Central Queensland Coal Project

Appendix 15a – Draft Erosion and Sediment Control Plan

Central Queensland Coal

CQC SEIS, Version 3

October 2020

Central Queensland Coal

Conceptual Erosion and Sediment Control Plan

Central Queensland Coal Project




September 2020

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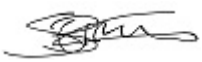
Signatures						

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1. PROJECT OVERVIEW

1.1 Project Description

Central Queensland Coal Proprietary Limited (Central Queensland Coal) and Fairway Coal Proprietary Limited (Fairway Coal) (the joint Proponents) are currently progressing through the Environmental Impact Statement (EIS) approvals process for the proposed Central Queensland Coal Mine Project (the Project).

The Project is located along the Bruce Highway, 130 km northwest of Rockhampton in the Styx River Basin in Central Queensland. It is situated within the Livingstone Shire Council Local Government Area and is located within the following properties:

- The Project is generally located on the “Mamelon” property, described as real property Lot 11 on MC23, Lot 10 on MC493 and Lot 9 on MC496.
- A train loadout facility (TLF) will also be located on the “Strathmuir” property, described as real property Lot 9 on MC230.
- A small section of haul road to the TLF will be located on the “Brussels” property described as real property Lot 85 on SP164785.

The Project will involve open cut coal mining and will be located within Mining Lease (ML) 80187 and ML 700022, which are within Mineral Development Licence 468 and adjacent to Exploration Permit for Coal (EPC) 1029, both of which are held by the Proponents. Upon approval of the EIS process, it is intended that all aspects of the Project will be authorised by a site-specific environmental authority (EA).

Development and initial early construction work of the Project are proposed to commence upon approval of the EIS and EA and extend operationally for approximately 19 years until mining and rehabilitation activities are successfully completed.

The operational phase of the Project will consist of two open cut operations that will be mined using a truck and shovel methodology and processed in two Coal Handling and Preparation Plants (CHPP). At maximum production the mine will produce 10 Mtpa of Run of Mine (ROM) coal. Rehabilitation works will occur progressively through the mine operational phase.

A new TLF will be developed to connect into the existing Queensland Rail North Coast Rail Line. This connection will allow the product coal to be transported to the established coal loading infrastructure at the Dalrymple Bay Coal Terminal (DBCT).

1.2 Purpose

This Erosion and Sediment Control Plan (ESCP) is a conceptual plan, developed for the purpose of supporting the CQC Project EIS approvals. The ESCP consolidates the

proposed strategies and information related to erosion and sediment control for the future Project and provides the framework for development of an ESCP that will be required under an Environmental Authority when approvals are obtained.

In line with *International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines 2008* (hereby referred to as 'IECA Guideline') requirements, the purpose of this conceptual ESCP includes:

- Identify environmentally sensitive areas (ESAs) and their Environmental Values (EVs) within and surrounding the project area.
- Identify risks to these ESAs and EVs due to erosion and sediment such as dispersive or acid sulphate soils or potential mass movement.
- Confirm the standard of controls that will be required to manage erosion and sediment risks based on identified ESAs and their values.
- Demonstrate to the regulatory authority that there is feasible means of constructing the Project while still protecting key environmental values.

1.3 Scope and Limitations

Due to the conceptual nature of the proposed Project, this ESCP is congruent to the level of detail required for the EIS approvals process and will be required to be updated prior to commencing operations to account for operational and environmental risks at that time.

The background information and data described within this ESCP is based on the studies undertaken to inform the EIS and Supplementary EIS (SEIS) for the CQC Project.

Similarly, proposed controls related to erosion and sediment controls may be described within other chapters and technical reports for the SEIS however additional considerations and controls (beyond those discussed in those chapters) may be outlined within this ESCP.

1.3.1 Assumptions and Exclusions

There was no risk of Acid Sulphate Soils identified within the Project area (HESSE, 2020) and as a result of operations has been described within this ESCP as low to extremely low (refer to Section 3.4.3) and its management is not included within this conceptual ESCP.

1.4 Relevant Information, Reports and Guidelines

This ESCP has been developed with consideration to:

- IECA Guidelines (2008 and 2018 Appendix B revision);
- *Department of Environment and Science (DES) Guideline - Model mining conditions, Version 6.02, 2017*;

- Legislative requirements (refer to Section 2); and,
- Technical reports/chapters for the SEIS for the Project, specifically:
  - Land, Waste Rock, Surface Water and Draft EA Conditions;
  - *Agricultural Land and Soil Suitability CQC Project* Report, prepared by Horizon Environmental Soil Survey & Evaluation, Revision 3, May 2020;
  - *Land Stability Assessment* Report, prepared by RGS, Revision 1, 11 May 2020; and,
  - *Flood Study and Site Water Balance Technical Report,* prepared by WRM, Revision 0_DRAFT, May 2020
  - *Project Sediment Budget Assessment Report,* prepared by Engeny, Revision 0, June 2020

2. LEGISLATIVE REQUIREMENTS

The relevant legislation or guidance material that have been considered in the development of this ESCP is outlined below.

2.1 Environmental Protection Act 1994 and Environmental Protection Regulation 2019

The *Environmental Protection Act 1994* (EP Act) is the primary legislation for environmental management and protection in Queensland. It plays an important role in the protection and management of Queensland's environment, particularly in relation to the regulating activities which have potential to release contaminants into the environment (defined as Environmentally Relevant Activities (ERAs)) and defines Environmental Values.

The *Environmental Protection Regulation 2019* (EP Regulation) includes Environmental Objectives and Performance Outcomes for key environmental aspects such as air, water, wetlands and land.

The ESC measures outlined within Section 5 of this report aim to manage potential erosion and sediment impacts of the Project and therefore generally aim to achieve the Environmental Objectives and Performance Outcomes under the EP Regulation.

2.2 Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity))

The purpose of the EPP (Water and Wetland Biodiversity) is to identify EVs as defined in Section 9 of the EP Act (and associated Water Quality Objectives (WQO)) for Queensland waters.

The Project is located within the Styx River Basin and as such the Project EVs and WQO are defined under the *Environmental Protection (Water) Policy 2009 Styx River, Shoalwater Creek and Water Park Creek Basins Environmental Values and Water Quality Objectives 2014* (refer to Section 3.3).

2.4 DES Guideline – Model Mining Conditions 2017

The purpose of the DES Model Mining Conditions Guideline is to provide a set of model conditions to form general environmental protection commitments for the mining activities and the EA conditions pursuant to the EP Act. The guideline states that the 'model conditions should be applied to all new mining project applications lodged after the guideline is approved', therefore the Project is subject to the criteria outlined in this guideline.

Relevant conditions that are proposed for the Project are outlined in Table 2.1.

Table 2.1 Proposed EA Conditions for the Project Relevant to Erosion & Sediment Control (Refer to Central Queensland Coal Project SEIS Version 3, Chapter 23 - Draft EA Conditions)

Proposed EA Condition Number	Proposed Condition
C5	A Mineral Waste Management Plan (MWMP) must be developed prior to the commencement of the Project and implemented. The MWMP must, at minimum, include the following items: [items a)-d) and f)-g) refer to Central Queensland Coal Project SEIS – Draft EA Conditions chapter] e) Monitoring and management of erosion, groundwater and surface water (including run-off and seepage) at ex-situ waste landforms;
F12	Releases to water must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build-up of sediment in such waters.
F27	An Erosion and Sediment Control Plan must be developed by a suitably qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.
F28	Stormwater, other than mine affected water, is permitted to be released to waters from: a) Erosion and sediment control structures that are installed and operated in accordance with the Erosion and Sediment Control Plan required by condition F27; and b) Water management infrastructure that is installed and operated, in accordance with a Water Management Plan that complies with condition F26 for the purpose of ensuring water does not become mine affected water.
Table 23-15 Rehabilitation Requirements	There are various references to the management of erosion as part of the proposed rehabilitation completion criteria for ensuring stability and post mining land uses for open cut pits, stockpiles, mine infrastructure, water infrastructure (dams and drains), haul road corridor and the train loadout facility. This criteria includes: - Installation of contour or graded drains to manage erosion for open cut pits - No active areas of rill erosion and drainage follows appropriate drainage paths - Certification that erosion activities are not greater than at comparable reference site for waste rock stockpiles and water infrastructure and evidence that vegetation type and density are of species suitable to the site and for erosion minimisation - Achieving a stable site with adequate cover and permanent drainage with no erosion issues for mine infrastructure areas, haul roads and the train loadout facility.
Table 23-16 Interim	There are various references to application of erosion and sediment controls under an ESCP as part of the proposed interim completion criteria for open cut pits, overburden stockpiles, mine

Proposed EA Condition Number	Proposed Condition
Completion Criteria	infrastructure area and roads, water infrastructure including dams, drains and sumps, haul road, road furniture and drains and the train loadout facility.

2.5 The Reef 2050 Plan and Reef 2050 Water Quality Improvement Plan

The *Reef 2050 Plan* is the overarching framework for protecting and managing the Great Barrier Reef (GBR) from 2015 to 2050 (DotEE 2015). By addressing the Reef 2050 Water Quality Targets (WQT), the Project would contribute to improving ecosystem health and water quality.

The five-year *Reef 2050 Water Quality Improvement Plan 2017 – 2022* aligns with the *Reef 2050 Plan* and seeks to improve the water quality flowing from the catchments adjacent to the Reef. The targets within the *Reef 2050 Water Quality Improvement Plan* define the reductions needed for each of the Great Barrier Reef catchments by 2025 including commitments for achieving reductions of up to 50% in sediments.

Under the *Reef 2050 Water Quality Improvement Plan*, sediment loads are assessed through the Paddock to Reef Integrated Monitoring, Modelling and Reporting Program, using a combination of monitoring and modelling data. The Paddock to Reef Program includes catchment scale water quality monitoring of sediment loads entering the GBR lagoon that is implemented through the Great Barrier Reef Catchment Loads Monitoring Program.

The proposed Project is located within the Styx Drainage Basin of the Fitzroy Natural Resource Management region of which the latter represents approximately 37 per cent of the total GBR catchment area. The annual average Total Suspended Solids (TSS) loads from the Fitzroy catchment was monitored as 2,300,000 tonnes (t) at the Fitzroy River gauging station at Rockhampton (Bartley.R et al, 2017). The 2017 Scientific Consensus Statement - A synthesis of the science of land-based water quality impacts on the Great Barrier Reef, presents a modelled rate of total TSS load exported to the coast for the Styx catchment of 0.3 t/ha/year (Bartley.R et al, 2017).

An overview of how the Project will address the WQT relevant to erosion and sediment control is provided in Section 5.7. Refer also to *Project Sediment Budget Assessment* Report (Engeny, 2020).

3. SITE CONDITIONS AND PLANNING

3.1 Site Description

3.1.1 Topography

Based on a combination of both publicly available topography data and LiDAR capture for the Project, the topography typically ranges within the Project area from 11.4 to 43.8 m AHD, whereas some of the Mamelon property further to the south has steeper slopes and reaches elevations of up to approximately 250 m AHD. The topography of the Project MLs can be described as floodplains that are generally described as flat or undulating lands which drains via several smaller creeks and tributaries to the Styx River and estuary, and into the Coral Sea (refer to Section 3.1.3).

The proposed Project will include the development of two open cut pits, two out of pit waste rock dumps and construction of mine infrastructure that will alter the local topography including localised catchment delineation and slopes. It is expected that processing areas, haul roads, ROM and associated ancillary areas will have slopes similar or less than the existing topography however side slopes of the waste rock dumps may (in the worst case) be constructed in 10 metre lifts with a maximum slope of 30%.

Refer to Figure 3.1 for an overview of the existing Project site topography.

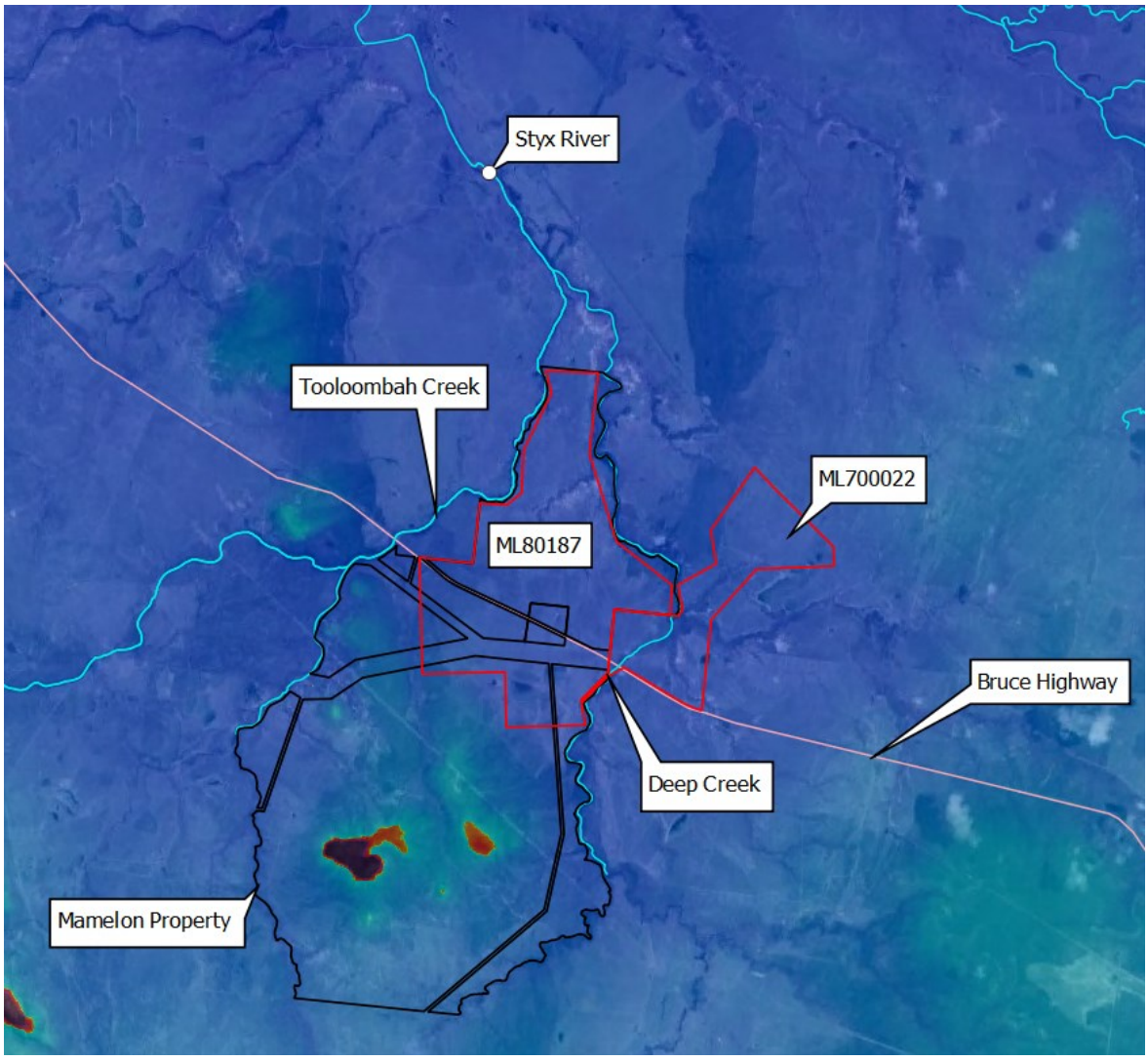

Figure 3.1 Existing Topography and Receiving Waterways for the Project

3.1.2 Land Use

The Project is located within the Styx River Basin which discharges to the GBR Marine Park. The Project is bordered by two watercourses as defined under the Water Act; Tooloombah Creek and Deep Creek. These creeks meet at a confluence downstream of the Project area to form the Styx River. The coastal zone, commencing downstream of the North Coast Rail Line, is located approximately 10 km downstream of the ML area. The GBR Marine Park is located approximately 40 km downstream of the ML area.

Cattle grazing is the primary current land use for the Project area and has been estimated to have occurred within the Project area since the early 1860s. The entirety of the Mamelon property including all road reserves (excluding the Bruce Highway) is used for grazing of which ~70% has been assessed as useable for grazing due to lack of woodlands/vegetation.

The largest source of in-stream sediment within the Fitzroy Catchment is attributed to grazing land (Bartley, R et al, 2017).

During operations, the Project will destock offset habitat within the Mamelon property which will enable any undisturbed land, including the riparian corridors and associated buffer zones, (and future rehabilitation areas), to regenerate from the existing grazing pressures.

The land within the Project disturbance area does not support any homesteads, gas or water pipelines, or communications. The existing Powerlink 275 kilovolt Stanwell to Nebo transmission alignment extends outside the southern ML 80187 boundary and the easement is situated well outside the proposed disturbance areas. Several stockyards are located within the disturbance area but will no longer be in use during mining operations.

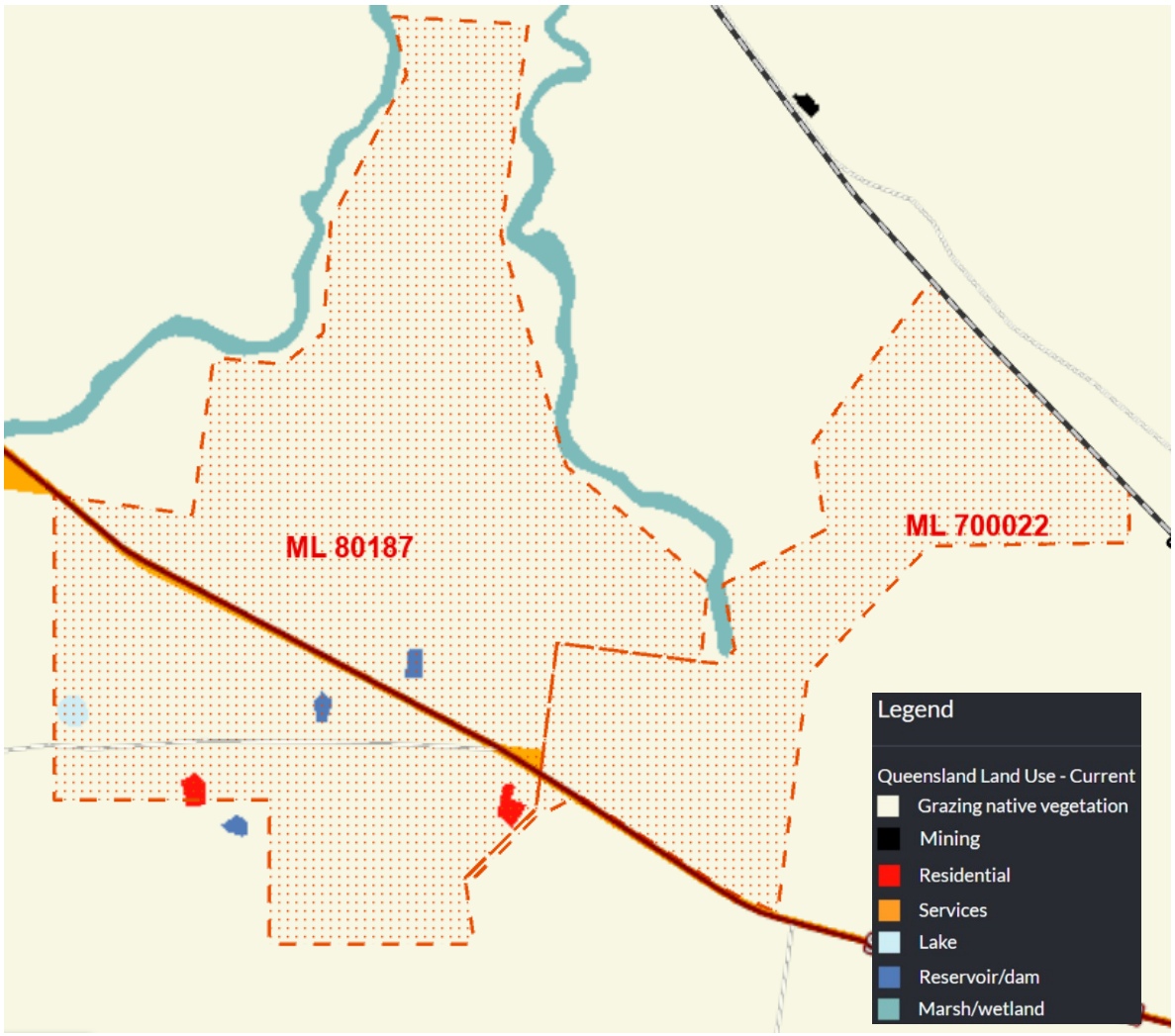

Figure 3.2 CQC Project Existing Land Use (QGlobe, 2020)

3.1.3 Waterways and Wetlands

The mine area and TLF is situated within the lower catchments of Tooloombah Creek and Deep Creek, which are sub-catchments within the Styx River catchment. Both creeks feed directly into the Styx River (2 km north of the Project area) which discharges into the Broad Sound estuary 8km to the north of the Project which is a wetland listed in the Directory of Important Wetlands of Australia. The haul road to the TLF crosses Deep Creek. Tooloombah Creek and Deep Creek are described as non-perennial or ephemeral, only flowing during and immediately following rainfall events (WRM, 2020).

Both Tooloombah Creek and Deep Creek are defined as Watercourses under the Water Act 2000. Both Tooloombah Creek and Deep Creek are located outside the Project area, however several of their tributary drainage features reside within the Project area. These drainage features are minor in nature, are ranked as either first or second order drainage features and are classified as nonperennial (QGlobe, 2020).

The proposed Project activities will not require physical disturbance (i.e. crossings or diversion) of the two Watercourses (with the exception of the haul road crossing of Deep Creek) however disturbance to the minor drainage features will be required as construction and operations of the Project progresses.

The Project area consists of several wetlands of varying size. Most of these are mapped as having been artificially created ('turkey nest' dams and dammed creek lines to support grazing). The two nearest wetlands recorded as having high ecological significance are located:

- One south of the Bruce Highway, on the western ML boundary.
- Broad Sound Estuary which is listed in the Directory of Important Wetlands located 8 km directly north.

Whilst the Broad Sound Estuary is located outside of the Project area, the wetland south of the highway will remain located within the Project area and adjacent to proposed road infrastructure and the southern waste rock dump (refer to Figure 3.4).

Refer to Figure 3.3 for an overview of the Project catchments, waterways and wetlands.

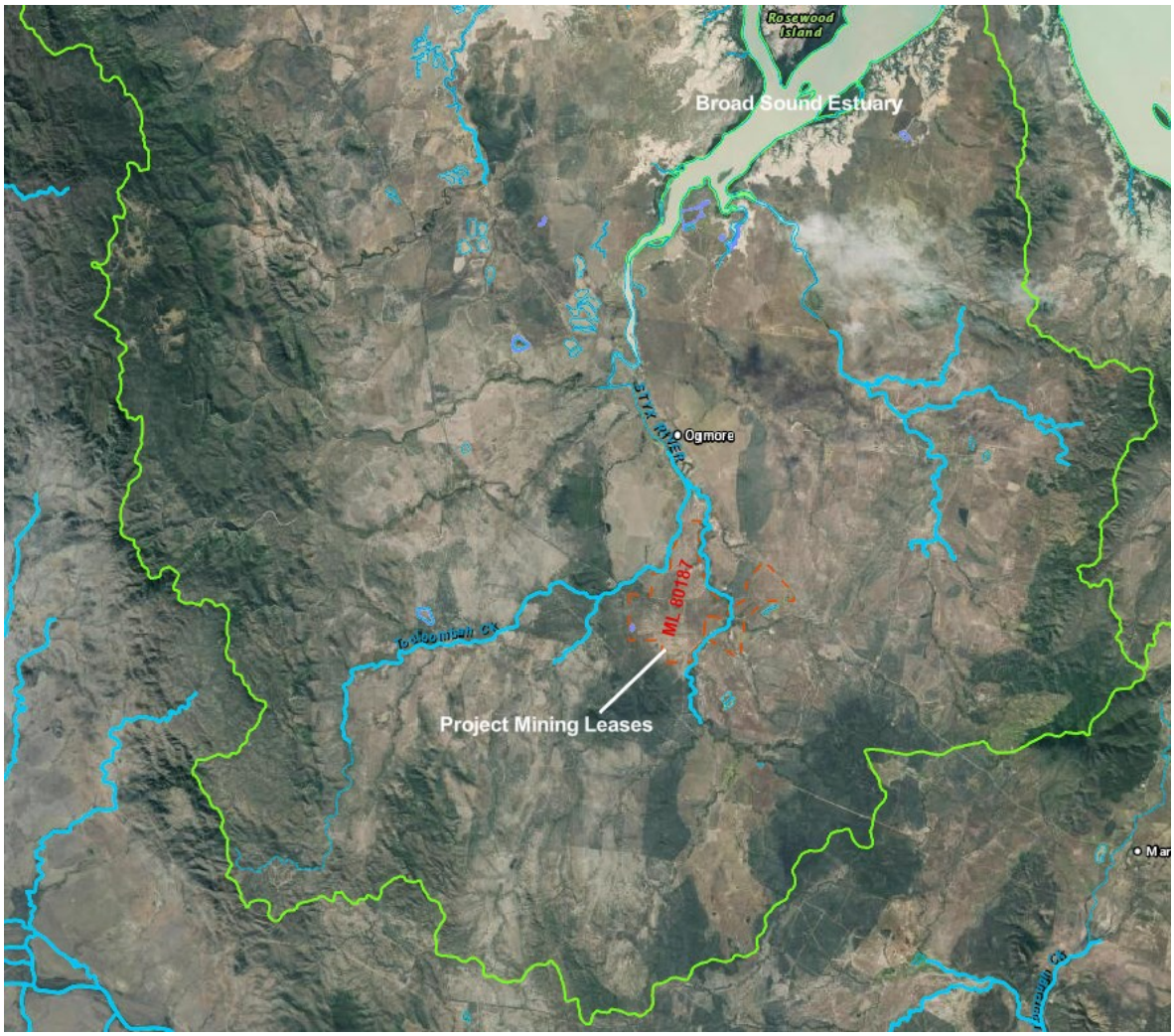

Figure 3.3 CQC Project Catchment, Waterways and Wetlands

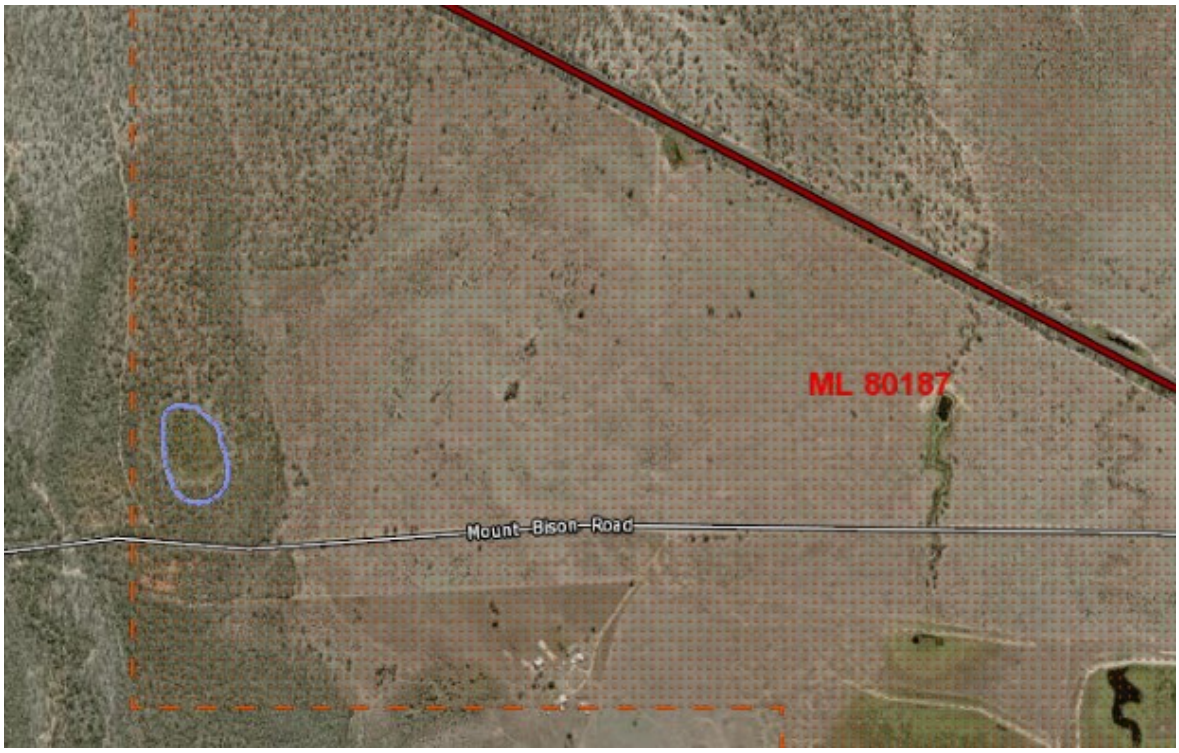

Figure 3.4 Location of Nearest High Ecological Significance Wetland in Relation to Mining Lease (QGlobe, 2019)

3.1.4 Vegetation

The Project is located within the Brigalow Belt North bioregion of which large sections have been cleared of remnant native vegetation for grazing, agriculture and mining. Areas to the north and east of the Project area have been substantially impacted by vegetation clearing associated with cattle grazing activity. Connectivity between remaining tracts of vegetation is maintained only by thin strips of riparian vegetation along Tooloombah and Deep Creek.

Some clearing of vegetation will be required within the Project area to facilitate construction and operations of the mining activities.

Outside of the Project area, woodland and open forest habitat to the south and east of the site remains contiguous with an extensive tract of remnant vegetation, which includes Tooloombah Creek Conservation Park. To the west of the Project remains extensive tracts of remnant forest associated with the nearby Broad Sound Range..

3.2 Environmentally Sensitive Areas and Environmental Values

It is important to identify all ESAs and EVs within and surrounding the Project to ensure the design basis for erosion and sediment controls considers and mitigates against any potential impacts to these features.

ESA mapping identified one Category B ESA within the Project area associated with remnant vegetation listed as Endangered under the *Vegetation Management Act 1999.*

Several Category A, B and C ESAs as defined under the EP Regulation are located within 50 km of the Project area (refer to Table 3.1).

Tooloombah Creek Conservation Park (Category A) is located less than 1 km west of the ML boundary. The Great Barrier Reef World Heritage Area and Great Barrier Reef Marine Park boundaries and Broad Sound Fish Habitat Area overlap (all Category B) and are located 8 km north of the Project. Waters associated with the Styx River are also designated as a 'coastal management district' which is also a Category C ESA.

The key ESAs relevant to the ESCP will be those located directly adjacent to or downstream of the Project.

Table 3.1 Environmentally Sensitive Areas within 50km of the Project area

Environmentally Sensitive Area	Category	Approximate distance to Project area (km)
		Mine area
Tooloombah Creek Conservation Park	Category A	0.8
Great Barrier Reef World Heritage Area	Category B	8.0
Bukkulla Conservation Park	Category A	16.9
Marlborough State Forest	Category C	16.5
Eugene State Forest	Category C	19.0
Mt Buffalo State Forest	Category C	25.0
Develin Nature Refuge	Category C	19.0
Burwood Nature Refuge	Category C	19.3
Great Barrier Reef Marine Park – general use area	Category B	8.0
Fish Habitat Area – Broad Sound	Category B	8.0
Endangered remnant vegetation	Category B	Within entire 25 km radius
Marine Plants	Category B	7.5 (north – associated with Styx River estuarine plain)
Coastal Management District	Category C	2.0 (north – associated with Styx River)

EVs for the waterways within and surrounding the Project area are defined within the *Environmental Protection (Water) Policy 2009 - Styx River, Shoalwater Creek and Water Park Creek Basins Environmental Values and Water Quality Objectives* and are outlined in Table 3.2.

Surface fresh waters within and surrounding the Project area have been assessed as having environmental value for all defined EVs except Aquaculture and Industrial Use.

Table 3.2 Surface Water Environmental Values (Orange Environmental, 2020)

Environmental Value	SURFACE FRESH WATERS in developed areas (e.g. urban, industrial, rural residential, agriculture, farmlands) - Southern Styx fresh waters (including Granite, Tooloombah and Wellington creeks)
Aquatic ecosystems	✓
Irrigation	✓

Environmental Value	SURFACE FRESH WATERS in developed areas (e.g. urban, industrial, rural residential, agriculture, farmlands) - Southern Styx fresh waters (including Granite, Tooloombah and Wellington creeks)
Farm supply	✓
Stock water	✓
Aquaculture	
Human consumer	✓
Primary recreation	✓
Secondary recreation	✓
Visual recreation	✓
Drinking water	✓
Industrial use	
Cultural and spiritual values	✓

3.3 Water Quality Objectives

Unlike urban development where planning schemes and the IECA Guidelines provide an indicative total suspended solids concentration target for sediment control during construction, model mining conditions for proposed coal mines do not currently stipulate any water quality targets for waters managed under an ESCP.

Therefore, Water Quality Objectives (WQOs) are relevant to the ESCP as they will assist in defining the performance criteria or water quality targets required to assess the performance of any proposed erosion and sediment controls.

The WQO for suspended solids within the *Environmental Protection (Water) Policy 2009 - Styx River, Shoalwater Creek and Water Park Creek Basins Environmental Values and Water Quality Objectives* for lowland fresh waters (Deep and Tooloombah Creeks) is <10 mg/L. There is currently no determined suspended solids WQO for the estuary waters such as the Styx River.

Baseline water quality sampling for receiving waterways indicated that the 80th percentile of baseline suspended solids concentrations are above the WQO (Orange Environmental, 2020).

Turbidity shows a similar pattern to suspended solids, although in comparison to the GV more sites are below the criterion – Deep Creek remains above, as do Mamelon, Neerim Creeks, and the dams.

Deep Creek shows much higher suspended solids and turbidity levels than any sampled location, with an overall median of 30 mg/L and 165 NTU respectively, compared to around 10 mg/L and 10 NTU for the sampled locations (Orange Environmental, 2020). Ongoing monitoring and understanding of local background water quality concentrations will continue to inform suitable trigger levels for future monitoring of the performance of the proposed erosion and sediment control measures (refer to Section 5.7 and 5.9).

3.4 Soils Classification

Soil characteristics for the Project area were assessed via both desktop and field studies.

3.4.1 Desktop Results

The land systems and their associated major soil types for the Project area were assessed using the Capricornia Coast St Lawrence-Marlborough Area land systems survey - Department of Primary Industries 1995 (HESSE, 2020),.

Results from the desktop assessment identified Plainview soils as the most extensive (2,141 ha, Class C2), being a poorly mapped complex of Black and grey, strongly sodic cracking clays; bleached loamy and clay loamy surface, brown and grey, alkaline sodic duplex soils. Somerby (869 ha, Class C1) grey and brown strongly sodic cracking clays are the next most extensive land system across the Project area. These were followed by:

- Tooloomba bleached sandy and loamy, brown and grey sodic duplex soils (500 Ha, Class C2);
- Woodstock red, massive, gradational loams and clay loams (444 Ha, Class C2);
- Styx brown, massive fine sandy loams (132 Ha, Class A);
- Torilla red, structured gradational clay loams and uniform clays (119 Ha, Class C2);
- Blackwater Grey, brown and black cracking clay soils (8 Ha, Class A); and,
- Artillery brown and grey sodic duplex soils (3 Ha, Class C2).

3.4.2 Field Results

Field soil sampling was conducted in accordance with technical guidelines (refer to Soil and Land Suitability Technical Report (HESSE, 2020)) with 145 soil observations including 54 full soil samples.

The relevance of identifying and field-testing soil types for the ESCP is critical to informing the design of suitable erosion and sediment controls. For example, key laboratory testing results confirmed the soil map units across the Project site to be made up of the following:

- The majority of the Project area is of a Sodosols soil type.
- The southern boundary of the ML80187 and some areas near the TLF are of a Kandosols soil type.
- The areas of lower elevation within the northern end of ML80187 contains both Sodosols and Vertosols.

There are three major soil units in the project area and all three are determined to have moderate to very high exchangeable sodium concentrations, making them dispersive and susceptible to erosion (RGS, 2020).

The topsoil material was described as having a relatively high risk of erosion from wind and water and is generally limited to 0.2 to 0.3 m depth (HESSE, 2020). Subsoils below these depths are characterised by increased sodicity, salinity and dispersive behaviour (HESSE, 2020). Soil pH ranged from moderately acidic (Kandosols) to strongly alkaline (Vertosols and some Sodosols).

It should be noted that soil sampling discussed above was limited to topsoils and sub-soils (horizon A and B) which will remain relevant for any surface disturbance however waste characterisation studies indicated that the overburden, interburden and potential coal reject materials, which will be exposed and stockpiled during operations, were also determined to have high exchangeable sodium concentrations and would therefore have a very high potential for dispersion (RGS, 2020).

3.4.3 Acid Sulphate Soils

The project area (in which disturbance could take place) is above 20 m elevation and is free from drainage water hazards from acid sulphate soils (HESSE, 2020).

Geochemical characterisation was undertaken for 174 samples (including overburden, interburden and rejects material). The majority of the samples were classifiable as non-acid forming. The acid drainage potential of the rejects was determined to be negligible (RGS, 2020).

3.5 Contaminated Land

A search of the DES Environmental Management Register (EMR) and Contaminated Land Register (CLR) database was undertaken to determine whether a notifiable activity has been undertaken within the Project area. The EMR provides information on historic and current land uses, including whether the land has been, or is currently used for a notifiable activity, or has been contaminated by hazardous material.

The CLR includes land that has been proven (through investigation) to be contaminated and is causing or has the potential to cause serious environmental harm. Therefore, land will only be recorded on the CLR when an investigation shows it is contaminated and action must be undertaken to remediate or manage the land.

There are no land parcels within the Project area that are listed on the EMR or CLR (refer to the Central Queensland Coal Project SEIS Version 3, Chapter 5 - Land).

4. EROSION AND SEDIMENT LOSS RISK ASSESSMENT

The risk of erosion and consequent loss of sediment has been calculated for the Project for both the existing pre-mine condition (baseline) and operationally which accounts for waste rock material and the layout of the proposed Mine.

4.1 Baseline Assessment

The erosion and sediment loss risk for the pre-mine scenario is governed by the soil type, soil cover, topography and slope, rainfall intensity and land use, being grazing. Understanding the baseline erosion and sediment risk assists in quantifying the current sediment load contributions to the environment as a result of agricultural activities undertaken on the Project site that will cease when the Project is operational.

4.1.1 Paddock to Reef Program

Government programs like the Paddock to Reef program are aimed at both monitoring and modelling the land and catchments that report to the GBR and the water quality factors that influence it.

The annual average Total Suspended Solids (TSS) loads from the Fitzroy catchment was monitored as 2,300,000 tonnes (t) at the Fitzroy River gauging station at Rockhampton (Bartley.R et al, 2017). The 2017 Scientific Consensus Statement - A synthesis of the science of land-based water quality impacts on the Great Barrier Reef, presents a modelled rate of total TSS load exported to the coast for the Styx catchment of 0.3 t/ha/year (Bartley.R et al, 2017).

4.1.2 Soil Loss Modelling

Erosion rates and sediment generation loads incorporating the impacts of grazing land uses were also modelled as part of the nearby Lower Fitzroy River Infrastructure Project EIS, using soil types and slopes from Yaamba and Rookwood in Central Queensland that are representative of the Project area. The modelling was conducted using HowLeaky? which is a water balance and water quality conceptual model (State of Queensland, 2016). The resultant sediment generation rates are outlined in Table 4.1 covering a range of grazing intensities, topography and soil types.

Table 4.1 Modelled Annual Sediment Loads, Lower Fitzroy River Infrastructure Project, Yaamba Climate Data (extract from State of Queensland, 2016)

Land Use, Soil Type and Grazing Intensity	Annual Sediment Load Rate (t/ha/year)
Floodplain, vertosol/sodosols – low stocking pasture	0.34
Floodplain, vertosol/sodosols – moderate stocking pasture	0.72

Land Use, Soil Type and Grazing Intensity	Annual Sediment Load Rate (t/ha/year)
Floodplain, vertosol/sodosols – excess stocking pasture	1.6
Upland Slopes, sodosols – moderate stocking pasture	1.9

4.1.3 Sediment Generation Estimation for the Project Areas

As grazing is known to take place across the majority of the Mamelon property and the Project area is located in the floodplain, it is considered reasonable to assume that the sediment load rate of 0.72 t/ha/year is most representative of the current land use management for the Project area and can be used to estimate the baseline sediment generation loads.

The resulting estimated soil loss for the mining leases and Project Disturbance Area are presented in Table 4.2.

Table 4.2 Estimated Baseline Sediment Generation

Area	Approximate Surface Area (ha)	Estimated Soil Loss (t/year)
Mamelon Property	6,250	4,500
Mining Lease - ML80187	1,915	1,379
Mining Lease - ML700022	746	537
Disturbance Area Footprint (Refer to Section 4.2.1)	1,375	990
Total (Baseline) (Mamelon Property and ML 700022)	**6,996**	**5,037**

4.2 Construction and Operational Assessment

The erosion and sediment risk assessment has been calculated based on the proposed mine layout described in Section 4.2.1 and illustrated in Figure 4.1.

4.2.1 Proposed Mine Layout and Activities Relevant to the ESCP

Construction and operation of the mine will disturb approximately 1,375 hectares of land which will consist of:

- Open Cuts 1 and 2.

- Two CHPPs and product coal stockpiles.
- Two Run of Mine (ROM) coal stockpile areas and ROM dump station.
- ROM coal haul roads and waste rock haul roads.
- Product coal and conveyor.
- Water infrastructure including water supply and mine affected water dams, sediment affected water dams and clean water dams.
- Light and heavy vehicle internal roads and access roads.
- Buildings associated with the construction and operation of the mine including administration buildings, workshop, fuel storage and light vehicle parking.
- 5.48 km haul road from the product stockpiles to the TLF including the return haul road loop.
- Sub-surface power, water and telecommunications services.
- Rail loop connecting to the North Coast Rail line.
- Hardstand area to receive product coal haul trucks from the haul road.

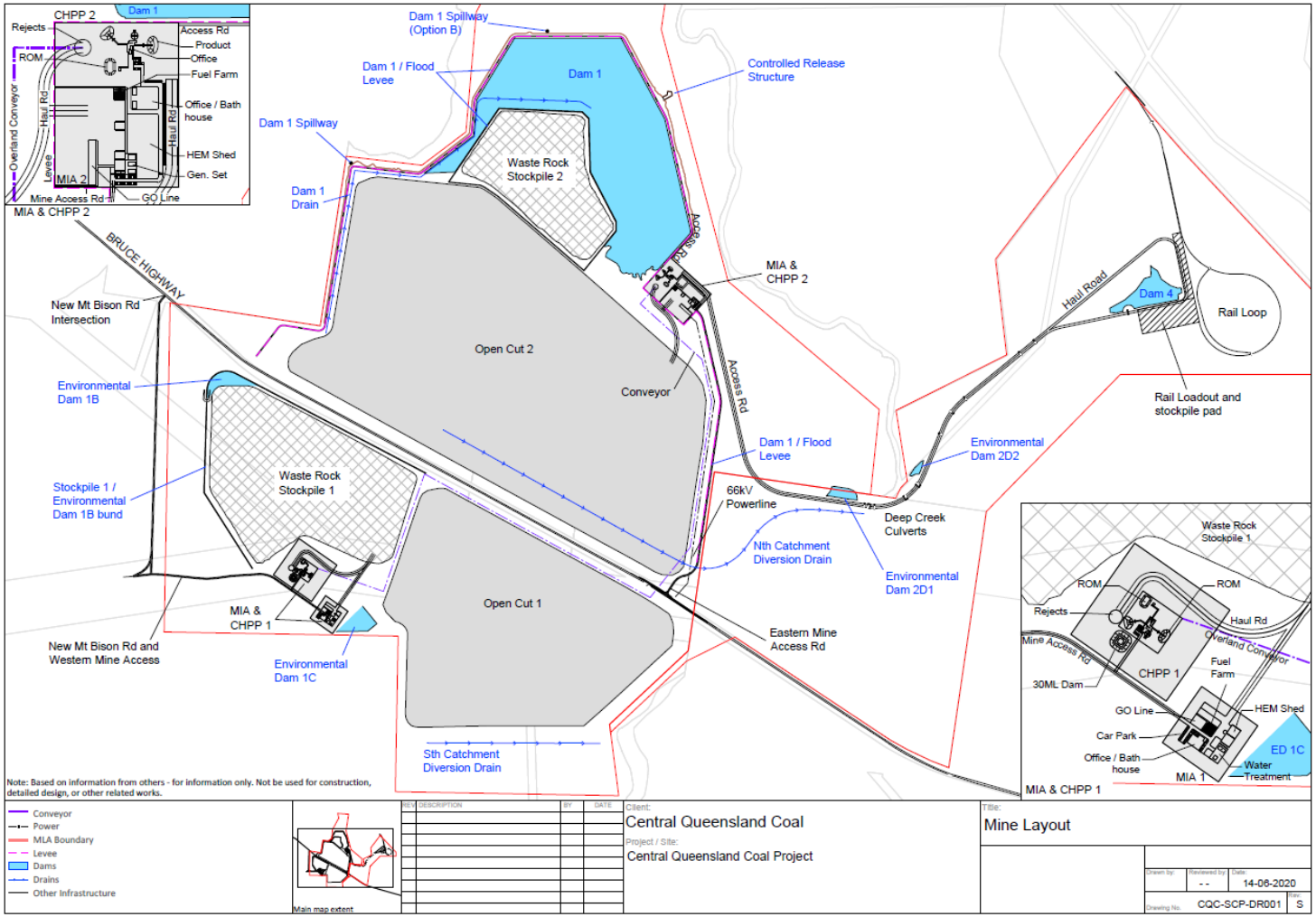

Figure 4.1 SEIS Mine Layout (CQC, 2020)

4.2.2 Estimated Soil Loss

Estimated soil loss as a result of erosion has been estimated for the 'worst-case' sediment generation scenario for the Project (Refer to Figure 4.2) which is conservatively represented by:

- The two out of pit dumps at their maximum footprint but prior to reshaping for the final landform to reduce batter slopes and/or establishment of rehabilitation.
- The two pits backfilled to their associated consequent minimal footprint.

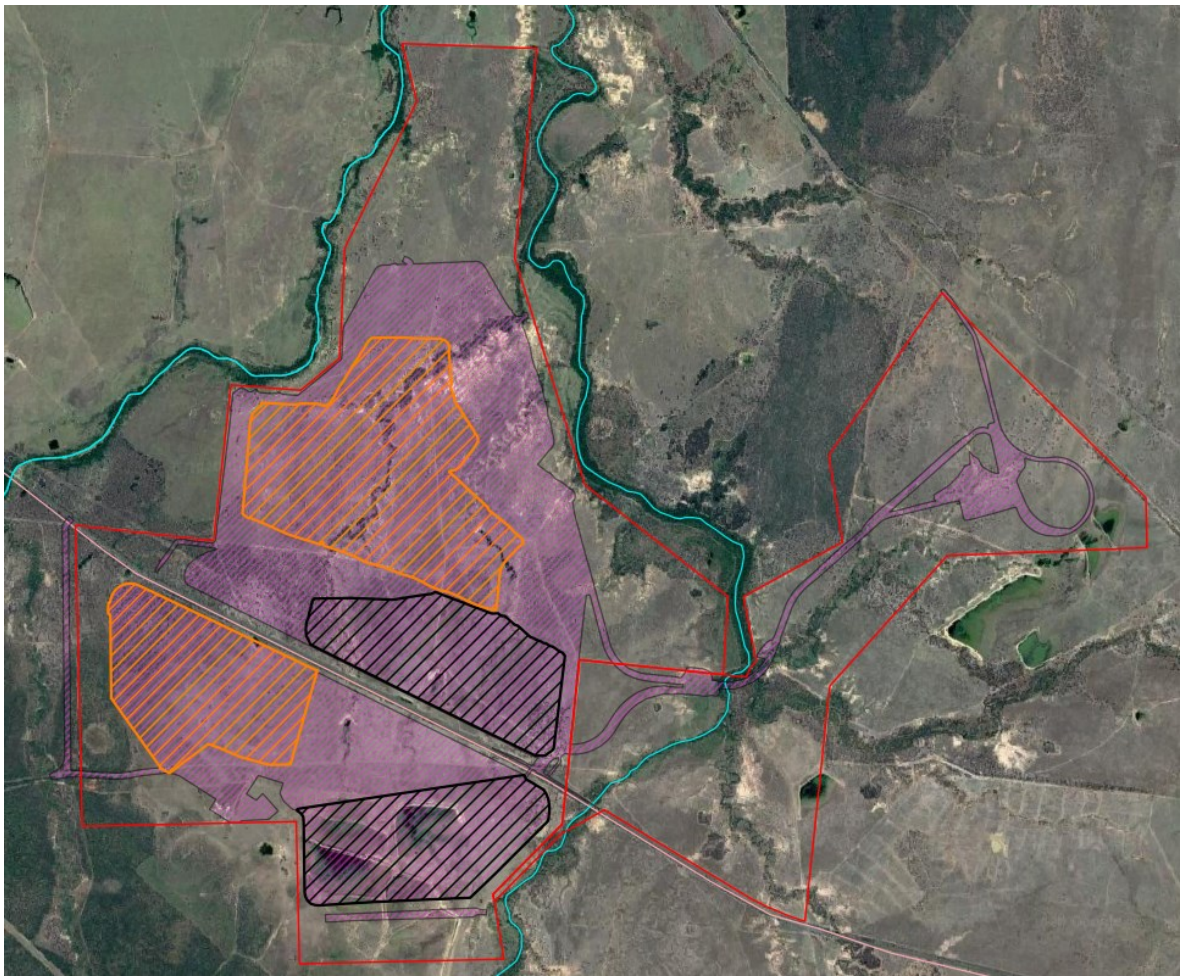

Figure 4.2 Conceptual 'Worst-Case' Disturbance Footprint of the Pits (Black Shading) and Out of Pit Dumps (Brown Shading) for use in the RUSLE

The soil loss has been estimated by applying the Revised Universal Soil Loss Equation (RUSLE):

$$A = K \times R \times LS \times P \times C$$

A is the estimated soil loss in tonnes/hectare/year

K = 0.06 (adopted conservative soil erodibility factor derived from Table E4 of IECA with additional 20% increase to account for the surface and subsoils as well as overburden and interburden material which are likely sodic and dispersive)

R = 3,665 (rainfall erosivity factor calculated based on the 2 year Average Recurrence Interval (ARI) 6 hour rainfall event for the Project location as per IECA Guidelines). Whilst construction and disturbance during the wet season will be avoided where possible (refer to Section 5), the annual R factor has been applied to account for conservative rainfall erosivity for the soil loss estimations.

LS = variable dependant on the length and slope of the catchment. The Project area has been characterised by a LS factor range from 0.2 in gently sloped areas to 2.23 for the out of pit dumps with their maximum slopes. During later stages of operations, it is expected that processing areas, haul roads, ROM and associated ancillary areas will have slopes similar or less than the existing topography however side slopes of the waste rock dumps have conservatively been assumed to be ten metre lifts with a maximum slope of 30%. The ESCP and RUSLE calculations will be updated prior to these operational phases and any consequent changes to ESC measures assessed.

P = 1.3 which is the default conservative construction phase value representing a compacted and smooth surface.

C = 1.0 which is the default conservative construction phase value representing no ground cover or management

The key proposed mitigation measure for sediment control during operations is the construction and operation of a number of water storages to capture surface water runoff that may have entrained sediment. There are six water storages proposed that will receive runoff from disturbed areas (Refer to Figure 4.1 and Section 5.6.3). In order to incorporate the effectiveness and impact of these structures in reducing the overall sediment generation that enters the receiving environment, the RUSLE was applied to each dam catchment within the 'worst-case' scenario with their associated slopes and expected soil types. The mine pits internally drain and are therefore not included within each dam's catchment area.

Refer to Table 4.3 for the estimated soil loss calculations for the Project areas. It can be seen that the areas of the Proposed mine that have a higher erosion risk and potential for sediment generation are the mine pits and waste rock dumps which is driven primarily by the expected steep slopes. This combined with the high potential for dispersion for the waste rock dump material (refer to Section 3.4) results in the greatest risk for loss of sediment from these areas over the life of mine.

Table 4.3 Estimated 'Worst-Case' Operational Sediment Generation

Dam	Estimated Catchment Area (ha)	Estimated Average Soil Loss (t/year)
ED 2D1	18	1,050

Dam	Estimated Catchment Area (ha)	Estimated Average Soil Loss (t/year)
ED 2D2	11	620
Dam 4	45	2,400
ED 1C	18	2,300
ED 1B	165	69,300
Dam 1	1,015	143,900
Total	1,272	219,570

It should be reiterated that this is a conservative estimate and actual sediment loss from the waste rock dump slopes is proposed to be mitigated by a number of controls (Refer to Section 5.5) including stabilising the waste rock dump surfaces during mining by the use of hard rock preferentially placed on the outer slopes, until the final landform can be achieved and final rehabilitation undertaken.

5. EROSION AND SEDIMENT CONTROL MEASURES

Vegetation clearing, mining operations and earthworks required during both construction and operation of the mine activities will expose the land to varying levels of erosion due to the combined effects of key factors such as soil type, surface slopes and extent of ground coverage, runoff potential and rainfall intensity.

An ESCP is a dynamic management plan that must be regularly updated to ensure it remains effective for the changes to the site conditions and catchments. The ESCP will need to be updated prior to operations commencing to account for operational and environmental risks at that time.

This conceptual ESCP describes the proposed general strategies and controls for management of erosion and sediment based on the site conditions (described in Section 3) and proposed mine features (described in Section 4.2).

5.1 Principles for Design of ESC Measures

In line with best practice guidelines for Queensland (IECA Guidelines), the principles for development of erosion and sediment controls required for the proposed Project include:

- Appropriately integrate the development into the site
- Integrate erosion and sediment control risks into site planning and construction planning
- Develop effective and flexible ESCPs based on anticipated soil loss, weather, and construction activities
- Minimise the extent and duration of soil disturbance
- Control water movement through the site
- Minimise soil erosion
- Promptly stabilise disturbed areas
- Maximise sediment retention on the site
- Maintain all ESC measures in proper working order at all times
- Monitor the site and adjust ESC practices to maintain the required performance standard.

The following factors were taken into consideration when determining the level of ESC protection required:

- The properties of the surface materials – Refer to Section 3.1 and 3.4
- Local rainfall and climate conditions – Refer to Section 4.2 and 5.2
- The nature of the landforms being protected – Refer to Section 3.1
- The sensitivity of the receiving environment – Refer to Section 3.1 and 3.2
- The erosion risk ratings based on soil loss estimates for the proposed mine – Refer to Section 4.2.

Requirements from the *DES Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (2016)* were also considered.

5.2 Rainfall, Timing and Duration

Unlike short-term construction projects, the CQC Mine will have a mine life of approximately 19 years and therefore ESC measures have to account for seasonal variability in climate and rainfall conditions.

As the proposed mine is located in a sub-tropical climate, soil erosion management shall be undertaken in a two season approach; the wet season (December to March) and dry season (April to November). The IECA Guidelines erosion hazard rating based on average monthly rainfall depths for nearby Marlborough is High for the wet season months and ranges from Moderate to Very Low for the dry season months.

Strategies to be employed under the ESCP to account for seasonal fluctuations in erosion risk include:

- To be conservative, all permanent ESC measures should be designed based on the wet season rainfall depths and/or additional controls proposed during the wet season months;
- Where practical, high risk disturbance activities such as vegetation clearing and construction activities will be undertaken during the dry season and for non-active areas:
  - During September:
    - Land clearing is to be limited to eight weeks;
    - Disturbed soil surfaces are stabilised with minimum 60% cover within 30 days of completion of works if rainfall is reasonably possible;
    - Unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 30 days.
  - From June to September:
    - Land clearing is to be limited to eight weeks;
    - Disturbed soil surfaces stabilised with minimum 70% cover within 30 days of completion of works within any area of a worksite;

    - Unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 30 days.
  - During April to May and October to November:
    - Land clearing is limited to six weeks;
    - Disturbed soil surfaces stabilised with minimum 70% cover within 20 days of completion of works within any area of a work site;
    - Staged construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 3m vertical increments wherever reasonable and practicable;
    - Unfinished earthworks are suitably stabilised if rainfall is reasonably possible, and disturbance is expected to be suspended for a period exceeding 20 days.
  - From December to March:
    - Land clearing is limited to four weeks
    - Disturbed soil surfaces stabilised with minimum 75% cover within 10 days of completion of works within any area of a work site;
    - Staged construction and stabilisation of earth batters (steeper than 6H:1V) in maximum 3m vertical increments wherever reasonable and practicable;
    - Soil stockpiles and unfinished earthworks are suitably stabilised if disturbance is expected to be suspended for a period exceeding 10 days.

- Implementation of a pre wet season inspection checklist which encompasses the ESC measures (refer to Appendix B for examples of relevant inspection items).

5.3 Construction and Clearing

The principles for ESC management during initial clearing and construction are generally aligned with the ongoing ESC strategy for the proposed mine. Key aspects relative to the construction period or any clearing activities are outlined below.

5.3.1 Stabilised Site Entry/Exit Points

- During clearing and construction, all site exit points will be stabilised with rock pads or have vibration grids installed to collect sediment from vehicles exiting the site and avoid tracking of sediment onto public roads. The stabilised site exits shall be maintained and cleaned or repaired as necessary to ensure they are working efficiently.

5.3.2 Minimising and Managing Disturbance

- As an overriding principle, minimising all land disturbance, including vegetation clearance, to only that immediately required to achieve development requirements.

- Works will be scheduled to minimise the area of active disturbance at any one time.

- Erosion control measures shall be installed prior to clearing and grubbing operations, wherever possible. Where access to an area is required prior to installation, erosion

control measures shall be installed concurrently with clearing operations. Control measures shall be installed within 48 hours of clearing operations.

- 'No Go Zones' will be shown on ESC Design Drawings (to be developed as part of detailed design and mine plans prior to commencement of mining) and delineated on site prior to any clearing.
- Diversion of uncontaminated (clean) surface water runoff around areas disturbed by construction activities and/or clearing.
- Once clearing and grubbing erosion and sediment control devices are installed (i.e. temporary silt fences, inlet/outlet protectors), the operational drainage diversions and channels with accompanying environmental dams (refer to Section 5.6) shall be constructed, followed by appropriate slope stabilisation controls, placement of rock rip-rap in selected areas, and seeding of slopes and stockpiles, where required.
- Control flow velocities in such a manner that prevents soil erosion along drainage paths and at the entrance and exit of all drains during all storms up to the relevant design storm discharge (refer to Section 5.5.1).
- Dust suppression measures (e.g. use of water trucks and spraying stockpiles with suitable soil binders) will be implemented (refer to Section 5.5.2).
- ESCs are to be maintained until final rehabilitation has been completed and a stable landform is achieved in accordance with rehabilitation requirements.

5.3.3 Access Tracks and Roads

- Where possible, vehicle movements will be restricted to existing roads.
- The duplication of parallel/multiple tracks or turnouts are to be avoided.
- Maintain a vegetation buffer between any access tracks and nearby watercourses.
- Be positioned along contour lines limiting grade changes where practicable.

5.3.4 Vegetation Clearing

- Land clearing is limited to an area suitable to complete within the time periods specified in Section 5.2 depending on the month and expected rainfall.
- Maximum of 50 days after commencement of site stabilisation, for identified areas, before specified minimum ground cover (e.g. organic or rock mulch, synthetic blankets, vegetation or combination thereof) is achieved in all areas except for active areas.

- Root stock will be retained in the ground after clearing to reduce erosion and to facilitate rapid rehabilitation, where possible. This is excluding areas of permanent infrastructure, mining pits and access routes.
- Vegetation will be progressively cleared where practical to minimise the area of soil exposed.
- Identify, isolate and protect all mature native vegetation where appropriate. Protected vegetation areas will be identified and clearly marked out on site before commencing clearing works.
- Vegetation that is cleared is to be preferentially mulched and used to stabilise exposed soils on site or strategically placed to provide habitat for fauna where possible.

5.3.5 Stockpiles

- Stockpiles should be located at least 100 m away from drainage lines / waterways where possible.
- Stockpiles which are exposed for prolonged periods or have been identified as having a high erosivity risk, will be stabilised where required using chemical surface stabilisers or by other methods such as seeding.
- Topsoils will be stockpiled separately from other materials (e.g. vegetation), where it can be readily recovered for reuse.
- Stockpiles will not impede natural or constructed surface drainage channels or access tracks.

Maintaining the integrity of the topsoils stripped prior to construction is integral for final rehabilitation, as these soils are necessary for future regeneration of vegetation. The following mitigation measures will be implemented to avoid the loss of topsoil (i.e. increase of sedimentation) or impact to topsoil quality.

- In areas where there is little topsoil or there is evidence of existing salinity, topsoil may be ameliorated with mulch, or another approved ameliorant (i.e. gypsum) to facilitate revegetation.
- No topsoil stripping works will occur during significant rainfall events or when significant rainfall events are expected.
- Topsoil stripping will be timed in accordance with site conditions, once topsoil moisture following the wetter months has decreased enough to minimise compaction issues.
- Where practicable, soils will be replaced in the order of excavation.

- The height of topsoil stockpiles should be limited to no more than 2 m with stable batters (generally 1V:3H).
- Where possible, topsoil stockpiles will be located in the upstream end of catchments and are to be located away from subsoils.
- Topsoil will not be used as backfill material.

5.4 Waterway Crossings

Several minor and one major waterway crossing (of Deep Creek) is proposed for the haul road connecting the MIA and CHPP 2 with the TLF. These crossings are conceptualised as box culvert crossings with capacity to pass a minimum 10 year Average Recurrence Interval (ARI) design discharge. Discharges above the design event will pass over the box culvert as a floodway-type arrangement. Controls to manage erosion and sedimentation risks associated with the crossings include:

- Construction of crossings should occur during periods of no flow (where possible.
- Use of any existing clearings through riparian vegetation, if any, will be utilised to minimise additional riparian vegetation clearing.
- Scour protection will be provided at the culvert outlets.

5.5 Erosion Controls

Erosion control during operations will be generally similar to the measures implemented during construction and includes drainage control for any disturbed catchments and activities such as rehabilitation and dust suppression.

General erosion control measures to be implemented for all disturbed catchments include:

- As an overriding principle, minimising all land disturbance, including vegetation clearance, to only that immediately required to achieve development requirements.
- Works will be scheduled to minimise the area of active disturbance at any one time.
- Erosion control measures shall be installed prior to clearing and grubbing operations, wherever possible. Where access to an area is required prior to installation, erosion control measures shall be installed concurrently with clearing operations. Control measures shall be installed within 48 hours of clearing operations.
- ‘No Go Zones’ will be shown on ESC Design Drawings (to be developed as part of detailed design and mine plans prior to commencement of any new areas of mining) and delineated on site prior to any clearing.

- Diversion of uncontaminated (clean) surface water runoff around areas disturbed by mining activities and/or clearing.
- Control flow velocities in such a manner that prevents soil erosion along drainage paths and at the entrance and exit of all drains during all storms up to the relevant design storm discharge (refer to Section 5.5.1).
- Dust suppression measures (e.g. use of water trucks and spraying stockpiles with suitable soil binders) will be implemented (refer to Section 5.5.2).
- ESCs are to be maintained until final rehabilitation has been completed and a stable landform is achieved in accordance with rehabilitation requirements.

Waste Rock Dumps

Waste rock dump surfaces are proposed to be stabilised during mining by the use of hard rock preferentially placed on the outer slopes, until the final landform can be achieved and final rehabilitation undertaken.

Other surface roughening techniques, such as walking a hillside with tracked equipment, may also be employed to minimise erosion potential for slope faces. Although a reduced batter grade is more desirable from a potential erosion perspective, this also increases the footprint of the alignment which has other environmental implications associated with additional clearing.

Operational Works Areas

The main operational work areas, such as the CHPP and stockpile areas, will be gently sloping to flat (<1% slope gradient) and generally consist of compacted surfaces with higher gravel content which will minimise raindrop impact erosion.

Stockpiles

Topsoil stockpiles should be constructed no higher than 2 m and subsoil stockpiles no higher than 10 m with a slope of ≤ 15° This will help to minimise erosion from the stockpiles by limiting the length and steepness of the outer stockpile slopes. Stockpiles to be retained for a period of greater than three months, and which have not naturally established a suitable density of groundcover to minimise erosion, will be bunded around the perimeter to minimise sediment mobilisation (refer to Section 5.6).

Roads

Haul roads will be built up above natural surface in most areas and designed to be water shedding to avoid pooling and piping which can lead to scouring, and erosion of the road surface and embankments. Haul roads will be constructed using compacted competent local soil materials, which are generally high in gravel content. Sandstone or waste rock material will be utilised only where the upper soil profile is found to be unsuitable for road construction. The construction material will be taken into consideration in the detailed

design of ESC measures for roads and more conservative controls utilised where potentially dispersive soils are used including capping and revegetation with non-dispersive material.

Haul roads are expected to be sprayed with water to minimise dust generation (refer to Section 5.5.2) which will minimise dust emissions and/or wind erosion.

Minimising Erosion of Slopes

Steep slopes and batters will require stabilisation, particularly slopes for the environmental dams, stockpiles, new roadside batters or channels and areas with potentially wet soils. Terracing, geotextile, or geo-matting shall be used where required, in combination with riprap at drainage points and with seeding and mulching, where possible.

Surface roughening techniques, such as walking a hillside with tracked equipment, may also be employed to minimise erosion potential for slope faces. Although a reduced batter grade is more desirable from a potential erosion perspective, this also increases the footprint of the alignment which has other environmental implications associated with additional clearing.

5.5.1 Drainage

Clean Water Drains and Diversions

Diversion drains and bunds are proposed to divert clean water runoff around the disturbed mine areas, including the open pits and waste rock dumps. Whilst the general layout of the mine has been designed to avoid any diversions of determined Watercourses of higher environmental value, namely Deep Creek and Tooloombah Creek, catchment diversion drains have been proposed around the mining footprint both south and north of the highway (Refer to Figure 4.1). The northern drain will exist until it is mined out, with the southern established prior to works south of the highway. These clean water diversions reduce contamination of clean water runoff and the downstream receiving environment.

Other minor banks and drains shall be installed as per design details (refer to Appendix C for standard installation details).

Dirty Water Drains and Diversions

Dirty water drains will be constructed to collect runoff from waste rock stockpiles and processing facilities within the vicinity of the CHPP, ROM and MIA, and convey runoff in a non-erosive manner to the CHPP environmental dams and waste rock dump environmental dams. These dirty water drains will be sized to capture runoff generated from a minimum 24 hour 10 year ARI event.

All diversion drains and diversion banks will be designed with geotechnically and erosionally stable batter slopes.

Earthen diversion banks and berms will be utilised to assist in reducing site erosion by reducing the length of slope (and therefore potential soil loss), increasing the time of

concentration of overland flow and directing overland flow towards a stable outlet point or sediment control.

The surface area of disturbance areas will be broken up where practicable using flow diversion banks placed at regular intervals down the slope with the recommended maximum spacing of drainage systems down exposed, non-vegetated or recently seeded slopes provided in Table 5.1.

Table 5.1 Maximum Flow Diversion Bank Spacing (IECA, Table 4.3.2)

Batter Slope (%)	Horizontal Spacing (m)	Vertical Spacing (m)
1	80	0.8
2	60	1.2
4	40	1.6

Discharge from each diversion structure will be via a level spreader or rock chute, to ensure that the concentrated surface flow is transitioned back to sheet flow in a way that minimises erosion downslope of the outlet.

Minor drains, banks and diversions shall be installed as per design details (refer to Appendix C for standard installation details).

5.5.2 Wind Erosion

The region's climate seasonality also makes it prone to wind erosion, particularly during the dry season. Wind erosion is a key contributor to dust generation which has the potential to impact residents surrounding the site, vegetation communities and the operation of the mine itself if located downwind.

Dust emissions will be controlled using water trucks on haul roads and sprays will be used if required to control dust at topsoil and product stockpiles.

Any additional cleared areas that are not required during the operation of the mine will be progressively rehabilitated according to the site rehabilitation and ESC strategy. This will restore a suitable density of groundcover to the exposed surfaces reducing the risk of dust generation.

5.5.3 Destocking

The destocking of offset habitat within the Mamelon property as discussed in Section 4.1 will allow for the natural regeneration of land already impacted by grazing that will remain undisturbed by the mine (Refer to Figure 5.1 which outlines the areas currently under investigation). The finalised offset areas will be destocked and no grazing will occur within

the offset areas (except on a periodic as-needed basis to manage fuel load and for weed management).

In addition, cattle grazing will be progressively decreased within the mining leases during the operational period and at approximately year 10, no grazing is proposed within the entirety of the two mining leases.

The destocking and cessation of active grazing within the mining leases and offset areas within the Mamelon property will allow for the natural regeneration of land currently impacted by grazing activities, particularly along waterways. This is a preventative control and combined with the erosion and sediment mitigation measures that will be implemented by the Project, is expected to contribute towards a reduction in mobilised sediments compared to that of the current agricultural land use.

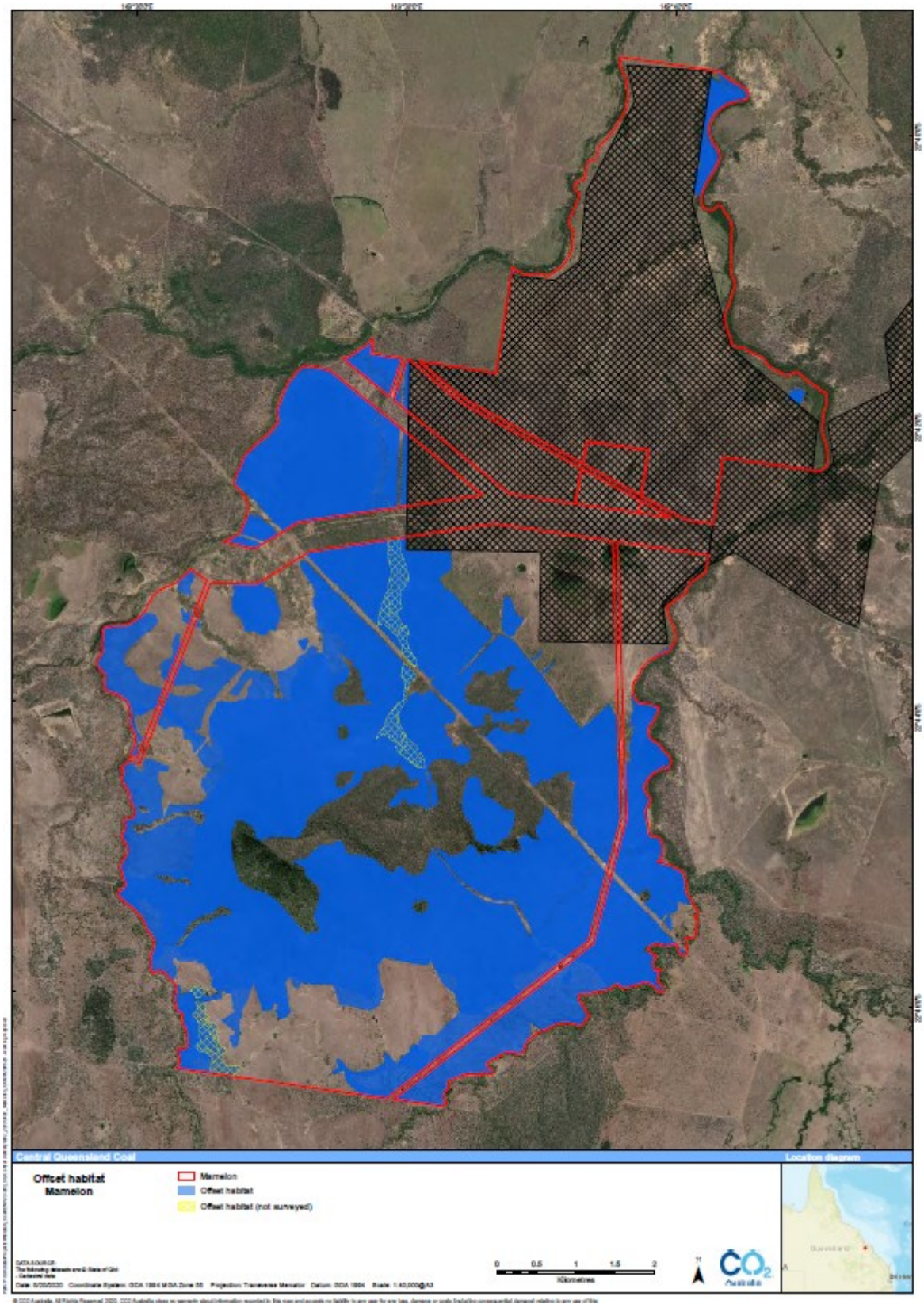

Figure 5.1 Offset Habitat Being Considered for the Mamelon Property (CO_2 Australia, 2020)

5.6 Sediment Controls

A range of sediment controls will be required across the Project area depending on the size of the upstream catchment and estimated soil loss. In general, a catchment greater than 1 hectare will always trigger a Type 1 control (Sediment Basin) unless the soil loss estimate is calculated to be low (refer to Figure 5.2).

Catchment Area (m^2) [1]	Soil loss (t/ha/yr) [2]			Soil loss (t/ha/month) [3]		
	Type 1	Type 2	Type 3	Type 1	Type 2	Type 3
250	N/A	N/A	[4]	N/A	N/A	[4]
1000	N/A	N/A	All cases	N/A	N/A	All cases
2500	N/A	> 75	75	N/A	> 6.25	6.25
>2500	> 150	150	75	> 12.5	12.5	6.25
> 10,000	> 75	N/A	75	> 6.25	N/A	6.25

Figure 5.2 Sediment Control Standards (IECA, 2018)

5.6.1 Vegetation Buffers – Type 3

Buffer strips of vegetation will be left intact, wherever possible, between disturbance works and wetland and/or waterway banks to help protect water quality. Where possible a 15 m wide vegetated buffer will be retained to allow a natural filter between exposed soils and receiving waterways/wetlands or ESAs.

The destocking proposed in Section 4.1 and 5.5.3 will allow vegetation and groundcover in previously grazed areas along the waterways to regenerate. In the longer term this measure will act as a vegetation buffer and assist in capturing sediment runoff from upstream catchments.

5.6.2 Sediment Traps – Type 3

Where localised runoff from disturbed areas is unable to be diverted to sediment basins, sediment traps will be used to filter and intercept runoff leaving the site. These sediment traps include a variety of measures including rock socks, mulch, rock checks, sand bags and sediment fences (Refer to Appendix C for typical standard installation details for mulch bunds and sediment fences). Sediment traps shall be installed where needed for small and/or flat disturbance areas to provide temporary protection against sediment loss e.g. around stockpiles or flat laydown areas.

5.6.3 Sediment Basins (Water Storages) – Type 1

Water storages will be constructed at key locations around the Project boundary and will perform as sediment basins to collect catchment runoff (Refer to Table 5.2 and Figure 4.1).

Table 5.2 Proposed Water Storages for the Project

Table 4.1 Proposed Water Storages for the Project Dam	Surface Water Catchment	Receiving Waterway	Volume (ML) (WRM, 2020)
ED 2D1	Haul road	Deep Creek	26.9
ED 2D2	Haul road		
Dam 4	Natural, rail loop and haul road		95.8
ED 1C	MIA, CHPP	n/a – overflows to Dam 1	44.1
ED 1B	Waste Rock Stockpile 1	Tooloombah Creek	23.7
Dam 1	Waste Rock Stockpile 2, MIA, CHPP, haul road, natural	Tooloombah Creek	2,783

Stored water from the dams will be preferentially used in the mine operation activities, including for dust suppression and top up of the MIA process water ponds. All dams except for Dam 1 will be operated empty to ensure maximum settling capacity prior to rainfall events. The environmental dams will be desilted prior to the commencement of the wet season to maximise the available storage capacity.

Volumes for the proposed dams were validated through water balance modelling which was completed for the storages and concluded that in dry conditions and median conditions there are no uncontrolled releases. Under wet and very wet climatic conditions, uncontrolled overflows were modelled as occurring more frequently for Dam 1 and ED 1B especially in the latter stages of the Project. There are also controlled releases from Dam 1 under both median and wet climatic scenarios but these occur under specific water quality conditions.

Due to the dispersive nature of some of the soil types within the Project area and within the waste rock dumps, in combination with the surrounding environmental sensitive areas, it is likely that flocculation will be required to achieve effective settling of fine and/or dispersive sediments. As the flocculants and their dosing rates are dependent on the soil types within each catchment, these factors will be determined as part of future ESCP updates and prior to each catchment's disturbance.

Flocculation may not be required if:

- It can be demonstrated through baseline water quality data that the Project would not release sediment concentrations greater than the natural pre-mining concentrations;
- If the catchment soil types contain less than 33% particles finer than 0.02 mm and no more than 10% of soil is dispersive; and/or,

- If it can be demonstrated that chemical flocculation is not reasonable or practicable due to physical layout restrictions such as multiple inflow locations.

5.7 Control of Sediment

The main contaminant of concern managed under the ESCP is suspended solids. Where an ESC measure such as a water storage is also designed or expected to manage catchment flows from mine affected sources, other contaminants may be present and are to be managed and monitored under the site mine water management system.

Implementation of the discussed ESCs (including destocking) and based on the modelled releases and assumed outflow sediment concentrations, an annual worst-case sediment loss volume was estimated for the Project at approximately 2,297 t/year. When compared to the estimated baseline sediment generation volumes (Refer to Section 4.1), the total worst-case sediment budget under average climatic conditions (i.e. comparison of baseline to operational period) for the Project is a reduction of about 50%.

Regardless of the climate conditions, if the water storages are operated to allow effective sedimentation to occur, this will greatly reduce the risk of sediment being released from storage overflows or releases.

5.7.1 Reef 2050 Plan WQTs

An assessment of potential Project impacts against the Reef 2050 WQTs that are specifically relevant to this ESCP and sediment load reduction is provided in Table 5.3.

Table 5.3 Assessment Against Reef 2050 Plan WQT

WQT	Assessment
At least a 20 per cent reduction in anthropogenic end-of-catchment loads of sediment in priority areas, on the way to achieving up to a 50 per cent reduction by 2025.	Under average climatic conditions it has been determined that the Project will result in a positive contribution to this target through the expected reduction in sediment load reporting to Tooloombah Creek and Deep Creek in comparison to baseline (current) conditions. Under average climatic conditions it was determined the total worst-case sediment budget (i.e. comparison of baseline to operational period) for the Project is a reduction of about 50%. That is that the proposed water storages under average climatic conditions in addition to the destocking of the undisturbed MLs and Mamelon offset areas will reduce the estimated baseline sediment generation rate of 5,037 t/year to approximately 2,297 t/year. Under wet or very wet climatic conditions, there is potential for an increase in sediment loss through increased frequency of uncontrolled releases from Dam 1 and ED1B, however the additional sediment loss is not expected to approach or exceed the baseline generation rate where effective erosion and sediment control is implemented on site including potentially flocculation of the water storages (if determined to be required).

5.8 Maintenance and Inspections

Maintenance is a critical component to ensuring ongoing effectiveness of all ESC measures. It is expected that future amendments to the ESCP will assign the specific roles and responsibilities of the below maintenance requirements to mine personnel/departments Maintenance measures required under this ESCP include:

- The condition and functionality of all Type 3 sediment controls shall be monitored as part of the routine and rainfall triggered inspections. Maintenance shall include repairing/replacing damaged sediment fencing or traps and removal of sediment if necessary.
- Desilting of water storages when sediment is greater than 70% capacity of the sediment zone or prior to the commencement of the wet season.
- Inspections will be undertaken in accordance with the frequencies shown in Table 5.4 for areas of active disturbance and generally for permanent ESC measures across site.
- Inspections of active disturbance areas will be performed weekly but can also be triggered by intense rainfall events. An example of a weekly ESC Inspection Checklist is provided in Appendix B.
- Observations made during inspections, along with data captured during environmental monitoring events (i.e. water quality monitoring) will be used to identify required preventative and/or corrective actions (refer to Section 5.9).
- Once a preventative or corrective action is identified the closeout of the action is to be tracked to ensure actions are addressed in a timely manner to minimise the likelihood of recurrence.

Table 5.4 ESC Inspection Frequencies and Corrective Actions

Monitoring Requirement	Frequency	Performance Criteria	Corrective Action
Inspection of ESC measures and management of disturbed areas	Weekly or in response to significant rainfall events (nominal >25mm in 24 hours)	ESCs are functioning as per their design. At least 70% storage capacity is retained for all sediment controls	Maintenance and/or desilting to restore capacity and function of ESC device Identify source of inability to meet performance criteria (e.g. incorrect installation, excess sediment generation) and address on a case-by-case basis.
Inspection of ESC water release or overflow outlet	Weekly or in response to significant rainfall	No offsite accumulation of sediment.	Identify source of inability to meet performance criteria and address on a case-by-case basis.

Monitoring Requirement	Frequency	Performance Criteria	Corrective Action
locations (e.g. dam spillways)	events (nominal >25 mm in 24 hours)	No scouring to the bed or banks of receiving waterways	This may include: Inspection of ESC performance upstream of the dam outlets, desilting of water storages, implementation of additional ESC measures (e.g. flocculation)

5.9 Monitoring

The main contaminant of concern to be monitored under the ESCP is suspended solids. Where an ESC measure such as a water storage is also designed or expected to manage catchment flows from mine affected sources, other contaminants may be present and are to be managed and monitored under the site mine water management system.

Water quality monitoring is proposed for all dams that discharge into the receiving environment and locations both up and downstream of the mine. These upstream and downstream locations should be aligned with Receiving Environment Monitoring Program (REMP) surface water monitoring locations. Monitoring will undertaken as soon as practical after the commencement of a release from any water storage to the receiving environment for both TSS and turbidity. Refer to Appendix 10F of the CQC Project SEIS Version 3 (Receiving Environment Monitoring Program) for further details on the proposed REMP.

A copy of water quality records should be kept on site in accordance with proposed EA conditions.

5.9.1 Performance Criteria

There are no proposed prescribed performance criteria within the draft EA conditions for waters managed purely under the ESCP (i.e. excludes mine affected water sources).

However, Appendix 5A of the CQC Project SEIS Version 3 (Surface Water Technical Report) proposes a turbidity release limit of 50 NTU. This limit represents a conservative initial trigger level for future monitoring of the performance of the proposed erosion and sediment control measures.

It is recommended that a site-specific relationship be developed between turbidity and suspended solids based on baseline water quality data. This will enable the rapid feedback of turbidity monitoring into site management actions (such as flocculation and/or cessation of discharge from a sedimentation basin).

Baseline monitoring prior to mine development and ongoing background water quality monitoring (i.e. REMP) during operations will be useful to continue to establish local water quality conditions for the parameters of interest (TSS, NTU, pH, standard physio-chemical

parameters and any specific contaminants that may be disturbed on the site during construction).

5.10 Training

An ESC briefing will be provided as part of the site induction. All relevant personnel shall be trained in the requirements of the most current ESCP.

6. CONTINUOUS IMPROVEMENT

This ESCP is to be updated prior to construction and operations commencing to account for operational and environmental risks at that time. Each update to the ESCP should specify:

- Period of the mine plan that the ESCP has been developed for.
- Construction methods with material specifications and dimensions for relevant erosion and sediment controls.
- Proposed staging for installation of controls.
- Expected performance outcomes.
- Monitoring, maintenance and reporting program.

Whilst there is no prescribed frequency for update of the ESCP under the DES model mining conditions, updates will be required prior to commencement of a new stage of construction or operations. At a minimum, the ESCP shall be reviewed at least annually during operations.

7. QUALIFICATIONS

a. In preparing this document, including all relevant calculation and modelling, Engeny Water Management (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

b. Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

c. Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

   (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

   (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

d. Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the works, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works. All limitations of liability shall apply for the benefit of the employees, agents and representatives of Engeny to the same extent that they apply for the benefit of Engeny.

e. This document is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this report.

f. If any claim or demand is made by any person against Engeny on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the report or information therein, Engeny will rely upon this provision as a defence to any such claim or demand.

g. This report does not provide legal advice.

8. REFERENCES

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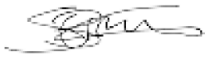
APPENDIX A

Certification

This conceptual ESCP satisfies the following requirements:

1) The intent and minimum standards required by all relevant legislative policies relating to erosion and sediment control
2) Review and approval by personnel suitably trained and experienced
3) Is both reasonable and practicable
4) Contains sufficient information to allow appropriate implementation of the plan

Signature: Date: 7/09/2020



Printed Name:

Samantha Breslin – CPESC 9474

Appendix B

Example Weekly ESC Inspection Checklist

Weekly ESC Inspection Checklist			
Type of Inspection			
Routine			
Rainfall Event (Before)			
Rainfall Event (After)	(cm of rain/duration)		
Intermittent Dewatering			
Area Inspected:			
Inspected BY:		Date	
Item No.	Inspection Items	Compliant (Yes / No)	Comment
1	Have the management practices identified in the ESCP been installed according to specification and in the identified locations		
2	Is there any evidence that sediment is leaving the construction site? If yes, specify		
3	Is there any evidence of erosion on fill slopes, temporary stockpiles? If yes, specify		
4	Do any sediment trapping / filtering devices (i.e. sediment fence) require repair or clean-out to maintain proper function? If yes, specify		
5	Do any velocity reduction devices (i.e. rip-rap aprons) require repair or clean-out to maintain proper function? If yes, specify		
6	Do any runoff diversion features (i.e. lined swales, storm drain inlet protection) require repair or clean-out to maintain proper function? If yes, specify		
7	Do any area in which temporary or permanent vegetative stabilisation measures are being taken show signs of bare spots, insufficient growth or germination? If yes identify locations and specify remedial action (e.g. irrigation, fertilisation, seeding, mulching, maintenance)		
8	Are on-site traffic, parking, equipment laydown, supply and waste storage restricted to those areas specifically designated for those purposes?		
9	Is there any evidence of sediment, debris or mud tracked out of the construction areas?		
Note: Attach additional sheets if needed to identify plans for corrective actions, expected date of implantation, who is to perform the work and any other relevant specifics			

Appendix C

Typical Standard Installation Details

EROSION AND SEDIMENT CONTROL NOTES

1. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IN PLACE PRIOR TO CLEARING COMMENCING AND IMPLEMENTED IMMEDIATELY FOLLOWING CLEARING, TO PREVENT SEDIMENT LADEN WATER LEAVING THE SITE.
2. DISTURBED AREAS WILL BE MINIMIZED TO THE GREATEST EXTENT POSSIBLE, AND TEMPORARILY OR PERMANENTLY STABILIZED OR RESTORED AS THE WORK PROGRESSES.
3. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ARE NOT STATIC AND WILL NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE OR FOR EACH PROJECT STAGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN ACCORDANCE WITH ESCP, THEN ALTERNATIVE MEASURES MUST BE IMPLEMENTED IMMEDIATELY.
4. WORKS SHOULD BE COMPLETED IN THE DRY SEASON, WHERE POSSIBLE.
5. WORKS TO BE COMPLETED IN STAGES TO REDUCE DURATION OF SOIL EXPOSURE.
6. SEPARATE CLEAN RUNOFF FROM DIRTY CONSTRUCTION AREA RUNOFF BY INSTALLING DIVERSION CHANNELS OR BANKS ON THE UPSTREAM SIDE OF THE WORKS AREA. WHERE SPACE IS LIMITED THEN SEDIMENT FENCE WILL BE USED TO SEPARATE CLEAN RUNOFF.
7. SHORT TERM MATERIAL STOCKPILES SHOULD HAVE SILT FENCES IMPLEMENTED AROUND THEM.
8. STOCKPILES ARE NOT TO IMPEDE NATURAL SURFACE, CONSTRUCTED SURFACE, DRAINAGE CHANNELS OR ACCESS TRACKS.
9. SEDIMENT CONTROL DEVICES SHOULD BE INSPECTED AFTER A RUNOFF PRODUCING RAINFALL EVENT. DEVICES SHOULD BE DESILTED AS NECESSARY TO ENSURE THEY ARE FULLY OPERATIONAL.
10. SEDIMENT CONTROL MEASURES SHOULD NOT BE REMOVED UNTIL THE SITE IS STABILISED.

VIBRATION GRID

MATERIALS

- ROCK: WELL GRADED, HARD, ANGULAR,EROSION RESISTANT ROCK, NOMINAL DIAMETER OF 50 TO 75mm (SMALL DISTURBANCES) OR 100 TO 150mm(LARGE DISTURBANCES). ALL REASONABLE MEASURES MUST BETAKEN TO OBTAIN ROCK OF NEAR UNIFORM SIZE.
- FOOTPATH STABILISING AGGREGATE: 25TO 50mm GRAVEL OR AGGREGATE.
- GEOTEXTILE FABRIC: HEAVY-DUTY,NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH ('BIDIM' A24 OR EQUIVALENT).

INSTALLATION:

1. GRIDS TO BE LOCATED AT ENTRY/EXIT LOCATIONS TO SEALED ROADS.
2. ONE ENTRY/EXIT TO BE MAINTAINED AT ONE TIME WHERE POSSIBLE.
3. CLEAR THE LOCATION OF THE VIBRATION GRID, REMOVING STUMPS,ROOTS AND OTHER VEGETATION TO PROVIDE A FIRM FOUNDATION SO THAT THE ROCK IS NOT PRESSED INTO SOFT GROUND. CLEAR SUFFICIENT WIDTH TO ALLOW PASSAGE OF LARGE VEHICLES,BUT CLEAR ONLY THAT NECESSARY FOR THE EXIT. DO NOT CLEAR ADJACENT AREAS UNTIL THE REQUIRED EROSION AND SEDIMENT CONTROL DEVICES ARE IN PLACE.
4. GRADE THE LOCATION OF THE VIBRATION GRID SO THAT RUNOFF FROM THE UNIT WILL NOT FLOW INTO THE SEALED ROAD, BUT WILL FLOW TOWARDS AN APPROPRIATE SEDIMENT-TRAPPING DEVICE.
5. ENSURE THAT THE INSTALLATION OF THE VIBRATION GRID HAS ADEQUATE SEDIMENT STORAGE VOLUME UNDER THE GRID. WHERE NECESSARY, INSTALL SUITABLE PRECAST SEDIMENT COLLECTION CHAMBERS.
6. PLACE A ROCK PAD/RAMP FORMING A MINIMUM 200mm THICK LAYER OF CLEAN,OPEN-VOID ROCK OVER THE ROADWAY BETWEEN THE VIBRATION GRID AND THE SEALED STREET TO PREVENT TYRES FROM PICKING UP MORE SOIL AFTER THEY HAVE BEEN CLEANED.
7. THE TOTAL LENGTH OF THE VIBRATION GRID AND ROCK RAMPS SHOULD BE AT LEAST 15m WHERE PRACTICABLE, AND AS WIDE AS THE FULL WIDTH OF THE ENTRY OR EXIT AND AT LEAST 3m. THE ROCK RAMP SHOULD COMMENCE AT THE EDGE OF THE OFF-SITE SEALED ROAD OR PAVEMENT.

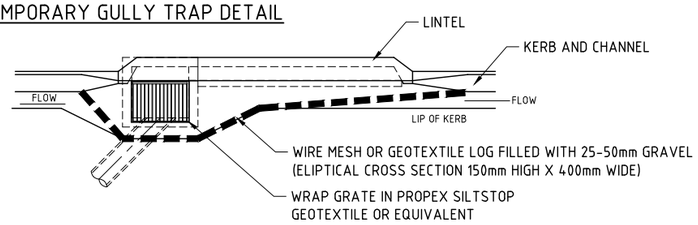
MAINTENANCE:

1. INSPECT VIBRATION GRID PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF-PRODUCING RAINFALL, OR OTHERWISE AT FORTNIGHTLY INTERVALS
2. IF SAND, SOIL, SEDIMENT OR MUD IS TRACKED OR WASHED ONTO THE ADJACENT SEALED ROADWAY, THEN SUCH MATERIAL MUST BE PHYSICALLY REMOVED, FIRST USING A SQUARE-EDGED SHOVEL, AND THEN A STIFF-BRISTLED BROOM, AND THEN BY A MECHANICAL VACUUM UNIT, IF AVAILABLE
3. IF NECESSARY FOR SAFETY REASONS, THE ROADWAY SHALL ONLY BE WASHED CLEAN AFTER ALL REASONABLE EFFORTS HAVE BEEN TAKEN TO SHOVEL AND SWEEP THE MATERIAL FROM THE ROADWAY.
4. WHEN THE VOIDS BETWEEN THE ROCK BECOMES FILLED WITH MATERIAL AND THE EFFECTIVENESS OF THE ROCK RAMPS ARE REDUCED TO A POINT WHERE SEDIMENT IS BEING TRACKED OFF THE SITE, A NEW 100mm LAYER OF ROCK MUST BE ADDED AND/OR THE ROCK PAD MUST BE EXTENDED.
5. ENSURE ANY ASSOCIATED DRAINAGE CONTROL MEASURES ARE MAINTAINED IN ACCORDANCE WITH THEIR DESIRED OPERATIONAL CONDITION.

REMOVAL:

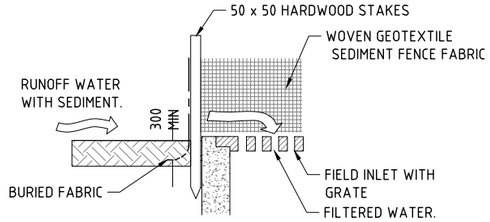
1. THE VIBRATION GRID SHOULD BE REMOVED ONLY AFTER IT IS NO LONGER NEEDED AS A SEDIMENT CONTROL DEVICE.
2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. RE-GRADE AND STABILISE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

TEMPORARY GULLY TRAP DETAIL

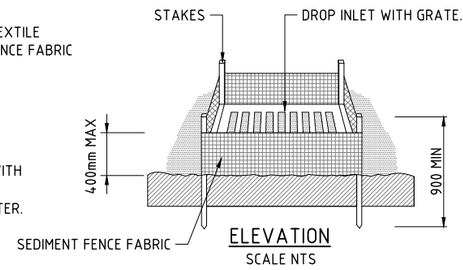


TYPICAL DETAIL
SCALE NTS

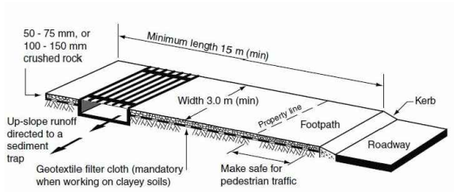
GEOTEXTILE FILTER FABRIC DROP INLET SEDIMENT TRAP



SECTION
SCALE NTS

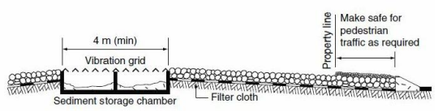


ELEVATION
SCALE NTS

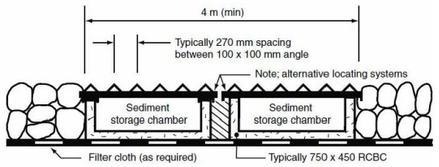


(d) Typical layout of a vibration grid

FROM IECA (INTERNATIONAL EROSION SEDIMENT ASSOCIATION)



(a) Typical profile of a vibration grid



(b) Typical profile of the vibration panels

CONSTRUCTION - VIBRATION GRID DETAIL
SCALE NTS

CONTOUR BUNDS/DIVERSION DRAINS

INSTALLATION:

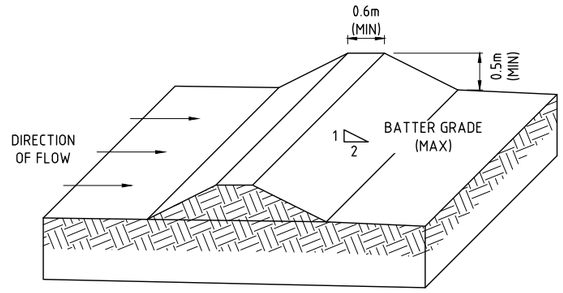
1. CLEAR THE LOCATION FOR THE CHANNEL, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND CONSTRUCTION EQUIPMENT.
2. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD ANY ASSOCIATED EMBANKMENTS.
3. BE GENERALLY CONSTRUCTED TO A MAXIMUM LONGITUDINAL GRADE OF 2.5%.
4. STABILISE THE 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.
5. CONSTRUCT UPSTREAM CLEAN WATER DIVERSION BUNDS TO REDIRECT CLEAN WATER FOR EACH STAGE WHERE REQUIRED.

MAINTENANCE:

1. D INSPECT THE DIVERSION CHANNEL AND 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 WORK DOWNSTREAM OF 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. STABILES THE AREA AS SPECIFIED IN THE APPROVED PLAN.



TYPICAL PROFILE OF DIVERSION BUND
SCALE NTS

REV	BY	DATE	REVISION DESCRIPTION	PM APPD.
A	LZ		FOR REVIEW	

DOC. NUMBER	DOCUMENT TITLE
REFERENCE DOCUMENTS	

Central QueenslandCoal

ENGENY WATER MANAGEMENT
Ph. 07 3221 7174
Level 3
500 Queen St
Brisbane QLD
www.engeny.com.au

STATUS: FOR INFORMATION

DESIGNED		CHECKED		
DRAWN	LZ	CHECKED		
PM APPD.		PD APPD.		
RPEQ		RPEQ No.		

CENTRAL QUEENSLAND COAL

EROSION SEDIMENT CONTROL NOTES AND DETAILS SHEET 1 OF 4

ORIGINAL SIZE	DWG NO.	REV.
A1	M7264-001-DWG-0001	A

CHUTES - GENERAL SPECIFICATIONS

INSTALLATION

1. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
2. CONSTRUCT THE SUBGRADE TO THE REQUIRED ELEVATIONS. REMOVE ALL UNSUITABLE MATERIAL AND REPLACE WITH STABLE MATERIAL TO ACHIEVE THE DESIRED FOUNDATIONS.
3. IF THE CHUTE IS TEMPORARY, THEN COMPACT THE SUBGRADE TO A FIRM CONSISTENCY. IF THE CHUTE IS INTENDED TO BE PERMANENT, THEN COMPACT AND FINISH THE SUBGRADE AS SPECIFIED WITHIN THE DESIGN PLANS.
4. IF THE CHUTE IS TO BE LINED WITH ROCK, THEN AVOID COMPACTING THE SUBGRADE TO A CONDITION THAT WOULD PREVENT THE ROCK LINING FROM ADEQUATELY BEDDING INTO THE SUBGRADE.
5. ENSURE THE SUBGRADE IS FIRM ENOUGH TO MINIMISE WATER SEEPAGE.
6. ON FILL SLOPES, ENSURE THAT THE SOIL IS ADEQUATELY COMPACTED FOR A WIDTH OF AT LEAST ONE METRE EACH SIDE OF THE CHUTE TO MINIMISE THE RISK OF SOIL EROSION, OTHERWISE PROTECT THE SOIL WITH SUITABLE SCOUR PROTECTION MEASURES SUCH AS TURF OR EROSION CONTROL MATS.
7. PLACE AND SECURE THE CHUTE LINING AS DIRECTED.
8. IF CONCRETE IS USED AS A LINING, THEN KEEP THE SUBGRADE MOIST AT THE TIME CONCRETE IS PLACED. FORM, CUT-OFF WALLS AND ANCHOR BLOCKS AS DIRECTED IN THE APPROVED PLANS.
9. INSTALL AN APPROPRIATE OUTLET STRUCTURE (ENERGY DISSIPATER) AT THE BASE OF THE CHUTE.
10. ENSURE WATER LEAVING THE CHUTE AND THE OUTLET STRUCTURE WILL FLOW FREELY WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.
11. APPROPRIATELY STABILISE ALL DISTURBED AREAS IMMEDIATELY AFTER CONSTRUCTION.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL CHUTES, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY.
2. CHECK FOR MOVEMENT OF, OR DAMAGE TO, THE CHUTE LINING, INCLUDING SURFACE CRACKING.
3. CHECK FOR SOIL SCOUR ADJACENT THE CHUTE. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.
4. WHEN MAKING REPAIRS, ALWAYS RESTORE THE CHUTE TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.

REMOVAL

1. TEMPORARY CHUTES SHOULD BE REMOVED WHEN AN ALTERNATIVE, STABLE, DRAINAGE SYSTEM IS AVAILABLE.
2. REMOVE ALL MATERIALS AND DEPOSITED SEDIMENT, AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. GRADE THE AREA IN PREPARATION FOR STABILISATION, THEN STABILISE THE AREA.

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

MATERIALS:

ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK.
GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION (ROCK OUTLET PADS)

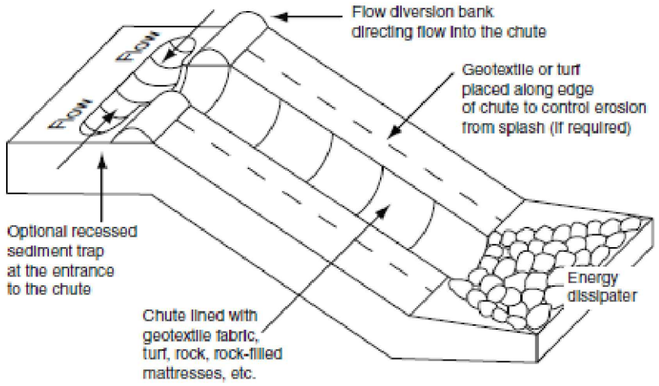
1. THE DIMENSIONS OF THE OUTLET STRUCTURE MUST ALIGN WITH THE DOMINANT FLOW DIRECTION.
2. EXCAVATE THE OUTLET PAD FOOTPRINT TO THE SPECIFIED DIMENSION SUCH THE WHEN THE ROCK IS PLACED IN THE EXCAVATED PIT THE TOP OF THE ROCKS WILL BE LEVEL WITH THE SURROUNDING GROUND, UNLESS OTHERWISE DIRECTED.
3. IF THE EXCAVATED SOILS ARE DISPERSIVE, OVER-EXCAVATED THE ROCK PAD BY AT LEAST 300MM AND BACKFILL WITH STABLE, NON-DISPERSIVE MATERIAL.
4. LINE THE EXCAVATED PIT WITH GEOTEXTILE FILTER CLOTH, PREFERABLY USING A SINGLE SHEET. IF JOINTS ARE REQUIRED, OVERLAP THE FABRIC AT LEAST 300MM.
5. ENSURE THE FILTER CLOTH IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300MM.
6. ENSURE THERE ARE AT LEAST TWO LAYERS OF ROCKS. WHERE NECESSARY, REPOSITION THE LARGER ROCKS TO ENSURE TWO LAYERS OF ROCKS ARE ACHIEVED WITHOUT ELEVATING THE UPPER SURFACE ABOVE THE PIPE INVERT.
7. ENSURE THE ROCK IS PLACED IN A MANNER THAT WILL ALLOW WATER TO DISCHARGE FREELY FROM THE PIPE.
8. ENSURE THE UPPER SURFACE OF THE ROCK PAD DOES NOT CAUSE WATER TO BE DEFLECTED AROUND THE EDGE OF THE ROCK PAD.
9. IMMEDIATELY AFTER CONSTRUCTION, APPROPRIATELY STABILISE ALL DISTURBED AREAS.

MAINTENANCE

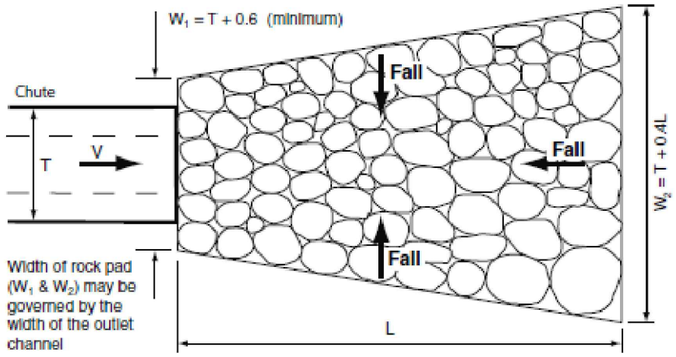
1. WHILE CONSTRUCTION WORKS CONTINUE ON THE SITE, INSPECT THE OUTLET STRUCTURE AFTER SIGNIFICANT RUNOFF PRODUCING RAINFALL, OR ON AT LEAST A WEEKLY BASIS.
2. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

REMOVAL

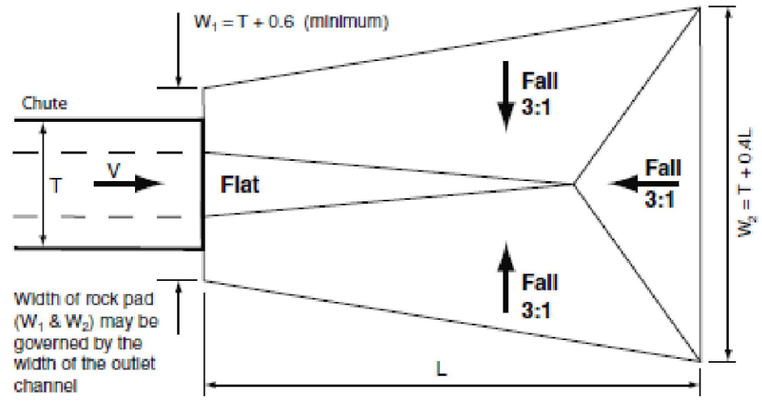
1. TEMPORARY OUTLET STRUCTURES SHOULD BE COMPLETELY REMOVED, OR WHERE APPROPRIATE, REHABILITATED SO AS NOT TO CAUSE ONGOING ENVIRONMENTAL NUISANCE OR HARM.
2. FOLLOWING REMOVAL OF THE DEVICE, THE DISTURBED AREA MUST BE APPROPRIATELY REHABILITATED SO AS NOT TO CAUSE ONGOING ENVIRONMENTAL NUISANCE OR HARM.
3. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.



(a) Temporary drainage chute with rock pad outlet structure

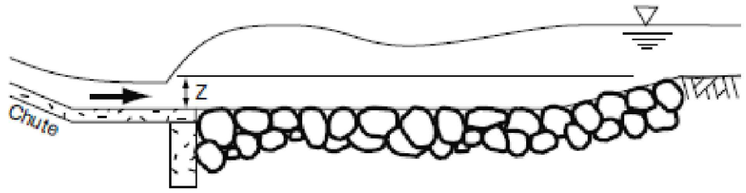


(c) Typical layout of a rock pad outlet structure for a drainage chute



T = Maximum top width of flow at base of chute

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



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

Notes:

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

REV	BY	DATE	REVISION DESCRIPTION	PM APPD.
A	LZ		FOR REVIEW	

DOC. NUMBER	DOCUMENT TITLE
REFERENCE DOCUMENTS	

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STATUS: FOR INFORMATION

DESIGNED		CHECKED		
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RPEQ		RPEQ No.		

CENTRAL QUEENSLAND COAL

EROSION SEDIMENT CONTROL
NOTES AND DETAILS
SHEET 2 OF 4

ORIGINAL SIZE: A1
DWG NO.: M7264-001-DWG-0002
REV.: A

SEDIMENT FENCE

MATERIALS

- FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140GSM. ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).
- FABRIC REINFORCEMENT: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.
- SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. 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;
   (ij) AT LEAST 2m FROM THE TOE OF ANY FILLING OPERATIONS THAT MAY RESULT IN SHIFTING SOIL/FILL DAMAGING THE FENCE.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.
9. WHEREVER POSSIBLE, CONSTRUCT THE SEDIMENT FENCE FROM A CONTINUOUS ROLL OF FABRIC. TO JOIN FABRIC EITHER:
   a. 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
   b. 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:

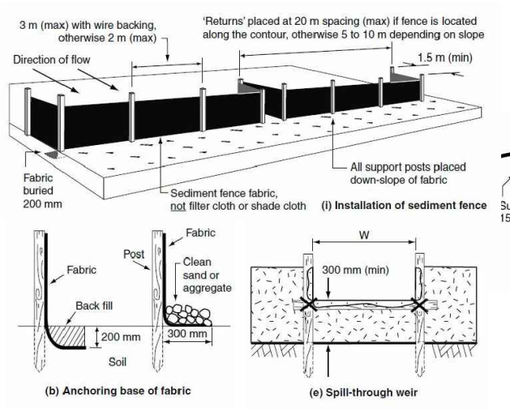
1. LOCATE THE SPILL-THROUGH WEIR SUCH THAT THE WEIR CREST WILL BE LOWER THAN THE GROUND LEVEL AT EACH END OF THE FENCE.
2. ENSURE THE CREST OF THE SPILL-THROUGH WEIR IS AT LEAST 300mm THE GROUND ELEVATION.
3. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE SUPPORT POSTS/ STAKES EACH SIDE OF THE WEIR. CUT THE FABRIC DOWN THE SIDE OF EACH POST AND FOLDOLHE 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 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.



SEDIMENT FENCE TYPICAL DETAIL

NOT TO SCALE

MULCH FILTER BERMS

MATERIALS

- MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.
- MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m.
- MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO DWG M2300-038-DWG-0102 FOR LOCATION OF THE MULCH BERM DURING STAGE 08 WORKS.
2. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.
3. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.
4. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.
5. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.
2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.
3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.
4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY REMEDIATED IN LINE WITH ESCP, THE BERM MAY BE REMOVED.
2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. REHABILITATE / REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

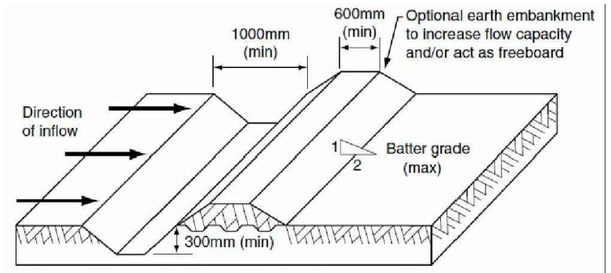


Figure 1 - Typical profile of diversion channel with bank

MULCH FILTER BERM TYPICAL DETAIL

NOT TO SCALE

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A	LZ		FOR REVIEW	

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REFERENCE DOCUMENTS	

Central QueenslandCoal

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STATUS: FOR INFORMATION

DESIGNED		CHECKED		
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PM APPD.		PD APPD.		
RPEQ		RPEQ No.		

CENTRAL QUEENSLAND COAL

EROSION SEDIMENT CONTROL NOTES AND DETAILS SHEET 3 OF 4

ORIGINAL SIZE: A1
DWG NO.: M7264-001-DWG-0003
REV.: A

ROCK FILTER DAM

MATERIAL:

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

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

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

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

INSTALLATION:

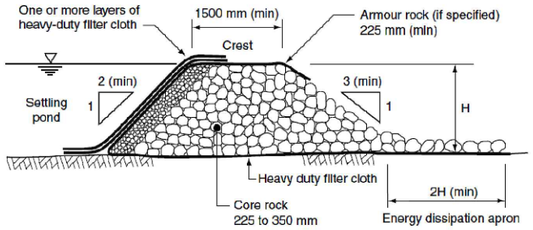
1. PRIOR TO COMMENCING ANY WORKS, OBTAIN ALL NECESSARY APPROVALS AND PERMITS REQUIRED TO CONDUCT THE NECESSARY WORKS INCLUDING PERMITS FOR THE DISTURBANCE OF RIPARIAN AND AQUATIC VEGETATION, AND THE CONSTRUCTION OF ALL PERMANENT OR TEMPORARY INSTREAM BARRIERS AND INSTREAM SEDIMENT CONTROL MEASURES.
2. CLEAR THE LOCATION FOR THE DAM; CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS AND TO INSTALL THE DAM.
3. REMOVE ANY CLEARED ORGANIC MATTER AND DEBRIS FROM THE CHANNEL AND DISPOSE OF IT PROPERLY. DO NOT USE ORGANIC MATTER OR DEBRIS TO BUILD THE ROCK FILTER DAM.
4. TO ASSIST IN THE EVENTUAL REMOVAL OF ALL MATERIALS USED IN THE CONSTRUCTION OF THE ROCK FILTER DAM, A PROTECTIVE LAYER OF GEOTEXTILE FILTER CLOTH (PREFERABLY IN THE FORM OF A SINGLE SHEET) SHALL BE PLACED OVER THE CHANNEL AREA AND DAM ABUTMENTS PRIOR TO INSTALLATION OF THE DAM. IF MORE THAN ONE SHEET OF FABRIC IS REQUIRED, OVERLAP THE FABRIC BY AT LEAST 600mm.
5. IF DISPERSIBLE, HIGHLY UNSTABLE, OR HIGHLY EROSIVE SOILS ARE EXPOSED, THEN PRIORITY SHALL BE GIVEN TO THE PROMPT STABILISATION OF ALL SUCH AREA.
6. PLACE THE CORE ROCK FOR THE ROCK FILTER DAM. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.
7. THE ROCK MATERIAL USED TO FORM THE DAM SHOULD BE WELL-GRADED MIXTURE OF ROCK WITH A MINIMUM SIZE OF 225mm AND A MAXIMUM OF 350mm (EXCLUDING ARMOUR ROCK). THE ROCK MAY BE MACHINE PLACED WITH THE SMALLER ROCKS WORKED INTO THE VOIDS OF THE LARGER ROCKS.
8. SMALL ROCK FILTER DAMS (<1m HIGH) SHOULD BE CONSTRUCTED IN A SLIGHTLY CURVED PROFILE (IN PLAN VIEW) POINTING UPSTREAM. THE CENTRE OF THE DAM'S CREST SHOULD BE SLIGHTLY LOWER (TYPICALLY 200mm) THAN THE OUTER ABUTMENTS TO PROMOTE INITIAL OVERTOPPING AT OR NEAR THE CENTRE OF THE CHANNEL.
9. WHERE NECESSARY, EXTENDED THE ROCK PROTECTION DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REQUIRED. OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER.
10. INSTALL THE SPECIFIED FILTER (AGGREGATE AND/OR FILTER CLOTH) ON THE UPSTREAM FACE OF THE ROCK FILTER DAM.
11. IF FILTER CLOTH IS USED, THEN:
    - 11.1. EXTEND THE FABRIC OVER THE CREST OF THE ROCK FILTER DAM INTO THE SPILLWAY CHUTE;
    - 11.2. CONSIDER THE PLACEMENT OF SEVERAL LAYERS OF OVERLAPPING FABRIC, THUS ALLOWING EACH LAYER TO BE REMOVED INDIVIDUALLY ONCE THE FABRIC BECOMES BLOCKED WITH SEDIMENT.
12. TAKE ALL NECESSARY MEASURES TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE:

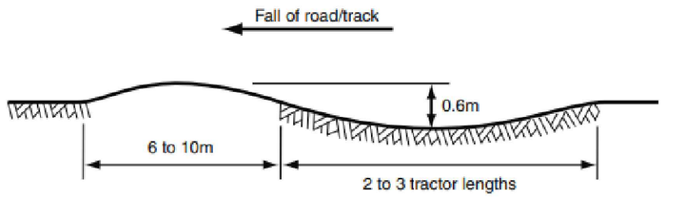
1. INSPECTION THE ROCK FILTER DAM, AFTER RUNOFF PRODUCING RAINFALL.
2. IDEALLY, ROCK FILTER DAMS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAY BE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.
3. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.
4. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.
5. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.
6. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE DAM.
7. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.
8. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL:

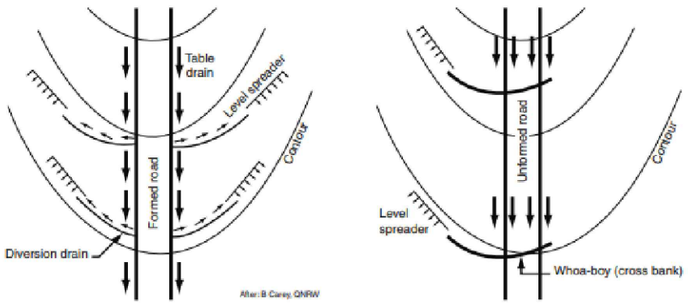
1. THE ROCK FILTER DAM SHOULD BE REMOVED AS SOON AS POSSIBLE AFTER THEY ARE NO LONGER NEEDED.
2. ALL SETTLED SEDIMENT UPSTREAM SHOULD BE REMOVED PRIOR TO THE DAM'S REMOVAL. DISPOSE OF THE SEDIMENT IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
3. REMOVE ALL MATERIALS USED TO FORM THE EMBANKMENT INCLUDING THE GEOTEXTILE FILTER CLOTH AND DISPOSE OF IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.



ROCK FILTER DAM
NOT TO SCALE



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



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

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LAST MODIFIED:8/17/2020 10:32 AM

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REFERENCE DOCUMENTS	DOC. NUMBER	DOCUMENT TITLE

Central QueenslandCoal

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CENTRAL QUEENSLAND COAL

EROSION SEDIMENT CONTROL NOTES AND DETAILS SHEET 4 OF 4

ORIGINAL SIZE	DWG NO.	REV.
A1	M7264-001-DWG-0004	A