28 REHABILITATION AND CLOSURE

28.1 ADEQUACY OF ASSESSMENT

28.1.1 REHABILITATION AND CLOSURE PLAN

Issue:

Concern was raised that a closure plan was not detailed in the Executive Summary of the Draft EIS. It was also suggested that a detailed closure plan should be submitted to the South Australian Government before it decided whether to approve the expansion project or not.

Submissions: 2 and 391

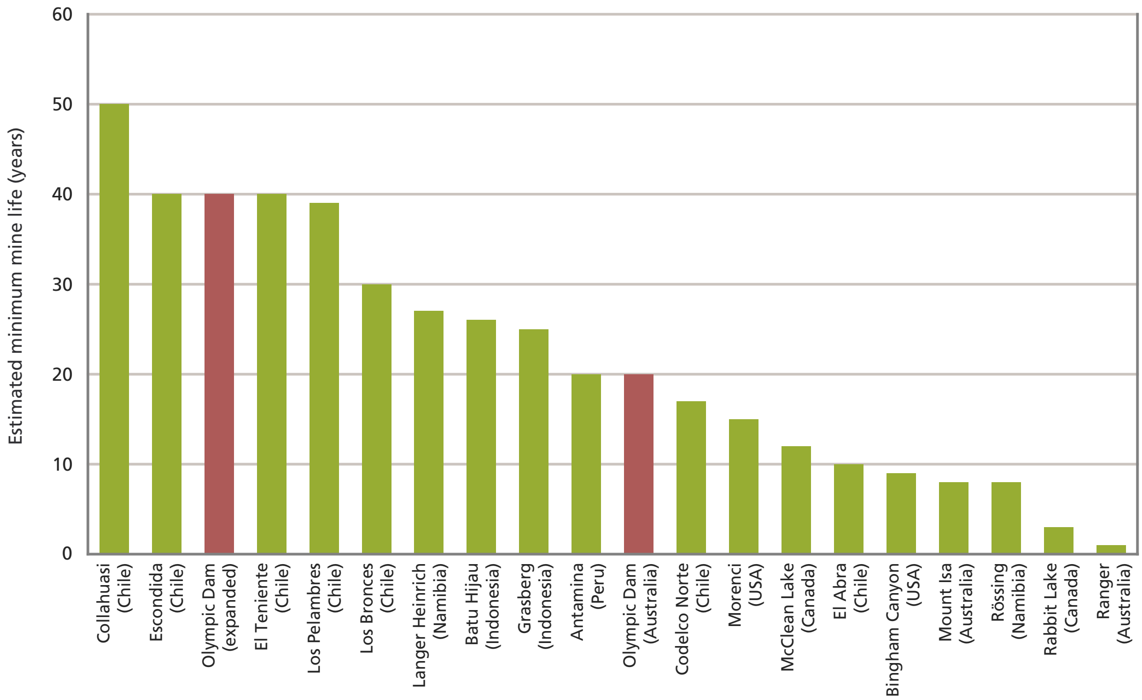
Response:

The approach to closure planning was outlined on page 54 of the Executive Summary and detailed in Chapter 23 of the Draft EIS. As described in the Executive Summary, the existing Rehabilitation and Closure Plan for the current Olympic Dam operation would be updated to include the expanded mine components of the proposed expansion (should it be approved) after the detailed design phase of the project had been completed.

The Rehabilitation and Closure Plan would be updated annually in accordance with the BHP Billiton Group Closure Standard, which dictates that all time periods over which closure activities are expected to occur are specified in the Closure Plan.

Updates to land disturbance and rehabilitation activities are reported to the Minister for Mineral Resources Development in the BHP Billiton Annual Environmental Management and Monitoring Report (EMMR), which is submitted to the South Australian Government for review each year. The EMMR is available to download (free of charge) from the Olympic Dam page of the SA Government Department of Primary Industries and Resources (PIRSA) website <http://www.pir.sa.gov.au/minerals/sa_mines/approved_mines/olympic_dam>.

The Draft EIS presented the assessment of an expanded operation over 40 years. However, the ore body at Olympic Dam is so large that the life of the mine could continue well beyond 40 years (as presented in Figure 3.9 of the Draft EIS and reproduced here as Figure 28.1). BHP Billiton has extensive experience with long-lifespan mines, such as the Escondida copper mine in Chile. It adopts a dynamic approach to planning for closure, so that new technologies and revised standards can be incorporated to more easily accommodate stakeholder requirements, which may change over the long term. As discussed in Chapter 23 of the Draft EIS, it is unclear from the outset whether all components of the mining operation would be closed at the same time. For example, the desalination plant at Point Lowly and the port infrastructure at the Port of Darwin may be left in place to service the government, local community and/or other industries. Decisions regarding the future of each component would be made in close consultation with relevant stakeholders and on an ongoing basis throughout the life of the mine. This approach facilitates consideration of variables (e.g. advances in technology, changes in land use, climactic conditions, and the future political, social and economic environment) that may influence the decision-making process, but cannot be easily predicted so far in advance of mine closure.



Source: Multiple references cited, refer to Figure 28.1 in Supplementary EIS reference list for the various data sources

Figure 28.1 Life of Olympic Dam mine compared to other mines

28.1.2 LONG-TERM MANAGEMENT CONTROLS

Issue:

Clarification was sought on the environmental impacts likely to persist following mine closure, and the proposed timeframe for rehabilitation. Specific requests for information included:

- proposed timeframe for rehabilitation of the rock storage facility (RSF) and tailings storage facility (TSF)
- cost-benefit analysis of the TSF and RSF construction strategies, including design options for progressive rehabilitation
- open-pit design elements that would ensure safety and stability during operations and post-closure
- acknowledgement that the South Australian Government would implement an independent audit of the open pit, post-closure, to determine the need for ongoing pit management and maintenance before BHP Billiton's handover of the site
- confirmation that fauna and human health values would be protected
- assessment and modelling of TSF capping options to confirm there would be minimal infiltration to groundwater and landform stability post-closure.

Submissions: 1, 2, 16, 233 and 290

Response:

Proposed timeframe for closure of the RSF and TSF

As noted in the response above, the Draft EIS presented the assessment of an expanded operation over 40 years, but the ore body at Olympic Dam is so large that the operational life of the mine could continue well beyond 40 years (as presented in Figure 3.9 of the Draft EIS and reproduced here as Figure 28.1 above). BHP Billiton has extensive experience with long-life-span mines, such as the Escondida copper mine in Chile. It adopts a dynamic approach to planning for closure so that new technologies and revised standards could easily be incorporated over the long period that the mine was in operation. As was described in Section 23.8 of the Draft EIS, this approach would entail a full update of the existing Rehabilitation and Closure Plan to incorporate expanded components of the operation, including the RSF and TSF, in the event that the proposed expansion received approval to proceed.

The Olympic Dam Rehabilitation and Closure Plan would be updated annually in accordance with BHP Billiton Group Closure Standard, which requires specification of the time periods over which closure activities are expected to occur. Closure timelines would be modified as the project schedule was refined; this would reflect any changes to the estimated minimum life of the mine, and closure timeframes for all components would be amended if operations were extended beyond 40 years.

Cost-benefit analysis of the TSF and RSF construction strategies, including design options for progressive rehabilitation

Rehabilitation strategy for the RSF

Active rehabilitation of the RSF is inconsistent with the integrated design strategy proposed in Section 5.4.6 of the Draft EIS. The proposed progressive construction approach is intended to ensure the long-term safety, stability and integrity of the RSF by implementing an economical construction model that optimises the efficient lateral and vertical movement of mine rock. The vertical movement of mine rock is a far more resource-intensive process that, if completed out of sequence, would complicate the strategic placement of material.

The RSF is designed to minimise the distance mine rock needs to be moved within the design principles of maintaining a buffer to Arid Recovery, encapsulating potentially reactive materials, and avoiding erosion (Draft EIS Section 5.4.6). To meet these objectives, materials would be placed at various levels and locations that optimised the trade-off between the energy required to haul loads on flat ground and the energy required to haul loads up ramps to higher areas on RSF benches. The optimal solution requires all areas of the RSF to be accessible throughout the project life as the shape of the pit changes, the location of the haul ramps within the pit are relocated accordingly and the RSF grows over time. Minimising haul distances also reduces other impacts such as fuel use and associated greenhouse gas emissions, dust emissions, tyre wear etc.

Moreover, as noted in the Draft EIS and Supplementary EIS, the proposed expansion is likely to continue well beyond 40 years. In this event, mine rock would be hauled to the southern and northern areas of the RSF well beyond the initial 40 year horizon, thus rendering any progressive rehabilitation of the RSF in these areas irrelevant.

It is also important to understand that even small changes to the currently optimised RSF design would have significant financial implications. For example, costs would increase in the order of many hundreds of millions of dollars if only a small percentage of the 12,700 Mt RSF were to be transported a few kilometres further than the optimal design.

Furthermore, allowing vegetation to re-establish on the RSF naturally and sparsely, is consistent with the natural mesas that occur in northern South Australia (which the RSF would resemble). Section 23.8.2 of the Draft EIS noted that these local mesas generally support little vegetation except in drainage lines around their bases. In light of this limitation, a passive revegetation strategy for the RSF has been proposed.

Rehabilitation strategy for the TSF

The timing associated with the construction, commissioning and operation of the proposed TSF cells was detailed in Section 5.5.6 of the Draft EIS and is summarised in Table 28.1 of the Supplementary EIS. Minor changes have been made to incorporate cell 5, which was approved by the State Government after publication of the Draft EIS (see Section 1.4 of the Supplementary EIS for details).

Table 28.1 Timing of TSF cells

Stage	TSF cells	Evaporation ponds	Balance ponds
Existing (12 Mtpa)	5	5	0
Initial development (to 20 Mtpa)	2	0	2
Intermediate development (to 40 Mtpa)	3	0	1
Full operational capacity (to 60 Mtpa)	2 + 1[1]	0	1

[1] Indicates contingency TSF cell if required to manage water balance.

Progressive rehabilitation of the TSF proposed for the expansion project is considered impractical due to the physical constraints imposed by the volume of the tailings liquor generated in proportion to the rate at which water evaporates from the tailings. That is, in order to balance the need for storage areas large enough to accommodate the volume of tailings liquor generated, with the requirement to consolidate tailings by maintaining a rate-of-rise within storage cells of no greater than 2 m per year (taking into account the rate of evaporation), it is essential to operate multiple cells of a specific size simultaneously.

The new TSF has been designed to maximise operational efficiency and to minimise the facility footprint. The proposed TSF cells would facilitate a rate of evaporation sufficient to mitigate the need for additional evaporation ponds, even if high-rainfall events temporarily compromised water balance within cells, or the volume of tailings generated increased in the short term. Implementing a progressive rehabilitation strategy or closing TSF cells would be counter-productive, as this would simply require more TSF cells to be constructed (to maintain the critical balance between storage area, rate of evaporation, consolidation and integration of contingency capacity).

Open-pit design elements that would ensure safety and stability during operations and post-closure

Section 5.4 of the Draft EIS described the indicative design of the open pit during the assessed 40 years of operation. While these designs would be refined further during the detailed design phase of the project, the current open-pit designs incorporate a number of features to ensure safety and stability of the pit wall during and after operations, including constraints to pit wall slope angles and locating the RSF to ensure pit wall stability was maintained. The open pit cross-section provided in Figure 5.15 of the Draft EIS indicated that typical wall angles would be approximately 60 to 90 degrees from horizontal, and that the overall pit wall slope angle would be between 30 and 53 degrees, depending on the orientation of the pit and the type of rock being excavated at any one time. These values are consistent with those used in hard rock mines around the world.

Preliminary design assessment work has identified a risk that pit wall instability could occur within the first 10–40 m below the surface, where weathered layers of sand and earth may be susceptible to erosion by run-off. However, below 10–40 m, which is where hard rock begins, the pit wall would resist erosion and remain stable from that point. Erosion control measures would be adopted around the pit edge to mitigate the risk of pit instability to a depth of 40 m, including installing a bund around the pit edge to prevent infiltration of run-off and installing erosion control banks on the weathered slopes.

Acknowledgement that the South Australian Government would implement an independent audit of the open pit, post-closure, to determine the need for ongoing pit management and maintenance before BHP Billiton's handover of the site

Chapter 23 of the Draft EIS identified the objectives of the Rehabilitation and Closure Plan that would be developed in consultation with governments and other key stakeholders should the project be approved. These included stabilising disturbed areas (including the open pit), rehabilitating operational areas to minimise risk to the public, native fauna and livestock. Ongoing post-closure maintenance is also eliminated. Specific rehabilitation and closure objectives for each component of the expanded operation would be defined following the detailed design phase of the project and would integrate government requirements to provide technical audits, or reports, relating to elements of the project identified during the consultative closure planning process described in Chapter 23 of the Draft EIS.

Protection of human health and environmental values post-closure

The Rehabilitation and Closure Strategy included in Section 23.4 of the Draft EIS described multiple closure objectives relating to protecting human and environmental values. As previously described, these overarching objectives would inform the development of specific rehabilitation and closure criteria for each element of the proposed expanded operation. Performance measures would be developed in parallel with closure criteria so the success of design features, management actions and control measures intended to achieve the rehabilitation and closure objectives could be assessed. Table 23.1 in the Draft EIS provided a summary of closure objectives and performance measures for key aspects of the proposed expansion, including Terrestrial Ecology, Groundwater, Safety and Radiation, with performance measures relevant to protecting human health and environmental values. That table is reproduced in the Supplementary EIS as Table 28.2.

In addition, Chapter 27 of the Draft EIS described commitments to protect environmental and human health values post-closure. These include:

- a commitment to ensure that potentially reactive mine rock was fully encapsulated by benign material in the RSF
- implementation of controls to minimise seepage from the Tailings Storage Facility
- capping tailings cells with appropriate material at the end of the operating life to reduce the long-term release of radon and dust.

Table 28.2 Summary of closure objectives and performance measures

Aspect	Objective	Measure
Safety	Zero harm to members of the public	No preventable injuries or deaths occur
Landform stability	The waste landforms (RSF and TSF) remain stable over the long term Stability of rehabilitated sites is consistent with adjacent terrain Edges of the open pit are left in a stable condition	No exposure of hazardous materials occurs No evidence of subsidence around the edge of the open pit at closure
Groundwater	Minimise leachate entering the groundwater by covering the TSF and RSF with suitable non-reactive material Beneficial uses of groundwater and groundwater dependent ecosystems are protected	No mounding of groundwater above 80 mAHD Yet to be defined, but would be determined in the context of Schedule 2 of the Environment Protection (Water Quality) Policy 2003, and either an attenuation zone, or an amendment to the environmental value of the hyper saline groundwater body beneath Olympic Dam
Terrestrial ecology	Minimal risk of contaminated surface water harming fauna (particularly birds)	No adverse effects on fauna (particularly birds)
Soil contamination	Soil quality is compatible with final land uses after closure	Schedules B(4), B(5) and B(6) of the National Environment Protection (Assessment of Site Contamination) Measure 1999, relating to effects on human health, ecological receptors and groundwater, respectively
Visual amenity	Rehabilitated sites mimic regional terrain The open pit (which would not be filled) becomes a tourist attraction	None
Dust	Dust generation from the closed operation does not cause harm	Comply with OH&S dust limits Comply with NEPM limits for public exposure
Radiation	Exposure to gamma radiation, radionuclides in dust, and radon and its decay products do not cause harm to the public or biota	Comply with OH&S radiation limits (<1 mSv/a to members of the public) Radiation exposure is consistent with the as low as reasonably achievable (ALARA) principal
Rehabilitation	Rehabilitation of operational sites occurs progressively and results in landforms that are consistent with adjacent terrain or the final land use	Rehabilitation of sites occurs as soon as reasonably practical.

Assessment and modelling of TSF capping options to confirm minimal infiltration to groundwater and landform stability post-closure

Groundwater modelling

The results of groundwater modelling were presented in Chapter 12 of the Draft EIS and more recent modelling outcomes, including revised infiltration rates, are provided in Chapter 12 of the Supplementary EIS. Briefly, the studies confirm the negligible impact of seepage from the TSF to groundwater and the significant capacity of the material underlying the TSF to 'filter' contaminants and negate impacts to groundwater.

The Draft EIS (including the Tailings Storage Facility Design Report in Appendix F1) identified two options for the TSF cover design:

- 'Water shedding' to transport incident rainfall off the TSF and into the surrounding environment. The large size of each TSF cell suggests that some storm release function would occur.
- A 'store and release' system where some incident rainfall would be encouraged to infiltrate the upper layers of the cover where it would be temporarily retained, and then evaporate.

A submission questioned the differing rehabilitation options, including the variable application of topsoil and revegetation at different locations and whether this was considered by the seepage modelling. It was also noted that in Appendix E1 of the Supplementary EIS that the naturally sparse vegetation cover in the Olympic Dam area suggests that evapotranspiration would not make a significant contribution to the post closure water balance of the TSF at Olympic Dam.

The potential for variable seepage rates from the TSF was considered in the modelling using sensitivity analysis (specifically run XI in Appendix F4 of the Supplementary EIS). The modelling used a post-closure seepage rate of 1% of rainfall (1.5mm/yr) for the TSF. This seepage rate is consistent with the RSF post closure recharge and is appropriate for a TSF with no engineered cover (i.e. either the water shedding or the store and release cover would provide less infiltration than the worst-case situation modelled). The results of this sensitivity are shown in the attached Figures 6.19 and 6.20 of Appendix F4. At 500 years post closure, an increase (i.e. reduction in drawdown) in groundwater head beneath the TSF in excess of the base case model of between 1 and 2 m is predicted in the ZAL.

Landform stability

Conceptual plans for closure of the Tailings Storage Facility (TSF) were presented in Chapters 5 and 23 of the Draft EIS. These plans included covering the TSF with durable rock (preferably limestone or sandstone/quartzite).

A submission questioned the long-term stability of the TSF in the context of the potential for erosion of the proposed rock cover.

Several pieces of information are relevant to addressing this issue:

- the natural rates of erosion for the proposed capping material
- the climatic environment at Olympic Dam and the general lack of erosion from the existing 20 year old TSF
- calculations of erosion rates, capping depths and timeframes.

The introduction of the open pit and the removal of overburden material to gain access to the ore body means large quantities of benign or acid neutralising material would be available for capping the TSF (and constructing the outer embankment walls). The modelling shows the full construction and closure of the TSF would use about 10% of the available benign material, which is principally limestone and durable sandstone/quartzite, given the following assumptions:

- the final footprint of the tailings cells would be 4,000 ha
- the density of the rock to be used for capping (limestone) would be 2.6t/m^3 (Thomas 1998)
- 9,758 Mt of Class C (benign overburden material) and D (acid neutralising material) would be mined by year 40 (Draft EIS).

Quantitative studies using concentrations of ^{10}Be in quartz bearing rock were used to estimate the rate of erosion. Samples were collected from five climate zones and comprised various types of rock (Portenga et al. 2009). Globally, the erosion rates ranged between 0.05 to 113 m per million years (m/My).

A review of 372 samples of eroding, quartz-bearing bedrock from around the world was used to compare the rates of erosion. These samples came from a range of climatic zones and were classified as sedimentary, metamorphic or igneous rocks, or pure quartz. Erosion rates of rocks grouped by climate zone or by rock type are shown in Table 28.3 (Portenga et al. 2009).

Table 28.3 Average erosion rates of rocks from different climate zones or different rock types

Climate zone (N)	Erosion rate (m/My) Mean ± sd	Rock type(N)	Erosion rate (m/My) Mean ± sd
Temperate (78)	25.5 ± 3.7	Sedimentary (47)	18.5 ± 2.8
Cold (32)	15.7 ± 2.4	Metamorphic (52)	12.6 ± 1.8
Arid (213)	6.0 ± 0.9	Igneous (241)	8.3 ± 1.3
Tropical (15)	5.9 ± 1.1	Quartz (5)	2.3 ± 0.3
Polar (0.4)	3.1 ± 0.4		

(mean ± sd). N = number of samples in each class.

This information shows that rocks erode more rapidly in temperate or cold climates than in arid climates such as that at Olympic Dam, and that quartz erodes more slowly than any of the other rock types tested. The mean erosion rates for arid climate zones (like Olympic Dam) was 6 m per million years (or 0.006 mm per year), and quartz was found to erode at a rate of 2.3 m/My (or 0.0023 mm).

The volume of rain received at Olympic Dam is very low. The Draft EIS reports a mean annual rainfall at Roxby Downs of 167 mm, with rain falling on average only 40 days a year. SRK (Supplementary EIS Appendix E1) used daily precipitation data from Olympic Dam Aerodrome collected over 12 years from 1998 to the end of 2009 to model infiltration into the RSF. They excluded 2008-2009 data because these years were 'extraordinarily dry'. Even with the exclusion of these extraordinarily dry years, the mean total precipitation over those 10 years was 147 mm. It is acknowledged that rainfall intensity and flow velocities are important to the understanding of erosion potential, however so too is a general lack of rain as was highlighted by Portenga and others (2009) when they found that mean annual precipitation is negatively correlated with erosion rate.

Assuming a 10 m thick cap of quartz was placed on the TSF and, using the rates shown in Table 28.3, erosion at Olympic Dam would occur at a calculated rate of 0.0023 mm/year and it would take more than 4.3 million years to erode. To be overly conservative by adopting the highest erosion rate (i.e. that for sedimentary rocks) for the TSF cover, the facility would erode at 0.0185 mm/year and it would take more than 540,000 years to erode.

It is also noted, as per the description and plans provided in the Draft EIS, that the thickness of the TSF outer walls would be considerably greater than 10 m, and therefore should erosion of the embankment walls occur over time, it would take even longer to expose the encapsulated material than the periods noted above.

Issue:

It was suggested that options to cover the tailings and rock storage facilities should be developed using engineering design models incorporating current geotechnical information, including permeability parameters of soil, rock and site climatic conditions, and that these should be published in the Supplementary EIS.

Submission: 2

Response:

The closure planning associated with the proposed Olympic Dam expansion was detailed in Chapter 23 of the Draft EIS Section 23.8 and noted that the existing Rehabilitation and Closure Plan for the current operation would be updated to include the expanded mine components, including the rock storage facility (RSF) and the tailings storage facility (TSF). The overall strategy for closure and rehabilitation of the RSF was detailed in Section 23.8.2, which explained that the RSF cover would be constructed out of benign rock such as sandstone, quartzite and limestone to resist erosion in the long term. Ensuring that waste landforms remain stable in the long term is a key closure objective listed in Table 23.1 of the Draft EIS (reproduced as Table 28.2 of the Supplementary EIS). In the case of the RSF, this means ensuring that potentially reactive rock remains encased in a layer of benign material and that the impermeable outer layer is unlikely to degrade over time.

As described in Section 5.4.6 of the Draft EIS, the RSF would be progressively constructed over the entire area of the facility, over the life of the operation. The RSF would not reach final design height until approximately Year 40. Ongoing field trials and testing of mine rock removed from the open pit would continue to identify materials most likely to resist erosion in the long term (determined on the basis of trials undertaken on-site) and assist in developing optimum RSF design.

The overall strategy relating to closure and rehabilitation of the TSF was described in Section 23.8.4 of the Draft EIS, with the main objectives being the creation of a long-term and stable structure congruent with the surrounding landscape, and designed to minimise the potential for seepage, radon emanation and dust emissions.

Ensuring the long-term integrity of the TSF cover is important to achieving these closure objectives. Conceptual cover designs for TSF cells were presented in Section 10 of Appendix F1 of the Draft EIS. These would be further defined during the operational phase of the mine. As with development of RSF cover options, final composition and design of TSF covers would take into account the results of field trials and testing of materials undertaken on-site to integrate site-specific factors that may influence materials selection and design.

The predicted lifespan of TSF cells is about 40 years at a height of 65 m. In the time between commissioning and closure of new TSF cells, tests would continue to identify the best available material from which to construct TSF covers and refine cover designs.

28.1.3 RADIATION POST-CLOSURE

Issue:

It was suggested that the rehabilitation and closure strategy developed for the expanded Olympic Dam operation should meet international best practice for closure, which would require an analysis of potential radiation detriment to non-human biota, as detailed in the International Commission on Radiological Protection (ICRP) Publication 103 (ICRP 2008).

Submissions: 1, 2, 10, 125, 134, 144, 247 and 379

Response:

Detriment to non-human biota for the expanded operation was assessed and presented in Section 2.5.4 of Appendix S of the Draft EIS. A technical note confirming that impacts would be low during the operational phase is provided in Appendix M5 of the Supplementary EIS. Section 26.5.2 of the Supplementary EIS also provides an overview of radiation levels post-closure and concludes that levels would remain low over the long term; that they would be consistent with existing background levels; and that impacts to non-human biota post-closure would, therefore, be less than or equal to the predicted impacts during the operational phase.

28.1.4 REHABILITATION AND CLOSURE OBJECTIVES

Issue:

It was suggested that all land should be rehabilitated after mine closure, which would by definition include filling in the open pit and remediation of tailings mounds. It was also suggested that the rationale for rehabilitation options should be provided, to explain why the approach to applying topsoil and revegetation varies in different areas.

Submissions: 2, 10, 92, 182, 265, 269 and 391

Response:

As described and assessed throughout the Draft EIS, the open pit would be mined for at least 40 years, however the ore body at Olympic Dam is so large that the life of the mine could continue well beyond 40 years (as presented in Figure 3.9 of the Draft EIS and reproduced here as Figure 28.1). Since mining began at Olympic Dam, a comprehensive resource drilling, sampling and analytical program has been conducted to fully understand the geology, hydrogeology and geochemistry of the ore body and neighbouring material. About two-thirds of the material to be extracted from the open pit and stored in the rock storage facility (RSF) is benign or acid-neutralising, and about one-third is potentially acid-generating (i.e. reactive material when exposed to air and water). Mining technology has advanced to allow the type of material loaded into every haul truck to be known. Based on the reactivity of the material carried, each truck would be directed to a specific location on the RSF. This precision allows the RSF to be designed so that throughout the operation, and at closure, all potentially acid-generating material could be fully encapsulated in the RSF. This same encapsulation of reactive material by benign and/or acid-neutralising material would also occur for the decommissioned tailings cells.

To backfill the open pit would take approximately the same time as the original mining operation (i.e. between 40 and 100 years) and it would re-expose the potentially acid-generating material that was already encapsulated. The cost of such an exercise would not only be prohibitive but would significantly increase the predicted environmental impacts. For example, it would significantly increase the greenhouse gas emissions by operating the electric rope shovels and haul truck fleet for double the planned mining timeframe, and the works would continue to generate dust and noise for twice the planned period. Consequently, this option is not economically or environmentally practical.

Section 23.8 of the Draft EIS provided an outline of the approach to rehabilitation and closure for major project components including the open pit, RSF, tailings storage facility (TSF) and supply and infrastructure lines. A rehabilitation and closure strategy for individual project components was designed to integrate consideration of the unique attributes of each area of operation with its likely future use, engineering design parameters, environmental and human health considerations, site conditions and, ultimately, the achievement of post-closure rehabilitation and closure objectives outlined in Table 23.1 of the Draft EIS (reproduced in the Supplementary EIS as Table 28.2).

The discussion on topsoil and vegetation in Section 23.9 of the Draft EIS noted that a management plan would be prepared to guide the reuse of topsoil in areas where revegetation was considered appropriate. Generally, the decision on whether to revegetate particular areas and the techniques required to maximise the success of revegetation efforts would be confirmed following assessment of the attributes of each project component when detailed closure plans were prepared. As stated in Section 23.9 of the Draft EIS, generally, disturbed areas would be allowed to revegetate naturally, except:

- where site conditions required active revegetation due to adverse growing conditions
- following re-contouring of access tracks
- where respreading of cleared vegetation would promote rapid revegetation of linear infrastructure easements.

In some specific cases, namely the RSF and TSF, key attributes of these project components at closure are known in advance, either due to experience garnered from other mining operations or predictable outcomes of operational uses that necessitate a stated diversion from the general rules described above. For example, rather than encouraging natural revegetation of the TSF, the material applied to the surface of the cap would be designed to discourage the growth of deep-rooted species of flora that could penetrate the surface layer of the cap, potentially causing metal uptake by vegetation from soil at the deep root zone of the cap substrate. It is for this reason that the Draft EIS stated that revegetation of the TSF is considered inappropriate and rehabilitation of this component of the expanded operation would not follow the standard rationale for revegetation of other disturbed sites.

Previous experience at Olympic Dam and other mining operations in arid zones indicates that natural revegetation of the RSF would improve visual amenity over time, as vegetation would typically occur along drainage lines around the base of the RSF, congruent with the appearance of local mesas that support little vegetation on the upper surface.

28.1.5 FINANCIAL PROVISION FOR REHABILITATION AND CLOSURE

Issue:

Concern was raised that funds allocated for rehabilitation and closure, including restoration and revegetation of the open pit and tailings storage facility, were inadequate. It was requested that details of financial provisions for closure be provided in the Supplementary EIS, including particulars of the proposed rehabilitation bond payable to the South Australian Government. It was also suggested that a cost range of possible closure models examined in the economic feasibility assessment be provided.

Submissions: 1, 10, 16 and 40

Response:

It is not proposed that a rehabilitation bond be lodged with the South Australian Government. However, rehabilitation and closure goals and criteria would be set out in the Closure Plan, which would be developed and agreed in consultation with government and relevant community stakeholders, and would include decommissioning of infrastructure, rehabilitation and revegetation works, and follow-up monitoring to confirm the rehabilitation objectives had been achieved.

Rehabilitation costs would be reviewed regularly along with the Closure Plan, and adjusted as required to cover the ongoing liability for rehabilitation. As part of BHP Billiton's Closure Standard, an accounting provision is made to cover the likely range of anticipated closure and rehabilitation costs. The amount of this provision is considered commercially sensitive information and, as such, is not made publicly available.

28.2 INDIVIDUAL COMPONENTS

28.2.1 REHABILITATION AND CLOSURE STRATEGY FOR THE LANDING FACILITY

Issue:

Clarification was sought about why there was no proposed future use or timeline for rehabilitation of the landing facility or access corridor in the Draft EIS.

Submissions: 49, 68, 67, 211 and 386

Response:

As described in Section 23.8.12 of the Draft EIS, the landing facility 'may continue to be used as a landing for future mining or other enterprises in the region. Alternatively, the pier may be transferred to the South Australian Government or other entity for use by the public'.

If the SA Government decided during the course of the planning process that the continued use of the pier for other enterprises or as a public facility was not suitable, BHP Billiton would decommission the landing facility and rehabilitate the site at the completion of its operation or shortly thereafter.

Decommissioning would involve removal of concrete decking. Buried structures such as concrete piles and the underwater rock pad would remain. Removal of underwater infrastructure would have adverse impacts on the marine environment and, as such, it is standard practice for such structures to remain in place. No ongoing management or maintenance would be required following decommissioning of the site.

If no further use was identified for built structures associated with the quarantine laydown facility, these would be removed and recycled. Section 23.8.10 of the Draft EIS stated that the access corridor would be ripped and revegetated, preventing further use by motor vehicle traffic.

28.2.2 REMEDIATION OF SALINE SOIL

Issue:

It was suggested that watering with saline water to control dust would prevent rehabilitation of overburden soils.

Submission: 173

Response:

Section 5.7.2 of the Draft EIS listed the project areas where saline water would be used for dust suppression, and this covers most areas where ground-disturbing works would be undertaken to accommodate infrastructure for the proposed expansion. Salinisation of soil is unlikely to occur in areas where watering to control dust was required only in the short term, for example, during the construction of buildings and linear infrastructure such as the gas and water supply pipelines, rail line and electricity transmission line. Those soils at risk of becoming saline as a result of prolonged dust suppression activities are primarily located on the Special Mining Lease and are associated with the project components that are major sources of particulate emissions. These include the open pit, RSF, and unsealed haul and access roads.

Section 23.5 of the Draft EIS explained that closure criteria would be developed for all project components based on the post-operational land use objectives identified following consultation with stakeholders. Section 23.8 did, however, outline the proposed rehabilitation and closure strategies for two of the key areas where it is predicted that salt may accumulate in soils - the edges of the open pit and the RSF.

The impact of saline soil on proposed rehabilitation of these areas would be negligible as revegetation is not proposed for the open pit and growth of indigenous plants (that are generally salt-tolerant) would be encouraged around the base of the RSF.

Also, as stated in Section 23.8.3 of the Draft EIS, all haul and access roads would be re-contoured and ripped to encourage natural revegetation. These tracks would also be actively replanted with local salt-tolerant plants following closure. It is expected that salt levels in these areas would attenuate over time (when the saline water was no longer used and rainfall 'flushed' the salts from the soil). Natural regeneration and colonisation of salt-tolerant and other species of plants would be likely to occur over time as soil salinity subsided.

Appendix N3 of the Draft EIS provided a comprehensive list of indigenous plant species recorded within the EIS Study Area. Many of these are reported to be well suited for revegetation of saline substrates that occur on mine sites due to the use of hypersaline groundwater for various mining activities (Barrett 2000). For example, *Atriplex* spp, *Maireana* spp and *Halosarcia* spp are all indigenous to the EIS Study Area and have been successfully established on highly saline landforms in the eastern goldfields region of semi-arid Western Australia (Barrett 2000).