Central Queensland Coal Project

Appendix 15b – Styx Catchment Sediment Budget

Central Queensland Coal

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WATER MANAGEMENT

CENTRAL QUEENSLAND COAL

Project Sediment Budget Assessment

Central Queensland Coal Project




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1. INTRODUCTION

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).

1.1 Purpose

The purpose of this report is to summarise and assess the potential estimated sediment generation from the proposed Project in comparison to the existing baseline sediment generation attributed to current land uses within the Project area. This comparison will outline the estimated changes and impacts to sediment loads entering the receiving environment and the Great Barrier Reef (GBR) as a result of the Project and includes a discussion on the mitigation and preventative measures that are committed to be undertaken during the operational phase of the mine.

1.2 Project Description

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 the majority of the Project is located within the “Mamelon” property, described as real property Lot 11 on MC23, Lot 10 on MC493 and Lot 9 on MC496 (Refer to Figure 1.1).

The Project will involve open cut coal mining and will be located within Mining Lease (ML) 80187 and ML 700022. 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 Train Loadout Facility will be developed within ML 700022 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).

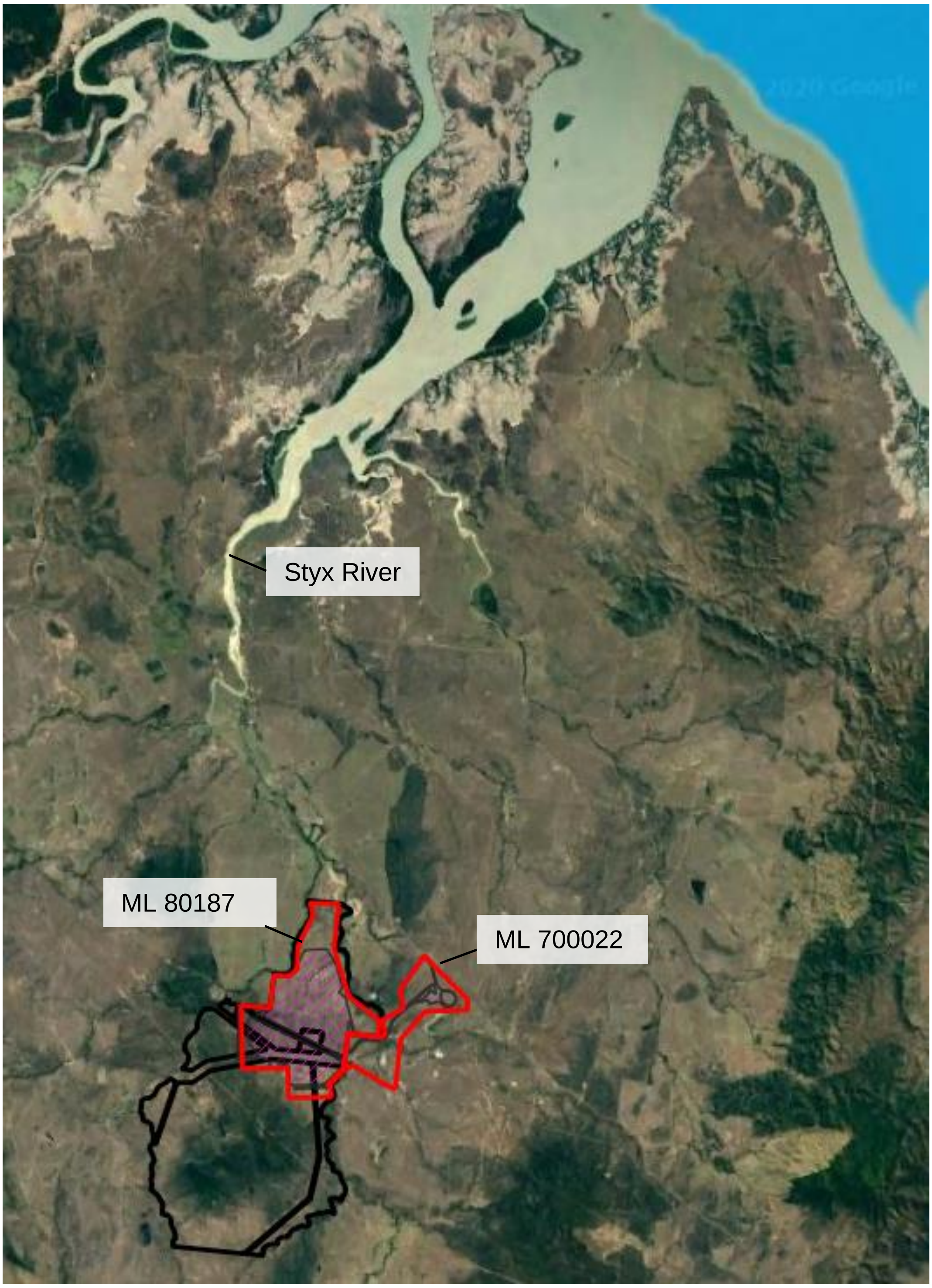

Figure 1.1 Overview of Mamelon Property Location (Black), Project Mining Leases (Red) and Proposed Mining Disturbance Area Footprint (Shaded)

2. RECEIVING ENVIRONMENT DESCRIPTION

2.1 Topography

The topography of the Project MLs can be described as floodplains that are generally flat or undulating land which drains via several smaller creeks and tributaries to the Styx River and estuary, and into the Coral Sea (Refer to Figure 2.1).

Based on a combination of both publicly available topography data and LiDAR capture for the Project, the typical elevation 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.

2.2 Catchment and Waterways

The Project is located within the Styx River Basin (which is a sub-basin of the Fitzroy Catchment) which discharges to the Great Barrier Reef (GBR) Marine Park. The Project is bordered by two watercourses as defined under the Water Act; Tooloombah Creek and Deep Creek (Refer to Figure 2.1). 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.

2.3 Soils

Desktop and field soil sampling for the Project area indicated the presence of:

- Sodosols which laboratory testing generally resulted in Emerson Class Numbers of 1 and 2 which indicate greater dispersive potential compared to other soil types. Sodosols can be described as being highly susceptible to erosion when disturbed.

- Vertosols and kandosols which are described as being moderate to highly susceptible to erosion on steep slopes and/or with intense rainfall.

It should be noted that soil types above are limited to topsoils and sub-soils which are relevant for any surface disturbance however waste characterisation studies also described the overburden and interburden materials as sodic (RGS, 2020) and therefore also have a greater susceptibility to erosion.

2.4 Land Use

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. Current stocking rates within the Mamelon property have been advised to be between 800 to 1500 head of cattle. 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).

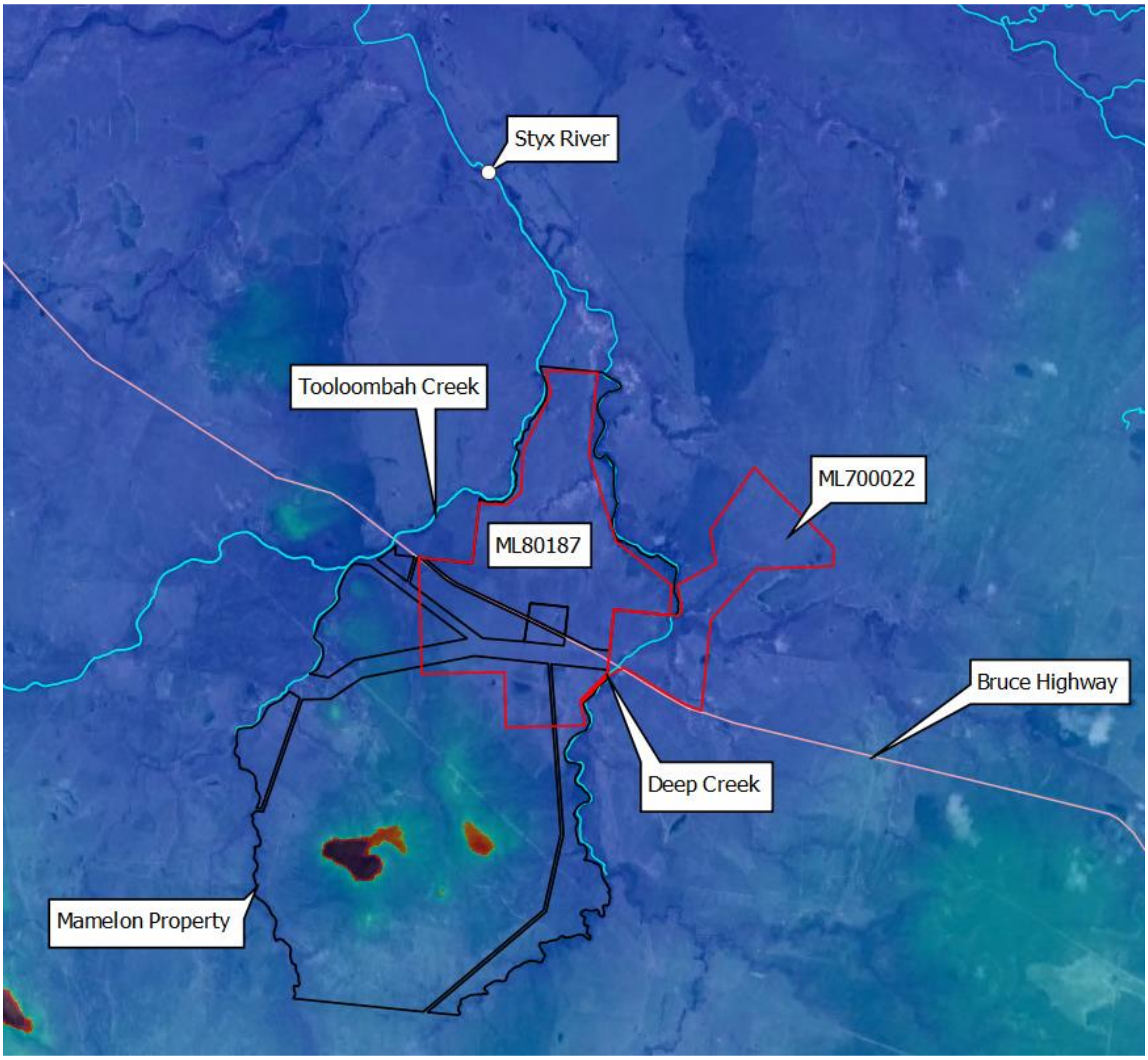

Figure 2.1 Topography and Receiving Waterways for the Project (Blue – Floodplain < 50mAHD, Red/Green – Slopes >50mAHD)

3. EXISTING (BASELINE) SEDIMENT GENERATION

3.1 Influence of Existing Land Uses

Erosion and sediment generation is a natural geomorphological function and occurs currently within the catchments of the proposed Project.

The rate of erosion and sediment generation is a function of many factors including (but not limited to) rainfall intensity, soil types, topography, slopes and vegetation. The existing (baseline) sediment generation from the proposed Project area is therefore heavily influenced by the current land use of grazing which occurs throughout the majority of the Mamelon property (Refer to Section 2.4).

Grazing of cattle can increase erosion and sediment generation through:

- Decrease of ground coverage i.e. grasses (through grazing or compaction).
- Increased soil disturbance from movement of the cattle in riparian zones (i.e. slopes of waterway banks) (BRS, 2001).

3.2 Estimation of Existing (Baseline) Sediment Generation

3.2.1 Paddock to Reef Program

Government programs like the Paddock to Reef Integrated Monitoring, Modelling and Reporting Program (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 Paddock to Reef program provides the framework for evaluating and reporting progress towards Reef 2050 Water Quality Improvement Plan (Reef 2050 WQIP) targets (Refer to Section 7) through reef water quality report cards (DES, 2020).

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).

3.2.2 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 3.1 covering a range of grazing intensities, topography and soil types.

Table 3.1 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
Floodplain, vertosol/sodosols – excess stocking pasture	1.6
Upland Slopes, sodosols – moderate stocking pasture	1.9

3.2.3 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.

For the purposes of this assessment and to be able to compare equitably with the operational Project phase and to incorporate the effectiveness of preventative and mitigation measures, the estimated baseline sediment generation has been calculated separately for the entire Mamelon Property, the two MLs and the proposed Project Disturbance Area Footprint.

The resulting estimated soil loss is presented in Table 3.2 for each area.

Table 3.2 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	1,375	990
Total (Baseline) **(Mamelon Property and ML 700022)**	**6,996**	**5,037**

4. OPERATIONAL SEDIMENT GENERATION

Clearing and ongoing disturbance associated with the proposed mining activities has the potential to cause increased sediment generation from the site. 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 coal 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 will be constructed in ten metre lifts with a maximum slope of 30%, although this will be reduced for the final landform to a maximum of 12%.

Similar to the surface and subsoils, the interburden and overburden material that will be stockpiled within the waste rock dumps is described as sodic (RGS, 2020) and therefore has a greater susceptibility to erosion, particularly prior to rehabilitation when it is more exposed. This combined with the steeper slopes indicate the waste rock dumps will likely have the greatest contribution to sediment generation within the site.

To estimate the potential 'worst-case' sediment generation from the proposed Project, the Revised Universal Soil Loss Equation (RUSLE) can be applied for the period of the mine life that represents the greatest risk of increased sediment generation. This conservative snapshot is represented with:

- 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.

This scenario will result in a conservative estimation as the proposed Project Mine Schedule allows for progression stabilisation, reshaping and rehabilitation of the out of pit dumps.

Figure 4.1 illustrates the extent of the out of pit dumps and pits during the 'worst-case' disturbance footprint adopted for the operational phase sediment generation estimation.

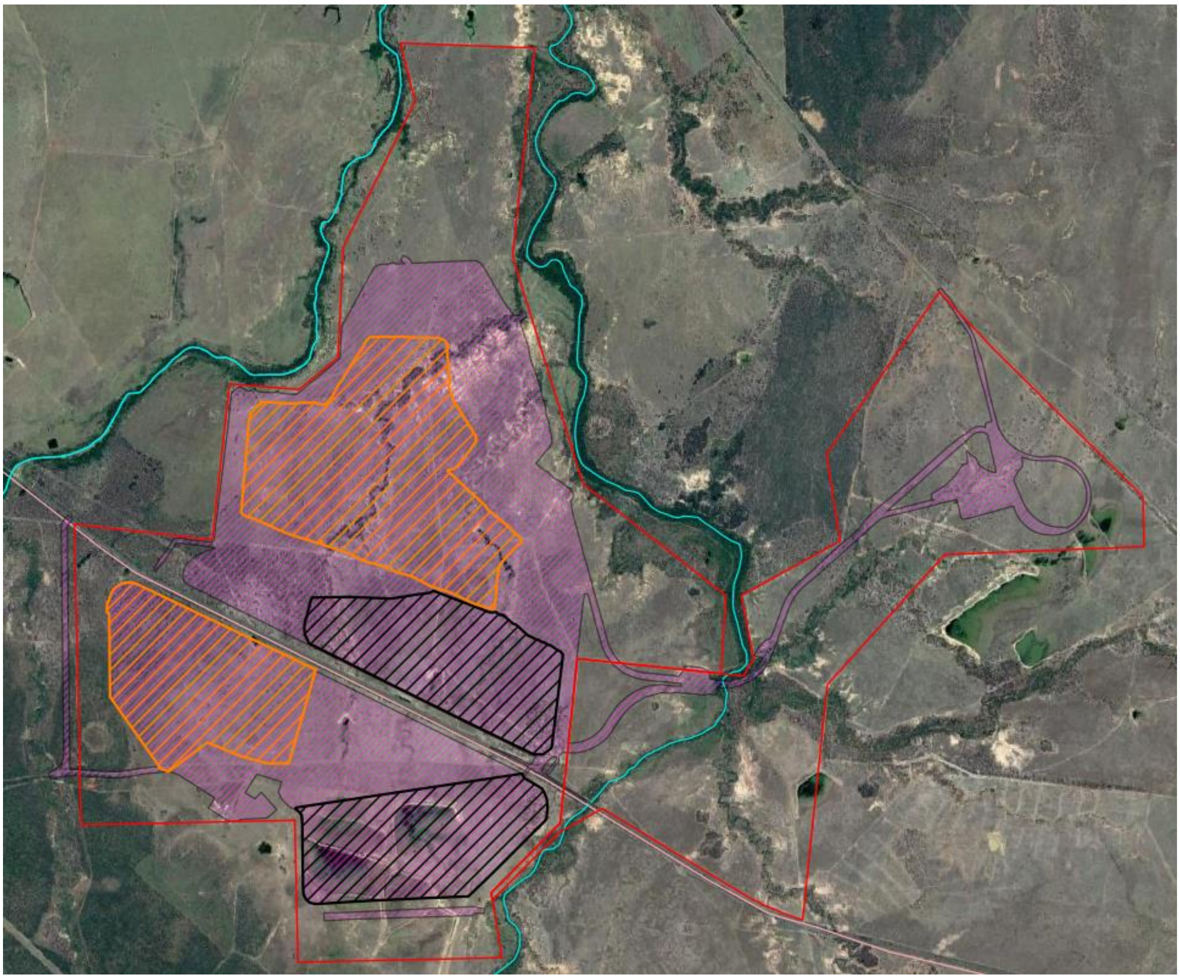

Figure 4.1 Conceptual 'Worst-Case' Disturbance Footprint of the Pits (Black Shading) and Out of Pit Dumps (Brown Shading) for use in the RUSLE

The RUSLE calculation is commonly used to predict long term average soil loss rates resulting from surface water flows (runoff) (IECA, 2008). It should be noted that any sediment generation calculations are estimates only and monitoring of sediment generation through ongoing field inspections and water quality samples are additional valuable tools to verify existing sediment generation from the proposed Project (Refer also to Section 5.2.5).

The RUSLE calculation is given in Equation 1

$$Equation\ 1 - \ A = K \times R \times LS \times P \times C$$

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

K = soil erodibility factor

R = rainfall erosivity factor calculated based on the 2 year Average Recurrence Interval (ARI) 6 hour rainfall event for the Project location as per International Erosion Control Association (IECA) Guidelines.

LS = variable dependant on the length and slope of the catchment.

P = "P-factor" which represents practices, management or methods for controlling erosion. 1.3 is the default (maximum) conservative value representing a compacted and smooth surface.

C = "C-factor" which represents groundcover and management practices of the area. 1.0 is the default (maximum) conservative 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 Table 4.1 and Figure 4.2)

Table 4.1 Proposed Water Storages for the Project

Dam	Surface Water Catchment	Receiving Waterway
ED 2D1	Haul road	Deep Creek
ED 2D2	Haul road	
Dam 4	Natural, rail loop and haul road	
ED 1C	MIA, CHPP	n/a – overflows to Dam 1
ED 1B	Waste Rock Stockpile 1	Tooloombah Creek
Dam 1	Waste Rock Stockpile 2, MIA, CHPP, haul road, natural	Tooloombah Creek

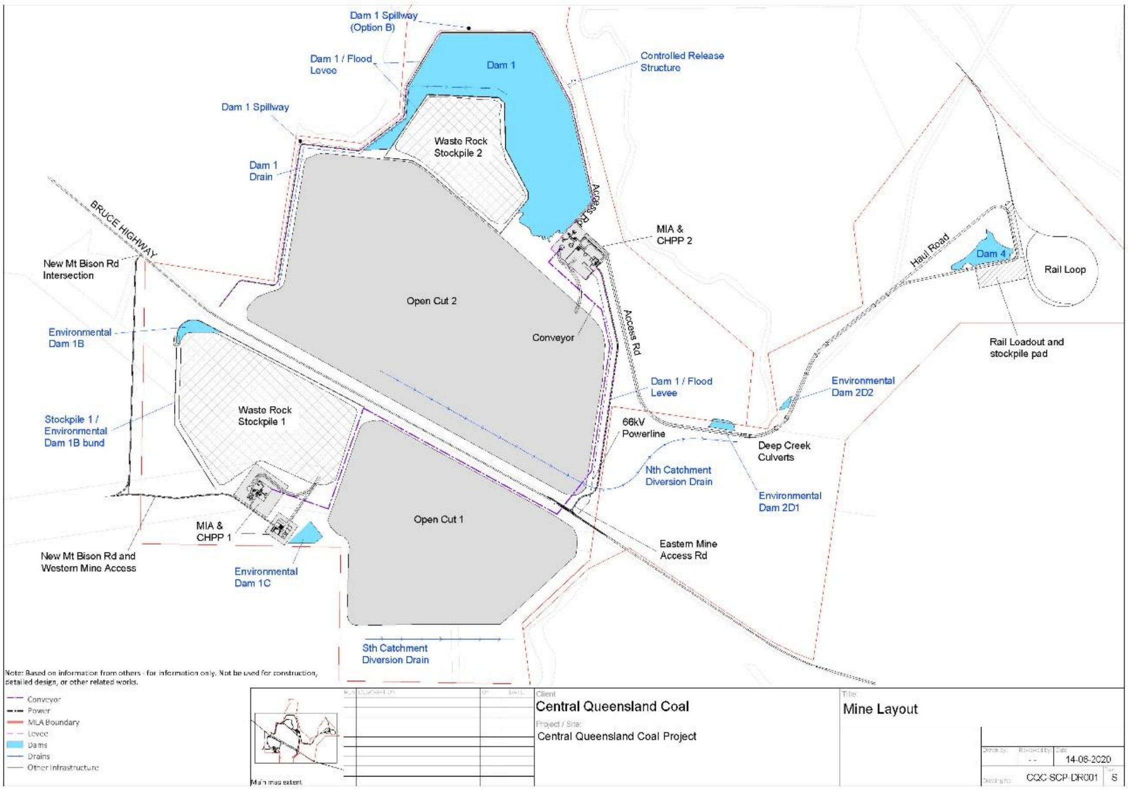

Figure 4.2 General Mine Layout Including Water Storages

In order to incorporate the effectiveness and impact of these structures in reducing the overall sediment generation that enters the receiving environment (see Section 6.2), the sediment generation rate was calculated for each dam catchment within the 'worst-case' disturbance footprint scenario shown in Figure 4.1. The mine pits internally drain and are therefore not included within each dam's catchment area.

The factors adopted for the operational 'worst-case' RUSLE calculations are presented in Table 4.2.

Table 4.2 RUSLE Factors Adopted for Operational Phase Sediment Generation Estimate

RUSLE Factor	Adopted Value	Justification
K	0.06	Conservative factor adopted with additional 20% increase to account for the surface and subsoils as well as overburden and interburden material which are likely sodic and dispersive. Sourced from Table E4 of IECA
R	3,665	This is the annual R Factor calculated for the project location based on the 2 year ARI, 6 hour event in accordance with IECA.

RUSLE Factor	Adopted Value	Justification
P	1.3	Default value described as 'compacted and smooth', the adopted factor is conservative and also represents no erosion management practices in place
C	1.0 (max) – no ground cover	Adopted C-factor was generally the maximum of 1 to represent the disturbed catchments
LS	Adopted range from 0.2 in gently sloped areas to 2.23 for the out of pit dumps with their maximum slopes	Based on average or worst-case predicted slope-lengths and sourced from Table E3 of IECA. Slopes of the waste rock dumps assumed to be ten metre lifts with a maximum slope of 30%

The resulting estimated soil loss for the catchment areas draining to each of the water storage dams is presented in Table 4.3.

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
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**

As can be seen the catchments for the two dams that receive runoff from the out of pit waste rock dumps (ED 1B and Dam 1) have significantly higher estimated soil loss volumes due to the higher erosivity of the steeper dump slopes.

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 5.2) 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. ADDITIONAL PREVENTATIVE AND MITIGATION MEASURES

5.1 Offsets, Destocking and Waterway Regeneration

Central Queensland Coal has committed to set aside offset habitat within the Mamelon property (Figure 5.1 outlines the areas currently under investigation). The final offset area is expected to be approximately 2,000 ha. 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 (~2,600 ha).

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.

For the purposes of assessing the impact destocking will have on reducing the baseline sediment generation (Refer to Section 6.2), it is considered reasonable to assume that the low grazing intensity sediment load rate of 0.34 t/ha/year (from Table 3.1) can be used to represent the sediment generation from destocked areas.

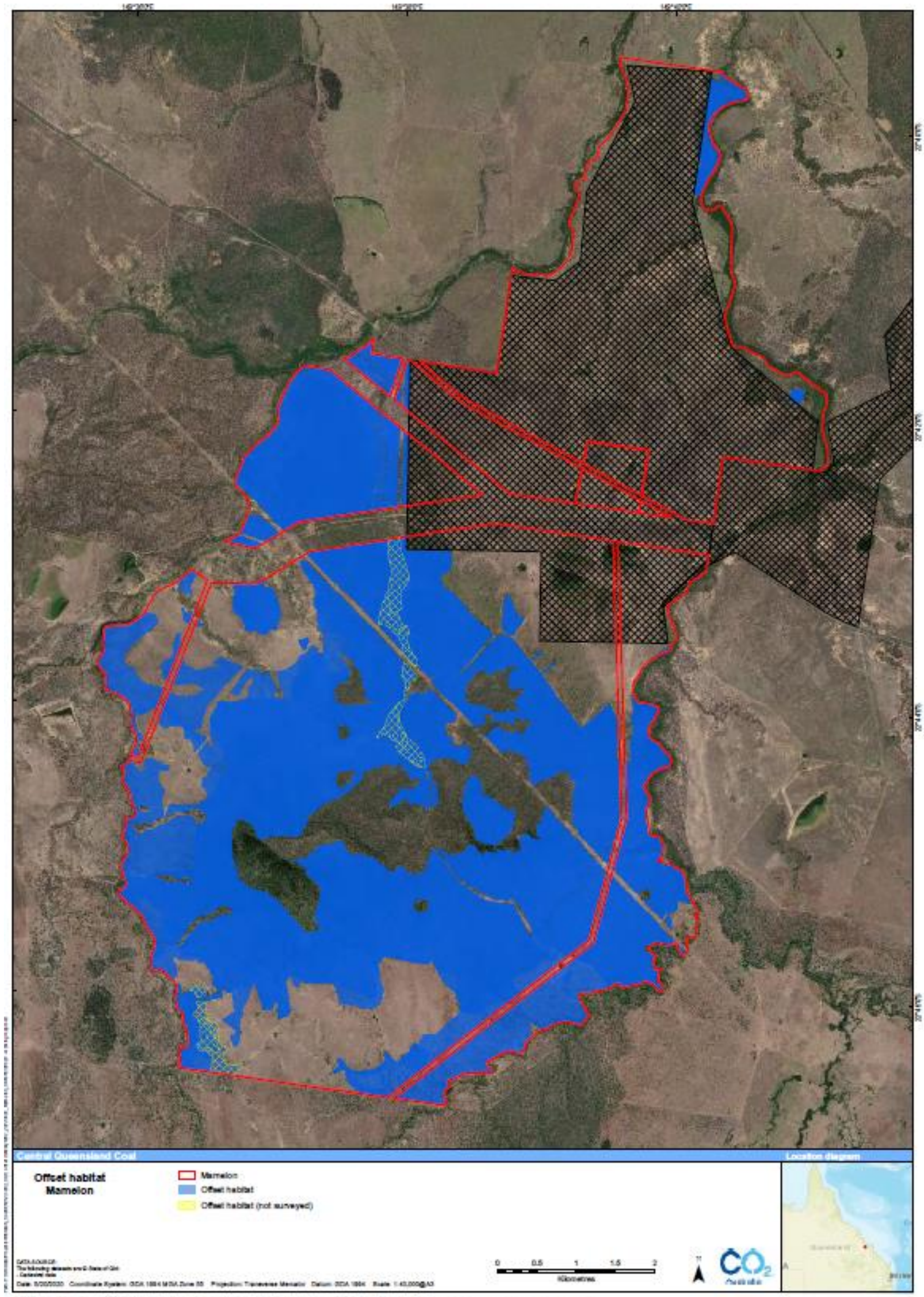

Figure 5.1 Offset Habitat Being Considered for the Mamelon Property (CO_2 Australia, 2020)

5.1.1 Waterway Regeneration

Destocking of MLs and offset areas, will allow for continued regeneration of riparian zones that are typically impacted from stock accessing the waterway. Even though there is some dieback or significant impacts considered possible, for certain tree species within some of the riparian zone of Deep Creek during the latter years of the project, this is due mainly to drawdown of groundwater from mining operations. If this were to occur, there are provisions in place within the Groundwater Dependant Ecosystem Management and Monitoring Plan for replanting within the riparian zones to be undertaken using smaller drought tolerant species will regenerate in their place and therefore from a sediment perspective it is still likely that the removal of grazing in the vicinity of these waterways will reduce the sediment loads into these waterways in the long term despite the predicted impacts and potential loss of canopy trees.

5.2 Other Erosion and Sediment Control Measures

Other erosion and sediment control measures that will be implemented by CQC during operations are outlined below. These measures cannot easily be quantified in terms of their effectiveness of reducing sediment loss into the receiving environment however are still effective and critical to reducing erosion and consequent sediment generation in all stages of the Project life.

5.2.1 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, including conducting high risk disturbance activities such as vegetation clearing and construction activities during the dry season where possible.
- Develop effective and flexible Erosion and Sediment Control Plans (ESCPs) based on anticipated soil loss, weather, and construction activities. A preliminary ESCP has been prepared for the Project that incorporates these factors.
- Minimise the extent and duration of soil disturbance.
- Control water movement through the site including clean water drainage around disturbed areas where possible.
- Minimise soil erosion.
- Promptly stabilise disturbed areas.
- Maximise sediment retention on the site.

- Maintain all ESC measures in proper working order at all times including routine desilting (minimum annual) of water storages.
- Monitor the site and adjust ESC practices to maintain the required performance standard.

5.2.2 Minimising Erosion of Slopes

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.

5.2.3 Drainage

Dirty water drains will be constructed to collect runoff from disturbed areas such as the waste rock dumps and convey flows in a non-erosive manner to the water storages. In addition, 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 water storage.

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.

5.2.4 Sediment Controls

The water storages located at key locations around the Project boundary are the main sediment control for the site (Refer to Section 4 and 6) however additional lesser sediment controls may also be utilised (where required) such as rock socks, mulch, rock checks, sand bags and sediment fences. These measures can 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.

5.2.5 Maintenance, Monitoring and Inspections

Maintenance is a critical component to ensuring ongoing effectiveness of all ESC measures. It is expected that the Erosion and Sediment Control Plans (ESCP) will be continuously updated during operations and include the specific roles and responsibilities of all maintenance, monitoring and inspection requirements for site ESCs.

Monitoring will be a critical component of assessing the ongoing performance of sediment control on site and deriving actual potential sediment loss into the receiving environment. It is expected that routine and event-based monitoring will include water quality samples for suspended solids and will be undertaken within all water storages and both up and downstream of the site.

6. SEDIMENT BUDGET ASSESSMENT

Without preventative and mitigation controls in place there is a potential that the nature of mining activities and presence of the out of pit dumps could increase the sediment generation of the Project area above the existing baseline generation rates.

However as discussed in Section 4 the Project proposes to construct and manage six key water storages that will contain runoff from all disturbed areas of the site. During the operational phase these dams will be the most effective controls at controlling sediment and minimising its discharge into the receiving environment.

6.1 Water Storage Releases

Discharges from the proposed dams were modelled by WRM using an OPSIM water balance model. Dam 1 is proposed to have a controlled release point where, under certain conditions, mine affected water can be released to Deep Creek. Overflows from other dams would be classed as uncontrolled releases if rainfall was to exceed the storage design criteria (WRM, 2020). Table 6.1 outlines the modelled controlled and uncontrolled releases for the proposed Project.

Table 6.1 Water Storages Modelled Releases (WRM, 2020)

Dam	Release Likelihood/Frequency	Release Volume
Controlled Releases		
Dam 1	For very wet climatic conditions (1%ile), predicted annual controlled releases range between 2,790 and 2,930 ML/year. For wet climatic conditions (10%ile), predicted annual controlled releases range between 780 and 1,430 ML/year. For median climatic conditions (50%ile), predicted annual controlled releases range are up to 40 ML/year.	
Uncontrolled Releases		
Dam 1	~1% risk of overflow over the first ten years of the Project increasing to ~10% during latter years. There are no modelled overflows during the median and drier climatic conditions.	Maximum annual overflow volume of 320 ML during the first ten years of the Project and maximum 2,500ML during the latter years, however in the 10th percentile, this volume reduces to ~65ML. There are no modelled overflow volumes during the median and drier climatic conditions.
ED 2D1	~1% risk of overflow over the life of the Project	Maximum annual overflow volume of 22 ML

Dam	Release Likelihood/Frequency	Release Volume
ED 2D2	~1% risk of overflow over the life of the Project	Maximum annual overflow volume of 22 ML
Dam 4	~1% risk of overflow over the life of the Project	Maximum annual overflow volume of 130 ML
ED 1B	~10% risk of overflow over the last ten years of the Project There are no modelled overflows during the median and drier climatic conditions.	Maximum annual overflow volume of ~700 ML during the last ten years of the Project in the 10th percentile, this volume reduces to ~200ML. There are no modelled overflow volumes during the median and drier climatic conditions.
ED 1C	Release frequency/volume unknown however if it were to overtop it reports to Dam 1 (i.e. does not discharge to receiving environment)	

Table 6.1 indicates 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.

To account for potential sediment loss during controlled releases and uncontrolled releases, a sediment concentration has been assumed within the release/overflow volumes. Average overflow volumes are required to compare the sediment volumes equitably with the baseline and operational estimations provided in Sections 3 and 4. In the absence of supplied average overflow volumes, 25% of the worst-case 10%ile release/overflow volumes has been adopted.

The adopted sediment concentrations are 60 mg/L for controlled releases and 100 mg/L for uncontrolled releases. The concentration for controlled releases is derived from the 80th percentile of all baseline water quality data for surrounding creeks and the Styx River. It is reasonable to assume that less sediment is present in controlled releases compared to uncontrolled events due to the release conditions that apply and assuming the release occurs from the surface of the storage and more sediment has settled. Additional controls such as flocculation can assist with improving the efficiency of sedimentation (Refer to Section 6.2).

Table 6.2 outlines the resultant estimated sediment contained within the average controlled and uncontrolled releases.

Table 6.2 Estimated Average Sediment Loads within Controlled and Uncontrolled Releases

Dam	Average Annual Release Volume (ML/year)	Average Sediment Load (t/year)
Dam 1	Controlled Releases – 358 ML	21
	Uncontrolled Releases – 16 ML	2
ED 1B	Uncontrolled Releases – 50 ML	5
Total		**28**

The sediment load has also been estimated for the 1%ile overflow volumes with an estimated concentration of 100 mg/L applied conservatively for both controlled and uncontrolled events.

Table 6.3 outlines the resultant estimated sediment contained within the 1%ile controlled and uncontrolled releases.

Table 6.3 Estimated Sediment Loads within 1%ile Controlled and Uncontrolled Releases

Dam	1%ile Annual Release Volume (ML/year)	1%ile Sediment Load (t/year)
Dam 1	Controlled Releases – 2,930 ML	293
	Uncontrolled Releases – 2,500 ML	250
ED 1B	Uncontrolled Releases – 700 ML	70
ED 2D1	Uncontrolled Releases – 22 ML	2
ED 2D2	Uncontrolled Releases – 22 ML	2
Dam 4	Uncontrolled Releases – 130 ML	13
Total		**630**

6.2 Sediment Budget Outcomes

Table 6.4 outlines the estimated average sediment generation rate for the Project if the discussed water storages and destocking measures are implemented.

Table 6.4 Estimated 'Worst-Case' Operational Sediment Generation with Adopted Controls in Place

Area	Approximate Catchment Area (ha)	Adopted Controls	Estimated Soil Loss (t/year)
Mamelon Property (excluding offset areas and MLs)	1,600	-	1,152
Offset areas within Mamelon property and MLs (excluding Disturbance Area)	3,290	Destocking	1,117
'Worst-Case' Disturbance Area	1,272	Water Storages (with average controlled and uncontrolled releases)	28
Total (under average climatic conditions)			**2,297**

Therefore, under average climatic conditions it is reasonable to assume 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 very wet climatic conditions it is expected that Dam 1 and ED1B will overflow at an increased frequency with an estimated total site sediment load of 630 t/year. However, even considering this increase, the total worst-case sediment generation rate would still remain well below the baseline rate and it is therefore expected that even during wetter years, the rate of sediment released to the receiving environment would remain less than baseline, assuming that the water storages all effectively settle out captured sediment and are routinely desilted.

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.

According to the IECA Appendix B Revision 2018, High Efficiency Sediment Basins (Type A and B) produce a higher treatment efficiency and improved environmental outcomes (IECA, 2018). A key design element of HES basins is flocculation for potentially dispersive material. If, based on monitoring undertaken during operations, CQC require additional sediment retention within the water storages, flocculation may be a useful additional control to implement.

7. THE REEF 2050 PLAN AND REEF 2050 WATER QUALITY IMPROVEMENT PLAN

The Reef 2050 Plan is the overarching framework for protecting and managing the GBR from 2015 to 2050 (DotEE 2015). The five-year Reef 2050 Water Quality Improvement Plan 2017 – 2022 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 (Refer to Table 7.1). By addressing the Reef 2050 Water Quality Targets (WQT), the Project will contribute to improving ecosystem health and water quality.

Based on the outcomes of the sediment budget for the Project, an assessment against the Reef 2050 WQTs sediment load reduction target is provided in Table 7.1.

Table 7.1 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).

8. 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.

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g. This report does not provide legal advice.

9. REFERENCES

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