NSW GOVERNMENT

NSW Resources Regulator

REHABILITATION INFORMATION RELEASE

DATE: August 2021

Geomorphic landform establishment at Mount Pleasant Operations coal mine

Overview

This release provides information about geomorphic landform establishment on mining leases (ML) 1645, ML 1708, ML 1709, ML 1713, ML 1750, and ML 1808 on part of the Mount Pleasant Operations coal mine near Muswellbrook, NSW (the mine).

The mine

The mine is an open cut coal mine located in the upper Hunter Valley, approximately three kilometres north west of Muswellbrook, NSW.

The mine currently extracts coal using open cut mining methods (truck and shovel operations) pursuant to development consent DA 92/97. This was approved under the NSW *Environmental Planning and Assessment Act 1979* by the (then) NSW Minister for Urban Affairs and Planning on 22 December 1999. The mine has approval to operate until 22 December 2026.

Coal was first mined in July 2018 and included off-site coal transport using rail infrastructure. Rehabilitation has been progressing in stages in the south east of ML 1645 and ML 1750 in the eastern section of the overburden emplacement area (around 100 hectares). This area had significant landform design input including:

- GeoFluv[1] landform design and modelling, which adopts geomorphic[2] landform design principles to facilitate long term stability

[1] 'GeoFluv' is a patented approach to land rehabilitation which recognises the importance of 'natural' landform and erosion patterns in the successful rehabilitation.

[2] Geomorphic design is a method where a landscape is constructed based on a set of geomorphic rules such as Strahler stream order, hillslope length and curvature and stream length. These rules are derived from an analogue site which is

- SIBERIA[3] erosion modelling of the GeoFluv landform to validate the design and long-term water run-off and erosion impacts
- design of the water management structures.

MACH Energy Australia (MACH) recently commenced a field plot trial through the University of Newcastle to ground truth the GeoFluv model assumptions.

Figure 1 Mount Pleasant Operation's mine (within ML1645, ML1708, ML1709, ML1713, ML1750 & ML1808)

Required rehabilitation outcomes

The required rehabilitation outcomes for rehabilitation are detailed in the Mount Pleasant Operation mining operations plan and rehabilitation management plan (MOP/RMP) approved by the NSW Resources Regulator. The MOP/RMP requires the title holder to achieve the approved rehabilitation objectives, rehabilitation completion criteria and final landform. This includes the following key obligations:

- final landforms are safe, stable, non-polluting and sustainable for the intended final (post-mining) land use(s)

deemed to have properties suitable for the post-mining landform. The goal is to mimic the geomorphic patterns of nature to provide an erosionally stable, ecologically functional and aesthetically pleasing reconstructed landform.

[3] 'SIBERIA' is a computer model used for simulating the evolution of landscapes under the action of run-off and erosion over long term scales.

- final landforms are integrated with surrounding natural landforms
- micro-relief and drainage lines, that are consistent with surrounding topography, are incorporated into the final landform to the greatest extent practicable.

Rehabilitation progress

Rehabilitation commenced before the first coal was extracted in 2018, in accordance with the obligations set out in the approved MOP/RMP. Figures 2 to 4 show aerial imagery of the progress of rehabilitation between 2019 and 2021. Figures 5 to 8 show on-the-ground progress.

Figure 2 Status of rehabilitation works in 2019 (Source: MACH Energy Propeller Imagery)

Figure 3 Status of rehabilitation works in 2020 (Source: MACH Energy Propeller Imagery)

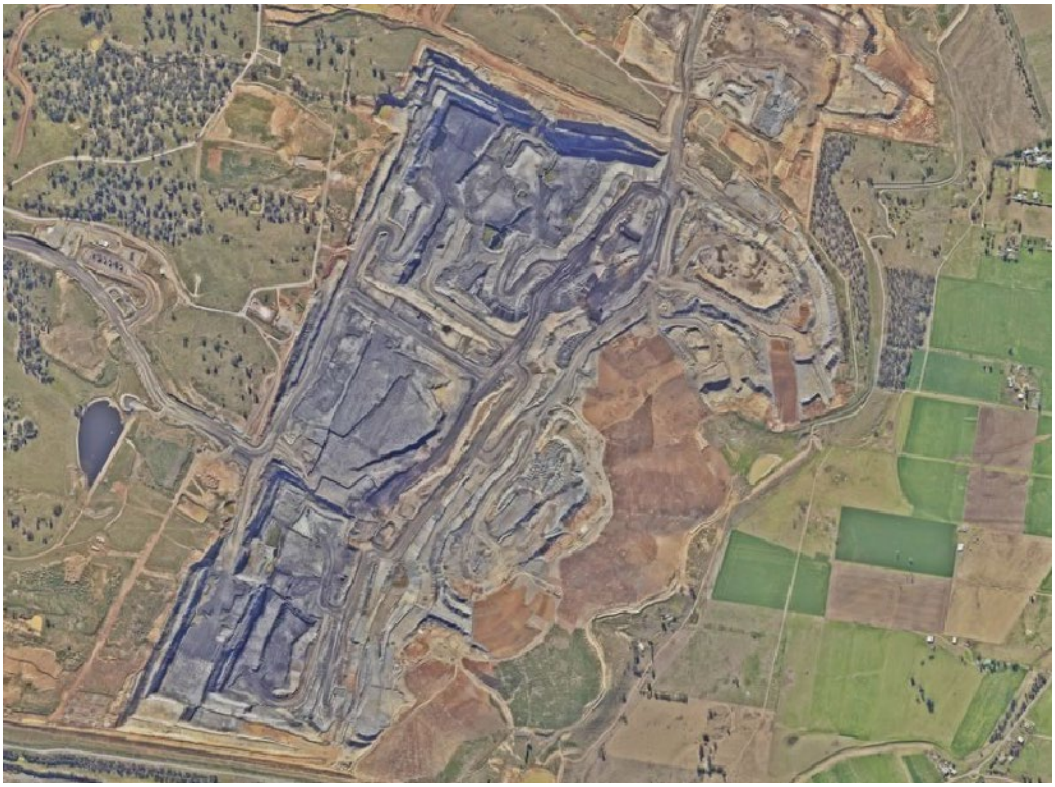


Figure 4 Status of rehabilitation works in 2021 (Source: MACH Energy Propeller Imagery)

Figure 5 Rehabilitation progression – Stage 6 and 7 - eastern overburden area

Figure 6 Rehabilitation progression – Stage 8 - eastern overburden area

Figure 7 Rehabilitation progression – Stage 9 - eastern overburden area

Figure 8 Rehabilitation progression – Stage 10 - eastern overburden area

Construction Quality Assurance

The mine incorporates a comprehensive rehabilitation control system into their rehabilitation. This process includes significant landform design input from:

- GeoFluv modelling
- SIBERIA erosion modelling, which is a form of landform evolution modelling, to validate that the GeoFluv landform design and associated surface water drainage network will be stable in the long term.

Rehabilitation controls that are implemented by the mine through the construction of final landforms to ensure the success of rehabilitation include:

- Inspection and test plans (ITP) requiring sign off from the environment, engineering and survey teams, for managing the quality control and assurance of each of the following stages of rehabilitation:
  - ☐ design
  - ☐ bulk shaping
  - ☐ topsoil placement
  - ☐ installation of habitat features, ripping, seeding and tree planting.
- Both on the ground and drone flight monthly inspections by the environment team, including identification of erosion areas.
- Drone flyovers that are conducted to generate as-constructed contours to verify that the landform has been constructed in accordance with the design. This involves the generation of 'heat-maps' that highlight areas that exceed a 0.5 metre tolerance level from the design contours. Where the tolerance level is exceeded, further earthworks are undertaken to ensure the landform is compliant with design before the ITP is signed off and rehabilitation proceeds to the next stage.
- A rehabilitation monitoring program, including a detailed rehabilitation monitoring manual and annual analogue and rehabilitation site surveys.
- Post-rainfall drone flyovers of major water management features.
- Bi-annual aerial mapping using LiDAR[4].

[4] LiDAR (light detection and ranging) is an optical remote sensing technique that uses laser light to densely sample the surface of the earth, producing accurate measurements. It is primarily used in airborne laser mapping applications.

This information is incorporated into the mine's GIS systems to ensure controls are maintained and recorded for accuracy.

Figure 9 Mount Pleasant Operation Stage 9 – design ITP

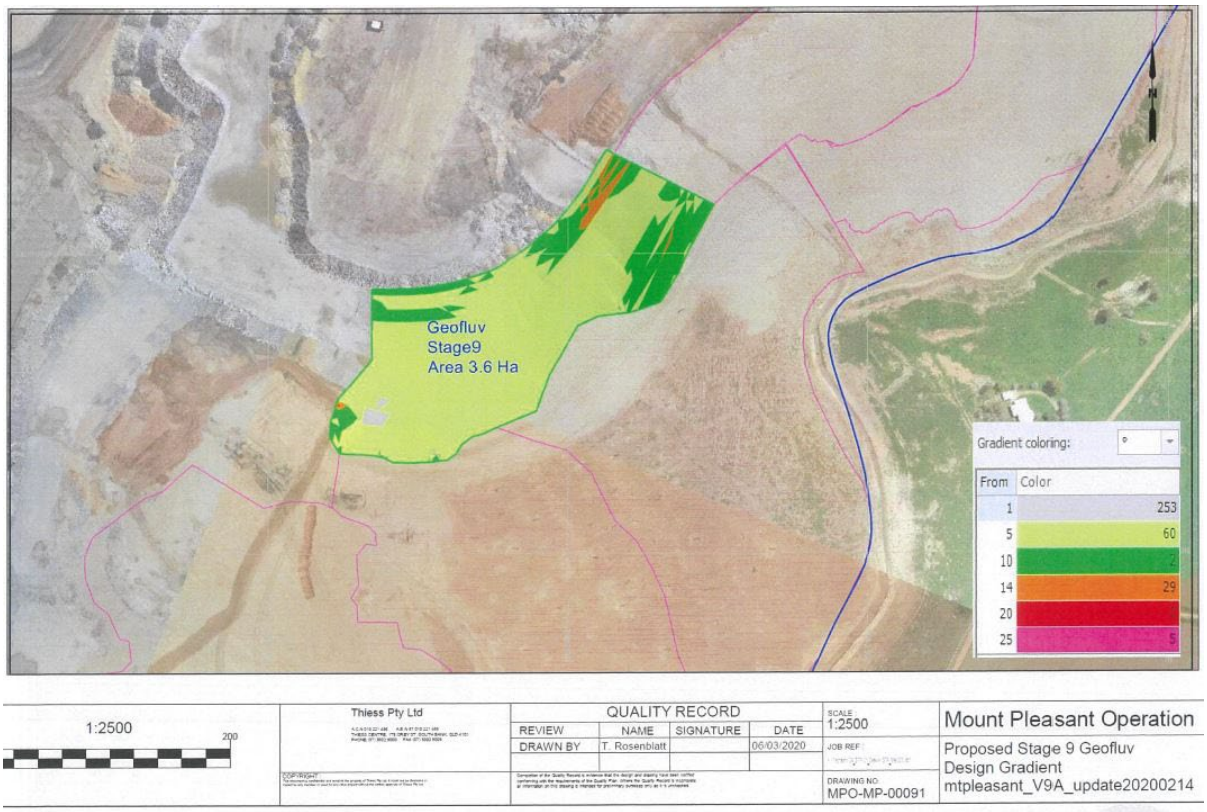


Figure 10 Mount Pleasant Operation Stage 9 – landform construction ITP

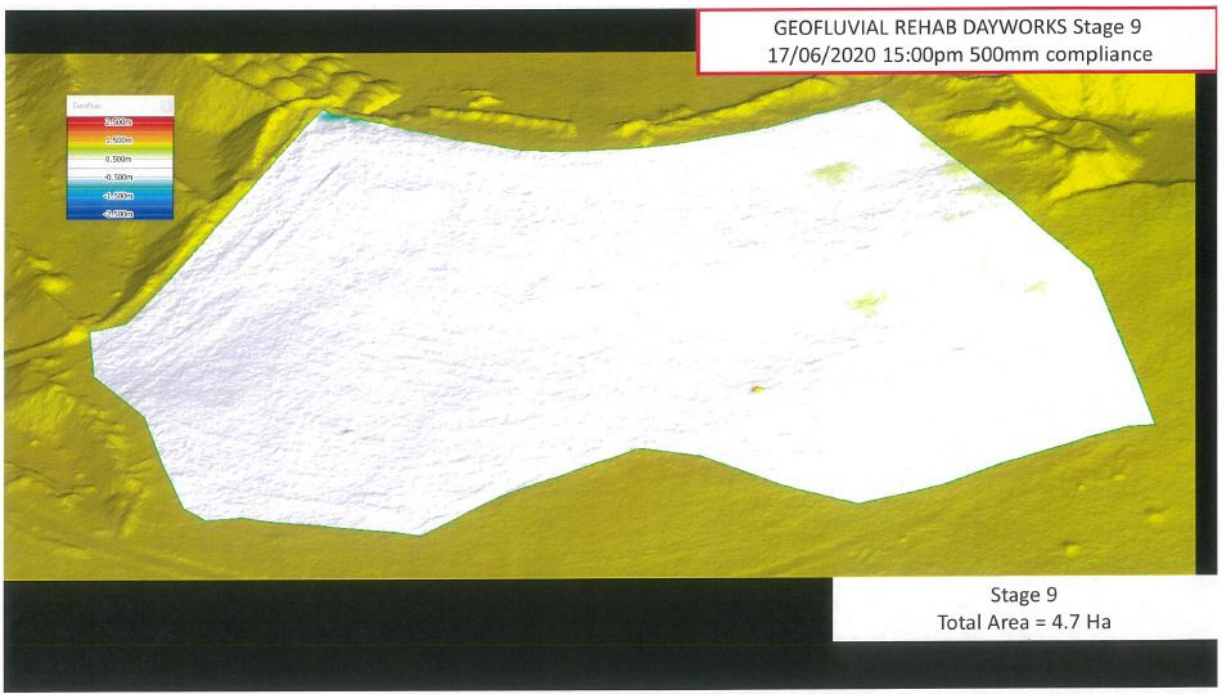


Figure 11 Mount Pleasant Operation Stage 9 – topsoil spreading ITP

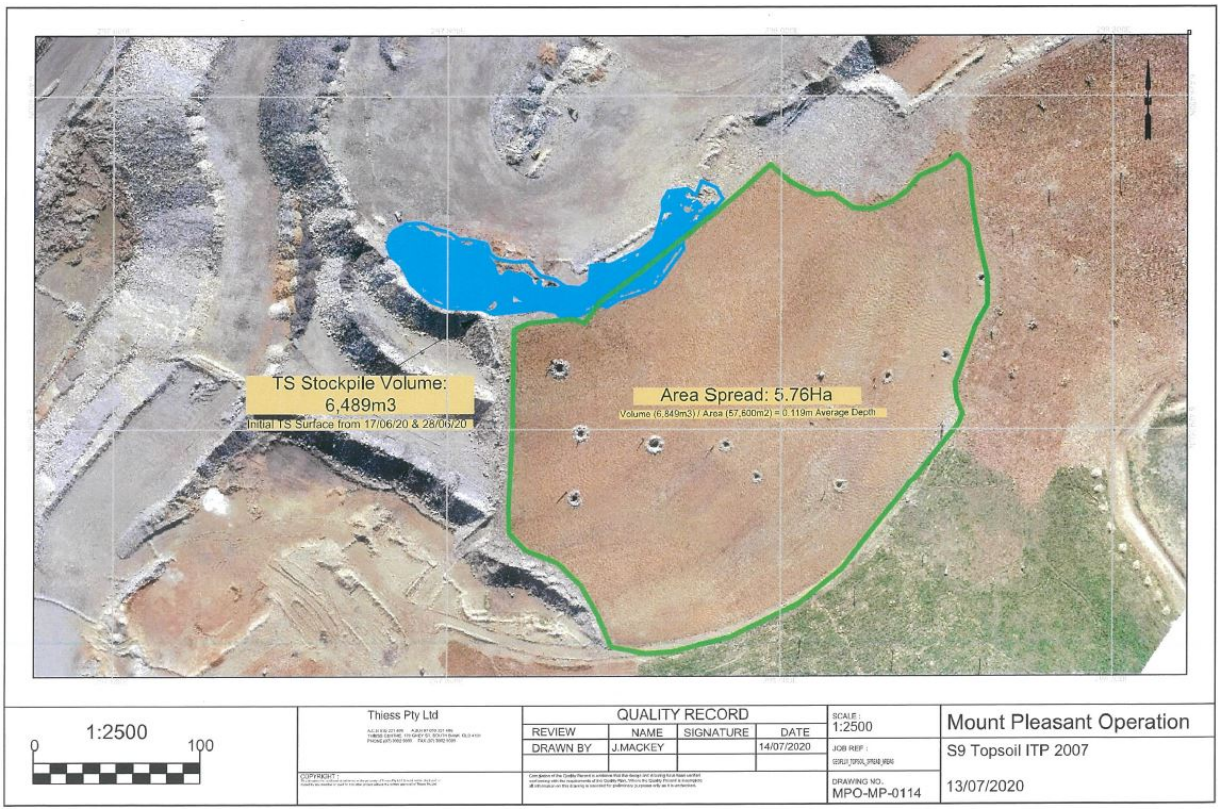
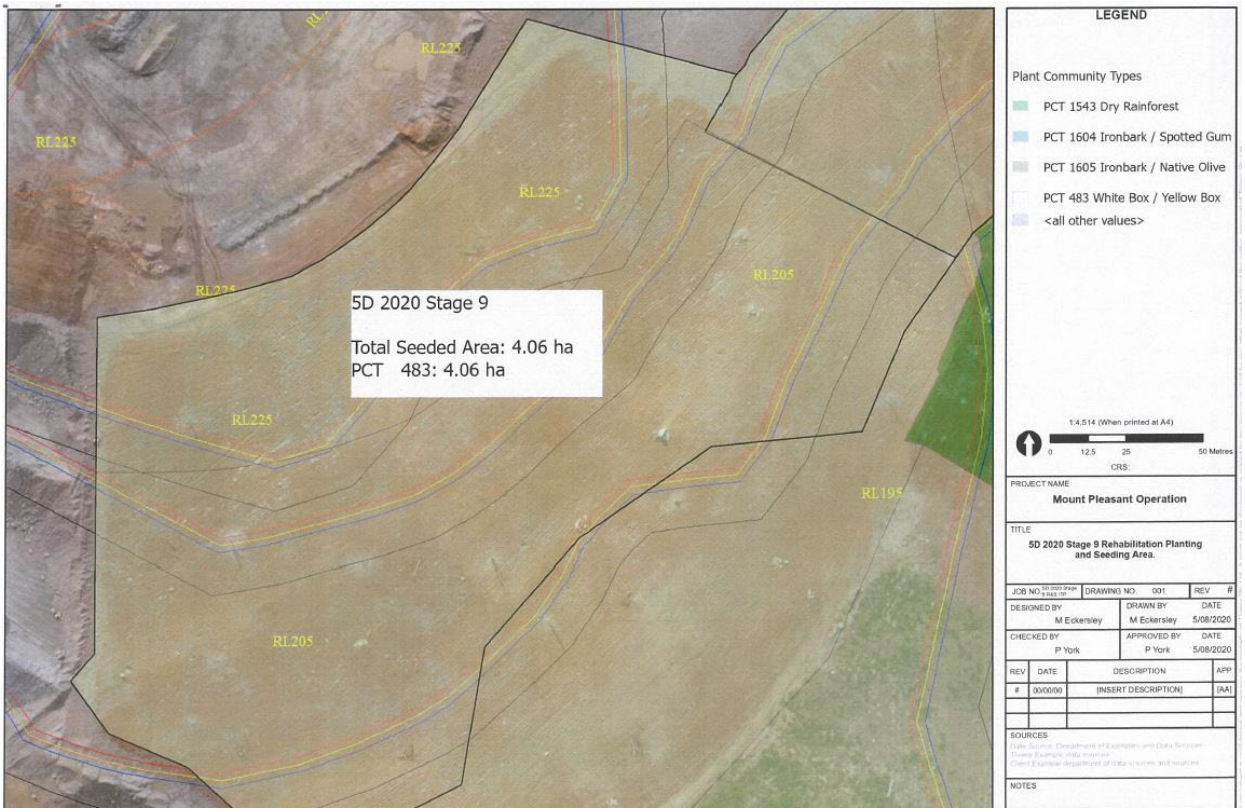


Figure 12 Mount Pleasant Operation Stage 9 – ripping and seeding ITP



The construction quality assurance process adopted at Mount Pleasant provides:

- increased confidence that the design will likely result in the reduction in the risk of long-term landform failure
- a likely reduction in maintenance requirements, including significant re-work, to address issues of erosion and subsequent landform failure attributable to poor design and or execution
- valuable information, such as as-constructed drawings and long-term modelling data, which along with monitoring data, can be used to validate that rehabilitation objectives and completion criteria have been met
- a potential reduction in the time it may take to achieve sign-off from the Regulator that rehabilitation obligations have been fulfilled.

Industry Recommendations

The Regulator expects title holders to comply with their obligations under the *Mining Act 1992*. This includes:

- undertaking rehabilitation progressively, in a timely manner
- designing final landforms to ensure that they are stable in the long term, such as the utilisation of geomorphic design principles for complex landforms
- considering the use of landform evolution modelling to provide confidence that design will be stable in the long term before it is constructed
- implementing quality assurance processes that validate landform construction has been implemented in accordance with design
- developing and implementing rehabilitation techniques, in consideration of detailed risk assessments and sound scientific principles, to overcome barriers/constraints to achieving successful rehabilitation
- undertaking monitoring to assess whether rehabilitation is trending towards meeting the approved rehabilitation objectives, rehabilitation completion criteria, final landform and final land use in a timely manner
- developing and implementing a maintenance program for rehabilitation areas to rectify potential issues identified from the monitoring program

- maintaining records of the methods used to establish rehabilitation, as well as monitoring data, to demonstrate success and facilitate continual improvement.

Further information

- Fact sheet: Exploration and mining rehabilitation
- Regulating risk to rehabilitation
- Landform Evolution Modelling and Geomorphic Design Principles for Mine Rehabilitation Landforms – Questions and answers
- Form ESF2: Rehabilitation completion
- Rehabilitation compliance and reporting reforms
- Australian Government, Department of Industry, Innovation and Science 2016: Leading Practice Sustainable Development Program in the Mining Industry – Mine Rehabilitation
- Australian Government, Department of Industry, Innovation and Science 2016: Leading Practice Sustainable Development Program for the Mining Industry – Risk Management

About this information release

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