY CONTROLLED DISCHARGES. DOSING WITH A COAGULANT AND/OR FLOCCULANT IS ANTICIPATED TO BE REQUIRED TO REACH ACCEPTABLE LEVELS OF pH AND SUSPENDED SOLIDS. CONTRACTOR TO CONFIRM THE DETAILED METHODS FOR FLOCCULATION, AND THE TYPES AND DOSES OF COAGULANTS AND / OR FLOCCULANTS TO BE UTILISED ON SITE.
15. DURING CONSTRUCTION, STOCKPILES AND AREAS OF BARE SOIL OR EARTH THAT ARE LIKELY TO BECOME ERODED MUST BE ADEQUATELY PROTECTED – BY UPSLOPE SURFACE WATER DIVERSION, DOWNSLOPE SEDIMENT CONTROLS AND TEMPORARY SURFACE COVERINGS.
16. TOPSOIL STOCKPILES ARE TO BE MULCHED OR TEMPORARILY VEGETATED IF THEY ARE TO REMAIN FOR MORE THAN 10 DAYS.
17. MAXIMUM LENGTH OF EXPOSED SLOPE TO BE LIMITED TO 80m BY THE USE OF THE EROSION AND SEDIMENT DEVICES SHOWN.
18. CLEAN WATER DIVERSION DRAINS TO BE TURFED IF LONGITUDINAL GRADE <10% AND 2 YR ARI VELOCITY IS LESS THAN 1.5m/s, OTHERWISE THEY ARE TO BE ROCK LINED.
19. THE OUTLETS OF ALL DIVERSION DRAINS TO HAVE ROCK SCOUR PROTECTION INSTALLED TO ACT AS AN OUTLET DISCHARGE ENERGY DISSIPATER.
20. VELOCITY CONTROLS AND / OR CHANNEL LININGS TO BE UTILISED WITHIN EARTH LINED CATCH DRAINS WITH FLOW VELOCITIES >0.6m/s.
21. FOR MANAGEMENT OF DISPERSIVE SOILS REFER TO IECA *'BEST PRACTICE EROSION AND SEDIMENT CONTROL (NOVEMBER,2008)'* GUIDELINES AND IPSWICH CITY COUNCILS *'IMPLEMENTATION GUIDELINE No. 28 - DISPERSIVE SOIL MANAGEMENT'* FOR FURTHER GUIDANCE.
22. FOR IDENTIFIED DISPERSIVE SOILS AREAS, FLOW DIVERSION BUNDS/BANKS SHOULD BE ADOPTED OVER CUT IN CATCH DRAINS. WHERE CUT IN DRAINS ARE NECESSARY WITHIN DISPERSIVE SOIL AREAS, THESE CATCH DRAINS SHOULD BE ADEQUATELY LINED WITH A MINIMUM OF 150mm OF NON-DISPERSIVE MATERIAL PRIOR TO THE INSTALLATION OF OTHER TEMPORARY CHANNEL LININGS OR CHECK DAMS.
23. ALL DISTURBED SURFACES OTHER THAN CHANNEL WORKS AREAS TO BE EITHER ADEQUATELY SEALED, STABILISED OR VEGETATED TO THE DESIGN REQUIREMENTS WITHIN 20 DAYS OF COMPLETION OF SITE WORKS FOR MODERATE EROSION RISK AREAS, AND WITHIN 10 DAYS FOR HIGH EROSION RISK AREAS.
24. CHANNEL WORKS AREAS TO BE ADEQUATELY STABILISED OR VEGETATED TO THE DESIGN REQUIREMENTS WITHIN 10 DAYS OF COMPLETION OF WORKS FOR MODERATE EROSION RISK AREAS, AND WITHIN 5 DAYS FOR HIGH EROSION RISK AREAS.

EROSION RISK

1. FROM TABLE 4.4.5 - EROSION RISK RATING BASED ON AVERAGE MONTHLY RAINFALL DEPTH OF THE IECA GUIDELINES, THE SUBJECT SITE IS ESTIMATED TO HAVE AN EROSION RISK RATING RANGING BETWEEN 'HIGH' FOR THE MONTHS OF DECEMBER THROUGH TO FEBRUARY, TO 'LOW' FOR JULY THROUGH TO SEPTEMBER. REFER TO TABLE BELOW FOR THE MONTHLY EROSION RISK RATINGS FOR NEARBY LOCATIONS OF IPSWICH AND TOOWOOMBA.

EROSION RISK RATING BASED ON AVERAGE MONTHLY RAINFALL DEPTH TABLE

LOCATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
IPSWICH	H	H	M	M	M	M	L	L	L	M	M	H
TOOWOOMBA	H	H	M	M	M	M	M	L	M	M	M	H

2. FROM TABLE 4.4.7 OF THE IECA GUIDELINES, THE FOLLOWING BEST PRACTICE LAND CLEARING AND REHABILITATION REQUIREMENTS HAVE BEEN RECOMMENDED FOR 'LOW', 'MODERATE' AND 'HIGH' EROSION RISK RATINGS:

FOR A 'LOW' EROSION RISK RATING:
- LAND CLEARING LIMITED TO MAXIMUM OF EIGHT WEEKS OF WORK.
- DISTURBED SOIL SURFACES STABILISED WITH A MINIMUM 70% COVER WITHIN 30 DAYS OF COMPLETION OF WORKS WITHIN ANY AREA OF A WORK SITE.
- UNFINISHED EARTHWORKS ARE SUITABLY STABILISED IF RAINFALL IS REASONABLY POSSIBLE, AND DISTURBANCE IS EXPECTED TO BE SUSPENDED FOR A PERIOD EXCEEDING 30 DAYS.

FOR A 'MODERATE' EROSION RISK RATING:
- LAND CLEARING LIMITED TO MAXIMUM OF SIX WEEKS OF WORK.
- DISTURBED SOIL SURFACES STABILISED WITH A MINIMUM 70% COVER WITHIN 20 DAYS OF COMPLETION OF WORKS WITHIN ANY AREA OF A WORK SITE.
- STAGE CONSTRUCTION AND STABILISATION OF EARTH BATTERS (STEEPER THAN 6H:1V) IN MAXIMUM 3m VERTICAL INCREMENTS WHEREVER REASONABLE AND PRACTICABLE.
- UNFINISHED EARTHWORKS ARE SUITABLY STABILISED IF RAINFALL IS REASONABLY POSSIBLE, AND DISTURBANCE IS EXPECTED TO BE SUSPENDED FOR A PERIOD EXCEEDING 20 DAYS.

FOR A 'HIGH' EROSION RISK RATING:
- LAND CLEARING LIMITED TO MAXIMUM OF FOUR WEEKS OF WORK.
- DISTURBED SOIL SURFACES STABILISED WITH A MINIMUM 75% COVER WITHIN 10 DAYS OF COMPLETION OF WORKS WITHIN ANY AREA OF A WORK SITE.
- STAGE CONSTRUCTION AND STABILISATION OF EARTH BATTERS (STEEPER THAN 6H:1V) IN MAXIMUM 3m VERTICAL INCREMENTS WHEREVER REASONABLE AND PRACTICABLE.
- THE USE OF TURF TO FORM GRASSED SURFACES GIVEN APPROPRIATE CONSIDERATION.
- SOIL STOCKPILES AND UNFINISHED EARTHWORKS ARE SUITABLY STABILISED IF DISTURBANCE IS EXPECTED TO BE SUSPENDED FOR A PERIOD EXCEEDING 10 DAYS.

APPLICATION OF EROSION CONTROL MEASURES TO SOIL SLOPES (TABLE 4.4.13 OF IECA 2008)

FLAT LAND	MILD SLOPE	STEEP SLOPE
(FLATTER THAN 1 in 10)	(1 in 10 - 1 in 4)	(STEEPER THAN 1 in 4)
EROSION CONTROL BLANKETS	BONDED FIBRE MATRIX	BONDED FIBRE MATRIX
GRAVELLING	COMPOST BLANKETS	CELLULAR CONFINEMENT SYSTEMS
MULCHING	EROSION CONTROL BLANKETS, MATS AND MESH	COMPOST BLANKETS
REVEGETATION	MULCHING WELL ANCHORED	EROSION CONTROL BLANKETS, MATS AND MESH
ROCK MULCHING	REVEGETATION	REVEGETATION
SOIL BINDER	ROCK MULCHING	ROCK ARMOURING
TURFING	TURFING	TURFING

LEGEND

- WORKS BOUNDARY
- CLEARING LIMITS
- CATCHMENT BOUNDARY
- **CATCHMENT 1B 0.640ha** — CATCHMENT ID AND AREA
- SF — SEDIMENT FENCE (REFER IECA STD DWG SD-SF-01 AND SD-SF-02). SEDIMENT FENCE INSTALLED DOWN THE SLOPE TO HAVE RETURNS, WITH SPILL THROUGH WEIRS, PLACED AT REGULAR INTERVALS. ENDS OF SEDIMENT FENCE TO BE EXTENDED UPSLOPE AT LEAST 1.0m.
- SF — SEDIMENT FENCE SPILL THROUGH WEIR. PROVIDE BATTER CHUTE TO ADJACENT CATCH DRAIN WHERE OUTLET GRADE EXCEEDS 1 IN 20 (5%)
- FLOW CONTROL BERM/BUND (REFER IECA STD DWG SD-CB-01 AND SD-MB-01 FOR TYPICAL DETAILS)
- DD — CLEAN WATER DIVERSION DRAIN, REFER NOTES 18 & 19 (REFER IECA STD DWG No. SD-DC-01)
- CD — DIRTY WATER CATCH DRAIN, REFER NOTES 19 & 20 (REFER IECA STD DWG No. SD-CD-01, SD-CD-02, SD-CD-04 & SD-CD-05)
- 36 — EXISTING CONTOUR (1.0m INTERVAL)
- 36 — FINISHED CONTOUR (0.25m INTERVAL)
- TEMPORARY LINED BATTER CHUTE (REFER IECA STD DWG SD-CH-01, SD-CH-02, SD-CH-03 AND SD-CH-06)
- SITE COMPOUND (INDICATIVE ONLY)
- SEDIMENT BASIN (REFER TO TABLE 1 AND 2 FOR DETAILS, INDICATIVE LOCATION ONLY, REFER IECA STD DWG SD-SB-05 AND SD-SB-06)
- CHECK DAM (INDICATIVE ONLY, REFER IECA STD DWG SD-RCD-01)(SAND BAGS TO BE USED WHERE CHANNELS ARE <0.5m DEPTH, ROCK TO BE USED WHERE CHANNELS ARE >0.5m DEPTH)
- ON GRADE OR SAG PIT FILTER SOCK INLET PROTECTION (REFER IECA STD DWG SD-FS-01 AND SD-SA-01)
- SEDIMENT BASIN EMERGENCY SPILLWAY LOCATION (INDICATIVE ONLY, TO BE CONFIRMED ON-SITE)
- DESIGNATED STOCKPILE LOCATION (INDICATIVE ONLY, IF REQUIRED)
- AREA TO BE TOPSOILED AND SEEDED OR STABILISED TO DESIGN REQUIREMENTS. BATTERS TO BE LANDSCAPED, TURFED OR HYDROMULCHED ETC IN ACCORDANCE WITH APPROVED CIVIL DRAWINGS.
- TURF FULL VERGE AREA FROM BACK OF KERB TO LOT BOUNDARY. TURF LINE INTER-ALLOTMENT DRAINAGE CHANNELS (REFER IECA STD DWG SD-GFS-01 AND SD-GFS-02)
- FABRIC DROP INLET PROTECTION AROUND FIELD INLET (REFER IECA STD DWG SD-FD-01 AND SD-FD-02)
- CONSTRUCTION ENTRY / EXIT ROCK PAD (INDICATIVE ONLY, REFER IECA STD DWG SD-EXIT-01 AND SD-EXIT-02)
- SEDIMENT TRENCH AND WEIR (REFER IECA STD DWG SD-SS-01, SD-SS-02, SD-SW-01 AND SD-SW-02) (INDICATIVE LOCATION ONLY, FINAL POSITION TO BE CONFIRMED ON SITE)
- ROCK FILTER DAM (REFER TO IECA STD DWG SD-RFD-01 AND SD-RFD-02) (INDICATIVE LOCATION ONLY, FINAL POSITION TO BE CONFIRMED ON-SITE)
- SP1 — WATER QUALITY SAMPLING LOCATION (INDICATIVE ONLY, CONTRACTOR TO CONFIRM ON SITE)
- BONDED FIBRE MATRIX OR APPROVED EQUIVALENT HYDRAULICALLY APPLIED STABILISER TO BE APPLIED TO ALL BATTERS TO SUPERINTENDENTS INSTRUCTIONS (REFER IECA STD DWG SD-BFM-01). ANY TABLE DRAINS TO BE STABILISED USING EROSION CONTROL METHODS SUITABLE FOR CONCENTRATED FLOW AREAS.
- LS — LEVEL SPREADER FLOW DISSIPATER (INDICATIVE ONLY, REFER IECA STD DWG SD-LS-01)
- FLOW DIRECTION

Rev.	Date	Description	Des.	Verif.	Appd.
C	22/02/2023	SITE LAYOUT UPDATED	H.T.	B.W.	J.O.S.
B	01/02/2023	DESIGN AMENDED	H.T.	B.W.	J.O.S.
A	20/02/2020	ISSUE FOR APPROVAL	M.D.	C.D.B.	C.D.B.

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Drawn	C.V	Date 21/01/2020
Checked	C.D.B.	Date 20/02/2020
Designed	M.D.	Date 20/01/2020
Verified	C.D.B.	Date 20/02/2020
Approved		Date 20/02/2020

Client: KALFRESH PTY LTD

Project: SCENIC RIM AGRICULTURAL INDUSTRIAL PRECINCT

Title: EROSION AND SEDIMENT CONTROL LEGEND AND NOTES

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	GRID	Scale	Size
AHD		AS SHOWN	A1

Drawing Number: 510357-008-CI-1020

Revision: C

EROSION AND SEDIMENT CONTROL CONSTRUCTION SEQENCE

PHASE 1 - PRIOR TO EARTHWORKS:

1. INSTALL CONSTRUCTION ENTRY/EXIT AND SITE FENCING. IF REQUIRED SECURITY GATES TO BE INSTALLED.
2. INSTALL 'NO GO' FENCING TO RESTRICT ACCESS TO PROTECTED AREAS.
3. INSTALL SEDIMENT FENCING ALONG DOWNSLOPE EXTENT OF WORK AREAS.
4. WHERE PRACTICAL INSTALL CLEAN WATER DIVERSION DRAINS/BUNDS AROUND CONSTRUCTION AREAS AND APPROPRIATELY STABILISE. OUTLET OF DIVERSION DRAINS TO HAVE APPROPRIATE SCOUR PROTECTION INSTALLED.
5. TEMPORARY STOCKPILE AREAS TO BE MARKED OUT. TOPSOIL TO BE TRANSPORTED IN A DAMP CONDITION TO RETAIN SOIL STRUCTURE. TOPSOIL STOCKPILES TO BE LOW FLAT LONG MOUNDS.
6. STRIP AND STOCKPILE TOPSOIL FROM SEDIMENT BASIN AREAS.
7. CONSTRUCT SEDIMENT BASINS AND OTHER NOMINATED SEDIMENT CONTROL DEVICES AS NOTED. PROVIDE APPROPRIATE SAFETY FENCING IF BATTERS STEEPER THAN 1 IN 4 ARE USED.
8. CONSTRUCT PERIMETER BUNDS/CATCH DRAINS ALONG DOWNSLOPE EXTENT OF WORK AREAS TO DIRECT DIRTY WATER RUNOFF TOWARDS NOMINATED SEDIMENT CONTROL DEVICES. AS NOTED OR WHERE IDENTIFIED THROUGH MONITORING CHECK DAMS OR CHANNEL LININGS MAY BE NECESSARY TO ASSIST WITH THE MANAGEMENT OF FLOW VELOCITIES.
9. FINAL LOCATION OF EROSION, SEDIMENT AND DRAINAGE CONTROL DEVICES TO BE CONFIRMED ON SITE WITH CONTRACTOR'S ENVIRONMENTAL MANAGER AND THE SUPERINTENDENT.

PHASE 2 - DURING EARTHWORKS:

1. ENSURE THAT NOMINATED CONTROL MEASURES FROM PHASE 1, WHICH ARE TO REMAIN IN PLACE, ARE MAINTAINED AND FUNCTIONAL.
2. STRIP AND STOCKPILE TOPSOIL FROM EARTHWORKS AREAS.
3. EARTHWORKS TO BE CARRIED OUT PROGRESSIVELY AND COMPACTED IN STAGES TO PREVENT LARGE AREAS OF UNCONSOLIDATED MATERIALS BEING PRESENT ON SITE.
4. DIVERT ALL DIRTY WATER RUNOFF TOWARDS NOMINATED SEDIMENT CONTROL DEVICES. AS EARTHWORKS PROGRESSES REVIEW AND ADD/AMEND DIRTY WATER DRAINAGE CONTROL DEVICES AS REQUIRED. VELOCITY CONTROLS TO BE IMPLEMENTED AS REQUIRED.
5. REVIEW LOCATION AND MINIMUM SIZING OF SEDIMENT CONTROL DEVICES AS EARTHWORKS PROGRESSES, AND AMENDED AS NECESSARY.
6. SEDIMENT FENCING / DIVERSION BUNDS TO BE INSTALLED ALONG THE TOP OF BATTERS TO MANAGE UNCONTROLLED FLOWS DOWN THE EXPOSED STEEP AREAS. TEMPORARY BATTER CHUTES TO BE UTILISED TO CONTROL FLOWS DOWN BATTER SLOPES WHERE REQUIRED.
7. PROGRESSIVELY RESPREAD TOPSOIL FOLLOWING COMPLETION OF EARTHWORKS STAGES, LEAVING IN A ROUGHENED STATE. TOPSOIL TO BE TRANSPORTED IN A DAMP CONDITION TO RETAIN SOIL STRUCTURE. SEED/MULCH/HYDROMULCH/TURF AREAS IMMEDIATELY UPON COMPLETION. IRRIGATE AREAS AS REQUIRED.
8. AS ROADS ARE FORMED, SANDBAG CHECK DAMS TO BE PLACED TO ASSIST WITH MANAGING RUNOFF VELOCITIES.
9. FINAL LOCATION OF EROSION, SEDIMENT AND DRAINAGE CONTROL DEVICES TO BE CONFIRMED ON SITE WITH CONTRACTOR'S ENVIRONMENTAL MANAGER AND THE SUPERINTENDENT.
10. REGULARLY MONITOR AND MAINTAIN EROSION, SEDIMENT AND DRAINAGE CONTROLS TO ENSURE MEASURES REMAIN FUNCTIONAL. DAMAGED AND/OR INEFFECTIVE CONTROLS AND MATERIALS ARE TO BE REPAIRED, REFURBISHED OR REPLACED.
11. INSPECT ALL CONTROL DEVICES AND MEASURES PRIOR TO AND FOLLOWING RAINFALL EVENTS, AND REPAIR/REPLACE AS REQUIRED.

PHASE 3 - SITE STABILISATION:

1. ENSURE THAT NOMINATED CONTROL MEASURES FROM PHASES 1 AND 2, WHICH ARE TO REMAIN IN PLACE, ARE MAINTAINED AND FUNCTIONAL.
2. UNCOMPLETED EARTHWORKS AREAS TO BE TEMPORARILY STABILISED WITH APPROPRIATE SOIL BINDER/MULCH/HYDROMULCH OR EQUIVALENT WHERE WORKS HAVE CEASED FOR AN EXTENDED PERIOD OF TIME (SUBJECT TO EROSION RISKS).
3. MONITOR AND MAINTAIN ALL TEMPORARY CONTROL DEVICES AND PERMANENT STABILISATION MEASURES. DAMAGED AND/OR INEFFECTIVE CONTROLS AND MATERIALS ARE TO BE REPAIRED, REFURBISHED OR REPLACED.
4. INSPECT ALL CONTROL DEVICES AND MEASURES PRIOR TO AND FOLLOWING RAINFALL EVENTS, AND REPAIR/REPLACE AS REQUIRED.
5. RESEED AND IRRIGATE ANY DISTURBED AREAS.
6. SEDIMENT BASINS AND OTHER SEDIMENT CONTROL DEVICES TO BE DECOMMISSIONED FOLLOWING ADEQUATE STABILISATION OF THE UPSLOPE CONTRIBUTING CATCHMENT AREAS.
7. WHERE SEDIMENT BASIN AREA DOES NOT FORM PART OF PERMANENT STORMWATER MANAGEMENT STRATEGY, AREA TO BE APPROPRIATELY STABILISED. DOWNSLOPE SEDIMENT FENCING TO REMAIN IN PLACE UNTIL ADEQUATE STABILISATION OF DISTURBED AREA.
8. TEMPORARY STOCKPILE AREAS AND SITE COMPOUND/OFFICE TO BE DECOMMISSIONED AND AREAS APPROPRIATELY STABILISED.
9. DOWNSLOPE EXTENT OF WORK AREA SEDIMENT FENCING TO REMAIN IN PLACE UNTIL ADEQUATE STABILISATION OF CONTRIBUTING UPSLOPE CATCHMENT AREA.
10. PLANTING, TURFING, MULCHING ETC. TO NOMINATED APPROVED LANDSCAPE PLANS.

DUST MANAGEMENT NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR THE CONTROL OF ALL DUST EMISSIONS DURING ALL EARTHWORKS OPERATIONS.

2. DUST CONTROL TECHNIQUES AND PRACTICES MAY INCLUDE, BUT MAY NOT BE LIMITED TO, THE FOLLOWING TO MINIMISE THE MOVEMENT OF DUST OFF-SITE:
   - THE PRE-CLEARING OF LAND WILL BE MINIMISED. NO VEGETATION STRIPPING/CLEARING WILL OCCUR IN SITUATIONS OF HIGH WIND.
   - ALL PERMANENT BUNDS AND RESHAPED AREAS WILL BE RE-VEGETATED AS QUICKLY AS POSSIBLE.
   - STABILISATION AND RE-VEGETATION OF FILL AREAS.
   - STOCKPILING ON-SITE WILL BE MINIMISED WHERE POSSIBLE.
   - CONSIDER THE ORIENTATION OF TEMPORARY STOCKPILES TO MINIMISE THE EFFECT OF PREVAILING WINDS.
   - PROVISION OF BARRIER FENCE WIND BREAKS.
   - WATER CARTS OPERATING AS WARRANTED.
   - MAINTENANCE OF VEGETATED BUFFERS AND/OR THE IMPLEMENTATION OF BARRIERS, PARTICULARLY AROUND STOCKPILE AREAS.
   - USE OF SHAKEDOWN AREAS FOR HAUL TRUCKS LEAVING THE SITE.
   - MINIMISATION OF VEHICULAR MOVEMENT EXCEPT FOR DESIGNATED TRAFFIC ROUTES.

3. VISUAL MONITORING IS TO BE UNDERTAKEN THROUGHOUT THE CONSTRUCTION PHASE. DUST MONITORING DEVICES MAY NEED TO BE INSTALLED WHERE IDENTIFIED THROUGH MONITORING. THE CONTRACTOR IS TO ENSURE ANY DUST PRODUCTION IS KEPT TO A MINIMUM AND ACTION TAKEN ON ANY COMPLAINTS RECEIVED. IF VISIBLE DUST EMISSIONS ARE OBSERVED WORKS TO CEASE IMMEDIATELY UNTIL APPROPRIATE DUST CONTROL MEASURES CAN BE PUT IN PLACE.

4. THE CONTRACTOR SHALL MAINTAIN A DAILY RECORD OF SITE CONDITIONS AND THE DUST MANAGEMENT MEASURES IMPLEMENTED. COMPLAINTS BY RESIDENTS ARE TO BE RECORDED IN A COMPLAINTS REGISTER.

5. DEPENDING ON THE SOURCE OF THE DUST THE FOLLOWING MEASURES WILL BE IMPLEMENTED:
   - APPLY WATER SPRAYS TO VEGETATION.
   - DAMPEN EXPOSED AREAS.
   - ENSURE ALL LOADED TRUCKS ARE COVERED.
   - INCREASE NUMBER OF WATER TRUCKS IN OPERATION.
   - CEASE OPERATIONS DURING PERIODS OF EXTREME WINDS.

6. PRIOR TO COMMENCEMENT OF BULK EARTHWORKS, THE CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION OF A SPRINKLER SYSTEM IF WATER TRUCK OPERATION IS NOT ABLE TO BE UNDERTAKEN. A 100mm MINIMUM DIAMETER PRESSURE MAIN IS TO BE LAID, THE EXACT ALIGNMENT TO BE DETERMINED ON SITE BY THE SUPERVISING ENGINEER. A DIESEL PUMP WITH PRESSURE REDUCING VALVE WILL OPERATE DURING BULK EARTHWORKS. VALVES WILL BE LOCATED AT 100m INTERVALS ALONG THE MAIN FROM WHICH 'EASYSHIFT' SPRINKLERS (OR APPROVED EQUIVALENT) CONNECT. SPRINKLERS ARE TO HAVE A MINIMUM CAPACITY OF 0.7 LITRES PER SECOND, A MINIMUM 16m SPREAD RADIUS AND TRAFFICABLE HOSES. THE CONTRACTOR SHALL ENSURE ALL EXPOSED EARTHWORK AREAS ARE WATERED AS REQUIRED LIMITING THE OCCURRENCE OF DUST TO A LEVEL ACCEPTABLE TO THE LOCAL COUNCIL.

EROSION AND SEDIMENT MANAGEMENT STRATEGY

OBECTIVE/TARGET	COMPLY WITH THE EROSION AND SEDIMENT CONTROL PLAN AS SHOWN, TO CONTROL EROSION AND SEDIMENT TRANSPORT. ENSURE THAT ALL EROSION AND SEDIMENT CONTROL DEVICES ARE OPERATIONAL AT ALL TIMES.
MANAGEMENT STRATEGY	CONTRACTOR TO IDENTIFY AND CHECK DIRECTION OF STORMWATER OVER LAND FLOWS AS SHOWN ON PLAN. PROVIDE BARRIERS AND OTHER CONTROL MEASURES SHOWN ON THE PLAN TO PREVENT STORMWATER FLOWS OVER EMBANKMENTS, AND SEDIMENTS INTO THE RECEIVING ENVIRONMENT
TASKS/ACTIONS	ERECT SEDIMENTATION BARRIERS AT PERIMETER OF CONSTRUCTION AREAS AS SHOWN ON EROSION AND SEDIMENT CONTROL PLAN.
FREQUENCY/DEADLINE	CONTRACTOR TO INSPECT DEVICES AT LEAST WEEKLY AND PRIOR TO AND IMMEDIATELY FOLLOWING EACH SIGNIFICANT RAINFALL EVENT.
RESPONSIBLE PERSON/ ORGANISATION	CONTRACTOR TO BE RESPONSIBLE FOR INSPECTIONS AND MAINTENANCE OF CONTROL DEVICES.
REPORTING/REVIEW	SITE WORKMEN TO ADVISE FOREMAN IF THEY NOTICE ANY CONTROLS NEEDING REPAIR. ALL WATER QUALITY SAMPLING DATA INCLUDING DATES AND AMOUNTS OF RAINFALL, DATES OF TESTING AND WATER RELEASE MUST BE MAINTAINED IN AN ON-SITE REGISTER. THIS REGISTER IS TO BE MAINTAINED FOR THE DURATION OF THE APPROVED WORKS, AND MADE AVAILABLE TO COUNCIL OFFICERS ON REQUEST.
CORRECTIVE ACTIONS	IF EROSION AND SEDIMENT CONTROL DEVICES HAVE BEEN FOUND TO BE DEFICIENT OR FAILED IN SERVICE DUE TO UNFORSEEN CIRCUMSTANCES, CORRECTIVE ACTION IS TO BE UNDERTAKEN BY THE CONTRACTOR IMMEDIATELY WHICH MAY INCLUDE AMENDMENTS/ADDITIONS TO THE ORIGINAL EROSION AND SEDIMENT CONTROL PLANS. SUCH ADDITIONS OR AMENDMENTS ARE TO BE APPROVED BY THE SUPERINTENDENT.

Rev.	Date	Description	Des.	Verif.	Appd.
C	22/02/2023	SITE LAYOUT UPDATED	H.T.	B.W.	J.O.S.
B	01/02/2023	DESIGN AMENDED	H.T.	B.W.	J.O.S.
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Checked	C.D.B.	Date 20/02/2020
Designed	M.D.	Date 20/01/2020
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Approved		Date 20/02/2020

Client: KALFRESH PTY LTD

Project: SCENIC RIM AGRICULTURAL INDUSTRIAL PRECINCT

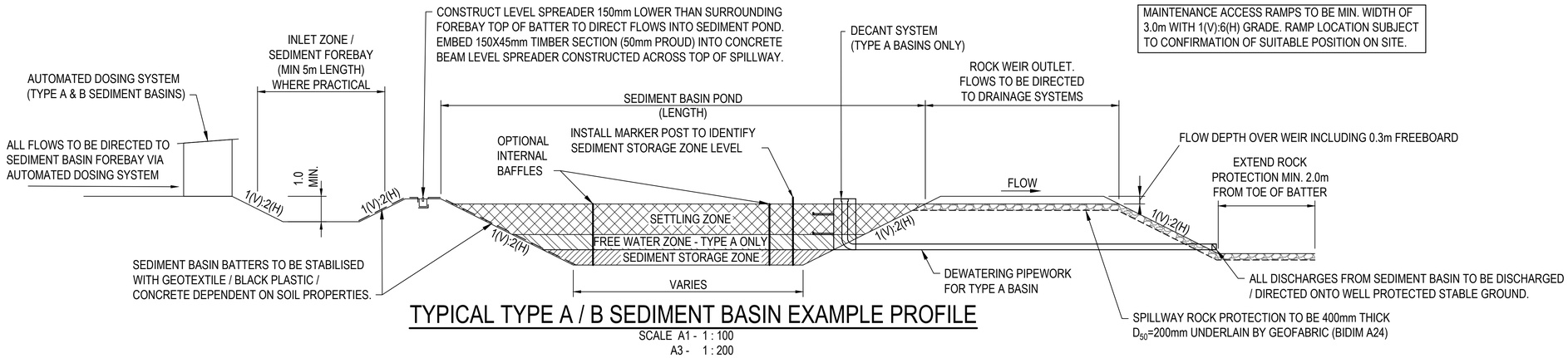
Title: EROSION AND SEDIMENT CONTROL CONSTRUCTION SEQUENCE

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	GRID	Scale	Size
AHD		AS SHOWN	A1

Drawing Number: 510357-008-CI-1021

Revision: C



MAINTENANCE ACCESS RAMPS TO BE MIN. WIDTH OF 3.0m WITH 1(V):6(H) GRADE. RAMP LOCATION SUBJECT TO CONFIRMATION OF SUITABLE POSITION ON SITE.

NOTE:
THE EROSION AND SEDIMENT STRATEGY SHOWN ON THIS PLAN IS CONCEPTUAL ONLY BASED ON THE SINGLE PHASE BULK EARTHWORKS CONTOURS PROVIDED. THE CONTRACTOR IS TO PREPARE AND MAINTAIN THEIR OWN EROSION AND SEDIMENT CONTROL PLANS, IN ACCORDANCE WITH THE IECA GUIDELINES, BASED UPON THEIR CHOSEN CONSTRUCTION METHODOLOGY AND SEQUENCING, AND THE PREVAILING SITE CONDITIONS FOR ALL PHASES OF THE WORKS (I.E. CLEARING AND GRUBBING, BULK EARTHWORKS, CIVIL WORKS AND SITE STABILISATION).
ALL MEASURES ARE TO BE SUPPLEMENTED WITH MONITORING AND MAINTENANCE ON SITE. ADDITIONAL CONTROLS OR MODIFICATIONS TO WORK PRACTICES MAY BE REQUIRED TO SUIT THE SITE CONDITIONS OR CONSTRUCTION SEQUENCING AS IDENTIFIED THROUGH ON-SITE MONITORING.

TYPICAL TYPE A / B SEDIMENT BASIN EXAMPLE PROFILE

SCALE A1 - 1 : 100
A3 - 1 : 200

TABLE 1 - 'IDEAL SIZED' TYPE B SEDIMENT BASIN CONCEPTUAL DETAILS

DEVICE ID	CATCHMENT	CATCHMENT AREA (ha)	SIDE BATTERS	BASIN LENGTH @ MID-ZONE DEPTH (m)	BASIN WIDTH @ MID-ZONE DEPTH (m)	BASIN AREA @ MID-ZONE DEPTH (m^2)	SETTLING ZONE DEPTH (m)	SEDIMENT STORAGE DEPTH (m)	TOTAL DEPTH FROM SPILLWAY (m)	SETTLING ZONE VOLUME (m^3)	SEDIMENT STORAGE VOLUME (m^3)	TOTAL BASIN STORAGE VOLUME (m^3)	INLET ZONE LENGTH (m)	INLET ZONE WIDTH (m)	INLET ZONE DEPTH (m)	EMERGENCY SPILLWAY LENGTH (m)	Q20 SPILLWAY DEPTH (m)	FREEBOARD (m)
SB-2A	C_2A	3.54	1 IN 3	90	30	2685	0.50	0.20	0.70	1343	403	1745	9	31	1.0	30	0.08	0.3
SB-2B	C_2B	3.92	1 IN 3	93	31	2904	0.52	0.20	0.72	1510	453	1963	9	33	1.0	31	0.09	0.3
SB-2C	C_2C	3.13	1 IN 3	84	28	2373	0.50	0.20	0.70	1186	356	1542	9	30	1.0	28	0.08	0.3
SB-2E	C_2E	2.74	1 IN 3	77	26	1978	0.50	0.20	0.70	989	297	1285	8	27	1.0	26	0.07	0.3
SB-2F	C_2F	2.01	1 IN 3	67	22	1486	0.50	0.20	0.70	743	223	966	7	24	1.0	22	0.07	0.3
SB-2G	C_2G	2.02	1 IN 3	68	23	1531	0.50	0.20	0.70	765	230	995	7	24	1.0	23	0.07	0.3
SB-2H	C_2H	1.57	1 IN 3	60	20	1192	0.50	0.20	0.70	596	179	775	6	21	1.0	20	0.06	0.3
SB-2I	C_2I	5.40	1 IN 3	110	37	3999	0.61	0.20	0.81	2439	732	3171	11	38	1.0	37	0.09	0.3
SB-2J	C_2J	4.97	1 IN 3	100	33	3342	0.56	0.20	0.76	1872	561	2433	10	35	1.0	33	0.09	0.3

TABLE 2 - 'IDEAL SIZED' TYPE A SEDIMENT BASIN CONCEPTUAL DETAILS

DEVICE ID	CATCHMENT	CATCHMENT AREA (ha)	SIDE BATTERS	BASIN LENGTH @ MID-ZONE DEPTH (m)	BASIN WIDTH @ MID-ZONE DEPTH (m)	BASIN AREA @ MID-ZONE DEPTH (m^2)	SETTLING ZONE DEPTH (m)	FREE WATER DEPTH (m)	SEDIMENT STORAGE DEPTH (m)	TOTAL DEPTH FROM SPILLWAY (m)	SETTLING ZONE VOLUME (m^3)	SEDIMENT STORAGE VOLUME (m^3)	FREE WATER ZONE STORAGE (m^3)	TOTAL BASIN STORAGE VOLUME (m^3)	INLET ZONE LENGTH @ MID-ZONE LEVEL (m)	INLET ZONE WIDTH (m)	INLET ZONE DEPTH (m)	EMERGENCY SPILLWAY LENGTH (m)	Q20 SPILLWAY DEPTH (m)	FREEBOARD (m)	No. OF DECENT ARMS
SB-2M	C_2M	3.66	1 IN 3	50	17	848	0.6	0.20	0.25	1.05	509	153	138	799	5.0	19	1.0	17	0.14	0.3	8
SB-2N	C_2N	4.04	1 IN 3	53	18	936	0.6	0.20	0.25	1.05	562	169	154	885	5.0	19	1.0	18	0.14	0.3	9
SB-2O	C_2O	5.74	1 IN 3	63	21	1329	0.6	0.20	0.23	1.03	797	239	227	1263	6.0	23	1.0	21	0.15	0.3	12
SB-2P	C_2P	0.97	1 IN 3	26	9	225	0.6	0.20	0.42	1.22	135	40	30	205	5.0	10	1.0	9	0.09	0.3	2

SEDIMENT BASIN NOTES

1. FOR IDEAL SIZED SEDIMENT BASIN THE NOTED MINIMUM AVERAGE SETTLING ZONE AREAS, LENGTHS AND WIDTHS ARE AT THE MID-DEPTH OF THE SETTLING ZONE. THE TOTAL BASIN DIMENSIONS NEED TO CONSIDER THE ADOPTED BATTERS SLOPES.
2. IDEAL SIZED SEDIMENT BASIN RECOMMENDED 3:1 EFFECTIVE LENGTH TO WIDTH RATIO.
3. BASIN DEPTH MINIMUM ADOPTED FOR COMBINED SETTLING, FREE WATER (TYPE A ONLY) AND STORAGE VOLUME.
4. ADDITIONAL 0.45m MINIMUM REQUIRED ABOVE FOR SPILLWAY HEIGHT AND FREEBOARD (0.3m)
5. FOR IDEAL SIZED SEDIMENT BASIN:
   - SETTLING ZONE 0.6m MINIMUM DEPTH FOR TYPE A BASINS AND 0.5m MINIMUM DEPTH FOR TYPE B BASINS.
   - FREE WATER ZONE DEPTH 0.2m MINIMUM DEPTH (TYPE A ONLY).
   - SEDIMENT STORAGE ZONE 0.2m MINIMUM DEPTH.
6. FOR IDEAL SIZED SEDIMENT BASIN, SEDIMENT STORAGE VOLUME BASED ON 30% OF SETTLING ZONE VOLUME. A MARKER SHALL BE PLACED WITHIN THE BASIN TO SHOW THE LEVEL AT WHICH THE SEDIMENT STORAGE ZONE DESIGN CAPACITY OCCURS.
7. FOR IDEAL SIZED SEDIMENT BASIN EMERGENCY SPILLWAY WEIR LENGTHS BASED ON CONVEYING THE 20 YEAR ARI PEAK DISCHARGE, FOR THE CONTRIBUTING CATCHMENT AREA, WITH A MAXIMUM DEPTH OVER THE WEIR OF 0.15m.
8. SEDIMENT BASIN CUT/FILL BATTERS TO BE CONSTRUCTED TO TIE IN WITH THE EXISTING GROUND.
9. DEWATERING AND SPILLWAY OUTLET LOCATIONS ARE TO BE SPECIFIED ON SITE BY THE CONTRACTOR'S ENVIRONMENTAL MANAGER AND CONFIRMED BY THE SUPERINTENDENT.
10. WHERE ROCK IS ENCOUNTERED, THE CUT BATTER OF THE SEDIMENT BASIN MAY BE CONSTRUCTED WITH A NOMINAL BATTER SLOPE OF 1(V) : 1(H). FOR OTHER SOILS, THE CUT BATTER SLOPE SHALL BE CONSTRUCTED WITH A NOMINAL BATTER SLOPE OF 1(V) : 2(H) OR FLATTER IF IT IS CONSIDERED THAT THE 1(V) : 2(H) SLOPE IS NOT SUFFICIENTLY STABLE FOR THE SOILS ENCOUNTERED. APPROPRIATE BASIN BATTER SLOPES FOR THE ON SITE CONDITIONS ENCOUNTERED TO BE CONFIRMED BY GEOTECHNICAL ENGINEER.
11. EARTH EMBANKMENTS IN EXCESS OF 1m IN HEIGHT SHOULD BE CERTIFIED BY GEOTECHNICAL ENGINEER.
12. IF BATTER SLOPES STEEPER THAN 1(V) : 4(H) ARE USED AROUND EDGE OF SEDIMENT BASIN, THEN SAFETY FENCING IS TO BE SUPPLIED TO THE FULL PERIMETER FOR THE DURATION OF THE BASIN'S OPERATION.
13. TO INCREASE THE EFFECTIVE TREATMENT OF THE SEDIMENT BASINS, REFER TO SEDIMENT BASIN DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE GUIDELINES FOR DETAILS ON THE INCORPORATION OF ANCILLARY ITEMS SUCH AS INTERNAL BAFFLES.
14. REFER IECA *'BEST PRACTICE EROSION AND SEDIMENT CONTROL'* GUIDELINES APPENDIX B - SEDIMENT BASIN DESIGN AND OPERATION (REV. JUNE 2018) FOR THE FOLLOWING:
   - EXAMPLE BASIN PERFORMANCE REPORT.
   - SECTION B4 DEFAULT CONSTRUCTION SPECIFICATION.
15. REFER ABOVE, TO IECA STD DWGS SD-SB-05 AND SD-SB-06, AND TO APPENDIX A OF THE WATER BY DESIGN SEDIMENT MANAGEMENT ON CONSTRUCTION SITES DOCUMENT FOR TYPICAL SEDIMENT BASIN DETAILS.

SEDIMENT BASIN MANAGEMENT NOTES

1. TESTING OF pH, TOTAL SUSPENDED SOLIDS (TSS) AND TURBIDITY WITHIN ANY TEMPORARY SEDIMENT BASINS IS TO OCCUR PRIOR TO ANY CONTROLLED DISCHARGES FROM THE SITE AND AT THE FOLLOWING FREQUENCIES FOR THE DURATION OF THE CONSTRUCTION PHASE:
   - IMMEDIATELY FOLLOWING RAIN EVENTS > 25mm IN A 24 HOUR PERIOD.
2. IF THE pH OR TSS / TURBIDITY READINGS ARE OUTSIDE THE ALLOWABLE RELEASE CRITERIA, THEN FURTHER DOSING WITH AN APPROPRIATE APPROVED COAGULANT AND / OR FLOCCULANT IS REQUIRED UNTIL ACCEPTABLE LEVELS ARE REACHED.
3. WATER QUALITY MONITORING RESULTS ARE TO BE RETAINED ON SITE AND BE MADE AVAILABLE FOR VIEWING UPON REQUEST.
4. PRIOR TO A RAINFALL EVENT, TO IMPROVE THE EFFICIENCY AND EFFECTIVENESS OF THE FLOCCULATION PROCESS, IT IS RECOMMENDED THAT THE CONTRACTOR UNDERTAKE TRIAL TESTING TO DETERMINE APPROPRIATE FLOCCULANT AND / OR COAGULANT TYPES, AND DOSING RATES FOR THE ON-SITE SOILS. THIS GENERALLY INVOLVES CONDUCTING SOIL JAR TESTS OF THE ON-SITE SOILS. FOR THE CHARACTERISTICS OF VARIOUS FLOCCULATING AGENTS REFER TO TABLE 1 IN THE *'CHEMICAL COAGULANTS AND FLOCCULANTS'* FACT SHEET BY IECA, OBTAINABLE FROM THE IECA WEBSITE UNDER THE BEST PRACTICE EROSION AND SEDIMENT CONTROL 'APPENDIX B - REVISION JUNE 2018' SECTION. FOR DETAILS ON THE SOIL JAR TESTING PROCEDURE, REFER TO SECTION 5 OF THE FACT SHEET MENTIONED ABOVE.
5. MANAGING THE FLOCCULATION OF THE SEDIMENT BASINS SHOULD BE UNDERTAKEN USING AUTOMATED DOSING SYSTEMS SUCH AS RAINFALL OR FLOW ACTIVATED FLOCKING SYSTEMS. THIS WILL ALLOW MAXIMUM TIME FOR FLOCCULATION TO OCCUR TO ASSIST IN REDUCING THE RUNOFF HOLDING TIMES. THE EFFECTIVENESS OF THE FLOCCULANT WILL DETERMINE THE ACTUAL RUNOFF HOLDING TIMES FOR EACH BASIN. THE DETAILED METHODS FOR FLOCCULATION AND TYPES OF FLOCCULANTS TO BE USED ARE TO BE CONFIRMED BY THE CONTRACTOR.
6. WHERE APPROPRIATE THE CONTRACTOR MAY ALSO CONSIDER PASSIVE APPLICATION TECHNIQUES OF COAGULANTS AND / OR FLOCCULANTS, SUCH AS 'FLOC BLOCKS' OR SIMILAR PLACED WITHIN CATCH DRAINS, TO IMPROVE THE EFFICIENCY AND EFFECTIVENESS OF THE FLOCCULATION PROCESS.
7. TO ASSIST WITH THE PERFORMANCE OF THE SEDIMENT BASINS, IN-LINE PERMEABLE INTERNAL BAFFLES CAN BE INCORPORATED ACROSS THE BASIN SETTLING ZONE PERPENDICULAR TO THE DIRECTION OF FLOW.
8. THE SEDIMENT BASINS MUST OPERATE AS WET BASINS, WITH THE TREATED RUNOFF TO BE DECANTED FROM THE BASINS ONCE COMPLIANT WITH THE 'DISCHARGE PERFORMANCE CRITERIA'. AS SOON AS CONDITIONS ALLOW, THE WATER LEVEL WITHIN THE BASINS SHOULD BE LOWERED BACK DOWN TO AT LEAST THE INVERT OF THE SETTLING ZONE. THIS WILL ALLOW THE SETTLING ZONE VOLUME OF THE BASINS TO BE AVAILABLE FOR THE NEXT RAINFALL EVENT.
9. IN THE EVENT THAT THE SEDIMENT BASIN CANNOT BE DE-WATERED TO RE-INSTATE THE SETTLING ZONE VOLUME PRIOR TO BEING SURCHARGED BY THE FOLLOWING RAINFALL EVENT, THE CONTRACTOR MUST RECORD THE OCCURRENCE OF SUCH AN EVENT AND REPORT IT TO THE LOCAL AUTHORITY. SUBJECT TO CONSULTATION WITH AND APPROVAL FROM THE LOCAL AUTHORITY, ALTERNATIVE OPERATING PROCEDURES FOR THE SEDIMENT BASINS MAY NEED TO BE ADOPTED IN ORDER TO ACHIEVE OPTIMUM ENVIRONMENTAL PROTECTION.

Rev.	Date	Description	Des.	Verif.	Appd.
C	22/02/2023	SITE LAYOUT UPDATED	H.T.	B.W.	J.O.S.
B	01/02/2023	DESIGN AMENDED	H.T.	B.W.	J.O.S.
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0 1 2 4 6 8 10m
SCALE 1:100 @A1

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Checked	C.D.B.	Date 20/02/2020
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Client: KALFRESH PTY LTD
Project: SCENIC RIM AGRICULTURAL INDUSTRIAL PRECINCT
Title: EROSION AND SEDIMENT CONTROL CONCEPT DEVICE DETAILS
Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | GRID | Scale: AS SHOWN | Size: A1
Drawing Number: 510357-008-CI-1022 | Revision: C

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CAD File: \\aus\fcfs02\data\5103-57\008 - DETAILED BULK EARTHWORKS\Drawings\510357-008-CI-1023.dwg

NOTES:

1. THIS PLAN IS TO BE READ IN CONJUNCTION WITH NOTES AND LEGEND ON DRG. 510357-008-CI-1020, 1021 AND 1022.
2. CONSTRUCTION OF BY-PASS CHANNEL TO BE STAGED, WITH STAGING TO BE CONFIRMED BY CONTRACTOR. WHERE PRACTICAL ACTIVE CONSTRUCTION AREAS SHOULD BE ISOLATED OFF-LINE TO EXTERNAL CATCHMENT LOW FLOWS. WHERE PRACTICAL CONSTRUCT AND STABILISE A LOW FLOW DIVERSION CHANNEL TO ALLOW EXTERNAL CATCHMENT LOW FLOWS TO BE CONVEYED EITHER THROUGH OR AROUND ACTIVE CONSTRUCTION AREAS.
3. ALL DISTURBED SURFACES OTHER THAN CHANNEL WORKS AREAS TO BE EITHER ADEQUATELY SEALED, STABILISED OR VEGETATED TO THE DESIGN REQUIREMENTS WITHIN 20 DAYS OF COMPLETION OF SITE WORKS DURING MONTHS WITH MODERATE EROSION RISK, AND WITHIN 10 DAYS DURING MONTHS WITH HIGH EROSION RISK.
4. CHANNEL WORKS AREAS, INCLUDING BATTERS, TO BE ADEQUATELY STABILISED (100% COVERAGE) OR VEGETATED TO THE DESIGN REQUIREMENTS WITHIN 10 DAYS OF COMPLETION OF WORKS DURING MONTHS WITH MODERATE EROSION RISK, AND WITHIN 5 DAYS DURING MONTHS WITH HIGH EROSION RISK. ADDITIONAL EROSION CONTROL METHODS, SUCH AS HYDRAULICALLY APPLIED SOIL BINDERS/BLANKETS, MAY NEED TO BE APPLIED IF VEGETATION COVERAGE OF 100% CANNOT BE IMMEDIATELY ACHIEVED.
5. BATTER SLOPES DOWNSTREAM OF SEDIMENT BASIN TEMPORARY SPILLWAYS TO BE ADEQUATELY STABILISED WITH GEOFABRIC AND ROCK.
6. CONTRACTOR TO REVIEW EROSION AND SEDIMENT CONTROL STRATEGY FOR THE BORROW PIT AREAS FOLLOWING CONFIRMATION OF THE CONSTRUCTION TIMING AND EXTENT OF WORKS AREA, WITH THE STRATEGY TO BE REVISED AS NECESSARY TO SUIT.

CONTRACTOR TO REVIEW EROSION AND SEDIMENT CONTROL STRATEGY FOR THE EARTHWORKS ASSOCIATED WITH THE PROPOSED WATER STORAGE DAM FOLLOWING CONFIRMATION OF THE CONSTRUCTION TIMING. ADDITIONAL SEDIMENT CONTROLS, SUCH AS A SEDIMENT BASIN, MAY BE REQUIRED IF THE WORKS IS TIMED SEPARATELY TO THE PROPOSED BY-PASS CHANNEL CONSTRUCTION WORKS.

NOTE:

THE EROSION AND SEDIMENT STRATEGY SHOWN ON THIS PLAN IS CONCEPTUAL ONLY BASED ON THE SINGLE PHASE BULK EARTHWORKS CONTOURS PROVIDED. THE CONTRACTOR IS TO PREPARE AND MAINTAIN THEIR OWN EROSION AND SEDIMENT CONTROL PLANS, IN ACCORDANCE WITH THE IECA GUIDELINES, BASED UPON THEIR CHOSEN CONSTRUCTION METHODOLOGY AND SEQUENCING, AND THE PREVAILING SITE CONDITIONS FOR ALL PHASES OF THE WORKS (I.E. CLEARING AND GRUBBING, BULK EARTHWORKS, CIVIL WORKS AND SITE STABILISATION).
ALL MEASURES ARE TO BE SUPPLEMENTED WITH MONITORING AND MAINTENANCE ON SITE. ADDITIONAL CONTROLS OR MODIFICATIONS TO WORK PRACTICES MAY BE REQUIRED TO SUIT THE SITE CONDITIONS OR CONSTRUCTION SEQUENCING AS IDENTIFIED THROUGH ON-SITE MONITORING.

CUNNINGHAM HIGHWAY

EROSION AND SEDIMENT CONTROL PLAN

SCALE 1:2000

Rev.	Date	Description	Des.	Verif.	Appd.
D	22/02/2023	SITE LAYOUT UPDATED	H.T.	B.W.	J.O.S.
C	01/02/2023	DESIGN AMENDED	H.T.	B.W.	J.O.S.
B	14/04/2020	FISH MITIGATION MEASURES ADDED	B.J.F.	B.W.	J.O.S.
A	20/02/2020	ISSUE FOR APPROVAL	M.D.	C.D.B.	C.D.B.

0 50 100 150 200m
SCALE 1:2000 @A1

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Drawn	C.V	Date 21/01/2020
Checked	C.D.B.	Date 20/02/2020
Designed	M.D.	Date 20/01/2020
Verified	C.D.B.	Date 20/02/2020
Approved		Date 14/04/2020

Client: KALFRESH PTY LTD
Project: SCENIC RIM AGRICULTURAL INDUSTRIAL PRECINCT
Title: EROSION AND SEDIMENT CONTROL CONCEPT LAYOUT PLAN

Status: FOR APPROVAL
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DATUM	GRID	Scale	Size
AHD		AS SHOWN	A1

Drawing Number: 510357-008-CI-1023
Revision: D

Appendix C: Standard Drawings

MATERIAL

MULCH: TYPICALLY 100% WOOD FIBRE, 100% BAGASSE, OR 75% CANE FIBRE AND 25% RECYCLED PAPER. THE REMAINDER MUST CONSIST OF SUITABLE MULCHING MATERIAL SUCH AS RECYCLED PAPER.

TACKIFIER: NON RE-WETTING, CROSS-LINKED, GUAR PRODUCT COMBINED WITH EITHER A COPOLYMER PVA BINDER (TROPICAL ENVIRONMENTS) OR POLYACRYLAMIDES (PAMs), UNLESS USED SPECIFICALLY FOR WEED CONTROL.

APPLICATION

THE FOLLOWING SPECIFICATION APPLIES TO GRASS SEEDING, NOT THE APPLICATION OF NATIVE TREE OR SHRUB SEED. THE ADOPTED SPECIFICATION MUST BE APPROPRIATE FOR LOCAL CONDITIONS.

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND APPLICATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF APPLICATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO APPLICATION.

3. ENSURE THE SURFACE IS FREE OF DEEP TRACK MARKS OF OTHER FEATURES THAT MAY RESULT IN ONGOING FLOW CONCENTRATION DOWN THE SLOPE. WHERE NECESSARY, ESTABLISH UP-SLOPE DRAINAGE CONTROLS TO LIMIT RUN-ON WATER THAT MAY DISTURB THE MATRIX.

4. CONTOUR SCARIFY THE SOIL SURFACE AND FILL AREAS PRIOR TO APPLICATION OF THE MATRIX.

5. IF THE SOIL IS DRY, WATER THE TREATMENT AREA BEFORE APPLICATION TO INCREASE PENETRATION OF THE ADHESIVE AND FERTILISER ADDITIVES.

6. MACHINE APPLICATIONS MUST COMPRISE A MINIMUM OF TWO PASSES IN OPPOSITE DIRECTIONS UNLESS OTHERWISE SPECIFIED. ENSURE COMPLETE COVERAGE OF THE SPECIFIED TREATMENT AREA OCCURS.

7. DURING APPLICATION, ALL REASONABLE EFFORTS MUST BE TAKEN TO AVOID SPRAY ONTO ROADS, PATHWAYS, DRAINAGE CHANNELS NOT INTENDED FOR APPLICATION, AND EXISTING VEGETATION.

8. CONTINUE TO WATER AFTER ALLOWING 24 HOURS DRYING TIME. WATER AS REQUIRED TO MAINTAIN SUITABLE GERMINATION AND PLANT GROWTH. THE MATRIX SHOULD BE KEPT MOIST UNTIL SUCCESSFULLY SEED GERMINATION OCCURS.

MAINTENANCE

1. INSPECT THE APPLICATION FORTNIGHTLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CHECK FOR RILL EROSION, OR DISLODGMENT OF THE FIBRE MATRIX.

3. REPLACE ANY DISPLACED FIBRE MATRIX TO MAINTAIN THE REQUIRED COVERAGE.

4. IF STORMWATER RUNOFF DISPLACES MORE THAN 10% OF THE FIBRE MATRIX, THEN INVESTIGATE THE NEED FOR ADDITIONAL DRAINAGE CONTROLS TO PREVENT FURTHER DISPLACEMENT.

5. CONTINUE INSPECTIONS UNTIL VEGETATION IS SUITABLY ESTABLISHED OR EROSION CONTROL IS NO LONGER REQUIRED.

6. IF THE FIBRE MATRIX IS NOT EFFECTIVE IN CONTAINING THE SOIL EROSION IT SHOULD BE REPLACED, OR AN ALTERNATIVE EROSION CONTROL PROCEDURE ADOPTED.

Drawn:	Date:		
GMW	Dec-09	Bonded Fibre Matix	BFM-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE BERM, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY.

4. FORM THE BERM FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS.

5. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED.

6. CHECK THE ALIGNMENT OF THE BERM TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION.

7. ENSURE THE BERM DISCHARGES TO A STABLE OUTLET.

8. ENSURE THE BERM DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT FLOW CONTROL BERMS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. INSPECT THE BERM FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY.

3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

5. REPAIR ANY PLACES IN THE BERM THAT ARE WEAKENED OR IN RISK OF FAILURE.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW CONTROL BERM SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

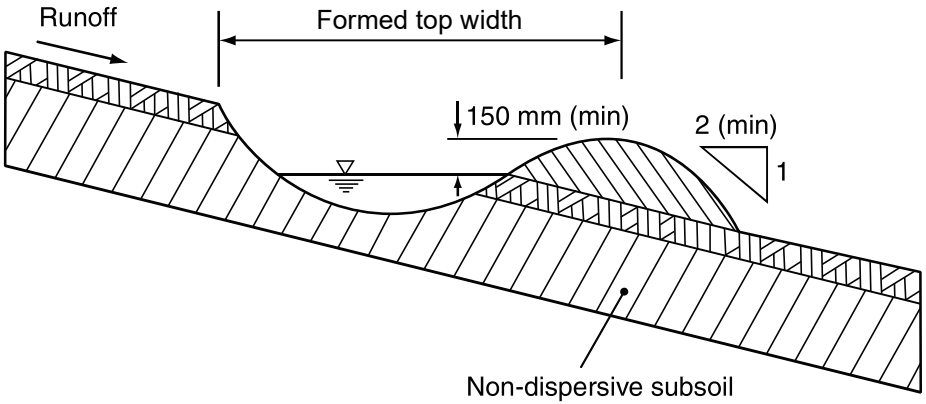
2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.

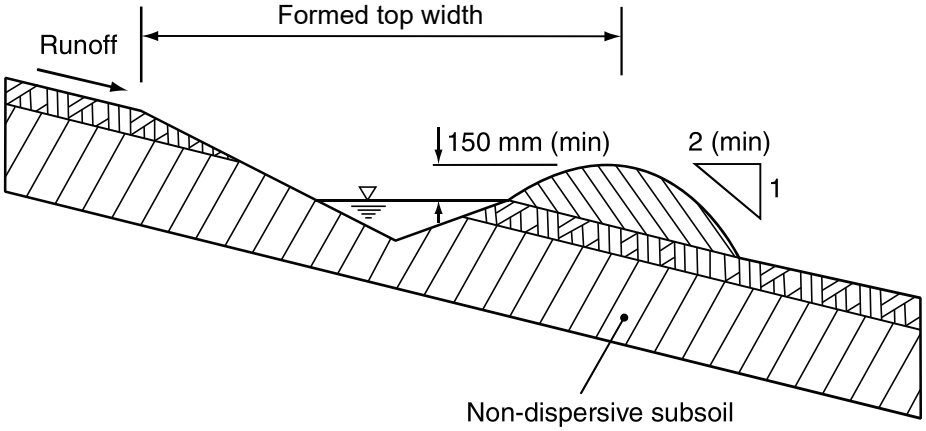
Table 1 - Recommended dimensions of flow control berms

Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

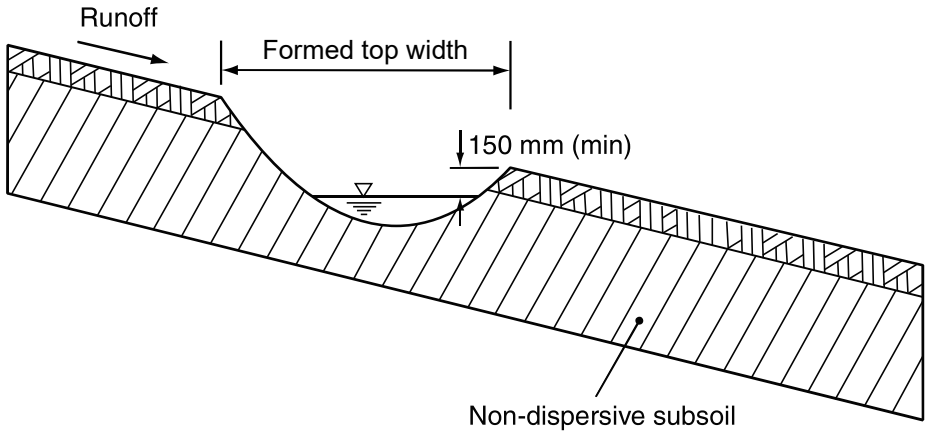
Drawn:	Date:		
GMW	Dec-09	Flow Control Berms	CB-01



(a) Parabolic catch drain with down-slope bank



(b) Triangular V-drain with down-slope bank



(c) Parabolic catch drain without bank

Constructed dimensions of parabolic catch drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-A	1.6 m	0.30 m
Type-B	2.4 m	0.45 m
Type-C	3.6 m	0.65 m

Constructed dimensions of triangular V-drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-AV	2.0 m	0.30 m
Type-BV	2.7 m	0.45 m
Type-CV	3.9 m	0.65 m

NOT TO SCALE

Drawn:	Date:		
GMW	Dec-09	Catch Drains	CD-01

INSTALLATION (EARTH-LINED)

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

4. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF REQUIRED CHANNEL GRADIENT.

5. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

6. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT.

7. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

8. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT SOIL EROSION WILL BE PREVENTED FROM OCCURRING. SPECIFICALLY, ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE TEMPORARY DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED SITE REHABILITATION PLAN.

Drawn:	Date:		
GMW	Dec-09	Catch Drains - Earth Lined	CD-02

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

5. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF CHANNEL GRADIENT.

6. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

7. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT. WHERE NECESSARY, CUT THE DRAIN SLIGHTLY DEEPER THAN THAT SPECIFIED ON THE PLANS SUCH THAT THE CORRECT CHANNEL DIMENSIONS ARE ACHIEVED FOLLOWING PLACEMENT OF THE TURF.

8. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

9. TURF SHOULD BE USED WITHIN 12-HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA).

10. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

11. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

12. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF.

13. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

14. FOR WIDE DRAINS AND HIGH VELOCITY CHUTES, LAY THE FIRST ROW OF TURF IN A STRAIGHT LINE DIAGONAL TO THE DIRECTION OF FLOW. STAGGER SUBSEQUENT ROWS IN A BRICK-LIKE (STRETCHER BOND) PATTERN. THE TURF SHOULD NOT BE STRETCHED OR OVERLAPPED. USE A KNIFE OR SHARP SPADE TO TRIM AND FIT IRREGULARLY SHAPED AREAS.

15. FOR NARROW DRAINS, LAY THE TURF ALONG THE DIRECTION OF THE DRAIN, ENSURING, WHEREVER PRACTICABLE, THAT A LONGITUDINAL JOINT BETWEEN TWO STRIPS OF TURF IS NOT POSITIONED ALONG THE INVERT OF THE DRAIN.

16. ENSURE THE TURF EXTENDS UP THE SIDES OF THE DRAIN AT LEAST 100mm ABOVE THE ELEVATION OF THE CHANNEL INVERT, OR AT LEAST TO A SUFFICIENT ELEVATION TO FULLY CONTAIN EXPECTED CHANNEL FLOW.

17. ON CHANNEL GRADIENTS OF 3:1(H:V) OR STEEPER, OR IN SITUATIONS WHERE HIGH FLOW VELOCITIES (i.e. VELOCITY >1.5m/s) ARE LIKELY WITHIN THE FIRST 2-WEEKS FOLLOWING PLACEMENT, SECURE THE INDIVIDUAL TURF STRIPS WITH WOODEN OR PLASTIC PEGS.

18. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

19. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH.

20. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT DOWN-SLOPE SOIL EROSION WILL BE PREVENTED FROM OCCURRING. ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED PLAN.

Drawn:	Date:		
GMW	Dec-09	Catch Drains - Grass Lined	CD-03

INSTALLATION (DRAIN FORMATION)

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

4. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF CHANNEL GRADIENT.

5. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

6. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT.

7. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

8. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT SOIL EROSION WILL BE PREVENTED FROM OCCURRING. ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

INSTALLATION (MAT PLACEMENT)

THE METHOD OF MAT INSTALLATION VARIES WITH THE TYPE OF MAT. INSTALLATION PROCEDURES SHOULD BE PROVIDED BY THE MANUFACTURER OR DISTRIBUTOR OF THE PRODUCT. A TYPICAL INSTALLATION PROCEDURE IS DESCRIBED BELOW, BUT SHOULD BE CONFIRMED WITH THE PRODUCT MANUFACTURER OR DISTRIBUTOR.

1. EROSION CONTROL MATS MUST BE STORED AWAY FROM DIRECT SUNLIGHT OR COVERED WITH ULTRAVIOLET LIGHT PROTECTIVE SHEETING UNTIL THE SITE IS READY FOR THEIR INSTALLATION.

2. VEHICLES AND CONSTRUCTION EQUIPMENT MUST NOT BE PERMITTED TO MANOEUVRE OVER THE GEOTEXTILE UNLESS IT HAS BEEN COVERED WITH A LAYER OF SOIL OR GRAVEL AT LEAST 150mm THICK. FILL MATERIAL SHALL NOT BE MIXED OVER THE GEOTEXTILE.

3. IF THE CHANNEL IS TO BE GRASSED, PREPARE A SMOOTH SEED BED OF APPROXIMATELY 75mm OF TOPSOIL, SEED, FERTILISE, WATER AND RAKE TO REMOVE ANY REMAINING SURFACE IRREGULARITIES.

4. EXCAVATE A 300mm DEEP BY 150mm WIDE ANCHOR TRENCH ALONG THE FULL WIDTH OF THE UPSTREAM END OF THE AREA TO BE TREATED.

5. AT LEAST 300mm OF THE MAT MUST BE ANCHORED INTO THE TRENCH WITH THE ROLL OF MATTING RESTING ON THE GROUND UP-SLOPE OF THE TRENCH.

6. STAPLE THE FABRIC WITHIN THE TRENCH AT 200 TO 250mm SPACING USING 100mm WIDE BY 150mm PENETRATION LENGTH U-SHAPED, 8 TO 11 GAUGE WIRE STAPLES. NARROWER U-SECTIONS MAY EASILY TEAR THE MATTING WHEN PLACED UNDER STRESS.

7. WHEN ALL MATS HAVE BEEN ANCHORED WITHIN THE TRENCH ACROSS THE FULL WIDTH OF THE TREATED AREA, THEN THE TRENCH IS BACKFILLED AND COMPACTED. THE MATS ARE THEN UNROLLED DOWN THE SLOPE SUCH THAT EACH MAT COVERS AND PROTECTS THE BACKFILLED TRENCH.

8. WHEN SPREADING THE MATS, AVOID STRETCHING THE FABRIC. THE MATS SHOULD REMAIN IN GOOD CONTACT WITH THE SOIL.

9. IF THE CHANNEL CURVES, THEN SUITABLY FOLD (IN A DOWNSTREAM DIRECTION) AND STAPLE THE FABRIC TO MAINTAIN THE FABRIC PARALLEL TO THE DIRECTION OF CHANNEL FLOW.

10. STAPLE THE SURFACE OF THE MATTING AT 1m CENTRES. ON IRREGULAR GROUND, ADDITIONAL STAPLES WILL BE REQUIRED WHEREVER THE MAT DOES NOT INITIALLY CONTACT THE GROUND SURFACE.

11. AT THE END OF EACH LENGTH OF MAT, A NEW TRENCH IS FORMED AT LEAST 300mm UP-SLOPE OF THE END OF THE MAT SUCH THAT THE END OF THE MAT WILL BE ABLE TO FULLY COVER THE TRENCH. A NEW ROLL OF MATTING IS THEN ANCHORED WITHIN THIS TRENCH AS PER THE FIRST MAT. AFTER THIS NEW MAT HAS BEEN UNROLLED DOWN THE SLOPE, THE UP-SLOPE MAT CAN BE PINNED IN PLACE FULLY COVERING THE NEW TRENCH AND AT LEAST 300mm OF THE DOWN-SLOPE MAT. THE PROCESS IS CONTINUED DOWN THE SLOPE UNTIL THE DESIRED AREA IS FULLY COVERED.

12. IN HIGH-VELOCITY CHANNELS, INTERMEDIATE ANCHOR SLOTS ARE USUALLY REQUIRED AT 10M INTERVALS DOWN THE CHANNEL.

13. ANCHOR THE OUTER MOST EDGES (TOP AND UPPER MOST SIDES) OF THE TREATED AREA IN A 300mm DEEP TRENCH AND STAPLE AT 200 TO 250mm CENTRES.

14. IF THE CHANNEL WAS GRASS SEEDED PRIOR TO PLACEMENT OF THE MATS, THEN THE MATS SHOULD BE ROLLED WITH A SUITABLE ROLLER WEIGHING 60 TO 90kg/m, THEN WATERED.

15. THE INSTALLATION PROCEDURE MUST ENSURE THAT THE MAT ACHIEVES AND RETAINS GOOD CONTACT WITH THE SOIL.

16. DAMAGED MATTING MUST BE REPAIRED OR REPLACED.

ADDITIONAL INSTRUCTIONS FOR THE INSTALLATION OF JUTE MESH (NOT JUTE BLANKETS):

1. ENSURE THE JUTE MESH IS LAID ON A FIRM EARTH SURFACE THAT HAS BEEN TRIMMED, TOPSOILED, WATERED, SOWN WITH SEED AND FERTILISER.

2. THE JUTE MESH IS THEN EITHER TAMPED OR ROLLED FIRMLY ONTO THE PREPARED SURFACE, AVOIDING STRETCHING, WATERED TO ENCOURAGE THE PENETRATION OF THE BITUMEN EMULSION, AND FINALLY SPRAYED WITH A TOP LAYER OF BITUMEN AT 1 TO 3 LITRES PER SQUARE METRE.

3. THE RATE OF EMULSION APPLICATION SHOULD BE ADJUSTED SUCH THAT THE EMULSION JUST STARTS TO POND IN THE MESH SQUARES.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED PLAN.

Drawn:	Date:		
GMW	May-10	Catch Drains - Geotextile Lined	CD-04

MATERIALS

ROCK:
(i) ALL ROCK MUST BE HARD, WEATHER RESISTANT, AND DURABLE AGAINST DISINTEGRATION UNDER CONDITIONS TO BE MET IN HANDLING, PLACEMENT AND OPERATION.

(ii) ALL ROCK MUST HAVE ITS GREATEST DIMENSION NOT GREATER THAN 3 TIMES ITS LEAST DIMENSIONS.

(iii) THE ROCK USED IN FORMATION OF THE DRAIN MUST BE EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND HAVE SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. DIRT, FINES, AND SMALLER ROCK MUST NOT EXCEED 5% BY WEIGHT.

(iv) THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. SPECIFIC GRAVITY TO BE AT LEAST 2.5.

(v) THE COLOUR OF THE RIPRAP SHALL BE [INSERT] AND MUST BE APPROVED BY THE ENGINEER. ONCE APPROVED, THE COLOUR SHALL BE KEPT CONSISTENT THROUGH THE PROJECT.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. PRIOR TO PLACEMENT, ALL ROCKS MUST BE VISUALLY CHECKED FOR SIZE, ELONGATION, CRACKS, DETERIORATION AND OTHER VISIBLE. THE DEGREE AND THOROUGHNESS OF SUCH CHECKING MUST BE APPROPRIATE FOR THE POTENTIAL CONSEQUENCES ASSOCIATED WITH FAILURE OF THE STRUCTURE OR PURPOSE FOR WHICH THE MATERIAL WILL BE USED.

3. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

5. REMOVE ALL SOFT, YIELDING MATERIAL; REPLACE WITH SUITABLE ON-SITE MATERIAL; COMPACT TO SMOOTH FIRM SURFACE.

6. EXCAVATE THE DRAIN TO THE LINES AND GRADES SHOWN ON THE APPROVED PLANS. OVER-CUT THE DRAIN TO A DEPTH EQUAL TO THE SPECIFIED DEPTH OF ROCK PLACEMENT SUCH THAT THE FINISHED TOP SURFACE WILL BE AT THE ELEVATION OF THE SURROUNDING LAND. PLACEMENT OF THE ROCK LINING MUST NOT REDUCE THE DRAIN'S TOP WIDTH AND DEPTH AS SPECIFIED WITHIN THE APPROVED PLANS.

7. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10CM EVERY 10m FOR EACH 1% OF CHANNEL GRADIENT.

8. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

9. IF THE DRAIN IS CUT INTO A DISPERSIVE (SODIC) SOIL, THEN PRIOR TO PLACING FILTER CLOTH, THE EXPOSED DISPERSIVE SOIL MUST BE COVERED WITH A MINIMUM 200mm THICK LAYER OF NON-DISPERSIVE SOIL PRIOR TO PLACEMENT OF FILTER CLOTH OR ROCKS.

10. IF A FILTER CLOTH UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FILTER CLOTH IS REQUIRED TO OVER THE AREA, OVERLAP THE EDGE OF EACH SHEET AT LEAST 300mm, AND SECURE ANCHOR PINS AT MINIMUM 1M SPACING ALONG THE OVERLAP.

11. ENSURE THE FILTER CLOTH IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300mm.

12. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER LAYER. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS.

13. PLACE ROCK LINING TO THE EXTENT AND DEPTH INDICATED WITHIN THE APPROVED PLANS.

14. ENSURE THE ROCK IS PLACED IN AN APPROPRIATE MANNER TO AVOID DISPLACING UNDERLYING MATERIALS OR PLACING UNDUE IMPACT FORCE ON THE BEDDING MATERIALS.

15. ENSURE THE ROCK IS PLACED WITH A MINIMUM THICKNESS OF 1.5 TIMES THE NOMINAL ROCK SIZE (D50).

16. ENSURE MATERIALS THAT ARE D50 AND LARGER ARE POSITIONED FLUSH WITH THE TOP SURFACE WITH FACES AND SHAPES MATCHED TO MINIMISE VOIDS.

17. ENSURE PROJECTIONS ABOVE OR DEPRESSIONS UNDER THE SPECIFIED TOP SURFACE ARE LESS THAN 20% OF THE ROCK LAYER THICKNESS. THE AVERAGE SURFACE PLANE OF THE FINISHED ROCK IS DEFINED AS THE PLANE WHERE 50% OF THE TOPS OF ROCKS WOULD CONTACT.

18. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT (AVERAGE SURFACE PLANE ALONG CHANNEL INVERT) TO THE TOP OF THE EMBANKMENT. THE AVERAGE SURFACE PLANE OF THE FINISHED ROCK IS DEFINED AS THE PLANE WHERE 50% OF THE TOPS OF ROCKS WOULD CONTACT.

19. TO THE MAXIMUM DEGREE PRACTICABLE, THE MATERIAL BETWEEN LARGER ROCK MUST NOT BE LOOSE OR EASILY DISPLACED BY THE EXPECTED FLOW.

20. AFTER PLACEMENT OF THE ROCK LINING, ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

21. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT SOIL EROSION WILL BE PREVENTED FROM OCCURRING. ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. CLOSELY INSPECT THE OUTER EDGES OF THE ROCK PROTECTION. ENSURE WATER ENTRY INTO THE ROCK-LINED AREA IS NOT CAUSING EROSION ALONG THE EDGE OF THE ROCK PROTECTION.

3. CAREFULLY CHECK THE STABILITY OF THE ROCK LOOKING FOR INDICATIONS OF PIPING, SCOUR HOLES, OR BANK FAILURES.

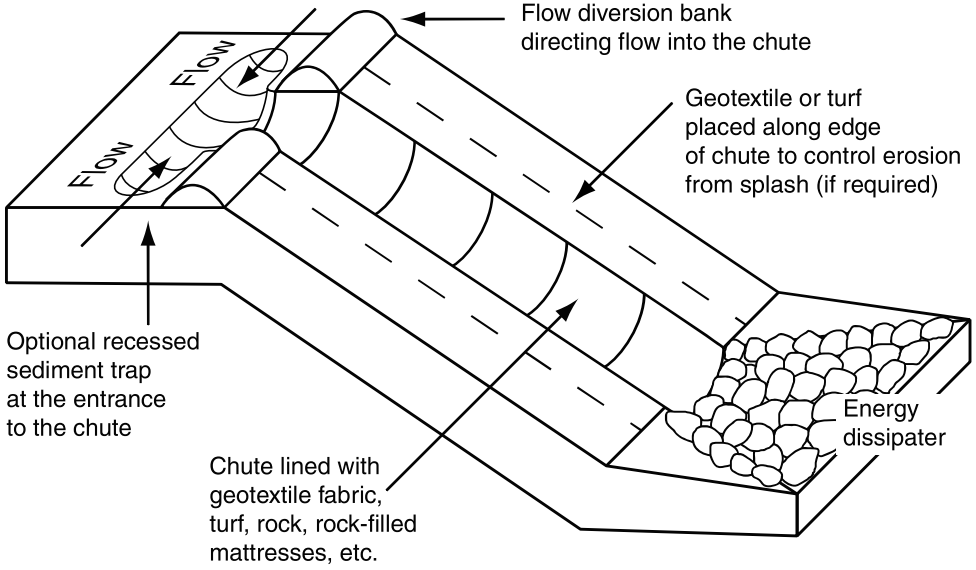
4. REPLACE OR REPOSITION THE SURFACE ROCK SUCH THAT THE DRAIN FUNCTIONS AS REQUIRED AND THE DRAIN'S REQUIRED HYDRAULIC CAPACITY IS NOT REDUCED.

5. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

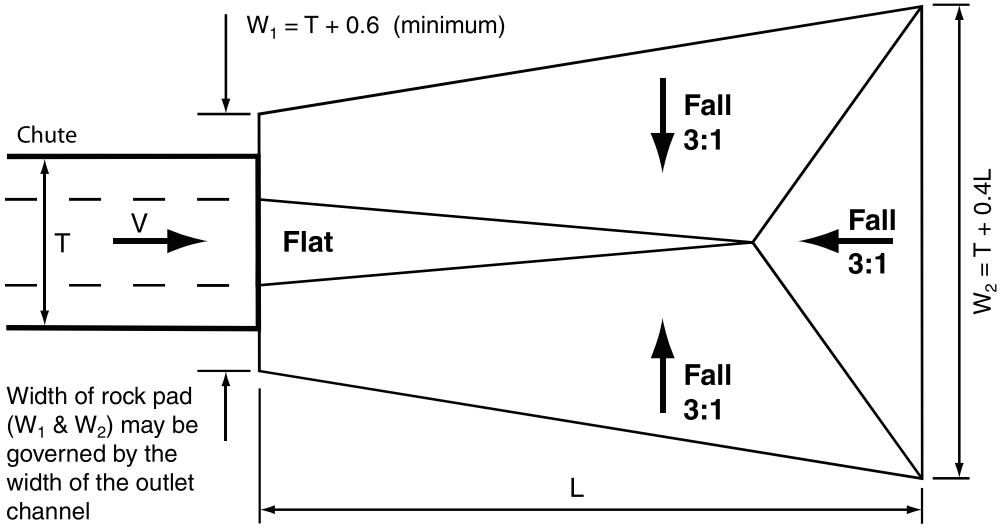
6. ENSURE SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

7. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

Drawn:	Date:		
GMW	Dec-09	Catch Drains - Rock Lined	CD-05

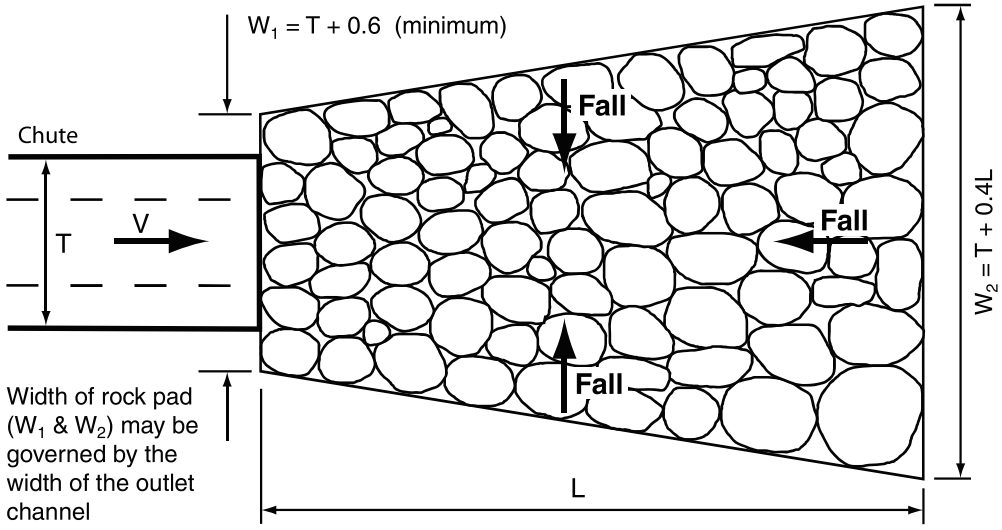


(a) Temporary drainage chute with rock pad outlet structure

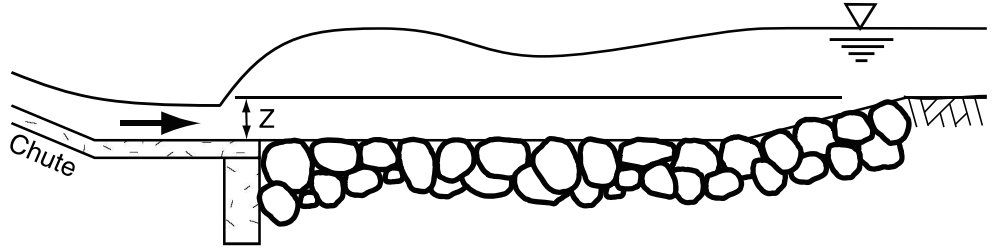


T = Maximum top width of flow at base of chute

(b) Typical layout of an outlet energy dissipater for a drainage chute



(c) Typical layout of a rock pad outlet structure for a drainage chute



(d) Typical profile of a rock pad outlet structure for a drainage chute

Notes:

1. Drawings applicable to temporary drainage chutes, **not** basin spillways.
2. A rock pad outlet structure is just one option for the design of the outlet energy dissipater.

Drawn:	Date:		
GMW	Dec-09	Chutes - General	CH-01

CHUTES - GENERAL SPECIFICATIONS

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CONSTRUCT THE SUBGRADE TO THE ELEVATIONS SHOWN ON THE PLANS. REMOVE ALL UNSUITABLE MATERIAL AND REPLACE WITH STABLE MATERIAL TO ACHIEVE THE DESIRED FOUNDATIONS.

3. IF THE CHUTE IS TEMPORARY, THEN COMPACT THE SUBGRADE TO A FIRM CONSISTENCY. IF THE CHUTE IS INTENDED TO BE PERMANENT, THEN COMPACT AND FINISH THE SUBGRADE AS SPECIFIED WITHIN THE DESIGN PLANS.

4. IF THE CHUTE IS TO BE LINED WITH ROCK, THEN AVOID COMPACTING THE SUBGRADE TO A CONDITION THAT WOULD PREVENT THE ROCK LINING FROM ADEQUATELY BEDDING INTO THE SUBGRADE.

5. ENSURE THE SUBGRADE IS FIRM ENOUGH TO MINIMISE WATER SEEPAGE.

6. ON FILL SLOPES, ENSURE THAT THE SOIL IS ADEQUATELY COMPACTED FOR A WIDTH OF AT LEAST ONE METRE EACH SIDE OF THE CHUTE TO MINIMISE THE RISK OF SOIL EROSION, OTHERWISE PROTECT THE SOIL WITH SUITABLE SCOUR PROTECTION MEASURES SUCH AS TURF OR EROSION CONTROL MATS.

7. PLACE AND SECURE THE CHUTE LINING AS DIRECTED.

8. IF CONCRETE IS USED AS A LINING, THEN KEEP THE SUBGRADE MOIST AT THE TIME CONCRETE IS PLACED. FORM, CUT-OFF WALLS AND ANCHOR BLOCKS AS DIRECTED IN THE APPROVED PLANS.

9. INSTALL AN APPROPRIATE OUTLET STRUCTURE (ENERGY DISSIPATER) AT THE BASE OF THE CHUTE (REFER TO SEPARATE SPECIFICATIONS).

10. ENSURE WATER LEAVING THE CHUTE AND THE OUTLET STRUCTURE WILL FLOW FREELY WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

11. APPROPRIATELY STABILISE ALL DISTURBED AREAS IMMEDIATELY AFTER CONSTRUCTION.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL CHUTES PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY.

2. CHECK FOR MOVEMENT OF, OR DAMAGE TO, THE CHUTE LINING, INCLUDING SURFACE CRACKING.

3. CHECK FOR SOIL SCOUR ADJACENT THE CHUTE. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.

4. WHEN MAKING REPAIRS, ALWAYS RESTORE THE CHUTE TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.

REMOVAL

1. TEMPORARY CHUTES SHOULD BE REMOVED WHEN AN ALTERNATIVE, STABLE, DRAINAGE SYSTEM IS AVAILABLE.

2. REMOVE ALL MATERIALS AND DEPOSITED SEDIMENT, AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA IN PREPARATION FOR STABILISATION, THEN STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.

ADDITIONAL SPECIFICATIONS FOR ROCK PAD OUTLET STRUCTURE AT BASE OF CHUTE:

MATERIALS:

ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. SPECIFIC GRAVITY TO BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION (ROCK OUTLET PADS)

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. THE DIMENSIONS OF THE OUTLET STRUCTURE MUST ALIGN WITH THE DOMINANT FLOW DIRECTION.

3. EXCAVATE THE OUTLET PAD FOOTPRINT TO THE SPECIFIED DIMENSION SUCH THE WHEN THE ROCK IS PLACED IN THE EXCAVATED PIT THE TOP OF THE ROCKS WILL BE LEVEL WITH THE SURROUNDING GROUND, UNLESS OTHERWISE DIRECTED.

4. IF THE EXCAVATED SOILS ARE DISPERSIVE, OVER-EXCAVATED THE ROCK PAD BY AT LEAST 300mm AND BACKFILL WITH STABLE, NON-DISPERSIVE MATERIAL.

5. LINE THE EXCAVATED PIT WITH GEOTEXTILE FILTER CLOTH, PREFERABLY USING A SINGLE SHEET. IF JOINTS ARE REQUIRED, OVERLAP THE FABRIC AT LEAST 300mm.

6. ENSURE THE FILTER CLOTH IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300mm.

7. ENSURE THERE ARE AT LEAST TWO LAYERS OF ROCKS. WHERE NECESSARY, REPOSITION THE LARGER ROCKS TO ENSURE TWO LAYERS OF ROCKS ARE ACHIEVED WITHOUT ELEVATING THE UPPER SURFACE ABOVE THE PIPE INVERT.

8. ENSURE THE ROCK IS PLACED IN A MANNER THAT WILL ALLOW WATER TO DISCHARGE FREELY FROM THE PIPE.

9. ENSURE THE UPPER SURFACE OF THE ROCK PAD DOES NOT CAUSE WATER TO BE DEFLECTED AROUND THE EDGE OF THE ROCK PAD.

10. IMMEDIATELY AFTER CONSTRUCTION, APPROPRIATELY STABILISE ALL DISTURBED AREAS.

MAINTENANCE

1. WHILE CONSTRUCTION WORKS CONTINUE ON THE SITE, INSPECT THE OUTLET STRUCTURE PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING RAINFALL, AND ON AT LEAST A WEEKLY BASIS.

2. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

REMOVAL

1. TEMPORARY OUTLET STRUCTURES SHOULD BE COMPLETELY REMOVED, OR WHERE APPROPRIATE, REHABILITATED SO AS NOT TO CAUSE ONGOING ENVIRONMENTAL NUISANCE OR HARM.

2. FOLLOWING REMOVAL OF THE DEVICE, THE DISTURBED AREA MUST BE APPROPRIATELY REHABILITATED SO AS NOT TO CAUSE ONGOING ENVIRONMENTAL NUISANCE OR HARM.

3. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

Drawn:	Date:		
GMW	Dec-09	Chutes - General	CH-02

INSTALLATION (CHUTE FORMATION)

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE CHUTE CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY.

4. CONSTRUCT THE SUBGRADE TO THE ELEVATIONS SHOWN ON THE PLANS. REMOVE ALL UNSUITABLE MATERIAL AND REPLACE WITH STABLE MATERIAL TO ACHIEVE THE DESIRED FOUNDATIONS.

5. IF THE CHUTE IS TEMPORARY, THEN COMPACT THE SUBGRADE TO A FIRM CONSISTENCY. IF THE CHUTE IS INTENDED TO BE PERMANENT, THEN COMPACT AND FINISH THE SUBGRADE AS SPECIFIED WITHIN THE DESIGN PLANS.

6. ENSURE THE SUBGRADE IS FIRM ENOUGH TO MINIMISE WATER SEEPAGE.

7. ENSURE THE SIDES OF THE CHUTE ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE.

8. ENSURE THE COMPLETED CHUTE HAS SUFFICIENT DEEP ALONG ITS FULL LENGTH.

9. ENSURE THE CHUTE IS STRAIGHT FROM ITS CREST TO THE TOE OF THE CHUTE.

10. ON FILL SLOPES, ENSURE THAT THE SOIL IS ADEQUATELY COMPACTED FOR A WIDTH OF AT LEAST ONE METRE EACH SIDE OF THE CHUTE TO MINIMISE THE RISK OF SOIL EROSION, OTHERWISE PROTECT THE SOIL WITH SUITABLE SCOUR PROTECTION MEASURES SUCH AS TURF OR EROSION CONTROL MATS.

11. PLACE AND SECURE THE CHUTE LINING (REFER TO SEPARATE SPECIFICATIONS).

12. IF CONCRETE IS USED AS A LINING, THEN KEEP THE SUBGRADE MOIST AT THE TIME CONCRETE IS PLACED. FORM, CUT-OFF WALLS AND ANCHOR BLOCKS AS DIRECTED IN THE APPROVED PLANS.

13. INSTALL AN APPROPRIATE OUTLET STRUCTURE (ENERGY DISSIPATER) AT THE BASE OF THE CHUTE (REFER TO SEPARATE SPECIFICATIONS).

14. ENSURE WATER LEAVING THE CHUTE AND THE OUTLET STRUCTURE WILL FLOW FREELY WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

15. APPROPRIATELY STABILISE ALL DISTURBED AREAS IMMEDIATELY AFTER CONSTRUCTION.

INSTALLATION (FABRIC PLACEMENT)

THE METHOD OF FABRIC INSTALLATION VARIES WITH THE TYPE OF FABRIC. INSTALLATION PROCEDURES SHOULD BE PROVIDED BY THE PRODUCT MANUFACTURER OR DISTRIBUTOR. A TYPICAL INSTALLATION PROCEDURE IS DESCRIBED BELOW, BUT SHOULD BE CONFIRMED WITH THE PRODUCT MANUFACTURER OR DISTRIBUTOR.

1. GEOSYNTHETIC FABRICS MUST BE STORED AWAY FROM DIRECT SUNLIGHT OR COVERED WITH ULTRAVIOLET LIGHT PROTECTIVE SHEETING UNTIL THE SITE IS READY FOR THEIR INSTALLATION.

2. EXCAVATE A 300mm DEEP BY 150mm WIDE ANCHOR TRENCH ALONG THE FULL WIDTH OF THE UPSTREAM END OF THE AREA TO BE TREATED.

3. AT LEAST 300mm OF THE FABRIC MUST BE ANCHORED INTO THE TRENCH WITH THE ROLL OF MATTING RESTING ON THE GROUND UP-SLOPE OF THE TRENCH.

4. STAPLE THE FABRIC WITHIN THE TRENCH AT 200 TO 250mm SPACING USING 100mm WIDE BY 150mm PENETRATION LENGTH U-SHAPED, 8 TO 11 GAUGE WIRE STAPLES. NARROWER U-SECTIONS MAY EASILY TEAR THE MATTING WHEN PLACED UNDER STRESS.

5. WHEN FABRIC HAS BEEN ANCHORED WITHIN THE TRENCH, THEN BACKFILLED THE TRENCH AND COMPACT.

6. WHEN SPREADING THE FABRIC, AVOID STRETCHING THE MATERIAL.

7. ENSURE THE FABRIC REMAINS IN GOOD CONTACT WITH THE SOIL.

8. IF THE INFLOW CHANNEL CURVES (UPSTREAM OF THE CREST), THEN SUITABLY FOLD (IN A DOWNSTREAM DIRECTION) AND STAPLE THE FABRIC TO MAINTAIN THE FABRIC PARALLEL TO THE DIRECTION OF CHANNEL FLOW.

9. STAPLE THE SURFACE OF THE FABRIC AT 1m CENTRES. ON IRREGULAR GROUND, ADDITIONAL STAPLES WILL BE REQUIRED WHEREVER THE FABRIC DOES NOT INITIALLY CONTACT THE GROUND SURFACE.

10. INSTALL INTERMEDIATE ANCHOR TRENCHES AT 3m (MAX) INTERVALS.

11. IF THE CHUTE EXTENDS BEYOND THE LENGTH OF THE FABRIC, THEN FORM A NEW TRENCH IS FORMED AT LEAST 300mm UP-SLOPE OF THE END OF THE FABRIC SUCH THAT THE END OF THE FABRIC WILL BE ABLE TO FULLY COVER THE TRENCH. A NEW ROLL OF FABRIC IS THEN ANCHORED WITHIN THIS TRENCH AS PER THE FIRST. THE PROCESS IS CONTINUED DOWN THE SLOPE UNTIL THE DESIRED AREA IS FULLY COVERED.

12. IF CHUTE IS SUBJECT TO LATERAL INFLOWS, TEN ANCHOR THE OUTER MOST SIDES OF THE FABRIC IN A 300mm DEEP TRENCH AND STAPLE AT 200 TO 250mm CENTRES.

13. THE INSTALLATION PROCEDURE MUST ENSURE THAT THE FABRIC ACHIEVES AND RETAINS GOOD CONTACT WITH THE SOIL.

14. DAMAGED FABRIC MUST BE REPAIRED OR REPLACED.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL CHUTES PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY.

2. CHECK FOR MOVEMENT OF, OR DAMAGE TO, THE CHUTE LINING, INCLUDING SURFACE CRACKING.

3. CHECK FOR SOIL SCOUR ADJACENT THE CHUTE. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.

4. ENSURE SEDIMENT IS NOT PARTIALLY BLOCKING FLOW ENTRY INTO THE CHUTE. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

5. DISPOSE OF ANY SEDIMENT IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

6. WHEN MAKING REPAIRS, ALWAYS RESTORE THE CHUTE TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CHUTE IS FINISHED AND THE AREA IS STABILISED, THE CHUTE AND ANY ASSOCIATED FLOW DIVERSION BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY MATERIALS, SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA IN PREPARATION FOR STABILISATION, THEN STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.

Drawn:	Date:		
GMW	Dec-09	Chutes - Synthetic Linings	CH-03

MATERIALS

ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. SPECIFIC GRAVITY TO BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION (CHUTE FORMATION)

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CHUTE CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY.

5. CONSTRUCT THE SUBGRADE TO THE ELEVATIONS SHOWN ON THE PLANS. REMOVE ALL UNSUITABLE MATERIAL AND REPLACE WITH STABLE MATERIAL TO ACHIEVE THE DESIRED FOUNDATIONS.

6. IF THE CHUTE IS TEMPORARY, THEN COMPACT THE SUBGRADE TO A FIRM CONSISTENCY. IF THE CHUTE IS INTENDED TO BE PERMANENT, THEN COMPACT AND FINISH THE SUBGRADE AS SPECIFIED WITHIN THE DESIGN PLANS.

7. AVOID COMPACTING THE SUBGRADE TO A CONDITION THAT WOULD PREVENT THE TURF FROM BONDING WITH THE SUBGRADE.

8. ENSURE THE SIDES OF THE CHUTE ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE.

9. ENSURE THE COMPLETED CHUTE HAS SUFFICIENT DEEP ALONG ITS FULL LENGTH.

10. ENSURE THE CHUTE IS STRAIGHT FROM ITS CREST TO THE TOE OF THE CHUTE.

11. ON FILL SLOPES, ENSURE THAT THE SOIL IS ADEQUATELY COMPACTED FOR A WIDTH OF AT LEAST ONE METRE EACH SIDE OF THE CHUTE TO MINIMISE THE RISK OF SOIL EROSION, OTHERWISE PROTECT THE SOIL WITH SUITABLE SCOUR PROTECTION MEASURES SUCH AS TURF OR EROSION CONTROL MATS.

12. PLACE AND SECURE THE TURF AS DIRECTED.

13. INSTALL AN APPROPRIATE OUTLET STRUCTURE (ENERGY DISSIPATER) AT THE BASE OF THE CHUTE (REFER TO SEPARATE SPECIFICATIONS).

14. ENSURE WATER LEAVING THE CHUTE AND THE OUTLET STRUCTURE WILL FLOW FREELY WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

15. APPROPRIATELY STABILISE ALL DISTURBED AREAS IMMEDIATELY AFTER CONSTRUCTION.

INSTALLATION (ROCK PLACEMENT)

1. OVER-CUT THE CHANNEL TO A DEPTH EQUAL TO THE SPECIFIED DEPTH OF ROCK PLACEMENT SUCH THAT THE FINISHED ROCK SURFACE WILL BE AT THE ELEVATION OF THE SURROUNDING LAND.

2. ROCK MUST BE PLACED WITHIN THE CHANNEL AS SPECIFIED WITHIN THE APPROVED PLANS, INCLUDING THE PLACEMENT OF ANY SPECIFIED FILTER LAYER.

3. IF DETAILS ARE NOT PROVIDED ON THE ROCK PLACEMENT, THEN THE PRIMARY ARMOUR ROCK MUST BE EITHER PLACED ON:
(i) A FILTER BED FORMED FROM A LAYER OF SPECIFIED SMALLER ROCK (ROCK FILTER LAYER);
(ii) AN EARTH BED LINED WITH FILTER CLOTH;
(iii) AN EARTH BED NOT LINED IN FILTER CLOTH, BUT ONLY IF ALL VOIDS BETWEEN THE ARMOUR ROCK ARE TO BE FILLED WITH SOIL AND POCKET PLANTED IMMEDIATELY AFTER PLACEMENT OF THE ROCK.

4. IF A ROCK/AGGREGATE FILTER LAYER IS SPECIFIED, THEN PLACE THE FILTER LAYER IMMEDIATELY AFTER THE FOUNDATIONS ARE PREPARED. SPREAD THE FILTER ROCK IN A UNIFORM LAYER TO THE SPECIFIED DEPTH BUT A MINIMUM OF 150mm. WHERE MORE THAN ONE LAYER OF FILTER MATERIAL HAS BEEN SPECIFIED, SPREAD EACH LAYER SUCH THAT MINIMAL MIXING OCCURS BETWEEN EACH LAYER OF ROCK.

5. IF A GEOTEXTILE (FILTER CLOTH) UNDERLAY IS SPECIFIED, PLACE THE FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FABRIC IS REQUIRED TO OVER THE AREA, OVERLAP THE EDGE OF EACH SHEET AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP.

6. ENSURE THE GEOTEXTILE FABRIC IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300mm.

7. WHERE NECESSARY, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE OR SAND SHOULD BE PLACED OVER THE FABRIC TO PROTECT IT FROM DAMAGE.

8. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER LAYER. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS.

9. PLACE ROCK TO ITS FULL THICKNESS IN ONE OPERATION. DO NOT PLACE ROCK BY DUMPING THROUGH CHUTES OR OTHER METHODS THAT CAUSE SEGREGATION OF ROCK SIZES.

10. THE FINISHED SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

11. IMMEDIATELY UPON COMPLETION OF THE CHANNEL, VEGETATE ALL DISTURBED AREAS OR OTHERWISE PROTECT THEM AGAINST SOIL EROSION.

12. WHERE SPECIFIED, FILL ALL VOIDS WITH SOIL AND VEGETATE THE ROCK SURFACE IN ACCORDANCE WITH THE APPROVED PLAN.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL CHUTES PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY.

2. CHECK FOR SCOUR OR DISLODGED ROCK. REPAIR DAMAGED AREAS IMMEDIATELY.

3. CLOSELY INSPECT THE OUTER EDGES OF THE ROCK PROTECTION. ENSURE WATER ENTRY INTO THE CHANNEL OR CHUTE IS NOT CAUSING EROSION ALONG THE EDGE OF THE ROCK PROTECTION.

4. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.

5. CAREFULLY CHECK THE STABILITY OF THE ROCK LOOKING FOR INDICATIONS OF PIPING, SCOUR HOLES, OR BANK FAILURES.

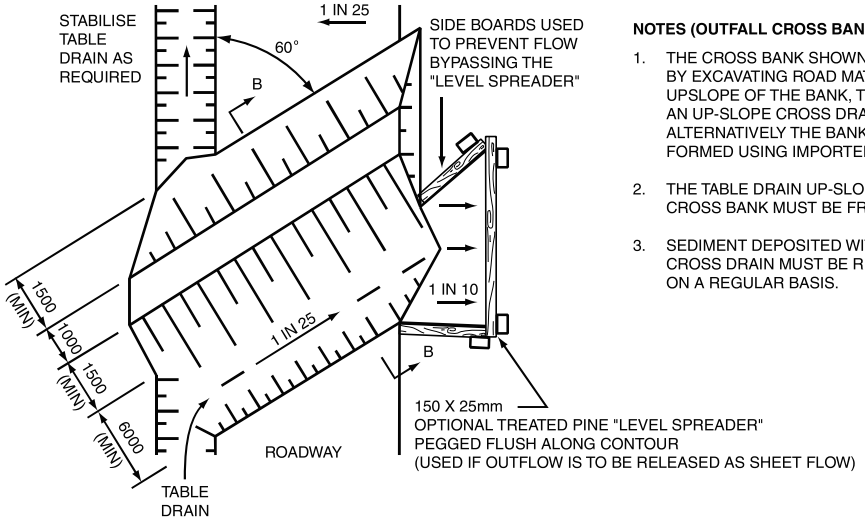
6. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

7. ENSURE SEDIMENT IS NOT PARTIALLY BLOCKING FLOW ENTRY INTO THE CHUTE. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

8. DISPOSE OF ANY SEDIMENT IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

9. WHEN MAKING REPAIRS, ALWAYS RESTORE THE CHUTE TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.

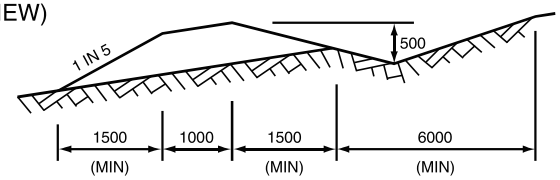
Drawn:	Date:		
GMW	May-10	Chutes - Rock Linings	CH-06



NOTES (OUTFALL CROSS BANK):

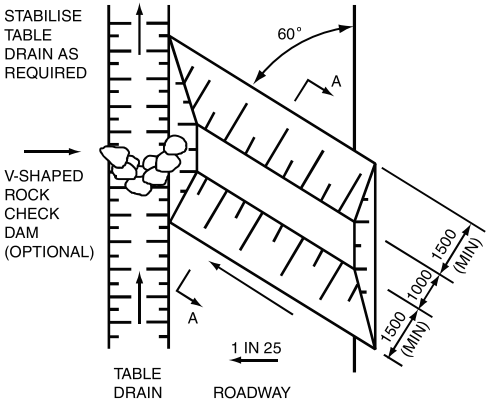
1. THE CROSS BANK SHOWN IS FORMED BY EXCAVATING ROAD MATERIAL UPSLOPE OF THE BANK, THUS FORMING AN UP-SLOPE CROSS DRAIN. ALTERNATIVELY THE BANK COULD BE FORMED USING IMPORTED MATERIAL.
2. THE TABLE DRAIN UP-SLOPE OF THE CROSS BANK MUST BE FREE DRAINING.
3. SEDIMENT DEPOSITED WITHIN THE CROSS DRAIN MUST BE REMOVED ON A REGULAR BASIS.

OUTFALL CROSS BANK (PLAN VIEW)



CROSS BANK PROFILE (INSITU MATERIAL)

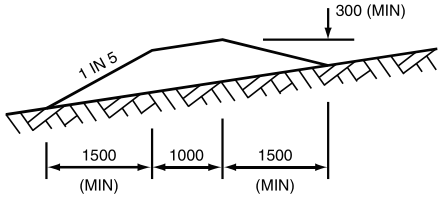
(a) Outfall cross-bank for low speed tracks



NOTES (INFALL CROSS BANK):

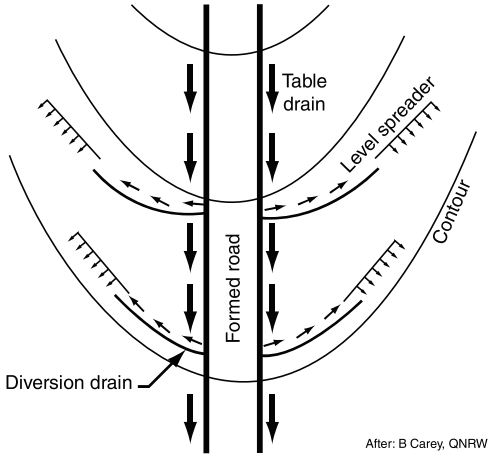
1. THE CROSS BANK SHOWN IS FORMED USING IMPORTED MATERIAL AND THUS DOES NOT REQUIRE ANY EXCAVATIONS INTO THE ROAD UP-SLOPE OF THE BANK. ALTERNATIVELY, THE BANK COULD BE FORMED USING INSITU MATERIAL.
2. ROCK CHECK DAMS OR OTHER STABILISATION MEASURES PLACED IN THE TABLE DRAIN MUST NOT CAUSE PONDING ON THE ROAD.

INFALL CROSS BANK (PLAN VIEW)

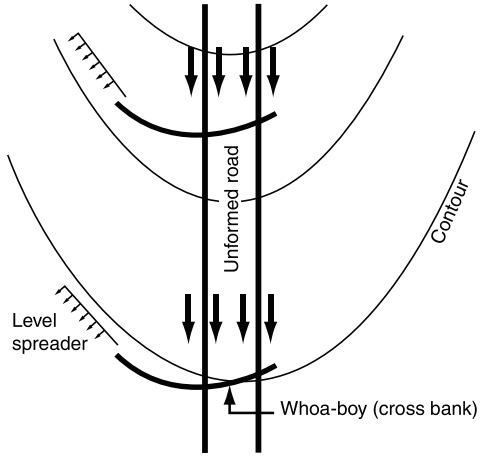


CROSS BANK PROFILE (IMPORTED MATERIAL)

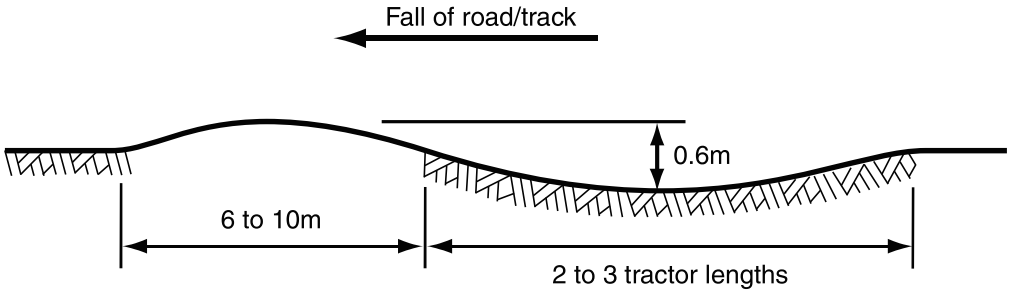
(b) Infall cross-bank for low speed tracks



After: B Carey, QNRW



(c) - (d) Drainage options for ridge tracks



(e) Typical cross-bank profile for low speed tracks

General notes:

1. Drainage structures are applicable to unsealed roads and tracks.
2. Design details vary with traffic volume and speeds.

Drawn:	Date:		
GMW	Dec-09	Construction Road Drainage	CR-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE BANK, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

4. FORM THE BANK FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS.

5. IF EARTH IS USED, THEN ENSURE THE SIDES OF THE BANK ARE NO STEEPER THAN A 2:1 (H:V) SLOPE, AND THE COMPLETED BANK MUST BE AT LEAST 500mm HIGH.

6. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED.

7. CHECK THE BANK ALIGNMENT TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION.

8. THE BANK SHOULD BE VEGETATED (TURFED, SEEDED AND MULCHED), OR OTHERWISE STABILISED IMMEDIATELY, UNLESS IT WILL OPERATE FOR LESS THAN 30 DAYS OR IF SIGNIFICANT RAINFALL IS NOT EXPECTED DURING THE LIFE OF THE BANK.

9. ENSURE THE EMBANKMENT DRAINS TO A STABLE OUTLET, AND DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT FLOW DIVERSION BANKS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. INSPECT THE BANK FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY.

3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

5. REPAIR ANY PLACES IN THE BANK THAT ARE WEAKENED OR IN RISK OF FAILURE.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW DIVERSION BANK SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.

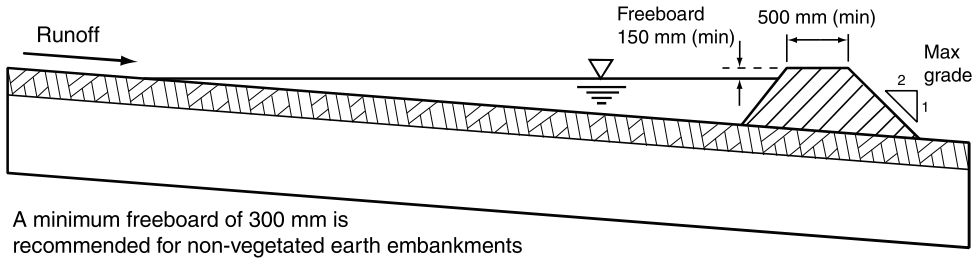


Figure 1 - Typical profile of flow diversion bank formed from earth

Table 1 - Recommended dimensions of flow diversion banks

Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

Drawn:	Date:		
GMW	Dec-09	Flow Diversion Banks	DB-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CHANNEL, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND CONSTRUCTION EQUIPMENT.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD ANY ASSOCIATED EMBANKMENTS.

5. EXCAVATE THE DIVERSION CHANNEL TO THE SPECIFIED SHAPE, ELEVATION AND GRADIENT. THE SIDES OF THE CHANNEL SHOULD BE NO STEEPER THAN A 2:1 (H:V) IF CONSTRUCTED IN EARTH, UNLESS SPECIFICALLY DIRECTED WITHIN THE APPROVED PLANS.

6. STABILISE THE CHANNEL AND BANKS IMMEDIATELY UNLESS IT WILL OPERATE FOR LESS THAN 30 DAYS. IN EITHER CASE, TEMPORARY EROSION PROTECTION (MATTING, ROCK, ETC.) WILL BE REQUIRED AS SPECIFIED WITHIN THE APPROVED PLANS OR AS DIRECTED.

7. ENSURE THE CHANNEL DISCHARGES TO A STABLE AREA.

ADDITIONAL REQUIREMENTS FOR TURF PLACEMENT:

1. TURF SHOULD BE USED WITHIN 12 HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA).

2. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

3. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

4. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF.

5. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

6. ENSURE THE TURF EXTENDS UP THE SIDES OF THE DRAIN AT LEAST 100mm ABOVE THE ELEVATION OF THE CHANNEL INVERT, OR AT LEAST TO A SUFFICIENT ELEVATION TO FULLY CONTAIN EXPECTED CHANNEL FLOW.

7. ON CHANNEL GRADIENTS OF 3:1(H:V) OR STEEPER, OR IN SITUATIONS WHERE HIGH FLOW VELOCITIES (i.e. VELOCITY >1.5m/s) ARE LIKELY WITHIN THE FIRST TWO WEEK FOLLOWING PLACEMENT, SECURE THE INDIVIDUAL TURF STRIPS WITH WOODEN OR PLASTIC PEGS.

8. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

9. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH

MAINTENANCE

1. DURING THE SITE'S CONSTRUCTION PERIOD, INSPECT THE DIVERSION CHANNEL WEEKLY AND AFTER ANY INCREASE IN FLOWS WITHIN THE CHANNEL. REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE CHANNEL. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE CONSTRUCTION WORK ABOVE A TEMPORARY DIVERSION CHANNEL IS FINISHED AND THE AREA IS STABILISED, THE AREA SHOULD BE APPROPRIATELY REHABILITATED.

2. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.

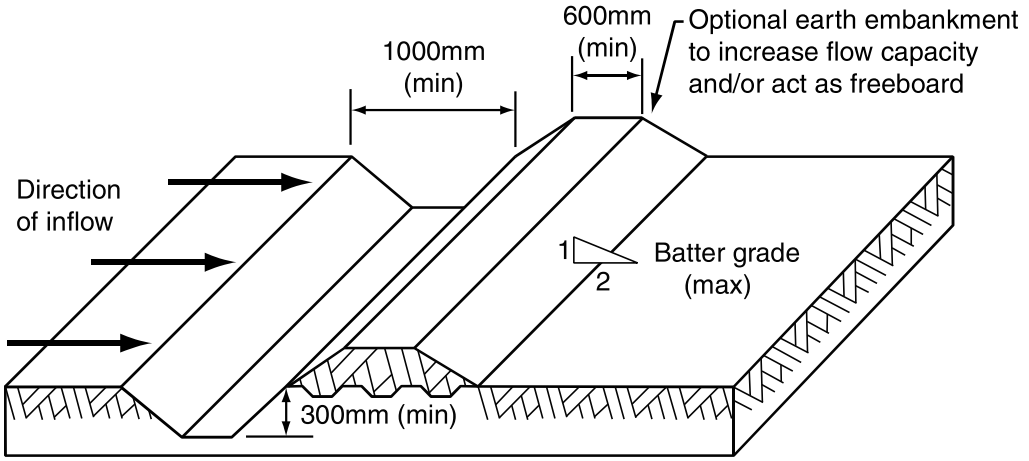
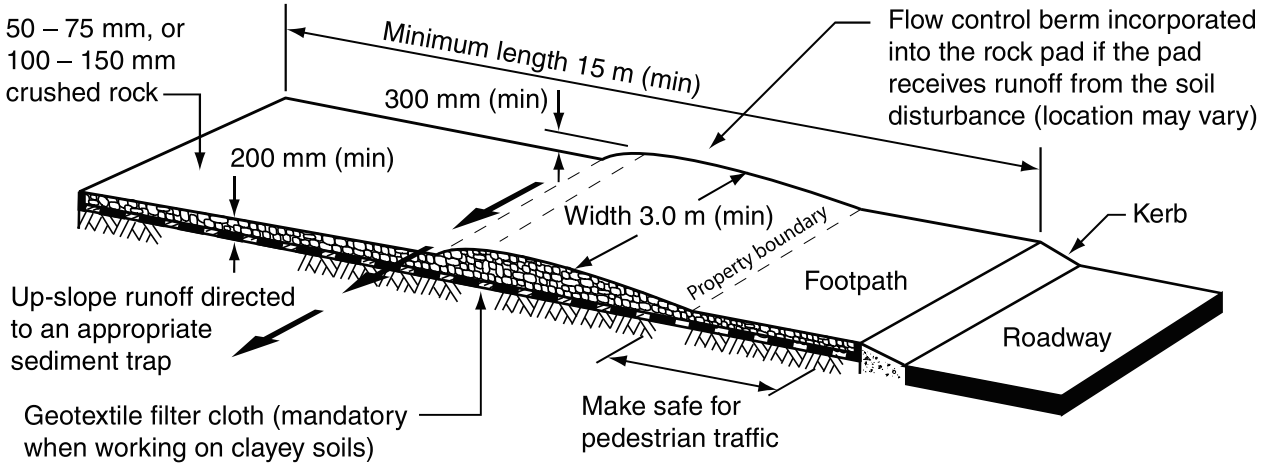
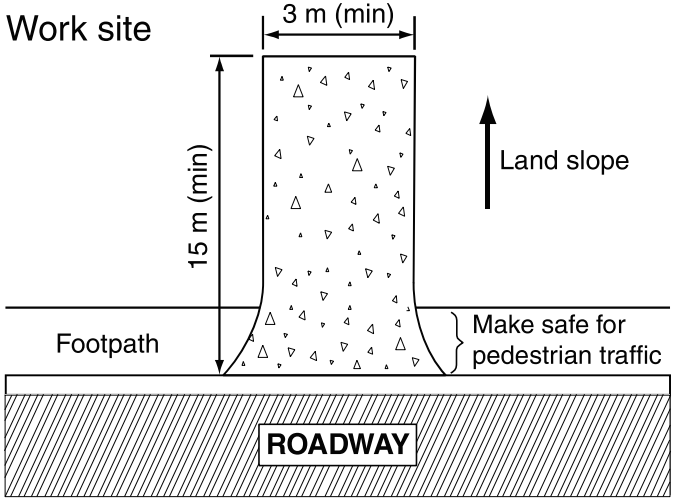


Figure 1 - Typical profile of diversion channel with bank

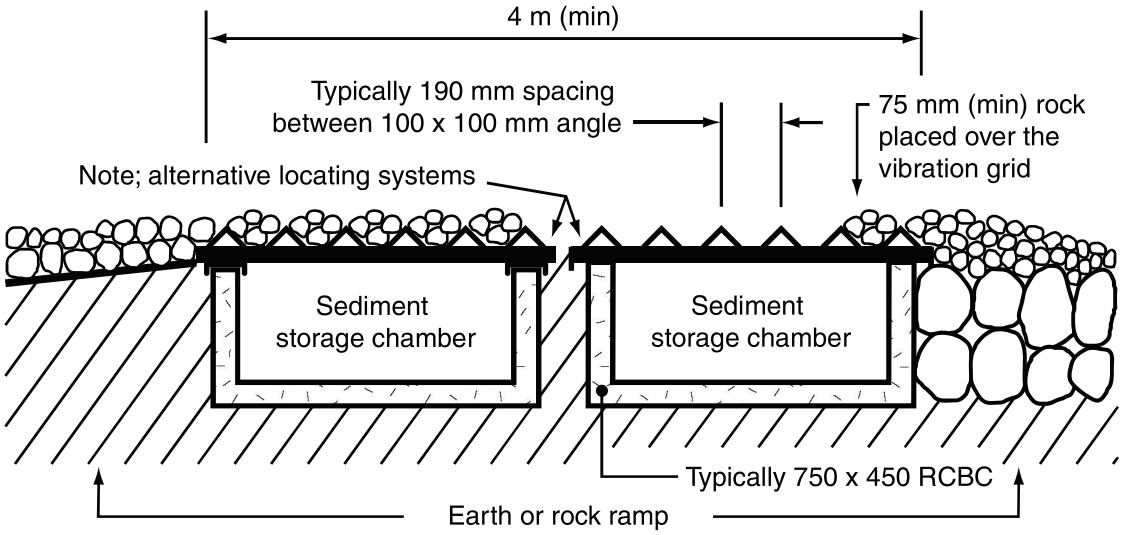
Drawn:	Date:		
GMW	Dec-09	Diversion Channels	DC-01



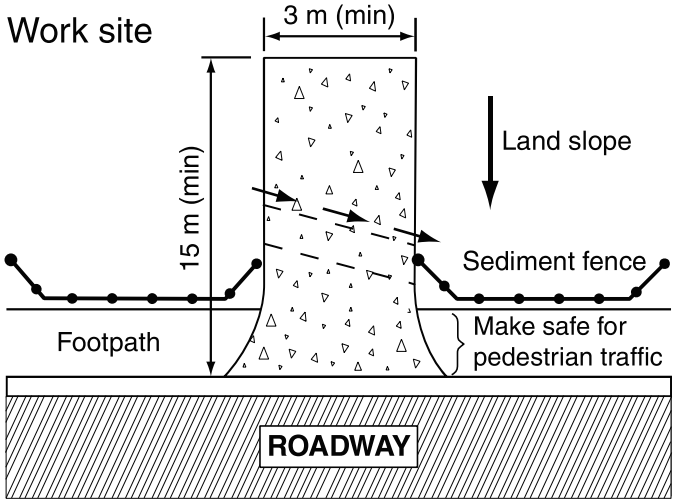
(a) Rock entry/exit pad for construction sites (refer to Standard Drawing Exit-03 for building sites)



(b) Rock pad sloping away from road



(c) Alternative low maintenance arrangement (still under development)



(d) Rock pad sloping towards the road

Drawn:	Date:		
GMW	Apr-10	Construction Exit - Rock Pad (construction sites only)	Exit-01

MATERIALS

ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, NOMINAL DIAMETER OF 50 TO 75mm (SMALL DISTURBANCES) OR 100 TO 150mm (LARGE DISTURBANCES). ALL REASONABLE MEASURES MUST BE TAKEN TO OBTAIN ROCK OF NEAR UNIFORM SIZE.

FOOTPATH STABILISING AGGREGATE: 25 TO 50mm GRAVEL OR AGGREGATE.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH ('BIDIM' A24 OR EQUIVALENT).

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND DIMENSIONAL DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION OF THE ROCK PAD, REMOVING STUMPS, ROOTS AND OTHER VEGETATION TO PROVIDE A FIRM FOUNDATION SO THAT THE ROCK IS NOT PRESSED INTO SOFT GROUND. CLEAR SUFFICIENT WIDTH TO ALLOW PASSAGE OF LARGE VEHICLES, BUT CLEAR ONLY THAT NECESSARY FOR THE EXIT. DO NOT CLEAR ADJACENT AREAS UNTIL THE REQUIRED EROSION AND SEDIMENT CONTROL DEVICES ARE IN PLACE.

3. IF THE EXPOSED SOIL IS SOFT, PLASTIC OR CLAYEY, PLACE A SUB-BASE OF CRUSHED ROCK OR A LAYER OF HEAVY-DUTY FILTER CLOTH TO PROVIDE A FIRM FOUNDATION.

4. PLACE THE ROCK PAD FORMING A MINIMUM 200mm THICK LAYER OF CLEAN, OPEN-VOID ROCK.

5. IF THE ASSOCIATED CONSTRUCTION SITE IS UP-SLOPE OF THE ROCK PAD, THUS CAUSING STORMWATER RUNOFF TO FLOW TOWARDS THE ROCK PAD, THEN FORM A MINIMUM 300mm HIGH FLOW CONTROL BERM ACROSS THE ROCK PAD TO DIVERT SUCH RUNOFF TO A SUITABLE SEDIMENT TRAP.

6. THE LENGTH OF THE ROCK PAD SHOULD BE AT LEAST 15m WHERE PRACTICABLE, AND AS WIDE AS THE FULL WIDTH OF THE ENTRY OR EXIT AND AT LEAST 3m. THE ROCK PAD SHOULD COMMENCE AT THE EDGE OF THE OFF-SITE SEALED ROAD OR PAVEMENT.

7. FLARE THE END OF THE ROCK PAD WHERE IT MEETS THE PAVEMENT SO THAT THE WHEELS OF TURNING VEHICLES DO NOT TRAVEL OVER UNPROTECTED SOIL.

8. IF THE FOOTPATH IS OPEN TO PEDESTRIAN MOVEMENT, THEN COVER THE COARSE ROCK WITH FINE AGGREGATE OR GRAVEL, OR OTHERWISE TAKE WHATEVER MEASURES ARE NEEDED TO MAKE THE AREA SAFE.

MAINTENANCE

1. INSPECT ALL SITE ENTRY AND EXIT POINTS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER RUNOFF-PRODUCING RAINFALL, OR OTHERWISE AT FORTNIGHTLY INTERVALS.

2. IF SAND, SOIL, SEDIMENT OR MUD IS TRACKED OR WASHED ONTO THE ADJACENT SEALED ROADWAY, THEN SUCH MATERIAL MUST BE PHYSICALLY REMOVED, FIRST USING A SQUARE-EDGED SHOVEL, AND THEN A STIFF-BRISTLED BROOM, AND THEN BY A MECHANICAL VACUUM UNIT, IF AVAILABLE.

3. IF NECESSARY FOR SAFETY REASONS, THE ROADWAY SHALL ONLY BE WASHED CLEAN AFTER ALL REASONABLE EFFORTS HAVE BEEN TAKEN TO SHOVEL AND SWEEP THE MATERIAL FROM THE ROADWAY.

4. WHEN THE VOIDS BETWEEN THE ROCK BECOMES FILLED WITH MATERIAL AND THE EFFECTIVENESS OF THE ROCK PAD IS REDUCED TO A POINT WHERE SEDIMENT IS BEING TRACKED OFF THE SITE, A NEW 100mm LAYER OF ROCK MUST BE ADDED AND/OR THE ROCK PAD MUST BE EXTENDED.

5. ENSURE ANY ASSOCIATED DRAINAGE CONTROL MEASURES (e.g. FLOW CONTROL BERM) ARE MAINTAINED IN ACCORDANCE WITH THEIR DESIRED OPERATIONAL CONDITIONS.

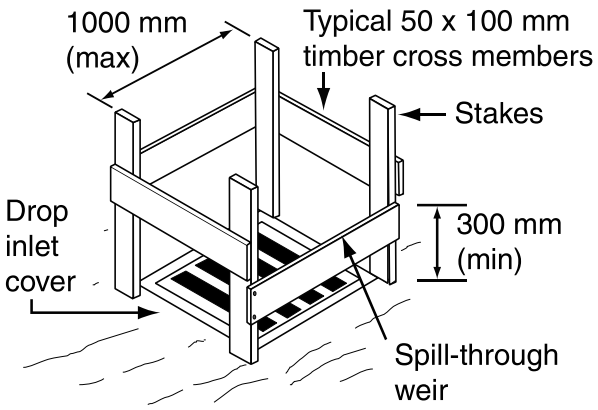
6. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

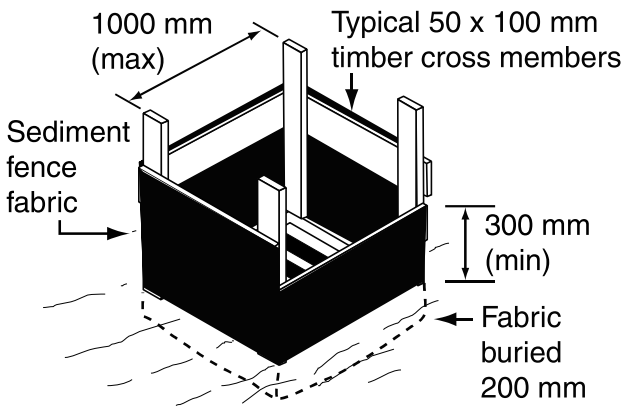
1. THE ROCK PAD SHOULD BE REMOVED ONLY AFTER IT IS NO LONGER NEEDED AS A SEDIMENT TRAP.

2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. RE-GRADE AND STABILISE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

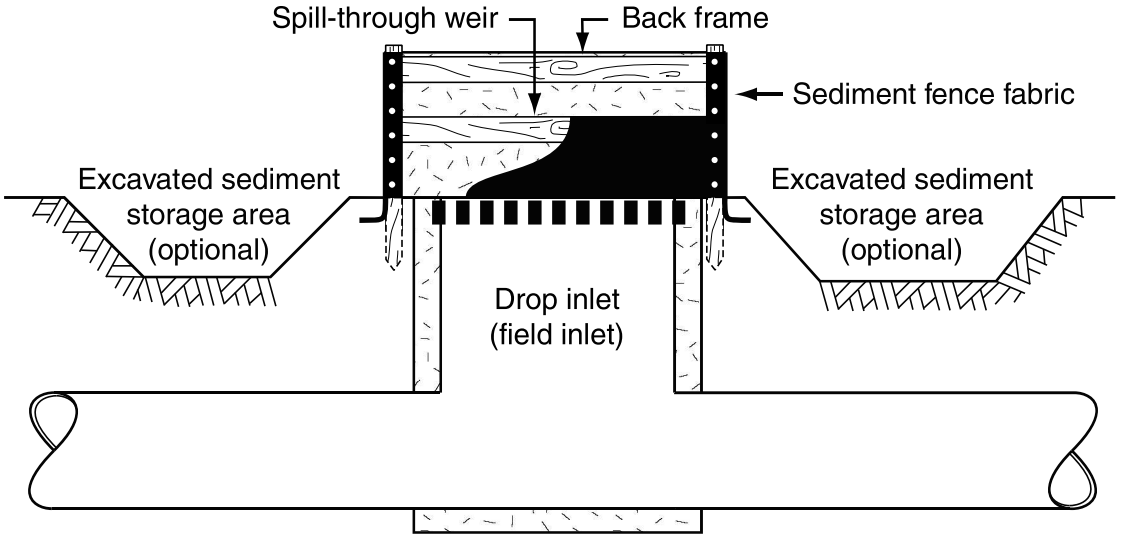
Drawn:	Date:		
GMW	Apr-10	Construction Exit - Rock Pad (construction sites only)	Exit-02



(a) Details of support frame with spill-through weir



(b) Fabric drop inlet protection with spill-through weir



(c) Fabric drop inlet protection with optional excavated sediment storage area and settling pond

Drawn:	Date:		
GMW	Dec-09	Fabric Drop Inlet Protection	FD-01

MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN REINFORCED FABRIC. THE FABRIC WIDTH SHOULD BE AT LEAST 700mm, WITH A MINIMUM UNIT WEIGHT OF 140g/m^2. FABRICS SHOULD CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

STAKES: MINIMUM 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS.

TIMBER CROSS MEMBERS: 50 X 100mm TIMBER OR EQUIVALENT.

AGGREGATE: 15 TO 25mm CRUSHED ROCK.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND DIMENSIONAL DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE THAT THE INSTALLATION OF THE SEDIMENT TRAP WILL NOT CAUSE UNDESIRABLE SAFETY OR FLOODING ISSUES.

3. WHERE POSSIBLE, EXCAVATE A 200x200mm TRENCH AROUND THE INLET STRUCTURE.

4. SPACE STAKES EVENLY AROUND THE PERIMETER OF THE STORMWATER INLET AT A MAXIMUM 1m SPACING, AND SECURELY DRIVE THEM INTO THE GROUND.

5. WHERE NECESSARY, INSTALL A HORIZONTAL SPILL-THROUGH WEIR TO LIMIT THE MAXIMUM HEIGHT WATER PONDING AROUND THE STRUCTURE.

6. ENSURE THE MAXIMUM POND HEIGHT WILL NOT CAUSE A SAFETY HAZARD, INCLUDING UNDESIRABLE FLOODING OF AN ADJACENT PROPERTY OR ROADWAY. WHEREVER PRACTICAL, THE SPILL-THROUGH WEIR SHOULD BE AT LEAST 300mm ABOVE GROUND LEVEL.

7. IF A SPILL-THROUGH WEIR IS NOT INSTALLED, THEN FRAME THE TOP OF THE STAKES WITH HORIZONTAL CROSS MEMBERS.

8. CUT FABRIC FROM A CONTINUOUS ROLL TO ELIMINATE JOINTS.

9. PLACE THE BOTTOM 300mm OF FABRIC IN THE EXCAVATED TRENCH.

10. SECURELY FASTEN THE FABRIC TO THE STAKES AND CROSS MEMBERS. AT THE FABRIC JOINT, OVERLAP THE FABRIC TO THE NEXT STAKE.

11. BACKFILL THE TRENCH WITH AT LEAST 200mm OF AGGREGATE OR COMPACTED SOIL. IF A TRENCH CANNOT BE EXCAVATED, LAY THE BOTTOM 300mm OF FABRIC EVENLY ON THE GROUND SURFACE AND COVER WITH A 300mm LAYER OF AGGREGATE, NOT EARTH OR SOIL.

12. WHERE REQUIRED, INSTALL A FLOW CONTROL BUND TO MAINTAIN THE SPECIFIED POOL DEPTH AND CONTROL THE MOVEMENT OF WATER.

13. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE AND TO PREVENT UNSAFE ENTRY INTO THE STORMWATER INLET.

MAINTENANCE

1. INSPECT THE SEDIMENT TRAP AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT AND MAKE REPAIRS AS NEEDED TO THE SEDIMENT TRAP AND ASSOCIATED FLOW CONTROL BUNDS.

2. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. SEDIMENT DEPOSITS SHOULD BE REMOVED IMMEDIATELY IF THEY REPRESENT A SAFETY RISK.

REMOVAL

1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED.

Drawn:	Date:		
GMW	Dec-09	Fabric Drop Inlet Protection	FD-02

MATERIALS

SOCKS: MINIMUM 200mm DIAMETER SYNTHETIC OR BIODEGRADABLE TUBES MANUFACTURED FROM NON-WOVEN OR COMPOSITE FABRIC SUITABLE FOR THE 'FILTRATION' OF COARSE SEDIMENTS.

FILL MATERIAL: STRAW, CANE MULCH, COMPOSTED MATERIAL (AS4454), COARSE SAND, OR CLEAN AGGREGATE.

STAKES: MINIMUM 25 x 25mm TIMBER.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE THE SOCKS ARE PLACED INDIVIDUALLY OR COLLECTIVELY (AS A SINGLE SEDIMENT TRAP) SUCH THAT:
(i) LEAKAGE AROUND OR UNDER THE SOCKS IS MINIMISED;
(ii) ADJOINING SOCKS ARE TIGHTLY BUTTED OR OVERLAPPED AT LEAST 450mm;
(iii) THE SURFACE AREA OF POTENTIAL WATER PONDING UP-SLOPE OF EACH SEDIMENT TRAP IS MAXIMISED;
(iv) TO THE MAXIMUM DEGREE PRACTICAL, ALL SEDIMENT-LADEN WATER WILL PASS THROUGH THE FORMED POND BEFORE FLOWING OVER THE DOWN-SLOPE END OF THE SEDIMENT TRAP.

3. WHEN PLACED ACROSS THE INVERT OF MINOR DRAINS, ENSURE THE SOCKS ARE PLACED SUCH THAT:
(i) THE CREST OF THE DOWNSTREAM SOCK IS LEVEL WITH THE CHANNEL INVERT AT THE IMMEDIATE UPSTREAM SOCK (IF ANY);
(ii) EACH SOCK EXTENDS UP THE CHANNEL BANKS SUCH THAT THE CREST OF THE SOCK AT ITS LOWEST POINT IS LOWER THAN GROUND LEVEL AT EITHER END OF THE SOCK.

4. IF STAKES ARE REQUIRED TO ANCHOR THE SOCKS, THEIR SPACING DOES NOT EXCEEDING 1.2m OR SIX TIMES THE SOCK DIAMETER (WHICHEVER IS THE LESSER). A MAXIMUM STAKE SPACING OF 0.3m APPLIES WHEN USED TO FORM CHECK DAMS.

MAINTENANCE

1. INSPECT ALL FILTER SOCKS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.

2. REPAIR OR REPLACE DAMAGED SOCKS.

3. THE BULK OF THE SEDIMENT COLLECTED BEHIND THE FILTER SOCKS SHOULD BE REMOVED BY SHOVEL AFTER EACH STORM EVENT.

4. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

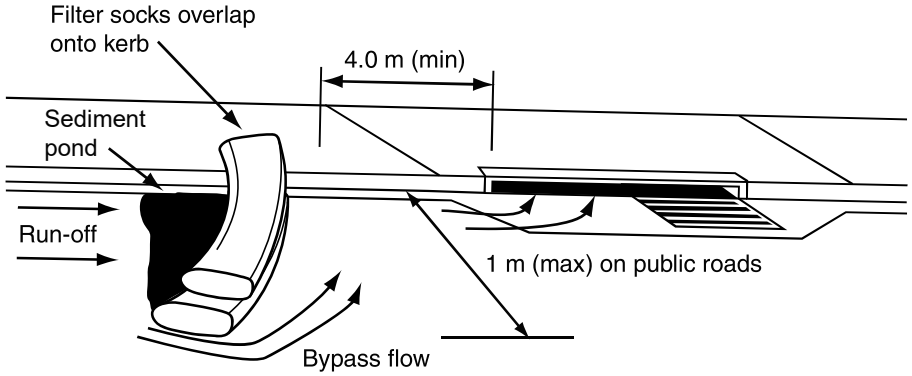
REMOVAL

1. ALL SAND, SOIL, SEDIMENT OR MUD MUST BE PHYSICALLY REMOVED FROM SEALED SURFACES, FIRST USING A SQUARE-EDGED SHOVEL, AND THEN A STIFF-BRISTLED BROOM, AND THEN BY A MECHANICAL VACUUM UNIT, IF AVAILABLE.

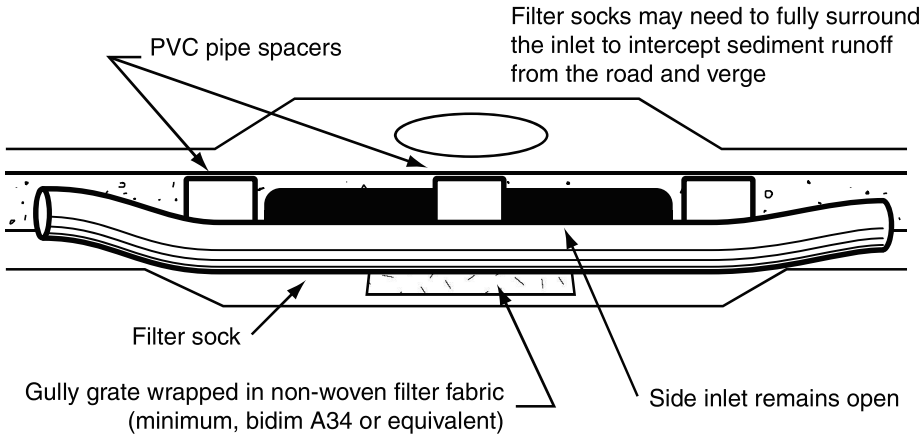
2. IF NECESSARY FOR SAFETY REASONS, THE SEALED SURFACE SHALL ONLY BE WASHED CLEAN AFTER ALL REASONABLE EFFORTS HAVE BEEN TAKEN TO SHOVEL AND SWEEP THE MATERIAL FROM THE SURFACE.

3. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

4. ALL SYNTHETIC (PLASTIC) MESH OR OTHER NON READILY BIODEGRADABLE MATERIAL MUST BE REMOVED FROM THE SITE ONCE THE SLOPE OR DRAIN IS STABILISED, OR THE SOCKS HAVE DETERIORATED TO A POINT WHERE THEY ARE NO LONGER PROVIDING THEIR INTENDED DRAINAGE OR SEDIMENT CONTROL FUNCTION.

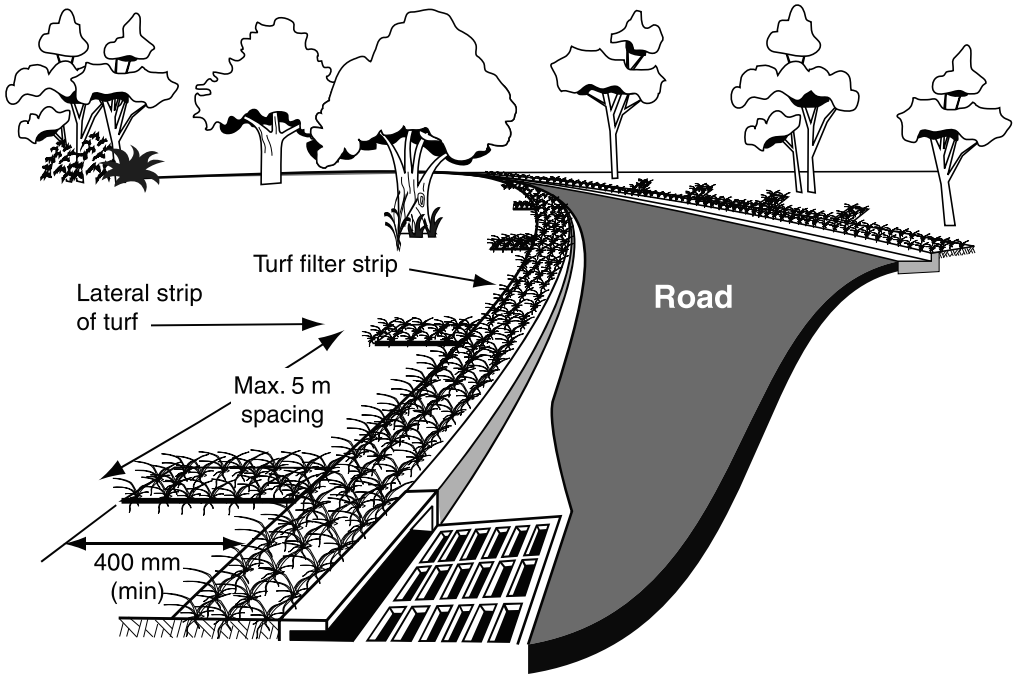


(a) On-grade kerb inlet sediment trap

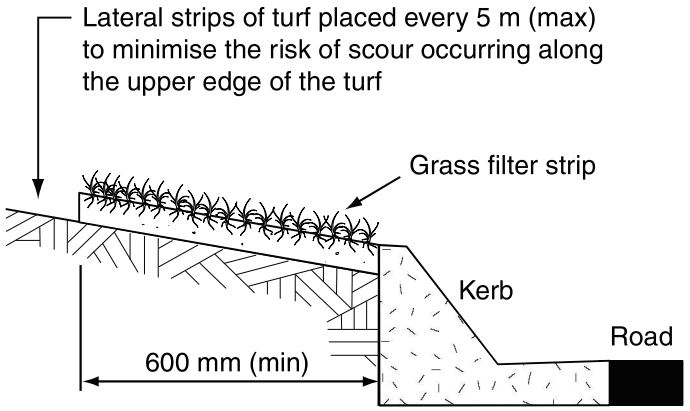


(b) Sag inlet sediment trap

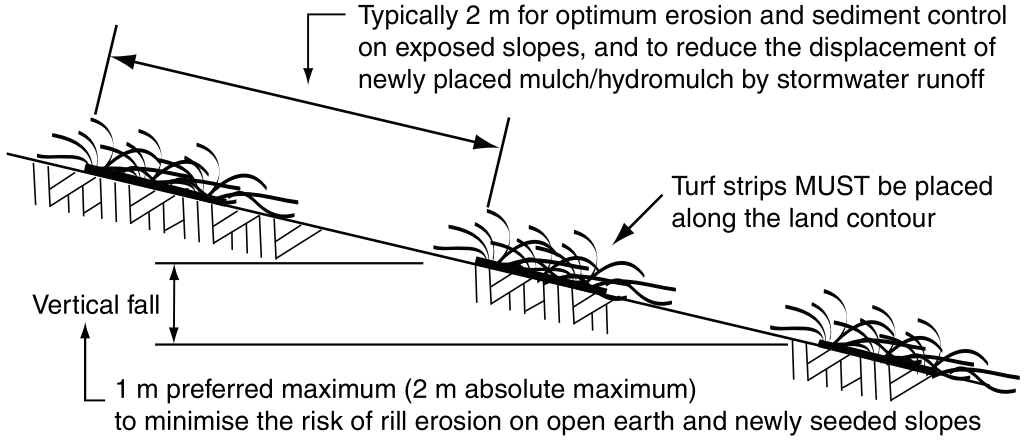
Drawn:	Date:		
GMW	Dec-09	Filter Socks - Concentrated Flow	FS-01



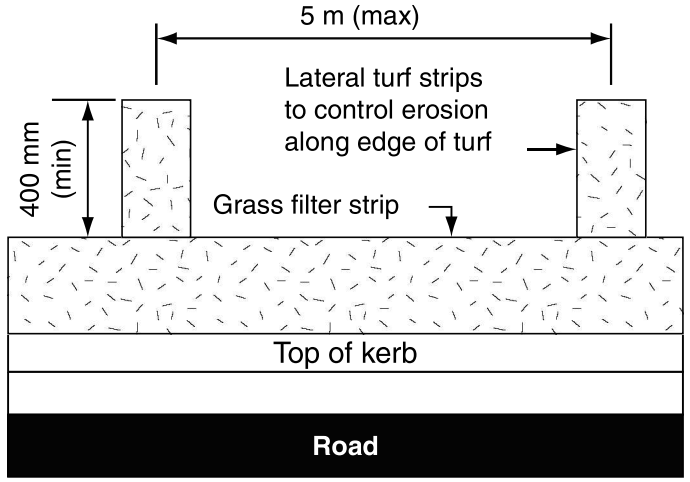
(a) Placement of grass filter strips along road kerb



(b) Placement of grass filter strips along edge of impervious surface



(c) Placement of grass filter strips along the contour of a slope



(d) Placement of grass filter strips along edge of impervious surface

Drawn:	Date:		
GMW	Dec-09	Grass Filter Strips	GFS-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED, PRIOR TO PLANTING.

3. REMOVE ALL OBJECTIONABLE MATERIAL FROM THE AREA TO BE TURFED.

4. ALL TURF SHOULD BE USED WITHIN 12-HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS.

5. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

6. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

7. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

8. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

9. IF THE FILTER STRIPS ARE REQUIRED TO BE PLACED ALONG THE CONTOUR, THEN ENSURE EACH ROW OF TURF IS PLACED ALONG A LINE OF CONSTANT LAND ELEVATION.

10. IF THE FILTER STRIPS ARE PLACED AT AN ANGLE TO THE LAND SLOPE (i.e. SUCH THAT UP-SLOPE RUNOFF WILL BE DEFLECTED ALONG THE UPPER EDGE OF THE TURF), THEN LATERAL STRIPS OF TURF MUST BE PLACED AT MAXIMUM 5m INTERVALS AND EXTENDING AT LEAST 400mm UP-SLOPE OF THE FILTER STRIP.

11. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH.

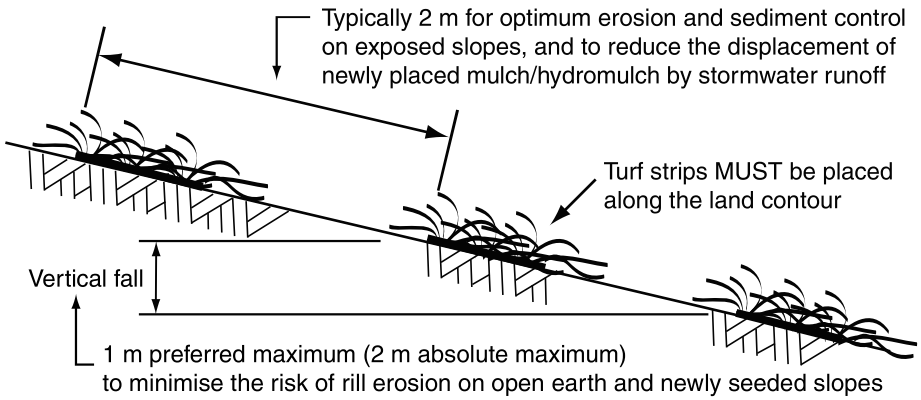
MAINTENANCE

1. INSPECT THE GRASS FILTER STRIPS AFTER EACH RUNOFF EVENT. CHECK FOR EVIDENCE OF CONCENTRATED RILL-FORMING FLOW ALONG THE UPPER EDGE OF THE TURF.

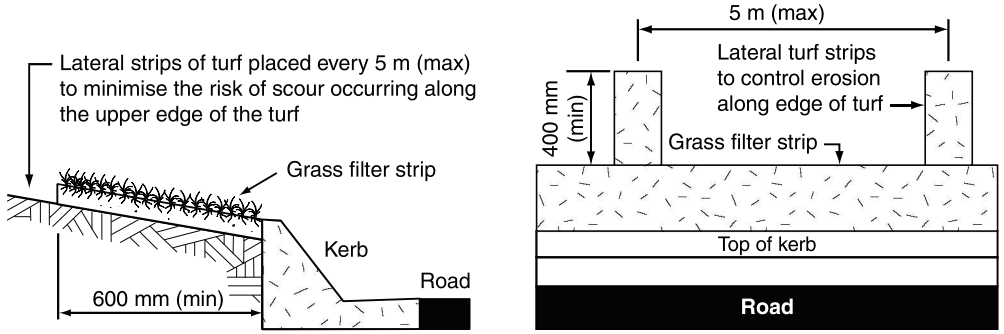
2. IF EXCESSIVE EROSION IS OCCURRING ALONG THE UP-SLOPE EDGE OF THE TURF, THEN PLACE ADDITIONAL DIAGONAL TURF STRIPS. ALTERNATIVELY, USE SANDBAGS TO APPROPRIATELY DIVERT RUNOFF THROUGH THE GRASS.

3. MAINTAIN A HEALTHY AND VIGOROUS GRASS CONDITION WHENEVER AND WHEREVER POSSIBLE, INCLUDING WATERING AND FERTILISING AS NEEDED.

4. WHERE PRACTICABLE, MAINTAIN A MINIMUM LEAF LENGTH OF 50mm. MOWING SHOULD NOT BE ATTEMPTED UNTIL THE TURF IS FIRMLY ROOTED, USUALLY 2 TO 3 WEEKS AFTER LAYING.



(a) Placement of grass filter strips along the contour of a slope



(b) Placement of grass filter strips along edge of impervious surface

Drawn:	Date:		
GMW	Apr-10	Grass Filter Strips	GFS-02

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEREVER PRACTICAL, LOCATE THE LEVEL SPREADER ON UNDISTURBED, STABLE SOIL.

3. ENSURE FLOW DISCHARGING FROM THE LEVEL SPREADER WILL DISPERSE ACROSS A PROPERLY STABILISED SLOPE NOT EXCEEDING 10:1 (H:V) AND SUFFICIENTLY EVEN IN GRADE ACROSS THE SLOPE TO AVOID CONCENTRATING THE OUTFLOW.

4. THE OUTLET SILL OF THE SPREADER SHOULD BE PROTECTED WITH EROSION CONTROL MATTING TO PREVENT EROSION DURING THE ESTABLISHMENT OF VEGETATION. THE MATTING SHOULD BE A MINIMUM OF 1200mm WIDE EXTENDING AT LEAST 300mm UPSTREAM OF THE EDGE OF THE OUTLET CREST AND BURIED AT LEAST 150mm IN A VERTICAL TRENCH. THE DOWNSTREAM EDGE SHOULD BE SECURELY HELD IN PLACE WITH CLOSELY SPACED HEAVY-DUTY WIRE STAPLES AT LEAST 150mm LONG.

5. ENSURE THAT THE OUTLET SILL (CREST) IS LEVEL FOR THE SPECIFIED LENGTH.

6. IMMEDIATELY AFTER CONSTRUCTION, TURF, OR SEED AND MULCH WHERE APPROPRIATE, THE LEVEL SPREADER.

MAINTENANCE

1. INSPECT THE LEVEL SPREADER AFTER EVERY RAINFALL EVENT UNTIL VEGETATION IS ESTABLISHED.

2. AFTER ESTABLISHMENT OF VEGETATION OVER THE LEVEL SPREADER, INSPECTIONS SHOULD BE MADE ON A REGULAR BASIS AND AFTER RUNOFF-PRODUCING RAINFALL.

3. ENSURE THAT THERE IS NO SOIL EROSION AND THAT SEDIMENT DEPOSITION IS NOT CAUSING THE CONCENTRATION OF FLOW.

4. ENSURE THAT THERE IS NO SOIL EROSION OR CHANNEL DAMAGE UPSTREAM OF THE LEVEL SPREADER, OR SOIL EROSION OR VEGETATION DAMAGE DOWNSTREAM OF THE LEVEL SPREADER.

5. INVESTIGATE THE SOURCE OF ANY EXCESSIVE SEDIMENTATION.

6. MAINTAIN GRASS IN A HEALTH CONDITION WITH NO LESS THAN 90% COVER UNLESS CURRENT WEATHER CONDITIONS REQUIRE OTHERWISE.

7. GRASS HEIGHT SHOULD BE MAINTAINED AT A MINIMUM 50mm BLADE LENGTH WITHIN THE LEVEL SPREADER AND DOWNSTREAM DISCHARGE AREA, AND A MAXIMUM BLADE LENGTH NO GREATER THAN ADJACENT GRASSES.

REMOVAL

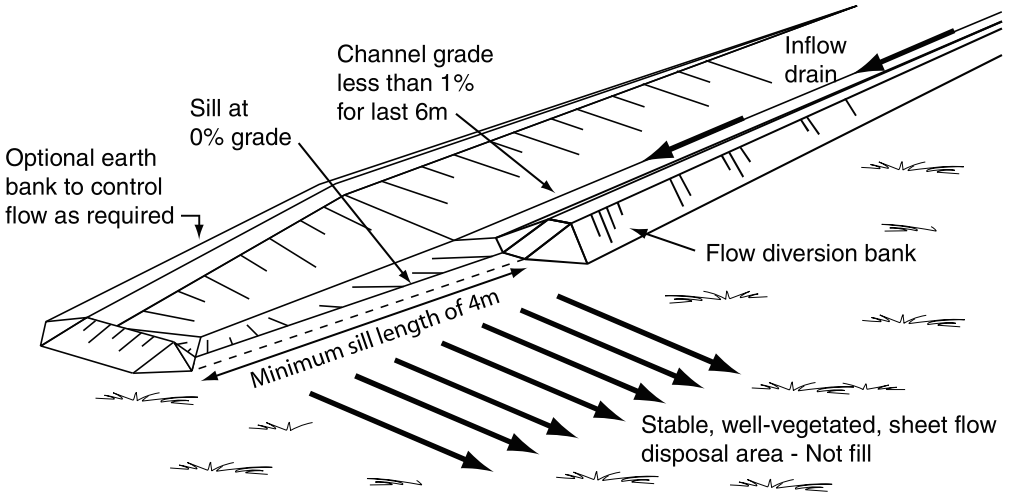
1. TEMPORARY LEVEL SPREADERS SHOULD BE DECOMMISSIONED ONLY AFTER AN ALTERNATIVE STABLE OUTLET IS OPERATIONAL, OR WHEN THE INFLOW CHANNEL IS DECOMMISSIONED.

2. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

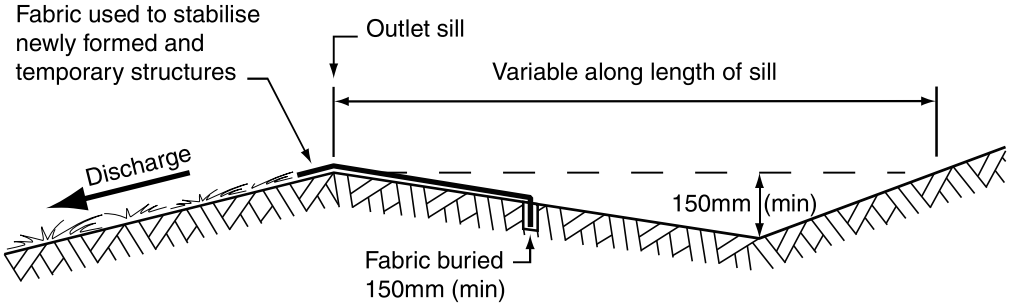
3. REMOVE AND APPROPRIATELY DISPOSE OF ANY EXPOSED GEOTEXTILE.

4. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

5. STABILISE THE AREA AS SPECIFIED ON THE APPROVED PLAN.



(a) Typical layout of level spreader



(b) Typical profile of the the outlet weir

Drawn:	Date:		
GMW	Dec-09	Level Spreaders	LS-01

MATERIALS

(i) MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(ii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m.

(iii) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A MULCH FILTER BERM, TO THE MAXIMUM DEGREE PRACTICAL, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

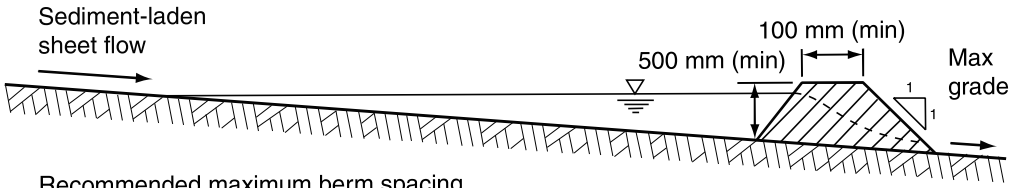
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	30 m
5%	25 m
10%	15 m
20%	8 m

Figure 1 - Typical placement of mulch filter berm

Drawn:	Date:		
GMW	Apr-10	Mulch Filter Berms	MB-01

MATERIALS

ROCK: 150 TO 300mm NOMINAL DIAMETER, HARD, EROSION RESISTANT ROCK. SMALLER ROCK MAY BE USED IF SUITABLE LARGE ROCK IS NOT AVAILABLE.

SANDBAGS: GEOTEXTILE BAGS (WOVEN SYNTHETIC, OR NON-WOVEN BIODEGRADABLE) FILLED WITH CLEAN COARSE SAND, CLEAN AGGREGATE, STRAW OR COMPOST.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. PRIOR TO PLACEMENT OF THE CHECK DAMS, ENSURE THE TYPE AND SIZE OF EACH CHECK DAMS WILL NOT CAUSE A SAFETY HAZARD OR CAUSE WATER TO SPILL OUT OF THE DRAIN.

3. LOCATE THE FIRST CHECK DAM AT THE DOWNSTREAM END OF THE SECTION OF CHANNEL BEING PROTECTED. LOCATE EACH SUCCESSIVE CHECK DAM SUCH THAT THE CREST OF THE IMMEDIATE DOWNSTREAM DAM IS LEVEL WITH THE TOE OF THE CHECK DAM BEING INSTALLED.

4. ENSURE THE CHANNEL SLOPE IS NO STEEPER THAN 10:1 (H:V). OTHERWISE CONSIDER THE USE OF A SUITABLE CHANNEL LINER INSTEAD OF THE CHECK DAMS.

5. CONSTRUCT THE CHECK DAM TO THE DIMENSIONS AND PROFILE SHOWN WITHIN THE APPROVED PLAN.

6. WHERE SPECIFIED, THE CHECK DAMS SHALL BE CONSTRUCTED ON A SHEET OF GEOTEXTILE FABRIC USED AS A DOWNSTREAM SPLASH PAD.

7. EACH CHECK DAM SHALL BE EXTENDED UP THE CHANNEL BANK (WHERE PRACTICABLE) TO AN ELEVATION AT LEAST 150mm ABOVE THE CREST LEVEL OF THE DAM.

MAINTENANCE

1. INSPECT EACH CHECK DAM AND THE DRAINAGE CHANNEL AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CORRECT ALL DAMAGE IMMEDIATELY. IF SIGNIFICANT EROSION OCCURS BETWEEN ANY OF THE CHECK DAMS, THEN CHECK THE SPACING OF DAMS AND WHERE NECESSARY INSTALL INTERMEDIATE CHECK DAMS OR A SUITABLE CHANNEL LINER.

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS

4. CHECK FOR SOIL SCOUR AROUND THE ENDS OF EACH CHECK DAM. IF SUCH EROSION IS OCCURRING, CONSIDER EXTENDING THE WIDTH OF THE CHECK DAM TO AVOID SUCH PROBLEMS.

5. IF SEVERE SOIL EROSION OCCURS EITHER UNDER OR AROUND THE CHECK DAMS, THEN SEEK EXPERT ADVICE ON AN ALTERNATIVE TREATMENT MEASURE.

6. REMOVE ANY SEDIMENT ACCUMULATED BY THE CHECK DAMS, UNLESS IT IS INTENDED THAT THIS SEDIMENT WILL REMAIN WITHIN THE CHANNEL.

7. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN CONSTRUCTION WORK WITHIN THE DRAINAGE AREA ABOVE THE CHECK DAMS HAS BEEN COMPLETED, AND THE DISTURBED AREAS AND THE DRAINAGE CHANNEL ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, ALL TEMPORARY CHECK DAMS MUST BE REMOVED.

2. REMOVE THE CHECK DAMS AND ASSOCIATED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

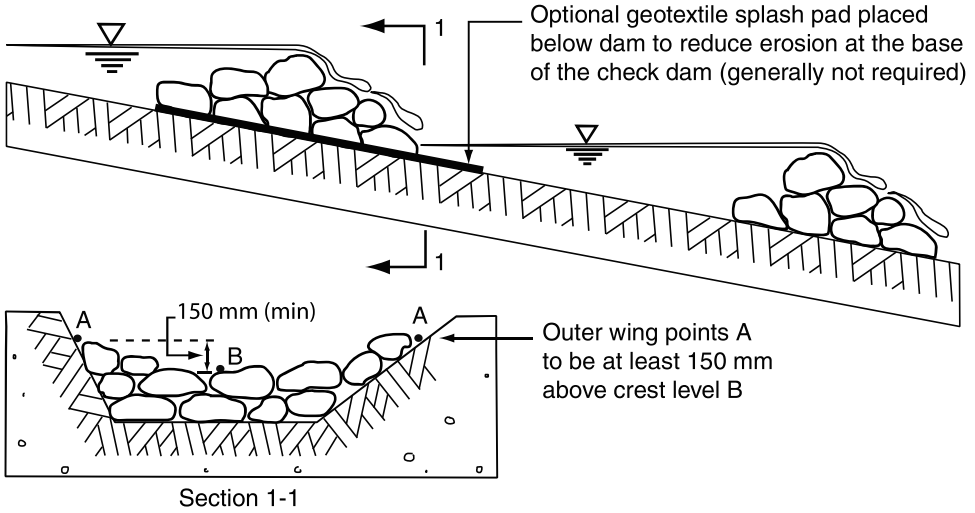
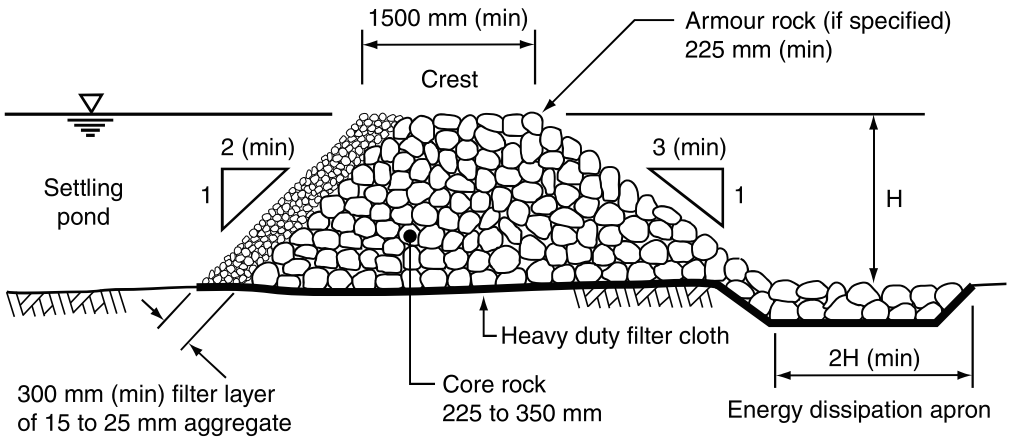
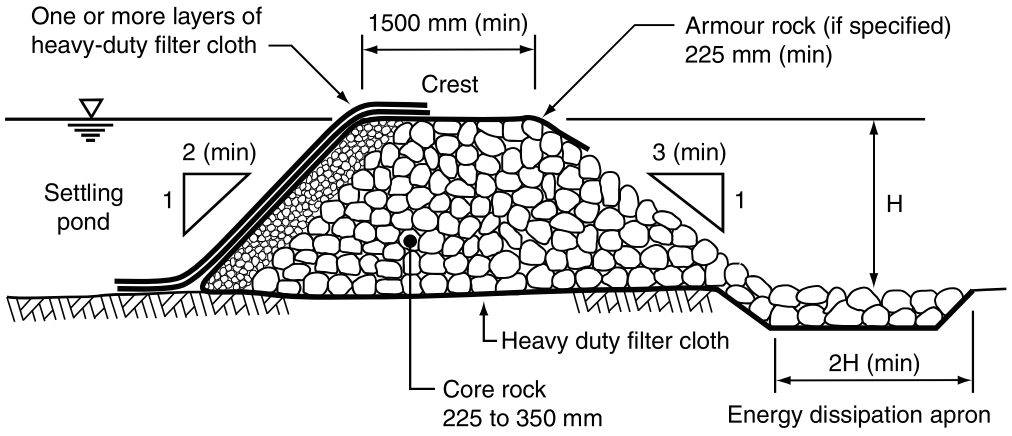


Figure 1 - Layout and profile of check dams (rock check dams shown)

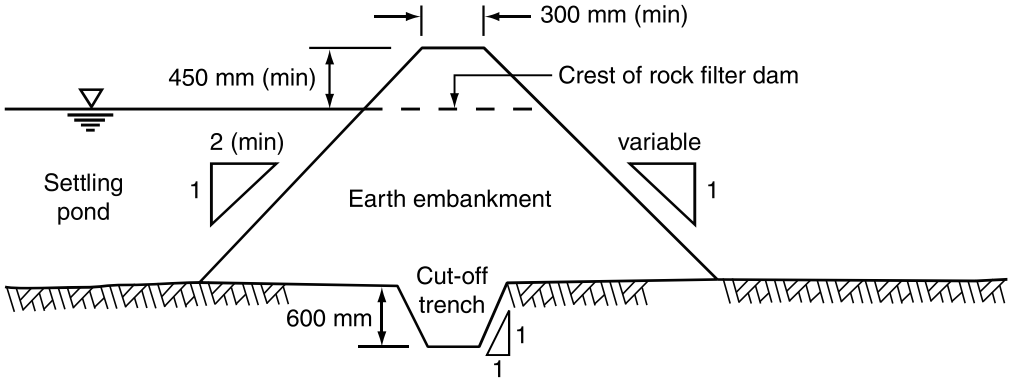
Drawn:	Date:		
GMW	Dec-09	Check Dams	RCD-01



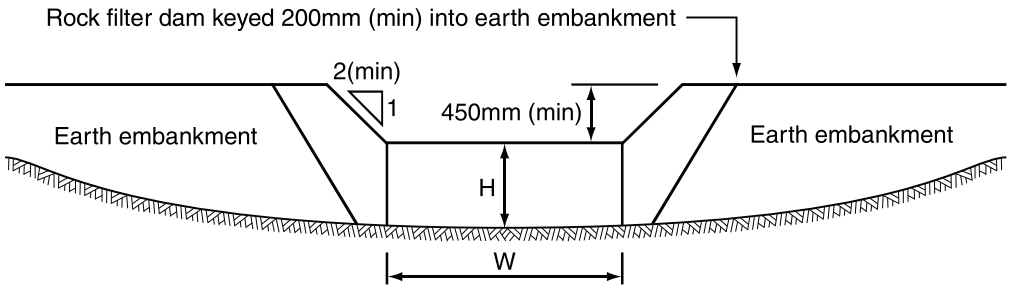
(a) Rock filter dam with aggregate filter



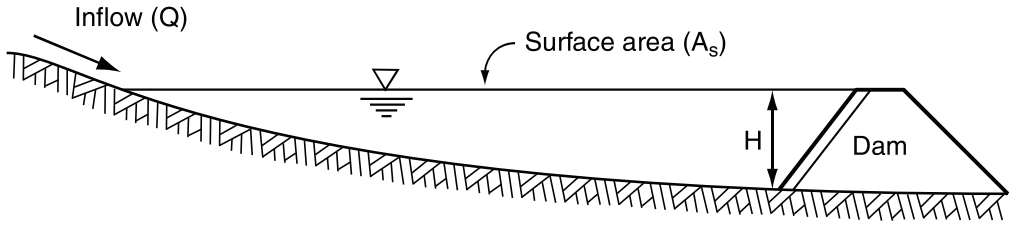
(b) Rock filter dam with geotextile and aggregate filter



(c) Typical cross-section of constructed earth abutment



(d) Typical profile of rock filter dam crest when integrated into an earth embankment



(e) Settling pond

Drawn:	Date:		
GMW	Feb-10	Rock Filter Dam	RFD-01

MATERIALS

PRIMARY CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm, OR GREATER THAN 350mm.

ARMOUR ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm.

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE FOUNDATION AREA OF THE ROCK FILTER DAM OF WOODY VEGETATION AND ORGANIC MATTER. DELAY CLEARING THE UP-SLOPE POND AREA UNTIL THE DAM IS FORMED AND IS ABLE TO ACT AS A SUITABLE SEDIMENT TRAP, OTHERWISE AN ALTERNATIVE TEMPORARY DOWNSTREAM SEDIMENT TRAP MAY BE REQUIRED DURING CONSTRUCTION OF THE ROCK FILTER DAM.

3. IF SPECIFIED ON THE PLANS, EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE-LINE OF THE DAM AND EARTH ABUTMENTS (IF ANY).

4. COVER THE FOUNDATION AREA AND CUT-OFF TRENCH WITH HEAVY-DUTY FILTER FABRIC BEFORE BACKFILLING WITH THE CORE ROCK. OVERLAP ADJOINING FABRIC SHEETS A MINIMUM OF 600mm.

5. CONSTRUCT THE ASSOCIATED EARTH ABUTMENT (IF ANY). ALL CUT AND FILL SLOPES SHOULD BE 2:1(H:V) OR FLATTER. THE DOWNSTREAM FACE OF EARTH ABUTMENTS SHOULD BE 3:1(H:V) OR FLATTER. EARTH ABUTMENTS SHOULD BE CONSTRUCTED OF WELL-COMPACTED, EROSION RESISTANT SOIL THAT IS FREE OF VEGETATION AND ROOTS. OVERFILL EARTH ABUTMENTS 150mm TO ALLOW FOR SETTLEMENT.

6. PLACE THE CORE ROCK FOR THE ROCK FILTER DAM. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.

7. ENSURE THE ROCK IS MACHINE PLACED WITH THE SMALLER ROCKS WORKED INTO THE VOIDS OF THE LARGER ROCKS.

8. IF SPECIFIED, CONSTRUCT THE SPILLWAY SECTION USING THE SPECIFIED ARMOUR ROCK. THE SPILLWAY SHOULD HAVE A MINIMUM PROFILE DEPTH OF 300mm. THE SPILLWAY WEIR CREST MUST BE LEVEL ACROSS ITS FULL WIDTH. THE MAXIMUM LONGITUDINAL SLOPE OF THE ROCK SPILLWAY SHOULD BE 3:1(H:V). THE MINIMUM THICKNESS OF ARMOUR ROCK PROTECTION SHOULD BE 500mm, OR TWICE THE NOMINAL ROCK SIZE, WHICHEVER IS THE GREATER.

9. ENSURE THE SPILLWAY OUTLET SECTION EXTENDS DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REACHED, OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER. THE EDGES OF THE SPILLWAY SHOULD BE LEFT FLUSH WITH THE SURROUNDING GROUND.

10. INSTALL THE SPECIFIED FILTER (AGGREGATE AND/OR FILTER CLOTH) ON THE UPSTREAM FACE OF THE ROCK FILTER DAM.

11. IF FILTER CLOTH IS USED, THEN:
(i) EXTEND THE FABRIC OVER THE CREST OF THE ROCK FILTER DAM INTO THE SPILLWAY CHUTE;
(ii) CONSIDER THE PLACEMENT OF SEVERAL LAYERS OF OVERLAPPING FABRIC, THUS ALLOWING EACH LAYER TO BE REMOVED INDIVIDUALLY ONCE THE FABRIC BECOMES BLOCKED WITH SEDIMENT.

12. CLEAR THE SETTLING POND AREA OF WOODY VEGETATION AND ORGANIC MATTER TO THE DIMENSIONS SPECIFIED WITHIN THE PLANS.

13. WHERE NECESSARY, EXCAVATE THE UPSTREAM SETTLING POND AND/OR SEDIMENT STORAGE PIT IN ACCORDANCE WITH THE APPROVED PLANS. EXCAVATED PITS TYPICALLY HAVE SIDE SLOPES OF 2:1(H:V) OR FLATTER UNLESS STEEPER SLOPES ARE KNOWN TO BE STABLE.

14. STABILISE ANY ASSOCIATED EARTH EMBANKMENTS IMMEDIATELY AFTER CONSTRUCTION THROUGH APPROPRIATE COMPACTION, VEGETATION AND/OR EROSION CONTROL MATTING.

15. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

16. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. CHECK ALL ROCK FILTER DAMS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT ALL ROCK AND EARTH EMBANKMENTS FOR UNDERCUTTING OR UNDESIRABLE SEEPAGE FLOWS.

3. IDEALLY, ROCK FILTER DAMS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAYBE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.

4. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.

5. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.

6. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.

7. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE SPILLWAY.

8. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.

9. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

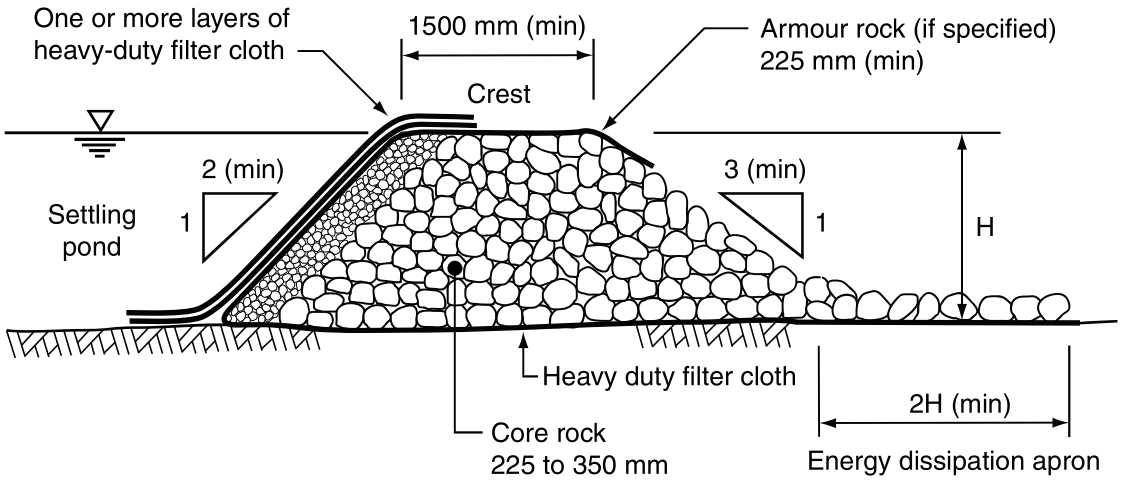
REMOVAL

1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

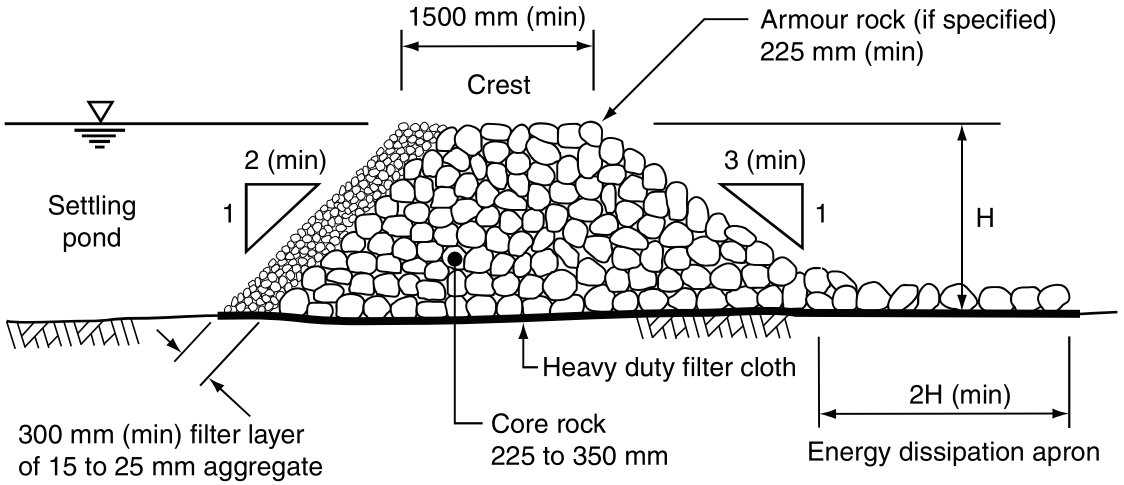
2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE SETTLING POND PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED TO MINIMISE THE EROSION HAZARD.

Drawn:	Date:		
GMW	Apr-10	Rock Filter Dam	RFD-02



(a) Rock filter dam with aggregate filter (instream installation)



(b) Rock filter dam with geotextile and aggregate filter (instream installation)

Drawn:	Date:		
GMW	Feb-10	Rock Filter Dam (Instream)	RFD-03

MATERIALS
PRIMARY CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm, OR GREATER THAN 350mm.

ARMOUR ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm.

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.

INSTALLATION
1. PRIOR TO COMMENCING ANY WORKS, OBTAIN ALL NECESSARY APPROVALS AND PERMITS REQUIRED TO CONDUCT THE NECESSARY WORKS INCLUDING PERMITS FOR THE DISTURBANCE OF RIPARIAN AND AQUATIC VEGETATION, AND THE CONSTRUCTION OF ALL PERMANENT OR TEMPORARY INSTREAM BARRIERS AND INSTREAM SEDIMENT CONTROL MEASURES.

2. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

3. IF THERE IS FLOW WITHIN THE WATERCOURSE OR DRAINAGE CHANNEL AT THE TIME OF CONSTRUCTION OF THE ROCK FILTER DAM, THEN DOWNSTALL APPROPRIATE INSTREAM SEDIMENT CONTROL DEVICES AND/OR FLOW DIVERSION SYSTEMS PRIOR TO CONSTRUCTION OF THE DAM. SUCH MEASURES SHOULD ONLY BE INSTALLED IF CONSIDERED APPROPRIATE FOR THE LOCAL CONDITIONS, AND ONLY IF THEIR INSTALLATION IS JUDGED TO PROVIDE A NET OVERALL ENVIRONMENTAL BENEFIT.

4. TO THE MAXIMUM DEGREE PRACTICAL, CONSTRUCTION ACTIVITIES AND EQUIPMENT SHALL NOT OPERATE WITHIN OPEN FLOWING WATERS.

5. CLEAR THE LOCATION FOR THE DAM; CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS AND TO INSTALL THE DAM.

6. REMOVE ANY CLEARED ORGANIC MATTER AND DEBRIS FROM THE CHANNEL AND DISPOSE OF IT PROPERLY. DO NOT USE ORGANIC MATTER OR DEBRIS TO BUILD THE ROCK FILTER DAM.

7. TO ASSIST IN THE EVENTUAL REMOVAL OF ALL MATERIALS USED IN THE CONSTRUCTION OF THE ROCK FILTER DAM, A PROTECTIVE LAYER OF GEOTEXTILE FILTER CLOTH (PREFERABLY IN THE FORM OF A SINGLE SHEET) SHALL BE PLACED OVER THE CHANNEL AREA AND DAM ABUTMENTS PRIOR TO INSTALLATION OF THE DAM. IF MORE THAN ONE SHEET OF FABRIC IS REQUIRED, OVERLAP THE FABRIC BY AT LEAST 600mm.

8. IF DISPERSIBLE, HIGHLY UNSTABLE, OR HIGHLY EROSIVE SOILS ARE EXPOSED, THEN PRIORITY SHALL BE GIVEN TO THE PROMPT STABILISATION OF ALL SUCH AREAS.

9. PLACE THE CORE ROCK FOR THE ROCK FILTER DAM. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.

10. THE ROCK MATERIAL USED TO FORM THE DAM SHOULD BE WELL-GRADED MIXTURE OF ROCK WITH A MINIMUM SIZE OF 225mm AND A MAXIMUM OF 350mm (EXCLUDING ARMOUR ROCK). THE ROCK MAY BE MACHINE PLACED WITH THE SMALLER ROCKS WORKED INTO THE VOIDS OF THE LARGER ROCKS.

11. SMALL ROCK FILTER DAMS (< 1m HIGH) INCLUDING SHOULD BE CONSTRUCTED IN A SLIGHTLY CURVED PROFILE (IN PLAN VIEW) POINTING UPSTREAM. THE CENTRE OF THE DAM'S CREST SHOULD BE SLIGHTLY LOWER (TYPICALLY 200mm) THAN THE OUTER ABUTMENTS TO PROMOTE INITIAL OVERTOPPING AT OR NEAR THE CENTRE OF THE CHANNEL..

12. WHERE NECESSARY, EXTEND THE ROCK PROTECTION DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REACHED, OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER.

13. INSTALL THE SPECIFIED FILTER (AGGREGATE AND/OR FILTER CLOTH) ON THE UPSTREAM FACE OF THE ROCK FILTER DAM.

14. IF FILTER CLOTH IS USED, THEN:

(i) EXTEND THE FABRIC OVER THE CREST OF THE ROCK FILTER DAM INTO THE SPILLWAY CHUTE;

(ii) CONSIDER THE PLACEMENT OF SEVERAL LAYERS OF OVERLAPPING FABRIC, THUS ALLOWING EACH LAYER TO BE REMOVED INDIVIDUALLY ONCE THE FABRIC BECOMES BLOCKED WITH SEDIMENT.

15. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE
1. INSPECT THE ROCK FILTER DAM PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER RUNOFF PRODUCING RAINFALL, OR OTHERWISE ON A WEEKLY BASIS.

2. IDEALLY, ROCK FILTER DAMS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAY BE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.

3. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.

4. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.

5. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.

6. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE DAM.

7. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.

8. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL
1. THE ROCK FILTER DAM SHOULD BE REMOVED AS SOON AS POSSIBLE AFTER THEY ARE NO LONGER NEEDED.

2. IF THERE IS FLOW WITHIN THE WATERCOURSE OR DRAINAGE CHANNEL AT THE TIME OF REMOVAL OF THE ROCK FILTER DAM, THEN INSTALL APPROPRIATE INSTREAM SEDIMENT CONTROL DEVICES AND/OR FLOW DIVERSION SYSTEMS PRIOR TO ITS REMOVAL. SUCH MEASURES SHOULD ONLY BE INSTALLED IF CONSIDERED APPROPRIATE FOR THE LOCAL CONDITIONS, AND ONLY IF THEIR INSTALLATION IS JUDGED TO PROVIDE A NET OVERALL ENVIRONMENTAL BENEFIT.

3. ALL SETTLED SEDIMENT UPSTREAM SHOULD BE REMOVED PRIOR TO THE DAM'S REMOVAL. DISPOSE OF THE SEDIMENT IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

4. REMOVE ALL MATERIALS USED TO FORM THE EMBANKMENT INCLUDING THE GEOTEXTILE FILTER CLOTH AND DISPOSE OF IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

5. RESTORE THE WATERCOURSE CHANNEL TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILISE AND/OR REVEGETATE ALL DISTURBED AREAS.

Drawn:	Date:		
GMW	Feb-10	Rock Filter Dam (Instream)	RFD-04

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE THAT THE INSTALLATION OF THE SEDIMENT TRAP WILL NOT CAUSE UNDESIRABLE SAFETY OR FLOODING ISSUES.

3. INSTALL SEDIMENT TRAP IN ACCORDANCE WITH STANDARD DRAWING SUPPLIED WITH THE APPROVED PLAN, OR AS DIRECTED BY THE SITE SUPERVISOR.

4. ENSURE THE SEDIMENT TRAP FULLY ENCLOSES THE KERB INLET. USE APPROPRIATE SPACERS TO ENSURE THE SEDIMENT TRAP DOES NOT BLOCK THE SIDE-ENTRY INLET.

5. IF NECESSARY, INSTALL ADDITIONAL 'ON-GRADE KERB INLET SEDIMENT TRAPS' UP-SLOPE OF THE SAG INLET TO ADEQUATELY RETAIN THE EXPECTED QUANTITY OF SEDIMENT RUNOFF.

6. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. INSPECT ALL SEDIMENT TRAPS DAILY AND IMMEDIATELY AFTER RUNOFF-PRODUCING RAINFALL. MAKE REPAIRS AS NEEDED.

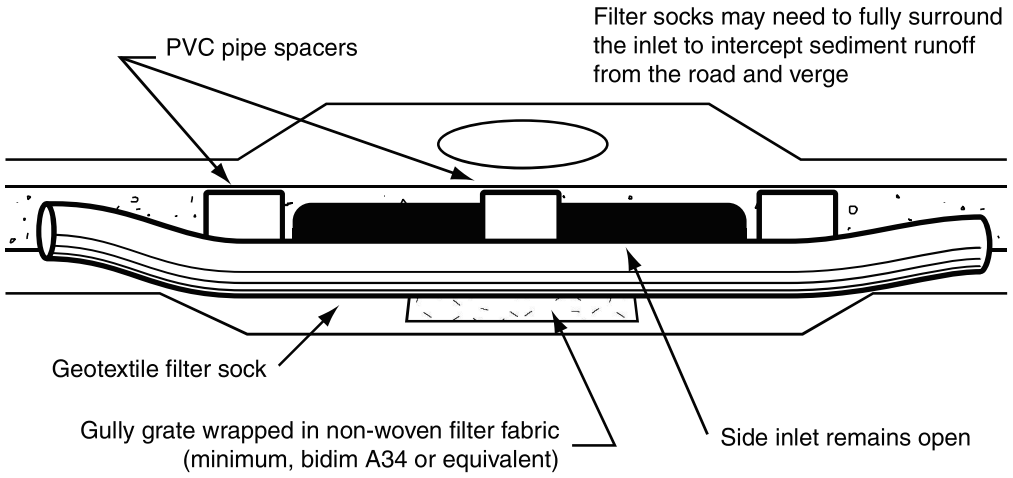
2. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. ENSURE SEDIMENT DOES NOT ENTER THE STORMWATER DRAIN DURING DE-SILTING OPERATIONS AND MAINTENANCE OF THE TRAP.

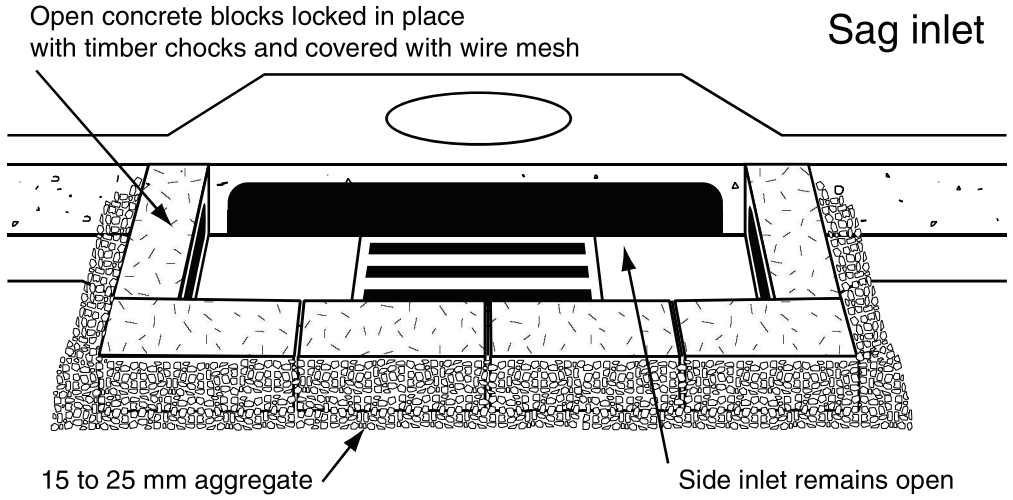
4. SEDIMENT ON THE ROAD SHALL BE REMOVED IMMEDIATELY IF IT REPRESENTS A SAFETY HAZARD.

REMOVAL

1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.



(a) Filter sock sediment trap on a sag inlet



(b) Block and aggregate type sediment trap on a sag inlet

Drawn:	Date:		
GMW	Dec-09	Sag Kerb Inlet Sediment Trap	SA-01

MATERIALS

EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. THIS SPECIFICATION MAYBE REPLACED BY AN EQUIVALENT STANDARD BASED ON THE EXCHANGEABLE SODIUM PERCENTAGE.

RISER PIPE: MINIMUM 250mm DIAMETER.

SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL (d50) ROCK SIZE. LARGE ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM 'BIDIM' A24 OR EQUIVALENT.

CONSTRUCTION

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLANT REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.

2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.

4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.

5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE.

6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.
CUT-OFF TRENCH:

7. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING THE EMBANKMENT.

8. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600mm DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600mm. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).

9. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.

10. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

EMBANKMENT:

11. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.

12. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A SOIL SCIENTIST OR GEOTECHNICAL SPECIALIST.

13. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250mm CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA AND THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.

14. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SEPARATE INSTALLATION SPECIFICATIONS.

15. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.

16. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].

17. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75mm FROM THE SPECIFIED DIMENSIONS.

18. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IS NOT PLACED WITHIN THE EARTH EMBANKMENT.

19. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL ON THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.

20. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.

(continued on SB-06)

Drawn:	Date:		
GMW	Feb-10	Sediment Basins	SB-05

SPILLWAY CONSTRUCTION:

21. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.

22. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.

23. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.

24. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300mm BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300mm OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000mm UPSTREAM OF THE SPILLWAY CREST.

25. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300mm AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.

26. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.

27. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.

28. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

29. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50mm ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.
ESTABLISHMENT OF SETTLING POND:

30. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.

31. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION OR THE RE-SUSPENSION OF SETTLED SEDIMENT.

32. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE APPROVED PLANS). USE AT LEAST A 75mm WIDE POST FIRMLY SET INTO THE BASIN FLOOR.

33. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH, OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.

34. INSTALL ALL APPROPRIATE MEASURES TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED PUBLIC ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

MAINTENANCE OF SEDIMENT BASIN

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:

(i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.

(ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.

(iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON (IF ANY) OTHERWISE AT LEAST FORTNIGHTLY.

(iv) PRIOR TO, AND IMMEDIATELY AFTER, PERIODS OF 'STOP WORK' OR SITE SHUTDOWN.

2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSAL AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.

3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.

4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.

5. CHECK ALL EMBANKMENTS FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.

6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.

7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

REMOVAL OF SEDIMENT BASIN

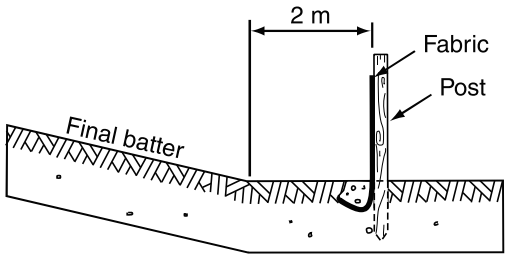
1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED, THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.

2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.

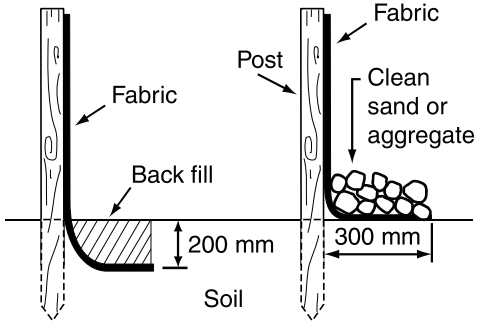
3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

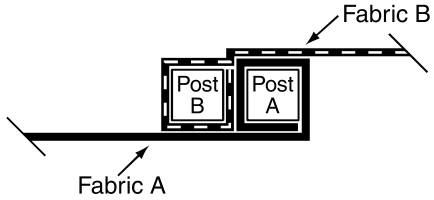
Drawn:	Date:		
GMW	Feb-10	Sediment Basins	SB-06



(a) Location of fence relative to base of slope

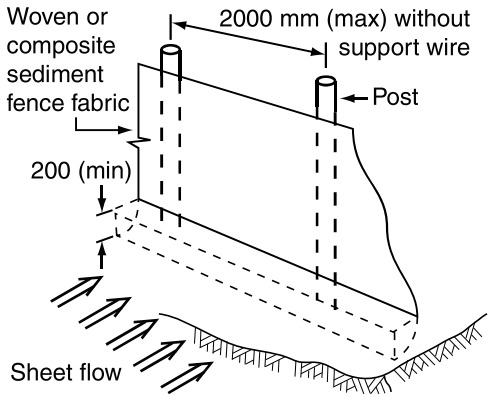


(b) Anchoring base of fabric

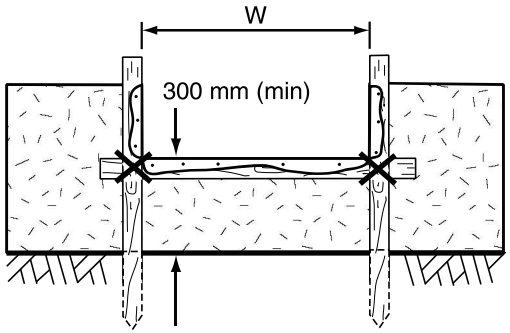


Fabric to fold around each stake one full turn.
Stake B to be drive tightly against Stake A.
The tops of both stakes to be secured with wire.

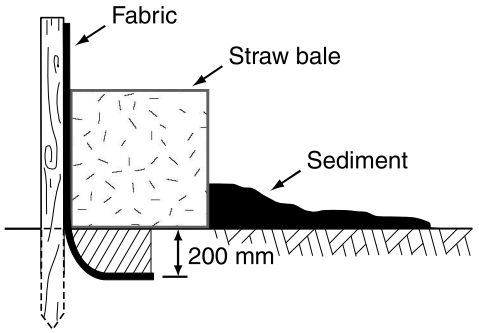
(c) Joining fabric - Method 1



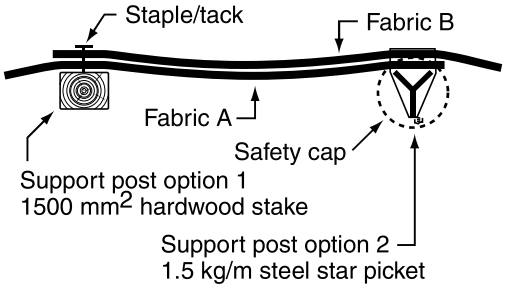
(d) Installation without backing support



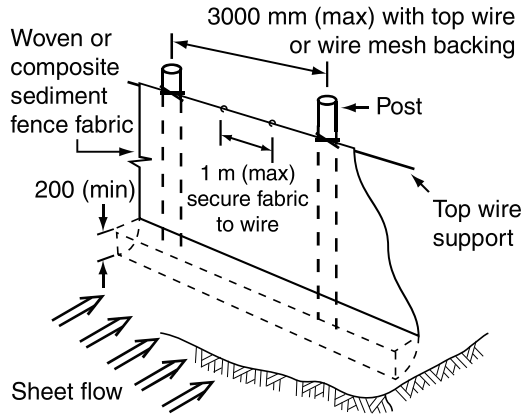
(e) Spill-through weir



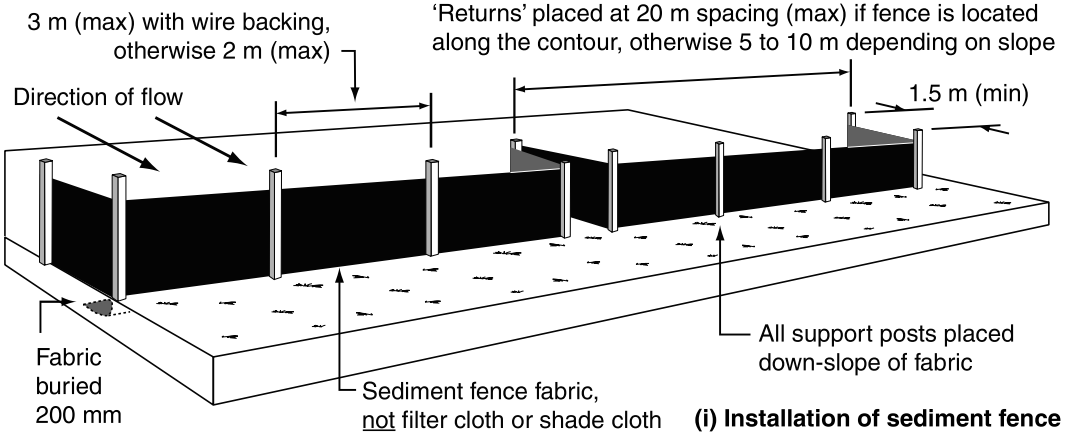
(f) Placement of up-slope straw bale



(g) Joining fabric - Method 2



(h) Installation with top wire support



(i) Installation of sediment fence

Notes:

1. Sediment fence to be installed along a line of constant ground elevation wherever practical.
2. Both end of the sediment fence to extend up the slope at least 1m.
3. Support post to be spaced a maximum 2m unless the fence is supported by a top wire or wire mesh backing, in which case 3m maximum spacing.
4. Fence 'returns' shall be installed at maximum 20m spacing if fence is installed along the contour, otherwise 5 to 10m maximum spacing.
5. Minimum 4 staples or tie wires per stake.

Drawn:	Date:		
GMW	Dec-09	Sediment Fence	SF-01

MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140GSM. ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. TO THE MAXIMUM DEGREE PRACTICAL, AND WHERE THE PLANS ALLOW, ENSURE THE FENCE IS LOCATED:
(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;
(ii) ALONG A LINE OF CONSTANT ELEVATION WHEREVER PRACTICAL;
(iii) AT LEAST 2m FROM THE TOE OF ANY FILLING OPERATIONS THAT MAY RESULT IN SHIFTING SOIL/FILL DAMAGING THE FENCE.

3. INSTALL RETURNS WITHIN THE FENCE AT MAXIMUM 20m INTERVALS IF THE FENCE IS INSTALLED ALONG THE CONTOUR, OR 5 TO 10m MAXIMUM SPACING (DEPENDING ON SLOPE) IF THE FENCE IS INSTALLED AT AN ANGLE TO THE CONTOUR. THE 'RETURNS' SHALL CONSIST OF EITHER:
(i) V-SHAPED SECTION EXTENDING AT LEAST 1.5m UP THE SLOPE; OR
(ii) SANDBAG OR ROCK/AGGREGATE CHECK DAM A MINIMUM 1/3 AND MAXIMUM 1/2 FENCE HEIGHT, AND EXTENDING AT LEAST 1.5m UP THE SLOPE.

4. ENSURE THE EXTREME ENDS OF THE FENCE ARE TURNED UP THE SLOPE AT LEAST 1.5m, OR AS NECESSARY, TO MINIMISE WATER BYPASSING AROUND THE FENCE.

5. ENSURE THE SEDIMENT FENCE IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE FENCE, AND THE UNDESIRABLE DISCHARGE OF WATER AROUND THE ENDS OF THE FENCE.

6. IF THE SEDIMENT FENCE IS TO BE INSTALLED ALONG THE EDGE OF EXISTING TREES, ENSURE CARE IS TAKEN TO PROTECT THE TREES AND THEIR ROOT SYSTEMS DURING INSTALLATION OF THE FENCE. DO NOT ATTACH THE FABRIC TO THE TREES.

7. UNLESS DIRECTED BY THE SITE SUPERVISOR OR THE APPROVED PLANS, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE PROPOSED FENCE LINE, PLACING THE EXCAVATED MATERIAL ON THE UP-SLOPE SIDE OF THE TRENCH.

8. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 3m IF SUPPORTED BY A TOP SUPPORT WIRE OR WEIR MESH BACKING, OTHERWISE NO GREATER THAN 2m.

9. IF SPECIFIED, SECURELY ATTACH THE SUPPORT WIRE OR MESH TO THE UP-SLOPE SIDE OF THE STAKES WITH THE MESH EXTENDING AT LEAST 200mm INTO THE EXCAVATED TRENCH. ENSURE THE MESH AND FABRIC IS ATTACHED TO THE UP-SLOPE SIDE OF THE STAKES EVEN WHEN DIRECTING A FENCE AROUND A CORNER OR SHARP CHANGE OF DIRECTION.

10. WHEREVER POSSIBLE, CONSTRUCT THE SEDIMENT FENCE FROM A CONTINUOUS ROLL OF FABRIC. TO JOIN FABRIC EITHER:
(i) ATTACH EACH END TO TWO OVERLAPPING STAKES WITH THE FABRIC FOLDING AROUND THE ASSOCIATED STAKE ONE TURN, AND WITH THE TWO STAKES TIED TOGETHER WITH WIRE; OR
(ii) OVERLAP THE FABRIC TO THE NEXT ADJACENT SUPPORT POST.

11. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS USING 25 X 12.5mm STAPLES, OR TIE WIRE AT MAXIMUM 150mm SPACING.

12. SECURELY ATTACH THE FABRIC TO THE SUPPORT WIRE/MESH (IF ANY) AT A MAXIMUM SPACING OF 1m.

13. ENSURE THE COMPLETED SEDIMENT FENCE IS AT LEAST 450mm, BUT NOT MORE THAN 700mm HIGH. IF A SPILL-THOUGH WEIR IS INSTALLED, ENSURE THE CREST OF THE WEIR IS AT LEAST 300mm ABOVE GROUND LEVEL.

14. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

ADDITIONAL REQUIREMENTS FOR THE INSTALLATION OF A SPILL-THROUGH WEIR

1. LOCATE THE SPILL-THROUGH WEIR SUCH THAT THE WEIR CREST WILL BE LOWER THAN THE GROUND LEVEL AT EACH END OF THE FENCE.

2. ENSURE THE CREST OF THE SPILL-THROUGH WEIR IS AT LEAST 300mm THE GROUND ELEVATION.

3. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE SUPPORT POSTS/ STAKES EACH SIDE OF THE WEIR. CUT THE FABRIC DOWN THE SIDE OF EACH POST AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

4. INSTALL A SUITABLE SPLASH PAD AND/OR CHUTE IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION AND APPROPRIATELY DISCHARGE THE CONCENTRATED FLOW PASSING OVER THE WEIR.

MAINTENANCE

1. INSPECT THE SEDIMENT FENCE AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. IF THE FENCE IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 1/3 THE HEIGHT OF THE FENCE.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS 6-MONTHS.

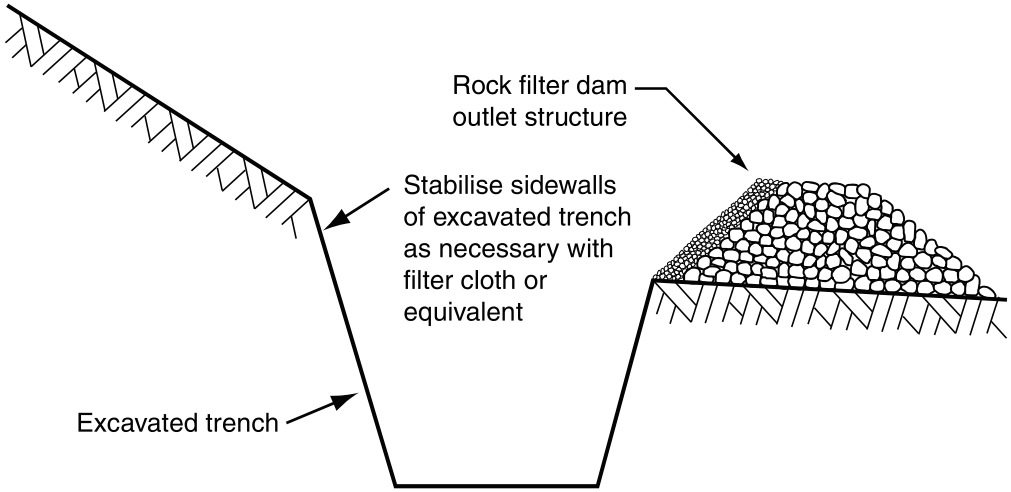
REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT FENCE ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE FENCE MUST BE REMOVED.

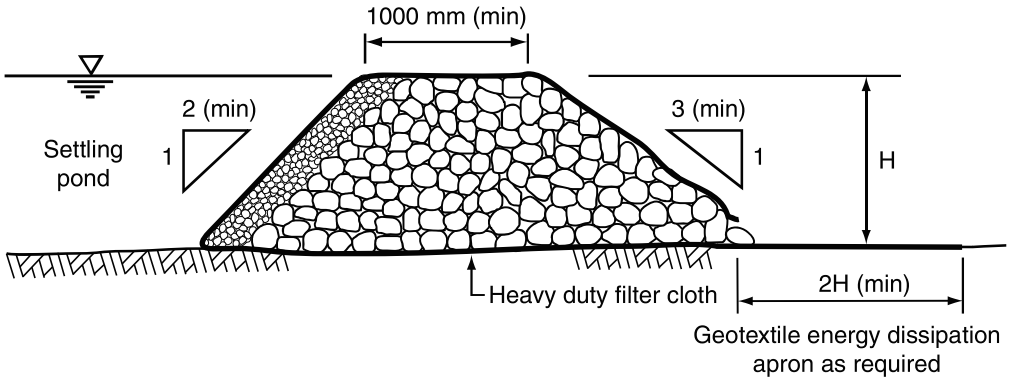
2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

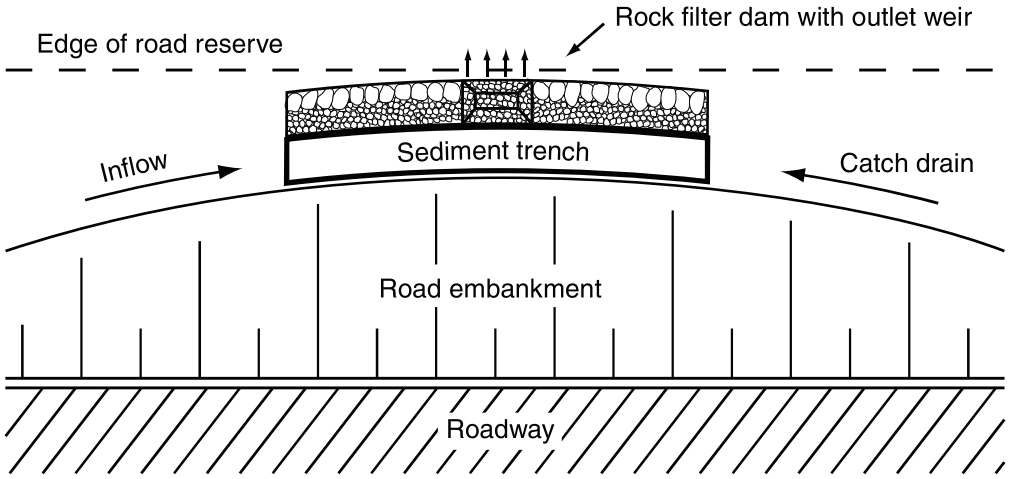
Drawn:	Date:		
GMW	Apr-10	Sediment Fence	SF-02



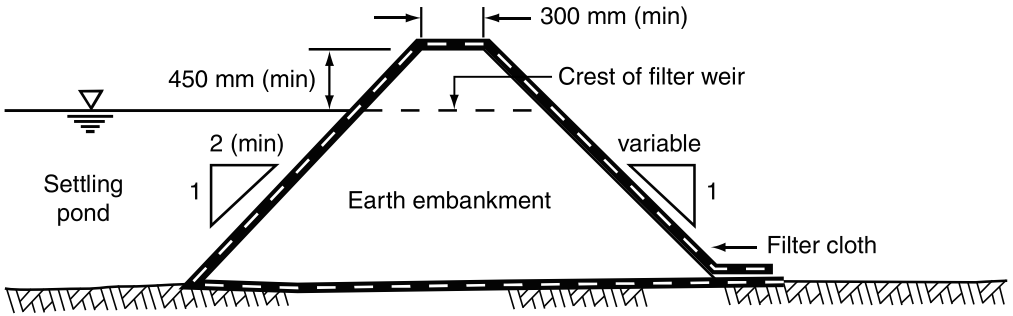
(a) Sediment trench with rock filter dam outlet



(b) Rock filter dam outlet structure



(c) Typical layout of sediment trench at base of fill embankment



(d) Typical cross-section of adjoining earth abutments (if required)

Drawn:	Date:		
GMW	Feb-10	Sediment Trench	SS-01

MATERIALS
EMBANKMENT CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm FOR EMBANKMENTS HIGHER THAN 0.5m.

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.

INSTALLATION
1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE FOUNDATION AREA OF THE OUTLET STRUCTURE OF WOODY VEGETATION AND ORGANIC MATTER. DELAY CLEARING THE UP-SLOPE SETTLING POND AREA UNTIL THE OUTLET STRUCTURE IS FORMED.

3. CONSTRUCT THE ASSOCIATED EARTH ABUTMENT (IF ANY). ALL CUT AND FILL SLOPES SHOULD BE 2:1(H:V) OR FLATTER. THE DOWNSTREAM FACE OF EARTH ABUTMENTS SHOULD BE 3:1(H:V) OR FLATTER. EARTH ABUTMENTS SHOULD BE CONSTRUCTED OF WELL-COMPACTED, EROSION RESISTANT SOIL THAT IS FREE OF VEGETATION AND ROOTS.

4. IF A ROCK FILTER DAM OUTLET STRUCTURE IS USED, THEN PLACE THE CORE ROCK FOR THE OUTLET STRUCTURE. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.

5. IF A SEDIMENT WEIR OUTLETSTRUCTURE OR FILTER TUBE DAM OUTLET STRUCTURE IS USED, THEN REFER TO THE RELEVANT INSTALLATION SPECIFICATIONS.

6. IF SPECIFIED, CONSTRUCT THE SPILLWAY SECTION USING THE SPECIFIED ARMOUR ROCK. THE SPILLWAY SHOULD HAVE A MINIMUM PROFILE DEPTH OF 300mm. THE SPILLWAY WEIR CREST MUST BE LEVEL ACROSS ITS FULL WIDTH. THE MAXIMUM LONGITUDINAL SLOPE OF THE ROCK SPILLWAY SHOULD BE 3:1(H:V)..

7. ENSURE THE SPILLWAY OUTLET SECTION EXTENDS DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REACHED, OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER. THE EDGES OF THE SPILLWAY SHOULD BE LEFT FLUSH WITH THE SURROUNDING GROUND.

8. INSTALL THE SPECIFIED FILTER SYSTEM ON THE UPSTREAM FACE OF THE OUTLET STRUCTURE.

9. IF FILTER CLOTH IS USED, THEN EXTEND THE FABRIC OVER THE CREST OF THE OUTLET STRUCTURE INTO THE SPILLWAY CHUTE.

10. STABILISE ANY ASSOCIATED EARTH EMBANKMENTS IMMEDIATELY AFTER CONSTRUCTION THROUGH APPROPRIATE COMPACTION, VEGETATION AND/OR EROSION CONTROL MATTING.

11. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

12. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE
1. CHECK ALL SEDIMENT TRENCHES AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT ALL EMBANKMENTS FOR UNDERCUTTING OR UNDESIRABLE SEEPAGE FLOWS.

3. IDEALLY, SEDIMENT TRENCHES SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAY BE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.

4. IF FLOW THROUGH THE SEDIMENT TRENCH IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.

5. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.

6. CHECK THE STRUCTURE AND DISCHARGE AREA FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.

7. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE SPILLWAY.

8. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.

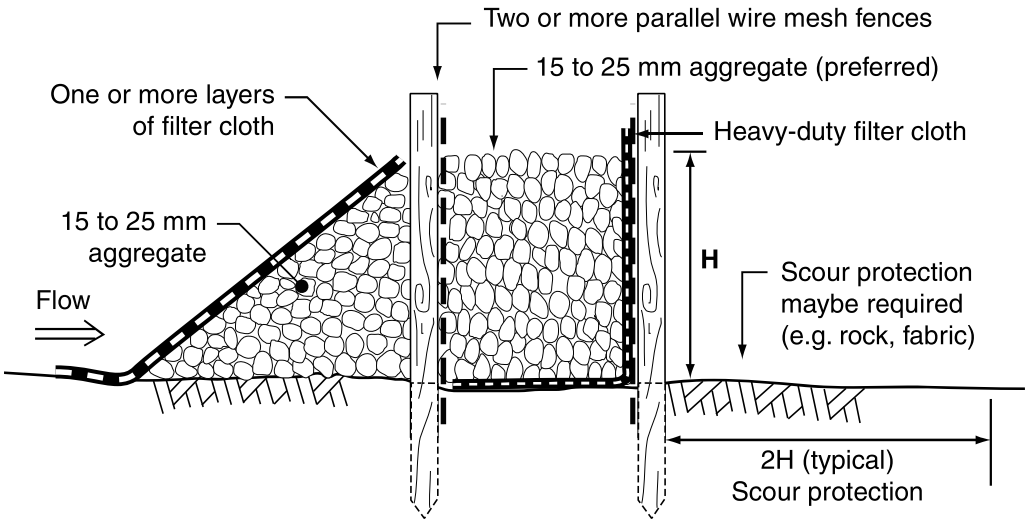
9. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL
1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

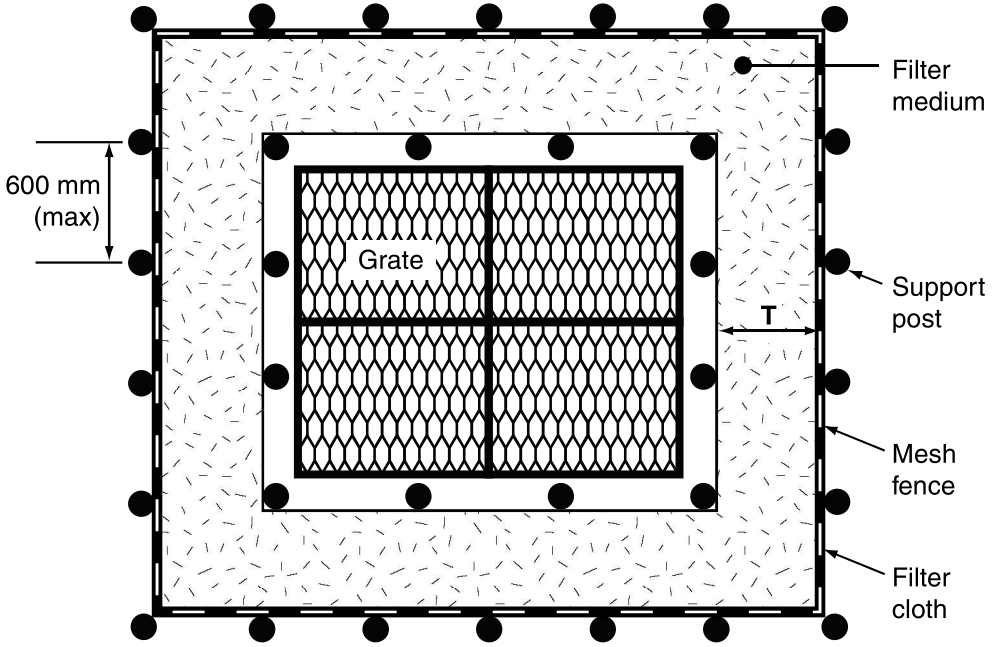
2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE SETTLING POND PRIOR TO THE SEDIMENT TRAP'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED TO MINIMISE THE EROSION HAZARD.

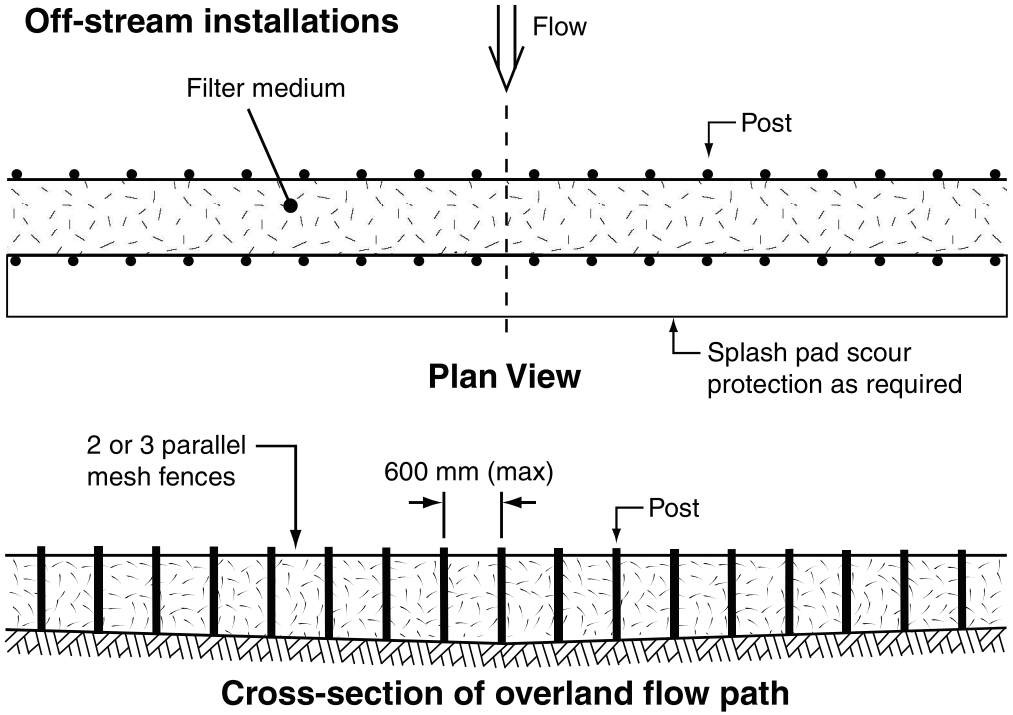
Drawn:	Date:		
GMW	Feb-10	Sediment Trench	SS-02



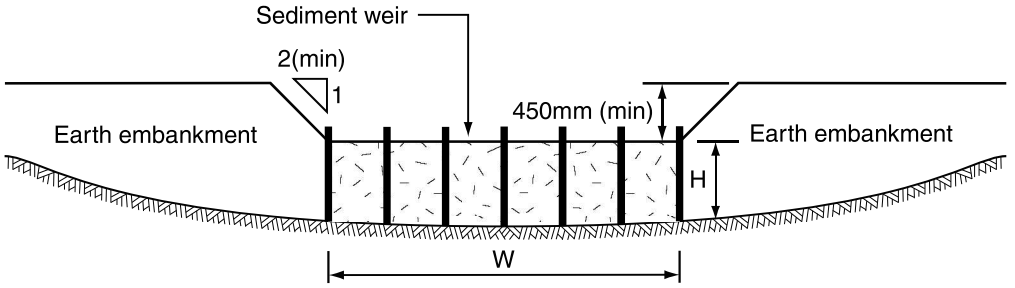
(a) Sediment weir with aggregate and geotextile filter



(c) Sediment weir drop inlet protection (plan view)



(b) Typical installation of an off-stream sediment weir



(d) Sediment weir with constructed earth abutments

Drawn:	Date:		
GMW	Feb-10	Sediment Weir (Off-stream)	SW-01

MATERIALS

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING WIRE MESH.

WIRE MESH: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

PRIMARY CORE ROCK: 15 TO 75mm ROUND OR CRUSHED (ANGULAR) ROCK.

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.

WOVEN FLOW CONTROL FABRIC: MINIMUM UNIT WEIGHT OF 140GSM, WITH ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE.

ARMOUR ROCK (SPLASH PAD): WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE NOT LESS THAN 225mm.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. IF REQUIRED, ESTABLISH AN ACCESS TRACK TO THE SEDIMENT TRAP FOR CONSTRUCTION PURPOSES AND ONGOING MAINTENANCE. CLEAR ONLY THOSE AREAS NECESSARY TO COMPLETE THE IMMEDIATE WORKS.

3. CLEAR THE FOUNDATION AREA OF THE SEDIMENT WEIR OF WOODY VEGETATION AND ORGANIC MATTER. DELAY CLEARING THE UP-SLOPE POND AREA UNTIL THE WEIR IS FORMED AND IS ABLE TO ACT AS A SUITABLE SEDIMENT TRAP.

4. IF SPECIFIED ON THE PLANS, EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE-LINE OF THE EARTH ABUTMENTS (IF ANY).

5. COVER THE FOUNDATION AREA AND CUT-OFF TRENCH WITH HEAVY-DUTY FILTER FABRIC. OVERLAP ADJOINING FABRIC SHEETS A MINIMUM OF 600mm AT ALL JOINTS.

6. INSTALL THE SUPPORT POSTS AT A MAXIMUM 600mm CENTRES, AND ATTACH THE WIRE MESH TO THE INSIDE OF THE POSTS. INSTALL THE PARALLEL WIRE MESH FENCES AT THE SPACING AND NUMBER SPECIFIED IN THE APPROVED PLANS.

7. PLACE FILTER CLOTH AND/OR WOVEN FABRIC (AS SPECIFIED) ON THE UPSTREAM SIDE OF THE MOST DOWNSTREAM FENCE.

8. INSTALL THE INTERNAL FILTER MEDIUM BETWEEN THE PARALLEL FENCES. IF AGGREGATE IS USED, IT SHOULD BE PLACED IN MAXIMUM 400mm LIFTS. AFTER EACH 400mm LIFT, LACE DIAGONAL SUPPORT POSTS TOGETHER USING FENCING WIRE TO IMPROVE STABILITY OF THE WEIR. REPEAT THIS PROCESS UNTIL THE WEIR REACHES THE SPECIFIED HEIGHT.

9. CONSTRUCT THE ASSOCIATED EARTH ABUTMENT (IF ANY). ALL CUT AND FILL SLOPES SHOULD BE 2:1(H:V) OR FLATTER. THE DOWNSTREAM FACE OF EARTH ABUTMENTS SHOULD BE 3:1(H:V) OR FLATTER. EARTH ABUTMENTS SHOULD BE CONSTRUCTED OF WELL-COMPACTED, EROSION RESISTANT SOIL THAT IS FREE OF VEGETATION AND ROOTS. OVERFILL EARTH ABUTMENTS 150mm TO ALLOW FOR SETTLEMENT.

10. INSTALL THE SPECIFIED UPSTREAM FILTER MATERIAL TO THE UPSTREAM FACE OF THE SEDIMENT WEIR. IF FABRIC FILTER IS TO BE USED, CONSIDER ATTACHING SEVERAL LAYERS OF FILTER CLOTH, THUS ALLOWING EACH LAYER TO BE PROGRESSIVELY REMOVED AS THE FABRIC HAS BECOME BLOCKED WITH SEDIMENT. THE AGGREGATE FILTER SHOULD BE FORMED AGAINST THE SEDIMENT WEIR FRAME AT A SLOPE OF 2:1 (H:V) OR FLATTER.

11. CLEAR THE SETTLING POND AREA OF WOODY VEGETATION AND ORGANIC MATTER TO THE DIMENSIONS SPECIFIED WITHIN THE PLANS.

12. WHERE NECESSARY, EXCAVATE THE UPSTREAM SETTLING POND AND/OR SEDIMENT STORAGE PIT IN ACCORDANCE WITH THE APPROVED PLANS. EXCAVATED PITS TYPICALLY HAVE SIDE SLOPES OF 2:1(H:V) OR FLATTER UNLESS STEEPER SLOPES ARE KNOWN TO BE STABLE.

13. IF OVERTOPPING FLOOD FLOWS ARE POSSIBLE DURING OPERATION OF THE SEDIMENT WEIR, THEN CONSTRUCT AN APPROPRIATE SPLASH PAD DOWNSTREAM OF THE WEIR TO CONTROL SOIL EROSION.

14. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

15. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. CHECK ALL SEDIMENT WEIRS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT ALL EMBANKMENTS FOR UNDERCUTTING OR UNDESIRABLE SEEPAGE FLOWS.

3. IDEALLY, SEDIMENT WEIRS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAY BE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.

4. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.

5. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.

6. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.

7. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE DOWNSTREAM SPLASH PAD.

8. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.

9. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

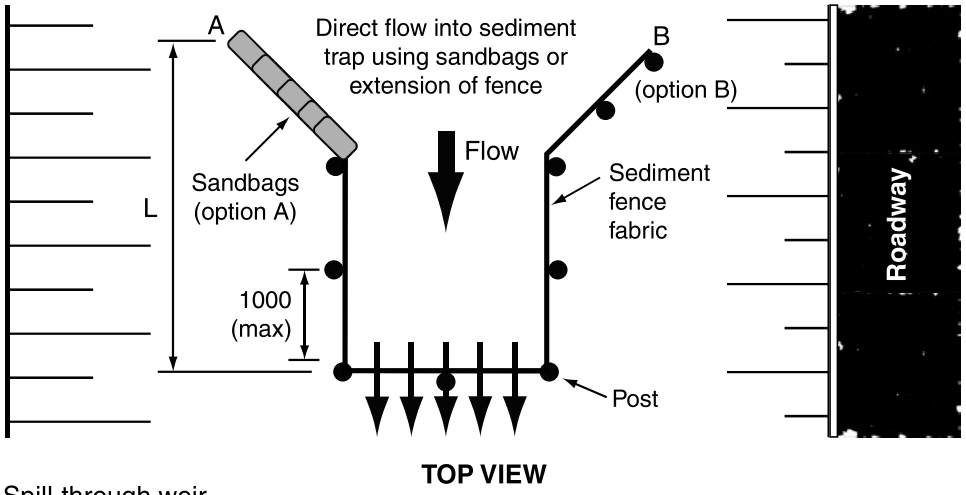
REMOVAL

1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

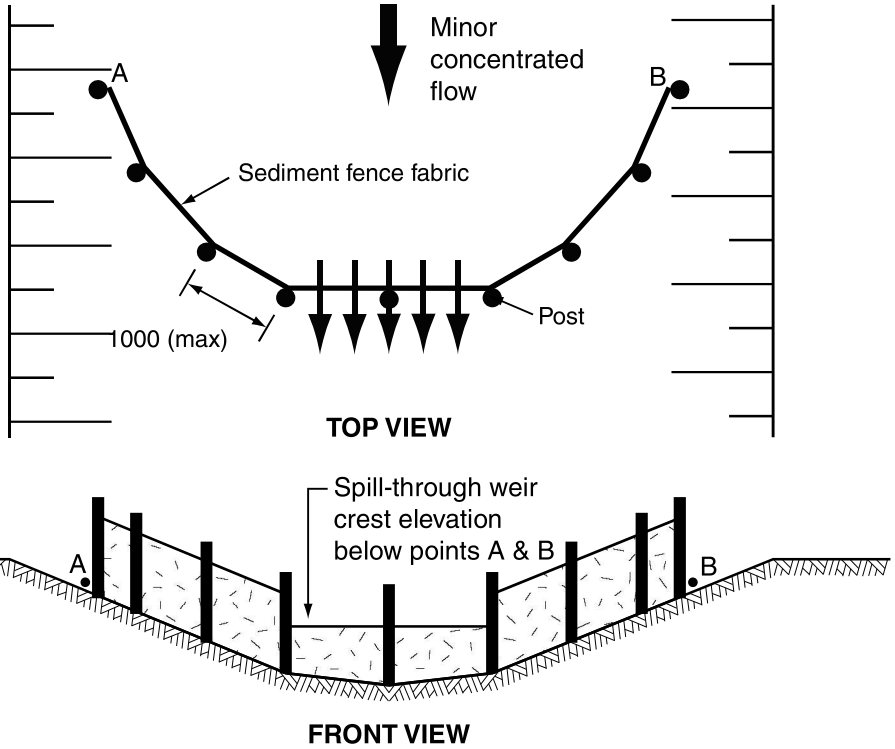
2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE SETTLING POND PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED TO MINIMISE THE EROSION HAZARD.

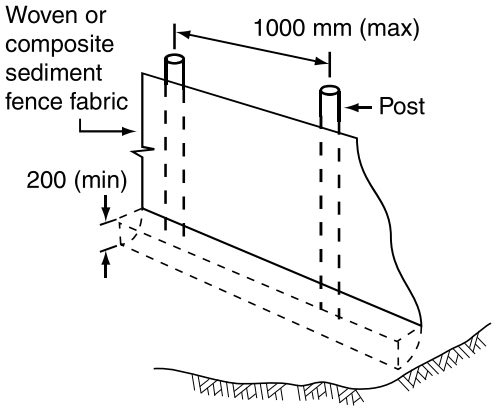
Drawn:	Date:		
GMW	Apr-10	Sediment Weir (Off-stream)	SW-02



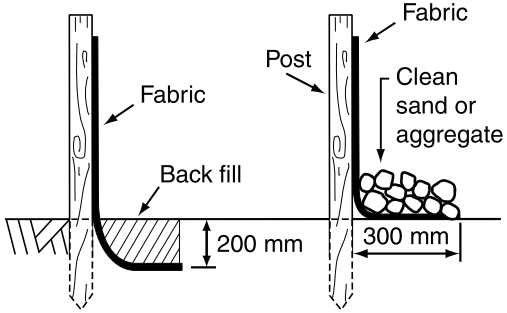
(a) Type AU 'narrow' sediment trap



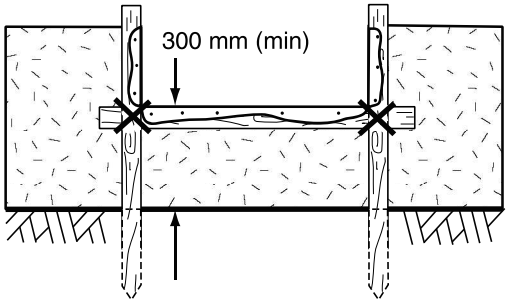
(b) Type BU 'wide' sediment trap



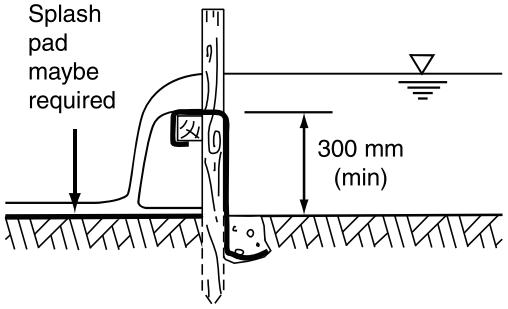
(c) Spacing of support posts



(d) Trenching of fabric



(e) Spill-through weir



(f) Sectional view of weir

Drawn:	Date:		
GMW	Apr-10	U-Shaped Sediment Trap	UST-01

MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140g/m^2. ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: (IF USED) WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. INSTALL THE FABRIC IN A U-SHAPE, EXTENDING THE WING WALLS EITHER UP THE SIDE SLOPES AND/OR UP THE CHANNEL INVERT (AS DIRECTED) TO A POINT WHERE THE GROUND LEVEL IS AT LEAST 100mm HIGHER THAN THE CREST OF THE SPILL-THROUGH WEIR.

3. ENSURE THAT THE EXPECTED CHANNEL FLOW WILL ENTER THE SEDIMENT TRAP, EITHER BY EXTENDING THE WING WALLS UP THE BANK SLOPE, OR CONSTRUCTING SANDBAG FLOW DIVERSION BANKS.

4. UNLESS DIRECTED BY THE SITE SUPERVISOR, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE ALIGNMENT OF THE SPILL-THROUGH WEIR AND WING WALLS.

5. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 1m.

6. CONSTRUCT THE SEDIMENT TRAP FROM A CONTINUOUS ROLL OF FABRIC.

7. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS/STAKES USING 25mm STAPLES OR TIE WIRE AT MAXIMUM 150mm SPACING WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.

8. INSTALL A SPILL-THOUGH WEIR AT THE LOWEST POINT IN THE FENCE. THE WEIR MUST BE AT LEAST 300mm ABOVE ADJACENT GROUND LEVEL, AND BELOW THE LOWEST GROUND LEVEL AT THE ENDS OF THE WING WALLS.

9. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE ADJACENT SUPPORT POSTS. CUT THE FABRIC DOWN THE SIDE OF THE POSTS AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

10. IF DIRECTED, INSTALL A SUITABLE SPLASH PAD IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION DOWNSTREAM OF THE SEDIMENT TRAP.

11. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

MAINTENANCE

1. INSPECT THE SEDIMENT TRAP AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.
4. IF THE FABRIC IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS/STAKES.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 150mm.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS SIX MONTHS.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT TRAP ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE SEDIMENT TRAP MUST BE REMOVED.

2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

Drawn:	Date:		
GMW	Apr-10	U-Shaped Sediment Trap	UST-02

Appendix D: Erosion Hazard Assessment

Erosion Hazard Assessment Form

Condition	Points	Score	Trigger value
AVERAGE SLOPE OF DISTURBANCE AREA [1]			
• not more than 3% [3% . 33H:1V]	0		
• more than 3% but not more than 5% [5% = 20H:1V]	1	2	**4**
• more than 5% but not more than 10% [10% = 10H:1V]	2		
• more than 10% but not more than 15% [15% . 6.7H:1V]	4		
• more than 15%	6		
SOIL CLASSIFICATION GROUP (AS1726) [2]			
• GW, GP, GM, GC	0		
• SW, SP, OL, OH	1	3	
• SM, SC, MH, CH	2		
• ML, CL, or if *imported fill* is used, or if soils are untested	3		
EMERSON (DISPERSION) CLASS NUMBER [3]			
• Class 4, 6, 7, or 8	0		
• Class 5	2	4	**6**
• Class 3, (default value if soils are untested)	4		
• Class 1 or 2	6		
DURATION OF SOIL DISTURBANCE [4]			
• not more than 1 month	0		
• more than 1 month but not more than 4 months	2	6	**6**
• more than 4 months but not more than 6 months	4		
• more than 6 months	6		
AREA OF DISTURBANCE [5]			
• not more than 1000 m^2	0		
• more than 1000 m^2 but not more than 5000 m^2	1	6	**4**
• more than 5000 m^2 but not more than 1 ha	2		
• more than 1 ha but not more than 4 ha	4		
• more than 4 ha	6		
WATERWAY DISTURBANCE [6]			
• No disturbance to a watercourse, open drain or channel	0	2	**2**
• Involves disturbance to a constructed open drain or channel	1		
• Involves disturbance to a natural watercourse	2		
REHABILITATION METHOD [7]			
Percentage of area (relative to total disturbance) revegetated by seeding without light mulching (i.e. worst-case revegetation method).			
• not more than 1%	0	4	
• more than 1% but not more than 5%	1		
• more than 5% but not more than 10%	2		
• more than 10%	4		
RECEIVING WATERS [8]			
• Saline waters only	0	2	
• Freshwater body (e.g. creek or freshwater lake or river)	2		
SUBSOIL EXPOSURE [9]			
• No subsoil exposure except of service trenches	0	2	
• Subsoils are likely to be exposed	2		
EXTERNAL CATCHMENTS [10]			
• No external catchment	0	2	
• External catchment diverted around the soil disturbance	1		
• External catchment not diverted around the soil disturbance	2		
ROAD CONSTRUCTION [11]			
• No road construction	0	2	
• Involves road construction works	2		
pH OF SOILS TO BE REVEGETATED [12]			
• more than pH 5.5 but less than pH 8	0	1	
• other pH values, or if soils are untested	1		
Total Score [13]		36	

Appendix E: Erosion & Sediment Control Checklist

Weekly Site Inspection

LOCATION .....

INSPECTION OFFICER .....**DATE** .....

SIGNATURE .....

Legend: 4 OK 7 Not OK N/A Not applicable

Item	Consideration	Assessment
1	Public roadways clear of sediment.	.....
2	Entry/exit pads clear of excessive sediment deposition.	.....
3	Entry/exit pads have adequate void spacing to trap sediment.	.....
4	The construction site is clear of litter and unconfined rubbish.	.....
5	Adequate stockpiles of emergency ESC materials exist on site.	.....
6	Site dust is being adequately controlled.	.....
7	Appropriate drainage and sediment controls have been installed prior to new areas being cleared or disturbed.	.....
8	Up-slope "clean" water is being appropriately diverted around/through the site.	.....
9	Drainage lines are free of soil scour and sediment deposition.	.....
10	No areas of exposed soil are in need of erosion control.	.....
11	Earth batters are free of "rill" erosion.	.....
12	Erosion control mulch is not being displaced by wind or water.	.....
13	Long-term soil stockpiles are protected from wind, rain and stormwater flow with appropriate drainage and erosion controls.	.....
14	Sediment fences are free from damage.	.....
15	Sediment-laden stormwater is not simply flowing "around" the sediment fences or other sediment traps.	.....
16	Sediment controls placed up-slope/around stormwater inlets are appropriate for the type of inlet structure.	.....
17	All sediment traps are free of excessive sediment deposition.	.....
18	The settled sediment layer within a sediment basin is clearly visible through the supernatant prior to discharge such water.	.....
19	All reasonable and practicable measures are being taken to control sediment runoff from the site.	.....
20	All soil surfaces are being appropriately prepared (i.e. pH, nutrients, roughness and density) prior to revegetation.	.....
21	Stabilised surfaces have a minimum 70% soil coverage.	.....
22	The site is adequately prepared for imminent storms.	.....
23	All ESC measures are in proper working order.	.....

Appendix F: Soil Loss Calculations

RUSLE Soil Loss Calculations

PROJECT:- Kalfresh - Bulk Earthworks

DESIGNER:- CD

JOB No:- 510357

DATE:- 21/Feb/23

RUSLE Calculations

	Catchment ID															
	C_2A	C_2B	C_2C	C_2D	C_2E	C_2F	C_2G	C_2H	C_2I	C_2J	C_2K	C_2L	C_2M	C_2N	C_2O	C_2P
Period	Annual															
S	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
R (calculated)	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9
R (from IECA BPESC App E for Brisbane)	3705	3705	3705	3705	3705	3705	3705	3705	3705	3705	3705	3705.0	3705.0	3705.0	3705.0	3705.0
R (adopted)	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9	2857.9
K	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
LS - Area 1	0.19	0.19	0.19	0.17	0.19	0.19	0.19	0.19	0.19	0.19	0.885	1.88	3.28	2.97	1.51	1.51
Length	80m	80m	80m	5m	80m	80m	80m	80m	80m	80m	15m	10m	50m	50m	50m	50m
Slope	1.0%	1.0%	1.0%	3.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	10.0%	25.0%	14.0%	13.0%	8.0%	8.0%
Area (m^2)	35670	39220	31255	6280	27405	20072	20162	15706	54008	49711	14600	2546	36598	40433	57393	9711
LS - Area 2	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.665	0.09	0.09	0.09	0.09	0.09
Length	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m	5m
Slope	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	15.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Area (m^2)	0	0	0	0	0	0	0	0	0	0	14600	0	0	0	0	0
LS - Combined	0.19	0.19	0.19	0.17	0.19	0.19	0.19	0.19	0.19	0.19	0.78	1.88	3.28	2.97	1.51	1.51
P	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
C	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A - Soil Loss (tonnes/ha/yr)	36.4	36.4	36.4	32.6	36.4	36.4	36.4	36.4	36.4	36.4	148.6	360.4	628.8	569.4	289.5	289.5
Area (m^2)	35670	39220	31255	6280	27405	20072	20162	15706	54008	49711	29199	2546	36598	40433	57393	9711
Minimum Sediment Trap Type	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1

Appendix G: Sediment Control Device Conceptual Sizing

TYPE B SEDIMENT BASIN SUMMARY

PROJECT:- Kalfresh - Bulk Earthworks **DESIGNER:-** CD

JOB No:- 510357 **DATE:-** 21/02/2023

TYPE B SEDIMENT BASIN DETAILS

DEVICE ID	CONTRIBUTING CATCHMENT ID	CATCHMENT AREA	SIDE BATTERS	LENGTH @ MID DEPTH OF BASIN SETTLING ZONE	WIDTH @ MID DEPTH OF BASIN SETTLING ZONE	BASIN AREA @ MID DEPTH OF SETTLING ZONE	SETTLING ZONE DEPTH	SEDIMENT STORAGE DEPTH	TOTAL DEPTH FROM SPILLWAY	SETTLING ZONE VOLUME	SEDIMENT ZONE STORAGE VOLUME	TOTAL BASIN STORAGE VOLUME	INLET ZONE LENGTH AT TOP LEVEL	INLET ZONE WIDTH AT TOP LEVEL	INLET ZONE DEPTH	EMERGENCY SPILLWAY LENGTH	Q20 SPILLWAY DEPTH	FREEBOARD
SB-2A	C_2A	3.54ha	1in3	90m	30m	2685m²	0.50m	0.20m	0.70m	1343m³	403m³	1745m³	9m	31m	1.0m	30.0m	0.08m	0.3m
SB-2B	C_2B	3.92ha	1in3	93m	31m	2904m²	0.52m	0.20m	0.72m	1510m³	453m³	1963m³	9m	33m	1.0m	31.0m	0.09m	0.3m
SB-2C	C_2C	3.13ha	1in3	84m	28m	2373m²	0.50m	0.20m	0.70m	1186m³	356m³	1542m³	9m	30m	1.0m	28.0m	0.08m	0.3m
SB-2E	C_2E	2.74ha	1in3	77m	26m	1978m²	0.50m	0.20m	0.70m	989m³	297m³	1285m³	8m	27m	1.0m	26.0m	0.07m	0.3m
SB-2F	C_2F	2.01ha	1in3	67m	22m	1486m²	0.50m	0.20m	0.70m	743m³	223m³	966m³	7m	24m	1.0m	22.0m	0.07m	0.3m
SB-2G	C_2G	2.02ha	1in3	68m	23m	1531m²	0.50m	0.20m	0.70m	765m³	230m³	995m³	7m	24m	1.0m	23.0m	0.07m	0.3m
SB-2H	C_2H	1.57ha	1in3	60m	20m	1192m²	0.50m	0.20m	0.70m	596m³	179m³	775m³	6m	21m	1.0m	20.0m	0.06m	0.3m
SB-2I	C_2I	5.40ha	1in3	110m	37m	3999m²	0.61m	0.20m	0.81m	2439m³	732m³	3171m³	11m	38m	1.0m	37.0m	0.09m	0.3m
SB-2J	C_2J	4.97ha	1in3	100m	33m	3342m²	0.56m	0.20m	0.76m	1872m³	561m³	2433m³	10m	35m	1.0m	33.0m	0.09m	0.3m

TYPE A SEDIMENT BASIN SUMMARY

PROJECT:- Kalfresh - Bulk Earthworks **DESIGNER:-** CD

JOB No:- 510357 **DATE:-** 21/02/2023

TYPE A SEDIMENT BASIN DETAILS

DEVICE ID	CONTRIBUTING CATCHMENT ID	CATCHMENT AREA	SIDE BATTERS	LENGTH @ MID DEPTH OF BASIN SETTLING ZONE	WIDTH @ MID DEPTH OF BASIN SETTLING ZONE	BASIN AREA @ MID DEPTH OF SETTLING ZONE	SETTLING ZONE DEPTH	FREE WATER DEPTH	SEDIMENT STORAGE DEPTH	TOTAL DEPTH FROM SPILLWAY	SETTLING ZONE VOLUME	SEDIMENT ZONE STORAGE VOLUME	FREE WATER ZONE STORAGE	TOTAL BASIN STORAGE VOLUME	INLET ZONE LENGTH AT TOP LEVEL	INLET ZONE WIDTH AT TOP LEVEL	INLET ZONE DEPTH	EMERGENCY SPILLWAY LENGTH	Q20 SPILLWAY DEPTH	FREEBOARD	No. OF DECANT ARMS
SB-2M	C_2M	3.66ha	1in3	50m	17m	848m²	0.60m	0.20m	0.25m	1.05m	509m³	153m³	138m³	799m³	5m	19m	1.0m	17.0m	0.14m	0.3m	8
SB-2N	C_2N	4.04ha	1in3	53m	18m	936m²	0.60m	0.20m	0.25m	1.05m	562m³	169m³	154m³	885m³	5m	19m	1.0m	18.0m	0.14m	0.3m	9
SB-2O	C_2O	5.74ha	1in3	63m	21m	1329m²	0.60m	0.20m	0.23m	1.03m	797m³	239m³	227m³	1263m³	6m	23m	1.0m	21.0m	0.15m	0.3m	12
SB-2P	C_2P	0.97ha	1in3	26m	9m	225m²	0.60m	0.20m	0.42m	1.22m	135m³	40m³	30m³	205m³	5m	10m	1.0m	9.0m	0.09m	0.3m	2

ROCK FILTER DAM & SEDIMENT WEIR SUMMARY

PROJECT:- Kalfresh - Bulk Earthworks **DESIGNER:-** CD

JOB No:- 510357 **DATE:-** 21/02/2023

ROCK FILTER DAM DETAILS

DEVICE ID	CONTRIBUTING CATCHMENT ID	MIN. SETTLING POND SURFACE AREA (m^2)	SUGGESTED SETTLING POND LENGTH (m)	SUGGESTED SETTLING POND WIDTH (m)	DEVICE THICKNESS (IN DIRECTION OF FLOW) (D) (m)	ROCK FILTER HEIGHT (H_1) (m)	FILTER AGGREGATE SIZE (mm)	ROCK FILTER THICKNESS (m)	MIN. CORE ROCK SIZE (mm)	ROCK FILTER LENGTH (W_1) (m)	SPILLWAY LENGTH (W_2) (m)	SPILLWAY DEPTH (m)	EMBANKMENT HEIGHT (H_2) (m)
RFDC_2K	C_2K	123.3	3	42	MIN. 1.5	0.5	25	0.3	225	3	7	0.0	0.5
RFDC_2L	C_2L	134.1	4	34	MIN. 1.5	0.5	25	0.3	225	4	7	0.0	0.5

SEDIMENT WEIR DETAILS

DEVICE ID	CONTRIBUTING CATCHMENT ID	MIN. SETTLING POND SURFACE AREA (m^2)	SUGGESTED SETTLING POND LENGTH (m)	SUGGESTED SETTLING POND WIDTH (m)	ROCK FILTER HEIGHT (H_1) (m)	FILTER AGGREGATE SIZE (mm)	ROCK FILTER THICKNESS (m)	ROCK FILTER LENGTH (W_1) (m)	SPILLWAY LENGTH (W_2) (m)	SPILLWAY DEPTH (m)	EMBANKMENT HEIGHT (H_2) (m)
SWC_2D.1	C_2D	21.0	5	5	0.3	15	0.3	3	5	0.3	0.6
SWC_2D.2	C_2D	21.0	5	5	0.3	15	0.3	3	5	0.3	0.6

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Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of place and of belonging. That's why at Stantec, we always design with community in mind.

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We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

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Design with community in mind