

Mined Land Rehabilitation Policy

The Queensland Government is committed to ensuring land disturbed by mining activities is rehabilitated to a safe and stable landform that does not cause environmental harm and is able to sustain an approved post-mining land use.

Land disturbed by mining activities will be rehabilitated progressively as it becomes available, to minimise the risks of environmental impacts and reduce cumulative areas of disturbed land.

The progress and outcomes of progressive rehabilitation activities will be monitored and reported on to demonstrate how successful they have been in achieving progress towards the approved post-mining landform, and to inform corrective action where required.

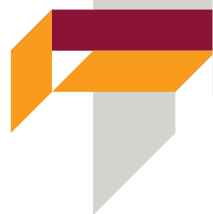
To provide certainty about the outcomes and timing of rehabilitation, all site-specific mines will prepare a Progressive Rehabilitation and Closure Plan (PRCP). The plan will include binding, time-based milestones for actions that achieve progressive rehabilitation and will ultimately support the transition to the mine site's future use.

Disturbed land associated with mining activities is considered available for rehabilitation unless it is:

- being actively mined, or
- being used for operating mining infrastructure, or
- overlaying a probable or proven resource reserve identified for extraction in the approved PRCP within 10 years, or
- the site of built infrastructure that will be retained as a beneficial asset in the approved PRCP.

Land disturbed by mining activities is considered to be rehabilitated when it can be demonstrated it is safe, stable, does not cause environmental harm, and is able to sustain the post-mining land use approved in the PRCP.





When preparing a PRCP, the mining company will identify suitable post-mining land uses having regard to the surrounding landscape, community views and the objectives of any local and regional planning strategies. The PRCP must be approved by the administering authority.

For all sites, the administering authority will not approve a PRCP that includes an area that does not sustain a post-mining land use, unless the authority holder can demonstrate the proposed treatment of the land meets current best practice management, and:

- rehabilitating the area would pose a greater environmental risk than not rehabilitating, or
- the environmental risks from the area are localised, and the cost of rehabilitation would be so excessive as to not be in the public interest.

This applies to existing site-specific mines where rehabilitation outcomes are not clear in an environmental authority, and they need to be developed and clarified. Public consultation will be required where the rehabilitation outcomes proposed are different to those approved in the environmental authority or consulted on through an EIS.

However, where there are clear requirements for rehabilitation outcomes in the approved environmental authority the above criteria do not apply. The approved rehabilitation outcomes can be translated into the PRCP and will not require public consultation.

In addition to the above, for all new site-specific mines, the administering authority will not approve a PRCP that includes a void situated wholly or partially in a floodplain unless the void will be rehabilitated to a safe and stable landform that is able to sustain an approved post-mining land use that does not cause environmental harm.

For new site-specific mines, the community must be consulted during the development of a PRCP, as part of the consultation process associated with an application for environmental authority.

Areas that are not rehabilitated to sustain a post-mining land use may require additional on-going management. In these cases any residual risk payment to the administering authority will include provision for this ongoing management.

Information about a company's rehabilitation performance, including measured progress towards the approved post-mining land use and monitoring data about the success of rehabilitation activities, will be communicated to the public throughout the life of a mine. This includes data on progressive rehabilitation activities and any progressive rehabilitation certification.



Department of
**Environment and
Heritage Protection**

Ref EPML00732813

28 July 2017

sch4p4(6) Personal Information

Manager – HSET Systems
C/o Ensham Resources Pty Ltd
PO Box 1565
Emerald QLD 4720

Dear sch4p4(6) Personal Inform

I write in response to the Rehabilitation Management Plan (RMP) submitted to the Department of Environment and Heritage Protection (the department) on 30 May 2017, 20 June 2017 and 30 June 2017, as required by Condition G11 of the environmental authority (EA) EPML00732813 for the Ensham Coal Mine (Ensham).

As per Condition G13, the department accepts the submission on 30 June 2017 as the Approved Rehabilitation Management Plan. Following finalisation of the Residual Void Project (RV Project) and approval of the rehabilitation success criteria for voids, the EA holders must update the Approved Rehabilitation Management Plan required by Condition G11 to reflect the approved rehabilitation success criteria for voids.

During the meeting held between the department and Ensham representatives on 23 June 2017, the department requested updates to be made to the RMP, including commitments to provide:

- Qualitative data relating to the stage and quality of the rehabilitation areas on Ensham in section 2.1 of the RMP;
- Images of the rehabilitation areas to support the qualitative data relating to stage and quality in section 2.1 of the RMP;
- The proposed design, including the proposed final footprint, of rehabilitation to 2018 in section 2.2 of the RMP;
- Updated description of the identified reference sites in section 8 of the RMP; and,
- Coordinates and description of a reference site relating to Boggy Creek riparian site in section 8 of the RMP.

As agreed within the abovementioned meeting, the additional information must be included within the revised RMP submission following finalisation of the RV Project and approval of the rehabilitation success criteria for voids.

Should you have any further enquiries, please contact Charissa Allan of the department on (07) 4987 9339.

Yours sincerely

Kate Bennink
Manager Environmental Services

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The department accepts the submission for rehabilitation completed by 30 June 2017 in accordance with Condition G8 and Table G1: Rehabilitation.30 June 2017. .

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Rehabilitation of Final Voids

Contents

Background.....	3
Rehabilitation of Final Voids.....	3
Rehabilitation of Voids in Floodplains.....	4

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Background

- Australia has the 5th largest reserves of black coal in the world (as measured by economic demonstrated resources). Geoscience Australia has estimated that Australia's economic demonstrated resources (EDR) of black coal account for approximately 9 per cent of the global total (The United States of America has the largest share of coal resources in the world, followed by China, India and Russia).
- In Australia, nearly 80 per cent of coal is produced from open-cut mines in contrast with the rest of the world where open-cut mining accounts for 40 per cent of coal production. Open cut mining is cheaper than underground mining and enables up to 90 per cent recovery of the coal resource (Minerals Council of Australia, 2016).
- In Queensland, of the 54 operating coal mines, 41 of them use open-cut methods to extract coal, with these 41 mines contributing more than 200 million tonnes (Mt) or approximately 82% of the total 243 Mt of coal produced in 2014 – 2015 (Department of Natural Resources and Mines, 2016). This trend is set to continue with a number of medium/large scale open-cut coal mining projects currently at various stages of the approvals process. In addition, ongoing exploration activities occurring at existing open-cut mines, have resulted in extended life of mine projections for available open-cut coal reserves across Queensland's mining areas.
- Open-cut coal mining projects in Queensland typically employ strip-mining techniques which involve removal of soil and rock (overburden) above a layer or seam of coal, followed by the removal of the coal itself. Open-cut, strip mining operations in Queensland do differ slightly, based off the deposit geometry and type, however the typical cycle of operations consists of vegetation clearing, soil removal, drilling and blasting of overburden (if needed), stripping, removal of the coal, and finally rehabilitation (Hustrulid, 2006)
- One of the key challenges facing open-cut coal mining operations in Queensland over the past 25 – 30 years has been the increasing size of the active mining pit as the mine progresses. A number of open-cut coal mines in Queensland are currently nearing the end of their mine life, or have ceased operations, typically this occurs when the cost of extracting the coal resource outweighs its financial value, such as when the coal seam has dipped so far that the cost of removing overburden from above it is prohibitively expensive. At this point a mining operation may choose to cease mining, leaving a void in the landscape known as a 'final void'.

Rehabilitation of Final Voids

- Final voids present a significant potential danger to people, stock and wildlife, as well as being potential sources of environmental pollution (Department of Mines and Energy, Queensland 1995). Apart from important environmental considerations and in the interest of public safety, final voids require safety barriers to prevent inadvertent public access.
- Achieving acceptable rehabilitation outcomes for final voids in Queensland poses several unique challenges, including the following:
 1. Voids are deep and void lakes are typically stratified in terms of chemistry and dissolved oxygen concentration, affecting biological characteristics over time.
 2. Voids often have connectivity to saline groundwater.
 3. Evaporation exceeds rainfall, creating the potential for super-salinity to develop in shallow void lakes.
 4. Voids are highly visible to stakeholders and perceived as a risk to humans and the environment.
- Bowman (2002) assessed final void water quality at seven Queensland and two NSW coal mines, concluding salinity was the major issue with water chemistry dominated by sodium and sodium chloride. This ACARP study found that, in most situations, void water is derived from surface runoff and there is a link between void water salinity and suspended solid load in runoff water, indicating that erosion of overburden dumps is a significant contributor to void water salinity.

- Leading global practice in final void rehabilitation is complete backfilling and high wall elimination. Backfilling final voids can mitigate many of their social and environmental risks, and presents the opportunity to return land to a form that supports pre-mine use. In the United States, backfilling in coal mine final voids has been required by law since the 1970s.
- When final voids are not backfilled and extend below the groundwater table, pit/void lakes can form (Zhou et al. 2009). These lakes can (in some cases) draw down local groundwater aquifers and can take a significant time to fill with water (or reach equilibrium), often centuries. Water quality in these final void lakes is typically poor and will worsen over time.
- The Guideline – Rehabilitation requirements for mining projects (EM1122) lists a hierarchy of possible strategies to achieve rehabilitation goals for domains involving final voids. Backfilling to original ground level is generally acceptable, construction of safety barriers may be acceptable in some cases, however the presence of hazardous materials and/or poor quality water is rarely acceptable.

Rehabilitation of Voids in Floodplains

- Flood plains are typically broad areas of alluvium around or near a river or creek that are subject to flooding (Macquarie, 2016).
- Floodplains are hydrologically important, environmentally sensitive, and ecologically productive areas that perform many natural functions, including:
 1. Cleaning floodwater by removing sediments, nutrients and other pollutants, protecting drinking water, recreational amenity and aquatic ecosystems. Floodplain vegetation also regulates water temperature through the provision of shaded areas.
 2. Providing habitat for plants, birds and freshwater aquatic species.
 3. Provide flood storage by taking on and storing excess water during flood events and allowing it to be released slowly back into the watercourse, overland and into groundwater.
 4. Groundwater recharge, which regulates the availability of water during dry periods.
- Coal mining operations located on floodplains pose a significant risk to water quality, groundwater flow regimes and geomorphological processes. The key risk remains the potential for inundation of the final void post mining, through extreme flood events, geomorphological processes such as meander migration, or geotechnical pit wall failure or piping failure. The potential impacts of pit inundation could have significant consequences and include:
 1. Loss of water from a stream system and downstream impacts on water dependent ecosystems;
 2. Downstream water quality impacts associated with efforts to pump out the flooded void; and
 3. Incision or scour between the pit and the existing water course. There are potential flow paths that could develop as a result of flood related pit inundation that represent a risk of incision and scour in the mining and post mining landscape. Such flow paths have potential to capture the alignment of the associated watercourse with resulting impacts on the community, agriculture and the environment.
 4. There is also increased potential for erosion associated with constricting the floodplain (by levees and overburden emplacements) and increasing floodplain stream powers and sheer stress. Typically, mine sites located in Queensland contain highly dispersive soils, which increases the risk of erosion and scouring.
 5. There are also potential cumulative impacts when considering existing operations located on floodplains, where a new project (or expansion of an existing project) may be located nearby.
- Alternatives involving the diversion of water into voids are not acceptable, for the following reasons:
 1. This activity represents a major take of water from any catchment area will affect the future security of supply to all water resource projects lower down in the basin.
 2. The impact of fresh water diversions into coal mine voids would have a measurable effect on the total quality of waters remaining in the system at points downstream.
 3. The scale of the impact on the quality of water supplies at points downstream of those diversions would be proportional to the number of mines which are engaged in the practice of diverting clean water into their voids.

4. Abstractions that are to be continued and repeated in perpetuity are for no beneficial use.
 5. Statutory Plans cover the use of water resources in various Basins. Any proposal to harvest the very large volumes of water such as would be involved in any proposal to fill old mine voids with river water would likely affect the operation, if not the actual content of those various Water Plans.
- Final voids resulting from coal mining operations are not authorised to remain on floodplains in Queensland and must be backfilled.

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Background.....	3
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- Open-cut coal mining projects in Queensland typically employ strip-mining techniques which involve removal of soil and rock (overburden) above a layer or seam of coal, followed by the removal of the coal itself. Open-cut, strip mining operations in Queensland do differ slightly, based off the deposit geometry and type, however the typical cycle of operations consists of vegetation clearing, soil removal, drilling and blasting of overburden (if needed), stripping, removal of the coal, and finally rehabilitation (Hustrulid, 2006)
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6. The proposal to divert water as inflow and/or outflow from a mining void may lead to 'diversion structures' within a floodplain that require permanent monitoring and maintenance to ensure stability in their own right and not unduly impact the integrity and performance of impacted watercourses. Such management may ultimately fall back to the underlying tenure holder or the state who would then be burdened with the liability (managing the structures and outflow water quality) thus allowing the companies to disassociate themselves from any future obligations.

Table 1: Coal mining operations located in a mapped floodplain.

Matter	Number of Mines	Comments
Open Cut and Underground Coal Mines in QLD who are in construction, operation, care & maintenance or in closure operations.	62 coal mines in total.	
Open Cut Coal Mines (Operational, C&M and In Construction) in Flood Plains.	37 coal mines in total, made up of: <ul style="list-style-type: none"> • 11 fully in floodplain <ul style="list-style-type: none"> o 8 operational coal mines o 2 care & maintenance coal mines o 1 pre-construction (Alpha Coal Mine) • 26 partially in floodplain <ul style="list-style-type: none"> o 17 operational coal mines o 2 care & maintenance coal mines o 6 pre-construction 	
Open Cut Coal Mines (Operational, C&M and In Construction) in Flood Plains with authorised Final Voids in EA.	14 coal mines in total, made up of: <ul style="list-style-type: none"> • 9 operational coal mines • 1 care & maintenance • 4 pre-construction 	Where mines has an EA that authorised a set amount of hectares for final voids.
Open Cut Coal Mines (Operational, C&M and In Construction) in Flood Plains with no EA conditions specifically authorising Final Voids.	17 coal mines in total, made up of: <ul style="list-style-type: none"> • 15 coal mines with generic residual voids must not cause harm EA conditions (but no specific authorisation for Final Voids). • 2 coal mines with no residual void EA conditions 'silent' (including no generic residual voids must not cause harm EA condition). <ul style="list-style-type: none"> o Dawson South o Lake Vermont 	Example of 'generic' condition: <i>'Residual voids must not cause any serious harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition of this environmental authority.'</i>

Open Cut Coal Mining – Rehabilitation of Final Voids

Australia has the 5th largest reserves of black coal in the world (as measured by economic demonstrated resources). Geoscience Australia has estimated that Australia's economic demonstrated resources (EDR) of black coal account for approximately 9 per cent of the global total (The United States of America has the largest share of coal resources in the world, followed by China, India and Russia).

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One of the key challenges facing open-cut coal mining operations in Queensland over the past 25 – 30 years has been the increasing size of the active mining pit as the mine progresses. A number of open-cut coal mines in Queensland are currently nearing the end of their mine life, or have ceased operations, typically this occurs when the cost of extracting the coal resource outweighs its financial value, such as when the coal seam has dipped so far that the cost of removing overburden from above it is prohibitively expensive. At this point a mining operation may choose to cease mining, leaving a void in the landscape known as a 'final void'.

Rehabilitation of final voids

Final voids present a significant potential danger to people, stock and wildlife, as well as being potential sources of environmental pollution (Department of Mines and Energy, Queensland 1995). Apart from important environmental considerations and in the interest of public safety, final voids require safety barriers to prevent inadvertent public access.

Achieving acceptable rehabilitation outcomes for final voids in Queensland poses several unique challenges, including the following:

1. Voids are deep and void lakes are typically stratified in terms of chemistry and dissolved oxygen concentration, affecting biological characteristics over time.
2. Voids often have connectivity to saline groundwater.
3. Evaporation exceeds rainfall, creating the potential for super-salinity to develop in shallow void lakes.
4. Voids are highly visible to stakeholders and perceived as a risk to humans and the environment.

Bowman (2002) assessed final void water quality at seven Queensland and two NSW coal mines, concluding salinity was the major issue with water chemistry dominated by sodium and sodium chloride. This ACARP study found that, in most situations, void water is derived from surface runoff and there is a link between void water salinity and suspended solid load in runoff water, indicating that erosion of overburden dumps is a significant contributor to void water salinity.

Leading global practice in final void rehabilitation is complete backfilling and high wall elimination. Backfilling final voids can mitigate many of their social and environmental risks, and presents the opportunity to return land to a form that supports pre-mine use. In the United States, backfilling in coal mine final voids has been required by law since the 1970s.

When final voids are not backfilled and extend below the groundwater table, pit/void lakes can form (Zhou et al. 2009). These lakes can (in some cases) draw down local groundwater aquifers and can take a significant time to fill with water (or reach equilibrium), often centuries. Water quality in these final void lakes is typically poor and will worsen over time.

The *Guideline – Rehabilitation requirements for mining projects* (EM1122) lists a hierarchy of possible strategies to achieve rehabilitation goals for domains involving final voids. Backfilling to original ground level is generally acceptable, construction of safety barriers may be acceptable in some cases, however the presence of hazardous materials and/or poor quality water is rarely acceptable.

Rehabilitation of voids in floodplains

Flood plains are typically broad areas of alluvium around or near a river or creek that are subject to flooding (Macquarie, 2016).

Floodplains are hydrologically important, environmentally sensitive, and ecologically productive areas that perform many natural functions, including:

- Cleaning floodwater by removing sediments, nutrients and other pollutants, protecting drinking water, recreational amenity and aquatic ecosystems. Floodplain vegetation also regulates water temperature through the provision of shaded areas.
- Providing habitat for plants, birds and freshwater aquatic species.
- Provide flood storage by taking on and storing excess water during flood events and allowing it to be released slowly back into the watercourse, overland and into groundwater.
- Groundwater recharge, which regulates the availability of water during dry periods.

Coal mining operations located on floodplains pose a significant risk to water quality, groundwater flow regimes and geomorphological processes. The key risk remains the potential for inundation of the final void post mining, through extreme flood events, geomorphological processes such as meander migration, or geotechnical pit wall failure or piping failure. The potential impacts of pit inundation could have significant consequences and include:

- Loss of water from a stream system and downstream impacts on water dependent ecosystems;
- Downstream water quality impacts associated with efforts to pump out the flooded void; and
- Incision or scour between the pit and the existing water course. There are potential flow paths that could develop as a result of flood related pit inundation that represent a risk of incision and scour in the mining and post mining landscape. Such flow paths have potential to capture the alignment of the associated watercourse with resulting impacts on the community, agriculture and the environment.
- There is also increased potential for erosion associated with constricting the floodplain (by levees and overburden emplacements) and increasing floodplain stream powers and sheer stress. Typically, mine sites located in Queensland contain highly dispersive soils, which increases the risk of erosion and scouring.
- There are also potential cumulative impacts when considering existing operations located on floodplains, where a new project (or expansion of an existing project) may be located nearby.

Alternatives involving the diversion of water into voids are not acceptable, for the following reasons:

- This activity represents a major take of water from any catchment area will affect the future security of supply to all water resource projects lower down in the basin.
- The impact of fresh water diversions into coal mine voids would have a measurable effect on the total quality of waters remaining in the system at points downstream.
- The scale of the impact on the quality of water supplies at points downstream of those diversions would be proportional to the number of mines which are engaged in the practice of diverting clean water into their voids.
- Abstractions that are to be continued and repeated in perpetuity are for no beneficial use.
- Statutory Plans cover the use of water resources in various Basins. Any proposal to harvest the very large volumes of water such as would be involved in any proposal to fill old mine voids with river water would likely affect the operation, if not the actual content of those various Water Plans.

Final voids resulting from coal mining operations are not authorised to remain on floodplains in Queensland and must be backfilled.