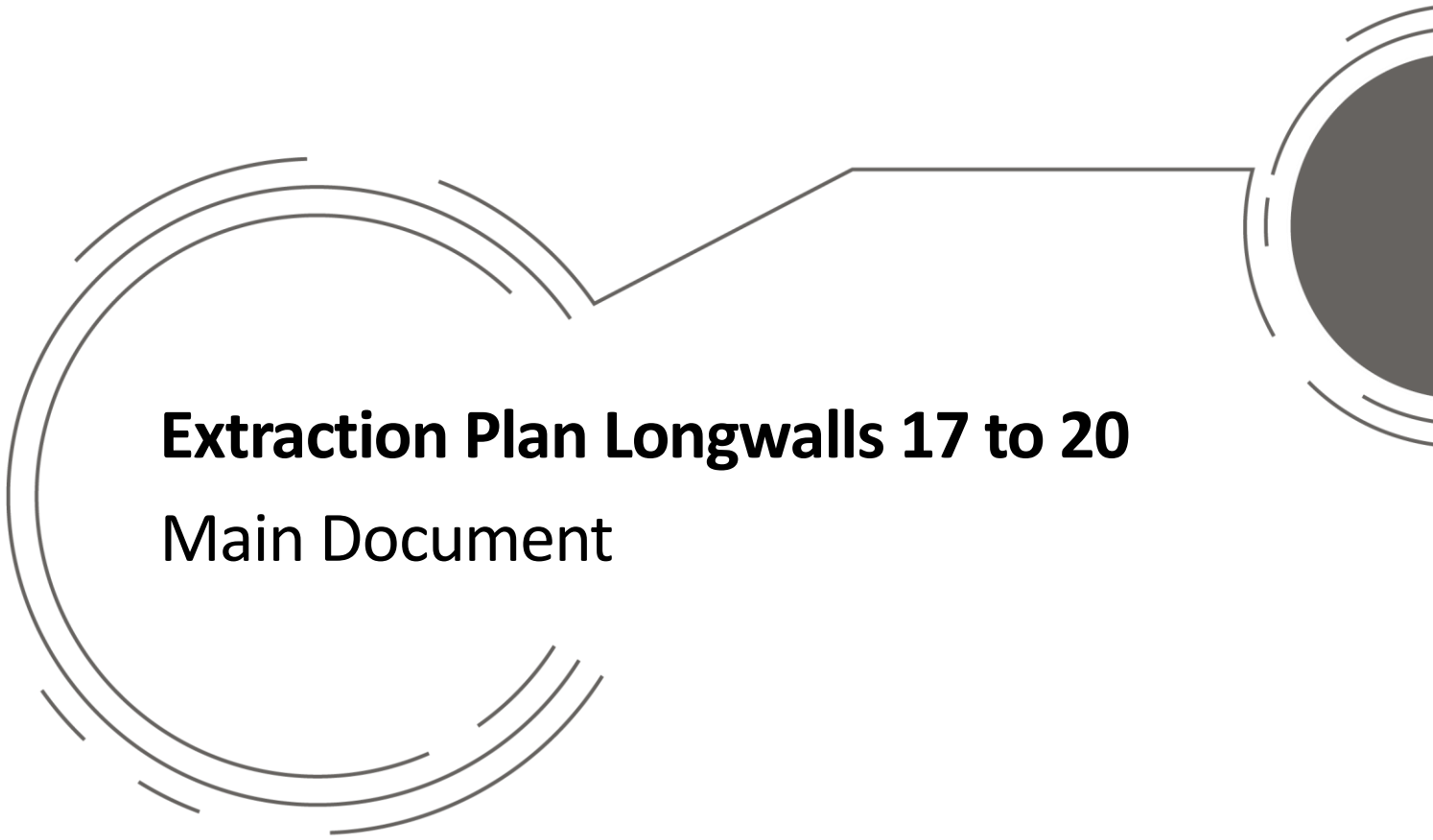


INTEGRA UNDERGROUND

GLENCORE



Extraction Plan Longwalls 17 to 20

Main Document

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1. Purpose

The purpose of this Extraction Plan Main Document (Extraction Plan) is to provide for the adequate management of subsidence impacts to natural and built features from the extraction of Longwalls (LW) 17 to 20 in the Middle Liddell seam at the Integra Underground. Subsidence performance measures are specified in Project Approval (PA) 08_0101 as modified (see **Section 3.6**).

Key objectives of the Extraction Plan will be achieved by:

- Providing an overview of the planned coal resource recovery methods;
- Identifying and characterisation of the natural and built features within the Extraction Plan Area;
- Identifying the predicted subsidence impacts and/or environmental consequences within the Extraction Plan Area associated with the planned coal recovery;
- Identifying, and implementing as appropriate, a monitoring and management regime to control the identified subsidence risks; and
- Implementing a review and adaptive management process to provide feedback on the implemented monitoring and management regime.

2. Scope

2.1 Overview

In December 2015, HV Coking Coal Pty Ltd (HVCC), a 100% Glencore-owned company, acquired all assets associated with the Integra Underground Mine (Integra Underground), which had been placed in care and maintenance in May 2014. During this time, environmental management of the site was maintained under a care and maintenance environmental management system.

Prior to HVCC's purchase of Integra Underground, the mine formed part of the larger Integra Mine Complex. This complex comprised both underground and open cut operations and operated under a single Project Approval instrument which combined the Project Approval for Integra Underground (PA 08_0101) and Integra Open Cut (PA 08_0102). Following the separation of ownership of the open cut and underground, the combined Project Approval was modified to separate the open cut and underground approvals. The underground mine now operates under PA 08_0101 as modified.

Underground operations recommenced in 2017, with development resuming in February 2017 and longwall extraction resuming in May 2017 (in accordance with the Extraction Plan as required under Condition 20 of Schedule 3 of PA 08_0101). An application for Modification to PA 08_0101 (MOD 7) and accompanying Environmental Assessment was lodged with the Department of Planning and Environment (DPE, now Department of Planning, Industry and Environment [DPIE]) in June 2017. Subsequently, approval was granted by the DPE on 15 September 2017. The modification application was made to facilitate the construction of a water pipeline from Integra Underground to the adjacent Mount Owen Complex and the subsequent use of the pipeline to transfer mine water. The modification enables surplus mine water collected at Integra Underground to be managed at Mt Owen Glendell Operations (MGO) and within Glencore's Greater Ravensworth Area Water Sharing Scheme (GRAWSS).

An application for Modification 8 (MOD 8) to PA 08_0101 and accompanying Environmental Assessment was lodged with the DPIE in November 2017. Approval was granted by the DPIE on 16 April 2018. MOD 8 allows continuation of longwall mining of the Middle Liddell seam further to the north of the previously approved longwall panels, along with the construction and operation of ancillary surface infrastructure required to support the mining activities.

This Extraction Plan has been submitted by HVCC to DPIE to seek approval for the secondary extraction of LW 17 to LW 20 within the Middle Liddell seam in accordance with PA 08_0101. This Extraction Plan has been prepared as per the Extraction Plan Guideline (DPIE, 2015) and follows a similar framework as the Integra Underground LW 15 and 16 Extraction Plan which was approved by the DPIE on 8 August 2019.

2.2 Project Area

The Project Area (referred to as the Extraction Plan Area) for LWs 17–20 is determined as the area within a distance equal to the overburden depth to the mining horizon (equivalent to a 45° angle of draw) around the outermost goaf edges of the planned panel voids (1 x Depth Zone). A horizontal distance equal to overburden depth from the nearest goaf edge is considered a conservative option for the identification of surface features and assessment of impacts to these features. Any subsidence related movements beyond this distance are expected to be insignificant for all practical purposes (SCT, 2020).

The Extraction Plan Area is outlined in **Figure 2-1** and **Figure 2-2**.

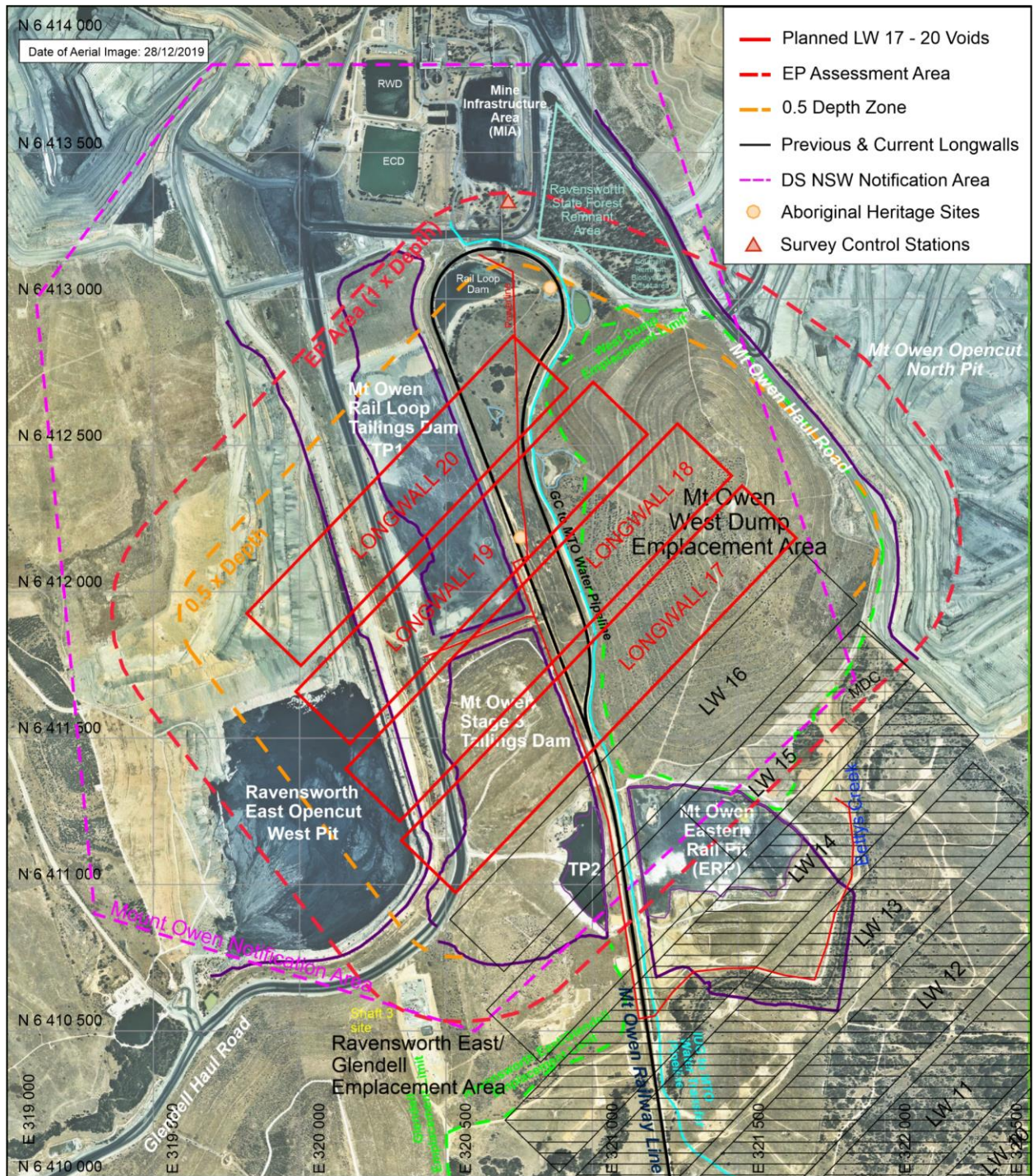


Figure 2-1 – Locations of Surface Features (SCT 2020)

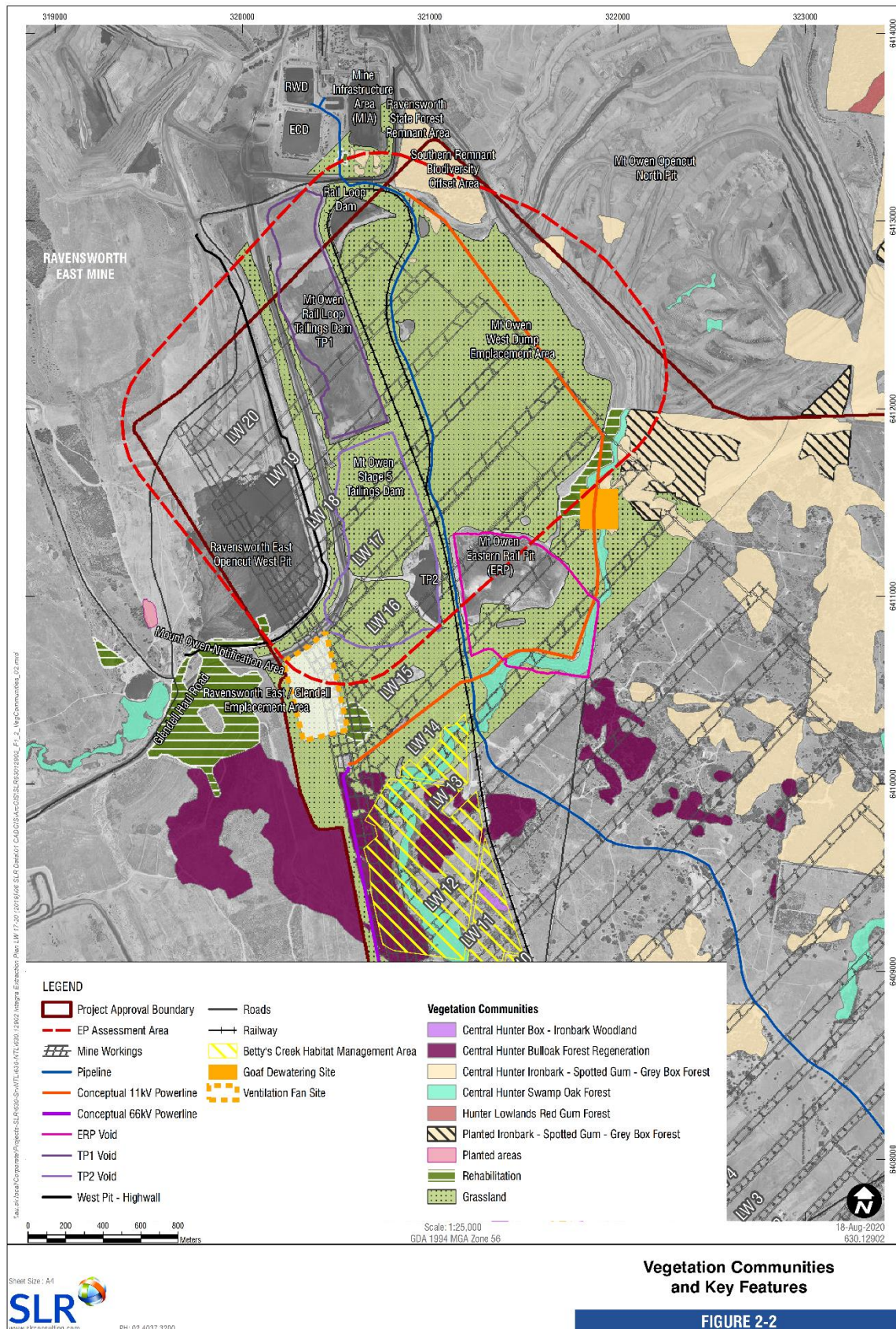


Figure 2-2 – Vegetation Communities and Key Features

2.3 Document Structure

This Extraction Plan has been prepared to address conditions of the PA 08_0101 and structured in accordance with the *Guidelines for the Preparation of Extraction Plans* (Draft V5) (Extraction Plan Guidelines). The document structure for this Extraction Plan is outlined below.

Volume 1 – Extraction Plan	Volume 2 – Built Features Management Plan and Asset Management Plans	Volume 3 – Specialist Assessments	Volume 4 – Graphical Plans
Extraction Plan – Main Doc App A – Risk Assessment App B – Coal Resource Recovery Plan App C – Subsidence Monitoring Program App D – Public Safety Management Plan App E – Water Management Plan (Site wide document) App F – Biodiversity Management Plan (Site wide document) App G – Aboriginal Heritage Management Plan (Site wide document) App H – Historic Heritage Management Plan (Site wide document) App I – Land Management Plan App J – Endorsement, Consultation and Approval App K – Rehabilitation Management Plan (Mining Operations Plan; Site wide document)	Built Features Management Plan, including: App A – TARP App B – Mount Owen Rail Infrastructure Asset Management Plan (MSEC) App C – Mount Owen Glendell Operations Key Features Asset Management Plan App D – Subsidence Management Protocol	Subsidence Impact Assessment (SCT 2020) Surface Water Impact Assessment (Engeny 2020) Groundwater Impact Assessment (AGE 2020)	Plan 1 – Workings and Dimensions Plan 2 – Surface Features Plan 3A – Geological Data: Seam Floor Contours Plan 3B – Geological Data: Seam Thickness Contours Plan 3C – Geological Data: Depth of Cover Contours Plan 4A – Geological Data: Seam Interburden Contours Plan 4B – Geological Data: Seam Thickness Contours Plan 5 – Mining Titles & Land Ownership Plan 6 – Geological Logs Plan 7A – Subsidence Effect Monitoring Plan Plan 7B – Subsidence Effect Monitoring Plan (with Aerial Photograph)

2.4 Extraction Plan Team

Schedule 3, Condition 20 of the Project Approval states:

The Proponent must prepare an Extraction Plan for all second workings on site. This plan must:

- *be prepared by a team of suitably qualified and experienced persons whose appointment has been endorsed by the Secretary.*

The team who prepared this Extraction Plan is outlined in **Table 2-2**. The suitably qualified and experience experts were endorsed by the DPIE on 25 May 2020 (**Volume 1, Appendix J**).

Table 2-1 – Extraction Plan Team Members

Reference	Title
Extraction Plan coordination and preparation	1. Chloe Piggford – Glencore 2. Chris Jones* – SLR Consulting 3. Megan Crowhurst – SLR Consulting
Coal Resource Recovery Plan	1. Chloe Piggford – Glencore 2. Chris Jones* – SLR Consulting 3. Megan Crowhurst – SLR Consulting
Subsidence Monitoring Program	1. Chloe Piggford – Glencore 2. Chris Jones* – SLR Consulting 3. Megan Crowhurst – SLR Consulting
Built Features Management Plan (including Asset Management Plans)	1. Chloe Piggford – Glencore 2. Chris Jones* – SLR Consulting 3. Megan Crowhurst – SLR Consulting 4. James Barbato – MSEC
Public Safety Management Plan	1. Chloe Piggford – Glencore 2. Chris Jones* – SLR Consulting 3. Megan Crowhurst – SLR Consulting
Water Management Plan	1. Existing site wide management plan 2. Updated by Glencore in 2019
Biodiversity Management Plan	1. Existing site wide management plan 2. Originally prepared by EMM Consulting Pty Ltd (EMM) and Glencore 3. Updated by SLR Consulting and Glencore in 2019

Reference	Title
Land Management Plan	1. Chloe Piggford – Glencore 2. Chris Jones* – SLR Consulting 3. Megan Crowhurst – SLR Consulting
Heritage Management Plan (Aboriginal and Historic)	1. Existing site wide management plans 2. Originally prepared by EMM Consulting Pty Ltd (EMM) and Glencore 3. Updated by SLR Consulting and Glencore in 2018
Subsidence Assessment (Specialist Assessment 1)	1. Ken Mills – Strata Control Technology (SCT) 2. Stephen Wilson – SCT
Surface Water Impact Assessment (Specialist Assessment 2)	1. Susan Shield – Engeny 2. Michael Best – Engeny
Groundwater Impact Assessment (Specialist Assessment 3)	1. Bryce McKay – AGE 2. Neil Manewell – AGE
Graphical Plans	1. Trevor Collins – Trevor Collins Drafting & Survey 2. Richard Vetter – Mine Surveyor, Integra Underground

* Chris Jones was endorsed by DPIE on 25 May 2020 and ceased employment with SLR Consulting on 31 July 2020. Therefore, Chris prepared the draft documentation; however, did not finalise the documentation.

2.5 Risk Management

A risk assessment was completed for the LW 17-20 Extraction Plan Area on 4 March 2020. A copy of the full risk assessment and methodology is included as **Volume 1, Appendix A**. The Risk Assessment identified a total of 38 potential risks / hazards. Based on the current risk ranking, six were considered to be medium risk and all others were considered to be low risk.

The medium risks identified as part of the risk assessment are outlined in **Table 2-3**.

Table 2-2 – Summary of Medium Risks and Additional Controls

Potential Risk & Consequence	Additional Controls
Surface subsidence effects / cracking impede drainage paths, resulting in ponding of surface water in rail loop cutting.	• Prepare Surface Water Assessment including TP1 drain.
Surface subsidence effects / cracking / horizontal movements, resulting in damage to ventilation infrastructure.	• Prepare <i>Built Features Management Plan</i> for LW 17-20 (consider existing plan).
Surface subsidence effects / cracking, resulting in contour drains impacted and not functioning as designed/ remediation costs.	• Prepare <i>Mount Owen Glendell Operations Key Features Asset Management Plan</i> for LW 17-20. • Review monitoring requirements.

Potential Risk & Consequence	Additional Controls
Isolated failures on highwall - rock falls, resulting in production delay/ loss of revenue/ remediation costs/ equipment damage/ personnel injury.	• Prepare geotechnical assessment for LW 17-20 by Mt Owen Geotech Engineers. • Monitoring of LW16 impacts (e.g. radar first 500m of LW16).
Isolated failures on highwall - slope failure, resulting in production delay/ loss of revenue/ remediation costs/ equipment damage/ personnel injury.	• Prepare geotechnical assessment for LW 17-20 by Mt Owen Geotech Engineers. • Monitoring of LW16 impacts (e.g. radar first 500m of LW16).
Highwall/pit integrity reduced, resulting in remediation costs.	• Prepare geotechnical assessment for LW 17-20 by Mt Owen Geotech Engineers. • Monitoring of LW16 impacts (e.g. radar first 500m of LW16).

3. Planning

The statutory requirements relating to this Extraction Plan are outlined within **Section 3**.

3.1 Project Approval

Table 3-1 outlines the requirements of Schedule 3, Condition 20 of PA 08_0101 (MOD 8) relating to the preparation of this Extraction Plan.

Table 3-1 – PA 08_0101 Condition

Condition	Extraction Plan Reference
The Proponent must prepare an Extraction Plan for all second workings on site. This plan must:	Section 2.4
a) Be prepared by a team of suitably qualified and experienced persons whose appointment has been endorsed by the Secretary.	
b) Be approved by the Secretary before the Proponent undertakes any second workings covered by the plan.	The overall Extraction Plan has been submitted to the DPIE for approval.
c) Include detailed plans of the proposed second workings and any associated surface development.	Graphical Plans (Volume 4).
d) Include detailed performance indicators for each of the performance measures in Table 10.	Section 3.6
e) Provide revised predictions of the conventional and non-conventional subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this approval that specifically addresses the incremental and cumulative subsidence effects and impacts of multi-seam mining.	Section 5.2 Specialist assessment attached – Volume 3, Specialist Assessment 1.
f) Describe the measures that would be implemented to ensure compliance with the performance measures in Table 10, and remediate any predicted subsidence impacts and/or environmental consequences; including the following, which have been prepared in consultation with DRG: coal resource recovery plan that demonstrates effective recovery of the available resource;	Section 5.3 See <i>Coal Resources Recovery Plan (Volume 1, Appendix B)</i>
- a subsidence monitoring program to: - provide data to assist in the management of the risks associated with subsidence; - validate the subsidence predictions; and - analyse the relationship between the subsidence effects and impacts under the Extraction Plan and any ensuing environmental consequences;	Section 6.1 See <i>Subsidence Monitoring Program (Volume 1, Appendix C)</i> .
A Built Features Management Plan, which has been prepared in consultation with the owners of such features, to manage the potential impacts and consequences of subsidence on any built features;	See <i>Built Features Management Plan (Volume 2)</i>

Condition	Extraction Plan Reference
A Public Safety Management Plan to ensure public safety at the site; and	See <i>Public Safety Management Plan (Volume 1, Appendix D)</i> .
A revised Rehabilitation Management Plan;	Covered by the MOP (Volume 1, Appendix K).
g) Include a: - Water Management Plan, which has been prepared in consultation with EPA and DoI Water, to manage the potential impacts and consequences of subsidence on surface water and groundwater resources, flooding and existing and proposed creek diversions; and which includes: - surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality; - a program to monitor and report groundwater inflows to underground workings; - a program to manage and monitor impacts on groundwater bores on privately-owned land;	Site wide document. Volume 1, Appendix E. Note: The Water Management Plan is a site wide document as opposed to the Extraction Surface Water Assessment which applies to surface water resources potentially impacted as a result of mining within the Extraction Plan Area (LW 17 -20). Therefore, the monitoring program in the Extraction Surface Water Assessment will be followed directly in regard to LW 17-20 and the monitoring program in the Water Management Plan will be applied to all areas.
Biodiversity Management Plan, which has been prepared in consultation with OEH, to manage the potential impacts and consequences of subsidence on biodiversity and which includes measures to manage potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna;	Site wide document. Volume 1, Appendix F.
Land Management Plan, which has been prepared in consultation with relevant landowners, to manage the potential impacts and consequences of subsidence on land in general;	Volume 1, Appendix I.
Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders of Aboriginal heritage, to manage the potential impacts and consequences of subsidence on heritage sites or values;	Site wide document. Volume 1, Appendix G and Appendix H.
h) Include Trigger Action Response Plans, or equivalent, to address potential subsidence impacts and environmental consequences that may result from mining subsidence;	TARPs are outlined in key Management Plans
i) Include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measures in Table 10, or where any such exceedance appears likely; and	Section 6.2
j) Include a program to collect sufficient baseline data for future Extraction Plans. The Proponent must implement the approved plan as approved from time to time by the Secretary.	See <i>Subsidence Monitoring Program (Volume 1, Appendix C)</i> .
Schedule 5, Condition 2 – Management Plan Requirements	

Condition	Extraction Plan Reference
The Proponent must ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include: a) detailed baseline data;	Section 5.1 Other site Management Plans and Asset Management Plans
b) a description of: - The relevant statutory requirements (including any relevant approval, licence or lease conditions); - Any relevant limits or performance measures/criteria; and - The specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 3
c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 6 and 7
d) a program to monitor and report on the: - Impacts and environmental performance of the project; and - Effectiveness of any management measures (see (c) above);	Section 6. <i>Subsidence Monitoring Program (Volume 1, Appendix C)</i> Other site Management Plans and Asset Management Plans
e) a contingency plan to manage any unpredicted impacts and their consequences;	Section 6.2
f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Review process – Section 8.2 Adaptive Management – Section 7.3
g) a program to regularly review management practices to align with contemporary best practice industry standards;	Review process – Section 8.2
h) a protocol for managing and reporting any: - Incidents; - Complaints; - Non-compliances with the conditions of this approval and statutory requirements; and - Exceedances of the impact assessment criteria and/or performance criteria; and	Section 7
i) a protocol for periodic review of the plan.	Section 8.2

3.2 Mining Lease

Table 3-2 outlines the Project Approval requirements relating to the preparation this Extraction Plan. This condition relating to the preparation of an Extraction Plan is outlined in CL 382, ML 1740, ML 1742 and ML 1786.

Table 3-2 – Mining Lease Conditions

Mining Lease Condition	Extraction Plan Reference
6. Extraction Plan (a) In this condition: (i) approved Extraction Plan means a plan, being: A. an extraction plan or subsidence management plan approved in accordance with the conditions of a relevant development consent and provided to the Secretary; or B. a subsidence management plan relating to the mining operations subject to this lease: I. submitted to the Secretary on or before 31 December 2014; and II. approved by the Secretary (ii) relevant development consent means a development consent or project approval issued under the Environmental Planning & Assessment Act 1979 relating to the mining operations subject to this lease.	This Extraction Plan has been developed for LW 17 -20.
(b) The lease holder must not undertake any underground mining operations that may cause subsidence except in accordance with an approved Extraction Plan.	No secondary extraction within LW 17-20 will be completed until this Extraction Plan has been approved.
(c) The lease holder must ensure that the approved Extraction Plan provides for the effective management of risks associated with any subsidence resulting from mining operations carried out under this lease.	Risk assessment completed for Extraction Plan (Volume 1 Appendix A). Management Plans developed, including <i>Public Safety Management Plan</i> (Appendix D).
(d) The lease holder must notify the Secretary within 48 hours of any: (i) incident caused by subsidence which has a potential to expose any person to health and safety risks; (ii) significant deviation from the predicted nature, magnitude, distribution, timing and duration of subsidence effects, and of the potential impacts and consequences of those deviations on built features and the health and safety of any person; or (iii) significant failure or malfunction of a monitoring device or risk control measure set out in the approved Extraction Plan addressing: A. built features; B. public safety; or C. subsidence monitoring.	Public Safety TARP developed within <i>Public Safety Management Plan</i> (Appendix D) See <i>Built Features Management Plan</i> (Volume 2) and site Environmental Management Plans.

3.3 Statement of Commitments

Table 3-3 outlines the subsidence measures from the Statement of Commitments which are part of PA 08_0101. Many of these commitments are not applicable to this Extraction Plan area, as they refer to mining within different mine seams.

Table 3-3 – Statement of Commitments Conditions

Desired Outcome	Existing or Proposed Actions	Timing	Extraction Plan Reference
Subsidence			
Subsidence management	<i>Subsidence Management Plan</i> applications will be submitted to the Resource Regulator detailing strategies to manage subsidence impacts, inclusive of measures referenced in this EA.	Prior to the commencement of proposed longwall mining in the affected area.	This Extraction Plan replaces SMP Requirement and is submitted to DPIE.
	The mine plan for the Barrett seam longwall blocks will be developed and operated to provide a minimum 40 metre separation between the boundary to the connected alluvium and the 20mm subsidence line.	Prior to the commencement of longwall mining in the affected area and ongoing.	N/A. Mining in Middle Liddell Seam.
	In addition to the overarching SMPs, specific management plans will be developed which will address potential subsidence impacts on specific items or areas of sensitivity, roads and associated infrastructure, transmission lines, communication infrastructure, Bettys Creek, farm fences, farm buildings and farm dams.	Prior to the commencement of proposed longwall mining in the affected area.	<i>Mount Owen Rail Infrastructure Asset Management Plan</i> and <i>Mount Owen Mine Key Features Asset Management Plan (Volume 2)</i> prepared for LW 17-20. Environmental Management Plans prepared for the site.
	Subsidence monitoring involving cross lines, longitudinal lines and three dimensional surveying will be undertaken to confirm the levels of subsidence occurring and enable refinements to subsidence predictions.	Prior to, during and after mining in the Barrett and Hebden Seams.	<i>Subsidence Monitoring Program (Volume 1, Appendix C)</i> prepared for LW 17-20.
	Temporary remediation works will progress during mining, with permanent remediation works completed following full subsidence impacts in an area.	Continuous and as required.	Remediation measures as per Extraction Plan.
Management of subsidence impacts on surface infrastructure	The new <i>Forest Road Subsidence Management Plan</i> to be built upon the existing management plan to reflect the expected subsidence and associated impacts.	Prior to the commencement of proposed longwall mining in the affected area.	<i>Built Features Management Plan (Volume 2)</i> has been developed for LW 17-20. No impacts to Forest Road from LW 17-20.
	As part of Hebden SMP development, a management plan for Glennies Creek Road and associated infrastructure will be prepared.	Prior to the commencement of proposed longwall mining in the affected area	N/A. Mining in Middle Liddell Seam.

Desired Outcome	Existing or Proposed Actions	Timing	Extraction Plan Reference
	As part of Barrett SMP development, a management plan for Middle Falbrook Road and associated infrastructure will be prepared.	Prior to the commencement of proposed longwall mining in the affected area.	N/A. Mining in Middle Liddell Seam.
	Possum Skin Dam will be decommissioned.	Prior to the commencement of longwall mining which would potentially affect the stability of integrity of the dam wall.	N/A
Management of subsidence impacts on surface infrastructure	The current <i>Electricity Transmission Lines Subsidence Management Plan</i> will be revised for inclusion in the new SMPs and will detail management of subsidence effects on powerlines.	Prior to the commencement of proposed longwall mining in the affected area.	A single pole overhead 11kV electricity transmission line traverses the Extraction Plan Area from north to south. The sections of this powerline above LWs 17-20 are positioned on natural ground surface and not expected to be significantly impacted by the planned mining of these panels. The management of this powerline is covered within the <i>Mount Owen Glendell Operations Key Features Asset Management Plan</i> .
	The existing management plan for the Forest Road communications/Telstra line will be reviewed and updated in consultation with Telstra to reflect changes resulting from this proposal.	Prior to the commencement of proposed longwall mining in the affected area.	N/A. The publicly accessible section of Forest Road is outside the Extraction Plan Area.
	Stakeholder consultation and monitoring of the existing communication cable adjacent to the Mount Owen Rail Spur will be carried out to make sure the cable remains serviceable during subsidence.	As required.	<i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i> has been prepared for LW 17-20
	Should GMO's mine plan change, any potential subsidence effects on its tailings dams or highwalls will be addressed in the relevant SMPs at that time.	Prior to the commencement of proposed longwall mining in the affected area.	<i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i> has been prepared for LW 17-20.

Desired Outcome	Existing or Proposed Actions	Timing	Extraction Plan Reference
	HV Coking Coal will undertake a more detailed assessment of potential impacts on the Ravensworth East / GMO and Glendell Open Cuts.	Following finalisation of the surface mine layout and prior to mining within these areas.	<i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i> and Subsidence Impact Assessment (SCT 2020) has been prepared for LW 17-20.
	HV Coking Coal will provide stakeholders such as Singleton Shire Council and landowners who border roads with a monthly update of the location of the longwall face relative to the road, and the estimated progress of the longwall during the following month.	Monthly.	Relevant stakeholder and landowner is Mt Owen Glendell Operations. Monthly update is provided as per Section 3.7 of this Extraction Plan.
	Signs will be erected by HV Coking Coal at points on the road at the edge of the longwall subsidence impact zone.	Prior to the commencement of proposed longwall mining in the affected area.	Signs indicating the proposed subsidence impact area are erected off Forest Road.
	Approval will be sought from the Resource Regulator and ARTC prior to any mining within the Main Northern Railway protection zone. Any proposed workings in the Main Northern Railway protection zone will be designed to be long term stable – taking site conditions into consideration.	Prior to mining within the protection zone.	No mining within the Main Northern Railway protection zone. <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i> developed for the Mount Owen Rail line which is a private siding connected to the Main Northern Railway in consultation with ARTC.
	A subsidence management plan will be devised in consultation with the MSB and the owners of houses above Barrett Seam Longwall 7.	Prior to the commencement of proposed longwall mining in the affected area.	N/A. Mining in Middle Liddell Seam.
Management of subsidence impacts on surface infrastructure	Surveys will be conducted prior to, during and after mining, to confirm the levels of subsidence movements and impacts, and identify if triggers for implementation of management measures have been reached.	Prior to the commencement of proposed longwall mining in the affected area.	<i>Subsidence Monitoring Program (Appendix C)</i> has been prepared for LW 17-20.
	HV Coking Coal and the MSB will undertake rebuilding, rectification of structural work, re-levelling and remedial work to surface water drainage and sewerage systems at the existing Glennies Creek	As required.	N/A. Outside of Extraction Plan Area for LW 17-20.

Desired Outcome	Existing or Proposed Actions	Timing	Extraction Plan Reference
	Community Hall as required to remediate anticipated subsidence damage.		
Ensure minimal subsidence impacts on natural features	The Hebden SMPs to be developed will incorporate and build upon the existing <i>Surface Drainage Management Plan</i> .	Prior to the commencement of proposed longwall mining in the affected area.	N/A. Mining in Middle Liddell Seam.
	A <i>Bettys Creek Diversion Management Plan</i> will be prepared as part of the Hebden SMPs.	Prior to the commencement of proposed longwall mining in the affected area.	N/A. Mining in Middle Liddell Seam.
	HV Coking Coal will prepare: • A response strategy to address any destabilisation of Main Creek; • A works programming for any necessary remedial works in Main Creek should subsidence expression initiate incision and headward erosion; • An outline of expansion of piezometric monitoring; and • A TARP as part of a surface water and groundwater monitoring and management program	Prior to Hebden Seam longwall mining undermining Main Creek.	N/A. Mining in Middle Liddell Seam.
Ensure minimal subsidence impacts on farm infrastructure.	The Hebden SMPs and Barrett SMPs to be developed will incorporate and build upon the existing Farm Fences, Farm Buildings and Farm Dams Subsidence Management Plans, as appropriate	Prior to the commencement of proposed longwall mining in the affected area.	N/A. Mining in Middle Liddell Seam.

3.4 Work Health and Safety Regulations

Mining of LWs 17-20 will be completed in accordance with the requirements of Work Health and Safety legislation. A separate High Risk Notification is being prepared for LW 15 and 16 to meet the health and safety requirements. Condition 67(2) of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* states the following:

- a) So far as is reasonably practicable, the rate, method, layout, schedule and sequence of mining operations do not put the health and safety of any person at risk from subsidence, and
- b) Monitoring of subsidence is conducted, including monitoring of its effects on relevant surface and subsurface features, and
- c) Any investigation of subsidence and any interpretation of subsidence information is carried out only by a competent person, and
- d) All subsidence monitoring data is provided to the regulator in the form and at the times required by the regulator, and
- e) So far as is reasonably practicable, procedures are implemented for the effective consultation, co-operation and co-ordination of action with respect to subsidence between the mine operator and relevant persons conducting any business or undertaking that is, or is likely to be, affected by subsidence.

3.5 Extraction Plan Guideline

Section 3 of the Extraction Plan Guideline (DPIE, 2015) requires an overview component as part of the Extraction Plan. This information is outlined within this document and other key management plans, including:

- **Mine Planning and Design** – covered within **Section 4** of this document. This is also outlined within other key management plans such as the *Coal Resource Recovery Plan* and Graphical Plans.
- **Subsidence Predictions** – summarised within **Section 5** of this document. Additional details within the SCT Subsidence Assessment (Volume 3 – Specialist Assessment 1).
- **Performance Objectives** – Outlined within **Section 3.6** of the document.
- **Subsidence Management Strategies and Measures** – outlined within management plans (see document structure **Section 2.3**).

3.6 Performance Measures and Indicators

Table 3-4 has been developed to address Schedule 3, Condition 17 of the PA 08_0101. The detailed performance indicators are monitored through a combination of management plans prepared as part of this Extraction Plan and existing approved Environmental Management Plans for Integra Underground.

Table 3-4 – Performance Measures and Indicators

Aspect	Performance Measure	Predicted Compliance Against Performance Measure	Performance Indicator	Monitoring Program Summary
Water				
Glennies Creek alluvial aquifer	Negligible impact	Compliance expected because the aquifer is remote from mining area (SCT 2020).	Negligible impacts on Glennies Creek alluvial aquifer based on groundwater monitoring program. No groundwater incident as a result of subsidence.	Section 8.1 of the <i>Water Management Plan (Appendix E)</i> outlines monitoring of alluvial aquifers. The groundwater monitoring program focusses on collecting information on potential impacts to: • Groundwater levels on neighbouring properties and any beneficial groundwater users; • Groundwater dependant ecosystems associated with alluvial aquifers of Glennies Creek, Bettys Creek and Main Creek; and • Groundwater quality.
Natural watercourses on site	No greater environmental consequences than predicted in the Underground Project EA	Compliance expected because no greater subsidence effects for natural ground compared to Underground Project EA. No natural watercourses above LWs 17–20. Mount Owen North Pit approved to mine through some natural watercourses (SCT 2020).	No deterioration in channel stability as a result of subsidence Measured surface water quality is within the triggers (and investigation process) presented in Table 7-3 of the WMP	Section 7 of the <i>Water Management Plan (Appendix E)</i> outlines surface water monitoring. The monitoring program includes Glennies Creek, Bettys Creek and Main Creek. The surface water monitoring program focusses on collecting information on potential impacts to: • Catchment areas of Glennies Creek, Bettys Creek and Main Creek; and • Stream stability and health.

Aspect	Performance Measure	Predicted Compliance Against Performance Measure	Performance Indicator	Monitoring Program Summary
Mount Owen Bettys Creek Diversions	No greater than the environmental consequences predicted in the Underground Project EA, unless the owner agrees otherwise in writing	Compliance expected because no greater subsidence effects for natural ground compared to Integra Underground Project EA. Mount Owen North Pit approved to mine through some sections of the Bettys Creek MDC during the next 5-10 years. Common ownership (Glencore) of assets (SCT 2020).	No deterioration in channel stability as a result of subsidence No ponding as a result of subsidence No significant weed growth or vegetation death	<i>Creek Diversion Management Plan</i> - Section 5 of the <i>Water Management Plan (Appendix E)</i> outlines monitoring of aspects within creek diversions including cross-section analysis and flow event overview/analysis to identify, monitor and rectify any major environmental and/or operational issues.
Underground Project Creek Diversions	Remain hydraulically and geomorphologically stable	N/A - not built yet as these diversions are mitigation measures for Hebden Seam mining (SCT 2020).	N/A	N/A
Other water storages and drainage lines	No greater than the environmental consequences predicted in the Underground Project EA	Compliance expected because no greater subsidence effects for natural ground compared to Underground Project EA. Mount Owen North Pit approved to mine through some farm dams and drainage lines.	No deterioration in dam integrity as a result of subsidence	Section 7 of the <i>Water Management Plan (Appendix E)</i> outlines surface water monitoring for onsite dams. <i>Mount Owen Mine Key Features Asset Management Plan (Volume 2)</i> identifies the process of monitoring sediment control dams (Table 5-1). This includes weekly inspections during active subsidence.
Biodiversity				
Threatened species, populations, habitat or ecological communities	Negligible impact	Compliance expected because no greater subsidence effects compared to Underground Project EA. Mount Owen North Pit approved to mine through some areas of natural vegetation and endangered ecological communities.	No unauthorised disturbance. No material, unforeseen impacts on threatened species, populations, habitat or ecological communities based on monitoring program.	Section 4 of the <i>Biodiversity Management Plan (Appendix F)</i> outlines ecological monitoring. Current monitoring includes terrestrial vegetation, and riparian vegetation along Bettys Creek.

Aspect	Performance Measure	Predicted Compliance Against Performance Measure	Performance Indicator	Monitoring Program Summary
			No biodiversity or ecology incident as a result of subsidence.	
Built Features				
All built features (except those fully covered by an operative contractual arrangement with another mine owner or other owner of the relevant built feature)	Safe, serviceable and repairable, unless the owner agrees otherwise in writing, including: - serviceability should be maintained wherever practicable; - loss of serviceability must be fully compensated; and - damage must be fully repaired or replaced, or else compensated.	Compliance expected (with management plans and controls in place) because no greater subsidence effects for natural ground compared to Underground Project EA. Common ownership (Glencore) of assets (SCT 2020).	No material, unforeseen impacts on built features as listed in Volume 2 (Table 4-2). Implementation of communication methods, including Mount Owen Railway Technical Committee (Volume 2).	The <i>Subsidence Monitoring Program (Appendix C)</i> and <i>Built Features Management Plan (Volume 2)</i> outline subsidence monitoring. This includes pre and post mining of each longwall panel to assess subsidence against the key performance measures identified in Section 4.2 of the <i>Subsidence Monitoring Program</i> .
Public Safety				
Public Safety	No additional risk due to mining	Compliance expected (with management plans and controls in place) and because no greater subsidence effects for natural ground compared to Underground Project EA. Majority of land owned by Glencore and is not easily accessible by the public (SCT 2020).	No material, unforeseen risks to public safety. No public safety incidents as a result of subsidence.	The <i>Public Safety Management Plan (Appendix D)</i> and <i>Built Features Management Plan (Volume 2)</i> outline the monitoring commitments and actions around public safety in relation to subsidence.

3.7 Consultation

A summary of key consultation completed for this Extraction Plan is outlined in **Table 3-5**. Consultation mostly related to the infrastructure within the Extraction Plan Area and is subsequent to consultation undertaken for previously approved Extraction Plans and longwall panels.

Table 3-5 – Summary of Consultation

Date	Consultation Method	Stakeholders and Experts Consulted or Present	Details
26 April 2018	Letter	Registered Aboriginal Parties (RAPs)	Approved <i>Aboriginal Heritage Management Plan</i> was sent to all RAPs. The only response received was from the Wonnarua Nation Aboriginal Corporation. No updates were required.
Monthly (incl. December 2019 to August 2020)	Meeting	Mt Owen Glendell Operations	Monthly meetings to discuss interactions between Mt Owen Glendell Operations and Integra Underground, including longwall progress and subsidence effects and monitoring.
4 March 2020	Risk Assessment	Integra Underground, Mt Owen Glendell Operations, SCT, MSEC, SLR	Risk assessment for the LW 17-20 Extraction Plan Area.
30 April 2020	Meeting	Community Consultative Committee (CCC)	Update of operations undertaken during 2019, discussion on planned activities in 2020.
31 March 2020	Report	DPIE, NSW Resources Regulator, DPIE – Biodiversity and Conservation Division, Natural Resources Access Regulator, NSW EPA, Singleton Shire Council, Subsidence Advisory NSW, CCC members, publicly available	Submission and provision of the 2019 Annual Review. Included reference to the submission of this Extraction Plan being planned for 2020.
7 May 2020	Letter	DPIE	Endorsement sought for proposed team to prepare Extraction Plan LW 17-20. Feedback sought from DPIE on proposed preparation method and timeline. Subsequent endorsement by the Secretary received on 25 May 2020.

Date	Consultation Method	Stakeholders and Experts Consulted or Present	Details
29 May 2020	Letter	NSW Resources Regulator	Feedback sought from NSW Resources Regulator on proposed preparation method and timeline.
14 August 2020	Letter	Forestry Corporation of NSW	Update on predicted subsidence effects and monitoring recommendations in relation to Ravensworth State Forest.
21 August 2020	Letter	Office of the Rail Safety Regulator (ONRSR)	Provision of draft <i>Mount Owen Rail Infrastructure Asset Management Plan</i> for LW 17-20.
21 August 2020	Letter	Australian Rail Track Corporation (ARTC)	Provision of draft <i>Mount Owen Rail Infrastructure Asset Management Plan</i> for LW 17-20.

4. Mine Plan

4.1 Mine Plan and Design

LWs 17-20 are a continuation of an existing series of sixteen longwall panels progressing to the northwest. Longwall panels are to be developed to the northeast from the main headings in the southwest. The direction of longwall retreat is from the northeast toward the main headings. LWs 17-20 are immediately adjacent to the existing LW 16 panel. The proposed dimensions are outlined in **Table 4-1**.

Table 4-1 – Proposed LW 17-20 Panel Dimensions

Panel	Nominal Gate Road Width (m)	MG Chain Pillar Width Coal Rib to Rib (m)	LW Void Width (m)	LW Void Length	Extraction Height Range (m)
LW 17	5.2	49	257.1	1681	2.8m – 3.2m
LW 18	5.2	49	257.1	1637	2.8m – 3.2m
LW 19	5.2	49	257.1	1467	2.8m – 3.2m
LW 20	5.2	49	257.1	1315	2.8m – 3.2m

4.2 Mine Schedule

Table 4-2 outlines the scheduled start date and completion date of the mining of LWs 17-20.

Table 4-2 – Geometry of the Proposed Panels LW 17-20

Panel	Start Date	Completion Date
LW 17	January 2021	August 2021
LW 18	September 2021	April 2022
LW 19	May 2022	October 2022
LW 20	December 2022	June 2023

As mine scheduling can be impacted by many factors, the dates listed in **Table 4-2** are indicative only.

5. Subsidence Assessment

5.1 Summary of Previous Subsidence Monitoring

This section has been prepared based on the Subsidence Assessment by SCT (2020) which is attached as **Volume 3, Specialist Assessment 1**. A copy of the key features within the Extraction Plan Area is outlined within **Section 5** and is presented in **Figure 2-1**.

Analysis of the subsidence monitoring results of the natural ground surface above LW 1-15 at Integra Underground indicates that the subsidence behaviour and the general form of the subsidence movements is as expected for the site characteristics and mining geometries involved.

There have been lower levels of subsidence over LW 1-5 and greater subsidence over LW 6-15, consistent with increased panel width from LW 6 onward. The chain pillars are clearly visible in the profile and the components of sag and strata compression subsidence are consistent with expectation based on panel and pillar widths, and overburden depth.

A series of both cross panel (traverse) and long panel (longitudinal) monitoring lines have been installed and regularly surveyed. An extensive set of monitoring lines have also been established along and parallel to the Mount Owen Rail Line to monitor the ground behaviour along this corridor.

A summary of the subsidence data for the existing monitoring lines including B Line (the main cross panel line) above LW 1-11, G Line across LW 10-12, H Line adjacent to the Mount Owen Rail line over LW 7-12, P Line over LW 12-14 and G Line extension over LW 13 is presented.

The subsidence monitoring recommended in previous Extraction Plan Subsidence Assessments for LW 13-14 and LW 15-16 was aimed at capturing measurements of subsidence behaviour of the fill material emplaced over the ERP and enhancing the database of the extent and magnitude of horizontal (far-field) movements at Integra Underground.

In addition, survey measurements and visual inspections for subsidence effects and potential impacts from longwall mining to open cut surface mining operations at Mt Owen – North Pit were undertaken during Longwall 14 and initial mining in Longwall 15.

Table 5-1 shows a summary of the main subsidence parameters comparing predicted with the actual measured after LW 1-14. The maximum value at the completion of each panel may not necessarily be in proximity to that panel.

The subsidence behaviour for LWs 17-20 is expected to be similar to the subsidence behaviour observed over previous longwall panels (SCT, 2020).

Table 5-1 – Comparison of Predicted Subsidence Values with Measured Values

LW	Predicted Maximum Subsidence (mm)	Measured Maximum Subsidence (mm)	Predicted Maximum Tilt in Flat Terrain (mm/m)	Measured Maximum Tilt (mm/m)	Predicted Maximum Strain Tens & Comp (mm/m)	Measured Maximum Strain (mm/m)
1	<30	N/A	0	N/A	0	N/A
2	750	430	7	3-5	3.4 & 5.2	1-2
3	920	760	7	5-6	3.9 & 5.9	2-3.5
4	820	860	7	5-6	3.3 & 5.1	2-3

LW	Predicted Maximum Subsidence (mm)	Measured Maximum Subsidence (mm)	Predicted Maximum Tilt in Flat Terrain (mm/m)	Measured Maximum Tilt (mm/m)	Predicted Maximum Strain Tens & Comp (mm/m)	Measured Maximum Strain (mm/m)
5	840	950	7	5-6	3.4 & 5.2	2-3
6	1470	970	10	6-9	5.7 & 8.8	2-3
7	1500	1270	10	6-9	6.0 & 9.3	2-3
8	1500	1310	10	6-9	5.9 & 9.1	2-3
9	1500	1400	10	6-9	5.5 & 8.5	2-3
10	1600	1350	12	6-9	6 & 9	3-4
11	1600	1410	12	8-11	6 & 9	4-6
12	1600	1500	12	8-10	6 & 9	4-6
13	1400	700	14	5	7 & 10	4 & 4
14	1400	750	14	12*	7 & 10	4-4
15	1500	730	14	10	7 & 10	3 & 7

*Unconventional effect - typically 4.

Subsidence over previously mined panels is expected to increase as additional longwall panels are mined. Maximum subsidence is expected to remain around 1.6m above panels to LW 12 and increase to 1.9-2.0m over for Longwalls 13-14 and Longwalls 15-16 respectively as forecast in SCT (2017a) and SCT (2018) after the mining of Longwalls 17-20. Subsidence over the chain pillars is also expected to increase slightly with each additional panel and as the overburden depth increases.

5.2 Subsidence Predictions of LWs 17-20

Subsidence predictions relating to the Extraction Plan Area are outlined within the Subsidence Assessment prepared by SCT (2020) which is included within **Volume 3, Specialist Assessment 1**. The Extraction Plan process provides an opportunity to update subsidence forecasts and assessment of impacts based on additional information and understanding gained since Project Approval.

In areas that have been filled with waste rock such as above part of the ERP, subsidence is expected to be of greater magnitude than in areas of natural ground. Tilts are expected to be less than those predicted for undisturbed ground due to the softening effects of the backfill. Strains are expected to be approximately double the magnitude of strains in undisturbed ground, especially in areas where there is a free surface available for horizontal movement.

Previous monitoring indicates that the subsidence from LWs 17-20 are likely to represent typical subcritical width behaviour with the maximum subsidence controlled primarily by panel geometry consistent with consideration of the subsidence mechanics (Mills 1998).

Predictions of strains and tilts are based on the empirical relationships developed by Holla (1991) adjusted for the Integra Underground site-specific subsidence monitoring results. Previous monitoring experience provides a cross-check on the values determined and the approach appears to provide a reasonable basis for estimating the maximum values likely to occur.

Table 5-2 summarises the main subsidence parameters expected above the four panels in the Extraction Plan Area as a basis for developing performance indicators. For a visual representation of LW areas refer to Graphical Plans 7A and 7B (**Volume 4**).

Table 5-2 – Comparison of Predicted Subsidence Parameters for Longwalls 17-20

Assessment	Max Subsidence (m)	Maximum Tilt (mm/m)	Maximum Strain Tension (mm/m)	Maximum Strain Compression (mm/m)
Natural or Undisturbed Ground				
GCUC (SCT 2006)	1.6	12	6	9
Integra Underground MOD 8 (SCT 2017b)	2.0 (2.2*)	14 (15*)	7 (8*)	10 (11*)
LW 15 and 16 Extraction Plan (SCT 2018)	2.0	14	7	10
LW 17-20 Extraction Plan (SCT 2020)	2.0	14	7	10
Disturbed or Modified Overburden (fill material or emplacement areas)				
GCUC (SCT 2006)	-	-	-	-
Integra Underground MOD8 (SCT 2017b)	2.8 (3.0*)	14 (15*)	14 (16*)	20 (22*)
LW 15 and 16 Extraction Plan	2.5	14	14	20
LW 17-20 Extraction Plan (SCT 2020)	2.5	14	14	20

* approved for Longwalls 15-19 with 330m wide voids

5.2.1 Vertical Subsidence

Based on the monitoring results available at the completion of LW 14 and the assumption of the range of seam mining height, the maximum subsidence at the conclusion of mining LW 17-20 is forecast to be no greater than 2.0m on undisturbed ground.

Figure 5-1 shows contours of conventional subsidence for natural ground that are expected over LWs 17-20 at the completion of the proposed longwall mining in the Extraction Plan Area. These subsidence contours are based on goaf edge subsidence profiles measured previously at Integra Underground with an upper limit of maximum subsidence of 2.0m.

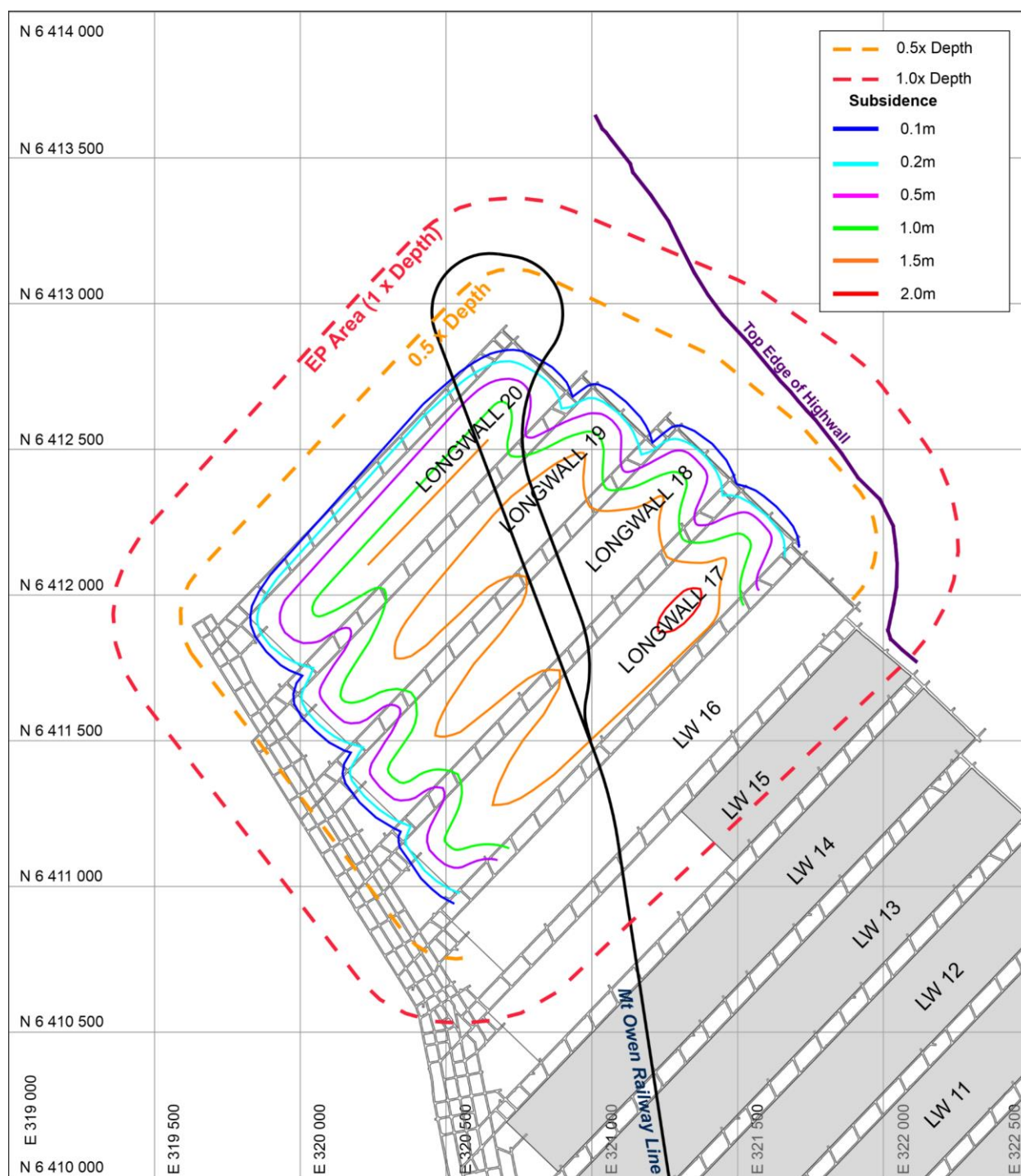


Figure 5-1 – Forecast Vertical Subsidence Contours for LWs 17-20 only (SCT 2020)

Some differences in subsidence from that forecast may occur due to localised effects of topography, geology, and the modified mining surfaces. Variations between the measured and forecast vertical subsidence are not expected to be of any practical significance.

Maximum vertical subsidence in a single seam situation is naturally variable by about $\pm 15\%$ for any given panel geometry and overburden depth. Subsidence contours shown should be regarded as indicative of the general level of subsidence rather than as precise indications of subsidence at a point. Any variations in cutting heights that may occur are expected to proportionally influence the maximum subsidence and other subsidence parameters.

The maximum subsidence over each panel is initially expected to be about 1.5m when that panel finishes. The mining of each panel is expected to increase the subsidence over previous panels. Mining of subsequent panels will then increase the initial subsidence over each panel up towards the maximum value forecast.

5.2.2 Tilt

Using the approach outlined by Holla, maximum tilts are inversely proportional to overburden depth. The Holla method adjusted for the site conditions indicates tilts of up to 14mm/m in the shallower areas of natural ground located in the vicinity of the Mt Owen Rail Line Loop. Due to the softening effect of the fill material, areas of modified overburden are expected to experience a similar maximum or slightly lower magnitude tilt compared to those predicted for natural, undisturbed ground.

This forecast maximum systematic tilt of up to 14mm/m is expected in flat terrain with the possibility of higher tilts in steeper terrain.

Over the centre of each longwall panel, tilt is likely to be transitory, although some low levels of residual tilt may remain. Tilt is likely to be permanent near the solid goaf edges and may be greater near the finish of each longwall panel. As each subsequent longwall panel is mined, and there is additional vertical subsidence over the chain pillar, slight variations in permanent tilt is likely near the panel edges.

5.2.3 Horizontal Movement

Horizontal subsidence movements of up to about 500mm are expected to occur in the Extraction Plan Area as a result of mining Longwalls 17-20. In general, horizontal movements over panels are expected to occur initially in a direction toward the mining face and once the longwall face has passed, in the direction of mining.

Horizontal stress relief movements (far-field movements) of typically less than 200-300mm may extend some distance beyond the longwall panel goaf edge. These far-field horizontal movements and those near the panel edges due to draping of the strata into the void created by mining, are expected to occur predominantly in a direction toward the goaf and to be typically permanent. Horizontal movements are expected to be larger in sloping terrain, adjacent to free surfaces such as open cut voids and areas of fill material or waste rock emplacements.

In flat terrain conditions, initial movements of typically less than 150mm occur toward the approaching longwall face followed by a reversal in direction once the longwall face has passed to give a final offset in the direction of mining of up to about 100mm.

In the central section of the longwall panel, horizontal movements are predominantly transitory in nature with a permanent offset in the direction of mining. Near the panel edges, horizontal movements are predominantly toward the goaf and the offset in this direction is normally permanent.

Horizontal stress relief movements may extend some distance beyond the longwall panel goaf edge. Survey control for subsidence monitoring at Integra Underground has previously not been strong enough to give high confidence measurement of horizontal stress relief movements.

The majority of maximum measured horizontal movements for LWs 7-14 have been in the range 200-400mm. These measurements are consistent with the 300-400mm range anticipated.

Horizontal strains measured to date have typically been in the order of 1-4mm/m with localised peaks around 6mm/m. Maximum compressive strains are typically slightly greater than the maximum tensile strains. The strains are typically about half the maximum values anticipated for gently undulating terrain.

5.2.4 Strain and Surface Cracks

For the natural ground along the Mt Owen Rail Line corridor, the maximum strains are forecast to be less than 7mm/m in tension and 10mm/m in compression as a result of mining Longwalls 17-20. Strains in disturbed ground are expected to be approximately double the magnitude of strains in undisturbed ground.

In areas of natural ground, tension cracks of up to 50mm may occur in areas of tensile strain depending on the nature of the surface terrain. Cracks are expected to be generally less than about 25mm wide in flat or gently undulating land. Cracks are most likely to develop over the longwalls panels in the vicinity of panel edges and along the tops of topographic highs. Those along permanent goaf edges are likely to remain once mining is complete. Permanent tension cracks are likely to be perceptible at the start of each panel. Transient tension cracks may also occur at regular intervals above the centreline of the panel typically just behind the retreating longwall face. These cracks may remain permanently open near the finish line of each panel.

Larger cracks may develop over the mining modified ground, particularly at the top of slopes in the backfill material and at the interface between natural and backfilled ground.

Permanent compression humps and associated low angle fracturing may become apparent at topographic lows such as drainage channels particularly where bedrock is exposed. These effects are not expected to be significant within the Extraction Plan Area.

5.2.5 Unconventional Subsidence Effects

Previous experience at Integra Underground indicates that unconventional subsidence effects may occur within the Extraction Plan Area, but the potential is low because the amount of disturbance caused by previous mining.

Larger, non-systematic tilts and strains are possible as a result of surface topography and the surface expression of geological structure. These effects are difficult to forecast because bedding planes and geological structure are not typically apparent until they become mobilised by mining subsidence. At critical sites, unconventional subsidence movements are typically able to be detected by regular monitoring early on before they become significant.

Valley closure horizontal movements may also occur at topographic low points but any such movements in the vicinity of LWs 17-20 are expected to be of low magnitude and generally insignificant.

5.3 Subsidence Impacts and Management of Features

Table 5-3 outlines the key natural features and Aboriginal heritage sites within the Extraction Plan Area. There are no European or Historic heritage sites within the Extraction Plan Area. Details relating to water management were assessed in the Surface Water Impact Assessment (Engeny 2020) and the Groundwater Impact Assessment (AGE 2020).

Table 5-3 – Summary of Subsidence Impacts – Natural Features and Heritage

Feature	Brief Description	Impact	Management	Timing and Frequency
Bettys Creek	Bettys Creek is an ephemeral watercourse that meanders across and is incised some 2-3m into the general flood plain in its natural state in the south eastern part of the Extraction Plan Area above LWs 13 and 14. The overland flow paths to the northern part of Bettys Creek have been significantly altered by surface mining operations. Bettys Creek was diverted around and across the ERP above LWs 13 and 14 in an engineered diversion channel called the Middle Diversion Channel (MDC). The MDC then extends from LW 14 over LW 15 to the edge of the Mt Owen - North Pit surface mining areas. A small section of natural vegetation adjacent to the MDC of Bettys Creek above LW 15 is within the LW 17-20 Extraction Plan area.	SCT (2020) states a small section of natural vegetation adjacent to the Bettys Creek MDC is located beyond the half depth (26.5° angle of draw) from the edges of LW 17-20. Any impacts are less than those detailed in the original Underground Project Environmental Assessment.	Managed as per the <i>Integra Underground Water Management Plan (Volume 1 Appendix E)</i> . AGE have proposed no changes to management and no additional monitoring of Bettys Creek to what is already undertaken under MOD 8 approval and the approved <i>Water Management Plan</i> .	Timing and frequency as per <i>the Integra Underground Water Management Plan (Volume 1 Appendix E)</i> . Monitoring and management summary: - Stream level – daily. - Water quality testing – Quarterly. - CSIRO Stream Health Assessment and Rapid Appraisal of Riparian Condition – Annual Assessment - Visual inspection and photographs – Pre, during and post impacts. - Review of cross sections – Annual Assessment. Notification and incident response should be conducted in line with the TARP.
Groundwater – Alluvials	Groundwater Specialist Assessment (AGE 2020) states that the current conceptualisation of the groundwater system remains unchanged from those described in AGE (2017) for MOD8 to PA08_0101 but over a smaller area. Depressurisation of the Permian strata below the level of the alluvial aquifers is evident in the monitoring bore network, indicating a reduced flow of	The incrementally updated model predicts drawdown in the Permian strata to predominantly propagate to the north-west away from already depressurised strata. As the direction of mining is away from the alluvium, previously mined longwall panels provide a buffering effect and no impacts to the alluvium are expected. Groundwater impacts as drawdown are consistent with Project Approval 08_0101 as they are less than those predicted for MOD8 (AGE 2020).	Managed as per the site <i>Water Management Plan (Volume 1 Appendix E)</i> . AGE have proposed no changes to management and no additional monitoring of groundwater to what is already undertaken under MOD 8 approval and the approved <i>Water Management Plan</i> .	Timing and frequency as per <i>the Integra Underground Water Management Plan (Volume 1 Appendix E)</i> . In summary: Water level logger/dip meter (Twice daily and bi-monthly monitoring).

Feature	Brief Description	Impact	Management	Timing and Frequency
	Permian groundwater towards the Quaternary alluvium (AGE 2020). The Main Creek and Bettys Creek alluvium appear to have not been historically exploited for groundwater extraction due to the yield and salinity limiting productivity (AGE 2020). The alluvial sediments along Glennies Creek have historically been tapped for agricultural purposes using shallow wells. Whilst this practice has decreased with the growth of mining in the region, a single well remains active within the Glennies Creek alluvium to the east of the IUG on Glennies Creek. There is no recorded abstraction of groundwater from the Permian strata for agricultural or other uses, due to yield and salinity limiting productivity (AGE 2020).	Water quality beneficial use categories are not expected to be downgraded in any way (AGE 2020). As no impacts to the alluvium are anticipated and groundwater dependant ecosystems (GDE's) are primarily associated with riparian vegetation and alluvium along Bettys Creek and Main Creek, no impacts are expected in relation to GDEs (AGE 2020). Likewise, as the only private bore in the area targets the Glennies Creek alluvium and as no impacts to the alluvium are predicted, no impacts to private bores in the area are anticipated (AGE 2020). Predicted inflows to mining areas and indirect groundwater impacts on alluvial systems are less than those predicted for MOD8. Extraction of LW 17-20 is therefore in accordance with the project approval and groundwater impact predictions remain compliant with the requirements under the NSW AIP. Integra Underground holds sufficient water licence allocations to account for the predicted groundwater take associated with extraction of LW 17-20 (AGE 2020).	If any observable loss of flow or riparian vegetation in Glennies, Main or Bettys Creeks are identified, then a qualified hydrologist will assess whether the loss of flow is due to the underground mine. Mitigation strategies will be developed and implemented as necessary.	
Groundwater – Quality		Mining activities at Integra Underground promote a downward vertical hydraulic gradient due to underground dewatering and subsidence. This minimises the potential risk of saline groundwater from the Permian strata flowing into alluvium and creeks. Therefore, the extraction of LW17-20 is not expected to cause an increase in the groundwater salinity of creeks and alluvial aquifers; however, there may be a slight decrease in salinity due to the reduced discharge from the Permian strata associated with mining at Integra Underground (AGE 2020).	Managed as per the site <i>Water Management Plan</i> (Volume 1 Appendix E). AGE have proposed no changes to management and no additional monitoring of groundwater to what is already undertaken under MOD 8 approval and the approved <i>Water Management Plan</i>.	Timing and frequency as per <i>the Integra Underground Water Management Plan (Volume 1 Appendix E)</i>. In summary: • Bi-monthly (every two months)

Feature	Brief Description	Impact	Management	Timing and Frequency
Ecology	The ecology within the LW 17--20 Extraction Plan Area is outlined within the <i>Integra Underground Biodiversity Management Plan (Volume 1 Appendix F)</i>. Vegetation communities within the Extraction Plan Area have also been outlined in the <i>Land Management Plan (Volume 1 Appendix I)</i>. The area is heavily disturbed, with most vegetation relating to mine site rehabilitation from Mount Owen. The following vegetation communities are outlined within the Extraction Plan area: • Cleared Grassland or Mine Site Rehabilitation – from Mount Owen; • Central Hunter Swamp Oak Forest; • Central Hunter Ironbark – Spotted Gum – Grey Box Forest; and • Planted Ironbark-Spotted Gum – Grey Box Forest. A small section of the Ravensworth State Forest (Ravensworth remnant area) and the neighbouring southern remnant biodiversity offset area to the north of LW 19 are within the Extraction Plan Area but beyond half depth from LWs 17-20.	Consistent with the subsidence impacts expected to the natural section of Bettys Creek, impacts to natural vegetation from the planned mining of LWs 17-20 are expected to be minor and no greater than impacts described in the GCUC Project Environmental Assessment, less than those detailed in the original Underground Project Environmental Assessment for the approved multi-seam mining and less than forecast in the Environmental Assessment for Mod 8 (SCT 2020). The only substantial areas of natural vegetation (native grassland) located above LW 17-20 are located adjacent to and within the Mt Owen Rail Line Loop area. These features are likely to experience the full range of subsidence movements forecast for the planned mining, but they are not expected to be significantly impacted by these movements (SCT 2020). Subsidence effects to Ravensworth State Forest are expected to be limited to low-level vertical and horizontal movements of less than 100mm and most likely less than 20-30mm (SCT 2020). This limit impact is reflective of the State Forest not being included in proposed subsidence monitoring (SCT 2020).	Managed as per the <i>Biodiversity Management Plan (Volume 1 Appendix F)</i>. Should a subsidence impact occur which cannot be remediated to the satisfaction of the DPIE, Integra Underground will provide a suitable offset to compensate for a subsidence impact or environmental consequence in accordance with Schedule 3, Condition 17A and 17B of PA 08_0101.	Timing and frequency as per the <i>Biodiversity Management Plan (Volume 1 Appendix F)</i>. In summary: monitoring of vegetation areas will be completed for each mining panel, preferably within 6 – 12 weeks of completion. Where impacts are detected then targeted and appropriate remediation will be implemented.

Feature	Brief Description	Impact	Management	Timing and Frequency
Aboriginal Heritage	Aboriginal Heritage sites within the Extraction Plan Area are outlined within the site <i>Aboriginal Heritage Management Plan</i> (SLR Update, 2018). Two Aboriginal Heritage sites (37-3-1173 and 37-3-1175) are present within the LW 17-20 Extraction Plan area. Site 37-3-1173 (MOCO IF-4) is located approximately 200m beyond the northwest corner of LW 20 and site 37-3-1175 (MOCO IF-6) is located over LW 19 (SCT, 2020).	Impacts to heritage sites are to be managed as per the <i>Aboriginal Heritage Management Plan (Volume 1 Appendix G)</i>. Section 5.2 of the SCT report (2020) states that vertical subsidence at site 37-3-1173 is expected to be less than 50mm and imperceptible for all practical purposes. Site 37-3-1175 is located in LW19 where up to 1.8m of vertical subsidence is forecast at the completion of LW 20. SCT (2020) states that no perceptible impacts from the planned mining of LW 17-20 are expected at sites 37-3-1173 and 37-3-1175 due to the type of the site, the nature of the terrain and the magnitude of subsidence movements forecast. Activities requiring archaeological salvage excavation in the Integra Underground project area are complete. Archaeological excavation of Aboriginal sites is not a requirement of this stage of the operation. Should archaeological excavation be required, a method will be prepared in consultation <i>Aboriginal Heritage Management Plan (Volume 1 Appendix G)</i>.	Managed as per the <i>Aboriginal Heritage Management Plan (Volume 1 Appendix G)</i>. In summary: • Prior to any remediation that may be required, OEH and local Aboriginal community representatives will be consulted should there be impacts to potential Aboriginal deposits as a result of remediation works along creeks and works to rehabilitate cracks; • Prior to any subsidence remediation works, a qualified archaeologist will assess the potential impact of the planned works; and • As required, should subsidence levels be greater than predicted, archaeological subsurface testing may be undertaken in affected areas with the involvement of Aboriginal stakeholders and OEH.	Timing and frequency as per the <i>Aboriginal Heritage Management Plan (Volume 1 Appendix G)</i>. In summary: See the 'Management' column.

Table 5-4 outlines the key built features within the Extraction Plan Area. The impacts and descriptions have been summarised from the SCT Subsidence Report (2020).

Table 5-4 – Summary of Subsidence Impacts – Built Features

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
Public Utilities and Amenities				
Survey Control Stations	The existing state survey station identified within the Extraction Plan Area is mark SS_96126 which is positioned adjacent to the elevator conveyor for the train loadout bin.	Based on the subsidence monitoring and measurements of far-field movements from underground mining at the Integra Underground, it is likely that these marks have already undergone significant horizontal and vertical movements as a result of previous mining up to LW 15 and from nearby open cut excavations. The proposed mining of LWs 17-20 is expected to cause additional movements at these marks.	Managed as per <i>Built Features Management Plan (Volume 2)</i> . In summary: - Notifying the asset owner (Land and Property Information) to temporarily 'decommission' a mark that is located within the extent of far-field effects around current mining by removing its coordinates from the database during the period of active mining. A notification to NSW Land Registry Services will be made regarding the proposed subsidence impacts from LW 17-20 to the relevant survey marks. - Re-establishing the horizontal and vertical position once subsidence is complete. - Returning the mark to service with revised coordinates.	Timing and frequency as per the <i>Built Features Management Plan (Volume 2)</i> . In summary: See the 'Management' column.
Mine Owned Infrastructure				
Powerlines	A single pole overhead 11kV electricity transmission line traverses the Extraction Plan Area from north to south. The sections of this powerline above LW 17-20 are positioned on natural ground surface. The powerline runs from the Mount Owen MIA to the southern extent of the ERP through the centre of Mt Owen Rail Line loop	This powerline is expected to experience the full range of subsidence movements forecast for natural ground over LWs 17-20. Experience at Integra Underground from other sites indicates that single pole powerline structures are generally tolerant of subsidence movements. Subsidence monitoring of individual poles during mining indicates that maximum ground tilts and strains do not necessarily transfer fully to the pole structures due to nature of the material around the foundation of the poles.	Managed as per <i>Built Features Management Plan (Volume 2)</i> . Integra Underground will place conductors in roller sheaves and manage guy wire tensions at changes of direction during the period of active subsidence. A review of conductor clearances along the line should be undertaken to make sure the poles are spaced closely enough to maintain conductors ground clearances throughout the period of mining.	Timing and frequency as per the <i>Built Features Management Plan (Volume 2)</i> . In summary: - Review of power poles prior to undermining. - Mitigation measures to be installed prior to undermining.

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Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	generally adjacent to the rail line across the causeway between TP2 and the ERP. In addition to water management installations at TP1, TP2, ERP and West Pit, this powerline now also supplies the pumping equipment at the sediment and stormwater dams recently constructed above LW 14 and 15 to treat run-off from the WOOP Dump and any future overflow from the ERP.			- Sheaves should be in place prior to the longwall face approaching within half depth of each pole. - Conductor clearances review should occur prior to mining. A program within the <i>Built Features Management Plan (Volume 2)</i> for regular visual inspection during the period of active subsidence and appropriate remediation as required is considered suitable to manage any potential impacts.
Mount Owen Rail Line	The Extraction Plan Area includes the loop of the Mount Owen Rail Line, a section of the single line as well as infrastructure associated with the rail. The rail switch (point blades or turnout) at the end of the loop is located above the eastern edge of LW 17. LWs 17-20 mine under most, but not all, of the rail loop.	Impacts on the rail corridor from mining LWs 17-20 are expected to be less than impacts described in GCUC Project EA and less than those detailed in the original Integra Underground Project EA for the approved multi-seam mining. The magnitudes of subsidence effects and impacts are expected to be consistent with those described in SCT (2017c) for MOD8 to PA08_0101 but over a smaller area. All impacts to the Mt Owen Rail Line and associated infrastructure are expected to be manageable (albeit with two sections of trackwork to be impacted in quick succession) with a similar asset management plan to that currently in place at Integra Underground for this infrastructure. The overburden depth along the rail line corridor from LW17-20 ranges from 480m to 500m. For the mining	Managed under <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2, Appendix B)</i>. TARP in the <i>Mount Owen Rail Infrastructure Asset Management Plan</i> provides details of management measures. In summary, the Railway and its associated infrastructure will be monitored using ground monitoring, strain and temperature gauges, track geometry trolley and visual inspections.	Timing and frequency as per the <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2, Appendix B)</i>. In summary: - Ground monitoring – as per <i>Subsidence Monitoring Program (Appendix C)</i>. - Visual inspections – Weekly pre, during and post monitoring.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
		of LW 17-20, maximum subsidence parameters forecast for the railway corridor are vertical subsidence of 1.9m, tilt of 12mm/m with strain values of 5mm/m in tension and 8mm/m in compression.		
Communications Cables	Communication cables for signalling and other purposes are laid alongside the Mount Owen rail line. It is understood from the Australian Rail Track Corporation that the cables are most likely to be direct buried, possibly in sand, covered by at least a danger marking tape and possibly a "Vinedex" type barrier. Depth of burial could range from approximately 0.5m to greater than 1m. All the cables are understood to be PVC insulated copper cables.	The communications cables are expected to experience the full range of forecast subsidence movements during the mining of LW 17-20. These cables are expected to be tolerant to these movements consistent with experience over previous panels.	Management under <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i>. In summary the potential for impacts on the signal line will be managed using the ground monitoring line along the Railway and visual inspections of the surface. An impedance test can be carried out to assess the mining-induced impacts on the cable. Alternatively, the signal line could be locally unburied, exposed and inspected if an irregular ground movement is measured. In the case of loss of signal, the control room will be notified, and the trains can be escorted along the affected section of the Railway. No reasonably practical elimination, substitution and engineering controls could be identified as the signal line is buried in the ground. An administrative control of implementing a monitoring and TARP has been selected.	Timing and frequency as per <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i>. In summary: • The potential for impacts on the signal line will be managed using the ground monitoring line along the Railway and visual inspections of the surface. • An impedance test can be carried out to assess the mining-induced impacts on the cable. • Alternatively, the signal line can be locally unburied, exposed and inspected if an irregular ground movement is measured. • In the case of loss of signal, the control room will be notified and the trains can be

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Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
				escorted along the affected section of the Railway.
Bettys Creek Bridges	There are two bridges across Bettys Creek, one for the rail and the other for the road. The rail and road bridges over Bettys Creek are located above the inter-panel chain pillar between Longwalls 13 and 14 outside the Extraction Plan Area.	These bridges are expected to undergo vertical subsidence of 1.3m and 1.4m from the planned mining of LWs 15 and 16 respectively (SCT 2017). The structure of the two bridges was recently modified to accommodate the subsidence movements, including valley closure effects, from the mining of LW 13 and subsequent longwall panels (SCT 2017). While the Bridges are located south of and outside of the Affection Area for Longwalls 17 to 20, they have been included in the <i>Mount Owen Rail Infrastructure Asset Management Plan</i> as they could experience low level far-field movements and could be sensitive to these movements. Subsidence effects and impacts to these features are expected to be substantially complete after the mining of LW 16, as these bridges are beyond half depth from LWs 17-20.	Managed under <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i>.: Existing survey marks and tell-tales can be measured, during the mining of these longwalls, if required. The 3D marks and tell tales will be inspected and the base line survey undertaken, prior to LW 17 reaching 100 m before first rail contact, in accordance with the LW 17 Action Plan. Subsequent surveys are only required if recommended by the Technical Committee.	Timing and frequency as per the <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i>. In summary: See the 'Management' column.
Water Supply Pipeline	There are several 300mm+ diameter, flexible polyethylene pipelines delivering water across the Extraction Plan Area for LW 17-20 as part of the surface water management system. The sections of pipelines positioned above ground are unlikely to be impacted by subsidence movements from the mining of LW 17-20. A buried raw water supply pipe that services Mt Owen and Glendell Mines runs alongside Mt	The pipeline is expected to experience the full range of forecast subsidence movements during the mining of LW 17-20 but is expected to be tolerant to these movements consistent with experience over previous panels.	Managed under <i>Mount Owen Mine Key Features Asset Management Plan (Volume 2 Appendix C)</i>. In summary: - Weekly inspections during active subsidence. - Double sleeved for high risk pipelines in environmentally sensitive areas - Differential flow monitoring for high risk pipelines in environmentally sensitive areas	Visual inspections – Weekly pre, during and post monitoring.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	Owen Rail Line. The pipeline extends from Glennies Creek to the Mt Owen CHPP within the MIA. The pipe is understood to be welded polyethylene pipe buried to a nominal depth of 0.7m. A new polyethylene water pipeline was constructed in 2017 between the mine infrastructure areas of Integra Underground and Mount Owen. The pipeline traverses LW 13 and then parallels the buried raw water supply pipeline adjacent to the Mt Owen Rail Line over LWs 14-20.			
Maintenance Road	The maintenance road that services the Mount Owen Rail Line is located immediately to the east of the rail line. This road is a single lane, unsealed road not accessible to the public. Public access is restricted by locked gates. This road provides a connection between the MOC MIA and Forest Road along the rail corridor.	The road is expected to experience the full range of forecast subsidence movements during the mining of LW 17-20 but there is not expected to be any significant change in the condition of the road as a result of subsidence movements. There is some potential for minor cracks, compression humps and local changes in grade, both along and across the road. There is also some increased potential for ponding across the road in the centres of longwall panels following heavy rain.	Managed as per <i>Built Features Management Plan (Volume 2)</i> and <i>Mt Owen Rail Infrastructure Asset Management Plan (Volume 2 Appendix B)</i>. A culvert located under the rail embankment in the centre of LW 14 is expected to be effective in managing ponding in this area. The use of warning signs, regular inspections, and timely remediation of any impacts are considered appropriate measures to manage potential impacts.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: • Signage will be erected along public roads adjacent to the Extraction Plan area. • Roads and tracks within the Extraction Plan Area will be remediated if subsidence impacts are identified. • Visual inspections – Weekly pre, during and post monitoring.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
Mount Owen Active Mining Area – North Pit	The south western highwall and haul road around the rim of North Pit extend into the Extraction Plan Area. The highwall and the haul road are largely beyond half depth from the edges of LWs 17–20.	The subsidence assessment for PA08_0101 MOD8 presented in SCT (2017c) identified several potential interactions between the open cut mining and underground longwall panels. These include: • highwall and slope instability in the open cut on slopes directly mined under or within 0.4 times depth to the underground mining • potential for floor heave in the floor of the open cut • potential for blasting efficiency of the surface mining to be decreased by subsidence fracturing • potential for blast vibration to affect the underground • increased potential for surface inflows into the underground mine workings • increased potential for methane emissions into the open cut. For the mining of LWs 17–20 most of these potential interaction issues are no longer valid due the shortening of LWs 17-20 which increases the offset to the North Pit. Changes to the MTO mining schedule has also meant that surface mining has not yet progressed to areas above the goaf areas of LW 15 to LW 9 as approved in the MOCO Project (SSD-5850). From the list of potential interaction issues, blast vibration is likely to be the most significant impact in the short-term for Integra Underground. Impacts to the North Pit from the planned mining of LWs 17-20 are expected to be insignificant and much less than those outlined in <i>SCT 2017b</i> for MOD8. Notwithstanding the input of other specialists, any potential impacts from subsidence movements are not expected to constitute a principal hazard as defined by the <i>Work Health and Safety (Mines and Petroleum Sites) Regulation 2014</i>.	Managed under <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i>. In summary: • Regular face position updates sent to Mount Owen. • Mount Owen Mine Safety Management System including the Mine Inspection System manages the risk of highwall rockfalls under normal circumstances. The probability of any potential rock falls is expected to be much less than the risk of any rock falls that would be managed under normal circumstances. • A Mount Owen - Integra surface access protocol has been developed. • Monitoring and management methods undertaken by Thiess as per the Mt Owen Geotechnical Principle Hazard Management Plan. Subsidence and stability monitoring of the highwall and haul road by MTO during the first 500m of LWs 15 and 16 was recommended in the subsidence assessment for LWs 15 and 16 EP SCT (2018). With the shortening of LWs 17-20 from the LWs 15-20 layout assessed in SCT (2017c) and the experience now available from monitoring LWs 14 and 15, the need for ongoing subsidence and stability monitoring post LW 16 has been reviewed by Mt Owen Glendell. The Mt Owen Geotechnical Principal Hazard Management Plan includes interactions between the North Pit highwall and Integra Underground.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: • Visual inspections – Weekly pre, during and post monitoring. • Continued regular liaison between Mount Owen and Integra Underground. • As per Mt Owen Geotechnical Principal Hazard Management Plan

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		Subsidence effects and impacts are expected to be reduced from the maxima forecast in SCT (2017c) due to the reduced panel lengths for LWs 15-20 and a smaller subsidence footprint. The mine plan changes are expected to result in a significant reduction in the potential for interactions with Mt Owen operations (MTO) at the North Pit, including impacts to the haul road and stability of the highwall. The highwall and almost all the haul road are located beyond half depth from LWs 17-20. Vertical subsidence is expected to be less than 30mm at the small section of the haul road above the corner of LW 17 located within half depth of LWs 17-20. Horizontal movement at this location are expected to be less than 100mm. These low-level subsidence movements are expected to be imperceptible and of no practical consequence for the highwall and haul road.		
Ravensworth East – West Pit	The position of the southern section of the Ravensworth East - West Pit, relative to the 0.5 depth zone and Extraction Plan Area for LW 17-20, is shown on Figure 2-1. The southern end of the pit is currently being used for tailings emplacement and water storage. A section of the exposed southern and eastern highwall is within the Extraction Plan Area. Further to the north and still within the Extraction Plan Area, the pit is being filled with waste rock overburden material.	The main impacts from mining LWs 17-20 are expected to be the potential for instability of the exposed highwalls, potential for backfill instability and increased potential for water ingress to the underground workings because the overburden thickness is reduced by the depth of the West Pit.	Managed under <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i>. In summary: - Regular face position updates sent to Mount Owen. - Mount Owen Mine Safety Management System including the Mine Inspection System manages the risk of highwall rockfalls under normal circumstances. The probability of any potential rock falls is expected to be much less than the risk of any rock falls that would be managed under normal circumstances. - Surveys of distributed survey pegs around the around the top edge of the highwall of Ravensworth East - West Pit will be undertaken to confirm the magnitude of any ground movements that may lead to subsidence impacts to the highwall and the ventilation shaft.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Visual inspections – Weekly pre, during and post monitoring. - Continued regular liaison between Mount Owen and Integra Underground. - Survey measurements of the subsidence movements around the top edge of highwall pre and post mining of each

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
			A Mount Owen Glendell - Integra Underground surface access protocol has been developed.	Longwall panel (LW17-19).
Glendell Haul Road	The Glendell haul road extends from the active Barrett Pit to the southern ROM stockpile at Mt Owen CHPP. The haul road crosses the Extraction Plan Area for LW 17-20. The haul road traverses around the West Pit, over the filled section of TP2 and alongside TP1, crossing the longwalls panels from the south eastern corner of LW 17 to near the centre of LW 20. Above the corner of LW 17 the thickness of the fill material in TP2 is estimated at 15-20m. Other sections of the haul road have been constructed with fill material to approximately 10-15m above the natural ground level.	The haul road is likely to experience up to 1.6m of vertical subsidence with corresponding tilts and strains. The maximum effects are expected primarily over LW 19. Increased tilt and strains from vertical and horizontal movements may cause perceptible cracking on the hard surface of the road with local changes in grade, both along and across the haul road that could affect drainage. There is also some potential for minor compression humps. These potential changes are more likely to affect light vehicles rather than significantly impact on the serviceability of the road for the haul truck fleet. Some increased maintenance may be required over the current and previous longwall panels during the period of active subsidence. The impacts of vertical subsidence may also be evident at the interface of natural ground and fill material in TP2 over LWs 17 and 18. A crack or small step may form across the haul road above LW 17. A similar crack may form along the edge of the haul road above LW 18.	Managed under <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i>. In summary: - Regular face position updates sent to Mount Owen. - Inspections of haul road. - Warning signs. - A Mount Owen Glendell - Integra Underground surface access protocol has been developed.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Continued regular liaison between Mount Owen/Glendell and Integra Underground. - Visual inspections – Weekly pre, during and post monitoring.
Eastern Rail Pit	The Eastern Rail Pit (ERP) has completed coal production since the GCUC Project and Underground Project EA. This shallow pit was mined to a maximum depth of about 35m. The ERP is has been partially filled and capped, with only a small area of open void located above LW 14-	Any additional impacts to the ERP from the planned mining of LWs 17 – 20 are expected to be minor and manageable. Some additional subsidence movements are expected at the north west corner of the open void above LWs 15 and 16 from the mining of LW 17 and subsequent panels, but these will be small by comparison to the movements associated with LWs 15 and 16. The potential for increased inflow from the ERP into Integra Underground mine workings has been	Managed as per the <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i>. In summary: - Maintaining the pit water at a low level during periods of active undermining. - As a precaution, access to any roads positioned close to the top edge of highwall should be restricted during the period of active undermining. - Regular face position updates sent to Mount Owen.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: Continued regular liaison between Mount Owen and Integra Underground.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	16. The ERP does not extend over Longwalls 17–20. The corner of the ERP where the exposed northern and western highwalls meet is closest to LW 17 and approximately 180m from the panel edge. The highwalls at this location are currently 15m high following emplacement of approximately 15m of tailings. Most of the open void was recently mined under by LW 15 without significant impact.	assessed for LWs 15-20 in an independent study by groundwater specialists (AGE 2017) as part of the EA for MOD8 to the Integra Project approval. Any increase in groundwater flow between the surface and underground workings from the mining of LWs 17-20 is not expected to be at a rate sufficient to constitute an inrush hazard for Integra Underground.	- Mount Owen Mine Safety Management System including the Mine Inspection System manages the risk of highwall rockfalls under normal circumstances. The probability of any potential rock falls is expected to be much less than the risk of any rock falls that would be managed under normal circumstances. - A Mount Owen Glendell – Integra Underground surface access protocol has been developed.	Visual inspections – Weekly pre, during and post monitoring.
TP1/Mount Owen Rail Loop Tailings Dam	A section of the Dam Safety NSW Mt Owen Notification Area that surrounds the prescribed/declared dam referred to as Mt Owen Rail Loop Tailings Dam (TP1) is shown in Figure 2-1. LWs 17-20 mine within the DSNWS Notification Area for TP1 and LWs 18, 19 and 20 are planned to mine directly under the dam. TP1 was formed as an open cut pit to a depth of around 30m. Earth embankments at the southern end form the dam wall. The dam storage is almost completely full of tailings with only a small section of ponded water at the southern end. The capping process has started from the northern end of this dam with around 30% of the surface area completed to date. The capping is currently outside half	The subsidence effects from the planned mining of LWs 17-20 is not expected to have any practical or significant impact on tailings, capping or any exposed highwall edges and pit surrounds. TP1 is not expected to have any practical impacts or pose an inrush risk to the mining of LWs 17-20. TP1 is expected to experience the full range of subsidence effects forecast. Minor impacts may include cracking of the surface of the tailings and capping material if the capping has advanced to be above the longwalls at the time of mining these panels and changes in level that may affect where water ponds and can drain. The potential for increased inflow into Integra Underground mine workings has been assessed in an independent groundwater study (AGE 2017). The minimum overburden depth between the floor of TP1 and the mining horizon is approximately 450m. The height of depressurisation is estimated using the approach described by Tammetta (2012) to be 280m above the mining horizon for an assumed mining height of 3.2m. The base of the open cut void is	Managed as per <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i>. In summary: - This includes regular inspections and subsidence monitoring. - Dam Safety NSW consent and Chief Inspector of Coal Mines (CICM) approval are expected to be required for the mining of both development roadways and longwall extraction within the Mount Owen Notification Area while ever TP1 remains as a prescribed/declared dam. To reduce the potential for overflow from TP1 due to surface tilting, it is recommended that, as part of the <i>Built Features Management Plan (Volume 2)</i>, the area is regularly inspected, any ponded water in TP1 is drawn down to a low-level during periods of active subsidence for each panel mining directly below TP1 and potential overflow points are reviewed following the completion of each panel. Integra Underground will complete as per recommendations. Engeny (2020) notes that with the direction of mining of LW 19 proceeding generally from North East to South	Dam Safety NSW and CICM approval prior to undermining. Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Continued regular liaison between Mount Owen and Integra Underground. - Visual inspections – Weekly pre, during and post monitoring.

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Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	depth from the edge of LW 20 but is likely to extend into the area of active subsidence by the time LW 20 is mined.	approximately 170m above the top of the zone of depressurisation. There is expected to be very limited potential for significant inflow from TP1 through this interval. There is no potential for flows of a magnitude sufficient to constitute an inrush hazard to Integra Underground. The earth embankment that forms the lower end of TP1 is approximately 5m high. The ground strains expected in this area are less than 4mm/m. The earth embankment is expected to be able to accommodate this level of ground strain without perceptible impact. An impact assessment was undertaken by Engeny (2020) to consider the potential effects of subsidence on the grade of the TP1 drain. This assessment found that the grade for the drain will potentially be reduced by between 0.09% and 0.18% with the downstream section of the drain being more greatly affected than the upstream.	West the upstream section of the TP1 drain will be affected by subsidence prior to the downstream section. Therefore, there is potential for the subsidence impacts on the drain to be initially greater than the ultimate impact and should be monitored during the progress of the mining of the longwalls in this area.	
Embankments and Cuttings	Within the Extraction Plan Area for LW 17-20, the Mount Owen Rail Line Loop passes through and over series of cuttings and embankments. There are three railway embankments and six railway cuttings located within the affection area. The cuttings are generally less than 5-6m deep with embankments generally less than 2-3m high. There are several culverts through the embankments as part of the surface water management system. Above the longwalls, the longer cuttings are over LWs 17, 18 and	No significant impacts are expected in the cuttings, but some cracking and minor slumping may be evident. Subsidence movements may cause some low magnitude lateral spreading and minor cracking of the rail embankments, but it is not expected to cause any significant instability of the rail foundation. No significant impacts are expected to the culvert.	Managed as per the <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i> . In summary Subsidence and other monitoring and regular inspections are expected to be effective in identifying any significant stability issues, as well as impacts to drainage.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Continued regular liaison between Mount Owen and Integra Underground. - Visual inspections – Weekly pre, during and post monitoring.

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Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	19 and the main embankment is over LW 19. There is a culvert through this low embankment positioned above the chain pillar between LWs 19-20. This culvert allows overflow from the western sediment dam for the WOOP Dump run-off to flow to the main rail loop dam via another dam within the loop. The cuttings and emplacements are expected to experience the full range of subsidence effects forecast.			
TP2 Ravensworth East Tailings Dam/Mount Owen Stage 5 Tailings Dam	The Ravensworth East Tailings Pit / Mt Owen Stage 5 Tailings Dam, also referred to as TP2, is located adjacent to the Mt Owen Rail Line between TP1 and the ERP. TP2 was originally mined to a depth of approximately 35m. TP2 is filled with waste rock from Glendell Mine. There are no tailings in this pit. The section of TP2 above LWs 17 and 18 has been substantially backfilled, capped and largely rehabilitated to a height of approximately 15m above the original ground level. A small area of the void above LWs 15 and 16 is still open and used as part of surface water management system to store and filter water. Infrastructure for pumping from the southeast corner of the storage was recently upgraded.	Impacts to TP2 from planned mining of LWs 17-20 are expected to be generally insignificant and not expected to have any significant consequence. The only potential impacts relate to minor differential subsidence that may become apparent on the Glendell haul road. LW 15 mined below part of this area. Additional subsidence movements are expected to occur at the open void above LWs 15 and 16 when LW 17 and subsequent panels are mined. Forecast subsidence movements are likely to result in further settlement of the fill material and may induce cracking particularly at the crest of steeper sections of fill material. Impacts in the form of cracks, steps and potholes may form along the interface between fill material and natural ground surface around the buried perimeter of the TP2 pit. The additional settlement and impacts are generally not expected to have any significant consequence other than minor differential subsidence that may become apparent on the Glendell haul road. Other potential impacts include	Managed as per <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i> . This includes regular inspections and subsidence monitoring.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i> . In summary: - Continued regular liaison between Mount Owen and Integra Underground. - Visual inspections – Weekly pre, during and post monitoring.

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Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	One side of the open void, approximately 25m deep, forms the western side of the rail line causeway with the ERP forming the other side. LW 15 mined below part of this area.	cracking and rock falls on the exposed highwall, slope instability in steeper parts of the emplaced material and potential for increased inflow to the underground mine workings. The rate of inflow from TP2 into Integra Underground mine workings has been assessed for LWs 15-20 in an independent study by groundwater specialists (AGE 2017) as part of the EA for MOD8 to the Integra Project Approval. Any increase groundwater flow between the surface and underground workings from the mining of LWs 17-20 is not expected to be at a rate sufficient to constitute an inrush hazard for Integra Underground.		
Mount Owen Active Mining Area/ Overburden Emplacement (including WOOP Dump)	There are several areas of rehabilitated waste rock fill from the Glendell, Ravensworth East and Mount Owen open cut mines located within the Extraction Plan Area for LWs 17-20. The major emplacements are the WOOP Dump, the Glendell/ Ravensworth East area and the Glendell area. Other minor emplacements include those associated with the rehabilitation of TP2 and the ERP. The emplacement areas located above LWs 17–20 include parts of the WOOP Dump and TP2.	The Glendell/Ravensworth East and Glendell emplacement areas are further than half depth from LWs 17–20 and unlikely to be perceptibly impacted by mining these longwall panels. Total vertical subsidence of up to 2.5m with strains up to 14mm/m in tension and 20mm/m in compression are forecast. Cracking may develop along the crest of topographic high points allowing water ingress during periods of heavy rain. This ingress has potential to contribute to minor instability on steeper sections between contour drains on the WOOP Dump, but such instability is not expected to be significant. The drop structure on the western slope of the WOOP Dump is not expected to be significantly impacted. Some minor remediation work may be required to the contour drains, drop structure and sediment control dams, but overall, any subsidence impacts to this modified landform are expected to be manageable.	Managed as per <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i> including weekly inspections during active subsidence.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Continued regular liaison between Mount Owen and Integra Underground. - Visual inspections – Weekly pre, during and post monitoring. Including the drop structure, access tracks and contour banks.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
Integra Underground Gas Drainage Infrastructure	Components of the Integra Underground gas management system either already exist or are proposed within the Extraction Plan Area for LW 17-20. Existing operational installations are currently above LW 15 and 16. The system comprises surface to seam boreholes with collar installations and surface pipeline networks for either flaring the gas to reduce greenhouse gas emissions or delivery to a central gas drainage plant for power generation. The existing gas management system is expected to be extended to cover areas above LW 17-20 wherever surface access is practical.	This equipment is expected to experience the full range of subsidence effects forecast. This gas drainage equipment is designed to accommodate the anticipated subsidence movements and effective, management measures are in place.	The <i>Integra Underground Ventilation Control Plan</i> includes TARP's to manage potential impacts to the gas drainage infrastructure. A regular network inspection regime will be undertaken.	Timing and frequency as per <i>Integra Underground Ventilation Control Plan</i> . In summary: Visual inspections – Weekly pre, during and post monitoring.
Ventilation Shaft 3 and Associated Infrastructure	A new surface to seam ventilation shaft for Integra Underground known as Shaft 3 has recently been commissioned. The surface installations for the shaft, including main fans and service boreholes, are located beyond the finish line of LW 16 on the southern edge of the Extraction Plan Area. The shaft and associated infrastructure, including service boreholes are beyond half depth from the finish line of LW 17.	No significant impacts from the planned mining in LWs 17–20 are expected. Subsidence effects at the shaft site, in addition to those from mining in LWs 15 and 16, are expected to include small additional horizontal movements. Impacts are expected to be limited to additional shearing on bedding planes that may intersect the shaft and adjacent service boreholes. SCT understands that the shaft infrastructure has been designed to accommodate the forecast subsidence movements with provision for minor adjustments to equipment during the mining of each longwall.	Managed as per <i>Built Features Management Plan (Volume 2)</i> . Surveys of distributed survey pegs around the top edge of Ventilation Shaft 3 will be undertaken to confirm the magnitude of any ground movements that may lead to subsidence impacts to the highwall and the ventilation shaft. the <i>Built Features Management Plan (Volume 2)</i> and subsidence monitoring program includes inspections for the periods of mining the last 500m in LW 17 and 18 and surveys as per recommendations by SCT.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i> . In summary: - Inspections for the periods of mining the last 500m in LW 17 and 18 and monitoring as required. - Survey measurements of the subsidence movements around the top edge of highwall pre and post mining of each

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Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
				Longwall panel (LW17-19).
Planned Dewatering and Ventilation Infrastructure	MOD8 to Integra Underground PA08_0101 provides consent for HVCC to construct additional surface infrastructure above the northern sections of LWs 15 - 20. This additional infrastructure includes a dewatering borehole with pumping equipment and ventilation shafts with exhaust fans supplied by an 11kV powerline. This infrastructure has not been constructed.	The goaf dewater borehole collar is proposed to be located near the recently constructed stormwater dam and over the northern section of LW 14/15 development roadways. The exact position of the dewatering infrastructure and planned bleeder shafts, exhaust fan installations and powerline extension are yet to be finalised. Integra Underground will undertake a detailed assessment of potential subsidence impacts to this infrastructure, once the final positions, longwall geometry and relative timing of mining is known. Subsidence effects and impacts to the planned infrastructure are expected to be manageable with appropriate assessment and design considerations.	Managed as per <i>Built Features Management Plan (Volume 2)</i> and <i>Mount Owen Glendell Operations Key Features Asset Management Plan (Volume 2 Appendix C)</i> including weekly inspections as part of operations during active subsidence.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: Inspections and monitoring as determined by the detailed assessment.
Access Roads	There are unsealed access roads and four-wheel drive tracks for light vehicles located throughout the Extraction Plan Area for LWs 17-20.	The impacts from the planned mining of LW 17-20 on the tracks or roads are expected to be essentially similar to impacts previously observed over the earlier longwall panels. These previous impacts have all been minor and easily managed. There is some potential for cracks, compression humps and local changes in grade, both along and across the road that may result in minor ponding. These impacts would not be significantly out of context with the general nature of the terrain and other hazards that might exist unrelated to subsidence impacts. Some minor repair work may be required to smooth out irregularities, fill any open cracks that may form and restore damage.	Managed as per <i>Built Features Management Plan (Volume 2)</i>. In summary: - The use of warning signs, regular inspections, and timely remediation are key controls which will be implemented to manage potential impacts. - No public access to the Extraction Plan Area.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Visual inspections – Weekly pre, during and post monitoring. - Roads and tracks within the Extraction Plan Area will be remediated if subsidence impacts are identified.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
Sediment Control Dams	The main sediment control or run-off filtering dam located within the Extraction Plan Area is located at the base of the drop structure on the western slope of the WOOP Dump. Other similar dams for the Ravensworth East/Glendell emplacement area, stormwater collection on the eastern slope of the WOOP Dump (Dam 4) and sediment control dams for the ERP are located to the east of LW 15 and outside the Extraction Plan Area. The run-off dam for the WOOP Dump is located adjacent to the rail line and overflows to feed a smaller dam on natural ground within the rail loop via culverts under the maintenance road and rail line embankment. The water from these dams then flows into the Rail Loop Dam.	These two dams are expected to experience the full range of subsidence movements forecast for the planned mining of LWs 17-20. Minor surface cracking and changes in level are expected due to transient tilting of the surface as the planned longwalls mine under these features. These impacts are expected to be temporary. Minor remedial work may be required at the LWs 19-20 chain pillar and LW 20 goaf edge to adjust gradients and restore flow paths. No significant impacts to the culverts are expected.	Managed as per <i>Built Features Management Plan (Volume 2)</i> and <i>Land Management Plan (Appendix I)</i>. In summary: Inclusion of sediment control dams with regular inspections during the period of active mining.	Timing and frequency as per <i>Subsidence Monitoring Program (Appendix C)</i>. In summary: - Visual inspections – Weekly pre, during and post monitoring. - Subsidence repair as required.
Surface Drainage	The lowest point in the rail loop is on the western incoming track adjacent to the northern edge of the filled section of TP2 near the southern end of TP1. This point is above LW 18 and is expected to be lowered by up to 1.8m at the completion of mining LWs 18–20. This change in reduced level may affect drainage to the west and around the rim of the West Pit to	The drainage of the surface within the rail loop is likely to be impacted by the forecast vertical subsidence and tilt for the mining of LWs 17-20. However, impacts are expected to be minor in nature, repairable and manageable within provisions of the surface water management system for the site.	Managed as per <i>Water Management Plan (Appendix E)</i> and <i>Built Features Management Plan (Volume 2)</i>. In summary: - If a suitable gradient cannot be re-established, pumping equipment in conjunction with the adjacent TP1 and TP2 installations may need to be installed at the low point to avoid temporary ponding (SCT 2020). - Integra Underground will undertake regular inspections during the period that the area is	Timing and frequency of monitoring as per <i>Water Management Plan (Appendix E)</i> and <i>Built Features Management Plan (Volume 2)</i>. In summary: See the 'Management' column.

Feature	Brief Description (SCT 2020)	Impact (SCT 2020)	Management	Timing and Frequency
	the dam above the south-western corner of this pit. There are seven culverts that pass through the Railway formation within the Affectation Area. Some culverts allow water drainage across the Railway formation and other culverts are used to pass water pipelines through the formation.		affected by active subsidence from each longwall panel (SCT 2020). The components of the surface water monitoring program for the Extraction Plan Area include monitoring of: • Surface water quality; • Channel stability; • Ponding; • Erosion; • Riparian vegetation; and • Dam (Engeny, 2020).	

6. Measurement and Evaluation

6.1 Subsidence Monitoring

Subsidence monitoring has been completed for LW 1-14, and the majority of LW 15. The subsidence monitoring for LWs 17-20 is outlined within the Subsidence Monitoring Program (**Volume 1, Appendix C**). A summary of the proposed monitoring program is outlined below in **Table 6-1** and **Figure 6-1**. This monitoring program was also outlined in Section 6 of the SCT Report (**Volume 3**).

Table 6-1 – Summary of Subsidence Monitoring

Subsidence Line/Location	Subsidence Monitoring Description
R Line	R Line currently extends as a subsidence line to midway across LW 17 and as a series of isolated points for 750m from the edge of LW 16 to LW 19. An extension of R Line alongside the Mount Owen Rail Line is recommended with each longwall panel. R Line is the main monitoring line at Integra Underground and the only line suitable to demonstrate compliance with subsidence predictions. The rail corridor is the only area of natural ground suitable for a subsidence line. The proposed timing of monitoring will be from the commencement of LW 17 and completed monthly. It is recommended that the isolated marks are maintained to more than 1km ahead of the active longwall and “infilled” with marks at 20m spacing. Infilling to at least 250m beyond the edge of the active longwall panel is considered a minimum for compliance monitoring. Infilling to 500m ahead of the active longwall panel would improve the reliability of measurements of angle of draw and other horizontal subsidence parameters to generally enhance the understanding of subsidence behaviour at Integra Underground (SCT, 2020).
Ravensworth East - West Pit	An array of survey points around the edge of the highwall for Ravensworth East - West Pit to monitor movements that may lead to instability in this area. Surveys of distributed survey pegs around the around the top edge of the highwall of Ravensworth East - West Pit are recommended to confirm the magnitude of any ground movements that may lead to subsidence impacts to the highwall and the ventilation shaft. Monitoring should occur through to the completion of LW 19 (SCT, 2020).
Mt Owen – North Pit	With the shortening of LWs 17-20 and the experience now available from monitoring LWs 14 and 15, SCT (2020) suggests that ongoing subsidence monitoring post LW 16 appears unlikely to be necessary.
Ventilation Shaft 3	An array of survey points around Ventilation Shaft 3 site to confirm the surface and sub-surface movements and potential impacts to this infrastructure. Surveys of distributed survey pegs around the around the top edge of the highwall of Ventilation Shaft 3 are recommended to confirm the magnitude of any ground movements that may lead to subsidence impacts to the highwall and the ventilation shaft. Monitoring should occur through to the completion of LW 19 (SCT, 2020).
LiDAR	LiDAR surveys of the surface at the end of each panel are recommended to provide control on the magnitude and nature of subsidence movements in areas remote from the main subsidence lines. LiDAR surveys conducted routinely for MTO would only need to be extended slightly to cover the area of LWs 17-20. These surveys provide confirmation of subsidence movements across the entire site. Their accuracy is less than conventional subsidence lines, but the context they provide enables much more effective control and management of subsidence impacts. LiDAR surveying is considered a necessary part of contemporary subsidence monitoring systems. .

Subsidence Line/Location	Subsidence Monitoring Description
Monitoring of Rail Line and Bettys Creek Bridges	Full monitoring program outlined within the <i>Mount Owen Rail Infrastructure Asset Management Plan (Volume 2, Appendix B)</i> . This includes ground monitoring, rail strain and temperature gauges, and visual inspections.
Train Loading Infrastructure (GNSS Monitoring)	There is currently no reliable information on far-field subsidence movements at Integra Underground. These movements are observed at other sites at distances up to 3km in advance of longwall mining. Although typically only a few tens of millimetres in magnitude until closer to active mining, such movements nevertheless have potential to affect alignment sensitive infrastructure. Installation of at least one continuous, near real-time GNSS (GPS) monitoring unit at or adjacent to the train loading infrastructure at the MOC MIA is recommended (SCT, 2020). This GNSS monitoring unit is recommended in the event that Longwall 20 will be extracted. The requirement for this GNSS monitoring unit will be reviewed prior to commencement of Longwall 19. An initial unit would monitor far-field movements in three-dimensions and provide advance warning of movement that any critical infrastructure might experience from LWs 17-20. Additional units could be installed subsequently on other infrastructure as required. The system has the ability to be reviewed in near real time and can be set to alarm if trigger levels are exceeded. Without any monitoring of far-field movements, there can be no reliable confirmation that infrastructure is not being impacted. This monitoring is considered necessary for management of critical infrastructure (SCT 2020).

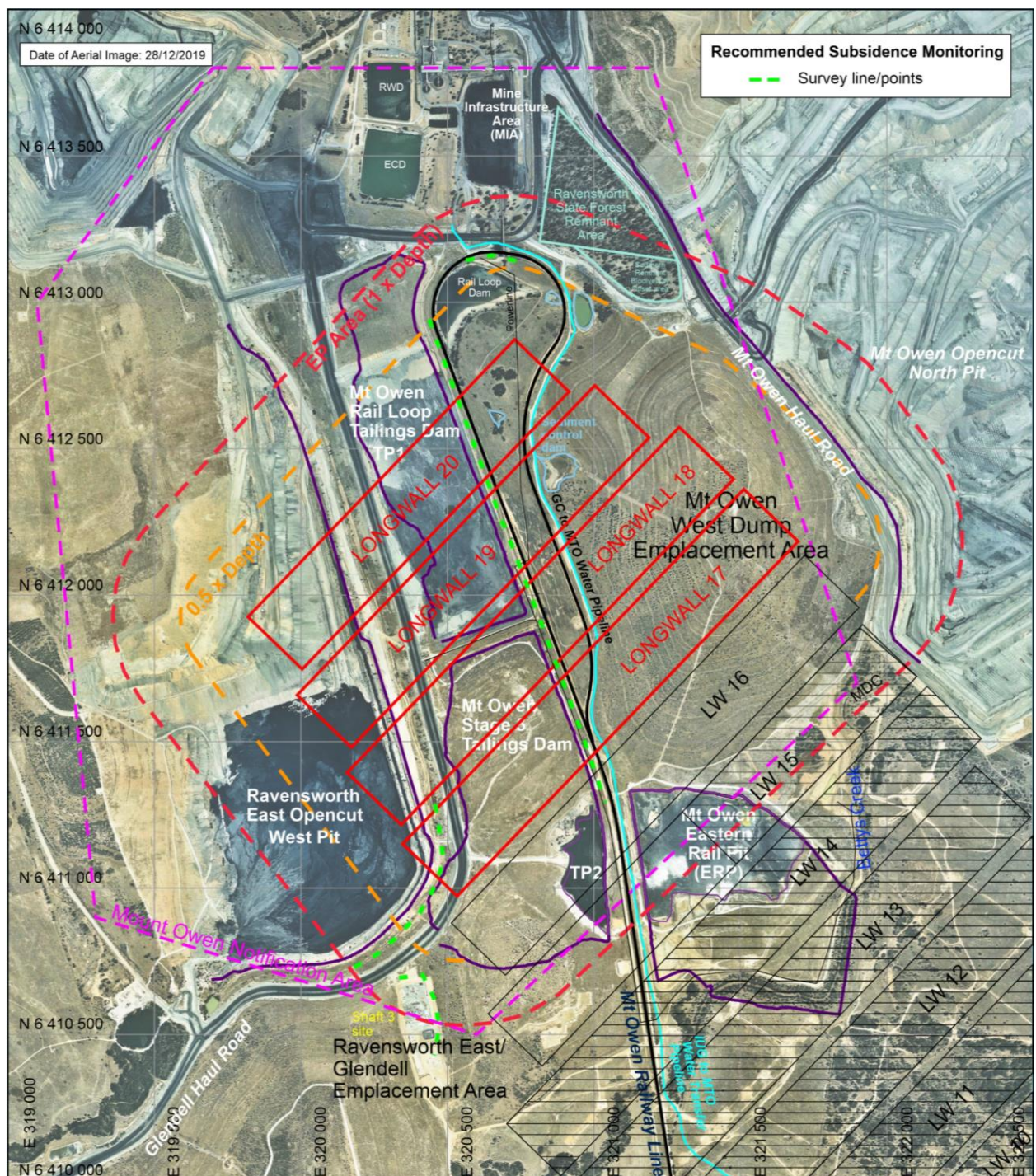


Figure 6-1 – Proposed Subsidence Monitoring for LW 17-20 (SCT 2020)

6.2 Contingency Response

In the event that observed subsidence impacts exceed the performance measures a general contingency response includes:

- The observation will be reported to the Environment and Community Manager within 24 hours.
- The observation will be recorded.
- Integra Underground will report any exceedance of the performance measures to the relevant Government departments and stakeholders as soon as practicable after becoming aware of the incident.
- Integra Underground will assess the exceedances referred to in the relevant TARP and where appropriate, implement measures in accordance with the appropriate Management Plan/s.
- Integra Underground will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary.
- Integra Underground will provide the Secretary and any relevant agencies with a detailed report on the incident within seven days of the date of the incident.
- Integra Underground will identify an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders.
- Integra Underground will consult with DPIE and other relevant government agencies/stakeholders to develop a course of action.
- Integra Underground will continue to monitor performance with the new action plan in place and, if successful will formalise these actions as part of a revised Extraction Plan through adaptive management.
- The predicted issues and proposed management are outlined in Section 5.3 of this Main Document.

6.3 Monitoring of the Success of Remediation Issues

Any significant subsidence remediation completed by Integra Underground will be added to the Integra Underground rehabilitation monitoring program and reported in the Integra Underground Annual Review.

A summary of subsidence impacts and remediation will be provided in the Annual Review (**Section 7.1.1**). Integra Underground's Rehabilitation Monitoring Program is included in the MOP.

7. Implementation

7.1 Reporting

7.1.1 Annual Review

The Annual Review is prepared to summarise Integra Undergrounds environmental performance for the reporting year and is prepared in accordance with Schedule 5, Condition 11 of PA 08_0101 and to satisfy Mining Lease conditions.

7.1.2 Reporting Frequency

The frequency of reporting will occur as per the requirement of Asset Management Plans. The Extraction Plan Guideline requires bi-monthly subsidence impact reporting of new impacts with reference to performance measures and/or indicators, six-monthly reporting of all impacts and environmental monitoring results including reference to TARPs and assessment of compliance with performance measures and indicators.

7.1.3 Stakeholder Updates

The Integra Underground Community Consultative Committee is given regular updates on the status of the progress and activities of the operations.

The land that will be subsidised for LWs 17-20 is solely owned by Glencore and regular liaison will be undertaken between Integra Underground and Mount Owen Glendell Operations as mining progresses.

7.1.4 Health and Safety Reporting

Reporting is required as part of the *Work Health and Safety (Mines and Petroleum Site) Regulation 2014*.

7.2 Adaptive Management

Integra Underground's approach to managing subsidence and environmental impacts at the mine includes using past performance to guide and improve future monitoring and management actions.

Monitoring of the environment and the subsequent response to mining induced subsidence has been in place at Integra Underground prior to mining and has led to an improved understanding of the environment and site specific subsidence behaviour. Updated information from monitoring is then incorporated into Integra Underground's management plans to improve preventative and remedial actions. If updates to this Extraction Plan are required, these will be submitted to the DPIE for approval.

7.3 Community Complaints

Integra Underground operates a dedicated community enquiries and complaints hotline in accordance with Environment Protection Licence 3390. The details of this hotline are advertised on the Integra Underground website.

A procedure for handling complaints has been implemented as part of the *Integra Underground Environmental Management Strategy (EMS)*.

A summary of the complaints received by the community will be reported in the Annual Review.

7.4 Document Control

This Extraction Plan and supporting documents will be controlled as part of the *Integra Underground Document Control System*. This system provides an electronic control system for document management and access by relevant personnel.

7.5 Roles and Responsibilities

Detailed below are the key personnel involved with implementing this Extraction Plan including their roles and responsibilities in implementing this Extraction Plan.

Table 7-1 – Summary of Key Roles and Responsibilities

Role	Responsibilities
Operations Manager	- Provide resources for the implementation of this Extraction Plan. - Conduct underground mining activities in accordance with the Extraction Plan. - Notify and liaise with the Resource Regulator Inspectors (if required).
Environment and Community Manager	- Liaise with Government Agencies and community members in relation to subsidence matters and the Extraction Plan subsidence predictions and monitoring program. - Manage environmental monitoring and reporting in accordance with this Extraction Plan and relevant Environmental Management Plans. - Manage and implement subsidence management actions required by the Extraction Plan (in liaison with Mount Owen Glendell Operations) - Liaise with Government Agencies in relation to environmental consequences of subsidence and proposed management strategies. - Liaise with landholders in relation to environmental consequences of subsidence, the monitoring program and any remediation works. - Inform Community Consultative Committee of mine progression. - Review and update the Extraction Plan and sub plans as required. - Complete environmental and planning reporting requirements.
Technical Services Manager	- Coordinate the Mine Surveyor and completion of subsidence monitoring in accordance with the Extraction Plan. - Review subsidence monitoring data against predictions and TARPs in order to trigger any actions required on the basis of subsidence results. - Manage and implement subsidence management actions required by the Extraction Plan in relation to infrastructure (in liaison with Mount Owen Glendell Operations). - Complete health and safety reporting requirements.
Mine Surveyor	Complete subsidence monitoring as per the Subsidence Monitoring Program and report to stakeholders where required (in liaison with Environment and Community Manager)

8. Review and Improvement

8.1 Incident Reporting

Integra Underground will notify the DPIE and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. Incident reporting will be completed in accordance with Schedule 5 Condition 9 of the PA 08_0101.

8.2 Review of Extraction Plan

Review of the Extraction Plan and/or any of the sub-plans, and revision if necessary, shall occur where significant unpredicted impacts and/or environmental consequences are identified through the monitoring and management strategies proposed in the Extraction Plan.

Any revision to the Extraction Plan including component sub-plans must be submitted to DPIE for approval.

9. Document Information

9.1 Related Documents

This Extraction Plan Main Document forms part of the overall Extraction Plan documentation. See **Section 2.3** which outlines the full Extraction Plan documentation.

Related documents, listed in **Table 9-1** – below, are *documents* directly related to or referenced from within this document.

Table 9-1 – Related documents

Number	Title
INTUG-793190785-45	Environment Management Strategy

9.2 Reference Information

Reference information, listed in **Table 9-2** below, is *information* that is directly referred to for the development of this document.

Table 9-2 – Reference information

Reference	Title
AGE (2017)	Integra Underground – Groundwater Impact Assessment
AGE (2020)	Integra Underground Mine LW17-LW20 Extraction Plan Groundwater Assessment
Hansen Bailey (2017)	Integra Underground Mine Longwall Extension Modification Environmental Assessment for HV Coking Coal Pty Ltd
SCT (2017a)	Integra Underground Mine: Subsidence Assessment for LW 13 and LW14 Extraction Plan (INT4604A)
SCT (2017b)	Integra Underground Mine: Subsidence Assessment for Modification to PA08_0101 (INT4648)
SCT (2018)	Integra Underground Mine: Subsidence Assessment for Longwalls 15 and 16 Extraction Plan (INT4852)
SCT (2020)	Integra Underground Mine: Subsidence Assessment for LW17-20 Extraction Plan
Engeny (2020)	Extraction Surface Water Assessment

9.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in **Table 9-3** below. Example detail shown below.

Table 9-3 – Change Information

Version	Date	Change Details
1.0	August 2020	New document for LW 17-20.
2.0	January 2021	Updated Extraction Plan LW 17 to 20 based on DPIE feedback
3.0	February 2021	Updated Extraction Plan LW 17 to 20 based on further DPIE feedback