enviro consulting

Erosion & Sediment Control Plan

Courtney Drive Estate – Stage 1-3, Upper Coomera

Progressive Erosion and Sediment Control Plan – Earthworks 002

Revision No	Date	Prepared by	Reviewed By	Approval
0	16/10/2023	Alisha Croft	Michael Williams	Alisha Croft CPESC #9428

CPESC	*Alisha Croft*	*0419 674 283*
Senior Project Manager	*Michael Williams*	*0472 723 733*

Alisha Croft #9428

1. SCOPE

This Progressive Erosion and Sediment Control Plan (ESCP) has been developed for the Earthworks phase for the Courtney Drive residential estate for Stage 1-3, Upper Coomera QLD. With additional progressive erosion and sediment control plans to be prepared for the Civil stages.

1.1 Guidelines

This ESCP has been prepared in accordance with the following document(s):

- Best Practice Erosion and Sediment Control (IECA, 2008)

1.2 Certification

This ESCP will be reviewed and certified by a CPESC prior to commencement of works. This review and certification will ensure the plan has been prepared to satisfy the intent and minimum standards nominated within the IECA (2008) Best Practice Erosion and Sediment Control Guideline.

2. PROJECT DESCRIPTION

2.1 Location & Land use

The site is located off Courtney Drive in Upper Coomera and will connect Courtney Drive with Rangeview Road. (**Figure 1**).

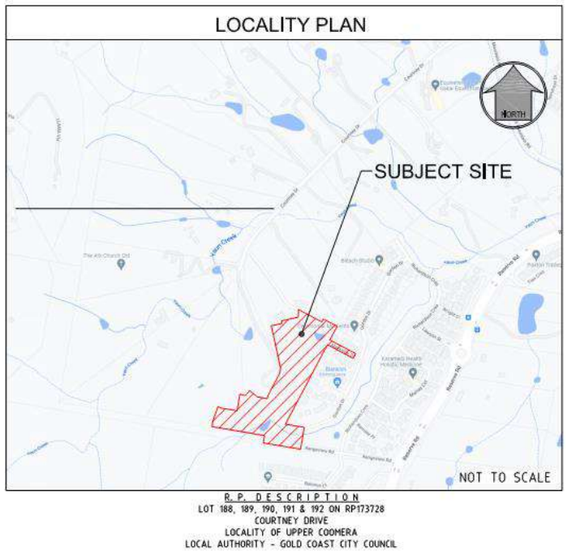


Figure 1: Locality Plan

2.1.1 Scope of Works

The scope of works is as follows:

- Site clearing and grubbing, inclusive of the removal of existing site trees;
- Undertake bulk earthworks activities;
- Construction of proposed lots and establishment of retaining between lots in accordance with design;
- Construction of stormwater infrastructure;
- Construction of proposed residential streets
- Installation of all relevant signage and line marking;

The general arrangement of Erosion and Sediment Controls are illustrated in **figure 2**.

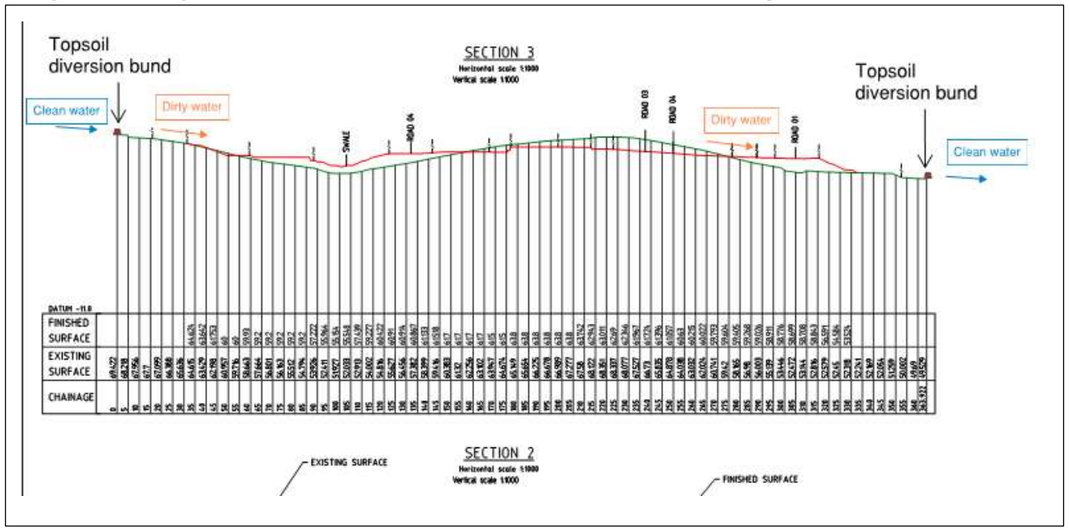


Figure 2: Typical Erosion and sediment control arrangement

3. SITE DESCRIPTION

3.1 Climate & Rainfall risk

Historic rainfall data for Upper Coomera has been extracted from the Coomera Foxwell Road Weather Station (Station No. 40516) the closest long-term gauging station to the site, is illustrated in **Figure 3**. Relatively wetter conditions typically occur from November to June and drier conditions tend to persist from July to October. The corresponding Erosion Risk Rating (rainfall depth) is colour coded from **Table 1** (Based on IECA Table 4.4.2).

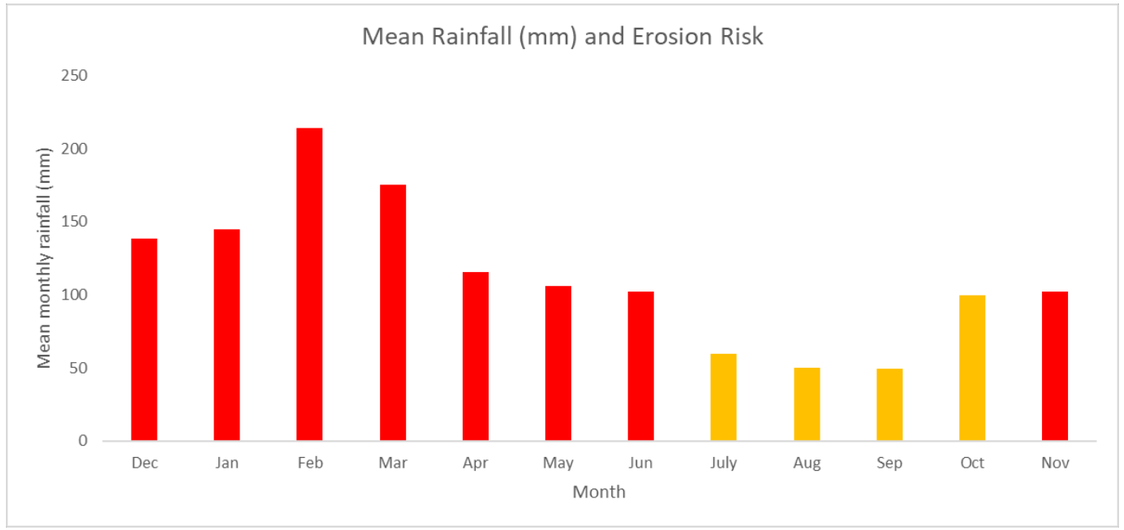


Figure 3: Mean Rainfall data, Coomera Foxwell Road Alert Weather Station #40516 (1997-2023)

Table 1: ***Erosion Risk Rating Categories (rainfall depth) as per Table 4.4.2, IECA, 2008***

Erosion Risk Rating	Average Monthly rainfall depth (mm)
Very Low	0 to 30
Low	30+ to 45
Moderate	45+ to 100
High	100+ to 225
Extreme	>225

3.2 Topography and drainage

Based on contours presented on the IFC Drawings and the Geotechnical report prepared by Pacific Geotech in January 2023, 'the site topography typically comprises a ridge line which meanders in a north south lineation through the centre of the site. The ridge line typically comprises flat or gentle sloping terrain of less than 5° in slope gradient. This ridge line is flanked to the east and west by mild sloping terrain typically ranging between 5° and 15° in slope gradient with some localised steeper areas ranging up to approximately 20° in slope gradient.' (*Geotechnical Investigation and Landslide Risk Assessment for proposed residential subdivision, end of Courtney Drive, Upper Coomera, January 2023, Pacific Geotech*)

Numerous drainage lines are currently present across the site, with the main drainage line traversing from the South western corner towards the north, a wide drainage area discharges to the west and another drainage feature discharges to the north. Each drainage line moves through an existing dam within the confines of the site prior to discharging offsite. The project shall utilize these existing dams as part of the clearing and grubbing phase of the project until the final sediment basins can be established for utilization during earthwork stages.

3.3 Soils

Soils located onsite consist of high plasticity clay soils or clayey sands.

4. RISK ASSESSMENT

4.1 IECA Soil loss assessment

Based on the requirements of IECA (2008), an erosion risk assessment has been conducted using the Revised Universal Soil Loss Equation (RUSLE). The calculated soil loss is then used to determine the level of sediment control required.

A = K x R x LS x P x C Equation 1 (IECA 2008)

Where:

A is the predicted soil loss (t/Ha/yr)
K is the soil erodibility factor
R is the rainfall erosivity factor
LS is the slope length/gradient factor
P is the erosion control practice factor
C is the ground cover and management factor

4.1.1 K - Factor - Soils

Soils located onsite consist of Sandy Clay/ Clay present in area. As such a conservative assumption has been made for the K factor resulting in an adopted K factor of 0.051.

4.1.2 R - Factor - Rainfall

An annual erosivity factor of 5489 has been adopted based on a 2-year, 6-hour rainfall intensity of 15.6mm/hr and the following equation from section E3.2 of IECA (2008).

R = 164.74 (1.1177)S S0.6444

4.1.3 LS – Slope Length

As described in Section 3.2, the topography of the site comprises of moderate slopes. Based on existing/design surface levels, LS factors have been adopted as follows:

- Grades up to 8.75%, slope length will be limited to 25m between checks – adopted LS-factor 2.05
- Grades up to 10.62%, slope length will be limited to 25m between checks – adopted LS-factor 2.81
- Grades up to 16.87%, slope length will be limited to 10m between checks – adopted LS-factor 5.52

4.1.4 Cover (C) and Practice (P) Factors

A C factor of 1 has been adopted in accordance with industry practice to reflect the worst-case level of cover offered during the proposed development activities.

The P factor represents the combined effect of management practices and structural methods to control erosion. An industry default P factor value of 1.3 has been applied to the risk assessment, which is recommended for the construction phase condition (per table E11 of IECA, 2008).

4.1.5 Estimated Soil Loss

Results of the erosion risk assessment are presented in **Table 2**. Sediment control type derived from IECA (2008) Table 4.5.1

Table 2: Estimated soil loss from each site catchment

Site	Disturbed Area (HA)	R	K	LS	P	C	A (t/ha/yr)	Adopted Control	Comment
Catchment 1	4.36	5489	0.05	1.47	1.3	1	535	Type 1	Check dam spacing at 25m; excavated sediment traps at outlet/discharge locations; and C-factor reduction during months when soil loss exceeds 12.5t/ha/month i.e. from December to March. Note: C-factor reduction can be achieved in a number of ways including application of soilbinder and revegetation treatments
Catchment 2	2.91	5489	0.05	2.05	1.3	1	746	Type 1	
Catchment 3	5.4	5489	0.05	2.05	1.3	1	746	Type 1	

Due to an estimated soil loss of a maximum of 746t/ha/yr based on the construction stage of the proposed works and maximum area proposed for disturbance associated with the project, the Erosion risk is nominated as High in accordance with Table 4.4.3 of IECA (**Table 2**). Erosion and sediment control will be installed for the project in accordance with the risk profile and specific constraints of the site (Table 4).

Table 4: Erosion risk rating based on estimated soil loss rate (as per Table 4.4.3 IECA 2008)

Erosion Risk Rating*	Soil loss (t/ha/yr)
Very Low	0 to 150
Low	150+ to 225
Moderate	225+ to 500
High	500+ to 1500
Extreme	>1500

Table 5: Erosion Control Standards

Erosion Risk as per Table 4.4.7 of IECA	Limit of forward Clearing	Stabilisation – Temporary	Stabilisation – Permanent
All	All reasonable and practicable steps 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 building/construction works.		
Low	Clearing and stripping is limited to 8 weeks prior to the scheduled commencement of bulk earthworks	Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 30 days	Disturbed soil surfaces are stabilised with a minimum 70% cover within 30 days of the completion of works within any area of a work site.
Moderate	Clearing and stripping is limited to 6 weeks prior to the scheduled commencement of bulk earthworks	Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 20 days.	Disturbed soil surfaces are stabilised with a minimum 70% cover within 20 days of the completion of works within any area of a work site.
High	Clearing and stripping is limited to 4 weeks prior to the scheduled commencement of bulk earthworks	Soil Stockpile & unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 10 days.	Disturbed soil surfaces are stabilised with a minimum 75% cover within 10 days of the completion of works within any area of a work site

5. GENERAL NOTES

- This Erosion and Sediment Control Plan (ESCP) has been prepared to provide a site specific ESCP to demonstrate the management of erosion and sediment control in accordance with the Best Practice Erosion and Sediment Control Guidelines (IECA, 2008).
- This ESCP shall be supplemented by Progressive Erosion and Sediment Control Plans (PESCP). PESCPs are to be developed to identify the specific location and, where required, additional erosion and sediment controls applicable to individual work stages. PESCPs shall be documented via mark ups to approved plans. Where a change in the level of sediment control standard is proposed in a PESCP, the PESCP shall be reviewed and approved by an appropriately qualified person prior to the change being implemented.
- Minimise the extent and duration of disturbance, maintaining existing ground cover to the greatest extent possible.
- Commissioning / decommissioning of plant and refuelling to be undertaken a minimum of 30m away from any watercourse/drainage line.
- All ERSED controls to be inspected regularly (weekly, pre/post rainfall event i.e. forecast or actual rainfall of >10mm) with maintenance/repairs to be undertaken when necessary
- Revegetation of disturbed/bare areas to be progressively implemented
- Where clean water drains and sediment traps/sumps are necessary, all clean water drains, and sediment traps and associated drainage must be installed and commissioned prior to the commencement of any grubbing works within the catchment area
- All controls must be installed within approved project footprint.
- Ensure all site access is stabilised with rumble grid and clean rock.

6. STAGING

Stage 1 - Vegetation removal, clear and grub, topsoil strip	Phase 1: • Site Establishment of access tracks, clearing and minor topsoil strip in locations for clean water drains only, installation of clean water drains, diversion bunds, clean water diversion drains, sediment basins and traps and other appropriate erosion and sediment controls. Temporary crossings are also to be installed where necessary with clean water diversion drains. Phase 2: • Clearing and grubbing to commence on approval from Project Environmental Site Representative of all clean water drains, sediment traps/basins and establishment controls installed appropriately. Clearing to commence in a sequential approach. Clearing activities will only remove large vegetation and retain groundcover wherever possible. • Vegetation will be stockpiled downslope of cleared zone and accessible from access track in readiness for mulching. Phase 3: • Mulching of stockpiled vegetation and stockpiling of mulch or integration into erosion and sediment controls. Phase 4:

	• Topsoil strip to commence in a staged approach across site and topsoil placed in designated topsoil stockpile areas with controls installed and maintained.
Stage 2 – Bulk Earthworks	Phase 1: • Cut and fill will continue through footprint, establishing supplementary controls as required (locations tbd onsite) such as mulch bunds and sediment fence or geofabric overplaced and wrapped up to act as filter fence at base of fill zones and around drainage inlet locations. Stabilisation to occur on cut/fill batters throughout works. Areas to be progressively revegetated as they are completed. Phase 2: • Civil works to commence, ensuring all site dirty water is directed into site sediment basins.
Stage 3 – Stabilisation/ Revegetation	• Site wide stabilisation and revegetation via seeding of any areas not already revegetated as part of progressive stabilisation works. Site must achieve 70% vegetated cover for works to be considered effectively stabilised.

7. DEWATERING AND WATER QUALITY

- Basins to be dewatered prior to rain event that is likely to produce runoff; however, during dry conditions water may be retained in the settling pond as a source of construction water (i.e. dust suppression).
- If possible, it is recommended that dewatering/spread of collected runoff from basins be applied to well vegetated lands at least 40m away from any waterway to allow it to infiltrate within the site boundary, if this is done, ensure water is applied slowly and in a manner that avoids concentrated surface runoff and/or erosion.
- If actively discharging (pumping or siphoning) the water out of the basin, water must be treated to achieve, pH 6.5-8.5, <10mg/L oil and grease and no visible trace and a standard 90%ile total suspended solids concentration not exceeding 50mg/L or 50%ile NTU reading (as per IECA Best Practice Erosion and Sediment Control Guidelines Appendix B) and no more than a 10% increase in background conditions.
- Where captured basin water is to be used onsite for dust suppression or construction purposed, water does not require testing or treatment.

8. DESILTING

- Install an appropriate painted desilting marker in the basin to indicate top of sediment storage zone. Basin must be desilted if the next storm event is likely to cause sediment to rise above this marker point; or if sediment is already above the marker; or if the sediment has exceeded 90% of the nominated sediment storage volume.
- Removal of all sediment/materials collected from the basin to be disposed of in a suitable manner that will not cause an erosion or pollution/environmental hazard.
- Refer to ESCP for recommended volume and dimensions for proposed sediment basin. Note that all dimensions are approximate and subject to verification with review of detailed ground survey and alignment.
- All earthen embankments (for basins or otherwise) greater than 1m in height to be certified by a qualified geotechnical specialist to ensure structural integrity for the desired design criteria and anticipated period of operation
- Upon decommissioning of sediment basins, all water contained within must be removed and disposed of appropriately before the removal of any basin embankments

9. OVERVIEW OF KEY ESC TECHNIQUES

Drainage Controls – Catch Drains (CD) and Diversion Banks (DB)

This ESCP identifies the location of catch drains and diversion banks required to divert upslope clean water away from areas of soil disturbance, stockpiles and excavations, and to collect dirty runoff water from disturbed areas and stockpiles and direct it to a sediment trap and to control water flow through the worksite to avoid damage to unfinished areas of earthworks and infrastructure. Due to the presence of potentially dispersive subsoils on the site, diversion banks have been used wherever possible. Diversion banks, when constructed by pushing soil from the down-slope side, avoid exposing sodic subsoils and maintain in-situ groundcover in the flow path.

Where site mulch is available in sufficient quantities, temporary diversion banks/sediment filters may be formed from mulch. Temporary sandbag diversion banks will also be used to provide temporary diversion of water in locations of limited space and active construction areas prior to forecast wet weather.

Erosion Controls – Soil Binders

Soil binders are a form of chemical surface stabiliser and/or soil-bonding agent applied to exposed soil surfaces to control erosion. Soil binders are suitable for minor drainage lines, upper waterway banks, batters and topsoil stockpiles. Soil binders have been specified for use on batter locations and drainage lines in the project area, to provide temporary erosion control during construction activities and reduce predicted soil loss and associated requirements for sediment controls.

Soilbinders (or revegetation treatments) are required to be applied to disturbed batters between the months of December to March to reduce C-factor prior to rainfall forecast >10mm in 24 hours.

Sediment Controls

The following key sediment controls are specified in this plan and have been applied to individual catchments based on the results of the RUSLE soil loss predictions (Section 3.5).

Sediment basins – Due to the size and slopes present onsite, Type B sediment basins have been nominated to capture and treat site runoff in applicable catchments.

Rock Checks/Filter Dam (Type 2) – Where drainage topography allows, rock checks and rock filter dams have been utilised to slow the velocities of site dirty water.

Sediment Fence (Type 3) - Sediment fences have been nominated to provide sediment controls in locations that are likely to receive predominantly sheet flows. Used in conjunction with concentrated flow sediment treatment techniques. Where site mulch is available in sufficient quantities, Type 3/perimeter controls may be formed from mulch.

Site Exit / Entry - To prevent sediment tracking onto public roads, stabilised rock pad entry locations have been identified. Associated drainage and sediment controls have been identified to contain and treat runoff in accordance with the adopted sediment control standard for individual catchments. Adjacent roads should be inspected regularly, and any sediment deposited on public roads should be removed in a safe manner and disposed of to an approved disposal facility

Mulch berms and bunds – site won mulch berms and bunds have been nominated across the slopes and perimeter of the project to slow sheet flows and velocity of dirty water down slopes.

10. STOCKPILE MANAGEMENT

Place stripped soil at approved stockpile locations

Stockpile topsoil at a height no greater than 2m.

Stockpile any excess subsoil or spoil separately from topsoils and at designated stockpile locations upslope of sediment traps.

Install non-woven sediment fence (bidim A34 or equiv) around stockpiles as per SD-FF-1

Where topsoil stockpiles will remain undisturbed for greater than nominated erosion standard, apply seeding of a cover crop at the rate of 10kg/ha to topsoil stockpiles. Refer to revegetation specifications for seed mix.

Where subsoil / spoil stockpiles will remain undisturbed for greater then nominated erosion standard, apply temporary cover or soil binder.

Temporary Stabilisation Erosion Standard

Month	Temporary Stabilisation Erosion Standard
Dec, Jan, Feb	10 days
Mar – Jun, Oct – Nov	20 days
July – Sept	30 days

11. INSPECTIONS & MONITORING

All erosion and sediment control measures, including drainage measures, must be always maintained and in proper working order during their operational life.

All drainage, erosion and sediment controls shall be inspected daily when rain is occurring (if site access is available) weekly, prior to and following a rainfall event of sufficient intensity and duration to cause on-site runoff immediately prior to and following periods of site shutdown.

Inspections shall include checks of all drainage, erosion and sediment control measures including site discharge points for:

- evidence of excessive sediment transport and or deposition either on or off site
- evidence of excessive erosion either on site or immediately downstream
- treatment and de-watering requirements for sediment basins / sediment traps
- the progress and stability of site rehabilitation and revegetation works.

Where inspections identify a non-conforming control measure, or issues that are likely to prevent the achievement of the erosion and sediment control objectives, corrective or preventative actions will be developed and implemented as necessary to achieve the required erosion and sediment control performance standards.

A written record / register of monitoring observations and maintenance tasks shall be kept on site and available for inspection.

12. SITE REHABILITATION

The following site rehabilitation requirements are to be read in conjunction with the project specific landscaping, soil management and revegetation plans and applicable project requirements. Where there is an inconsistency between the site rehabilitation measures in this document, and the project specific contract documents, the site specific and contract documents shall prevail.

Disturbed areas shall be stabilised within the following time frames

Permanent Stabilisation Erosion Standard

Month	Temporary Stabilisation Erosion Standard
Dec, Jan, Feb	10 days
Mar – Jun, Oct – Nov	20 days
July – Sept	30 days

Areas shall be considered stable once they achieve 70% cover in 90% of the relevant catchment. Temporary drainage, erosion and sediment control structures shall not be decommissioned until this level of cover is achieved within the upslope catchment.

Compacted areas / areas subject to construction traffic shall be first scarified to a minimum depth of 50mm to address compaction from construction traffic and assist in tying in topsoil. On steeper slopes (<3H:1V) scarification may alternatively be undertaken via track walking up and down the slope.

Stripped topsoil shall be reinstated in accordance with pre-stripping profiles and depths. Topsoil shall be placed at a minimum of 75mm and lightly compacted, reinstating the original top 50mm as the final layer. On slopes steeper than 4H:1V topsoil reinstatement shall be reduced to 50mm to minimise slumping.

Ensure all dispersive / sodic subsoil is adequately covered with a minimum of 50mm of non-dispersive topsoil.

Apply seed, fertiliser and hydromulch to disturbed areas as per rehabilitation specifications.

Apply follow up watering on a daily basis (subject to weather conditions) to hydromulched areas.

Any excess spoil shall be removed from the site to an approved disposal location and the stockpile location rehabilitated as per other disturbed areas

Seed Mix

Where a site-specific seed mix is not specified, the below table provides a seed mix suitable for use in site rehabilitation or temporary seeding.

Seed Mix Specifications

	Summer Blend (Nov – Feb)	Mid-Season (Mar/Apr & Sep/Oct)	Winter Blend (May – Aug)
Unhulled green couch (Cynodon dactalyon)	**35kg/ha**	**35 kg/ha**	**35 kg/ha**
Hulled green couch (Cynodon dactalyon)	**35 kg/ha**	**35 kg/ha**	**35 kg/ha**
Japanese or Shirohie Millet	**30 kg/ha**	**15 kg/ha**	**0**
Perennial Rye Grass	**0**	**15 kg/ha**	**30 kg/ha**

Hydromulch Specifications

Paper pulp at 2t/ha or wood pulp at 2.5t/ha plus tackifier at 5 to 10% by weight.

Appendix A : Progressive Erosion and Sediment Control Drawings

LEGEND

Stabilised exit

Mulch bund

Sediment Basin

Sediment trap

Dirty water drain

Dirty water flow direction

Sediment fence

Rock Checks

Install rock checks down access track every 25m and trafficable rollover bunds at 50m intervals to divert water into site controls

Sediment trap 1
Dimensions -
10m(L) x 5m(W) x 0.6m(D)

Install rock checks in dirty water drain

Install perimeter controls around topsoil and mulch stockpile site - sediment fence and mulch bund.

Sediment trap 2
Dimensions -
10m(L) x 8m(W) x 1m(D)

Install rock checks in dirty water drain

Utilise site-won mulch as mulch bunds around perimeter across slopes onsite

Basin 3
Minimum capacity 2660m3
Spillway: 12m wide - lined with geofab and d50 300mm rock

Sediment trap 5
Dimensions -
10m(L) x 6m(W) x 1m(D)

Catchment 3

Catchment 1

Catchment 2

Install rock checks in dirty water drain

Basin 1
Minimum capacity 2030m3
Spillway: 11m wide - lined with geofab and d50 300mm rock

Sediment trap 3
Dimensions -
10m(L) x 10m(W) x 1.5m(D)

Install rock checks in dirty water drain

Install rock checks in dirty water drain

Install sediment fence on completion of cut of batter

Progressively stabilise batters across site or utilise soil binder prior to forecast wet weather

Basin 2
Minimum capacity 1433m3
Spillway: 10m wide - lined with geofab and d50 300mm rock

Sediment trap 4
Dimensions -
10m(L) x 6m(W) x 1m(D)

COURTNEY DR
GORDON DR
RICHARDSON CR
RANGEVIEW ROAD
ROAD 01
ROAD 02
ROAD 03
ROAD 04
ROAD 05
ROAD 06

LEGEND

EXISTING KERB (INVERT)
EXISTING PROPERTY LINE
EXISTING CONTOURS
FUTURE KERB (INVERT)
FUTURE PROPERTY LINE
PROPOSED KERB (INVERT)
PROPOSED PROPERTY LINE
PROPOSED RETAINING WALL
DESIGN CONTOURS
SITE BOUNDARY
STAGE BOUNDARY

NORTH

0 15 30 45 60 75m
Scale 1:1500 - A1 (1:3000 - A3)

PROJECT NAME

COURTNEY DR UPPER COOMERA

STAGE 01

RP DESCRIPTION

LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

HB Land

REV	DATE	DESCRIPTION	INT
B	14-07-23	RFI AMENDMENTS	EP
A	03-03-23	COUNCIL ISSUE	JB

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING
Robin Russell & ASSOCIATES PTY. LTD.
BENNETT+BENNETT

DRAWING TITLE

BULK EARTHWORKS
SECTION KEY PLAN

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065
mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

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APPROVED		RPEQ 4706	DATE 03-03-23

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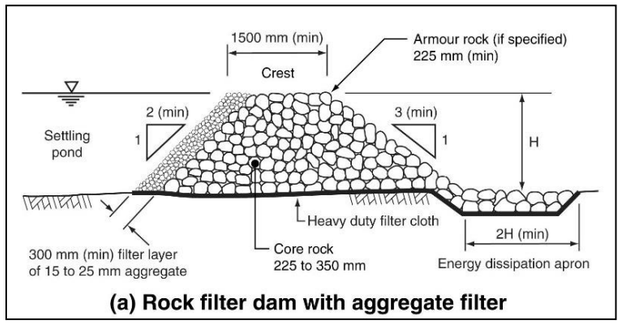
REV A

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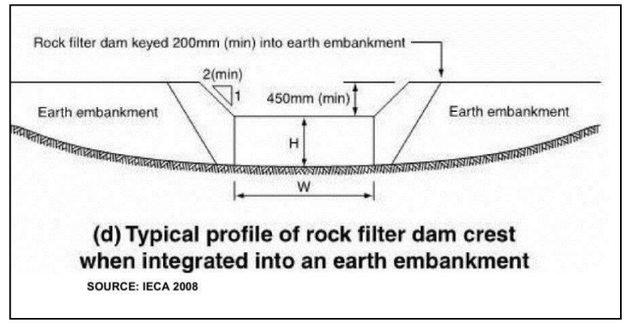
Appendix B : Standard Drawings and Calculations

Excavated Sediment Trap Calculator

Excavated Sediment Trap Calculator									
Chainage		Size only	Size only	Size only	Size only	Size only	Size only	Size only	Size only
Control design life	time	5	5	5	5	5	5	5	5
Max catchment size	m2	20000	15000	10000	7500	5000	2500	1000	500
ToC	Minutes	10.0	9.0	8.0	7.0	6.0	5.0	3.0	3.0
Rainfall	mm/h	143.0	148.0	154.0	161.0	168.0	176.0	194.0	194.0
Runoff	coefficient	1	1	1	1	1	1	1	1
Rational Method	m3/s	0.794	0.617	0.428	0.335	0.233	0.122	0.054	0.027
Particle Size targetted	lookup	0.100	0.100	0.100	0.100	0.100	0.150	0.150	0.15
Surface area	m2/m3/s	**111**	**86**	**60**	**47**	**33**	**8**	**3**	**2**
Volume at 0.6m		67	52	36	28	20	5	2	1



(a) Rock filter dam with aggregate filter

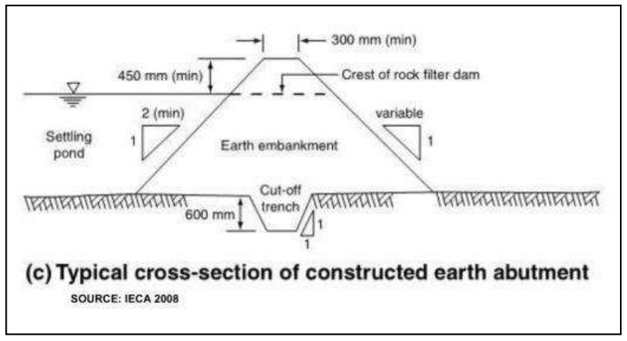


(d) Typical profile of rock filter dam crest when integrated into an earth embankment

SOURCE: IECA 2008

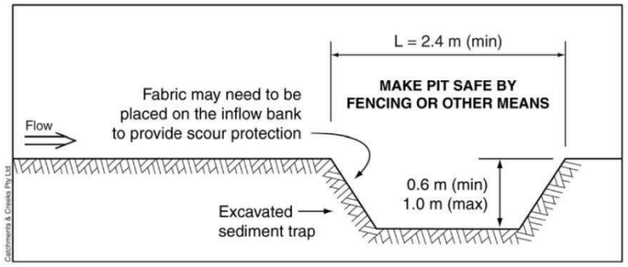
Design standard	Critical sediment size (mm)	Surface area of settling pond per unit discharge ($m^2/m^3/s$) [1]			Allowable through-velocity (m/s)
		10° C [2]	15° C [2]	20° C [2]	
Type 3 sediment trap	0.50	6	5.2	4.6	0.3
	0.20	38	33	29	0.3
	0.15	67	60	52	0.3
Type 2 sediment trap	0.10	150	130	115	0.2
	0.05	600	525	460	0.2
Type 1 sediment trap	0.04	940	820	720	0.2
	0.02	3700	3230	2860	0.2

[1] Pond area is based on a rectangular pond operating with uniform inflow conditions across its width.
[2] Assume a pond temperature the same as the typical rainwater temperature during the time of year when the pond is likely to be operating at capacity.



(c) Typical cross-section of constructed earth abutment

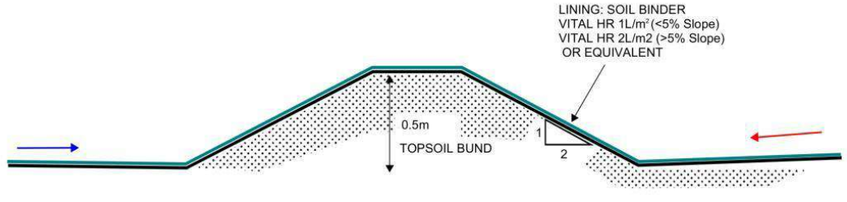
SOURCE: IECA 2008

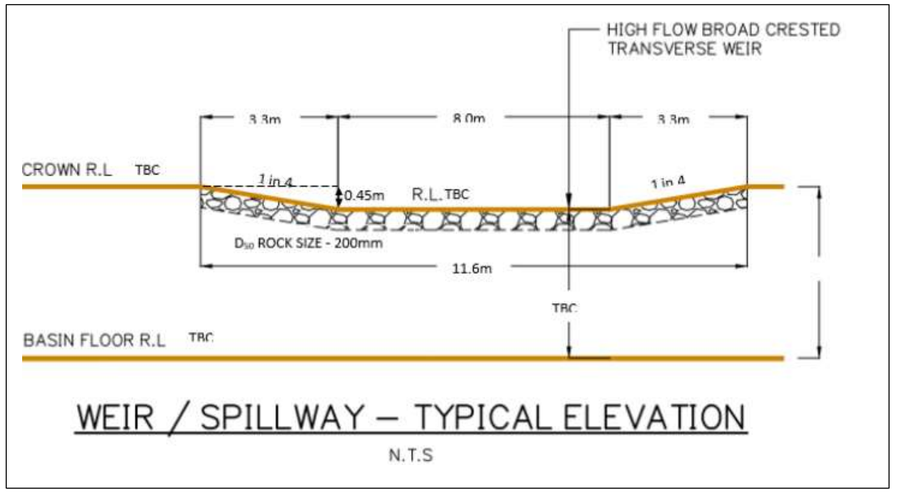


Classification	Minimum particle size	Typical trapped particles
Type 1	< 0.045mm	Clay, silt & sand
Type 2	0.045 – 0.14mm	Silt & sand [1]
Type 3	> 0.14mm	Sand
Supplementary	> 0.14mm	Sand

[1] Technically, silt particles have a grain size of 0.002 to 0.02mm, which means that only Type 1 sediment traps are likely to capture silt-sized particles. However, for general discussion purposes, it can be assumed that Type 2 systems capture a significant proportion of silt-sized particles.

DIVERSION BUND SECTION



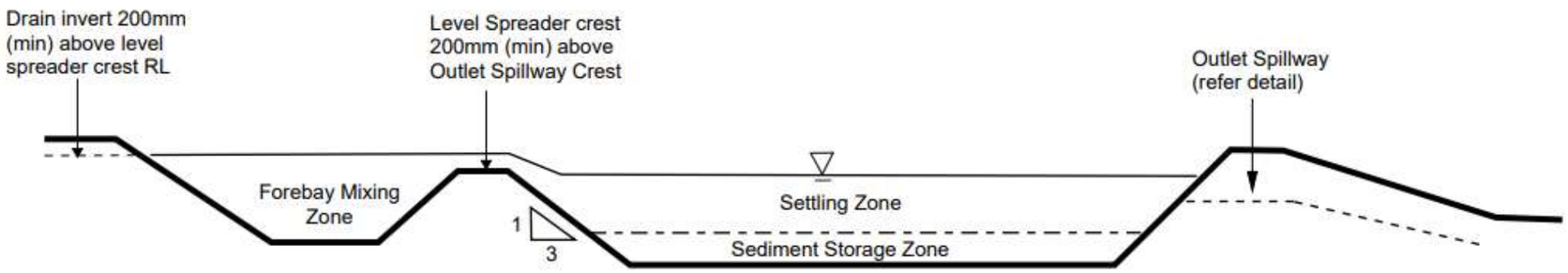


WEIR / SPILLWAY – TYPICAL ELEVATION

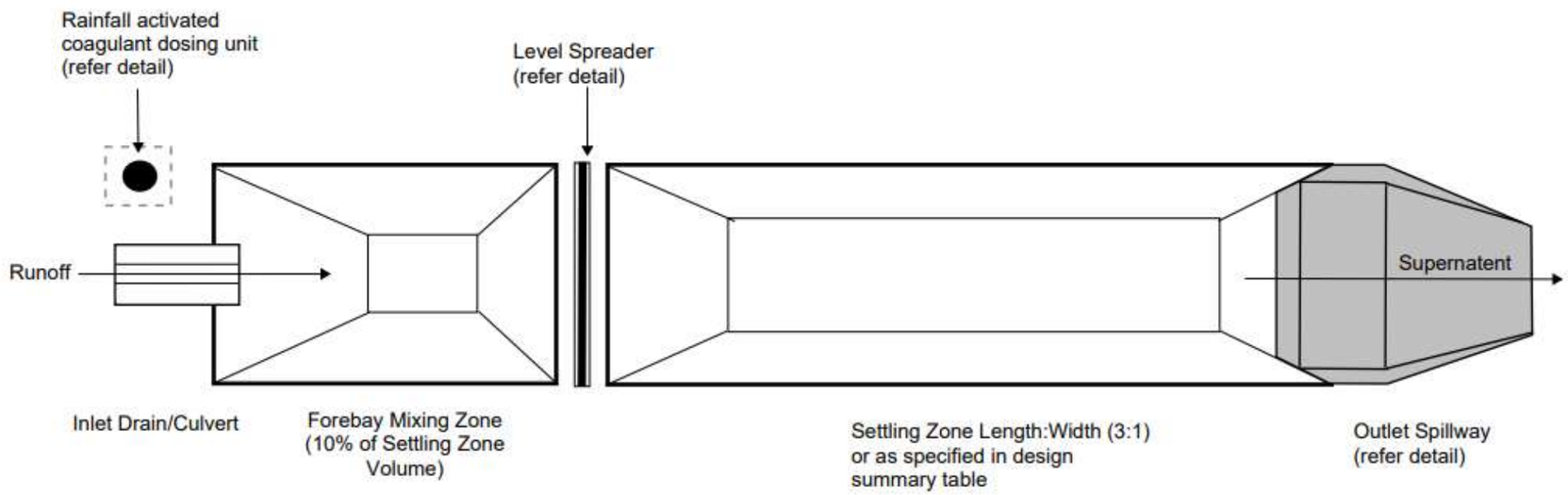
N.T.S

Sediment Basin

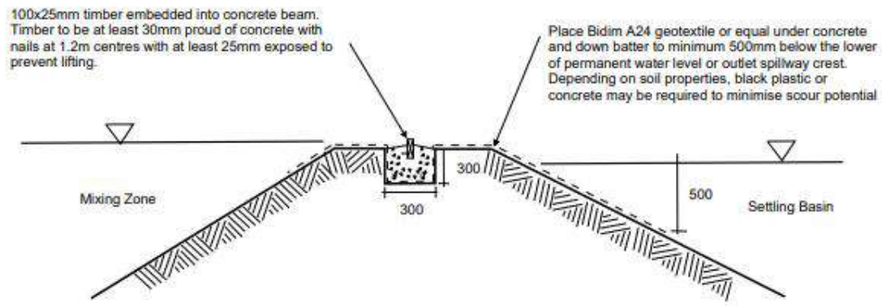
		Q3mth Design Flowrate Calc.						Settling Zone						Forebay		Sediment Storage Zone			Overall Dimensions relative to spillway crest (excl. Forebay)			Spillway									
Basin ID	Catchment Area (Ha)	C_{10}	C_1	tc	$I_{1yr,tc}$ (mm/hr)	Q1yr (m^3/s)	Q3mth (m^3/s)	Residence Time (hr)	Settling Zone Depth (m)	Ave. settling zone area (m2)	Settling Volume (m3)	W:L (1:X)	Scour Velocity (m/s)	Forebay Min. Depth (m)	Forebay Vol (m3)	Sed Storage Vol (m3)	Sed Storage depth (approx.) (m3)	Batter (1:X)	Width (m)	Length (m)	Depth (m)	Basin Design Life	Design ARI	C	I (mm/hr)	Q (m^3/s)	Head over spillway (m)	Spillway crest length (m)	Spillway Crest RL (m)	Min Embankment RL (m)
1	4.36	0.7	0.56	10	5.19	0.04	0.02	2	0.6	471	1369	3	0.002	1	137	311	0.2	3	14.3	43.0	0.8	3-12months	1:20yr	0.74	143	1.27	0.3	4.6	10	10.75
2	2.91	0.7	0.56	10	5.19	0.02	0.01	2	0.6	314	914	3	0.002	1	91	289	0.2	3	12.0	36.1	0.8	3-12months	1:20yr	0.74	143	0.85	0.3	3.0	10	10.75
3	5.4	0.7	0.56	10	5.19	0.04	0.02	2	0.6	583	1695	3	0.003	1	170	537	0.2	3	15.7	47.2	0.8	3-12months	1:20yr	0.74	143	1.58	0.3	5.6	10	10.75



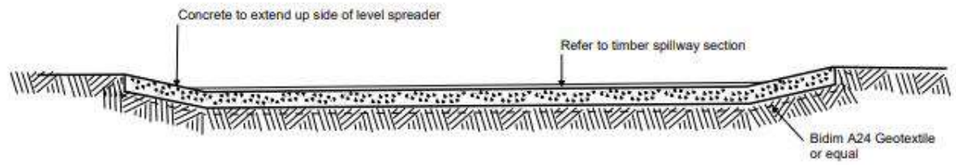
Type B Sediment Basin Long Section (Typical NTS)



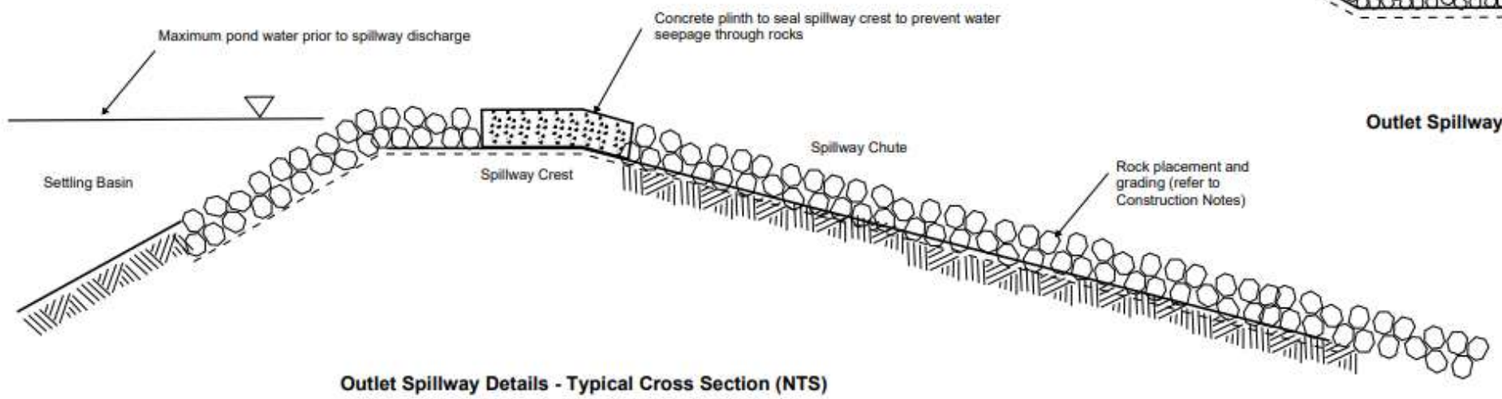
Type B Sediment Basin Plan View (Typical NTS)



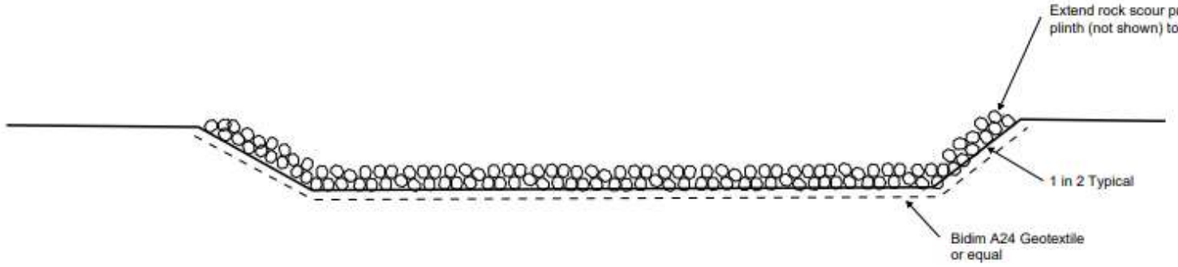
Level Spreader Details - Typical Cross Section (NTS)



Level Spreader Details - Typical Long Section (NTS)



Outlet Spillway Details - Typical Cross Section (NTS)



Outlet Spillway Details - Typical Long Section (NTS)

EROSION & SEDIMENT CONTROL PLAN

Courtney Drive Estate Stage 1-3, Upper Coomera

Rev: 0

Date: 16/10/23

ESCP No. 002

Notes:

Auto Doser

1. Provided as either Floc Box or iFOD-Rain to manufacturers specification.
2. Doser and supply of flocculant to be provided on level pad 4mx4m within 10m of dosing point.
3. All-weather access track to be provided to doser.
4. Flocculant provided as Turbiclear (ACH). If alternative flocculant used then the basin size is to be increased according to jar settlement test (refer to table below.

Jar Settlement after 15 mins (mm)	Multiplication Factor to Settling Zone Volume
50	x3
75	x2
100	x1.5
150	x1

Basin construction:

Materials-

5. Earth Fill: clean soil with Emerson Class 2(1), 3, 4 or 5 and free of roots, woody vegetation, rocks and other unsuitable material. Soil with Emerson Class 4 and 5 may not be suitable depending on particle size distribution and degree of dispersion. Class 2(1) should only be used upon recommendation from geotechnical specialist.
6. Spillway rock: hard, angular, durable, weather resistant and evenly graded rock with 50% by weight larger than the specified nominal (d50) rock size. Large rock should dominate, with sufficient small rock to fill the voids between larger rock. the diameter of the largest rock should be no larger than 1.5 times the nominal rock size. The specific gravity should be at least 2.5.
7. Geotextile fabric: heavy duty, needle-punched, non-woven cloth, minimum 'bidim' A24 or equivalent.

Construction-

8. Notwithstanding any description contained with approved plans or specifications, the Contractor shall be responsible for satisfying themselves as to the nature and extent of the specified works and the physical and legal conditions under which the works will be carried out. This shall include means of access, extent of clearing, nature of the materials to be excavated, type and size of mechanical plant required, location and suitability of water supply for construction and testing purposes, and any other likely matters affecting the construction of the works.
9. Refer to approved plans for location, dimensions, and construction details. If there are questions or problems with the location, dimensions, or method of installation, contact the engineer or responsible on-site officer for assistance.
10. Before starting any clearing or construction, ensure all the necessary materials and components are on the site to avoid delays in completing the sediment basin once works begin.
11. Install requires short term sediment control measures downstream of the proposed earthworks to control sediment runoff during construction of the basin.
12. The area to be covered by the embankment, borrow pits and incidental works, together with an area extending beyond the limits of each for a distance not exceeding five (5) metres all around must be cleared of all trees, scrub, stumps, roots, dead timber and rubbish and disposed of in a suitable manner. Delay clearing the main basin area until the embankment is complete.
13. Ensure all holes made by grubbing within the embankment footprint are filled with sound material, adequately compacted, and finished flush with the natural surface.

Cut-off Trench-

14. Before construction of the cut-off trench or any ancillary works within the embankment footprint, all grass growth and topsoil must be removed from the area to be occupied by the embankment and must be deposited clear of this area and reserved for topdressing the completed embankment.
15. Excavate a cut-off trench along the centre line of the earth fill embankment. Cut the trench to stable soil material, but in no case make it less than 600mm deep. the cut-off trench must extend into both abutments to at least the elevation of the outlet spillway crest. Make the minimum bottom width wide enough to permit operation of the excavation and compaction equipment, but in no case less than 600mm. Make the side slopes of the trench no steeper than 1:1 (H:V).
16. Ensure all water, loose soil, and rock are removed from the trench before backfilling commences. The cut-off trench must be backfilled with select earth-fill of the type specified for the embankment, and this soil must have a moisture content and degree of compaction the same as specified for the core zone.
17. Material excavated from the cut-off trench may be used in the construction of the embankment provided it is suitable and it is placed in the correct zone according to its classification.

Embankment-

18. Scarify areas on which fill is to be placed before placing the fill.
19. Ensure al fill material used to form the embankment meets the specifications certified by a soil scientist of geotechnical specialist.
20. The fill material must contain sufficient moisture so it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Place fill material in 150 to 200mm continuous layers over the entire length of the fill area and then compact before placement of further fill.
21. Unless specified on the approved plans, compact the soil at about 1% to 2% wet optimum and to 95% modified or 100% standard compaction.embankment to an elevation 10% higher than the design height to allow for settling
22. Where both dispersive and non-dispersive classified earth-fill materials are available, non-dispersive earth-fill must be used in the core zone. the remaining classified earth-fill materials must only be used as directed by the site superintendent.
23. Where specified, construct the embankment to an elevation 10% higher than the design height to allow for settling; otherwise finished dimensions of the embankment after spreading of topsoil must conform to the drawing with a tolerance of 75mm from specified dimensions.
24. Ensure debris and other unsuitable building waste is not placed within the earth embankment.
25. After completion of the embankment all loose uncompacted earth-fill material on the upstream and downstream batter must be removed prior to spreading topsoil.
26. Topsoil and re-vegetate/stabilise all exposed earth as directed within the approved plans.

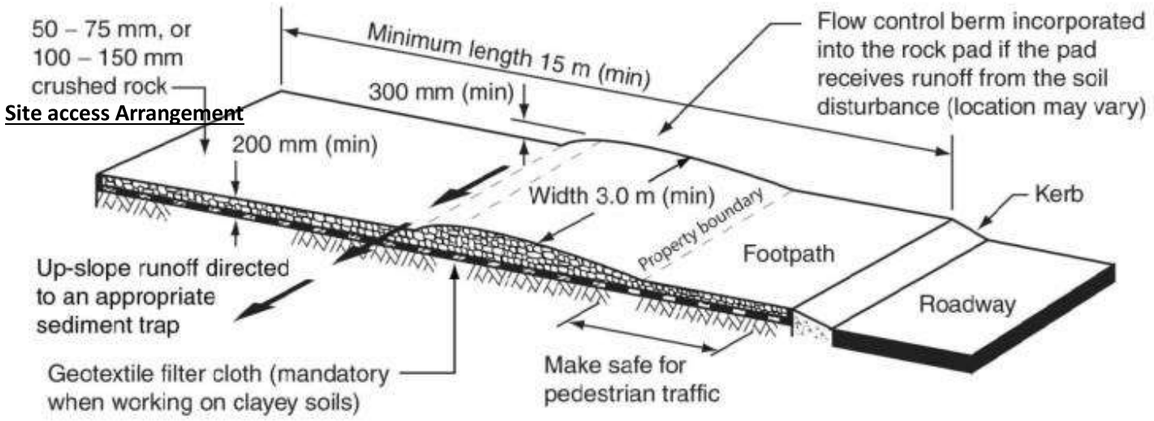
Spillway construction-

27. The spillway must be excavated as shown on the plans, and the excavated material if classified as suitable, must be used in the embankment, and if not suitable it must be disposed of into spoil heaps.
28. Ensure excavated dimensions allow adequate boxing-out such that the specified elevations, grades, chute width, and entrance and exit slopes for the emergency spillway will be achieved after placement of the rock or other scour protection measures as specified in the plans.
29. Place specified scour protection measures on the emergency spillway. Ensure the finished grade blends with the surrounding area to allow a smooth flow transition from spillway to downstream channel.
30. If a synthetic filter fabric underlay is specified, place the fabric directly on the prepared foundation. if more than 1 sheet of filter fabric is required, overlap the edges by at least 300mm and place anchor pins at minimum 1m spacing along the overlap. bury the upstream end of the filter fabric a minimum 300mm below ground and where necessary, bury the lower end of the fabric or overlap a minimum 300mm over the next downstream section as required. Ensure the filter fabric extends at least 1000mm upstream of the spillway crest.
31. Take care not to damage the fabric during or after placement. If damage occurs, remove the rock and repair the sheet by adding another layer of fabric with a minimum overlap of 300mm around the damaged area.3If extensive damage is suspected, remove and replace the entire sheet.
32. where large rock is used, or machine placement is difficult, a minimum 100mm layer of fine gravel, aggregate, or sand may be needed to protect the fabric.
33. Placement of rock should follow immediately after placement of the filter fabric. Place rock so that it forms a dense, well graded mass of rock with a minimum of voids. the desired distribution of rock throughout the mass may be obtained by selective loading at the quarry and controlled dumping during final placement.
34. The finished slope should be free of pockets of small rock or clusters of large rocks. Hand placing may be necessary to achieve the proper distribution of rock sizes to produce a relatively smooth, uniform surface. the finished grade of the rock should blend with the surrounding are. No overfall or protrusion of rock should be apparent.
35. Ensure that the final arrangement of the spillway crest will not promote excessive flow through the rock such that the water can be retained within the settling basin at the elevation no less than 50mm above of below the nominated spillway crest elevation.

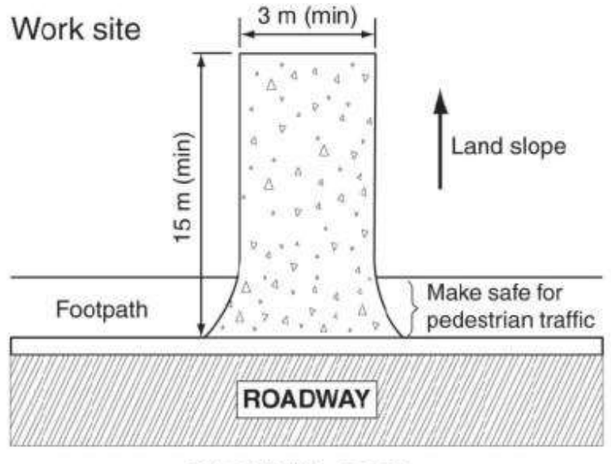
Establishing the settling pond-

36. The area to be covered by the stored water outside of the limits of the borrow pits must be cleared rubbish. Trees must be cut down stump high and removed from the immediate vicinity of the work.
37. Establish all required inflow chutes and inlet baffles, if specified, to enable water to discharge into the basin in a manner that will not cause soil erosion or the re-suspension of settled sediment.
38. Install a sediment storage level marker post with a cross member set just below the top of the sediment storage zone (as specified on the approved plans). Use at least a 75mm wide post firmly set into the basin floor.
39. If specified, install internal settling pond baffles. Ensure the crest of these baffles is set level with, or just below, the elevation of the emergency spillway.
40. Install all appropriate measures to minimise safety risk to on-site personnel and the public caused by the presence of the settling pond. Avoid steep, smooth internal slopes. Appropriately fence the settling pond and post warning signs if unsupervised public access is likely or there is considered to be an unacceptable risk to the public.

Site access Arrangement

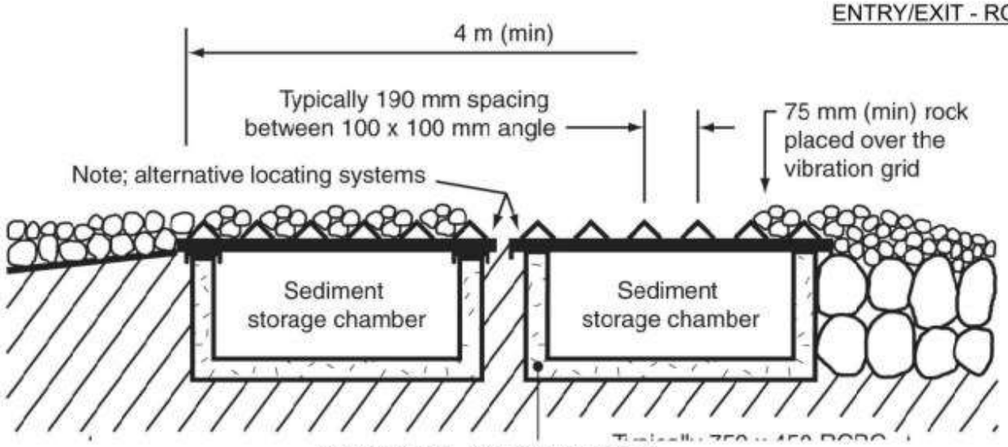


ENTRY/EXIT - ROCK

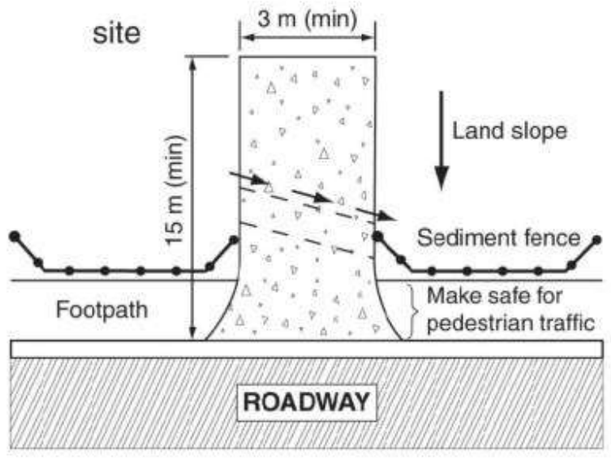


ENTRY/EXIT - ROCK
(SLOPING AWAY FROM ROAD)

ENTRY/EXIT - ROCK



ENTRY/EXIT - VIBRATION GRID



ENTRY/EXIT - ROCK
(SLOPING TOWARD ROAD)

STANDARD DRAWINGS SOURCED FROM CATCHMENT AND CREEKS

MATERIALS

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

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

INSTALLATION

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

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

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

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

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

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

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

MAINTENANCE

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

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

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS

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

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

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

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

REMOVAL

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

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

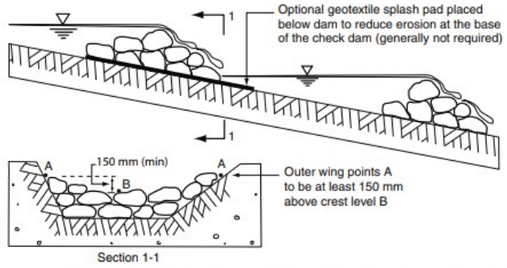


Figure 1 - Layout and profile of check dams (rock check dams shown)

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

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INSTALLATION

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

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

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

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

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

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

7. ENSURE THE CHANNEL DISCHARGES TO A STABLE AREA.

ADDITIONAL REQUIREMENTS FOR TURF PLACEMENT:

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

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

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

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

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

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

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

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

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

MAINTENANCE

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

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

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

REMOVAL

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

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

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

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

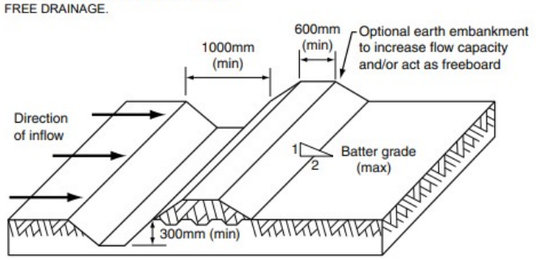


Figure 1 - Typical profile of diversion channel with bank

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

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INSTALLATION

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

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

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

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

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

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

7. ENSURE THE BERM DISCHARGES TO A STABLE OUTLET.

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

MAINTENANCE

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

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

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

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

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

REMOVAL

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

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

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

Table 1 - Recommended dimensions of flow control berms

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

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

Catchments & Creeks Pty Ltd

INSTALLATION

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

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

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

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

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

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

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

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

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

MAINTENANCE

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

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

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

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

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

REMOVAL

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

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

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

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

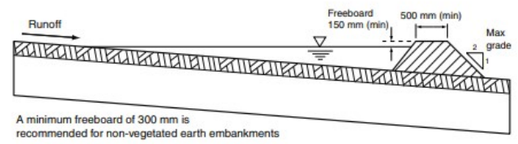


Figure 1 - Typical profile of flow diversion bank formed from earth

Table 1 - Recommended dimensions of flow diversion banks

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

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

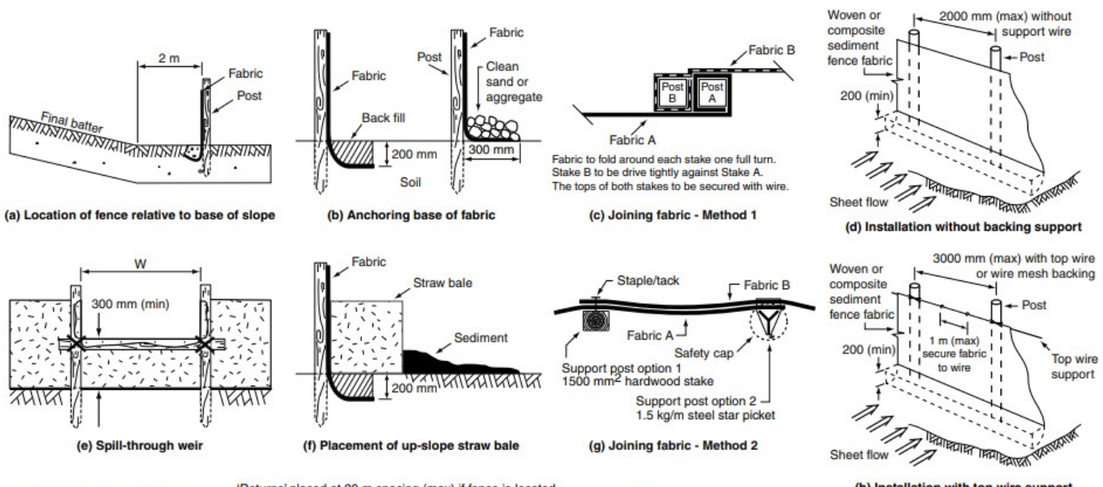
EROSION & SEDIMENT CONTROL PLAN

Courtney Drive Estate Stage 1-3, Upper Coomera

Rev: 0

Date: 16/10/23

ESCP No. 002



Notes:

1. Sediment fence to be installed along a line of constant ground elevation wherever practical.
2. Both end of the sediment fence to extend up the slope at least 1m.
3. Support post to be spaced a maximum 2m unless the fence is supported by a top wire or wire mesh backing, in which case 3m maximum spacing.
4. Fence 'returns' shall be installed at maximum 20m spacing if fence is installed along the contour, otherwise 5 to 10m maximum spacing.
5. Minimum 4 staples or tie wires per stake.

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

Catchments & Creeks Pty Ltd

MATERIALS

POLYACRYLAMIDE:
(i) CHOICE OF POLYACRYLAMIDE SHOULD BE BASED ON THE MOST ENVIRONMENTALLY SAFE, ANIONIC PRODUCT AVAILABLE. CATIONIC POLYACRYLAMIDE SHALL NOT BE USED.

(ii) POLYACRYLAMIDE USED FOR EROSION AND SEDIMENT CONTROL SHALL BE WATER SOLUBLE, LINEAR, OR NON-CROSS LINKED.

(iii) GRANULAR POLYACRYLAMIDE MUST BE STORED OUT OF THE SUN WHILE NOT IN USE.

APPLICATION

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

2. POLYACRYLAMIDE, COMBINED WITH WATER, IS VERY SLIPPER AND CAN REPRESENT A SAFETY HAZARD. APPROPRIATE MANAGEMENT OF ANY SAFETY HAZARD MUST BE ACHIEVED.

3. ENSURE ALL POLYACRYLAMIDE ARE USED FOR PURPOSES AND AT APPLICATION RATES IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS.

4. POLYACRYLAMIDE MUST NOT BE ADDED TO WATER DISCHARGING DIRECTLY FROM THE SITE.

5. PRE-DISSOLVE THE DRY, GRANULAR POLYACRYLAMIDE INTO A CONCENTRATED SOLUTION OVERNIGHT OR SEVERAL HOURS BEFORE USAGE.

6. PRIOR TO APPLICATION, ENSURE SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PRACTICES COMPLY WITH BEST PRACTICE.

7. PRE-FILL A TANK APPROXIMATELY 1/8 FULL WITH WATER PRIOR TO INPUT OF THE PRE-PREPARED, CONCENTRATED POLYACRYLAMIDE SOLUTION. CONTINUE TO FILL THE TANK WITH THE REQUIRED WATER VOLUME. THE WATER MUST HAVE LOW TURBIDITY IN THE RANGE OF 20 NTU OR LESS.

8. APPLY THE MIXTURE UNTIL THE SOIL SURFACE IS UNIFORMLY AND COMPLETELY WETTED.

9. ALL REASONABLE EFFORTS SHOULD BE TAKEN TO APPLY POLYACRYLAMIDE SOLUTION TO THE SOIL WHILE THE SOIL IS IN A 'DRY' CONDITION.

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

MAINTENANCE

1. INSPECT THE TREATED SURFACE PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT FORTNIGHTLY INTERVALS.

2. REAPPLY WITHIN 48 HOURS AFTER THE TREATED AREAS HAS BEEN DISTURBED BY EARTHMOVING MACHINERY IF EROSION CONTROL IS REQUIRED.

3. REAPPLY AS NECESSARY ON DAMAGED AREAS.

4. REAPPLICATION IS GENERALLY NOT REQUIRED UNLESS THE TREATED AREA IS DISTURBED, A PERIOD OF 60-DAYS HAS PASSED, OR UNLESS ACCEPTABLE TURBIDITY LEVELS ARE EXCEEDED. IF THE TREATED AREA HAS BEEN MULCHED, THEN REAPPLICATION MAY NOT BE REQUIRED FOR SEVERAL MONTHS.

Drawn:	Date:		
GMW	Dec-09	Polyacrylamide	PAM-01

Catchments & Creeks Pty Ltd

MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140GSM. ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

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

SUPPORT POSTS/STAKES: 1500mm² (MIN) HARDWOOD, 2500mm² (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

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

2. TO THE MAXIMUM DEGREE PRACTICAL, AND WHERE THE PLANS ALLOW, ENSURE THE FENCE IS LOCATED:
(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;
(ii) ALONG A LINE OF CONSTANT ELEVATION WHEREVER PRACTICAL;
(iii) AT LEAST 2m FROM THE TOE OF ANY FILLING OPERATIONS THAT MAY RESULT IN SHIFTING SOIL/FILL DAMAGING THE FENCE.

3. INSTALL RETURNS WITHIN THE FENCE AT MAXIMUM 20m INTERVALS IF THE FENCE IS INSTALLED ALONG THE CONTOUR, OR 5 TO 10m MAXIMUM SPACING (DEPENDING ON SLOPE) IF THE FENCE IS INSTALLED AT AN ANGLE TO THE CONTOUR. THE 'RETURNS' SHALL CONSIST OF EITHER:
(i) V-SHAPED SECTION EXTENDING AT LEAST 1.5m UP THE SLOPE; OR
(ii) SANDBAG OR ROCK/AGGREGATE CHECK DAM A MINIMUM 1/3 AND MAXIMUM 1/2 FENCE HEIGHT, AND EXTENDING AT LEAST 1.5m UP THE SLOPE.

4. ENSURE THE EXTREME ENDS OF THE FENCE ARE TURNED UP THE SLOPE AT LEAST 1.5m, OR AS NECESSARY, TO MINIMISE WATER BYPASSING AROUND THE FENCE.

5. ENSURE THE SEDIMENT FENCE IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE FENCE, AND THE UNDESIRABLE DISCHARGE OF WATER AROUND THE ENDS OF THE FENCE.

6. IF THE SEDIMENT FENCE IS TO BE INSTALLED ALONG THE EDGE OF EXISTING TREES, ENSURE CARE IS TAKEN TO PROTECT THE TREES AND THEIR ROOT SYSTEMS DURING INSTALLATION OF THE FENCE. DO NOT ATTACH THE FABRIC TO THE TREES.

7. UNLESS DIRECTED BY THE SITE SUPERVISOR OR THE APPROVED PLANS, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE PROPOSED FENCE LINE, PLACING THE EXCAVATED MATERIAL ON THE UP-SLOPE SIDE OF THE TRENCH.

8. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 3m IF SUPPORTED BY A TOP SUPPORT WIRE OR WEIR MESH BACKING, OTHERWISE NO GREATER THAN 2m.

9. IF SPECIFIED, SECURELY ATTACH THE SUPPORT WIRE OR MESH TO THE UP-SLOPE SIDE OF THE STAKES WITH THE MESH EXTENDING AT LEAST 200mm INTO THE EXCAVATED TRENCH. ENSURE THE MESH AND FABRIC IS ATTACHED TO THE UP-SLOPE SIDE OF THE STAKES EVEN WHEN DIRECTING A FENCE AROUND A CORNER OR SHARP CHANGE OF DIRECTION.

10. WHEREVER POSSIBLE, CONSTRUCT THE SEDIMENT FENCE FROM A CONTINUOUS ROLL OF FABRIC. TO JOIN FABRIC EITHER:
(i) ATTACH EACH END TO TWO OVERLAPPING STAKES WITH THE FABRIC FOLDING AROUND THE ASSOCIATED STAKE ONE TURN, AND WITH THE TWO STAKES TIED TOGETHER WITH WIRE; OR
(ii) OVERLAP THE FABRIC TO THE NEXT ADJACENT SUPPORT POST.

11. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS USING 25 X 12.5mm STAPLES, OR TIE WIRE AT MAXIMUM 150mm SPACING.

12. SECURELY ATTACH THE FABRIC TO THE SUPPORT WIRE/MESH (IF ANY) AT A MAXIMUM SPACING OF 1m.

13. ENSURE THE COMPLETED SEDIMENT FENCE IS AT LEAST 450mm, BUT NOT MORE THAN 700mm HIGH. IF A SPILL-THOUGH WEIR IS INSTALLED, ENSURE THE CREST OF THE WEIR IS AT LEAST 300mm ABOVE GROUND LEVEL.

14. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

ADDITIONAL REQUIREMENTS FOR THE INSTALLATION OF A SPILL-THROUGH WEIR

1. LOCATE THE SPILL-THROUGH WEIR SUCH THAT THE WEIR CREST WILL BE LOWER THAN THE GROUND LEVEL AT EACH END OF THE FENCE.

2. ENSURE THE CREST OF THE SPILL-THROUGH WEIR IS AT LEAST 300mm THE GROUND ELEVATION.

3. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE SUPPORT POSTS/ STAKES EACH SIDE OF THE WEIR. CUT THE FABRIC DOWN THE SIDE OF EACH POST AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

4. INSTALL A SUITABLE SPLASH PAD AND/OR CHUTE IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION AND APPROPRIATELY DISCHARGE THE CONCENTRATED FLOW PASSING OVER THE WEIR.

MAINTENANCE

1. INSPECT THE SEDIMENT FENCE AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

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

4. IF THE FENCE IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 1/3 THE HEIGHT OF THE FENCE.

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

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS 6-MONTHS.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT FENCE ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE FENCE MUST BE REMOVED.

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

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

Drawn:	Date:		
GMW	Apr-10	Sediment Fence	SF-02

Catchments & Creeks Pty Ltd

enviro consulting

Erosion & Sediment Control Plan

Courtney Drive Estate – Stage 1-3, Upper Coomera

Progressive Erosion and Sediment Control Plan – Clearing and Grubbing 001

Revision No	Date	Prepared by	Reviewed By	Approval
0	28/09/2023	Alisha Croft	Michael Jabbour	Alisha Croft CPESC #9428

CPESC	*Alisha Croft*	*0419 674 283*
Senior Project Manager	*Michael Williams*	*0401 857 055*

Alisha Croft #9428

1. SCOPE

This Progressive Erosion and Sediment Control Plan (ESCP) has been developed for the clearing and grubbing phase for the Courtney Drive residential estate for Stage 1-3, Upper Coomera QLD. With additional progressive erosion and sediment control plans to be prepared for the Earthworks and Civil stages.

1.1 Guidelines

This ESCP has been prepared in accordance with the following document(s):

- Best Practice Erosion and Sediment Control (IECA, 2008)

1.2 Certification

This ESCP will be reviewed and certified by a CPESC prior to commencement of works. This review and certification will ensure the plan has been prepared to satisfy the intent and minimum standards nominated within the IECA (2008) Best Practice Erosion and Sediment Control Guideline.

2. PROJECT DESCRIPTION

2.1 Location & Land use

The site is located off off Courtney Drive in Upper Coomera and will connect Courtney Drive with Rangeview Road. (**Figure 1**).

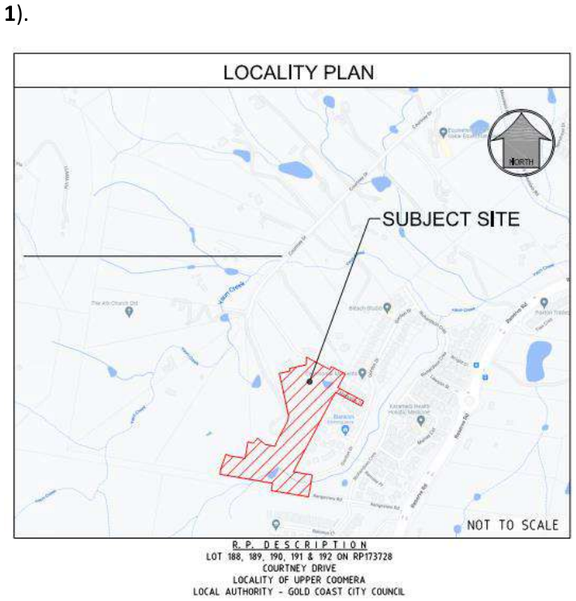


Figure 1: Locality Plan

2.1.1 Scope of Works

The scope of works is as follows:

- Site clearing and grubbing, inclusive of the removal of existing site trees;
- Undertake bulk earthworks activities;
- Construction of proposed lots and establishment of retaining between lots in accordance with design;
- Construction of stormwater infrastructure;
- Construction of proposed residential streets
- Installation of all relevant signage and line marking;

The general arrangement of Erosion and Sediment Controls are illustrated in **figure 2**.

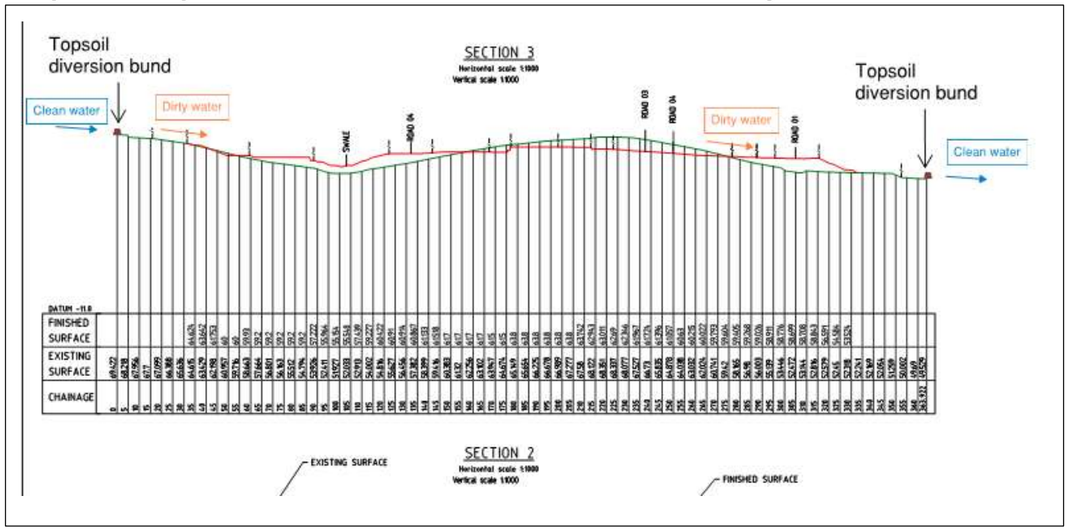


Figure 2: Typical Erosion and sediment control arrangement

3. SITE DESCRIPTION

3.1 Climate & Rainfall risk

Historic rainfall data for Upper Coomera has been extracted from the Coomera Foxwell Road Weather Station (Station No. 40516) the closest long-term gauging station to the site, is illustrated in **Figure 3**. Relatively wetter conditions typically occur from November to June and drier conditions tend to persist from July to October. The corresponding Erosion Risk Rating (rainfall depth) is colour coded from **Table 1** (Based on IECA Table 4.4.2).

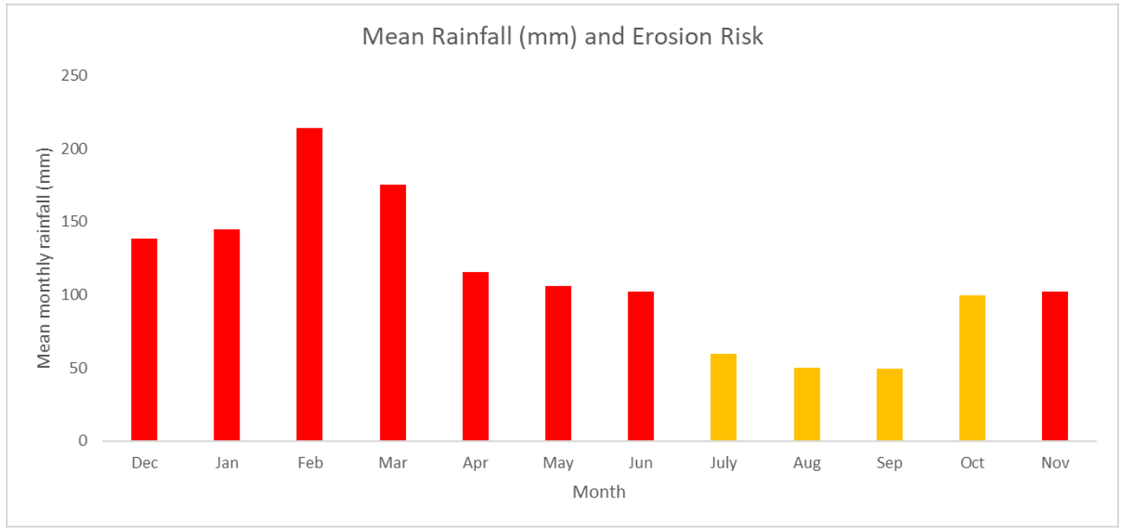


Figure 3: Mean Rainfall data, Coomera Foxwell Road Alert Weather Station #40516 (1997-2023)

Table 1: ***Erosion Risk Rating Categories (rainfall depth) as per Table 4.4.2, IECA, 2008***

Erosion Risk Rating	Average Monthly rainfall depth (mm)
Very Low	0 to 30
Low	30+ to 45
Moderate	45+ to 100
High	100+ to 225
Extreme	>225

3.2 Topography and drainage

Based on contours presented on the IFC Drawings and the Geotechnical report prepared by Pacific Geotech in January 2023, 'the site topography typically comprises a ridge line which meanders in a north south lineation through the centre of the site. The ridge line typically comprises flat or gentle sloping terrain of less than 5° in slope gradient. This ridge line is flanked to the east and west by mild sloping terrain typically ranging between 5° and 15° in slope gradient with some localised steeper areas ranging up to approximately 20° in slope gradient.' (*Geotechnical Investigation and Landslide Risk Assessment for proposed residential subdivision, end of Courtney Drive, Upper Coomera, January 2023, Pacific Geotech*)

Numerous drainage lines are currently present across the site, with the main drainage line traversing from the South western corner towards the north, a wide drainage area discharges to the west and another drainage feature discharges to the north. Each drainage line moves through an existing dam within the confines of the site prior to discharging offsite. The project shall utilize these existing dams as part of the clearing and grubbing phase of the project until the final sediment basins can be established for utilization during earthwork stages.

3.3 Soils

Soils located onsite consist of high plasticity clay soils or clayey sands.

4. RISK ASSESSMENT

4.1 IECA Soil loss assessment

Based on the requirements of IECA (2008), an erosion risk assessment has been conducted using the Revised Universal Soil Loss Equation (RUSLE). The calculated soil loss is then used to determine the level of sediment control required.

$$A = K \times R \times LS \times P \times C$$ Equation 1 (IECA 2008)

Where:

A is the predicted soil loss (t/Ha/yr)
K is the soil erodibility factor
R is the rainfall erosivity factor
LS is the slope length/gradient factor
P is the erosion control practice factor
C is the ground cover and management factor

4.1.1 K - Factor - Soils

Soils located onsite consist of Sandy Clay/ Clay present in area. As such a conservative assumption has been made for the K factor resulting in an adopted K factor of 0.051.

4.1.2 R - Factor - Rainfall

An annual erosivity factor of 5489 has been adopted based on a 2-year, 6-hour rainfall intensity of 15.6mm/hr and the following equation from section E3.2 of IECA (2008).

R = 164.74 (1.1177)S S0.6444

4.1.3 LS – Slope Length

As described in Section 3.2, the topography of the site comprises of moderate slopes. Based on existing/design surface levels, LS factors have been adopted as follows:

- Grades up to 8.75%, slope length will be limited to 25m between checks – adopted LS-factor 2.05

4.1.4 Cover (C) and Practice (P) Factors

A C factor of 1 has been adopted in accordance with industry practice to reflect the worst-case level of cover offered during the proposed development activities.

The P factor represents the combined effect of management practices and structural methods to control erosion. An industry default P factor value of 1.3 has been applied to the risk assessment, which is recommended for the construction phase condition (per table E11 of IECA, 2008).

4.1.5 Estimated Soil Loss

Results of the erosion risk assessment are presented in **Table 2**. Sediment control type derived from IECA (2008) Table 4.5.1

Table 2: Estimated soil loss from each site catchment

Site	Disturbed Area (HA)	R	K	LS	P	C	A (t/ha/yr)	Adopted Control	Comment
Catchment 1	4.36	5489	0.05	1.47	1.3	1	535	Type 1	Check dam spacing at 25m; excavated sediment traps at outlet/discharge locations; and C-factor reduction during months when soil loss exceeds 12.5t/ha/month i.e. from December to March. Note: C-factor reduction can be achieved in a number of ways including application of soilbinder and revegetation treatments
Catchment 2	2.91	5489	0.05	2.05	1.3	1	746	Type 1	
Catchment 3	5.4	5489	0.05	2.05	1.3	1	746	Type 1	

Due to an estimated soil loss of a maximum of 746t/ha/yr based on the construction stage of the proposed works and maximum area proposed for disturbance associated with the project, the Erosion risk is nominated as High in accordance with Table 4.4.3 of IECA (**Table 2**). Erosion and sediment control will be installed for the project in accordance with the risk profile and specific constraints of the site (Table 4).

Table 4: Erosion risk rating based on estimated soil loss rate (as per Table 4.4.3 IECA 2008)

Erosion Risk Rating*	Soil loss (t/ha/yr)
Very Low	0 to 150
Low	150+ to 225
Moderate ✓	225+ to 500
High	500+ to 1500
Extreme	>1500

Table 5: Erosion Control Standards

Erosion Risk as per Table 4.4.7 of IECA	Limit of forward Clearing	Stabilisation – Temporary	Stabilisation – Permanent
All	All reasonable and practicable steps 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 building/construction works.		
Low	Clearing and stripping is limited to 8 weeks prior to the scheduled commencement of bulk earthworks	Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 30 days	Disturbed soil surfaces are stabilised with a minimum 70% cover within 30 days of the completion of works within any area of a work site.
Moderate	Clearing and stripping is limited to 6 weeks prior to the scheduled commencement of bulk earthworks	Unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 20 days.	Disturbed soil surfaces are stabilised with a minimum 70% cover within 20 days of the completion of works within any area of a work site.
High	Clearing and stripping is limited to 4 weeks prior to the scheduled commencement of bulk earthworks	Soil Stockpile & unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 10 days.	Disturbed soil surfaces are stabilised with a minimum 75% cover within 10 days of the completion of works within any area of a work site

5. GENERAL NOTES

- This Erosion and Sediment Control Plan (ESCP) has been prepared to provide a site specific ESCP to demonstrate the management of erosion and sediment control in accordance with the Best Practice Erosion and Sediment Control Guidelines (IECA, 2008).
- This ESCP shall be supplemented by Progressive Erosion and Sediment Control Plans (PESCP). PESCPs are to be developed to identify the specific location and, where required, additional erosion and sediment controls applicable to individual work stages. PESCPs shall be documented via mark ups to approved plans. Where a change in the level of sediment control standard is proposed in a PESCP, the PESCP shall be reviewed and approved by an appropriately qualified person prior to the change being implemented.
- Minimise the extent and duration of disturbance, maintaining existing ground cover to the greatest extent possible.
- Commissioning / decommissioning of plant and refuelling to be undertaken a minimum of 30m away from any watercourse/drainage line.
- All ERSED controls to be inspected regularly (weekly, pre/post rainfall event i.e. forecast or actual rainfall of >10mm) with maintenance/repairs to be undertaken when necessary
- Revegetation of disturbed/bare areas to be progressively implemented
- Where clean water drains and sediment traps/sumps are necessary, all clean water drains and sediment traps and associated drainage must be installed and commissioned prior to the commencement of any grubbing works within the catchment area
- All controls must be installed within approved project footprint.
- Ensure all site access is stabilised with rumble grid and clean rock.

6. STAGING

Stage 1 - Vegetation removal, clear and grub, topsoil strip	Phase 1: • Site Establishment of access tracks, clearing and minor topsoil strip in locations for clean water drains only, installation of clean water drains, diversion bunds, clean water diversion drains, sediment basins and traps and other appropriate erosion and sediment controls. Temporary crossings are also to be installed where necessary with clean water diversion drains. Phase 2: • Clearing and grubbing to commence on approval from Project Environmental Site Representative of all clean water drains, sediment traps/basins and establishment controls installed appropriately. Clearing to commence in a sequential approach. Clearing activities will only remove large vegetation and retain groundcover wherever possible. • Vegetation will be stockpiled downslope of cleared zone and accessible from access track in readiness for mulching. Phase 3: • Mulching of stockpiled vegetation and stockpiling of mulch or integration into erosion and sediment controls. Phase 4:

	• Topsoil strip to commence in a staged approach across site and topsoil placed in designated topsoil stockpile areas with controls installed and maintained.
Stage 2 – Bulk Earthworks	Phase 1: • Cut and fill will continue through footprint, establishing supplementary controls as required (locations tbd onsite) such as mulch bunds and sediment fence or geofabric overplaced and wrapped up to act as filter fence at base of fill zones and around drainage inlet locations. Stabilisation to occur on cut/fill batters throughout works. Areas to be progressively revegetated as they are completed. Phase 2: • Civil works to commence, ensuring all site dirty water is directed into existing site sediment basins.
Stage 3 – Stabilisation/ Revegetation	• Site wide stabilisation and revegetation via seeding of any areas not already revegetated as part of progressive stabilisation works. Site must achieve 70% vegetated cover for works to be considered effectively stabilised.

7. DEWATERING AND WATER QUALITY

- Basins to be dewatered prior to rain event that is likely to produce runoff; however, during dry conditions water may be retained in the settling pond as a source of construction water (i.e. dust suppression).
- If possible, it is recommended that dewatering/spread of collected runoff from basins be applied to well vegetated lands at least 40m away from any waterway to allow it to infiltrate within the site boundary, if this is done, ensure water is applied slowly and in a manner that avoids concentrated surface runoff and/or erosion.
- If actively discharging (pumping or siphoning) the water out of the basin, water must be treated to achieve, pH 6.5-8.5, <10mg/L oil and grease and no visible trace and a standard 90%ile total suspended solids concentration not exceeding 50mg/L or 50%ile NTU reading (as per IECA Best Practice Erosion and Sediment Control Guidelines Appendix B) and no more than a 10% increase in background conditions.
- Where captured basin water is to be used onsite for dust suppression or construction purposed, water does not require testing or treatment.

8. DESILTING

- Install an appropriate painted desilting marker in the basin to indicate top of sediment storage zone. Basin must be desilted if the next storm event is likely to cause sediment to rise above this marker point; or if sediment is already above the marker; or if the sediment has exceeded 90% of the nominated sediment storage volume.
- Removal of all sediment/materials collected from the basin to be disposed of in a suitable manner that will not cause an erosion or pollution/environmental hazard.
- Refer to ESCP for recommended volume and dimensions for proposed sediment basin. Note that all dimensions are approximate and subject to verification with review of detailed ground survey and alignment.
- All earthen embankments (for basins or otherwise) greater than 1m in height to be certified by a qualified geotechnical specialist to ensure structural integrity for the desired design criteria and anticipated period of operation
- Upon decommissioning of sediment basins, all water contained within must be removed and disposed of appropriately before the removal of any basin embankments

9. OVERVIEW OF KEY ESC TECHNIQUES

Drainage Controls – Catch Drains (CD) and Diversion Banks (DB)

This ESCP identifies the location of catch drains and diversion banks required to divert upslope clean water away from areas of soil disturbance, stockpiles and excavations, and to collect dirty runoff water from disturbed areas and stockpiles and direct it to a sediment trap and to control water flow through the worksite to avoid damage to unfinished areas of earthworks and infrastructure. Due to the presence of potentially dispersive subsoils on the site, diversion banks have been used wherever possible. Diversion banks, when constructed by pushing soil from the down-slope side, avoid exposing sodic subsoils and maintain in-situ groundcover in the flow path.

Where site mulch is available in sufficient quantities, temporary diversion banks/sediment filters may be formed from mulch. Temporary sandbag diversion banks will also be used to provide temporary diversion of water in locations of limited space and active construction areas prior to forecast wet weather.

Erosion Controls – Soil Binders

Soil binders are a form of chemical surface stabiliser and/or soil-bonding agent applied to exposed soil surfaces to control erosion. Soil binders are suitable for minor drainage lines, upper waterway banks, batters and topsoil stockpiles. Soil binders have been specified for use on batter locations and drainage lines in the project area, to provide temporary erosion control during construction activities and reduce predicted soil loss and associated requirements for sediment controls.

Soilbinders (or revegetation treatments) are required to be applied to disturbed batters between the months of December to March to reduce C-factor prior to rainfall forecast >10mm in 24 hours.

Sediment Controls

The following key sediment controls are specified in this plan and have been applied to individual catchments based on the results of the RUSLE soil loss predictions (Section 3.5).

Sediment basins – Due to the size and slopes present onsite, one Type D sediment basin has been nominated to capture and treat site runoff in applicable catchments.

Rock Checks/Filter Dam (Type 2) – Where drainage topography allows, rock checks and rock filter dams have been utilised to slow the velocities of site dirty water.

Sediment Fence (Type 3) - Sediment fences have been nominated to provide sediment controls in locations that are likely to receive predominantly sheet flows. Used in conjunction with concentrated flow sediment treatment techniques. Where site mulch is available in sufficient quantities, Type 3/perimeter controls may be formed from mulch.

Site Exit / Entry - To prevent sediment tracking onto public roads, stabilised rock pad entry locations have been identified. Associated drainage and sediment controls have been identified to contain and treat runoff in accordance with the adopted sediment control standard for individual catchments. Adjacent roads should be inspected regularly, and any sediment deposited on public roads should be removed in a safe manner and disposed of to an approved disposal facility

10. STOCKPILE MANAGEMENT

Place stripped soil at approved stockpile locations

Stockpile topsoil at a height no greater than 2m.

Stockpile any excess subsoil or spoil separately from topsoils and at designated stockpile locations upslope of sediment traps.

Install non-woven sediment fence (bidim A34 or equiv) around stockpiles as per SD-FF-1

Where topsoil stockpiles will remain undisturbed for greater than nominated erosion standard, apply seeding of a cover crop at the rate of 10kg/ha to topsoil stockpiles. Refer to revegetation specifications for seed mix.

Where subsoil / spoil stockpiles will remain undisturbed for greater then nominated erosion standard, apply temporary cover or soil binder.

Temporary Stabilisation Erosion Standard

Month	Temporary Stabilisation Erosion Standard
Dec, Jan, Feb	10 days
Mar – Jun, Oct – Nov	20 days
July – Sept	30 days

11. INSPECTIONS & MONITORING

All erosion and sediment control measures, including drainage measures, must be always maintained and in proper working order during their operational life.

All drainage, erosion and sediment controls shall be inspected daily when rain is occurring (if site access is available) weekly, prior to and following a rainfall event of sufficient intensity and duration to cause on-site runoff immediately prior to and following periods of site shutdown.

Inspections shall include checks of all drainage, erosion and sediment control measures including site discharge points for:

- evidence of excessive sediment transport and or deposition either on or off site
- evidence of excessive erosion either on site or immediately downstream
- treatment and de-watering requirements for sediment basins / sediment traps
- the progress and stability of site rehabilitation and revegetation works.

Where inspections identify a non-conforming control measure, or issues that are likely to prevent the achievement of the erosion and sediment control objectives, corrective or preventative actions will be developed and implemented as necessary to achieve the required erosion and sediment control performance standards.

A written record / register of monitoring observations and maintenance tasks shall be kept on site and available for inspection.

12. SITE REHABILITATION

The following site rehabilitation requirements are to be read in conjunction with the project specific landscaping, soil management and revegetation plans and applicable project requirements. Where there is an inconsistency between the site rehabilitation measures in this document, and the project specific contract documents, the site specific and contract documents shall prevail.

Disturbed areas shall be stabilised within the following time frames

Permanent Stabilisation Erosion Standard

Month	Temporary Stabilisation Erosion Standard
Dec, Jan, Feb	10 days
Mar – Jun, Oct – Nov	20 days
July – Sept	30 days

Areas shall be considered stable once they achieve 70% cover in 90% of the relevant catchment. Temporary drainage, erosion and sediment control structures shall not be decommissioned until this level of cover is achieved within the upslope catchment.

Compacted areas / areas subject to construction traffic shall be first scarified to a minimum depth of 50mm to address compaction from construction traffic and assist in tying in topsoil. On steeper slopes (<3H:1V) scarification may alternatively be undertaken via track walking up and down the slope.

Stripped topsoil shall be reinstated in accordance with pre-stripping profiles and depths. Topsoil shall be placed at a minimum of 75mm and lightly compacted, reinstating the original top 50mm as the final layer. On slopes steeper than 4H:1V topsoil reinstatement shall be reduced to 50mm to minimise slumping.

Ensure all dispersive / sodic subsoil is adequately covered with a minimum of 50mm of non-dispersive topsoil.

Apply seed, fertiliser and hydromulch to disturbed areas as per rehabilitation specifications.

Apply follow up watering on a daily basis (subject to weather conditions) to hydromulched areas.

Any excess spoil shall be removed from the site to an approved disposal location and the stockpile location rehabilitated as per other disturbed areas

Seed Mix

Where a site-specific seed mix is not specified, the below table provides a seed mix suitable for use in site rehabilitation or temporary seeding.

Seed Mix Specifications

	Summer Blend (Nov – Feb)	Mid-Season (Mar/Apr & Sep/Oct)	Winter Blend (May – Aug)
Unhulled green couch (Cynodon dactalyon)	**35kg/ha**	**35 kg/ha**	**35 kg/ha**
Hulled green couch (Cynodon dactalyon)	**35 kg/ha**	**35 kg/ha**	**35 kg/ha**
Japanese or Shirohie Millet	**30 kg/ha**	**15 kg/ha**	**0**
Perennial Rye Grass	**0**	**15 kg/ha**	**30 kg/ha**

Hydromulch Specifications

Paper pulp at 2t/ha or wood pulp at 2.5t/ha plus tackifier at 5 to 10% by weight.

Appendix A : Progressive Erosion and Sediment Control Drawings

LEGEND

Stabilised exit

Mulch bund

Sediment Basin - in existing dam location

Sediment trap

Dirty water drain

Dirty water flow direction

Sediment trap 1
Dimensions -
10m(L) x 5m(W) x 0.6m(D)

Sediment trap 2
Dimensions -
10m(L) x 8m(W) x 1m(D)

Sediment trap 3
Dimensions -
10m(L) x 10m(W) x 1.5m(D)

Basin 1
Minimum capacity 2030m3
Spillway: 11m wide - lined with
geofab and d50 300mm rock
Note - utilise existing dam during
clearing and direct all water into dam

Basin 2
Minimum capacity 1433m3
Spillway: 10m wide - lined with
geofab and d50 300mm rock
Note - utilise existing dam during
clearing and direct all water into dam

Basin 3
Minimum capacity 2660m3
Spillway: 12m wide - lined with
geofab and d50 300mm rock
Note - utilise existing dam during
clearing and direct all water into dam

Catchment 1

Catchment 2

Catchment 3

COURTNEY DR

ROAD 01

ROAD 02

ROAD 03

ROAD 04

ROAD 11

GORDON DR

RICHARDSON CR

PATTERSON CT

RANGEVIEW ROAD

LEGEND

EXISTING KERB (INVERT)
EXISTING PROPERTY LINE
EXISTING CONTOURS
FUTURE KERB (INVERT)
FUTURE PROPERTY LINE
PROPOSED KERB (INVERT)
PROPOSED PROPERTY LINE
PROPOSED RETAINING WALL
DESIGN CONTOURS
SITE BOUNDARY
STAGE BOUNDARY

NORTH

0 15 30 45 60 75m

Scale 1:1500 - A1 (1:3000 - A3)

PROJECT NAME

COURTNEY DR UPPER COOMERA

STAGE 01

RP DESCRIPTION

LOT 188, 189, 190, 191 & 192 ON RP173728
COURTNEY DRIVE
LOCALITY OF UPPER COOMERA
LOCAL AUTHORITY - GOLD COAST CITY COUNCIL

CLIENT

HB Land

REV	DATE	DESCRIPTION	INT
B	14-07-23	RFI AMENDMENTS	EP
A	03-03-23	COUNCIL ISSUE	JB

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ASSOCIATED CONSULTANTS

BIOME WATER AND ENVIRONMENTAL CONSULTING

Robin Russell & ASSOCIATES PTY. LTD.

BENNETT+BENNETT

DRAWING TITLE

BULK EARTHWORKS
SECTION KEY PLAN

MORTONS urbansolutions
Urban & Regional Planning
Civil Engineering
Project Coordination

MUS Pty Ltd T/As
Mortons-Urban Solutions
ABN: 39 116 375 065

mortons@urbansolutions.net.au
www.urbansolutions.net.au
Tel 07 5571 1099

Postal Address
PO Box 2484
Southport QLD 4215

Gold Coast Office
Suite 9, 19 Short St
Southport QLD 4215

DESIGNED	RB	DRAWN	EMH
APPROVED	RPEQ 4706	DATE	03-03-23

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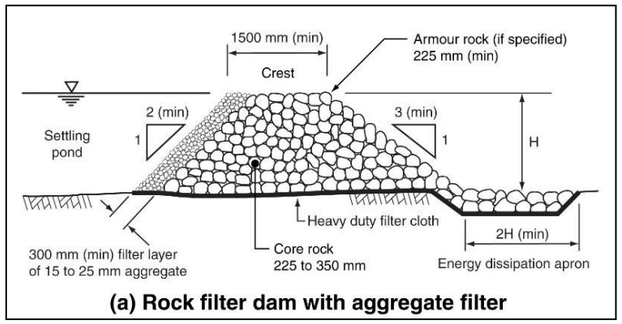
REV A

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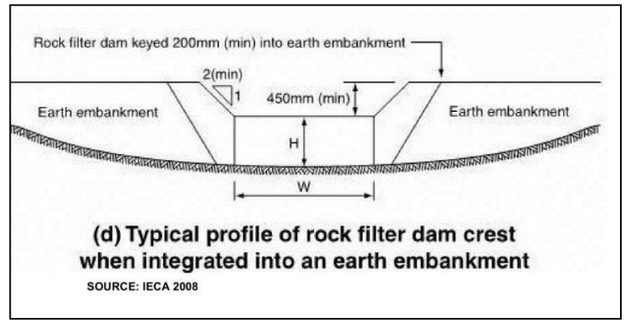
Appendix B : Standard Drawings and Calculations

Excavated Sediment Trap Calculator

Excavated Sediment Trap Calculator									
Chainage		Size only	Size only	Size only	Size only	Size only	Size only	Size only	Size only
Control design life	time	5	5	5	5	5	5	5	5
Max catchment size	m2	20000	15000	10000	7500	5000	2500	1000	500
ToC	Minutes	10.0	9.0	8.0	7.0	6.0	5.0	3.0	3.0
Rainfall	mm/h	143.0	148.0	154.0	161.0	168.0	176.0	194.0	194.0
Runoff	coefficient	1	1	1	1	1	1	1	1
Rational Method	m3/s	0.794	0.617	0.428	0.335	0.233	0.122	0.054	0.027
Particle Size targetted	lookup	0.100	0.100	0.100	0.100	0.100	0.150	0.150	0.15
Surface area	m2/m3/s	**111**	**86**	**60**	**47**	**33**	**8**	**3**	**2**
Volume at 0.6m		67	52	36	28	20	5	2	1



(a) Rock filter dam with aggregate filter

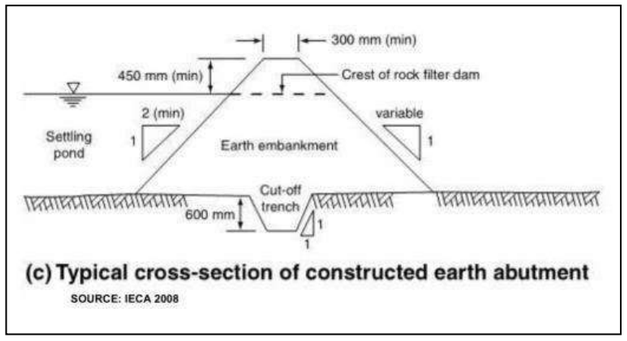


(d) Typical profile of rock filter dam crest when integrated into an earth embankment

SOURCE: IECA 2008

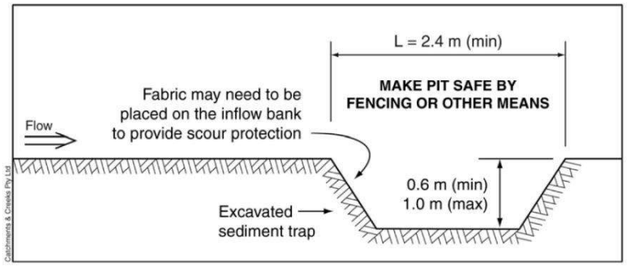
Design standard	Critical sediment size (mm)	Surface area of settling pond per unit discharge ($m^2/m^3/s$) [1]			Allowable through-velocity (m/s)
		10° C [2]	15° C [2]	20° C [2]	
Type 3 sediment trap	0.50	6	5.2	4.6	0.3
	0.20	38	33	29	0.3
	0.15	67	60	52	0.3
Type 2 sediment trap	0.10	150	130	115	0.2
	0.05	600	525	460	0.2
Type 1 sediment trap	0.04	940	820	720	0.2
	0.02	3700	3230	2860	0.2

[1] Pond area is based on a rectangular pond operating with uniform inflow conditions across its width.
[2] Assume a pond temperature the same as the typical rainwater temperature during the time of year when the pond is likely to be operating at capacity.



(c) Typical cross-section of constructed earth abutment

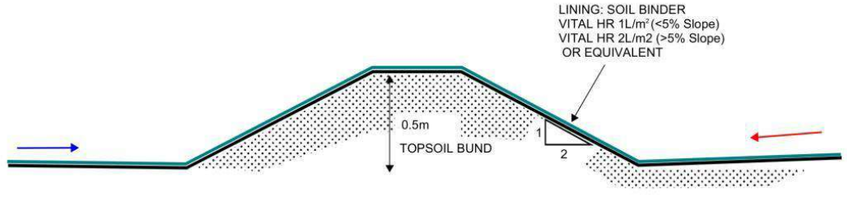
SOURCE: IECA 2008

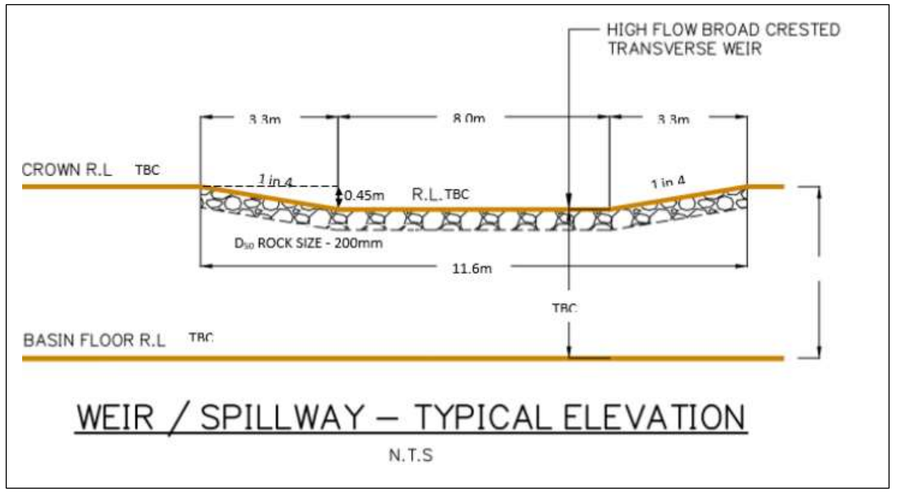


Classification	Minimum particle size	Typical trapped particles
Type 1	< 0.045mm	Clay, silt & sand
Type 2	0.045 – 0.14mm	Silt & sand [1]
Type 3	> 0.14mm	Sand
Supplementary	> 0.14mm	Sand

[1] Technically, silt particles have a grain size of 0.002 to 0.02mm, which means that only Type 1 sediment traps are likely to capture silt-sized particles. However, for general discussion purposes, it can be assumed that Type 2 systems capture a significant proportion of silt-sized particles.

DIVERSION BUND SECTION



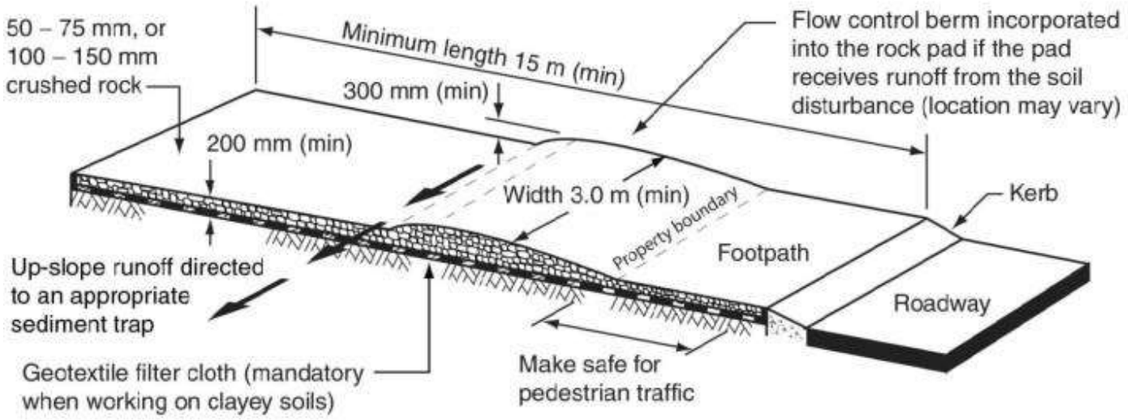


WEIR / SPILLWAY – TYPICAL ELEVATION

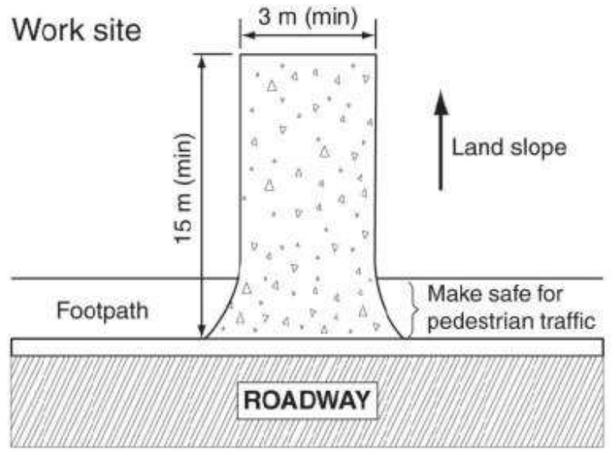
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	EROSION & SEDIMENT CONTROL PLAN **Courtney Drive Estate Stage 1-3, Upper Coomera**	**Rev: 0** **Date: 28/09/23** **ESCP No. 001**

Site access Arrangement

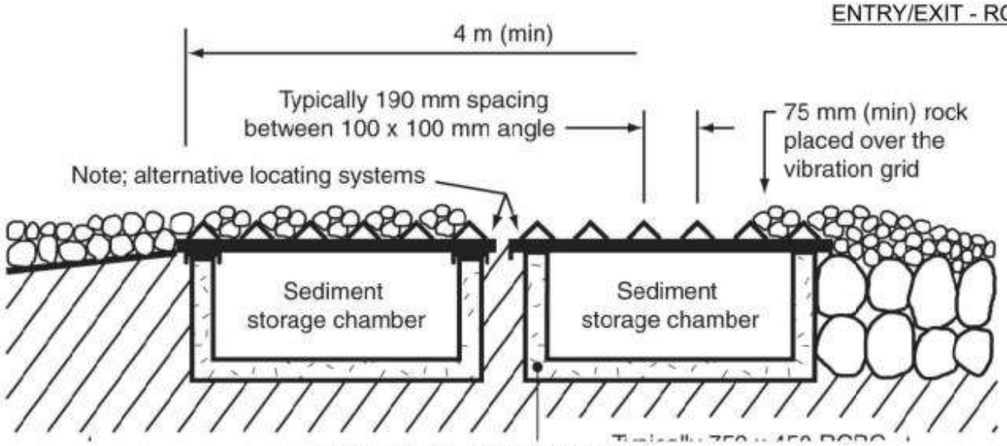


ENTRY/EXIT - ROCK

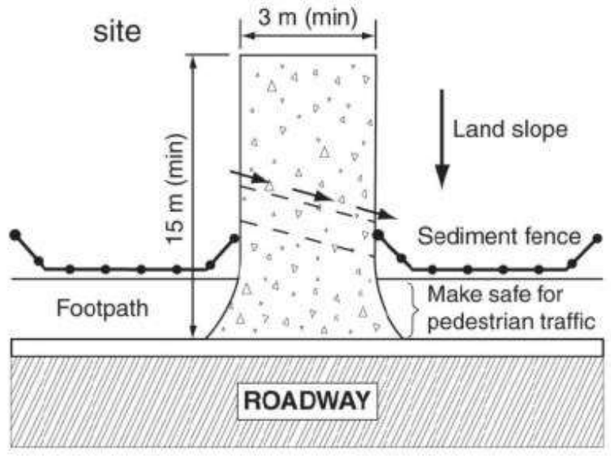


ENTRY/EXIT - ROCK
(SLOPING AWAY FROM ROAD)

ENTRY/EXIT - ROCK



ENTRY/EXIT - VIBRATION GRID



ENTRY/EXIT - ROCK
(SLOPING TOWARD ROAD)

STANDARD DRAWINGS SOURCED FROM CATCHMENT AND CREEKS

EROSION & SEDIMENT CONTROL PLAN

Courtney Drive Estate Stage 1-3, Upper Coomera

Rev: 0

Date: 28/09/23

ESCP No. 001

INSTALLATION

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

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

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

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

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

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

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

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

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

MAINTENANCE

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

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

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

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

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

REMOVAL

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

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

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

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

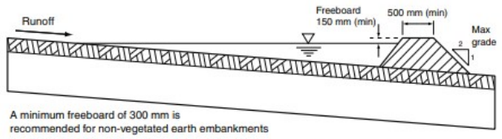


Figure 1 - Typical profile of flow diversion bank formed from earth

Table 1 - Recommended dimensions of flow diversion banks

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

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

Catchments & Creeks Pty Ltd

MATERIALS

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

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

INSTALLATION

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

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

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

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

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

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

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

MAINTENANCE

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

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

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS

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

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

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

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

REMOVAL

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

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

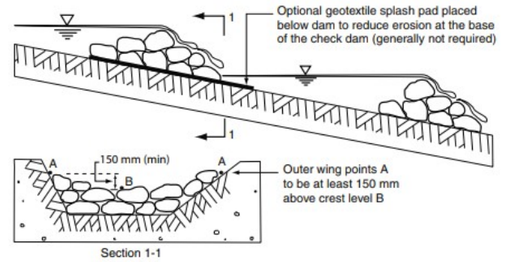


Figure 1 - Layout and profile of check dams (rock check dams shown)

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INSTALLATION

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

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

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

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

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

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

7. ENSURE THE CHANNEL DISCHARGES TO A STABLE AREA.

ADDITIONAL REQUIREMENTS FOR TURF PLACEMENT:

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

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

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

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

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

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

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

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

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

MAINTENANCE

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

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

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

REMOVAL

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

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

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

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

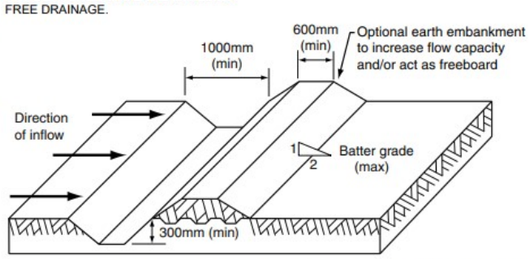


Figure 1 - Typical profile of diversion channel with bank

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GMW	Dec-09	Diversion Channels	DC-01

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MATERIALS

POLYACRYLAMIDE:
(i) CHOICE OF POLYACRYLAMIDE SHOULD BE BASED ON THE MOST ENVIRONMENTALLY SAFE, ANIONIC PRODUCT AVAILABLE. CATIONIC POLYACRYLAMIDE SHALL NOT BE USED.

(ii) POLYACRYLAMIDE USED FOR EROSION AND SEDIMENT CONTROL SHALL BE WATER SOLUBLE, LINEAR, OR NON-CROSS LINKED.

(iii) GRANULAR POLYACRYLAMIDE MUST BE STORED OUT OF THE SUN WHILE NOT IN USE.

APPLICATION

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

2. POLYACRYLAMIDE, COMBINED WITH WATER, IS VERY SLIPPER AND CAN REPRESENT A SAFETY HAZARD. APPROPRIATE MANAGEMENT OF ANY SAFETY HAZARD MUST BE ACHIEVED.

3. ENSURE ALL POLYACRYLAMIDE ARE USED FOR PURPOSES AND AT APPLICATION RATES IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS.

4. POLYACRYLAMIDE MUST NOT BE ADDED TO WATER DISCHARGING DIRECTLY FROM THE SITE.

5. PRE-DISSOLVE THE DRY, GRANULAR POLYACRYLAMIDE INTO A CONCENTRATED SOLUTION OVERNIGHT OR SEVERAL HOURS BEFORE USAGE.

6. PRIOR TO APPLICATION, ENSURE SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PRACTICES COMPLY WITH BEST PRACTICE.

7. PRE-FILL A TANK APPROXIMATELY 1/8 FULL WITH WATER PRIOR TO INPUT OF THE PRE-PREPARED, CONCENTRATED POLYACRYLAMIDE SOLUTION. CONTINUE TO FILL THE TANK WITH THE REQUIRED WATER VOLUME. THE WATER MUST HAVE LOW TURBIDITY IN THE RANGE OF 20 NTU OR LESS.

8. APPLY THE MIXTURE UNTIL THE SOIL SURFACE IS UNIFORMLY AND COMPLETELY WETTED.

9. ALL REASONABLE EFFORTS SHOULD BE TAKEN TO APPLY POLYACRYLAMIDE SOLUTION TO THE SOIL WHILE THE SOIL IS IN A 'DRY' CONDITION.

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

MAINTENANCE

1. INSPECT THE TREATED SURFACE PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT FORTNIGHTLY INTERVALS.

2. REAPPLY WITHIN 48 HOURS AFTER THE TREATED AREAS HAS BEEN DISTURBED BY EARTHMOVING MACHINERY IF EROSION CONTROL IS REQUIRED.

3. REAPPLY AS NECESSARY ON DAMAGED AREAS.

4. REAPPLICATION IS GENERALLY NOT REQUIRED UNLESS THE TREATED AREA IS DISTURBED, A PERIOD OF 60-DAYS HAS PASSED, OR UNLESS ACCEPTABLE TURBIDITY LEVELS ARE EXCEEDED. IF THE TREATED AREA HAS BEEN MULCHED, THEN REAPPLICATION MAY NOT BE REQUIRED FOR SEVERAL MONTHS.

Drawn:	Date:		
GMW	Dec-09	Polyacrylamide	PAM-01