



MGO
MTOWEN/GLENDELLOPERATIONS
GLENCORE

ANNUAL REVIEW


1 January 2020 – 31 December 2020

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MT OWEN GLENDELL OPERATIONS

Annual Review 2020

Title Block

Name of operation	Mt Owen Glendell Operations
Name of operator	Mt Owen, Ravensworth East and Glendell Mines
Development consent/ project approval	MGO Mining Operations Plan (Mt Owen, Glendell and Ravensworth East), DA SSD-5850 (Mt Owen and Ravensworth East) and DA 80/952 (Glendell).
Name of holder of development consent/ project approval	Mt Owen Pty Limited
Mining lease and Exploration Lease #	Mt Owen & Rav East – CCL715, CL383, ML1355, ML1415, ML1419, ML1453, ML1475, ML1561, ML1608, ML1629, ML1673, ML1694, ML1741, ML1802, MLA512, MLA513, EL6254, EL5824, A268, A423, A429, AL08 Glendell – ML1629, ML1673
Name of holder of mining lease	Mt Owen Pty Limited
Mining lease and Exploration Lease #	Glendell – CL358, MPL343, ML1410, ML1476, EL6594, EL8184
Name of holder of mining lease	Glendell Tenements Pty Ltd
Water licence #	Refer list provided in Table 31
Name of holder of water licences	Mt Owen Pty Limited
MOP/ RMP start date	January 2020
MOP/ RMP end date	June 2024
Annual Review start date	01/01/2020
Annual review end date	31/12/2020
<p>I, Jason Desmond, certify that this audit report is a true and accurate record of the compliance status of Mt Owen Glendell Operations for the period 01/01/2020 to 31/12/2020 and that I am authorised to make this statement on behalf of Mt Owen Glendell Operations.</p> <p><i>Note.</i></p> <p>a) <i>The Annual Review is an 'environmental audit' for the purposes of section 122B (2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
Name of authorised reporting officer	Jason Desmond
Title of authorised reporting officer	Environment and Community Manager
Signature of authorised reporting officer	
Date	31/03/2021

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1 Executive Summary and Statement of Compliance

1.1 Executive Summary

This Annual Review ('the report') is for the period of 01 January 2020 to 31 December 2020. It is required under:

- Schedule 5, Condition 5, of Development Approval SSD-5850 (MTO and Ravensworth East)
- Schedule 5, Condition 5, of Development Approval 80/952 (Glendell).

The report has been prepared in accordance with the NSW Department of Planning and Environment (DP&E) Annual Review Guideline, dated October 2015.

Mt Owen Glendell Operations (MGO) produced a total of 12.82 Million tonnes of run of mine (ROM) coal during the reporting period. In 2020, Product Coal totalled 7.48 Million tonnes (see [Table 1](#)).

Table 1: Summary of ROM and Product Coal

Site	2020 ROM Coal (Mt)	ROM Consent Limit (Mt)	2020 Product Coal (Mt)
Mt Owen	8.06	10	4.46
Glendell	3.56	4.5	2.19
Ravensworth East	1.20	4	0.83
Total	12.82	17*	7.48

*Only 17 million tonnes of ROM Coal allowed to be processed via CHPP in a calendar year as per SSD-5850

A total of 860 trains were loaded during the reporting period, with 7.39 Mt of the 7.48Mt Product Coal railed from site (Approximately 0.09Mt stockpiled at year end).

On 30 January 2020 DPIE approved Mt Owen Continued Operations Modification 3 (SSD-5850) and on 4 March 2020 DPIE approved Glendell DA80/952 Modification 4.

On 14 April 2020 DPIE RR approved MGO MOP Amendment A for the period 2020-June 2024 and on 18 December 2020 DPIE RR approved MGO MOP Amendment B for the period 2020-June 2024.

Air Quality

Late 2019 coincided with a period of unprecedented bushfires in Australia that continued into January and February of 2020. These conditions adversely affected air quality across many parts of NSW and a total of 24 days in 2020 were subsequently declared as extraordinary events. Measurements of PM₁₀, PM_{2.5}, TSP and deposited dust were compared to the short and long term impact assessment criteria from the Mt Owen and Glendell development consents. It was determined that Mt Owen Glendell Operations was in compliance with its development consents (DA 80/952 and SSD-5850) in terms of air quality impacts at all reportable monitoring sites for data collected in 2020.

Predictions of air quality from the latest environmental assessment of the approved operation were compared to the measurement results. The comparisons showed that predicted PM₁₀, TSP and deposited dust levels were generally higher than the 2020 measurement results. This outcome reflected the generally conservative nature of air quality models as well as the increase in rainfall that was observed in 2020.

Water

The Surface Water Management and Monitoring Plan (SWMMP), Groundwater Management and Monitoring Plan (GWMMP), Erosion and Sediment Control Plan, Creek Diversions Plan and Surface Water and Groundwater Response Plan (SWGWRP) were all revised and approved by DPIE in 2020.

In 2020, there were a number of monitoring results that exceeded baseline trigger levels for the creek's at MGO. The sites that triggered SWMMP criteria in 2020 were internally reviewed in accordance with the 2020 SWGWRP. These reviews confirmed that external reporting of these results was not required in line with the SWGWRP.

Stream condition at Bowman's Creek, Swamp Creek and Betts creek remained stable in classification to that of 2019. There was either no change or a slight decrease in stream health at Yorks Creek from 2019. At Main Creek, stream health remained constant or slightly improved compared to 2019. Creek diversions onsite undergo quarterly condition monitoring and annual stream stability and stream health assessments. Outcomes of Creek monitoring show mixed results, with decreased conditions, improved conditions, or no change. Generally an improvement in vegetation cover was noted due to high rainfall being received.

MGO monitor groundwater level and quality for 98 groundwater monitoring bores as per the MGO GWMMP. Monitoring results for a number of bores exceeded the decline in level (drawdown) during 2020. Review of water quality results and comparison to trigger levels for EC and pH identified several trigger exceedances in 2020. Generally, these exceedances were either in line with historical trends or correlated with groundwater conditions recovering from several years of drought conditions.

Biodiversity

MGO completed its third round of monitoring on its Conservation Agreements (CAs) Offsets with overall good composite value scored throughout the offsets, the report also provided recommended actions to be completed in 2021.

In addition, comprehensive fauna and flora monitoring surveys were conducted at MGO offsets in 2020, identifying a new bird species, the Wonga Pigeon in the North West Offset. Eight threatened species were recorded in 2020, which included 3 birds, 3 terrestrial/arboreal mammals and 2 microbat species. The Spotted-tail Quoll, Squirrel Glider and Brush-tailed Phascogale were recorded by either remote camera monitoring or nest box occupation.

A total of 78 new nest boxes and 5 log habitat structures were installed at MGO in 2020 (throughout the biodiversity offsets and on site). Of the 295 total nest boxes there was an occupation rate of 15.2% in 2020.

The weed action plan implemented in 2018 continued in 2020, with targeted weed control continuing across MGO offsets and rehabilitation areas. The targeted wild dog and fox baiting program continued in the MGO offsets during the report period. The program consisted of a seasonal '1080' baiting program undertaken in Autumn (May) and Spring (October) across on-site Biodiversity Offset Areas (BOAs) and monthly canid ejector bait program across off-site BOAs.

Noise

The noise monitoring program for MGO incorporates both continuous noise monitors and attended noise monitoring. During the attended noise monitoring, there was one non-compliance, where the Mt Owen mine exceeded the nominated criteria during applicable meteorological conditions. The exceedance occurring in June was reported to the relevant agencies and no further action was requested. The applicable noise criteria and the predicted noise levels are the same for each of the monitoring locations and therefore the comparison with the criteria also demonstrates a comparison with the predicted noise levels. Results do not appear to indicate any trends in the data.

During 2020 MGO continued to develop the Noise Analysis Tool (NAT), to allow enhanced separation of noise contribution, which assists Mining Supervisors to plan and modify operational controls in adverse noise conditions.

Blasting

There was a decrease in the number of blasts during 2020, a total of 238 blasts occurred at MGO compared to 248 in 2019. 2020 blasting consisted of 90 blasts at Mt Owen, 110 blasts at Glendell and 38 blasts at Ravensworth East. No blasting was undertaken in the North Void. MGO recorded no non-compliances with the Blast Management Plan during 2020.

Heritage

Inspections were carried out during the 2020 reporting period for Aboriginal and European cultural heritage sites, in accordance with the Ground Disturbance Permit process. In 2020 MGO, in conjunction with two Registered Aboriginal Parties (RAPs) and an OzArk archaeologist, continued the monitoring of Aboriginal heritage sites across both MGO and Integra Underground. During this reporting period, four Aboriginal sites were salvaged, one site was fully salvaged and two others had specific segments salvaged to allow for mining under DA 80/952. One other site was attempted to be salvaged for mining under SSD-5850 however the artefact could not be located and the site was determined to be destroyed by the RAPs and archaeologist. Artefacts salvaged were taken to Umwelt as agreed with the RAPs. Artefacts salvaged are under the care of MGO and will be housed in the storage facility at the Wollombi Brook Conservation Agreement Area once building has been completed in 2021. There were no environmental incidents relating to Aboriginal heritage in 2020.

During the reporting period MGO continued to care for Ravensworth Homestead and undertake quarterly monitoring of European sites. In 2020, the former Ravensworth Public School underwent demolition works and became a managed ruin. Unfortunately, on the 15 April 2020, Hebden Public School burnt down due to a suspected arson attack. On the 26 August 2020, the damaged school remains were dismantled and disposed of.

Rehabilitation

Rehabilitation continued across MGO during 2020 generally in accordance with the Rehabilitation Management Plan (RMP) / Mining Operations Plan (MOP). Glendell completed 56.5ha of rehabilitation during 2020 including 35.1 ha of open grassland or pasture areas and 21.4 ha of open woodland areas. In 2020 Mt Owen rehabilitated a total of 38 ha of open forest rehabilitation. This included 13.2 ha of the natural landform design technique being incorporated at Mt Owen North Pit.

Rehabilitation across MGO was generally stable and no critical erosion features were identified. Some erosion features were identified during the 2020 monitoring which will require monitoring and or maintenance. Weed incursion has been identified as the main issue for rehabilitation impacts at MGO. The results from the 2020 monitoring also highlighted the requirement in some areas for increases and decreases in existing stem densities and lower and mid storey vegetation depending on existing performance condition. The management of these requirements is also ongoing and targeted based on the outcomes of annual monitoring recommendations so that improvement trends can be monitored overtime.

While there are localised issues with rehabilitation performance identified across the site (which in most cases could be successfully controlled/ treated in the next reporting period), established rehabilitation at MGO generally showed good performance in 2020 following improved rainfall conditions compared to the drought conditions of the previous several years.

Environmental Incidents

MGO recorded 56 environmental incidents during the reporting period, compared to 44 environmental incidents in 2019. One incident was classified as category 2, thirty six as category 1, and nineteen were classified as nil category . Of the 36 Category 1 incidents, there were 26 hydrocarbon spills less than 1000 L, one noise exceedance, three blast fume related events, one illegal dumping incident, one Ground Disturbance Permit breach, one erosion related event, one water incident, one spontaneous combustion incident and one fire incident. Contaminated material from hydrocarbon spill related incidents was collected and taken to the bioremediation area at Glendell and Mt Owen for treatment.

Community Complaints and Consultation

During 2020, four community complaints were recorded at MTO. The complaints consisted of one relating to noise and three relating to blast vibrations. Responses were quickly provided for the complaints where complainants were not anonymous and the blast parameters were explained. Glendell and Ravensworth East received a total of 12 community complaints consisting of 10 relating to noise, one for blast dust and one relating to air quality. Two Community Consultative Committee (CCC) meetings and four Community Gatherings were held during 2020. The May 2020 CCC meeting was held via Webex due to site Covid-19 controls being enforced.

Visual Impact

MGO undertook direct seeding and tube stock planting works in September 2019 as part of the development of the Middle Falbrook Tree Screening as described in MOCO MOD 2. Seeding works utilised a mix of species endemic to the local area. Preparatory weed control, ripping and fencing works were also undertaken during the reporting period prior to planting.

In 2020, additional direct seeding and tube stock planting was completed which the screen demonstrated great ground cover with evidence of thriving saplings. MGO will continue to monitor and manage the development of the tree screen during the next reporting period in accordance with Schedule 3 Condition 39A of SSD-5850.

Demolition Works

During the reporting period, two properties were demolished which comprised of Former Hebden Public School and Ravensworth's Primary School (as mentioned in heritage section above). Approximately 20.84 tonnes of waste was removed from the site including

8.34 tonnes of mixed waste and 12.5 tonnes of Asbestos contaminated soil was removed from Hebden public school. For Ravensworth Public School, approximately 415.6 tonnes of waste was removed from the site including 38.24 tonnes of mixed waste, 308.18 tonnes of concrete waste, 69.18 tonnes of asbestos material.

In 2021, demolition works are planned to improve visual amenity on Glennies Creek Road. Two dilapidated houses are planned to be demolished and all waste is to be removed from site.

Independent Audit

An independent environmental audit as required by the approvals was conducted by Jacobs at MGO during December 2020. The audit covered the reporting period 31 October 2017 to 2 December 2020, and consisted of a desktop review of documentation, interviews with key MGO staff, and a field inspection. The audit identified 7 non-compliance recommendations with no 'high-risk' non-compliances were identified. All 7 issues were classified as administrative in nature. The audit report was submitted to DPIE in February 2021, at the time of this report feedback is yet to be received.

1.2 Statement of Compliance

Mt Owen/Glendell Operations (MGO) incorporates:

- Mt Owen Open Cut Mine (MTO), including the MGO Coal Handling and Preparation Plant (CHPP)
- Glendell Open Cut Mine
- Ravensworth East Open Cut Mine.

During the reporting period, each operation functioned under their own development consent and Environment Protection Licence (EPL), together with Mining Leases (MLs) and secondary approvals, such as management plans and water licences.

MGO holds over 100 approvals, containing more than 2,000 conditions. **Table 2** summarises the state of compliance against the site's major approvals during 2020. Non-compliances are listed in **Table 3** and detailed in later sections of this report.

Table 2: Statement of Compliance for 2020

Relevant Approvals	Compliance
MOC Mining Operations Plan (Mt Owen, Glendell and Ravensworth East)	Yes
DA SSD-5850 (Mt Owen / Ravensworth East)	No
DA 80/952 (Glendell)	Yes
EPBC 2013/6978	Yes
Mt Owen EPL 4460	No
Glendell EPL12840	Yes
CCL0715	Yes
CL0358	Yes
CL0382	Yes
CL0383	Yes

Relevant Approvals	Compliance
ML 1355	Yes
ML 1419	Yes
ML 1453	Yes
ML 1561	Yes
ML 1475	Yes
ML 1608	Yes
ML 1410	Yes
ML 1415	Yes
ML 1476	Yes
ML 1694	Yes
ML 1629	Yes
ML 1741	Yes
ML 1794	No
MPL 343	Yes
EL5824	No
EL6594	Yes
EL8184	Yes
Water Licences	Yes

Table 3: Non-Compliances

Relevant Approval	Condition #	Condition Description	2020 Compliance Status	Comment	Annual Review Section
DA SSD-5850*	Schedule 5, Condition 9A	Breach of operational noise conditions – June 2020	Non-Compliant	N1 Noise Exceedance. DPIE & EPA notified.	Section 11

*Non-compliance also reported to EPA as a breach against EPL 4460, condition L3.1, noise operating criteria.

Compliance status key for Table 2:

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with: <ul style="list-style-type: none"> potential for serious environmental consequences, but is unlikely to occur; or potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with: <ul style="list-style-type: none"> potential for moderate environmental consequences, but is unlikely to occur; or potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-Compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

1.3 Statutory Requirements

Various statutory approvals stipulate the requirements related to this Annual Review. These requirements are summarised in Table 4.

Table 4: Statutory Requirements

Approval	Condition	Relevant Section of Document
<p>Development Consents SSD-5850 (Mt Owen and Ravensworth) and 80/952 (Glendell), Schedule 5, Condition 5</p>	<p>By the end of March each year, or as otherwise agreed with the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Secretary. This review must:</p> <p>(a) describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;</p> <p>(b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against the:</p> <ul style="list-style-type: none"> • relevant statutory requirements, limits or performance measures/criteria; • monitoring results of previous years; and • relevant predictions in the documents listed in condition 2(a) of Schedule 2 or 3; <p>(c) identify any non-compliance or incident over the past year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;</p> <p>(d) identify any trends in the monitoring data over the life of the development;</p> <p>(e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and</p> <p>(f) describe what measures will be implemented over the next year to improve the environmental performance of the development.</p>	<p>(a) 4, 6, 7, 8 (b) 6, 7, 8, 9 (c) 1, 11 (d) Various (e) Various (f) Various</p>
<p>Development Consent 80/952 (Glendell), Schedule 4, Condition 7</p>	<p>Continuous Improvement 7. The Applicant must:</p> <p>(a) implement all reasonable and feasible best practice noise mitigation measures;</p> <p>(b) investigate ways to reduce the noise generated by the development, including maximum noise levels which may result in sleep disturbance; and</p> <p>(c) report on these investigations and the implementation and effectiveness of these measures in the Annual Review.</p>	<p>6</p>
<p>Development Consent 80/952 (Glendell), Schedule 4, Condition 46</p>	<p>Monitoring of Coal Transport 46. The Applicant must keep records of the amount of coal transported from the site each year, and include these records in the Annual Review.</p>	<p>4.3.1 and Appendix B</p>
<p>Development Consent 80/952 (Glendell), Schedule 4, Condition 52</p>	<p>The Applicant must ... (e) report on waste management and minimisation in the Annual Review, ...</p>	<p>4.3.2</p>
<p>Development Consent SSD-5850 (Mt Owen and Ravensworth) Schedule 3, Condition 41</p>	<p>The Applicant must ... (d) monitor and report on the effectiveness of the waste minimisation and management measures in the annual review referred to in condition 5 of Schedule 5.</p>	
<p>Development Consent SSD-5850 (Mt Owen and Ravensworth) Schedule 3, Condition 26</p>	<p>Water Management Plan The Applicant must ... (vii) a protocol to report on the measures, monitoring results and performance criteria identified above, in the annual review referred to in condition 5 of Schedule 5.</p>	
<p>Development Consent SSD-5850 (Mt Owen and Ravensworth) Schedule 3, Condition 18</p>	<p>Air Quality Operating Conditions The Applicant must: ... (h) carry out regular monitoring to determine whether the development is complying with the relevant conditions of this consent, and report on this in the annual review referred to in condition 5 of Schedule 5.</p>	<p>6.3 and Appendix F</p>
<p>Development Consent SSD-5850 (Mt Owen and Ravensworth) Schedule 3, Condition 31</p>	<p>Biodiversity Management Plan The Applicant must ... report on the effectiveness of the above measures against the periodic performance and completion criteria, as part of the annual review referred to in condition 5 of Schedule 5</p>	<p>6.4</p>

Approval	Condition	Relevant Section of Document
Development Consent SSD-5850 (Mt Owen and Ravensworth) Schedule 3, Condition 45	Rehabilitation Management Plan The Applicant must ... include a program to monitor, independently audit and report on the effectiveness of the measures in paragraph (h) above, and progress against the detailed performance and completion criteria in paragraph (g) above (at a minimum these reporting requirements must be included as part of the annual review referred to in condition 5 of Schedule 5)	8
Exploration Licence EL8184, Conditions 043 and 044	043. The licence holder must submit an Environmental Management Report to the Department in the following circumstances: a) where the licence holder is seeking to renew this exploration licence, an Environmental Management Report must accompany an exploration licence renewal application; or b) where the licence holder is seeking to cancel or part cancel this exploration licence, an Environmental Management Report must accompany an exploration licence cancellation application; c) where the licence holder is not seeking to renew or cancel this exploration licence, and Environmental Management Report must be submitted prior to the expiry of this exploration licence. 044. The report must be prepared in accordance with any Director-General's requirements for environmental and rehabilitation reporting on exploration licences and include information on all disturbance resulting from prospecting operations and rehabilitation carried out within the exploration licence area. The report must be prepared to the satisfaction of the Director-General.	043. Entire document 044. Entire document
Mining Tenement CCL0715, Schedule 00 Conditions 004 and 005	004. The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director-General. 005. The EMR must: a) report against compliance with the MOP; b) report on progress in respect of rehabilitation completion criteria; c) report on the extent of compliance with regulatory requirements; and d) have regard to any relevant guidelines adopted by the Director-General.	004. Entire document 005. a) 8 b) 8 c) Entire document d) Entire document
Mining Tenement CL0358, Schedule 00 Condition 004	The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director-General. The EMR must: i) report against compliance with the MOP; ii) report on progress in respect of rehabilitation completion criteria; iii) report on the extent of compliance with regulatory requirements; and iv) have regard to any relevant guidelines adopted by the Director-General.	i) 8 ii) 8 iii) Entire document iv) Entire document
Mining Tenements ML1410, ML1415, ML1453, ML1475, ML1476, ML1561, Schedule 00 Conditions 003.01 and 003.02	003.01. Within 12 months of the commencement of mining operations and thereafter annually or, at such other times as may be allowed by the Director-General, the lease holder must lodge an Annual Environmental Management Report (AEMR) with the Director-General. 003.02. The AEMR must be prepared in accordance with the Director-General's guidelines current at the time of reporting and contain a review and forecast of performance for the preceding and ensuing twelve months in terms of:- a) the accepted Mining Operations Plan; b) development consent requirements and conditions; c) Environment Protection Authority and Department of Land and Water Conservation licences and approvals; d) any other statutory environmental requirements; e) details of any variations to environmental approvals applicable to the lease area. and f) where relevant, progress towards final rehabilitation objectives.	003.01 Entire document 003.02 a) 8 b) Various c) Various d) Various e) 4.2 f) 8
Mining Tenements ML1608 and ML1629, Schedule 00 Conditions 04 and 05	04. The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director-General. 05. The EMR must: - report against compliance with the MOP; - report on progress in respect of rehabilitation completion criteria; - report on the extent of compliance with regulatory requirements; and - have regard to any relevant guidelines adopted by the Director-General.	04. Whole document 05. - 8 - 18 - Entire document - Entire document

Approval	Condition	Relevant Section of Document
Mining Tenements ML1694 and MP0343, Schedule 00 Condition 04	The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director-General. The EMR must: (i) report against compliance with the MOP; (ii) report on progress in respect of rehabilitation completion criteria; (iii) report on the extent of compliance with regulatory requirements; and (iv) have regard to any relevant guidelines adopted by the Director-General.	i) 8 ii) 18 iii) Entire document iv) Entire document

2 Introduction

Mt. Owen/Glendell Operations (MGO) comprises of (see **Error! Reference source not found.** and **Error! Reference source not found.**):

- Mt Owen Open Cut Mine (MTO), including the MGO Coal Handling and Preparation Plant (CHPP)
- Glendell Open Cut Mine (Glendell)
- Ravensworth East Open Cut Mine (Ravensworth East)

This Annual Review ('the report') is prepared for the reporting period 01 January 2020 to 31 December 2020. The report has been prepared in accordance with the NSW Department of Planning and Environment (DP&E) Annual Review Guideline, dated October 2015. It covers the reporting requirements of:

- Development consent (DA) SSD-5850 for MTO and Ravensworth East
- DA 80/952 for Glendell
- Associated approvals, mining and exploration leases, and environmental management plans.

Mt. Owen/Glendell Operations (MGO)

MGO is located on Hebden Road at Ravensworth, approximately 20 km north-west of Singleton, NSW. MGO is owned and managed by Mt Owen Pty Limited (Mt Owen), which is a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore). MTO is operated by Thiess Proprietary (Pty) Limited (Ltd) (Thiess).

Mt Owen Open Cut Coal Mine (MTO)

Mining operations at MTO began in 1993 under the management of Hunter Valley Coal Corporation Pty Limited (HVCC). Xstrata (now Glencore) acquired MTO in 2003. MTO was granted DA 14-01-2004 in December 2004, which was supported by the MTO Environmental Impact Statement (EIS), December 2003 (Umwelt, 2003).

A modification to DA 14-1-2004 was approved in December 2010. This allowed for the construction and operation of a rail facility on the MTO rail loop. Further modification was approved in 2014 to increase the CHPP to 17 Million tonnes per annum (Mtpa) run-of-mine (ROM) coal equivalent from MTO, Glendell and Ravensworth East.

In January 2018 an application was made to DP&E to surrender DA 14-01-2004 as it is replaced by DA SSD-5850. Approval to surrender DA 14-01-2004 was received from DP&E on 29 May 2018.

Mount Owen Continued Operations (MOCO)

Mount Owen Continued Operations (MOCO), the continued operation of both MTO and Ravensworth East, was granted DA SSD-5850 in November 2016. The approval was supported by the MOCO EIS, January 2015 (Umwelt, 2015).

A modification to DA SSD-5850 was approved in August 2017 to allow for the inclusion of the Greater Ravensworth Water Sharing Scheme (GRAWTS), and the construction of a water pipeline from Integra Underground Mine to MGO.

A second modification to DA SSD-5850 was approved September 2019 to allow an increased disturbance area and extend mining operations to 31 December 2037. A third modification to SSD-5850 was approved January 2020 which was an administrative modification in which a land parcel was included within the Schedule of Land.

Glendell Open Cut Coal Mine

Glendell was granted DA 80/952 in May 1993.

The DA was modified in 1997 to enable the extraction of coal from an undeveloped coal reserve, totalling 3.6 Mtpa of ROM coal. The modification allowed for the construction of a CHPP and the MTO rail loop, and for Glendell to be integrated into the MOC. A further modification of the DA 80/952 was undertaken in February 2008. This was to allow for mining operations to continue until the end of June 2024, and to permit extraction of up to 4.5 Mt of ROM coal annually. Modification 3 of DA 80/952 was approved in late 2016. The modification permits the relocation of a section of the 132 kilovolt (kV) powerlines, to allow for the continuation of mining in the Barrett Pit.

A fourth modification to DA80/952 was approved in March 2020 which is an extension to the approved Barrett pit shell to access additional ROM coal and to install a western haul road under the existing approval.

Ravensworth East Open Cut Coal Mine

Ravensworth East was acquired in 1997 by Peabody Resources Ltd. In March 2000, DA 52-03-99 was granted. This was to enable production of up to 4 Mtpa. This allowed mining operations to commence in August 2000 and continue for up to 21 years.

Enx Resources (now Glencore) purchased Ravensworth Operations Pty Ltd in March 2002. The operation included the Ravensworth East and Narama mines. A mining operations plan (MOP) was granted in December 2002, which allowed for the transport and processing of coal from Ravensworth East to the MTO CHPP. Modification to the DA in 2005 allowed the integration of Ravensworth East with MTO.

In 2016, Modification 6 to the DA was approved. This allowed an integrated tailings management strategy between Liddell Operations, Ravensworth Operations and the MOC.

In January 2018 an application was made to DP&E to surrender DA 52-03-99 as Ravensworth East has been included in SSD-5850. Approval to surrender DA 52-03-99 was received from DP&E on 29 May 2018.

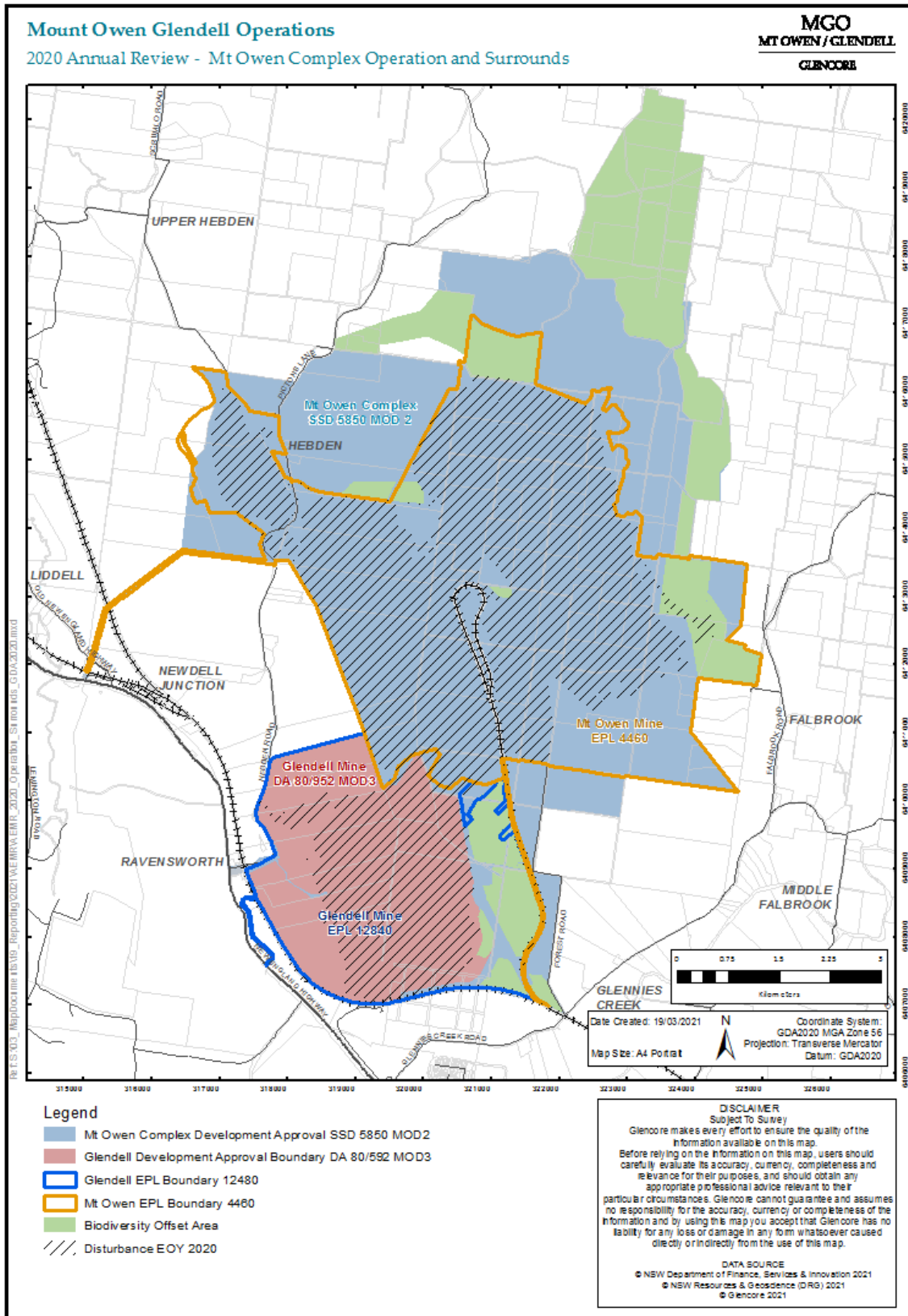


Figure 1: Mt Owen/Glendell Operations Overview and Disturbance as of 31 December 2020

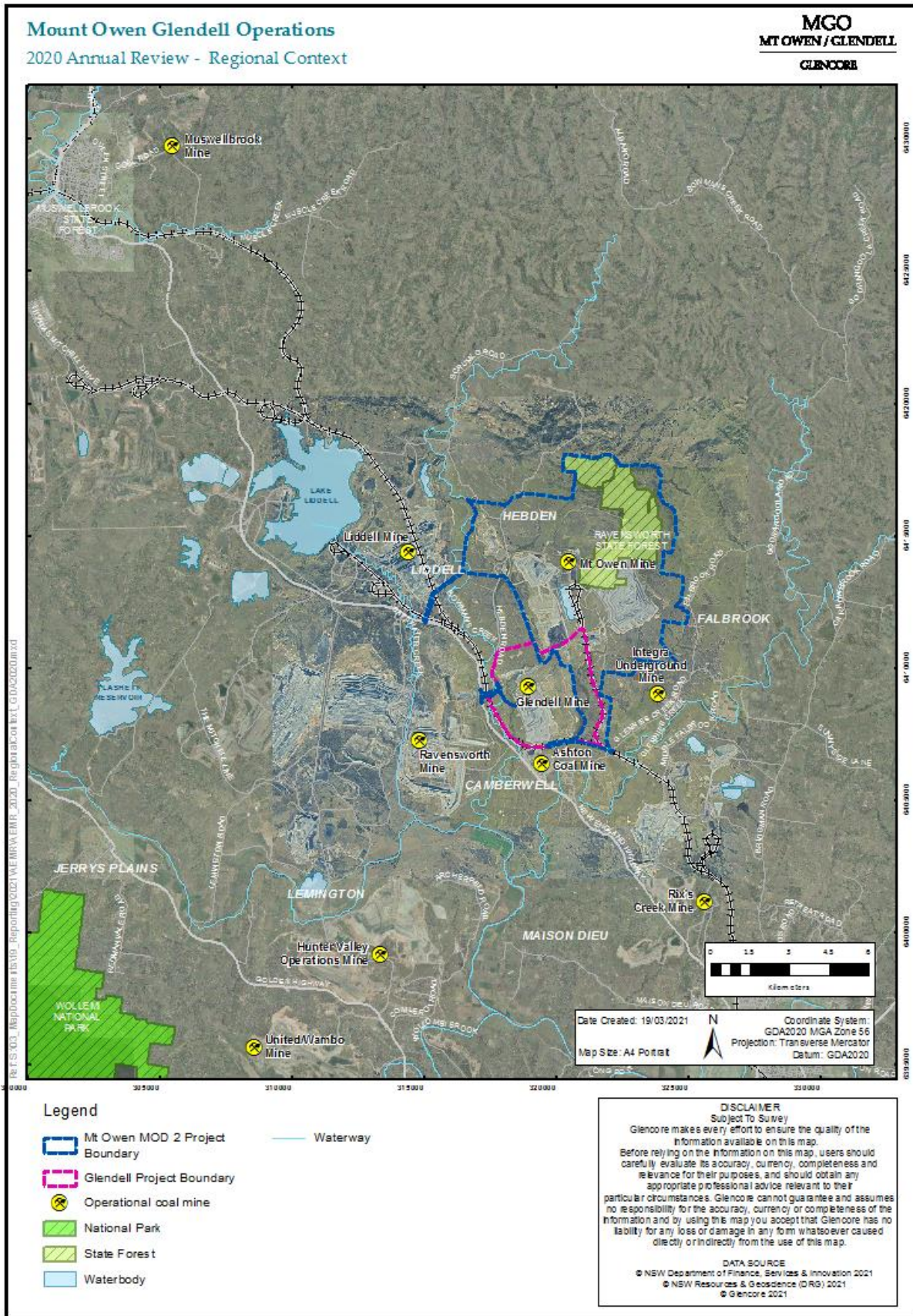


Figure 2: MGO Overview – Regional Context

Mine Contacts

Mine contacts are provided in [Table 5](#).

Table 5: MGO Contact Details

Name	Position Held	Contact Details
Mt Owen Glendell Operations Management		
Geoff Kelly	Mt Owen / Glendell Operations – Operations Manager	(02) 6520 2601
Jeroen Hendricks	Thiess Operations Manager	(02) 6570 0811
Jason Desmond	Environment and Community Manager	(02) 6520 2693
General Contact Details		
Mt Owen / Glendell Operations		Street Address: 158 Hebden Road Ravensworth NSW 2330 Postal Address: PO Box 320, Singleton NSW 2330 Phone: 02 6570 0800 Facsimile : 02 6576 1643 24-hour Community Hotline: 1800 730 883 24-hour Blasting Hotline: 1800 319 566 Emergency Response Line: 1800 248 745 Website: www.mtovencomplex.com.au

3 Approvals

MGO operates under a number of approvals and licences which are summarised in [Table 6](#) and illustrated in [Figure 3](#).

Updates to MGO approvals throughout the 2020 reporting period included:

- 30 January 2020 - Mt Owen SSD-5850 Modification 3 was approved by DPIE. This approval was an administrative modification in which a land parcel was included within the Schedule of Land. 4 March 2020 – Glendell DA80/952 Modification 4 was approved by DPIE. This approval allowed for an extension to the approved Barrett pit shell to access additional ROM coal and to install a western haul road under the existing approval.
- 14 April 2020 - MGO MOP Amendment A for the period 2020-June 2024 was approved by DPIE RR until 31 December 2020. This MOP Amendment incorporated the Glendell Mod 4 approval.
- 18 December 2020 – MGO MOP Amendment B for the period 2020-June 2024 was approved by DPIE RR until 30 June 2024. This MOP Amendment incorporated the reduction of mining within the Ravensworth East mining area.

As at 31 December 2020 MGO approvals awaiting determination:

- Mt Owen SSD-5850 Modification 4 awaiting DPIE approval. This modification relates to the amalgamation of SSD-5850 with Glendell Continued Operations Project (GCOP) (SSD-9349).
- Mt Owen SSD-5850 Modification 5 awaiting DPIE approval. This modification is administrative to remove the TSR Biodiversity Offset and seek alternative offset arrangements.
- Mt Owen SSD-5850 Modification 6 awaiting DPIE approval. This modification is for the realignment of the Mt Owen to Ravensworth water pipeline under GRAWTS to run along the southern extent of Glendell Barrett Pit. The existing pipeline is north of the current operation within the GCOP project footprint.

Table 6: MGO Approval Conditions

Consent Number	Consent Description	Date Granted	Expiry Date
MGO MOP (Mt Owen, Glendell and Ravensworth East)	Mt Owen Complex Mining Operations Plan (Mt Owen, Glendell and Ravensworth East)	18/12/2020	30/06/2024
DA SSD-5850 (Mt Owen and Ravensworth East)	Development Approval SSD-5850	03/11/2016	31/12/2037
EPBC 2013/6978	Environment Protection and Biodiversity Conservation (EPBC) Act approval 2013/6978	19/01/2017	31/12/2037
WA 20WA210940	Water Supply Works	01/08/2009	31/07/2029
WA 20WA211430	Water Approval (Water Supply Works) – Swamp Creek Lower Diversion	01/05/2008	31/07/2022
WA 20WA211425	Water Supply Works – Swamp Creek Middle Diversion	01/08/2009	31/07/2022
WA 20WA211429	Water Supply Works – Yorks Creek Diversion	16/05/2007	15/05/2023
WA 20WA212660	Water Approval (Water Supply Works) – Bettys Creek Lower Diversion	11/02/2013	07/02/2023
WA 20WA212187	Water Supply Works – Bettys Creek Upper and Middle Diversion	01/08/2009	17/10/2022
ML 1355	Mining Lease	30/06/2014	23/07/2036
ML 1419	Mining Lease	02/02/2015	12/11/2033
ML 1561	Mining Lease	16/02/2005	16/02/2026

Consent Number	Consent Description	Date Granted	Expiry Date
ML 1608	Mining Lease	18/12/2007	19/12/2028
ML 1794	Mining Lease	16/07/2019	31/12/2031
ML 1802	Mining Lease		30/03/2041
CL 383	Coal Lease	26/06/2014	12/11/2033
CL 358	Coal Lease	26/03/1990	27/03/2032
A 268	Exploration Authorisation	13/09/2017	25/08/2022
EL5824	Exploration Licence	14/11/2016	Perpetuity
EL 6254	Exploration Licence	06/07/2020	04/06/2021
EL8916	Exploration Licence	02/12/2019	05/12/2022
Section 126 (Stages 1 and 2)	Emplacement Approval	7/11/1996	N/A
Section 126 (Stages 3 and 4)	Emplacement Approval	23/12/2003	N/A
EPL 4460	Environment Protection Licence 4460 (Mt Owen and Ravensworth East)	17/08/2017	02/09/2019 (Review Date)
MGO Drilling fluid order & exemption	Environment Protection Licence	27/11/2020	27/05/2021
WAL7823	Water Licence (Domestic and Stock)	17/05/2010	Perpetuity
WAL7826	Water Licence (Domestic and Stock)		Perpetuity
WAL754	Water Licence (Domestic and Stock)	01/07/2004	Perpetuity
WAL7817	Water Licence (Domestic and Stock)	17/10/2011	Perpetuity
WAL13324	Water Licence (Domestic and Stock)	20/08/2019	Perpetuity
WAL11084	Water Licence (Domestic and Stock)	01/07/2004	30/06/2027
WAL7814	Water Licence (High Security)	15/03/2011	Perpetuity
WAL41542	Water Licence (General Security)		Perpetuity
WAL41540	Water Licence (General Security)		Perpetuity
20BL168116	Groundwater Licence – Monitoring Bore	15/06/2001	Perpetuity
20BL169332	Groundwater Licence – Monitoring Bore	24/08/2004	Perpetuity
20BL169333	Groundwater Licence – Monitoring Bore	24/08/2004	Perpetuity
20BL169334	Groundwater Licence – Monitoring Bore	24/08/2004	Perpetuity
20BL169335	Groundwater Licence – Monitoring Bore	24/08/2004	Perpetuity
20BL169336	Groundwater Licence – Monitoring Bore	24/08/2004	Perpetuity
20BL171536	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity

MT OWEN GLENDELL OPERATIONS

Annual Review 2020

Consent Number	Consent Description	Date Granted	Expiry Date
20BL171538	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171539	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171540	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171541	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171544	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171546	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171542	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171534	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171707	Groundwater Licence – Monitoring Bore	17/08/2007	Perpetuity
20BL171543	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171545	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL169544	Saline Water Excavation Bore	24/02/2005	Perpetuity
DA 80/952	Development Approval 80/952	01/12/2016	30/06/2024
WA 20WA201228	Water Approval (Water Supply Works)	01/07/2004	30/06/2027
WA 20WA201868	Water Approval (Water Supply Works)	01/07/2004	05/01/2028
WA 20WA210993	Water Supply Works – Swamp Creek Upper Diversion	01/08/2009	31/07/2022
WA 20WA215076	Water Approval (Water Supply Works)	01/07/2016	Perpetuity
WA 20WA201499	Water Approval (Water Supply Works)	01/06/2004	30/06/2027
WA 20WA201677	Water Supply Works	01/07/2004	28/06/2028
WA 20WA200727	Water Supply Works	01/07/2004	08/10/2028
MPL 343	Mining Purposes Lease	16/06/1996	04/01/2026
ML 1629	Mining Lease	08/03/2009	09/03/2030
ML 1673	Mining Lease		11/11/2033
ML 1741	Mining Lease		Perpetuity
ML 1475	Mining Lease	23/11/2000	23/11/2021
ML 1476	Mining Lease	23/11/2000	23/11/2021
ML 1694	Mining Lease	21/10/2013	22/10/2034
EL 8916	Exploration Licence	4/12/2019	2/12/2022
EPL 12840	Environment Protection Licence 12840	17/08/2017	18/11/2019 (Review Date)
WAL704	Water Licence (High Security)	02/05/2008	Perpetuity
WAL1118	Water Licence (High Security)	02/05/2008	Perpetuity

Consent Number	Consent Description	Date Granted	Expiry Date
WAL9521	Water Licence (High Security)	22/05/2008	Perpetuity
WAL612	Water Licence (General Security)	02/05/2008	06/02/2029
WAL637	Water Licence (General Security)	02/05/2008	Perpetuity
WAL613	Water Licence (General Security)	01/07/2004	Perpetuity
WAL705	Water Licence (General Security)	02/05/2008	Perpetuity
WAL1119	Water Licence (General Security)	02/05/2008	Perpetuity
WAL1215	Water Licence (General Security)	02/05/2008	Perpetuity
WAL1420	Water Licence (Supplementary Water)	02/05/2008	Perpetuity
WAL706	Water Licence (Domestic and Stock)	23/03/2005	Perpetuity
WAL1218	Water Licence (Domestic and Stock)	31/03/2005	Perpetuity
WAL41521	Water Licence (General Security)		Perpetuity
WAL13750	Water Licence (General Security)	20/10/2006	19/10/2026
WAL41526	Water Licence (General Security)	01/07/2016	30/06/2029
WAL18000	Water Licence (General Security)	20/08/2019	Perpetuity
WAL18310	Water Licence (Unregulated)	16/05/2014	Perpetuity
20CA200608	Water Licence (Water Supply Works and Water Use)	01/07/2004	30/06/2027
20CA200382	Water Licence (Water Supply Works and Water Use)	01/07/2004	06/02/2019
20CA200445	Water Licence (Water Supply Works and Water Use)	01/07/2004	30/06/2027
20CA210976	Water Licence (Water Supply Works and Water Use)	01/08/2009	31/07/2022
20CA201623	Water Licence (Water Supply Works and Water Use)	01/07/2004	30/06/2027
20BL171535	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity
20BL171547	Groundwater Licence – Monitoring Bore	03/10/2007	Perpetuity

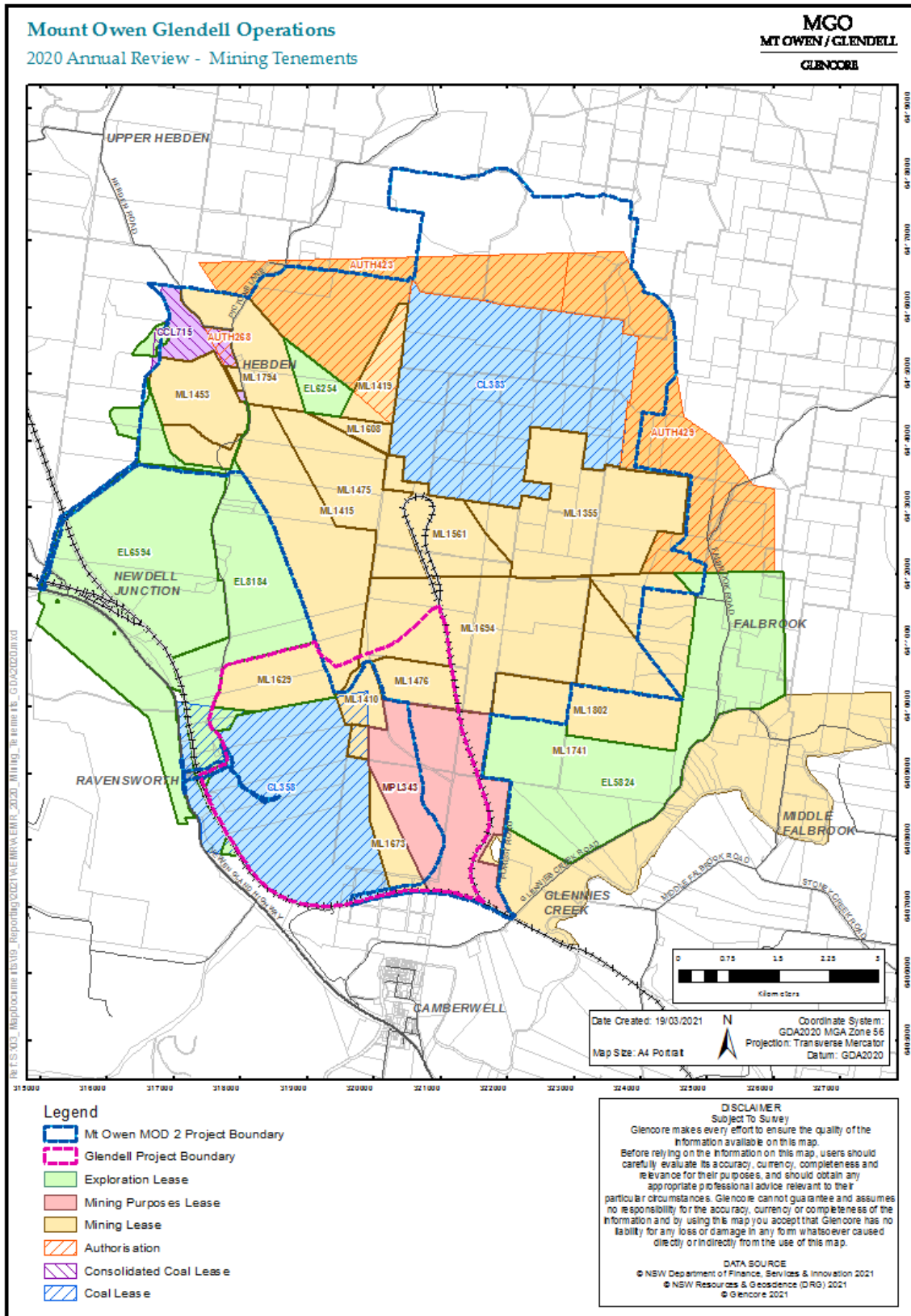


Figure 3: MGO Mining Tenements

Environmental management plans have been developed for MGO and are outlined in [Table 7](#). The date of the most recent review is provided below.

Table 7: MGO Environmental Management Plans

Environmental Management Plans	Revision Date
MGO Environmental Management Strategy	June 2020
MGO Pollution Incident Response Management Plan	June 2020
MGO Noise Management Plan	March 2019
MGO Blast Management Plan	May 2020
MGO Air Quality and Greenhouse Gas Management Plan	December 2020
MGO Aboriginal Cultural Heritage Management Plan	April 2020
MGO Historic Heritage Management Plan	April 2020
MGO Water Management Plan	October 2020
MGO Surface Water Management and Monitoring Plan	October 2020
MGO Groundwater Management and Monitoring Plan	October 2020
MGO Erosion and Sediment Control Plan	October 2020
MGO Surface Water and Groundwater Response Plan	October 2020
MGO Creek Diversion Plan	May 2020
MGO Biodiversity Offset Management Plan	December 2018
MGO Mining Operations Plan / Rehabilitation Management Plan	December 2020
Glendell Greenhouse Gas and Energy Efficiency Plan (superseded with MGO Air Quality and Greenhouse Gas Management Plan)	July 2019
Rehabilitation Strategy	May 2020

4 Operations Summary

4.1 Mining Operations

In 2020, MGO produced a total of 12.82 Mtpa of ROM coal, consisting of:

- 8.06 Mt for MTO
- 1.20 Mt for Ravensworth East Mine
- 3.56 Mt for Glendell Mine.

A total of 7.48 Mt product coal was produced, with MTO, Ravensworth East and Glendell producing 4.46 Mt, 0.83 Mt and 2.19 Mt respectively. The DA limit for ROM coal for MTO is 10 Mtpa, Ravensworth East is 4 Mtpa, and Glendell is 4.5 Mtpa. Details of the amount of ROM coal mined from each site, and the total amount of coal mined at the complex is provided in [Table 8](#).

Table 8: MGO Production Summary

Material	Approved limit (specify source)	2020 Reporting Period (Forecast)	2020 Reporting Period (Actual)	2021 Reporting Period (Forecast)
Mt Owen				
Prime Overburden (Mbcm)	-	38.10	36.86	35.69
ROM Coal Mined (Mt)	10 (Development Consent)	8.63	8.06	7.75
Saleable Product (Mt)	-	4.74	4.46	4.68
ROM Coal Fed (Mt)	-	8.42	7.89	8.09
Glendell				
Prime Overburden (Mbcm)	-	20.11	21.14	14.71
ROM mined (Mt)	4.5 (Development Consent)	3.66	3.56	3.44
Saleable Product (Mt)	-	2.03	2.19	2.18
ROM Coal Fed	-	3.48	3.55	3.53
Ravensworth East				
Prime Overburden (Mbcm)	-	9.14	8.45	2.66
ROM mined (Mt)	4 (Development Consent)	1.89	1.20	1.36
Saleable Product (Mt)	-	0.97	0.83	0.81
ROM Coal Fed	-	1.80	1.40	1.36
CHPP				
Coarse Waste Reject (Mt)	-	3.58	3.36	3.67
Total MGO ROM Coal Fed	17 (Development Consent)	13.69	12.84	12.98
Fine Waste Reject (Mt)	-	2.38	2.10	1.83

During 2020 a MOP Amendment B was drafted to include operational changes. The MOP was submitted to DPIE RR and approved 18 December 2020. In 2020, approximately 243 people were employed at Glendell and 366 at Mt Owen (58 Glencore and 308 Thiess).

4.2 Project Approvals

Mt Owen Continued Operations

Mt Owen Continued Operation (MOCO) received approval in November 2016, under SSD-5850. The approval combined the existing development consents for Mt Owen and Ravensworth East, extending the operation until 2031. In August 2017, MGO modified SSD-5850 ('Modification 1') to allow for the construction of a mine water pipeline from Integra Underground Mine to MGO. In September 2019, Modification 2 (Mod 2) to SSD-5850 was approved. This allows the additional mining of 35 Mt of ROM coal and extends the life of mine to 31 December 2037. During January 2020, Modification 3 (Mod 3), an administrative mod, was approved by DPIE for the inclusion of one land parcel within the 'Schedule of Land'.

During 2020, MGO submitted the following modifications for approval by DPIE:

- MOCO Mod 4 – This modification relates to the amalgamation of SSD-5850 with Glendell Continued Operations Project (GCOP) (SSD-9349).

- MOCO Mod 5 – This modification is administrative to remove the TSR Biodiversity Offset and seek alternative offset arrangements.
- MOCO Mod 6 - This modification is for the realignment of the Mt Owen to Ravensworth water pipeline under GRAWTS to run along the southern extent of Glendell Barrett Pit. The existing pipeline is north of the current operation within the GCOP (SSD-9349) project footprint.

Glendell Continued Operations

Glencore is seeking approval to extend the open cut mining operations at Glendell, north from the existing Barrett Pit known as Glendell Continued Operations Project (GCOP)(SSD-9349). The extension of the current operations would extract an additional 140 Mt of ROM coal, down to the Hebden coal seam. This would extend the mining operations of Glendell to approximately 2044.

During 2018, a Preliminary Environmental Assessment for the project was prepared and submitted to DPIE. The Secretary's environmental assessment requirements (SEARs) were received by Glencore in July 2018. A development application, accompanied by a detailed Environmental Impact Statement (EIS) was submitted to DPIE during 2019. DPIE placed the EIS on Public exhibition from 11 December 2019 until 14th February 2020. There was 359 submissions received for the Project. These included 16 from Government, 16 from Special Interest Groups and 327 from Community Members. Of the 327 Community submissions; 200 were supporting, 117 objecting and 10 provided comment.

The Response to submissions was submitted to DPIE in two parts during May and October 2020. A separate response to the Federal Government's Independent Expert Scientific Committee (IESC) was submitted in August 2020. During the end of 2020 Glencore continued to respond to Government Departments and complete further consultation with the Heritage Council and Singleton Council regarding the proposed Ravensworth Homestead relocation options.

Glencore continued consultation with near neighbours and stakeholders regarding the project during the reporting period.

A project specific website was established in 2020 in relation to this project: www.glendell.com.au

Glendell Mine – Modification 4 – Minor Extension

In November 2018 Glencore submitted an application to modify DA 80/952 to provide for a minor extension to the Barrett Pit at Glendell Mine in order to access an additional 2.5 Mt ROM Coal (Modification 4). Thirty nine (39) submissions were received on the application, including four from government agencies and thirty five (35) from community members, organisations and special interest groups. A Response to Submissions was prepared and submitted to DPIE in May 2019. DPIE referred the Mod to the IPC during November 2019 for Determination. During early 2020, MGO engaged with the IPC prior to DPIE approval being granted 4th March 2020.

4.3 Other Operations

4.3.1 Train and Conveyor Movements

Table 9 summarises the train and conveyor movements undertaken at the MGO during 2020. Daily train movements are provided in **Appendix B**.

Table 9: MGO Train and Conveyor Movements 2020

Train Movements	Total
Annual Average Daily Train Movements	2.35 Trains Per Day
Total Train Movements 2020	860 Trains
Annual Average Daily Train Tonnage	20,179.78 Tonnes Per Day
Annual Average Monthly Train Tonnage	615,483.35 Tonnes Per Month
Total Product Coal Loaded from CHPP	7.39 Million Tonnes
Average Train Loading Time	119 Mins
Average Load Rate (Tonnes per hour)	4,326.9 Tonnes Per Hour
Compliance Limit	May Process up to 17 Million Tonnes of ROM coal Per Year

Note: Product coal can be stockpiled when not required, hence the product coal sales total will differ from product coal railed to port total.

Coal Transport Rates and Sales

ROM coal from MGO is transported for processing to the CHPP. Product coal is conveyed to the product coal stockpile where it is stored according to coal quality, and loaded onto trains for transport to Newcastle Port. During the reporting period, total sales of product coal from MGO loaded onto 860 trains ([Appendix B, Table 1](#)) and railed from site was 7.39 Mt. This included:

- 4.406 Mt from MTO
- 2.984 Mt from Glendell and Ravensworth East.

A 600,000 tonne (t) product stockpile is located at the CHPP. The stockpile currently has five product types:

- Semi-soft
- High Ash Thermal
- Mid Ash Thermal
- Low Ash Thermal (<0.6% sulphur)
- Low Ash Thermal (>0.6% sulphur).

4.3.2 Waste and Other Hazardous Material Management

Recycling and disposal of waste at MGO focuses on the correct handling, storage, segregation and reuse of materials. MGO recycles waste wherever possible, to reduce the amount of waste destined for landfill.

Waste facilities at MGO are located between the CHPP and the Main Dump.

During the reporting period approximately 1,373 tonnes of material was recycled at Glendell and Ravensworth East. This is slightly more than in 2019 (1,281 tonnes). There was more scrap steel recycled in 2020 compared to 2019 (by approximately 30 tonnes), The recycling rate for 2020 (86.21 %) was higher than 2019 (80.21 %).

At MTO approximately 1,426 tonnes was recycled in 2020. This is more than in 2019 (1,366 tonnes). The recycling rate for 2020 (82.91 %) was slightly lower than 2019 (83.65%).

Waste oil, scrap steel, timber, paper and cardboard, oil filters and batteries were the major waste streams recycled during 2020 (Table 10).

Table 10: MGO Recycled Materials (2019 and 2020)

Waste Stream	Mt Owen		Glendell and Ravensworth East	
	2019	2020	2019	2020
Paper and Cardboard (t)	14.2 (CHPP: 0.4)	15.6 (CHPP: 0.1)	9.26	12.8
Waste Oil (Hazardous) (t)	588.3	515.4 (CHPP: 1.6)	647.6	656.8
Grease (t)	7.0	8.7	1.18	1.4
Oil filters (t)	38.3	24.2	26.63	26.2
Batteries (Hazardous) (t)	14.9	18.1	5.2	8.2
Scrap Steel (t)	180 (CHPP: 49.3)	214.6 (CHPP: 140.8)	120.23	153.1
Timber (t)	47.9 (CHPP: 0.4)	55.2	8.02	45.1

*co-mingled recycling at MTO includes paper and cardboard, and also glass, aluminium, and plastic.

MGO disposes of waste heavy vehicle tyres through deep burial in overburden dumps, the location of all tyres is tracked by using spatial data. During 2020, 127 tyres at Glendell and 225 at Mt Owen were buried as compared to 93 tyres at Glendell and 220 at Mt Owen in 2019 (Table 11).

Table 11: MGO Waste Tyre Burial 2019 and 2020

Waste Stream	Mt Owen		Glendell and Ravensworth East	
	2019	2020	2019	2020
Waste Tyres	220	225	93	127

Bulk fuel facilities at the MGO are bunded and designed to hold at least 110 percent (%) of the largest fuel storage tank. This is as per Australian Standard (AS) 1940-2004 – The Storage and Handling of Flammable and Combustible Liquids. Emergency measures and safeguards are in place in the event of a spill. There is low potential for off-site contamination once fuel is received on-site, as all handling and transport of fuel is within the contained water management system.

Monthly housekeeping inspections are undertaken across MGO, to monitor implementation of the Waste and Hydrocarbon Management Plans.

MGO implemented a number of waste management improvement actions during 2020, including:

- MTO:
 - Implementation of a new alternator and starter motor recycling bin
- Glendell:
 - Installation of aerosol can specific bins on site to further segregate waste streams and increase recycling capability

During the reporting period there were a number of hydrocarbon spills reported at MGO (refer 4.3.3) Contaminated soil from these spills was either transported to the onsite bioremediation area at the Glendell mine for land farming or treated in situ.

4.3.3 Environmental Incidents

Environmental incidents at MGO are classified into six categories (based on Glencore’s Internal Incident Reporting):

- **Nil Category**
- **Category 1:** Negligible - An incident that causes negligible, reversible environmental impact, requiring very minor or no remediation
- **Category 2:** Minor – An incident that causes minor, reversible environmental impacts, require minor remediation
- **Category 3:** Significant – An incident that has caused moderate, reversible environmental impact with short-term effect, requiring moderate remediation
- **Category 4:** Serious – An incident that has caused significant environmental impact, with medium-term effect, requiring significant remediation
- **Category 5:** Disastrous – An incident that has caused disastrous environmental impact, with long-term effect, requiring major remediation.

MGO recorded 56 environmental incidents during the reporting period. This is higher than 2019, where 42 environmental incidents were recorded (see Table 12).

Table 12: MGO Environmental Incidents

Incident Category	Mt Owen Incidents		Glendell & Rav. East Incidents		Total Glendell/Mt Owen	
	2019	2020	2019	2020	2019	2020
Category 0	3	6	4	13	7	19
Category 1	8	19	29	17	35	36
Category 2	0	1	0	0	0	1
Category 3	0	0	0	0	0	0
Total	11	26	33	30	42	56

At MGO, the total number Environmental Incidents have slightly increased from 2019. In 2020 there was one Category 2 and 36 Category 1 incidents. However, there was an increase of Nil Categories from 7 to 19 which accounts for the overall incident increase.

The one category 2 incident was a 1710L hydrocarbon spill that occurred as a result of a large rock splitting the tank of a truck while it was being loaded.

Of the 36 Category 1 incidents:

- 26 hydrocarbon spills less than 1000 L
- 1 noise exceedance
- 3 blast fume related events
- 1 illegal dumping incident
- 1 GDP breach
- 1 erosion related event
- 1 water incident
- 1 spontaneous combustion incident
- 1 fire incident

The 19 Category 0 (Nil Categories) incidents related to noise exceedance, incorrect waste disposal and small hydrocarbon spills (<20 L).

A breakdown of the incidents is provided in [Appendix C, Table 2](#).

4.3.4 Land Ownership

MGO landholdings total over 9000 hectares. The landholdings cover the immediate and surrounding areas of the MGO, excluding the Ravensworth State Forest (RSF), which is situated north-east of MTO. The RSF consists of approximately 880 ha, and is owned by the Forestry Corporation of NSW. Land not actively used for mining purposes is managed for either grazing or biodiversity offsets.

During 2020, two properties were acquired by MTO from private landowners. Both properties are located in Middle Falbrook, one is 0.67ha located at Lot 560 DP1104561, whilst the other, Lot 1 DP600327 is 40.47ha. Total land ownership for MGO is summarised in [Table 13](#).

Table 13: Land Ownership

Operation	Land Owned (ha)	Land Leased (ha)
Mt Owen	6,675.73	331*
Glendell	2733.1	15.3
Total	9,408.83	346.9

* Incorporates the leased crown roads associated with offset properties.

4.3.5 Exploration

During 2020, the following exploration activities were conducted:

- Integra exploration drilling for structure, coal quality and stress testing
- Mt Owen near-mine exploration drilling for structural definition, geotechnical testing and piezometer installation.

Details are listed in **Table 14**.

Table 14: Exploration completed in 2020

Site	No of Holes	Surface Lease	Subsurface Lease 1
Integra	5	EL5824	CL382
Mt Owen	10	ML1355, ML1694	CL382

4.3.6 Next Reporting Period

During the 2021 reporting period, it is projected that the following activities will occur at MGO:

Mt Owen

- Mining and dumping will continue in a south-easterly direction. Mt Owen has 28 hectares of rehabilitation planned, consisting of woodland areas.
- Capping and rehabilitation will continue to progress at North Void. There is 10 hectares of rehabilitation planned, consisting of pasture and woodland areas.

Glendell

- Mining and dumping will continue to the north. Glendell has 37 hectares of planned rehabilitation for Barrett Pit.

Ravensworth East

- Mining has been reduced at the Bayswater North Pit. No rehabilitation is planned for Ravensworth East in 2021. If economic market conditions changed, any changes to the mine plan would be captured via a MOP amendment being placed with DPIE RR.

5 Actions Required from Previous Annual Review

The 2019 Annual Review document was submitted to DPIE on 31 March 2020 in accordance with Schedule 5 Condition 5 of SSD-5850 (as modified) and Schedule 5 Condition 5 of DA 80/952.

Minor alterations to the 2019 Annual Review document were made at the request of DPIE and subsequently re-submitted on 14 May 2019. DPIE acknowledged their satisfaction of the 2019 Annual Review on 2 June 2020. No formal notification has been received by the Resources Regulator as of this reports submission.

Table 15 summarises the improvement actions from the 2019 Annual Review and their statuses at 31 December 2020. DPIE did not require additional actions from the previous Annual Review.

Table 15: Actions Required from 2019 Annual Review

Action Required from Previous Annual Review	Action Taken	Section discussed in 2019 AR	Completion Date
MGO Improvements from 2019 Annual Review			
1. Implement maintenance activities in line with 2019 Annual rehabilitation monitoring report recommendations. Consider implementation of recommendations from Centre for Mined Land Rehabilitation (University of Queensland) Monitoring review completed in 2019.	Ongoing	Rehabilitation	Expected Completion: (30/09/2021)
2. Implement SMART alarming using the NAT tool system.	Completed	Noise	22/12/2020
3. Installation of recycled Spotted-quoll habitat throughout MGO biodiversity offsets	Completed	Biodiversity	27/11/2020
4. Further implement the actions from the Upper Bettys Creek Diversion Remediation Plan and add to 2018 and 2019 remediation works. Further works such as infill planting to be completed at Lower Bettys Creek Diversion in 2020.	Ongoing	Water	Expected Completion: (31/08/2021)
5. Further improve the DNAT and expand its use to include dust contribution.	Completed	Air quality	22/12/2020
6. Complete 3-yearly Independent Environmental Audit.	Completed	Audit (Appendix I)	December 2020
7. MOP Amendment to be compiled if Glendell DA 80/952 MOD4 is approved. 2020- June 2024-MOP currently approved until 31 December 2020.	Completed	Mine Operations	14/4/2020
8. Review all management plans in line with SSD-5850 and DA 80/952 approvals received in 2019 and 2020.	Completed	Management (Plans updated on external website as approved).	22/12/2020
9. Progress the Wollombi Brook Cultural Heritage Keeping & Teaching Place with the Bulga Mine.	Completed	Heritage	23/11/2020
10. Complete recommendations from 2019 annual groundwater review.	Ongoing	Water	Expected completion (30/06/2021)

6 Environmental Performance

MGO environmental performance is measured against the criteria set out in:

- DA SSD-5850 for both MTO and Ravensworth East
- DA 80/952 for Glendell

An Environmental Management Strategy and specific management plans (see [Table 7](#)) have been developed to minimise environmental impacts from the MGO. They provide the strategic context for environmental management across the complex. Performance in the reporting period is discussed in the following sections.

6.1 Operational Noise

MGO has a range of management strategies in place to limit the generation of noise and noise impacts to the surrounding environment. During 2020, the following activities were undertaken:

- regular attended noise monitoring in accordance with the MGO Noise Monitoring Program;
- noise monitoring supplementary to the regular noise monitoring to ensure periods of potential adverse weather were represented by monitoring data;
- continued use of directional real-time noise units integrated to MGO Noise Monitoring Network;
- maintenance of the real-time noise monitoring Sentinex (Sx) network ;
- ongoing measurement of machine sound power levels to monitor equipment performance and the potential for degradation of the noise attenuation equipment;
- continue to use the Air Quality Control System environmental forecast summary report to identify periods of potential adverse weather that could affect the propagation of noise;
- ongoing MGO employee education on noise management;
- development and implementation of MGO specific Noise training packages delivered to site specific personnel; and
- review of MGO Noise Management Plan (Approved by DPIE December 2020) following Glendell Mod 4.

6.1.1 Noise Monitoring Program

The noise monitoring program includes both continuous noise monitors and attended noise monitoring. It is designed to measure the contribution that Mt Owen, Ravensworth East and Glendell Mines make to the environmental noise levels in the region surrounding MGO.

Compliance with the development consents and regulatory requirements is determined from the routine attended noise monitoring. Unattended Sentinex (Sx) noise monitors provide supporting information to the compliance assessment process when high noise levels are recorded during the attended noise monitoring program.

A detailed noise compliance assessment, including an assessment of compliance with noise criteria, is provided in the MGO attended noise monitoring reports available via the MGO website (Mt Owen/Glendell Open Cut (glencore.com.au)).

The details of the noise monitoring locations (attended and real-time units) are provided in [Appendix D Table 3](#) and shown in [Figure 4](#). Attended noise monitoring locations N1 to N4, N8 to N11 and N17 are shown on [Figure 4](#). Continuous and attended locations were selected as being representative of the nearest and/or most affected residences to the east, south and south-east of MGO. Locations are reviewed and where necessary, revised over the life of operations.

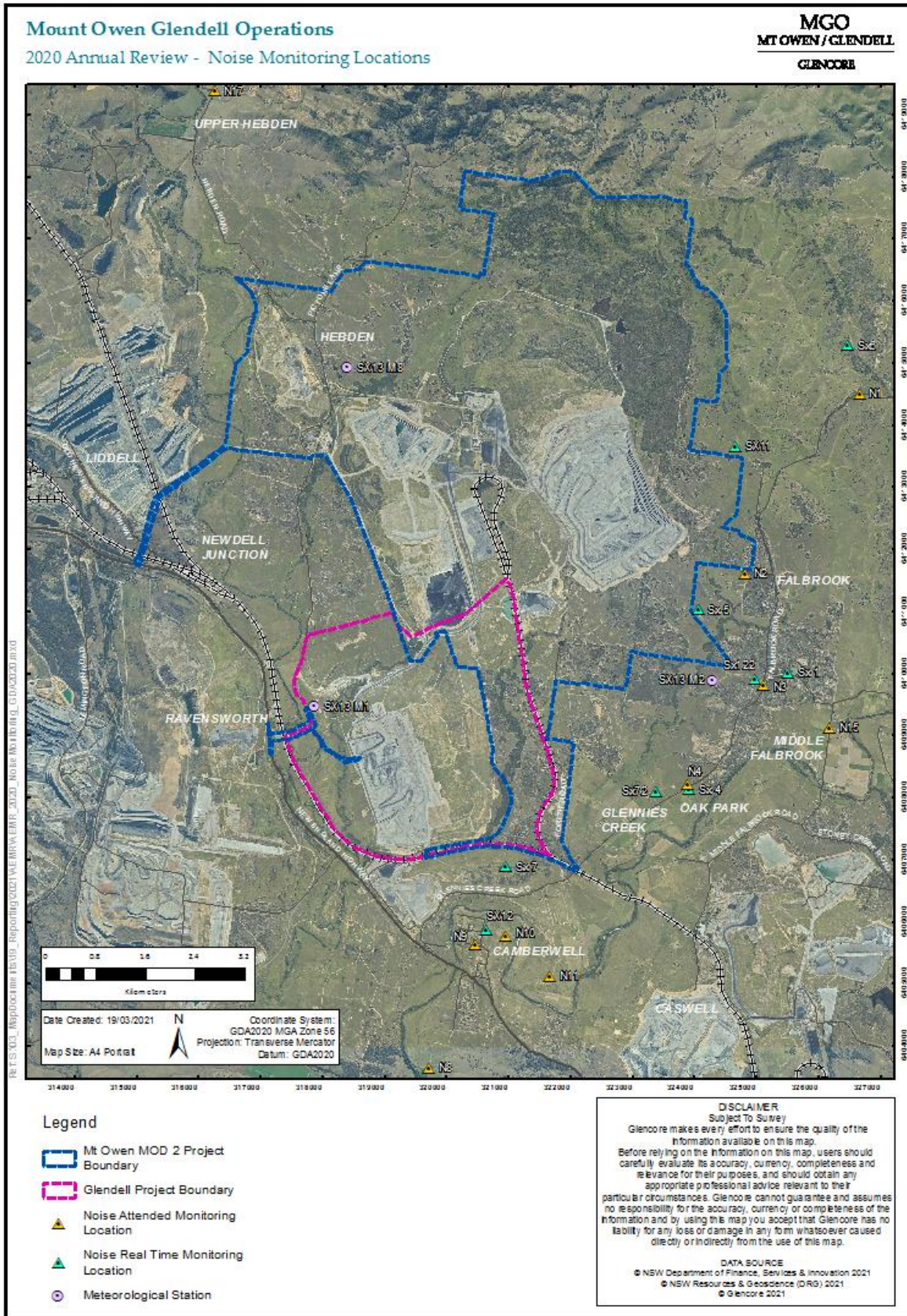


Figure 4: MGO Noise Monitoring Locations

6.1.2 MGO Dust and Noise Analysis Tool – DNAT

The Dust/Noise Analysis Tool (DNAT) continued to be utilised to monitor environmental impacts on the Camberwell, Falbrook and Middle Falbrook areas during the reporting period. The DNAT is a web page based tool that assists Mining Supervisors to plan and modify operational controls in adverse noise conditions. The readings from the Upper Hunter Air Quality Monitor in Camberwell were included in the webpage to assist in the management of dust.

6.1.3 MGO Sound Power Level Assessment

MGO is required to undertake an assessment of the equipment fleet against the indicative equipment listed in DA 80/952 every 5 years to confirm that noise impacts have not significantly changed. Global Acoustics were engaged to determine sound power data for mobile equipment at Glendell. A total of 26 plant items were tested during the 2020 sound power survey. A copy of the assessment report is included in [Appendix D](#).

Under the Mount Owen Continued Operations (SSD-5850) development approval, a minimum of 20% of the mobile fleet requires sound power testing per year. Thearle Engineering were engaged to complete the sound power testing. The assessment results were compared with the nominated sound power levels for the operating fleets in Appendix E of the Noise Impact Assessment in the Mt Owen Continued Operations Environmental Assessment (2014). The assessment results are also compared against the Glencore Coal Assets Australia (GCAA) protocol GCAA 11.11 Noise Management as a secondary reference. A total of 19 plant items were tested. A copy of the assessment report developed by Thearle Engineering is included in [Appendix D](#).

6.1.4 Noise Monitoring Performance

Attended noise monitoring was undertaken monthly during the night-time periods in accordance with the Noise Management Plan and the EMS. Additional monitoring of day and evening periods occurred seasonally at Mt Owen in accordance with EPL 4460 during the reporting period.

Results of the 2020 attended noise monitoring program are summarised in [Table 16](#) and [Table 17](#), for Mt Owen, and [Table 18](#) and [Table 19](#), for Glendell. During the attended noise monitoring, there was one non-compliance, where the Mt Owen mine exceeded the nominated criteria during applicable meteorological conditions. The exceedance occurring in June was reported to the relevant agencies and no further action was requested.

Night time monitoring results are displayed in [Appendix D, Figures 1 and 2](#). Detailed seasonal noise reports are also available on the Glencore website at <https://www.glencore.com.au/>. The results presented in [Appendix D](#) and within the seasonal reports do not appear to indicate any trends in the data.

Generally, the applicable noise criteria and the predicted noise levels are the same for each of the monitoring locations and therefore the comparison with the criteria also demonstrates a comparison with the predicted noise levels.

Table 16: Summary of Mt Owen 2020 Environmental Noise Level (dB(A)) Contribution (LAeq, 15min)

Monitoring Location	Monitoring Period	Criteria	Jan 2020	Feb 2020	March 2020	April 2020	May 2020	June 2020	July 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020
N1	Day	35	IA	N/A ²	N/A ²	<25	N/A ²	N/A ²	IA	N/A ²	N/A ²	IA	N/A ²	N/A ²
	Evening	35	IA	N/A ²	N/A ²	<30	N/A ²	N/A ²	IA	N/A ²	N/A ²	IA	N/A ²	N/A ²
	Night	35	IA	IA	IA	<30	<25	37	30	33	<25	IA	<30	<30
								36 ³						
							29 ⁴							
N2 ¹	Day	N/A	<30	N/A ²	N/A ²	<30	N/A ²	N/A ²	<30	N/A ²	N/A ²	<30	N/A ²	N/A ²
	Evening	N/A	IA	N/A ²	N/A ²	27	N/A ²	N/A ²	<25	N/A ²	N/A ²	IA	N/A ²	N/A ²
	Night	N/A	IA	<25	<25	36	31	45	<30	40	41	IA	<30	<30
N3	Day	41	<30	N/A ²	N/A ²	<30	N/A ²	N/A ²	<30	N/A ²	N/A ²	IA	N/A ²	N/A ²
	Evening	41	<30	N/A ²	N/A ²	35	N/A ²	N/A ²	IA	N/A ²	N/A ²	IA	N/A ²	N/A ²
	Night	41	IA	IA	IA	IA	38	<36	35	37	35	39	31	<30
N4	Night	42	IA	IA	IA	IA	<35	<35	40	<39	37	39	39	IA
N8 ¹	Night	N/A	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N9 ¹	Night	N/A	IA	IA	IA	IA	<35	IA	IA	IA	IA	<35	IA	IA
N10	Night	35	IA	IA	IA	<35	<35	IA	<35	IA	IA	<33	IA	IA
N11	Night	35	IA	IA	IA	IA	IA	IA	IA	IA	IA	<35	IA	IA

Note:

1 There is no noise criteria for this monitoring location.

2 Day and evening monitoring is only required once every quarter and was not required for this monthly monitoring round.

3 Re-measure undertaken following an initial exceedance at N1 as per the NMP

4 Follow-up measurement undertaken after an initial exceedance at N1 as per the NMP

Table 17: Summary of Mt Owen's Environmental Noise Level (dB(A)) Contribution (LA1, 1min) - Night

Monitoring Location	Criteria	Jan 2020	Feb 2020	March 2020	April 2020	May 2020	June 2020	July 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020
N1	45	IA	IA	IA	<30	<30	44	38	43	<35	IA	<35	32
							43 ²						
							34 ³						
N2 ¹	N/A	IA	<25	<25	41	44	57	<30	51	55	IA	<35	<30
N3	45	IA	IA	IA	IA	43	39	43	45	44	43	40	39
N4	50	IA	IA	IA	IA	<35	42	50	45	42	44	46	IA
N8 ¹	N/A	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N9 ¹	N/A	IA	IA	IA	IA	<35	IA	IA	IA	IA	<35	IA	IA
N10	45	IA	IA	IA	<35	<40	IA	<40	IA	IA	<33	IA	IA
N11	45	IA	IA	IA	IA	IA	IA	IA	IA	IA	<35	IA	IA

Note:

- 1 There is no noise criteria for this monitoring location.
- 2 Re-measure undertaken following an initial exceedance at N1 as per the NMP
- 3 Follow-up measurement undertaken after an initial exceedance at N1 as per the NMP

Table 18: Summary of Glendell's Environmental Noise Level (dB(A)) Contribution (LAeq, 15min) - Night

Monitoring Location	Monitoring Period	Criteria	Jan 2020	Feb 2020	March 2020	April 2020	May 2020	June 2020	July 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020
N1 ¹	Night	N/A	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N2 ¹	Night	N/A	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N3	Night	38	IA	IA	IA	IA	<35	<35	<35	IA	<35	<36	<35	31
N4	Night	38	IA	IA	IA	IA	IA	IA	<35	IA	<35	IA	IA	IA
N8	Night	35	IA	IA	IA	IA	IA	IA	IA	32	<35	IA	IA	IA
N9	Night	42	<30	IA	IA	<42	<35	<35	<35	40	<35	<35	<35	<35
						40 ²								
						<40 ³								
N10	Night	40	<35	IA	IA	38	IA	<35	<35	37	<35	IA	37	<35
N11	Night	38	<35	IA	IA	<35	<35	IA	<35	38	<35	IA	<35	<35

Note:

- 1 There is no noise criteria for this monitoring location.
- 2 Re-measure undertaken following an initial exceedance at N9 as per the NMP
- 3 Follow-up measurement undertaken after an initial exceedance at N9 as per the NMP

Table 19: Summary of Glendell's Environmental Noise Level (dB(A)) Contribution (LA1, 1min) - Night

Monitoring Location	Criteria	Jan 2020	Feb 2020	March 2020	April 2020	May 2020	June 2020	July 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020
N1 ¹	N/A	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N2 ¹	N/A	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA	IA
N3	45	IA	IA	IA	IA	<35	<40	44	IA	<35	44	<35	<35
N4	45	IA	IA	IA	IA	IA	IA	<35	IA	40	IA	IA	IA
N8	45	IA	IA	IA	IA	IA	IA	IA	38	<35	IA	IA	IA
N9	45	38	IA	IA	54	<35	40	<35	<45	43	40	<40	<35
					45 ²								
					42 ³								
N10	45	<35	IA	IA	44	IA	<35	<35	<45	42	IA	43	<35
N11	45	38	IA	IA	<35	<35	IA	40	45	<40	IA	<40	<40

Note:

1 There is no noise criteria for this monitoring location.

2 Re-measure undertaken following an initial exceedance at N9 as per the NMP

3 Follow-up measurement undertaken after an initial exceedance at N9 as per the NMP

6.1.5 Continuous Improvement

As a part of the ongoing commitment to the management of noise impacts from the MGO, a range of activities have been undertaken during 2020 that fall within the continuous improvement program. The most important being:

- Dust & Noise Analysis Tool (DNAT) smart alarm improvements and noise roses – Allows enhanced separation of noise contribution (Trains, neighbouring mine noise, community). The continued implementation of the web-based tool assists in managing operational noise (refer 6.1.2) across MGO
- Development of a 3D Predictive Noise Model for MGO
- Implementation of DPIE approved MGO Noise Management Plan
- Modifications and improvement of real-time monitoring network
- Review and simplification of noise alarm response

During 2021, continuous assessment and improvement of the real-time monitoring network and management alarms will continue.

6.2 Blasting

6.2.1 Blast Management and Monitoring

MGO blast management practices for the life of operations are managed in accordance with the MGO Blast Management Plan.

Blast monitoring locations are shown in [Figure 5](#).

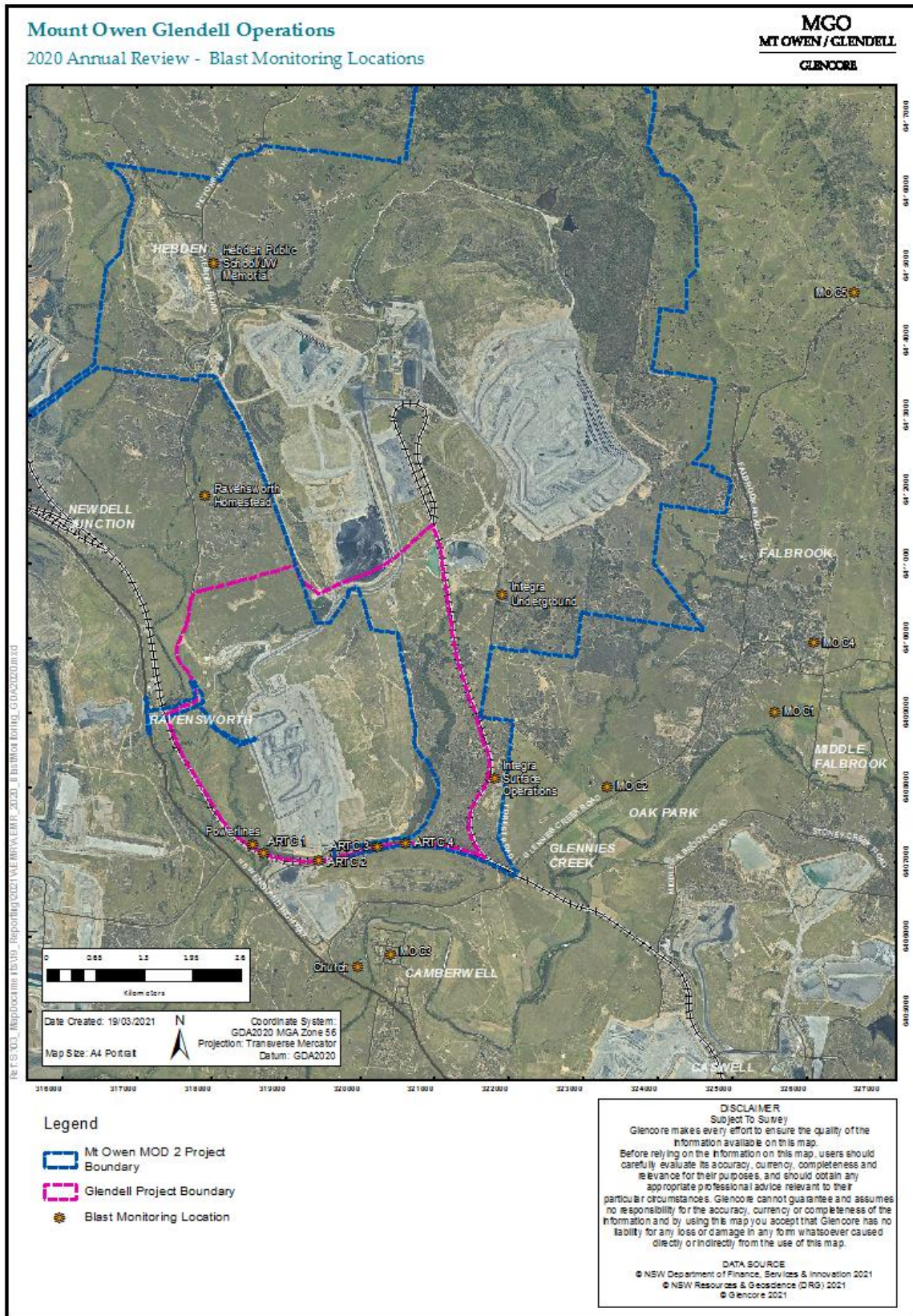


Figure 5: MGO Blast Monitoring Locations

6.2.2 Blast Performance

Table 20 summarises MGO’s performance against the approved blasting hours and frequencies for 2020. Table 21 summarises MGO’s blasting criteria and performance for 2020. All blasts were fired within approved blasting hours. Two (2) blasts were fired at Mt Owen between 7am and 9am (Monday to Saturday inclusive). One (1) blast was fired at Ravensworth East between 7am and 9am (Monday to Saturday inclusive) during 2020.

Table 20: MGO Blasting Hours and Frequencies for 2020

Approval	Operation	Compliant?	Approved blasting hours	Approved Blast Frequencies:		Actual Blast Frequencies (2020)		
				Maximum number of blasts per day	Average number of blasts per week	Total number of blasts recorded	Maximum number of blasts per day	Average number of blasts per week
DA 80/952	Glendell	Yes	9am – 5pm Monday to Saturday (EST) 9am – 6pm Monday to Saturday (DST)	2	5 ³	110	2	2.1 ⁵
SSD-5850	Ravensworth East	Yes	9am – 5pm Monday to Saturday ²	2	5 ⁴	38	2	0.7 ⁵
SSD-5850	Mt Owen	Yes	9am – 5pm Monday to Saturday ²	2	8 ⁴	90	2	1.7 ⁵

1. Does not apply to blasts that generate ground vibration of 0.5mm/s or less at any residence on privately-owned land, or to blast misfires required to ensure the safety of the mine, its workers or the general public.

2. With the exception of an allowable maximum of 12 blasts in a calendar year which may be undertaken between 7 am and 9 am (Monday to Saturday inclusive).

3. Averaged over a 12-month period

4. Averaged over a calendar year

5. Averaged over the 2020 calendar year i.e. 1 Jan 2020 – 31 Dec 2020

EST – Eastern Standard Time

DST – Daylight Savings Time

Table 21: MGO Blasting Criteria and Performance for 2020

Location	Operation	Approval Criteria			Environmental Performance	Key Trends	Implemented/ Proposed Management Actions
		Airblast Over Pressure (dB(Lin Peak))	Ground Vibration (mm/s)	Allowable Exceedance			
Residents on Privately-Owned Land	Mt Owen	120	10	0%	Compliant	Nil	Nil
	Ravensworth East Glendell	115	5	5% of the total number of blasts over a period of 12 months	Compliant		
Ravensworth Homestead	Ravensworth East	126	5	0%	Compliant	Nil	Nil
Chain of Ponds Inn	Mt Owen	133	10	0%	Compliant	Nil	Nil
Kangory (Dulwich) Homestead	Mt Owen	126	5	0%	Compliant	Nil	Nil
Former Hebden Public School	Mt Owen	n/a	16	0%	Compliant	Nil	Nil

John Winter Memorial	Mt Owen	n/a	250	0%	Compliant	Nil	Nil
St Clements Church	Glendell	120	5	0 %	Compliant	Nil	Nil
	Glendell	115	2	5% of the total number of blasts over a period of 12 months	Compliant	Nil	Nil
Main Northern Railway Culverts and Bridges	Glendell	120	25	Negotiated Agreement	Compliant	Nil	Nil
Powerlines	Glendell	n/a	25	Negotiated Agreement	Compliant	Nil	Nil
Integra Underground Surface	Mt Owen	n/a	25 or 100	0%	Compliant	Nil	Nil
Integra Underground Workings	Mt Owen	n/a	10 or 250	0%	Compliant	Nil	Nil

Mt Owen

- Overpressure and vibration compliance results for Mt Owen are detailed in **Appendix E, Tables 6 to 10**. Compliance summaries are provided in **Appendix E, Table 4** and **5**.
- There were a total of 90 blasts fired at Mt Owen during the reporting period averaging less than 2 blasts fired per week (maximum of 8 blasts per week over the 12 month period allowed), no blasting non-compliances were identified at Mt Owen during the report period.

Glendell

- Overpressure and vibration compliance results for Glendell are detailed in **Appendix E, Table 11 to 14**. Compliance summaries are provided in **Appendix E, Tables 4** and **5**.
- There were a total of 110 blasts fired at Glendell during the reporting period averaging over 2 blasts (maximum of 5 blasts per week averaged over the 12 month period allowed) fired per week, no blasting non-compliances were identified at Glendell during the report period.

Ravensworth East

- Overpressure and vibration compliance results for Ravensworth East are detailed in **Appendix E, Tables 6 to 10**. Compliance summaries are provided in **Appendix E, Tables 4** and **5**.
There were a total of 38 blasts fired at Ravensworth East during the reporting period averaging less than 1 blast fired per week (maximum of 5 blasts per week average over the 12 month period allowed) , no blasting non-compliances were identified at Ravensworth East during the report period.

All blasting results from MGO are also available on the website at: <https://www.glencore.com.au/operations-and-projects/coal/current-operations/mt-owen-glendell-open-cut>

6.3 Air Quality

6.3.1 Air Quality Management and Monitoring

Air quality is managed in accordance with the approved MGO Air Quality Management Plan. Monitoring locations are shown in **Figure 6: MGO Air Quality Monitoring Locations**. Results of air quality monitoring are presented in **Appendix F**.

Air quality conditions can be characterised by various substances and by various measurement techniques. Airborne particulate matter is typically the key air quality issue for open cut mining and the monitoring in the vicinity of MGO includes the measurement of:

- Particulate matter (as PM₁₀)
- Particulate matter (as PM_{2.5})
- Particulate matter (as TSP)
- Dust deposition

Appendix F, Tables 15 - 20 present the monitoring results for 2020 and for recent years. It should be noted that the measurement data represent the contributions from all sources that have at some stage been upwind of each monitor. In the case of particulate matter (as PM₁₀), the background concentration may contain emissions from many sources such as from mining activities, construction works, bushfires and 'burning off', industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollens, moulds etc.

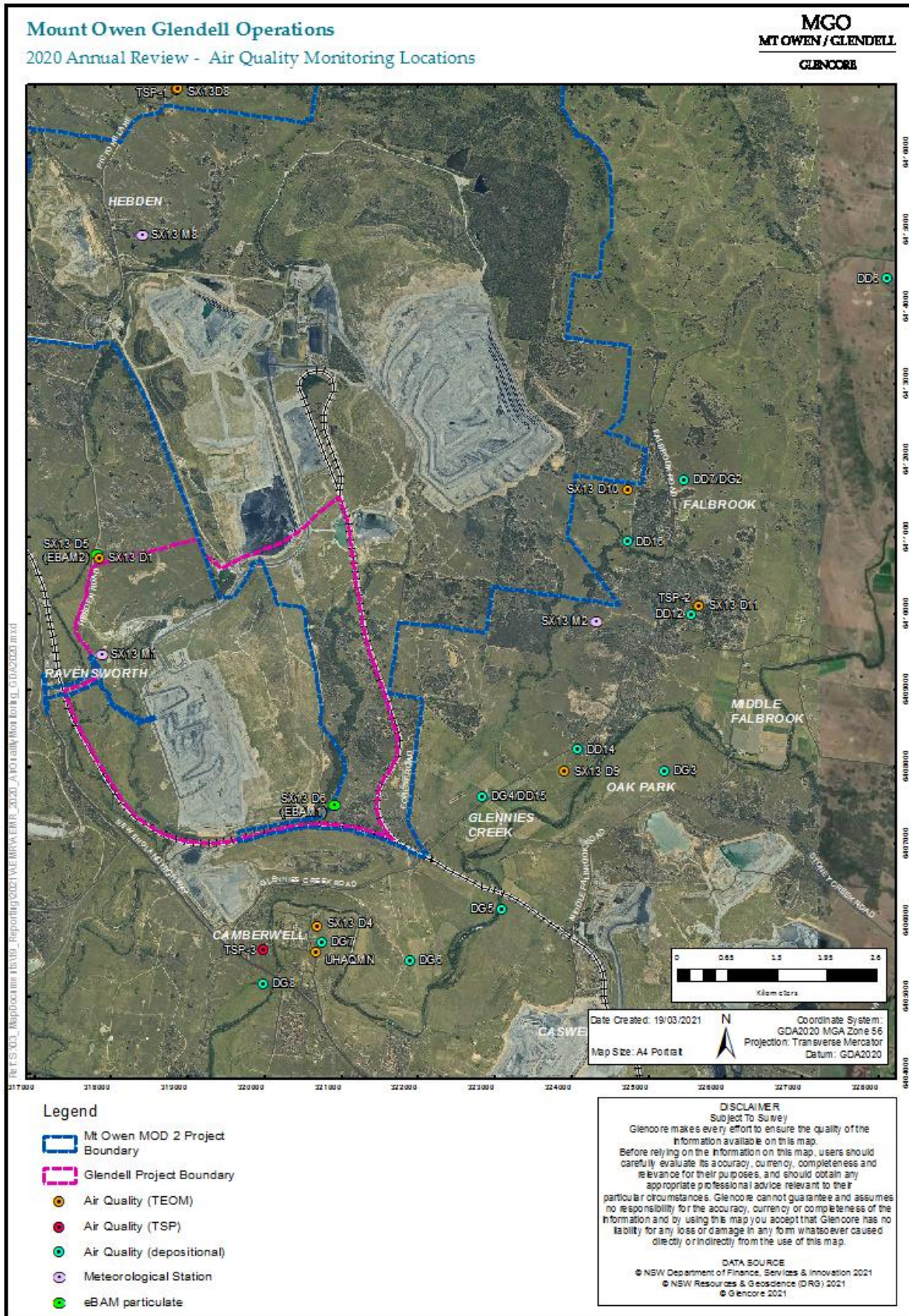


Figure 6: MGO Air Quality Monitoring Locations

6.3.2 Meteorological Conditions

Meteorological monitoring is undertaken at MGO in accordance with SSD-5850 and DA 80/952 at the locations shown in **Figure 6: MGO Air Quality Monitoring Locations**. MGO operates a continuous meteorological monitoring network which includes three (3) 10 metre tower weather stations, (known as Sx13 M1, Sx13 M2 and Sx13 M8), located to the west and south-east of the active mining areas respectively.

The wind-roses (**Figure 7: 2020 Annual Wind Roses for Sx13 M1, Sx13 M2 and Sx13 M8**) show the frequency of wind speeds and wind directions based on hourly records for each location. The circular format of the wind rose shows the direction from which the wind blew and the length of each "spoke" around the circle shows how often the "wind blew from that direction". The different colours of each spoke provide details on the speed of the wind from each direction.

It can be seen from **Figure 7** that winds in 2020 were from the southeast and northwest. This pattern of winds is common for many parts of the Hunter Valley and reflects the northwest-southeast alignment of the valley. Wind patterns were similar at all three locations.

Rainfall data for Singleton Army Base (the closest monitoring station), collected from the Bureau of Meteorology (BoM) website, confirms that 2020 was much wetter than average. A total of 945.8 mm was recorded in 2020 and was well above (265.8mm) the long term average of 680 mm.

Approximately 841mm of rainfall was recorded at MGO at Sx13 M2 during the reporting period. Due to faults in the SX13 M1 sample site in 2020, data from sample site SX13 M2 was used in the period. In the previous reporting period, approximately 397mm of rainfall was recorded, highlighting that 2020 was wetter than previous years.

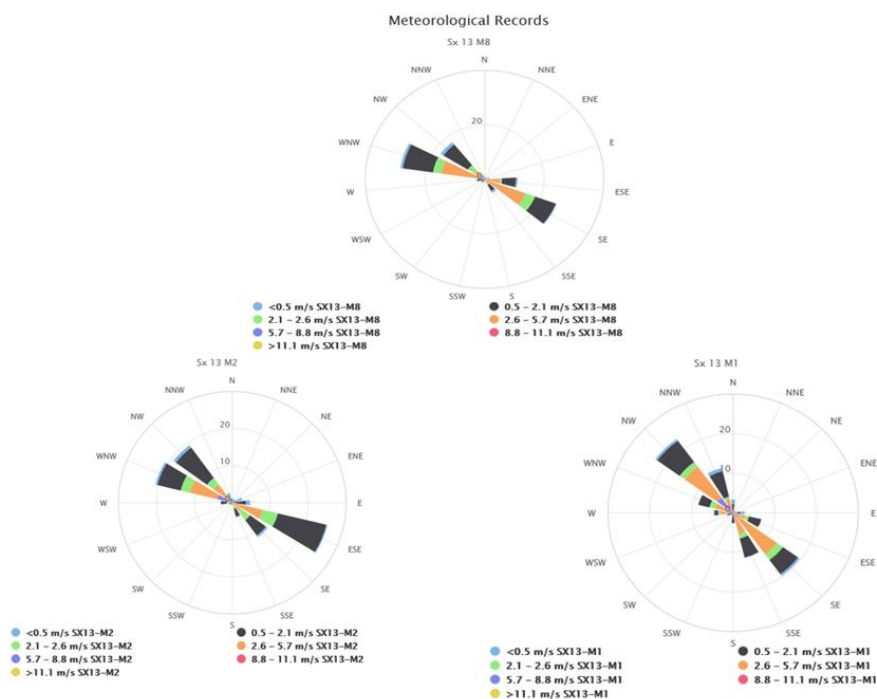


Figure 7: 2020 Annual Wind Roses for Sx13 M1, Sx13 M2 and Sx13 M8

6.3.3 Air Quality Performance

Overview

Late 2019 coincided with a period of unprecedented bushfires in Australia, predominantly across southeast Australia, but also affecting a reported 4 million hectares of land in NSW since early November 2019. The bushfires continued into January 2020 and adversely affected air quality across many parts of NSW. A total of 24 days in 2020 were subsequently declared as extraordinary events, based on advice from the DPIE.

Particulate Matter as PM₁₀

Figure 6 shows the location of monitors which are used to measure PM₁₀ concentrations. The concentrations are measured by a variety of instruments including Tapered Element Oscillating Microbalance (TEOM) and High Volume Air Samplers (HVAS).

Table 22 summarises the measured PM₁₀ concentrations. As noted in the development consents (DA 80/952 and SSD-5850) determination of compliance against the impact assessment criteria is to exclude “extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Secretary”. Therefore the results have been calculated without extraordinary events. The data in Table 22 show that, without extraordinary events, the PM₁₀ concentrations at all five monitors (bold text) were below the 24-hour and annual average criteria. Consequently the monitoring demonstrates compliance with DA 80/952 and SSD-5850 in terms of particulate matter as PM₁₀. Appendix F provides a more detailed analysis of the monitoring data including a description of how the contributions from the direction of MGO were calculated.

Table 22: Summary of PM10 concentrations from MGO monitors in 2020

Statistic	SX13 D1	SX13 D4	SX13 D8	SX13 D9	SX13 D11	Criterion	Environmental Performance this Reporting Period	Implemented/ Proposed Management Actions
Maximum 24-hour average in µg/m³								
Measurement (all data)	92	101	99	87	59	NA	NA	NA
Measurement (without extraordinary events)	52	58	45	45	41	NA	NA	NA
Calculated contribution from direction of MGO (without extraordinary events)	18	38	5	26	22	50 (SSD-5850) 50 (DA 80/952)	Compliant	Continuation of existing management and mitigation measures
Annual average in µg/m³								
Measurement (all data)	19	24	19	19	15	NA	NA	NA
Measurement (without extraordinary events)	17	21	17	17	14	25 (SSD-5850) 30 (DA 80/952)	Compliant	Continuation of existing management and mitigation measures
Calculated contribution from direction of MGO (without extraordinary events)	2	5	0	4	2	NA	NA	NA

Particulate Matter as PM_{2.5}

Figure 6 shows the location of monitors which are used to measure PM_{2.5} concentrations. Table 23 summarises the measured PM_{2.5} concentrations. As noted in the development consent (SSD-5850) determination of compliance against the impact assessment criteria is to exclude “extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Secretary”. Therefore the results have been calculated without extraordinary events. The contribution from the direction of MGO could not be determined as monitoring to carry out an upwind-downwind calculation was not available. However the data in Table 23 show that, without extraordinary events, the PM_{2.5} concentrations were below the 24-hour and annual average criteria. Consequently the monitoring demonstrates compliance with SSD-5850 in terms of particulate matter as PM_{2.5}. Appendix F provides a more detailed analysis of the monitoring data.

Table 23: Summary of PM_{2.5} concentrations from MGO monitors in 2020

Statistic	SX13 D11	Criterion	Environmental Performance this Reporting Period	Implemented/ Proposed Management Actions
Maximum 24-hour average in µg/m³				
Measurement (all data)	31.5	NA	NA	NA
Measurement (without extraordinary events)	20.7	NA	NA	NA
Calculated contribution from direction of MGO (without extraordinary events)	Not calculated	25 (SSD-5850)	Compliant	Continuation of existing management and mitigation measures
Annual average in µg/m³				
Measurement (all data)	6.5	NA	NA	NA
Measurement (without extraordinary events)	6.0	8 (SSD-5850)	Compliant	Continuation of existing management and mitigation measures
Calculated contribution from direction of MGO (without extraordinary events)	Not calculated	NA	NA	NA

Particulate Matter as TSP

TSP concentrations have been measured at three locations by HVAS. Figure 6 shows the location of the monitoring sites. It should be noted that TSP 1 is on mine owned land. Table 24 shows the measured annual average TSP concentrations from each monitor for data collected in 2020. Annual averages have been calculated without extraordinary events for comparison with the development consent criteria. The data shows that, without extraordinary events, the TSP concentrations at TSP 1, TSP 2 and TSP 3 were below 90 µg/m³. Consequently the monitoring demonstrates compliance with the development consents in terms of particulate matter as TSP.

Table 24 Summary of TSP concentrations from MGO monitors in 2020

Statistic	TSP 1	TSP 2	TSP 3	Criterion	Environmental Performance this Reporting Period	Implemented/ Proposed Management Actions
Annual average in $\mu\text{g}/\text{m}^3$						
Measurement (all data)	46	64	68	NA	NA	NA
Measurement (without extraordinary events)	42	62	67	90 (SSD-5850) 90 (DA 80/952)	Compliant	Continuation of existing management and mitigation measures

Depositional Dust

Figure 6 shows the location of the monitoring sites. Table 25 shows the measured annual average deposited dust levels from each monitor for data collected in 2020. The annual averages presented in Table 25 excluded monthly results marked as contaminated by the monitoring contractor but did not exclude periods of “extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed to by the Secretary”, as per the provisions of the development consents. The deposited dust levels from Table 25 were below $4 \text{ g}/\text{m}^2/\text{month}$ at all monitoring sites. The calculations also show that the MGO did not exceed the “incremental impact” criteria from the development consents (that is, $2 \text{ g}/\text{m}^2/\text{month}$).

Table 25 Summary of deposited dust levels from MGO monitors in 2020

Statistic	DD6	DD7/DG2	DD12	DD14	DD16	DG3	DD15/DG4	DG5	DG6	DG7	DG8	Criterion	Environmental Performance this Reporting Period
Annual average in $\text{g}/\text{m}^2/\text{month}$													
Annual average	2.2	2.4	3.2	3.8	2.1	2.8	4.0	2.8	3.0	3.1	1.9	4 (SSD-5850) 4 (DA 80/952)	Compliant
Estimated MGO contribution to annual average	0.1	0.6	1.1	1.9	0.9	1.1	2.0	1.3	1.2	1.1	0.3	2 (SSD-5850) 2 (DA 80/952)	Compliant

EIS Predictions

The measured annual average PM_{10} , TSP and deposited dust levels have been compared to the predictions made in the latest environmental assessment of the approved operation, that is, the Statement of Environmental Effects (SEE) for Mount Owen Continued Operations Modification 2 (Jacobs, 2018). The SEE predictions for Year 2 (approximately 2020) have been extracted for the comparison.

Table 26 shows the comparisons. Predictions of annual average PM_{10} concentrations were between 1.2 and 2.4 times higher than the measurement results, depending on the location. Predicted annual average TSP concentrations were between 1.2 and 1.8 times

higher than the measurement results and predicted annual average deposited dust levels were between 0.8 lower and 1.8 times higher than the measurement results. The comparisons highlight the generally conservative nature of air quality models. In addition, rainfall in 2020 was above the long term average and would likely have been a key factor for minimising elevated levels of these air quality indicators. The air quality models do not usually simulate the effect of rainfall on air quality. The results are also generally within the factor-of-two accuracy that has been recognised for these types of models (US EPA, 2005).

Table 26 Comparison between EIS predictions and measurements in 2020

Location	Prediction (Mt Owen Mod 2 for Year 2)	Measurement (2020 excluding extraordinary events)
Annual average PM ₁₀ in µg/m ³		
SX13 D1	41	17
SX13 D4	35	21
SX13 D8	21	17
SX13 D9	30	17
SX13 D11	25	14
Annual average TSP in µg/m ³		
TSP 1	74	42
TSP 2	76	62
TSP 3	79	67
Annual average deposited dust in g/m ² /month		
DD6	2.1	2.2
DD7/DG2	2.7	2.4
DD12	3.1	3.2
DD14	3.0	3.8
DD16	3.8	2.1
DG3	3.0	2.8
DD15/DG4	3.0	4
DG5	3.2	2.8
DG6	3.5	3
DG7	3.1	3.1
DG8	3.4	1.9

Summary

Late 2019 coincided with a period of unprecedented bushfires in Australia that continued into January and February of 2020. These conditions adversely affected air quality across many parts of NSW and a total of 24 days in 2020 were subsequently declared as extraordinary events. Measurements of PM₁₀, PM_{2.5}, TSP and deposited dust were compared to the short and long term impact assessment criteria from the Mt Owen and Glendell development consents. It was determined that Mt Owen Glendell Operations was in compliance with its development consents (DA 80/952 and SSD-5850) in terms of air quality impacts at all reportable monitoring sites for data collected in 2020.

Predictions of air quality from the latest environmental assessment of the approved operation were compared to the measurement results. The comparisons showed that predicted PM₁₀, TSP and deposited dust levels were generally higher than the 2020

measurement results. This outcome reflected the generally conservative nature of air quality models as well as the increase in rainfall that was observed in 2020.

Further information on the air quality data can be found in the independent air quality report, prepared by a suitably qualified air quality specialist, in [Appendix F](#).

6.3.4 Continuous Improvement

As a part of the ongoing commitment to the management of dust impacts from MGO, a range of activities have been undertaken during 2020 that fall within the continuous improvement program. The most important being:

- Dust suppression tools added to Glendell stemming trucks;
- Modification and improvement of real-time monitoring network;
- Acquisition of refurbished TEOM unit from USA to be used as part replacement for old units;
- Installation of two PM_{2.5} TEOMs monitors as required by the MOCO Mod 2 approval;
- Review and update of the Air Quality and Greenhouse Gas Management Plan; and
- Implementation of Glendell and Mt Owen Dust Analysis Tool on the existing Noise Analysis Tool (DNAT) web page, to assist mining supervisors with the management of dust.

A number of activities to be undertaken in 2021 include:

- Implementation of two PM_{2.5} TEOMs monitors to be part of MGO Real Time Dust Monitoring Network for Mt Owen following the approval of the Air Quality and Greenhouse Gas Management Plan in December 2020;
- Continuous assessment and improvement of the real-time monitoring network and management alarms;
- Review and simplification of dust alarm response;
- New water fill point to be installed near WOOP dump closer to Mount Owen North Pit active operations; and
- Further DNAT development to incorporate site specific contribution dust contribution.

6.3.5 Greenhouse Gas

Energy consumption at MGO is monitored and reported in accordance with Glencore requirements and with the reporting requirements of the National Greenhouse & Energy Reporting (NGER) system. In the 2019/2020 financial year reporting period, the total emissions produced by Glendell were estimated to be 202,165 t CO₂-e. Total emissions produced by Mt Owen in the 2019/2020 NGER report period were estimated to be 175,794 t CO₂-e. A summary of greenhouse gas emissions for 2019/2020 is provided in [Table 27](#).

In 2020, Glendell and Mt Owen's separate Greenhouse Gas reporting requirements were updated in accordance with section 22X of the NGER Act. In April 2020, the Clean Energy Regulator (CER) approved the combined facility of Mt Owen Complex. The

Safeguard Baseline emissions number reported for the Mt Owen Complex is 982,160t CO₂-e. During the 2019/2020 NGER report period, this provided Net Position Number of 604,201 t CO₂-e below the Safeguard baseline value.

Table 27: Greenhouse Gas Emissions at Glendell/Mt. Owen Operations

Emission Source	Glendell (t CO ₂ -e)	Mt Owen (t CO ₂ -e)
Scope 1 Emissions		
Diesel	111,377	133,950
Petrol/ Gasoline	0	0
Liquid Petroleum Gas	0	0
Fugitive emissions	47,344	41,844
Scope 2 Emissions		
Electricity	43,444	0
Total Emissions	202,165	175,794

According to the Glendell Mine Operations Environmental Assessment (2007), the greenhouse gas emissions for mining activities have been estimated at 161,749 t CO₂-e per annum, whilst the Mt Owen Continued Operations Environmental Assessment (2014) details that scope 1 and scope 2 emissions will total 394,000 t CO₂-e per annum. It can be acknowledged that in 2020 MGO as a whole was well below the forecasted scope 1 & 2 emissions.

In 2020, there were a number of improvements completed to reduce greenhouse gas emissions generated at MGO. These included the utilisation of portable solar lights, limiting haul road distances through Glendell Mod 4 road designs and ensuring water level sensors on pumps incorporated variable speed drives. In December 2020, the Annual Greenhouse Gas Workshop was held and various energy saving opportunities were discussed and actioned for 2021. These included continued implementation of LED lighting within workshop areas as well as the CHPP, and the investigation of circuit timers for mining infrastructure areas.

6.4 Biodiversity and Land Management

The Biodiversity Offset Management Plan (BOMP) at MGO forms part of the MGO EMS. The BOMP is used to describe the controls and monitoring implemented for the management of flora and fauna. The objectives for land management at MGO are based on land management principles, including:

- erosion prevention
- pasture diversity
- careful grazing management
- noxious weed and feral animal control.

Natural regeneration is promoted where practical to enhance biodiversity and landscape amenity.

6.4.1 Biodiversity Offset Areas

MGO were required to secure a number of Biodiversity Offset Areas (BOAs) in accordance with conditions of SSD-5850 and DA 80/952.

In 2018, five Conservation Agreements (CAs) were gazetted in consultation with the NSW Environment, Energy and Science Group (then Office of Environment and Heritage OEH) and the Biodiversity Conservation Trust (BCT). These CAs were implemented for the following Conservation Areas:

- Bettys Creek (Enex Foydell) Conservation Area.
- Bettys Creek (Glendell) Conservation Area.
- Mount Owen Offsets Conservation Area, represented by a cluster of four smaller offset areas, being;
 - North East Offset;
 - Forest East Offset;
 - South East Offset;
 - South East Corridor Offset.
- Southern Remnant Offset Conservation Area.
- North West Offset Conservation Area.

All Conservation areas were inspected by the BCT during June 2020 as part of the annual inspection regime.

MGO is in the process of long term securing the remaining BOAs through Stewardship Agreements under the BioBanking Biodiversity and Offset Scheme, therefore, BOAs are current managed under the BOMP, and those include the following properties:

- Cross Creek Offset Site.
- Stringybark Habitat Corridor Offset Site.
- Esparanga Offset Site.
- Mitchell Hills North Offset Site.

All BOAs in the process of Stewardship Agreements were inspected by the BCT during September 2020 as part of the Stewardship Agreement application process.

Details of the CAs and BOAs are provided in [Table 28](#) with their locations shown in in [Figure 8: MGO Biodiversity Offset Areas](#) and [Figure 9](#).

The specific location of the Rehabilitation Woodland Offset is yet to be determined; selection of this area will be undertaken in accordance with the Schedule 3 Condition 31 (d) of SSD-5850.

Table 28: Biodiversity Offset Areas

Offset Area	Plant Community Type	Size (ha)
DA 80/952		
Bettys Creek Habitat Management Area (HMA) incorporating*: - Bettys Creek (Enex Foydell) - Bettys Creek (Glendell)	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	174.0
	1692 - Bull Oak Grassy Woodland of the Central Hunter Valley	
	1731 - Swamp Oak – Weeping Grass Grassy Riparian Forest of the Hunter Valley	
	Derived Native Grassland	
DA SSD-5850 (Mount Owen Offsets)		
Northwest Offset*	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	71.4
	1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (1213 Decommissioned and merged with 1590)	
	Derived Native Grassland	
Northeast Offset*	1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (1213 Decommissioned and merged with 1590)	83.6
	1614 - Grey Gum - Grey Myrtle - Narrow-leaved Stringybark - Rusty Fig open forest on ranges of the Upper Hunter	
	Derived Native Grassland	
Southeast Offset*	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (Including planted variant)	58.3
	Derived Native Grassland	
Southeast Corridor Offset*	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (including planted variant)	74.1
	Derived Native Grassland	
	1731 - Swamp Oak – Weeping Grass Grassy Riparian Forest of the Hunter Valley	
Forest East Offset*	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (including planted variant)	110.9
	Derived Native Grassland	
	1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (1213 Decommissioned and merged with 1590)	
Southern Remnant Offset*	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (including planted variant)	4.0
Cross Creek Offset Site	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (including red gum variant)	367.0
	Derived Native Grassland	
Stringybark Habitat Corridor Offset Site	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	97.5
	1598 Forest Red Gum grassy open forest on floodplains of the lower Hunter	
	Dry Rainforest	
	1731 - Swamp Oak – Weeping Grass Grassy Riparian Forest of the Hunter Valley	
	Derived Native Grassland	
	African Olive Infestation	
Esparanga Offset Site	618 White Box x Grey Box - Red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	303.0
	281 Rough-Barked Apple - Red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	
	618 White Box x Grey Box - Red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley (Shrubby variant)	
	281 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	
	1607 Blakelys Red Gum - Narrow-leaved Ironbark - Rough-barked Apple shrubby woodland of the upper Hunter	

Offset Area	Plant Community Type	Size (ha)
	1654 Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley	
	Derived Native Grassland	
Mitchell Hills North Offset Site	1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (1213 Decommissioned and merged with 1590)	143.7
	1543 Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley	
	624 Large-fruited Grey Gum - Narrow-leaved Stringybark open forest on sheltered sandstone hillslopes in the Scone region of the upper Hunter Valley	
	Derived Native Grassland	
Rehabilitation Woodland	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	518.0

* Conservation Areas gazetted in consultation with the Biodiversity and Conservation Division (BCD) of DPIE and the Biodiversity Conservation Trust (BCT) and as administered by the Minister administering the *Biodiversity Conservation Act 2016* (BC Act).

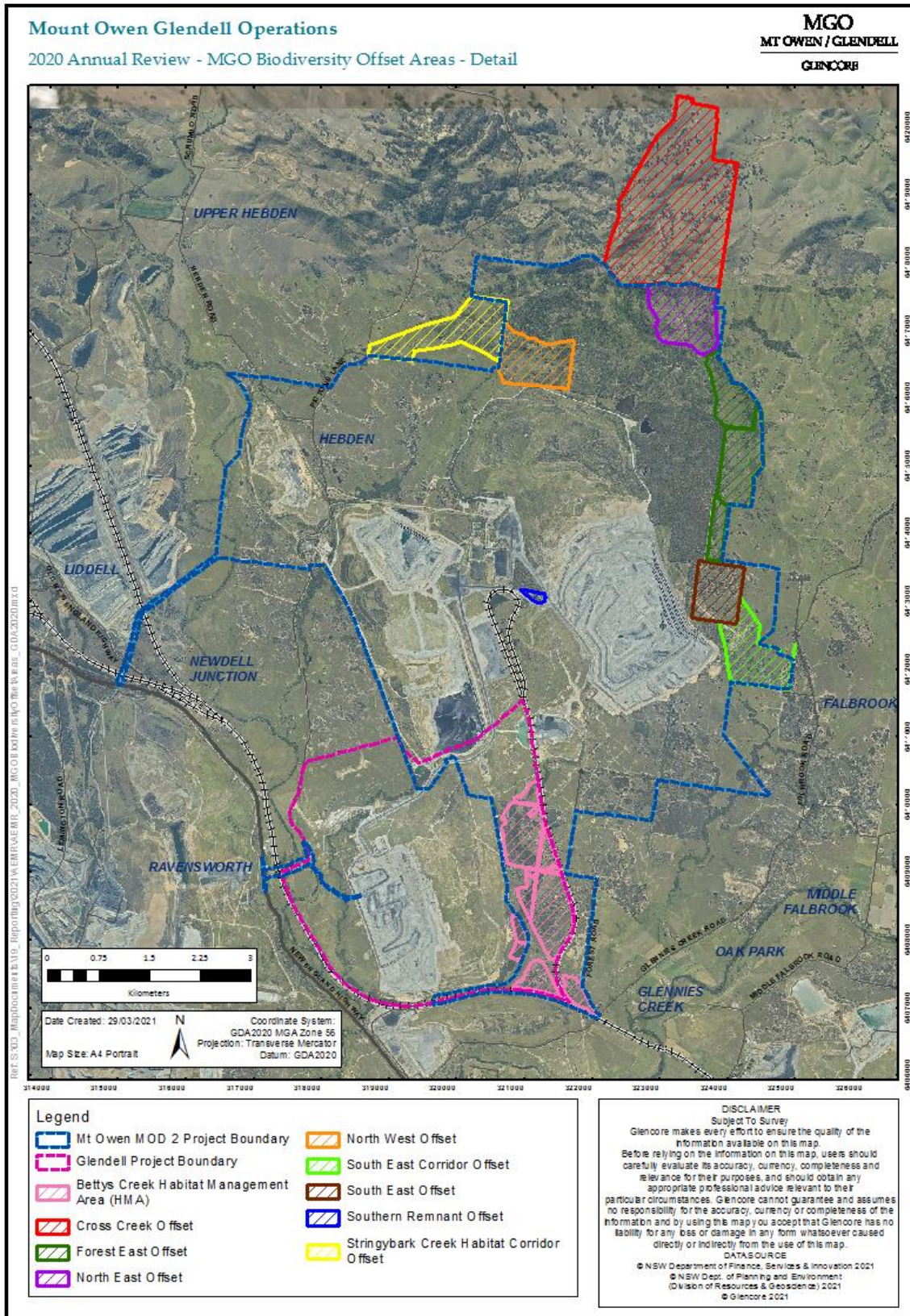


Figure 8: MGO Biodiversity Offset Areas

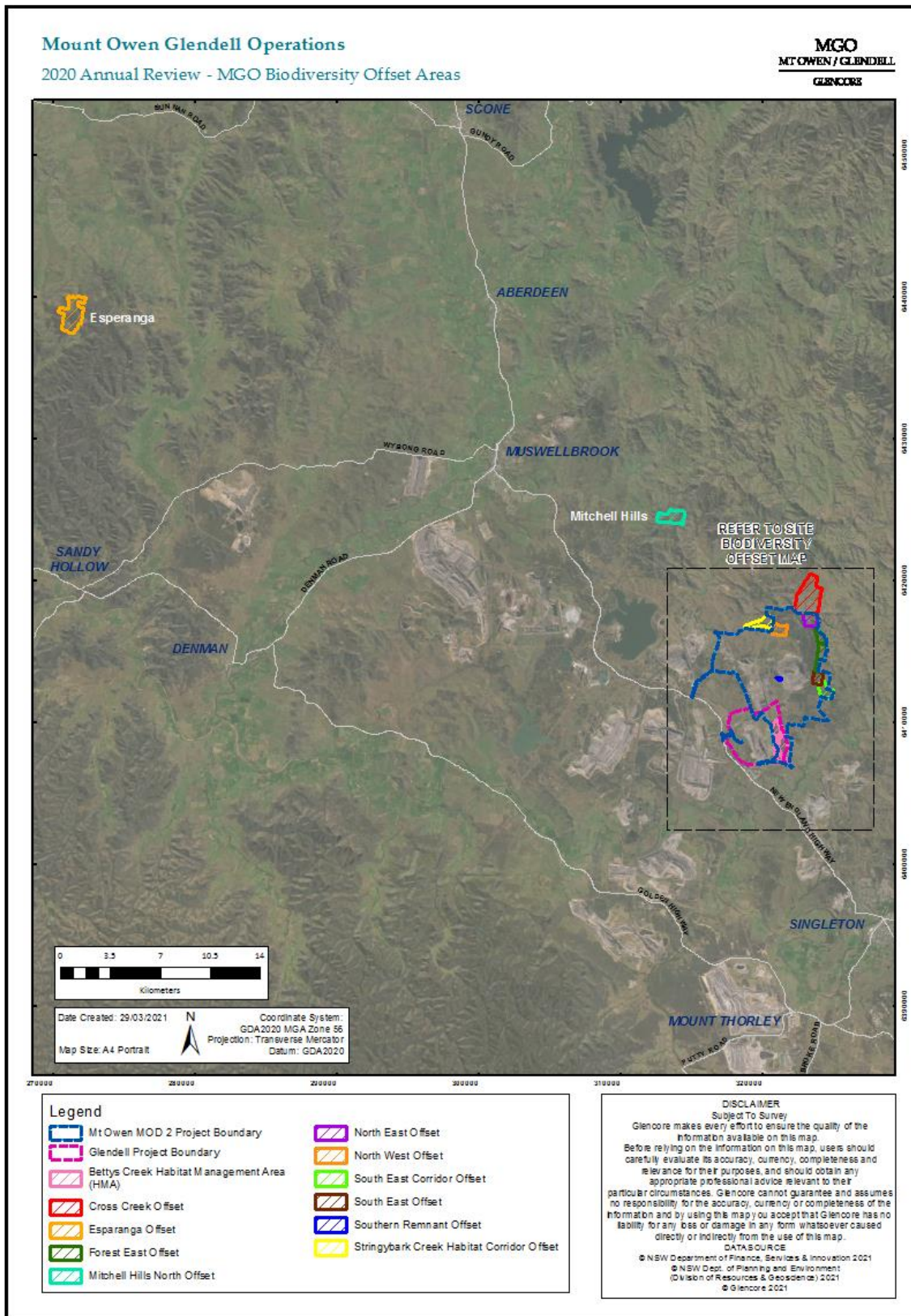


Figure 9: MGO Site Biodiversity Offset Areas - Detail

6.4.2 Rehabilitation Woodland Offset

MGO is required to identify 518 hectares of mine rehabilitation to commit as a BOA within five years of commencement of operations (i.e. by 2022). This area is to be restored to *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC* under the BC Act. The long term conservation of this offset will be determined in accordance with Condition 29, Schedule 3 of SSD-5850 (MOD2).

Details of the rehabilitation to be undertaken in the Rehabilitation Woodland Offset Area are included in the MOP as well as the Rehabilitation Strategy.

6.4.3 Flora Monitoring

As specified within Annexure D of the CAs, annual monitoring of each Conservation Area is required. Monitoring methods during 2020 were consistent with Annexure D of each CA and included:

- photo monitoring for comparison to baseline photos taken between 2015 and 2017 (undertaken at the exact location and from the exact bearings as baseline photos)
- quadrat monitoring, to compare data to benchmark data provided in Annexure D, Table 2 of each CA
- walkthrough assessment of opportunistic sightings, including:
 - fire events or impacts of fire management
 - weeds (including compilation of list of exotic species and recording new weed infestations including location and extent)
 - pest animals (species and location must be recorded, including evidence of pest animals such as burrows, scats or disturbance)
 - visitor impact and vehicle access (including evidence of any recent usage, and the presence of any new access trails or tracks)
 - rubbish dumping
 - natural regeneration of previously disturbed areas and
 - sightings of threatened species.

All monitoring works were undertaken by qualified ecologists. Monitoring was undertaken at the locations required as per Annexure D, Table 1 of each CA, and reproduced in **Table 29: Conservation Agreement Monitoring Locations - 2020**. Photo monitoring locations are shown in **Figure 10**.

Table 29: Conservation Agreement Monitoring Locations - 2020

Site Name	Plant Community Type	Monitoring Type
Bettys Creek (Enex Foydell) CA*		
P07	Derived Native Grassland (proposed for 1692 - Bull Oak Grassy Woodland of the Central Hunter Valley)	Photo & Quadrat
P08	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	Photo & Quadrat
P09	1731 - Swamp Oak – Weeping Grass Grassy Riparian Forest of the Hunter Valley	Photo & Quadrat
GHMA05	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	Photo & Quadrat
GHMA08	Derived Native Grassland (proposed for 1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter)	Photo & Quadrat
GHMA09	1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter	Photo & Quadrat
GHMA11	Derived Native Grassland (proposed for 1691 - Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter)	Photo & Quadrat
GHMA13	Derived Native Grassland (proposed for 1692 - Bull Oak Grassy Woodland of the Central Hunter Valley)	Photo & Quadrat
Bettys Creek (Glendell) CA*		
BCCA-A	Derived Native Grassland (proposed for 1692 - Bull Oak Grassy Woodland of the Central Hunter Valley)	Photo & Quadrat [^]
Mount Owen Offsets CA*		
P01	1731 - Swamp Oak – Weeping Grass Grassy Riparian Forest of the Hunter Valley	Photo & Quadrat
P02	Derived Native Grassland (Proposed for Plant Community Type (PCT) 1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter)	Photo & Quadrat
P05	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	Photo & Quadrat
Photo 3	1614 - Grey Gum - Grey Myrtle - Narrow-leaved Stringybark - Rusty Fig open forest on ranges of the Upper Hunter	Photo & Quadrat [^]
Photo 4	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	Photo & Quadrat [^]
Southern Remnant CA		
Photo 6	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	Photo & Quadrat [^]
Northwest Offset CA		
P06	1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter	Photo & Quadrat
Photo 5	Derived Native Grassland (Proposed for PCT 1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter)	Photo & Quadrat [^]

* The CA naming conventions differ slightly from the BOAs (due to ownership/cadastral issues) in the following ways:

Bettys Creek HMA is split into the Bettys Creek (Enex Foydell) and Bettys Creek (Glendell) CAs (see [Table 28](#)); and

Northeast Offset, Southeast Offset, Southeast Corridor and Forest East Offset are amalgamated into the collective Mount Owen Offsets CA.

[^] Additional quadrat monitoring sites were established at previously photo monitoring sites to track vegetation change over time and allow comparisons against benchmarks

6.4.3.1 2020 Flora Monitoring Results

Biodiversity management performance in the Conservation Areas for 2020 is summarised in [Table 30](#) and includes recommended management actions for 2021.

Table 30: Biodiversity Management Summary 2020 – Conservation Areas

Conservation Area	Management actions undertaken in previous 12 months	Key Trends	Actions for 2021
Bettys Creek (Enex Foydell) CA	<ul style="list-style-type: none"> • Weed Control of Coolatai Grass, African Boxthorn, Galenia and Prickly Pear • Pest Control • Supplementary planting • Monitored direct seeding works • Canopy thinning of PCT 1692 • Incorporated habitat features such as fallen logs and rock piles in active regeneration areas. 	<ul style="list-style-type: none"> • CA composite site value scores increased in 2020 compared to 2019. No site scored below 'Moderate'. • Native species richness increased in 2020 compared to 2019 during drought conditions. • Native over-storey and ground cover other (forbs, ferns and graminoids) increased in 2020, likely due to above average rainfall. • Habitat values indicative of mature forest and woodland ecosystems (i.e. fallen logs and trees with hollows) were well below benchmark values. • Passive Regeneration sites generally met or exceeded benchmark values in native plant species richness, native ground cover other and native over-storey cover • No new records of threatened plants were recorded. Grey-crowned Babblers continue to persist and utilise the CA as breeding and foraging habitat. 	<ul style="list-style-type: none"> • Ongoing management of Coolatai Grass. Investigate potential alternative techniques to manage Coolatai Grass • Introduce ecological fire regime to encourage regeneration as well as maintain open grasslands and woodland structure.
Bettys Creek (Glendell) CA		<ul style="list-style-type: none"> • Site value score decreased in 2020 and remained at Low. This is largely driven by decreases in native species richness and increases in exotic species cover. • An increase in native grass cover and exotic cover, and decrease of native forbs, ferns and graminoids occurred in 2020 relative to 2019. • Above average rainfall and overcompetitive nature of exotic species and the native grass <i>Cynodon dactylon</i> present at the site has displaced other common native species that were recorded in low numbers in 2019. • Native grass cover was the only attribute that met benchmark values. • No records of threatened plants were recorded. 	<ul style="list-style-type: none"> • Continue to monitor European Rabbit, Brown Hare and macropod populations. • Continue to monitor 2020 revegetation. • Continue to monitor 2019 direct seeding works • Incorporate habitat features such as fallen logs, rock piles in active regeneration areas. • Continue to monitor nest box use by native species. • Improve track near entrance with gravel for all weather access. • Prepare and submit project plan of canopy thinning trial of PCT 1692 to BCT.

Conservation Area	Management actions undertaken in previous 12 months	Key Trends	Actions for 2021
<p>Mount Owen Offsets CA</p>	<ul style="list-style-type: none"> • Weed control of Coolatai Grass, African Olive, Sharp Rush Galenia and Prickly Pear. • Monitor European Rabbit, Brown Hare and macropod populations. • Monitor direct seeding works and continue works if technique is successful. • Incorporate habitat features such as fallen logs, rock piles in active regeneration areas. • Native vine control (non-lethal) in PCT 1614. • Realignment of Site P01 to avoid crossing the creek line and better represent the PCT's condition. This realignment will be completed in the 2020 monitoring period 	<ul style="list-style-type: none"> • Higher species richness was recorded across all sites. • Monitoring sites within the Mount Owen Offset CA received Moderate and Good composite site value scores. • Native over-storey cover and native mid-storey cover increased generally and is likely a result of above average rainfall. • Native grass cover shows a steady decline in direct response to competition from increased weed species richness and cover. Other sites remained stable or increased in native grass cover. • Four attributes measured in PCT 1614 met benchmark values, including native over-storey, native mid-storey cover, native groundcover other and native plant species richness, indicating the dry rainforest has responded well to wetter conditions and is improving in structure and species richness. • For Existing Woodland/ Forest management zones in PCT 1602 native over-storey cover, native groundcover other, native plant species richness and fallen logs reached or exceeded benchmark values • Passive Regeneration performed poorly despite the above average rainfall suggesting the need for more intervention or increased sampling effort to better represent the management zone • Existing Woodland/ Forest management zone of PCT 1731 performed better in 2020 with four attributes: native overstorey cover, mid-storey cover, native groundcover grass and native plant species reaching benchmark targets. • No records of threatened plants were recorded in 2020. 	<ul style="list-style-type: none"> • Ongoing weed control of Coolatai Grass, African Olive, Galenia and Pear. • Continue to monitor European Rabbit, Brown Hare and macropod populations. • Continue to monitor success of 2020 revegetation. • Continue to monitor 2019 direct seeding works • Repair track to allow all weather access. • Incorporate habitat features such as fallen logs, rock piles in active regeneration areas. • Implement non-lethal native vine control trial in PCT 1614 . • A Vegetation Management Plan (VMP) should be developed and implemented • Continue to monitor erosion associated with Bettys Creek Diversion • Introduce ecological fire regime
<p>North West Offset CA</p>	<ul style="list-style-type: none"> • Weed control of African Olive, Coolatai Grass and Pear. • Monitor pest species European Rabbit, Brown Hare and macropod populations. • Incorporate habitat features such as fallen logs, rock piles in active regeneration areas 	<ul style="list-style-type: none"> • The monitoring sites across the North West CA received Moderate and Good composite site value scores. • Native mid-storey remained stable between 2018 and 2020. The increase in native herbs, ferns and graminoids is also indicative of wetter conditions promoting a flush of germinates. • For Active Regeneration management zones, no attributes met benchmark values. 	<ul style="list-style-type: none"> • Ongoing weed control of African Olive, Coolatai Grass and Pear. • Continue to monitor pest species European Rabbit, Brown Hare and macropod populations. • Incorporate habitat features such as fallen logs and rock piles in active regeneration areas. • Introduce ecological fire regime to encourage regeneration as well

Conservation Area	Management actions undertaken in previous 12 months	Key Trends	Actions for 2021
			as maintain open grasslands and woodland structure.
Southern Remnant Offset CA	<ul style="list-style-type: none"> • Weed control of Prickly Pear. • Monitor pest species European Rabbit, Brown Hare and macropod populations. • Monitor direct seeding works and continue works if technique is successful. • Incorporate habitat features such as fallen logs, rock piles in active regeneration areas. • Monitor nest box use by native animals and check condition. Nest box adjacent site Photo06 had fallen and was infested by bees 	<ul style="list-style-type: none"> • The monitoring site within the Southern Remnant CA improved further with a higher composite site value score than last year • Increases in native species richness, native over-storey, native mid-storey and the cover of native herb, ferns and graminoids were recorded in 2020. • Exotic plant cover remained at zero despite above average rainfall, which is encouraging. • Five attributes met or exceeded benchmark values, including native over-storey cover, native mid-storey, native groundcover others, native species richness number of trees with hollows and fallen logs. • The open understorey and large edge to area ratio continues to favour a large population of Noisy Miners, which were seen harassing Grey-crowned Babblers during the 2020 monitoring • The revegetation in 2019 is showing promising signs with good recruitment of understorey plants in rip lines. • No records of threatened plants were recorded in 2020. 	<ul style="list-style-type: none"> • Continue to monitor pest species European Rabbit, Brown Hare and macropod populations. • Investigate Noisy Miner management. • Continue to monitor 2019 direct seeding works. • Monitor recovery of disturbed land associated with boundary fence realignment for potential weed populations. • Incorporate habitat features such as fallen logs, rock piles in active regeneration areas. • Continue to monitor nest box use by native animals and check condition. • Re-install the nest box adjacent site Photo06. • Introduce ecological fire regime



Figure 11: Acacia Decora germinate in direct seeding rip line of Southern Remnant CA

In 2020, the BOAs including Cross Creek Offset Site, Stringybark Habitat Corridor Offset Site, Esparanga Offset Site and Mitchell Hills North Offset Site did not require management actions. These sites were submitted to the BCT to become stewardship agreements. Management actions will continue in year 1 of the agreement granted approval.

6.4.4 Fauna Monitoring

6.4.4.1 Monitoring Methods

Fauna monitoring undertaken at MGO fauna monitoring sites and within the Biodiversity Offset Areas consists of the following methods:

- Diurnal woodland bird surveys,
- Targeted winter bird surveys,
- Microbat echolocation call surveys,
- Diurnal herpetofauna surveys,
- Nocturnal spotlight surveys,
- Call playback surveys, and
- Remote camera surveys.

6.4.4.2 Monitoring Results (MGO Sites)

Climatic conditions experienced in 2020 contrasted to the previous years which were very dry, with significant rainfall events recorded throughout the 2020 year. The majority of dams and water bodies were filled, with the annual rainfall for 2020 of 841mm for MGO well above the annual average of 649mm.

A total of 54 bird species were recorded in 2020 by census survey, and an additional 37 by observations outside the census survey. The cumulative total for bird species at MGO is 171 species. One new bird species was recorded in 2020, the Wonga Pigeon. Analysis of the bird species diversity indices at each fauna monitoring site recorded significant variations between sites and between

years. The rehabilitation site Reh1 recorded the highest bird species diversity in 2020, with Rehabilitation Site Reh3 scoring high bird species diversity also. The two remnant Forest sites also scored highly in 2020.

Monitoring for mammal species in 2020 was undertaken with remote field cameras, trapping surveys for smaller mammals and microbats, and nest box inspections. Field cameras recorded a diverse number of medium to larger mammals, including 3 introduced species. The threatened Spotted-tail Quoll was captured at one location in 2020, but also recorded by field camera at nearby offsets also. The threatened Brush-tailed Phascogale and Squirrel Glider were recorded in nestboxes in 2020, both being located in Rehabilitation sites. Many additional nestboxes throughout MGO also exhibit evidence of use due to presence of their characteristic leaf nests. The small terrestrial native mammals, Common Dunnart and Yellow-footed Antechinus are still persistent within MGO, although numbers captured in 2020 were significantly lower. Twelve microbat species were recorded by trapping and echolocation call recordings.

Nest boxes installed in the rehabilitation sites recorded the presence of Squirrel Glider, Brush-tailed Phascogale, Common Brushtail Possum and evidence of microbat use. Boxes specific to some fauna groups were only installed in 2018 – 2019, with relatively rapid occupation within 12 months of installation.

Six reptile species were detected in 2020, including one new species in 2020, the Burton's Snake-lizard. Surveys for frogs recorded increased diversity and abundance compared to 2019, due to many of the dams filling following several years of extended drought. The annual rainfall recorded at MGO in 2020 was 841mm, above previous reporting period 397mm.

In 2020, 12 threatened species were recorded, 6 bird species, 3 non-flying mammals and 3 microbat species. A total of 27 threatened species have been detected at the MGO since the commencement of fauna monitoring. Overall usage of nest boxes across all broad habitats and nest box types indicate 10.4% of all installed boxes were utilised in 2020 within the Mt Owen Glendell Operation. However, analysis of separate fauna groups reveal higher occupation rates by specific species, such as gliders (36.8% of boxes utilised), possums (25.0% of boxes utilised) and bird boxes (12.5% utilisation). The low usage of microbats is attributed to the older style of nest boxes which have been installed since 1994, and many of which are now in relatively poor condition.

Fauna species recovered from felled habitat trees include Lace Monitor (x4), Robust Velvet Gecko (1) and Common Brushtail Possum (x2). No individuals were injured in the felling operation, and were either removed and released in nearby forest, or allowed to disperse without human intervention. Habitat features such as dead trees with hollows were identified for use as either ground logs or standing trees to be placed in the rehabilitation areas.

6.4.4.3 Monitoring Results (MGO Offsets)

Overall, the fauna monitoring for MGO Offsets, undertaken over the period 1996 – 2020, has recorded a total of:

- 165 native and 2 introduced bird species
- 45 native and 10 introduced mammal species
- 32 reptiles
- 19 frog species.

In the 2020 monitoring period, a total of 86 bird species, 12 native and 9 introduced mammals, 10 microbat species, 7 reptile and 6 frog species were recorded. The highest bird species diversity in 2020 was recorded at Esparanga, Mitchell Hills and Bettys Creek

HMZ, each supporting very different vegetation communities and habitat types. Significant bird species diversity scores at several offset sites likely a combination of improved climatic conditions in 2020, with above average rainfall recorded at each offset.



A: Brushtail Possum in nestbox, Bettys Creek HMZ



B: Lace Monitor in nestbox, South East Corridor, VCA



C: Wedge-tail Eagle viewing field camera, Esparanga Offset



D: Squirrel Glider in nestbox, Stringybark Creek VCA

Figure 12: Opportunistic photos of fauna identified in offset areas

Cumulative Threatened Fauna

MGO carries out seasonal fauna monitoring across site rehabilitation areas and onsite BOAs. This includes monitoring of birds, reptiles, mammals and frogs. Table 31 lists the threatened species observed since 1996 at MGO.

Table 31: Threatened species observed at MGO 1996 – 2020

Common Name	EPBC	BC Act	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Swift Parrot	E	E										√		√							√						
Green & Golden Bell Frog	E	CE	√	√		√						√*															
Little Eagle		V	√	√		√		√																			
White-bellied Sea Eagle		V				√	√		√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Little Lorikeet		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√			√	√	√		√	
Powerful Owl		V									√	√	√	√													
Masked Owl		V		√		√		√	√	√	√	√	√		√	√		√		√	√					√	
Brown Treecreeper		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Speckled Warbler		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Black-chinned Honeyeater		V	√	√						√	√																
Scarlet Robin		V		√														√									
Flame Robin		V				√	√																				
Hooded Robin		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√	√		√					
Grey-crowned Babbler		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Varied Sittella		V		√	√	√	√		√	√	√	√	√	√	√											√	√
Dusky Woodswallow		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Diamond Firetail		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√								

MT OWEN GLENDELL OPERATIONS

Annual Review 2020

Common Name	EPBC	BC Act	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Spotted-tail Quoll	V	V					√	√	√	√	√		√	√	√	√	√	√	√	√	√			√		√	√
Brush-tailed Phascogale		V																√					√	√		√	√
Koala		V	√*																							√*	
Squirrel Glider		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√			√
New Holland Mouse	V									√	√	√	√	√									√				
Grey-headed Flying-fox	V	V		√			√				√		√	√			√						√			√	√
Yellow-bellied Sheathtail-bat		V												√*		√*	√*		√*	√*							
Eastern-Coastal Freetail-bat		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√
Large-eared Pied Bat	V	V				√*		√*					√*		√*						√*	√*					
Eastern Bentwing-bat		V	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√			√	√
Little Bentwing-bat		V						√*							√*	√											√
Large-footed Myotis		V				√		√				√		√	?	?						√					
Greater Broad-nosed Bat		V					√	√	√		√				?	?	√		√	√							

E = Endangered

V = Vulnerable

√* Unconfirmed sighting

Biodiversity Management Works

6.4.5 Biodiversity Offset Areas (BOAs) Management

6.4.5.1 Direct Seeding

In 2020 MGO carried out direct seeding works across its Offset Areas. A total of 23.5 hectares were direct seeded within the vegetation community 1602 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter. A photo showing one seeded area is included in [Figure 13](#)Error! Reference source not found.. Further direct seeding works are planned for Autumn 2021.



Figure 13: Example of direct seeding works completed at Stringybark Offset Area

6.4.5.2 Compensatory Planting

In accordance with DA 80/952 and SSD-5850, a compensatory planting ratio of 10:1 is required for every Hunter River Oak removed or severely damaged as a result of works associated with the Relocation of the Transmission line at GLD and the installation of the Greater Ravensworth Area Tailing Pipeline Infrastructure during the 2017 reporting period. While clearing activities were minimised, works removed or severely damaged 198 mature Hunter River Oaks. In accordance with DA 80/952 and SSD-5850, MGO planted approximately 2,000 Hunter River Oak tubestock within the Bowmans Creek Riparian Corridor during the 2017 reporting period. Portable solar panel electric fencing was also installed at the time of planting to deter livestock and other animals from entering the planting areas.

MGO monitored the development of the Hunter River Oak plantings during the 2018 reporting period and noted that less than 10% of the original plantings has survived. It was identified this was largely due to:

- Below average rainfall experienced during the two previous reporting periods

- Presence of livestock within planting area i.e. failure to contain livestock with portable solar powered electric fence
- Planting of tubestock undertaken during winter.

In the 2020 reporting period, as a result of the low survival rate, MGO planted an additional 2,000 Hunter River Oak using the direct seed technique. Additional fencing was installed to protect plantings from grazing activities. There was no strike in 2019 due to unfavourable drought conditions.

Tube stock planting is planned for April 2021 in the areas that are now fenced. The tube stock growth will be assisted by a watering program and pest control in planting areas. MGO will continue to monitor the survival rate and report on planting progress in the next Annual Review.

6.4.5.3 South East Corridor – Tree Planting

As per BOMP requirements a total of 13,200 tubes were planted on South East Corridor Offset with a canopy to shrub ratio of 1.66. These activities were completed from 2017 - 2019 in order to enhance corridor function in this area. In 2020, this area was monitored and maintained good survival and growth, with the density of canopy and mid story species appropriate for the target vegetation type. **Table 32: South East Corridor Offset tree planting species** shows planted species.

Table 32: South East Corridor Offset tree planting species

Species	Common Name	Number
<i>Eucalyptus fibrosa</i>	Broad leaf ironbark	1000
<i>Eucalyptus crebra</i>	Narrow leaf ironbark	1060
<i>Corymbia maculata</i>	Spotted gum	340
<i>Eucalyptus moluccana</i>	Grey Box	400
<i>Allocasuarina luehmannii</i>	Bull oak	400
<i>Casuarina glauca</i>	Swamp oak	200
<i>Angophora floribunda</i>	Rough bark apple	120
<i>Eucalyptus tereticornis</i>	Forest red gum	1000
<i>Melaleuca styphelioides</i>	Prickly leaf paperbark	120
<i>M. decora</i>	White feather honey myrtle	120
<i>M. nodosa</i>	Ball honey myrtle	200
TOTAL overstorey		4960
<i>Acacia decora</i>	Western golden wattle	880
<i>Acacia decurrens</i>	Green Wattle	640
<i>Acacia falcata</i>	Falcate wattle	800
<i>Acacia parvipinnula</i>	Silver stem wattle	780

Species	Common Name	Number
<i>Acacia implexa</i>	Hickory	880
<i>Daviesia ulicifolia</i>	Gorse bitter pea	400
<i>Acacia amblygona</i>	Fan wattle	540
<i>Acacia paradoxa</i>	Kangaroo thorn	80
<i>Dodonaea viscosa</i>	Hop bush	800
<i>Indigofera australis</i>	Indigo	600
<i>Bursaria spinosa</i>	Blackthorn	800
<i>Breynia oblongifolia</i>	Coffee bush	600
<i>Kunzea occidentalis</i>	Tick bush	440
TOTAL shrubs		8 240
TOTAL plants		13 200

6.4.5.4 Habitat Augmentation

A total of 78 additional nest box structures were installed across MGO Biodiversity Offsets and Rehabilitation Areas in 2020 (Figure 14). This included 14 Small Mammal Boxes, 13 Microbat Boxes, 23 Bird Boxes, 12 Glider Boxes and 16 Possum Boxes.

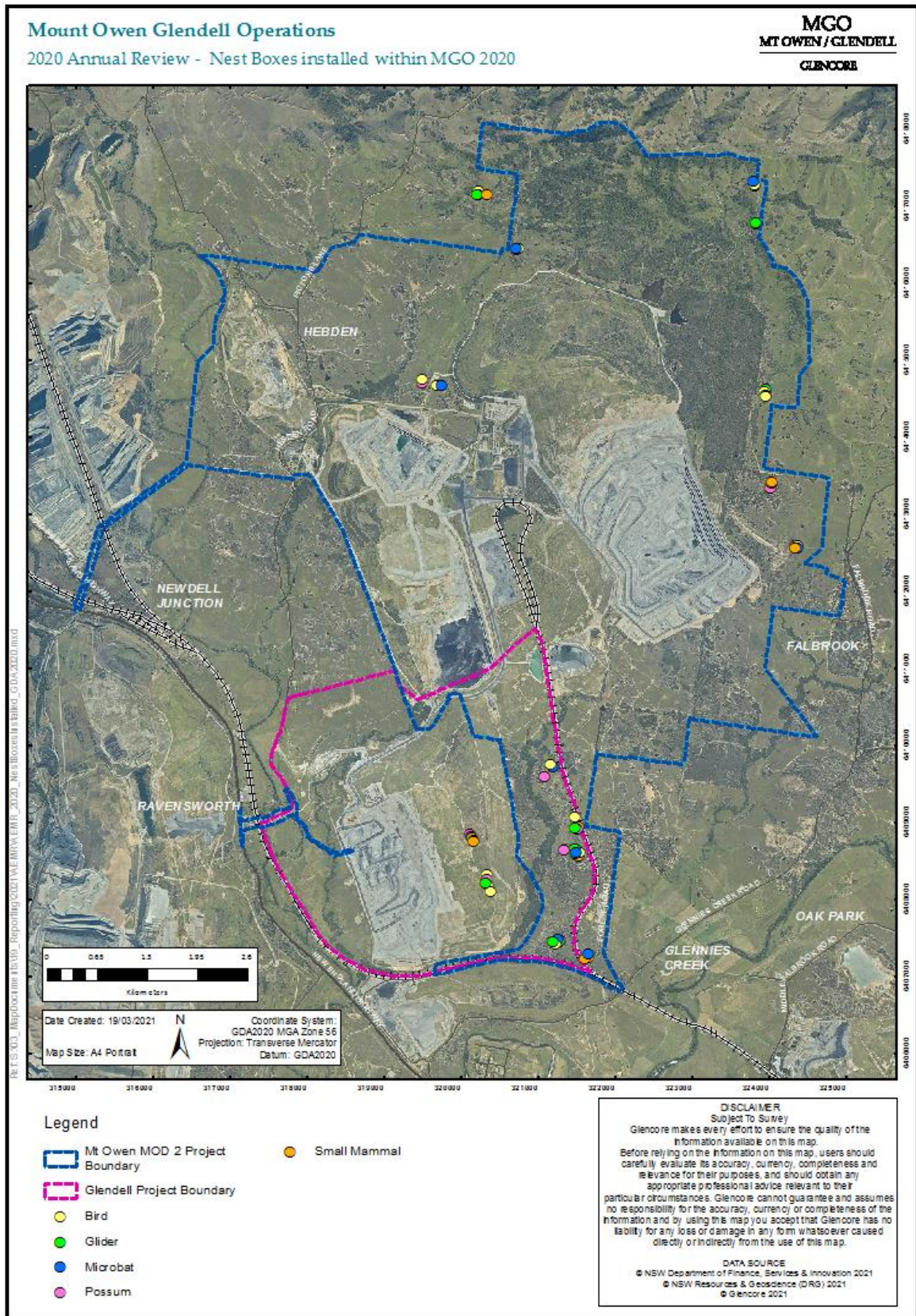


Figure 14: Nest Boxes Installed at MGO in 2020

The BOMP (2018) details specific habitat creation for Spotted-tail Quolls in the Stringybark Creek BOA. These structures consisted of 5m lengths x 30cm diameter disused polypipe utilised by MGO for water management and were installed in 2019. In 2020, there was evidence of Spotted-tail Quolls utilising these structures across MGO (refer to [Figure 15](#)). Due to this success, additional structures were installed in the Cross Creek offset and the East West Corridor Management Area. These areas which have been identified as ideal locations to create habitats for the Spotted-tail Quoll. Branches and other small logs have been used to cover the poly-pipe to create the habitat feature (refer to [Figure 15](#)).

No specific habitat enhancement works are specified for the Esparanga BOA. The offset supports a high density of habitat trees with hollows, negating the need for installation of specific fauna nest boxes.



A: Evidence of Spotted-tail Quoll at polypipe structure, Stringybark Creek VCA, 2020



B: Log feature habitat installed in East-West Corridor

Figure 15: Habitat Augmentation features installed within BOAs

6.4.5.5 Weed Management

A Weed Action Plan was developed to identify all targeted weed control activities at the MGO. The plan was implemented during the 2020 reporting period, continuing the active programs of control that have been implemented since 1996. Throughout the MGO rehabilitated areas, weeds targeted during 2020 included:

- Galenia
- Lantana
- Coolatai Grass
- Prickly Pear
- Acacia Saligna.

Weeds were also sprayed in areas across the MGO buffer land and BOAs, targeting species including but not limited to:

- African Boxthorn - *Lycium ferocissimum*
- African Olive - *Olea europaea subsp. Cuspidate*
- African Lovegrass - *E. curvula*
- Acacia Saligna.
- Bathurst Burr - *Xanthium spinosum*
- Blackberry - *Rubus fruticosus species aggregate*
- Coolatai Grass - *Hyparrhenia hirta*
- Cotton Bush – *Gomphocarpus fruticosus*
- Inkweed - *Phytolacca octandra L.*
- Lantana - *Lantana camara*
- Pampass Grass – *Cortaderia spp.*
- Prickly Pear - *Opuntia spp.*
- Saffron Thistle – *Carthamus lanatus*
- Scotch Thistle - *Onopordum acanthium*
- Tiger Pear - *Opuntia aurantiaca*
- Spear Thistle - *Cirsium vulgare*

A summary of weed management works undertaken in MGO biodiversity offsets during the reporting period is included in [Table 33](#). During 2020 a successful weed management program was implemented targeting Acacia Saligna, African Boxthorn and Kia Apple. Targeted weed management actions can be seen in [Figure 16](#).



Figure 16: Targeted weed control works in MGO Offset Areas

Table 33: MGO Weed Works Completed in Biodiversity Offsets 2020

Offset Area	Weed Control Applied to Area	Weeds Targeted
Northwest Offset	Woody, herbaceous	<ul style="list-style-type: none"> • Low volume basal bark spray application of African Olive, • Low volume foliar spray application of Coolatai Grass, Prickly Pear. • Cut and paint of African Olive using chainsaws and hand saws. • High volume spray application targeting Coolatai Grass.
Northeast Offset	Woody, herbaceous	<ul style="list-style-type: none"> • Low volume basal bark spray application of African Olive, • Low volume foliar spray application of Coolatai Grass, Prickly Pear and St John's Wort. • Cut and paint of African Olive using chainsaws and hand saws. • High volume spray application targeting Coolatai Grass. • High Volume Spray Application targeting Lantana
Southeast Offset	Herbaceous	<ul style="list-style-type: none"> • Low volume spray application of <i>E. curvula</i> (African Lovegrass) and <i>H. hirta</i> (Coolatai Grass).

		<ul style="list-style-type: none"> • Low volume spray application of Galenia • Cut and paint of African Olive using chainsaws and hand saws. • High volume spray application targeting Coolatai Grass • High volume spray application targeting Prickly Pear. • High Volume Spray Application targeting Lantana
Forest East Offset	Herbaceous	<ul style="list-style-type: none"> • Low volume spray application of E. curvula (African Lovegrass) and H. hirta (Coolatai Grass). • Cut and paint of African Olive using chainsaws and hand saws. • High volume spray application targeting Coolatai Grass • High volume spray application targeting Prickly Pear. • High Volume Spray Application targeting Lantana
Southeast Corridor Offset	Herbaceous	<ul style="list-style-type: none"> • Low volume spray application of E. curvula (African Lovegrass) and H. hirta (Coolatai Grass). • Cut and paint of African Olive using chainsaws and hand saws. • High volume spray application targeting Coolatai Grass • High volume spray application targeting Prickly Pear
Southern Remnant Offset	Woody	<ul style="list-style-type: none"> • Low volume spray application of Prickly Pear.
Stringybark Creek Habitat Corridor	Woody, herbaceous	<ul style="list-style-type: none"> • Low volume basal bark spray application of African Olive, low volume foliar spray application of Coolatai Grass, Prickly Pear. • Cut and paint of African Olive using chainsaws and hand saws. • High volume spray application targeting Coolatai Grass.
Esparanga Offset	Foliar Spray	<ul style="list-style-type: none"> • Low volume foliar spray application of Coolatai Grass, Prickly Pear and Inkweed
Mitchell Hills Offset	Foliar Spray	<ul style="list-style-type: none"> • Low volume foliar spray application of Coolatai Grass, Prickly Pear..
Bettys Creek Habitat Management Area (HMA)	Woody, herbaceous	<ul style="list-style-type: none"> • High volume spray application targeting Coolatai Grass and African Lovegrass. • Low volume spray application of Prickly Pear. • Low volume spray application of Galenia species. • Cut and paint application on African Boxthorn. • Low volume and high-volume spray application of lines 1m wide were applied to all vegetation.

6.4.5.6 Offset & Buffer Land Pest Control

A Vertebrate Pest Monitoring Program (VPMP) was implemented across MGO BOAs and buffer lands during the report period, utilising a range of temporary and permanently installed motion detection cameras. The VPMP detected a range of pests, including deer, wild dogs, pigs, foxes and humans (as a result of unauthorised access).

Offset Pest Control

A targeted wild dog and fox baiting program was conducted across MGO offsets during the report period. The program consisted of a seasonal ‘1080’ baiting program undertaken in Autumn (May) and Spring (October) across on-site BOAs, and monthly canid ejector bait program across off-site BOAs. Trained personnel placed ‘1080’ poison baits, and ejector baits around across all areas. Results of the 2020 offset baiting program are summarised in **Error! Reference source not found.**, and photos in [Error! Not a valid bookmark self-reference.](#)

Table 34: Wild Dog and Fox Biodiversity Offset Baiting Program – 2020 results

	Number of bait locations	Total number of baits made available to targeted species	Number of baits taken by targeted species	Targeted species success rate
1080 Baiting Program				
Autumn	74	222	26 (10 Wild Dogs & 16 Foxes)	11.7%
Spring	74	222	50 (33 Wild Dogs & 17 Foxes)	22.5%
Ejector Baiting Program				
Annual	23	276	122	44.2%



Figure 17: Images captured on motion cameras in Offset Areas during 2020

Buffer land Pest Control

During 2020, 9 baits were taken by non-target species, including 5 goannas and 4 miscellaneous. The poison is not lethal to goannas. Goannas tend to be problematic in the warmer months when they are more active and, as such, baiting in summer is not recommended. Of the baits taken by goannas, all were taken during the spring program. Trapping was not conducted in Spring 2020 (see Table 35 and photos in Figure 18).

Table 35: Wild Dog and Fox Buffer Land Baiting Program – 2020 results

	Number of locations	Total number of baits made available to targeted species	Number of targeted species culled	Targeted species success rate
1080 Baiting Program				
Autumn	80	240	11	4.5%
Spring	84	252	47	19%
Trapping				
Autumn	38	-	7	18.4%
Spring	N/A	N/A	N/A	N/A



Figure 18: Images captured during buffer land spring baiting program

A number of combined firearm culls were undertaken during 2020 across buffer lands and offsets. This resulted in the culling of the following target species listed in Table 36.

Table 36: Wild Dog and Fox Buffer firearm cull – 2020 results

Target Species	Number
----------------	--------

Deer	18
Rabbits	221

6.5 Heritage

6.5.1 Aboriginal Heritage

MGO has implemented an Aboriginal Cultural Heritage Management Plan (ACHMP). The ACHMP provides strategies for the management of remaining registered Aboriginal sites. It also provides for the management of the Bettys Creek, Swamp Creek, Yorks Creek and Bowmans Creek areas that fall outside the approved MGO disturbance boundaries. These areas retain Aboriginal heritage and archaeological values that require management, despite being salvaged.

MGO utilises ground disturbance permits (GDPs) to prevent damage to known valid Aboriginal sites. Alternatively, a due diligence assessment is conducted, and any necessary controls implemented. This is completed prior to authorisation of ground disturbance work.

A meeting between MGO and the Aboriginal community was held in June 2020. Another meeting was attempted to be held in November 2020, however a lack of attendance from stakeholders resulted in it being cancelled. The Aboriginal Cultural Heritage Working Group (ACHWG) representatives discussed the greater involvement of the Aboriginal community stakeholders in the conservation and management of Aboriginal cultural heritage. Further discussion was also held regarding the construction and housing of salvaged artefacts at the Wollombi Brook Conservation Agreement Area, with construction of the facility scheduled to commence in 2020. Unfortunately due to Covid-19, the open day was unable to be held with the Registered Aboriginal Parties (RAP's) to discuss management options for the York's Creek Aboriginal Conservation Area.

2020 Monitoring Program

In 2020 MGO, in conjunction with two RAPs and an OzArk archaeologist, continued the monitoring of Aboriginal heritage sites across both MGO and Integra Underground (see Figure 19 and Figure 20). The monitoring, occurring quarterly, includes:

- site condition monitoring - previously recorded sites are inspected to evaluate the condition of the site.
- management recommendations may be made to improve the condition of a site, should it be required.

MGO monitored quadrants 1, 3 and 4 during 2020 with over 51 artefact sites visited. Quadrant 2 could not be visited due to heavy rain restricting access to sites on the scheduled day. Artefacts were found to be well-preserved with minor management recommendations such as improved signage required.

MGO and an OzArk archaeologist are also required to undertake photographic monitoring every three years. In 2020, photographic monitoring was performed in August and November, covering 10 previously recorded sites. No immediate management was required at the sites however some stones at Bettys Creek Stone Arrangement have been dislodged by kangaroo traffic and consultation with RAPs on future management strategies is recommended.



Figure 19: Retouched mudstone blade artefact monitored in 2020 in MGO's Buffer Lands



Figure 20: Silcrete core artefact monitored in 2020 in MGO's Buffer Lands

Salvages During 2020

During 2020, four sites were salvaged under permit, and in accordance with the ACHMP. One site was fully salvaged and two others had specific segments salvaged to allow for mining under DA 80/952. One other site was attempted to be salvaged for mining under SSD-5850 however the artefact could not be located and the site was determined to be destroyed by the RAPs and archaeologist. Artefacts salvaged were taken to Umwelt as agreed with the RAPs.

6.5.2 European Heritage

MGO manages European heritage through the implementation of the Historic Heritage Management Plan (HHMP). MGO demonstrates a varied historical pattern of European habitation. Prior European land use in the area has identified a range of activities, from dairying to mixed farming, cropping, and mining activities.

MGO has committed to continual historical heritage management initiatives. They include:

- Implementing a quarterly heritage monitoring program
- Ongoing maintenance of sites.

During 2020 the Marali House had the fence and signage fixed. (see [Figure 21](#)). Monitoring during the reporting period found that sites are well-preserved with minimal management recommendations required, such as the timber loading ramps pictured below in [Figure 22](#).



Figure 21: Fence at Marali Homestead



Figure 22: Timber loading ramp to be managed in-situ

6.5.3 Visual Amenity

MGO undertook direct seeding and tube stock planting works in September 2019 as part of the development of the Middle Falbrook Tree Screening as described in MOCO MOD 2. Seeding works utilised a mix of species endemic to the local area. Preparatory weed control, ripping and fencing works were also undertaken during the reporting period prior to planting.

In 2020, additional direct seeding and tube stock planting was completed which the screen demonstrated great ground cover with evidence of thriving saplings. This included the planting of an additional 120 overstorey tubestock and seeding of overstorey as well as mid storey species. Evidence of this work was provided to DPIE during August 2020 (DPIE Portal reference SSD-5850-PA-32). MGO will continue to monitor and manage the development of the tree screen during the next reporting period in accordance with Schedule 3 Condition 39A of SSD-5850.

6.5.4 Demolition Works

During the reporting period two properties were demolished which comprised of Former Hebden Public School as well as a Ravensworth Primary School.

Hebden Public School

Hebden Public School was dismantled and disposed of due to a fire that burnt it down on the 15 April 2020 from a suspected arson attack. Demolition commenced on the 26 August 2020 and was completed with waste removed on the 17 September 2020. [Figure 23](#) and [Figure 24](#) shows before and after photos of the demolition. Approximately 20.84 tonnes of waste was removed from the site including 8.34 tonnes of mixed waste and 12.5 tonnes of Asbestos contaminated soil.



Figure 23: Demolition of Hebden PS - before



Figure 24: Demolition of Hebden PS - after

Ravensworth Public School

The former Ravensworth Public School was partially demolished as a result of it being set on fire by suspected vandals. Demolition commenced in June 2020 and was completed in September 2020. The demolition left parts of the public school as a heritage ruin site in line with community feedback. [Figure 25](#) and [Figure 26](#) shows before

and after photos of the demolition. Approximately 415.6 tonnes of waste was removed from the site including 38.24 tonnes of mixed waste, 308.18 tonnes of concrete waste, 69.18 tonnes of asbestos material.

Asbestos removal work was undertaken by a licensed asbestos removal contractor – JR Richards - in accordance with the Safe Work NSW *Code of Practice – How to Safely Remove Asbestos* 2016 and the *NSW Work Health and Safety Regulation 2017*, Clauses 473, 474 and 482. An independent certifier (TMT Industries) was engaged to undertake a visual inspection of the site to confirm the removal of the asbestos. This inspection was undertaken on 11 June 2020 and it determined that no further action was required.

MGO held a community event during December 2020 at the site on completion of works. This event allowed various stakeholders to view the “managed ruin” status of the site as well as interpretive signage installed to educate the community on the heritage values of the site.



Figure 25: Ravensworth Public School - before



Figure 26: Demolition of Ravensworth Public School - After

7 Water Management

MGO operates under a suite of water management plans, all of which were approved by DPIE during 2020. These include:

- Water Management Plan (Overarching) (October 2020)
- Surface Water Management and Monitoring Plan (SWMMP) (October 2020)
- Groundwater Management and Monitoring Plan (GWMMP) (October 2020)
- Erosion and Sediment Control Plan (October 2020)
- Creek Diversions Plan (May 2020)
- Surface Water and Groundwater Response Plan (SWGWRP) (October 2020)

The SWMMP, GWMMP and SWGWRP were all reviewed during 2020, in consultation with relevant government agencies.

Mining related water licensing and relevant pumped volumes at MGO are outlined in [Table 37](#). Glencore owns a number of additional surface water licences associated with farm irrigation on Glencore land. These licences have

been excluded from this annual review as they are not linked to mining and not required under any consent. Water take is water taken by the operation in the previous water year (1st July 2019 to 30th June 2020).

Table 37: MGO 2020 Water Licensing Summary

Water Licence Number	Water sharing plan, source and management zone (as applicable)	Licence Activity/ Entitlement	Description	Water take (ML) 1/7/ 2019 – 30/6/2020
Surface Water Licences				
WAL7814	Hunter Regulated Water Sharing Plan, Zone 3A (Glennies Ck)	Licence to pump 1000 units.	Water pumped to Mt Owen and Integra to be treated and used throughout operational facilities.	798.1
20WA210993	Hunter Unregulated and Alluvial Water Sources, Jerrys Management Zone (Jerrys Water Source)	Upper diversion of Swamp Creek	Diversion complete being maintained through inspections and annual stream stability assessments.	N/A
20WA211425	Hunter Unregulated and Alluvial Water Sources, Jerrys Management Zone (Jerrys Water Source)	Middle Diversion of Swamp Creek	Diversion complete being maintained through inspections and annual stream stability assessments.	N/A
20WA211430	Hunter Unregulated and Alluvial Water Sources, Jerrys Management Zone (Jerrys Water Source)	Lower diversion of Swamp Creek	Diversion complete being maintained through inspections and annual stream stability assessments.	N/A
20WA211429	Hunter Unregulated and Alluvial Water Sources, Jerrys Management Zone (Jerrys Water Source)	York's Creek diversion	Diversion complete being maintained through inspections and annual stream stability assessments.	N/A
20WA212187	Hunter Unregulated and Alluvial Water Sources, Jerrys Management Zone (Jerrys Water Source)	Upper and middle diversion of Bettys Creek	Diversion complete being maintained through inspections and annual stream stability assessments.	N/A
20WA212660	Hunter Unregulated and Alluvial Water Sources, Jerrys Management Zone (Jerrys Water Source)	Lower diversion of Bettys Creek	Diversion complete being maintained through inspections and annual stream stability assessments.	N/A
Groundwater Licences				
20BL169337	N/A	Groundwater extraction for dewatering purposes – Mt Owen North Pit 140 units	Groundwater extraction at Mt Owen North Pit.	652

Water Licence Number	Water sharing plan, source and management zone (as applicable)	Licence Activity/ Entitlement	Description	Water take (ML) 1/7/ 2019 – 30/6/2020
20BL170294	N/A	Groundwater extraction for dewatering purposes – Eastern Rail Tailings Pit 220 units	Groundwater extraction at Eastern Rail Pit.	
20BL170295	N/A	Groundwater extraction for dewatering purposes – Bayswater North and West Pit 800 units	Groundwater extraction at Bayswater North and West Pit	
20BL168209	N/A	Saline water extraction bore - 2,500 units	Additional allocation for groundwater extraction across the Mt Owen Complex. Groundwater take should be compared to total allocation to determine compliance with licensing.	
20BL169544	N/A	Saline water extraction bore - 2,500 units	Additional allocation for groundwater extraction across the Mt Owen Complex. Groundwater take should be compared to total allocation to determine compliance with licensing.	
20BL168116	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL169332	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL169333	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL169334	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL169335	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL169336	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171534	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171535	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171536	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171537	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171538	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171539	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A

Water Licence Number	Water sharing plan, source and management zone (as applicable)	Licence Activity/ Entitlement	Description	Water take (ML) 1/7/ 2019 – 30/6/2020
20BL171540	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171541	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171542	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171543	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171544	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171545	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171546	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL171547	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A
20BL168116	N/A	Monitoring bore	Monitoring bore used for groundwater monitoring.	N/A

7.1 Water and Salt Balance

The MGO operates a water management system designed to ensure efficient operation of the site through the control of water inflow and the ready provision for onsite demands. Appendix G, Figure 5 details the water flow path throughout the complex. In average to dry rainfall periods, MGO is predicted to operate with a water deficit in absence of water imports from either the GRAWTS or from licensed surface water allocations. A summary of the 2020 MGO water and salt balance is in [Table 38](#).

Table 38: MGO Water and Salt Balance for 2020

Aspect	Volume (ML)	Salt (T)
INFLOWS		
Runoff	5,575	6,816
Glennies Creek Extraction	1,245	335
Transfers from Other Sites	1,261	6,731
Tailings Bleed Water to West Pit ¹	6,025	32,168
CHPP Feed ROM Moisture	770	4,113
Groundwater Inflow	652	2,833
Total	15,528	52,997
OUTFLOWS		
Evaporation	1,210	-
Exported to Other Sites	5,521	7,670
Entrainment ²	1,567	8,369
Dust Suppression	1,592	3,824
Off-site Discharge	-	-
Total	9,891	19,863
BALANCE		
Inflow – Outflow	5,636	4,680
Change in Storage³	2,592	17,265
Inflow – Outflow – Change in Storage	3,043	15,868
Error	11.97%	21.78%

1. Tailings bleed from Ravensworth and Liddell tailings.

2. Includes water entrained in tailings, product coal and coarse rejects.

3. Accounts for the estimated water storage in the West Pit overburden emplacement area spoil over the reporting period.

The water balance assessment for 2020 produced a net inventory change over the year of 5,636ML of which, 2,592ML is estimated to be stored in the overburden of the four primary pits. There is an estimated volume error of approximate 12% in the water balance and 22% in the salt mass balance. This is likely due to an underestimation of outflows from either seepage to west pit overburden from West Pit tailings or an under estimation/measurement of dewatering volumes. It is also considered that an overestimation of inflows of seepage to Baywater North Pit from West Pit tailings could also be the cause of this imbalance. During 2021 MGO plans to review assumptions and measurements made in these areas to refine the water balance calculations.

7.2 Hunter River Salinity Trading Scheme (HRSTS)

MGO currently holds 5 credits in the scheme. MGO does not have an active discharge point. Water is transferred to other sites as part of the GRAWTS where discharges may occur under given conditions. Mt Owen credits would be transferred to the relevant discharge site if discharge was to occur.

7.3 Surface Water

Monitoring Program and Triggers

7.3.1 Water Quality

MGO monitors surface water quality at 19 creek locations surrounding the site (Figure 27). These include:

- Bowmans Creek (5 sites: BMC1-BMC5)
- Yorks Creek (3 sites: YC1-YC3)
- Swamp Creek (4 sites: SC1-SC4)
- Bettys Creek (4 sites: BC1-BC4)
- Main Creek (3 sites: MC1-MC3).

Sites are monitored for pH, electrical conductivity (EC) and total suspended solids (TSS). Results are recorded within the site Environmental Monitoring Database. Results are assessed against baseline trigger levels outlined in the MGO SWMMP.

Table 39: Surface Water Quality Triggers

Water Quality Variable	Bowmans Creek	Yorks Creek	Swamp Creek	Bettys Creek	Main Creek
pH	7.5 – 8.1	7.0 – 7.9	7.1 – 8.6	7.1 – 8.3	7.1 – 8.4
EC (µS/cm) ¹	1,288 - 2,430	5,286 - 8,852	824 - 8,824	1,882 - 6,680	1,191 – 5,440
TSS (mg/L) ¹	10 - 26	20 - 33	21 - 35	16 - 52	10 - 140

¹ 80th percentile range for EC and TSS. Sites have specific triggers as per MGO's approved SWMMP.

MGO has defined 80th percentile trigger values for EC and TSS, and 20th percentile (acidic) and 80th percentile (alkaline) triggers for pH. Triggers are specific to each individual creek monitoring site. These values are based on historical datasets for each site. The Specific triggers are contained within MGO's approved SWMMP.

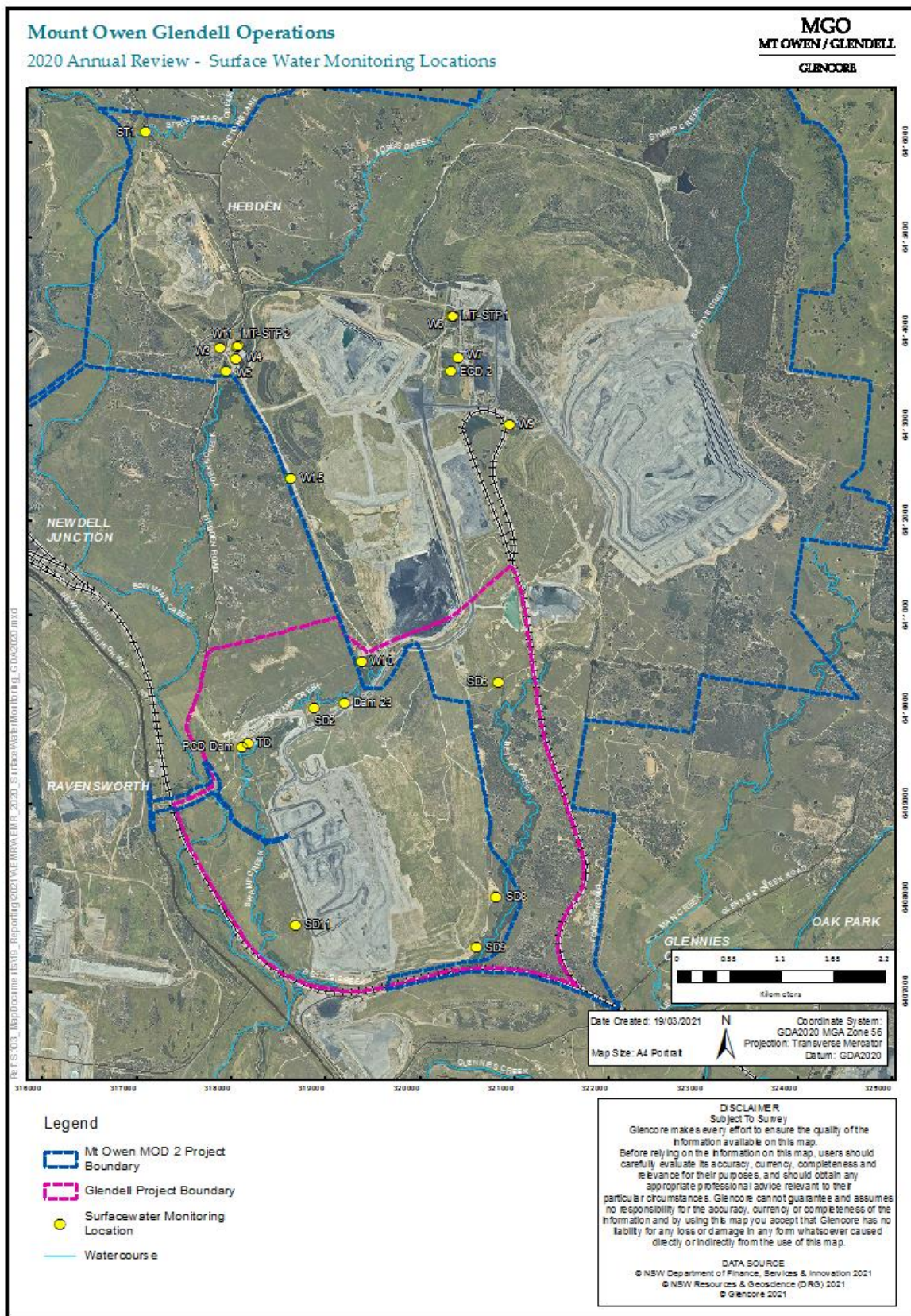


Figure 27: MGO Surface Monitoring Locations

Channel Stability and Stream Health

Annual channel stability and stream health assessment is also carried out across both existing creeks and creek diversions at the site. MGO monitors channel stability and stream health at 41 locations ([Figure 28](#)). These include:

- Bowmans Creek (2 sites: BMC1-BMC2)
- Yorks Creek (3 sites: YC1-YC3)
- Swamp Creek (4 sites: SC1-SC4)
- Bettys Creek (2 sites: BC1-BC2)
- Main Creek (2 sites: MC1-MC2)
- Bettys Creek Diversion (25 sites: UBD1-UBD6, MBD1-MBD6 and LBD1-LBD13)
- Swamp Creek Diversion (3 sites: SC1A-SC1C).

Channel stability is assessed using the CSIRO Ephemeral Stream Assessment and Stream Health (2011) and the using the Rapid Appraisal of Riparian Condition (RARC) (2005) methodologies. [Table 40](#) and [Table 41](#) outline the scoring system for both these methodologies.

Table 40: CSIRO Ephemeral Stream Assessment Stability Classifications (CSIRO, 2011)

Activity Rating (%)	Classification	Discussion of Classification
> 80	Very Stable	Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate.
70-80	Stable	Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilising to a more stable form, or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.
60-69	Potentially Stabilising	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.
50-59	Active	Drainage line is actively eroding and remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.
<50	Very Active	Drainage line is very actively eroding and immediate remedial actions are required. It is important to classify if erosion is caused primarily by upstream flows, lateral flows or unstable wall materials so that appropriate rehabilitation can be carried out.

Table 41: Summary Table of Indicators, Functions and Components Assessed in the RARC Index (Jansen et al. 2005).

Functions of the riparian zone at different levels of organisation	Components of the riparian ecosystem that perform those functions	Indicators of the functions used in the RARC
Physical		
Reduction of erosion of banks	Roots, groundcover	Vegetation cover
Sediment trapping	Roots, fallen logs, ground cover	Canopy cover, fallen logs, ground cover vegetation, leaf litter cover
Controlling stream microclimate/discharge/water temperatures	Riparian forest	Canopy cover
Filtering of nutrients from upslope	Vegetation, leaf litter	Ground cover vegetation, leaf litter cover
Community		
Provision of organic matter to aquatic food chains	Vegetation	Vegetation cover*, leaf litter cover
Retention of plant propagules	Fallen logs, leaf litter	Fallen logs, litter cover
Maintenance of plant diversity	Regeneration of dominant species, presence of important species, dominance of natives versus exotics	Native canopy and shrub regeneration, grazing damage to regeneration, reeds, native vegetation cover*
Provision of habitat for aquatic and terrestrial fauna	Fallen Logs, leaf litter, standing dead trees/hollows, riparian forest, habitat complexity	Fallen logs, leaf litter cover, standing dead trees, hollows, vegetation cover*, number of vegetation layers
Landscape		
Provision of biological connections in the landscape	Riparian forest (cover, width, connectedness)	Vegetation cover*, width of riparian vegetation, longitudinal continuity of riparian vegetation, proximity to other habitat
Provision of biological connections in the landscape	Riparian forest (cover, width, connectedness)	Vegetation cover*, width of riparian vegetation, longitudinal continuity of riparian vegetation, proximity to other habitat

Table 42: Summary RARC Classification System

RARC Total Score	Classification
40-50	<i>Excellent</i>

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35-39	<i>Good</i>
30-34	<i>Average</i>
25-29	<i>Poor</i>
< 25	<i>Very Poor</i>

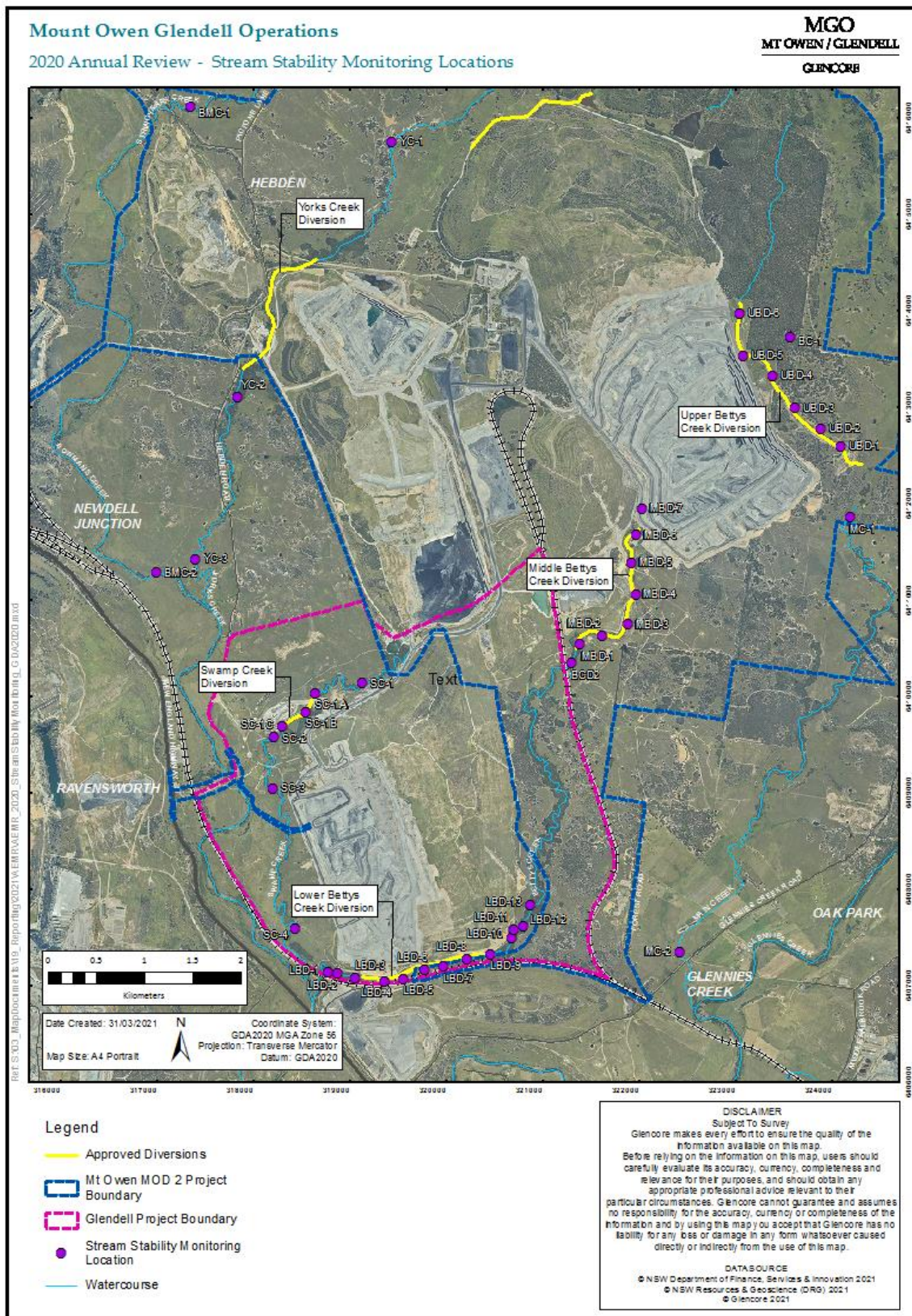


Figure 28: Stream Stability and Stream Health Assessment Locations

7.3.2 Surface Water Performance

Over the last several years MGO has received lower than average rainfall (see 6.3.2). This has resulted in long periods of no flow conditions within MGO's creek systems. As a result MGO was unable to obtain water samples from Swamp Creek (SC3) during the reporting period. Where samples were able to be collected, in the majority of cases, these samples were collected during no flow conditions.

A summary of the monitoring results is presented in [Table 43](#). A copy of the surface water monitoring results for all monitoring locations is included in [Appendix G, Tables 21-27](#). A comparison of 2020 data against historical data for the last five years is provided in [Appendix G, Tables 28-31](#). Although several sites had water triggers throughout the year, an expert review was not required in line with the SWGWRP TARP.

Table 43: Summary of Surface Water Monitoring Results 2020

Site	pH			EC ($\mu\text{S/cm}$)			TSS (mg/L)			Data Capture (%)	Comment
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg		
BMC1	7.10	7.90	7.63	571	7,880	1,916	1	1620	138	100%	Samples collected under trickle/steady flow conditions
BMC2	6.00	7.90	7.49	491	1,873	1,358	2	92	18	100%	Samples collected under low or no flow conditions
BMC3	7.40	8.00	7.70	483	1,751	1,165	1	17	6	100%	Dry from January to April (samples collected under no flow conditions)
BMC4	6.90	8.00	7.40	484	2,100	1,330	1	25	8	100%	Dry in November. Samples collected under no flow conditions
BMC 5	7.10	8.20	7.57	668	2,130	1,321	1	49	13	100%	Dry in January and March (samples collected under no flow conditions)
YC1	6.90	7.20	7.08	563	3,190	1,818	8	148	40	100%	Dry all year except from April to August and December
YC2	6.90	7.40	7.15	433	2,090	1,200	3	389	81	100%	Dry from January to March, May and October to September (samples collected under no flow conditions)
YC3	7.10	7.20	7.13	119	1,329	724	13	331	126	100%	Dry in all months except July – August and December (samples collected under no flow conditions)
SC1	7.90	9.80	8.93	288	640	562	3	19	7	100%	Samples collected under no flow conditions
SC2	7.10	7.90	7.34	141	1,190	302	10	205	85	100%	

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SC3	-	-	-	-	-	-	-	-	-	-	Dry from January – December (no samples able to be taken).
SC4	6.80	6.80	6.80	222	222	222	54	54	54	100%	Dry in all months except July (samples collected under no flow conditions)
BC1	6.80	7.30	7.05	376	508	442	12	15	14	100%	Dry in all months except February and July (samples collected under no flow conditions)
BC2	7.20	8.20	7.57	76	749	419	21	985	348	100%	Dry in all months except February – March and July (samples collected under no flow conditions)
BC3	6.70	7.10	6.84	105	327	229	25	94	49	100%	Dry in January – February, May – June and September to November (samples collected under no flow conditions)
BC4	6.80	7.20	6.95	223	466	353	5	59	21	100%	Dry in January and November (samples collected under no flow conditions)
MC1	6.70	7.80	7.15	236	874	446	19	56	35	100%	Dry in January, April, June and August to October (samples collected under no flow conditions)
MC2	6.80	7.10	6.98	303	995	515	15	99	55	100%	Dry in January, March to June and September to October (samples collected under no flow conditions)
MC3	6.90	7.40	7.10	304	574	440	5	38	23	100%	Dry from January to June (samples collected under no flow conditions)
GC2	7.68	7.73	7.71	430	792	611	8	10	9	100%	Monitoring commenced in November 2020. 2 samples collected.
GC3	7.72	7.74	7.73	435	771	603	6	13	9.50	100%	Monitoring commenced in November 2020. 2 Samples collected

Red indicates exceedance of preliminary trigger – refer discussion below.

Bowmans Creek

Monitoring data collected for 2020 for Bowmans creek was generally in line with baseline conditions (refer **Appendix G, Table 43**). Exceedances of SWMMP trigger levels are outlined in **Table 44**. Results for a majority of

sites in 2020 showed variances that were outside the historical range (highest and lowest measurements recorded throughout the entire monitoring period) in which the measurements are not considered extraordinary. The sites that triggered SWMMP criteria in 2020 were internally reviewed in accordance with the 2020 SWGWRP. These reviews confirmed that external reporting of these results was not required in line with the SWGWRP. These sites were all sampled under “no flow” or “trickle flow” conditions during 2020.

Table 44: Summary of SWMMP Trigger Exceedances for Bowmans Creek for 2020

Sample Site	Date	Analyte	Result (2020)	Trigger Level	Historical Range (pre 2020)	Comments
BMC1	Jan – March, May and Oct	pH	7.1 (min) and 7.6 (max)	7.7 – 8.1	6.75 – 8.22	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BMC1	Jan – Feb, April - June	EC	7880 (max)	1288	360 - 3,880	One result outside of historical range (January). Results returned to within historical range following January result. Site is upstream of MGO. Result not attributable to MGO.
BMC1	March	TSS	1620 (max)	10	1 - 100	One result outside of historical range (March). Likely due to increased creek flow following elevated rainfall. Not attributable to MGO.
BMC2	Feb – Mar, May – July, Oct and Dec	pH	6.0 (min) & 7.7 (max)	7.8 - 8.1	7.2 - 8.8	One result outside of historical range (February). Result was within ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BMC2	Feb - June	EC	1873 (max)	1386	334 - 2820	Within historical range. Not attributable to MGO.
BMC2	Feb and March	TSS	92 (max)	26	1 - 642	Within historical range. Not attributable to MGO.
BMC3	May – July, Oct and Dec	pH	7.4 (min) and 7.7 (max)	7.8 - 8.1	7.2 - 8.4	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BMC4	Jan – May, Oct and Dec	pH	6.9 (min) and 7.4 (max)	7.5 – 8.0	7.0 – 8.21	One result outside of historical range (February). Result was within ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BMC4	Jan - July	EC	2100 (max)	1257	503 - 1956	One result outside of historical range (January). Results returned to within historical range following January result. Not attributable to MGO.
BMC4	Jan and Sep	TSS	25 (max)	17	2 - 201	Within historical range. Not attributable to MGO.
BMC5	Feb, April, May, July and Sep - Dec	pH	7.1 (min) and 8.2 (max)	7.7 – 8.0	7.2 – 8.6	One result outside of historical range (April). Result was within ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BMC5	March and June	TSS	49 (max)	14	1 - 64	Within historical range. Not attributable to MGO.

Bowmans Creek was assessed for stream stability and stream health at two locations and results are included in **Table 45**. In 2020, the stream condition has remaining static at both monitoring points since monitoring in 2019. There has also been no overall change in stream health classification. The ‘Very Poor’ stream health classification

for Bowmans Creek is generally a reflection of past land use and management. Ongoing weed management of Mother-of-millions and *Acacia saligna* will be completed in 2021 following on from 2020 weed management works.

Table 45: Bowmans Creek Stream Health and Stability – 2020 and 2019

Monitoring Point	Stream Stability (CSIRO)		Stream Health (RARC)	
	2019	2020	2019	2020
BMC1	63% (Potentially Stabilising)	63% (Potentially Stabilising)	Very Poor	Very Poor
BMC2	72% (Stable)	72% (Stable)	Very Poor	Very Poor

Yorks Creek

Monitoring data collected for 2020 for Yorks Creek was generally in line with baseline conditions (refer [Appendix G, Table 22](#)). Exceedances of SWMMP trigger levels are outlined in [Table 46](#). 2020 monitoring results for York’s Creek in exceedance of SWMMP trigger levels were internally reviewed in accordance with the 2020 SWGWRP. These reviews confirmed that external reporting of the results was not required in line with the SWGWRP. These sites were all sampled under “no flow” conditions during 2020.

Table 46: Summary of SWMMP Trigger Exceednaces for Yorks Creek for 2020

Sample Site	Date	Analyte	Result	Trigger Level	Historical Range	Comments
YC1	May and Dec	pH	6.9 (min) and 7.0 (max)	7.1 – 7.7	6.0 – 8.31	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
YC1	April, July and Dec	TSS	148 (max)	25	1 - 640	Within historical range. Not attributable to MGO.
YC2	Dec	pH	6.9	7 – 7.8	6.3 – 8.6	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
YC2	June, July and Dec	TSS	389 (max)	20	2 - 620	Within historical range. Not attributable to MGO.
YC3	Dec	TSS	331 (max)	33	1 - 290	One result outside of historical range. Result likely caused by heavy rainfall prior to monitoring date. Not attributable to MGO.

Yorks Creek was assessed for stream stability and stream health at three locations and results are included in [Table 47](#). Stream stability has remained similar to 2019 results at two monitoring sites, with only one site decreasing slightly in stability classification. Stream health, similarly to 2019, has two sites demonstrating very poor stream health and one site demonstrating poor stream health.

Table 47: Yorks Creek Stream Health and Stability - 2019 and 2020

Monitoring Point	Stream Stability (CSIRO)		Stream Health (RARC)	
	2019	2020	2019	2020
YC1	53% (Active)	56% (Active)	Very Poor	Poor
YC2	72% (Stable)	69% (Potentially Stabilising)	Poor	Very Poor
YC3	63% (Potentially Stabilising)	63% (Potentially Stabilising)	Very Poor	Very Poor

Swamp Creek

Swamp Creek sample site SC3 was dry for all of 2020 and site SC4 was dry every month except July. Sample sites SC1, SC2 and SC4 were able to be recorded, however, monitoring was carried out under “no flow” conditions. The exceedances of SWMMP trigger levels at Swamp Creek during 2020 are detailed in [Table 48](#). Monitoring data for Swamp Creek is included in [Appendix G, Table 23](#).

2020 monitoring results for SC1 and SC2 in exceedance of SWMMP trigger levels were internally reviewed in accordance with the 2020 SWGWRP. These reviews confirmed that external reporting of the results was not required in line with the SWGWRP. These sites were all sampled under “no flow” conditions during 2020.

Table 48: Summary of Exceedances for Swamp Creek for 2020

Sample Site	Date	Analyte	Result	Trigger Level	Historical Range	Comments
SC1	Jan - Mar, Sep - Dec	pH	9.1 (min) and 9.8 (max)	7.7 – 8.6	6.4 – 10.1	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
SC2	March - Dec	pH	7.1 (min) and 7.4 (max)	7.4 – 8.2	6.6 – 9.73	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
SC2	Jan, Feb, April, July - Dec	TSS	205 (Max)	35	2 – 290	Within historical range. Not attributable to MGO.

Swamp Creek was assessed for stream stability and stream health at four locations. Results are included in [Table 49](#). Stream stability remained relatively constant across four sites in comparison to 2019 results. Stream health remained constant, and was generally classified as ‘Very Poor’ (between 2014 and 2020). Similar to other creeks in the area, the low health scores are a result of past land use and management where cattle were not excluded from riparian areas. Fencing inspections are completed bi-annually to ensure cattle are excluded from these areas.

Table 49: Swamp Creek 2020 Stream Health and Stability

Monitoring Point	Stream Stability (CSIRO)		Stream Health (RARC)	
	2019	2020	2019	2020
SC1	66% (Potentially Stabilising)	66% (Potentially Stabilising)	Very Poor	Very Poor

SC2	59% (Active)	63% (Potentially Stabilising)	Very Poor	Very Poor
SC3	63% (Potentially Stabilising)	63% (Potentially Stabilising)	Very Poor	Very Poor
SC4	63% (Potentially Stabilising)	59% (Active)	Very Poor	Very Poor

Betty's Creek

Bettys Creek was dry for the majority of 2020. Monitoring of all sites were only possible in select months and monitoring was carried out under “no flow” conditions. Monitoring data for Betty’s Creek is included in [Appendix G, Table 42](#).

2020 monitoring results for Bettys Creek sites in exceedance of SWMMP trigger levels were internally reviewed in accordance with the 2020 SWGWRP. These reviews confirmed that external reporting of the results was not required in line with the SWGWRP. These sites were all sampled under “no flow” conditions during 2020 (see [Table 50](#)).

Table 50: Summary of Exceedances for Bettys Creek for 2020

Sample Site	Date	Analyte	Result	Trigger Level	Historical Range	Comments
BC1	Feb	pH	6.8	7.1 – 7.6	5.41 – 8.3	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BC2	Feb and July	pH	7.2 (min) and 7.3 (max)	7.4 – 8.3	6.2 – 9.4	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BC2	March	TSS	985	40	1 - 900	One result outside of historical range. Likely due to elevated rainfall. Not attributable to MGO.
BC3	March, July – August and December	pH	6.7 (min) and 6.9 (max)	7.1 – 7.9	5.0 – 8.38	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BC3	July and Dec	TSS	94 (max)	52	1 – 382	Within historical range. Not attributable to MGO.
BC4	Feb – Aug, Dec	pH	6.8 (min) and 7.0 (max)	7.1 – 7.8	6.43 – 8.3	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
BC4	July	TSS	59	52	5 - 912	Within historical range. Not attributable to MGO.

Bettys Creek was assessed for stream stability and stream health at two locations. Results are included in. Stream stability remained constant across the two sites (since 2019). Stream health deviated slightly from 2019 results, with both sites generally being classified as ‘Average’.

Table 51: Bettys Creek 2020 and 2019 Stream Health and Stability

Monitoring Point	Stream Stability (CSIRO)		Stream Health (RARC)	
	2019	2020	2019	2020

BC1	66% (Potentially Stabilising)	66% (Potentially Stabilising)	Good	Average
BC2	78% (Stable)	75% (Stable)	Very Poor	Average

Main Creek

Main Creek was dry for the majority of 2020. Monitoring was only possible for some months at all sites, with monitoring carried out under “no flow” conditions. The exceedances at this location during the monitoring period can be seen in [Table 52](#). The exceedances that were outside the historical range were deemed to be not attributable to MGO. Monitoring data for Main Creek is included in [Appendix G, Table 25](#).

Table 52: Summary of Exceedances for Main Creek 2020

Sample Site	Date	Analyte	Result	Trigger Level	Historical Range	Comments
MC1	Feb – March, July and December	pH	6.7 (min) and 7.8 (max)	7.1 – 7.6	6.31 – 8.00	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
MC2	Feb, July – August, Nov - Dec	pH	6.8 (min) and 7.1 (max)	7.3 – 8.4	6.1 – 8.9	Within historical range and ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
MC2	Feb, July and Dec	TSS	99 (max)	50	2 - 572	Within historical range. Not attributable to MGO.
MC3	July – Sep, Nov - Dec	pH	6.9 (min) and 7.1 (max)	7.3 – 7.6	7.2 – 7.9	One result outside of historical range (November). Result was within ANZECC Guidelines Criteria (6.5 – 8.0). Not attributable to MGO.
MC3	July – Sep, Nov - Dec	TSS	38 (max)	10	2 - 20	Two results outside of historical range (September and November). Result likely to be influenced by increased runoff into Main Creek. Not attributable to MGO

Main Creek was assessed for stream stability and stream health at two locations. Results are included in [Table 53](#). Compared to 2019, stream stability remained constant at one site (MC1) and improved at the other site (MC2). Stream health remained constant, and was generally classified as ‘Very Poor’. Main Creek has been cleared in the past and has minimal riparian vegetation. This is the main reason for the low health score. No signs of waterlogging were recorded during routine monthly monitoring or annual stream stability and health assessments.

Table 53: Main Creek 2020 and 2019 Stream Health and Stability

Monitoring Point	Stream Stability (CSIRO)		Stream Health (RARC)	
	2019	2020	2019	2020
MC1	63% (Potentially Stabilising)	63% (Potentially Stabilising)	Very Poor	Very Poor
MC2	56% (Active)	59% (Active)	Very Poor	Very Poor

Creek Diversions

Creek diversions onsite undergo quarterly condition monitoring and annual stream stability and stream health assessments. Quarterly monitoring is targeted at identifying areas requiring maintenance such as erosion and weed control. Annual stream stability and health assessments follow the same methodology as that carried out for local creeks (Ephemeral Stream Assessment and RARC) and results can be compared to existing creek lines to assess performance of diversions.

Table 54 presents a comparison of diversion condition between 2014 and 2020 and Table 55 shows a similar comparison for stream health. Monitoring locations are shown on Figure 28.

Table 54: Comparison of Creek Diversion conditions - 2014 and 2020

Creek Diversion	Transect	2014 Condition	2020 Condition	Condition Trajectory
Upper Bettys Creek Diversion	UBD-1	Active	Potentially Stabilising	Static
	UBD-2	Active	Potentially Stabilising	Improved
	UBD-3	Active	Potentially Stabilising	Static
	UBD-4	Very Stable	Potentially Stabilising	Static
	UBD-5	Stable	Potentially Stabilising	Static
	UBD-6	Very Stable	Stable	Static
Middle Bettys Creek Diversion	MBD-1	Stable	Very Stable	Static
	MBD-2	Potentially Stabilising	Potentially Stabilising	Static
	MBD-3	Stable	Potentially Stabilising	Static
	MBD-4	Active	Potentially Stabilising	Static
	MBD-5	Very Stable	Very Stable	Static
	MBD-6	Potentially Stabilising	Potentially Stabilising	Static
Lower Bettys Creek Diversion	LBD-1	Potentially Stabilising	Potentially Stabilising	Static
	LBD-2	Potentially Stabilising	Potentially Stabilising	Static
	LBD-3	Stable	Potentially Stabilising	Static
	LBD-4	Stable	Stable	Static
	LBD-5	Stable	Potentially Stabilising	Static

Creek Diversion	Transect	2014 Condition	2020 Condition	Condition Trajectory
	LBD-6	Stable	Stable	Static
	LBD-7	Stable	Stable	Static
	LBD-8	Stable	Stable	Static
	LBD-9	Stable	Potentially Stabilising	Static
	LBD-10	Potentially Stabilising	Stable	Static
	LBD-11	Stable	Stable	Static
	LBD-12	Very Stable	Stable	Static
	LBD-13	Stable	Stable	Static
Swamp Creek Diversion	SC-1A	Active	Potentially Stabilising	Static
	SC-1B	Very Stable	Stable	Static
	SC-1C	Very Stable	Stable	Decreased

Table 55: Stream Health at MGO diversions – 2014 to 2020

Site Description	2014 Classification	2020 Classification	Trend	Description of change
Swamp Creek 1A (SC1A)	Very Poor	Very Poor	Stable	Overall condition remains stable since May 2020.
Swamp Creek 1B (SC1B)	Very Poor	Average	Recent improvement	Recent improvement in vegetation coverage of the riparian.
Swamp Creek 1C (SC1C)	Very Poor	Very Poor	Recent decline	Condition has declined back to 2019 condition. Reduction in Habitat features such as debris and fallen logs since May 2020. Groundcover is still dominated by exotic species including Chloris gayana (Rhodes Grass).
Upper Bettys Diversion 1 (UBD1)	Very Poor	Very Poor	Stable	Condition has remained stable, with the site's very poor condition resulting from low understorey and groundcover on both banks.

Site Description	2014 Classification	2020 Classification	Trend	Description of change
Upper Bettys Diversion 2 (UBD2)	Very Poor	Very Poor	Stable	Condition has remained stable since May 2020 survey.
Upper Bettys Diversion 3 (UBD3)	Very Poor	Very Poor	Stable	Condition has remained stable, with the site's very poor condition resulting from low understorey and groundcover on both banks.
Upper Bettys Diversion 4 (UBD4)	Very Poor	Very Poor	Recent Decline	Condition has declined since monitoring was last undertaken in May 2020. Significant decline in habitat features and reduction in riparian canopy continuity vegetation.
Upper Bettys Diversion 5 (UBD5)	Very Poor	Very Poor	Stable	Condition has remained relatively stable. However, there have been some minor increases to native vegetation cover and representation, likely as a result of recent favourable weather conditions.
Upper Bettys Diversion 6 (UBD6)	Very Poor	Very Poor	Stable	Condition has remained relatively stable. There has been a minor decrease in vegetation cover and habitat representation.
Middle Bettys Diversion 1 (MBD1)	Poor	Average	Recent improvement	Recent improvements in condition across all attributes.
Middle Bettys Diversion 2 (MBD2)	Poor	Very Poor	Recent Decline	Condition has declined since monitoring was last undertaken in May 2020. This includes a reduction in natives, debris, features and cover.
Middle Bettys Diversion 3 (MBD3)	Poor	Very Poor	Recent Decline	Condition has declined since May 2020 as a result of a reduction in native species representation. This is likely due to recent favourable weather conditions promoting relatively more growth amongst fast-growing exotic groundcover and understorey species, in comparison to slower growing native dominated canopy species.

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Site Description	2014 Classification	2020 Classification	Trend	Description of change
Middle Bettys Diversion 4 (MBD4)	Very Poor	Very Poor	Stable	Condition has remained stable. There has been very minimal increase in overall condition score since May 2020.
Middle Bettys Diversion 5 (MBD5)	Very Poor	Very Poor	Stable	Condition has remained stable. There has been very minimal increase in overall condition score since May 2020.
Middle Bettys Diversion 6 (MBD6)	Very Poor	Very Poor	Stable	Condition has remained stable. There has been minor increase in overall condition score since last assessment in May 2020.
Middle Bettys Diversion 7 (MBD7)	Very Poor	N/A	No longer monitored	Not monitored in 2020.
Lower Bettys Diversion 1 (LBD1)	Very Poor	Poor	Stable	Condition has remained relatively stable, however, minor decrease in vegetation cover.
Lower Bettys Diversion 2 (LBD2)	Very Poor	Poor	Stable	Condition has remained stable. There has been very minimal change in overall condition score since May 2020.
Lower Bettys Diversion 3 (LBD3)	Poor	Poor	Recent improvement	Although still a significant decline from the October 2020, there has been an increase in overall condition since May 2020 due to increase in native vegetation coverage.
Lower Bettys Diversion 4 (LBD4)	Very Poor	Very Poor	Stable	Condition has decreased slightly since May 2020 with a loss in habitat features.
Lower Bettys Diversion 5 (LBD5)	Very Poor	Very Poor	Stable	Condition has remained stable with very minimal change in overall condition since May 2020.
Lower Bettys Diversion 6 (LBD6)	Very Poor	Very Poor	Stable	Condition has remained relatively stable since May 2020.

Site Description	2014 Classification	2020 Classification	Trend	Description of change
Lower Bettys Diversion 7 (LBD7)	Very Poor	Very Poor	Stable	Condition has remained relatively stable, with minor decreases in vegetation coverage and debris.
Lower Bettys Diversion 8 (LBD8)	Very Poor	Very Poor	Stable	Condition has remained relatively stable, with minor increases in native species regeneration due to revegetation of the area.
Lower Bettys Diversion 9 (LBD9)	Very Poor	Very Poor	Recent decline	Condition has had a minor decline since May 2020, with minor decrease in native species representation and vegetation cover. However, this may be the result of a change in surveyors between May 2020 and October 2020.
Lower Bettys Diversion 10 (LBD10)	Average	Poor	Stable	Although a drop in condition category, the condition has remained relatively stable with minimal declines in habitat, native species representation, vegetation cover and debris (such as leaf litter and fallen logs).
Lower Bettys Diversion 11 (LBD11)	Poor	Poor	Stable	Condition has remained relatively stable, with minimal decline in native species representation, and features such as native canopy and understorey species regeneration. Although condition has dropped into "poor" category the site still scores in its upper limits
Lower Bettys Diversion 12 (LBD12)	Average	Average	Recent improvement	Recent increase in condition, with significant improvement in native species representation and debris cover.
Lower Bettys Diversion 13 (LBD13)	Average	Good	Stable	Condition has remained stable since May 2020.

Site Description	2014 Classification	2020 Classification	Trend	Description of change
Main Creek 1 (MC1)	Very Poor	Very Poor	Stable	Condition has remained stable with minimal decrease in habitat and vegetation coverage.
Main Creek 2 (MC2)	Very Poor	Very Poor	Stable	Condition remained stable with extremely poor overall condition.
Bowmans Creek 1 (BMC1)	Very Poor	Very Poor	Stable	Condition has declined, with significant decline in habitat features.
Bowmans Creek 2 (BMC2)	Very Poor	Very Poor	Recent decline	Significant decline across all attribute. A change in surveyor may have contributed to the large reduction overall condition score.

N/A - Data not available due to clearing/earthworks within the predetermined transect

Erosion and Sediment

MGO carries out quarterly and post-rainfall erosion and sediment control inspections. These inspections are to identify issues that require maintenance, and where possible these issues are rectified prior to the next inspection. As a result of low rainfall and ongoing management, MGO did not have any instances where sediment dams overflowed during 2020. There were also no environmental incidents or complaints relating to erosion and sediment control.

Further Improvements

Ongoing repairs and maintenance across all creek diversions are an ongoing focus at MGO. 2020 saw the review and approval of the MOC Creek Diversion Plan following approval of Glendell Mod 4. The plan ensures MGO will continue to monitor the Creek Diversion as per the current monitoring program. In 2020, erosion works were completed in close proximity to Hebden Road that were associated with the Yorks Ck Diversion. The works involved the use of an excavator to reshape the eroded gully followed by infilling of rock and installation of erosion and sediment controls. The disturbed topsoil was ripped and pasture seeded to stabilise the diversion bank (see Figure 29).

The Upper Bettys Creek Diversion Remediation Plan (requested by DPIE) was implemented in 2018 and is aimed at establishing a resilient vegetation layer to provide sustained protection from further erosion in and around the diversion. Remedial works occurred in Upper Betty's Creek and Middle Betty's Creek in 2020 to repair areas of minor erosion in line with 2019 stream health monitoring. In-fill tree and reed planting occurred in Lower Betty's Creek diversion in 2020 for areas of limited success since establishment in 2014. Approximately 3000 tubestock and 500 reeds were planted within this diversion.

In 2021, further erosion repair works are planned in-line with recommendations provided from bi-annual diversion and stream health inspections.



Figure 29: Yorks Creek Diversion (Hebden Rd) remediation works completed in 2020

Acid mine drainage is monitored on-site by site geologist as part of the blasting process. In 2020 MGO completed annual sampling of surface water contained within open cut mining areas (sumps) to further validate that acid rock drainage was not present at MGO.

7.4 Groundwater Monitoring Program and Triggers

Groundwater monitoring is undertaken in accordance with the approved MGO Groundwater Management and Monitoring Plan (GWMMP), and includes depth to water (to calculate drawdown), pH and EC. The location of monitoring bores is shown on **Figure 30**. Monitoring data is compared to the groundwater performance criteria in **Table 56**.

Table 56: Relevant Groundwater Performance Criteria

Aspect	Performance Measures	Performance Indicator/Trigger
Alluvial aquifers	Groundwater levels (depth to water)	Drawdown greater than historical average plus 1 standard deviation.
	Groundwater quality (pH and EC)	pH or EC outside of 80 th percentile of historical data for specific bore locations. Groundwater quality concentrations outside of trigger value for at least one parameter for 2 or more consecutive (quarterly) monitoring rounds.

Aspect	Performance Measures	Performance Indicator/Trigger
Hardrock aquifers	Groundwater levels (depth to water)	Drawdown greater than historical average plus 1 standard deviation.
	Groundwater quality (pH and EC)	pH or EC outside of 80 th percentile of historical data for specific bore locations. Groundwater quality concentrations outside of trigger value for at least one parameter for 2 or more consecutive (quarterly) monitoring rounds.
Groundwater inflows to mining pits	Calculated inflows to mining pits	Groundwater inflow to mining pits is >10% higher than predicted for three consecutive months Groundwater inflows exceed WAL limits
Seepage/leachate	Presence of seepage/leachate from water storages	Visual inspections of water storages (as per the MGO Erosion and Sediment Control Plan) shows seepage zones and reporting water balance indicates seepage is greater than negligible (i.e: >5% of inflows to water storages)
	Seepage/leachate from emplacement areas	Visual inspections of water storages (as per the MGO Erosion and Sediment Control Plan) indicates seepage areas and confirms location of drainage pathways outside of water management system.
	Seepage/leachate from backfilled voids	No increasing trends in water quality parameters in monitoring bores surrounding backfilled voids. An increasing trend would be indicated by 4 consecutive water quality readings showing continual increases in analyte concentrations.

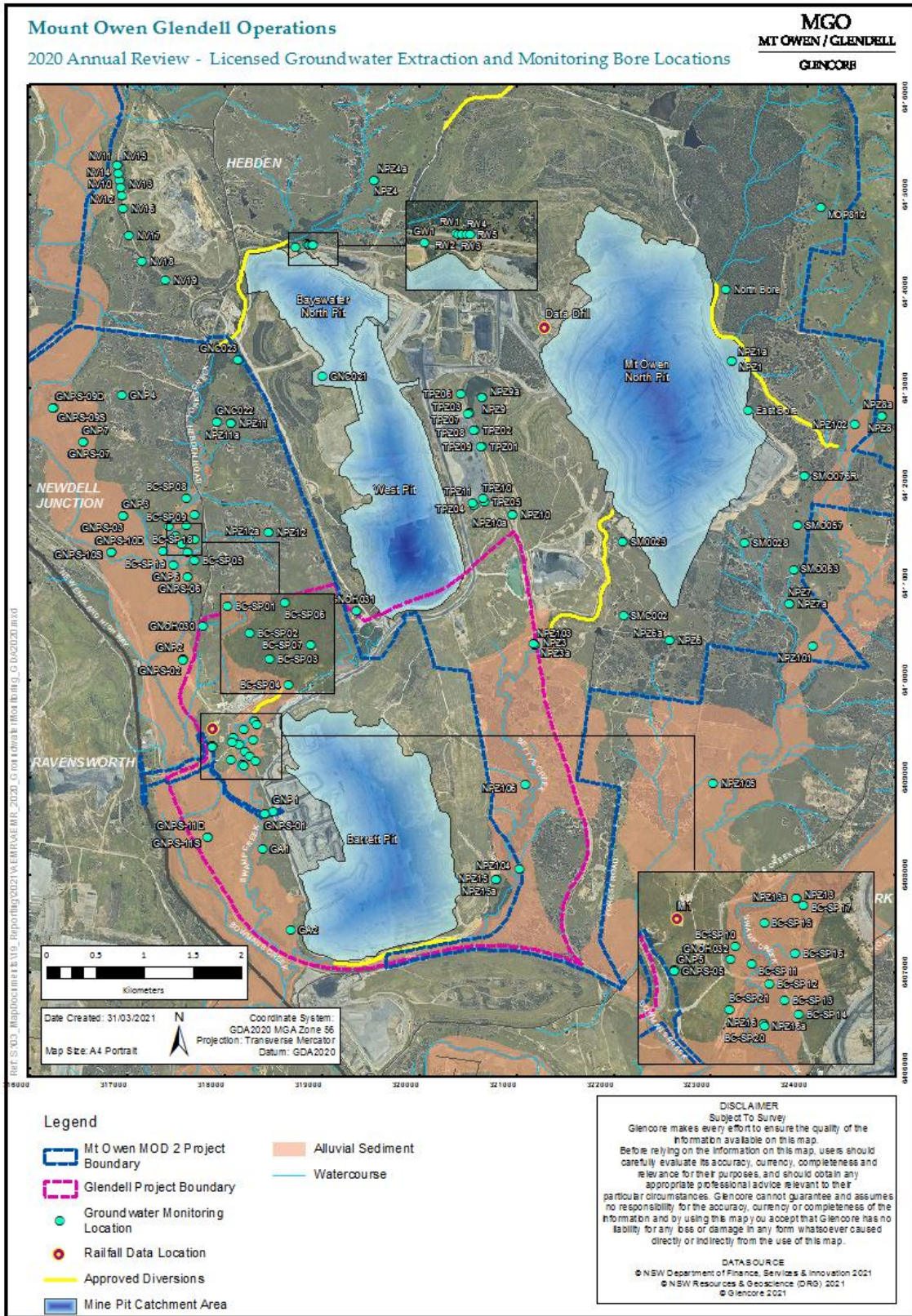


Figure 30: MGO Groundwater Extraction and Monitoring Bores

7.4.1 Groundwater Performance

Groundwater monitoring results for 2020 were used to assess the predicted impacts on the surrounding areas and compared against predicted studies. A summary of the findings is provided in [Table 57](#).

The annual groundwater review for the 2020 monitoring period (SLR, 2020) identified several trigger exceedances in the

as summarised below:

- Water Level drawdown:
 - Bores: NPZ103, NPZ106, BC-SP02, BC-SP04, BC-SP06, BC-SP07, BC-SP08, BC-SP09, GA1, BC-SP10, BC-SP14, BC-SP21, NPZ101 and NPZ107S, NPZ1, NPZ4, NPZ6, NPZ9, NPZ11, NPZ13, North, NPZ1a, NPZ7a, NPZ8a, NPZ7, NPZ8, NPZ16, NPZ107D, NPZ108D, NPZ11a, NPZ4a, NPZ6a, NPZ13a, and NPZ15a.
 - At all VWP locations
- Electrical Conductivity:
 - Bores BC-SP04, BC-SP05 and BC-SP08, NPZ101, NPZ107S, NPZ108S, NPZ1, NPZ3a, NPZ4, NPZ11, NPZ1a, NPZ8, NPZ16, NPZ4a, NPZ10a, and NPZ13a .
- pH:
 - Bores NPZ1a, NPZ107D, NPZ180D, and NPZ11a

A summary of the findings from the investigations 2020 are included below: For alluvial bores:

- Decreased water levels were determined to be associated with prevalent dry climate in recent years. During 2020 average rainfall was experienced however this was yet to lead to widespread recovery of water levels in the shallow alluvium. The region entered non-drought conditions in November 2020;
 - Electrical Conductivity (EC) triggers were deemed to be attributed to the lack of freshwater recharge as a result of climatic conditions, it is expected that the EC will improve with recovering water levels.
- For hard rock aquifers:
 - The water levels and EC levels in some monitoring bores show a clear response to climate conditions with some monitoring bores also responding to depressurisation as a result of mining.

A review into the water level decline including a comparison to predicted groundwater level impacts will be conducted in 2021.

- pH observations in NPZ107D and NPZ108D have been elevated during the length of their respective record. There is no sign of a trend apparent. A revision of trigger levels will be conducted during 2021 to reflect historical results.

A copy of the monitoring results for individual groundwater monitoring locations is included in [Appendix G, Table 32](#) along with a summary of the 2020 results for all bores ([Appendix G, Table 33](#)).

A comprehensive review of groundwater is located in the 2020 Annual Groundwater Review (SLR, March 2021) report, which is also included in [Appendix G](#).

Table 57: Summary of Groundwater Bores against Performance Data in 2020

Site ID	Investigation Criteria Triggered?			
	Drawdown	pH	EC	
			12,800 µS/cm trigger	>1,000 µS/cm change
Yorks Creek Alluvium				
BC-SP06	✓ (Q1, Q2, Q3, Q4)	x	x	x
BC-SP07	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
BC-SP08	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q2, Q3, Q4)	x
BC-SP09	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q3)	x
NPZ4	✓ (Q1, Q2, Q3, Q4)	✓ (Q2)	✓ (Q1, Q2, Q3, Q4)	x
NPZ11	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q2, Q3, Q4)	x
Yorks Creek and Bowmans Creek Alluvium				
BC-SP01	Insufficient water to sample			
BC-SP02	✓ (Q1, Q2, Q3, Q4)	x	x	x
BC-SP03	Insufficient water to sample			
BC-SP04	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q2, Q4)	x
BC-SP05	x	x	✓ (Q2, Q3, Q4)	x
Bowmans Creek Alluvium				

Site ID	Investigation Criteria Triggered?			
	Drawdown	pH	EC	
			12,800 μ S/cm trigger	>1,000 μ S/cm change
BC-SP18	Insufficient water to sample			
BC-SP19	Insufficient water to sample			
BC-SP22	✓ (Q2)	x	x	x
GNPS-02	✓ (Q1)	✓ (Q2)	x	x
GNPS-03	Insufficient water to sample			
GNPS-05	Insufficient water to sample			
GNPS-06	✓ (Q1, Q2)	✓ (Q1, Q2)	x	x
GNPS-07	Insufficient water to sample			
GNP09S	x	x	x	x
GNP10S	x	x	x	x
GNP11S	x	x	x	x
Swamp Creek and Bowmans Creek Alluvium				
BC-SP20	Insufficient water to sample			
BC-SP21	✓ (Q3, Q4)	x	x	x
Swamp Creek Alluvium				
BC-SP10	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
BC-SP11	✓ (Q1, Q2, Q3, Q4)	x	x	x
BC-SP12	✓ (Q2)	x	x	x
BC-SP13	Insufficient water to sample			
BC-SP14	✓ (Q1, Q2, Q3, Q4)	x	x	x
BC-SP15	✓ (Q3)	Insufficient water to sample		
BC-SP16	✓ (Q3)	Insufficient water to sample		
BC-SP17	✓ (Q3)	Insufficient water to sample		
GA1	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
GA2	✓ (Q1, Q2, Q3)	x	x	x
Lower Pikes Gully				
NPZ13	✓	x	x	x

Site ID	Investigation Criteria Triggered?			
	Drawdown	pH	EC	
			12,800 µS/cm trigger	>1,000 µS/cm change
	(Q1, Q2, Q3, Q4)			
Upper Pikes Gully				
NPZ11a	✓ (Q1, Q2, Q3, Q4)	✓ (Q1, Q2, Q3, Q4)	x	x
Lower Liddell				
NPZ13a	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q1, Q2, Q3, Q4)	x
Upper Liddell				
NPZ16a	Insufficient water to sample			
Ravensworth				
NPZ6	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
NPZ6a	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
NPZ9	x	✓ (Q2)	x	x
Lemington				
NPZ7	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q1, Q2, Q3, Q4)	x
NPZ8	✓ (Q1)	x	✓ (Q1, Q2, Q3, Q4)	x
NPZ15	Insufficient water to sample			
NPZ16	✓ (Q1, Q2, Q3, Q4)	x	✓ (Q1, Q2, Q3, Q4)	x
Bettys Creek Alluvium				
North	✓ (Q1, Q4)	x	x	x
NPZ1	x	✓ (Q2)	✓ (Q1, Q2, Q3, Q4)	x
NPZ10	x	x	x	x
NPZ103	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
NPZ104	Insufficient water to sample			
NPZ106	✓ (Q1, Q2, Q3, Q4)	Insufficient water to sample		
Main Creek Alluvium				
NPZ101	✓ (Q1, Q2, Q3, Q4)	✓ (Q2)	✓ (Q1, Q2, Q3, Q4)	x
NPZ102	✓ (Q1, Q2, Q3, Q4)	✓ (Q2)	x	x

Site ID	Investigation Criteria Triggered?			
	Drawdown	pH	EC	
			12,800 µS/cm trigger	>1,000 µS/cm change
NPZ105	Insufficient water to sample			
NPZ107S	x	✓ (Q2)	x	x
NPZ108S	x	✓ (Q2)	x	x
Hard Rock Aquifer				
NPZ1a	✓ (Q1, Q2, Q3, Q4)	✓ (Q1, Q3, Q4)	✓ (Q3, Q4)	x
NPZ3a	x	x	✓ (Q1, Q2, Q3, Q4)	x
NPZ4a	✓ (Q1, Q2, Q3, Q4)	✓ (Q2)	✓ (Q1, Q2, Q3, Q4)	x
NPZ7a	✓ (Q1, Q2, Q3, Q4)	x	x	x
NPZ8a	✓ (Q1, Q2, Q3, Q4)	x	x	x
NPZ9a	Bore obstruction, unable to sample			
NPZ10a	✓ (Q1, Q2)	✓ (Q2)	✓ (Q1, Q2)	x
NPZ15a	x	x	x	x

7.4.2 Groundwater Inflows Estimates

For each pit, modelled rainfall-runoff, supplied pit dewatering volumes and assumed change in storage was used to calculate the groundwater inflow monthly for 2020. This calculated groundwater inflow was then compared to the model predicted groundwater inflow provided in EIS approval documents. A summary is provided in [Table 58](#).

Table 58: Summary of Groundwater Seepage Data for 2020

In	Out	Accumulation	Balance		
Modelled Runoff (ML)	Dewatered Volume (ML)	Stored Water Volume (ML)	Calculated Groundwater Inflow (ML)**	2014 Modification EA Predicted Groundwater Inflow (ML)	Difference between calculated and predicted groundwater inflow (ML)
Mt Owen (North Pit)					
1539	459	71	16	334	318
Glendell*					
650	387	23	142	438	296
Ravensworth East (Bayswater North Pit)					
377	7373	204	39***	81	81

In	Out	Accumulation	Balance		
Modelled Runoff + Tailings Recovery water (ML)	Dewatered Volume + Evaporation (ML)	Stored Water Volume (ML)	Calculated Groundwater Inflow (ML)	2014 Modification EA Predicted Groundwater Inflow (ML)	Difference between calculated and predicted groundwater inflow (ML)
Ravensworth East (West Pit)**					
2204	3000	163	494	110	384

Note: * Glendell predicted groundwater inflow (ML) was calculated from the 2007 Modification EA.

** Other inflows are under investigation which may reduce the 'balance' currently attributed to groundwater inflow.

*** Modelled GW inflow

Mt Owen (North Pit)

As [Table 58](#) shows, 1539 ML of runoff was modelled as reporting to the North Pit while dewatering estimates totalled 459 ML. To ensure calculated groundwater inflows in each month were not negative, the stored pit water volumes were assumed which resulted in a stored water volume of 71 ML at the end of the reporting period (this would include water stored within the in-pit waste rock emplacement). This results in a calculated groundwater inflow of 16 ML. This is 318 ML less than the total 2014 MOCO Project model predicted groundwater inflow volume of 334 ML.

Glendell Pit

Data provided in [Table 58](#) shows that 650 ML of runoff was modelled as reporting to the Glendell Pit while dewatering estimates totalled 387 ML. To ensure calculated groundwater inflows in each month were not negative, the stored pit water volumes were assumed which resulted in a stored water volume of 23 ML at the end of the 2020 calendar year (this would include water stored within the in-pit waste rock emplacement). This results in a calculated groundwater inflow of 142 ML. This is 296 ML less than the total 2007 Modification EA model predicted groundwater inflow volume of 438 ML.

It should be emphasised that, given the lack of available estimates of stored water volume, the monthly stored water volumes are an assumption. It is also noted that mining in the Glendell Pit is occurring up-dip and therefore there is likely to be a significant volume of water stored within backfilled in-pit waste rock. This assumption directly affects the estimated groundwater inflow rates.

Ravensworth East (Bayswater North Pit)

As [Table 58](#) shows, 377 ML of runoff was modelled as reporting to the Bayswater North Pit while dewatering estimates totalled 7373 ML. To ensure calculated groundwater inflows in each month were not negative, the stored pit water volumes were assumed which resulted in a stored water volume of 204 ML at the end of 2020

calendar year. Based on input and output volumes, groundwater inflows volume has been modelled resulting in 39ML for the 2020 calendar year. This is 42 ML less than the total 2014 MOCO Project model predicted groundwater inflow volume of 81 ML.

It should be noted that during the 2020 reporting period, the Bayswater North Pit began receiving water seepage from the West Pit Tailing Storage Facility. This has resulted in a increased water being received in the Bayswater North Pit and larger than usual dewatering volume from this pit. During 2021, MGO will continue to monitor and investigate the seepage of water into the Bayswater North Pit.

Ravensworth East (West Pit)

As [Table 58](#) shows that 2204 ML of runoff, tailings water recovery was modelled as reporting to the West Pit while dewatering and evaporation estimates totalled 3000 ML. To ensure calculated groundwater inflows in each month were not negative, the stored pit water volumes were assumed which resulted in a stored water volume of 163 ML at the end of 2020 calendar year. This results in a calculated groundwater inflow of 494 ML. This is 384 ML more than the total 2014 MOCO Project model predicted groundwater inflow volume of 110 ML.

The estimates of stored water volume directly affect the calculation of groundwater inflow. An increase in the estimated stored water volumes would increase the calculated groundwater inflow volumes. Similarly, estimates of tailings water recovery directly affect groundwater inflow estimates. Higher rates of water recovery from the settling tailings would decrease the calculated groundwater inflow volumes.

As stated above in relation to seepage to the Bayswater North Pit, other inflow and outflows of this storage will continue to be monitored and investigated as required to improve the water balance between the two pit areas.

Alluvium Monitoring

During 2020 there was no mining at either Glendell or Mt Owen Mine that further intersected alluvium. Southern areas of Glendell's Barrett Pit are monitored as a part of site wide geotechnical assessments. To date, there has been no observed inflow from alluvium in this area and as a result no cut off wall or similar is required.

Groundwater Licence 20BL169337

In accordance with Condition 4 of Groundwater Licence 20BL169337, an assessment of compliance against the conditions is presented in [Table 59](#).

Table 59: Assessment of Compliance with Licence 20BL169337

Condition Number	Condition description (detailed summary)	Compliance Status	Comment	Where addressed in Annual Review
1)	The following definitions apply to this licence: Alluvial water inflow means water contained within an alluvium which, if intercepted by mining activity, will give rise to an inflow of water into a mine work. Annual review means the annual review required by condition 3, schedule 6 of the project approval (DA 14-1-2004). The alluvium is defined as an extensive stream-laid deposit of unconsolidated material, including gravel, sand, silt and clay. Mine works means any extraction of material from land for excavation relating to the construction and/or operation of open-cut mining at Mt Owen mine.	NA	NA – definitions only	NA
2)	The licence holder must implement a methodology to the satisfaction of DPI Water to estimate the annual volume of alluvial water inflow (water budget) that the licence holder is likely to extract during the water year. This estimate must be reported annual in the annual review.	Compliant		Section 7.4
3)	The licence holder must include in the Annual Review a map which shows the licensed site and the current areas where mine works have interfered with alluvial sediment.	Compliant		Figure 30 (Groundwater Monitoring Bores)
4)	The licence holder must report in the Annual Review:	Compliant	As reported.	Section 7.4 Groundwater & Appendix G
	I) The monitoring results of any groundwater monitoring with respect to this licence;	Compliant	This Table	Table 59
	II) A summary of new bores or pits constructed during the year;	Compliant.	There were no new bores or pits constructed during the year. There was no VWP's installed throughout 2020.	N/A
	III) The trend graphs for monitoring data collected for each bore associated with the mine works;	Compliant	As reported in the Appendix (SLR report)	Appendix G
	IV) A summary of any contingency event (event) that impacted on groundwater during the last report period, including actions taken to remedy the event and any additional monitoring carried out on the event.	Compliant	No event has occurred that has impacted on groundwater during 2020	Section 7.4

Condition Number	Condition description (detailed summary)	Compliance Status	Comment	Where addressed in Annual Review
5)	An extraction measurement device must be installed and maintained on each extraction device (pump) used for extraction of water under this licence, and such devices must be of a type and standard, and must be maintained in a manner, which is acceptable to DPI Water.	Compliant	A flow meter device was installed in 2017.	N/A
6)	The licence holder must ensure that the independent environmental audit as required by condition 8 of schedule 6 DA 14-1-2004 is submitted to DPI Water. The audit must: I) Assess compliance with the conditions of the licence, including the groundwater monitoring and contingency plan;	Compliant	Refer to Independent Audit Report www.mtowencomplex.com.au <u>The latest Independent Audit was conducted in December 2020. Report currently awaiting regulatory review.</u>	N/A
	II) Review actual impacts of the extractions on any aquifers, groundwater dependent ecosystems and any streams in the area;	Compliant	Refer to Independent Audit Report www.mtowencomplex.com.au <u>The latest Independent Audit was conducted in December 2020. Report currently awaiting regulatory review.</u>	N/A
	III) Make comparisons between actual and predicted impacts (modelled results);	Compliant	Refer to Independent Audit Report www.mtowencomplex.com.au <u>The latest Independent Audit was conducted in December 2020. Report currently awaiting regulatory review.</u>	Error! Reference source not found.
	IV) Provide recommendations as to works that ought to be performed or additional obligations that ought to be imposed in order to rectify any impacts on groundwater.	Compliant	Refer to Independent Audit Report www.mtowencomplex.com.au <u>The latest Independent Audit was conducted in December 2020. Report currently awaiting regulatory review.</u>	N/A

Condition Number	Condition description (detailed summary)	Compliance Status	Comment	Where addressed in Annual Review
7)	DPI water shall have the right during the currency of this licence to vary at any time the volumetric allocation, or the rate at which this allocation is taken.	NA	N/A – note only	N/A
8)	The volume of groundwater extracted from the works authorised by this licence shall not exceed 140 megalitres in any 12 month period commencing 1 st July.	Compliant	The extraction beyond this licence limit is included in the 5.9GL of allocated hardrock aquifer licences held by MGO	Section 7.4.2

Further Improvements

The following summarises the recommendations made by the 2020 Annual Groundwater review (SLR, March 2021):

- Attempt to restore function to faulty VWP sensors/ sensors with no data, i.e:
 - All sensors at GNP1, GNP3 and GNP6
 - SMO028-LBA, GNP2-MLD and GNP5-BAR
 - Sensor S1567 at GNC022 and sensor S1346 at GNC023
- Investigate the obstruction at bore NPZ10a and attempt to clear for resumption of sampling
- Investigate the status of bore GNPS-01
- Continue to monitor all bores in accordance with approval requirements, including the backfilled void bores
- Develop a trigger value assessment protocol for the VWP sensors
- Investigate the water level trigger exceedances for the hard rock bores, including a comparison with predicted water level impacts
- Review of groundwater level trigger limits to prevent natural variations and predicted drawdown from mine activities resulting in trigger exceedances.
- Review the groundwater monitoring network to clearly identify the screened lithology in each bore and outline the purpose and applicability of each bore for assessing potential groundwater related impacts. This includes the removal of bores that have been blocked for several years or have other issues that make the data less reliable:
 - NPZ109D, NPZ9a, NPZ10a, NV10C, NV11C, NV12C, NV13C, TPZ10 and TPZ11 – Blocked
 - BNO009 and BNO011 can only be dipped (blocked)
 - NPZ11A, NV14A – periodically blocked (tree roots) and high gas levels, potentially decommission

- NV12A, NV12B – Damaged (pipe bent)
- GNPS-01 - Destroyed
- GNP3 – VWP reported faulty
- SMO023 – Unknown sensor depths
- Amend the GMMP to reflect changes in bore network.

8 Rehabilitation

During the reporting period MGO submitted two amendments to the MOP/Rehabilitation Management Plan to Resources Regulator for approval. The revised MOP included updated text and plans to reflect current, mining operations and rehabilitation.

Rehabilitation was carried out in accordance with:

- MGO MOP/ Rehabilitation Management Plan
- MGO Biodiversity and Offset Strategy
- MGO Rehabilitation Strategy
- Mt Owen and Glendell Annual Rehabilitation and Closure Management Plan (ARLCP, an internal MGO document).

Rehabilitation is designed to achieve a stable final landform compatible with the surrounding environment and to meet the landform commitments presented in the MOP/ Rehabilitation Management Plan as well as the Rehabilitation Strategy.

Table 60 provides a summary of rehabilitation activities at MGO for 2019 and 2020 and the rehabilitation forecast to be undertaken in 2021. All values presented are in hectares.

Table 60: MGO Rehabilitation Summary

Mine Area Type	Previous Reporting Period (2019)	This Reporting Period – Forecast (2020)*	This Reporting Period - Actual (2020)	Next Reporting Period – Forecast (2021)**
Total Mine Footprint	2860	2875.4	2995.7	3056.2
Total active Disturbance	1396	1415.7	1436.4	1479.9
Land being prepared for rehabilitation	0	0	0	0
Land under active rehabilitation	1464	1459.7	1559.3	1576.3
Completed Rehabilitation	104	104.4	95.3	67.1

* Forecasts for 2020 based on MOP Amendment A. These differ from values within the current MOP Amendment B approved December 2020.

**Forecasts based on MOP Amendment B.

Rehabilitation continued across MGO during 2020 generally in line with the ARCP / MOP (Table 61). 95.3 ha of rehabilitation was completed across MGO, made up of 56.5ha at Glendell and 38.8 ha at Mt Owen.

Table 61: 2020 Rehabilitation works compared to MOP

Mine Area Type	2020 Actual Data (Mt Owen Complex)	MOP Prediction
Rehabilitation (ha)	95.3	84.8
Disturbance (ha)	54.9	44
Rehabilitation Disturbance (ha)	61.0*	19.6

Note: increased rehabilitation disturbance was partially rehabilitated in same year. This has resulted in a higher rehab total than what was predicted.

Glendell

GLD completed 56.5 ha of rehabilitation during 2020 including 35.1ha of open grassland or pasture areas and 21.4ha of open woodland areas (see Figure 31). In woodland areas, GLD continued to use a species mix which incorporates a number of shrub and understorey species, characteristic of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest. GLD also made improvements to the rehabilitation process, deep ripping directly prior to seeding. This change in the rehabilitation process provides a rougher surface finish improving infiltration, limiting surface runoff and therefore reducing any potential erosion issues.

Mt Owen

In 2020 MTO rehabilitated 38ha of open forest rehabilitation. Rehabilitation methodology remains largely unchanged at MTO with past success an indicator that processes are suitable for the conditions. Focus is placed on the use of direct place topsoil from pre-strip areas and the majority of 2020 rehabilitation was able to utilise this resource. The rest of the area was rehabilitated using subsoil with the addition of gypsum to counter any soil dispersion. Natural landform design continued to be incorporated into the rehabilitation process during 2020, with 13.2 ha completed on the North Pit rehabilitation area.



Figure 31: Newly completed rehabilitation at Glendell

8.1 Rehabilitation Monitoring

The objective of rehabilitation monitoring is to assess the progression of rehabilitation areas towards relevant criteria and commitments and to facilitate continuous improvements in rehabilitation practices.

Commencing in 2020, GCAA implemented across its NSW operations common templates for rehabilitation monitoring, performance indicators and completion criteria. This standardised approach adopts monitoring according based on the establishment age of the rehabilitation areas. These are defined by two distinct groups known as Initial Establishment Monitoring (IEM) and Long Term Monitoring (LTM).

Initial Establishment Monitoring focuses on rehabilitation which is 1 to 3 years of age since establishment. Monitoring of these areas evaluates the germination success, landform stability and early identification of problematic weeds.

Long Term Monitoring focuses of rehabilitation which is 4 years or greater in age since establishment and evaluates and tracks progress towards completion criteria using detailed scientific monitoring methods.

The 2020 monitoring program included a combination of:

- Remote sensing – identification of mapping areas of recalcitrant bare ground >1,000m² in size;
- Walkover inspection – high level assessment of rehabilitation condition and ground-truthing the findings of remote sensing; and
- Long term monitoring – plot/transect based monitoring collecting scientific data and trends on vegetation community establishment.

The 2020 monitoring campaign included the assessment of 22 rehabilitation blocks covering a cumulative area of 486.9ha, comprising of 14 IEM blocks and 8 LTM blocks. In addition, one native reference site was also monitoring in 2020 under the GCAA reference site sharing program. The monitoring program is designed to assess all rehabilitation block areas at least once every three years. As this monitoring methodology was introduced in 2020 data presented here presents the current trends for the blocks monitored, over the next several years all blocks will be monitored under this methodology which will then allow for more direct comparison of trends over time.

Table 62: Rehabilitation Parameters Monitored provides details of the rehabilitation blocks monitored in 2020 and **Figure 32** shows the locations.

Performance against key rehabilitation metrics was assessed for each rehabilitation polygon. A summary of this data is presented in **Table 62**Error! Reference source not found.. Each polygon is assigned one of four performance rankings as per the criteria below.

Category	Criteria
Rework	<ul style="list-style-type: none"> • Does not meet completion criteria.

Category	Criteria
	<ul style="list-style-type: none"> Extensive rework required that would not typically form part of a rehabilitation maintenance program; e.g. slopes do not comply with approval requirements, large bare areas >0.1ha, very severe and widespread erosion, etc. TARP Condition Red.
Maintenance	<ul style="list-style-type: none"> Does not meet completion criteria. Routine rehabilitation maintenance works required (e.g. weed control, infill seeding/plantings, repair of minor erosion, fertiliser application). TARP Condition Amber.
Monitor	<ul style="list-style-type: none"> Trajecting towards completion criteria but does not meet all criteria No intervention required other than ongoing routine land management, but continued monitoring required (e.g. ecologically young areas, variable results). TARP Condition Green.
Acceptable	<ul style="list-style-type: none"> Rehabilitation objectives and completion criteria are generally met and the area is ready for sign off by regulators. Routine management and monitoring should be continued to maintain status until relinquishment process is sought. TARP Condition Green.

Table 62: Rehabilitation Parameters Monitored

Type	Mine site	Mining area	Block code	Domain	Area (ha)	Sites	2020 Performance Condition Status
IEM	Glendell	Barrett pit	IEM-BP-CSB-2018	Corridor/Shelter belt	11.6	3	Maintenance
IEM	Glendell	Barrett pit	IEM-BP-CSB-2019	Corridor/Shelter belt	33.2	0	Maintenance
IEM	Glendell	Barrett pit	IEM-BP-GP-2019	Open Grassland	2.4	0	Maintenance
IEM	Mt Owen	North pit	IEM-NP-CHSGIGBF-2017	Open Woodland	20.6	4	Maintenance
IEM	Mt Owen	North pit	IEM-NP-CHSGIGBF-2019	Open Woodland	37.5	0	Monitor
IEM	Rav East	North void	IEM-BN-CHGBIW-2017-1	Open Woodland	6.7	3	Rework
IEM	Rav East	Bayswater north	IEM-BN-CHGBIW-2017-2	Open Woodland	4.4	2	Maintenance

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Type	Mine site	Mining area	Block code	Domain	Area (ha)	Sites	2020 Performance Condition Status
IEM	Rav East	Bayswater north	IEM-BN-CHGBIW-2019-1	Open Woodland	12.9	0	Maintenance
IEM	Rav East	Bayswater north	IEM-BN-CHGBIW-2019-2	Open Woodland	1.8	0	Maintenance
IEM	Rav East	Bayswater north	IEM-BN-CHGBIW-2019-3	Open Woodland	6.6	0	Monitor
IEM	Rav East	North void	IEM-NV-CHGBIW-2018-1	Open Woodland	15.6	4	Rework
IEM	Rav East	North void	IEM-NV-CHGBIW-2018-2	Open Woodland	13.3	3	Maintenance
IEM	Rav East	North void	IEM-NV-CHGBIW-2019	Open Woodland	21.6	0	Monitor
IEM	Rav East	Tailings pond 01	IEM-TP1-GP-2018	Open grassland	8.4	2	Maintenance
LTM	Glendell	Barrett pit	LTM-BP-CSB-B1	Corridor/ Shelter belt	82.0	8	Maintenance
LTM	Glendell	Tailings pond 02	LTM-TP2-CSB-B1	Corridor/ Shelter belt	22.3	4	Maintenance
LTM	Mt Owen	North pit	LTM-NP-CHSGIGBF-B1	Open Woodland	60.8	5	Maintenance
LTM	Mt Owen	North pit	LTM-NP-CHSGIGBF-B2	Open Woodland	74.4	5	Maintenance
LTM	Mt Owen	North pit	LTM-NP-CHSGIGBF-B3	Open Woodland	17.2	4	Maintenance
LTM	Rav East	Bayswater north	LTM-BN-CHGBIW-B1	Open Woodland	8.3	3	Maintenance
LTM	Rav East	Bayswater north	LTM-BN-CHGBIW-B2	Open Woodland	6.5	3	Maintenance
LTM	Rav East	Bayswater north	LTM-BN-GP-B1	Open Grassland	8.2	2	Monitor
Total					476.3		55



Figure 32: Rehabilitation Parameters Monitored

Based on the observations and results from the 2020 walkover inspection and transect-based monitoring an assessment of rehabilitation progress against the relevant MOP (including TARP) and Rehabilitation Strategy criteria is provided in [Table 63](#) for the LTM Open Grassland block.

Table 63: 2020 Rehabilitation Progress Summary - Open Grassland Rehabilitation LTM Block

Monitoring Block	LTM-BN-GP-B1	
MOP / Rehabilitation Strategy Criteria	Compliant	TARP
Slopes generally <14 degrees (Glendell)	Yes	Green
No drainage issues threatening to cause rehabilitation failure	Yes	Green
Land capability classification criteria met	Yes	Green
No large bare patches indicating poor soil/spoil quality	Yes	Green
No evidence of spontaneous combustion	Yes	Green
No gully or tunnel erosion features, or rill erosion >200mm deep	Yes	Green
Protective ground cover is at least 80%	Yes	Green
Weed presence does not present a risk to the intended land use	Yes	Green
Pasture establishment is in good health and provides adequate cover	Yes	Green
>75% of herbage cover provided by grasses and legumes suitable for grazing	No	Amber
Pasture production is comparable to similarly managed pastures	No	n/a

Based on the observations and results from the 2020 walkover inspection and transect-based monitoring an assessment of rehabilitation progress against the relevant MOP (including TARP) and Rehabilitation Strategy criteria is presented in [Table 64](#) for the LTM Corridors/Shelter belts blocks.

Table 64: 2020 Rehabilitation Progress Summary - Corridors/Shelter Belts Rehabilitation LTM Blocks

Monitoring Block	LTM-BP-CSB-B1		LTM-BP-CSB-B1	
MOP / Rehabilitation Strategy Criteria	Compliant	TARP	Compliant	TARP
Slopes generally <14 degrees (Glendell)	Yes	Green	Yes	Green
No evidence of spontaneous combustion	Yes	Green	Yes	Green
No large bare patches indicating poor soil/spoil quality	Yes	Green	Yes	Green

No drainage issues threatening to cause rehabilitation failure	Yes	Green	Yes	Green
No gully or tunnel erosion features, or rill erosion >200mm deep	Yes	Green	Yes	Green
Habitat features incorporated in landform	Yes	n/a	Yes	n/a
Protective ground cover is at least 70%	Yes	Green	Yes	Green
No significant weed infestations	No	Amber	No	Amber
Tree stem densities ≥400 stems/ha	Yes	n/a	Yes	n/a
Evidence of flowering, seeds or second-generation seedlings for trees and shrubs	Yes	n/a	Yes	n/a
Rehabilitation areas provide a range of structural features (trees, shrubs, ground cover, developing litter layer etc.)	Trending	Green	Trending	Green
Corridors are successfully established and suitable for fauna species movement	Trending	Green	Trending	Green

Based on the observations and results from the 2020 walkover inspection and transect-based monitoring an assessment of rehabilitation progress against the relevant MOP (including TARP) and Rehabilitation Strategy criteria is presented in [Table 65](#) for the LTM Open Woodland blocks being returned to CHGBIW.

Table 65: 2020 Rehabilitation Progress Summary - Open Woodland (CHGBIW) LTM Blocks

Monitoring Block	LTM-BN-CHGBIW-B1		LTM-BN-CHGBIW-B2	
	Compliant	TARP	Compliant	TARP
Slopes generally <10 degrees (MTO/Rav East)	Yes	Green	Yes	Green
Overburden emplacements include informal undulations	No	n/a	No	n/a
Artificial habitat features incorporated in the landform	No	n/a	No	n/a
Landforms are free draining to local watercourses	Yes	Green	Yes	Green
No drainage issues threatening to cause potential rehabilitation failure	Yes	Green	Yes	Green
No gully or tunnel erosion features, or rill erosion >200mm deep	Yes	Green	Yes	Green

No large bare patches (>1,000 ²) indicating poor soil/spoil quality	Yes	Green	Yes	Green
No evidence of spontaneous combustion	Yes	Green	Yes	Green
Soil pH in the range of reference sites	Not assessed	Not assessed	Not assessed	Not assessed
The rehabilitation surface is a suitable growing medium (as evidenced by vegetation establishment)	Yes	Green	Yes	Green
Protective ground cover is at least 70%	Yes	Green	Yes	Green
Cover of priority weeds is within range of reference sites	No	Amber	No	Amber
No significant weed infestations within the Blocks	No	Red	No	Red
Evidence of nutrient cycling processes (litter cover) within benchmarks	Yes	n/a	Yes	n/a
Species composition and assemblages characteristic of target community	Yes	Green	Yes	Green
Native tree diversity >75% of reference sites or published community benchmarks	Yes	Green	No	Amber
Native shrub diversity >75% of reference sites or published community benchmarks	No	Red	No	Red
Native ground cover diversity >75% of reference sites or published community benchmarks	No	Red	No	Red
Trees FPC trending towards target community	Trending	n/a	Trending	n/a
Shrubs FPC trending towards target community	No	n/a	No	n/a
Ground cover FPC trending towards target community	No	n/a	No	n/a
>75 percent of trees are healthy and growing	Yes	n/a	Yes	n/a
Evidence of flowering, seeds for trees and shrubs	Yes	n/a	Yes	n/a
At least one second-generation seedling present per plot	Trending	n/a	Trending	n/a
Rehabilitation provides a range of structural features (e.g. trees, shrubs, ground cover, litter layer, etc.)	Trending	n/a	Trending	n/a

Based on the observations and results from the 2020 walkover inspection and transect-based monitoring an assessment of rehabilitation progress against the relevant MOP (including TARP) and Rehabilitation Strategy criteria is provided in [Table 66](#) for the LTM Open Woodland blocks being returned to CHSGIGBF.

Table 66: 2020 Rehabilitation Progress Summary - Open Woodland (CHSGIGBF) LTM Blocks

Monitoring Block	LTM-NP-CHSGIGBF-B1		LTM-NP-CHSGIGBF-B2		LTM-NP-CHSGIGBF-B3	
	Compliant	TARP	Compliant	TARP	Compliant	TARP
Slopes generally <10 degrees (MTO/Rav East)	Yes	Green	Yes	Green	Yes	Green
Overburden emplacements include informal undulations	No	n/a	No	n/a	No	n/a
Artificial habitat features incorporated in the landform	Yes	Green	Yes	Green	Yes	Green
Landforms are free draining to local watercourses	Yes	Green	Yes	Green	Yes	Green
No drainage issues threatening to cause potential rehabilitation failure	Yes	Green	Yes	Green	Yes	Green
No gully or tunnel erosion features, or rill erosion >200mm deep	Yes	Green	Yes	Green	Yes	Green
No large bare patches (>1,000 ²) indicating poor soil/spoil quality	Yes	Green	Yes	Green	Yes	Green
No evidence of spontaneous combustion	Yes	Green	Yes	Green	Yes	Green
Soil pH in the range of reference sites	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
The rehabilitation surface is a suitable growing medium (as evidenced by vegetation establishment)	Yes	Green	Yes	Green	Yes	Green
Protective ground cover is at least 70%	Yes	Green	Yes	Green	Yes	Green
Cover of priority weeds is within range of reference sites	No	Green	No	Amber	No	Amber
No significant weed infestations within the Blocks	No	Red	No	Red	No	Red

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Evidence of nutrient cycling processes (litter cover) within benchmarks	No	n/a	No	n/a	No	n/a
Species composition and assemblages characteristic of target community	Yes	Green	No	Red	No	Red
Native tree diversity >75% of reference sites or published community benchmarks	Yes	Green	Yes	Green	Yes	Green
Native shrub diversity >75% of reference sites or published community benchmarks	Yes	Green	Yes	Green	Yes	Green
Native ground cover diversity >75% of reference sites or published community benchmarks	No	Red	No	Red	No	Red
Trees FPC trending towards target community	Trending	n/a	No	n/a	No	n/a
Shrubs FPC trending towards target community	Yes	n/a	Yes	n/a	Yes	n/a
Ground cover FPC trending towards target community	Yes	n/a	Yes	n/a	Yes	n/a
>75 percent of trees are healthy and growing	Yes	n/a	Yes	n/a	Yes	n/a
Evidence of flowering, seeds for trees and shrubs	Yes	n/a	Yes	n/a	Yes	n/a
At least one second-generation seedling present per plot	Yes	n/a	No	n/a	Yes	n/a
Rehabilitation provides a range of structural features (e.g. trees, shrubs, ground cover, litter layer, etc.)	Yes	n/a	Yes	n/a	Yes	n/a

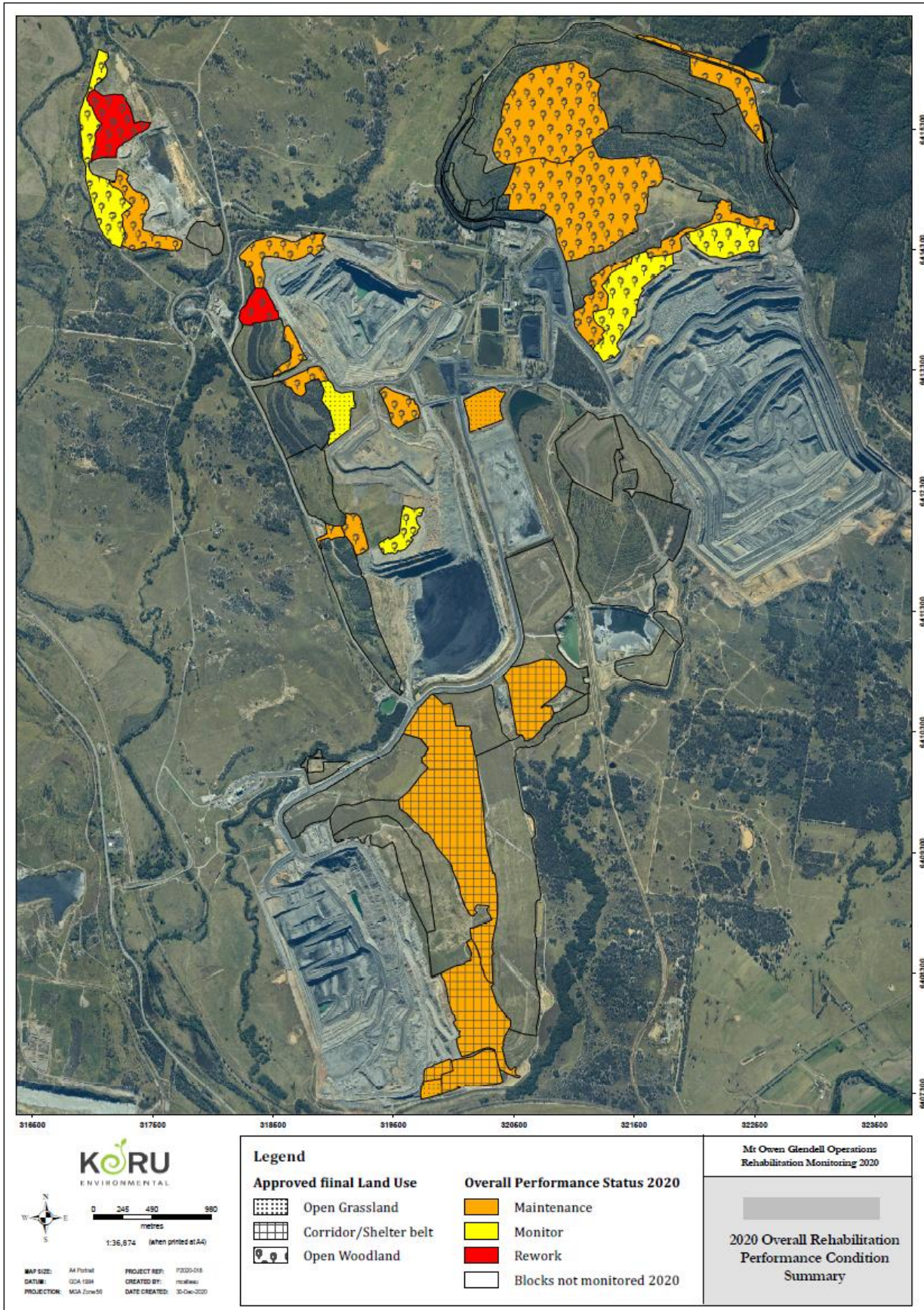


Figure 33: Summary of Rehabilitation Performance for 2020 Monitoring

In areas currently as showing an unsatisfactory performance in 2019, it was identified that the key issues and factors impeding the successful establishment of stable and self-sustaining vegetation communities include:

- erosion;
- weed incursion; and
- sub-adequate species assemblages.

Rehabilitation across MGO was generally stable and no critical erosion features were identified. Some erosion features were identified during the 2020 monitoring which will require monitoring and or maintenance.

Weed incursion has been identified as the main issue for rehabilitation impacts at MGO. Weed populations are widespread and threaten the ecological integrity of the rehabilitated communities. The main species of concern at the time of the 2020 monitoring included *Galenia pubescens* (*Galenia*), *Acacia saligna* (Golden wreath wattle) and *Hyperhenia hirta* (Coolatai grass). The management of these species is ongoing using a targeted approach based on annual monitoring recommendations.

The results from the 2020 monitoring also highlighted the requirement in some areas for increases and decreases in existing stem densities and lower and mid storey vegetation depending on existing performance condition. The management of these requirements is also ongoing and targeted based on the outcomes of annual monitoring recommendations so that improvement trends can be monitored overtime.

While there are localised issues with rehabilitation performance identified across the site (which in most cases could be successfully controlled/ treated in the next reporting period), established rehabilitation at MGO generally showed good performance in 2020 following improved rainfall conditions compared to the drought conditions of the previous several years.. Going forward, the continued monitoring of rehabilitation performance will allow MGO to build a robust database of relevant and scientific data. This dataset will allow an accurate and reliable assessment of rehabilitation performance to be made against regulatory requirements and assist in presenting a strong case for successful land relinquishment in the future.

8.2 Further Improvements, Trials and Research

MGO developed a program to address the absence of difficult to establish EEC species within the rehabilitation. Work began late in 2017 on seed collection and propagation of these species. During 2020 native seed was collected from existing established rehabilitation as well as buffer land areas. The aims of this program are to:

- Supplement the existing rehabilitation areas with missing or under represented EEC species and important missing secondary species through targeted planting;
- Establish patches of plants from which seed can be harvested in the future for use on new rehabilitation; and
- Establish of patches of plants which will self-seed and increase in population size, increasing the resilience and sustainability of plant communities within rehabilitation.

It is envisaged that this program will be ongoing for a number of years and the success of this targeted and innovative approach to EEC rehabilitation at MGO will be reported on in future Annual Reviews. During 2020 MGO developed seed collection nurseries within the Mt Owen Rehab areas as part of this program.



Figure 34: Example of seed nursery development at Mt Owen

During 2020, MGO also undertook additional work in existing rehabilitation areas to progress rehabilitation areas towards final landform requirements these included:

- Ongoing weed and pest management;
- Planting of 500 native reeds in the North Void area;
- Re-seeding of 10 hectares of woodland species on Western Out of Pit (WOOP) dump;
- Re-seeding of 7.5 hectares of woodland species in the North Void Area ([Figure 35](#));
- Commencement of work to re-seed approximately 27 hectares to woodland species on the Barrett Pit RL150 rehabilitation area; and
- Installation of additional 12 nesting boxes in the Barrett Pit Rehabilitation area.



Figure 35: 7.5ha area of re-seeding to woodland in the North Void

8.3 Rehabilitation Activities for the next reporting period (2021)

Rehabilitation activities planned at MGO for 2021 include (see Figure 36):

Mt Owen

- 38 ha of Open Woodland and Forest Rehabilitation
- 27 ha of planned disturbance
- 10 ha of tree seeding on the north-western side of the WOOP dump to Open Woodland community (currently pasture dominated)
- 13ha of re-work in north void to establish Open Woodland Rehabilitation in areas currently dominated by pasture (following on from 2020)

Glendell

- 37 ha of Open Grassland and Open Woodland Rehabilitation
- 0 ha of planned disturbance
- 15 ha of re-work on the western side of West Pit tailing's dam to repair erosion and establish Open Woodland Rehabilitation (currently pasture dominated)
- 27 ha of re-work on the Barrett Pit RL150 dump to establish Open Woodland Rehabilitation (currently pasture dominated)

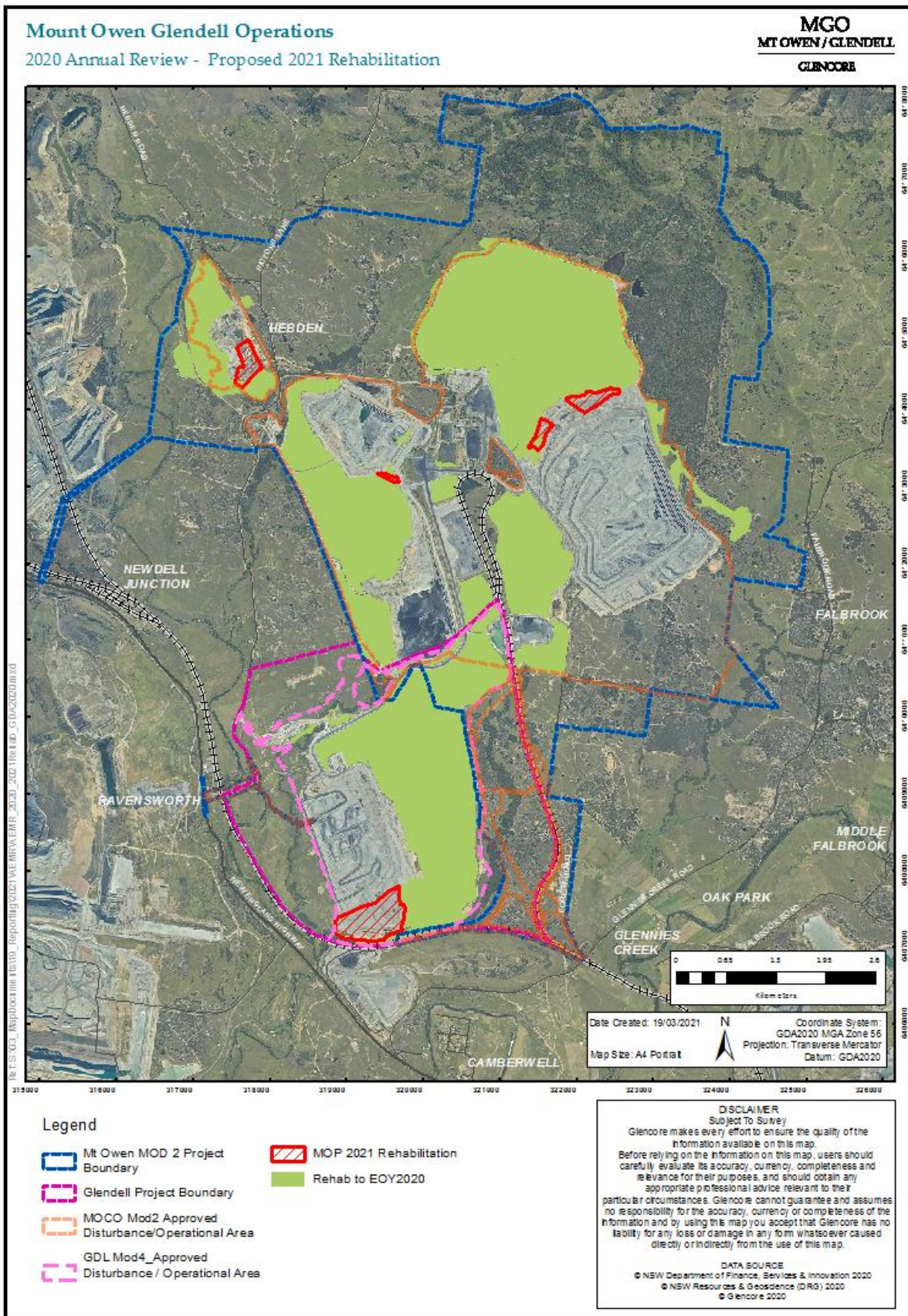


Figure 36: Mt Owen Complex Proposed Rehabilitation for 2020

9 Community

9.1 Community Engagement and Activities 2020

During the reporting period, informal discussions continued with local landowners, regulatory authorities and other stakeholders on the status of operational activities within MGO.

MGO implemented the community engagement program, consisting of:

- one-on-one meetings with:
 - community neighbours
 - regulators
 - non-governmental organisations
- distribution of Community Newsletters
- Community Consultative Committee (CCC) meetings.
- Informal community gatherings

Topics of discussion included:

- progress of development applications
- progress of MOP / RMP
- current operational environmental performance
- environmental monitoring results
- rehabilitation progress.

Details of community engagement activities undertaken at MGO during 2020 are included in [Table 67](#) with an example in.

Table 67: Community Engagement Activities for 2020

Date	Community Group	Community Activity	Topics Covered
30 April 2020	CCC	Community Consultative Committee Meeting	General overview of MGO operations, environmental performance, approvals update, exploration activities update and Integra Mine update.
05 May 2020	Hebden Community Gathering	Community Gathering	Cancelled due to Covid 19
04 June 2020	Aboriginal Cultural Heritage Working Group Meeting	Biannual Meeting	General overview of MGO operations, environmental performance, approvals update, aboriginal cultural heritage update, Integra Mine update and York's Creek VCA area update.
04 August 2020	Glennies Creek Community	Coffee and a Chat (Day 1)	General overview of MGO operations and Environmental performance.

Date	Community Group	Community Activity	Topics Covered
21 August 2020	Glennies Creek Community	Coffee and a Chat (Day 2)	General overview of MGO operations and Environmental performance.
12 November 2020	Aboriginal Cultural Heritage Working Group Meeting	Biannual Meeting	Meeting forced to be cancelled due to lack of stakeholder turnout.
22 October 2020	Camberwell Community	Coffee and a Chat	General overview of MGO operations and Environmental performance
29 October 2020	CCC	Community Consultative Committee Meeting	General overview of MGO operations, environmental performance, approvals update, exploration activities update, local historical heritage, and Integra Mine update.
10 December 2020	Hebden Community	Coffee and a Chat	General overview of MGO operations, Environmental performance and history and management of Ravensworth Primary School.
21 December 2020	Singleton Neighbourhood Centre	Donation Drop off and delivery	MGO and CHPP donations were delivered to the neighbourhood centre. Hampers were then delivered by the team to struggling singleton locals.

MGO organised community coffee events at Hebden, Glennies Creek and Camberwell for the residents of the Goorangoola, Falbrook, Camberwell Village and Hebden areas, as well as the CCC representatives. These events provided an opportunity to discuss topics such as:

- post-mining land use
- rehabilitation
- updates on the MGO projects
- feral animal control
- air quality, blast and noise management.

9.2 Community Contributions

Table 68 summarises the community contributions made by MGO during 2020.

Table 68: 2020 MGO Community Contributions

Date	Community Group	Reason for Contribution	Amount
January 2020	Mt Pleasant Public School	Education Support Program	\$4500
February 2020	Police Citizens Youth Club	Friday Afternoon Fun Program	\$5250
March 2020	Wildlife Aid	Food and medical supplies injured animals	\$2000
June 2019	St. Catherine's Catholic College	Chicken Caravan Installation	\$4176

Date	Community Group	Reason for Contribution	Amount
August 2020	RSPCA	Purchase of hoses	\$1792
August 2020	Wanaruah Local Aboriginal Lands Council	Elder Group Shirt Purchases	\$988
October 2020	Hunter Homeless	Donation to support homeless people in the Hunter	\$4000
October 2020	Samaritans Singleton	Christmas Lunch	\$3000
November 2020	Mt Olive Community Hall	Mobile Booster	\$2048
November 2020	Movember	Raise money for Men's health	\$201
November 2020	Mt Pleasant Public School	Sports Program	\$3000
November 2020	Singleton Men's Shed	Crew community donation	\$200
November 2020	Rural Fire Service - Singleton	Crew community donation	\$200
November 2020	Wildlife Aid	Crew community donation	\$200
November 2020	Hunter Valley Ranch Sorting	Crew community donation	\$400
November 2020	Hunter Homeless Support	Crew community donation	\$600
November 2020	Singleton Neighbourhood Centre Inc.	Purchase and Instalment of Security Cameras and Lights	\$3707
December 2020	Singleton RFS	Lolly Run	\$2000
December 2020	Hunter Valley Ranch Sorting	Competition prizes – Horse rugs	\$1000
December 2020	Hebden RFS (See Figure 40)	Community Grant and Canopy	\$2,410
December 2020	Hebden Community Hall	Community Hall upgrades	\$16,240
MOC Total Community Contributions			\$57,912



Figure 37: Hebden RFS Community Donation

9.3 Summary of MGO Community Complaints

Mt Owen received 4 community complaints during 2020 consisting of:

- 3 for blasting (Vibration)
- 1 for noise

Glendell and Ravensworth East received a total of 12 community complaints during 2020 consisting of:

- 10 for noise;
- 1 for air quality;
- 1 for blasting (dust)

MGO responded and investigated all complaints received during 2020. All complaints are contained within the Community Complaints Register which is available on the Glencore website: <https://www.glencore.com.au/>

Further information can be found in **Appendix H, Table 34**.

9.4 Complaint Trends and Actions

In 2020 Mt Owen received 4 community complaints, compared to one received in 2019 (**Figure 38**). This is a slight increase in the number of complaints received from the previous year.

Glendell received 12 community complaints in 2020, a significant decrease of 31 complaints received in 2019 (43). This included a decrease of four noise complaints and an increase of six air quality complaints compared to 2018.

Each complaint is investigated individually for compliance.

Noise related complaints during the morning period dominated during 2020. This is consistent with a predominant temperature inversion at that time of the day. Temperature inversions are monitored across MGO on a daily basis in an effort to reduce associated impacts. MGO adjust production to reduce noise impacts associated with heavy machinery during periods of increased risk.

Blasts are systematically monitored and constant improvements are made through meteorology predictions and blast modelling to reduce community impacts. Blast overpressure and vibration results for MGO were all within approval compliance limits during the report period.

Air Quality across MGO is continually monitored through a system of meteorological predictions, modelling and reactive alarming systems to reduce community impacts. As operations progress, these systems are reviewed and revised to ensure air quality is suitably managed onsite.

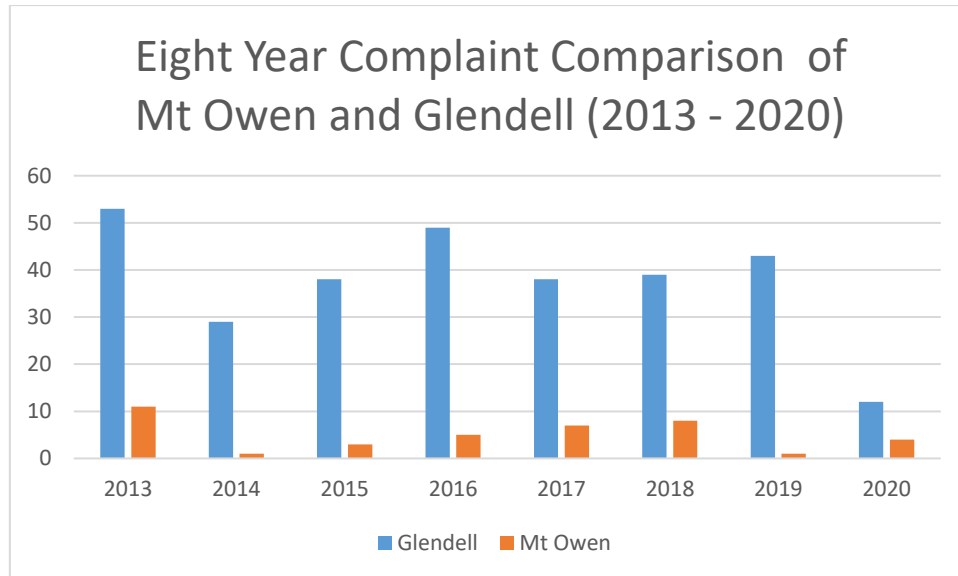


Figure 38: Comparison of Complaints Received at Mt Owen and Glendell from 2013 to 2020

10 Independent Audit

An independent audit was conducted by Jacobs at MGO during December 2020. The audit covered the reporting period 31 October 2017 to 2 December 2020, and consisted of a desktop review of documentation, interviews with key MGO staff, and a field inspection.

The audit was conducted generally in accordance with *State significant developments Independent Audit Guideline, October 2015* (DPIE); *ISO 14001:2015* Environmental management systems and *ISO 19011:2018* Guidelines for auditing management systems.

The audit identified 7 non-compliance recommendations with no 'high-risk' non-compliances were identified. All 7 issues were classified as administrative in nature. The audit report was submitted to DPIE in February 2021, MGO is yet to receive a response at the time of compiling this annual review.

Table 69 below summarises MGO's audit report response to audit finding and Action plan as submitted to DPIE on the 19th February 2020.

The MGO Independent Audit report completed by Jacobs can be seen in Appendix I. This audit report as well as previous audit reports and recommendations are located on the MGO website: <https://www.mtowencomplex.com.au/en/Pages/home.aspx>.

Table 69: IEA report response to audit findings and action plan following audit

Ref	Requirement	Auditors Recommendation	Risk	MGO Response and Action Plan	Timing
SSD 5850 Non-compliance Recommendations					
1	Schedule 2, Condition 17	Ensure all required consultation is documented in CMO	Administrative	Following finalisation of the Planning Agreement (PA) with Singleton Council, MGO will maintain record of consultation as required by the condition.	Q2 2021
2	Schedule 3, Condition 5	Conduct an internal review of the NMP and operating procedures relating to noise to determine if any improvements can be made and communication to those with responsibility for noise control	Administrative	Since the incident relating the noise exceedance on 17 June 2020, MGO has reviewed the Noise Management Plan and associated noise management processes which did not identify the need for any further action. A record of this review was submitted to DPIE on 4 August 2020. No further action required to address this recommendation.	Complete
3	Schedule 3, Condition 15	Ensure Preblast procedures are compliant with the Blast Management Plan and the approvals and reinforce with training the timing requirements of the BMP and approvals.	Administrative	Since the blast miscapture incident on 5 September 2018, MGO implemented improved communication methods to ensure that personnel servicing blast monitoring equipment and their respective task coordinators were aware of blasting activities at both Glendell and Mt Owen mining areas. Furthermore pre- blast assessments now also require review of monitor status prior to blasting. No Further action is required to address this recommendation.	Complete
4	Schedule 3, Condition 15 (c)	Condition is explicit in requiring a Road Closure plan however mine plans indicate that this will not be required in life of mine. MGO should seek permission from DPIE to forego the requirement for a road closure plan.	Administrative	MGO views the requirement for this plan to not have been triggered as mining is not anticipated to be within 500m of a public road. Section 3.5 of the Approved MGO Blast Management Plan details that this plan will be developed should mining be planned within 500m of a public road. Nonetheless, MGO will seek clarification from DPIE that the Road Closure Management Plan is not required unless mining with 500m of a public road.	Q2 2021

Ref	Requirement	Auditors Recommendation	Risk	MGO Response and Action Plan	Timing
5	Schedule 3, Condition 16 & 18	Ensure compliance with the Air Quality Management Plan and approvals requirements when managing air quality. Review training needs and retrain if required.	Administrative	MGO continues to implement the controls identified in the Air Quality Management Plan to maintain compliance with approval conditions. This includes the provision of training in management of air quality for mine personnel. MGO will review for adequacy air quality training needs and reassess if required.	Q2 2021
DA 80/952 Non - compliance Recommendations					
6	Schedule 3, Condition 4	Revise the quarterly noise monitoring summary report by inclusion of a statement of compliance for cumulative noise.	Administrative	<p>MGO's Noise Management Plan describes the processes in place for reasonable and feasible management of cumulative noise impacts with neighbouring mines. This includes a process for monitoring all noise sources from the real time monitoring system, regular interaction meetings with neighbouring mines, a protocol for triggering detailed cumulative noise assessments and a process for notifying neighbouring mines if attended noise monitoring identifies other mines noise to be of concern.</p> <p>MGO believes that these measures satisfy the requirement of the approval condition however, MGO will undertake a review of existing processes in relation to management of cumulative noise including options for assessment of compliance.</p>	Q2 2021
7	Schedule 3, Condition 20	Ensure compliance with the Air Quality Management Plan and approvals requirements when managing air quality. Review training needs and retrain if required.	Administrative	This recommendation is a duplicate to that of recommendation Number 5. As the site is operated as a complex no additional action is required to address this separately to that already list above.	N/A

11 Incidents and Non-Compliances 2020

MGO reported one (1) non-compliance during 2020, as detailed in **Table 70: Non-Compliance Reported in 2020**.

Table 70: Non-Compliance Reported in 2020

Agency	Approval	Description	Follow up/ Action taken
NSW DPIE*	DA SSD-5850, Schedule 3, Condition 5	Breach of Operational Noise conditions at N1 on 17 June 2020.	<ul style="list-style-type: none"> - Exceedance at location N1 on 17 June 2020 was investigated and corrective actions were implemented. - DPIE & the EPA were notified via email. - An additional noise monitoring test was scheduled at the site within one week of the exceedance (24/06/20) in accordance with the approved Noise Management Plan. - Noise exceedance report developed – submitted to DPIE 15 July 2020. - Corrective Action Plan was submitted within the exceedance report to decrease likelihood of recurrence. - No remediation measures directed by the Secretary. - MGO provided written notification to all affected landowners regarding exceedance of noise limits (24/06/20) as well as results of retest which were back within compliance (30/06/2020).

12 Activities to Improve Environmental Management in 2021

Table 71 lists activities recognised during 2020 that should aid in improving the overall environmental performance at MGO for 2021 reporting period.

Table 71: Performance Improvement Summary for 2021

Aspect	Implementation Timeframe	Effect on Management Plans	Improvement Action
Air Quality	Q1	Nil	Use of Petrotac (or alternative) around LV/Infrastructure (Non-HV roads) at Mt Owen.
Air Quality	Q4	Nil	North ROM hopper sprays (high-pressure) trial.
Independent Compliance Audit	Q2-Q4	Nil	Complete required actions from Q4 2020 Audit.
Land Management	Q1	Nil	On-site and off-site seed nursery to be created for site
Management Plans	Q2	Revision to required plans	Review all management plans in line with approvals received in 2021
Noise	Q2	Nil	Implementation of 3D Noise Model at Mt Owen
Rehabilitation	Q4	Nil	3 year plan for rehabilitation certification to be developed
Tailings Dam	Q1-Q4	Nil	Increased focus on capping – North Void progressive rehab