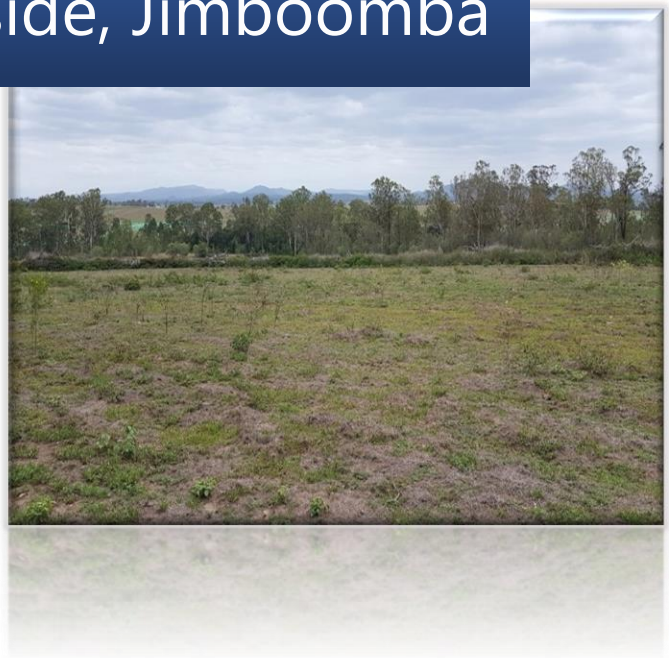
Gallagher Environmental

Erosion & Sediment Control Plan (ESCP): Road Crossing Clearing Phase, Riverside, Jimboomba



Client: Colliers

Report No: GE24.069.R1a

Date: 29th January 2025

CPESC ENVIROCERT

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Job No.	GE24.069
Document No:	GE24.069.R1a.doc
Title:	Erosion & Sediment Control Plan (ESCP): Road Crossing Clearing Phase, Riverside Jimboomba
Project Manager:	Glen Gallagher
Qualifications:	BScApp(EnvSc)(Hons) MEIANZ CPESC
Client:	Colliers
Client Contact:	Mr. Dan Collins
Synopsis:	A detailed ESCP providing site-specific management protocols for the construction phase of the development.

REVISION & CHECKING HISTORY

Revision Number	Date	Issued by	Signature
Original	23 January 2025	G Gallagher	GMGallagher
1	29 January 2025	G Gallagher	GMGallagher

DISTRIBUTION

Destination	Revision		
	Original	A	-
Colliers	1	1	
GE Database	1	1	

LIMITATIONS

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This report is not a guarantee that the site conditions will behave in accordance with the interpretation set out herein, but rather our opinion as to the correct interpretations based on the results of desktop review, site investigations, in situ testing and/or laboratory testing in accordance with generally accepted consulting practice. To the best of our knowledge, information contained in this report is accurate at the date of issue. The interpretation of scientific data, however, often involves both professional and subjective judgments. As such, interpretation is open to error. In addition, site conditions are subject to change in a limited time and there remains a risk that the site conditions will differ from these interpretations. Gallagher Environmental waives all responsibility for loss or damage where information provided by the Client (including third parties) used in the preparation of this report was inaccurate or in error.

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1. INTRODUCTION

1.1 ESCP Overview

Gallagher Environmental (GE) was commissioned by Colliers to prepare an Erosion & Sediment Control Plan (ESCP) for the proposed 'Road Crossing Clearing Phase' located Riverside, Jimboomba.

The purpose of the ESCP is to define the overall erosion hazard of the proposed land clearing works and to provide appropriate management strategies in order to ensure adverse effects on the environment from soil erosion are mitigated during the clearing phase of the development. Furthermore, the ESCP has been prepared with reference to the *IECA (2008/2018) Best Practice Erosion and Sediment Control Guideline* ('IECA Guidelines') to assist the Civil Contractor in meeting their overarching environmental obligations.

The ESCP is divided into sections describing: the physical characteristics of the site; an assessment of the soil erosion potential; and subsequent management strategies to be employed during the construction phase of the development.

1.2 Aims & Objectives

The site ESCP shall provide a framework to ensure that the potential sediment and erosion impacts of the proposed development are appropriately managed throughout the Land Clearing Phase.

Moreover, the objectives of the ESCP are to ensure the following:

- All reasonable and practical sediment and erosion control measures are taken to prevent or minimise the likelihood of environmental harm;
- Land Clearing activities are undertaken without adverse environmental impacts on-site or on adjacent or downstream areas; and
- Land Clearing activities are undertaken without causing nuisance to neighbouring residents.

1.3 ESCP Timeframe

The ESCP is intended to cover the Land Clearing Phase of the development.

Hold Point: Prior to earthwork (soil) disturbance for any section of the works, the Contractor must install applicable erosion and sediment controls prior to further earthworks, excluding limited and necessary clearing for ESC control installation.

1.4 Responsibility for Implementation

The Civil Contractor is responsible for the implementation of the site ESCP during the construction phase and the Civil Contractor's environmental representative(s) must be competent and experienced in relation to the specific requirements of on-site environmental management. All site staff are responsible for ensuring that all construction-related activities are carried out in a manner that precludes or mitigates potential impacts in accordance with the ESCP. Furthermore, a copy of the ESCP must be kept on site and available at all times during the construction phase.

1.5 ESCP Amendments

The ESCP is a flexible document that shall be modified in the event that site conditions change significantly from those considered within the ESCP and as site knowledge and site construction and engineering experience allows. This may be due to necessary changes in the construction schedule and any unforeseen issues that may arise during land clearing activities.

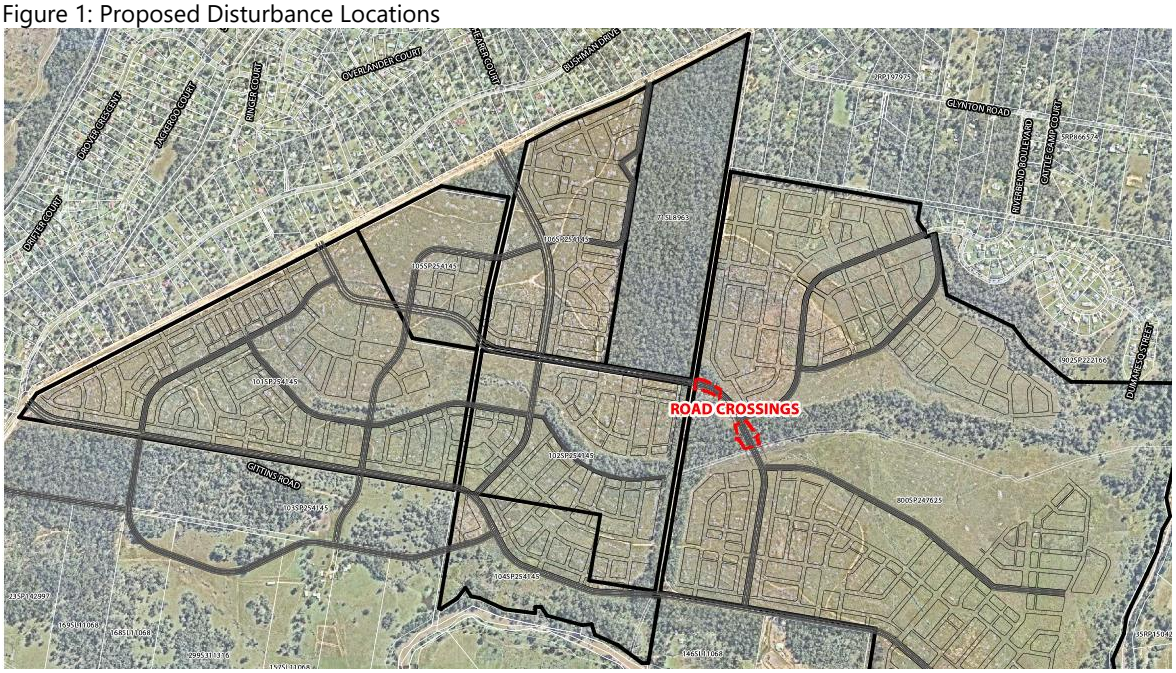
In the event that a monitoring program detects a notable failure to achieve the required ESC objectives, the source of the failure shall be appropriately investigated, including engagement of a suitably-qualified professional (e.g. CPESC) where required, and the ESCP suitably modified to ensure incidents do not recur.

2. SITE DESCRIPTION

2.1 Proposed Disturbance

The total disturbance area of the proposed land clearing works is approximately 1.0ha across two (2) separate and adjacent land tracts (refer Figure 1).

Figure 1: Proposed Disturbance Locations



The clearing works shall not involve topsoil stripping or bulk earthworks, however the process of land (vegetation) clearing including the use of heavy machinery (e.g. bulldozer) shall increase the exposure of the surface (topsoil) materials. This increases soil erosion rates from these areas during rainfall events until rehabilitation with grass cover.

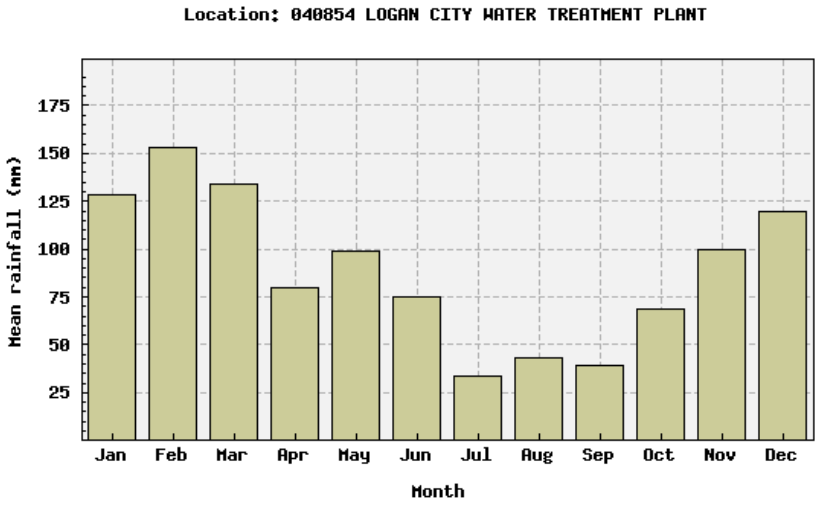
2.2 Slopes & Drainage

The slopes associated with the proposed land clearing areas are generally very gently inclined to gently inclined with slopes generally ranging between 0.5% to 6%. The majority of the proposed land disturbance is very gently inclined (<3%). The sites drain towards a centrally-located (ephemeral) drainage line that intersects the southern land tract, with a west to east ephemeral flow direction. Slope and drainage features have been examined as part of calculations presented in Section 3.1.

2.3 Rainfall /Climate

As per Bureau of Meteorology (BoM) website online data for Logan (Location 040854), the wet season in the project area begins in December through to March, as indicated in Figure 2 below:

Figure 2: Annual Rainfall Averages (BoM).



The rainfall intensity data for Jimboomba is shown in Figure 3 below:

Figure 3: Rainfall Intensity Data for the site (BoM)

Intensity-Frequency-Duration Table

Location: 27.825S 152.975E Issued: 16/10/2019

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

	Average Recurrence Interval						
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	111	142	178	199	227	265	295
6Mins	103	132	166	185	212	248	276
10Mins	84.4	108	136	152	174	204	227
20Mins	62.4	80.0	101	113	130	152	169
30Mins	50.8	65.2	82.3	92.4	106	125	139
1Hr	33.8	43.4	55.0	61.9	71.3	83.8	93.5
2Hrs	21.0	27.0	34.3	38.7	44.6	52.4	58.5
3Hrs	15.6	20.1	25.5	28.7	33.1	38.9	43.4
6Hrs	9.31	12.0	15.2	17.1	19.7	23.1	25.8
12Hrs	5.62	7.23	9.23	10.4	12.0	14.2	15.9
24Hrs	3.48	4.51	5.85	6.67	7.77	9.24	10.4
48Hrs	2.13	2.80	3.73	4.31	5.08	6.13	6.96
72Hrs	1.54	2.02	2.73	3.18	3.77	4.59	5.23

(Raw data: 44.59, 7.28, 2.05, 82.86, 13.66, 4.44, skew=0.15, F2=4.39, F50=17.12)

The calculated annual rainfall erosivity factor based on the following equation:

$R = 164.74(1.1177)^{S} \times S^{0.6444}$;

where S is the 2 year ARI, 6 hour rainfall event (mm) = 12.0 mm/hr (Jimboomba)

The calculated R factor (annual) is 3105.

2.4 Soil Types

According to the Australian Soil Resource Information System ('ASRIS' - http://www.asris.csiro.au), the broadscale mapping indicates the Chromosol and Kandosol soil orders featuring sandy loam (10-20%) clay and loamy sand (<10% clay) A horizons (topsoil) respectively.

A field and laboratory assessment undertaken by Gallagher Environmental in 2019 (Ref: GE19.078.R1B) was in high agreement with the mapping data, with topsoil texture types revealing little variation across the proposed clearing areas of the entire development area. Soil textures ranged between loamy sand to light sandy loam with generally with single-grained or moderate soil structure grade. The A horizon (topsoil) also exhibited a very low soil dispersion risk, with Class 7 – Class 8 Emerson Class results.

On the basis of presumed worst-case soil textures (i.e. higher silt and fine sand content) observed, a Soil K factor was estimated in accordance with the methodology presented within Soils & Construction (2004). A conservative soil K (erodibility) factor of 0.024 has been used to represent the site topsoil materials.

Gallagher Environmental
Soil Water Environment

CLIENT : CALIBRE GROUP
ADDRESS : RIVERSIDE JIMBOOMBA
JOB NO : GE19.078

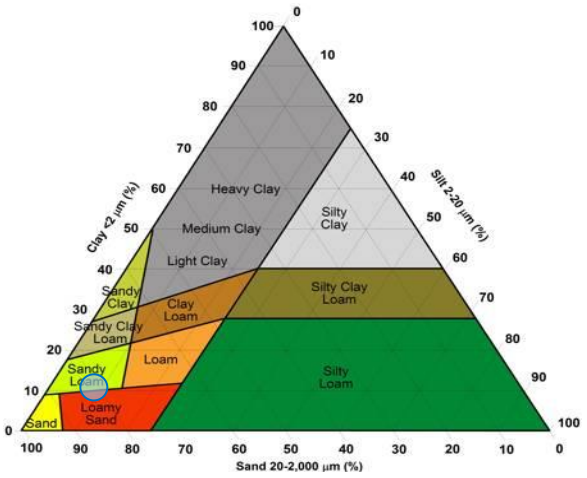
SAMPLE: A HORIZON

Estimation of Soil K Factor

(Soils & Construction, 2004)

Soil Texture	Sand (0.1 - 2.0mm)	67 %	*Sandy Loam*
- Fine Earth Fraction	Fine Sand (0.02 - 0.1mm)	8 %	*-Mod. Polyhedral Structure*
- Field Results	Silt (0.002 - 0.02mm)	12 %	*- Emerson Class 7-8*
	Clay (<0.002mm)	13 %	
	Gravel (>2mm)	<5 %	
Structure Grade	1- Very fine granular (<1mm)		
	2- Fine granular (1- 2mm)		
	3- Granular (2 - 10mm)		
	4- Blocky, platy or massive		✓
Permeability Grade	1- >130 mm/hr		
	2 - 60 to 130 mm/hr		
	3 - 20 to 60 mm/hr		✓
	4 - 5 to 20mm/hr		
	5 - 1 to 5mm/hr		
	6 - <1mm/hr		
Organic Matter	Topsoil (assumed)	2.0 %	✓
	Subsoil (assumed)	0.0 %	
	Laboratory Result	- %	
Soil Dispersion Factor	Dispersive	+20 %	
	Slightly Dispersive	+10 %	
	Non-Dispersive	0 %	✓

Calculated K Factor	0.022
Safety Factor (+)	+10 %
Estimated K Factor	**0.024**



Glen Gallagher CPESC No. 8346

3. ESC DESIGN METHODOLOGY

3.1 Soil Erosion Potential

'Soil erosion' can be defined as one or a combination of the following forms (Witheridge and Walker, 1996[1]):

- Wind Erosion – Soil movement, as a result of wind velocity and turbulence;
- Raindrop impact erosion - The impact of raindrops on bare soil surfaces or through a thin film of surface water, resulting in the detachment of soil particles;
- Sheet erosion - The uniform removal of soil in thin layers from sloping land;
- Rill erosion – The removal of soil by water from small, shallow yet well defined channels under concentrated overland flow;
- Gully erosion – An advanced stage of rill erosion where channels are larger and deeper than rills;
- Stream bank erosion - This form of erosion in an urban environment often results from changes in catchment hydrology; and
- Mass movement – When large areas of soil and rock slide or slip down steep slopes and the movement of deep subsoils on slopes of various gradients during high rainfall periods.

Furthermore, Houghton and Charman (1986)[2] define 'soil erosion potential' as the susceptibility of a parcel of land to the prevailing agents of erosion and is dependant on site-specific factors such as climate, landform, soil erodibility, land use and land management factors.

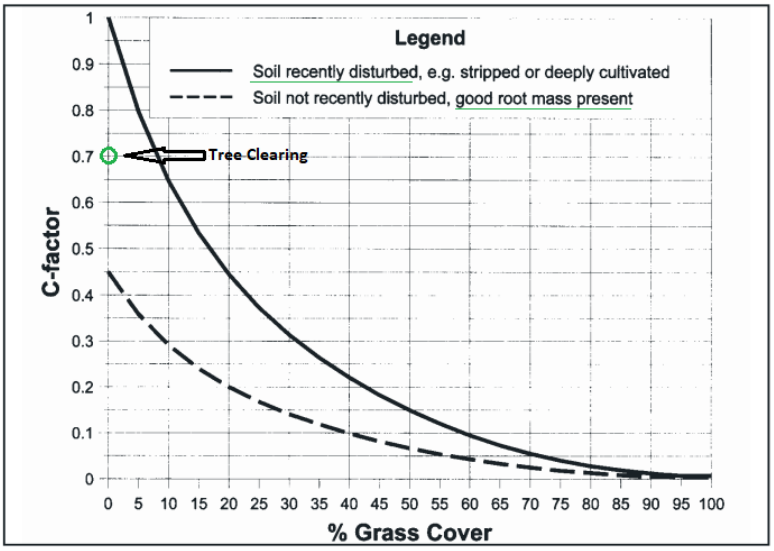
3.2 Soil Erosion Hazard Calculations

The overall soil erosion hazard calculations for the entire land clearing phase are shown in Table 1 below.

The C Factor of 0.7 was estimated based on the likely soil disturbance (tree clearing; no stripping/earthworks) in accordance with Section A6 of 'Soils and Construction- Managing Urban Stormwater' (Landcom NSW, 2004), as shown in Figure 4 below:

[1] Witheridge, G. and Walker, R (1996) *Soil Erosion & Sediment Control: Engineering Guidelines for Queensland Construction Sites.* The Institute of Engineers, Australia, Queensland Division. Brisbane.
[2] Houghton, P.D. and Charman, P.E.V. (1986) *Glossary of Terms used in Soil Conservation*. Department of Conservation and Land Management, Sydney.

Figure 4: C Factor Estimation



The P Factor was estimated at 1.0 given the absence of earthworks and the resulting track-walking up and across the slope due to heavy machinery.

Table 1: Catchment Soil Loss Rates (>0.1ha)

Location	Area (ha)	LS Factor	C Factor	P Factor	Estimated Soil Loss[1] (t/ha/yr)	ESC Control Classification	Erosion Hazard Class
Northern Tract	0.35	0.63 (4.0% @ 40m)	0.7	1.0	33	Type 3	Very Low
Southern Tract-North Portion	0.35	0.57 (3.0% @ 60m)	0.7	1.0	30	Type 3	Very Low
Southern Tract-South Portion	0.30	0.34 (2.0% @ 50m)	0.7	1.0	18	Type 3	Very Low

[1] RUSLE: A = R.K.LS.C.P; where R = 3105 for Jimboomba, K Factor = 0.024

The overall soil loss rate for the bulk earthworks phase (from weighted mean above) is calculated as ***~27 t/ha/yr.*** A relationship between qualitative categories and the quantitative values for the construction phase (i.e. IECA Guidelines Table 3.1) is defined in Table 2 below.

Table 2: Erosion Hazard Categories (construction phase)

Soil Loss Class	Calculated Soil Loss (t/ha/yr)	Erosion Hazard
1	**<150**	**Very Low**
2	151-225	Low
3	226-350	Low-Moderate
4	351-500	Moderate
5	501-750	High
6	751-1500	Very High
7	>1501	Extreme

In accordance with IECA Guidelines, the Soil Loss Class for the proposed development is **'Class 1'** and therefore considered to be 'very low' risk.

3.2 Erosion & Sediment Control Techniques

The calculated soil losses and associated erosion risks for each identifies catchment determines the minimum sediment control standard in accordance with the IECA Guidelines, as shown in Table 3 below:

Table 3: Sediment Control Standards

Sediment Control Technique	Sub-Catchment Size (ha)	Calculated Soil Loss (t/ha/ha)	Default Control Measures	Applicable Site Catchments
1	0.25 – 1.0ha	>150	Sediment basin (in accordance with IECA design standards)	
	>1.0ha	>75		
2	0.10 – 0.25ha	>75	rock filter dam, mulch filter berm/vegetation stockpile windrows	
	0.25 – 1.0ha	75 – 150		
3	<0.10ha	All Cases	**sediment fences, mulch bunds/vegetation stockpile windrows, coir logs**	
	>0.10ha	**<75**		All catchments

Consequently, it is proposed to utilise the following *primary* control measures for each identified sub-catchment:

- Implementation of a stabilised entry/exit structure for site access;
- Progressive placement of 'Type 2/3' vegetation stockpile windrows along the contour and also on the upslope and downslope boundary of the clearing/disturbance limit (excluding ephemeral watercourse);
- Stabilisation of land clearing areas reaching final levels within the specified thirty (30) day timeframe.
- Implementation of a rock waterway crossing across the ephemeral waterway area.

- Stabilisation of the minor land clearing areas located within the ephemeral waterway area within a ten (10) day timeframe and a rock filter weir established at the downstream end of disturbance.

The location of ESC controls, construction sequencing and detailed design notes are provided in Appendix A (ESC Layout Plan).

The specific location of additional ESC controls to suit evolving earthworks and in accordance with the required ESCP management principles shall be updated by the Contractor on a regular basis.

All controls identified on the Contractor's Erosion and Sediment Control Plan shall be installed in accordance with the ESC Standard Drawings and manufacturer or suppliers' specifications.

ESC Standard Drawings for all of the require ESC controls are provided in the IECA (2008) Guidelines – Book 6 and also located at the following web link:

https://www.austieca.com.au/publications/book-6-standard-drawings

3.2.1 Vegetation Windrow Implementation

An example of the vegetation stockpile windrow that are present from previous clearing areas of the development is shown in Figure 1 below:

Figure 5: Existing Vegetation Windrow Example

Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the upslope and downslope boundary of the clearing/disturbance limit (and either side of the ephemeral drainage line).

Where practicable, clearing shall be initiated on the top of each catchment and works to progress downslope, in order to minimise upslope stormwater flows onto the disturbance areas.

The windrows of stockpiled vegetation shall be placed in a firm and compact manner that provides intimate contact between the ground surface and vegetation. The height of the windrows shall be a minimum height of 1.0m with a minimum 2.5m width (i.e. in the direction of flow).

The stockpiled vegetation used for windrow construction can also be mulched prior to use.

A sediment fence may be used to substitute the downslope vegetation stockpile windrow, as deemed required.

3.3 Stabilisation Requirements

Specific stabilisation requirements for the site are formulated in accordance with Table 4 below:

Table 4: Site Stabilisation Requirements

Erosion Hazard Class	Soil Loss (t/ha/yr)	Advance Clearing (weeks)	Max. days to stabilisation	Min % cover	Stabilisation of Earth Batters (>6H:1V)	Stabilisation of Stockpiles
Very Low	**<150**	**8**	**30**	**60%**		
Low	151-225	8	30	70%		
Moderate	226-500	6	20	70%	✓	
High	501-1500	4	10	75%	✓	✓
Extreme	>1501	2	5	80%	✓	✓

In accordance with the IECA Guidelines for 'Soil Loss Class 1' (i.e. very low risk), the following stabilisation requirements are considered applicable for the proposed earthworks, wherever practicable:

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works;
- All disturbed soil surfaces (including all batters) shall be stabilised with minimum **60%** equivalent grass cover (C Factor <0.1) within **30 days** of completion of works (i.e. finish level) within any area of the work site;
- Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding **30 days**;
- The use of stabilisation products shall conform to IECA (2008) or manufacturer's' minimum standards.

The stabilisation technique shall typically include grass seeding. Stabilised areas shall be monitored on a weekly basis (refer Section 4.1) until the stabilisation requirements have been achieved.

For areas with poor initial strike, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period.

3.3.1 Clearing in Ephemeral Waterway Area

In accordance with Table I-10 of the IECA (2008) Guidelines, clearing required in the ephemeral waterway area is considered a 'moderate risk' rating given the average monthly rainfall of the site (i.e. ~90mm) falls into the '45-100mm' bracket. Therefore, the following stabilisation requirements are considered applicable for the proposed clearing in waterway areas, wherever practicable:

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works;

- All disturbed soil surfaces shall be stabilised with minimum **80%** equivalent grass cover within **10 days** of completion of work within any waterway.

Given the limited nature of the land clearing in the waterway (~0.2ha) and that clearing can be initiated and completed (i.e. ready for stabilisation) within a <72hr timeframe, it is considered that the disturbance is considered 'a natural dry bed waterway where stream flows are possible' - in where the use of sediment weirs can be utilised in accordance with Table I-7 of the IECA (2008) guidelines.

Overall, the following strategy for clearing in the ephemeral waterways is as follows:

- The Contractor is required to utilise short term (1 -7 day) forecasts in order to schedule these works in dry weather;
- Once disturbance is initiated within the waterway, works shall be programmed to expedite the duration of disturbance in order to minimise potential exposure to rainfall, and these works shall be completed within a ≤72 hour timeframe.
- The haul road that passes through the drainage lines shall be constructed with geofabric layer overlain by gravel. The gravel shall be maintained where required to ensure clean water conveyance. Low flow aggie pipes may also be installed;
- A rock filter weir across the entire base width of the channel shall be implemented immediately downstream of the waterway disturbance and left in place until the area has reached the 'stabilisation requirements';
- All disturbed soil surfaces shall be stabilised with minimum **80%** equivalent grass cover within **10 days** of *completion* of work within the waterway, or to full equivalent natural condition, as determined by a CPESC or Environmental Engineer (RPEQ);
- Stabilisation techniques typically include turf or turf re-enforced matting (TRM). A CPESC or Environmental Engineer (RPEQ) shall be engaged to determine the stabilisation techniques to be utilised based on the slope/grade of channel and banks, and the time of year (e.g. rainfall/climate) of the stabilisation period;
- Stabilised areas shall be monitored on a weekly basis (refer Section 4.1) until the stabilisation requirements have been achieved. For areas with poor initial strike or failure, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil

Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period.

The requirements for the proposed clearing are contained in the relevant Drawing contained in Appendix A. This drawing may be continually updated by the Consulting Engineer, in consultation with a CPESC or Environmental Engineer (RPEQ), where required.

4 MONITORING & REPORTING

4.1 ESC Monitoring & Reporting

The Civil Contractor shall undertake routine inspections of all ESC measures and site discharge points, as follows:

- Within 24 hours of anticipated rainfall;
- Within 18 hours of a rainfall event;
- On a daily basis when rainfall is continually occurring; and
- On a weekly basis for other times during construction activities.

The Contractor shall install a proprietary rain gauge and keep a record of the rainfall depth (mm) of each rainfall event, and where possible duration of the rainfall event. A 'rainfall event' shall be defined as ≥15mm/24 hour period.

The routine ESC inspections shall include all drainage control structures, erosion and sediment control measures employed on-site, vehicle movement routes/carparks, material storage areas and all site discharge points to ensure they are serviceable in readiness for the next rainfall event.

All areas undergoing stabilisation shall be inspected on a weekly basis until the stabilisation requirements (refer Section 3.3) have been achieved.

The routine inspections shall be undertaken by the Contractor. The Contractor shall utilise their own internal documentation/pro forma's for inspection and non-compliance reporting.

4.2 Water Quality Monitoring & Requirements

Prior to the controlled discharge of any water (i.e. dewatering activities) from the site during construction, water sampling shall be undertaken to ensure the following water quality objectives are achieved:

- Water pH between 6.5 – 8.5;
- Total suspended solids ≤ 50 mg/L, or Turbidity < 60 NTU;
- Oils & grease – no visible films or odour; and
- Litter – no visible litter washed from the site.

Water quality monitoring results shall be retained at the site office and made available to Statutory Authorities upon request.

The Contractors' staff will be informed of all water quality monitoring obligations during the site induction.

Given the proposed nature of activities (land clearing only), controlled water quality discharge is considered unlikely to be required.

4.3 Non-Conformances

The Contractor's Site Manager shall identify any non-conformances with the requirements of this document. Appropriate corrective actions shall be implemented to ensure non-conformances do not recur. Consultation with relevant authorities shall be undertaken where necessary, or as directed by the Superintendent (i.e. Supervising Engineer) or Environmental Consultant (i.e. CPESC). Corrective actions shall be undertaken within 24 hours wherever practicable or as agreed with the Construction Superintendent.

In the event that a monitoring program detects a notable failure to achieve the required ESC objectives, the source of the failure shall also be investigated and the ESCP suitably modified to ensure incidents do not recur. The Non-Conformance Report must include but not be limited to i) details of the nature and cause; and ii) details of the required corrective actions. The Contractor shall utilise their own internal documentation/pro forma.

4.4 Environmental Duties

The Environmental Protection Act (EPAct) 1994 specifies that one must not carry out an activity that causes, or is likely to cause environmental harm unless all reasonable and practicable measures are taken to prevent or minimize harm. This principle is referred to as the 'The General Environmental Duty'. The EPAct also aims to protect the environment by directing all personnel to review and where possible, adopt better environmental management practices.

In addition, The EPAct makes it a duty on all citizens undertaking an activity to notify the 'Administering Authority' as soon as they become aware of the occurrence of material or serious environmental harm relating to that activity. This principle is referred to as 'The Duty to Notify'. This provision is to help establish a culture of environmental stewardship in the community where problems are reported before they cause irreparable harm to the environment.

4.5 Incidents & Emergencies

The Developer and any person appointed by the Developer (e.g. Contractor) as having responsibility for a control strategy set out in this ESCP have clearly defined responsibilities under the *Environmental Protection Act 1994* to report any incidents likely to cause environmental harm ***within 24 hours*** of becoming aware of the breach. If there is any doubt over any particular incident, advice should be sought from the Administering authorities and/or DEHP Guideline 'EM467'.

5 ESCP CERTIFICATION

This ESCP has been prepared with reference to the IECA (2008/2018) *Best Practice Erosion and Sediment Control* Guideline to assist the Developer and their agents (e.g. Civil Contractor) in meeting their overarching environmental obligations under the Environmental Protection Act (1994) and Environmental Protection (Water) Policy (2009).

All relevant control measures and procedures are to be supplemented with appropriate monitoring and maintenance and may typically include the provision of additional controls or modifications to suit the evolving site conditions during the land clearing phase.

Yours faithfully,

Glen Gallagher BScApp(Env Sc)(Hons) MEIANZ CPESC No. 8346
Principal Environmental Scientist | Gallagher Environmental

APPENDIX A:
ESCP - DRAWINGS & NOTES

SITE ENTRY/EXIT LOCATION

Stabilisation Requirements - General Areas:

The following stabilisation requirements for are considered applicable for the proposed land clearing (excluding waterways):

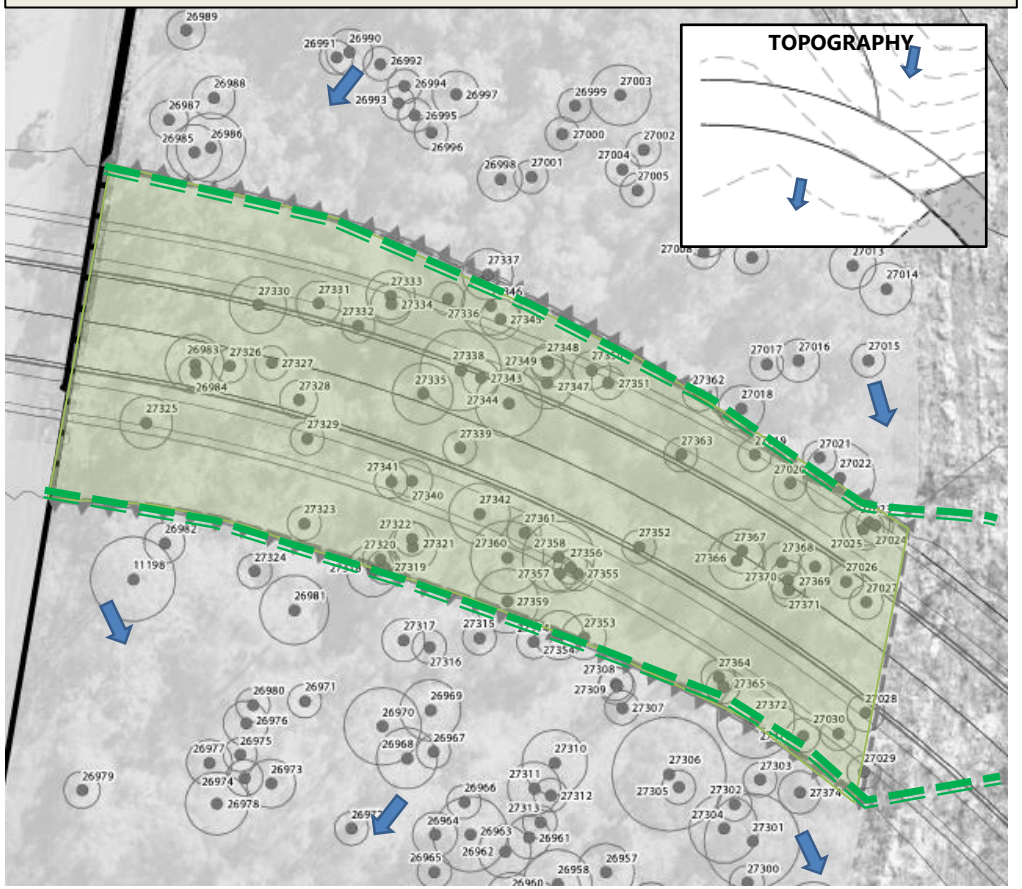
- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works.
- Disturbed soil surfaces stabilised with minimum 60% grass cover within **30 days** of completion of works (i.e. finish level) within any area of the work site.
- Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding **30 days**.
- The stabilisation technique shall typically include grass seeding. Stabilised areas shall be monitored on a weekly basis until the stabilisation requirements have been achieved.
- The use of stabilisation products (including seeding) shall conform to LCC or IECA minimum standards.
- For areas with poor initial strike, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period. Refer Standard Drawing 'R-01' for general requirements.

Clearing & Grubbing Phase:

This phase of works involves removal of trees and shrubs. Localised soil disturbance are required to remove roots/stumps.

No topsoil stripping (or other bulk earthworks) are allowed to occur during this phase of works.

- Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the downslope boundary of the clearing/disturbance limit (excluding waterway area) and the upslope boundary of the clearing/disturbance limit.
- The windrows of stockpiled vegetation shall be placed in a firm and compact manner that provides intimate contact between the ground surface and vegetation. The height of the windrows shall be a minimum height of 1.0m with a minimum 2.5m width (i.e. in the direction of flow).
  The stockpiled vegetation used for windrow construction can also be mulched prior to use. A sediment fence may be used to substitute a vegetation stockpile windrow.
- If localised drainage lines (i.e. concentrated flow paths) are intercepted in disturbance areas, rock check dams (200mm height) shall be placed within them at 40m intervals within the affected areas.



KEY

- Rock Entry/Exit Structure (indicative)
- Waterway Crossing
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction
- Proposed Clearing Area

ESC Standard Drawings for all of the require ESC controls are provided in the IECA (2008) Guidelines – Book 6 and located at the following web link:

https://www.austieca.com.au/publications/book-6-standard-drawings

A stabilised entry/exit structure shall be implemented at all access points.

Haul roads on-site shall be stable, shall possess adequate drainage and equipment movement shall be limited to designated routes in order to limit ruts, erosion and the tracking of sediment from the site.

Haul roads shall be constructed in general accordance with Standard Drawing 'CR-01' in Appendix B of the ESCP Report. This includes the use of level spreaders, diversion drains/whoa boys and the use of rock check or sandbag check dams within table drains at maximum 40m intervals.

All haul roads that pass through all channel/drainage lines ('Waterway Crossings') shall be constructed with geofabric layer overlain by gravel. The gravel shall be maintained where required to ensure clean water conveyance. Low flow aggie pipes may also be installed.

ALL ESC CONTROLS TO BE GROUND-TRUTHED AND UPDATED PROGRESSIVELY BY THE CONTRACTOR:

a) UPON SITE POSSESSION, WHERE REQUIRED
b) DURING CONSTRUCTION AS REQUIRED

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TITLE: ESC Layout Plan 1 – Northern Tract			DRAWING NO.: GE24.069.D1
JOB LOCATION: Riverside, Jimboomba – Road Crossing Clearing Phase			SCALE: 1:1200 @ A4
CLIENT: Colliers	DATE: 29.01.25	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

Clearing & Grubbing Phase:

This phase of works involves removal of trees and shrubs. Localised soil disturbance are required to remove roots/stumps.

No topsoil stripping (or other bulk earthworks) are allowed to occur during this phase of works.

- Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the downslope boundary of the clearing/disturbance limit (excluding waterway area) and the upslope boundary of the clearing/disturbance limit.
- The windrows of stockpiled vegetation shall be placed in a firm and compact manner that provides intimate contact between the ground surface and vegetation. The height of the windrows shall be a minimum height of 1.0m with a minimum 2.5m width (i.e. in the direction of flow).
  The stockpiled vegetation used for windrow construction can also be mulched prior to use. A sediment fence may be used to substitute a vegetation stockpile windrow.
- If localised drainage lines (i.e. concentrated flow paths) are intercepted in disturbance areas, rock check dams (200mm height) shall be placed within them at 40m intervals within the affected areas.

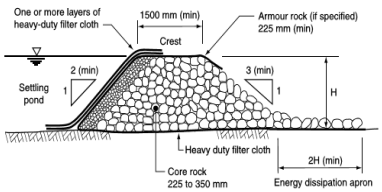
Stabilisation Requirements - General Areas:

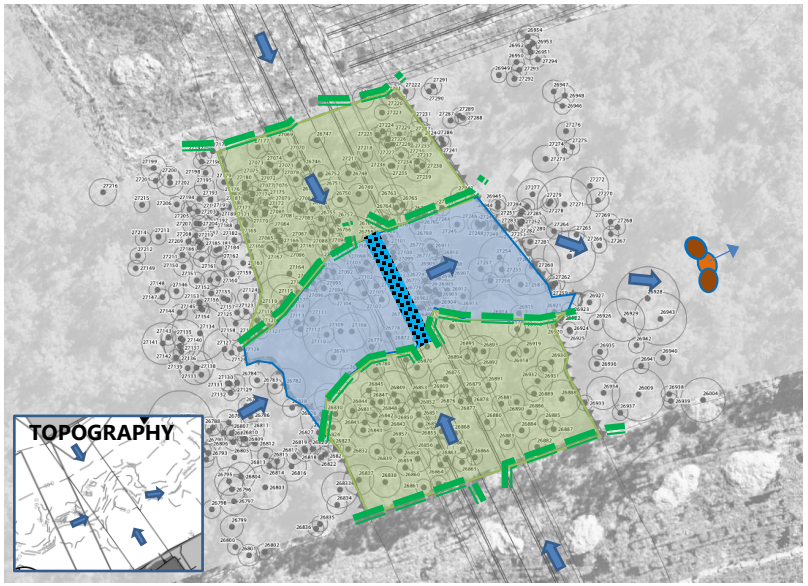
The following stabilisation requirements for are considered applicable for the proposed land clearing (excluding waterways):

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works.
- Disturbed soil surfaces stabilised with minimum 60% grass cover within **30 days** of completion of works (i.e. finish level) within any area of the work site.
- Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding **30 days**.
- The stabilisation technique shall typically include grass seeding. Stabilised areas shall be monitored on a weekly basis until the stabilisation requirements have been achieved.
- The use of stabilisation products (including seeding) shall conform to LCC or IECA minimum standards.
- For areas with poor initial strike, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period. Refer Standard Drawing 'R-01' for general requirements.

Rock Filter Weir Design:

Weir Filter Width	Rock Filter Height	Armour Rock Size	Filter Rock Size	Filter Rock Thickness	Geofabric Cover
Match Existing Channel	0.4m	≥225mm	50-75mm	300mm	2 x A24 Bidim





KEY

- Waterway Crossing
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction
- Proposed Clearing Area
- Proposed Waterway Clearing Area

ESC Standard Drawings for all of the require ESC controls are provided in the IECA (2008) Guidelines – Book 6 and located at the following web link:

https://www.austieca.com.au/publications/book-6-standard-drawings

A stabilised entry/exit structure shall be implemented at all access points.

Haul roads on-site shall be stable, shall possess adequate drainage and equipment movement shall be limited to designated routes in order to limit ruts, erosion and the tracking of sediment from the site.

Haul roads shall be constructed in general accordance with Standard Drawing 'CR-01' in Appendix B of the ESCP Report. This includes the use of level spreaders, diversion drains/whoa boys and the use of rock check or sandbag check dams within table drains at maximum 40m intervals.

All haul roads that pass through all channel/drainage lines ('Waterway Crossings') shall be constructed with geofabric layer overlain by gravel. The gravel shall be maintained where required to ensure clean water conveyance. Low flow aggie pipes may also be installed.

Waterway Clearing & Stabilisation Requirements:

The following stabilisation requirements for are considered applicable for the proposed waterway clearing works:

- The Contractor is required to utilise short term (1 -7 day) forecasts in order to schedule these works in dry weather;
- Once disturbance is initiated within any section of the waterway, works shall be programmed to expedite the duration of disturbance in order to minimise potential exposure to rainfall, and these works shall be completed within a ≤72 hour timeframe.
- All haul roads that pass through all channel/drainage lines shall be constructed with geofabric layer overlain by gravel ('Waterway Crossing'). The gravel shall be maintained where required to ensure clean water conveyance. Low flow aggie pipes may also be installed.
- A rock filter weir across the entire base width of the channel shall be implemented immediately downstream of the waterway disturbance and left in place until the area has reached the 'stabilisation requirements'.
- All disturbed soil surfaces shall be stabilised with minimum **80%** equivalent grass cover within **10 days** of *completion* of work within any waterway, or to full equivalent natural condition, as determined by a CPESC or Environmental Engineer (RPEQ);.
- Stabilisation techniques typically include turf or turf re-enforced matting (TRM). Prior waterway clearing works, a CPESC or Environmental Engineer (RPEQ) shall be engaged to determine the stabilisation techniques to be utilised based on the slope/grade of channel and banks, and the time of year (e.g. rainfall/climate) of the stabilisation period.
- Stabilised areas shall be monitored on a weekly basis until the stabilisation requirements have been achieved. For areas with poor initial strike or failure, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period.
- This drawing may be updated by the Consulting Engineer, in consultation with a CPESC or Environmental Engineer (RPEQ), where required.

CERTIFIED PROFESSIONAL CPESC® IN EROSION AND SEDIMENT CONTROL

ALL ESC CONTROLS TO BE GROUND-TRUTHED AND UPDATED PROGRESSIVELY BY THE CONTRACTOR:

a) UPON SITE POSSESSION, WHERE REQUIRED
b) DURING CONSTRUCTION AS REQUIRED

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TITLE: ESC Layout Plan 1 – Southern Tract			DRAWING NO.: GE24.069.D2
JOB LOCATION: Riverside, Jimboomba – Road Crossing Clearing Phase			SCALE: 1:2000 @ A4
CLIENT: Colliers	DATE: 23.01.25	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

ESC Control Measures

Hold Point: As soon as practicable and prior to progressive clearing works for any stage or section of the works, the Contractor must install the applicable erosion and sediment controls as contained on the ESCP Layout Plan and supporting notes herewith, prior to further earthworks (excludes the limited and necessary clearing for ESC control installation).

The specific location of all controls as per the ESC Layout Plan shall be subject to ground-truthing/site inspection.

ESC Standard Drawings are contained in Appendix B and all potentially required ESC controls are provided in the IECA (2008) Guidelines – Book 6 and also located at the following web link:

https://www.austieca.com.au/publications/book-6-standard-drawings

Dust Suppression

Dust control measures employed by the Contractor shall include:

- Water trucks operating to maintain moist soil conditions;
- Minimise vehicle movement except for designated traffic routes;
- The use of stabilised entry/exits and haul truck load covers;
- Maintaining the exposed soil surface in a roughened state;
- Soil binders sprayed over affected soil surfaces, if required;
- The implementation of windbreak screens, if required; and
- If visible dust emissions are occurring, works are to cease immediately until dust control measures are put in place and are satisfactorily mitigating dust emissions.

Water Quality

Prior to the controlled discharge of any water (i.e. dewatering activities) from the site during construction, water sampling shall be undertaken to ensure the following water quality objectives are achieved:

- Water pH between 6.5 – 8.5;
- Suspended Solids ≤50 mg/L
- Oils & grease – no visible films or odour; and
- Litter – no visible litter washed from the site.

Water quality monitoring results shall be retained at the site office and made available to Statutory Authorities upon request. The Contractors' staff will be informed of all water quality monitoring obligations during the site induction.

ESC Non-Conformances

- The Contractor's Site Manager shall identify any non-conformances with the requirements of this document. Appropriate corrective actions shall be implemented to ensure non-conformances do not recur. Consultation with relevant authorities shall be undertaken where necessary, or as directed by the Superintendent (i.e. Supervising Engineer) or Environmental Consultant (i.e. CPESC). Corrective actions shall be undertaken within 24 hours wherever practicable or as agreed with the Construction Superintendent.
- In the event that a monitoring program detects a notable failure to achieve the required ESC objectives, the source of the failure shall also be investigated and the ESCP suitably modified to ensure incidents do not recur.
- The Non-Conformance Report must include but not be limited to i) details of the nature and cause; and ii) details of the required corrective actions. The Contractor shall utilise their own internal documentation/pro forma.

ESC Monitoring & Reporting

The Civil Contractor shall undertake routine inspections of all ESC measures and site discharge points, as follows:

- Within 24 hours of anticipated rainfall;
- Within 18 hours of a rainfall event;
- On a daily basis when rainfall is continually occurring; and
- On a weekly basis for other times during construction activities.

- The Contractor shall install a proprietary rain gauge and keep a record of the rainfall depth (mm) of each rainfall event, and where possible duration of the rainfall event. A 'rainfall event' shall be defined as ≥15mm/24 hour period.
- The routine ESC inspections shall include all drainage control structures, erosion and sediment control measures employed on-site, vehicle movement routes/carparks, material storage areas and all site discharge points to ensure they are serviceable in readiness for the next rainfall event.
- All areas undergoing stabilisation shall be inspected on a weekly basis until the stabilisation requirements have been achieved.
- The routine inspections shall be undertaken by the Contractor. The Contractor shall utilise their own internal documentation/pro forma's for inspection and non-compliance reporting.

ESC Control Practices

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works.
- Clearing activities shall only occur within the dedicated clearing areas and shall be sequenced where possible to minimise the area of earthworks exposed to erosion and the overall duration that disturbed soils are exposed.
- The proposed clearing activities shall be undertaken in a manner that allows all reasonable and practicable measures to be undertaken in order to:

i) Allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities up to the design storm discharge events contained in this ESCP, wherever practicable;

ii) Minimise soil erosion resulting from rain, water flow and/or wind;

iii) Minimise adverse effects of soil/sediment runoff, including due regard to potential health & safety issues;

iv) Prevent or otherwise mitigate environmental harm resulting from construction-related soil erosion and sediment run-off; and

v) Ensure that the value and use of adjacent land/properties (including roads) are not diminished as a result of the adopted ESC measures.

- Temporary access roads on-site shall be stable, shall possess adequate drainage and equipment movement shall be limited to designated routes in order to limit ruts, erosion and the tracking of sediment from the site.
- Any spilt or transferred soil (or construction materials) onto roads shall be removed by mechanical sweeping and/or collection and stabilised elsewhere onsite at all times.
- Any scour that develops must be stabilised in order to mitigate further sediment erosion.
- All ESC measures shall receive maintenance when capacity falls below 75%.
- The ESCP is not exhaustive of the total requirements of the IECA Guidelines (2018) and therefore the Contractor shall consult these Guidelines as required.
- Additional or alternative ESC measures shall be implemented in the event that site inspections/monitoring of the Contractor's relevant personnel or the regulatory authority/Contract Administrator identifies that unacceptable off-site sedimentation is occurring as a result of construction activities and may typically include Type 2/3 sediment controls and other measures contained within IECA (2008) Guidelines.

NOTE: THIS PLAN MUST BE READ IN CONJUNCTION WITH THE OVER-ARCHING ESCP REPORT

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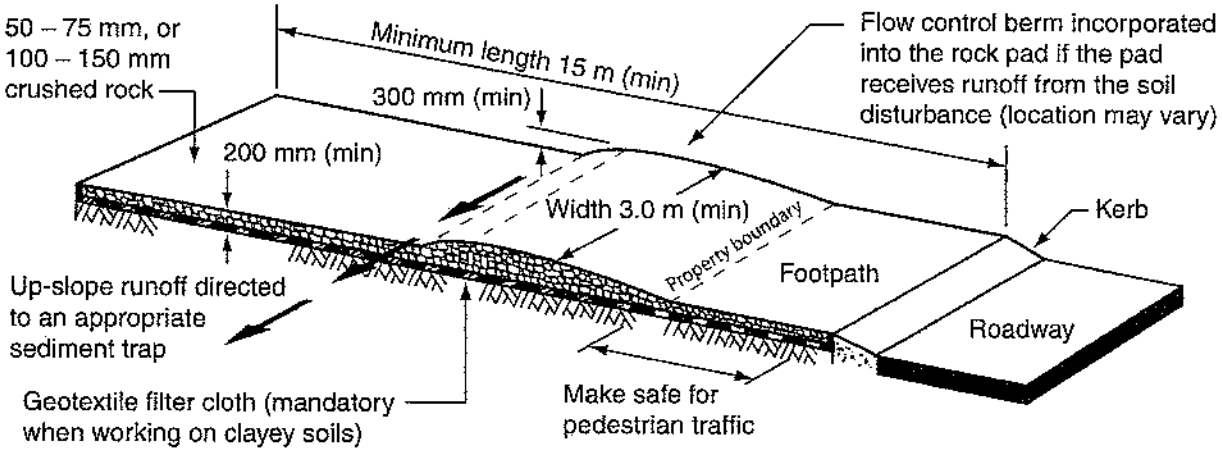
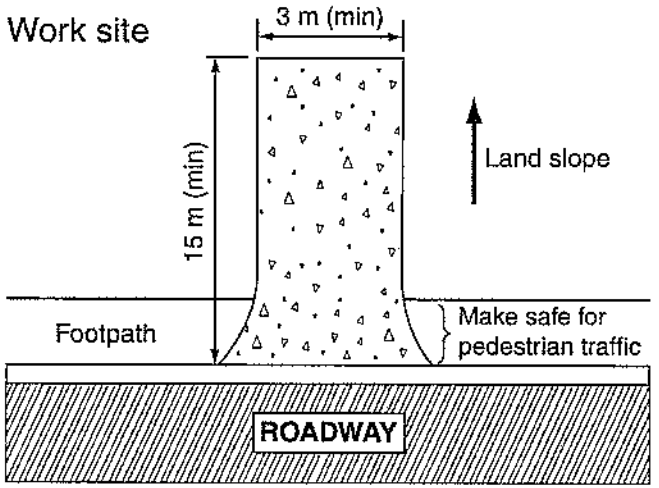
TITLE: ESCP Requirements I				DRAWING NO.: GE24.069.D3
JOB LOCATION: Riverside, Jimboomba – Road Crossing Clearing Phase				SCALE:
CLIENT: Calibre Group		DATE: 23.01.25	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

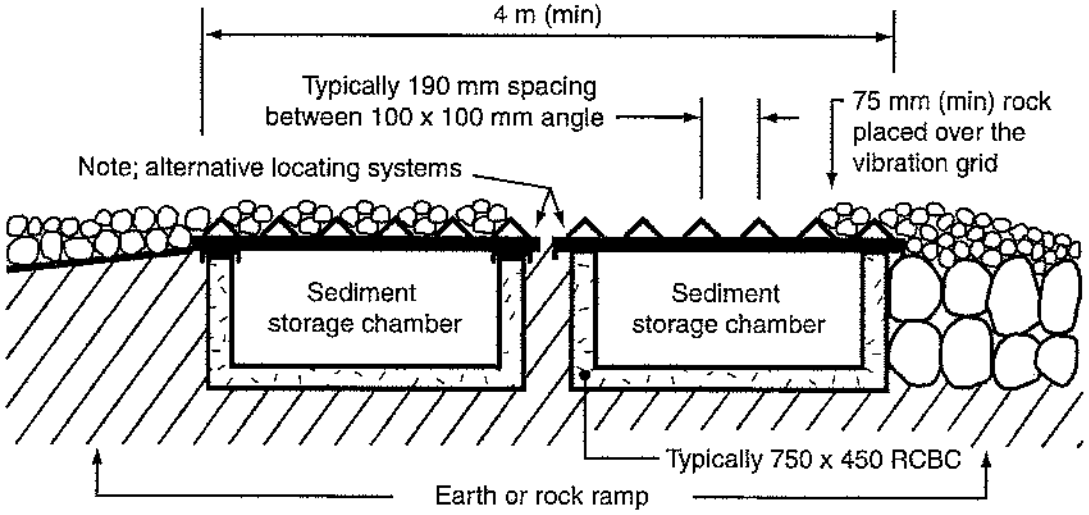
APPENDIX B:
STANDARD DRAWINGS



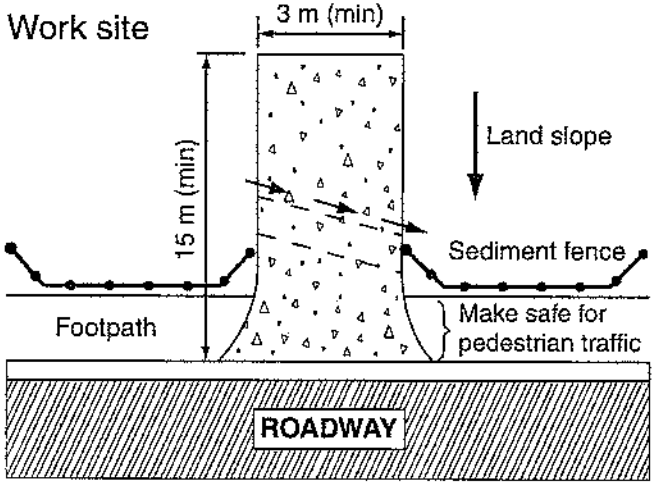
(a) Rock entry/exit pad for construction sites (refer to Standard Drawing Exit-03 for building sites)



(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

MATERIALS

COMPOSTS MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(i) WELL-DECOMPOSED 100% ORGANIC MATTER PRODUCED BY CONTROLLED AEROBIC (BIOLOGICAL) DECOMPOSITION.

(ii) MAXIMUM OF 1% OF INERT MATERIAL.

(iii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m, AND pH RANGE OF 5.0 TO 8.5.

(iv) 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 COMPOST FILTER BERM, TO THE MAXIMUM DEGREE PRACTICABLE, 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 ENDS OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED ALONG THE CONTOUR SUCH THAT WATER WILL POND EVENLY ALONG THE LENGTH OF THE BERM.

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 THE BERM 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.

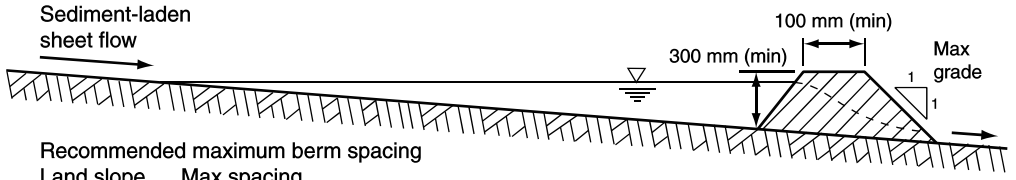
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

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.

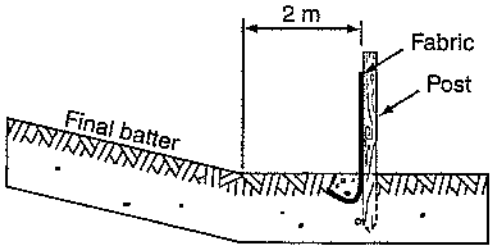


Recommended maximum berm spacing

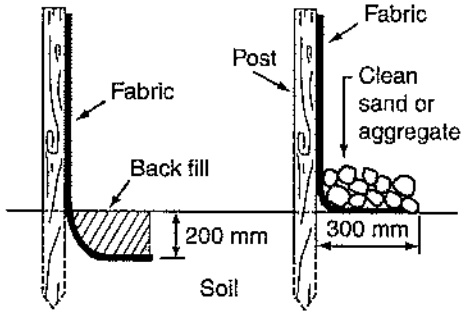
Land slope	Max spacing
< 2%	35 m
5%	25 m
10%	20 m
20%	12.5 m
25%	10 m

Figure 1 - Typical profile of a compost filter berm

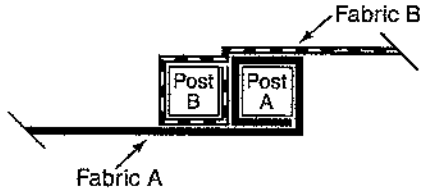
Drawn:	Date:		
GMW	Apr-10	Compost Filter Berm	CFB-01



(a) Location of fence relative to base of slope

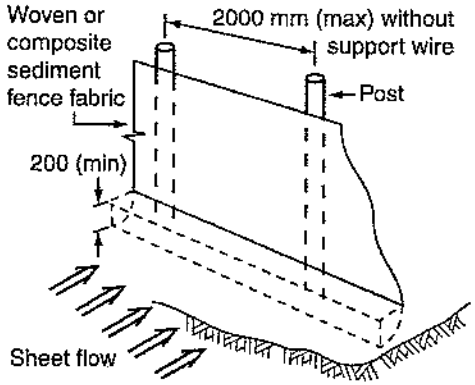


(b) Anchoring base of fabric

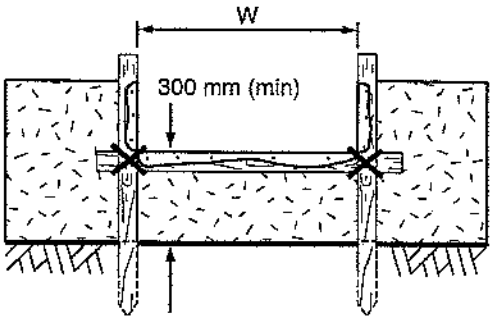


Fabric to fold around each stake one full turn.
Stake B to be drive tightly against Stake A.
The tops of both stakes to be secured with wire.

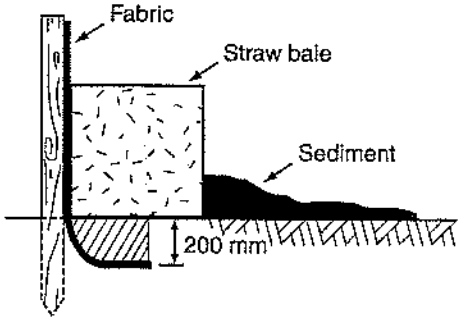
(c) Joining fabric - Method 1



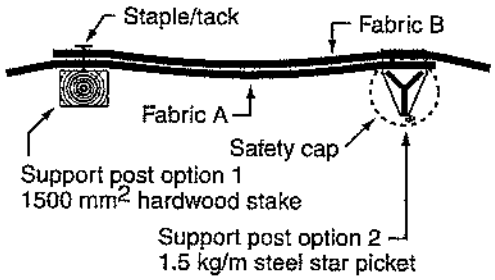
(d) Installation without backing support



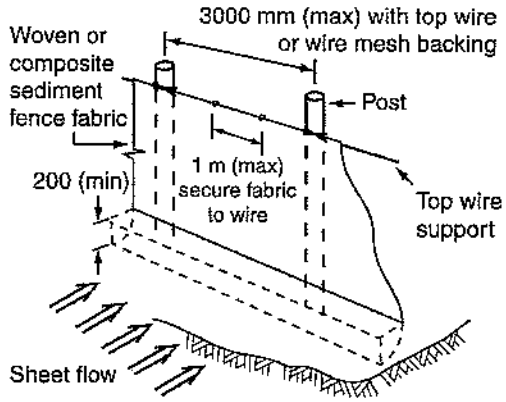
(e) Spill-through weir



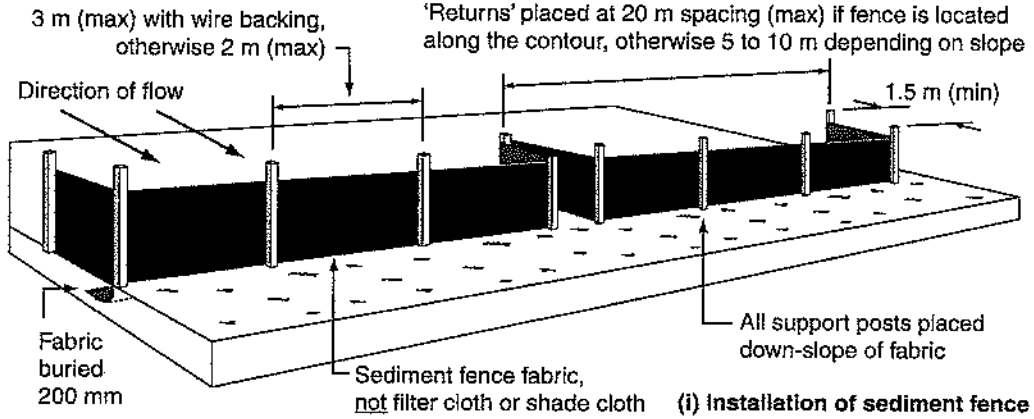
(f) Placement of up-slope straw bale



(g) Joining fabric - Method 2



(h) Installation with top wire support

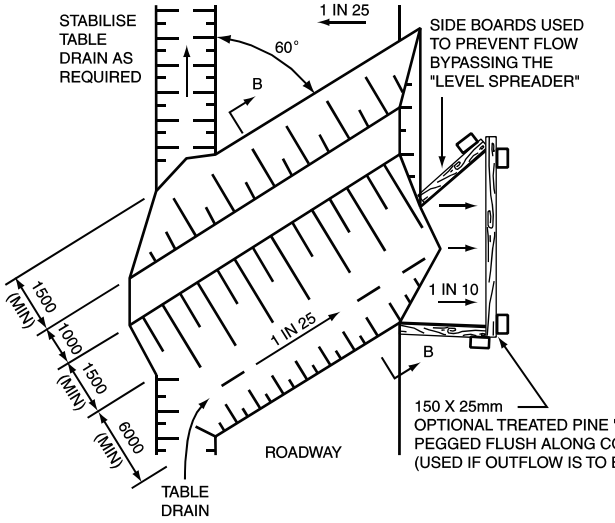


(i) Installation of sediment fence

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.

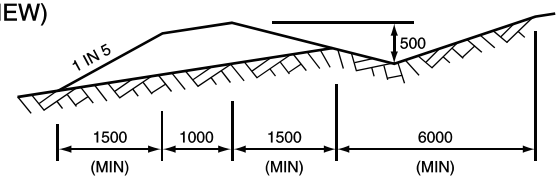
Drawn:	Date:		
GMW	Dec-09	Sediment Fence	SF-01



NOTES (OUTFALL CROSS BANK):

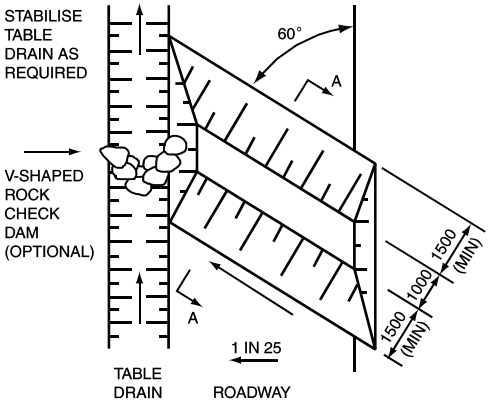
1. THE CROSS BANK SHOWN IS FORMED BY EXCAVATING ROAD MATERIAL UPSLOPE OF THE BANK, THUS FORMING AN UP-SLOPE CROSS DRAIN. ALTERNATIVELY THE BANK COULD BE FORMED USING IMPORTED MATERIAL.
2. THE TABLE DRAIN UP-SLOPE OF THE CROSS BANK MUST BE FREE DRAINING.
3. SEDIMENT DEPOSITED WITHIN THE CROSS DRAIN MUST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

OUTFALL CROSS BANK (PLAN VIEW)



CROSS BANK PROFILE (INSITU MATERIAL)

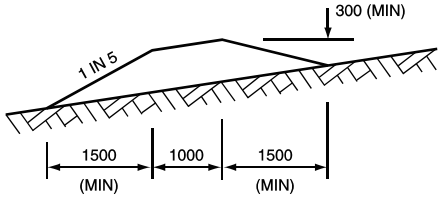
(a) Outfall cross-bank for low speed tracks



INFALL CROSS BANK (PLAN VIEW)

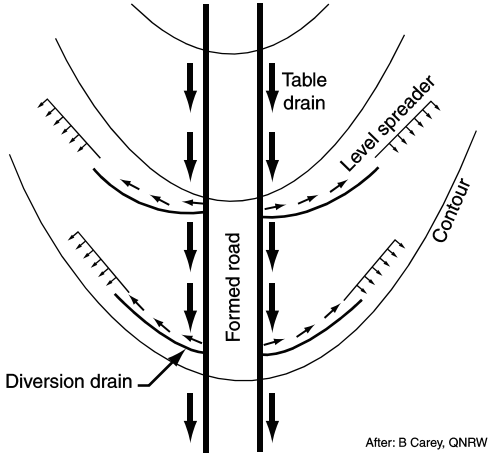
NOTES (INFALL CROSS BANK):

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.

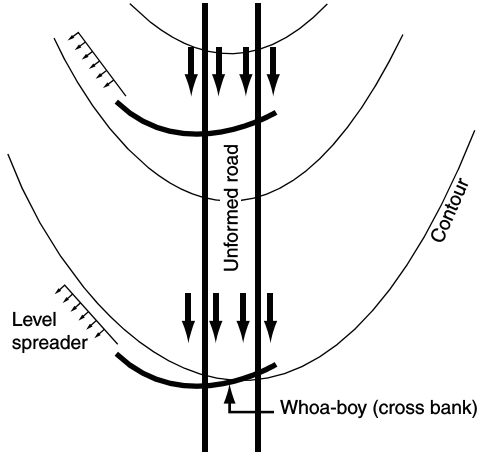


CROSS BANK PROFILE (IMPORTED MATERIAL)

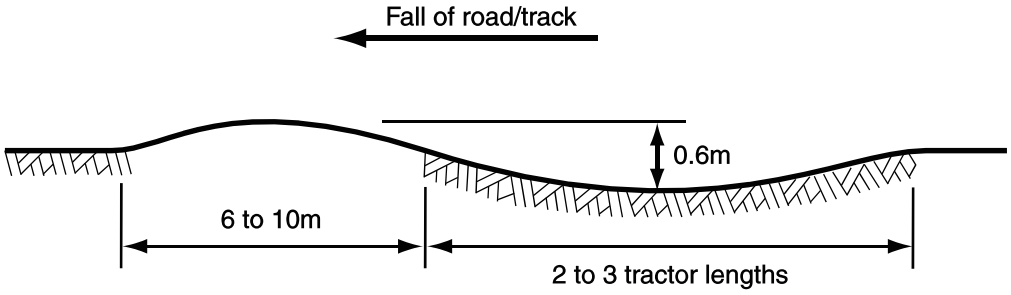
(b) Infall cross-bank for low speed tracks



After: B Carey, QNRW



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

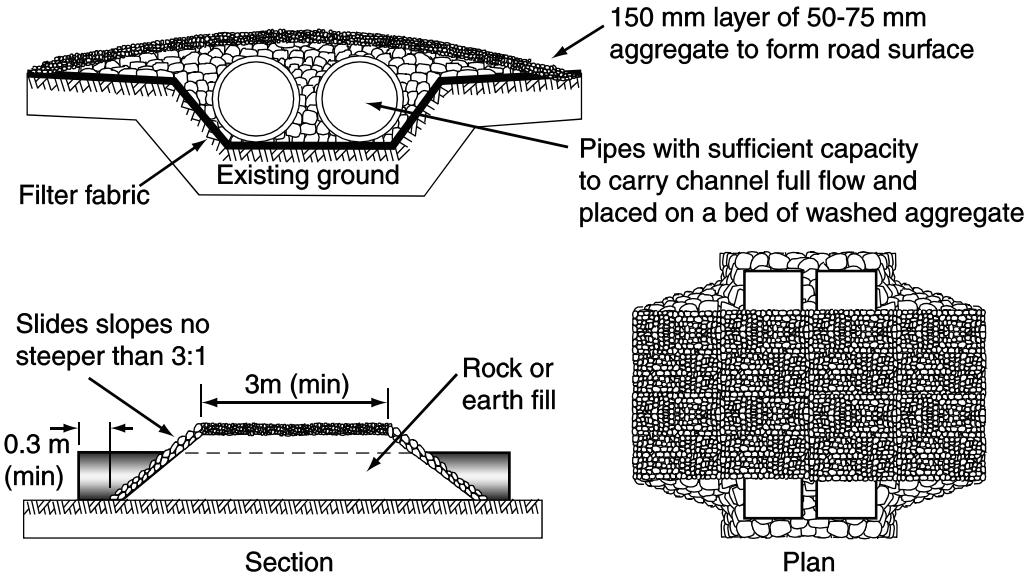


(e) Typical cross-bank profile for low speed tracks

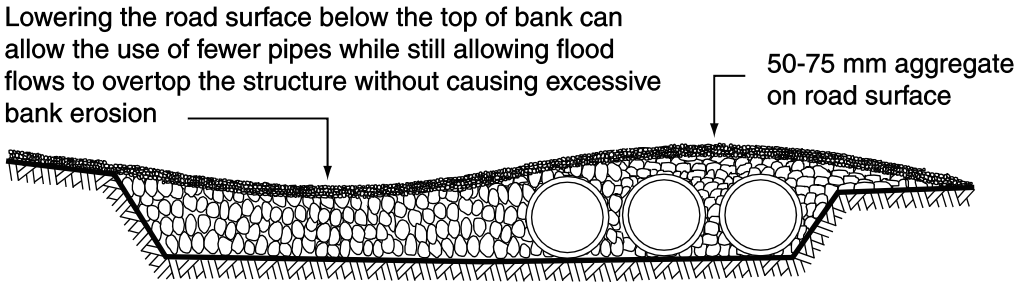
General notes:

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

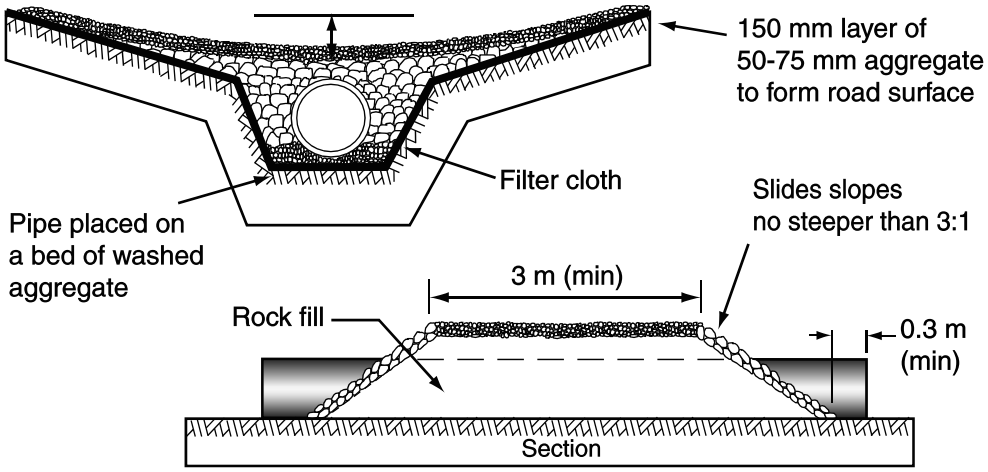


(a) Preferred arrangement for temporary culvert crossings

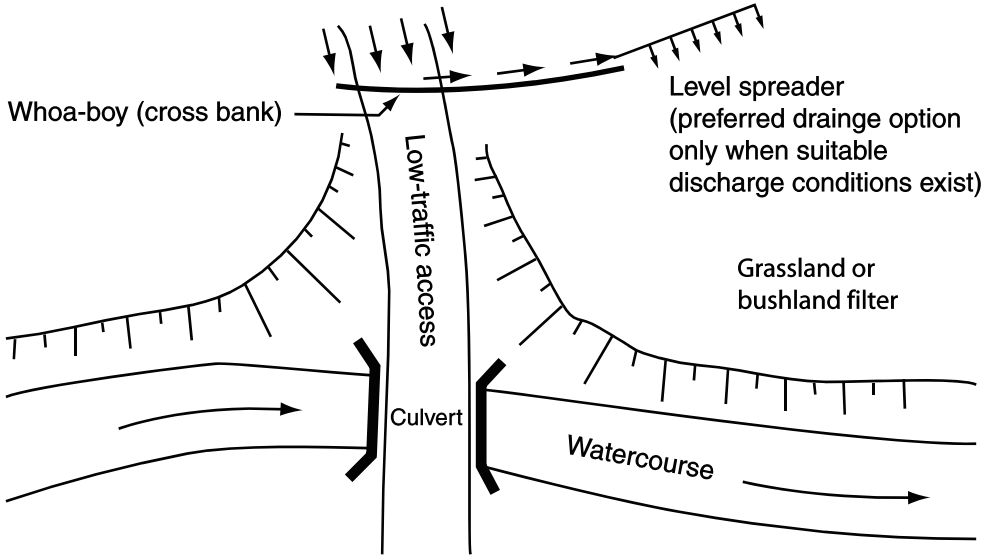


(b) Typical profile of temporary culvert crossings of wide channels

In situations where it is not practicable to allow overflows to initially passing around the culvert on a stable (well vegetated) stream bank, then the center must be set low to allow flow to pass over the culvert along the centreline of the channel



(c) Alternative layout for the crossing of confined channels



(d) Typical arrangement of surface runoff controls associated with approach ramps

Drawn:	Date:		
GMW	Dec-09	Temporary Culvert Crossing	TCC-01

MATERIALS

PRIMARY CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN,

ARMOUR ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN,

AGGREGATE FILTER: **50** mm 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 150mm 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