Integra Underground Mine
New and Extended Longwalls
(MP 08_0101 MOD 8)

Environmental Assessment Report

Sections 75W of the *Environmental Planning and Assessment Act 1979*

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1. BACKGROUND

The Integra Underground Project is located 10 kilometres north-west of Singleton in the Hunter Valley, within the Singleton local government area (see **Figure 1**). The underground mine has been operating since 1990.

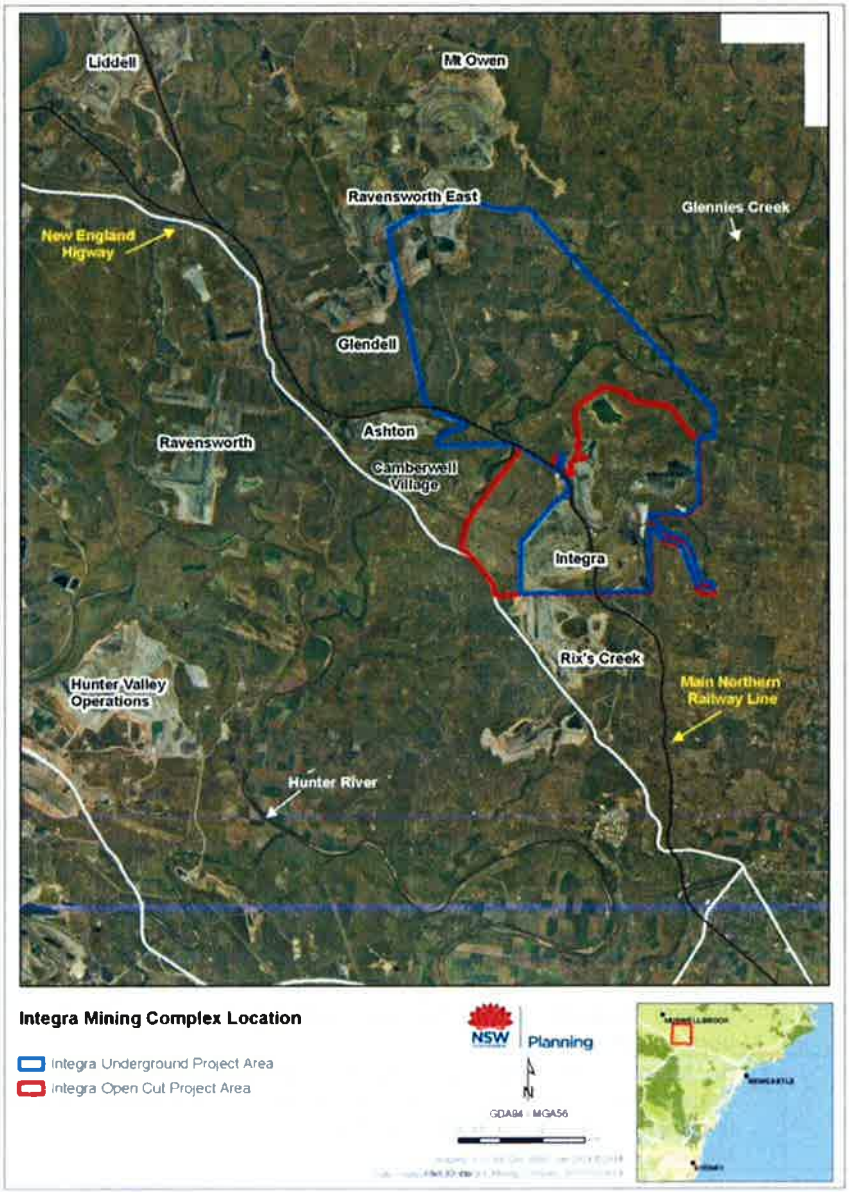

***Figure 1**: Regional location of the Integra Underground Project*

On 26 November 2010, the then Minister granted project approval under a single consolidated instrument for the operation of the Integra Underground Project (MP 08_0101) and the Integra Open Cut Project (MP 08_0102), replacing previous consents and approvals for what was then an integrated mining complex known as the Integra Coal Complex.

In December 2015, Bloomfield Collieries Pty Ltd (Bloomfield) acquired the Integra Open Cut Project from HV Coking Coal Pty Ltd (HVCC), separating the previous mining complex into two independent operations. Bloomfield, the owner of the adjacent Rix's Creek Coal Mine, now operates the Integra Open Cut Project under the new project title "Rix's Creek North". The Integra Underground Project has been retained by HVCC and is a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore).

On 23 August 2016, the consolidated project approval was modified by the then Planning Assessment Commission, as delegate of the Minister. This modification separated management of the open cut and underground mining operations into two independent project approvals, MP 08_0102 and MP 08_0101, respectively.

2. PROPOSED MODIFICATION

HVCC has identified an additional coal resource further to the north of the currently approved longwalls. HVCC proposes to modify MP 08_0101 to develop up to three additional longwalls in the Middle Liddell Seam and increase the lengths and widths of the currently approved LWs 15-17, recovering an additional 9.9 million tonnes (Mt) of run-of-mine (ROM) coal, within existing approved annual limits (see **Figures 2** and **3**). Processing of this coal is expected to generate up to 2.29 Mt of coarse rejects and 0.69 Mt of tailings, to be managed within existing tailings storage facilities. The proposed modification also involves the construction and operation of ancillary surface infrastructure required to support the proposed mining activities, including the construction and use of an additional access road off Middle Falbrook Road (see **Table 1**).

The proposed modification includes two potential mine plan options (herein referred to as either the LWs 15-20 and LWs 15-19 layouts or Future Underground Extraction Area). The final longwall layout would be determined as part of the Extraction Plan process already required under the project approval. The Department has assessed the proposed modification under both mine plan options and potential worst-case impacts. The LWs 15-19 layout contains a maximum panel width of 320 metres (m) and a resulting maximum void width of 330 m and the LWs 15-20 layout contains a maximum panel width of 246 m and a resulting maximum void width of 257 m (see **Figures 2** and **3**).

Integra Underground is located adjacent to the Mount Owen Complex, which is also owned and operated by subsidiaries of Glencore. The Department notes that whilst the proposed modification does not involve any modifications to the development consents for the Mount Owen Complex, the proposed mining activities and infrastructure development would be undertaken within the development consent boundaries for the Mount Owen Complex.

Given that both the Integra Underground and Mount Owen Complex are owned and operated by subsidiaries of Glencore, there is now opportunity for HVCC to recover coal resources beneath the surface mining operations at Mount Owen Complex, while not impacting on approved coal recovery at the Complex.

A comparison of the approved and proposed operations is set out in **Table 1**. A detailed description of the modification is provided in HVCC's Environmental Assessment (EA, see **Appendix A**).

Table 1: *Comparison of approved and proposed operations*

Component	Approved	Proposed
Life of Mine	• Until 31 December 2035	• No change
Underground Mining	• Underground mining (predominantly through longwall mining but also some bord and pillar mining)	• No change
Coal Reserves	• 57 Mt of ROM coal from Hebden and Barrett seams (in addition to previously approved 48.3 Mt of ROM coal from the Middle Liddell Seam)	• Up to an additional 9.9 Mt of ROM coal from the Middle Liddell Seam
Production Rate	• Up to 4.5 Mtpa of ROM coal	• No change
Surface Infrastructure	• Three ROM coal stockpiles • Portal entry	• No change • No change

	• Ventilation shafts	• No change to approved ventilation shafts. Additional surface auxiliary fans within the Future Underground Extraction Area
	• Administration building and bathhouse	• No change
	• Gas drainage boreholes	• Additional gas drainage boreholes
	• Gas flares	• Increased use of existing gas flares, but no additional flares
		• Goaf Dewatering Site
		• New store and access road
		• Additional electricity transmission lines and distribution lines
Mine Plan	• 17 longwall panels in the Middle Liddell Seam	• Extension to the lengths of LWs 15-17 and mining of additional longwall panels within the Future Underground Extraction Area, with two alternative mine layouts proposed
	• 15 longwall panels in the Hebden Seam	• No change
	• 7 longwall panels in the Barratt Seam	• No change
	• First workings in the Hebden, Barrett and Middle Liddell seams	• No change to approved first workings, except for realignment and extension of the North Mains
Coal Transportation	• Truck haulage of ROM coal from stockpiles to the CHPP • Rail to Newcastle • 8.500 tonne capacity trains • Train loading occurs at Integra Open Cut Mine (ie Rix's Creek North Mine)	• No change
Employment	• Up to 280 full-time equivalent personnel	• No change
Water Management	• Portal Sump	• No change
	• Process Water Dam	• No change
	• Transfer of mine water from Portal Sump to Integra Open Cut Mine (ie Rix's Creek North Mine)	• No change
	• Transfer of mine water from Portal Sump to Mount Owen Complex Water Management System	• No change to transfer of mine water from Portal Sump to Mount Owen Complex. Water would also be transferred from the Goaf Dewatering Site to Mount Owen Complex
		• Use of Dam C4 (at Rix's Creek North Mine) to store fresh water pumped from Glennies Creek for process water (subject to agreement with Bloomfield Collieries)
Waste Rock Management	• Coarse rejects are co-disposed in overburden emplacement areas at Integra Open Cut Mine (ie Rix's Creek North Mine) • Tailings are dewatered and emplaced within Tailings Dams (TD2 and TD3) at Integra Open Cut Mine (ie Rix's Creek North Mine)	• No change
Site Access	• Via an entry point off Middle Falbrook Road	• Construction and use of an additional access road off Middle Falbrook Road
		• During construction of surface infrastructure, access would also be via Hebden Road (via Glendell Mine), Glennies Creek Road and Forest Road
Operational Hours	• 24 hours a day, 7 days a week	• No change

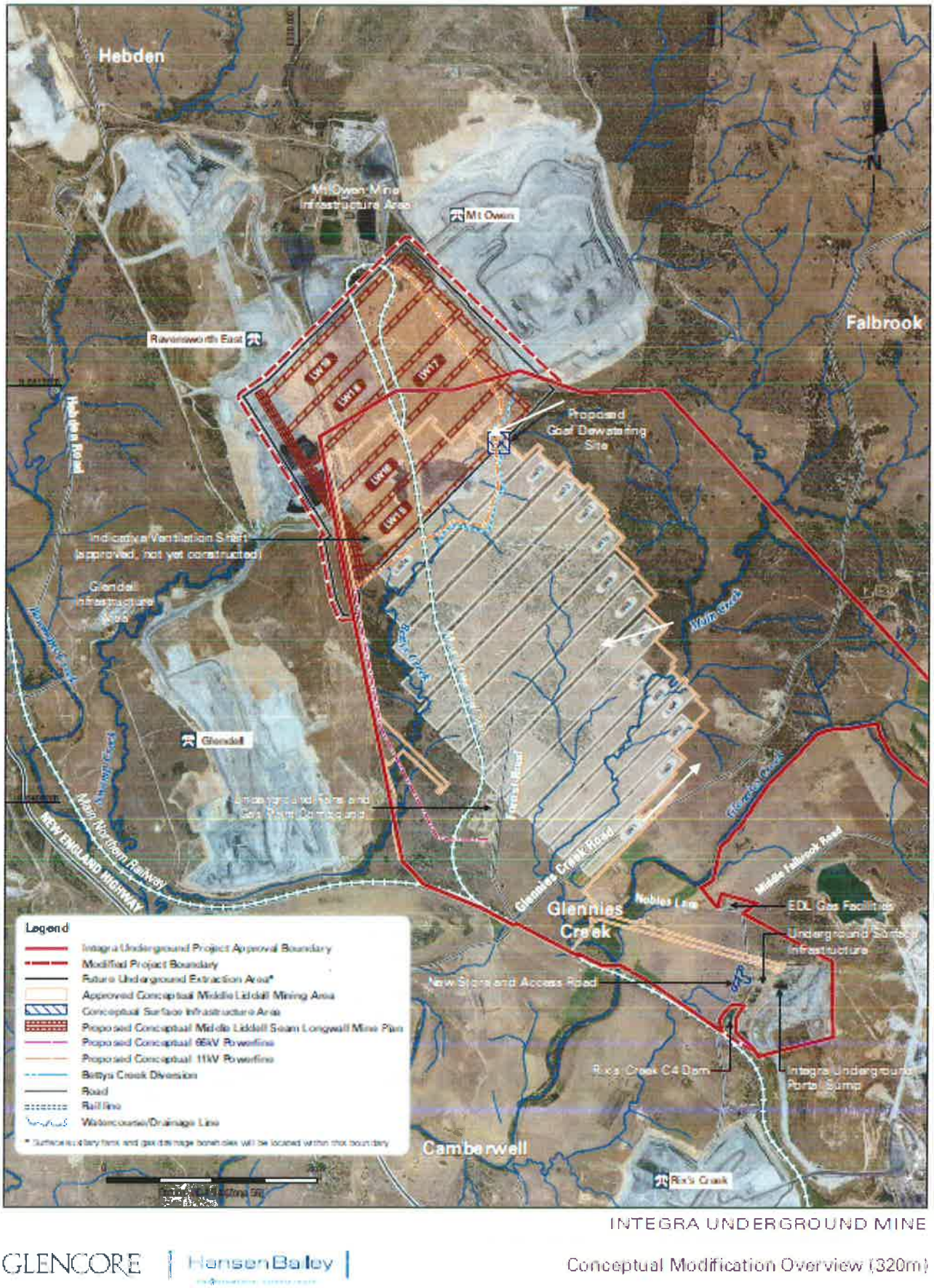

***Figure 2**: Potential mine plan - LWs 15-19 layout (330 m void width)*

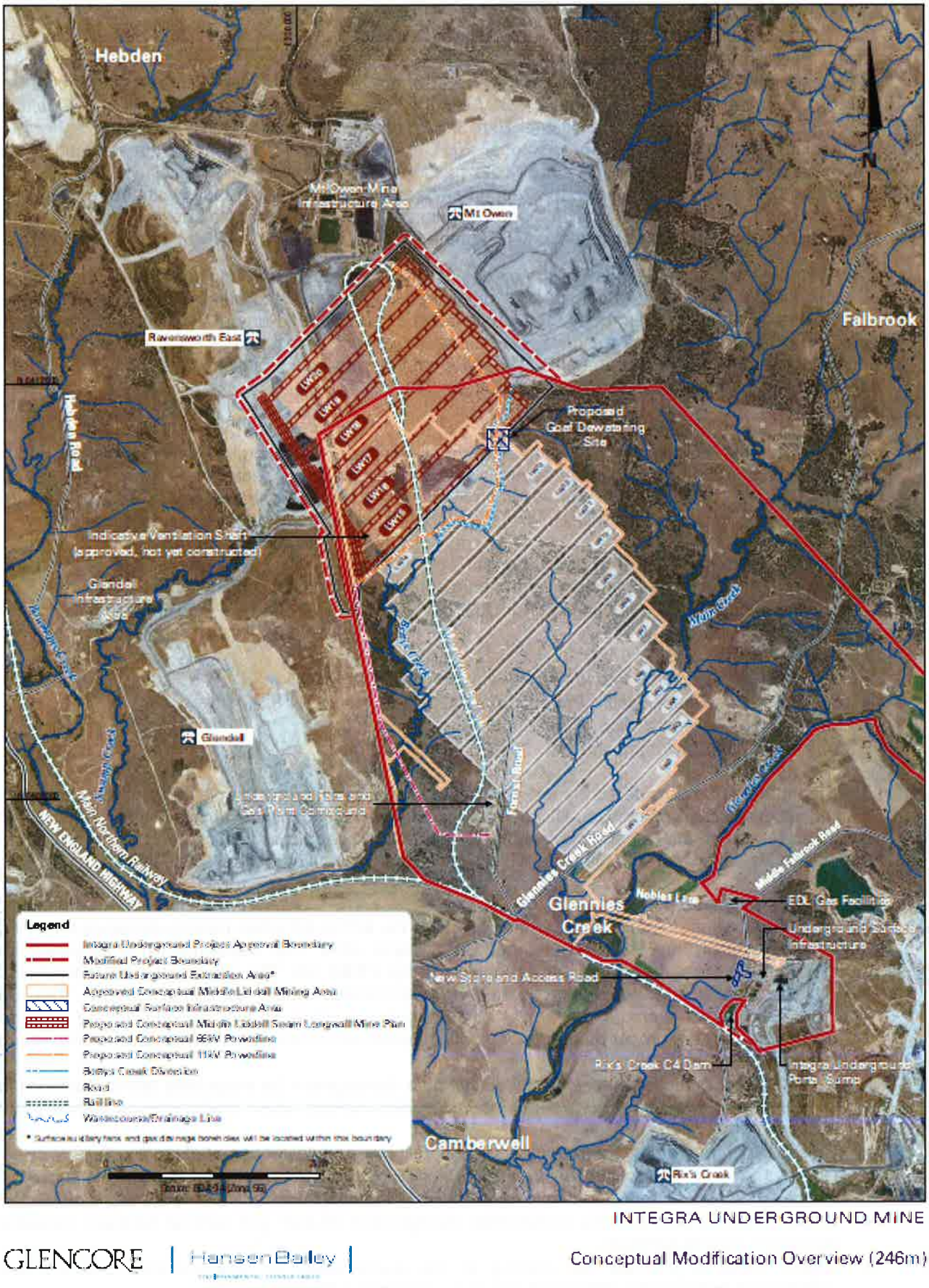

***Figure 3**: Alternative potential mine plan - LWs 15-20 layout (257 m void width)*

3. STATUTORY CONTEXT

3.1 Section 75W

The project was originally approved under Part 3A of the EP&A Act. The project is a transitional Part 3A project under Schedule 2 to the *EP&A (Savings, Transitional and Other Provisions) Regulation 2017*. The power to modify transitional Part 3A projects under section 75W of the Act as in force immediately before its repeal on 1 October 2011 is being wound up – but as the request for this modification was made before the 'cut-off date' of 1 March 2018, the provisions of clause 3 of Schedule 2 continue to apply. Consequently, this report has been prepared in accordance with the requirements of Part 3A and associated regulations, and the Minister (or delegate) may approve or disapprove the carrying out of the project under section 75W of the EP&A Act.

The proposed modification involves the extension of already approved longwall mining operations in the Middle Liddell Seam and construction of ancillary infrastructure to support the proposed mining operations at Integra Underground. The proposal would not change any of the core elements of the project, including the mining methods, operational hours, annual extraction volumes and processing rates. Consequently, the Department is satisfied that the proposed modification is within the scope of section 75W, and may be determined accordingly.

3.2 Approval Authority

The Minister for Planning is the approval authority for the application. However, the Independent Planning Commission of NSW must determine the application under section 4.5 of the EP&A Act and clause 8A of the *State Environmental Planning Policy (State and Regional Development) 2011* because a related entity, Glencore Australia Holdings Pty Ltd, has declared reportable political donations.

3.3 Environmental Planning Instruments

A number of environmental planning instruments apply to the modification, including:

- *State Environmental Planning Policy (SEPP) (Mining, Petroleum Production and Extractive Industries) 2007;*
- *SEPP (Infrastructure) 2007;*
- *SEPP No. 33 – Hazardous and Offensive Development;*
- *SEPP No. 44 – Koala Habitat Protection;*
- *SEPP No. 55 – Remediation of Land;* and
- *Singleton Local Environmental Plan 2013.*

The Department has considered the assessment of relevant environmental planning instruments in the EA and assessed the proposed modification against the relevant provisions of these instruments. Based on this assessment, the Department is satisfied that the proposed modification can be carried out in a manner that is consistent with the aims, objectives and provisions of these instruments.

3.4 Objects of the EP&A Act

The Minister or delegate must consider the objects of the EP&A Act when making decisions under the Act. The objects of the EP&A Act changed on 1 March 2018. The Department has assessed the proposed modification against the current objects of the EP&A Act. The objects of most relevance to the decision on whether or not to approve the proposed modification are found in section 1.3. They are:

- Object 1.3(a): *to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resource*;
- Object 1.3(b): *to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment*;
- Object 1.3(c): *to promote the orderly and economic use and development of land*;
- Object 1.3(e): *to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats*;
- Object 1.3(f): *to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)*;
- Object 1.3(i): *to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State*; and
- Object 1.3(j): *to provide increased opportunity for community participation in environmental planning and assessment.*

The Department is satisfied that the proposed modification encourages the proper management and development of resources (Object 1.3(a)) and the promotion of the orderly and economic use of land (Object 1.3(c)), since the:

- Modification involves a permissible land use on the subject land;
- targeted coal resource has been determined by DRG to be significant from a State and regional perspective;
- targeted coal resource is located entirely within mining lease areas, in a region that is dominated by coal mining operations;
- modification can be largely carried out using existing mine site and transport infrastructure; and
- modification would provide ongoing socio-economic benefits to the community of NSW.

The Department has considered the principles of ecologically sustainable development (ESD, Object 1.3(b)) in its assessment of the proposed modification. The Department has also noted HVCC's consideration of these matters (see Section 5.1.1 of the EA), and considers that the proposed modification is able to be carried out in a manner that is consistent with the principles of ESD. The Department's assessment has sought to integrate all significant environmental, social and economic considerations.

Consideration of the protection of the environment and heritage (Object 1.3(e) and(f)) is provided in **Section 5** of this report. The Department believes that the modification as proposed has been designed to minimise potential environmental and heritage impacts where practicable, including avoidance of direct disturbance to threatened biodiversity and Aboriginal cultural heritage items.

The Department exhibited the modification application and made the accompanying EA publicly available (Object 1.3(j)) No public or special interest group submissions were received.

4. CONSULTATION

4.1 Exhibition and Notification

The Department exhibited the modification application from 7 December 2017 until 21 December 2017 and made the accompanying EA publicly available on its website and at the Department's Information Centre, Singleton Shire Council's administrative centre and the office of the Nature Conservation Council.

In response to this exhibition, the Department received 8 submissions from public authorities, including NSW Government agencies. No public or special interest group submissions were received.

Copies of these submissions and a copy of HVCC's Response to Submissions (RTS) are included in **Appendix B** and **Appendix C**, respectively. A summary of the residual issues raised in these submissions is provided below (see **Appendix B** for agency comments on the RTS).

4.2 Agency Submissions

Office of Environment and Heritage (OEH) was satisfied with the assessment of Aboriginal cultural heritage and recommended that the mitigation and management measures as outlined in the EA be incorporated into the site's Aboriginal Cultural Heritage Management Plan.

OEH recommended that, for every native tree two metres or greater in height removed, ten compensatory trees of the same species be planted and managed until maturity. OEH noted that predicted subsidence is unlikely to have a significant impact on threatened species or native vegetation. Nevertheless, OEH recommended offsetting provisions for any mine subsidence that unexpectedly harms threatened species or native vegetation. These matters are dealt with in detail in **Sections 5.3** below.

The Department of Industry's **Crown Lands and Water Division (DoI Water)** requested clarification whether the peak predicted take from the Sydney Basin – North Coast Water Source would occur during the active or post-mining stage. It also sought clarification on the volume of surface water flow that would be lost as a result of subsidence. DoI Water requested these clarifications to ensure appropriate licensing could occur, rather than as matters of environmental concern. The Department has addressed water licensing in **Section 5.2**.

Roads and Maritime Services (RMS) recommended that HVCC be required to prepare and implement a Construction Traffic Management Plan for the proposed modification. The plan would address the

safest possible routes to and from the site for construction vehicles and ensure that appropriate traffic measures are in place during the construction phase. This recommendation has been further addressed in **Section 5**. RMS also provided advisory comments on the intersection of Bridgman Road and Stoney Creek Road. These have been further addressed in **Section 5**.

The Department's **Division of Resources and Geoscience (DRG)** did not raise any concerns with the proposed modification but noted that the Resources Regulator should be consulted regarding the proposed interactions with the Mount Owen mine's highwall. The Department's **Resources Regulator** noted that it did not have any specific advice regarding the proposed modification.

The **Dams Safety Committee (DSC)** advised the Department that the proposed modification falls within the Mount Owen Notification Area which surrounds the Mount Owen Rail Loop Tailings Dam (ie a prescribed dam of 'Significant' consequence category in the event of dam failure). As such, proposed mining within this area would need to be endorsed by the DSC. The Department notes that HVCC would need to make an application to DSC to this regard.

The **Environment Protection Authority (EPA)** did not raise any concerns regarding the proposed modification, instead providing several recommended conditions of approval for the management of construction noise, gas flaring and waste. These recommendations have been further addressed in **Section 5**.

The **Heritage Council of NSW** noted that it had no specific comments or recommendations provided the proposed modification is carried out in accordance with the Historic Heritage Management Plan (HHMP) that it had endorsed on 18 January 2017.

Subsidence Advisory NSW (SA NSW) did not raise any concerns over the proposed modification but noted that changes to the mine subsidence compensation system would take effect from 1 January 2018. Consequently, any subsidence impacts resulting from the proposed modification would be managed under the new system.

The Department did not receive a submission from **Singleton Shire Council**.

5. ASSESSMENT

The Department has assessed the merits of the proposed modification in accordance with the relevant objects and requirements of the EP&A Act. In assessing these merits, the Department has considered the:

- EA for the original Integra Underground Project application and EAs for subsequent modifications;
- conditions of approval for the Integra Underground Project, as amended by subsequent modifications;
- modification application MP 08_0101 (MOD 8) and accompanying documents; and
- relevant environmental planning instruments, policies and guidelines.

The Department considers that the key issues for assessment are the potential impacts of subsidence on built infrastructure, water resources and biodiversity. Consideration of these issues is provided below.

5.1 Subsidence

5.1.1 Introduction

The site and its vicinity has a long history of intensive mining using both open cut and underground methods. Integra Underground has previously mined 12 longwall panels in the Middle Liddell Seam under the current project approval (LWs 1-12). Longwall panels have varied in dimensions but have typically ranged up to 246 m for panel width, 2.8 m for panel height with depth of cover between 280 and 495 m.

HVCC is currently permitted to develop multi-seam mining operations in the Middle Liddell, Hebden and Barrett Coal Seams. However, multi-seam mine has not yet occurred at the site. HVCC anticipates that primary development within the Hebden Seam would occur concurrently with longwall extraction in the Middle Liddell Seam. Current forecasting indicates that secondary extraction of the Middle Liddell longwall panels would be undertaken through to approximately 2023 (subject to approval of this modification). Therefore, based on current forecasting, primary development within the Hebden Seam

may commence in approximately 2020-2023, whilst longwall extraction in the Hebden Seam may commence in approximately 2023.

A review of the site's history in regards to subsidence and associated impacts reveals very little in terms of significant impacts, indicating that the subsidence management framework at the site has been operating well.

In accordance with the Department's standard practice for managing mine subsidence, the mine is subject to existing approval conditions which stipulate key subsidence performance measures and require the development of detailed Extraction Plans to govern the mining of approved longwall panels. Each Extraction Plan is required to be approved by the Secretary before carrying out any second workings (such as longwall panel extraction).

Under its existing approval, HVCC is required to comply with a number of specific performance measures which are drafted so that individual impact limits apply to groups of similar and related features. The performance measures are targeted toward management regimes based not only on the significance and sensitivity of the feature being protected, but also the risk profile, likelihood and severity of potential impacts occurring at the particular feature.

These performance measures are not intended to act in isolation; rather, they operate to provide an umbrella framework under which a range of other considerations and assessments are undertaken either prior to, during or following the extraction of each longwall panel to avoid, minimise and mitigate subsidence impacts. These assessments are bought together in the preparation and approval of Extraction Plans (see Management and Mitigation below). The Extraction Plan process provides a detailed assessment process which supports the achievement of the performance measures set out in the consent.

The Extraction Plan process also supports a robust adaptive management framework. The preparation of an Extraction Plan for each group of longwall panels allows an iterative assessment of impacts to all built and natural features, ensuring that impacts are regularly re-assessed and impact management regimes further refined during the life of the project in response to the results of subsidence monitoring and recorded impacts.

The EA included a Subsidence Assessment undertaken by SCT Operations Pty Ltd (SCT). Since acquiring Integra Underground in 2015, HVCC has invested in further exploration and considered the options of additional longwall panels and increasing longwall face widths in the Middle Liddell Seam.

The Department's assessment covers the two proposed longwall panel layouts, namely:

- LWs 15-20: 257 m longwall panel void widths (246.2 m face width with a 5.2 m wide roadway at each end) (see **Figure 3**); and
- LWs 15-19: 330 m longwall panel void widths (320 m face widths with a 5.2 m wide roadway at each end) (see **Figure 2**).

The overburden depth above the proposed longwalls varies from approximately 270 m to 590 m. The coal seam dips to the northeast ranging from a moderate dip in the south west and central parts before flattening and rising steeply to the northeast. The lower depths of cover occur over the start and finish lines of the proposed longwalls where surface excavations associated with the Mount Owen North Pit and Ravensworth East – West Pit are located. The minimum overburden thickness is below the West Pit highwall near the finish lines of LW 18 (or LW 17).

The Department notes that these dimensions are not significantly different from those already approved and being extracted in the Middle Liddell Seam. Given the similarities in the mining geometry of the proposed longwalls to those already approved and being extracted, the Department considers that the proposed modification is likely to follow other trends at the site in regard to subsidence effects and impacts.

The area of the Subsidence Assessment was set as the area within a distance equal to the overburden depth from the outermost goaf edges of the maximum extent of each longwall panel layout. SCT contended that, in this case, an assessment area based on overburden depth was more reliably defined and not subject to variations in survey tolerance. The Department is satisfied that a horizontal distance equal to overburden depth from the nearest goaf is a conservative measure and that any subsidence-related movements beyond this distance are likely to be insignificant.

SCT considered that the proposed modification would be compliant with the existing project approval conditions and could be managed under the Extraction Plan process. Nevertheless, SCT identified two areas requiring further consideration, these being the potential for increased groundwater inflows and management of highwall stability in Mount Owen's North Pit. These matters are discussed in **Sections 5.2** and **5.1.4** respectively.

5.1.2 Subsidence Predictions and Effects

Subsidence effects refer to deformation of the groundmass due to mining, including all mining-induced ground movements. 'Conventional subsidence' includes vertical displacement, tilt, and tensile and compressive strains. Additional 'non-conventional subsidence' components include those arising in steep or incised topography (valley closure and upsidence) and far-field horizontal movements.

SCT's subsidence assessment states that subsidence effects would vary across the longwall areas due to variations in controlling factors such as cover depth and local geology. The maximum predicted conventional subsidence, tilt and strain due to the proposed longwalls under both potential mine plan layouts are summarised in **Table 2**.

Table 2: *Comparison of maximum predicted total subsidence parameters based on the two proposed mine plan layouts*

Layout	Maximum subsidence (mm)	Maximum tilt (mm/m)	Maximum tensile strain (mm/m)	Maximum compressive strain (mm/m)
Undisturbed ground (eg rail corridor and loop)				
LWs 15-20	2,000	14	7	10
LWs 15-19	2,200	15	8	11
Areas of waste rock emplacement (eg TP1, TP2, West Pit, Eastern Rail Pit, West Dump)				
LWs 15-20	2,800	14	14	20
LWs 15-19	3,000	15	16	22

The Department notes that the subsidence parameters presented in **Table 2** differ somewhat to those previously assessed under MP 06_0213. The changes primarily reflect the increased mining height, changed mining geometries, changed overburden conditions and the influence of waste rock fill. Additionally, the proposed LWs 15-19 layout is predicted to result in slightly greater subsidence effects than the proposed LWs 15-20 layout due to the wider void width. For areas already modified by mining (ie emplacement areas, open excavation areas and locations where interfaces of natural ground and fill material exist) there is potential for greater vertical subsidence, tilt and strains.

The predicted maximum tilt levels are generally consistent, or slightly greater, than those previously approved for areas of undisturbed ground. This results from the predicted increases in vertical subsidence, as well as the increased overburden depth within the proposed modification area.

The predicted increases in subsidence parameters do not necessarily reflect or imply significantly greater subsidence impacts or greater environmental consequences from those previously predicted. SCT concluded that the consequences of these increases are likely to be insignificant in the already substantially modified landform of the proposed modification area.

Given that the proposed modification seeks to amend the layout of the longwall panels in the Middle Liddell Seam and includes areas where the approved Hebden Seam workings would overlie the Middle Liddell Seam workings, multi-seam subsidence behaviour is expected. The original project was approved for vertical subsidence of up to 4 m arising from multi-seam mining. The proposed amendments to longwall panel layout are not expected to increase this maximum subsidence.

Overall, the Department is satisfied that an appropriate subsidence prediction model has been used and notes that the model is calibrated to local conditions and therefore has built in allowances for local natural variations. The Department considers that SCT's subsidence predictions are conservative.

5.1.3 Natural and Heritage Features and Potential Impacts

There are several natural and heritage features located above or near the proposed longwalls. Most of these features are located over the already approved LWs 13 and 14. Impacts on natural features are discussed below and in **Sections 5.2 – 5.3**. Impacts on Aboriginal and historic heritage features are discussed in **Section 5.4**.

Bettys Creek
Subsidence impacts resulting from the proposed modification are limited to some ponding following heavy rain. The Department notes that these impacts are no greater than those predicted in the original project EA. Potential impacts on Bettys Creek are further discussed in **Section 5.2.2**.

Natural Dams (Ponds)
Natural ponds to the south-east of the proposed extraction area are located on the general floodplain of Bettys Creek and appear to be remnants of old meander channels. The proposed modification would slightly increase the volume of each of these ponds. However, the increased ponding is expected to be accommodated within existing drainage lines.

Natural Vegetation
Natural vegetation near the proposed modification area is located:
- above LWs 13, 14 and 15 adjacent to Bettys Creek;
- adjacent to the Mount Owen Rail Line and Loop;
- in the Ravensworth State Forest remnant; and
- in the Southern Remnant Biodiversity Offset Area above the north-west corner of the last longwall panel.

No significant impacts are expected in these areas of native vegetation. Any impacts are expected to be minor and no greater than those described in the original projects EA. The Department is satisfied that HVCC has appropriate management and remediation methods in place (as required under existing conditions of approval) which it would be required to implement as part of the Extraction Plan process. Potential impacts on native vegetation are also further discussed in **Section 5.3**.

5.1.4 Built Features and Potential Impacts
There are a considerable number of built features located above the proposed longwalls; however, these are predominately related to mining operations (see below). There are no major farming operations above the proposed longwalls; however, some areas are used for light grazing. There are also no known water bores or wells within the proposed modification area, other than those owned by Glencore.

Except for three surveys marks, there are no public utilities within the proposed modification area. All three survey marks would require relocation due to the potential impacts of the proposed modification and approved open cut operations at Mount Owen. There are no public amenities or industrial, commercial or business establishments within the proposed modification area, other than Glencore's mining operations.

Mine-Owned Infrastructure
While infrastructure owned by the same or a related mining entity is not normally a focus for environmental impact assessment, given the proposed interactions between surface and underground operations and the potential work, health and safety issues, the Department has considered these features in relation to any potential environmental impacts that may occur.

The major mine-owned infrastructure located within the proposed modification area includes:
- parts of the Mount Owen mine infrastructure area including coal stockpiles, dams, coal handling and train loading infrastructure;
- Mount Owen Rail Line and associated infrastructure, including the single spur line and loop, the rail and road bridges over Bettys Creek, the adjacent maintenance road, buried raw water supply line, buried communication cables and powerlines;
- Mount Owen – North Pit Open Cut and Ravensworth East Open Cut – West Pit;
- Glendell haul road;
- the Eastern Rail Pit, TP1 and TP2 tailings dams;
- emplacement areas and rehabilitated areas; and
- infrastructure related to gas drainage and agriculture.

Potential interactions with the Mount Owen North Pit Highwall are discussed in a separate section below. Potential subsidence impacts and proposed management measures for all other mine infrastructure are discussed in **Table 3**.

Table 3: Summary of predicted subsidence impacts and management measures for mine-owned infrastructure

Built feature	Potential impact	Proposed management
Mine Infrastructure Area	SCT does not expect major impacts to t infrastructure within this area. Except for a series of run-off dams, most infrastructure is in areas expected to experience vertical and horizontal movements less than 50 mm. Tilts and strains are also predicted to be small. The main dam within the rail loop is not expected to be significantly impacted by increased tilt and strain. Secondary dams which feed into the main dam may experience temporary changes due to transient tilting of the surface as the proposed longwalls undermine these features.	HVCC proposes to carry out minor remedial work, if required, to adjust gradients and restore flow paths.
Mount Owen Rail Line	Subsidence may induce tilt which could cause localised increases in gradient along parts of the rail line. The Mount Owen rail spur has experienced subsidence from previous mining of the Middle Liddell seam, however, the safety and serviceability of the rail spur has always been maintained.	The Department notes that a Mount Owen Rail Line Management Plan has recently been prepared by Mine Subsidence Engineering Consultants Pty (MSEC) for mining of LWs 13 and 14. The management plan includes requirements for regular monitoring of rail stresses with oversight by a technical committee. The Department is satisfied that, subject to the implementation of the management plan for the proposed longwalls, the rail infrastructure can be appropriately managed.
Bettys Creek Bridges	The already approved mining of LWs 13 and 14 would undermine the road and rail bridges across Bettys Creek. The proposed modification would increase vertical subsidence from 1.1 m to 1.3 m. The effects of this increased vertical subsidence are not expected to be significant. The bridges may be vulnerable to horizontal closure that may occur across Bettys Creek. However, the mining of the proposed longwalls is not predicted to significantly increase closure movements.	The road and rail bridges are included in the Mount Owen Rail Line Management Plan and subject to oversight by a technical committee. The Department is satisfied that this remains an appropriate approach to management.
Communication Cables	Communication cables above the proposed longwalls are expected to experience the full range of subsidence impacts as outlined in **Table 2**. Consistent with previous mining experience, the cables are expected to be tolerant to such movements.	The communication cables would be included in the Mount Owen Rail Line Management Plan and subject to oversight by a technical committee. The Department is satisfied that this remains an appropriate approach to management.
Maintenance Road	The road is predicted to experience the full range of subsidence impacts as outlined in **Table 2**, however this is not expected to result in any significant changes to the condition of the road. Nevertheless, minor cracks, compression humps and local changes in grade could occur.	HVCC proposes to increase its maintenance schedule during active mining and proposes the use of warning signs, regular inspections and timely remediation. The Department is satisfied with these commitments.
Embankments and Cuttings	Subsidence is predicted to cause minor cracking on rail embankments and the sides of cuttings, however, it is not expected to cause any significant instability in the rail formation.	The Department is satisfied that subsidence monitoring and regular inspections undertaken as part of the Mount Owen Rail Line Management Plan would be effective in identifying any significant stability issues that may arise.
Water Supply Pipeline	A buried raw water supply pipe that services Glendell and the Mount Owen coal handling and preparation plant runs alongside the rail line. The pipeline is expected to experience the full range of subsidence movements as outlined in **Table 2**.	Previous mining experience and technical specifications indicate that the pipeline would be tolerant to such movements.
Powerlines	Powerlines located above the proposed modification area supply power to the water management installations for the TP1, TP2 and Eastern Rail Pit dams as well as the current West Pit water management measures. The powerlines are expected to experience the full range of subsidence movements as outlined in **Table 2**.	Previous mining experience at the site indicates that single pole powerline structures are generally tolerant of subsidence movements. The Department is satisfied that, subject to the monitoring proposed by HVCC, any impacts to powerlines would be negligible.
Ravensworth East – West Pit	The proposed modification may involve secondary extraction beneath the highwall of the West Pit. Potential impacts include rockfalls along 20% of the undermined	HVCC proposed the use of warning signs and access restrictions to manage any potential safety hazards.

	highwall and cracking along 70% of this length. Cracking or instability of waste rock stockpiles may also occur. The Department notes that West Pit is currently used for tailings emplacement and water storage. Given that it is not an active mining area, the potential instability is not expected to be a significant hazard.	Furthermore, existing conditions require HVCC to prepare and implement an Extraction Plan, which would be developed in consultation with Mount Owen. The Extraction Plan would include specific asset management plans for major mine infrastructure, ensuring that appropriate safeguards are in place.
Glendell Haul Road	The haul road is expected to experience up to 1.6 m of vertical subsidence and associated tilts and strains. Potential impacts to the serviceability of the road include localised changes in grade and compression humps.	Existing conditions require HVCC to prepare and implement an Extraction Plan, which would be developed in consultation with Glendell. HVCC also proposes to carry out minor remediation works as required.
Eastern Rail Pit	The Department notes that, whilst the Eastern Rail Pit has been substantially rehabilitated, the highwall in the remaining void may experience some instability. However, as the void is being backfilled, rockfalls are not considered a significant issue.	Existing conditions require HVCC to prepare and implement an Extraction Plan, which would be developed in consultation with Mount Owen. The Extraction Plan would include specific asset management plans for major mine infrastructure, ensuring that appropriate safeguards are in place. HVCC would also restrict access to the area.
TP1/ Mount Owen Rail Loop Tailings Dam	TP1 has been substantially capped with the remaining void space used as water storage. Predicted subsidence is not expected to result in impacts on the emplaced tailings or capping, however, there is potential for transient tilting to occur.	HVCC would ensure that stored water is maintained at a low level thereby reducing any potential environmental impacts. Any potential impacts would also be managed under the Extraction Plan process, in consultation with Mount Owen.
TP2/ Mount Owen Stage 5 Tailings Dam	TP2 has been substantially rehabilitated with the remaining void acting as water storage. The highwall in the remaining void may experience some instability. Since the void is currently used for water storage, rockfalls are not considered a significant issue.	The Extraction Plan would include specific asset management plans for major mine infrastructure, ensuring that appropriate safeguards are in place.
Overburden Emplacement Areas	The overburden emplacement areas above the proposed modification area are substantially rehabilitated. These areas are predicted to experience subsidence effects with additional settlement of unconsolidated materials and the potential for cracking and increased water ingress. SCT does not predict these impacts to be significant. The Department notes that sediment dams associated with these areas may experience serviceability issues due to tilting and cracking.	The Extraction Plan would include specific asset management plans for major mine infrastructure, ensuring that appropriate safeguards are in place. HVCC would also undertake remediation works to remediate surface cracking or restore the serviceability of sediment dams.
Gas Drainage Infrastructure	The existing gas management system would be extended to cover areas above the proposed longwalls where surface access is possible.	HVCC designs its gas drainage infrastructure to accommodate predicted subsidence impacts. Management measures are in place to assist in its operation, including systems to monitor gas flow composition with provisions for alarms and safety shut-off.
Agricultural Land	Some land located above the proposed longwalls is used for grazing purposes. The proposed modification is not expected to have impacts greater than those already approved.	Any surface cracking that does occur could be easily remediated.
Access Roads and Four-Wheel Drive Tracks	There is some potential for cracks, compression humps and local changes in grade on and along the roads and tracks.	These predictions are consistent with previous experience which has been successfully managed to date.
Farm Dams	There are several small farm dams located along the south-eastern portion of the proposed modification area, and on ephemeral drainage lines to Bettys Creek.	The proposed modification is not expected to have any impact greater than those already approved.

Mount Owen Complex North Pit Highwall

A Geotechnical Assessment undertaken by SCT assessed the potential impacts of subsidence on the highwall of the Mount Owen Complex North Pit. The Department notes that there are limited examples of previous undermining highwalls of active open cut mines. However, SCT contends that mining under highwalls is analogous to mining under natural cliff formations. As such, SCT used the known mechanics of subsidence resulting from longwall mining under natural cliff formations to predict potential impacts of longwall mining under a highwall. The Department accepts this approach. SCT advised, that based on mine plans, it appears that only LW 15 would mine below an active highwall of the North Pit. These interactions are further described below.

SCT outlined a number of potential interactions between the open cut highwall and the proposed longwalls. This includes highwall and slope instability, floor heave in the floor of the open cut, decreased blast efficiency for the surface mining resulting from subsidence fracturing, blast vibration affecting the underground mine, increased potential for surface inflows into the underground mine and methane emissions into the open cut.

- *Slope Instability*

The top 60 m section of the south-western highwall has the potential to be impacted by subsidence. Except for LW 15, these impacts are likely to be minor and mainly associated with the formation of tensile cracks. The Department notes that such cracks could potentially lead to increased water ingress during periods of heavy rainfall, thereby potentially resulting in slope instability. SCT considers that minor earthworks to control inflow of water are likely to be effective controls.

LW 15 is forecast to directly mine below a 45 m high section of highwall in 2019. The main risk associated with this section of proposed mining is rock fall, with up to 10% of the highwall directly undermined predicted to be impacted.

- *In-pit Floor Heave*

Mining of LW 15 has the potential for valley closure effects to generate floor heave in the base of the open cut. However, SCT contends that the magnitude of any such impact would be small and not result in any operational inconvenience. Furthermore, floor heave events are not expected to present a safety hazard.

- *Decrease in Blasting Efficiency*

Whilst the exact effect of subsidence fracturing on the efficiency of blasting cannot be quantifed, some decrease in blast efficiency is expected. The Department is satisfied that the likely interaction does not pose a risk to the environment and is a matter that could be managed under the requirements for blasting, as set out in the existing Mount Owen development consent.

- *Blast Vibrations*

Blasting is known to cause ground vibrations which could potentially affect underground operations. Nevertheless, HVCC and Mount Owen operate in accordance with an existing management plan used to coordinate surface blasting activities with appropriate underground responses. HVCC would refine this plan to reflect the proposed modification, if approved.

- *Increase in Surface Inflows and Methane Emissions*

The reduced distance between the top of the zone of depressurisation and the base of the open cut is expected to increase the potential for downward flow of surface water into the underground mine and the upward flow of methane from the underground into the open cut. The potential for methane emissions into the Mount Owen open cut presents potential safety hazards which would require further assessment under the Extraction Plan process. Increased risk of surface inflow is discussed further in **Section 5.2**.

- *Management and Mitigation*

Extraction Plans, as already required by existing conditions, would be the main management tool for the management and mitigation of the above potential risks and hazards. The Department econsiders that the current Extraction Plan process is an effective management measure for managing and mitigating such impacts. HVCC has further committed to preparing the Extraction Plan in consultation with Mount Owen and for it to include:

- further investigations of the Hebden Thrust fault and overburden stratigraphy to confirm geometries and material properties;
- further detailed geotechnical assessments for each longwall when up-to-date surface and underground mine plans are known;
- determination of appropriate stand-off distances; and
- development of a monitoring and management plan.

The Department is satisfied that the existing Extraction Plan condition effectively covers the above commitments and that no additional changes to the scope or process of the condition are necessary.

5.1.5 Conclusion

The Department is satisfied that HVCC's subsidence assessment has used conservative assumptions and that its subsidence predictions provide a sound basis to assess the proposal's potential subsidence impacts and associated environmental consequences.

Existing conditions of approval require HVCC to assess the potential subsidence impacts on built features through the Extraction Plan process and manage them according to established performance measures. HVCC is required to consult with relevant agencies during preparation of a comprehensive Extraction Plan which must be approved prior to extraction of any longwall. The Department is satisfied that existing conditions would appropriately manage subsidence impacts to built features.

The existing conditions include strict subsidence performance measures to protect all natural and built features in the underground mining area. The Department has recommended a condition requiring offsets to be provided should unforeseen impacts occur which cannot be successfully remediated (see **Section 5.3**). The Extraction Plan must contain a detailed subsidence impact assessment and a detailed subsidence monitoring program covering all significant built and natural features. The existing framework of conditions to manage subsidence and its potential impacts has so far proven highly successful in managing and mitigating subsidence risks.

The Department has carefully considered potential impacts of subsidence on natural and built features and is satisfied that these impacts are not significantly greater than those already approved. The Department considers that the existing performance measures remain appropriate and provide adequate protection to all significant surface features in the modification area.

5.2 Water Resources

The modification would cause surface and sub-surface subsidence impacts, including cumulative subsidence impacts, which could affect a range of surface water and groundwater features. The EA contained a detailed Groundwater Assessment and Surface Water Assessment to set out the potential impacts of the proposed modification. The Groundwater Assessment was independently peer reviewed by Dr Noel Merrick (HydroAlgorithmics) who found that the model was fit for purpose and had been conducted to a very high standard.

The Department's assessment has focussed on the LWs 15-19 layout option (unless specified otherwise) as it is generally considered to lead to greater impacts due to the wider longwall panels (ie 330 m void width).

5.2.1 Groundwater Resources

Local groundwater resources are characterised by two main aquifers, namely a Quaternary alluvial aquifer system which interacts with the surrounding surface creeks, and a less productive, deeper and more saline Permian porous rock aquifer system.

The Quaternary alluvium near the proposed modification is contained within relatively thin (ie 2 – 10 m thick) Quaternary alluvial sediments along Glennies, Main and Bettys Creeks. These alluvial aquifers are all categorised as 'shallow upriver' aquifers. Bettys Creek alluvium is predominantly unsaturated, whereas Main and Glennies Creeks are more variable with the extent of saturation ranging up to 9 m for Main Creek and 6 m for Glennies Creek.

The hardrock aquifer system is characterised by low yielding hard rock aquifers separated by aquicludes and aquitards. To better understand the hydraulic conductivity of the aquifer, packer testing

was undertaken which concluded that the aquicludes and aquitards are characterised by very low hydraulic conductivities and have the effect of retarding groundwater flows.

Assessment of Impacts

- *Alluvial Aquifers*

Groundwater flow patterns within the shallow alluvial aquifers generally reflect topographic levels and the containment of alluvium within the principal drainage pathways. Monitoring data shows that the alluvial aquifers recharge from rainfall.

Water levels in Glennies Creek are generally below the groundwater table except during periods of high flow. In periods of stream flows within Bettys and Main Creeks, water is likely to seep into neighbouring alluvial aquifers.

Seepage or flow of Permian groundwater into the alluvial aquifers is a common process in the Hunter Valley. This results in reduced groundwater pressures within the hardrock aquifers and also contributes to salinity within the alluvial aquifers.

It is generally accepted that upwards discharge of saline hard rock groundwater to the alluvium in the Hunter Valley would have been historically limited, due to the low vertical conductivity of the Permian strata. Nonetheless, over long periods of time (ie millennia) salinity can build up at the base of and around the edges of alluvial sediments. During and immediately after mining, this salinity build up is impeded as a result of mine-related groundwater drawdown. However, over the long term, ingress of water from the surface and from up-gradient Permain strata eventually fills the groundwater 'void' caused by mining. Increased fracturing may then allow larger quantities of this saline groundwater to eventually rise into the alluvium, displacing the better quality alluvial groundwater.

Salinity is the key restriction to groundwater resources being utilised for beneficial purposes. None of the groundwater alluvial systems (ie Bettys, Glennies or Main Creeks alluvium) satisfy the criteria for "highly productive groundwater" under the *NSW Aquifer Interference Policy 2012* (AIP) which requires salinity to be less than 1500 mg/L and yields to be in excess of 5 L/sec.

The groundwater assessment recorded three non-mine owned groundwater bores near the proposed modification area, of which only one is active and is located on the northern bank of Glennies Creek, approximately 6 km to the south-east of the proposed longwall panels. This bore is not predicted to experience any detectable decline in groundwater levels as a result of either approved mining or the proposed modification. The Department is satisfied that the proposal is not expected to affect any private user of alluvial groundwater.

Indirect water take from the alluvial systems (ie as the underlying Permian strata become depressurised) is predicted to occur as a result of the proposed modification. However, the change in flux (ie indirect water take) due to the proposed modification alone is predicted to be less than 1 ML/year from each alluvial and surface water system, which is considered negligible (see **Figure 4**). There would be no measurable changes in drawdown within the Quaternary alluvium because of the proposed modification, mainly due to the significant depth of the proposed mining (ie 300 m to 500 m). Alluvial drawdown from approved mining is predicted to be less than one metre within the associated alluvial areas.

- *Permian Aquifers and Mine Inflows*

The Upper Permian coal measures (which are generally saline aquifers) footprint are already largely desaturated within and around the mine. Historical and ongoing open cut and underground mining within the Integra area and adjoining mining operations have created a regional zone of depressurisation within the coal measures.

The enhanced permeability induced by subsidence of strata overlying the proposed longwalls would induce inflow that would directly intercept up to 257 ML/year of groundwater from the Permian coal measures. The Department notes that this is a relatively large amount which would account for approximately one third of total inflows to the Integra Underground workings, currently predicted at 680 ML/year. This would slowly reduce to between 10% and 15% of the total inflow at the end of all approved mining.

The extent of the zone of depressurisation resulting from the modification alone would extend approximately 4 km to the north-west of the modification area. However, the zone of depressurisation that would result from the modification does not extend towards the south where approved mining is

largely complete in the Middle Liddell Seam. This assists in explaining the predicted negligible drawdown in the overlying alluvial groundwater systems of Main, Bettys and Glennies Creeks. There are no records of any non-mine owned groundwater bores extracting from the Permian alluvial aquifers within the zone of depressurisation.

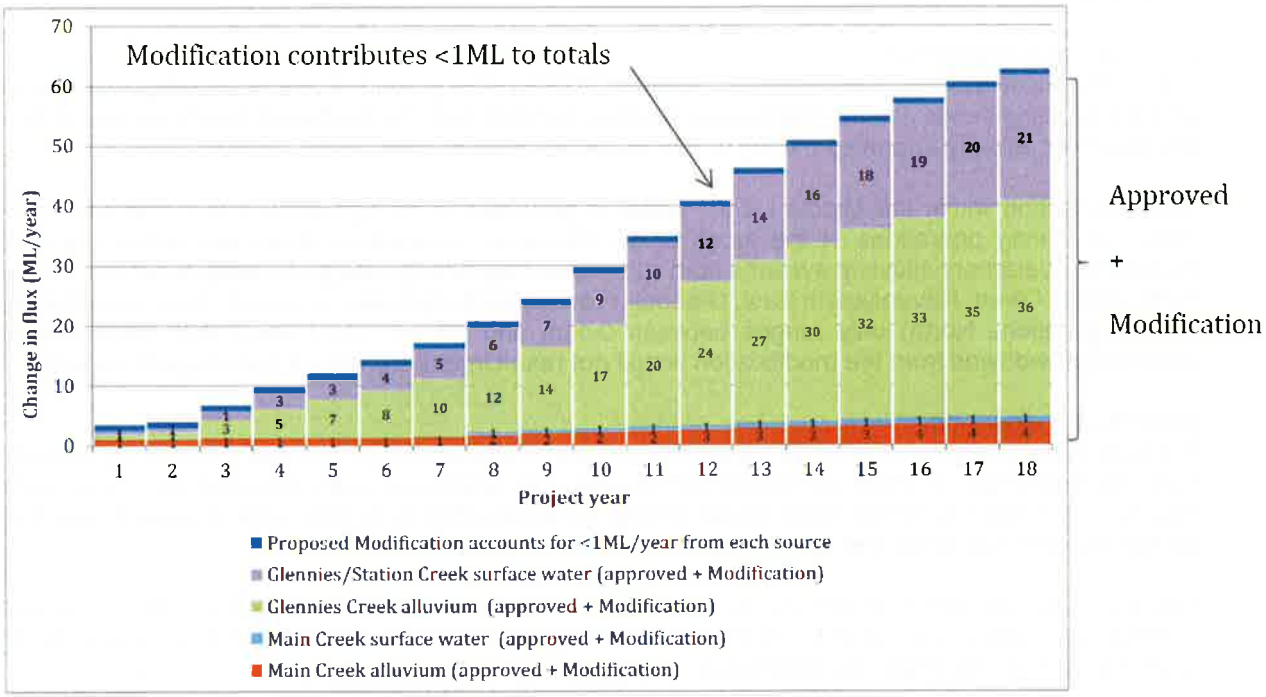

Figure 4: *Changes in groundwater flux to Quaternary alluvium and surface water systems resulting from approved mining and the proposed modification*

- *Hydraulic Connectivity*

The subsidence assessment defined the height of depressurisation as "the point at which downward vertical flow within the overburden strata can occur under the influence of gravity without the need for additional pressure". The inflow rate is then governed by the vertical hydraulic conductivity of the fracture network above the depressurised zone and the availability of a source of recharge.

Groundwater monitoring at Integra Underground indicates that the hydraulic conductivity of the subsided overburden strata is low enough for rainfall recharge to maintain the alluvial groundwater table at close to pre-mining levels, despite the disturbances and fracturing caused by subsidence.

The proposed modification is expected to significantly affect the height of depressurisation that can be expected due to greater mining height (ie 3.3 m), the proposed 257 m or 330 m wide voids and variations in overburden depth, particularly the thickness of natural ground.

Under the LWs 15-20 layout (ie 257 m void width option), the height of depressurisation is expected to be approximately 260 m above the mining horizon. Under the LWs 15-19 layout (ie 330 m void width option), it is expected to be approximately 330 m above the mining horizon Considering overburden depths generally in the range of 400 – 450 m, there is likely to be approximately 140 – 190 m between the top of the zone of depressurisation and the surface for the LWs 15-20 layout and 30 – 80 m for the LWs 15-19 layout. The Department is satisfied that broad scale hydraulic connectivity is unlikely to occur under either potential longwall layout scenario.

However, in the Ravensworth East - West Pit, the depth to the Middle Liddell Seam is approximately 270 m due to the depth of excavation in the open cut pit. The Department notes that this creates potential for the zone of depressurisation to extend through to the surface and thus potentially change the groundwater system in this location. Whilst accepting that such an interaction does not imply uncontrolled inflow from the surface to the mine, it does indicate the potential for increased inflow compared to previous site experience. The Department considers that this potential should be further assessed during the Extraction Plan process. The existing requirement for an Extraction Plan includes the preparation and implementation of a Water Management Plan which specifically requires a program to monitor and report on groundwater inflows to underground workings. HVCC must also operate under

surface water and groundwater impact assessment criteria, including the use of trigger levels for investigating any potentially adverse impacts on water resources or water quality.

- *Groundwater Dependent Ecosystems (GDEs)*

The proposed modification has the potential to alter hydrological regimes which could impact GDEs. The Department has assessed this matter further in **Section 5.3.2**.

- *Cumulative Drawdown*

Due to the highly modified landform surrounding Integra Underground, the zones of depressurisation from surrounding mines overlap with those expected to result from the proposed modification and those resulting from already approved mining at Integra Underground.

Depressurisation within the Middle Liddell Seam is predicted to be significant due to the cumulative impact of mining operations in the local region. However, cumulative drawdown within the more productive Quaternary alluvium systems from all surrounding mining (Integra Underground, Rix's Creek North, Mount Owen, Ravensworth East, Glendell, Ravensworth Operations, Liddell, Ashton and Hunter Valley Operations North) only ranges between 0.1 m and 0.5 m. The Department notes that the predicted drawdowns from the modification would not result in any significant hydrological impacts.

Groundwater Licensing

The peak volume of groundwater take predicted to be attributable to the modification requiring licensing is 257 ML/year (Year 5). When combined with already-approved operations, the peak volume would be 840 ML/year (Year 11). HVCC holds Water Access Licences (WALs) for 950 units of groundwater from the *North Coast Fractured and Porous Rock Water Sharing Plan* (WSP).

Based on 1 ML per unit of allocation, the Department and DoI Water are satisfied that the WALs held by HVCC are sufficient to cover the predicted peak volume of groundwater take of 840 ML/year for the approved mining and proposed modification.

The proposed modification is not expected to result in any measurable impacts to other water sources (either surface water or groundwater). The Department and DoI Water are satisfied that no additional water licences are required for the proposed modification.

Regardless, if additional shares are needed, the existing conditions require HVCC to have sufficient water during each stage of the development and to adjust the scale of mining operations to match its available water supply, if necessary.

Management and Mitigation

Integra Underground currently operates under a Water Management Plan, as required by existing approval conditions, which provides measures for mitigating potential groundwater impacts. Should the modification be approved, HVCC has committed to reviewing and updating its Water Management Plan to include:

- expansion of the existing monitoring network using multilevel vibrating wire piezometers to include additional sites;
- expanding the groundwater quality suite to include additional key analytes;
- continued reporting requirements; and
- validation of the groundwater model predictions every five years.

The existing Water Management Plan contains requirements for groundwater monitoring, groundwater assessment criteria (including trigger levels), a groundwater response plan and provisions to offset the loss of baseflow to watercourses. The Department is satisfied that these management measures could be applied to the proposed modification in an updated Water Management Plan. HVCC is also required to meet a performance measure of 'negligible impact' for the Glennies Creek alluvial aquifer.

5.2.2 Surface Water Resources

The proposed modification lies within the broader Bowmans Creek and Glennies Creek catchments, which are both sub-catchments of the Hunter River catchment. The proposed modification extraction area is located almost entirely within the catchment of the approved Mount Owen Complex, which covers an area of approximately 23 km² and comprises open cut pits, overburden emplacement areas, mine infrastructure and rehabilitated surfaces. The Mount Owen catchment is an internally draining catchment.

A small portion of the proposed modification lies within the Bettys Creek catchment which has previously been extensively modified by existing mining activities, resulting in a highly degraded catchment.

The previous modification for Integra Underground (ie MOD 7) integrated the Integra Underground Project into the Greater Ravensworth Area Water Sharing Scheme (GRAWSS). This expanded the scope of the GRAWSS to allow mine water generated from this Project to be beneficially used at the other sites within the GRAWSS, including Mount Owen, Liddell Mine and Ravensworth Operations.

The EA included water balance modelling to determine the impacts of the proposed modification on the Integra Underground Water Management System and the wider GRAWSS, as well as potential impacts on catchments and streams in the modification area.

Assessment of Impacts

- *Water Balance*

The results of the water balance model, including inflows to and outflows from the water management system, are shown in **Table 4**.

Table 4: *Predicted water balance*

Source	***Annual Water Balance (ML/year)***	
	Existing Operations	***Proposed Modification***
Water supplies (inputs)		
Underground mine dewatering: • Dewatered groundwater inflows (peak) • Recycled raw water supply	 292 208	 501 208
Runoff from portal sump catchment	96	96
Seepage from: • In-pit overburden emplacement area • Pit catchment	 1,095 123	 1,095 123
Total supplies	**1,814**	**2,023**
Water demands (outputs)		
Transfer of surplus water to Mount Owen Complex*	1,798	2,004
Net evaporation	16	19
Total demands	**1,814**	**2,023**
Stored water volume change	*0*	*0*

**a portion of this quantity may be transferred to Rix's Creek North Mine*

As can be seen from **Table 4**, Integra Underground would generate a surplus of mine water. This would increase from 1,798 ML/year to 2,004 ML/year as a result of the proposed modification. The greatest contributor to inflows is seepage from the overlying Rix's Creek North Mine, which accounts for approximately 1,218 ML/year. The volume of seepage would not be affected by the proposed modification.

The water balance modelling predicts that the Portal Sump has sufficient capacity to contain surplus mine water. In addition, the Department also notes that HVCC already has approval to transfer surplus mine water to Mount Owen Complex and to Rix's Creek North Mine.

Peak inflows to the Integra Underground Water Management System are predicted to increase by approximately 209 ML/year due to the modification. This increase is due to the additional mine dewatering that would be required.

All surplus water at Integra Underground must be transferred to either Mount Owen Complex or Rix's Creek North Mine. Of the additional 209 ML/year of peak inflows, the water balance predicts that approximately 206 ML/year would be transferred off-site, with the other 3ML/year being lost through evaporation.

Water balance modelling for the GRAWSS indicates that Mount Owen Complex generally experiences a deficit of process water during mining and coal processing operations. The additional 206 ML/year of mine water generated from the proposed modification would be utilised for these activities at Mount Owen Complex. The Department notes that it is therefore unlikely that additional transfers to the wider

GRAWSS or additional discharges from currently licensed discharge points would be required while active operations at Mount Owen Complex continue.

At completion of mining operations at Mount Owen Complex, the additional mine water could be utilised at Liddell Mine or Ravensworth Operations, increasing the storage inventory of the GRAWSS by 206 ML/year. During prolonged wet periods, it may be necessary to discharge excess mine water from licensed discharge points at Ravensworth Operations. The Department notes that this would represent a 2% increase in the total volume of water discharged from the GRAWSS, however, this would remain within licensing limits.

- *Catchment Yields*

The proposed modification could potentially impact on runoff volumes in the Bettys and Glennies Creeks catchments. However, the parts of the Bettys Creek catchment predicted to be affected are also within the catchment of the approved Mount Owen Complex water management system. Therefore, the Department is satisfied that the proposed modification would not result in any additional reduction to Bettys Creek catchment.

The proposed modification would result in containment of approximately 0.1 ha of Glennies Creek catchment. The Department is satisfied that this is a very minor decrease (<0.001%) in catchment size which would result in proportionate decreases (ie negligible) in catchment yield. Furthermore, no third-party water users are located along Glennies Creek downstream of Integra Underground.

- *Glennies Creek*

Glennies Creek and its tributaries (including Main Creek and an unnamed tributary) are located to the south-east of the proposed modification extraction area.

The proposed modification is not expected to result in any increase in underground water requirements (approximately 208 ML/year), and would therefore not result in any increase in abstraction of raw water from Glennies Creek.

The modification proposes the use of the C4 Dam (at Rix's Creek North Mine) for the storage of raw water, in addition to the storage capacity provided by the Process Water Dam. HVCC proposes that water captured within the C4 Dam would be used as the priority raw water supply for the modification.

- *Bettys Creek*

Bettys Creek has previously been diverted three times:

1) Upper Bettys Creek Diversion, located upstream of the Mount Owen Complex, has diverted the upper catchment of Bettys Creek into Main Creek;
2) Middle Bettys Creek Diversion, located downstream of the Mount Owen Complex and immediately upstream of the proposed modification area within the Mount Owen Complex water management complex; and
3) Lower Bettys Creek Diversion, located on the lower reach of Bettys Creek to divert flows around Mount Owen Complex.

The Bettys Creek Diversion is predicted to experience subsidence in the form of bed lowering, particularly the section of the diversion channel overlying LW 15. Indirect impacts could include sedimentation, water pooling and localised erosive processes. The Department notes that these are likely to be short-term.

Localised increases in flow velocities and shear stresses are predicted to increase by less than 0.5 m/s and 20 Newtons/m^2, respectively. These increases have the potential to increase localised bank instability within the diversion above chain pillars. Given that the diversion is located within the Mount Owen Complex final landform, it is likely to be removed or substantially altered during the rehabilitation process under SSD 5850.

The proposed electricity transmission lines and distribution lines (see **Table 1**) would cross Bettys Creek. The powerlines would span the creek channel and avoid any disturbance to the stream bed or bank. Any works within 40 m of watercourses would be undertaken in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (DPI 2007).

The proposed powerline and Goaf Dewatering Site would be located adjacent to Bettys Creek Diversion. The Department notes that previous flood modelling indicates that the 1 in 100-year flood

event is confined to the diversion channel. The Department is therefore satisfied that the proposed surface infrastructure would not encroach on the 1 in 100 flood extent of Bettys Creek.

HVCC proposes to implement appropriate erosion and sediment controls for all construction works. Under existing conditions, HVCC is required to implement an approved Erosion and Sediment Control Plan which describes measures to minimise soil erosion and potential transport of sediment to downstream waters.

Management and Mitigation
Integra Underground currently operates under a Water Management Plan, as required by existing approval conditions, which sets out measures for mitigating potential surface water impacts. Should the modification be approved, HVCC has committed to reviewing and updating its Water Management Plan to include an expanded monitoring network with additional monitoring sites.

The existing Water Management Plan contains requirements for surface water monitoring, surface water assessment criteria including trigger levels and a surface water response plan. The Department is satisfied that these management measures could be applied to the proposed modification in an updated Water Management Plan.

Having considered the water balance modelling undertaken for the modification, the Department is satisfied that:

- the GRAWSS scheme would have sufficient capacity to manage mine water transfers from the Integra Underground Project to Mount Owen Complex;
- the additional average annual inflows to Mount Owen Complex would not require any changes to the offsite discharge limits under existing EPLs; and
- appropriate controls can be incorporated into an updated Water Management Plan, such that the proposed modification would not result in significant additional risks of leakages or water storage overflows to receiving environments.

Overall the Department is satisfied that the modification is unlikely to result in detrimental impacts on nearby water resources and downstream users, and that the recommended conditions and updated Water Management Plan would provide appropriate controls for the protection of water resources.

5.3 Biodiversity

The EA was accompanied by an Ecological Impact Assessment (EIA) prepared by Cumberland Ecology, which considered the likely flora, fauna and ecological impacts of the proposed modification. This EIA included a desktop analysis of 31,416 hectare (ha) within a 10 km radius around the proposed modification area and a targeted field survey of vegetation communities and fauna habitat present. The assessment identified that the modification assessment area comprises 84.27 ha of native woodland and 470.34 ha of derived native grassland or disturbed areas.

5.3.1 Threatened Species and Communities

While no threatened fauna or flora species were recorded during field surveys, the EIA acknowledged that records for the surrounding area indicate the potential occurrence of 17 threatened fauna species and 7 threatened flora species within the assessment boundary.

The EIA identifies that the native vegetation communities within the proposed modification area generally occur as simplified, highly modified and isolated patches of open woodland. In total, the modification is predicted to result in additional (ie above that approved for the Mount Owen Complex) temporary disturbance and/or long-term removal of native woodland vegetation comprising about 0.15 ha of *Central Hunter Swamp Oak Forest* and 1.8 ha of regenerated *Central Hunter Bulloak Forest*.

Approximately 34 ha of *Central Hunter Ironbark – Spotted Gum – Grey Box Forest* was recorded within the modification assessment area. This community is listed as endangered under the *Biodiversity Conservation Act 2016* and critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. HVCC has committed to siting construction of all surface infrastructure in a manner that avoids direct disturbance to this community.

As the proposed modification relates primarily to underground mining, the direct disturbance required for the construction of surface infrastructure would be relatively minor. Overall, an additional (ie above that approved for the Mount Owen Complex) 1.95 ha of native woodland and 6.24 ha of grassland would be disturbed by the proposed modification. The Department notes that the proposed Goaf

Dewatering Site and powerlines would be almost entirely constructed within the approved disturbance area for the Mount Owen Complex. Similarly, the proposed auxiliary fans and gas drainage boreholes would be constructed in areas of grassland or within the approved disturbance area for the Mount Owen Complex.

To address the potential occurrence of threatened flora species and fauna habitat within the proposed modification area, the Department has previously recommended that HVCC be required to undertake pre-clearance surveys at appropriate times to identify key flora species and fauna habitat features, which could then be avoided where practicable. Where disturbance is necessary, translocation of particular species could be undertaken in accordance with an updated Biodiversity Management Plan. The Department and OEH are satisfied that the likelihood of significant long-term impacts on derived native grassland areas and associated threatened species is very low and is manageable through implementation of the mitigation measures already contained in conditions.

The surface area located above the proposed longwalls would be subject to surface and sub-surface subsidence impacts. Indirect impacts to biodiversity values could occur because of subsidence and could include alteration of hydrological regimes (see **Sections 5.2.1** and **5.2.2**), habitat fragmentation, edge effects and erosion and sedimentation (see **Section 5.2.2**).

5.3.2 Groundwater Dependent Ecosystems

Central Hunter Swamp Oak Forest is a riparian vegetation community which occurs within the modification assessment area along Bettys Creek. This community is classed as a "Terrestrial Vegetation" GDE.

Some direct disturbance (approximately 0.15 ha) is predicted to occur due to the construction of powerlines across Bettys Creek. The Department is satisfied that this is a minor impact and is unlikely to affect the long-term survival of the vegetation community. Furthermore, appropriate mitigation and management would further lessen any adverse impacts (see **Section 5.3.3**).

Underground mining has the potential to indirectly disturb GDEs via alteration of hydrological regimes. However, given the significant depth of mining (ie up to 500 m), the proposed modification would result in 0.25 m of drawdown, which is not predicted to induce any significant impact on alluvial aquifers (see **Section 5.2.1**) or GDEs. Furthermore, impacts on stream baseflow are predicted to be negligible (see **Sections 5.2.1** and **5.2.2**). The Department is therefore satisfied that the subsidence impacts of the proposed modification would not result in any significant impacts to GDEs.

5.3.3 Avoidance, Mitigation and Management

To avoid impacts to biodiversity, HVCC has limited the new surface infrastructure area to the smallest practicable extent, within technical constraints. The specific location of surface infrastructure would be determined during post-approval mine planning and engineering studies. HVCC emphasises that this flexibility would allow for optimised avoidance of impacts on threatened flora and fauna.

Where impacts to flora and fauna cannot be avoided, HVCC has proposed mitigation and management measures which are in accordance with the site's existing Biodiversity Management Plan, including:

- a vegetation clearance protocol, including pre-clearance surveys and procedures;
- collection of habitat features (eg tree hollows) for reinstatement in rehabilitation areas;
- ongoing management of weeds and pest animals;
- rehabilitation of temporary infrastructure sites;
- remedial works for impacts to creek lines arising from subsidence;
- maintaining hydrological function and fauna passage in the creeks and riparian zones during construction; and
- monitoring of riparian and revegetated areas.

The existing Biodiversity Management Plan reflects conditions of approval and contains requirements for fauna and flora monitoring and corrective measures in the event of adverse impacts. The Department is satisfied that these management measures could be reflected in an updated Biodiversity Management Plan.

HVCC has argued that this flexible design, the minimal amount of woodland to be cleared, the relatively young nature of woody vegetation present within the disturbance boundary and the mitigation measures proposed in the EA mean that the proposed modification would not result in any significant ecological

impacts. Consequently, HVCC considers that there is no need to provide biodiversity offsets for the modification. Nonetheless, HVCC has committed to like-for-like compensatory planting to compensate for the removal of established trees within areas predicted to be impacted by the proposed modification area (ie excluding areas that are approved to be disturbed by the Mount Owen Complex).

Consistent with the approach taken for recent assessments of tailings pipelines and electricity transmission line infrastructure at Integra Underground and Mount Owen, the Department considers that the biodiversity impacts of the proposed modification can be addressed by implementing detailed measures under the Biodiversity Management Plan to avoid vegetation clearance wherever possible and provide compensatory plantings for any mature vegetation cleared for the proposed modification.

To this end, the Department has recommended conditions requiring HVCC to plant and maintain 10 like-for-like trees for every mature tree that is cleared as part of the proposed modification, along with conditions requiring that any areas of temporarily disturbed land are replanted and rehabilitated in a timely manner.

OEH, in its submission on the EA, further recommended that any unpredicted subsidence effects or impacts that adversely affect threatened biodiversity should be offset. The Department notes that such conditions are now standard across underground development consents. The Department has therefore recommended a condition to this effect.

OEH has reviewed the Department's recommended conditions. The Department and OEH are satisfied that the recommended pre-clearance surveys, mitigation and management measures, rehabilitation requirements and additional compensatory plantings are sufficient to account for the proposal's biodiversity impacts. The Department considers that these requirements could be readily reflected in an updated version of the existing Biodiversity Management Plan.

5.4 Other Impacts

The Department has considered the other potential impacts of the proposed modification, and has summarised this consideration in **Table 5**.

***Table 5**: Assessment of other issues*

Issue	*Consideration*	*Recommendation*
Noise	• The EA included a Noise Assessment, undertaken by Bridges Acoustics. The assessment focused on the construction and operational noise levels that would be generated by the modification, in accordance with the relevant guidelines. • The nearest privately-owned sensitive receiver is identified as Residence 80 in the project approval. All other private residences are located further from the proposed modification and are less affected by noise enhancement resulting from prevailing winds. • The Department notes that Residence 80 is subject to acquisition on request under existing project approval conditions. Nevertheless, construction noise levels at Residence 80 are predicted to remain within the 'noise affected' level of 40 $L_{Aeq,\ 15min}$ as recommended by the Interim Construction Noise Guidelines. • The overall construction period is predicted to last for approximately 12 months. • Operational noise levels indicate no significant potential for noise associated with the modification to exceed operational noise criteria.	• It is considered that no changes to the existing operational noise criteria are necessary. • The EPA made a number of recommendations in regard to noise which the Department has considered and is satisfied are covered by existing conditions of approval. • The Department is satisfied that current conditions adequately regulate the predicted noise impacts of the modification. • Nevertheless, the Department has recommended specific reference to the proposed modification in condition 2A of Schedule 3, which relates to the management of construction noise.
Aboriginal and Historic Heritage	• The EA included an Aboriginal and Historic Heritage Impact Assessment (AHHIA) prepared by OzArk Environmental and Heritage Management (OzArk).	• The Department has carefully reviewed existing conditions and notes that they were

	• The AHHIA identified that the modification area contains six previously recorded Aboriginal cultural heritage (ACH) sites and one unlisted historic heritage site. • A field survey did not identify any new sites within the proposed modification area. • MOCO OS-6 (37-3-1194) is located to the east of an existing access track which is within the indicative easement for the 66 kV powerline. Avoidance of this site could be achieved by siting the powerline to the western side of the access track and within an existing disturbed area. None of the other Aboriginal heritage sites are expected to be impacted by surface disturbance. • Four of the Aboriginal heritage sites are expected to experience subsidence movements including surface cracking and/or water pooling. However, the types of sites located within the proposed modification area (ie artefact scatter or isolated find) are generally not sensitive to subsidence effects. • OzArk's assessment noted that the historic heritage site is not listed on relevant heritage registers and concluded that it did not have heritage significance. • Overall, the Department is satisfied that the modification would not materially affect heritage items and that the management of potential impacts could be achieved under an updated Integra Underground Heritage Management Plan.	modified in the approval of MOD 7 to strengthen provisions for protecting Aboriginal heritage items from both direct and indirect harm. • The conditions for the Integra Underground Heritage Management Plan were also updated to reflect the need to avoid (as far as practicable) and otherwise manage ACH on site, and to implement an ACH education program for all personnel and contractors involved in construction or surface disturbing activities. • The Department is satisfied that the recently updated conditions are adequate to monitor and manage heritage impacts. No further changes to conditions are recommended.
Air Quality	• The EA included an Air Quality and Greenhouse Gas Assessment (AQGGA) undertaken by Jacobs. • The construction of surface infrastructure would result in minor dust generating activities for around 12 months. • The EA identified that, without adequate controls, these construction works have the potential to generate low to medium air quality impacts and proposed dust mitigation measures to manage and mitigate these impacts. • However, this construction-generated dust would make a very minor addition to existing background dust levels (including mine generated dust) in the region. • Potential impacts would be further limited by HVCC's proposed mitigation and management measures which include progressive rehabilitation, treatment of unsealed roads, restricting vehicle speeds, minimising disturbance areas and monitoring. • The Department is satisfied that the air quality impacts of the modification could be effectively managed under the site's existing Air Quality and Greenhouse Gas Management Plan.	• No change to existing conditions.
Traffic	• The EA included a Traffic Impact Assessment (TIA) which considered the performance of key roads and intersections by comparing the projected construction traffic to existing traffic volumes. • The Department notes that the proposed modification would not alter the operational workforce or the approved duration of mining operations. An assessment of impacts during the operational phase is therefore not considered necessary. • During the modification's construction phase, vehicles would access the site via Middle Falbrook Road (the existing access), Hebden Road (via Mount Owen Complex), Glennies Creek Road or Forest Road. • During peak periods of construction, the proposal would generate approximately 68 vehicles/day, with approximately 14 vehicles/hour during the AM and PM peak hours. • The TIA concluded that the proposal represents a negligible increase to existing traffic volumes and would	• RMS recommended that HVCC be required to prepare and implement a Construction Traffic Management Plan. The Department agrees with RMS and has recommended a condition to such effect. • RMS provided advisory comments regarding the intersection of Bridgeman Road and Stony Creek Road. HVCC noted that it has consulted with Singleton Shire Council regarding the potential traffic impacts of the proposed modification. No issues were raised by Council regarding this

	not significantly affect the performance of key intersections. • The construction of a new access intersection along Middle Falbrook Road would improve operational efficiency and safety along this road. The new intersection and access road would be designed and constructed in accordance with the relevant Australian standards. The proposed works would be undertaken pursuant to approval by Singleton Shire Council under Section 138 of the *Roads Act 1993*.	intersection. Furthermore, the Department did not receive a submission from Council.
Visual	• The proposed surface infrastructure is to be located on land owned by subsidiaries of Glencore and would be within the boundary of the Mount Owen Complex. • As such, the proposed surface infrastructure would be consistent with the existing visual character of the area. • The proposed powerlines are the only surface infrastructure component that has a significant height dimension. • The proposed powerlines would follow the eastern extent of Glendell Mine before entering the Forest Road Ventilation Site. • The proposed powerlines may be visible from Forest Road which is a local road that is generally only used for access to mine infrastructure.	• No change to existing conditions

6. CONDITIONS

The Department has drafted a recommended Notice of Modification (see **Appendix D**) and a consolidated version of the approval as it is proposed to be modified (see **Appendix E**). The Department considers that the environmental impacts of the proposal can otherwise continue to be managed through existing conditions of approval.

The Department has also taken the opportunity to recommend some minor administrative changes to update existing conditions and reflect the Department's current drafting standards.

HVCC has considered the recommended conditions and has not raised any objections.

7. CONCLUSION

The Department has assessed the merits of the proposed modification in accordance with the requirements of the EP&A Act. This assessment has shown that, with the implementation of minor amendments to existing conditions, coupled with HVCC's proposed mitigation measures and required amendments to existing management plans, the proposed modification can be carried out with limited and acceptable environmental impacts.

The proposed underground longwall mining can be carried out economically and is a relatively straightforward variation to existing approved underground operations at Integra Underground.

Following on from its assessment of the project, the Department of Planning and Environment considers that the project is approvable, subject to the proposed conditions of approval (see **Appendix D**). This assessment report is hereby presented to the Independent Planning Commission of NSW for determination.

Recommended by:

Howard Reed 8.3.18

Howard Reed
Director
Resource Assessments

Recommended by:

9/3/18

Oliver Holm
Executive Director
Resource Assessments and Compliance