PLANS AND DOCUMENTS
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DEVELOPMENT APPROVAL

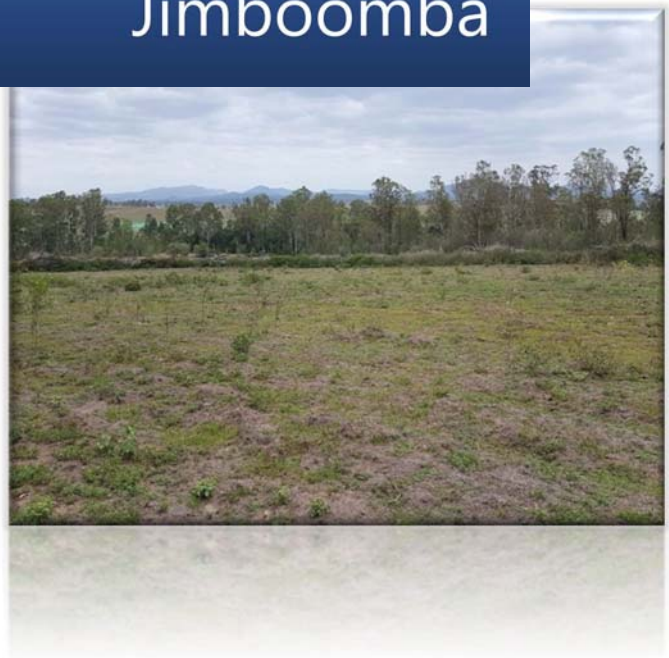
Approval no: DEV2023/1434

Date: 13/12/2023

Queensland Government

Gallagher Environmental

Erosion & Sediment Control Plan (ESCP): Riverbend – Bulk Earthworks, Jimboomba



Client: Colliers

Report No: GE23.054.R1a

Date: 16th November, 2023

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Job No.	GE23.054
Document No:	GE23.054.R1a.doc
Title:	Erosion & Sediment Control Plan (ESCP): Riverbend – Bulk Earthworks, Jimboomba
Project Manager:	Glen Gallagher
Qualifications:	BScApp(EnvSc)(Hons) MEIANZ CPESC
Client:	Colliers
Client Contact:	Mr. Simon Ridge
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 October 2023	G Gallagher	GMGallagher
A	16 November 2023	G Gallagher	GMGallagher

DISTRIBUTION

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

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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 'Riverbend – Bulk Earthworks' development located at Jimboomba.

The purpose of the ESCP is to define the overall erosion hazard of the proposed earthworks and to provide appropriate management strategies in order to ensure adverse effects on the environment from soil erosion are mitigated during the construction 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 construction 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;
- Construction activities are undertaken without adverse environmental impacts on-site or on adjacent or downstream areas; and
- Construction activities are undertaken without causing nuisance to neighbouring residents.

1.3 ESCP Timeframe

The ESCP is intended to cover the construction phase of the development.

Hold Point: Prior to earthwork 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 construction activities.

This also includes difficulties that may arise in ensuring appropriative diversion of stormwater to sediment basins, or clean stormwater diversion strategies that require alternative solutions during evolving earthworks and construction.

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 bulk earthworks package is approximately 85ha and the development involves topsoil stripping and cut to fill bulk earthworks. No civil works are proposed, and the disturbance areas shall be progressively re-topsoiled and stabilised with grass-seeding.

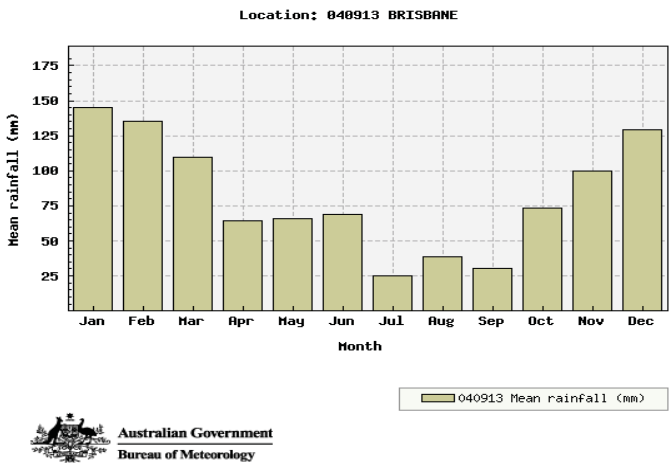
2.2 Slopes & Drainage

The slopes associated with the proposed bulk earthworks are generally very gently inclined to moderately inclined with slopes generally ranging between 0.5% to 12%. The majority of the proposed land disturbance is very gently inclined (<2%). The majority of the site drains towards a centrally-located drainage line (ephemeral) that flows west to east. Slope and drainage features have been examined as part of calculations presented in Section 3.1.

The proposed earthworks contain several non-contiguous disturbance areas, resulting in extensive external catchment areas that shall be diverted during construction. These are examined as part of calculations presented in Section 3.5.

2.3 Rainfall /Climate

As per Bureau of Meteorology (BoM) website online data for Brisbane (Location 040913), the wet season in the project area begins in November through to March, as indicated below:



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

The calculated R factor (annual) is 3105.

2.4 Soil Types

A Dispersive Soil Management Plan (DSMP) was prepared for the development by Lambert & Rehbein (2017). A review of borehole and soil dispersion data reveals eight (8) pertinent boreholes in relation to the currently proposed earthworks (BH10, BH13, BH15 -BH20). Soil profiles exhibited high uniformity of (CI) silty sandy clay to (CH) silty clay B2 horizons (subsoils). These soils correspond to light to heavy clay and silty clay soils in accordance with the Australian Soil Classification (ASC). In accordance with Table E4 of the IECA Guidelines (2008), a K factor ranging of approximately 0.012 - 0.025 would represent the subsoil textures identified.

The DSMP study revealed the presence of soil sodicity moderate occurrence of dispersive subsoils. Consequently, the site subsoil materials are assumed to be significantly dispersive and the K factor has been increased by a *minimum* 20% in accordance with IECA (2008) Guidelines.

Overall, a conservative K-factor of **0.030** (refer below) has been adopted to represent the subsoils to be disturbed and exposed during the construction phase.

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Soil Water Environment

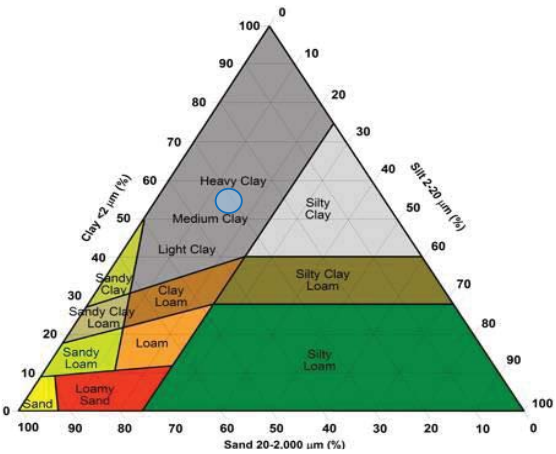
CLIENT : COLLIERS
ADDRESS : RIVERBEND JIMBOOMBA
JOB NO : GE23.054

SOIL: Medium-Heavy Clay (Silty)

Estimation of Soil K Factor

(Soils & Construction, 2004)

Soil Texture	Sand (0.1 - 2.0mm)	25 %	
- Fine Earth Fraction	Fine Sand (0.02 - 0.1mm)	5 %	
- Borelogs	Silt (0.002 - 0.02mm)	15 %	
	Clay (<0.002mm)	55 %	
	Gravel (>2mm)	<2 %	
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		0.0285	
Safety Factor (+)		+5 %	
Estimated K Factor		**0.03**	



Glen Gallagher CPESC No. 8346

3. ESC DESIGN METHODOLOGY

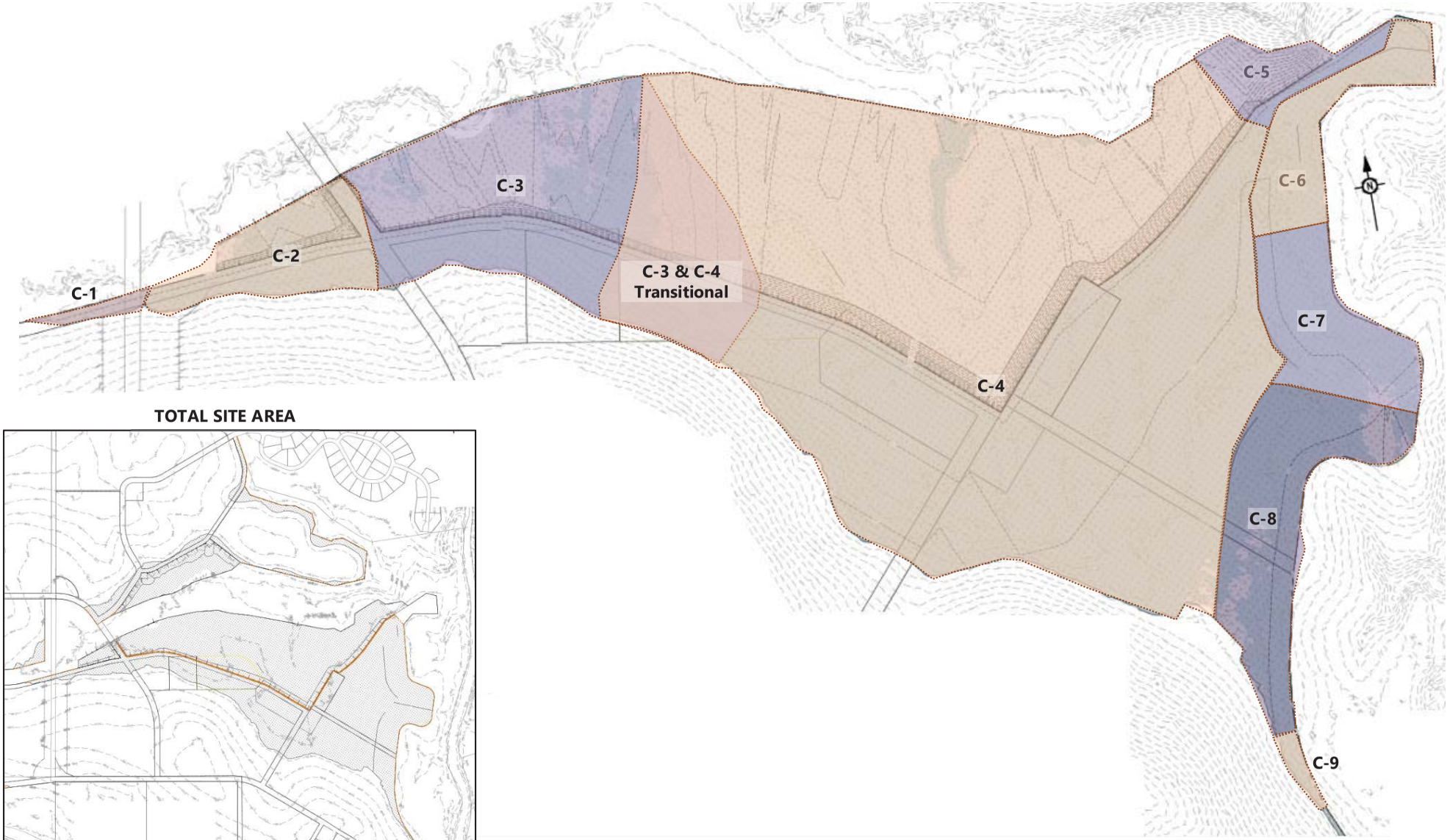
3.1 Soil Erosion Hazard Calculations

The catchment details and soil erosion hazard calculations for the 'worst-case' bulk earthworks phase are shown in Table 1 below. Overall, a conservative C-factor of 1.0 has been used to represent all disturbed soil surfaces and the default P (control practice) factors of 1.3 for construction phase has also been utilised. It should be noted that the catchment areas (ha) and LS, C and P factors represent the largest areas and 'worst-case' characteristics respectively during disturbance.

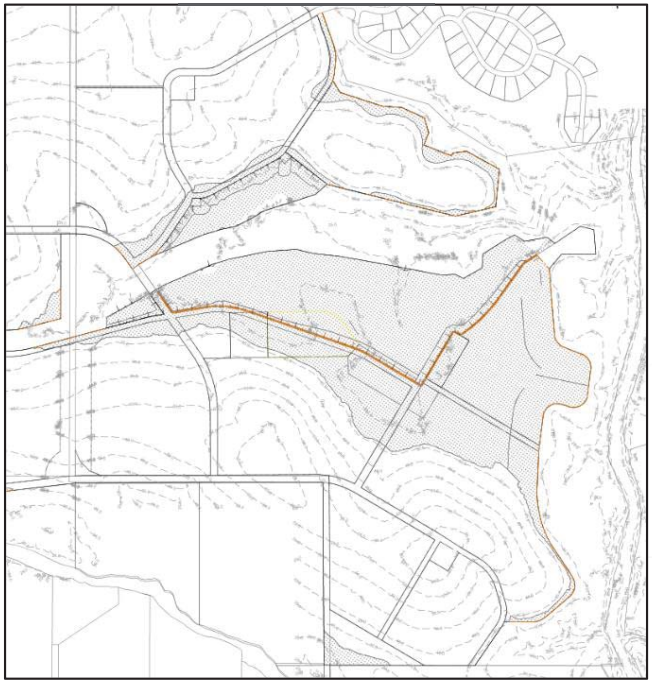
Table 1: Catchment Soil Loss Rates (>0.1ha)

Catchment	Area (ha)	LS Factor	C Factor	P Factor	Estimated Soil Loss[1] (t/ha/yr)	ESC Control Classification	Erosion Hazard Class
C-1	0.27	0.54 (5.0% @ 20m)	1.0	1.3	65	Type 3	Very Low
C-2	2.7	0.53 (2.5% @ 80m)	1.0	1.3	64	Type 3	Very Low
C-3	<13.1	0.41 (2.0% @ 80m)	1.0	1.3	49	Type 3	Very Low
C-4	<45.5	0.30 (1.5% @ 80m)	1.0	1.3	36	Type 3	Very Low
C-5	1.6	1.76 (7.0% @ 80m)	1.0	1.3	213	Type 1	Low
C-6	2.5	0.30 (1.5% @ 80m)	1.0	1.3	36	Type 3	Very Low
C-7	3.4	0.41 (2.0% @ 80m)	1.0	1.3	49	Type 3	Very Low
C-8	4.9	0.30 (1.5% @ 80m)	1.0	1.3	36	Type 3	Very Low
C-9	0.21	1.44 (11.0% @ 25m)	1.0	1.3	174	Type 2	Low
C-10	0.40	0.89 (10% @ 15m)	1.0	1.3	108	Type 2	Very Low
C-11	0.12	1.39 (12.0% @ 20m)	1.0	1.3	168	Type 2	Low
C-12	0.85	1.12 (12% @ 15m)	1.0	1.3	136	Type 2	Very Low
C-13	1.15	0.83 (8.0% @ 20m)	1.0	1.3	100	Type 1	Very Low
C-14	0.4	0.88 (6.5% @ 30m)	1.0	1.3	106	Type 2	Very Low
C-15	0.5	0. (6.5% @ 30m)	1.0	1.3	106	Type 2	Very Low
C-16	0.75	1.08 (8% @ 30m)	1.0	1.3	131	Type 2	Very Low
C-17	0.17	0.68 (8.0% @ 15m)	1.0	1.3	82	Type 2	Very Low
C-18	0.21	1.00 (11% @ 15m)	1.0	1.3	121	Type 2	Very Low
C-19	0.19	1.24 (13.0% @ 15m)	1.0	1.3	151	Type 2	Very Low
C-20	0.65	0.41 (3% @ 30m)	1.0	1.3	50	Type 3	Very Low
C-21	9.7	0.78 (3.5% @ 80m)	1.0	1.3	94	Type 1	Very Low
C-22	0.75	0.68 (3.5% @ 60m)	1.0	1.3	82	Type 2	Very Low
C-23	0.23	0.68 (5% @ 30m)	1.0	1.3	82	Type 2	Very Low

[1] RUSLE: A = R.K.LS.C.P; where R = 3105 for Jimboomba, K Factor = 0.030



TOTAL SITE AREA



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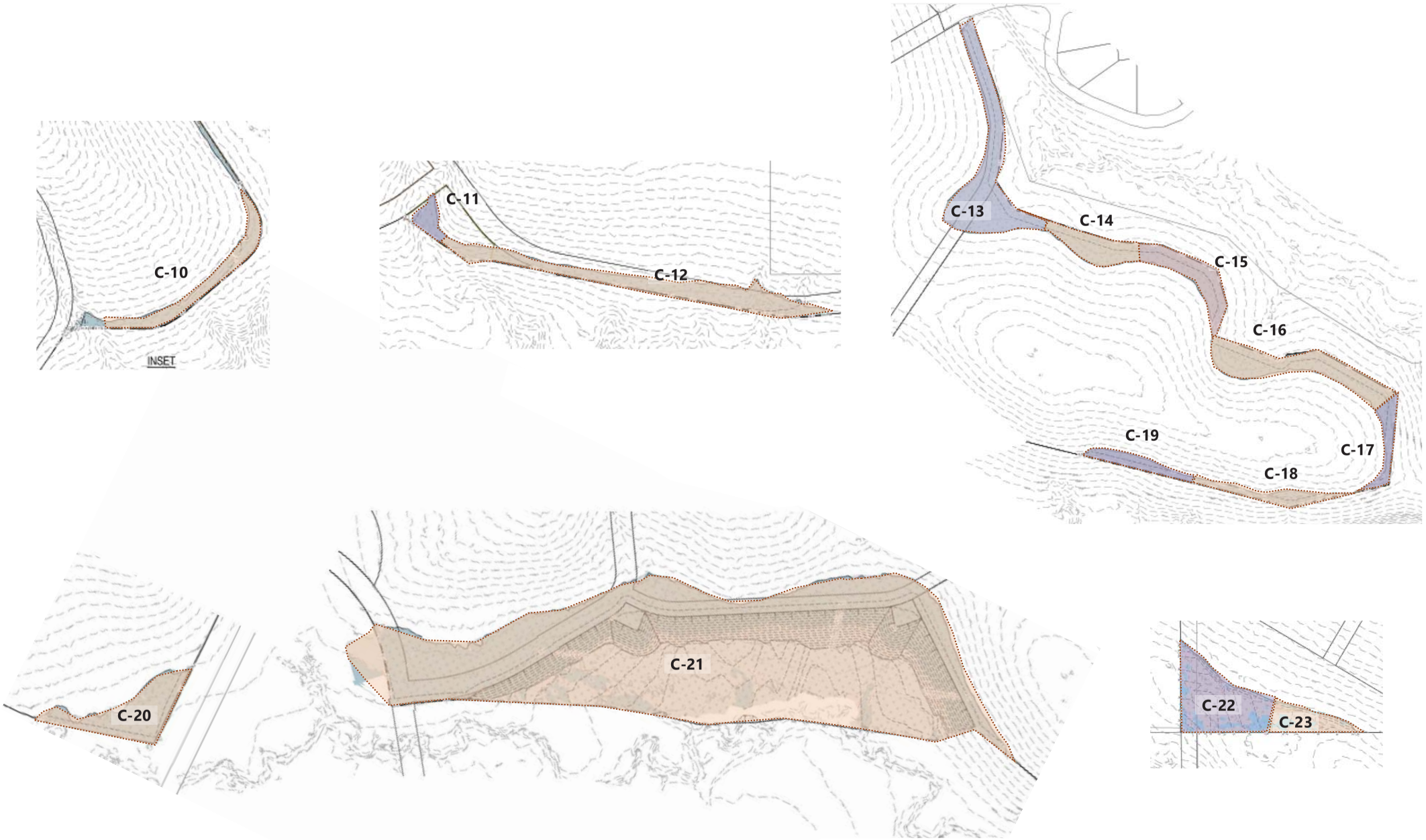
TITLE: ESC Sub-Catchment Plan – Bulk Earthworks (>0.1ha)		DRAWING NO.: GE23.054.A1	
JOB LOCATION: Riverbend Bulk Earthworks		SCALE: 1:8000 @ A4	
CLIENT: Colliers	DATE: 23.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346



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TITLE: ESC Sub-Catchment Plan – Bulk Earthworks (>0.1ha)			DRAWING NO.: GE23.054.A2
JOB LOCATION: Riverbend Bulk Earthworks			SCALE: 1:6500 @ A4
CLIENT: Colliers	DATE: 19.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

The overall soil loss rate for the bulk earthworks phase (from weighted mean above) is calculated as ***~55 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)	C-5
	>1.0ha	>75		C-13, C-21
2	0.10 – 0.25ha	>75	Sediment basin (less than design standard), rock filter dam, mulch filter berm	C-9, C-11, C-17 to C-19, C-23
	0.25 – 1.0ha	75 – 150		C-10, C-12, C-14 to C-16, C-22
3	<0.10ha	All Cases	sediment fences, coir logs sediment traps/check dams, field inlet protection	
	>0.10ha	<75		C-1 to C-4, C-6 to C-8, C-20

N.B. Given the large areas of catchments C-3 (up to 13.1ha) and C-4 (up to 45.5ha), it is recommended that HES Basins (without the safety factor) be utilised for an upgraded ESC Strategy from the designated 'Type 3' controls in these 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;
- Clean water diversion bunds constructed for the external stormwater catchments;
- For catchments, C-5, C-13 and C-21: Implementation of 'Type 1' HES sediment basins and stormwater diversion structures (e.g. diversion bunds) to appropriately divert on-site stormwater flows to the sediment basins;
- For catchments C-3 and C-4, an upgraded HES sediment basin control (without safety factor), including diversion structures;
- For remaining 'Type 2' and 'Type 3' catchments, the implementation of mulch filter berms on site disturbance boundaries that receive stormwater flows;
- Additional Rock Filter Dams for catchments C-11, C-12 and C-16;
- Lateral catch drains placed along the contour at specified intervals within inactive earthwork areas and in other areas prior to all forecast rainfall events, in order to maintain the effective slope lengths during bulk earthworks;
- Stabilisation of earthworks areas reaching final levels within the specified thirty (30) day timeframe.

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

3.3 Sediment Basin Design

3.3.1 Sediment Basin Type

The IECA Guidelines (2018) provide the following sediment basin types, as per Table 4 below:

Table 4: Sediment Basin Types

Sediment Basin Type	Soil and/or Catchment Conditions
Type A[1]	>12-month soil disturbance duration within the drainage catchment
Type B[1]	<12-month soil disturbance duration within the drainage catchment
Type C	<33% of soil <0.02mm and <10% dispersive

[1] Alternative measures such as batched (enlarged) sediment basins may be implemented in lieu of Type A or B basins where it can be shown that such measures will achieve a commensurate performance outcome (i.e. at least 80% of the annual average runoff volume can achieve the Water Quality Objectives (WQO's).

3.3.2 HES Basin Sizing

The 'Type B' HES sediment basin design in accordance with the IECA Guidelines (2018) are detailed in the following worksheets.

Settlement Coefficients (Ks) of 8,000 and 6,000 (i.e. without safety factor) have been utilised. Jar Settlement testing shall be required at the commencement of construction to validate the use of this Ks Factor. The Ks factor shall be increased (and basin sizes increased) where required, as governed by the results of the Jar Settlement test.

'TYPE B' HES BASIN DESIGN

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Catchment		Design Flowrate				Settling Zone						Sediment Storage Zone				Batters			Forebay	
Basin #	Area (ha)	C_{10}	tc (min)	$I_{3month,tc}$ (mm/hr)	Q_{3month} (m^3/s)	Ks (s/m)	Settling Zone	Settling Area (m^2)	Settling Volume	W:L (1:X)	Scour Velocity	Soil Loss (t/ha/yr)	Storage (months)	Sed Storage	Sed Storage	Inlet Batter	Other Batters	Ave. Batter	Batters (1:X)	Volume (m^3)
1	1.60	0.70	10	42	0.105	8000	1.00	502	502	3	✔ 0.008	213	2.7	61	0.20	3	3	3.000	2	50

Main Basin Dimensions									Forebay Dimensions					
At Weir Crest			Floor Level			At Top of Batter			At Level Spreader Weir			Floor Level		
Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)
14.88	44.65	1.20	7.69	37.46	0.0m	16.68	46.45	1.50	16.68	5.95	1.00	12.68	1.25	0.0

Spillway											
Basin Design Life	Design ARI	C_{10}	C	I (mm/hr)	Q (m^3/s)	Head over spillway (m)	Weir Side Slope (1:X)	Spillway Crest Length (m)	Total Spillway Length (m)	Weir Depth (to top of rock) (m)	Spillway Rock Size (D_{50} mm)
3-12months	1:20yr	0.7	0.74	174	0.57	0.15	1	5.7	6.3	0.3	150

Table B18 – Sediment settlement characteristics for design option 2B

Jar test settlement after 15 min (mm)	50	75	100	150	200	300
Laboratory settlement rate (m/hr)	0.20	0.30	0.40	0.60	0.80	1.20
Factor of safety	1.33	1.33	1.33	1.33	1.33	1.33
Design settlement rate, v_F (m/hr)	0.15	0.23	0.30	0.45	0.60	0.90
Design settlement coefficient, Ks (s/m)	24000	16000	12000	8000	6000	4000

Table 4.5.4 – C_{10} values for zero fraction impervious [1]

Land description	Dense bushland			Medium density bush, or Good grass cover, or High density pasture, or Zero tillage cropping			Light cover bushland, or Poor grass cover, or Low density pasture, or Low cover bare fallows		
Intensity (mm/hr) $^{f}I_{10}$	Soil permeability			Soil permeability			Soil permeability		
	High	Med	Low	High	Med	Low	High	Med	Low
39–44	0.08	0.24	0.32	0.16	0.32	0.40	0.24	0.40	0.48
45–49	0.10	0.29	0.39	0.20	0.39	0.49	0.29	0.49	0.59
50–54	0.12	0.35	0.46	0.23	0.46	0.58	0.35	0.58	0.69
55–59	0.13	0.40	0.53	0.27	0.53	0.66	0.40	0.66	0.70
60–64	0.15	0.44	0.59	0.30	0.59	0.70	0.44	0.70	0.70
65–69	0.17	0.50	0.66	0.33	0.66	0.70	0.50	0.70	0.70
70–90	0.18	0.53	0.70	0.35	0.70	0.70	0.53	0.70	0.70

Table 4.5.3 – Table of C_{10} values

Intensity (mm/hr) $^{f}I_{10}$	Fraction impervious f_i						
	0.00	0.20	0.40	0.60	0.80	0.90	1.00
39-44	Refer to Table 4.5.4	0.44	0.55	0.67	0.78	0.84	0.90
45-49		0.49	0.60	0.70	0.80	0.85	0.90
50-54		0.55	0.64	0.72	0.81	0.86	0.90
55-59		0.60	0.68	0.75	0.83	0.86	0.90
60-64		0.65	0.72	0.78	0.84	0.87	0.90
65-69		0.71	0.76	0.80	0.85	0.88	0.90
70-90		0.74	0.78	0.82	0.86	0.88	0.90

'TYPE B' HES BASIN DESIGN

Gallagher Environmental

Catchment		Design Flowrate				Settling Zone						Sediment Storage Zone				Batters			Forebay	
Basin #	Area (ha)	C_{10}	tc (min)	$I_{3month,tc}$ (mm/hr)	Q_{3month} (m^3/s)	Ks (s/m)	Settling Zone	Settling Area (m^2)	Settling Volume	W:L (1:X)	Scour Velocity	Soil Loss (t/ha/yr)	Storage (months)	Sed Storage	Sed Storage	Inlet Batter	Other Batters	Ave. Batter	Batters (1:X)	Volume (m^3)
2	1.15	0.70	11	40	0.072	8000	1.00	343	343	2	✔ 0.005	100	5.1	39	0.20	3	3	3.000	2	34

Main Basin Dimensions									Forebay Dimensions					
At Weir Crest			Floor Level			At Top of Batter			At Level Spreader Weir			Floor Level		
Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)
15.05	30.11	1.20	7.86	22.92	0.0m	16.85	31.91	1.50	16.85	4.98	1.00	12.85	0.28	0.0

Spillway											
Basin Design Life	Design ARI	C_{10}	C	I (mm/hr)	Q (m^3/s)	Head over spillway (m)	Weir Side Slope (1:X)	Spillway Crest Length (m)	Total Spillway Length (m)	Weir Depth (to top of rock) (m)	Spillway Rock Size (D_{50} mm)
3-12months	1:20yr	0.7	0.74	168	0.40	0.15	1	3.9	4.5	0.3	150

Table B18 – Sediment settlement characteristics for design option 2B

Jar test settlement after 15 min (mm)	50	75	100	150	200	300
Laboratory settlement rate (m/hr)	0.20	0.30	0.40	0.60	0.80	1.20
Factor of safety	1.33	1.33	1.33	1.33	1.33	1.33
Design settlement rate, v_F (m/hr)	0.15	0.23	0.30	0.45	0.60	0.90
Design settlement coefficient, Ks (s/m)	24000	16000	12000	8000	6000	4000

Table 4.5.4 – C_{10} values for zero fraction impervious [1]

Land description	Dense bushland			Medium density bush, or Good grass cover, or High density pasture, or Zero tillage cropping			Light cover bushland, or Poor grass cover, or Low density pasture, or Low cover bare fallows		
Intensity (mm/hr) $^{f}I_{10}$	Soil permeability			Soil permeability			Soil permeability		
	High	Med	Low	High	Med	Low	High	Med	Low
39–44	0.08	0.24	0.32	0.16	0.32	0.40	0.24	0.40	0.48
45–49	0.10	0.29	0.39	0.20	0.39	0.49	0.29	0.49	0.59
50–54	0.12	0.35	0.46	0.23	0.46	0.58	0.35	0.58	0.69
55–59	0.13	0.40	0.53	0.27	0.53	0.66	0.40	0.66	0.70
60–64	0.15	0.44	0.59	0.30	0.59	0.70	0.44	0.70	0.70
65–69	0.17	0.50	0.66	0.33	0.66	0.70	0.50	0.70	0.70
70–90	0.18	0.53	0.70	0.35	0.70	0.70	0.53	0.70	0.70

Table 4.5.3 – Table of C_{10} values

Intensity (mm/hr) $^{f}I_{10}$	Fraction impervious f_i						
	0.00	0.20	0.40	0.60	0.80	0.90	1.00
39-44	Refer to Table 4.5.4	0.44	0.55	0.67	0.78	0.84	0.90
45-49		0.49	0.60	0.70	0.80	0.85	0.90
50-54		0.55	0.64	0.72	0.81	0.86	0.90
55-59		0.60	0.68	0.75	0.83	0.86	0.90
60-64		0.65	0.72	0.78	0.84	0.87	0.90
65-69		0.71	0.76	0.80	0.85	0.88	0.90
70-90		0.74	0.78	0.82	0.86	0.88	0.90

'TYPE B' HES BASIN DESIGN

Gallagher Environmental

Catchment		Design Flowrate				Settling Zone						Sediment Storage Zone				Batters			Forebay	
Basin #	Area (ha)	C_{10}	tc (min)	$I_{3month,tc}$ (mm/hr)	Q_{3month} (m^3/s)	Ks (s/m)	Settling Zone	Settling Area (m^2)	Settling Volume	W:L (1:X)	Scour Velocity	Soil Loss (t/ha/yr)	Storage (months)	Sed Storage	Sed Storage	Inlet Batter	Other Batters	Ave. Batter	Batters (1:X)	Volume (m^3)
3	9.70	0.70	17	33	0.498	8000	1.40	1707	2390	2	✓ 0.012	94	3.9	237	0.20	3	3	3.000	2	239

Main Basin Dimensions									Forebay Dimensions					
At Weir Crest			Floor Level			At Top of Batter			At Level Spreader Weir			Floor Level		
Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)
31.95	63.89	1.60	22.34	54.28	0.0m	34.35	66.29	2.00	34.35	9.07	1.20	29.55	3.57	0.0

Spillway											
Basin Design Life	Design ARI	C_{10}	C	I (mm/hr)	Q (m^3/s)	Head over spillway (m)	Weir Side Slope (1:X)	Spillway Crest Length (m)	Total Spillway Length (m)	Weir Depth (to top of rock) (m)	Spillway Rock Size (D_{50} mm)
3-12months	1:20yr	0.7	0.74	141	2.80	0.25	1	13.0	13.8	0.4	200

Table B18 – Sediment settlement characteristics for design option 2B

Jar test settlement after 15 min (mm)	50	75	100	150	200	300
Laboratory settlement rate (m/hr)	0.20	0.30	0.40	0.60	0.80	1.20
Factor of safety	1.33	1.33	1.33	1.33	1.33	1.33
Design settlement rate, v_F (m/hr)	0.15	0.23	0.30	0.45	0.60	0.90
Design settlement coefficient, Ks (s/m)	24000	16000	12000	8000	6000	4000

Table 4.5.4 – C_{10} values for zero fraction impervious [1]

Land description	Dense bushland			Medium density bush, or Good grass cover, or High density pasture, or Zero tillage cropping			Light cover bushland, or Poor grass cover, or Low density pasture, or Low cover bare fallows		
Intensity (mm/hr) $^{f}I_{10}$	Soil permeability			Soil permeability			Soil permeability		
	High	Med	Low	High	Med	Low	High	Med	Low
39–44	0.08	0.24	0.32	0.16	0.32	0.40	0.24	0.40	0.48
45–49	0.10	0.29	0.39	0.20	0.39	0.49	0.29	0.49	0.59
50–54	0.12	0.35	0.46	0.23	0.46	0.58	0.35	0.58	0.69
55–59	0.13	0.40	0.53	0.27	0.53	0.66	0.40	0.66	0.70
60–64	0.15	0.44	0.59	0.30	0.59	0.70	0.44	0.70	0.70
65–69	0.17	0.50	0.66	0.33	0.66	0.70	0.50	0.70	0.70
70–90	0.18	0.53	0.70	0.35	0.70	0.70	0.53	0.70	0.70

Table 4.5.3 – Table of C_{10} values

Intensity (mm/hr) $^{f}I_{10}$	Fraction impervious f_i						
	0.00	0.20	0.40	0.60	0.80	0.90	1.00
39-44	Refer to Table 4.5.4	0.44	0.55	0.67	0.78	0.84	0.90
45-49		0.49	0.60	0.70	0.80	0.85	0.90
50-54		0.55	0.64	0.72	0.81	0.86	0.90
55-59		0.60	0.68	0.75	0.83	0.86	0.90
60-64		0.65	0.72	0.78	0.84	0.87	0.90
65-69		0.71	0.76	0.80	0.85	0.88	0.90
70-90		0.74	0.78	0.82	0.86	0.88	0.90

'TYPE B' HES BASIN DESIGN

Gallagher Environmental

Catchment		Design Flowrate				Settling Zone						Sediment Storage Zone				Batters			Forebay	
Basin #	Area (ha)	C_{10}	tc (min)	$I_{3month,tc}$ (mm/hr)	Q_{3month} (m^3/s)	Ks (s/m)	Settling Zone	Settling Area (m^2)	Settling Volume	W:L (1:X)	Scour Velocity	Soil Loss (t/ha/yr)	Storage (months)	Sed Storage	Sed Storage	Inlet Batter	Other Batters	Ave. Batter	Batters (1:X)	Volume (m^3)
4	13.10	0.70	20	31	0.632	6000	1.80	1263	2274	2	✔ 0.014	49	3.5	150	0.20	3	3	3.000	2	227

Main Basin Dimensions									Forebay Dimensions					
At Weir Crest			Floor Level			At Top of Batter			At Level Spreader Weir			Floor Level		
Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)
28.64	57.29	2.00	16.64	45.29	0.0m	31.04	59.69	2.40	31.04	8.99	1.40	25.44	2.69	0.0

Spillway											
Basin Design Life	Design ARI	C_{10}	C	I (mm/hr)	Q (m^3/s)	Head over spillway (m)	Weir Side Slope (1:X)	Spillway Crest Length (m)	Total Spillway Length (m)	Weir Depth (to top of rock) (m)	Spillway Rock Size (D_{50} mm)
3-12months	1:20yr	0.7	0.74	130	3.48	0.25	1	16.2	17.0	0.4	225

Table B18 – Sediment settlement characteristics for design option 2B

Jar test settlement after 15 min (mm)	50	75	100	150	200	300
Laboratory settlement rate (m/hr)	0.20	0.30	0.40	0.60	0.80	1.20
Factor of safety	1.33	1.33	1.33	1.33	1.33	1.33
Design settlement rate, v_F (m/hr)	0.15	0.23	0.30	0.45	0.60	0.90
Design settlement coefficient, Ks (s/m)	24000	16000	12000	8000	6000	4000

Table 4.5.4 – C_{10} values for zero fraction impervious [1]

Land description	Dense bushland			Medium density bush, or Good grass cover, or High density pasture, or Zero tillage cropping			Light cover bushland, or Poor grass cover, or Low density pasture, or Low cover bare fallows		
Intensity (mm/hr) $^{f}I_{10}$	Soil permeability			Soil permeability			Soil permeability		
	High	Med	Low	High	Med	Low	High	Med	Low
39–44	0.08	0.24	0.32	0.16	0.32	0.40	0.24	0.40	0.48
45–49	0.10	0.29	0.39	0.20	0.39	0.49	0.29	0.49	0.59
50–54	0.12	0.35	0.46	0.23	0.46	0.58	0.35	0.58	0.69
55–59	0.13	0.40	0.53	0.27	0.53	0.66	0.40	0.66	0.70
60–64	0.15	0.44	0.59	0.30	0.59	0.70	0.44	0.70	0.70
65–69	0.17	0.50	0.66	0.33	0.66	0.70	0.50	0.70	0.70
70–90	0.18	0.53	0.70	0.35	0.70	0.70	0.53	0.70	0.70

Table 4.5.3 – Table of C_{10} values

Intensity (mm/hr) $^{f}I_{10}$	Fraction impervious f_i						
	0.00	0.20	0.40	0.60	0.80	0.90	1.00
39-44	Refer to Table 4.5.4	0.44	0.55	0.67	0.78	0.84	0.90
45-49		0.49	0.60	0.70	0.80	0.85	0.90
50-54		0.55	0.64	0.72	0.81	0.86	0.90
55-59		0.60	0.68	0.75	0.83	0.86	0.90
60-64		0.65	0.72	0.78	0.84	0.87	0.90
65-69		0.71	0.76	0.80	0.85	0.88	0.90
70-90		0.74	0.78	0.82	0.86	0.88	0.90

'TYPE B' HES BASIN DESIGN

Gallagher Environmental

Catchment		Design Flowrate				Settling Zone						Sediment Storage Zone				Batters			Forebay	
Basin #	Area (ha)	C_{10}	tc (min)	$I_{3month,tc}$ (mm/hr)	Q_{3month} (m^3/s)	Ks (s/m)	Settling Zone	Settling Area (m^2)	Settling Volume	W:L (1:X)	Scour Velocity	Soil Loss (t/ha/yr)	Storage (months)	Sed Storage	Sed Storage	Inlet Batter	Other Batters	Ave. Batter	Batters (1:X)	Volume (m^3)
5	45.10	0.70	26	26	1.824	6000	1.80	3648	6567	1.5	✗ 0.021	36	4.9	530	0.20	3	3	3.000	2	657

Main Basin Dimensions									Forebay Dimensions					
At Weir Crest			Floor Level			At Top of Batter			At Level Spreader Weir			Floor Level		
Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)	Width (m)	Length (m)	Depth (m)
52.83	79.24	2.00	40.80	67.21	0.0m	55.83	82.24	2.50	55.83	10.95	1.90	48.23	2.65	0.0

Spillway											
Basin Design Life	Design ARI	C_{10}	C	I (mm/hr)	Q (m^3/s)	Head over spillway (m)	Weir Side Slope (1:X)	Spillway Crest Length (m)	Total Spillway Length (m)	Weir Depth (to top of rock) (m)	Spillway Rock Size (D_{50} mm)
3-12months	1:20yr	0.7	0.74	118	10.87	0.35	1	30.6	31.6	0.5	275

Table B18 – Sediment settlement characteristics for design option 2B

Jar test settlement after 15 min (mm)	50	75	100	150	200	300
Laboratory settlement rate (m/hr)	0.20	0.30	0.40	0.60	0.80	1.20
Factor of safety	1.33	1.33	1.33	1.33	1.33	1.33
Design settlement rate, v_F (m/hr)	0.15	0.23	0.30	0.45	0.60	0.90
Design settlement coefficient, Ks (s/m)	24000	16000	12000	8000	6000	4000

Table 4.5.4 – C_{10} values for zero fraction impervious [1]

Land description	Dense bushland			Medium density bush, or Good grass cover, or High density pasture, or Zero tillage cropping			Light cover bushland, or Poor grass cover, or Low density pasture, or Low cover bare fallows		
Intensity (mm/hr) $^{f}I_{10}$	Soil permeability			Soil permeability			Soil permeability		
	High	Med	Low	High	Med	Low	High	Med	Low
39–44	0.08	0.24	0.32	0.16	0.32	0.40	0.24	0.40	0.48
45–49	0.10	0.29	0.39	0.20	0.39	0.49	0.29	0.49	0.59
50–54	0.12	0.35	0.46	0.23	0.46	0.58	0.35	0.58	0.69
55–59	0.13	0.40	0.53	0.27	0.53	0.66	0.40	0.66	0.70
60–64	0.15	0.44	0.59	0.30	0.59	0.70	0.44	0.70	0.70
65–69	0.17	0.50	0.66	0.33	0.66	0.70	0.50	0.70	0.70
70–90	0.18	0.53	0.70	0.35	0.70	0.70	0.53	0.70	0.70

Table 4.5.3 – Table of C_{10} values

Intensity (mm/hr) $^{f}I_{10}$	Fraction impervious f_i						
	0.00	0.20	0.40	0.60	0.80	0.90	1.00
39-44	Refer to Table 4.5.4	0.44	0.55	0.67	0.78	0.84	0.90
45-49		0.49	0.60	0.70	0.80	0.85	0.90
50-54		0.55	0.64	0.72	0.81	0.86	0.90
55-59		0.60	0.68	0.75	0.83	0.86	0.90
60-64		0.65	0.72	0.78	0.84	0.87	0.90
65-69		0.71	0.76	0.80	0.85	0.88	0.90
70-90		0.74	0.78	0.82	0.86	0.88	0.90

3.3.3 Weir Spillway Design

For the sediment basins, it is proposed to provide an emergency spillway (outlet) to accommodate the 20yr ARI flows. In accordance with IECA Guidelines, this is the equivalent requirement for site disturbances with <12 months' duration. If longer duration's are proposed, the weir spillway design shall require review and update to comply with the IECA Guideline requirements.

The discharge calculations are provided in Table 5 below. Time of concentrations (Tc) were calculated assuming a conservative Horton's roughness value (n) of 0.028 for bare soil (IECA Guidelines).

Table 5: Discharge Calculations

Sediment Basin	Area (ha)	t_c (min)	Design Rainfall Intensity	Run-off Co-efficient (C_{20})	Discharge (Q)
1	1.6	10	174 mm/hr	0.74	0.57 m^3/s
2	1.15	11	168 mm/hr	0.74	0.40 m^3/s
3	9.7	17	141 mm/hr	0.74	2.80 m^3/s
4	<13.1	20	130 mm/hr	0.74	3.48 m^3/s
5	<45.5	25	118 mm/hr	0.74	10.87 m^3/s

The resultant water depths based on the nominated weir lengths are provided in Table 6 below:

Table 6: Weir Spillway Design

Sediment Basin	Minimum Weir Width	Depth of Water over Weir	Total Weir Depth
1	6.3m	0.15m	0.30m
2	4.5m	0.15m	0.30m
3	13.8m	0.25m	0.40m
4	17.0m	0.25m	0.40m
5	31.6m	0.35m	0.50m

It is considered that a weir freeboard of 150mm shall be acceptable provided all fill batters are instated in accordance with the project geotechnical requirements (i.e. minimum 95% compaction at ~OMC) and appropriately certified by the Geotechnical Testing Authority (GTA). Otherwise, the weir freeboard shall need to be increased to 300mm to comply with the IECA (2008) Guidelines if fill materials are utilised at the weir location.

3.4 Dirty Water Diversion Bunds

In accordance with the IECA Guidelines Table A1, water diversion structures shall be required to divert stormwater the 2yr ARI flows (<12 month operation).

For these bunds, conservative catchment grades immediately adjacent to and perpendicular to the proposed bund locations and conservative grades along the proposed bund flow paths were

examined. The minimum required dimensions of the diversion bunds to safely contain the modelled catchment flows in accordance with the equation for 'Asymmetric Triangular' V-drains (IECA Guidelines, 2008) are detailed in Table 7 below. A manning's roughness (n) value of 0.02 for dirty water bunds were also utilised. The results include an additional ~150mm freeboard in accordance with IECA Guidelines (2008).

Table 7: Minimum diversion bund dimensions

Perpendicular Grade of Upslope Area (%)	Diversion Bund Grade (%)	Catchment Area	Height (m)	Top Width (m)	Side Slope	Stabilisation
<5%	>0.5%	<0.6ha	0.30	0.30	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		0.6 – 3.0ha	0.40	0.40		
		3.0 – 5.5ha	0.45	0.45		
		5.5 – 7.0ha	0.50	0.50		
<5%	>3.0%	<0.5ha	0.25	0.25	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		0.5 – 1.7ha	0.30	0.30		
		1.7 - 3.0ha	0.35	0.35		
		3.0 - 6.0ha	0.40	0.40		
<10%	>0.25%	<0.25ha	0.30	0.30	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		0.25 -0.45ha	0.35	0.35		
		0.45 – 1.5ha	0.40	0.40		
		1.5 – 3.5ha	0.50	0.50		
<1%	>0.5%	<4.0ha	0.30	0.30	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		4 – 15ha	0.40	0.40		
		15 – 30ha	0.45	0.45		

For additional sediment trapping, sandbag check dams (maximum height of 150mm) shall also be placed along the base of each dirty-water diversion structure/bund at 40m intervals, wherever practicable.

If diversion channels are to be utilised in lieu of diversion banks, the required dimensions shall either be calculated in accordance with IECA Guideline requirements, or alternatively using the conservative diversion channel design tool (refer ESCP - Appendix A), that assumes 0.3m base width, 2H:1V batters, a 150mm freeboard and geofabric-lining for up to 2.0ha catchment areas.

3.5 Clean Water Diversion

In accordance with the IECA Guidelines (2008), clean water diversion structures shall be required in order to divert the external catchment from proposed disturbance areas for the 2yr ARI flows (<12 month operation). Peak flow calculations are shown in Table 8 below.

Table 8: Peak Flow Discharge Calculations

Diversion Structure	Catchment Area (ha)	t_c (min)	Design Rainfall Intensity	Run-off Co-efficient (C_{10})	Frequency Factor (C_2)	Discharge (Q)
C1	6.8	32 min	62 mm/hr	0.70	0.85	0.70m^3/s
C2	4.5	26 min	70 mm/hr	0.70	0.85	0.52m^3/s
C3	1.1	23 min	75 mm/hr	0.70	0.85	0.14m^3/s
C4	1.9	24 min	73 mm/hr	0.70	0.85	0.23m^3/s
C5	2.7	27 min	69 mm/hr	0.70	0.85	0.31m^3/s
C6	5.3	31 min	64 mm/hr	0.70	0.85	0.56m^3/s
C7	18.1	40 min	55 mm/hr	0.70	0.85	1.65m^3/s
C8	4.4	25 min	71 mm/hr	0.70	0.85	0.52m^3/s
C9	0.6	14 min	94 mm/hr	0.70	0.85	0.09m^3/s
C10	8.5	25 min	72 mm/hr	0.70	0.85	1.01m^3/s
C11	1.8	23 min	75 mm/hr	0.70	0.85	0.22m^3/s
C12	2.8	26 min	70 mm/hr	0.70	0.85	0.32m^3/s
C13	6.4	28 min	68 mm/hr	0.70	0.85	0.72m^3/s
C14A	14.3	30 min	65 mm/hr	0.70	0.85	1.54m^3/s
C14B	43.2	48 min	50 mm/hr	0.70	0.85	3.57m^3/s
C15	4.4	22 min	73 mm/hr	0.70	0.85	0.53m^3/s
C16	2.4	23 min	75 mm/hr	0.70	0.85	0.30m^3/s

For the use of diversion bunds, conservative catchment grades immediately adjacent to and perpendicular to the proposed bund locations and conservative grades along the proposed bund flow paths were examined. The minimum required dimensions of the diversion bunds to safely contain the modelled catchment flows in accordance with the equation for 'Asymmetric Triangular' V-drains (IECA Guidelines, 2008).

The results include an additional ~150mm freeboard in accordance with IECA Guidelines (2008) and are detailed in Table 9 below.

Table 9: Minimum Diversion Bund Dimensions

Diversion Bund	Height (m)	Top Width (m)	Side Slope	Stabilisation
C1	0.50	0.50	2H:1V	Ensure suitable soil compaction of the bund & Secured Geofabric
C2	0.50	0.50	2H:1V	
C3	0.35	0.35	2H:1V	
C4	0.45	0.45	2H:1V	
C5	0.45	0.45	2H:1V	
C6	0.50	0.50	2H:1V	
C7	0.70	0.70	2H:1V	
C8	0.45	0.45	2H:1V	
C9	0.35	0.35	2H:1V	
C10	0.60	0.60	2H:1V	
C11	0.40	0.40	2H:1V	
C12	0.45	0.45	2H:1V	
C13	0.60	0.60	2H:1V	
C14A	0.70	0.70	2H:1V	
C14B	0.75	0.75	2H:1V	
C15	0.50	0.50	2H:1V	
C16	0.45	0.45	2H:1V	

The flow path of the external clean water diversion bunds shall require stabilisation (e.g. secured geofabric).

3.6 Stabilisation Requirements

Specific stabilisation requirements for the site are formulated in accordance with Table 10 below:

Table 10: 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 (including hydromulch, seeding, chemical stabiliser/soil binders, geofabric/blankets) shall conform to IECA (2008) or manufacturer's' minimum standards.

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.

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.

The Civil Contractor shall also document and record the timing of completed (finished level) earthworks and subsequent soil stabilisation timeframes to ensure the requirements are met wherever practicable.

4.2 Water Quality Monitoring & Requirements

The water quality objectives for HES basin discharge is as follows:

- 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to ≤50mg/L Total Suspended Solids (TSS) and pH in the range of 6.5–8.5;
- Oils & grease – no visible films or odour; and
- Litter – no visible litter washed from the site.

N.B. A qualified Environmental Consultant may be engaged to establish a turbidity-total suspended solids correlation based on a minimum of five (5) samples in the 20 – 150 mg/L range to enable turbidity monitoring (field-based) to replace suspended solids monitoring (laboratory-based).

Water within the HES basin shall undergo 'active treatment' treated using a Floc Box™ (or similar) and operated in accordance with the manufacturers procedures and requirements. **Indicative treatment rates shall be based on jar testing undertaken at the commencement of construction.**

With regards to the required pH adjustment, 'passive' application of alkalinity products (e.g. ag lime placed in drains and in forebay) may also be a suitable alternative, in consultation with a qualified and suitably experienced Environmental Consultant.

Water quality testing shall be undertaken during all HES basin discharge events (i.e. daily during discharge).

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 <50 NTU;
- Oils & grease – no visible films or odour; and
- Litter – no visible litter washed from the site.

If water treatment is required to meet the water quality objectives prior to controlled discharge, the application of neutralising agent (e.g. hydrated lime or sodium bicarbonate) to raise water pH and the application of flocculant to reduce suspended solids levels may be used. If a pump is used to decant a waterbody, the intake pipe must not be allowed to rest on or near the settled sediment. Decanting must cease prior to settled sediments being drawn into the intake pipe.

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

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

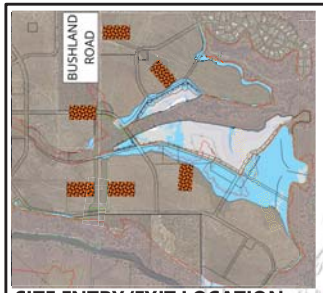
This ESCP has been prepared with reference to the IECA (2008/2018) *Best Practice Erosion and Sediment Control* Guideline to assist the Developer and their agents (e.g. Civil Contractor) in meeting their overarching environmental obligations under the Environmental Protection Act (1994) and Environmental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

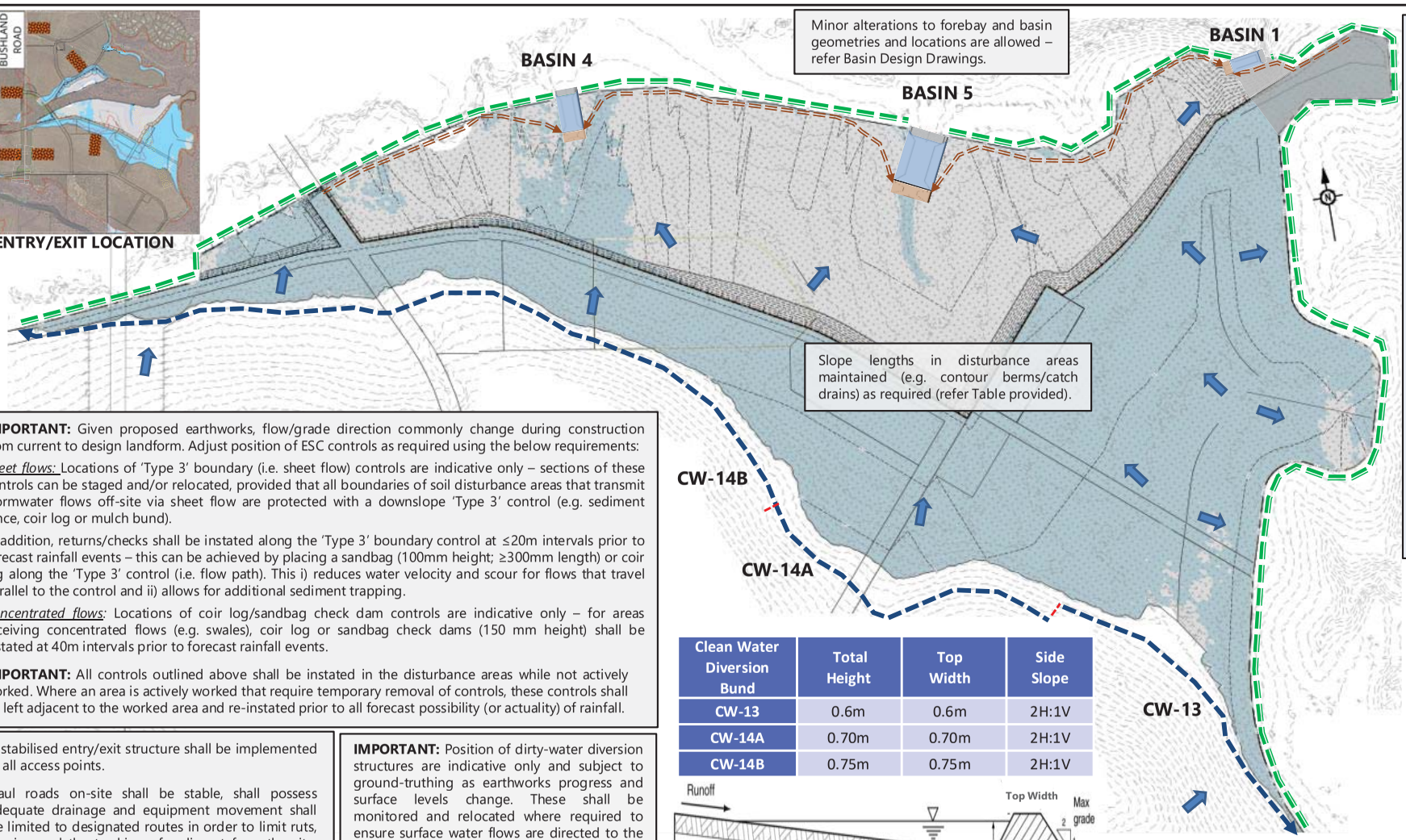
Yours faithfully,

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

APPENDIX A:
ESCP - DRAWINGS & NOTES



SITE ENTRY/EXIT LOCATION



Minor alterations to forebay and basin geometries and locations are allowed – refer Basin Design Drawings.

Slope lengths in disturbance areas maintained (e.g. contour berms/catch drains) as required (refer Table provided).

KEY

- Rock Entry/Exit Structure
- Clean Water Diversion Bund
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Dirty water diversion (indicative)
- Sediment Basin (refer separate drawing)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction

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

IMPORTANT: Given proposed earthworks, flow/grade direction commonly change during construction from current to design landform. Adjust position of ESC controls as required using the below requirements:

Sheet flows: Locations of 'Type 3' boundary (i.e. sheet flow) controls are indicative only – sections of these controls can be staged and/or relocated, provided that all boundaries of soil disturbance areas that transmit stormwater flows off-site via sheet flow are protected with a downslope 'Type 3' control (e.g. sediment fence, coir log or mulch bund).

In addition, returns/checks shall be instated along the 'Type 3' boundary control at ≤20m intervals prior to forecast rainfall events – this can be achieved by placing a sandbag (100mm height; ≥300mm length) or coir log along the 'Type 3' control (i.e. flow path). This i) reduces water velocity and scour for flows that travel parallel to the control and ii) allows for additional sediment trapping.

Concentrated flows: Locations of coir log/sandbag check dam controls are indicative only – for areas receiving concentrated flows (e.g. swales), coir log or sandbag check dams (150 mm height) shall be instated at 40m intervals prior to forecast rainfall events.

IMPORTANT: All controls outlined above shall be instated in the disturbance areas while not actively worked. Where an area is actively worked that require temporary removal of controls, these controls shall be left adjacent to the worked area and re-instated prior to all forecast possibility (or actuality) of rainfall.

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. *Whoa Boys can be implemented when access across diversion structures are required.*

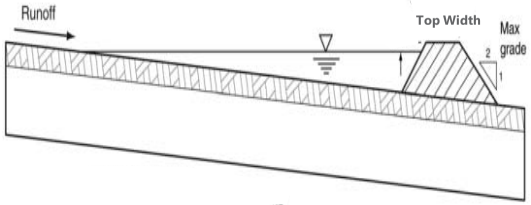
N.B. Site Compound can be located anywhere within site boundary – no additional controls required.

IMPORTANT: Position of dirty-water diversion structures are indicative only and subject to ground-truthing as earthworks progress and surface levels change. These shall be monitored and relocated where required to ensure surface water flows are directed to the sediment basin. *However, small sub-catchments along a site boundary that are <0.10ha in size are permissible to outlet towards a 'Type 3' boundary control.*

Instate sandbag checks (<150mm height) at 40m intervals along diversion structures prior to rainfall events.

Location of soil stockpiles may vary with evolving earthworks. A sediment fence shall be instated on the downslope aspect of all dedicated soil stockpile areas.

Clean Water Diversion Bund	Total Height	Top Width	Side Slope
CW-13	0.6m	0.6m	2H:1V
CW-14A	0.70m	0.70m	2H:1V
CW-14B	0.75m	0.75m	2H:1V



Clean Water Diversion Bunds (indicative location) shall be instated using laser levelling to minimise the external catchment area and to attain a ~0.25% channel grade.

Maximum allowable slope lengths (e.g. catch drains/berms): earthworks areas prior to rainfall or inactive areas of disturbance

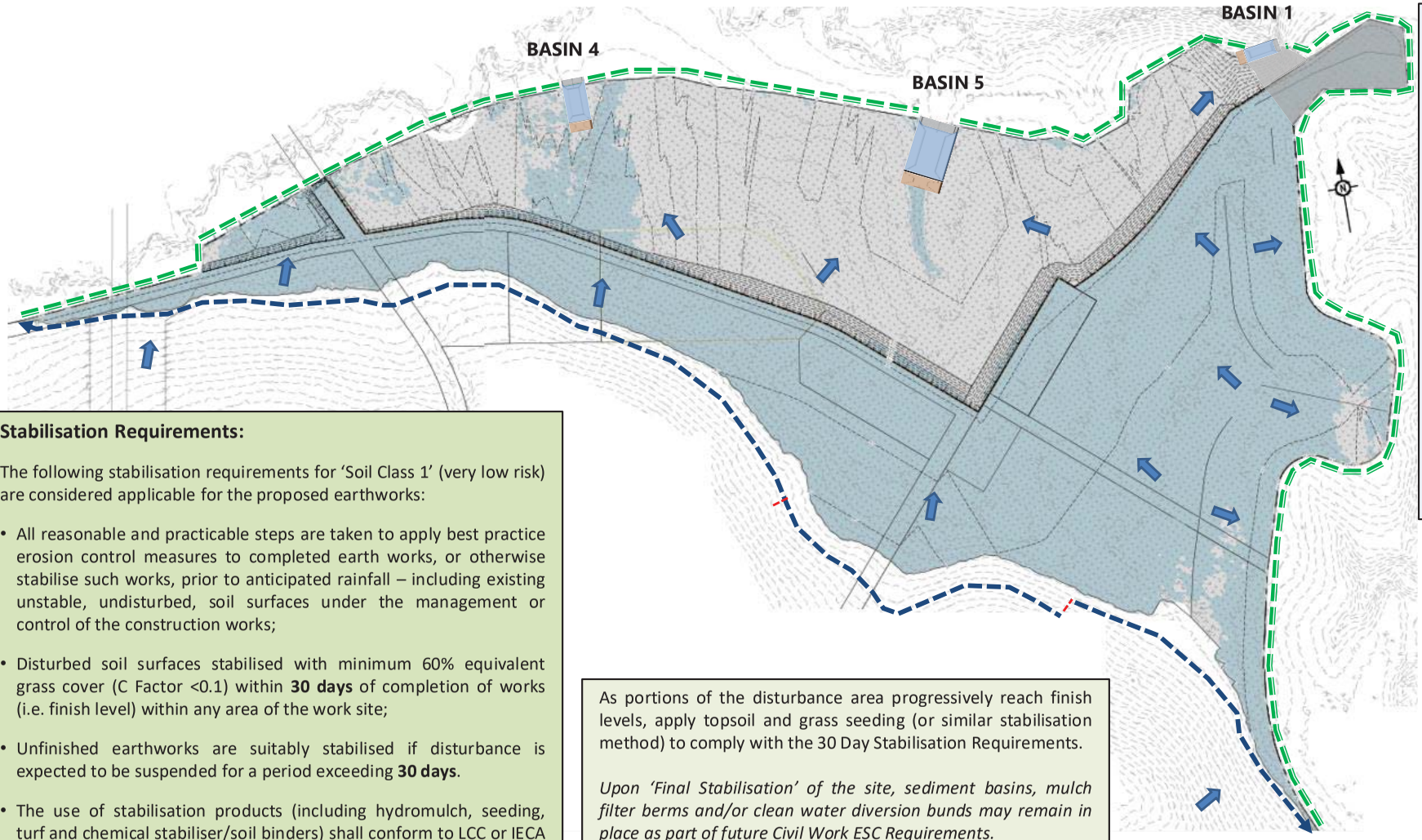
Slope (%)	Horizontal spacing (m)
1%	80m
2%	60m
4%	40m
6%	32m
8%	28m
10%	25m

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

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

Gallagher Environmental
Soil Water Environment
ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

TITLE: ESC Layout Plan 1 – Bulk Earthworks			DRAWING NO.: GE23.054.D1
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE: 1:9000 @ A4
CLIENT: Colliers	DATE: 16.11.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346



KEY

- Clean Water Diversion Bund
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Dirty water diversion (indicative)
- Sediment Basin (refer separate drawing)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction

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

Stabilisation Requirements:

The following stabilisation requirements for 'Soil Class 1' (very low risk) are considered applicable for the proposed earthworks:

- 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% 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 (including hydromulch, seeding, turf and chemical stabiliser/soil binders) shall conform to LCC or IECA minimum standards.

As portions of the disturbance area progressively reach finish levels, apply topsoil and grass seeding (or similar stabilisation method) to comply with the 30 Day Stabilisation Requirements.

Upon 'Final Stabilisation' of the site, sediment basins, mulch filter berms and/or clean water diversion bunds may remain in place as part of future Civil Work ESC Requirements.

ALL ESC CONTROLS TO BE GROUND-TRUTHED AND UPDATED PROGRESSIVELY BY THE CONTRACTOR:
a) UPON SITE POSSESSION, WHERE REQUIRED
b) DURING CONSTRUCTION AS REQUIRED

Gallagher Environmental
Soil Water Environment
ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

TITLE: ESC Layout Plan 1 – Stabilisation Phase			DRAWING NO.: GE23.054.D2
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE: 1:9000 @ A4
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

IMPORTANT: Given proposed earthworks, flow/grade direction commonly change during construction from current to design landform. Adjust position of ESC controls as required using the below requirements:

Sheet flows: Locations of 'Type 3' boundary (i.e. sheet flow) controls are indicative only – sections of these controls can be staged and/or relocated, provided that all boundaries of soil disturbance areas that transmit stormwater flows off-site via sheet flow are protected with a downslope 'Type 3' control (e.g. sediment fence, coir log or mulch bund).

In addition, returns/checks shall be instated along the 'Type 3' boundary control at ≤20m intervals prior to forecast rainfall events – this can be achieved by placing a sandbag (100mm height; ≥300mm length) or coir log along the 'Type 3' control (i.e. flow path). This i) reduces water velocity and scour for flows that travel parallel to the control and ii) allows for additional sediment trapping.

Concentrated flows: Locations of coir log/sandbag check dam controls are indicative only – for areas receiving concentrated flows (e.g. swales), coir log or sandbag check dams (150 mm height) shall be instated at 40m intervals prior to forecast rainfall events.

IMPORTANT: All controls outlined above shall be instated in the disturbance areas while not actively worked. Where an area is actively worked that require temporary removal of controls, these controls shall be left adjacent to the worked area and re-instated prior to all forecast possibility (or actuality) of rainfall.

IMPORTANT: Position of dirty-water diversion structures are indicative only and subject to ground-truthing as earthworks progress and surface levels change. These shall be monitored and relocated where required to ensure surface water flows are directed to the sediment basin. *However, small sub-catchments along a site boundary that are <0.10ha in size are permissible to outlet towards a 'Type 3' boundary control.*

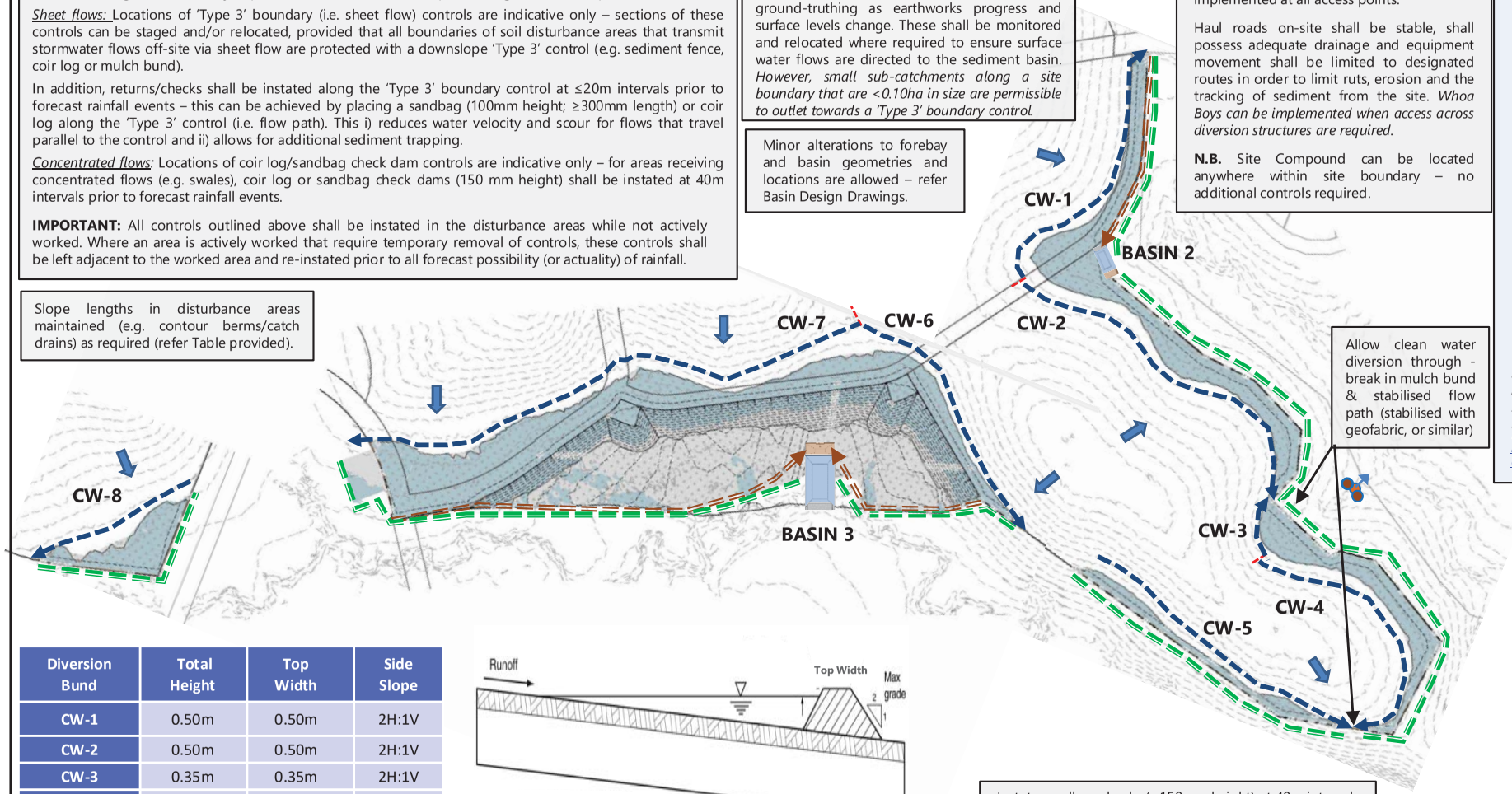
Minor alterations to forebay and basin geometries and locations are allowed – refer Basin Design Drawings.

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. *Whoa Boys can be implemented when access across diversion structures are required.*

N.B. Site Compound can be located anywhere within site boundary – no additional controls required.

Slope lengths in disturbance areas maintained (e.g. contour berms/catch drains) as required (refer Table provided).



Allow clean water diversion through - break in mulch bund & stabilised flow path (stabilised with geofabric, or similar)

KEY

- Clean Water Diversion Bund
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Dirty water diversion (indicative)
- Sediment Basin (refer separate drawing)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction

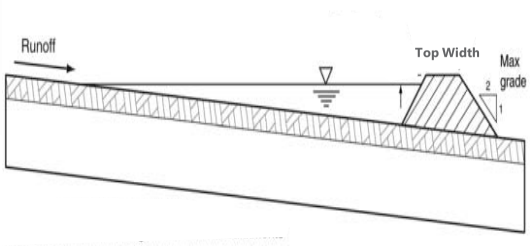
ESC Standard Drawings for all of the require ESC controls are provided in the IECA (2008) Guidelines – Book 6 and located at the following web link:

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

Maximum allowable slope lengths (e.g. catch drains/berms): earthworks areas prior to rainfall or inactive areas of disturbance

Slope (%)	Horizontal spacing (m)
1%	80m
2%	60m
4%	40m
6%	32m
8%	28m
10%	25m

Diversion Bund	Total Height	Top Width	Side Slope
CW-1	0.50m	0.50m	2H:1V
CW-2	0.50m	0.50m	2H:1V
CW-3	0.35m	0.35m	2H:1V
CW-4	0.45m	0.45m	2H:1V
CW-5	0.45m	0.45m	2H:1V
CW-6	0.50m	0.50m	2H:1V
CW-7	0.70m	0.70m	2H:1V
CW-8	0.45m	0.45m	2H:1V



Clean Water Diversion Bunds (indicative location) shall be instated using laser levelling to minimise the external catchment area and to attain a ~0.25% channel grade.

Instate sandbag checks (<150mm height) at 40m intervals along diversion structures prior to rainfall events.

Location of soil stockpiles may vary with evolving earthworks. A sediment fence shall be instated on the downslope aspect of all dedicated soil stockpile areas.

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

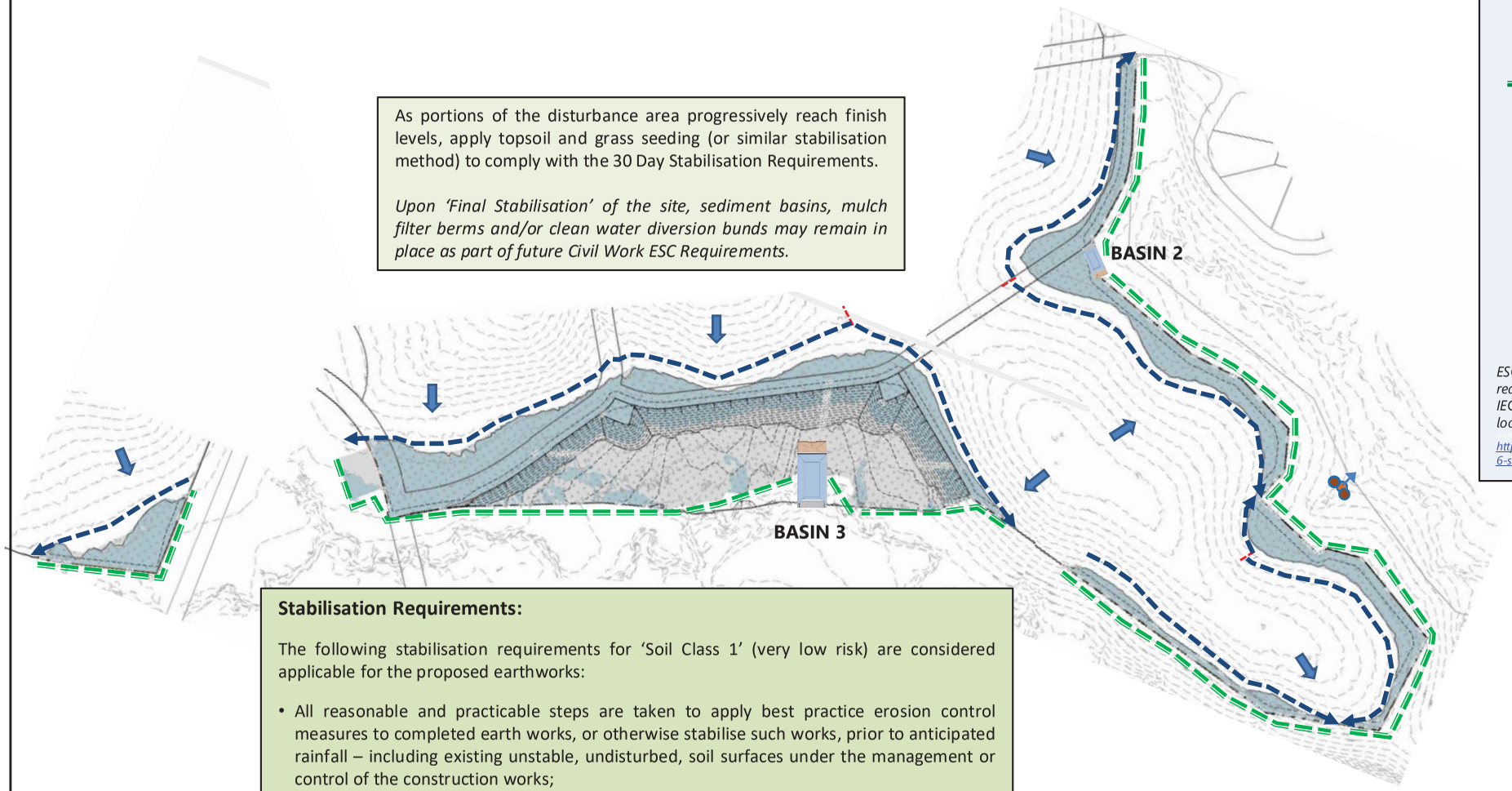
a) UPON SITE POSSESSION, WHERE REQUIRED
b) DURING CONSTRUCTION AS REQUIRED

Gallagher Environmental
Soil Water Environment
ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

TITLE: ESC Layout Plan – Bulk Earthworks II			DRAWING NO.: GE23.054.D3
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE: 1:8000 @ A4
CLIENT: Colliers	DATE: 23.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

As portions of the disturbance area progressively reach finish levels, apply topsoil and grass seeding (or similar stabilisation method) to comply with the 30 Day Stabilisation Requirements.

Upon 'Final Stabilisation' of the site, sediment basins, mulch filter berms and/or clean water diversion bunds may remain in place as part of future Civil Work ESC Requirements.



KEY

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- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Dirty water diversion (indicative)
- Sediment Basin (refer separate drawing)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction

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Stabilisation Requirements:

The following stabilisation requirements for 'Soil Class 1' (very low risk) are considered applicable for the proposed earthworks:

- 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% 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 (including hydromulch, seeding, turf and chemical stabiliser/soil binders) shall conform to LCC or IECA minimum standards.

ALL ESC CONTROLS TO BE GROUND-TRUTHED AND UPDATED PROGRESSIVELY BY THE CONTRACTOR:
a) UPON SITE POSSESSION, WHERE REQUIRED
b) DURING CONSTRUCTION AS REQUIRED

Gallagher Environmental
Soil Water Environment
ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

TITLE: ESC Layout Plan 2 – Stabilisation Phase			DRAWING NO.: GE23.054.D4
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE: 1:8000 @ A4
CLIENT: Colliers	DATE: 23.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

IMPORTANT: Given proposed earthworks, flow/grade direction commonly change during construction from current to design landform. Adjust position of ESC controls as required using the below requirements:

Sheet flows: Locations of 'Type 3' boundary (i.e. sheet flow) controls are indicative only – sections of these controls can be staged and/or relocated, provided that all boundaries of soil disturbance areas that transmit stormwater flows off-site via sheet flow are protected with a downslope 'Type 3' control (e.g. sediment fence, coir log or mulch bund).

In addition, returns/checks shall be instated along the 'Type 3' boundary control at ≤20m intervals prior to forecast rainfall events – this can be achieved by placing a sandbag (100mm height; ≥300mm length) or coir log along the 'Type 3' control (i.e. flow path). This i) reduces water velocity and scour for flows that travel parallel to the control and ii) allows for additional sediment trapping.

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IMPORTANT: All controls outlined above shall be instated in the disturbance areas while not actively worked. Where an area is actively worked that require temporary removal of controls, these controls shall be left adjacent to the worked area and re-instated prior to all forecast possibility (or actuality) of rainfall.

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. *Whoa Boys can be implemented when access across diversion structures are required.*

N.B. Site Compound can be located anywhere within site boundary – no additional controls required.

KEY

- Clean Water Diversion Bund
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
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- Flow Direction

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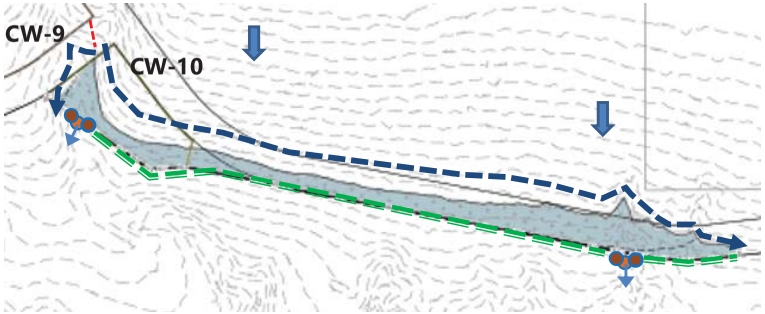
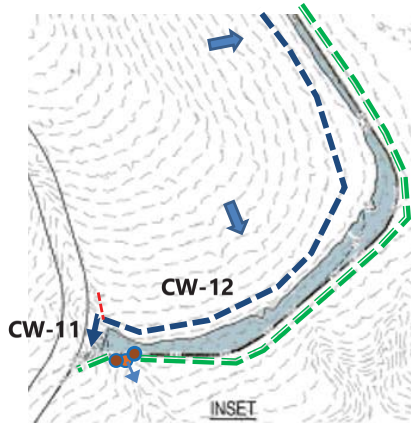




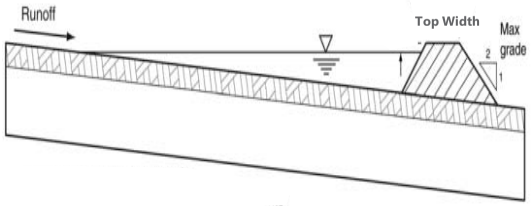
Maximum allowable slope lengths (e.g. catch drains/berms): earthworks areas prior to rainfall or inactive areas of disturbance

Slope (%)	Horizontal spacing (m)
1%	80m
2%	60m
4%	40m
6%	32m
8%	28m
10%	25m

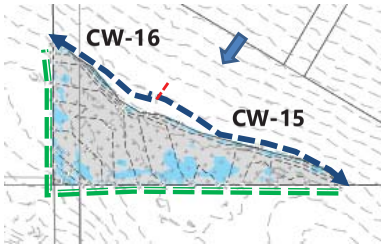
Slope lengths in disturbance areas maintained (e.g. contour berms/catch drains) as required (refer Table provided).

Location of soil stockpiles may vary with evolving earthworks. A sediment fence shall be instated on the downslope aspect of all dedicated soil stockpile areas.

Diversion Bund	Total Height	Top Width	Side Slope
CW-9	0.35m	0.35m	2H:1V
CW-10	0.60m	0.60m	2H:1V
CW-11	0.40m	0.40m	2H:1V
CW-12	0.45m	0.45m	2H:1V
CW-15	0.50m	0.50m	2H:1V
CW-16	0.45m	0.45m	2H:1V



Clean Water Diversion Bunds (indicative location) shall be instated using laser levelling to minimise the external catchment area and to attain a ~0.25% channel grade.



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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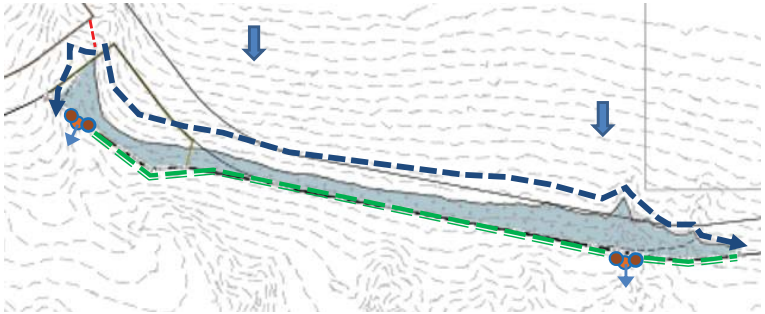
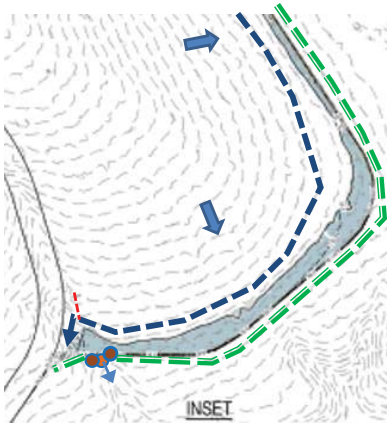
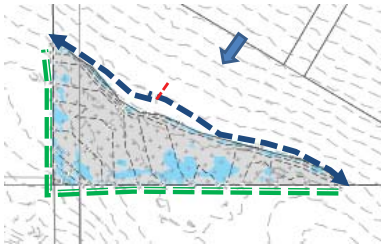
TITLE: ESC Layout Plan – Bulk Earthworks III			DRAWING NO.: GE23.054.D5
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE: 1:6000 @ A4
CLIENT: Colliers	DATE: 23.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

As portions of the disturbance area progressively reach finish levels, apply topsoil and grass seeding (or similar stabilisation method) to comply with the 30 Day Stabilisation Requirements.

Upon 'Final Stabilisation' of the site, mulch filter berms and/or clean water diversion bunds may remain in place as part of future Civil Work ESC Requirements.







KEY

- Clean Water Diversion Bund
- Mulch Filter Berm (min. 300mm high, min. 1.0m width)
- Dirty water diversion (indicative)
- Sediment Basin (refer separate drawing)
- Rock Filter Dam (min. 400m high, match channel width, with geofabric wrap)
- Flow Direction

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

Stabilisation Requirements:

The following stabilisation requirements for 'Soil Class 1' (very low risk) are considered applicable for the proposed earthworks:

- 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% 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 (including hydromulch, seeding, turf and chemical stabiliser/soil binders) shall conform to LCC or IECA minimum standards.

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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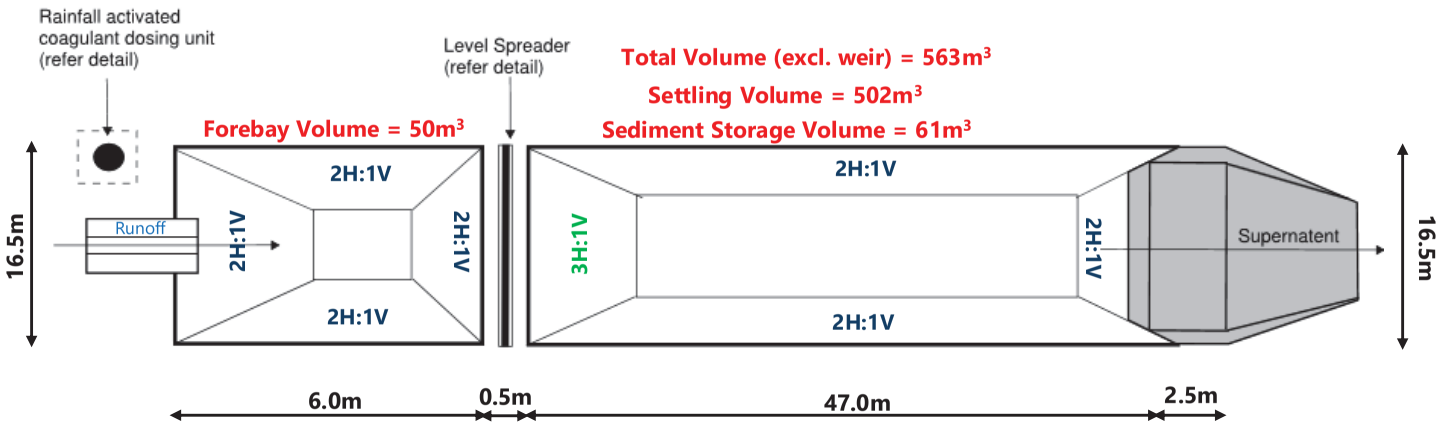
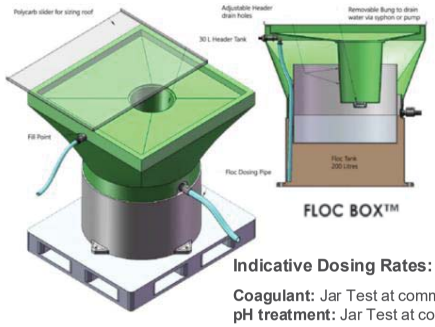
TITLE: ESC Layout Plan 3 – Stabilisation Phase			DRAWING NO.: GE23.054.D6
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE: 1:6000 @ A4
CLIENT: Colliers	DATE: 23.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

SEDIMENT BASIN 1



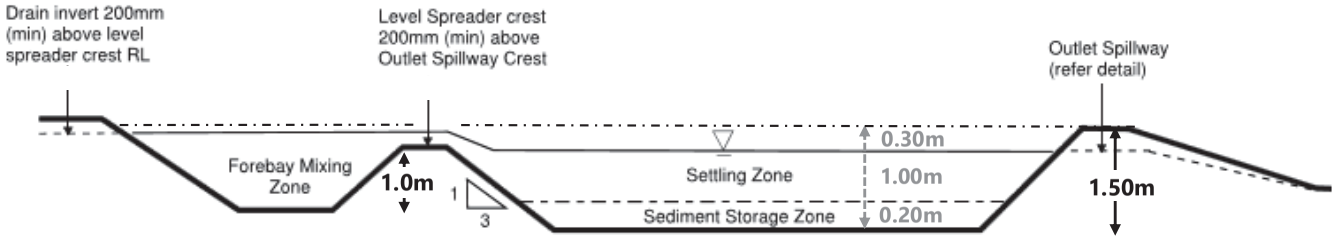
N.B. Minor alternations to the basin dimensions can be made, provided all required volumes and the L:W ratio are maintained. Sediment Forebay may be re-located.

Coagulant Dosing Unit
(400L)

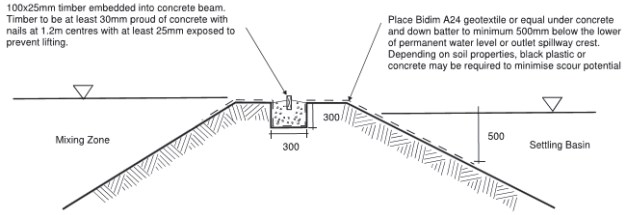


Indicative Dosing Rates:

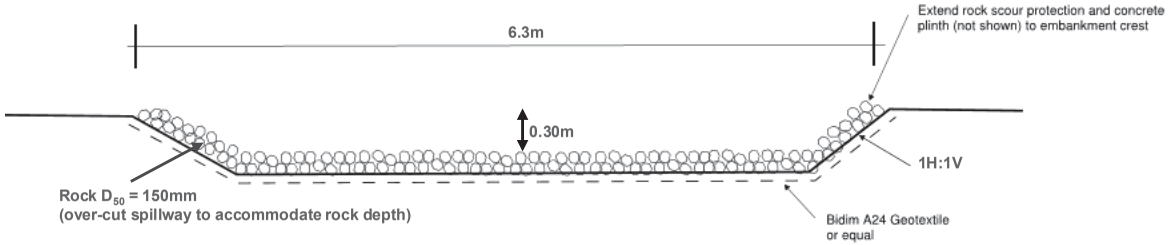
Coagulant: Jar Test at commencement
pH treatment: Jar Test at commencement

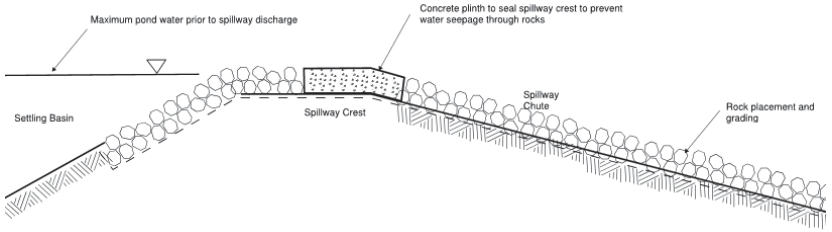


Level Spreader Details: Cross-Section



Outlet Spillway Details: Cross-Sections





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

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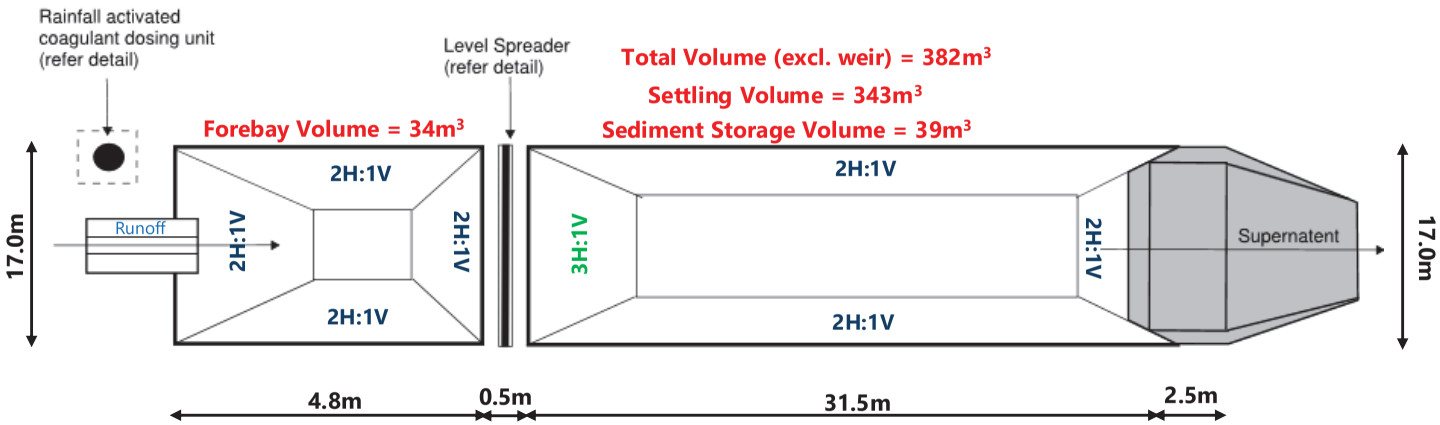
glen@genviro.com.au

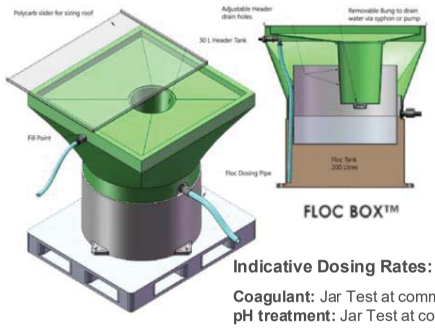
TITLE: HES Basin Design: Basin 1			DRAWING NO.: GE23.054.D7
JOB LOCATION: Riverbend, Jimboomba – Early Works			SCALE: NTS
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

SEDIMENT BASIN 2



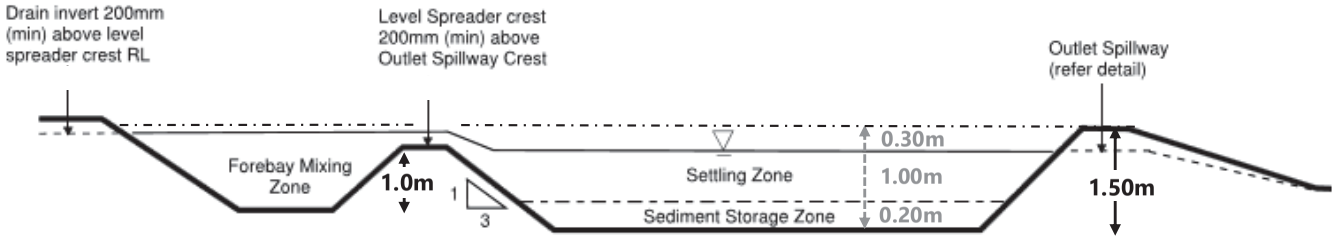
N.B. Minor alternations to the basin dimensions can be made, provided all required volumes and the L:W ratio are maintained. Sediment Forebay may be re-located.

Coagulant Dosing Unit
(200L)

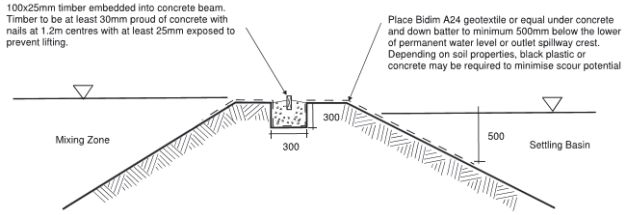


Indicative Dosing Rates:

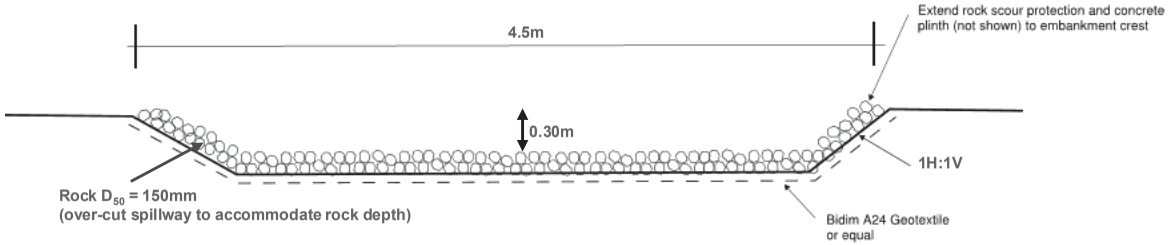
Coagulant: Jar Test at commencement
pH treatment: Jar Test at commencement

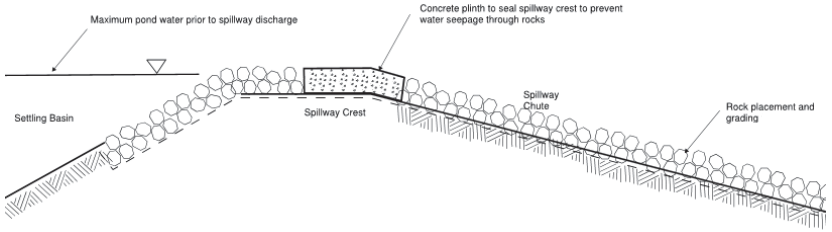


Level Spreader Details: Cross-Section



Outlet Spillway Details: Cross-Sections





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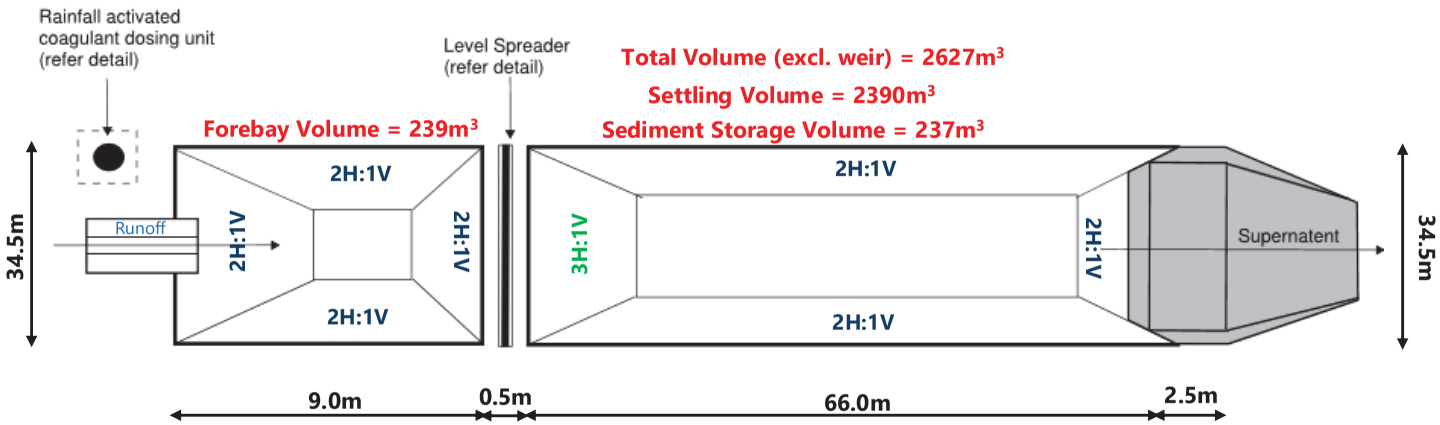
glen@genviro.com.au

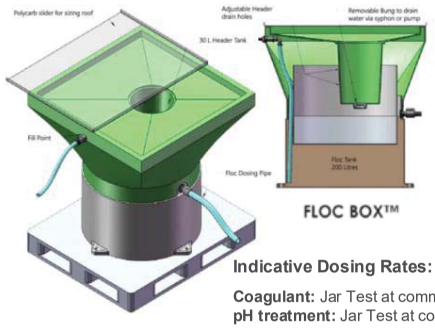
TITLE: HES Basin Design: Basin 2			DRAWING NO.: GE23.054.D8
JOB LOCATION: Riverbend, Jimboomba – Early Works			SCALE: NTS
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

SEDIMENT BASIN 3



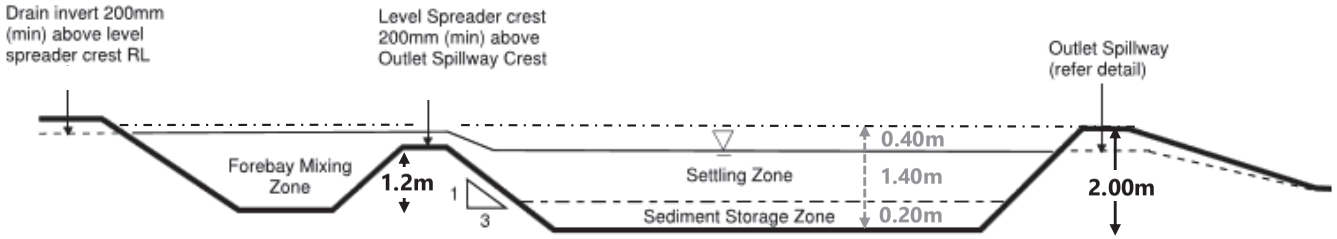
N.B. Minor alternations to the basin dimensions can be made, provided all required volumes and the L:W ratio are maintained. Sediment Forebay may be re-located.

Coagulant Dosing Unit
(>600L)

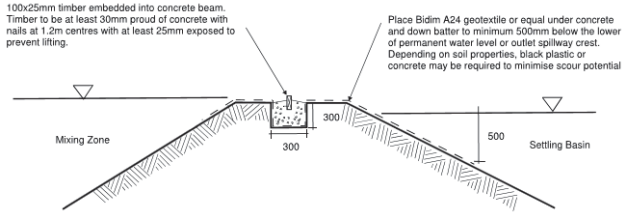


Indicative Dosing Rates:

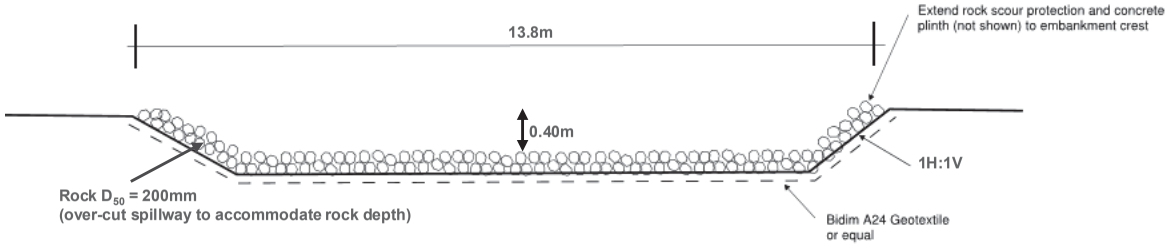
Coagulant: Jar Test at commencement
pH treatment: Jar Test at commencement

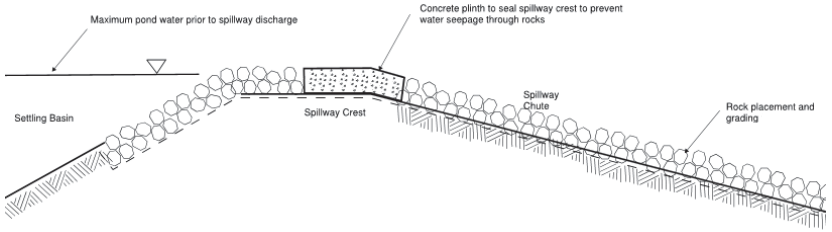


Level Spreader Details: Cross-Section



Outlet Spillway Details: Cross-Sections





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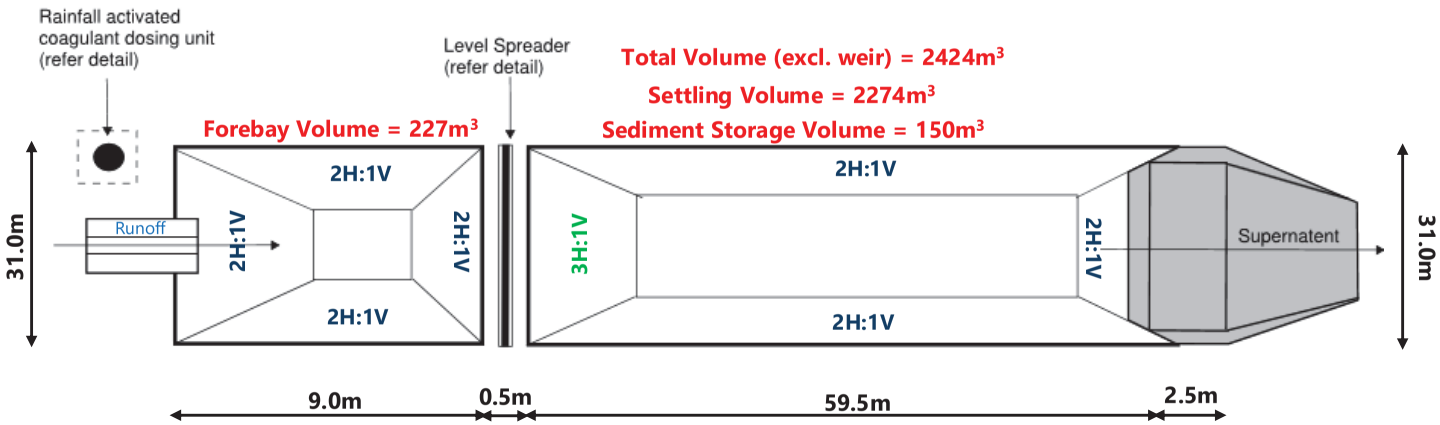
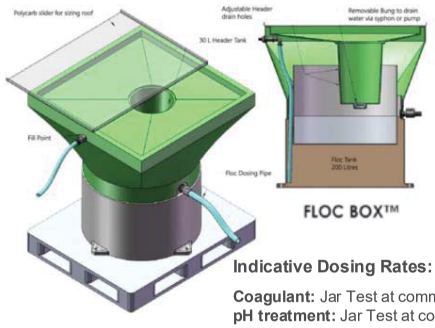
TITLE: HES Basin Design: Basin 3			DRAWING NO.: GE23.054.D9
JOB LOCATION: Riverbend, Jimboomba – Early Works			SCALE: NTS
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

SEDIMENT BASIN 4



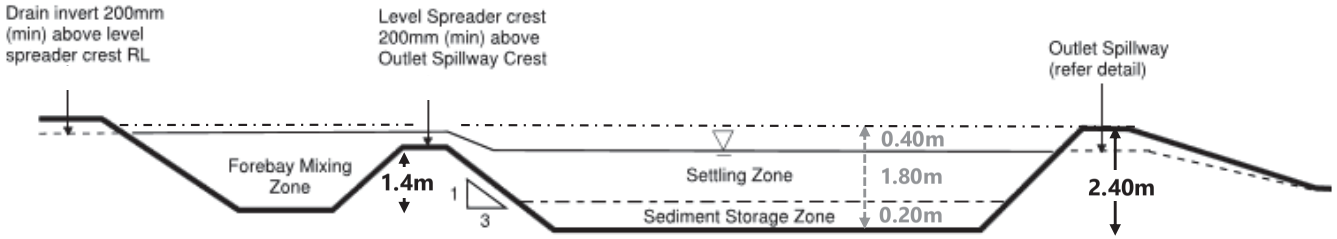
N.B. Minor alternations to the basin dimensions can be made, provided all required volumes and the L:W ratio are maintained. Sediment Forebay may be re-located.

Coagulant Dosing Unit
(>600L)

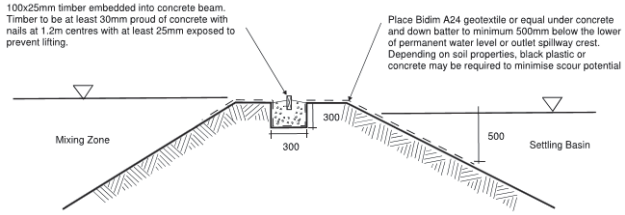


Indicative Dosing Rates:

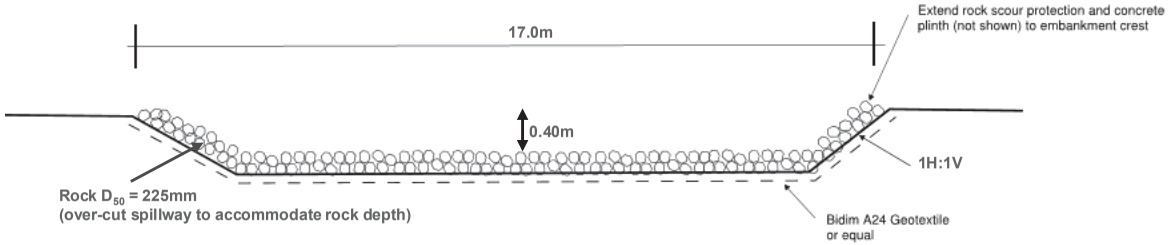
Coagulant: Jar Test at commencement
pH treatment: Jar Test at commencement

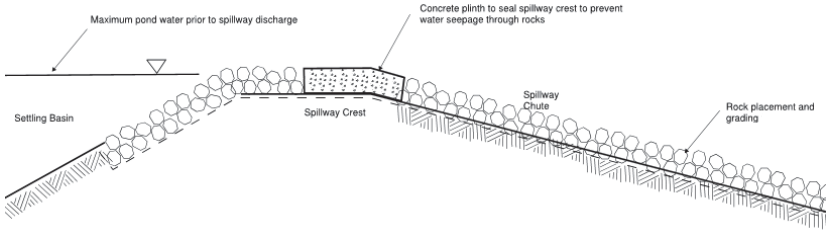


Level Spreader Details: Cross-Section



Outlet Spillway Details: Cross-Sections





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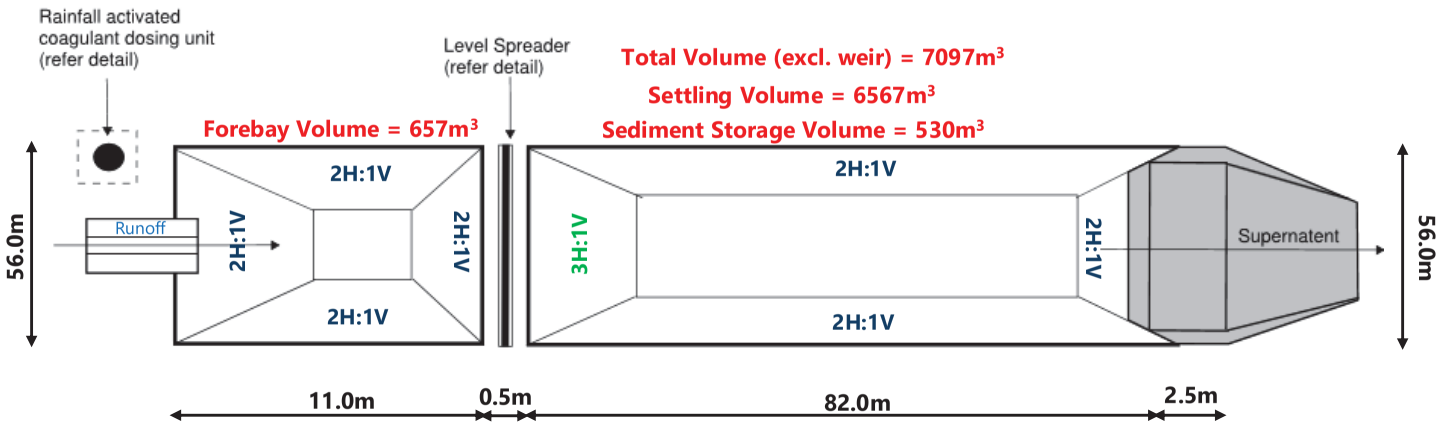
Gallagher Environmental
Soil Water Environment
ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

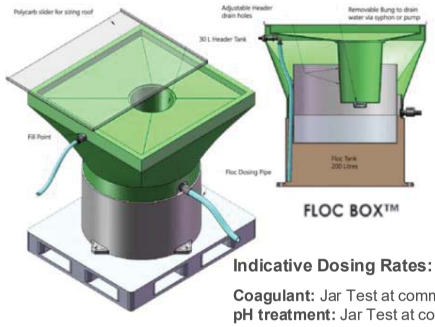
TITLE: HES Basin Design: Basin 4			DRAWING NO.: GE23.054.D10
JOB LOCATION: Riverbend, Jimboomba – Early Works			SCALE: NTS
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

SEDIMENT BASIN 5



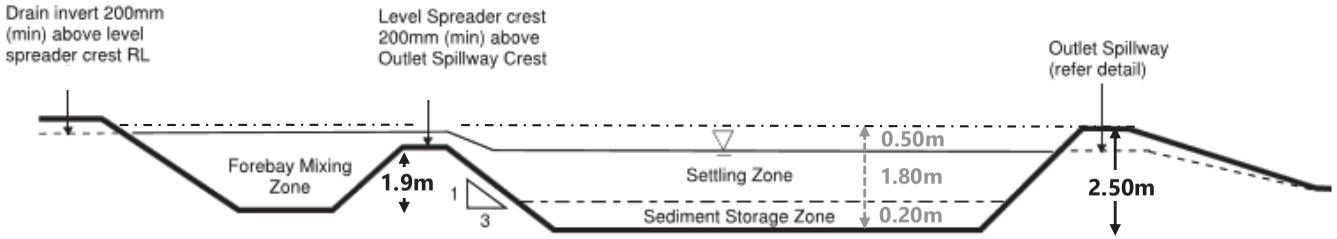
N.B. Minor alternations to the basin dimensions can be made, provided all required volumes and the L:W ratio are maintained. Sediment Forebay may be re-located.

Coagulant Dosing Unit
(>1600L)

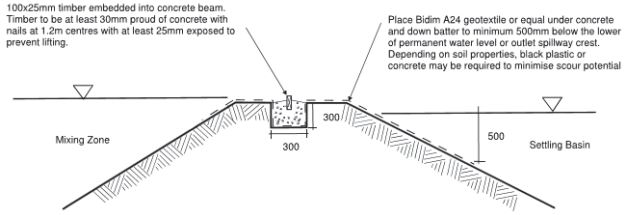


Indicative Dosing Rates:

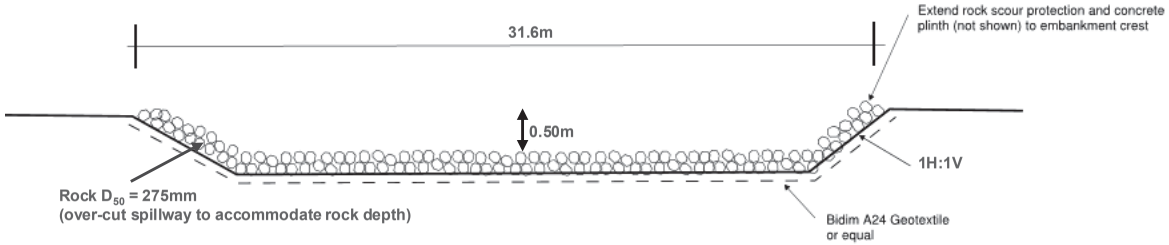
Coagulant: Jar Test at commencement
pH treatment: Jar Test at commencement

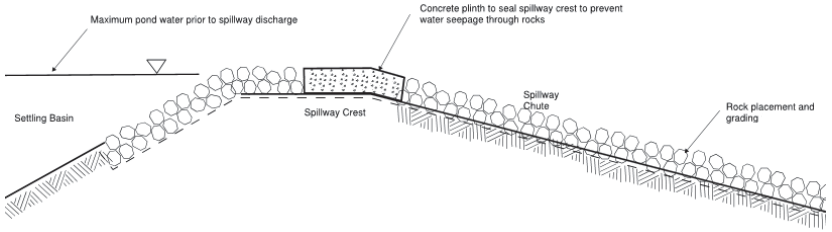


Level Spreader Details: Cross-Section



Outlet Spillway Details: Cross-Sections





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Gallagher Environmental
Soil Water Environment
ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

TITLE: HES Basin Design: Basin 5			DRAWING NO.: GE23.054.D11
JOB LOCATION: Riverbend, Jimboomba – Early Works			SCALE: NTS
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

Sediment Basin Requirements

- The sediment basins shall be excavated to attain the minimum volume/surface area and design requirements, in accordance with the sediment basin design provided and IECA Standard Drawings. *The basin volumes/dimensions shall be subsequently confirmed by field survey.*
- Fill embankments shall be adequately compacted in accordance with the geotechnical specification and stabilised to prevent breaching and subsequent bank erosion. The following construction parameters for fill embankment are recommended:
  - All fill batter – maximum 1V: 2H slope and min. 95% compaction
  - Batters shall be constructed in accordance with the site Geotechnical Specification and tested/certified by the Geotechnical Testing Authority (GTA)
- To increase the effective length-width ratio of the sediment basin, internal flow control baffles shall be instated (e.g. geofabric attached to support posts from the base of the basin to the height of the weir spillway) in workable configurations, where required.
- All sediment basin batters shall be inspected for signs of scour following significant rainfall events (≥15mm/24-hour) and any significant scour that develops must be stabilised in order to mitigate further scour/erosion.
- A marker shall be placed in the sediment basin denoting the respective settling and sediment storage zones. Any accumulated sediment shall be removed immediately in the event that the sediment storage zone is exceeded. Water can also be stored to the top of the sediment storage zone.
- The temporary sediment basins may be decommissioned when stabilisation requirements (≥60% stabilisation; C factor <0.10) have been achieved and, where required, 'Type 3' controls are appropriately working to control soil erosion and sediment runoff in accordance with the ESCP.

Sediment Basin Weir Spillway Requirements

- The Weir Spillway shall attain the minimum weir depths and weir widths provided.
- The spillway chute freeboard shall be at least 300mm.
- The embankment crest width shall be at least 2.5m.
- Spillway rock size has been nominated on the associated drawings and all rock used shall be reasonably well-graded.
- The weir spillway/outlet shall be over-cut (e.g. 200mm) to allow for spillway rock thickness and concrete plinth instated to prevent water seepage.
- The weir spillways shall be instated in accordance with the standard ESCP design notes provided and IECA Standard Drawings, wherever practicable.

Diversion Structure Requirements

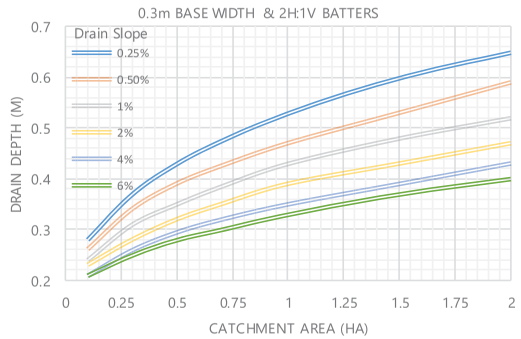
- All diversion bunds/structures shall be constructed to attain the minimum dimensions/stabilisation provided.
- The Clean Water Diversion Structures shall be stabilised (e.g. lined with geofabric, or similar) to ensure clean water conveyance.
- All dirty-water diversion structures shall have sandbag check dams (max. 150mm height) placed in a ≤40m spacing and in a manner that ensures the structures adequately contain the required stormwater flows without breaching/over-topping.
- The Civil Contractor shall program construction activities in a manner that ensures the appropriate diversion of on-site stormwater flows to the sediment basin during the construction phase until the applicable sediment basin is decommissioned. During initial and at various stages of construction, some diversion structures may also need to be established in slightly different locations than the indicative locations depicted in order to ensure that site grades are achievable to divert the stormwater appropriately.
- The location of dirty-water diversion structures shall be continually reviewed and re-located where required in order to ensure stormwater is appropriately directed to the sediment basin in a non-erosive manner for the 2 year ARI event.
- For instances when diversion channels need to be implemented or re-located due to the evolving nature of bulk earthworks, the required dimensions shall either be calculated in accordance with IECA Guideline requirements, or alternatively using the conservative diversion drain design tool provided that assumes 0.3m base width, 2H:1V batters and a 150mm freeboard .
- In addition to the above, the diversion bunds/ channels shall be instated in accordance with the standard ESCP design notes/drawings provided and IECA Guidelines, wherever practicable.

DIRTY-WATER DIVERSION BUNDS

Perpendicular Grade of Upslope Area (%)	Bund Flow Grade (%)	Catchment Area	Height (m)	Top Width (m)	Side Slope	Stabilisation
<5%	>0.5%	<0.6ha	0.30	0.30	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		0.6 – 3.0ha	0.40	0.40		
		3.0 – 5.5ha	0.45	0.45		
		5.5 – 7.0ha	0.50	0.50		
<5%	>3.0%	<0.5ha	0.25	0.25	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		0.5 – 1.7ha	0.30	0.30		
		1.7 - 3.0ha	0.35	0.35		
		3.0 - 6.0ha	0.40	0.40		
<10%	>0.25%	<0.25ha	0.30	0.30	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		0.25 -0.45ha	0.35	0.35		
		0.45 – 1.5ha	0.40	0.40		
		1.5 – 3.5ha	0.50	0.50		
<1%	>0.5%	<4.0ha	0.30	0.30	2H:1V	Sandbags (max. height 150mm) @ 40m intervals
		4 – 15ha	0.40	0.40		
		15 – 30ha	0.45	0.45		

CONSERVATIVE DRAIN DESIGN TOOL

($2yr_{5min}$ ARI; 25% impervious; n=0.025)



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TITLE: Sediment Basin & Diversion Structures			DRAWING NO.: GE23.054.D12
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE:
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

ESC Control Measures & Sequencing

Hold Point: As soon as practicable and prior to initial earthworks operations 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 nominated ESC controls and general ESC installation sequence for the proposed development are summarised below:

PHASE 1 –Bulk Earthworks

- Site establishment and implementation of entry/exit structures.
- Installation of Clean Water Diversion Bunds as areas progress.
- Mulch Filter Berms shall be instated on all disturbance area boundaries receiving stormwater flows prior to disturbance in the applicable catchments.
- Installation of the Sediment Basins and dirty-water diversion bunds prior to significant soil disturbances in their receiving catchment area.
- Topsoil and fill stockpile management strategies including the implementation of sediment fencing on the downslope aspect of all soil stockpiles shall be undertaken.
- Progressive general bulk earthwork operations (e.g. stripping; cut to fill bulk earthworks) shall be undertaken.
- Contour drains/berms shall be instated at the required intervals within inactive work areas and in other areas prior to forecast rainfall during bulk earthworks.

PHASES 2 – Temporary Stabilisation

- Progressive implementation of chosen temporary stabilisation measures on areas reaching finished level in accordance with the specified thirty (30) day requirements/timeframes. This shall be primarily re-topsoiling and grass seeding.
- Although temporary sediment basins may be decommissioned once stabilisation requirements have been met, it may be desirable for some (or all) basins to remain in place for future Civil Works.

ESC Standard Drawings

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

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

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

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.

Stockpile Management

- All fill or topsoil stockpiles shall be located away from areas of concentrated stormwater flows/drainage lines.
- All soil stockpiles shall have a downslope 'Type 3' control (e.g. sediment fence; mulch bund) instated. If a portion of the stockpile is actively worked, the 'Type 3' control must be implemented prior to any reasonable likelihood (>10%) of rainfall at the end of daily works.
- A flow diversion structure shall be implemented immediately upslope of soil stockpiles if upslope catchment exceeds 1500m^2.

Lateral Catch Drains/Berms

- Lateral catch drains/berms shall be placed along the contour at the specified intervals (refer ESC Layout Plan table) of inactive areas of the bulk earthworks areas and also within active areas prior to anticipated rainfall events wherever practicable.
- It should be noted that earthworks such as the implementation of diversion structures often break up/reduce the effective slope length (i.e. substitute for a catch drain/berm) and therefore can also be taken into consideration where appropriate in determining the overall horizontal spacing required.

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.
- Construction activities shall only occur within the dedicated constructions 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 construction 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.
- Site spoil must be lawfully disposed of in a manner that does not result in soil erosion or environmental harm.
- 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 can not be exhaustive of the total requirements of the IECA Guidelines (2018), or potentially other development approval documents not supplied, and therefore the Contractor shall consult these Guidelines and Documents as required, and also inform GE of any amendments, if also required.
- Additional/ alternative ESC measures shall be implemented in the event that site inspections/monitoring of the Contractor or the Regulatory Authority identifies that unacceptable off-site sedimentation is occurring as a result of construction activities.

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TITLE: ESCP Requirements I			DRAWING NO.: GE23.054.D13
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase			SCALE:
CLIENT: Colliers	DATE: 20.10.23	DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

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.

Rehabilitation & Stabilisation

- 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 immediately stabilised upon completion and all disturbed soil surfaces stabilised with minimum **60%** cover (i.e. C factor of <0.10) 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 (including hydromulch, seeding, turf, chemical stabiliser/soil binders, geofabrics) shall conform to LCC, IECA and/or manufacturer's minimum standards.

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 construction activities.

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, or Turbidity <50NTU;
- Oils & grease – no visible films or odour; and
- Litter – no visible litter washed from the site.

If water treatment is required to meet the water quality objectives prior to controlled discharge, the application of neutralising agent (e.g. hydrated lime or sodium bicarbonate) to raise water pH and the application of a flocculant/coagulant to reduce suspended solids levels may be used.

If a pump is used to decant a waterbody, the intake pipe must not be allowed to rest on or near the settled sediment. Decanting must cease prior to settled sediments being drawn into the intake pipe.

The water quality objectives for the HES basin discharge is as follows:

- 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to ≤50mg/L Total Suspended Solids (TSS) and pH in the range of 6.5–8.5;
- Oils & grease – no visible films or odour; and
- Litter – no visible litter washed from the site.

N.B. A qualified Environmental Consultant may be engaged to establish a turbidity-total suspended solids correlation based on a minimum of five (5) samples between 20 – 150 mg/L, to enable turbidity monitoring (field-based) to replace suspended solids monitoring (laboratory-based).

Water within the HES basin shall undergo 'active treatment' treated using a Floc Box™ and operated in accordance with the manufacturers procedures and requirements.

Indicative treatment rates based on jar testing shall be required at the commencement of construction.

Water quality testing shall be undertaken during all HES basin discharge events (i.e. daily during discharge).

Water quality monitoring reports shall be prepared and retained at the site office and made available to LCC staff upon request.

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.
- 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.
- The Civil Contractor shall also document and record the timing of completed (finished level) earthworks and subsequent soil stabilisation timeframes to ensure the requirements are met wherever practicable.

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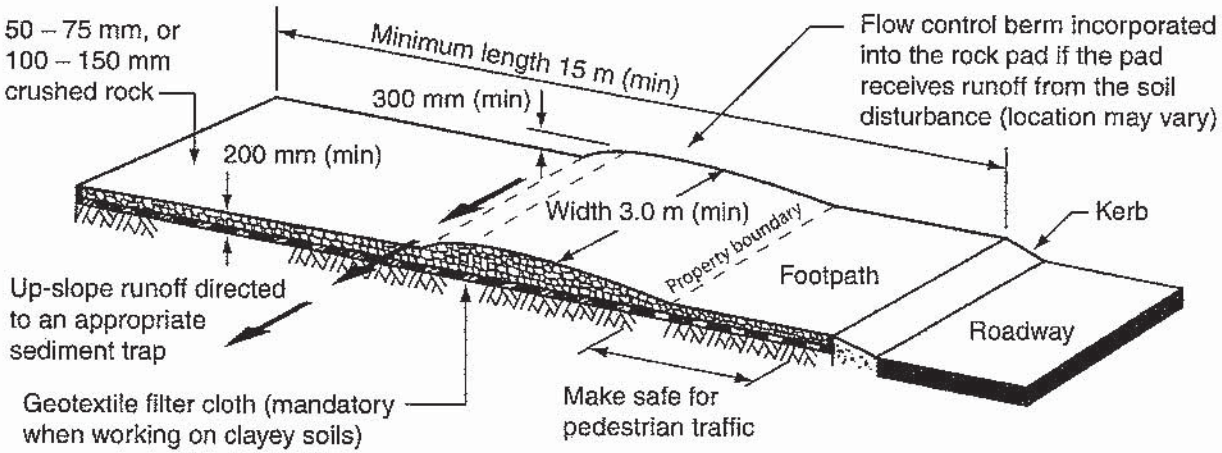
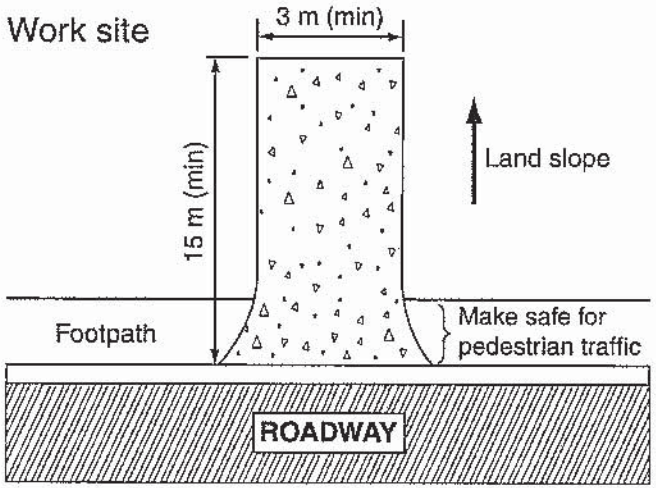
TITLE	DRAWING NO.
ESCP Requirements II	GE23.054.D14
JOB LOCATION: Riverbend, Jimboomba – Earthworks Phase	SCALE
CLIENT: Colliers	DATE: 20.10.23
DRAWN: GMG	SIGNED: GLEN GALLAGHER CPESC NO. 8346

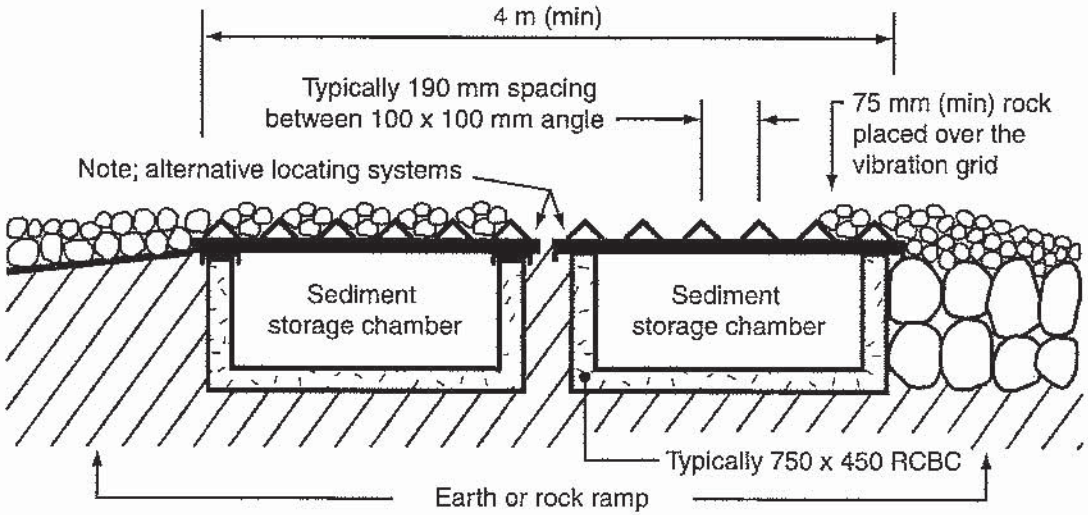
APPENDIX B:
STANDARD DRAWINGS



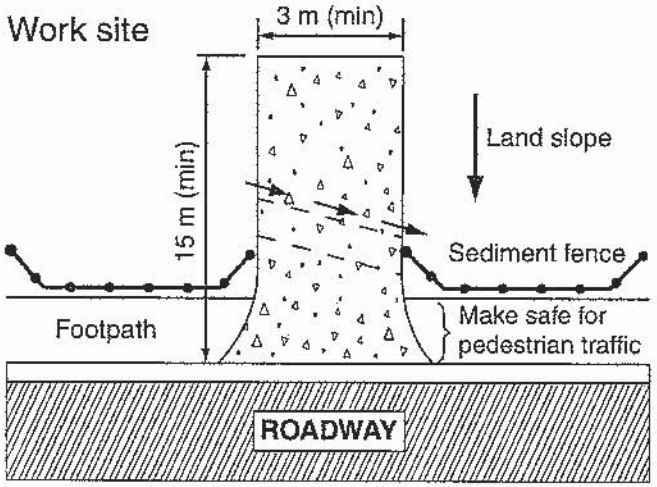
(a) Rock entry/exit pad for construction sites (refer to Standard Drawing Exit-03 for building sites)



(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

Catchments & Creeks Pty Ltd

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

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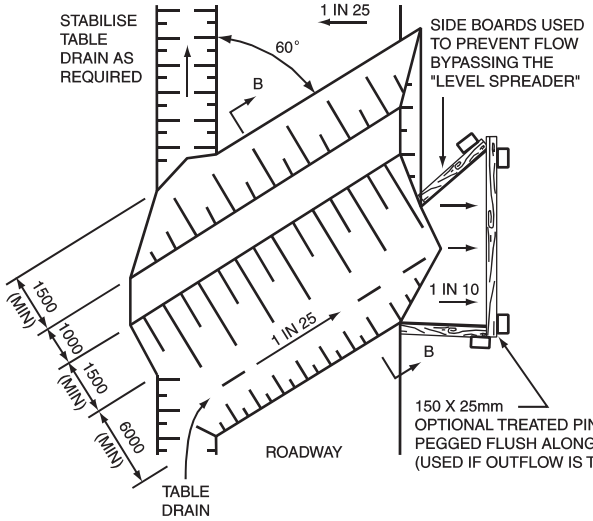
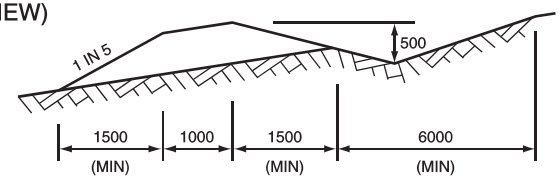


OUTFALL CROSS BANK (PLAN VIEW)

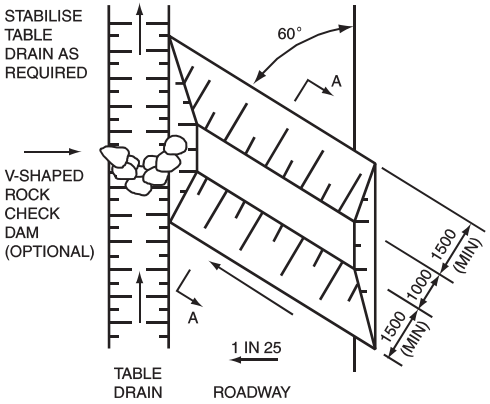
NOTES (OUTFALL CROSS BANK):

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.



CROSS BANK PROFILE (INSITU MATERIAL)

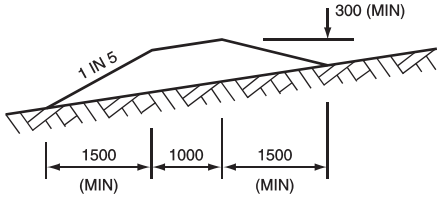
(a) Outfall cross-bank for low speed tracks



INFALL CROSS BANK (PLAN VIEW)

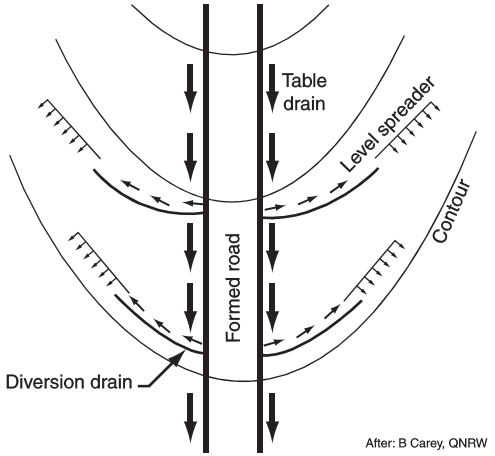
NOTES (INFALL CROSS BANK):

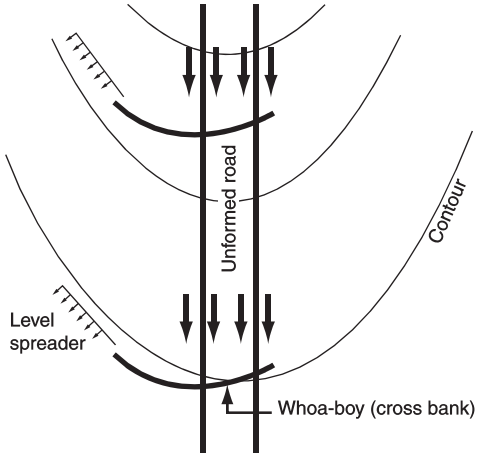
1. THE CROSS BANK SHOWN IS FORMED USING IMPORTED MATERIAL AND THUS DOES NOT REQUIRE ANY EXCAVATIONS INTO THE ROAD UP-SLOPE OF THE BANK. ALTERNATIVELY, THE BANK COULD BE FORMED USING INSITU MATERIAL.
2. ROCK CHECK DAMS OR OTHER STABILISATION MEASURES PLACED IN THE TABLE DRAIN MUST NOT CAUSE PONDING ON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



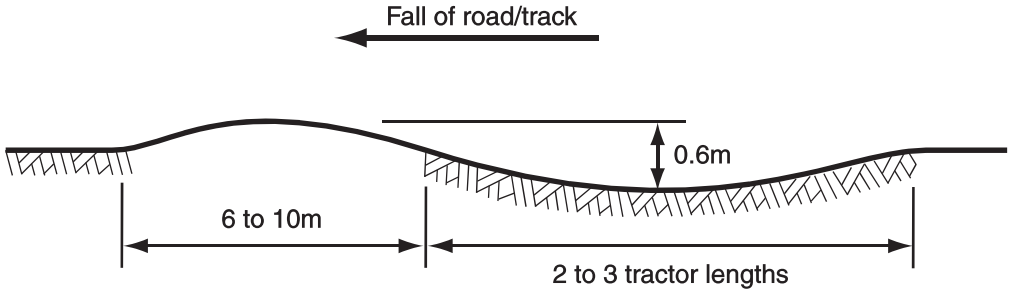
CROSS BANK PROFILE (IMPORTED MATERIAL)

(b) Infall cross-bank for low speed tracks





(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

Catchments & Creeks Pty Ltd

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.

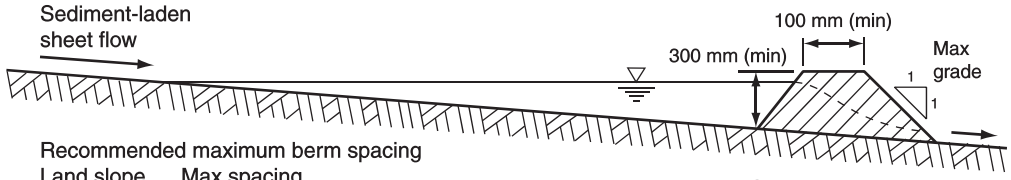
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

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

Catchments & Creeks Pty Ltd

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.

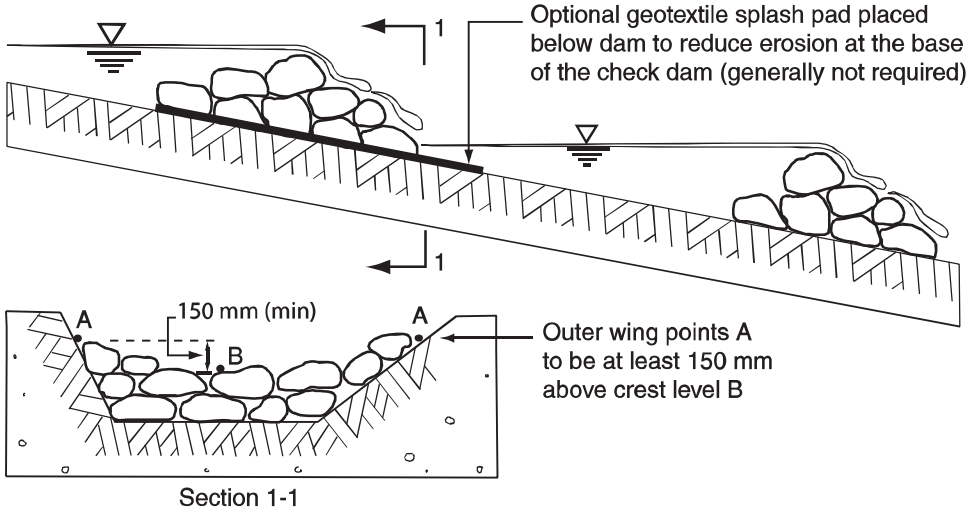


Figure 1 - Layout and profile of check dams (rock check dams shown)

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

Catchments & Creeks Pty Ltd

MATERIALS
GEO LOGS: MANUFACTURED FROM 100% JUTE, COIR (COCONUT FIBRE) OR A COMBINATION OF BOTH.

STAKES: MINIMUM 50 X 50mm X 0.9m HARDWOOD. STAKE LENGTH AND WIDTH MAY NEED TO VARY SLIGHTLY DEPENDING ON THE GROUND CONDITIONS.

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. PRIOR TO INSTALLATION ON CHANNEL/RIVER BANKS, PLACE A SUITABLE EROSION CONTROL MAT OVER ANY AREA WHERE THE LOGS ARE TO BE PLACED ABOVE AN EXPOSED SOIL.

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

4. WHEN PLACED ALONG A CHANNEL/RIVER BANK, DO NOT RECESS THE LOG MORE THAN 1/3 THE LOG DIAMETER INTO THE BANK.

5. ENSURE THE LOGS ARE PLACED TIGHTLY, END TO END.

6. WHERE PRACTICAL, THE EXTREME ENDS OF A ROW OF LOGS SHOULD BE ROTATED UP THE BANK AND SECURED WELL WITH STAKES.

7. SECURE THE LOGS BY DRIVING THE STAKES BETWEEN THE OUTER NETTING AND THE CORE MATERIAL EACH SIDE OF THE LOGS AND SECURED INTO THE GROUND, NOT THROUGH THE CENTRE OF THE LOG.

8. ENSURE THE SPACING OF STAKES (ONE ON EITHER SIDE) DOES NOT EXCEED AN INTERVAL OF 1m.

9. ONCE DRIVEN INTO THE GROUND, THE STAKES SHOULD IDEALLY SIT AT LEAST TWO-THIRDS BELOW THE GROUND AND ONE-THIRD ABOVE, AND IDEALLY SIT FLUSH WITH THE TOP OF THE LOG.

10. WHERE DIRECTED, INTERLACE COIR ROPE, GALVANISED WIRE, OR PLASTIC TREE TIES BETWEEN THE STAKES TO PROVIDE ADDITIONAL ANCHORAGE.

11. FILL AND SHAPE BEHIND THE LOGS IF REQUIRED.

12. IF STREAM FLOWS ARE LIKELY TO OVERTOP THE LOGS, THEN TAKE APPROPRIATE STEPS TO PREVENT HIGH VELOCITY FLOW ALONG THE LANDWARD SIDE OF THE LOGS. THIS CAN BE ACHIEVED WITH THE PLACEMENT OF ROCK CHECKS AT A SPACING NOT EXCEEDING 3m, OR THE PLACEMENT OF LOGS LATERALLY UP THE CHANNEL BANK.

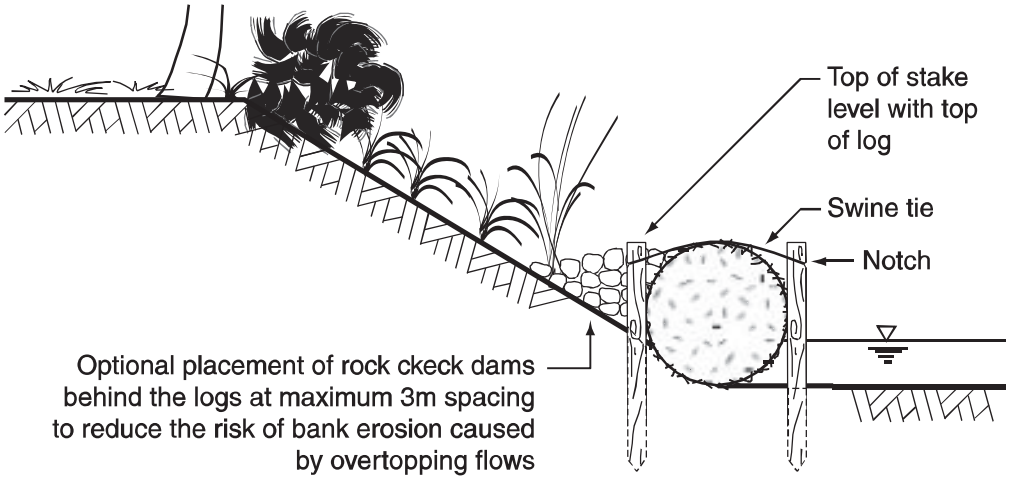
MAINTENANCE
1. WHILE ON-SITE WORKS CONTINUE, INSPECT ALL GEO LOGS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.

2. REPAIR OR REPLACE DISPLACED LOGS THAT ARE LIKELY TO CAUSE EROSION PROBLEMS.

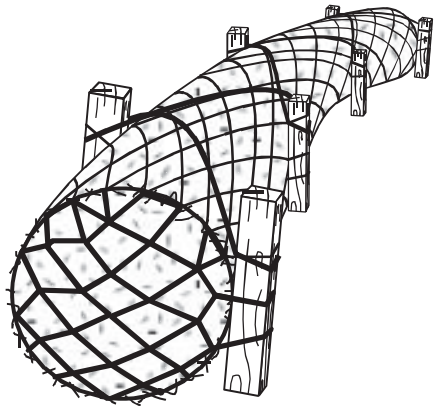
POST INSTALLATION MONITORING
1. MONITORING OF WORKS CAN INVOLVE SEVERAL DIFFERENT TECHNIQUES, SUCH AS PHOTO POINT MONITORING, AERIAL PHOTOGRAPHIC MONITORING, MEASURING PLANT SURVIVAL AND GROWTH, AND FLORA AND FAUNA SURVEYING.

2. INSPECT AND MAINTAIN GEO LOGS AFTER EACH HIGH FLOW EVENT FOR THE FIRST YEAR. MAINTENANCE MAY INVOLVE RESECURING LOGS, REPLACING LOGS, AND REPAIRING BREAKS IN THE NETTING.

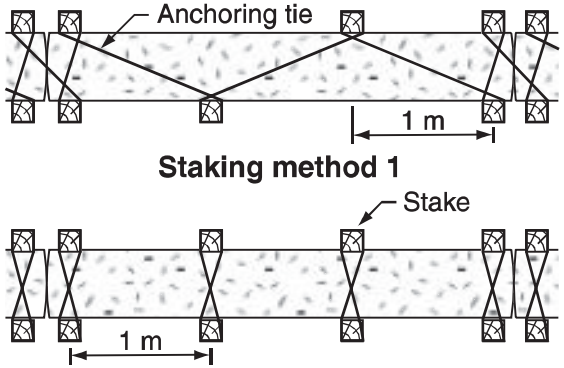
3. ANY NON-BIODEGRADABLE OR POTENTIALLY HAZARDOUS MATERIALS (INCLUDING HARDWOOD STAKES AND SYNTHETIC TWINE OR NETTING) SHOULD BE REMOVED ONCE WORKS HAVE REACHED THE END OF THEIR LIFE.



(a) Typical placement of geo log at toe of stream bank



(b) Typical anchorage of geo log



(c) Methods of stake placement

Drawn:	Date:		
GMW	May-10	Geo Logs (coir logs)	Log-01

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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. WHEN PLACED ACROSS NON-VEGETATED OR NEWLY SEEDED SLOPES, THE FILTER SOCKS MUST BE PLACED ALONG THE CONTOUR.

3. IF PLACED ON OPEN OR LOOSE SOIL, ENSURE THE FILTER SOCKS ARE TRENCHED 50 TO 100mm INTO THE GROUND.

4. ENSURE THE OUTER MOST ENDS OF EACH FILTER SOCK OR CONTINUOUS ROW OF FILTER SOCKS ARE TURNED UP THE SLOPE TO ALLOW WATER TO ADEQUATELY POND UP-SLOPE OF THE SOCKS, AND TO MINIMISE FLOW BYPASSING.

5. ENSURE THE ANCHORING STAKES ARE DRIVEN INTO THE END OF EACH SOCK AND ALONG THE LENGTH OF EACH SOCK AT A SPACING NOT EXCEEDING 1.2m OR SIX TIMES THE SOCK DIAMETER (WHICHEVER IS THE LESSER).

7. ADJOINING SOCKS MUST BE OVERLAPPED AT LEAST 450mm, NOT ABUTTED.

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 FILTER SOCKS.

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

REMOVAL

1. ALL EXCESSIVE SEDIMENT TRAPPED BY THE FILTER SOCKS MUST BE REMOVED FROM THE DRAIN OR SLOPE IF SUCH SEDIMENT IS LIKELY TO BE WASHED AWAY BY EXPECTED FLOWS.

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

3. 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.

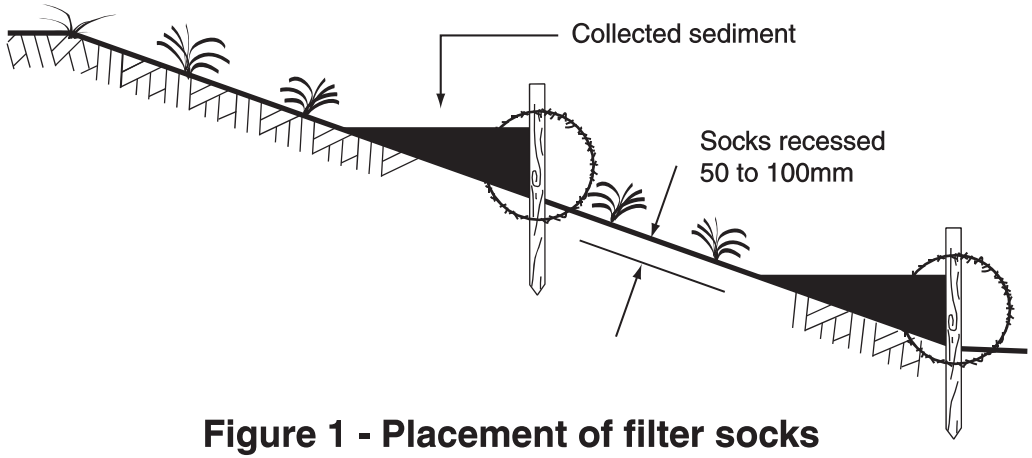

Figure 1 - Placement of filter socks

Drawn:	Date:		
GMW	Dec-09	Filter Socks - Sheet Flow	FS-02

Catchments & Creeks Pty Ltd

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

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