MT OWEN
OPEN CUT

GLENCORE

Erosion and Sediment Control Plan

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Table of Contents

1 Commitment and Policy

1.1 Background

This Erosion and Sediment Control (ESC) Plan is part of a set of documents that together form the Water Management Plan for Mount Owen Glendell Operations (MGO) (refer to **Figure 1.1**)

The Water Management Plan is one of a series of Environmental Management Plans that together form the Environmental Management Framework (EMF) for MGO. This plan is to be read in conjunction with the MGO **Water Management Plan.**

MGO is located within New South Wales (NSW), approximately 20 kilometres north-west of Singleton. Mount Owen Pty Limited (Mt Owen), a subsidiary of Glencore Coal Pty Limited (formerly Xstrata Coal Pty Limited) currently owns the three open cut operations in MGO:

- Mount Owen (North Pit), approved under Development Consent SSD – 5850;
- Ravensworth East (Bayswater North Pit), approved under Development Consent SSD – 5850; and
- Glendell (Barrett Pit), approved by Development Consent DA – 80/952.

Mining operations at the MGO include the integrated use of the Mt Owen Coal Handling and Preparation Plant (CHPP), coal stockpiles and rail load-out facility.

Three modifications have been approved to Mount Owen Continued Operations (MOCO) SSD-5850. Modification 1 (MOCO MOD 1) facilitated the construction of a water pipeline to convey mine water from Integra Underground Mine to MGO and was granted on 15 September 2017. Modification 2 (MOCO MOD 2) approved an extension to the mining area at North Pit to enable access to an additional approximately 35 Mt of ROM coal. MOD 2 also approved an extension of the Mount Owen Mine life by an additional 6 years to 2037 and was granted on 4 September 2019. On the 30 January 2020 an administrative modification (MOCO MOD 3) was approved by the NSW Department of Primary Industries and Environment (DPIE). There were no changes to statutory conditions associated with MOCO MOD 3.

The ESC Plan was updated and submitted to DPIE on 2 December, following approval of MOCO MOD 2. The approval of the plan was put on hold, however, in anticipation of an impending approval of the Glendell MOD 4.

A modification of DA 80/952 (GLD MOD 4) was approved by DPIE on 4 March 2020 for Glendell Mine. The modification allows for a minor extension to the approved pit shell in order to access an additional 2.5 million tonnes run of mine (Mt ROM) coal from the Barrett Pit and access via a western haul road under the current approval which expires 30 June 2024 (Umwelt, 2018b).

The SWMMP has now been updated to incorporate the requirements of MOCO MOD 2 and MOC MOD 3 as well as Glendell MOD 4, and supersedes the previously approved ESC Plan (November 2018).

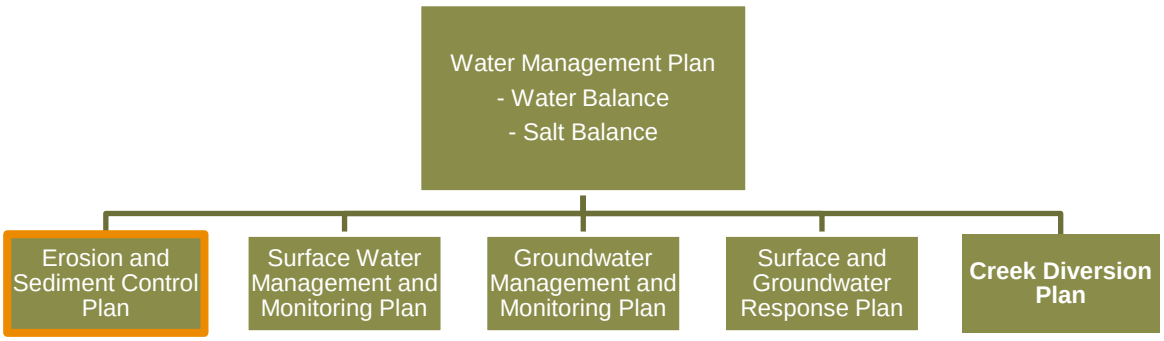

Figure 1.1 – MGO Water Management Plan Structure

1.2 Objectives of the ESC Plan

The objective of this ESC Plan is to ensure that appropriate structures and programs of work are in place to:

- Identify activities that could cause erosion and generate sediment or affect flooding, including activities on waterfront land;
- Describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and to manage flood risk;
- Describe the location, function and capacity of ESC structures and flood conveyance works;
- Provide that ESC structures are appropriately maintained;
- Fulfil the statutory conditions of relevant MGO approvals and licences; and
- Meet the requirements of the Blue Book (*Managing Urban Stormwater: Soils and Construction Volumes 1* and *Volume 2E, DECC 2008*) and Glencore Coal Assets Australia (GCAA).

1.3 Requirements of the ESC Plan

1.3.1 Statutory Requirements

Both the Mt Owen Mine (SSD-5850) and Glendell Mine (DA 80/952) development approvals stipulate requirements related to this ESC Plan (refer to ***Table 1.1***). The Statement of Commitments for the Mt Owen Mine and Glendell Mine development approvals relevant to the ESC Plan are provided in

Table 1.2. The Environmental Impact Statement for Continued Operations (SSD-5850) should be referred to for a comprehensive outline of the proposed extraction program for MGO.

Condition L1.1 of Environment Protection Licence (EPL) 4460 (Mt Owen Mine) and EPL 12840 (Glendell Mine) requires compliance with Section 120 of the *Protection of the Environment Operations Act 1997* (POEO Act), which prohibits pollution of waters.

The implementation of the management measures outlined in ***Section 3***, through minimising sediment generation and transportation to downstream waterways, facilitates achievement of this.

Table 1.1 – Relevant Development Consent Conditions

Mt Owen Continued Operations (SSD-5850, Schedule 3)	Glendell Mine (DA 80/952, Schedule 4)	Condition	Relevant Section of Plan
26 (c) (iii)	–	The Water Management Plan must include an Erosion and Sediment Control Plan that:	
26 (c) (iii)	–	Is consistent with the requirements of *Managing Urban Stormwater: Soils and Construction – Volume 1* and *Volume 2E Mines and Quarries*, or its latest version.	***Section 3.1.1***
26 (c) (iii)	–	Identifies activities that could cause soil erosion, generate sediment or affect flooding.	***Section 2.2***
26 (c) (iii)	–	Describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage flood risk.	***Section 3.1.1*** ***Section 3.2***
26 (c) (iii)	–	Describes the location, function, and capacity of erosion and sediment control structures and flood management structures.	***Section 3.1.2.1*** ***Section 3.2***
26 (c) (iii)	–	Describes what measures would be implemented to maintain the structures over time.	***Section 3.1.3*** ***Section 4***
–	32 (a)	Be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction – Volume 1* and *Volume 2E Mines and Quarries*, or its latest version	***Section 3.1.1***
–	32 (b)	Identify activities that could cause soil erosion and generate sediment, including activities on waterfront land (within 40 metres of a watercourse).	***Section 2.2***
–	32 (c)	Describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters.	***Section 3.1.1***
–	32 (d)	Describe the location, function and capacity of erosion and sediment control structures.	***Section 3.1.2.1*** ***Section 3.2***

–	32 (e)	Describe what measures would be implemented to maintain these structures over time.	***Section 3.1.3*** ***Section 4***

Table 1.2 – Relevant Statement of Commitments

Development Consent	Commitment	Relevant Section of Plan
Mt Owen Continued Operations (SSD-5850)	Erosion and sediment controls will be monitored during construction and operation in accordance with the Blue Book (Landcom 2004 and DECC 2008).	**Section 3.1.3** **Section 4**
Glendell Mine (DA 80/952)	Design surface water controls to ensure that clean runoff is separated from runoff within disturbed mining and infrastructure areas. Design sediment and erosion controls to ensure any runoff from disturbed areas is appropriately treated.	**Section 3.1.1** **Section 3.1.2.1**

1.3.2 GCAA Requirements

The GCAA ***Erosion and Sediment Control Procedure*** (CAA HSEC PRO 0016) outlines the following principles, which focus on minimising erosion, to guide all disturbance activities:

- Minimise disturbance wherever possible;
- Minimise upslope catchment and manage disturbed area runoff;
- Limit erosion and manage sediment; and
- Recover and save topsoil and progressively rehabilitate disturbed areas.

GCAA has adopted the design standard of the Blue Book, specifically *Managing Urban Stormwater: Soils and Construction Volume 2E* (DECC 2008). ***Section 3*** outlines how these principles are met.

1.4 Consultation

1.4.1 Consultation with Internal (Mt Owen) Stakeholders

This ESC Plan has been reviewed by members of the Mt Owen EMS Committee and endorsed at the meeting of 28 November 2016.

Details of Training and Communication arrangements are outlined in ***Section 3.3***.

1.4.2 Consultation with External Stakeholders

This document represents a revision of the originally approved MGO ESC Plan, which was submitted to the then Department of Environment and Climate Change (DECC) and the then Department of Water and Energy in 2008.

The December 2016 revision of the ESC Plan was prepared following approval of the Mt Owen Continued Operations SSD-5850 in consultation with the Environment Protection Authority (EPA) and the NSW Department of Primary Industries – Water (DPI – Water). A copy of the consultation records are provided in ***Appendix A***.

The final draft of the revised ESC Plan was submitted to the then Department of Planning and Environment (DP&E) in January 2017 and approved in November 2018.

The ESC Plan was updated following approval of MOCO MOD 2 and submitted to DPIE on 3 December 2019, in consultation with the EPA and DPIE – Water. A copy of the consultation records can be found on the DPIE major projects website.

The approval of the plan by DPIE, however was put on hold in anticipation of impending approvals to Glendell MOD 4 and MOCO MOD3. Following the receipt of these approvals, the ESC Plan has been reviewed and updated to incorporate these modifications. This has resulted in administrative changes only and therefore further consultation with external stakeholders is not considered necessary.

The revised ESC Plan was submitted and approved by DPIE in September 2020. A copy of the DP&E approval of the ESC Plan is provided in ***Appendix B***.

Version and revision history of this document is provided in **Section** Error! Reference source not found..

2 Planning

2.1 Environmental Baseline

2.1.1 Environmental Setting

The area surrounding MGO is dominated by established mining operations, including Liddell Coal Operations to the north-west, Ravensworth Surface Operations to the south-west; Integra Underground Mine and Rix's Creek Mine to the south-east and Ashton Mine to the south. Other land uses include cattle grazing (predominately on GCAA-owned land and managed by Colinta Holdings Pty Limited, a Glencore subsidiary), rural residential holdings, Hebden and Wild Quarries and Bayswater and Liddell Power Stations. Ravensworth State Forest lies immediately to the north of MGO.

There is an extensive history of mining operations at MGO, dating back to the early 1960s at the Ravensworth East Mine. Prior to this time, the land had been heavily cleared for agriculture and the majority remains as cleared grazing land. Areas of native woodland that currently exist have predominately regrown since the period of heavy vegetation clearing prior to 1958.

2.1.2 Site Characteristics

MGO is located on the eastern extremity of the Hunter Coal Fields with part of the land holding encompassing the steep escarpments of the Hunter Thrust. The topography of the area ranges from steep undulating country against the Thrust in the north, to flat or undulating in the south.

The area surrounding MGO is characterised by gently sloping alluvial plains and undulating hills. East and north-east of MGO, the terrain becomes more undulating and hilly.

The Project Area has been mapped using the Land and Soil Capability (LSC) classification which uses the site specific slopes, landforms and soil characteristics to assess and identify the limitations on the type and intensity of the use of land within the project area as well as the extent to which intensive management is required to prevent on and off site degradation (Refer to Appendix 12 of the Environmental Impact Statement for Continued Operations).

The different slope classes within the Project Area have been mapped and align with the slope classes used in the *NSW Land and Soil Capability Scheme* (OEH, 2012) and the Biophysical Strategic Agricultural Land (BSAL) verification criteria.

The dominant slope class within the proposed disturbance area is Class 3 (between 3-10%) which are predominately associated with the foothills of lower slopes in the North Pit Continuation area associated with the Bayswater soil landscape.

2.1.3 Soil Resources

Several soil landscapes are present in the region with the area of MGO dominated by the Bayswater Soil Landscape and small areas comprising the Hunter Soil Landscape are present in the lower drainage lines.

Descriptions of the soil profile characteristics and soil profile are shown in Error! Reference source not found. and **Table 2.1.**

Hazards, risks and constraints associated with each soil landscape are detailed in **Section 2.1.3** below.

2.1.3.1 Risks and Constraints of Soil Landscapes

Soils within the Bayswater Soil Landscape are susceptible to moderate sheet and gully erosion on the upper slopes with minor gullies (up to 3 m) associated with the high erodibility of the solodic soils. Soils in the mid to upper slopes are typically alluvial or colluvial comprising fine sandy loams to loams with weak structure. Salt deposits associated with erosion are also common in some areas particularly within the solodic and podzolic soils. Alluvial and prairie soils dominate the lower slopes of the Bayswater Soil Landscape. The erodibility is moderate to high and the soil salinity risk is low to high (Matthei, 1995).

The Hunter Soil Landscape comprises of alluvial soils susceptible to minor erosion along stream banks on watercourses with minor sheet and gully erosion on the adjacent terraces (Matthei, 1995 and Umwelt, 2014).

Soils of the Rosevale Soil Landscape are susceptible to minor to moderate sheet erosion on cleared areas and mass movement on steeper slopes. This soil landscape type has low soil salinity (Matthei, 1995).

Soils of the Liddell Soil Landscape are susceptible to low to high topsoil erosion and have high to very high erosion hazard generally (Matthei, 1995).

Overall, the regional scale soil landscape within MGO locality has been characterised by Matthei (1995) as:

- Generally undulating to steep terrain with erodible (susceptible to sheet and gully erosion), low fertility soils (excluding the Hunter Soil Landscape, which occurs on the floodplain and terraces of the Hunter River and its major tributaries (such as Bowmans Creek and Glennies Creek)). Some higher fertility soils occur to the north of Singleton and the Glennies Creek Dam;
- Having soils that are generally slightly to moderately acidic;
- Having a minimum typical profile depth for each soil landscape (0.35 m to 0.4 m) on the upper to mid slopes; and
- Having poorly drained soils with heavy clay B horizon within the lower slopes.

In addition, some of the weathered Permian materials, that will be extracted as part of the mining operations and emplaced in the overburden emplacement areas (refer to Section 2.5 of the Surface Water Management and Monitoring Plan), have been identified as potentially strongly sodic and dispersive.

There is a risk with these materials, that they will be erosive and subject to impacts from both direct rainfall and flowing water.

Where dispersive soils are identified within overburden, placement within 3 m of the surface of the final landform will be avoided, and surface areas during construction and operations will be managed as per the ground disturbance process and site specific strategies as outlined in **Section 3.1.2**.

2.1.3.2 Vulnerable Land

The Office of Environment and Heritage (OEH) online mapping service, maps isolated pockets of land to the north of MGO as ‘vulnerable land’, based on its erodibility or steepness of slopes. None of these areas are within the operational areas of MGO (Refer to **Figure 2.2**).

Historical ‘steep or highly erodible soils’ are mapped as occurring over parts of the pre mining landforms at Ravensworth East Mine and Glendell Mining, however, these areas have since been mined and are either current active overburden dumping areas or rehabilitated.

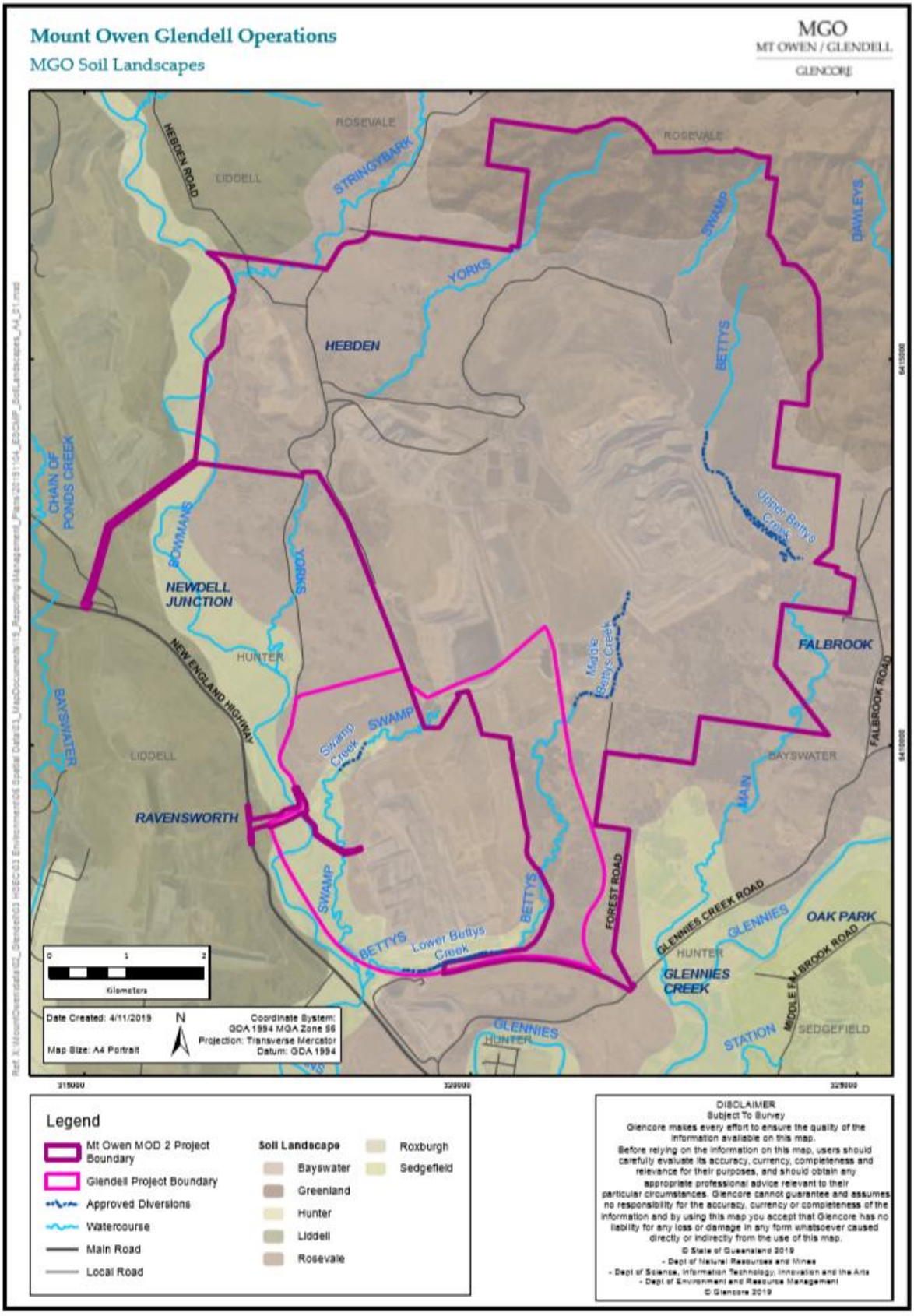

Figure 2.1 Soil Landscapes

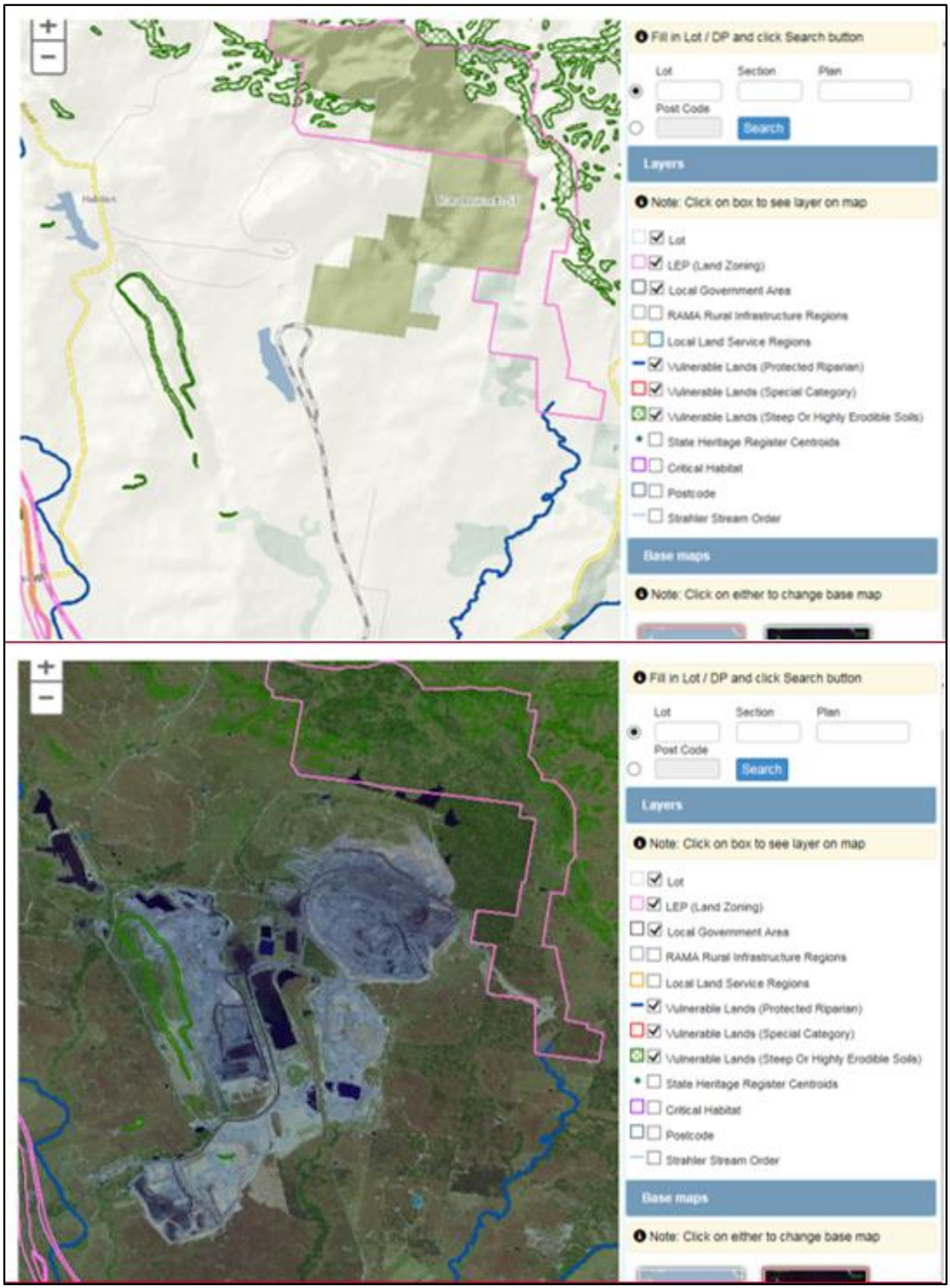

Figure 2.2 OEH Native Vegetation Information Online Mapping Tool - Vulnerable Areas (OEH, 2017)

Table 2.1 Soil Landscape Characteristics MGO (Umwelt, 2014)

Soil Landscape	Terrain	Soil Profile Types	Other Characteristics
Bayswater	Covers undulating low hills south-west of Muswellbrook. The dominant soil landscape in the Project Area.	The main soils are Yellow Solodic and Yellow and Brown Podzolic soils occurring on slopes, and Alluvial Soils in drainage lines.	Profile depth: 40-300cm pH: 5.5-7.0 Low soil fertility Poorly to well drained with low to high water holding capacity
Rosevale	Predominantly covers rolling hills to the north of Glennies Creek Dam.	The main soils are Red and Brown Podzolic Soils on the upper to lower slopes and on the steeper sections of footslopes of the Isismurra and Woolooma Formations. Yellow Soloths occur on midslopes and Euchrozems also occur on upper slopes.	Profile depth: 30-110cm pH: 5.5-8.0 Low to moderate soil fertility Drainage varies from rapid and imperfectly drained, to well drained. Low to moderate water holding capacity.
Hunter	Occurs throughout the floodplains of the Hunter River and its tributaries	The main soils of this landscape are all formed in alluvium.	Profile depth: 40-300cm pH: 5.5-7.5 Low to moderate soil fertility Drainage varies from rapid and imperfectly drained, to moderately well drained. Low to high water holding capacity.
Liddell	Covers undulating low hills and undulating hills in the Liddell Power Station area.	The main soils are Yellow Soloths on the slopes with some Yellow Solodic Soils on concave slopes. There are Earthy and siliceous Sands on mid to lower slopes where the parent material is more sandy.	Profile depth: 50-110cm pH: 6.0-6.5 Low soil fertility Poorly to well drained with low to moderate water holding capacity

2.1.4 Vegetation

Remnant vegetation occurring around MGO comprises of woodland, forest and riparian vegetation. Habitat and condition assessments were completed as part of the Ecological Impact Assessment completed for the Environmental Impact Assessment with results indicating that woodland/forest, riparian, shrubland and grassland formations are in good condition.

The areas surrounding and within MGO are predominately composed of valley floor woodlands, forests and native and exotic pastures derived from the clearing of woodlands. As outlined in the Ecological Assessment for the Mount Owen Continued Operations Project (Umwelt 2014) a total of 355 flora species were recorded during flora surveys, of which 26 per cent were not native to the area. Twelve native vegetation communities have been identified in being:

- Barrington Footslopes Dry Spotted Gum Forest
- Central Hunter Bulloak Forest regeneration
- Central Hunter Grey Box- Ironbark Woodland
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest (including plan
- Central Hunter Swamp Oak Forest
- Derived Native Grassland
- Dry Rainforest

- Hunter Footslopes Sheltered Forest
- Hunter Lowland Red Gum Forest
- Hunter Valley River Oak Forest
- Kunzea Closed Shrubland
- Mine Rehabilitation

2.1.4.1 Proposed Vegetation Management

MGO has sought to avoid and minimise potential impacts on the ecological values of the surrounding lands throughout the project planning process. Further to this, MGO has committed to the design and implementation of a comprehensive strategy to mitigate the residual impacts of the approved mining operations and are currently detailed in the ***MGO Biodiversity and Offset Management Plan and Strategy***. Some of these strategies and controls, which support the objectives of this ESC Plan, include:

- Feral animal and weed control;
- Rehabilitation/Revegetation of disturbed areas with species characteristic of extant vegetation communities;
- Management of erosion and sedimentation to ensure that adjoining vegetation communities and aquatic systems are not adversely impacted; and
- Ongoing monitoring and maintenance of revegetation works and habitat enhancement activities.

2.1.4.2 Progressive Rehabilitation

MGO has committed to progressive rehabilitation of post-mining areas to be completed as soon as practicable after shaped areas become available. It will also target the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC.

All rehabilitation works will be scheduled to commence as soon as practicable after disturbance and reformation of the landscape. Refer to the ***MGO Water Management Plan*** for an overview of the proposed rehabilitation for MGO.

2.1.5 Catchments and Hydrology

MGO is located within the catchments of Bowmans Creek and Glennies Creek. The Bowmans Creek catchment includes the sub-catchments of Stringybark Creek, Yorks Creek, Swamp Creek and Bettys Creek; while the Glennies Creek catchment includes the sub-catchment of Main Creek. Bettys Creek has been the subject of three approved diversions known as the Upper, Middle and Lower Bettys Creek diversions. Both Yorks Creek and Swamp Creek have also been the subject of approved diversions. The catchment areas for each creek within the MGO Project Area are described in the ***MGO Surface Water Management and Monitoring Plan*** and the key catchments and drainage lines are mapped in the Surface Water Assessment (Appendix 9) of the Environmental Impact Assessment for Mt Owen Continued Operations (Umwelt 2015) and an overview is provided in the ***MGO Water Management Plan***.

MGO has an extensive water management system (WMS), which includes mine dewatering systems, creek diversions, water storages, sediment dams, tailings ponds, pumps and pipeline infrastructure, drains and earthen bunding around stockpiles, hardstand areas, haul roads and refuelling areas.

Key functions of the WMS are to divert clean water around mining operations and minimise adverse effects on downstream waterways (both hydraulic and water quality impacts).

In addition to this, MGO is an integral part of the Greater Ravensworth Area Water and Tailings System (GRAWTS) with the adjacent Glencore mining operations, including Ravensworth Complex, Liddell Coal Operations and Integra Underground Mine. The GRAWTS allows greater flexibility in mine water management by the MGO.

Further details of the WMS are outlined in the ***MGO Water Management Plan***.

2.2 Potential Impacts

2.2.1 Erosion and Sediment

Mining operations that have the potential to cause erosion or generate sediment and impact the surrounding catchment areas are:

- Continued mining operations and construction activities at MGO;
- Clearing or disturbance of land for mining or other activities;
- Construction of operational sediment control measures within MGO;
- Construction of overburden and emplacement areas and haul routes within MGO;
- Placement of overburden and topsoil;
- Vehicle and equipment movements;
- Coal stockpiles and coal handling equipment areas; and
- Mine site rehabilitation.

Erosion and sedimentation impacts which may result from mining operations include:

- Increased runoff volumes and velocities from the removal of vegetation, land disturbance and the introduction of impervious surfaces on hardstand areas;
- Increased potential for sedimentation to occur from increased erosion and runoff associated with open cut mining, stockpiling of material and the construction of surface facilities, access roads/tracks and exploration drilling;
- Potential for increased scouring during the construction of surface facilities adjacent to watercourses; and
- Potential decline in water quality and degradation of local amenities through sediment transport to nearby watercourses.

2.2.1.1 At Risk Areas

Based on the baseline data provided in **Section 2.1**, areas within the MGO Project Area that have a serious risk of erosion and sedimentation impacts are outlined in **Table 2.2** below. The controls and management strategies in place to protect these areas are discussed in **Section 3**.

Table 2.2 Areas within the MGO Project Area with Serious Risk of Erosion or Sedimentation Impacts

Key Risk Areas	Justification
Vulnerable Lands	No future mining or emplacements areas (that have not been disturbed to date) are mapped as 'vulnerable land'.
Proposed Hebden Road/Rail Overpass and Proposed Bowmans Creek Bridge	These works are planned for areas that are mapped as Liddell Soil Landscape profile which has a high to very high erosion risk.

2.2.2 Flooding

Mining operations that have the potential to affect flooding include:

- Localised landform and catchment area changes due to open cut mining and overburden and tailings emplacement;
- The Bowmans Creek Bridge on Hebden Road; and
- The rail bridge over Bettys Creek.

Flood modelling and assessment was undertaken for the Mt Owen Continued Operations project by Umwelt (Umwelt 2015) for waterways and catchments surrounding MGO. Flood events were simulated for the 10%, 5% and 1% AEP design storm events (equivalent to the 10 year, 20 year and 100 year average recurrance interval (ARI) storm events).

In accordance with the *Floodplain Development Manual* (DIPNR 2005) the 1% AEP (or 100 year ARI) flood event has been used as a floodplain management tool in assessing impacts of the development. The modelled flood extent for 1% AEP storm event is presented in **Figure 2.3.** The flood modelling indicates that MGO is generally located outside of the 1% AEP event flood extent, with the exception of the proposed rail bridge over Bettys Creek, the proposed Bowmans Creek Bridge on Hebden Road and areas of flow conveyance within Bowmans Creek and Yorks Creek. There is no mining or overburden emplacement proposed within the 1% AEP event flood extent (Umwelt 2015).

Updated modelling and simulations were assessed in the MOCO MOD 2 SEE (Umwelt, 2018a) and Glendell MOD 4 SEE (Umwelt, 2018b) for the proposed modifications to the mine plan.

Modelling for MOCO MOD 2 indicates flood levels adjacent to the North Pit during a 0.1% AEP event could result in the intrusion of flood water into the Active Operational Area. An additional flood levee along the south-western edoge of the north pit will be constructed, as detailed in the SWMMP.

Modelling for Glendell MOD 4 indicated the 1% AEP flood event would extend along Swamp Creek and to within approximately 30 m of the proposed pitshell of the Barret Pit. A road safety berm will be constructed for flood mitigation for the 0.1% AEP flood event, as detailed in the SWMMP.

Given the location of these works outside of the predicted flood extent there is unlikely to be any significant impact on flood flow velocities or afflux effects (Umwelt, 2018b).

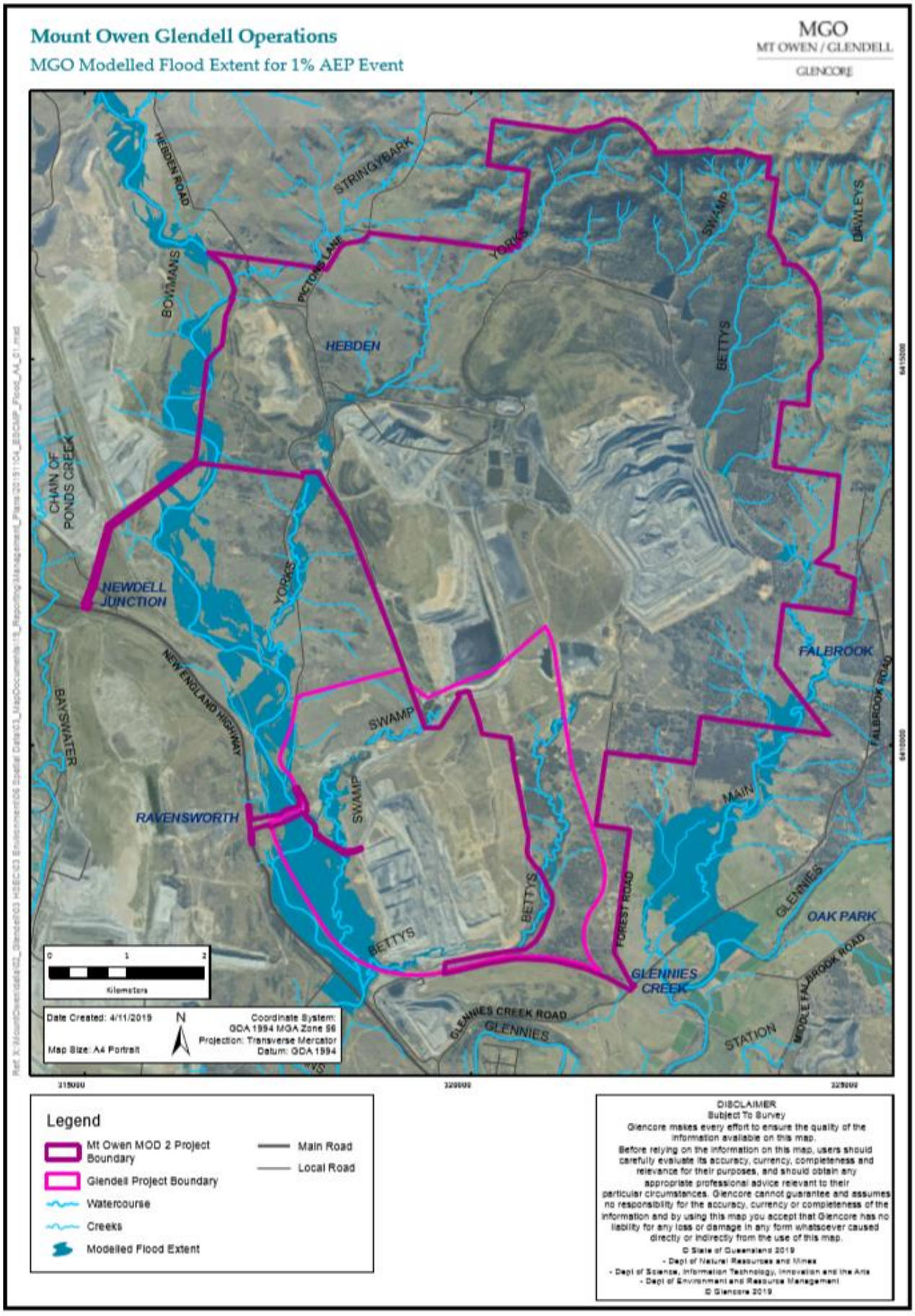

Figure 2.3 – MGO Modelled Flood Extent for 1% AEP Event

3 Implementation

3.1 Erosion and Sediment

3.1.1 Erosion and Sediment Control Strategy

MGO categorises water into three types to effectively manage water across the complex and to mitigate any potential for environmental harm to occur. Each type of water requires different management measures to minimise the risk of contamination of downstream drainage systems.

A description of the water quality and potential sources for the three categories of water are summarised in **Table 3.1**.

Table 3.1 – Water Categories and Design Criteria

Water Category	Water Description	Target Design Criteria
Clean Water	Runoff from undisturbed or rehabilitated areas where vegetation is fully established and where the water quality is suitable for release/discharge; and raw water imported under licence.	Release, where practicable, to downstream environment.
Dirty Water	Runoff from disturbed areas, such as active overburden emplacement areas or overburden emplacement areas where vegetation is not fully established. These areas have the potential for elevated suspended solids.	Managed in line with the Blue Book (*Managing Urban Stormwater: Soils and Construction Volume 1* and *Volume 2E*).
Mine Water	Water exposed to coal or used in coal processing and runoff within Mining Infrastructure Areas. Mine water includes water associated with groundwater inflows into open cut pits. This water may be highly saline and/or contain pollutants such as hydrocarbons.	Contained for events up to and including the 1% AEP, 24 hour storm event (equivalent to the 100 year ARI, 24 hour storm event).

As outlined in **Section 2.1.4**, the intent of the WMS is to convey clean water around the mining operations or, when runoff from rehabilitated areas becomes clean (in accordance with the site-specific trigger values outlined in the ***MGO Surface Water Management and Monitoring Plan***), enabling the runoff from these areas to flow directly to the downstream environment instead of being managed as part of the WMS.

This ESC Plan is concerned with the management of 'dirty' water as described in **Table 3.1**. Standard ESC techniques and management principles are utilised in accordance with the Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) and Volumes 2A, 2C, 2D and 2E (DECC, 2008) (the Blue Book) and GCAA ***Erosion and Sediment Control***. Specific references are detailed in Appendix C. These standard techniques and management principles are achieved at MGO through the following key principles:

- Prior to site disturbance, ESCs must be established and approved by the Environment and Community Department via the ***Ground Disturbance Permit*** (GDP) (Refer to ***Section 3.1.1.1***);
- Install erosion and sediment control measures as the first step in the process for land disturbance;
- Minimise all disturbed areas and stabilisation by progressive rehabilitation of disturbed land as soon as practicable in accordance with the Mining Operations Plan;
- Construction of diversion drains upslope of areas to be disturbed to direct clean runoff away from disturbed areas, where practical. The diversion drains will be designed to ensure effective segregation of sediment-laden runoff and allow clean surface water to return to natural watercourses;

- Construction of other ESC works such as silt fences and sediment dams prior to works commencing within the area;
- Construction of catch drains to capture runoff from disturbed areas and rehabilitation areas and direct runoff into sediment dams;
- Progressively stripping and stockpiling topsoil for later use in rehabilitation
- Topsoil stockpiles stored for more than three months will be fertilised and grassed to reduce the potential for weed contamination and erosion;
- Stockpiles will generally be less than three metres high and will be set out in windrows to maximise surface exposure and biological activity;
- Level or gently sloping areas will be selected as stockpile sites, where required, to minimise erosion and potential soil loss where possible;
- Appropriate sediment controls will be installed upslope of stockpiles to divert water around the stockpiles and downslope of stockpiles to prevent soil loss;
- Construction of all temporary drains as earthen drains at typical grades no steeper than 5% (giving maximum peak velocities in the order of 1.5 m/s) to minimise scouring, otherwise ensuring that adequate scour protection is provided. All drains are to be grassed to minimise erosion;
- Placement of geotextile liners and rock check dams in drains as required to reduce water velocities and prevent scouring;
- Construction of graded banks on reshaped overburden areas to minimise erosion and re-direct runoff to catch drains and water disposal areas;
- Locate stockpiled material away from concentrated water flows;
- Construction of road and earthworks cut and fill batters at slopes of 1V:3H (vertical: horizontal) or less (where possible) to maximise long term stability;
- Inspection and maintenance of all sedimentation controls and rehabilitation areas after storm events (greater than 25 mm of rainfall in 24 hours) to ensure ESCs are performing adequately; and follow up repair or redesign of ESCs that are not performing adequately;
- Maintenance of design capacity of sediment dams by removing built-up sediment;
- Regular maintenance of silt traps in the truckwash area;
- Application of gypsum or lime to mitigate soil sodicity/dispersibility where exposed subsoils have been identified;
- Establishment of vegetative cover on all rehabilitation areas as a priority to minimise exposed subsoils and the control of weeds through selective herbicide application and the reseeding of areas that fail to establish as soon as practicable;
- Restricting access to rehabilitated areas through the use of fencing and/or signposting;
- Flocculation of sediment dams as necessary to improve settlement of entrained sediment and to reduce total suspended solids (TSS) concentrations to less than 50 mg/L prior to release off site;
- Construction of drainage controls such as table drains at roadsides and on hardstand areas and toe drains on stockpiles; and
- Immediate repair or redesign of erosion and sediment controls that are not performing adequately, as identified in field inspections.

3.1.1.1 Ground Disturbance Procedure

Glencore has developed a Ground Disturbance Permit Procedure to ensure that site clearing activities are planned and carried out in a manner that minimises environment and community impacts. A Glencore Ground Disturbance Permit Form must be completed for all construction, ground disturbance

or clearing activities to detail the erosion and sediment control measures to be implemented for that activity.

The form requires detailed erosion and sediment control planning for each stage/area of the relevant activity in line with the Glencore Erosion and Sediment Control Procedure. This will include (but not be limited to) a combination of the following:

- An Erosion and Sediment Control Drawing;
- Information on ground cover, soil type and compaction requirements;
- Design calculations and key design assumptions for sediment control features such as sediment dams, including size of catchment area and proportion disturbed;
- An order of works based upon stabilisation of all areas of high erosion hazard at the earliest practical stage;
- Proposed time schedules for construction of structures and implementation of measures to control erosion and sedimentation;
- Reference to monitoring and maintenance procedures, including details of any water quality testing required;
- Rehabilitation requirements (e.g. seeding and fertiliser rates); and
- Standard document control information (e.g. date developed, person authorising the procedure and version number).

For construction activities, the Glencore Ground Disturbance Permit Form will be incorporated into the construction program and no earthworks or excavations will proceed until the contractor has installed the measures detailed within the Glencore Ground Disturbance Permit Form. Specific Glencore Ground Disturbance Permit Forms will be progressively amended where necessary to accommodate changes in construction activities, landforms, drainage paths and other conditions

3.1.2 Site Specific Strategies and Controls

A conceptual description of the criteria used to select, locate and define the function and capacity of ESC controls implemented at MGO is given in the following sections.

For the areas identified as having higher risk of erosion and sedimentation issues (Refer to **Section 2.2.1.1**), the following strategy, criteria and controls will be implemented as part of the required Ground Disturbance and Construction Procedures described above.

3.1.2.1 Selection of Control Techniques

In order to effectively plan for the design and installation of control measures that will have minimal erosion and sediment associated impacts upon the surrounding environment, the following steps will be followed:

1. Identify if the problem is associated with erosion or sedimentation:
    a. Where erosion is the issue, identify if particles are being detached by raindrop impact or flowing water; or
    b. Where sedimentation is the issue, identify if particles are being transported by sheet flow or concentrated flow; and
2. Select appropriate erosion and sediment control techniques as outlined in **Figure 3.1**.

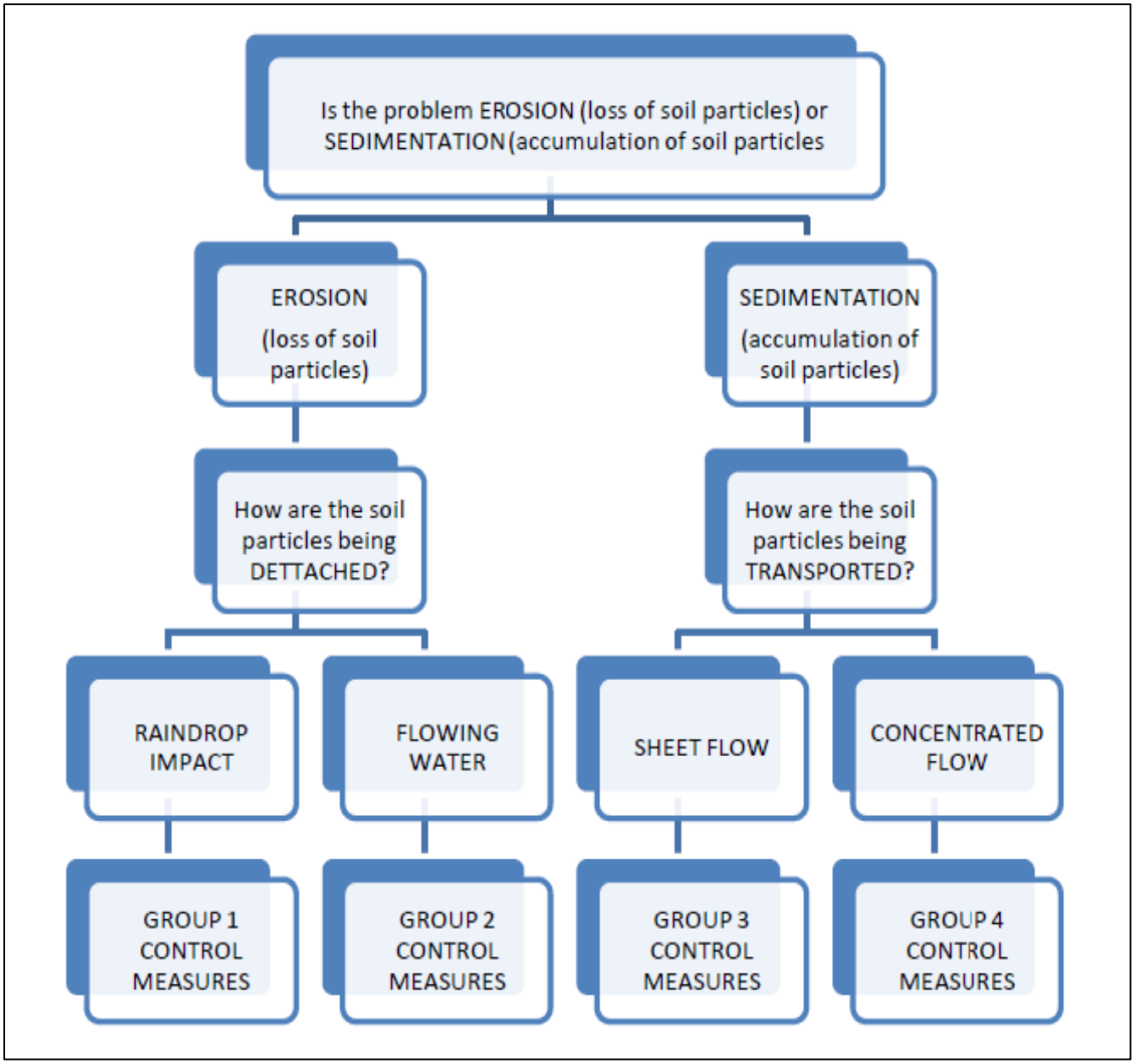

Figure 3.1 Erosion and Sediment Control Selection Procedure

3.1.2.2 Group 1– Erosion Control (Raindrop Impact)

The following erosion control techniques are recommended for implementation where soil particles are being detached by raindrop impacts:

- Vegetation;
- Batter blankets;
- Soil surface mulching;
- Surface roughening; and
- Geobinders.

3.1.2.3 Group 2 – Erosion Control (Flowing Water Impact)

The following erosion control techniques are recommended for implementation where soil particles are being detached by the impacts of flowing water:

- Up-slope diversions;
- Mid-slope diversions;
- Soft armour channels;
- Hard armour channels;
- In-stream diversions;
- Check dams;
- Batter drains;
- Grade control structures and flumes; and
- Outlet dissipation structures.

3.1.2.4 Drainage Channels (Dirty Water)

Dirty water drains are used to convey dirty water runoff to sediment dams. Dirty water drains are designed in accordance with GCAA standards and *Best Practice Erosion and Sediment Control Guidelines, IECA – Books 1-4 and Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed* (Landcom, March 2004) and the design criteria provided in **Appendix C.1.1 and Appendix C.1.2**. In general, the drains are trapezoidal in shape with maximum side slopes of 1V:2H and grass lined. Where water velocities exceed 1.5 m/s, the drains are protected from scour using rock bars every 100 metres.

3.1.2.5 Drainage Channels (Clean Water)

Suitably designed and constructed clean water drains are implemented where practical around MGO in accordance with GCAA standards and *Best Practice Erosion and Sediment Control Guidelines, IECA – Books 1-4 and Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed* (Landcom, March 2004) and the design criteria provided in **Appendix C.1.1 and Appendix C.1.2**.. Clean water drains are designed to convey the peak flows from the required design rainfall event. In general, the drains are trapezoidal in shape with maximum side slopes of 1V:2H and vegetated and/or rock lined banks. Where peak design water velocities exceed 1.5 m/s in a 5% AEP storm event, the drains are protected from scour using rock bars every 100 metres.

3.1.2.6 Group 3 – Sedimentation Control (Sheet Flow)

The following erosion control techniques are recommended for implementation where soil particles are being detached by sheet flow:

- Vegetative buffers;
- Sediment barriers/filters; and
- Site exit points.

3.1.2.7 Sediment Filter Fences and Other Temporary Sedimentation Control Methods

Sediment fences, sediment traps, rock check dams and other temporary erosion and sediment control measures from the Blue Book will be installed in advance of, or in conjunction with, earthworks to prevent sediment laden water leaving the site or entering clean water systems. These temporary controls are intended to be used for short periods whilst more permanent erosion and sediment control structures are being implemented or during emergency scenarios where permanent structures are not deemed appropriate.

Where necessary, sediment filter fences or other temporary controls are constructed immediately downslope of areas to be disturbed to minimise the potential for sediment transport into receiving waterways.

Sediment filter fences are constructed in line with *Best Practice Erosion and Sediment Control Guidelines, IECA – Books 1-4 and Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed* (Landcom, March 2004) and the design criteria provided in **Appendix C.1.1**.

Filter fences are generally comprised of geotextile filter fabric with structural posts. Where practicable, the fences are erected along contours at approximately 20 m intervals with small returns to limit the catchment size. This is necessary as sediment fences and other temporary controls are prone to failure in larger storm events and should be designed to ensure a maximum of 50 L/s passes through the sediment fence during a storm event. The upslope catchment is to have a maximum grade of 1V: 2H (vertical: horizontal). Sediment fences are not to be installed in high flow areas where the effectiveness of the fences may be impeded (e.g. perpendicular across waterways or drains).

3.1.2.8 Group 4 – Sedimentation Control (Concentrated Flow)

The following erosion control techniques are recommended for implementation where soil particles are being detached by concentrated flow:

- Sediment curtains/turbidity barriers;
- Sediment traps; and
- Sediment dams.

3.1.2.9 Sediment Dams

Sediment dams are to be constructed within dirty water catchments to capture and treat sediment laden water for treatment prior to discharge. Sediment dams will be installed where appropriate prior to any land disturbance activities occurring and maintained following completion of land disturbance activities. The design of each sediment dam will take into consideration the topsoil characteristics of the catchment, as well as the presence of any other potential pollutants (Refer to **Appendix C.1.1 and Appendix C.1.2**).

Sediment dam sizes will then be determined in accordance with the Blue Book for fine soils (i.e. type D or F) for the 95th percentile 5 day rainfall event (**Appendix C.1.1**). Where sediment is known/expected to be dispersive, MGO will investigate flocculation options to assist in settling fine particles. All sediment dams will be maintained in a drawn down state as far as practicable. Any water with less than adequate water quality (with TSS concentration greater than 50 mg/L) will be pumped back to the mine WMS and reused on site.

The location and capacity of sediment dams (current and proposed) is detailed in the MGO ***Water Management Plan***. The number and capacity of sediment dams will be related to the total area of catchment, the duration of disturbance and the anticipated soil loss according to the soil characteristics. The design criteria of each new sediment dam will be derived from the Blue Book and the GCAA ***Erosion and Sediment Control Procedure***.

3.1.3 Maintenance

All ESC measures are maintained in a functioning condition until individual areas have been deemed successfully rehabilitated. Where controls are observed to be not functioning correctly, the controls are restored to meet the required standard. Where significant erosion is observed to be occurring on a regular basis, additional controls are constructed.

The nominated person ultimately responsible for follow up maintenance of permanent ESC measures is outlined in ***Section 7***.

3.1.3.1 Sediment Dams

Sediment dams require regular maintenance to retain their function as per design criteria (i.e. the Blue Book). The required maintenance is determined through the visual inspections undertaken of the sediment dams on a routine basis or following rainfall (refer to ***Section 4.1***).

The sediment dams will be drawn down to a level which ensures that the full settling zone volume is available within the dam, within five days after the rainfall event occurred. This is typically undertaken by transferring water back into the mine water management system.

The sediment dams are also regularly de-silted when their storage capacity is reduced by the sediment storage zone volume (typically around 50%). The de-silting frequency is based on the amount of sediment being delivered into the sediment dam.

3.1.3.2 Drainage Channels

Any signs of erosion along the length of either clean water or dirty water catch drains will be noted and remedial works undertaken as required. Where significant erosion is observed, additional erosion controls will be constructed, which will include a combination of the re-establishment of vegetative cover, installation of an erosion blanket or rock armouring.

3.1.3.3 Temporary ESC Structures (Sediment Filter Fences)

Quarterly visual inspections and necessary repairs are made of temporary ESC structures, such as sediment filter fences, to maintain adequate function. Temporary structures will be removed when no longer required.

3.1.4 Works within Watercourses

Works within 40 m of watercourses, will only commence after any required approvals have been obtained. Any proposed works will be undertaken generally in accordance with the *DPI-Water Guidelines for Controlled Activities* (2012). For the work within 40 m of a watercourse, the design, construction and maintenance will be generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land, Policy and Guidelines for Fish Friendly Waterway Crossings* and *Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings* or their latest versions.

The following key measures will be implemented:

- Minimising the design and construction footprint and extent of disturbance as far as practicable;
- Maintaining the existing or natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse;
- Protecting against scour as necessary, such as using rock rip-rap and vegetation;
- Stabilisation and rehabilitation of all disturbed areas as soon as practicable;
- Schedule works for dry weather periods; and
- Inspection and maintenance of the works until the site is stable.

3.1.5 Existing and Proposed Erosion and Sediment Control Measures at MGO

The locations and types of existing and proposed erosion and sediment control measures at MGO are outlined within the MGO Water Management Plan including figures that outline the Blue Book mapping requirements for all stages of the proposed Project.

3.2 Flooding Management

A road safety berm will be constructed around North Pit Continuation and along the western wall of the Barret Pit to provide additional freeboard for the 1% AEP flood event.

To minimise the potential impacts of the additional catchment area at North Pit emplacement area flowing into Yorks Creek, there will be additional flow conveyance at Hebden Road.

The flow conveyance at Hebden Road will maintain existing channel stability. This will manage potential increase in velocity and Yorks Creek associated with the increase in peak flow rates and to manage potential impacts on access during flooding at the Hebden Road crossing of Yorks Creek.

Additional flow conveyance will be provided at the Hebden Road crossing for Yorks Creek and will consists of additional box culverts under the road.

3.3 Training and Communication

Generic training on the aspects of the ESC Plan is provided to all employees and contractors through the GCAA ***Generic Surface Induction*** and the ***Site Familiarisation*** process.

Selected site personnel whose duties directly involve the management of water at the MGO will undertake specific training in regards to site Operational Procedures which incorporate water management measures. Regular workforce communication days and toolbox talks allow for discussion of the objectives and requirements of this and any other relevant Plans.

Task Coordinators are required to undertake specific ***Ground Disturbance Permit Process*** training to understand the process and requirements of completing and implementing a GDP.

4 Measurement and Evaluation

4.1 Monitoring

4.1.1 Erosion and Sediment

The strategies outlined for the control of erosion and sedimentation will be inspected regularly during operation. Monitoring and inspections of the site will include:

- Inspections of water levels, silt build-up, scouring or erosion and the presence of hydrocarbons; and
- Revegetation progress of disturbed areas.

If the type and/or location of ESC strategies are identified during inspections as being ineffective, the control structures will be modified. Additional inspections will be carried out after high rainfall events (greater than 25 mm of rainfall in 24 hours) to ensure the effectiveness of the controls.

De-silting of ESC structures will be carried out as necessary to ensure the efficiency and capacity of the structure is maintained. This will be determined through visual assessment.

Completion of corrective actions identified during inspections are monitored during subsequent inspections.

4.1.2 Flooding

Monitoring of rainfall and storm events will occur though weather forecast and warnings information for potential flooding. Regular inspections of floodways and structures will be conducted to prepare for severe weather.

Dam walls and other flood management structures will be inspected for damage, overtopping, structural damage, slips, slumps or movement that may compromise the integrity of the structure. Spillways will be inspected for damage or flow obstructions. If there is severe damage to the integrity of flood management structures, the damage will be mitigated or repaired and/or emergency services notified.

5 Review and Improvement

5.1 Reporting

A summary of the effectiveness and performance of ESC measures will be reported in the Annual Review. Where relevant, the Review will include ESC related incidents, complaints and initiatives for implementation in the following year.

Where it is deemed that an ESC incident (potential or actual environmental harm) has occurred, reporting will be as per the ***MGO Pollution Incident Response Management Plan*** (PIRMP).

Notification must be made for all incidents defined under the Project Approval to the Secretary and any other relevant agencies immediately after becoming aware of the incident. A detailed report shall be provided within 7 days as per Schedule 5, Condition 9 and 9A of Mt Owen Mine SSD-5850 and Schedule 5 Condition 9 of Glendell Mine DA 80/952.

5.2 Plan Review

This ESC Plan will be reviewed in accordance with the MGO ***Environmental Management Framework*** and will occur within three months of:

- The submission of an Annual Review;
- The submission of an incident report;
- The submission of an independent environmental audit; or
- Any modification to the conditions of development consent for Mt Owen Continued Operations (SSD-5850) or Glendell Mine (DA 80/952).

MGO will review and if necessary, revise this ESC Plan where required. The ESC Plan will reflect any changes in environmental requirements, technology and operational procedures.

6 Commitments

All commitments outlined within this ESC Plan are detailed in **Table 6.1** below. Management commitments requiring actioning will be entered into the MGO Compliance Management System (CMO) and actioned. Records of documentation associated with the management commitments will also be maintained within the CMO.

Table 6.1 – Erosion and Sediment Control Plan Commitments

Number	Commitment	Relevant Section of Plan
1	Design criteria for all ESCs will be derived from the Blue Book and the GCAA ***Erosion and Sediment Control Procedure*** (CAA HSEC PRO 0016 11.06).	**Section 1.3.1, 1.3.2 & 3.1.1**
2	ESCs will be established and approved by the E&C Coordinator or MGO E&C Manager prior to any ground disturbance activities via a GDP.	**Section 3.1.1**
3	Diversion drains will be constructed upslope of disturbed areas to divert clean runoff.	**Section 3.1.1**
4	Catch drains will be constructed to capture runoff from disturbed areas and rehabilitation areas and direct runoff to sediment dams.	**Section 3.1.1**
5	Topsoil will be collected and stockpiled for use in later rehabilitation. Stockpiling guidelines outlined in section 3.1.1 of this plan will be followed.	**Section 3.1.1**
6	Appropriate sediment controls will be installed upslope of stockpiles to divert water around the stockpiles and downslope of stockpiles to prevent soil loss.	**Section 3.1.1**
7	All drains will be grassed and constructed at typical grades no steeper than 5% (giving maximum peak velocities in the order of 1.5 m/s) to minimise erosion.	**Section 3.1.1**
8	Geotextile liners and rock check dams will be constructed in drains as required to reduce water velocity and prevent scouring.	**Section 3.1.1**
9	Graded banks will be constructed on reshaped overburden areas to minimise erosion and re-direct runoff to catch drains and water disposal areas.	**Section 3.1.1**
10	Road and earthworks cut and fill batters will be constructed as per Blue Book and GCAA requirements	**Section 3.1.1**
11	Inspection and maintenance of all erosion, sedimentation and flood management controls and rehabilitation areas after storm events (greater than 25 mm of rainfall in 24 hours) and as identified in erosion and sediment control inspections (weekly during construction, monthly and quarterly as per schedule) to ensure ESCs are performing adequately; and follow up repair or redesign of ESCs that are not performing adequately. This includes desilting and dewatering, as well as erosion of structures.	**Section 3.1.1**
12	Gypsum or lime will be applied at quantified rates to mitigate soil sodicity/dispersibility where exposed subsoils have been identified.	**Section 3.1.1**
13	All ESCs will be maintained in a functioning condition until areas have been deemed successfully rehabilitated. Where ESCs are observed to be not functioning adequately, controls will be repaired or redesigned to meet the required standard as per section 3.1.2.1.	**Section 3.1.1**
14	Works within 40 m of watercourses will only commence after any required approvals are obtained.	**Section 3.1.4**
15	A road safety berm will be constructed around North Pit Continuation to provide additional freeboard for the 1% AEP flood event.	**Section 3.2**
16	Generic training on the aspects of the ESC Plan will be provided to all employees and contractors through the GCAA ***Generic Surface Induction*** and the ***Site Familiarisation*** process.	**Section 3.3**
17	Selected site personnel whose duties directly involve the management of water at the MGO will undertake specific training in regards to site operational procedures which incorporate water management measures. This training will be undertaken annually and when there is a change in personnel in key roles	**Section 3.3**
18	Task Coordinators are required to undertake specific Ground Disturbance Permit Process training to understand the process and requirements of completing and implementing a GDP.	**Section 3.3**

19	Monitoring of water quality in sediment dams with the potential to discharge off site will be undertaken monthly.	**Section 4.1.1**
20	Dam walls and other flood management structures will be inspected for damage, overtopping, structural damage, slips, slumps or movement that may compromise the integrity of the structure. Spillways will be inspected for damage or flow obstructions. If there is severe damage to the integrity of flood management structures, the damage will be mitigated or repaired and/or emergency services notified.	**Section 4.1.2**
21	A summary of the effectiveness and performance of ESC measures will be reported in the Annual Review. The Annual Review will also include any ESC related incidents or complaints from the previous year and any initiatives for implementation in the following year.	**Section 5.1**

7 Accountabilities

Table 7.1 outlines the accountabilities associated with this ESC Plan.

Table 7.1 – Accountabilities

Role	Accountabilities for this document
Operations Manager	Approve the ESC Plan. Provide adequate resources for the implementation of this Plan.
Environment and Community Manager	Implement the ESC Plan. Provide that the Training and Communication, Monitoring and Review and Improvement requirements of this Plan are met. Investigate and report all incidents involving the failure or damage to ESC or flooding structures.
Environment and Community Coordinator / Officer	Assist the E&C Manager as required in implementation of this Plan. Follow up on required inspection and maintenance of permanent ESC measures. Investigate and report all incidents involving the failure or damage to ESC or flooding structures.
Task Coordinators	Provide that the requirements of this Plan are met through compliance with GDP procedures. Report all incidents involving the failure or damage to ESC or flooding structures.
All contractors	Undertake works in accordance with the objectives and principles of this Plan and GDP (where relevant). Report all incidents involving the failure or damage to ESC or flooding structures.
All personnel	Undertake works in accordance with the objectives and principles of this Plan and GDP (where relevant). Report all incidents involving the failure or damage to ESC or flooding structures.

8 Definitions

Term	Definition
AEP	Annual exceedance probability
Annual Review	Annual report for Mt Owen Complex
ARI	Average recurrence interval
CMO	Compliance Management System
DA	Development application
DECC	Department of Environment and Climate Change
DPIE	Department of Planning, Industry and Environment
DPIE – Water	Department of Planning, Industry and Environment – Water
E&C	Environment and Community
EMF	Environmental Management Framework
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
ESC	Erosion and sediment control
GCAA	Glencore Coal Assets Australia
GDP	Ground Disturbance Permit
Ha	Hectares, equivalent to 10,000 m^2
km	Kilometre
m	Metre
mg/L	Milligram per litre
MIA	Mine Infrastructure Area
mm	Millimetre
MGO	Mount Owen Glendell Operations
MOCO	Mount Owen Continued Operations
m/s	Metre per second
POEO Act	*Protection of the Environment Operations Act 1997*
SSD	State significant development
TSS	Total suspended solids
WMS	Water management system

9 Document Information

9.1 Relevant Legislation

The following legislation is relevant to this Plan:

- *Environmental Planning and Assessment Act 1979*; and
- *Protection of the Environment Operations Act 1997*.

9.2 Related Documents

Related documents, listed in ***Table 9.2*** below, are internal documents directly related to or referenced from this document. Internal procedures have not been reviewed or endorsed by DPE and Glencore is responsible for verifying these procedures are in accordance with this management plan and generally in accordance with the Project Approval.

Table 9.2 – Related Documents

Number	Title
GCAA	
11.01	Annual Environment and Community Risk Assessments
11.06	Erosion and Sediment Control Procedure
CAA HSEC PER 0004	Ground Disturbance Permit
Mount Owen Glendell Operations	
MGOOC-1779562647-11480	Water Management Plan
MGOOC-1779562647-11190	Surface Water Management and Monitoring Plan
MGOOC-1779562647-11191	Environmental Management Framework
MGOOC-1779562647-10971	Creek Diversions Management Plan
Other	
Umwelt(Australia) Pty Limited, 2015	Environmental Impact Statement Mt Owen Continued Operations
Umwelt (Australia) Pty Limited, 2015	Agricultural Impact Assessment Mt Owen Continued Operations
Umwelt (Australia) Pty Limited, 2015	Surface Water Assessment Mt Owen Continued Operations
Umwelt 2018a	*Mount Owen Continued Operations Project Modification 2 Statement of Environmental Effects*
Umwelt 2018b	*Glendell Mine Modification 4 Statement of Environmental Effects*

9.3 Reference Information

Reference information, listed in ***Table 9.3*** below, is information that is directly related to the development of this document or referenced from within this document.

Table 9.3 – Reference Information

Reference	Title
DECC, 2008	The Blue Book, Managing Urban Stormwater: Volume 2E Mines and Quarries
DIPNR 2005	Floodplain Development Manual: The Management of Flood Liable Land
Landcom 2004	The Blue Book, Managing Urban Stormwater: Soils and Construction – Volume 1
Matthei 1995	Soil Landscapes of the Newcastle 1:100,000 Sheet

9.4 Change Information

A summary of the document history is provided in ***Table 9.4*** below.

Table 9.4 – Change Information

Version	Date	Review team (consultation)	Change Summary
1	November 2008	E&C Coordinator HSEC Manager	New document
2	November 2011	E&C Coordinator MGO E&C Manager	Updated the document in line with current practices and requirements
3	September 2013	MGO E&C Manager	Updated with current practices and reference to Glencore
4	July 2014	MGO E&C Manager	Updated in line with the comments from DP&I and in accordance with current practices
5	November 2015	MGO E&C Manager	Updated following the Independent Environmental Audit and comments from DP&E. Transferred into the new GCAA template.
6	December 2016	MGO EMS Steering Committee	Updated to address the Mt Owen Continued Operations development consent (SSD-5850) conditions and revised development consent for Glendell Mine (DA 80/952 MOD 3).
7	September 2017	MGO E&C Manager MGO E&C Coordinator	Management plan edited to incorporate feedback from regulators (DPE and DPI Water).
New SharePoint Version History			
1.0	March 2018	MGO E&C Manager	Updates to commitment register and associated plan text to streamline commitments.
2.0	November 2018	MGO E&C Manager	Approved by DPE
3.0	November 2019	MGO E&C Department	Review and Revision following approval of MOCO Modification 2.
4.0	March 2020	MGO E&C Department	Minor administrative review following approval of Glendell MOD 4

Appendix A - Erosion and Sediment Control Plan Consultation

Feedback from Department of Planning and Environment (2018)

Erosion and Sediment Control Plan – SSD 5850 – Condition 26, Schedule 3	**Satisfactory (Yes/No/Partial)**	**Comment**	**Action Required**
Erosion and Sediment Control Plan, that:			
• is consistent with the requirements of Managing Urban Stormwater: Soils and Construction - Volume 1 and Volume 2E Mines and Quarries, or its latest version; • identifies activities that could cause soil erosion, generate sediment or affect flooding; • describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage flood risk; • describes the location, function, and capacity of erosion and sediment control structures and flood management structures; and • describes what measures would be implemented to maintain the structures over time;	Yes	• Section 3 and Appendix C – Please provide specific section references from the "Blue Book" e.g. 'Temporary Water Diversion Structures will be constructed as per Figure SD 5-6 of Section 5.4.4 of Managing Urban Stormwater – Soils and Construction Volume 1'. Satisfied. • Satisfied – Section 2.2. • Satisfied – Section 3. • See Section 3.1.2 – Please include a figure detailing the permanent ESC on site and provide further details on the capacity of ESC and flood control structures. Satisfied. • See Section 3.1.3.3 and Section 4 – Please define how frequent "regular" is. Satisfied.	-
General Comments			
• The Department requires clear statements, please replace terms such as "should" or "may" with "will" etc. Not Satisfied. • See Section 5 – Please ensure incidents are reported per condition 9, Schedule 5. Not Satisfied.			
Erosion and Sediment Control Plan – DA 80/952 – Condition 32, Schedule 3	**Satisfactory (Yes/No/Partial)**	**Comment**	**Action Required**
The Erosion and Sediment Control Plan must:			
(a) be consistent with the requirements of Managing Urban Stormwater: Soils and Construction - Volume 1 and Volume 2E Mines and Quarries, or its latest version;	Yes	Section 3 and Appendix C – Please provide specific section references from the "Blue Book" e.g. 'Temporary Water Diversion Structures will be constructed as per Figure SD 5-6 of Section 5.4.4 of Managing Urban Stormwater – Soils and Construction Satisfied.	-
(b) identify activities that could cause soil erosion and generate sediment, including activities on waterfront land (within 40 metres of a watercourse);	Yes	Satisfied – Section 2.2.	-
(c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;	Yes	Satisfied – Section 3.	-
(d) describe the location, function, and capacity of erosion and sediment control structures; and	Yes	See Section 3.1.2 – Please include a figure detailing the permanent ESC on site and provide further details on the capacity of ESC and flood control structures. Satisfied.	-
(e) describe what measures would be implemented to maintain these structures over time.	Yes	See Section 3.1.3.3 and Section 4 – Please define how frequent "regular" is. Satisfied.	-
General Comments			
• The Department requires clear statements, please replace terms such as "should" or "may" with "will" etc. Not Satisfied. • See Section 5 – Please ensure incidents are reported per condition 9, Schedule 4. Not Satisfied.			

Appendix B - Erosion and Sediment Control Plan Approval

To be inserted once approved by the Department.

Appendix C - Design Standards for ESC Measures

C.1.1 GCAA Design Standards for ESC Measures

The applicable GCAA design standards are listed in **Table C-1** below.

Table C-1 – GCAA Design standards for selected ESC Measures

ESC Measure	Design Standard	Reference Documents
Sediment Basins	Queensland: Designed to contain the sediment load from a 1 in 10 year ARI 24 hour duration storm event. Containment of the runoff water may also be required depending on how the water is classified i.e. mine affected water or stormwater. New South Wales: Specific design requirements summarised in Appendix F and based on the soils classification and the procedures set out in Managing Urban Stormwater Soils and Construction. QLD & NSW: Dry freeboard of 300mm, Spillway capacity of 1 in 100 year ARI critical duration event.	Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed (Landcom, March 2004) Managing Urban Stormwater – Mines and Quarries, Vol 2E (DECC, June 2008) Best Practice Erosion and Sediment Control Guidelines, IECA (November 2008) Institution of Engineers Australia (QLD Division), Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites, June 1996 Individual sites' Environmental Authorities/Licences and Development Consents
Sediment Fences	Support post spacing max 2m, sediment fence material keyed into ground to 200mm or secured with 300mm of aggregate on the surface to the upstream.	As per figure SD 6-8, section 6.3.7, Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed (Landcom, March 2004)
Drainage Channels	Maintain channel velocity to < 1.5m/s where possible, 500mm dry freeboard above design event.	As section 5.4.4 Temporary Water Diversion Structures, Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed (Landcom, March 2004)
Rock check dams	Toe of check dam to be level with crest of next downstream check dam, centre of crest to be minimum 150mm lower than edges, check dam to be keyed into drain 150mm minimum, maximum 2H:1V for faces of check dams.	As per figure SD 5-4, section 5.4.3, Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed (Landcom, March 2004)
Chutes	Control exit velocity to < 1.5m/s.	As per section 5.4.4, 5.4.5, Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed (Landcom, March 2004)
Temporary Watercourse Crossings	Design to site acceptable ARI with upstream and downstream erosion protection.	As per figure SD 5-1, section 5.4.3 Temporary Waterway Crossings,Managing Urban Stormwater – Soils and Construction Vol 1, 4th Ed (Landcom, March 2004)

C.1.2 Construction and Design Matrix for Erosion and Sediment Control Structure

The following matrix provides design details for the construction of erosion and sediment control structures outlined in the ESC Plan.

Drain Type	Location	AEP Storm Event	Storm Duration	Freeboard	Typical Grade	Side Batters	Comments
Clean[2]	Entire site	5%	Time of concentration[1]	Minimum of 0.5 metres	0.5% to 1.0%	No steeper than 1:2 (v:h)	Where velocity >1.5 m/s in 20 year ARI storm event place rock bars every 100 metres to reduce scour potential. All drains to be vegetated and/or rock lined. Level spreaders to be located at ends of all drains.
Dirty[2]	Entire site	5%	Time of concentration[1]	Minimum of 0.5 metres	0.5% to 1.0%	No steeper than 1:2 (v:h)	Where velocity >1.5 m/s place rock bars every 100 metres to reduce scour potential. Level spreaders to be located at ends of all drains.

Note 1: To be determined based on methods outlined in Australian Rainfall & Runoff (AR&R) (Institution of Engineers, 1987) – Time of concentration for storm event and Manning's Equation for flow rate.

Note 2: For permanent drains that are to be in place for greater than 3 months

Sediment Dam Design Criteria

Location	Soil Type	Method	Sediment Zone[1]	Runoff Coefficient	Freeboard	Treatment and Pump Out	
						Overflow	Requirement
Disturbed Areas	Dispersive	Blue Book[3] Type D (dispersive) for 5 day Blue Book rainfall event	Sediment zone = 50% of settling zone	Runoff coefficient (C_v) = 0.9 (hardstand) Runoff coefficient (other areas) = 0.79	Design for minimum of 1 metre	Mine Water Management System	Ability to pump out in 5 days and sufficient downstream volume to contain spills
						Downstream creek systems	Ability to treat[2] and pump out full dam volume in 5 days
	Non-Dispersive	Blue Book[3] Type F (fine) for 5 day Blue Book rainfall event	Sediment zone = 50% of settling zone	Runoff coefficient (C_v) = 0.9 (hardstand) Runoff coefficient (other areas) = 0.79	Design for minimum of 1 metre	Mine Water Management System	Ability to pump out in 5 days and sufficient downstream volume to contain spills
						Downstream creek systems	Ability to treat[2] and pump out full dam volume in 5 days

Note 1: Total dam volume = Settling Zone + Sediment Zone (Blue Book – Landcom 2004).

Note 2: Treat to a level suitable for discharge or pump out to mine water management system.

Note 3: Managing Urban Stormwater: Soils and Construction (the Blue Book) - Volume 1 (Landcom, 2004) and Volume 2E (DECC, 2008).

Note: Percentile rainfall should be selected based on site specific risk profile (refer to Table 6.2 Volume 2E (DECC, 2008).