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Department of Regional NSW

Compliance audit program

Mount Thorley Warkworth

Mount Thorley Operations Pty Ltd and Warkworth Mining Ltd

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1. Introduction

1.1. Background

Mount Thorley Warkworth Complex (MTW) is an amalgamation of 2 open cut mines adjacent to each other: Mt Thorley Operations (MTO) and Warkworth Mine (Warkworth). Both mines have been in operation since 1981 and were integrated into one operation in February 2004 to form MTW. MTW is operated by Coal & Allied Pty Ltd. Yancoal Australia Limited is the parent company for the titleholders of MTO and Warkworth, and of the operator - Coal & Allied Pty Ltd.

MTW is about 14 km southwest of Singleton, in NSW. The mine comprises the authorisations summarised in Table 1, which are held by Mount Thorley Operations Pty Limited and Warkworth Mining Ltd.

Table 1 Summary of mining titles comprising MTW

Title	Grant	Expiry	MTW Area
CL 219 (1973)	23 September 1981	23 September 2023 (renewal pending)	MTO
CCL 753 (1973)	23 May 1990	17 February 2023	Warkworth
ML 1412 (1992)	11 January 1997	10 January 2018 (renewal pending)	Warkworth
ML 1590 (1992)	27 February 2007	26 February 2028	Warkworth
ML 1751 (1992)	17 March 2017	17 March 2038	Warkworth
ML 1752 (1992)	17 March 2017	17 March 2038	MTO

CL219 and ML 1752 are held by Mount Thorley Operations Pty Limited and CCL 753, ML 1412, ML 1590 and ML 1751 are held by Warkworth Mining Ltd. ML1828 was granted to Mount Thorley Coal Loading Ltd on 25 February 2022, however, it was excluded from the audit given it was not included as part of the mining operations plan during the audit period.

As part of the compliance audit program undertaken by the NSW Resources Regulator, an audit of the mining operations associated with MTW was undertaken on 31 May 2022.

1.2. Audit objectives

The objectives of the audit were to:

- undertake a compliance audit of MTW operated by Mount Thorley Operations Pty Limited and Warkworth Mining Ltd against the requirements of the *Mining Act 1992* and the conditions of the mining leases issued pursuant to that Act
- assess the operational performance of MTW's mining operations and the ability of the titleholder and operator to implement management systems and controls to provide for sustainable management of the operations.

1.3. Audit scope

The scope of the audit included:

- the mining and exploration activities associated with MTW including:

- mine development and exploration activities within CL219, CCL753, ML1412, ML1590, ML1751, and ML1752 rehabilitation activities associated with mining and exploration activities.
- a review of documents and records pertaining to the mining and exploration activities.
- the assessment of compliance for the period commencing 31 May 2020 to 31 May 2022.

1.4. Audit criteria

The audit criteria against which compliance was assessed included:

- *Mining Act 1992*, specifically Sections 5, 6, 163C to 163E, 163G, 378D
- Mining Regulation 2016, specifically clauses 59 to 68
- Conditions attached to CL219 (granted 23 September 1981, last renewed 17 December 2002, current renewal pending)
- Conditions attached to CCL753 (granted 23 May 1990, renewal 12 July 2022)
- Conditions attached to ML1412 (granted 11 January 1997, renewal pending)
- Conditions attached to ML1590 (granted 27 February 2007)
- Conditions attached to ML1751 (granted 17 March 2017)
- Conditions attached to ML1752 (granted 17 March 2017)
- Commitments made in Mount Thorley Warkworth mining operations plan dated 11 November 2020 (approved 24 November 2020) and as amended by the MOP addendum dated 8 November 2021 (approved 30 November 2021).
- *Exploration Reporting: A guide for reporting on exploration and prospecting in New South Wales* (Version 2, March 2016)
- *Rehabilitation Cost Estimation Tool Handbook* (June 2017)
- *ESG3: Mining Operations Plan (MOP) Guidelines*, September 2013
- *Guidelines and Format for Preparation of an Annual Environmental Management Report* (January 2006)

1.5. Publishing and disclosure of information

This audit report was published on the Regulator's website consistent with:

- Section 365 of the *Mining Act 1992*
- The Regulator's Public comment policy
- *Government Information (Public Access) Act 2009*

2. Audit methods

The audit process involved the interview of site personnel, a review of documentation and samples of records provided by the titleholder and operator and a site inspection of the operations to determining the level of compliance of the operations and assess the status of the operational performance. The audit process and methodology are described in more detail in the sections below.

2.1. Opening meeting

The opening meeting was held onsite at MTW on 31 May 2022. The audit team was introduced, and the scope of their responsibilities was conveyed to the auditees. The objectives and scope of the audit were outlined. The methods to be used by the team to conduct the audit were explained, including interview of personnel, review of documentation, examination of records and a site inspection to assess specific compliance requirements.

2.2. Site interviews and inspections

2.2.1. Data collection and verification

Where possible, documents and data collected during the audit process were reviewed on site. All information obtained during the audit process was verified by the audit team where possible. For example, statements made by site personnel were verified by viewing documentation and/or site inspections where possible. Where suitable verification could not be provided, this has been identified in the audit findings as not assessed.

2.2.2. Site inspections

A site inspection was undertaken of MTW including:

- tailings storage facilities (TSF) including the Loders Pit TSF and overburden emplacement, and the Centre Ramp TSF
- tailings dams (TD1 and TD2), and
- topsoil, seeding and rehabilitation areas including soil compost rehabilitation trial areas and the 'Green Mile' rehabilitation area.

2.3. Closing meeting

The closing meeting was held at MTW office on 31 May 2022. The objectives of this meeting were to discuss any outstanding matters, present preliminary findings and outline the process for finalising the audit report.

2.4. Compliance assessment definitions

The reporting of results from the compliance audit was determined based on the definitions presented below in Table 2.

Table 2 Audit assessment categories

ASSESSMENT	CRITERIA
Compliance	Sufficient and appropriate evidence is available to demonstrate the particular requirement has been complied with.
Non-compliance	Clear evidence has been collected to demonstrate the particular requirement has not been complied with. There are three subcategories of non-compliance reflecting the severity and level of risk associated with the non-compliance: NC1 – the absence of planning or implementation of a required operational element which has the potential to result in a significant risk. NC2 – an isolated lapse or absence of control in the implementation of an operational element which is unlikely to result in a significant risk. NC3 – an administrative or reporting non-compliance which does not have a direct environmental or safety significance. Note: The identification of a non-compliance in this audit may or may not constitute a breach of, or offence under, the *Mining Act 1992*. Non-compliances identified in this audit report may be further investigated by the Regulator and regulatory actions may be undertaken.
Observation of concern	Where an auditee may be compliant at the time of the audit but there are issues that exist that could result in the potential for future non-compliance if not addressed. Observation of concern was also used where an issue may not have particular compliance requirements, but which was not conducive to good management or best practice.

ASSESSMENT	CRITERIA
Suggestion for improvement	Where changes in processes or activities inspected or evaluated at the time of the audit could deliver improvement in relation to risk minimisation, sustainable outcomes and management practices.
Not determined	The necessary evidence has not been collected to enable an assessment of compliance to be made within the scope of the audit. Reasons why the audit team could not collect the required information include: ■ insufficient information on the file relating to the period covered by the audit or insufficient evidence collected to reach a conclusion ■ the wording on the criteria (approval condition) meant that no evidence could be gathered, or it was too difficult to gather the evidence. A 'not determined' assessment was also made where the condition was outside the scope of the audit.
Not applicable	The circumstances of the authorisation or licence holder have changed and are no longer relevant (e.g. no longer mining, mining equipment and plant has been removed). An invoking element in the criteria was not activated within the scope of the audit.

2.5. Reporting

Following completion of the site audit, the audit checklists were completed, and audit notes were reviewed to compile a list of outstanding matters to be noted in the audit report. This report was prepared to provide an overview of the operational performance of the site in relation to the mining and exploration operations and identify any non-compliances or observations of concern noted by the auditors during the site inspections and interviews.

The draft audit findings were forwarded to MTW for comment. Consideration was given to the representations made during the finalisation of the audit report as discussed in the audit findings.

3. Audit findings

3.1. Mining operations plan

Condition 2 of ML1590, CCL753 and CL219 and condition 3 of ML1751 and ML1752 require the lease holder to carry out mining operations in accordance with an approved mining operations plan (MOP).

MTW prepared the 'Mount Thorley Warkworth Mining Operations Plan' (MTW MOP) dated 11 November 2020 and as amended by the MOP addendum dated 8 November 2021 to satisfy the requirements of the MOP conditions. The MTW MOP was approved by the Regulator on 30 November 2021.

Generally, evidence was available to confirm that the controls and mitigative strategies outlined in the MTW MOP were implemented as outlined in the following sections.

3.1.1. Activities over the MOP term

Section 2.0 of the MTW MOP described the activities proposed to be undertaken during the MOP term which included:

- exploration activities – MOP section 2.3 proposed exploration drilling during the MOP period. The audit team noted exploration drilling during the audit period included areas ahead of mining operations in North Pit and South-West Pit and were associated with feasibility studies for potential underground mining at MTW – in accordance with the approved MTW MOP. Within MTO Group (and specifically CL219), 24 exploration boreholes were drilled between 31 May 2020 and 22 September 2021, and within MTW (2) Group, 40 boreholes were drilled, and magnetic and seismic surveys were completed between 31 May 2020 and 16 February 2022 - as outlined in the Annual Exploration Reports listed in section 3.4.2 below. MTW advised the audit team that all exploration drilling activities were reviewed prior to commencement as part of MTW's ground disturbance permit (GDP) process which included planned borehole locations and access tracks which were assessed for environmental, cultural heritage, and mining title issues, with necessary constraints and conditions placed on drilling programs as required. All boreholes were surveyed and where not required for monitoring purposes, were cement sealed on completion. Borehole sites were rehabilitated to an appropriate standard, as dictated by the GDP.
- waste management – MOP section 2.8.6 describes the total waste management system (TWMS) in place for MTW. Generally, co-mingled recyclable wastes are removed by licensed contractor to a Materials Recycling Facility at Thornton, and waste not suitable for recycling is removed by contractors and disposed of at the Singleton Shire Council Landfill. The TWMS allows for the tracking of wastes by type, weight and cost. The system is automated, with a parallel docketed system remaining in use to meet compliance obligations. Waste statistics at MTW were reported annually in the Annual Environmental Review. Documentation was available to confirm that a contract was in place for a waste management contractor. MTW maintained data on the types and volumes of waste disposed of each month, including the percentage of each waste stream that was recycled.
- construction – MOP section 2.9.2 describes the construction activities proposed during the MOP period including: varying the water management system to suit the advancing mine; mining and construction of the North Out of Pit (NOOP) dam to support the South Out of Pit Dam (constructed in 2011) in maintaining adequate storage in times of low rainfall and to reduce the need to pump water from the Hunter River; construction of a third crossing of Putty Road; internal haul roads and emergency access road between Putty Road and the Golden Highway for use by the Rural Fire Service (RFS); and electrical infrastructure and pipeline/pumping infrastructure ahead of the advancing mine.
- construction of sediment water management structures for the western advancing pre-strip at Warkworth was completed in quarter one of 2021. These structures were designed in accordance with Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries (the Blue Book). Remote boundary monitoring systems were installed on the additional new pre strip sediment dams (54N and 55N) and the Warkworth North Pit North drainage upgrade works were completed to improve water management and mitigate the risk of unauthorised water releases from site.

3.1.2. Operational risks relating to rehabilitation

Section 4.0 of the MTW MOP describes the operational issues which could potentially affect rehabilitation at MTW.

MOP section 6.8.2 Soil types and suitability outlined suitability testing of growing medium for rehabilitation during the growing media development phase to determine requirements for soil ameliorants. Soil testing was proposed at least once during rehabilitation monitoring to assess consistency with the performance criteria outlined in Table 33 of the MOP. The MOP outlined the key objectives for managing soil landscapes (in context of vegetative cover and soil stability) which included: minimising bare soil patches; and favourable nutrient, infiltration, and stability characteristics for the nominated vegetation communities.

On 26 June 2020, the Regulator undertook a targeted assessment program (TAP) at MTW which focused on soils and materials management for rehabilitation activities. MTW advised that

opportunities for improvement identified in the TAP report will be included in the MTW rehabilitation management plan to address the rehabilitation reforms.

MOP section 4.2.11 spontaneous combustion, noted that spontaneous combustion was considered a low risk at MTW with no ongoing issues however potential risks are managed through internal procedures. Controls included identifying and selectively managing waste material susceptible to spontaneous combustion such as placing carbonaceous material in active dumps for rapid and effective burial, minimising unplanned coal losses in overburden, maintaining overburden lift heights up to a maximum of 20 m to increase stability and compaction of emplacement areas and not exposing loose sulphurous and carbonaceous material for periods of time to allow heating.

MOP section 4.2.12 acid mine drainage (AMD), outlined how acid mine drainage was managed through internal environmental procedures including MTW's acid rock drainage and mineral waste management plan. The potential for AMD at MTW was considered low as supported by the findings of an independent review conducted in 2005 and further testing undertaken by MTW of overburden and interburden intervals between 2008 and 2016. No further AMD potential testing of spoil had occurred since as mining continued in the overburden and interburden intervals previously tested. MTW advised that the basal Archerfield seam was the only seam previously identified with AMD potential and given no mining had continued in this seam, the risk was low. MTW also undertook extensive surface water and groundwater testing, with reporting of these results in the annual environmental review. The site dams' pH trend - 2018 to 2021 shows alkaline pH levels between 8.4 to 9.2, which supported the view that MTW has a low risk of AMD.

During the audit, the audit team noted the presence of potential AMD leachate (iron precipitants and efflorescence) within a layer in the western wall of the Loders Pit TSF (see figure 1). MTW advised that iron rich minerals were identified in this layer, likely reacting with salts. This raised observation of concern no. 1: MTW should develop and implement standard business practices to identify and manage potentially hostile/carbonaceous materials within the mine plan.

Figure 1 Potential AMD leachate within western wall of Loders TSF

MOP section 4.2.13, contaminated land, discussed the management of land contamination through internal procedures with a contaminated sites register used to record and ensure follow up of any contamination that occurs on site. Before the cessation of mining activities in the MOP disturbance area, an assessment is proposed to determine whether potential contamination issues exist, and any remediation required. Hazardous substances contamination was considered a high risk for rehabilitation in the MOP risk assessment.

3.2. Rehabilitation

Condition 2 of ML1751 and ML1752, conditions 13 and 14 of ML1590, and conditions 18 to 25 of CCL753, CL219 and ML1412 require that any disturbance resulting from the activities carried out under the mining leases must be rehabilitated to the satisfaction of the Minister. An assessment of

compliance with the MOP commitments in relation to rehabilitation of the site was undertaken during the audit as detailed in the following sections.

3.2.1. Risk assessment

To achieve successful rehabilitation outcomes, the lease holder must be able to identify and manage any risks that could compromise rehabilitation outcomes.

At the time of the audit, the environmental risk assessment documented in section 4.1 of the approved MOP was current. The audit team noted this risk assessment is not specific to rehabilitation with limited control measures. There were 5 risks ranked as high and one risk ranked as moderate regarding rehabilitation including:

- air pollution and dust
- erosion and sedimentation
- surface water
- hazardous substances contamination
- weeds and pests, and
- bushfire.

The audit team noted that a more detailed rehabilitation risk assessment would address requirements of the operational rehabilitation reforms.

Generally, it was noted that MTW identified and implemented controls to address key risks. For example:

- MTW undertook an annual weed control program in rehabilitation areas, based on findings from the annual weed survey that lists weeds of national significance (WONS), noxious, environmental, and other non-declared weed species identified across MTW.
- The program aims to reduce weeds and assist native vegetation establishment and involves chemical and mechanical approaches – depending on the presence and progress of established native vegetation. For example, use of a weed wiper to control weeds that are taller than the native species and selective chemical control of weeds growing amongst desirable native species. MTW advised that weed treatment areas were assessed following completion of work to determine effectiveness.
- The audit team noted from the annual reports that in 2020, 281.6ha of existing rehabilitation areas received weed treatment (including boom spray, wick wiper treatment or selective weed control methods) and 255.9 ha were treated during 2021. During the site audit, the audit team noted amongst other weed and invasive / more prevalent species, significant presence of rhodes grass, galena, stinking roger and acacia saligna across rehabilitation areas (See Figure 2). MTW advised the audit team that the weed control program was targeting Rhodes grass which is being managed with selective treatments and relying on establishment of a native vegetation canopy to ‘shade out’ the grass.
- Regarding acacia saligna weed control, MTW noted they were mulching the acacia and wiping regrowth with little to no natives sown into that area. The mulch was used in the rehabilitation soil stockpile which would not be used in rehabilitation areas due to the potential seed load contained within the mulch. This raised observation of concern no. 2: the use of exotic cover crops across inactive rehabilitation areas (such as the “Green Mile” emplacement area) provides further impacts for future rehabilitation and establishing native vegetation as required by the MOP and development consent. MTW have committed to investigate why rehabilitation was not successful in these areas, and what strategies can be employed to reduce prevalence of weeds and improve native vegetation establishment.

Figure 2 Rhodes grass and acacia saligna dominant across rehabilitation areas

- Rilling and erosion was identified by the audit team along the high wall, south of the Mini Strip TSF (Figure 3). MTW advised that the area had been inspected with geotechnical and geochemical testing undertaken.

Figure 3 Rilling and erosion along high wall, south of Mini Strip TSF

- MTW noted spoil and compost rehabilitation trials on site, in accordance with the MOP. These are discussed in more detail in section 3.2.3 below.
- The rock lining of the South Pit North Drop Structure (eastern emplacement outer batter) was noted as sitting proud of the landform. As such, there is potential for surface water flows to undercut the drainage structure that may result in erosional issues, including risks associated with landform stability.
- MTW engaged consultants to undertake annual groundwater reviews which included analysis of monitoring data and reporting as part of the MTW groundwater monitoring program.
- MTW also engaged consultants to undertake annual historic heritage management plan compliance audit inspections and annual aboriginal heritage management plan compliance audit inspections, and the annual stream health and stability report.

It was also noted that MTW had engaged a consultant to prepare a rehabilitation management plan and associated rehabilitation risk assessment, in line with the operational rehabilitation reforms in place from July 2022.

3.2.2. Rehabilitation objectives and completion criteria

The post-mining land use goals are documented in section 5.2 of the approved MOP. The approved conceptual final landform rehabilitation plan which detailed the post-mining land uses for the site was included in Plan 4 of the MOP.

Tables 30 to 36 of the MTW MOP outlined the performance indicators and completion criteria for each domain for each stage of the rehabilitation process - from decommissioning through to ecosystem sustainability. Where relevant, the completion criteria were linked to a trigger action response plan (TARP) which outlined actions required where TARP triggers are exceeded. The audit team noted there was no real implementation or tracking of TARP thresholds. While this is an issue, it is an expectation of the audit team that these limitations would be addressed via documentation developed by MTW in accordance with the Mining Amendment (Standard Conditions of Mining Leases – Rehabilitation) Regulation 2021.

3.2.3. Rehabilitation progress

Rehabilitation activities and methodologies were described in sections 7.2 and 7.3 of the MTW MOP. Rehabilitation activities over the MOP term included:

- capping and rehabilitation of Tailings Dam 1 and 2
- rehabilitation of spoil emplacements in the Loders Pit, North Pit, Woodlands Pits and South Pit
- rehabilitation of the eastern face of the South Pit Centre Ramp area was to be undertaken from 2016 to 2018
- organics (composted municipal or green waste) were proposed to be used in place of chemical fertilisers to enhance soil nutrient, organic levels and improve soil structure in areas to be returned to native vegetation.

Evidence was available to indicate that rehabilitation activities are generally progressing in line with the MOP requirements. For example:

- capping and rehabilitation of tailings dam 1 and 2 (TD1 and TD2) had progressed (Figures 4 & 5). The audit team were advised for TD1, new materials had been used from the new dam to cover the site. TD1 had been rehabilitated, however, MTW were increasing the height of the dam and leveling the site, using clay materials. TD2 was last used for tailings in 2014. The dam was partially capped with Red Bank fly ash, at 46m depth. Capping had ceased due to instability associated with the fly ash (fines) towards the centre and requirement for further desiccation of the material due to recent rainfall resulting in up to 1.5m water pooling within the facility. MTW noted 8 million cubic metres of capping material is required to finish with a dome shape final landform.

Figure 4 Tailings dam 1

Figure 5 Tailings dam 2

- The audit team inspected the Loders Pit TSF - with no tailings deposited on the day (Figures 6 to 9). The audit team noted loose material along the high wall, initially believed to be a potential failure. However, further clarification from MTW confirmed this was a section of wall blasted to create access onto the catch bench from above and that the material is back from the crest, posing no risk of rockfall to operations below – as evident from Figure 6. MTW noted a high wall stability investigation had been completed – suggesting the high wall would have long term stability. MTW noted water had been diverted away from the tailings with decanting using pumps occurring within the TSF. MTW advised Loders Pit is regularly inspected for geotechnical hazards and a geotechnical hazard report for MTW is produced monthly, along with monthly surveys to determine volumes deposited. As illustrated in Figure 1, the audit team also noted the presence of potential AMD leachate (iron precipitants and efflorescence) in the western wall of the Loders Pit TSF (observation of concern no. 1).

Figure 1 Loose material observed on the high wall - Loders Pit TSF (Image provided by MTW representative)

Figure 2 High Wall - Loders Pit TSF

Figure 3 Entry to Loders Pit TSF

Figure 4 Overburden emplacement within Loders Pit TSF

- The western face of the South Pit Centre Ramp area was inspected during the audit (Figure 10 & 11). Flocculants had been added to the surface and vegetation was establishing along the northern and southern face of the Centre Ramp tailings dam.

Figure 5 South Pit Centre Ramp tailings – Northern face

Figure 6 South Pit Centre Ramp Tailings – Southern face

- MTW noted that rehabilitation progress was split by dump release of overburden material and progressed through to rehabilitation from bulk shaping, topsoil and compost application to seeding. There are several rehabilitation trials being performed at MTW such as the use of various compost and seeding into mine spoil (Figures 12 to 15). These were briefly discussed in section 6.8.2 of the MOP as well as the basic rehabilitation methodology such as forming, growth media development and seeding. During the audit, MTW noted that rehabilitation areas were approximately 50 m behind mining schedule.
- MTW advised gypsum was applied to overburden material to reduce sodicity. Compost application had helped to buffer the pH, however there was delayed germination with improvements observed over a 3-year period. MTW noted the sites had been prepared by ripping, aeration, and application of composts and gypsum. An air seeder was used for seeding application with seed mixes used as defined in the MOP and contracts in place with seed suppliers to replicate the MOP and to achieve diversity targets for species.
- MTW noted “Remondis” (Awaba Compost) and “Better Grow” (Mine Rehab Compost) composts were used across rehabilitation areas. The Better Grow compost has higher nutrient levels due to biosolids used during the composting process. The Remondis compost is made solely from source segregated food and garden waste with the minus 15mm component screened off for use in the nursery market. The removal of this fine material would likely reduce the nutrient levels in the resulting compost product as well. The audit team noted putrescible waste items in the Remondis compost (see Figure 14). This raised observation of concern No. 3: MTW should confirm the use of Remondis and Better Grow composts comply with Environmental Protection Authority (EPA) standards.

Figure 7 2020 topsoil and seeding area

Figure 8 2020 Landform and topsoil/seeding

Figure 9 Remondis compost with putrescible wastes

Figure 10 2020 soil and compost rehabilitation area

- During the audit, rehabilitation and trial areas between and north of the Centre Ramp TSF and Loders Pit were observed (Figures 16 to 21). The compost trials included areas with and without compost and found that the Better Grow compost (with high nutrient levels), stimulated exotic grass growth in topsoiled rehabilitation areas resulting in poor native vegetation establishment. However, MTW has had good results for establishment of native vegetation with the Better Grow compost where it is mixed with mine spoil and gypsum to form a growth medium. In the spoil/compost application, the weed seed load in topsoil is not present so weed competition is not a problem. In 2021, MTW attempted to solve the exotic grass issue seen in topsoiled rehabilitation by sourcing the Remondis compost with lower nutrient levels. It was found, however, the Remondis compost resulted in poor native vegetation establishment when used in the spoil/compost application (as seen in the foreground of Figures 12, 13 and 14). MTW suspects that higher nutrient level composts are better suited for use in spoil/compost applications. This theory will be tested with side-by-side trials of the Remondis and Better Grow compost products spread on spoil/compost rehabilitation areas in 2022.The audit team noted some diverse native species coming through including kangaroo grass, eucalypts and acacias, although sparse.

Figure 11 Rehabilitation trial area - rhodes grass dominant

Figure 12 Rehabilitation stockpile area

Figure 13 Weed species present within rehabilitation trial areas

Figure 14 Area dominated by rhodes grass and acacia saligna

- The drop structure within the 'Green Mile' emplacement area was designed using geo-fluv modelling and although not consistent with modern modelling, no erosion issues were observed. The area was seeded in 2019 and a mixture of rock and basalt had been used in its construction. Weedy vegetation, was observed across the area, raised earlier as observation of concern no 2 – and the audit team noted limited planned response action by MTW.

Figure 15 Green Mile drop structure

Figure 16 Green Mile emplacement

- MTW noted no formal quality assurance or quality control of the established landforms within rehabilitation areas apart from the initial topography factor design completed by a consultant. Internal surveys were also being undertaken of the established landform and referred to the consultant for verification of any new potential erosion risk.

MTW developed and implemented rehabilitation monitoring programs to monitor the progress of rehabilitation works. The following examples of rehabilitation monitoring were provided to and reviewed by the audit team:

- MTW has traditionally completed quadrat-based rehabilitation monitoring. However, in 2021, MTW introduced Dendra monitoring that included remote sensing/drone footage to enhance ground monitoring of the 500 ha of rehabilitation areas – allowing visual trends to be identified over time. The footage splits the site into 10 m-by-10 m pixels, allowing detailed interrogation of sites to identify weeds and other flora and fauna. The Dendra insights portal presents monitoring results spatially, such as vegetation health, erosion, fauna impacts and their presence, and weed species and coverage, which informs planning management activities to target 'hot spots' as part of work plans developed every few months.
- Inspections were noted to be very reactive and ad hoc throughout the year, sometimes triggered by rainfall and completion of rehabilitation works. Recording of inspection details and photos also varied and included use of an ArcGIS tablet-based program (Collector) and recording information in shared drives. A sample of these were observed by the audit team. The audit team noted no formal mechanism for following up actions (such as seeding and weed control) arising from environmental monitoring and inspections, although informally reported at managers meetings. The audit team also noted that there was no tangible implementation or tracking of TARP thresholds. A suggestion for improvement no. 1: MTW should consider a formalised inspection process for routine rehabilitation monitoring, which should outline criteria to be monitored.
- The audit team were advised that when areas were shaped in preparation for rehabilitation and landform establishment, surveyors were employed to confirm the shaped landform was consistent with the initial design and topography factor. Survey information was sent to the designer to confirm no additional erosion risk was introduced by the shaped landform when compared to the initial design.
- While MTW didn't have a formal system for assessing rehabilitation performance across the site against the rehabilitation objectives and completion criteria – rehabilitation monitoring did inform management activities with a traffic light system for corrective actions. For example, weed surveys undertaken guided the entire yearly weed control program - including weed control outside of rehabilitation areas. MTW also undertook post application soil testing to

determine contaminant levels, pH and Electrical Conductivity where soils and ameliorants (such as Remondis 'Better row' composts) were applied to rehabilitation areas and commenced rehabilitation trials to determine the best methodology for different compost/fertiliser applications in restoring native ecosystems. Apart from weed control and seed/fertiliser application, no other rehabilitation measures were discussed during the audit.

- MTW used the biodiversity assessment method (BAM) to track the success of rehabilitation in meeting final landuse objectives – noting that rehabilitation areas need to generate 11,000 worth of credits ten years post closure under BAM. MTW noted that monitoring of species richness and structure focussed on groundcover and mid cover during the audit period, with overstorey cover not relevant at this stage. MTW is working on building in criteria to determine the likeliness of achieving overstorey percentage and overstorey species counts over transects. This will likely feed into the rehabilitation reforms process.
- Results of rehabilitation inspection and monitoring programs, and rehabilitation progress against the MOP triggers, were illustrated through maps reported at monthly managers meetings. These helped to identify areas lagging with rehabilitation progress. Rehabilitation progress was also reported (using the same maps) at quarterly Community Consultation Committee (CCC) meetings and via annual reports. MTW also maintained 6 analogue sites for monitoring that were reported against in the annual reports).
- Where MTW engaged external consultants to perform monitoring programs (such as the annual aboriginal heritage management plan compliance audit inspections and annual historic heritage management plan compliance inspections, annual stream health and stability reports, and annual groundwater reviews), recommendations from these reports were not routinely entered into the action tracking system (Intelex). Whilst there was evidence available to demonstrate that some of the recommendations from external reports are actioned, there is potential for these actions to be missed. Furthermore, there was limited justification or evidence of decision making for not implementing these recommendations.

The observations above show there isn't a formal system to track recommendations from consultant's reports and findings from inspections. As suggestion for improvement no. 2: MTW should consider entering the findings from inspections, monitoring programs and recommendations from external consultant reports into the compliance database to provide a more robust system for tracking any actions identified and required.

3.3. Exploration

Condition 15 of ML1590, condition 50 of CCL753, CL219 and condition 51 of ML1412 includes requirements for exploratory drilling /prospecting within the lease area, including:

- notification to the regional hydrologist (ML1590) or the Director General (CCL753, CL219 and ML1412) of the intention to drill exploratory holes together with information on the location of the proposed holes
- requirements for the survey, sealing and rehabilitation of drill holes.

Within MTO (and specifically CL219), the audit team noted that 24 exploration boreholes were drilled between 31 May 2020 and 22 September 2021, as outlined in the Annual Exploration Reports listed in section 3.4.2.

Within Warkworth, the audit team noted 40 boreholes were drilled, and both a magnetic and seismic survey were completed between 31 May 2020 and 16 February 2022, as outlined in the Annual Exploration Reports listed in section 3.4.2.

Evidence was available to confirm notification to the Department as per condition 50 of CCL753 and CL219 (letter dated 7 March 2022, and exploration activity application dated April 2020).

3.4. Reporting

3.4.1. Annual rehabilitation reporting

Condition 3 of ML1751, ML1752 requires the lease holder to prepare a rehabilitation report that provides a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP. Condition 3 of ML1590, CCL753 and CL219 requires the lease holder to lodge an annual environmental management report (AEMR) containing a review and forecast of performance of, among other things, the accepted mining operations plan, and where relevant, progress towards final rehabilitation objectives.

MTW has submitted annual environmental management reports or annual reviews for the audit scope period as follows:

- Mount Thorley Warkworth 2021 annual review, part of the Yancoal Australia Group, dated 31 March 2021
- Mount Thorley Warkworth 2020 annual review, part of the Yancoal Australia Group, dated 29 April 2020

The audit team noted that the reports provide information on the progress of rehabilitation across the site, with detailed consultants reports included as appendices (such as the annual aboriginal heritage management plan compliance audit inspections and annual historic heritage management plan compliance inspections, annual stream health and stability reports, and annual groundwater reviews). The audit team noted there was no specific assessment of progress against the completion criteria defined in section 6 of the MOP, however, this will be addressed going forward as part of the rehabilitation reforms.

3.4.2. Annual exploration reporting

Section 163C of the *Mining Act 1992* and clause 59 of the Mining Regulation 2016 require the preparation and submission of an annual report, which provides full particulars of all exploration and other operations, or activities conducted during the 12-month period.

Five exploration reports have been submitted during the audit scope period:

- Annual Exploration Report for the period 23/09/2019 to 22/09/2020 CL 219 - ML 1547, ML 1752 – Mount Thorley ML Group ('MTO Group'), Yancoal Australia Ltd, dated 13 October 2020
- Annual Exploration Report for the period 23/9/2020 to 22/9/2021 - CL 219, ML 1547, ML 1752 – Mount Thorley ML Group ('MTO Group'), Yancoal Australia Ltd, dated 21 October 2021
- Annual Exploration Report Part A for the period 17/02/2021 to 16/02/2022 - CCL 753, ML 1412, ML 1590, ML 1751 (Act 1992) ('MTW (2) Group'), Warkworth Mining Ltd, dated 14 March 2022
- Annual Exploration Report Part B for the period 17/02/2021 to 16/02/2022 - CCL 753, ML 1412, ML 1590, ML 1751 (Act 1992) ('MTW (2) Group'), Warkworth Mining Ltd, dated 14 March 2022
- Annual exploration report For the period 17/02/2020 to 16/02/2021 CCL 753, ML 1412, ML 1590, ML 1751 ('MTW (2) Group'), Warkworth Mining Ltd, dated 12 March 2021

The reports for the 2020 and 2021 reporting periods were reviewed by the audit team and were found to be generally in accordance with the relevant departmental guidelines and templates.

3.4.3. Compliance and environmental incident reporting

Condition 4 of ML1751 and ML1752 requires the lease holder to notify the Department upon becoming aware of any breaches of the conditions of this mining lease or breaches of the Mining Act or Regulation within 7 days of the mining lease holder becoming aware of the breach.

The audit team noted 2 breaches of title conditions during the audit period for CL219 and CCL753 for failing to operate in accordance with an approved MOP due to 'delayed' rehabilitation forecasts.

An official caution was issued. MTW advised the audit team that they were unaware of any further breaches of their mining leases or breaches of the Mining Act or Regulation during the audit period.

Condition 5 of ML1751 and ML1752 requires the lease holder to provide environmental incident notifications and reports to the Secretary no later than 7 days after those environmental incident notifications and reports are provided to the relevant authorities under the *Protection of the Environment Operations Act 1997.*

As noted in MTW annual reviews, MTW had reported 6 reportable water related incidents to the EPA under the requirements of its environmental protection licence during the audit period. The audit team confirmed that these incidents were also reported to the Regulator, in accordance with the requirements of condition 5 of the mining leases. For example:

- overtopping of 4 boundary dams at Warkworth (Dam 46N, Dam 52N, Dam 53N, Dam SSD09) and a mine water dam at Mount Thorley Operations (Dam 1S) as a result of a greater than design rainfall event (79.4 mm) reported 4 January 2021
- overtopping of 3 boundary dams at Warkworth (Dam 53N, 54N and 55N) and a mine water dam at Mount Thorley Operations (Dam 1S) as a result of a greater than design rainfall event (175.2 mm) reported 19, 20 and 23 March 2021
- overtopping of 2 boundary dams at Warkworth (Dam 54N and Dam 53N) as a result of a greater than design rainfall event (110.6 mm) reported 12 November 2021
- overtopping of a boundary dam at Warkworth (Dam 53N) as a result of a greater than design rainfall event (84 mm) reported on 26 November 2021
- overtopping of a boundary dam at Warkworth (Dam 53N) as a result of greater than design rainfall being received reported on 8 March 2022 (which occurred on 7 March 2022)
- overtopping of a boundary dam at Warkworth (Dam 53N) as a result of greater than design rainfall being received reported on 26 March 2022.

3.5. Other mining lease compliance requirements

3.5.1. Notice to landholders

Condition 1 of mining leases ML1590, ML1751 and ML1752, condition 47 of ML1412, and condition 46 of CL219 and CCL753 require the lease holder to provide a notice in writing to each landholder within the lease area advising that the lease has been granted or renewed. None of the leases have been granted or renewed within the audit scope period, therefore, the notification requirements were not verified during the audit.

The audit team noted that ML1828 was granted on 25 February 2022, however, given this lease was not included as part of the mining operations plan during the audit period, this mining lease was excluded from the scope of the audit.

3.5.2. Security deposit

Under Condition 8 of ML1751 and ML1752, condition 26 of ML1590, condition 51 of CCL753 and CL219, and condition 52 of ML1412, the lease holder is required to provide and maintain a security deposit to secure funding for the fulfilment of obligations under the mining lease.

The security deposit required for MTW across all its titles was $196,736,000. A review of departmental records confirmed this amount was held.

3.5.3. Co-operation agreement

Condition 9 of ML1751 and ML1752 required the lease holder to make reasonable attempts to enter into a co-operation agreement with the holders of any overlapping titles.

A review of published departmental mapping system Minview confirmed EL8824 and EL7712 overlap ML1752 which are both held by Mount Thorley Operations Pty Limited. Therefore, co-operation agreement not required.

As an example of cooperation between MTW and adjoining mines, MTW advised the audit team of a boundary agreement held with a neighbouring mine.

3.5.4. Other conditions

CL219, CCL753, ML1412 and ML1590 are older leases that have a range of conditions that are no longer included as lease conditions on newer leases. These conditions and an assessment of compliance are provided below.

- Blasting (condition 11 on ML1590, and condition 26 on CL219, CCL753 and ML1412) – given that compliance with blasting requirements is a condition of the environmental protection licence for the site and is regulated by the EPA, compliance with the blasting conditions was not assessed.
- Dust (condition 17 of CCL753, CL219) and dust and conveyor systems (condition 17 of ML1412) - given that compliance with dust requirements is a condition of the environmental protection licence for the site and is regulated by the EPA, compliance with the blasting conditions was not assessed.
- Transmission lines, communication lines and pipelines (conditions 42 and 43 of ML1412, condition 41 of CL219, conditions 41, 42 and 55 of CCL753 and condition 17 of ML1590) – although these conditions were not assessed during the audit, the audit team noted that MTW used an internal web-based form for ground disturbance permits (GDP) to undertake required environmental checks for proposed disturbances. This also prompted discussions with other relevant departments, for example, statutory electrical position for works in powerlines.
- Trig stations and survey marks (condition 37 of CL219) - this condition was not assessed during the audit.
- Fences and gates (condition 18 of ML1590) – annual reports reviewed by the audit team noted a boundary fence audit was undertaken across MTW in May 2020 to identify fences that required repairs, maintenance or replacement with fence repairs completed during the audit period and documented in the annual reports. Fences and gates passed during the site inspection were generally observed to be well maintained.
- Roads and access tracks (conditions 31 and 32 of CL219 and CCL753, condition 56 of ML1412, and condition 19 of ML1590)– roads and tracks traversed during the site inspection were generally observed to be well maintained.
- Trees (planting and protection of) flora and fauna and arboreal screens (conditions 27 and 29 of CCL753 and CL219, and condition 28, 29 and 30 of ML1412), and trees and timber (condition 21 of ML1590) – annual reports noted visual amenity bunds were extended/implemented during the audit period including vegetation screening implemented west of the former Wallaby Scrub Road in 2020. The Annual reports also noted tree lopping as part of historic heritage management. The audit team noted that ML1590 was located within an easement with zoning ‘Special Purpose’ (SP2) Infrastructure (classified road). Land ownership of this easement was not determined by spatial database searches. Approvals to fell trees or cut timber were therefore not assessed during the audit.
- Prevention of soil erosion and pollution (condition 30 CCL753 and CL219, condition 31 of ML1412 and condition 16 of ML1590) – a stability issue was noted along the high wall of the Loders Pit tailings storage facility during the site audit. This was raised earlier as observation of concern no. 3.
- Shafts, drifts and adits (condition 14 of CCL753 and CL219) – these conditions were not assessed during the audit.

- Dumps (condition 15 and 16 of CCL753 and CL219) and dumps and coal preparation plant (condition 16 of ML1412) - these conditions were not assessed during the audit.
- Travelling stock reserves (conditions 38 and 39 of CCL753) – these conditions were not assessed during the audit as they were outside the Regulator's regulatory scope.
- Aboriginal place or relic (condition 43 of CCL753 and CL219 and condition 44 of ML1412) – during the audit period, MTW continued their regular, rolling program of compliance inspections to ensure that all Aboriginal cultural heritage sites were inspected regularly, and were assessed against the Aboriginal heritage management plan (AHMP).
- Settling dams or other dams (condition 56 of CCL753) – during the site visit, the audit team observed the partial capping of tailings dam 2 and found no issues.
- Catchment areas (condition 33 of CL219) – it was noted that MTW had reported six reportable water related incidents to the EPA under the requirements of its environmental protection licence during the audit period, as discussed in section 3.6.3 above.

Additional condition (condition 55 of CL219 – mining operations shall not be conducted within 50 metres of the surface area of an area measured 30 m either side of the banks of Wollombi Brook unless with the written consent of the Minister first had and obtained and subject to such conditions as he may impose) – the audit team noted no mining operations were conducted within this boundary during the audit period.

4. Compliance management

4.1. Identifying compliance obligations

Identifying compliance obligations is a critical step in the development of an effective compliance management system. Compliance obligations for a quarry can include:

- regulatory requirements (for example, environmental legislation)
- conditions imposed on the grant, renewal, or transfer of mining leases
- specific commitments made by the organisation (for example, MOP commitments).

Once identified, compliance obligations should be reviewed periodically to identify any changes in those obligations (for example, changes in legislation).

MTW established and implemented systems to manage compliance obligations and action tracking. Staff interviewed during the audit demonstrated a good knowledge of most compliance obligations, particularly those associated with the mining lease conditions and the MOP commitments. MTW undertook the following to identify and monitor their compliance obligations:

- The Yancoal Commercial/Tenements team maintain a compliance database for tracking annual report due dates, renewals, securities, royalties, and rents and levies which were reported to and discussed during biannual corporate meetings. A 3 yearly independent environmental audit was also completed as required by the development consent for the mine, which discussed compliance with obligations of permits and approvals.
- An action tracking system (Intelex) was used to capture risk assessments, to log incidents, and to record, assign and monitor actions outlined in key management documentation and audit findings. Risks born out of an incident were regularly reviewed and updated as part of Intelex process. Actions required by Regulatory Notices were entered into Intelex on a case-by-case basis.
- MTW also used an internal web-based form for ground disturbance permits (GDP) to undertake required environmental checks for proposed disturbances. The system identified land ownership, cultural heritage issues and required buffers for the proposed disturbance area and confirms requirements for survey, environmental monitoring, and any community consultation. The

process also prompted discussions with other relevant departments, for example, statutory electrical position for works in powerlines and the tenements team if works proposed outside land owned by MTW. GDPs were downloaded and required to be available at the disturbance site. Conditions of approval and post GDP inspections could also be triggered out of the system where required, and any proposed changes to the GDP needed to be first discussed and assessed by the MTW Environmental Team.

- It was outlined that any changes to compliance requirements were monitored and communicated by the Environment & Community Manager or the Yancoal corporate team as they arose with awareness communicated by the tech services team via emails and meetings if required.

It was noted that the obligations documented in the Intelex database did not include obligations imposed by the *Mining Act 1992* (for example, MOP expiry date or the requirement to obtain consent prior to suspending operations (Schedule 1B of the *Mining Act 1992*). A suggestion for improvement no. 3: MTW should consider expanding the obligations in the compliance database to include statutory conditions and other obligations under the *Mining Act 1992* and regulation and to address the regulatory reforms.

4.2. Inspections, monitoring and evaluation

An effective inspection, monitoring and evaluation process is required to:

- monitor the implementation of the risk controls
- evaluate the effectiveness of those controls based on an assessment of inspection and monitoring data
- implement an adaptive management approach if monitoring shows that controls may be ineffective.

Section 3.2.3 above outlined examples of rehabilitation monitoring developed and implemented by MTW to monitor the progress of rehabilitation works. During the audit, MTW also provided the following examples of inspection, monitoring and evaluation processes employed at the site:

- MTW used a tablet-based ArcGIS application (Collector) which was also available to their contractors. The application recorded photos and details of inspections and environmental works, such as dates, locations and details of activities such as weed control, revegetation and seed application (including the seed mix), and topsoil, compost and gypsum application (including the types and rates applied to the area).
- A sample of inspections were observed by the audit team, noting no formal mechanism for following up actions (such as seeding and weed control) arising from environmental monitoring and inspections, although informally reported at managers meetings. This was raised earlier as suggestion for improvement no. 1.
- MTW noted their semi-formal inspection process included specific controls for emplacement of carbonaceous material based on design guidelines and principal hazard management plan available to the mine planners and supervisors. Planning for emplacement of carbonaceous material for the week would identify areas of the ‘dump’ suitable for carbonaceous material. Logistical support and dispatch were also used to determine where trucks were directed in the pit with ‘dumps’ locked out to prevent emplacement of reject material. Where operators identified carbonaceous material – the supervisor advised which ‘dumps’ were suitable and where materials were dumped elsewhere, an incident would be generated and responded to.
- Results of rehabilitation inspection and ecological monitoring programs were reported via annual reports. While there was no formal system for action tracking recommendations from these reports, recommendations were considered as part of corporate budgeting processes and to inform future work programs that were tracked by the person accountable for that aspect. While there was evidence to demonstrate that some of the recommendations from external

reports are actioned, there is potential for these actions to be missed. This was raised earlier as suggestion for improvement no. 2.

4.3. Subcontractor management

Many mines use contractors to undertake specialist tasks. While the responsibility for compliance or the implementation of environmental controls is often passed to the contractor, the lease holder will retain accountability for compliance with its lease conditions and other compliance obligations. It is important that the lease holder exercises management control of its contractors by specifying contract requirements, providing oversight of contracted works, and evaluating the performance of the contractor during the contracted works.

The audit team noted that subcontractor requirements and oversight was largely managed through the Pegasus System which stored records for employees and contractors and provided notifications where licencing, induction and training renewals were required.

MTW also employed a tablet-based field data collection system (Collector) which was available for contractors who undertook weed control and rehabilitation works and monitoring. The MTW Environment Team also undertook task observations to assess the implementation of works and to authorise payments following completion of work.

4.4. Record keeping

Sections 163D and 163E of the *Mining Act 1992* relate to the creation and maintenance of records required under the Act, Regulations, or a condition of title. Records must be kept in a legible form for production to any inspector and maintained for four years after the expiry or cancellation of the title.

Generally, records were available to demonstrate compliance with most requirements, including MOP requirements. Records requested during the audit were made available for the audit team to review. Examples of records sighted during the audit included:

- exploration drilling notifications
- MTW ground disturbance permit (GDP) system
- tablet-based ArcGIS field data collection system (collector) for inspections and environmental works such as weed control and rehabilitation works.
- Dendra portal and photo portal for recording rehabilitation inspections and works
- environmental incident reports
- rehabilitation monitoring records, including MTW rehabilitation inspection reports
- annual work plan
- training and licencing records maintained, and expiry details prompted via login point (Pegasus)
- annual groundwater reviews undertaken during the audit period (2020 and 2021)
- annual stream health and stability report undertaken during the audit period (2020 and 2021)
- Mount Thorley Warkworth historic heritage management plan 2020 compliance audit inspection, dated December 2020
- Mount Thorley Warkworth Aboriginal heritage management plan 2020 compliance audit inspection, dated February 2021
- waste records
- exploration reporting, and
- annual environmental reporting.

5. Audit conclusions

From the evidence reviewed during the audit, and observations made on site during the audit site inspections, it was concluded that MTW was generally compliant with the requirements of the mining lease and MOP in relation to the operations of MTW.

MTW has compliance management and monitoring systems in place however, further development of the compliance database to include corrective actions and findings from inspections and monitoring programs and statutory requirements under the *Mining Act 1992* and regulation and to address the regulatory reforms would be beneficial to promote a more robust approach to compliance management and monitoring of rehabilitation performance on site.

No non-compliances were identified during the audit. Three observations of concern and 3 suggestions for improvement were noted by the audit team, as summarised in Table 3 and Table 4. Regulatory actions may be undertaken in relation to the observations of concern identified during the audit.

Table 3 Summary of observations of concern

OBSERVATION OF CONCERN NO.	DESCRIPTION OF ISSUE	RECOMMENDATION
1	During the audit, the audit team noted the presence of potential AMD leachate (iron precipitants and efflorescence) within a layer in the western wall of the Loders Pit TSF.	MTW develop and implement standard business practices to identify and manage potentially hostile/carbonaceous materials within the mine plan.
2	During the site audit, the audit team noted significant presence of rhodes grass and acacia saligna across rehabilitation areas.	The use of exotic cover crops across inactive rehabilitation areas (such as the “Green Mile” emplacement area) provides further impacts for future rehabilitation and establishing native vegetation as required by the MOP and development consent. MTW should further investigate why rehabilitation has not been successful in these areas, and what strategies can be employed to reduce prevalence of weeds and improve native vegetation establishment.
3	The audit team observed putrescible wastes within the Remondis compost used in rehabilitation areas	MTW confirm the use of Remondis and Better Grow composts comply with EPA standards.

Table 4 Summary of suggestions for improvement

SUGGESTIONS FOR IMPROVEMENT	DESCRIPTION OF ISSUE
1	MTW should consider a formalised and regular inspection process for routine rehabilitation monitoring, outlining specific criteria to be monitored and the frequency required.
2	MTW should consider entering the corrective actions and findings from inspections, monitoring programs and recommendations from external consultant reports such as additional monitoring requirements, into the compliance database. This would provide a more robust system for tracking any

SUGGESTIONS FOR IMPROVEMENT	DESCRIPTION OF ISSUE
	actions identified and required, ensuring that issues are identified and responded to appropriately, with monitoring and follow-up actions implemented as part of a regular inspection process.
3	MTW should consider expanding the obligations in the compliance database to include statutory conditions and other obligations under the *Mining Act 1992* and regulation and to address the regulatory reforms, with the rehabilitation risk assessment and rehabilitation management plan actions included. This could also include other government agency compliance requirements – for example, appropriate burial depths of compost materials for final rehabilitation.