4 POST MINING LANDFORM AND LAND USE

4.1 CONCEPTUAL LANDFORM DESIGN

4.1.1 Drayton Mine

The conceptual final landform at Drayton Mine will divert water around the North void and allow for free drainage into the four minor gullies of the Ramrod Creek catchment. The eastern and southern areas of the final landform will no longer be free draining with a significant proportion of the local catchment area occupied by the East and South voids.

Excluding the final voids, the final landform will be shaped to be consistent with the surrounding landscape, with slopes generally less than 10 degrees with a maximum of approximately 14 degrees. The final landform will typically be characterised by land with a capability Class of V to VII. Further details on the rehabilitation and conceptual final landform of Drayton Mine are presented in the *Drayton Mine, Rehabilitation and Offset Management Plan* (Anglo American, 2013) and approved Mining Operations Plan.

Following completion of mining at Drayton Mine in 2017, three final voids will remain in the North, South and East voids. These voids will all be utilised for future uses as described in **Section 4.2**.

The conceptual Drayton Mine final landform is shown on **Figure 10**.

4.1.2 Drayton South

The final landform proposed for the Drayton South area is consistent with the surrounding landscape, with slopes of approximately 10 degrees. The final landform will be typically characterised by land capability Class VI and VII.

To improve the design of the conceptual final landform, Anglo American is committed to developing a detailed plan for Drayton Mine and the Drayton South area through the use of GeoFluv™ software, which produces a free draining, integrated and sustainable landform that is stable against erosion. This will ensure undulating, convex landforms, rather uniform areas.

To minimise surface water catchment as far as practical, the conceptual final landform within the Drayton South area has been designed with the inclusion of diversion drains and contour banks to redirect surface water runoff away from low lying areas.

As part of the final landform it is planned that the final void at Drayton South will have the majority of the highwall blasted back and low wall graded to improve the safety and stability. Surface water runoff and groundwater seepage will settle in the remaining void, creating a final void lake.

The conceptual Drayton South final landform is shown in **Figure 11**.

4.2 POST MINING LAND USE

4.2.1 Drayton Mine

The Drayton Mine disturbance footprint will be rehabilitated with a mixture of woodland and pasture areas, aiming to link rehabilitation and remnant vegetation through the establishment of woodland corridors.

The existing Drayton Mine offset areas and Wildlife Refuge will continue to be maintained and improved, thereby enhancing wildlife and vegetation corridors.

Following completion of mining at Drayton Mine in 2017, three final voids will remain. The North void, which is situated on land owned by Anglo American, will be utilised as a waste emplacement area for rejects and/or tailings generated by Drayton South.

The South void is anticipated to be utilised as a water storage area. The East void is anticipated to be utilised as an emplacement area for tailings generated by the Drayton South and/or fly ash emplacement from Macquarie Generation based on ongoing consultation on void utilisation strategies between the two companies.

The availability of the voids in each of the scenarios described above will depend upon the circumstances that exist at the relevant time with Macquarie Generation as part of the East and South voids are located on land they own.

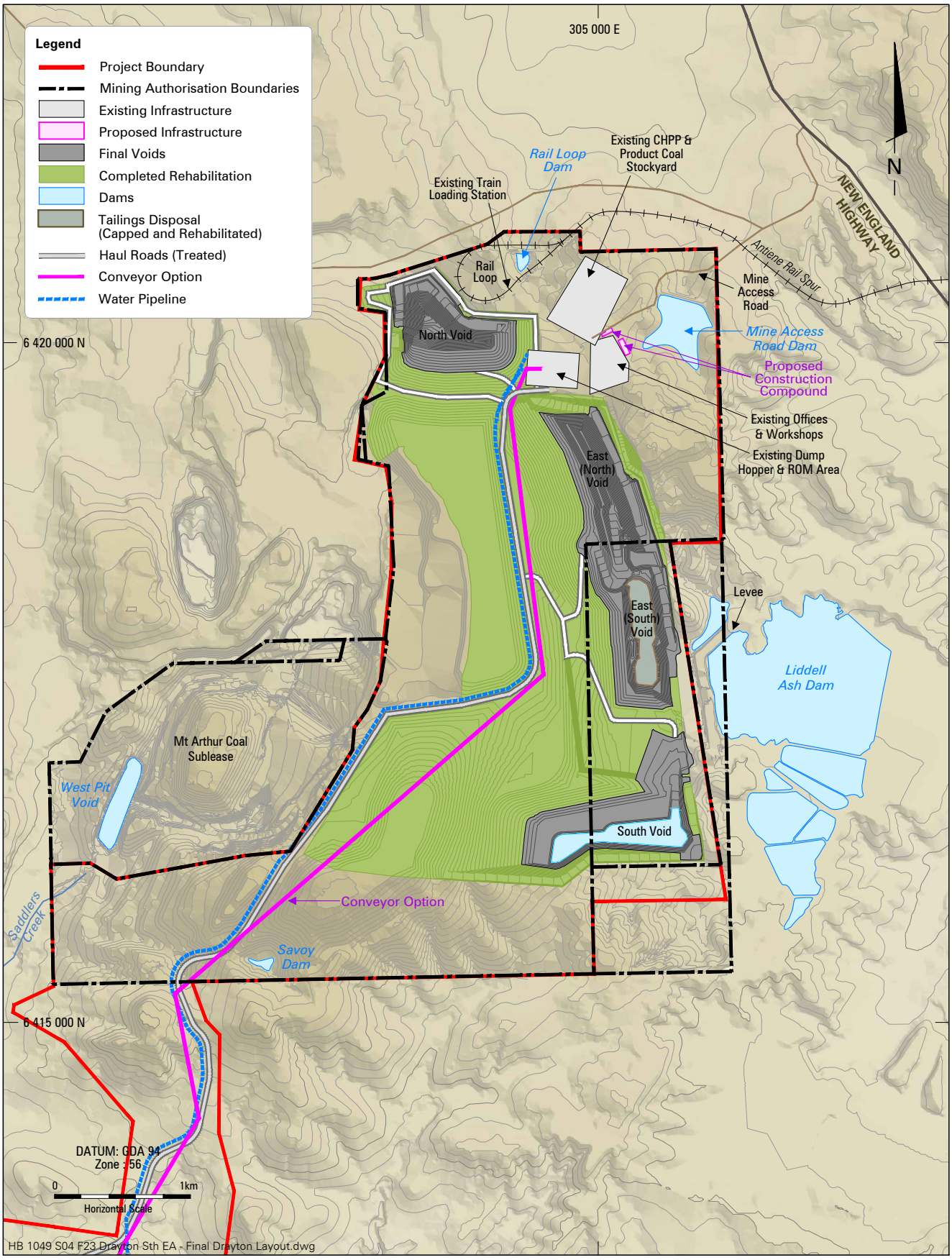
Further detail on the potential uses of the final voids at Drayton Mine is presented in Section 4.4.1 of the EA.

4.2.2 Drayton South

The Drayton South disturbance footprint and the Saddlers Creek corridor will be set aside as an onsite offset in perpetuity as part of the biodiversity offset strategy for the Project.

The following future land uses are considered as options for the final void within the Drayton South area:

- Overburden emplacement area for future open cut mining operations;
- Waste disposal area for future mining operations;
- Ash disposal area for neighbouring power stations;
- Water storage for neighbouring power stations or future mining operations;
- Aquaculture; or
- Recreational lake.



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Conceptual Drayton Mine Landform (2017)

FIGURE 10

DRAYTON SOUTH COAL PROJECT

Conceptual Drayton South 3D Final Landform

FIGURE **11**

5 REHABILITATION MANAGEMENT

5.1 OBJECTIVES

The overarching rehabilitation objectives for the Project (consistent with the Met Coal Rehabilitation Guideline) are to:

- Develop rehabilitation areas which are safe, stable, non-polluting and sustainable;
- Establish healthy and self-sustaining ecological communities on both re-contoured (rehabilitated) and non-disturbed offset areas;
- Implement assisted natural regeneration methods on undisturbed areas to increase the ecological integrity of offset areas and to enhance native vegetation density and diversity;
- Undertake progressive revegetation as soon as areas become available;
- Create a post-mining landform which enhances the local and regional habitat corridors as presented in the *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of New South Wales* (Synoptic Plan) (DMR, 1999);
- Develop a landscape that reduces the requirement for long term monitoring and management;
- Conduct maintenance (e.g. weed control, follow-up fertilizer, reseeding, erosion repair etc) until ecosystems achieve sustainability; and
- Monitor and manage rehabilitation areas to facilitate the process of achieving sign-off on completion criteria.

5.2 LANDFORM ESTABLISHMENT

Placement and shaping of overburden will be undertaken so as to create slopes with gradients generally less than 10 degrees, with a maximum of 14 degrees. As noted in Section 4.1.2, to improve the design of the conceptual final landform, Anglo American is committed to developing a detailed plan for future Drayton Mine and Drayton South rehabilitation areas through the use of GeoFluv™ software (or similar), which produces a free draining, integrated and sustainable landform that is stable against erosion. This will ensure undulating, convex landforms, rather than uniform areas. It is important to note, that this historic rehabilitation undertaken at Drayton will be retained as per the approved MOP.

Where practicable, any friable or weathered materials will be placed below the subsoil and topsoil layers in order to provide a cover of more competent material and avoid the exposure of large rocks on the final surface.

All rehabilitation works will be scheduled to commence as soon as practicable, where access permits. Disturbance of native vegetation will be kept to a minimum and clearing will be constrained to the footprint area of the infrastructure items and active mining areas. The establishment of the final landform will take place and OEAs will be progressively rehabilitated throughout mining operations.

Prior to the re-establishment of vegetation cover, temporary control measures will be utilised for erosion and sediment control. These measures may include sediment fences, sand bag sediment traps and rip rap scour protection. Consideration will be given to erosion and sedimentation control measures during the construction and operational phases such as restricting access or modifying activities during wet weather, establishing exclusion zones around areas undergoing rehabilitation, reporting erosion and sediment hazards and regular inspections and maintenance of structures.

5.2.1 Water Management

Surface water management structures will be progressively installed on the rehabilitated landform. Rock-lined drains will be used, where required, to convey water safely from the rehabilitated landform into the surface water management system. Where practicable, water management structures such as contour banks and drains will be constructed with longitudinal gradients that permit the transfer of water at non-erosive velocities. The purpose of these erosion and sediment control structures is to divide long sections of slope into shorter sections and thus reduce runoff flow velocity and depth, and also the potential for soil erosion.

However, in the event that unacceptable levels of erosion are observed, fast growing species identified as having a particular soil conservation application and/or specialised treatments will be established. The planting of trees and other vegetation around the various water management structures can enhance the filtration ability of these structures and surrounding areas and minimise the potential for erosion, as well as encouraging their use by native fauna.

5.3 SOIL RESOURCES

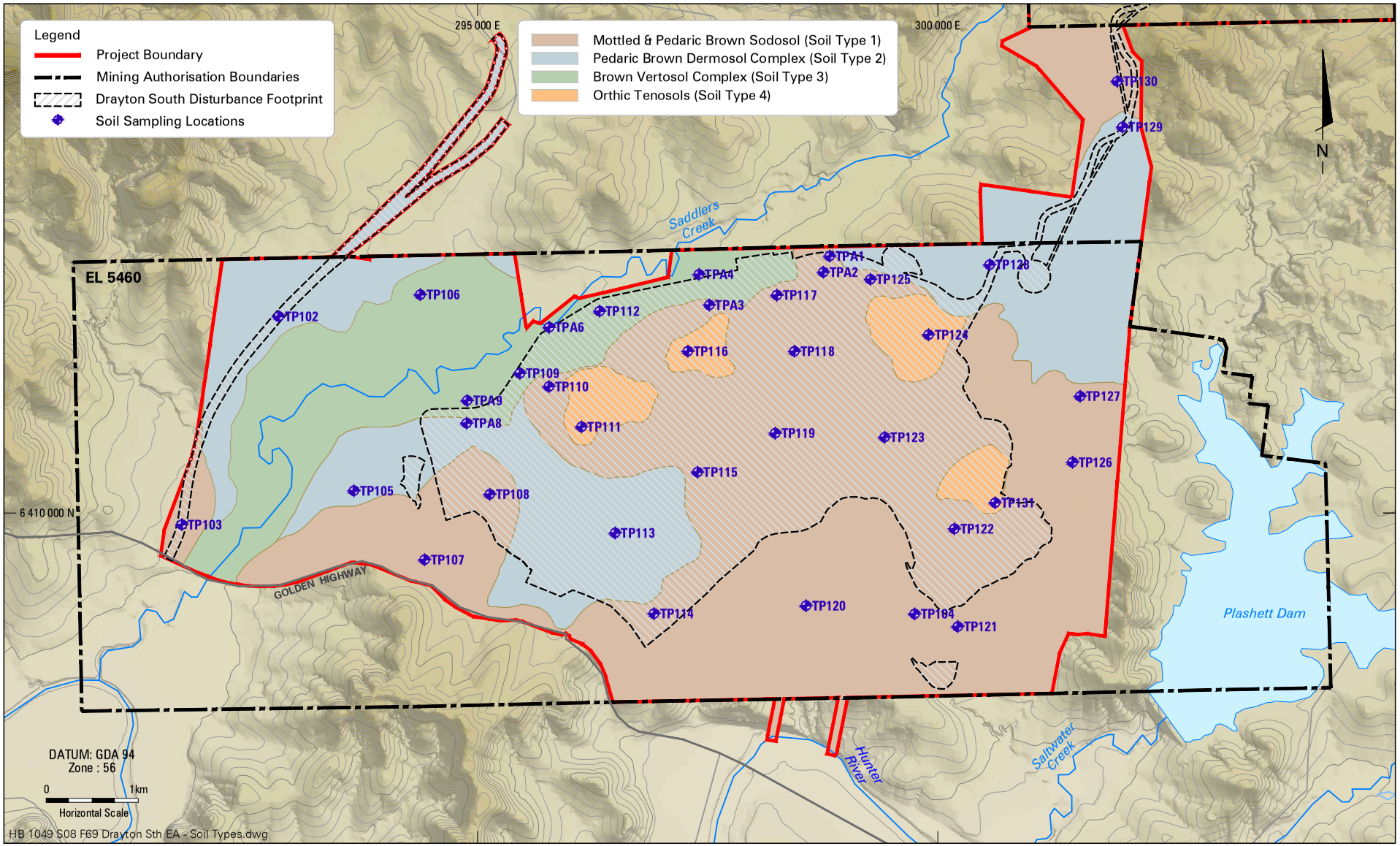
5.3.1 Topsoil Availability

The recommended stripping depth and topsoil balance for the Drayton South mining area is outlined in **Table 1**. The spatial distribution of each soil type within the Drayton South mining area is shown on **Figure 12**.

The estimated total volume of suitable topdressing material within the Drayton South disturbance footprint is approximately 4,151,000 m^3. Allowing for a 10% handling loss, approximately 3,735,900 m^3 of suitable topdressing is considered to be available.

Table 1
Topsoil Balance

Soil Type	Recommended Stripping Depth (m)	Disturbance Footprint (ha)	Volume Available (m^3)	Volume Available at 10% Loss (m^3)
1	0.20	1,124	2,248,000	2,023,200
2	0.25	450	1,125,000	1,012,500
3	0.30	122	366,000	329,400
4	0.20	206	412,000	370,800
Total Area (m^3)		**1,902**	**-**	
Total Volume (m^3)		**-**	**4,151,000**	**-**
Total Volume (10% Handling Loss Allowance)		**-**	**-**	**3,735,900**



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Soil Types

FIGURE 12

5.3.2 Soil Handling and Management Measures

The following procedure will be adhered to during stripping and handling of topsoil:

- Strip material to depths shown in **Table 1** for each of the main soil types. Close supervision of topsoil stripping will be undertaken to ensure that sodic subsoil material is not incorporated with more favourable topsoil;
- Maintain soil in a slightly moist condition during stripping. Material will not be stripped in either an excessively dry or wet condition;
- Place stripped material directly onto reshaped overburden and spread immediately (if mining sequences, equipment scheduling and weather conditions permit) to avoid the requirement for stockpiling;
- Where possible, less aggressive soil-handling equipment will be used during the salvage and transport of the stripped soil. Examples of this equipment include the use of graders or dozers to form the soil into wind-rows and the subsequent collection of this soil by open-bowl scrapers or dump trucks that have been loaded using front-end loaders;
- Where immediate use is not intended soil transported by dump trucks will be placed directly into storage. Soil transported by scrapers will be pushed to form stockpiles by other equipment (e.g. dozers) to avoid tracking over previously laid soil;
- The shape of topsoil dumps will be even with relatively shallow grades which will facilitate equipment access and subsequent weed scalping and topsoil recovery prior to respreading;
- The surface of soil stockpiles will be left in a coarsely textured condition (deep ripped). This will promote cover crop establishment, infiltration and will minimise erosion until vegetation is established, as well as reducing anaerobic zone formation;
- The maximum topsoil stockpile height will be 3 m. If long-term stockpiling is planned (i.e. greater than 12 months) the stockpile will be seeded with a heavy annual pasture seed mix (oats in cooler months and Japanese millet in warmer months). This will quickly establish a thick, dense sward which will restrict weed emergence and growth;
- Prior to spreading stockpiled topsoil onto reshaped overburden (particularly onto designated tree seeding areas), a weed assessment of stockpiles will be undertaken to determine if individual stockpiles require herbicide application and/or ‘scalping’ of weed species prior to topsoil spreading;
- An inventory and map of available topsoil will be maintained to ensure adequate topsoil materials continue to be available for rehabilitation activities; and
- Topsoil will be spread to depths between 0.15 m (for land capability VII and VIII) and 0.20 m (for land capability IV, V and VII).

Ongoing monitoring of the stockpiles will be carried out for the life of the Project and records of observations will be kept as well as any corrective action required and undertaken. An inventory of available topsoil will be maintained to ensure adequate topsoil volumes are available for planned rehabilitation activities.

5.3.3 Soil Replacement Protocol and Spreading

The following techniques are recommended to ensure optimum establishment and growth of vegetation:

- Ameliorate soils to minimise limitations. The main limitation for topsoil is weak soil structure. This limitation can be managed by the addition of organic matter or the establishment of an initial dense cover crop which will increase soil aggregate stability and improve soil structure;
- Topsoil will be placed to depths between 0.15 m (for land capability VII and VIII) and 0.20 m (for land capability IV, V and VII) ;
- Preferably, topsoil will be spread, deep ripped, treated with fertiliser and seeded in one consecutive operation in order to reduce the potential for topsoil loss from wind and water erosion. Where a temporary cover crop has been established to enhance soil organic content, ripping and reseeding will be repeated when the cover crop is mature in order to establish the final (woodland) ecosystem;
- Seeding should be undertaken immediately after ripping and before surface crusting occurs;
- Where practical, soil will be respread directly onto reshaped areas thus avoiding the need for stockpiling. Where stockpiling is necessary procedures will follow those described in **Section 5.3.2** of this report; and
- Ripping will be undertaken on (parallel to) the contour with the intention of both 'keying in' topsoil and underlying spoil, as well as decompacting the soil to facilitate healthy vegetation root growth. Best results will be obtained by ripping immediately prior to sowing. Rock raking will be undertaken prior to sowing to remove excessive surface rock if brought to the surface.

5.4 REVEGETATION

All revegetation operations are preferably undertaken immediately after ripping so that the ripped surface has minimal time to crust prior to seed application. The most effective way of controlling erosion will be to establish and/or maintain a healthy vegetation cover. Vegetation will provide effective surface protection against raindrop impact, bind the underlying soil to resist detachment by surface flows, and improve and maintain the soil's infiltration capacity, thereby decreasing the velocity and volume of runoff.

Should natural revegetation require acceleration, the following rehabilitation methods and techniques may be implemented depending on the requirements. These include:

- Use of mulch for soil protection and mixing with topsoil;
- Use of brush matting to import seed into cleared areas;
- Use of open weave jute mesh pegged in with steel pegs;
- Brush harvesting from nearby areas;
- Ripping of compacted wheel tracks; and.
- Protective, stock-proof fencing.

5.4.1 Disturbance Areas

Following the application of topsoil, disturbed areas (which are to be restored to rehabilitated woodland) will be initially stabilised using a cover crop of Japanese Millet (warm season) or Oats (cold season) sown at 40 kg/ha together with fertiliser (Granulock 15 at 200 kg/ha).

Once the cover crop hays off it will be deep ripped and seeded with the final vegetation seed mix. The final vegetation seed mix will be a combination of species that form Central Hunter Box – Ironbark Woodland and the Narrabeen Foot slopes Slaty Gum Woodland.

Proposed communities will largely be established through sowing of relevant native tree and shrub species. In addition to the initial heavy cover crop a light rate of a range of non-aggressive native pasture species will also be jointly sown with tree seed to assist initial groundcover stability while trees establish. Tube stock will be planted in selected areas to support the establishment of proposed woodland communities.

All revegetated areas will be fenced to exclude stock. Further, the following measures will be implemented:

- Use of local provenance native shrubs, trees and groundcover plants to optimise success of revegetation;
- Translocation of topsoil from the Disturbance Footprint to areas being rehabilitated/revegetated to conserve the native seed bank of local ecological communities (particularly native grasses);

- Inclusion of logs, dead trees and stumps in strategic locations to enhance fauna habitat;
- Incorporation of remnant natural vegetation where possible into vegetation corridors;
- Develop vegetative links between revegetated areas and remnant bushland;
- Management of weeds and feral animals in revegetated areas; and
- Maximize the use of natural regeneration.

5.4.2 Houston Visual Bund

The Houston visual bund will be progressively covered with available topsoil and rehabilitated. Following the application of topsoil, disturbed areas (which are to be restored to rehabilitated woodland) will be initially stabilised using a temporary cover crop of Japanese Millet (warm season) or Oats (cold season) sown at 40 kg/ha together with fertiliser (Granulock 15 at 200 kg/ha).

Tree screens, composed of species that form Central Hunter Box – Ironbark Woodland and the Narrabeen Foot slopes Slaty Gum Woodland will be established on the visual bund to restore visual amenity. Tube stock will be planted in selected sown areas to support the establishment of proposed woodland clusters and improvement in visual amenity.

5.4.3 Saddlers Creek Restoration

Saddlers Creek will be enhanced through the revegetation of an additional 62 ha of Hunter Floodplain Red Gum Woodland. This will be conducted in accordance with the collaborative agreement between Anglo American and the CMA (see Appendix J – Ecology Impact Assessment of the EA).

As Saddlers Creek is a moderately saline watercourse, salt tolerant species (representative of the target community) will be planted. Seedlings will be propagated from locally collected seed.

All revegetated areas will be fenced to exclude stock. Further, the following measures will be implemented:

- Inclusion of logs, dead trees and stumps in strategic locations to enhance fauna habitat (where practical);
- Incorporation of remnant natural vegetation where possible into vegetation corridors;
- Develop vegetative links between revegetated areas, tree screens and remnant bushland;
- Management of weeds and feral animals in revegetated areas; and
- Maximize the use of natural regeneration through stock exclusion.

5.5 REHABILITATION MAINTENANCE

Rehabilitated areas will be assessed against the rehabilitation objectives in **Section 5.1** and regularly inspected for the following key aspects:

- Evidence of any erosion or sedimentation;
- Success of initial establishment of crop or grass cover and tree and shrub seeding / plantings;
- Natural regeneration of native species;
- Weed infestation (primarily noxious weeds, but also where rehabilitation areas are dominated by other weeds and natives);
- Integrity of graded banks, diversion drains, waterways and sediment control structures; and
- General stability of the rehabilitation areas.

Where rehabilitation objectives have not been met within the required timeframes, maintenance works will be undertaken. This may include the following:

- Re-seeding and, where necessary, re-topsoiling and/or the application of specialised treatments such as composted mulch or biosolids to areas with poor vegetation establishment;
- Installation of tree guards around planted seedlings or construction of temporary fencing suitable for excluding native and feral fauna species should grazing and browsing by animals be excessive;
- Replacement of drainage controls if they are found to be inadequate for their intended purpose, or compromised by vegetation or wildlife;
- De-silting or repair of sediment control structures; and
- Where monitoring indicates the presence of excessive weeds or the potential for noxious weed infestation, necessary precautions to prevent the development of weeds within the rehabilitated areas will be undertaken.

5.5.1 Weed Management

The presence of weed species has the potential to have a major impact on revegetation and regeneration outcomes. Additionally, any presence of weed species within the surrounding land has the potential to significantly impact on the biodiversity value of the rehabilitated areas. Weed management will be a critical component of rehabilitation activities.

Weeds will be managed across the site through a series of control measures, including:

- Hosing down equipment in an approved wash down area before entry;
- Herbicide spraying or scalping weeds from topsoil stockpiles prior to re-spreading topsoil;

- Rehabilitation inspections to identify potential weed infestations; and
- Identifying and spraying existing weed populations together with ongoing weed spraying over the life of the mine.

The spread of declared noxious weeds will be managed by using the measures above. The monitoring and control of weed populations using herbicides will significantly reduce weed infestations. Weed control, if required, will be undertaken in a manner that will minimise soil disturbance. Any use of herbicides will be carried out in accordance with the regulatory requirements.

Records will be maintained of weed infestation locations and control programs will be implemented according to industry best management practice for the weed species concerned.

5.5.2 Feral Animal Control

A feral animal control strategy will be implemented to contain the spread of weeds and other detrimental impacts on rehabilitation areas by feral animals. Goats, foxes, cats, rabbits, hares, pigs and wild dogs will be controlled in accordance with Livestock Health and Pest Authority procedures.

5.5.3 Public Safety

Environmental management controls will be implemented to minimise the potential for impacts on public safety by the maintenance of fencing around those sections that are accessible to the public.

6 REHABILITATION MONITORING AND PERFORMANCE

6.1 REHABILITATION SUCCESS CRITERIA

The preliminary success criteria (or completion criteria) for the rehabilitation areas are included in **Table 2**. The success criteria are performance objectives or standards against which rehabilitation success is demonstrated. Satisfaction and maintenance of the success criteria (as indicated by monitoring results) will demonstrate that the rehabilitated landscape is ready to be relinquished from the mine's financial assurance and could be handed back to stakeholders in a productive and sustainable condition.

The success criteria will be reviewed every five years based on monitoring results. Stakeholder participation to ensure the nominated success criteria remain realistic and achievable will be undertaken at these times.

The success criteria comprise indicators that reflect the nominated post-mine land uses, being native woodland. Indicators have been developed for the rehabilitation elements in **Table 2**. For each element, standards that define rehabilitation success at mine closure are provided. Each criterion will be further developed to be specific, measurable, achievable, realistic and outcome based. Throughout the life of the Project, success criteria will be refined based on results of ongoing rehabilitation monitoring and may be amended as future research advances industry knowledge and practice.

Table 2
Preliminary Rehabilitation Criteria

Aspect	Domain		
	Disturbance Footprint	**Mine Site Facilities**	**Biodiversity Offsets**
	Objectives		
Landform	• Final slopes of the OEAs will be formed at nominal 10 degrees or less • Erosion channels or bare areas will be managed and eliminated where possible • Contour banks will be stable • The surface layer will be free from hazardous materials • All drill holes will be sealed	• Plains will be relatively flat with no slopes but free draining • Erosion will be managed to ensure the final land use is not compromised • Contour banks will be stable, revegetated and uniform • Surface layer will be free from hazardous materials • Riparian areas will be managed to prevent instability and erosion where possible and to ensure similar pre- mining flows	
Soil	• Topsoil will be spread on all rehabilitation surface areas as soon as possible to prevent the requirement for stockpiling and will include weed infestation assessment prior to placement • Soil shall be suitable for re-establishing vegetation and lightly contour ripped to create a key between the soil and spoil • pH will be monitored to encourage acceptable ranges for plant growth and similar quality to analogues sites		

Aspect	Domain		
	Disturbance Footprint	**Mine Site Facilities**	**Biodiversity Offsets**
	Objectives		
	• Erosion and sediment control will be achieved using GeoFluv™ software and through the construction of contour furrows or contour banks at intervals down slopes		
Water	• Runoff water quality from rehabilitated areas will be managed to reduce any possible threat to downstream water quality • Catchment areas will be free draining with low velocity to minimise surface erosion		
Vegetation	• Rehabilitated areas will be designed to attract the desired flora species characteristic of the pre-mining vegetation assemblages • Rehabilitated vegetation will be designed to develop the desired structure (i.e. shrubby forest or grassy woodland) • Second generation seedling production will be encouraged • The health of trees will be monitored for the long term to ensure high survival rates • Significant weed infestations or noxious weeds will be removed in accordance with relevant guidelines • The highest percentage soil surface cover possible will be maintained	• Rehabilitated areas will contain pastures characteristic of pre-mining land capability	• Rehabilitated areas adjoining biodiversity offsets or regional wildlife corridors will contain native vegetation with the desired structure and floristic characteristics of adjoining remnant areas • Rehabilitated creek lines and disturbed areas will be designed to contain the desired vegetation structure (i.e. Box-Gum Woodland) and characteristic species remnant areas
Fauna	• Vertebrate pests will be managed to ensure effective control • Rehabilitated areas will be designed to contain a range of habitat structures for native fauna (e.g. eucalypts, shrubs, ground layer, developing litter) • Rehabilitated areas will be designed to support stable populations of native fauna and will be monitored long term	• Vertebrate pests will be managed to be absent or kept under control and monitored on an annual basis	• Vertebrate pests will be managed to be absent or kept under control and monitored on an annual basis • Rehabilitated riparian areas and areas adjoining biodiversity offsets will be designed to contain a range of habitat structures for native fauna (e.g. eucalypts, shrubs, ground layer, developing litter)

Aspect	Domain		
	Disturbance Footprint	**Mine Site Facilities**	**Biodiversity Offsets**
	Objectives		
			• Rehabilitated areas will support regional wildlife corridors and where possible reduce barrier effects
Land Capability	• Rehabilitated areas will be designed to be of a land capability class suitable for biodiversity conservation	• Rehabilitated areas will be designed to be representative of a suitable land capability for slopes and batters • All sites which are not disturbed by mining activities will remain the same land capability as the pre-mining class • Native flora species typical of the local area will be used in the establishment of native forest and woodland in areas of pre-mining	• Rehabilitated areas will be designed to be representative of a suitable land capability for slopes and batters • All sites which are not disturbed by mining activities will remain the same land capability as the pre-mining class • Native flora species typical of the local area will be used in the establishment of native forest and woodland in areas of pre-mining

6.2 REHABILITATION MONITORING

Regular monitoring of the rehabilitated areas will be required during the initial vegetation establishment period and beyond to demonstrate whether the objectives of the rehabilitation strategy are being achieved and whether a sustainable and stable landform has been provided. **Table 3** presents the recommended monitoring program, including the specific aspects and elements to be monitored and monitoring frequencies for those various aspects.

Replicated monitoring sites will be established in representative rehabilitation areas of different ages. One monitoring site per 20 – 40 ha is recommended for each major age class of the rehabilitation areas. The sites will be monitored 12 months after establishment and then every three years.

Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations which will be representative of the range of conditions on rehabilitated areas. Annual reviews of monitoring data to assess trends and monitoring program effectiveness will be conducted. The outcome of these reviews will be included in the Annual Review.

In addition to the rehabilitated areas, at least two reference sites will be monitored to allow a comparison of the development and success of the rehabilitation against a target control site. Reference sites indicate the condition of surrounding un-disturbed areas for forest and woodland rehabilitation.

Table 3
Recommended Rehabilitation Monitoring Methodology

Plot Size	Measurement
General description	• Describe the vegetation in general terms, e.g. mixed eucalypt woodland with grass understorey and scattered shrubs, dense Acacia scrub, etc.
2 m x 2 m quadrats	• Count the number of plants of all species, excluding grass. • Measure live vegetation cover for understorey and grasses (separately) using a line intercept method. • Record details of ground cover (litter, logs, rocks etc.).
20 m x 10 m plots	• Count, by species, all trees >1.6 m tall. • Tag and measure DBH of trees >1.6 m tall, to a maximum of 6 for any one species. • Record canopy cover over the whole 20 m centreline when trees are tall enough. • Subjectively describe tree health, by species if relevant, noting signs of drought stress, nutrient deficiencies, disease and severe insect attack. Where health problems are noted, record the percentage of unhealthy trees. • Record any new plant species not present in the smaller plots, including any problem and declared noxious weeds. • Take five surface soil samples (e.g. at approx. 5 m intervals along the centreline) and bulk these for analyses of: pH, EC, available N, P, K and S, exchangeable Ca/Mg/K/Na; cation exchange capacity; exchangeable sodium percent (ESP) and total organic carbon percent.
50 m	• Along the 50 m erosion monitoring transect, record the location, number and dimension of all gullies >30 cm wide and/or 30 cm deep. • Erosion pins should be established in plots located in newer rehabilitation to record sheet erosion if present.
Rehabilitation in general	• When traversing between monitoring plots, note the presence/absence of species of interest not previously recorded (e.g. key functional or structural species, protected species, noxious weeds), as well as obvious problems including any extensive bare areas (e.g. those greater than 0.1 ha). • Observations such as this can provide useful, broad scale information on rehabilitation success and problems.
Photographic record	• For each 20 m x 10 m plot, a photograph should be taken at each end of the plot, along the centreline looking in (gps point and marked).

6.3 REHABILITATION TRIALS AND RESEARCH

There has been an extensive history of rehabilitation at Drayton Mine. This experience will be utilised and expanded upon for the Drayton South Project.

In order to develop a practical prescription for the establishment of nominated woodland communities at the Project a one hectare trial site, containing a range of treatments, was established on the Great Northern Tip on Drayton Mine in 2012. Details of this research are contained in "*Establishment Report Drayton South Native Woodland Trial*" (Global Soil Systems November 2012).

The trial is examining the suitability of a wide range of species with specific focus on two EEC communities, which include the Central Hunter Box-Ironbark Woodland and the Narrabeen Slopes Slaty Box Woodland. The trial includes the following treatments:

1. Comparison of the relative merits of tubestock versus direct seeding;
2. Within each EEC community assess the suitability of a wide range of relevant local native tree, shrubs and ground cover species; and
3. Compare the benefits of applying seed with and without fertiliser.

6.4 EXAMPLES OF SUCCESSFUL REVEGETATION

Anglo American has a proven track record for river restoration works. In 2005, a joint project between Anglo American and the CMA was established to improve the health of a 6.5 km section of the Hunter River and Dart Brook at Dartbrook Mine north of Muswellbrook. This project involved:

- Protection and enhancement of one of the largest remaining populations of River Red Gum (*Eucalyptus camaldulensis*);
- Promotion of natural regeneration within natural and artificial flood areas;
- Increasing native vegetation density and diversity;
- Minimisation of further riparian and stream biodiversity loss;
- Management of introduced species and weed infestations;
- Improvement of channel bed stability, water quality and flow regimes; and
- Restoration of fish habitat and native fish stocks.
- Ongoing management, including periodic inspections by the CMA and monitoring undertaken by external consultants using the methodology as prescribed by the CMA, has determined that these works are progressing well.

7 FINAL VOID MANAGEMENT

As evident on the conceptual final landform for Drayton Mine shown on **Figure 10**, coal extraction will leave a final void in each of the North, South and East pits. Further, as evident on the conceptual final landform for Drayton South shown on **Figure 11**, coal extraction will leave a final void in each of the Whynot pits.

There are several key environmental issues that have been considered for the long term management of the final void following closure of the Project. The issues are outlined below.

7.1 OBJECTIVES

The primary objectives of the final void management are to:

- Propose mitigation measures to minimise potential off-site impacts associated with the final void;
- Propose measures to be incorporated in the final landform which aim to minimise potential safety hazards to the general public; and
- Present options for the final land use of the final void following the completion of mining.

7.2 FINAL VOID REHABILITATION

7.2.1 Void Slope Stability

Low wall

The low wall is the side of the void containing overburden and disturbed and fragmented material. Stability of the low wall will be achieved in the following manner:

- The low wall will be battered back from the angle of repose to ensure the long term geotechnical stability of the face, with the determination of geotechnical stability and recommendations as to the final slope undertaken by a qualified geotechnical engineer on the basis of an assessment of the overburden material, the likely degree of settlement, and the degree of weathering expected in the long term. However it is expected that the low wall sides of the final void will be battered back to 10 degrees where practical or a maximum of 18 degrees (as deemed competent);
- Surface water drainage on and over the low wall will be minimised through the construction of drainage control structures with the aim of diverting as much of the catchment as possible away from the final void and back into the surface water system; and
- Erosion of the low wall will be controlled by limiting the length of slope through the use of contour and graded drains, minimising the slope, and by the establishment of suitable vegetation.

Highwall

The highwall is the actively mined side of the void and is generally comprised of undisturbed, solid material generally above the economically lower-most limits of the mineable seam.

Depending on the geology of the deposit, the highwall material may comprise a range of natural occurring soil or rock materials of varying strengths or states of weathering.

To ensure the safety of the final void, the surrounding final slopes should be left in a condition where the risk of slope failure is minimised. The highwall of the final void will be left at a suitable slope to ensure long term geotechnical stability or blasted to safe gradients. This will be assessed by a suitably qualified geotechnical engineer.

As per commitments outlined in the current Drayton MOP (Drayton Mine – 2012-2017), The three final void highwalls at Drayton will have inert material dumped from the crest above the highest coal seams, at 37 degrees, and then direct seeded. The three final low-walls will have inert material dumped at 37 degrees from base of the limit of rehabilitation ("sustainable highwalls").

Anglo American has commenced discussions with DRE on the implementation of these sustainable highwalls and any learnings from the implementation will be transferred to Drayton South to achieve the mine closure objectives.

7.2.2 Spontaneous Combustion

While spontaneous combustion is not identified to occur in the Drayton South area, it has been included in this document for reference as it has occurred at Drayton Mine (albeit in different coal seams), particularly where coal seams (and other carbonaceous materials) are left exposed (i.e. not capped or covered). There is also the possibility that a bushfire post closure could ignite any exposed seams if they are in close proximity to the surface.

The following should be undertaken to reduce the potential for spontaneous combustion:

- Accumulations of coal, coarse rejects and other carbonaceous material, particularly if it is known to contain pyritic material, will be buried under a minimum of 3 metres of inert overburden material;
- Should any outbreaks of spontaneous combustion occur during mining operation, the details on the materials involved, presence of pyrites, location, date, time and climatic conditions should be recorded on surveyed plans in accordance with the approved Drayton Mine Spontaneous Combustion Management Plan (this plan will be also revised to incorporate the Project); and
- These areas will be assessed at closure to ensure appropriate mitigation measures are in place to minimise the likelihood of spontaneous combustion occurring post mine closure. These areas should also be included as part of the ongoing inspection and monitoring that will be required following closure of the mine and before final lease relinquishment.

7.2.3 Control of Surface Water Inflow

The control of surface water inflow into the final void is essential for the long term management of water quality within the final void and will also aid in the control of erosion to low walls and highwalls. Surface water is a possible cause of slope deterioration and ultimate failure. Drainage has been directed away from the highwall face (where ever possible) through the construction of interceptor channel drains around the perimeter of the highwall, and spoon drains will be utilised on the upslope side of all benches.

Drainage over the low wall will be minimised through constructing surface water diversions. The drainage on the low wall will be limited and controlled to reduce the erosion potential. The catchment area of the final void will be minimised by the installation of diversion drains.

7.2.4 Public Safety Considerations

At mine closure, one of the main priorities for the final void will be to render it safe in terms of access by humans, livestock and wildlife. In order to achieve this, the following key activities should be considered:

- Instability of the low wall can induce failures or mass movement. To ensure the stability of the low walls, they will be battered back;
- Instability of the highwall can also induce failures and mass movement. To ensure the stability of the highwall to be retained post closure, an appropriately qualified geotechnical engineer will be consulted on final highwall design;
- Where possible, the exposed coal seams will be covered with inert material and the highwall mining drives capped to prevent ignition either from spontaneous combustion, bushfires or human interference;
- Suitable signs, clearly stating the risk to public safety and prohibiting public access, will be erected at 50 metre intervals along the entire length of the fence;
- A physical barrier will be constructed at a safe distance from the perimeter of the final void to prevent human access. The highwall areas should be secured by the construction of a trench and a 2 metre safety berm. Additional security measures will be installed as required by DRE. This is to provide an engineered barrier between the final void and the surrounding area. The trench and berm should be constructed in such a way that will physically stop most vehicles;
- Surface runoff from land surrounding the final void will be diverted so as to prevent any potential development of instability of the final void walls; Where practicable, grasses and shrubs / trees selected to conform to the agreed post-mining rehabilitation criteria and land use will be planted along the outside edge of the bund wall to lessen any visual impact of the final void wall; and
- Ongoing participation in industry research on final void management to align with evolving industry standards will be undertaken.

8 MINE CLOSURE

The existing mine closure plan for Drayton Mine will be revised, to incorporate the new components of the Project, and align with the AA plc Mine Closure Standards. The plan will be guided by the *Mine Closure and Completion* handbook and the *Strategic Framework for Mine Closure* and shall reflect contemporary expectations, including changes to the final mine plan, regulatory requirements, new technologies and stakeholder expectations.

The existing mine closure plan adopts the principles of the *Strategic Framework for Mine Closure* (ANZMEC MCA, 2000). The framework outlined under the mine closure plan, which will be utilised for the Project, includes:

- Enabling all stakeholders to have their interests considered within the mine closure process;
- Ensuring the mine closure process is timely, cost effective and orderly;
- Ensuring the cost of mine closure is reflected in the budget adequately and that the community is not left with a liability;
- Ensuring there is effective implementation of the mine closure process, including adequate resources and clear accountability;
- The establishment of a set of indicators and a rehabilitation monitoring program to ensure mine closure can be demonstrated as a successfully completed process where completion criteria are met;
- Establishing a point where all agreed criteria is deemed successfully met by the relevant stakeholders;
- Ensuring future public health and safety, environmental resources, post-mining land use and socio-economic assets are not affected in any negative way and enhanced where possible; and
- The implementation of sustainable development considerations in corporate decision making processes and the reduction of risk through management strategies based on sound data.

The existing mine site facilities and infrastructure within the Drayton South area, including the remote workshops, operations building and dragline and equipment laydown area will be decommissioned following the completion of mining within the Drayton South area, if that infrastructure is not required post-mining or sold on for other industrial purposes.

Any infrastructure including dams, levee banks, roads and buildings, which is beneficial for future use by post mine land owners, will be left in place in accordance with the relevant stakeholder or land owner agreements.

All concrete and bitumen, car parks and hardstand areas around the workshop and administration areas should be ripped up and the inert waste material placed in the open cut mining area and buried. All areas will then be capped with at least 2m of inert material, reshaped, deep ripped, topsoiled and seeded in accordance with **Section 5**. All areas will be designed with the GeoFluv™ software to ensure they are stable and free draining.

Land in the vicinity of mine site facilities will require remediation of any land contamination, ripping, topsoiling (if necessary) and seeding. The landscape will then be rehabilitated as part of the mine closure strategy for the Project.

All land within the Drayton South disturbance footprint (**Figure 8)** will be set aside as a biodiversity offset as the final land use post mining.

9 REFERENCES

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