



Gallagher Environmental

Erosion & Sediment Control Plan (ESCP): Riverside Jimboomba - Clearing Phase

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2020/1164

Date: 28 May 2021



Client: Calibre Group

Report No: GE19.078.R1B

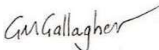
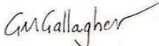
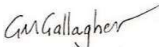
Date: 8th March 2021



DOCUMENT CONTROL

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	Document No:	GE19.078.R1B.doc
	Title:	Erosion & Sediment Control Plan (ESCP): Riverside Jimboomba – Clearing Phase
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	Client:	Calibre Group
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	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	3 February 2020	G Gallagher	
A	23 November 2020	G Gallagher	
B	8 March 2021	G Gallagher	

DISTRIBUTION

Destination	Revision		
	Original	A	B
Calibre Group	1	1	1
GE Database	1	1	1

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1. INTRODUCTION

1.1 ESCP Overview

Gallagher Environmental (GE) was commissioned by Calibre Group to prepare an Erosion & Sediment Control Plan (ESCP) for the proposed land clearing works located at 'Riverside Jimboomba', accessed via Teviot Road, Jimboomba.

The purpose of the ESCP is to define the overall erosion hazard of the proposed land clearing works and to provide appropriate management strategies in order to ensure adverse effects on the environment from soil erosion are mitigated during the clearing phase of the development. Furthermore, the ESCP has been prepared with reference to the *IECA (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, including detailed laboratory results; and subsequent management strategies to be employed during the land clearing phase of the development.

1.2 Scope of Study

The scope of the study included:

- Review of initial desktop information, sampling and laboratory analysis of samples recovered from ten (10) locations for the purposes of soil erosion hazard testing;
- A detailed desktop review of the proposed development area and site inspection by qualified GE staff; and
- The detailed interpretation and analysis of the data obtained and comment on relevant recommendations.

Furthermore, the investigation, field and laboratory testing and interpretation were carried out in general accordance with the following documents and standards:

- Best Practice Erosion & Sediment Control - Books 1, 2 & 3 (IECA, 2018);
- Urban Stormwater Quality Planning Guidelines (DEHP, 2010);
- Soils and Construction- Managing Urban Stormwater (Landcom NSW, 2004);
- Australian Soil & Land Survey Field Handbook (McDonald et. al., 1998);
- AS1289 Testing of Soils for Engineering Purposes; and
- Australian Soil Classification (Isbell, 2016).

1.3 Aims & Objectives

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

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

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

1.4 ESCP Timeframe

The ESCP is intended to cover the proposed land clearing phase of the development.

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

1.5 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.

1.6 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 experience allows. This may be due to necessary changes in the land clearing schedule and any unforeseen issues that may arise during land clearing activities.

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

2. SITE DESCRIPTION

2.1 Proposed Disturbance

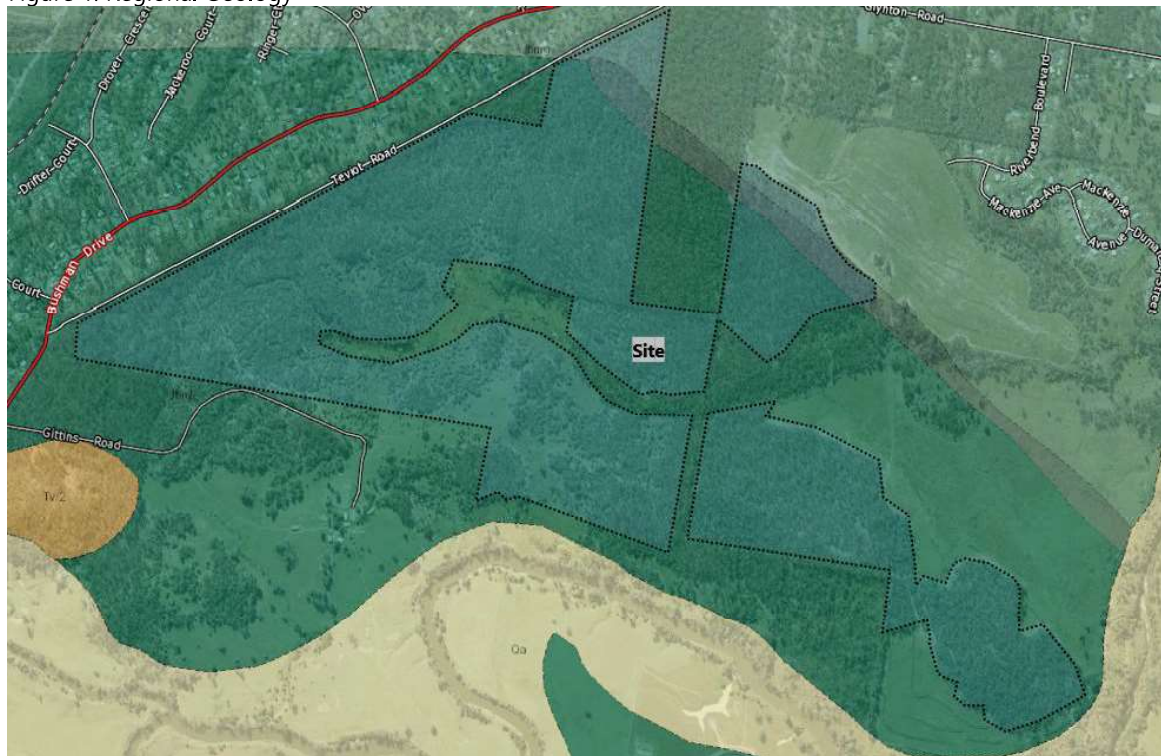
The total disturbance area of the proposed land clearing is approximately 260ha and is anticipated to be undertaken in multiple clearing phases and progressive stabilisation. The clearing works shall not involve topsoil stripping or bulk earthworks, however the process of land (vegetation) clearing including the use of heavy machinery (e.g. bulldozer) shall increase the exposure of the surface (topsoil) materials. This increases soil erosion rates from these areas during rainfall events until rehabilitation with grass cover.

2.2 Geology

Based on the Department of Mines 1:100,000 geological series maps, the site contains one (1) predominant lithology as follows and also displayed in Figure 1 below:

- Jbmk -'Koukandowie Formation' comprising 'lithofeldspathic labile and sublabile to quartzose sandstone, siltstone, shale, minor coal, ferruginous oolite marker' dating to the Jurassic Period;

Figure 1: Regional Geology



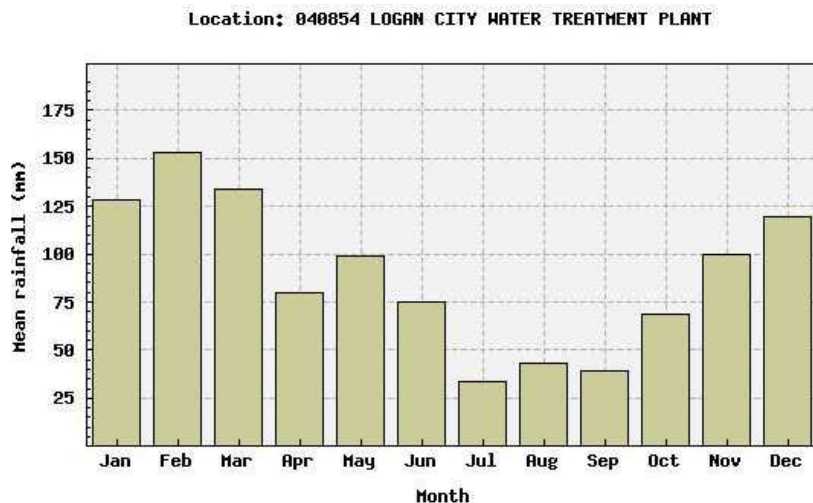
2.3 Slopes & Drainage

The slopes associated with the proposed land clearing are generally gently inclined, ranging between 1% - 12%. However, the majority of the proposed land clearing zones fall in the range of 4% - 9%. The proposed clearing areas involve numerous sub-catchments, with the majority of the clearing areas draining towards a centrally-located drainage line (ephemeral) that trends west to east. However, some areas also drain toward either the northern and southern site boundaries.

2.4 Rainfall /Climate

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

Figure 2: Annual Rainfall Averages (BoM).



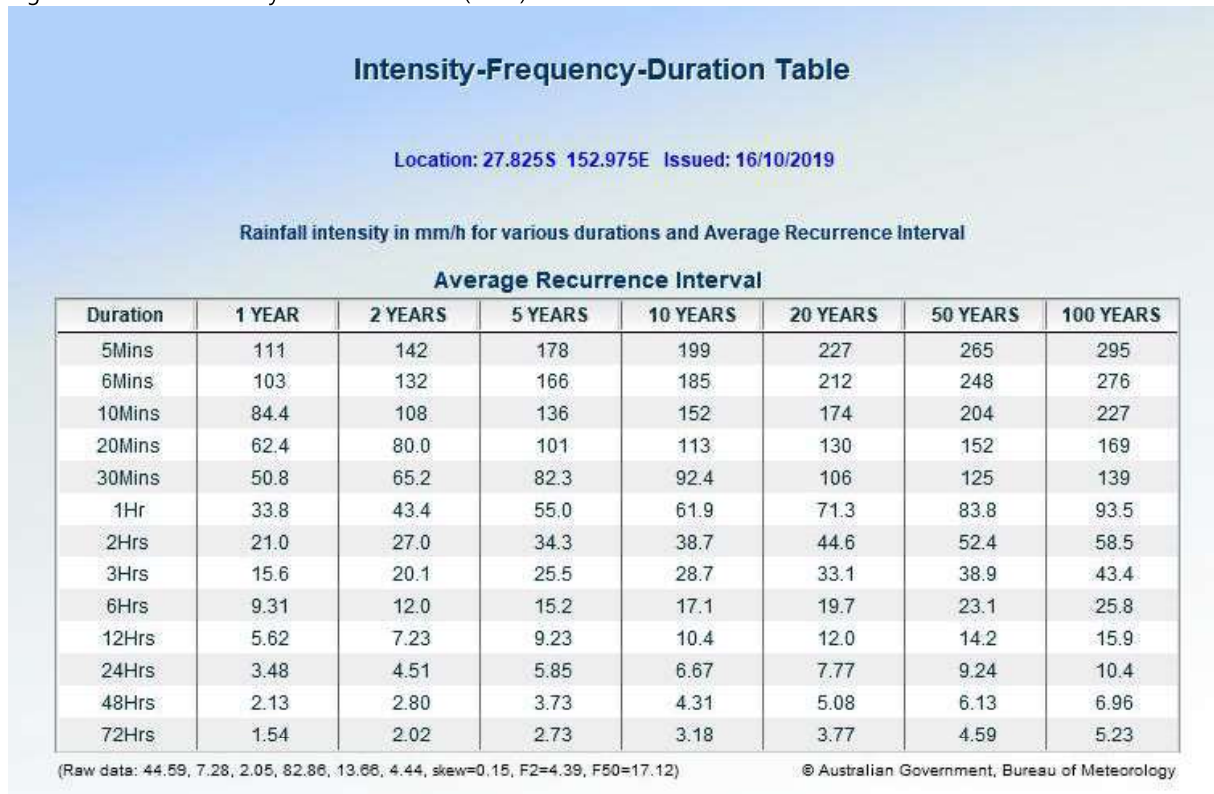
The calculated annual rainfall erosivity factor based on the following equation:

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

where S is the 2 year ARI, 6 hour rainfall event (mm) = 13.8 mm/hr (refer Figure 3).

The calculated R factor (annual) is 3105.

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



2.5 Soil Types

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

The field and laboratory assessment were in high agreement with the mapping data, with topsoil texture types revealing little variation across the proposed clearing areas. Soil textures ranged between loamy sand to light sandy loam with generally with single-grained or moderate soil structure grade. The soils were also revealed as a very low soil dispersion risk (refer Section 3.0 below).

3. LABORATORY RESULTS

Laboratory results undertaken in order to define soil dispersion potential are shown in the following table and discussed in the following sections. The laboratory certificates are attached in Appendix C. The site plan detailing borehole locations and pertinent laboratory results is provided in Drawing No. GE19.078.D1.

Table 1: Soil Laboratory Results

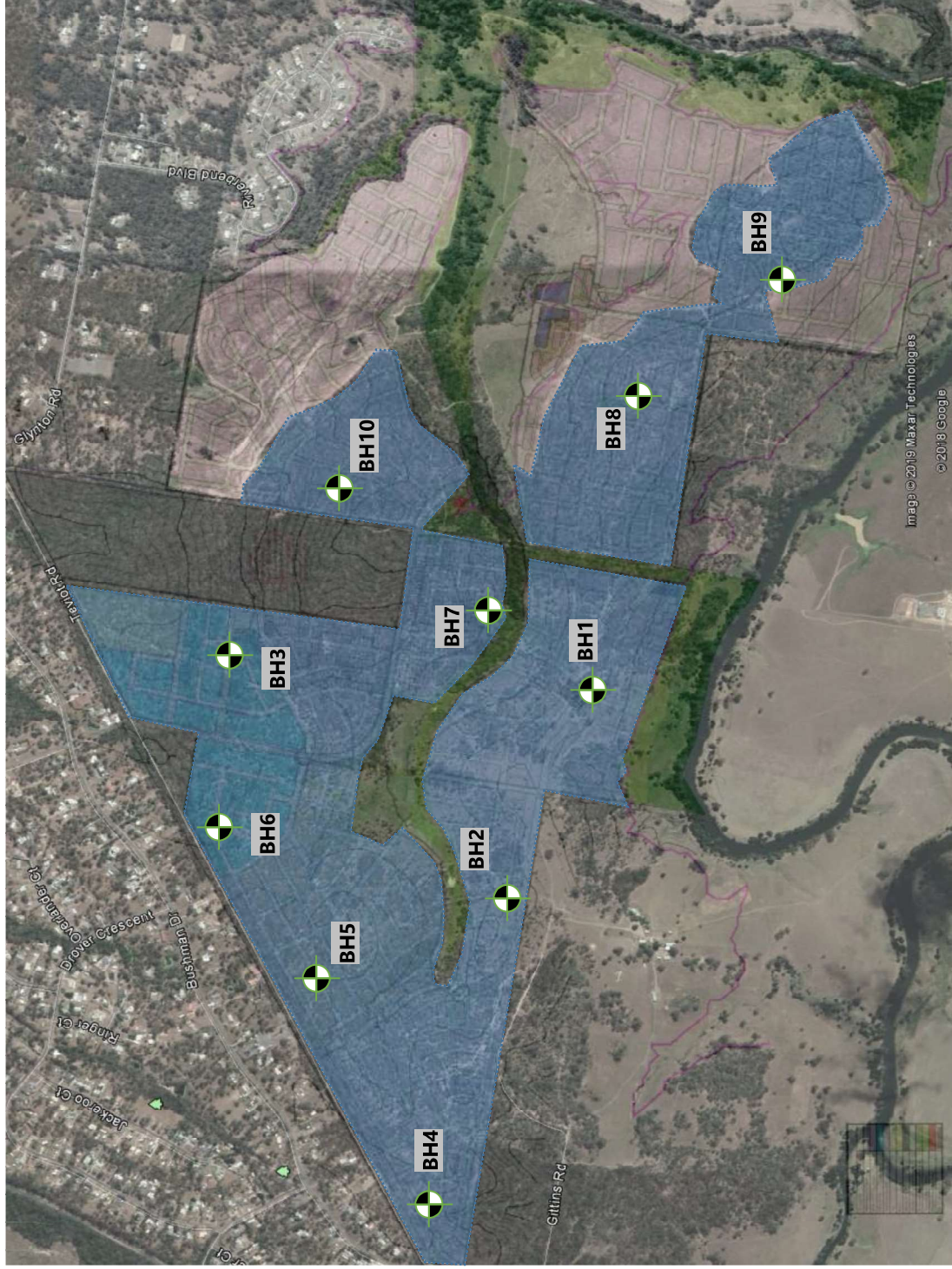
	Location	Soil Texture	Emerson Class	pH	EC _e (mS/cm)	ESP (%)	Interpretation
A Horizon (Topsoil)	BH1 0.0m	Loamy Sand	8	5.4	1.0		strongly acidic pH non-saline non-sodic very low soil dispersion risk
	BH2 0.0m	Light Sandy Loam	7	5.2	0.4		
	BH3 0.0m	Loamy Sand	8	5.1	0.6		
	BH4 0.0m	Light Sandy Loam	7	5.2	0.6		
	BH5 0.0m	Light Sandy Loam	7	5.3	0.7	5.1	
	BH6 0.0m	Light Sandy Loam	7	5.4	0.4		
	BH7 0.0m	Loamy Sand	7	5.2	1.3		
	BH8 0.0m	Loamy Sand	8	4.9	1.2	5.3	
	BH9 0.0m	Loamy Sand	8	4.9	0.7		
	BH10 0.0m	Light Sandy Loam	7	5.1	0.6		

3.1 Discussion

3.1.1 Emerson Class Tests

An Emerson number of 1 indicates a strongly dispersive soil, an Emerson number of 2 indicates a high risk of significant soil dispersion; an Emerson number of 3 indicates a moderate risk of significant soil dispersion; whilst an Emerson number ranging between 4 and 8 indicates a soil with low to negligible dispersion tendencies.

Emerson Class testing undertaken on ten (10) topsoil (i.e. A horizon) samples revealed Class 7 - 8 characteristics indicating a very low soil dispersion risk.



Key:

Proposed Clearing Areas

Emerson Class 1 or 2 – High to Very High Risk

Emerson Class 3 – Moderate Risk

Emerson Class >4 – Very Low to Low Risk

Gallagher Environmental		Drawing No.		GE19.078.D1	
Soil Water Environment		Scale		Scale Not Shown	
ABN 56 493 696 583		Date		30.01.20	
59 Cremorne Rd Kedron Qld 4031		Client		Calibre Group	
glen@genviro.com.au		Drawn		GIMG	
		Signed			
		Job Location		Riverside Jimboomba	
		Title		Sampling Locations	

3.1.2 Soil pH

Soil pH is a secondary indicator in the estimation of soil dispersion hazard; where significantly alkaline pH values (e.g. pH >8.0) can indicate a higher risk of soil sodicity and subsequent soil dispersion. Conversely, strongly acidic samples (i.e. pH <5.5) can indicate high bio-available aluminum that can help counter-act soil dispersion tendencies of sodium ions in the soil.

The obtained topsoil (i.e. A horizon) pH values of 4.9 – 5.4 are strongly acidic and indicate a decreased risk of soil dispersion via high bio-available aluminum levels.

3.1.3 Soil Salinity

Soil salinity reflects the relationship between landscape hydrology, geology, soil properties and vegetation. Soil salinity is also secondary indicator in the estimation of soil dispersion hazard. Soils with mildly saline values (or relatively higher values to comparison soils) can sometimes indicate higher levels of sodium and therefore can indicate a higher risk of soil sodicity and subsequent soil dispersion.

However, the actual soil dispersion risk is determined by the relative balance of sodium in relation to chloride levels within saline soils. Saline soils can often be sodic, but these soils will not show indicators of sodicity. The salt content of the soil prevents dispersion of soil particles in high enough concentrations. If this salt level falls below the requirement for soil stability even a small amount of sodium can produce adverse effects. A combination of high sodium levels and overall low salt will produce extremely poor physical conditions in soils associated with dispersive soils.

Soils that exhibit an $EC_e < 4$ mS/cm are considered to be non-saline.

The soil salinity classes are shown in Table 2 below.

Table 2: Salinity classes of soils (after Richards, 1954)

Class		EC_e (dS/m)	Comments
Non-saline	None	<2	Salinity effects mostly negligible
	Slight	2 – 4	Yields of very sensitive crops may be affected
Saline	Moderate	4 – 8	Yields of many crops affected
	Very	8 – 16	Only tolerant crops yield satisfactorily
	High	>16	Only a few very tolerant crops yield satisfactorily

The calculated EC_e (saturated) values for the topsoil materials ranged between 0.4 – 1.3 dS/m indicating that the topsoil materials are non-saline. Therefore, these soils would not receive any significant benefit from flocculation (i.e. counter-acting dispersion) due to inherent salinity levels.

3.1.4 Soil Sodidity (ESP)

Soil Sodidity is a measure of exchangeable sodium in relation to other exchangeable cations and is expressed as the Exchangeable Sodium Percentage (ESP). ESP is an important primary risk indicator in the identification of dispersive soils. The common problems that may be encountered with sodic soils are lower hydraulic conductivity (i.e. water logging), higher susceptibility to tunnel erosion and severe gully erosion, poor aeration and reduction in plant-available water capacity and poor leaching (i.e. build up of salts).

The tendency for soil dispersion usually increases with increasing ESP. Sodic soil layers ($ESP \geq 6$) may disperse and strongly sodic soils ($ESP \geq 15$) usually do. The Australian sodicity classifications are provided in Table 3 below:

Table 3: Sodidity classes of soils

Sodidity Classification	ESP (%)
Non-sodic	≤ 6
Sodic	6 – 15
Strongly sodic	> 15

Source: DPI (1993)

The ESP level of the topsoil (A horizon) samples were 5.1 – 5.3% indicating non-sodic soils.

3.1.5 Topsoil Nutrient Results

The topsoil (agronomic) test results, interpretation and recommendations in relation to *optimum* plant growth for 'kikuyu pastures (general grass)' are detailed in Table 4 below.

Table 4: Agronomic Test Results

Parameter	Result	Guideline Level	Interpretation	Treatment Rate
pH (H ₂ O)	4.9 – 5.4	5.5 – 8.0	Low. <i>Apply Ag. Lime</i>	Apply Ag. Lime (calcium carbonate) at 3-4 tonnes / ha
Calcium (meq/100g)	2.3	≥ 3.00	Low. <i>Apply Ag. Lime</i>	
Magnesium (meq/100g)	2.2 – 2.8	≥ 1.00	Satisfactory. <i>No action required.</i>	
Ca: Mg Ratio	0.8 – 1.0	1.5 – 8	Low. <i>Apply Ag. Lime</i>	
CEC (meq/100g)	6.7 – 7.4	≥ 8	Low. <i>Application of Ag. Lime will help raise CEC.</i>	
Aluminium (meq/100g)	0.8 – 1.2	< 1	Marginally Elevated. <i>Apply Ag. Lime.</i>	
Sodium (base %)	5.1 – 5.3	< 6	Satisfactory. <i>No action required.</i>	
EC (dS/m)	.05 – 0.09	< 0.4	Satisfactory. <i>No action required.</i>	

Sulphate (ppm)	10 – 50	≥10	Satisfactory. <i>No action required.</i>	
NOx- Nitrogen (ppm)	4 - 7	≥20	Low. <i>Apply Nitrogen fertiliser</i>	100 kg / ha
Phosphorus - (Olsen)(ppm)	<2	≥15	Very Low. <i>Apply Phosphorus fertiliser</i>	40 kg / ha
Potassium (meq/100g)	0.6 – 0.7	≥0.6	Satisfactory. <i>No action required.</i>	-

The recommended application rates including common ameliorant products are provided in Table 5 below. Given the relative homogeneity of soil results across the site, initial sections of cleared areas (e.g. several hectare) can be observed to ascertain whether grass cover strikes in a manner that complies with the thirty (30) day rehabilitation requirement (Refer Section 4.4) before applying the recommended amelioration strategy.

Table 5: Recommended Amelioration Strategy

Ameliorant		Treatment Rate
NPK Fertiliser	Ag. Lime	3 -4 tonnes per ha
	Nitrogen (N)	100 kg per ha
	Phosphorus (P)	40 kg per ha
	Potassium (K)	-

An NPK fertilizer product should be chosen with the approximate NPK ratios similar to the recommendations provided and the overall rate of the product calculated to ensure the minimum levels of each element are attained.

Alternatively, N & P fertiliser products can be used separately and blended, with examples as follows:

- Urea (45% N): 220kg/ha is equivalent to the required 100 kg/ha of Nitrogen (N)
- Triple Superphosphate (20% P): 200kg/ha is equivalent to the required 40 kg/ha of Phosphorus (P)

3.1.6 Soil K Factors

All sampled soil textures obtained during the site investigation were examined by a qualified Environmental Scientist experienced in the Australian Soil Classification (Isbell, 2016).

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

Estimation of Soil K Factor

(Soils & Construction, 2004)

Soil Texture	Sand (0.1 - 2.0mm)	67 %	<i>Sandy Loam</i>
- Fine Earth Fraction	Fine Sand (0.02 - 0.1mm)	8 %	-Mod. Polyhedral Structure
- Field Results	Silt (0.002 - 0.02mm)	12 %	- Emerson Class 7-8
	Clay (<0.002mm)	13 %	
	Gravel (>2mm)	<5 %	

Structure Grade	1- Very fine granular (<1mm)	
	2- Fine granular (1- 2mm)	
	3- Granular (2 - 10mm)	
	4- Blocky, platy or massive	✓

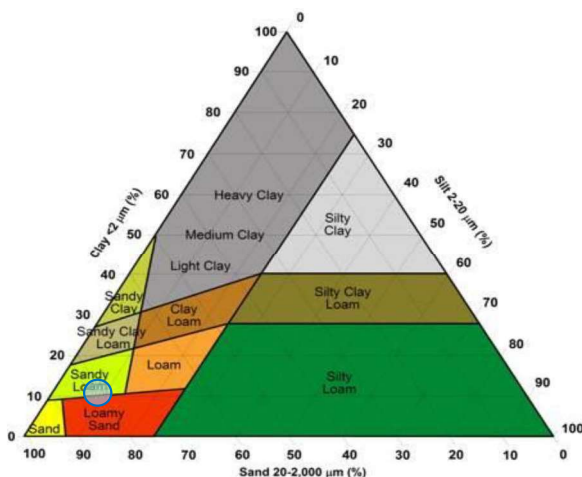
Permeability Grade	1- >130 mm/hr	
	2 - 60 to 130 mm/hr	
	3 - 20 to 60 mm/hr	✓
	4 - 5 to 20mm/hr	
	5 - 1 to 5mm/hr	
	6 - <1mm/hr	

Organic Matter	Topsoil (assumed)	2.0 %	✓
	Subsoil (assumed)	0.0 %	
	Laboratory Result	- %	

Soil Dispersion Factor	Dispersive	+20 %	
	Slightly Dispersive	+10 %	
	Non-Dispersive	0 %	✓

Calculated K Factor	0.022
Safety Factor (+)	+10 %

Estimated K Factor	0.024
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Glen Gallagher

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4. ESC DESIGN METHODOLOGY

4.1 Soil Erosion Potential

'Soil erosion' can be defined as one or a combination of the following forms (Witheridge and Walker, 1996¹):

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

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

4.2 Soil Erosion Hazard Calculations

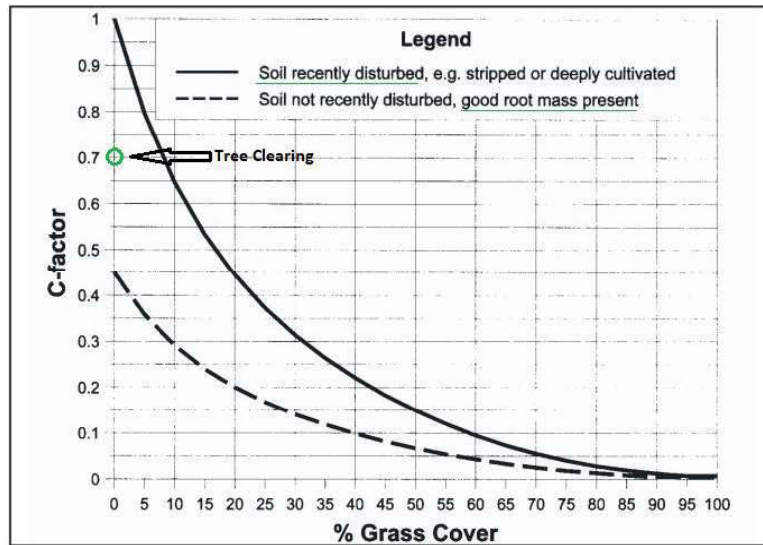
The overall soil erosion hazard calculations for the entire land clearing phase are shown in Table 6 below.

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

¹ Witheridge, G. and Walker, R (1996) *Soil Erosion & Sediment Control: Engineering Guidelines for Queensland Construction Sites*. The Institute of Engineers, Australia, Queensland Division. Brisbane.

² Houghton, P.D. and Charman, P.E.V. (1986) *Glossary of Terms used in Soil Conservation*. Department of Conservation and Land Management, Sydney.

Figure 4: C Factor Estimation



The LS factor was based on a mean 8% grade at an arbitrary 80m slope length in accordance with the IECA Guidelines (2018). The P Factor was estimated at 1.0 given the absence of earthworks and the resulting track-walking up and across the slope due to heavy machinery.

Table 6: Catchment Soil Loss Rates

Location	C Factor	P Factor	LS Factor	R Factor	K Factor	Calculated Soil Loss ¹ (t/ha/yr)
Site	0.7	1.0	2.05	3105	0.024	107

¹ RUSLE: $A = R.K.L.S.C.P$

The overall soil loss rate for the land clearing phase is calculated as **107 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 7 below.

Table 7: 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.

4.3 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 (2018), as shown in Table 8 below:

Table 8: Sediment Control Standards

Sediment Control Technique	Sub-Catchment Size (ha)	Calculated Soil Loss (t/ha/ha)	Example Control Measures
1	0.25 – 1.0ha	>150	Sediment basins (in accordance with IECA design standards)
	>1.0ha	>75	
2	0.10 – 0.25ha	>75	rock filter dam/weirs, mulch filter berms
	0.25 – 1.0ha	75 – 150	
3	<0.10ha	All Cases	sediment fences, coir logs sediment traps/check dams/windrows, field inlet protection
	>0.10ha	<75	

Given that the proposed land clearing shall be taken with progressive implementation of vegetation stockpile windrows along the contour (i.e. significantly less than 1ha of cleared areas exposed at any one time until 'Type 3' windrows/controls are in place for that area) as primary ESC control, it is proposed to set the stockpile windrows at required intervals (i.e. slope lengths) to qualify for 'Type 3' controls at the ≤ 75 t/ha/yr requirement.

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 accesses;
- Progressive placement of 'Type 3' vegetation stockpile windrows along the contour and also on the downslope boundary of the clearing/disturbance limit;
- Where practicable, clearing shall be initiated on the top of each catchment and works to progress downslope, in order to minimise upslope stormwater flows onto the disturbance areas. Where this is not practicable, a stockpile windrow shall be placed on the upper clearing limit to provide external stormwater flow retardance/diversion onto the clearing areas;
- 'Type 3' grass buffer zones are also present downslope of significant areas of the proposed land clearing zones;
- Stabilisation of land clearing areas within a thirty (30) day timeframe.
- Stabilisation of the minor land clearing areas located within the ephemeral waterway area within a ten (10) day timeframe and a rock filter weir established at the downstream end of disturbance.

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

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

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

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

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

4.3.1 Vegetation Windrow Implementation

Given that the proposed land clearing shall be taken with progressive implementation of vegetation stockpile windrows along the contour (i.e. significantly less than 1ha of cleared areas exposed at any one time until 'Type 3' windrows/controls are in place for that area) as primary ESC control, it is proposed to set the stockpile windrows at required intervals (i.e. slope lengths) to qualify for 'Type 3' controls at the ≤ 75 t/ha/yr requirement.

By back-calculating the required LS factor at various slope lengths in the RUSLE formula, the following maximum slope lengths have been calculated for the varying slopes presented across the land clearing areas (refer Table 9 below). However, a maximum 80m interval has been included in accordance with the IECA Guideline (2018), despite increased intervals otherwise allowable for very gentle (1 – 4%) gradients.

Table 9: Required Intervals for vegetation stockpile windrows placed along the contours

Mean Gradient	Minimum Intervals (Slope Lengths)
1 – 5 %	80m
6%	70m
7%	60m
8%	45m
9%	35m
10%	30m
11%	25m
12%	20m

An example of the vegetation stockpile windrow and a grass buffer that are present from previous clearing within the south-east corner of the site is shown in Plate 1 below:

Plate 1: Existing Vegetation Windrow & Grass Buffer (previous clearing in south-east corner of site)



Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the downslope boundary of the clearing/disturbance limit.

Stockpiled windrows of cleared vegetation shall be progressively shaped parallel to the site contours at maximum spacing in accordance with Table 9 spacing requirements.

Where practicable, clearing shall be initiated on the top of each catchment and works to progress downslope, in order to minimise upslope stormwater flows onto the disturbance areas. Where this is not practicable, a stockpile windrow shall be placed on the upper clearing limit to provide external stormwater flow retardance/diversion onto the clearing areas.

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

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

A sediment fence may be used to substitute a vegetation stockpile windrow, as deemed required, provided that all ESC requirements including the spacing requirements contained within Table 9 are maintained (i.e. sediment fencing installed at same spacing as vegetation windrow requirements).

4.4 Stabilisation Requirements

Specific stabilisation requirements for the site are formulated in accordance with Table 5 below:

Table 5: 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 land clearing (excluding waterway areas), wherever practicable:

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works;
- All disturbed soil surfaces shall be stabilised with minimum **60%** grass cover within **30 days** of completion of work within any area of the work site;
- Unfinished land clearing areas are suitably stabilised if disturbance is expected to be suspended for a period exceeding **30 days**.

The stabilisation technique shall typically include grass seeding. Stabilised areas shall be monitored on a weekly basis (refer Section 5.1) until the stabilisation requirements have been achieved.

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

4.4.1 Clearing in Ephemeral Waterway Areas

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

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall –

including existing unstable, undisturbed, soil surfaces under the management or control of the construction works;

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

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

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

- The Contractor is required to utilise short term (1 -7 day) forecasts in order to schedule these works in dry weather;
- Once disturbance is initiated within any contiguous section of the waterway, works shall be programmed to expedite the duration of disturbance in order to minimise potential exposure to rainfall, and these works shall be completed within a ≤72 hour timeframe (i.e. <72 hours of clearing undertaken at any one time, prior to stabilisation of each relevant area).
- All haul roads that pass through all channel/drainage lines shall be constructed with geofabric layer overlain by gravel. The gravel shall be maintained where required to ensure clean water conveyance. Low flow aggie pipes may also be installed;
- A rock filter weir across the entire base width of the channel shall be implemented immediately downstream of any contiguous section of the waterway disturbance and left in place until the area has reached the 'stabilisation requirements';
- All disturbed soil surfaces shall be stabilised with minimum **80%** equivalent grass cover within **10 days** of *completion* of work within any waterway, or to full equivalent natural condition, as determined by a CPESC or Environmental Engineer (RPEQ);
- Stabilisation techniques typically include turf or turf re-enforced matting (TRM). Prior to each phase of waterway clearing works, a CPESC or Environmental Engineer (RPEQ) shall be engaged to determine the stabilisation techniques to be utilised based on the slope/grade of channel and banks, and the time of year (e.g. rainfall/climate) of the stabilisation period;
- Stabilised areas shall be monitored on a weekly basis (refer Section 5.1) until the stabilisation requirements have been achieved. For areas with poor initial strike or failure, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period.

The requirements for the proposed clearing are also contained in Drawing No. 19.078.D4a (Appendix A). This drawing may be continually updated by the Consulting Engineer, in consultation with a CPESC or Environmental Engineer (RPEQ), where required.

5. MONITORING & REPORTING

5.1 ESC Monitoring & Reporting

The 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 clearing 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 $\geq 15\text{mm}/24$ hour period.

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

All areas undergoing stabilisation shall be inspected on a weekly basis until the stabilisation requirements (refer Section 4.4) have been achieved.

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

5.2 Water Quality Monitoring & Requirements

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

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

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

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

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

5.3 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.

5.4 Environmental Duties

The Environmental Protection Act (EPA) 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 EPA also aims to protect the environment by directing all personnel to review and where possible, adopt better environmental management practices.

In addition, The EPA 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.

5.5 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'.

Relevant contact details are as follows:

- 1 Logan City Council (ICC)
P: (07) 3412 5269
- 2 Department of Environment and Heritage Protection (DEHP)
P: 1300 130 372

6. ESCP CERTIFICATION

This ESCP has been prepared with due reference to the IECA (2018) *Best Practice Erosion and Sediment Control* Guideline to assist the Developer and their agents (e.g. 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 clearing phase.

Yours faithfully,



Glen Gallagher BScApp(Env Sc)(Hons) MEIANZ CPESC
Principal Environmental Scientist | Gallagher Environmental

APPENDIX A: ESCP - DRAWINGS & NOTES

Clearing & Grubbing Phase:

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

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

- Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the downslope boundary of the clearing/disturbance limit. Progressive placement of 'Type 3' vegetation stockpile windrows along the contour (in accordance with the included Table based on slope). Indicative grades have been provided but shall be ground-truthed for each clearing section by the Contractor or Consulting Engineer.
- Where practicable, clearing shall be initiated on the top of each catchment and works to progress downslope, in order to minimise upslope stormwater flows onto the disturbance areas. Where this is not practicable, a stockpile windrow shall be placed on the upper clearing limit to provide external stormwater flow retardance/diversion onto the clearing areas.
- The windrows of stockpiled vegetation shall be placed in a firm and compact manner that provides intimate contact between the ground surface and vegetation. The height of the windrows shall be a minimum height of 1.0m with a minimum 2.5m width (i.e. in the direction of flow). The stockpiled vegetation used for windrow construction can also be mulched prior to use. A sediment fence may be used to substitute a vegetation stockpile windrow, provided that all ESC requirements including the spacing requirements are maintained (i.e. sediment fencing installed at same spacing as vegetation windrow requirements).
- If localised drainage lines (i.e. concentrated flow paths) are intercepted in disturbance areas, rock check dams (200mm height) shall be placed within them at 40m intervals within the affected areas.
- Existing 'Type 3' grass buffer zones are also located in numerous areas downslope of the proposed clearing areas (Figure 1).
- Stabilisation of land clearing areas (excluding waterways) within a thirty (30) day timeframe – Refer 'Stabilisation Requirements' and Section 3.1.5 of the ESCP Report for Soil Amelioration Requirements.

Stabilisation Requirements:

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

- All reasonable and practicable steps are taken to apply best practice erosion control measures to completed earth works, or otherwise stabilise such works, prior to anticipated rainfall – including existing unstable, undisturbed, soil surfaces under the management or control of the construction works.
- Disturbed soil surfaces stabilised with minimum 60% grass cover within **30 days** of completion of works (i.e. finish level) within any area of the work site.
- Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding **30 days**.
- The stabilisation technique shall typically include grass seeding. Stabilised areas shall be monitored on a weekly basis until the stabilisation requirements have been achieved.

- The use of stabilisation products (including seeding) shall conform to LCC or IECA minimum standards.

- For areas with poor initial strike, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period. Refer Standard Drawing 'R-01' for general requirements.



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



Gallagher Environmental
Soil Water Environment

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59 Cremorne Rd Kedron Qld 4031
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TITLE

ESC Layout Plan – Clearing Phase: West Region

JOB LOCATION

Riverside Jimboomba

CLIENT

Calibre Group

DRAWING NO.

GE19.078.D1a

SCALE

1:13500 @ A4

DRAWN

GMG

DATE

8.03.21

SIGNED


GLEN GALLAGHER CPESC NO. 8346

KEY



Stabilised Entry-Exit



'Type 3' Vegetation Stockpiles
(refer Table for spacing)



'Type 3' Vegetation Stockpile
(boundary of clearing limits)

Maximum allowable slope lengths (between Vegetation Stockpiles placed along the contour):

Slope (%)	Horizontal spacing (m)
1 - 5%	80m
6%	70m
7%	60m
8%	45m
9%	35m
10%	30m
11%	25m
12%	20m

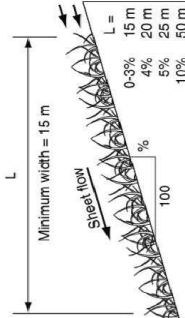


Figure 1 - Minimum dimensional requirements of a grassed buffer zone

Clearing & Grubbing Phase:

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

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

- Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the downslope boundary of the clearing/disturbance limit.
- Progressive placement of 'Type 3' vegetation stockpile windrows along the contour (in accordance with the included Table based on slope). Indicative grades have been provided but shall be ground-truthed for each clearing section by the Contractor or Consulting Engineer.
- Where practicable, clearing shall be initiated on the top of each catchment and works to progress downslope, in order to minimise upslope stormwater flows onto the disturbance areas. Where this is not practicable, a stockpile windrow shall be placed on the upper clearing limit to provide external stormwater flow retardance/diversion onto the clearing areas.
- The windrows of stockpiled vegetation shall be placed in a firm and compact manner that provides intimate contact between the ground surface and vegetation. The height of the windrows shall be a minimum height of 1.0m with a minimum 2.5m width (i.e. in the direction of flow).
- The stockpiled vegetation used for windrow construction can also be mulched prior to use. A sediment fence may be used to substitute a vegetation stockpile windrow, provided that all ESC requirements including the spacing requirements are maintained (i.e. sediment fencing installed at same spacing as vegetation windrow requirements).
- If localised drainage lines (i.e. concentrated flow paths) are intercepted in disturbance areas, rock check dams (200mm height) shall be placed within them at 40m intervals within the affected areas.
- Existing 'Type 3' grass buffer zones are also located in numerous areas downslope of the proposed clearing areas (Figure 1).
- Stabilisation of land clearing areas (excluding waterways) within a thirty (30) day timeframe – Refer 'Stabilisation Requirements' and Section 3.1.5 of the ESCP Report for Soil Amelioration Requirements.

Stabilisation Requirements:

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

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

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TITLE ESC Layout Plan – Clearing Phase:

Central North Region

JOB LOCATION

Riverside Jimboomba

CLIENT

Calibre Group

DATE

8.3.21

DRAWN

GMG

SIGNED

Glen Gallagher
GLEN GALLAGHER CPESC NO. 8346

DRAWING NO.

GE19.078.D2a

SCALE

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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 rut, erosion and the tracking of sediment from the site.

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

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

KEY



Stabilised Entry-Exit



'Type 3' Vegetation Stockpiles
(refer Table for spacing)



'Type 3' Vegetation Stockpile
(boundary of clearing limits)

Maximum allowable slope lengths (between Vegetation Stockpiles placed along the contour):

Slope (%)	Horizontal spacing (m)
1 - 5%	80m
6%	70m
7%	60m
8%	45m
9%	35m
10%	30m
11%	25m
12%	20m

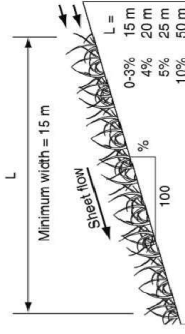


Figure 1 - Minimum dimensional requirements of a grassed buffer zone

Clearing & Grubbing Phase:

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

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

- Placement of 'Type 3' vegetation stockpile windrows shall occur immediately on the downslope boundary of the clearing/disturbance limit. Progressive placement of 'Type 3' vegetation stockpile windrows along the contour (in accordance with the included Table based on slope). Indicative grades have been provided but shall be ground-truthed for each clearing section by the Contractor or Consulting Engineer.
- Where practicable, clearing shall be initiated on the top of each catchment and works to progress downslope, in order to minimise upslope stormwater flows onto the disturbance areas. Where this is not practicable, a stockpile windrow shall be placed on the upper clearing limit to provide external stormwater flow retardance/diversion onto the clearing areas.
- The windrows of stockpiled vegetation shall be placed in a firm and compact manner that provides intimate contact between the ground surface and vegetation. The height of the windrows shall be a minimum height of 1.0m with a minimum 2.5m width (i.e. in the direction of flow). The stockpiled vegetation used for windrow construction can also be mulched prior to use. A sediment fence may be used to substitute a vegetation stockpile windrow, provided that all ESC requirements including the spacing requirements are maintained (i.e. sediment fencing installed at same spacing as vegetation windrow requirements).
- If localised drainage lines (i.e. concentrated flow paths) are intercepted in disturbance areas, rock check dams (200mm height) shall be placed within them at 40m intervals within the affected areas.
- Existing 'Type 3' grass buffer zones are also located in numerous areas downslope of the proposed clearing areas (Figure 1).
- Stabilisation of land clearing areas (excluding waterways) within a thirty (30) day timeframe – Refer 'Stabilisation Requirements' and Section 3.1.5 of the ESCP Report for Soil Amelioration Requirements.

Stabilisation Requirements:

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



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ESC Layout Plan – Clearing Phase:

South East Region

Riverside Jimboomba

Calibre Group

TITLE

JOB LOCATION

CLIENT

DRAWING NO.

GE19.078.D3a

SCALE

1:17000 @ A4

DRAWN

GMG

DATE

8.03.21

SIGNED

Glen Gallagher
GLEN GALLAGHER, GPESC NO. 8346

KEY



Stabilised Entry-Exit



'Type 3' Vegetation Stockpiles
(refer Table for spacing)



'Type 3' Vegetation Stockpile
(boundary of clearing limits)

**Maximum allowable slope lengths
(between Vegetation Stockpiles
placed along the contour):**

Slope (%)	Horizontal spacing (m)
1 - 5%	80m
6%	70m
7%	60m
8%	45m
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12%	20m

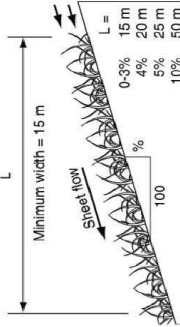
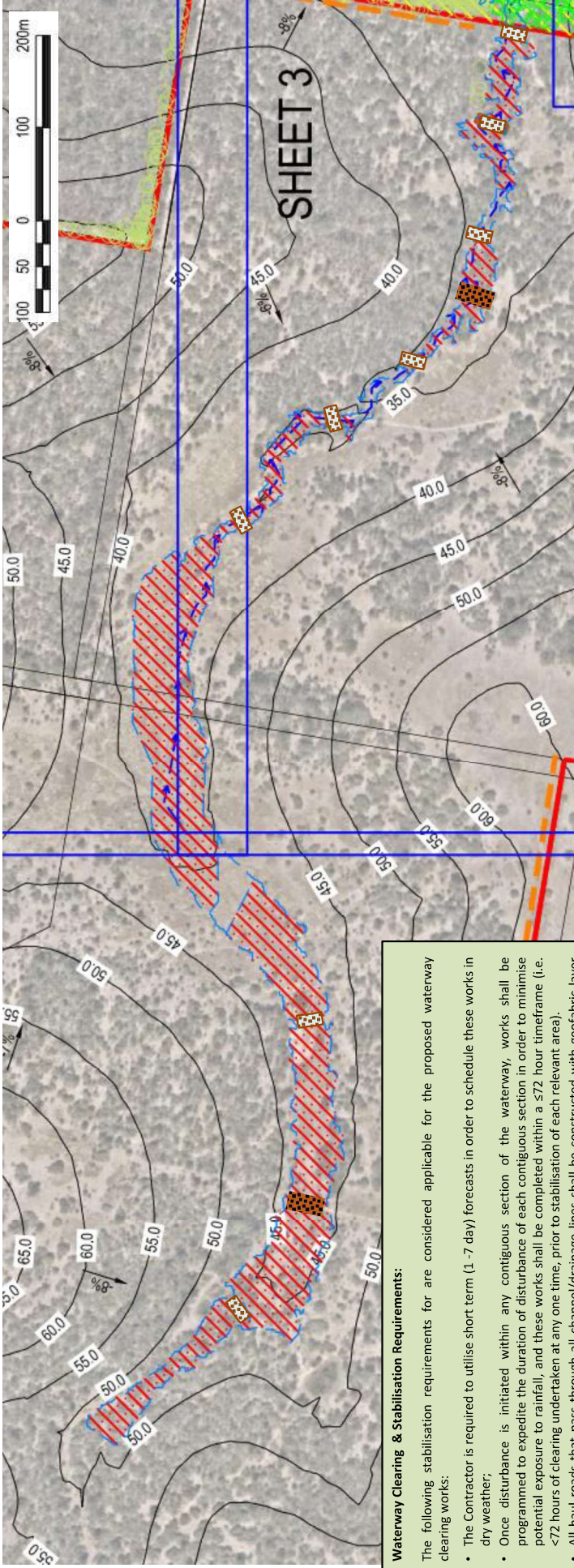


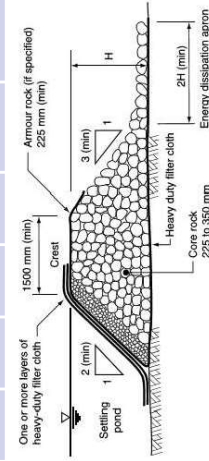
Figure 1 - Minimum dimensional requirements of a grassed buffer zone



N.B. 1 IN 5 YR ARI LOCAL FLOOD EXTENT SHOWN FOR REFERENCE PURPOSES TO SHOW MAXIMUM EXTENT OF PROPOSED CLEARING IN WATERWAY. ESC PLAN MAY BE UPDATED TO INCLUDE ACTUAL EXTENT OF WATERWAY (I.E. DEFINED BED & BANKS), WHICH WILL REDUCE EXTENT OF CLEARING CURRENTLY DEPICTED.

Rock Filter Weir Design:

Weir Filter Width	Rock Filter Height	Armour Rock Size	Filter Rock Size	Filter Rock Thickness	Geofabric Cover
Match Existing Channel	0.5m	≥225mm	~50mm	300mm	2 x A24 Bidim



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

KEY

- CLEARING WITHIN 1 IN 5 ARI LOCAL FLOOD EXTENT
- STABILISED WATERWAY CROSSING (INDICATIVE, CAN BE RE-LOCATED)
- ROCK FILTER WEIR (INDICATIVE LOCATION, REFER NOTES)

Waterway Clearing & Stabilisation Requirements:

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

- The Contractor is required to utilise short term (1 -7 day) forecasts in order to schedule these works in dry weather;
- Once disturbance is initiated within any contiguous section of the waterway, works shall be programmed to expedite the duration of disturbance of each contiguous section in order to minimise potential exposure to rainfall, and these works shall be completed within a <72 hour timeframe (i.e. <72 hours of clearing undertaken at any one time, prior to stabilisation of each relevant area).
- All haul roads that pass through all channel/drainage lines shall be constructed with geofabric layer overlain by gravel. The gravel shall be maintained where required to ensure clean water conveyance. Low flow aggie pipes may also be installed.
- A rock filter weir across the entire base width of the channel shall be implemented immediately downstream of any contiguous section of the waterway disturbance and left in place until the area has reached the 'stabilisation requirements'.
- All disturbed soil surfaces shall be stabilised with minimum **80%** equivalent grass cover within **10 days** of completion of work within any waterway, or to full equivalent natural condition, as determined by a CPESC or Environmental Engineer (RPEQ);
- Stabilisation techniques typically include turf or turf re-enforced matting (TRM). Prior to each phase of waterway clearing works, a CPESC or Environmental Engineer (RPEQ) shall be engaged to determine the stabilisation techniques to be utilised based on the slope/grade of channel and banks, and the time of year (e.g. rainfall/climate) of the stabilisation period.
- Stabilised areas shall be monitored on a weekly basis (refer Section 5.1) until the stabilisation requirements have been achieved. For areas with poor initial strike or failure, specific advice shall be obtained by a suitably qualified and experienced Landscape Consultant or Soil Scientist/Agronomist, including any additional irrigation requirements and/or re-seeding required, cognisant of the time of year (e.g. rainfall/climate) of the stabilisation period.
- This drawing may be updated by the Consulting Engineer, in consultation with a CPESC or Environmental Engineer (RPEQ), where required.



NOTE: THIS PLAN MUST BE READ
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Gallagher Environmental

Soil Water Environment

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TITLE	ESC Layout Plan – Clearing Phase: Ephemeral Waterway Areas	DRAWING NO.	GE19.078.D4a
JOB LOCATION	Riverside Jimboomba	SCALE	As Shown
CLIENT	Calibre Group	DATE	8.03.21
		DRAWN	GMG
		SIGNED	
			GLEN GALLAGHER CPESC NO. 8346

ESC Control Measures

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

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

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

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

Dust Suppression

Dust control measures employed by the Contractor shall include:

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

Water Quality

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

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

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



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



Gallagher Environmental
Soil Water Environment

ABN 56 493 696 583
59 Cremorne Rd Kedron Qld 4031
glen@genviro.com.au

TITLE		ESCP Requirements I		DRAWING NO.	GE19.078.D5
JOB LOCATION		Riverside Jimboomba		SCALE	
CLIENT		Calibre Group		DATE	23.11.20
				DRAWN	GMG
				SIGNED	
				GLEN GALLAGHER CPESC NO. 1846	

ESC Control Practices

- The Contractor's Site Manager shall identify any non-conformances with the requirements of this document. Appropriate corrective actions shall be implemented to ensure non-conformances do not recur. Consultation with relevant authorities shall be undertaken where necessary, or as directed by the Superintendent (i.e. Supervising Engineer) or Environmental Consultant (i.e. CPESC). Corrective actions shall be undertaken within 24 hours wherever practicable or as agreed with the Construction Superintendent.
- In the event that a monitoring program detects a notable failure to achieve the required ESC objectives, the source of the failure shall also be investigated and the ESCP suitably modified to ensure incidents do not recur.

The Non-Conformance Report must include but not be limited to i) details of the nature and cause; and ii) details of the required corrective actions. The Contractor shall utilise their own internal documentation/pro forma.

ESC Monitoring & Reporting

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

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

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

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

- All areas undergoing stabilisation shall be inspected on a weekly basis until the stabilisation requirements (refer Section 4.4) have been achieved.

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

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

Clearing activities shall only occur within the dedicated clearing areas and shall be sequenced where possible to minimise the area of earthworks exposed to erosion and the overall duration that disturbed soils are exposed.

The proposed clearing activities shall be undertaken in a manner that allows all reasonable and practicable measures to be undertaken in order to:

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;

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

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

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

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

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

Any spilt or transferred soil (or construction materials) onto roads shall be removed by mechanical sweeping and/or collection and stabilised elsewhere onsite at all times.

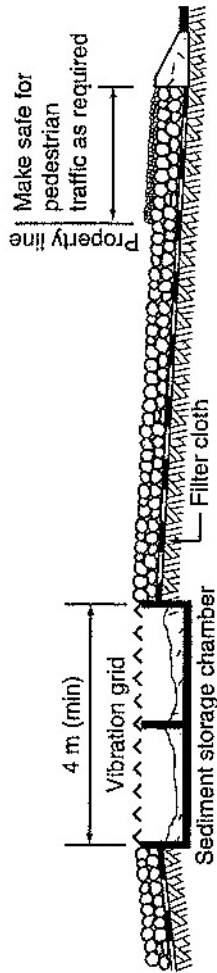
Any scour that develops must be stabilised in order to mitigate further sediment erosion.

All ESC measures shall receive maintenance when capacity falls below 75%.

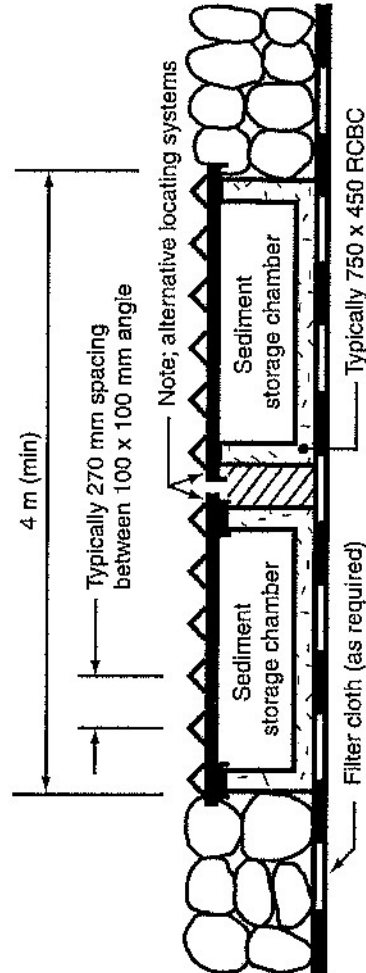
The ESCP is not exhaustive of the total requirements of the IECA Guidelines (2018) and therefore the Contractor shall consult these Guidelines as required.

Additional or alternative ESC measures shall be implemented in the event that site inspections/monitoring of the Contractor's relevant personnel or the regulatory authority/Contract Administrator identifies that unacceptable off-site sedimentation is occurring as a result of construction activities and may typically include Type 2/3 sediment controls and other measures contained within IECA (2008) Guidelines.

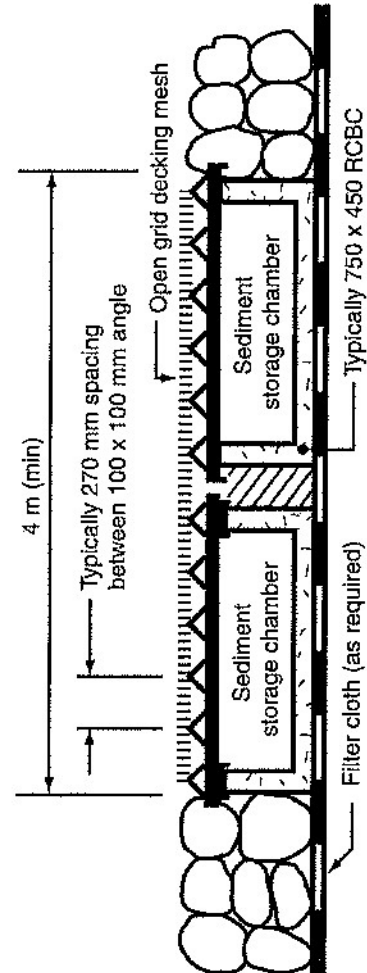
APPENDIX B: STANDARD DRAWINGS



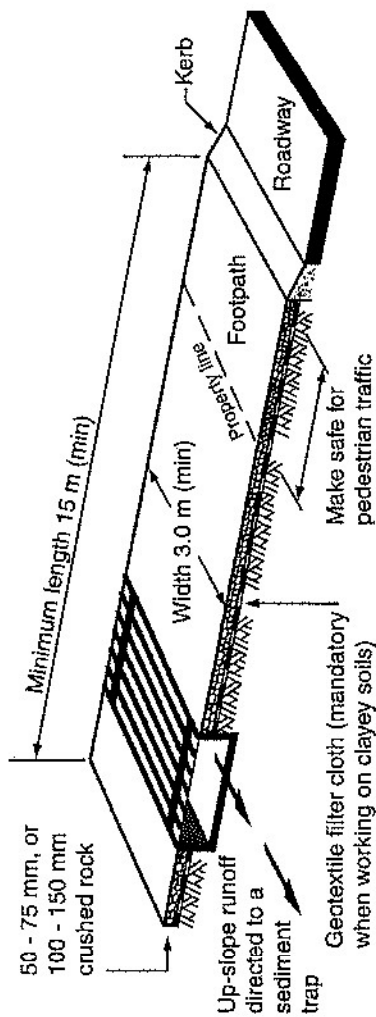
(a) Typical profile of a vibration grid



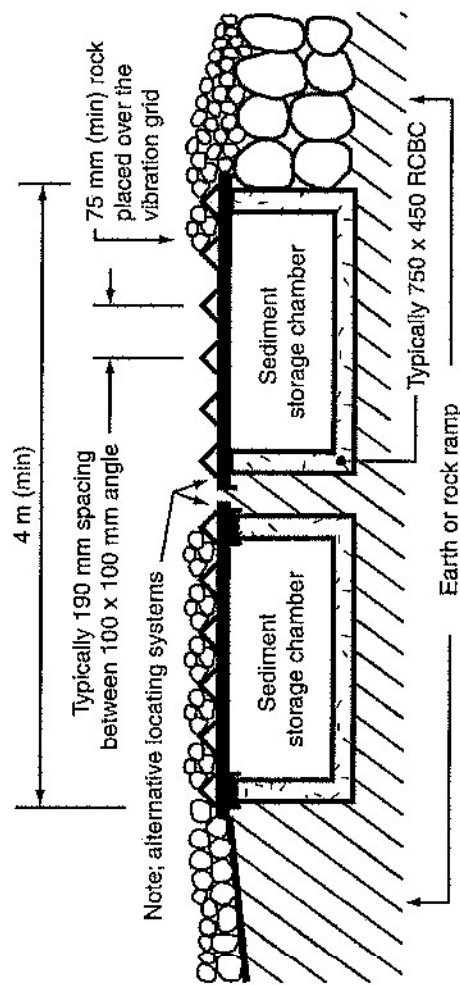
(b) Typical profile of the vibration panels



**(c) Alternative, high travel speed arrangement
(concept still under development)**



(d) Typical layout of a vibration grid



**(e) Alternative, medium travel speed arrangement
(concept still under development)**

Drawn: GMW

Date: Dec-09

Construction Exit - Vibration Grid

Exit-04

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 VIBRATION GRID, 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. GRADE THE LOCATION OF THE VIBRATION GRID SO THAT RUNOFF FROM THE UNIT WILL NOT FLOW INTO THE STREET, BUT WILL FLOW TOWARDS AN APPROPRIATE SEDIMENT-TRAPPING DEVICE.

4. ENSURE THAT THE INSTALLATION OF THE VIBRATION GRID HAS ADEQUATE SEDIMENT STORAGE VOLUME UNDER THE GRID. WHERE NECESSARY, INSTALL SUITABLE PRECAST SEDIMENT COLLECTION CHAMBERS.

5. PLACE A ROCK PAD/RAMP FORMING A MINIMUM 200mm THICK LAYER OF CLEAN, OPEN-VOID ROCK OVER THE ROADWAY BETWEEN THE VIBRATION GRID AND THE SEALED STREET TO PREVENT TYRES FROM PICKING UP MORE SOIL AFTER THEY HAVE BEEN CLEANED.

6. THE TOTAL LENGTH OF THE VIBRATION GRID AND ROCK RAMPS 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 RAMP 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 VIBRATION GRID PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT 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 RAMPS ARE 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 ARE MAINTAINED IN ACCORDANCE WITH THEIR DESIRED OPERATIONAL CONDITION.

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

REMOVAL

1. THE VIBRATION GRID SHOULD BE REMOVED ONLY AFTER IT IS NO LONGER NEEDED AS A SEDIMENT CONTROL DEVICE.

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:

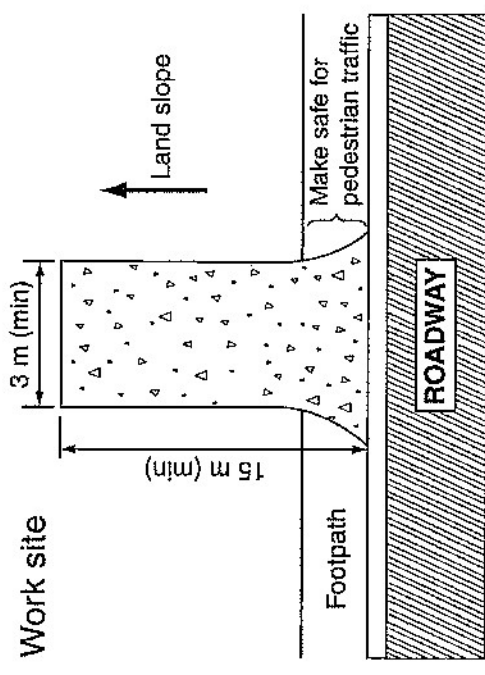
GMW

Date:

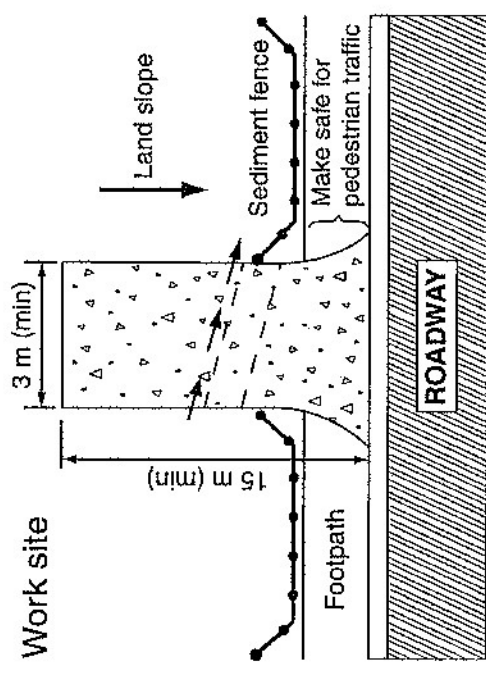
Apr-10

Construction Exit - Vibration Grid

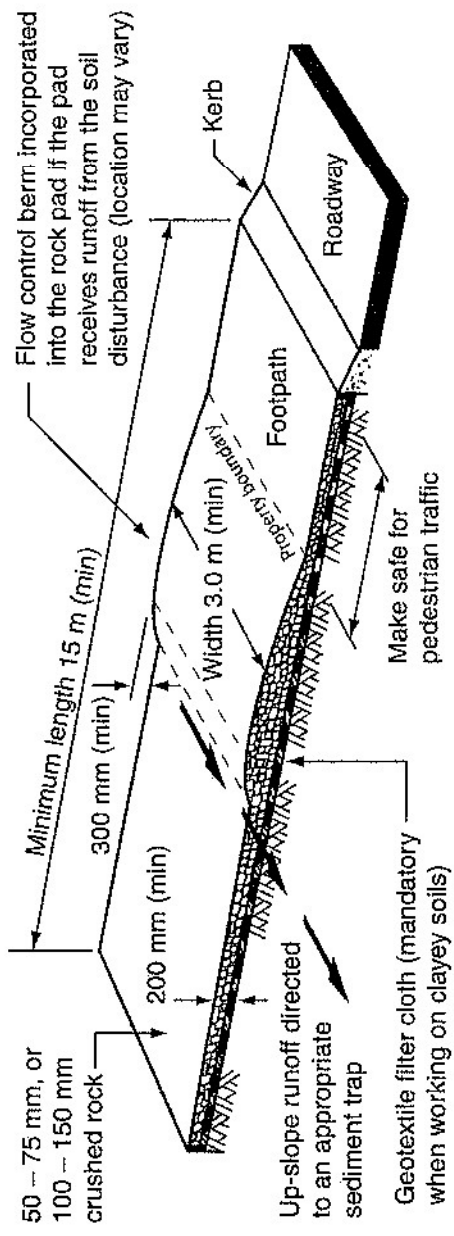
Exit-05



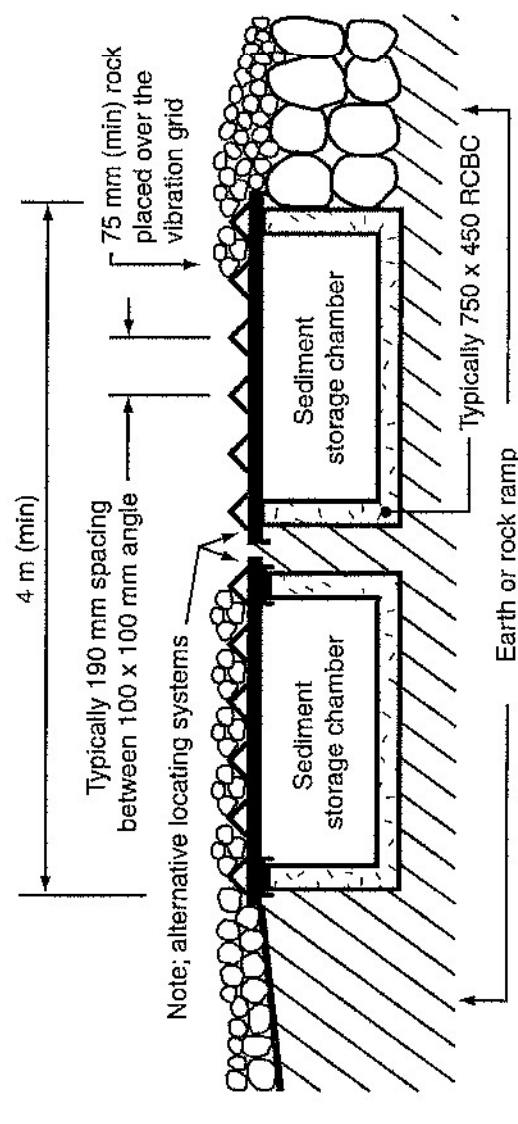
(b) Rock pad sloping away from road



(d) Rock pad sloping towards the road



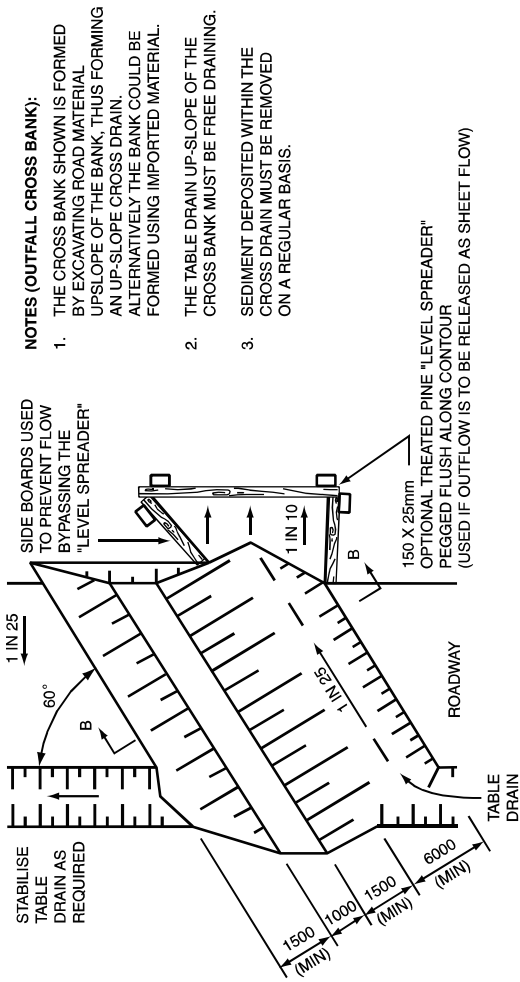
(a) Rock entry/exit pad for construction sites
(refer to Standard Drawing Exit-03 for building sites)



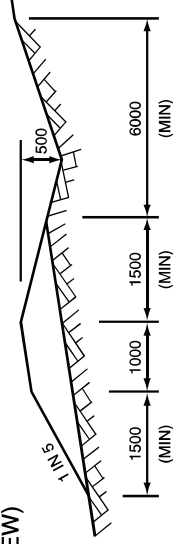
(c) Alternative low maintenance arrangement
(still under development)

Drawn: GMW	Date: Apr-10	Construction Exit - Rock Pad (construction sites only)	Exit-01
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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, THIS 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: GMW Date: Apr-10 Construction Exit - Rock Pad (construction sites only) Exit-02
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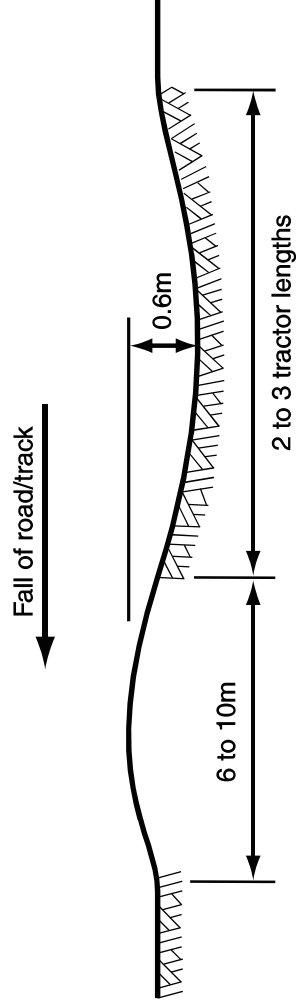


OUTFALL CROSS BANK (PLAN VIEW)

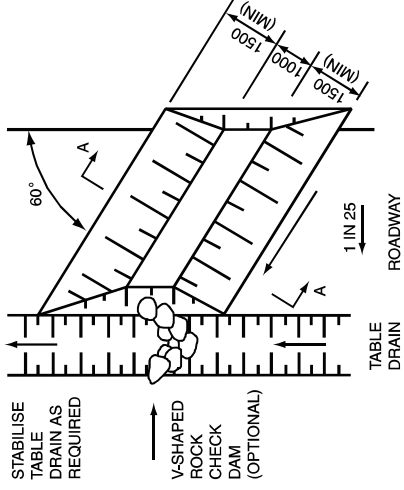


CROSS BANK PROFILE (INSITU MATERIAL)

(a) Outfall cross-bank for low speed tracks



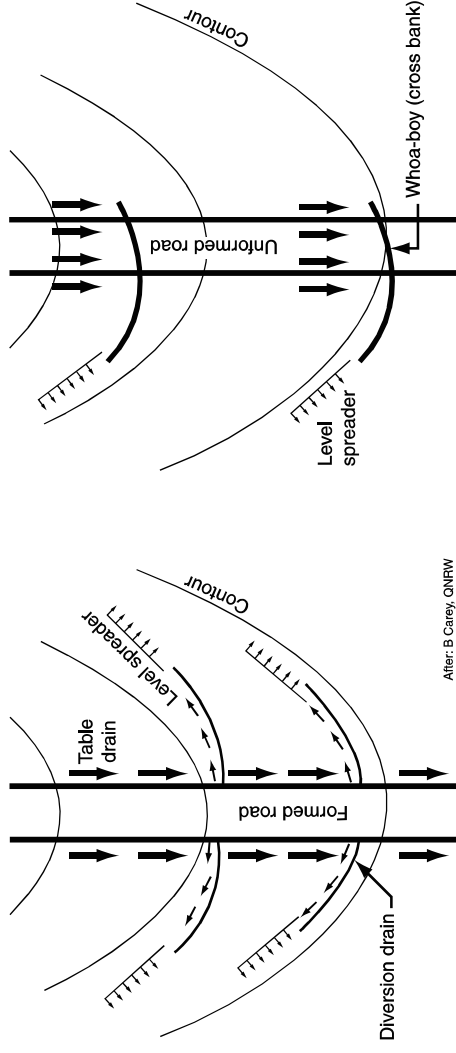
(e) Typical cross-bank profile for low speed tracks



INFALL CROSS BANK (PLAN VIEW)

CROSS BANK PROFILE (IMPORTED MATERIAL)

(b) Infall cross-bank for low speed tracks



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

General notes:

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

Drawn: **GMW**

Date:

Dec-09

Construction Road Drainage

CR-01

MATERIALS

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

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

INSTALLATION

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

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

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

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

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

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

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

MAINTENANCE

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

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

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS

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

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

REMOVAL

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.

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.

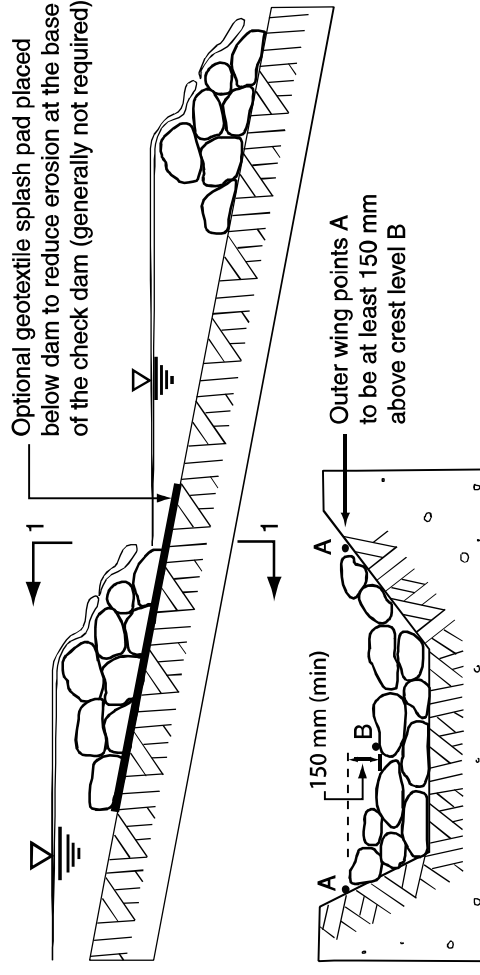


Figure 1 - Layout and profile of check dams (rock check dams shown)

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

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

2. TAKE ALL NECESSARY STEPS TO ENSURE DISTURBANCE TO THE BUFFER ZONE IS MINIMISED THROUGHOUT THE TIME IT IS USED AS A SEDIMENT TRAP.

3. TO THE MAXIMUM DEGREE PRACTICABLE, ENSURE FLOW PASSING THROUGH THE BUFFER ZONE IS NOT ALLOWED TO CONCENTRATE WITHIN DRAINAGE DEPRESSIONS, SWALES, RILLS OR WHEEL TRACKS.

4. WHERE NECESSARY, INSTALL APPROPRIATE DRAINAGE CONTROLS UP-SLOPE OF THE BUFFER ZONE TO DISTRIBUTE THE INFLOW ALONG THE FULLY LENGTH OF THE BUFFER ZONE AS 'SHEET FLOW'.

5. WHERE NECESSARY, INSTALL A COARSE SEDIMENT TRAP, SUCH AS A SEDIMENT FENCE, UP-SLOPE OF THE BUFFER ZONE TO REDUCE THE QUANTITY OF SEDIMENT PASSING ONTO THE GRASS. GENERALLY THIS IS REQUIRED IF LARGE QUANTITIES OF COARSE SEDIMENT ARE EXPECTED.

6. IF REQUIRED, INSTALL A LIGHT BARRIER FENCE TO CLEARLY IDENTIFY THE BUFFER ZONE AND HELP EXCLUDE CONSTRUCTION TRAFFIC.

MAINTENANCE

1. INSPECT THE BUFFER ZONE ON A REGULAR BASIS AND AFTER RUNOFF-PRODUCING RAINFALL.

2. ENSURE THAT THERE IS NO SOIL EROSION AND THAT SEDIMENT DEPOSITION IS NOT CAUSING THE CONCENTRATION OF FLOW THROUGH THE BUFFER ZONE, OR FLOW BYPASSING.

3. IF THE BUFFER ZONE HAS BEEN DISTURBED, TAKE NECESSARY STEPS TO RE-ESTABLISH SUITABLE SHEET FLOW CONDITIONS.

4. REMOVE EXCESSIVE ACCUMULATIONS OF SEDIMENT THAT MAY CAUSE THE CONCENTRATION OF FLOW. EXCESSIVE SEDIMENT SHOULD BE REMOVED AFTER EACH RUNOFF-PRODUCING RAINFALL EVENT, OR WHERE APPROPRIATE, EVENLY RAKED INTO THE SOIL. SEDIMENT SHOULD BE REMOVED IN A MANNER THAT AVOIDS DAMAGE TO THE BUFFER ZONE OR THE CREATION OF WHEEL TRACKS DOWN THE SLOPE.

5. EXCESSIVE SEDIMENT MAY BE DEFINED AS:

(i) ANY SEDIMENT THAT COVERS A PORTION OF THE GRASSED SURFACE; OR

(ii) SEDIMENT DEPOSITION SUCH THAT THE GRASS STRAND HEIGHT ABOVE THE SEDIMENT IS LESS THAN 50mm; OR

(iii) A DEPOSITION OF SEDIMENT IN EXCESS OF 750g/m² (APPROXIMATELY THE EQUIVALENT OF THREE 70mm DIAMETER BALLS OF DRY SOIL).

6. THE SOURCE OF ANY EXCESSIVE SEDIMENT SHOULD BE INVESTIGATED AND CONTROLLED WHERE PRACTICAL.

7. TAKE APPROPRIATE STEPS TO MAINTAIN AT LEAST 75% GRASS COVER OVER THE BUFFER ZONE.

8. WHERE PRACTICAL, MAINTAIN ANY GROUND COVER VEGETATION AT A HEIGHT GREATER THAN THE EXPECTED DEPTH OF WATER FLOW AND AT LEAST 50mm.

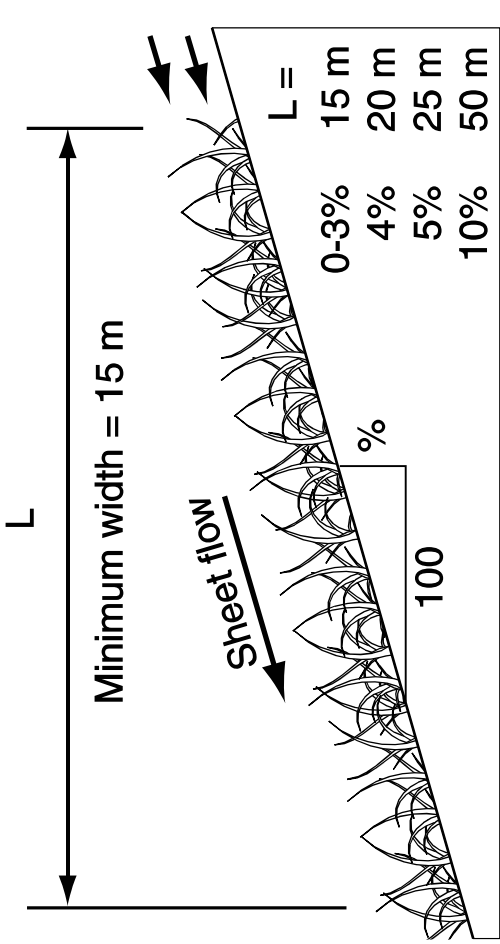


Figure 1 - Minimum dimensional requirements of a grassed buffer zone

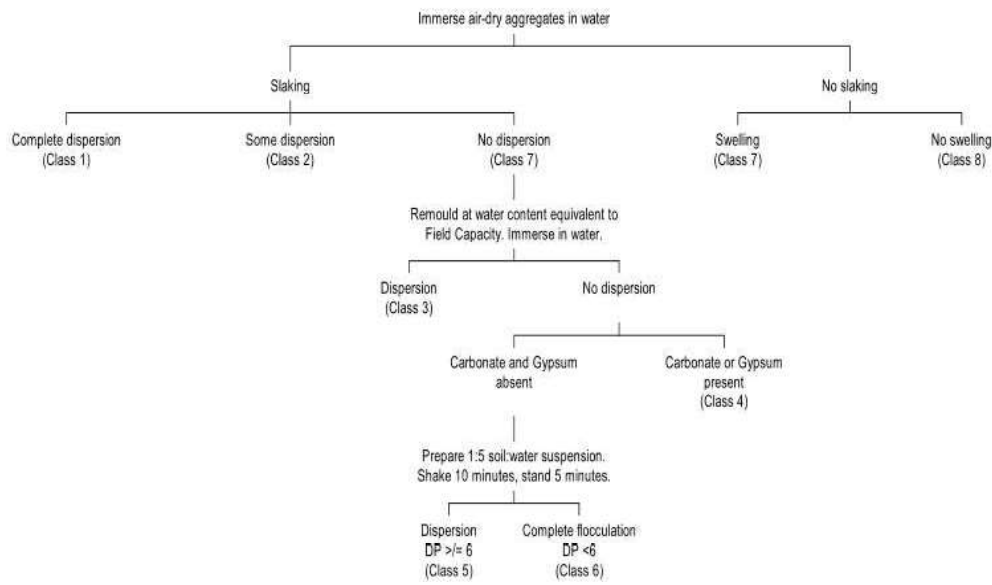
CAUTION: SPECIFICATIONS FOR SITE REVEGETATION VARY CONSIDERABLY FROM SITE TO SITE. SITE SUPERVISORS SHOULD OBTAIN SITE SPECIFIC PLANTING SPECIFICATIONS. INSTALLATION 1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND APPLICATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF APPLICATION CONTACT THE ENGINEER, LANDSCAPE ARCHITECT OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE. 2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING. 3. APPLY SOIL CONDITIONERS AND FERTILISER AS SPECIFIED ON THE APPROVED PLANS. RIP THE SOIL 100 TO 150mm TO MIX THE COMPONENTS INTO THE SOIL AND TO LOOSEN AND ROUGHEN THE SOIL SURFACE BEFORE SEEDING. 4. WHERE POSSIBLE, THERE SHOULD BE SUFFICIENT SOIL DEPTH TO PROVIDE AN ADEQUATE ROOT ZONE. THE DEPTH TO ROCK OR IMPERMEABLE LAYERS SUCH AS HARDPANS SHOULD BE 300mm OR MORE, EXCEPT ON SLOPES STEEPER THAN 2:1 (H:V) WHERE SUCH SOIL DEPTH MAY NOT BE FEASIBLE. 5. ENSURE THE SOIL pH IS WITHIN THE SPECIFIED RANGE. 6. APPLY SEED UNIFORMLY BY HAND OR WITH A CYCLONE SEEDER, DROP-TYPE SPREADER, DRILL, HYDROSEEDER, HYDROMULCHER, OR OTHER SUITABLE EQUIPMENT AS SPECIFIED. 7. WHEN USING BROADCAST-SEEDING METHODS, SUBDIVIDE THE AREA INTO WORKABLE SECTIONS AND APPLY ONE-HALF THE SPECIFIED QUANTITY OF SEED WHILE MOVING BACK AND FORTH ACROSS THE AREA, MAKING A UNIFORM PATTERN. THEN APPLY THE SECOND HALF IN THE SAME WAY, BUT MOVING AT RIGHT ANGLES TO THE FIRST PASS. COVER BROADCAST SEED BY RAKING		OR CHAIN DRAGGING; THEN FIRM THE SURFACE WITH A ROLLER TO PROVIDE GOOD SEED CONTACT. 8. APPLY SEED AT THE RECOMMENDED RATE, AND DISC OR OTHERWISE MECHANICALLY TREAT THE SURFACE TO BRING THE SEED INTO CONTACT WITH THE SOIL. 9. THE SEEDED AREA SHOULD BE MULCHED AS SPECIFIED IN THE APPROVED PLAN. MAINTENANCE 1. DURING THE CONSTRUCTION PHASE, INSPECT THE TREATED AREA FORTNIGHTLY AND AFTER RUNOFF-PRODUCING RAINFALL. MAKE REPAIRS AS NEEDED. 2. WATERING THE VEGETATION PERIODICALLY IS ESSENTIAL, ESPECIALLY IN THE FIRST 7 DAYS AFTER ESTABLISHMENT. USE LOW-PRESSURE SPRAYS BECAUSE HIGH-PRESSURE JETS CAN WASH AWAY THE SEED AND MULCH COVER. 3. WATERING SHOULD START IMMEDIATELY AFTER PLANTING. WATERING SHOULD COMPLY WITH SPECIFICATIONS PROVIDED WITH THE APPROVED PLANS. GENERALLY WATERING SHOULD VARY ACCORDING TO WEATHER AND SOIL CONDITIONS. A TYPICAL WATERING SCHEDULE MAY CONSIST OF THE FOLLOWING: (i) 25mm EVERY SECOND DAY FOR THE FIRST THREE WATERINGS; (ii) 25mm TWICE A WEEK FOR THE NEXT THREE WEEKS; AND (iii) 25mm ONCE WEEKLY FOR A FURTHER TWO WEEKS. 4. MONITOR SITE REVEGETATION, PARTICULARLY AFTER RAINFALL, AND APPROPRIATE MAINTENANCE AND/OR AMENDMENT TO ENSURE THAT THE REVEGETATION IS CONTROLLING EROSION AND STABILISING SOIL SLOPES AS REQUIRED. 5. WHERE PRACTICABLE, FILL IN, OR LEVEL OUT, ANY RILL EROSION BETWEEN PLANTS. IF EXCESSIVE EROSION OCCURS, THEN CONSIDER INCREASING THE PLANTING DENSITY, APPLYING APPROPRIATE EROSION CONTROL MEASURES, OR INTRODUCING ALTERNATIVE, NON-CLUMPING PLANT SPECIES.	6. AREAS MUST BE RE-SEEDED AND MULCHED IF THE VEGETATION FAILS TO ESTABLISH OR IS DAMAGED BY RUNOFF OR CONSTRUCTION ACTIVITIES. 7. IF THE TEMPORARY VEGETATION COVER OR EROSION CONTROL MEASURE (e.g. MULCH COVER) SHOULD FAIL FOR ANY REASON BEFORE ESTABLISHMENT OF THE PERMANENT VEGETATION COVER, THEN IT MUST BE REPLACED WITH AN APPROPRIATE TYPE OF COVER SUFFICIENT TO CONTROL SOIL EROSION. 8. IF THE PERMANENT VEGETATION SHOULD FAIL TO ESTABLISH OR TO ADEQUATELY RESTRAIN EROSION FOR ANY REASON DURING THE CONSTRUCTION OR MAINTENANCE PERIOD, THE AREA SHOULD BE REVEGETATED OR PROTECTED WITH OTHER EROSION CONTROL MEASURES AS APPROPRIATE. 9. IN AREAS WHERE THE OBTAINED VEGETATION COVER IS CONSIDERED INADEQUATE FOR EROSION CONTROL, THE AFFECTED AREA SHOULD BE OVER-SEEDED AND FERTILISED USING HALF THE ORIGINALLY SPECIFIED RATES, OR AS DIRECTED. 10. MAINTAIN GRASS BLADE LENGTH AT A MINIMUM 50mm HEIGHT WITHIN MEDIUM TO HIGH VELOCITY DRAINAGE AREAS, AND 20 TO 50mm WITHIN LOW VELOCITY FLOW PATHS. 11. WHERE NECESSARY, OR AS DIRECTED BY THE SITE SUPERVISOR, SLASH THE TEMPORARY CROP/GRASS COVER TO ALLOW THE SUCCESSFUL GROWTH OF THE UNDERLYING PERMANENT VEGETATION COVER. 12. CONTROL WEED GROWTH WITHIN 1m OF IMMATURE TREES FOR 6 TO 12 MONTHS FOR FAST GROWING SPECIES, AND 18 TO 20 MONTHS FOR SLOWER GROWING SPECIES, OR UNTIL THE END OF THE SPECIFIED MAINTENANCE PERIOD. 13. WHERE MULCH IS USED TO CONTROL WEED GROWTH, INSPECT AND WHERE NECESSARY, RENEW AT MAINTENANCE PERIODS NOT EXCEEDING 4 TO 6 MONTHS.	14. APPLY ADDITIONAL SEED, MULCH AND/OR SOIL CONDITIONING AS REQUIRED. MULCHES USUALLY NEED TO BE MAINTAINED OR RENEWED (AS NECESSARY) 2 TO 3 TIMES A YEAR. 15. INSPECT AND WHERE NECESSARY REPAIR PROTECTIVE FENCING AT MAINTENANCE PERIODS NOT EXCEEDING 1 MONTH. 16. RE-FIRM PLANTS LOOSENED BY WIND-ROCK, LIVESTOCK OR WILDLIFE. 17. REPLACE DEAD OR SEVERELY RETARDED PLANTS. 18. PRUNE ANY PLANTS OF DEAD OR DISEASED PARTS. CUT OFF ALL DAMAGED TREE LIMBS ABOVE THE TREE COLLAR AT THE TRUNK OR MAIN BRANCH. USE SEVERAL CUTS INCLUDING UNDERCUTTING TO AVOID PEELING BARK FROM THE HEALTHY AREAS OF THE TREE. 19. DISPOSE OF CLEARED VEGETATION IN AN APPROPRIATE MANNER SUCH AS CHIPPING OR MULCHING, ON-SITE BURIAL, OR OFF-SITE DISPOSAL. CLEARED VEGETATION SHOULD NOT BE DUMPED NEAR A WATERCOURSE OR ON A FLOODPLAIN WHERE IT COULD BE REMOVED BY FLOODWATERS. VEGETATION SHOULD NOT BE BURNT ON-SITE WITHOUT SPECIFIC APPROVAL FROM THE LOCAL AUTHORITY. 20. REPAIR DAMAGED TREE ROOTS BY CUTTING OFF THE DAMAGED AREAS AND SEALING THEM WITH AN APPROVED PRODUCT. SPREAD MOIST TOPSOIL OVER EXPOSED ROOTS.
Drawn: GMW		Date: Dec-09	Revegetation - General	R-01

APPENDIX C: LABORATORY CERTIFICATES

Emerson Class Test Certificate

(Method: AS1289 3.8.1)

Figure 1. Determining the Emerson Class Number of Aggregates



Sample	Emerson Class
BH1: 0.0m	8
BH2: 0.0m	7
BH3: 0.0m	8
BH4: 0.0m	7
BH5: 0.0m	7
BH6: 0.0m	7
BH7: 0.0m	7
BH8: 0.0m	8
BH9: 0.0m	8
BH10: 0.0m	7

pH & Electrical Conductivity (EC) Test Certificate

(Soil Chemical Methods - Rayment & Lyons, 2010)

Sample	pH _{1:5}	EC _{1:5} (dS/m)	Texture Factor	Estimated Ece
BH1: 0.0m	5.4	0.07	14	1.0
BH2: 0.0m	5.2	0.03	14	0.4
BH3: 0.0m	5.1	0.04	14	0.6
BH4: 0.0m	5.2	0.04	14	0.6
BH6: 0.0m	5.4	0.03	14	0.4
BH7: 0.0m	5.2	0.09	14	1.3
BH9: 0.0m	4.9	0.05	14	0.7
BH10: 0.0m	5.1	0.04	14	0.6

CERTIFICATE OF ANALYSIS

Work Order : **EB2001459**
Client : **GALLAGHER ENVIRONMENTAL**
Contact : **MR GLEN GALLAGHER**
Address : **59 CREMORNE ROAD KEDRON**
BRISBANE QUEENSLAND 4031
Telephone : **---**
Project : **19/078 Riverside Jimboomba**
Order number : **---**
C-O-C number : **---**
Sampler : **GLEN GALLAGHER**
Site : **---**
Quote number : **EN/333**
No. of samples received : **2**
No. of samples analysed : **2**

Page : **1 of 3**
Laboratory : **Environmental Division Brisbane**
Contact : **Customer Services EB**
Address : **2 Byth Street Stafford QLD Australia 4053**
Telephone : **+61-7-3243 7222**
Date Samples Received : **20-Jan-2020 14:33**
Date Analysis Commenced : **20-Jan-2020**
Issue Date : **29-Jan-2020 15:32**



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: **Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD



Page : 2 of 3
Work Order : EB2001459
Client : GALLAGHER ENVIRONMENTAL
Project : 19/078 Riverside Jimboomba

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key :

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

Ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

● ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.

● ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.

● ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity ($H^+ + Al^{3+}$).



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID			
Compound	CAS Number	Client sampling date / time		S5	S8
		LOR	Unit		
EA002: pH 1:5 (Soils)					
pH Value	----	0.1	pH Unit	5.3	4.9
EA010: Conductivity (1:5)					
Electrical Conductivity @ 25°C	----	1	µS/cm	48	85
EA055: Moisture Content (Dried @ 105-110°C)					
Moisture Content	----	0.1	%	7.4	4.1
ED005: Exchange Acidity					
Ø Exchange Acidity	----	0.1	meq/100g	1.4	1.2
Ø Exchangeable Aluminium	----	0.1	meq/100g	1.2	0.8
ED007: Exchangeable Cations					
Exchangeable Calcium	----	0.1	meq/100g	2.3	2.3
Exchangeable Magnesium	----	0.1	meq/100g	2.8	2.2
Exchangeable Potassium	----	0.1	meq/100g	0.6	0.7
Exchangeable Sodium	----	0.1	meq/100g	0.3	0.3
Cation Exchange Capacity	----	0.1	meq/100g	7.4	6.7
Exchangeable Sodium Percent	----	0.1	%	5.1	5.3
Calcium/Magnesium Ratio	----	0.1	-	0.8	1.0
Magnesium/Potassium Ratio	----	0.1	-	4.9	3.1
ED040S : Soluble Sulfate by ICPAES					
Sulfate as SO4 2-	14808-79-8	10	mg/kg	10	50
Sulfur as S	63705-05-5	10	mg/kg	<10	20
Silica	7631-86-9	1	mg/kg	27	13
Silicon	7440-21-3	1	mg/kg	12	6
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser					
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	4.4	6.6
EK081: Bicarbonate Extractable Phosphorus (Olsen)					
Bicarbonate Extractable P (Olsen)	----	1.0	mg/kg	<1.0	1.6