ROLLESTON
OPEN CUT

GLENCORE

Rehabilitation Management

Plan

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1. Purpose

The purpose of the Rehabilitation Management Plan (RM Plan) is to guide and demonstrate Rolleston Open Cut's (ROC) commitment to achieving high environmental performance through effective planning, resourcing and execution of land rehabilitation.

This Plan is in accordance with Environmental Authority EPML00370013 (EA) Conditions G1 & G2 and Glencore Coal Assets Australia (GCAA) *GCAA-625378177-10241 Rehabilitation Management Protocol.*

Upon mine closure, ROC aims to achieve a rehabilitated landscape supporting a healthy and sustainable ecosystem capable of similar land use (i.e. extensive grazing) as the surrounding landscape. The RM Plan's objectives include:

a) A stable, self-sustaining, safe and non-polluting environment,

b) An environment/ landscape that is free from liabilities for future stakeholders, and

c) Final rehabilitation that is compliant with the agreed post-mining land use within each identified domain.

2. Scope

This Plan shall apply to all land rehabilitation works on ROC, and will be applicable to all relevant ROC employees (contractors included), who shall familiarise themselves with this Plan.

Rehabilitation activities, coordinated and reported on by site's Environment & Community Department (E&C), are an integral part of the mining sequence, with scheduling undertaken by mine planners (Technical Services Department) and strategic dumping and shaping by the Mining Department.

Annual rehabilitation targets are determined through the annual Life of Mine Planning process and approved Progressive Rehabilitation and Closure Plan (PRCP), are reflected within the annual Estimated Rehabilitation Cost (ERC), the Annual Rehabilitation and Closure Plan and budgeted for accordingly. Annual targets include:

a) Total land to be disturbed for mining related activities,

b) Area to be shaped/ topsoiled,

c) Area to be seeded/ planted (permanent rehabilitation),

Accordingly, these are specified Key Performance Indicators (KPIs) to be delivered by site with regular progress reports to GCAA.

3. Legal Compliance

ROC's EA encompasses mining activities on the five Mining Leases; refer to Map 2. The authorised Run of Mine (ROM) coal tonnage is 19 million tonnes.

In accordance with ROC's EA, conditions G1 and G2, a rehabilitation management plan must be developed and implemented, and must:

a) Develop a final land use, landform design criteria and objectives for rehabilitation of all areas disturbed by mining activities for safe and sustainable mine closure;

b) Provide, for the final landform:

   i. Map(s) and/or schematic representations of drainage designs and features;

   ii. Erosion controls proposed on reshaped land.

c) Identify appropriate reference sites to be used to develop rehabilitation acceptance criteria for self-sustaining vegetation communities;

d) Identify specific rehabilitation acceptance criteria;

e) Describe the integration of vegetation and/or wildlife corridors within rehabilitation areas as required;

f) Map post closure domains and table the rehabilitation requirements applied to all mine domains with respect to rehabilitation goals, rehabilitation objectives, indicators and completion criteria;

g) Develop a progressive rehabilitation schedule aligned with the Later Development Plan indicating annual targets/milestones to achieve eventual whole of mine site rehabilitation;

h) Specify future planned rehabilitation methods for disturbance areas; and

i) Describe a program for monitoring and review of the effectiveness of the Rehabilitation Management Plan.

In addition to ROC's EA obligations, the operation has requirements under the *GCAA-625378177-10241 Rehabilitation Management Protocol,* and the Commonwealth Department of Environment and Energy (DoEE) approval (2001/497).

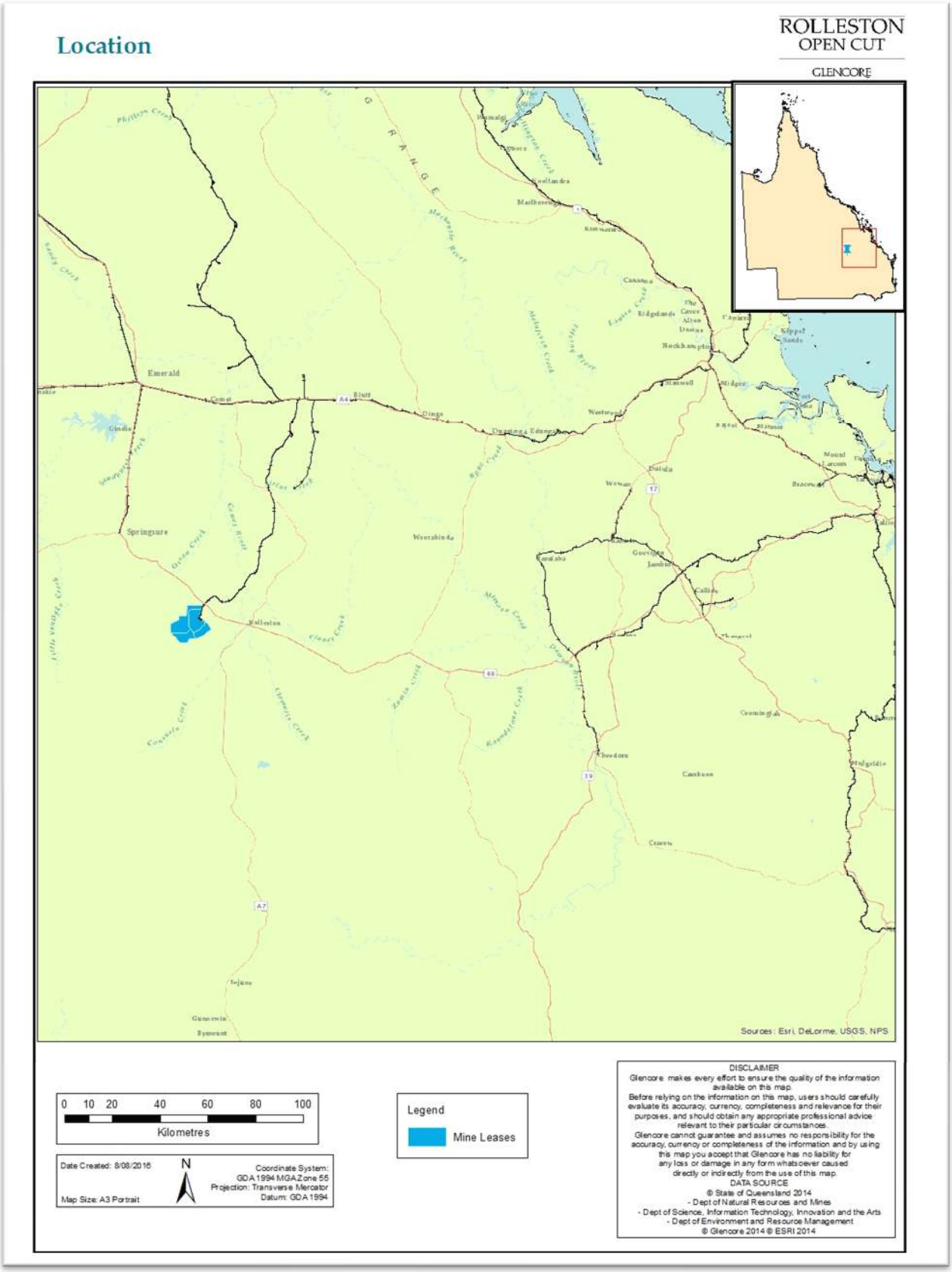
The DoEE approval requires 130 ha of Bluegrass community to be rehabilitated in mine spoil within the Spring Creek Pit area as an offset under the Environmental Protection for Biodiversity Conservation Act 1999 (EPBC Act). Approval of the Bluegrass Compensation Plan was granted in December 2003 by the Minister for the (then) Department of Environment and Heritage.

4. Location & Mine Lease

ROC is located 16 km west of the township of Rolleston in Central Queensland; approximately 275 km west of Gladstone.

The tenements to which this RM Plan applies are mining leases ML70307, ML70418, ML70415, ML70416, and ML70458. Two of these Mining Leases are infrastructure only - ML70418 covers the Rail Loop area and ML70458 covers Rolleston Coal Expansion Project (RCEP) water infrastructure.

The locality of the mining leases, primary road network, rail and townships are shown in Map 1.



Map 1: Site and Mine Lease Location

5. Mining Activities

ROC is a conventional open cut coal mining operation producing thermal coal for both export and domestic markets. The economic resource consists of gently dipping coal seams, making deposits suitable for a combination of dragline and truck, excavator and dozer operations. The current economic coal reserve is estimated at 270 Million tonnes (Mt) with an average strip ratio of 7.5:1 (bcm/t). The approved annual production limit for the site commenced in 2005 at 6Mt and has been increased to its current limit of 19 Mtpa. The nominal life of mine is estimated at 20 years under current approvals. Towards the end of the mine's life, it is expected that production will decrease as economic reserves decline.

The pit layout in the northern area of the mine is designed to accommodate Bootes Creek flows. A permanent diversion of Bootes Creek (through reshaped and rehabilitated mine spoil) has been constructed to accommodate the long term mining sequence. Spoil placement in this section was constructed with truck and excavator techniques to allow selective placement of overburden materials within the mine void. This ensured the underlying geology of the original watercourse was replicated in the final diversion.

ROC's existing and 2020 planned rehabilitation and disturbance footprint is illustrated in Map 2.

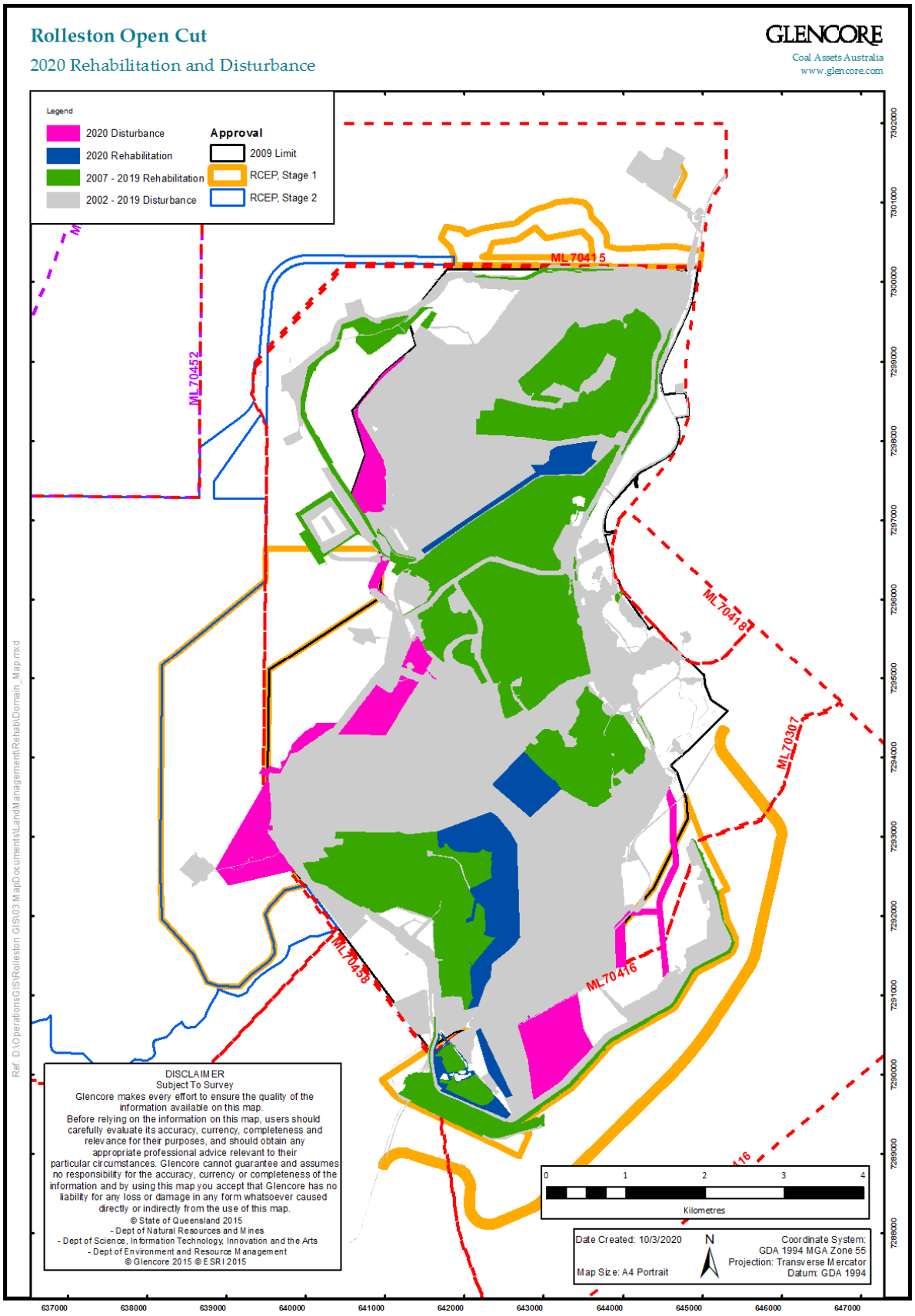
Rehabilitation of the mine site is undertaken progressively and will continue post-mining, as it progresses into care and maintenance and eventual relinquishment. ROC's rehabilitation and monitoring responsibilities will continue until relinquishment approval has been gained from the relevant regulatory authorities. A broad outline of rehabilitation scheduling for each operational area is outlined in section 8.1.1 of this Plan.

6. Current Rehabilitation Status

The rehabilitation of significantly disturbed land at ROC will be in accordance with the Schedule G of the EA.

ROC's rehabilitation status is assessed annually through detailed on-ground monitoring as well as through remote sensing. A GCAA-625378177-11398 Annual Rehabilitation Report Card is compiled which compares ROC's rehabilitation monitoring results against the parameters outlined within this Plan.

The recording and tracking of ROC's rehabilitation progression is captured in a spatial database (Geographical Information System) and numerically in ROC's rehabilitation database.



Map 2: 2020 Forecast Disturbance & Rehabilitation

7. Objectives & Criteria

The RM Plan is a life-of-mine strategic document for the management of progressive site rehabilitation consisting of detailed planning and design of post-mine landforms, concluding with the implementation of post mining land use which is safe, stable, non-polluting and self-sustaining. To achieve this, ROC has adopted a rehabilitation operating philosophy based on the following concepts:

a) Design earthworks and revegetate to pre-determined post-mine land use for each identified final landform domain;

b) Minimise land disturbance footprint;

c) Undertake progressive rehabilitation throughout life-of-mine;

d) Minimise erosion and its off-lease impacts;

e) Protect downstream water quality from contaminated runoff;

f) Recognise and protect downstream beneficial uses (surface and groundwater); and

g) Upon relinquishment of the ML, ensure that the agreed post-mine land use has been achieved.

Rehabilitation Domains are defined as land management units with similar characteristics, generally requiring similar rehabilitation treatment. The areas disturbed by mining at ROC will be separated into four post-mining land uses:

a) Grazing (including voids);

b) EPBC 2001/497 Offset Area (re-establish a minimum of 130 hectares of RE 11.8.11);

c) Water Infrastructure / Riparian; and

d) Infrastructure/Roads.

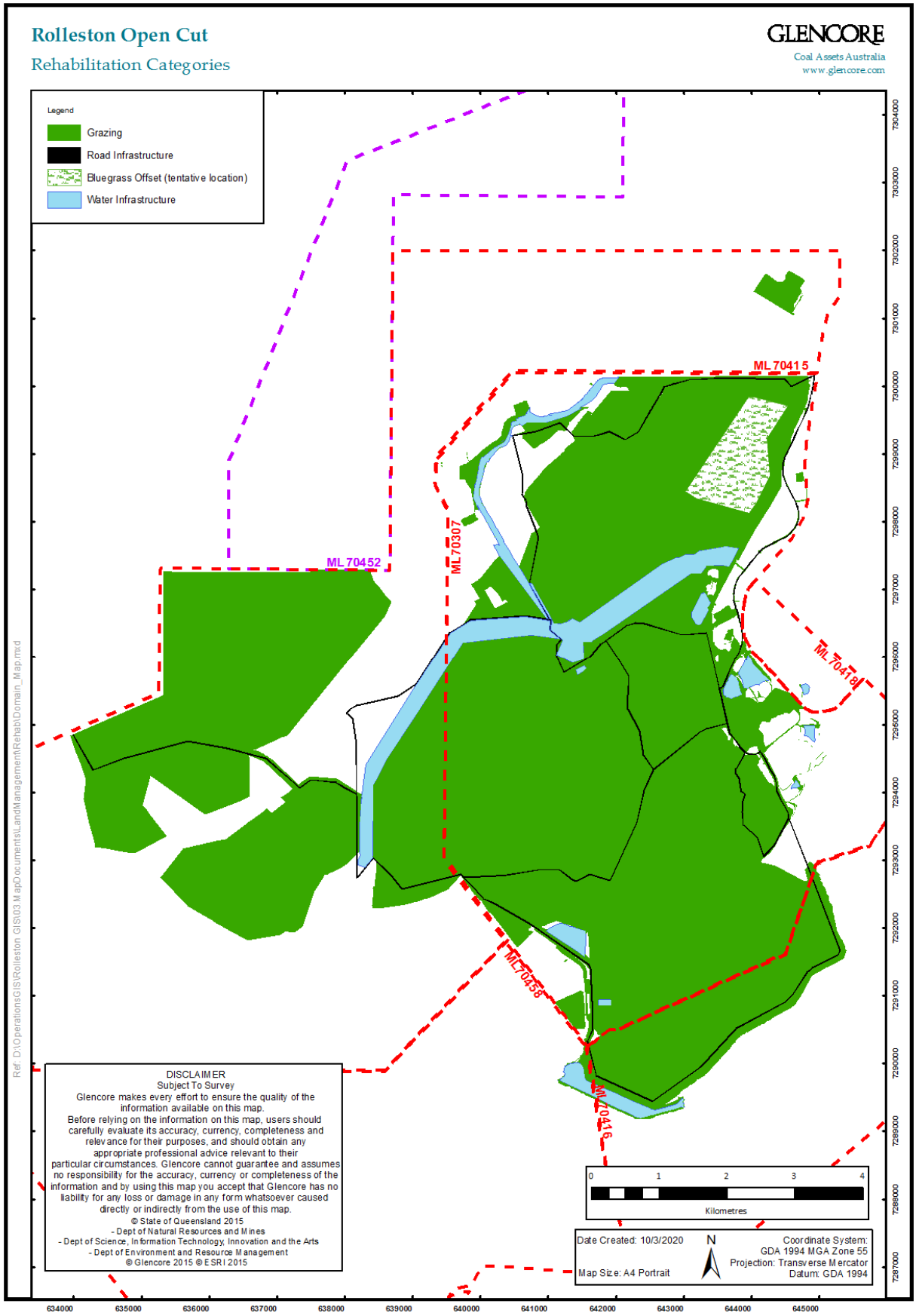
Each land use has its own establishment criteria allowing ROC to monitor the progress and ultimate success of rehabilitation against the targeted post-mining land use as outlined in Table 7-1. All categories, apart from infrastructure will be returned to a self-sustaining community using appropriate grass species and native trees and shrubs based on relevant reference sites.

The objective in identifying post-mining land uses (similar to pre-mining) is to develop strategies and targets for rehabilitation (that is, grazing).

Rehabilitation Goal	Goal	Objective	Indicator	Criteria
Grazing	Safe	Rehabilitation has no greater hazards than those in surrounding unmined land with the same land use	Hazard assessment	Not significantly different to surrounding lands used for grazing with similar slope gradients
	Stable	Rehabilitation is both geotechnically and erosionally stable	Factor of Safety	≥1.5
			Slope gradient	≤16%; ≤30% SEVT Trial; ≤35% Final Voids
			Groundcover	≥80% of reference sites
	Non-polluting	Surface runoff from rehabilitation achieves water quality objectives to protect aquatic ecosystem environmental values	pH, EC, ESP, turbidity, metals	Not significantly different to upstream levels
			Voids do not overtop	No spill events
	Land use	Rehabilitation is suitable for sustainable grazing	Land suitability assessment	Class 3 or 4
			Dry matter yield	≥80% of reference sites
			Species types	>50% of species from surrounding lands used for grazing
		Water storage for cattle	Salinity	≤4,000 mg/L
Bluegrass Community Offset	Safe	Rehabilitation has no greater hazards than those in surrounding unmined land with the same land use	Hazard assessment	Not significantly different to surrounding Bluegrass ecosystem areas
	Stable	Rehabilitation is both geotechnically and erosionally stable	Factor of Safety	≥1.5
			Slope gradient	≤16%
			Groundcover	≥80 of reference sites
	Non-polluting	Surface runoff from rehabilitation achieves water quality objectives to protect aquatic ecosystem environmental values	pH, EC, ESP, turbidity, metals	Not significantly different to upstream levels
	Land use	Terrestrial ecosystem	Area	≥130ha
			Soil depth	≥150mm, mean ≥200mm
			Dry matter yield	≥80% of reference sites
			Species types	>50% of the number of species in the reference sites
Riparian	Safe	Rehabilitation has no greater hazards than those in surrounding unmined land with the same land use	Hazard assessment	Not significantly different to surrounding riparian areas
	Stable	Rehabilitation is both geotechnically and erosionally stable	Factor of Safety	≥1.5
			Index of Diversion Condition (IDC)	≥10

	Non-polluting	Surface runoff from rehabilitation achieves water quality objectives to protect aquatic ecosystem environmental values	pH, EC, ESP, turbidity, metals	Not significantly different to upstream levels
	Land use	Conservation of rehabilitated creek diversion	IDC	≥10
			Water licence	Surrender application accepted
Infrastructure	Safe	Safety hazards are acceptable to landholder	Legally binding agreement	Executed by each party
	Stable	Landholder accepts condition of infrastructure including its structural integrity	Legally binding agreement	Executed by each party
	Non-polluting	Surface runoff from rehabilitated areas entering downstream meet water quality objectives to protect aquatic ecosystem environmental values	pH, EC, ESP, turbidity, metals	Not significantly different to upstream levels
	Land use	Landholder retained infrastructure	Legally binding agreement	Executed by each party

Table 7-1: Rehabilitation goals establishment Criteria



Map 3: Rehabilitation Domain Mapping

7.1 Rehabilitation Criteria

As mentioned in the Purpose of this Plan, ROC's main rehabilitation objectives are to return the post-mining landscape to:

a) A stable, self-sustaining, safe and non-polluting environment;

b) An environment/ landscape that is free from liabilities for future stakeholders; and

c) The identified post-mining land use within each rehabilitation domain.

Rehabilitation performance criteria will be reviewed periodically to ensure relevancy against ROC's rehabilitation objectives. The review will be conducted in accordance with industry standards, ROC's monitoring results and case studies.

The performance criteria will be used to determine whether rehabilitation objectives have been successfully achieved. The performance criteria outlined in Table 1 are based on the following objectives:

a) Landform stability:

   i. The combination of sometimes sodic spoil and black cracking clay topsoil means that the material used in landform construction and rehabilitation may at times have high erosion potential. For that reason, both short and long term landform stability is a major focus of rehabilitation success;

   ii. Final landforms are topsoiled to minimise erosion potential and enable growth of vegetation suitable for agreed final land use;

   iii. Absence of significant erosion gullies and active rills on sloping areas;

   iv. Erosion gullies to be repaired and the landform or drainage modified if necessary to prevent reoccurrence; and

   v. The surface of waste dumps shall be shaped to an undulating landform compatible with the surrounding environment.

b) Sustainable ecosystems:

   i. Establish self-sustaining vegetation over all disturbed areas other than post-mining infrastructure e.g. roads, dams;

   ii. The specific post closure land use requirements of each domain will ultimately reflect the types of ecosystem for each rehabilitated area. Targeted establishment criteria will assist in determining the success of ecosystem establishment;

   iii. Vegetation communities consistent with requirements for that particular rehabilitation goal particularly with regard to ecosystem types and the levels of surface cover, essential for surface erosion control; and

   iv. Through monitoring, identify and remediate underperforming rehabilitation areas, to ensure outcomes and recommendations for each domain area are met. Modifications may include re-shaping the landform, applying an ameliorant and/or re-seeding the area to enable successful vegetation growth.

c) Water quality:

   i. Ensure the quality of offsite runoff from established rehabilitated areas is not significantly different to upstream levels;

   ii. Water adversely affected by mining activities shall be retained within mined areas, unless treatment enables its compliant release from site in accordance with the Environmental Authority;

   iii. Implementation of the Receiving Environment Monitoring Program in accordance with Condition D20 of the EA to monitor, identify and describe any adverse impacts to

downstream surface water environmental values, quality and flows due to authorised mining activity;

iv. Modelling shows final voids will be a groundwater 'sink' with hydraulic gradients flowing towards the void. The water balance modelling indicates that spill events from the voids are unlikely; and

v. Salinity modelling indicates an increasing concentration of salt in the voids over time, however, modelled salinity levels indicate void water will be suitable for watering of beef cattle. The beneficial use of the water could be for beef cattle production in line with the surrounding land use.

d) Public safety:

i. Ensure all final voids are consistent with authorised/permitted activities;

ii. Rehabilitation has no greater hazards than those in surrounding unmined land with the same land use;

iii. Highwall and low-wall slopes of final voids are to be constructed in accordance with Table 2; and

iv. Ramps shall be retained to allow adequate access for livestock and wildlife.

e) Review of rehabilitation:

i. Regular reviews of rehabilitation practices are conducted and documented;

ii. Stakeholder concerns have been addressed and incorporated into planning; and

iii. Ensure that rehabilitation and mine closure practices are in accordance with standards and procedures current at the time when undertaken and approved by Department of Environment & Science (DES) under the relevant EA, and the agreed standards and methods are evident and stakeholders kept abreast of rehabilitation objectives and progress.

7.2 Final Landform & Residual Void Design

In addition to the performance criteria above, specific criteria for final landform and residual voids are required to meet relinquishment standards at the completion of post-mining rehabilitation. The criteria are developed in accordance with post-mining landform design and design for residual voids upon cessation of mining activities.

In the 2020 Life of Mine Plan the final voids cover approximately 186 ha. This area was determined using following definition of a final void: an area low in the post mining landform with slopes > 16% (other than in the floor of the void) where post mining runoff from the rehabilitated landform drains and accumulates.

Final voids will form a significant feature of the post mining landform at ROC. The depth of the final voids will range from a few metres deep up to over 100 meters deep. Where possible final voids will be backfilled however in the majority of cases this will (as indicated in both ROC EIS's) not be practical or economically feasible to do so. Whilst some residual pit voids are planned to remain, modelling has indicated the water is suitable for livestock, ensuring these areas do not become "non-use management areas". ROC is committed to minimising any residual pit voids (size and extent) where practicable, through integrated mine planning and environmental analysis, with a target of leaving all pit voids post-mining in a condition that is Safe, Stable, Non-polluting and Sustainable. Where cost effective, ROC will minimise out of pit dumps and in pit dump heights to reduce the size of the final void. For example ROC has determined the out of pit dump approved for Rolleston South is no longer required and the Gibbs Gully out of pit dump has reduced by ~80% of the approved size and the spoil for these two pits can be added to the existing Bootes West & Meteor West final landforms.

The minimum requirements for post-mining landform design for areas of disturbance are identified in Table 2 below.

7.2.1 Final Void Location

ROC final landform planning seeks to reduce void wall slopes to considerably less than angle of repose. Despite this, as described in Table 2, ROC is permitted to create 9 final voids (Spring Creek A, Spring Creek B, Meteor West, Bootes West, Rolleston South, Gibbs Gully, W2, W3, W4).

If unavoidable, each pit void will consider:

a) Potential pollution impacts, through seepage or leakage into important or used aquifers, surface creeks or other areas, and

b) Potential to create geotechnical risks through voids being located adjacent to important built or natural features.

<table>
<tr><th>Disturbance Type</th><th>Landform Design Criteria</th></tr>
<tr><td>Residual Void(s) maximum slope(s)</td><td>Low wall – angle of repose; and
Highwall to remain as mined where stable.
<table>
<tr><th>Void Area</th><th>Void high wall - competent rock slope (degrees)</th><th>Void low wall - incompetent rock slope (degrees)</th></tr>
<tr><td>Meteor Creek</td><td>45 to 65º</td><td>35 to 45º</td></tr>
<tr><td>Bootes Creek</td><td>45 to 75º</td><td>35 to 45º</td></tr>
<tr><td>Meteor West</td><td>45 to 65º</td><td>29 to 45º</td></tr>
<tr><td>Bootes West</td><td>45 to 75º</td><td>35 to 45º</td></tr>
<tr><td>Spring Creek</td><td>45 to 75º</td><td>35 to 45º</td></tr>
</table></td></tr>
<tr><td>Waste rock dump(s)</td><td>≤16% slope on external slopes,
≥ 150mm with an average minimum of 200mm depth of topsoil.</td></tr>
<tr><td>Infrastructure</td><td>≤5% slope,
≥ 150mm with an average minimum of 200mm depth of topsoil.</td></tr>
<tr><td>ROM area</td><td>≤5% slope,
≥ 150mm with an average minimum of 200mm depth of topsoil.</td></tr>
</table>

Table 7-2: Major areas of disturbance landform design criteria

For the duration of ROC's operations, the stability of pit and overburden dump slopes will be routinely reviewed and designs amended as operational changes occur.

7.3 Infrastructure

Upon final mine closure, all infrastructure constructed for ROC's operations (including water storage structures but excluding Aurizon's rail network) shall be demolished or removed from site prior to mining lease relinquishment. Alternatively, infrastructure may remain post-mining upon agreement with the Administering Authority.

Examples of infrastructure that may remain post-mining include permanent structures such as the Spring Creek, Sandy Creek and Bootes Creek diversions. It is also proposed that gravity fed water storages and some access roads will remain to compliment the post mining land use of grazing.

7.4 Exploration

Disturbance due to exploration activities in areas not scheduled to be mined within two years must be rehabilitated in accordance with the relevant EA or the provisions of the Queensland Department of Environment and Heritage Protection's *Eligibility criteria and standard conditions for exploration and mineral development projects—Version 2*. Should mining be scheduled to take place in an affected area within a 2 year period, only limited rehabilitation will occur to minimise potential for off-site environmental harm.

8. Rehabilitation Process

Progressive rehabilitation is a fundamental principle of ROC. Areas are rehabilitated annually in accordance with the ERC/ Approved PRCP, and the Site Life of Mine Plan.

Generally, the rehabilitation process requires dozers to reshape waste dumps to achieve final landform. Topsoil is then transported to the shaped area in rear dump trucks or scrapers and laid to a minimum average depth of 200mm. Where possible topsoil is direct placed following topsoil stripping.

If required, graded benches/terraces are constructed at pre-defined intervals down the slope of the rehabilitation area. The area is then ripped along the contour to approximately 500 mm depth.

Seeding and fertilising of the rehabilitation area commences soon after completion of topsoiling, or progressively throughout the year, as land becomes available.

Ideally, these activities are carried out prior to the annual wet season, (i.e. November-February).

Predominately, areas requiring rehabilitation are waste dumps, made up of spoil however some rehabilitation of water related infrastructure e.g. diversions, is at times required.

For rehabilitation that occurs outside of ROC's mining leases, e.g. rehabilitation of exploration drill sites within Exploration Permits for Coal (EPCs), a Notice of Entry- Advanced Activities (NOE) to the landholder, is required prior to accessing the EPC.

All rehabilitation activities carried out on ROC's mining leases or EPCs, are undertaken by competent and experienced ROC employees and/ or contractors.

8.1 Progressive Rehabilitation

Areas of land disturbance greater than 5 hectares no longer required for mining &/or related activities are progressively rehabilitated in accordance with this management plan as they become available.

There are currently five active pits and two inactive mining pits at ROC. The availability of areas for rehabilitation following mining activities is dependent on a number of variables such as:

a) Continued use of areas following mining e.g. for roads, electrical cables, water pipelines, hardstands, stockpiling of material such as topsoil or gravel;

b) Areas, particularly of dragline spoil, being scheduled for later infilling with material from future/adjacent mining areas;

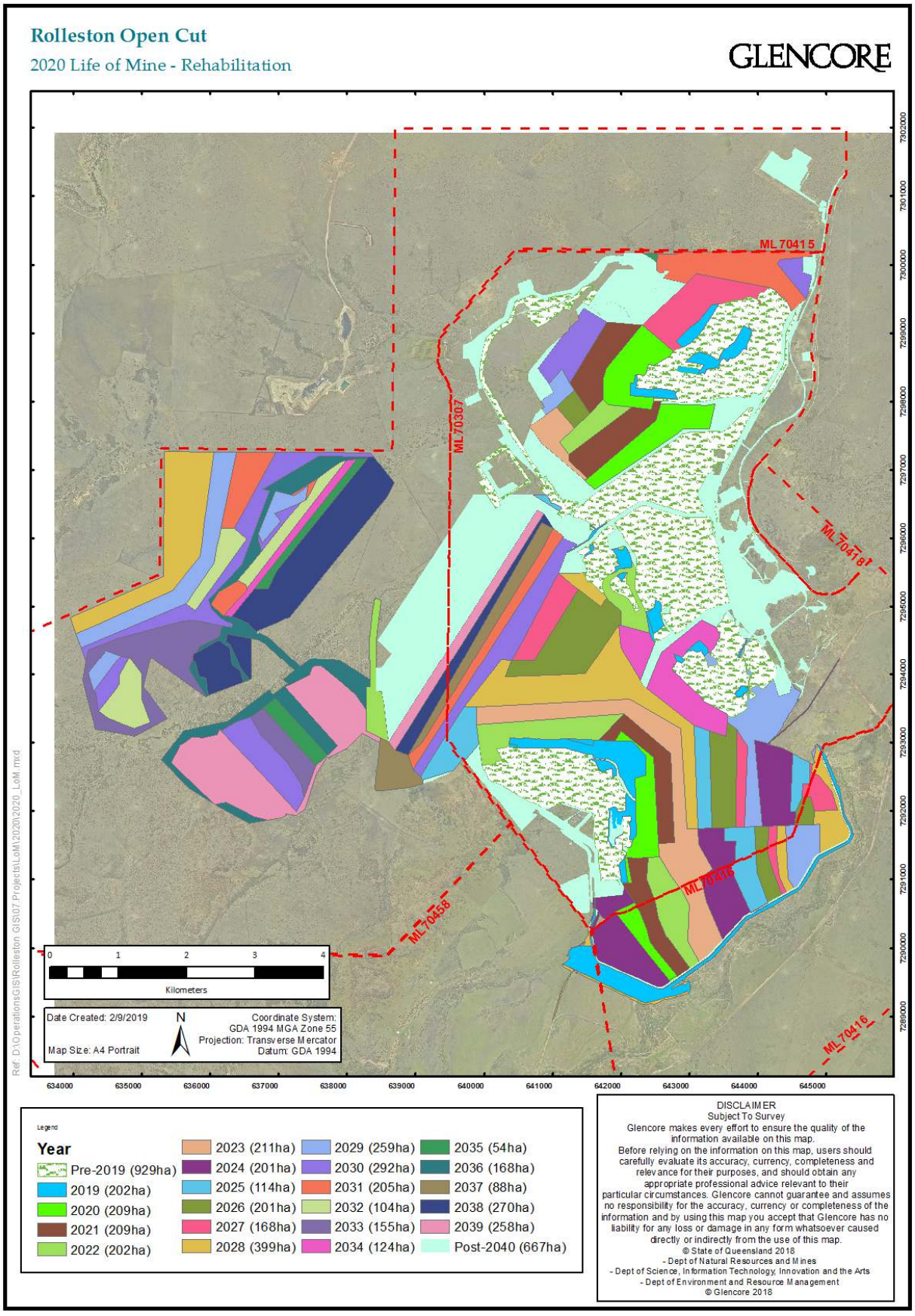
c) The extremities of some spoil dumps are unable to be rehabilitated until cessation of mining due to infrastructure located at the toe of the slope; and

d) Additional spoil material is required to form the final landform.

8.1.1 Rehabilitation Schedule for Life of Mine

Rehabilitation of the overburden emplacement areas and backfilled pits will be conducted progressively over the life of the mine, as an integral component of mining operations. The current Life of Mine rehabilitation schedule is illustrated in Map 4 and demonstrates progressive rehabilitation will occur as soon as practicable after mining disturbance.

Given that mine planning is dynamic and continuous throughout the operation of a mine, the Life of Mine rehabilitation schedule is reviewed annually and will continue to be developed as the mine progresses through its operational life.



Map 4 - 2020 Life of Mine Rehabilitation Schedule

8.2 Waste Landforms & Material Characterisation

If not managed correctly, the materials used to construct waste landforms at ROC can pose challenges to successful rehabilitation. The spoil is sometimes sodic, with some topsoil 'occasionally' exhibiting dispersive characteristics. Depending on the degree of sodicity, sodic spoils and topsoils can be highly dispersive in nature, and be susceptible to tunnel erosion. Additionally, some of ROC's available topsoil is a cracking clay, (Vertosol) which when accompanied with steep slopes and low ground cover is susceptible to erosion by rills and gullies caused by inherent low infiltration rates as well as concentration of overland flow. Therefore, initial landform design is paramount, accompanied with appropriate waste and soil placement and in isolated cases the application of ameliorants.

Extensive geochemistry analyses undertaken as part of both the 2002 and 2014 Environmental Impact Statement's (EIS) indicate that overburden has low acid forming potential and is considered non-saline. The ratio of non-acid forming (NAF) to Potential Acid Forming (PAF) is >20:1 thereby having a buffering effect. No acid or saline drainage has been evidenced at ROC since the commencement of mining operations in 2005. Specific management measures relating to acid or salinity producing material are therefore not necessary.

Successful revegetation of waste landforms is critical, not only to meet regulatory requirements for the return of specific ecosystems, but also to provide sufficient surface cover to ensure stability. Vegetation particularly grass species, is a major factor in controlling erosion and minimising sediment movement.

In the short term, stability of rehabilitated landforms is the primary objective. Over the longer term, whilst stability still remains important, successful plant community establishment is the principal factor in achieving a self-sustaining ecosystem.

The rehabilitation process for waste landforms involves:

a) Final landform shaping and drainage (as required);
b) Spoil treatment (if required);
c) Topsoil spreading;
d) Topsoil ripping;
e) Fertilising and seeding;
f) Rehabilitation monitoring/assessment; and
g) Rehabilitation repairs/ rework (if required).

Other supporting activities include:

a) Topsoil management; and
b) Seed supply and management.

8.3 Landform

Final landform design profiles, as a minimum, shall be consistent with EIS commitments. The 2002 EMOS, suggested that final landform profiles would not be required to exceed 30 metres above the surrounding topography. The 2014 EIS for the Rolleston Coal Expansion Project (RCEP) area committed to an upper limit for dump heights of 50m above the pre-mining landscape.

Table 8-1 lists the targeted maximum landform heights based on the average pre-mining elevation for each operational mining area, plus the applicable height allowance within in the relevant EIS.

Pit Name	Bootes Creek	Meteor Creek	Bootes West	Spring Creek	Meteor West	Gibbs Gully	Rolleston South
Elevation Australian Height Datum (AHD) (metres)	290	300	310	270	270	320	290

Table 8-1: Maximum spoil dump height for each operational mining area

8.3.1 Ponding

Due to the sodicity levels and high permeability of some of ROC's spoil, sometimes landform requirements need to consider mitigation strategies to reduce or eliminate ponding, thereby reducing potential development of tunnel erosion.

For landscapes where erosion-prone material is either exposed or located high in the soil profile, the development of tunnel erosion will be invariably linked to those areas where significant volumes of water are concentrated and/ or ponded for prolonged periods. Areas with dispersive subsoil can be quite stable provided ponding and intake areas are absent (Landloch 2009).

When considering strategies to eliminate ponding, the *internally drained rehabilitation* concept (as proposed in initial plans for the project) is considered unfeasible. The concept was initially developed on coarse, saline, sandstone spoil located on Glencore's Oaky Creek Coal Mine. Subsequently, the concept extended onto fine-grained sodic materials with considerably less success. It was found, that in some instances, the internally drained areas developed tunnel erosion. In other cases, the impermeable sodic material underlying the internally drained areas caused water to pond for prolonged periods, resulting in vegetation dieback.

8.3.2 Concentration of Flow

It is important to reduce or eliminate the concentration of overland flow (to reduce potential for development of rills and gullies) as well as ensuring that slope profiles reduce the occurrence of erosion.

Where possible, slopes are water-spreading rather than water-concentrating. Concentration of flow can be caused by depressions in slopes, poor cross-slope ripping (i.e. not on the contour) and excessively large rip lines. If the potential for erosive concentration of flow cannot be eliminated by final landform shaping, then the area of flow concentration, where possible, should be rock armoured to reduce erosion risk.

8.3.3 Contour Banks & Benches

Contour banks may be installed for a number of reasons, most commonly to reduce slope length to a non-erosive distance, to divert upslope runoff flows from impacting a downslope area under rehabilitation or to prevent runoff water from impacting on a haul road below a rehabilitated area. Contour banks in rehabilitated mine spoil areas should in the first instance be avoided but when necessary should be considered temporary and be removed once the rehabilitated area is established.

An alternative to contour banks is the installation of 15-25m wide benches. Constructed during landform reshaping (prior to topsoiling), benches have the benefit over contour banks of not having steep batters as well as generally having a greater channel and hence water carrying capacity. Benches become a permanent fixture in the landscape. All benches should have adequate channel capacity for runoff from a 1 in10 year rainfall event, and should have a longitudinal gradient of approximately 0.3%.

8.3.4 Rock Armouring

Areas where overland flow is concentrated, particularly on batter slopes, will be monitored for evidence of erosion and if necessary rock armouring will be used to protect against erosion by surface flows.

Significant overland flows may develop where there are opposing batter slopes draining to a central flow line, as runoff would be received from both batters.

8.4 Topsoil

Topsoil provides an essential growth medium for microbes and dependent vegetation. Refer to ROC's *ROLOC-2064063594-4072 Topsoil Management Plan* for all topsoil stripping, stockpiling and spreading requirements.

8.4.1 Ripping

When initially placed, it is typical for the topsoil to be compacted by a scraper or haul trucks/ dozer. The compaction lines may run vertically with the slope's gradient. Cross-slope ripping removes compaction and allows water percolation through the soil's profile. Successful ripping:

a) Does not bring significant quantities of underlying spoil to the surface,

b) Is placed precisely on the contour to avoid the potential to capture relatively large volumes of runoff and then convey the flow downslope, creating rills.

Rip lines represent transient roughness only (especially on self-mulching clays) and the necessary permanent hydraulic roughness will only be achieved by establishing a dense vegetation cover and application of rock armouring where/if required.

When ripping on the contour, GPS guidance or survey pegs at predetermined vertical intervals is recommended to facilitate the ripping operation.

The minimum depth of ripping is 500mm.

Post-ripping, slopes will be assessed visually to ensure they meet the above criteria. If any non-conformance areas are identified, the gradients of the rip lines will be checked and if found to be greater than 2% from the horizontal, the area will be re-surveyed and re-ripped.

8.5 Seeding & Fertilising

As a general rule, given the need to establish grass rapidly to ensure erosion control, fertiliser will be applied where Vertosol topsoil is being used. Lithosol, Ferrosol and Dermosol soils generally, upon being disturbed/ stripped, mobilise a large amount of nutrients which become available for plant uptake. As such, little to no fertiliser is required when direct placing these soils for rehabilitation purposes.

The primary objectives of applying fertiliser to recently established rehabilitation is to encourage strong initial plant vigour, enabling rapid development of ground cover and reduction in erosion potential.

Nitrogen and sulfur are highly mobile nutrients in soil and can rapidly leach from the surface to the root zone. In comparison, phosphorus and potassium are relatively immobile in soils with movement from the surface to the active root zone quite slow. Therefore, the correct application at ripping (ensuring adequate incorporation with the soil) is paramount.

ROC generally applies seed and fertiliser at the same time. If applied prior to ripping it presents the risk of a proportion of seed being buried, however the benefits of incorporating the seeding and fertilizing activity is considered to outweigh this risk. Additionally, scheduling of activities (especially those pertaining to earthworks) are dependent on machinery availability, which heavily influences ROC's rehabilitation timing.

The initial objective after seeding is the rapid establishment of a dense vegetative cover (usually in the form of some grass species and legumes).

ROC adopts several factors in the selection of plant species sown in rehabilitation areas, including:

a) Inclusion (where possible) of species identified in applicable monitoring reference sites located in adjacent non-mining landscapes, (including, pastoral area and the neighbouring Albinia National Park);

b) Species identified is surround Regional Ecosystems;

c) Promoting the re-establishment of areas of Bluegrass community in the northern section of the Mining Lease (Spring Creek Pit area); and

d) Minimising erosion, thus maintaining landform stability and downstream water quality, (perennial grass species such as Bluegrass and Black spear grass can aid in effective erosion control).

8.5.1 Seed Harvest, Supply & Storage

8.5.1.1 Seed Source

Predominately, rehabilitation activities aim to establish ecosystems, particularly grasslands that are similar to those currently growing in unmined areas of ROC's mining leases.

The majority of seed used for rehabilitation purposes is sourced via:

a) Commercial seed merchants; and/or

a) Harvesting seed from similar grasslands i.e. with a brush harvester.

8.5.1.2 Supply

For timely seeding operations, it is important that seed is available. For that reason it may be necessary to purchase seed several times per year to ensure timely access to fresh viable seed.

At the beginning of each year, an estimate is forecast for that year's seed requirement, allowing for the various topsoil types to be used.

Similarly, requirements for tree/legume seed will be estimated and orders placed early in the calendar year.

8.5.1.3 Storage

It is paramount that seed storage areas are dry, and where possible not subject to extreme heat or humidity. Ideally seed is stored in a climate controlled environment (i.e. refrigerated container). The control of vermin may also be required.

8.5.2 Seeding

Plant establishment has shown to be greatest when the seed is applied to freshly-disturbed soil, therefore it is preferable for seed to be applied either immediately before or after the topsoil is ripped and before rainfall has an opportunity to cause the formation of a surface crust.

Factors to consider prior to seeding include:

a) If the harvested native grass seed is chaffy, then sowing rates should be increased; and

b) Native legumes have limited success or are very slow to re-establish from the soil seed bank, therefore the seed mix should include introduced legumes such as Burgundy bean and stylos, to initiate nitrogen supply while native legumes establish.

8.5.3 Fertilizer Types & Rates

Predominately, fertilizer rates will depend on topsoil (and to a lesser degree spoil) fertility and its variability from site to site. Additionally, the health of the topsoil to be used will be considered and whether it has been stockpiled and for how long.

Generally, regardless of the soil's health, the fertiliser will consist of nitrogen, with varying levels of phosphorus, potassium, sulphur and micronutrients.

Due to the need to maintain slope stability, the rapid establishment of grass species on slopes is important. Additionally, because high grass cover can often impede tree growth, it is important to review the fertilization rates on landform crests, so as to promote tree establishment.

8.6 Other

Generally it is not expected that fauna will inhabit rehabilitated areas until revegetation has reached the stage where it can provide a sufficient habitat. The speed with which a rehabilitated area is colonised by fauna also depends on the mobility of different species as well as the connectivity of rehabilitated areas with surrounding undisturbed land.

8.7 General Disturbance Areas

Areas disturbed for ancillary mining activities, but which have not been subject to significant excavation (or placement of mine waste) will require rehabilitation progressively throughout ROC's operations. The majority of these areas will have reduced erosion risk as a result of:

a) Lower gradients or shorter slope lengths (or both);

b) The lack of underlying, unconsolidated, sometimes sodic waste (though some subsoils are also naturally sodic);

c) Topsoil in many instances will still be present; and

d) Comparatively smaller disturbed areas.

The establishment of a suitable vegetation cover in General Disturbance Areas will still require suitable site preparation and seeding.

9. Other Rehabilitation Considerations

9.1 Water Quality

9.1.1 Surface Water

The quality of surface runoff water can result in both on and off site impacts. The *ROLOC-2064063594-506 Water Management Plan* provides guidance in protecting downstream waterways. Primarily, this is through the containment of potentially mine affected water via drainage and pipeline networks reporting to strategically situated water storages and eventual offsite discharge if required under the EA.

Surface runoff from rehabilitation areas which has not yet met performance criteria in Table 1, will firstly pass through sediment control structures. This will reduce sediment loads entering waterways downstream of ROC.

Runoff water from rehabilitated areas improves in quality as revegetated areas mature, reducing erosion and resultant sediment loads in runoff. As closure progresses, it is expected that runoff water quality will increase to a quality which can freely drain into local watercourses (in accordance with legislative requirements).

9.1.2 Groundwater

During mining, pit dewatering will cause groundwater drawdown in the area immediately surrounding the pits resulting in net inflow into the pits. Post-mining landscape will include residual voids. These voids will gradually fill with water, forming mine pit lakes and eventually reach equilibrium as inflows from groundwater and rainfall/ runoff are balanced by evaporation losses (Landloch 2009). More detailed discussion on final voids in the *ROLOC-2064063594-5027 Conceptual Mine Closure Plan*.

Impacts of the residual voids on groundwater quality are considered unlikely, with net groundwater flow toward the pits, rather than away from them.

Schedule E of ROC's Environmental Authority, describes the groundwater monitoring program currently being undertaken by the operation.

Another potential groundwater impact is the leaching of water through deep drainage from retention dams. It is expected that any adverse impacts would be detected early through the groundwater monitoring program &/or the water infrastructure inspection regime.

9.1.3 Erosion & Sediment control

Sediment and erosion control measures in relation to rehabilitated areas at ROC include:

a) Landform design in accordance with Section 8.3 of this plan;

b) Employment of contour banks and/or benches accordance with Section 8.3.3;

c) Wherever possible, topsoils are selected for their ability to assist in erosion and sediment control. Refer to Section 3.3 of the *ROLOC-2064063594-4072 Topsoil Management Plan;*

d) Fertilizers and ameliorants may be applied to facilitate rapid vegetative (grass) cover (Section 8.5.3);

e) Deep ripping across the contour in accordance with Section 8.4.1 of this plan;

f) Rock armouring is used in areas of relatively high erosion risk, to provide both immediate and enduring protection of erosion by surface flows, (Section 8.3.5);

g) Rehabilitated areas report to mine affected water catchments until it can be demonstrated and certified that the rehabilitation is safe, stable, non-polluting and self-sustaining; and

h) Clean water catchments wherever possible are diverted around operational mining areas, thereby reducing the volumes of water reporting to disturbed areas with increased erosion potential.

9.2 Weed Management

Weed and pest management will be in accordance with ROC's *Pest Management Plan (ROLOC-2064063594-4068)*, which outlines the obligations in managing weeds found in site's rehabilitated areas, some of which include:

a) Where possible topsoil from disturbed or weed-infested areas is stockpiled in the same locality as it is stripped from to avoid the potential for spread of weeds;

b) Topsoil stockpiles may be treated with an approved herbicide to manage the weeds during storage and prior to reuse; and

c) Plant species used in rehabilitation are assessed for weed potential prior to use on the site.

10. Stakeholder Consultation

Glencore standards require that actions are taken to ensure rehabilitation methods and outcomes are consistent with leading practices applicable to the area, and that stakeholders are adequately informed of rehabilitation progress.

ROC engages stakeholders regularly through forums such as the Community Reference Group and mine tours. Rehabilitation targets and outcomes are reported and information comments and concerns noted.

Stakeholder concerns relevant to rehabilitation are documented and listed for consideration/ investigation. Annual rehabilitation monitoring and subsequent reporting may be made available to stakeholders if requested.

11. Monitoring

Rehabilitation monitoring is undertaken in accordance with the *GCAA-625378177-11398 11.16 Development of the Annual Rehabilitation Report Card Manual*.

Monitoring is completed on an annual basis with sufficient spatial and temporal replication to enable statistically valid conclusions under the rehabilitation program following which closure objectives and criteria will be reviewed.

The monitoring program examines:

a) Plant abundance, biodiversity, biomass;

b) Groundcover, evidence of erosion; and

c) Soil health.

Each factor is designed to identify and collect the necessary information to assist in decision making regarding rehabilitation success and record/ track development trends towards the establishment criteria.

Once rehabilitation areas are sufficiently mature, the monitoring of fauna may also be undertaken and used as an indicator of rehabilitation success for appropriate rehabilitation goals.

Monitoring sites in certified rehabilitation areas may be used as a 'benchmark' for comparative purposes with newly established rehabilitation. Once newly established rehabilitation sites have met the standards equivalent to benchmark sites, rehabilitation areas may be recommended for certification.

12. Land Management Techniques

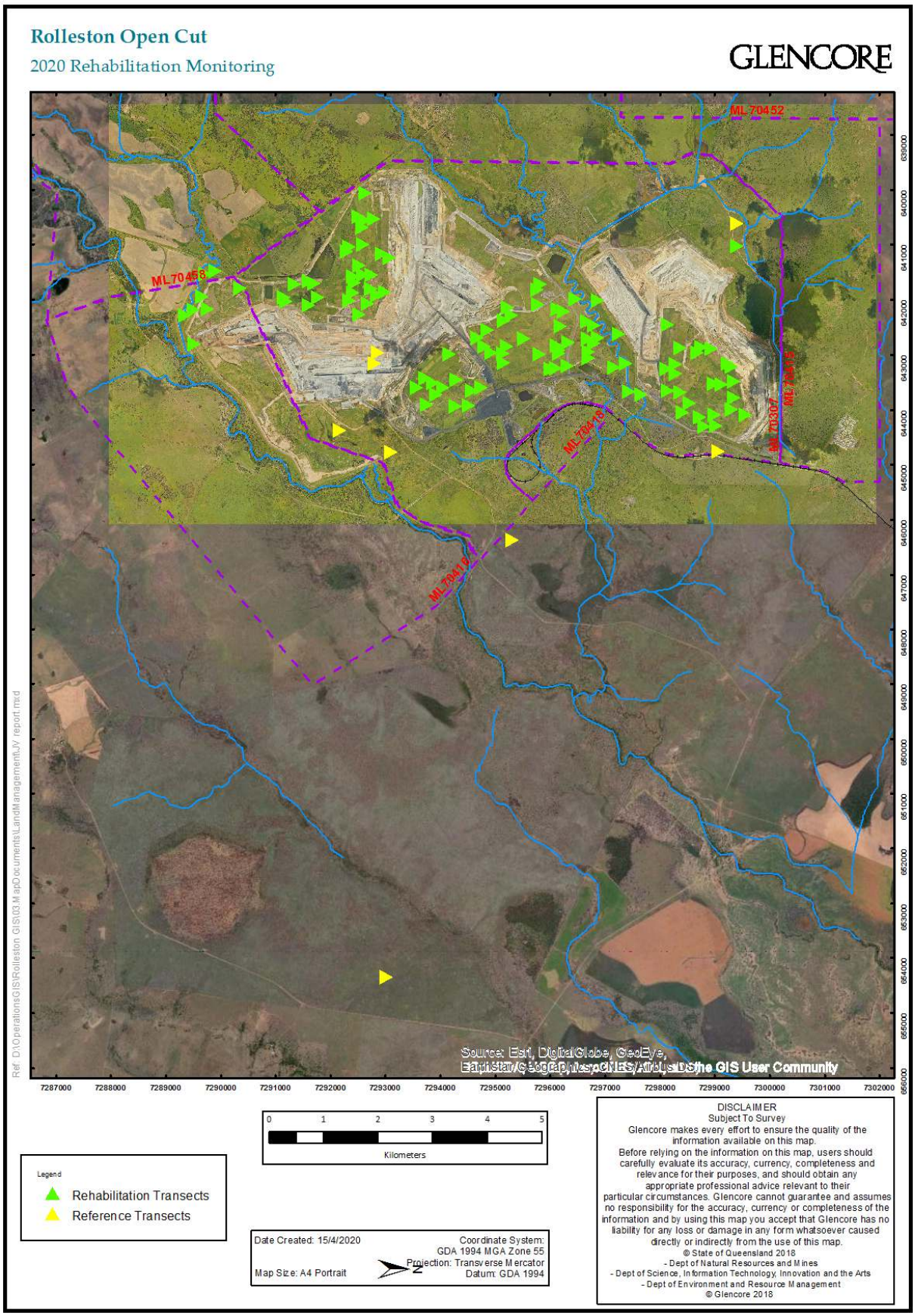
As a continual improvement process throughout the life of the mine, ROC will consider various land management techniques and review their success and effectiveness.

These could include:

a) Re-introduction of grazing to demonstrate that mining land rehabilitation can be returned to sustainable productive land uses;

b) Re-establishment of habitat similar to pre-mining regional ecosystems; and

c) Use of alternative technologies and/or techniques, (e.g. hay spreading).



Map 5 – Rehabilitation Monitoring Sites (current 2020)

13. Accountabilities

Roles	Accountabilities
Senior Site Executive (SSE)	a) Approve site specific management plans and procedures in relation to the Rehabilitation Management Plan; b) Overseeing the implementation of the relevant requirements of Rehabilitation Management Plan; and c) Provide that there are sufficient resources allocated and accountabilities assigned in order to implement rehabilitation management practices as required by this Plan.
E&C Manager	a) Review and update of the Rehabilitation Management Plan every three years or more often if required due to legislative or operational changes; b) Coordination and conduction of rehabilitation monitoring; c) Production and submission of the Annual Rehabilitation and Land Management Plan; d) Conduct regular consultation with identified stakeholders on rehabilitation plans, progress and outcomes; and e) Monthly and annual reporting on land rehabilitation.
Technical Services Manager	a) Incorporate rehabilitation in the Life of Mine Planning process; b) Design of finished spoil dumps to ensure final landform complies with the requirements of the Rehabilitation Management Plan; and c) Scheduling and development of mining sequence including considerations for strategic rehabilitation.
Open Cut Manager	a) Strategic dumping and shaping of mine spoil as prescribed in the Life of Mine Plan.
Coal Mine Workers	a) Compliance with Ground Disturbance Procedure and Permit conditions including but not limited to topsoil stripping depths.

14. Document Information

14.1 Related Documents

Related documents, listed in ***Table 14-1*** below, are *documents* directly related to or referenced from within this document.

Number	Title
	Nil

Table 14-1 – Related documents

14.2 Reference Information

Reference information, listed in ***Table 14-2*** below, is *information* that is directly referred to for the development of this document.

Number	Title
	Gilbert and Sutherland (2009). Sodic Soil Investigation, Rolleston Coal Mine, Xstrata Coal, Rolleston, Queensland. February, 2009.
	Landline Consulting (2010) Rolleston Coal Rehabilitation Monitoring Report. Report prepared for Xstrata Coal Queensland.
	Landline Consulting (2011) Rolleston Coal Rehabilitation Monitoring Report. Report prepared for Xstrata Coal Queensland.
	Landline Consulting (2012) Rolleston Coal Rehabilitation Monitoring Report. Report prepared for Xstrata Coal Queensland.
	Landline Consulting (2013) Rolleston Coal Rehabilitation Monitoring Report. Report prepared for Xstrata Coal Queensland.
	Landline Consulting (2014) Rolleston Open Cut Rehabilitation Monitoring Report. Report prepared for Rolleston Open Cut – Glencore.
	Landline Consulting (2015) Rolleston Open Cut Rehabilitation Monitoring Report. Report prepared for Rolleston Open Cut – Glencore.
	Landline Consulting (2016) Rolleston Open Cut Rehabilitation Monitoring Report. Report prepared for Rolleston Open Cut – Glencore.
	Landline Consulting (2017) Rolleston Open Cut Rehabilitation Monitoring Report. Report prepared for Rolleston Open Cut – Glencore.
	Landline Consulting (2018) Rolleston Open Cut Rehabilitation Monitoring Report. Report prepared for Rolleston Open Cut – Glencore.
	Landline Consulting (2019) Rolleston Open Cut Rehabilitation Monitoring Report. Report prepared for Rolleston Open Cut – Glencore.

Number	Title
	Landloch Pty Ltd (2009). Guidelines for rehabilitation of waste landforms and other disturbed areas, Rolleston Coal Pty Ltd. Report prepared for Xstrata Coal Queensland.
	Landloch Pty Ltd (2009a). Establishment criteria for Rolleston Coal Mine. Report prepared for Xstrata Coal Queensland.
	Lindsay, W. L. and W. A. Norvell. 1978. Development of a DTPA soil test for zinc, iron, manganese, and copper. Soil Sci. Soc. Amer.J. 42:421-428.
	McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J., and Hopkins, M.S. (1990) Australian Soil and Land Survey – Field Handbook. 2nd ed., Inkata Press, Melbourne, Australia.
	Hinz Consulting and Environmental Resources Management Australia (2002). Rolleston Coal Mine Environmental Impact Statement, Chapter 20: Rehabilitation and Decommissioning.
GCAA-625378177-10241	GCAA Rehabilitation Management Protocol
GCAA 625378177-13337	GCAA Mine Void Closure Policy
	ROC's Environmental Authority EPML00370013.
ROLOC-2064063594-498	Community and Stakeholder Engagement Plan
ROLOC-2064063594-4069	Mine Closure Plan
ROLOC-2064063594-506	Water Management Plan
ROLOC-2064063594-4068	Pest Management Plan
ROLOC-2064063594-4072	Topsoil Management Plan

Table 14-2 – Reference information

14.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in ***Table 14-3*** below. Example detail shown below.

Version	Date	Change Details
1.0	2012	Document created
2.0	29/01/2014	Updated document
3.0	08/11/2016	Alan Shaw reviewed to reflect CAA Protocol 0007 11.16 Rehabilitation Management. Updates following internal and external audits. Updated to reflect 2016 EA amendments.
4.0	19/07/2017	Ken Dixon Alan Shaw updated to reflect input from regulator, Updated references, Typographical/grammar edits.
7.0	30/03/2017	Due to SharePoint upgrade on 30/3/17 transferred to new site as incremented version number.
8.0	10/11/2017	Ken Dixon & Alan Shaw updated to align to DEHP requirements.
9.0	17/08/2020	Ken Dixon & Jeremy Duncan updated the Plan to meet the 'Land Outcome Documents' requirements for the Progressive Rehabilitation and Closure Plan.

Table 14-3 – Change information