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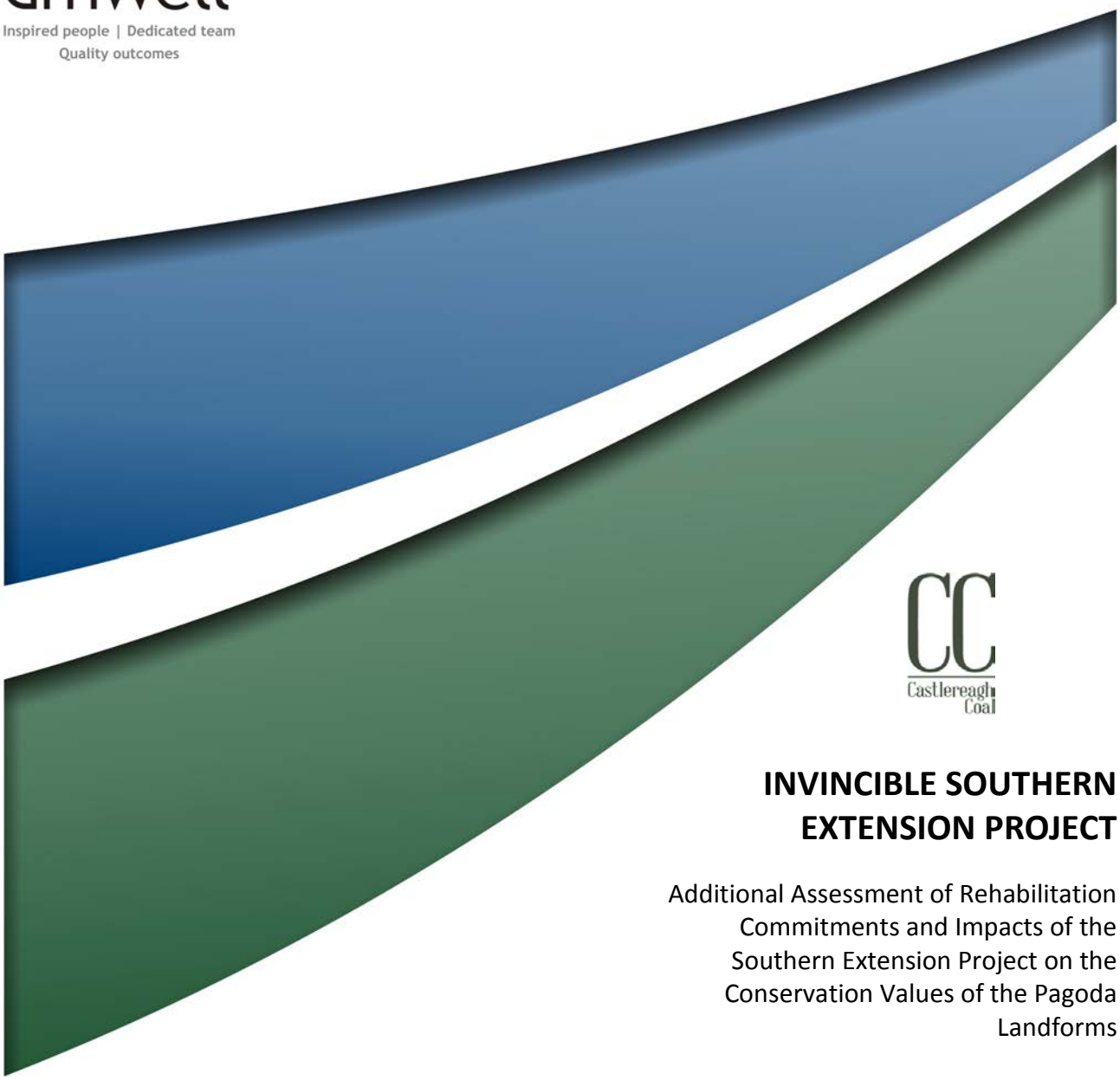

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Castlereagh Coal

INVINCIBLE SOUTHERN EXTENSION PROJECT

Additional Assessment of Rehabilitation Commitments and Impacts of the Southern Extension Project on the Conservation Values of the Pagoda Landforms

FINAL

July 2017

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1.0 Introduction

1.1 Background

The Department of Planning and Environment (DP&E) has sought further information regarding the mining of parts of the eastern area of the Southern Extension Area. DP&E have a recommendation as part of the draft conditions of consent for the restriction of mining within a significant proportion (approximately 14ha) of the proposed 49ha Southern Extension Area. The area identified in the draft recommendation aligns to an area identified as Final Landform Option 3b from the previous assessment of final landform options dated June 2017 (Final Landform Option report).

It is noted that Final Landform Option 3b was identified in response to DP&E's request to examine options for avoiding mining areas of steeper slope within the Southern Extension Area. As detailed in the Final Landform Option report the potential restriction of mining in this area would have a significant impact on the viability of the Southern Extension Project in terms of supplying target nut coal to Shoalhaven Starches. Further the additional overburden from this area would enable the achievement of a comparatively more effective final landform across the entire Invincible mine site. As has been reinforced through the Environmental Assessment (EA) and subsequent response reports, the achievement of a more effective final landform across Invincible is not a justification, nor a primary driver, for the Southern Extension Project, however there are substantial positive impacts associated with mining the full extent of the Southern Extension Area on achieving a stable final landform.

As detailed in Final Landform Options report, there are viable options for the further refinement of the conceptual final landform presented in the EA, that further reduce slopes within the Southern Extension Area to below 20^{o} through the use of surplus overburden from mining within the Southern Extension Area (identified as Final Landform Option 1 within the Final Landform Options report). Final Landform Option 1 is the preferred final landform option for the Southern Extension Project.

Final Landform Option 1 demonstrates that with further refinement through detailed design, and approval through the Mining Operations Plan (MOP) process with the NSW Department of Energy and Environment, Division of Resources and Energy (DRE) (now the Division of Resources and Geosciences (DRG) in the DP&E), these slopes could be further refined to be generally less than 18^{o} as was committed to in the EA (refer to Table 6.37 of the EA).

Of critical importance is the fact that DRG have not raised any issues in relation to the proposed mining and subsequent rehabilitation of the Southern Extension Area as detailed in the EA. In its latest submission on the Southern Extension Project, dated 29 March 2017, DRG (then DRE) stated:

> *"DRE has determined that the Proponent has adequately identified and addressed the assessed risks to environmental sustainability and that sustainable rehabilitation outcomes can be achieved as a result of the project.*
>
> *DRE has determined that sustainable rehabilitation outcomes can be achieved as a result of the project and that any identified risks or opportunities can be effectively regulated through the conditions of mining authorities issued under the Mining Act 1992.*
>
> *In particular, DRE is satisfied that the Project has the capacity of material to fill all current voids and the proposed southern extension and the site being reshaped and rehabilitated back to the required final land use outcome(s)."*

Notwithstanding, in response to the draft conditions of consent, DP&E has requested further justification for mining in these areas of proposed mining restriction having regard to the following issues:

- concerns regarding the ability to rehabilitate areas where pre-mining slopes exceed 20°
- the proposed restriction on mining of these pre-mining slopes of greater than 20° would also restrict:
    - disturbance to areas greater than 300m of a slaty pagoda formation, noting that the previous PAC Determination to refuse the Coalpac Modification Project had relied on comments from the earlier PAC Review Report on the Coalpac Consolidation Report relating to the imposition of setbacks to avoid impacts to pagoda structures and associated values, including impacts on the landscape values identified as warranting the 'highest level of protection'
    - visibility of the proposed Southern Extension Project from the Castlereagh Highway and
    - the overall cumulative effect of the above issues.

The above issues are dealt with directly in the EA for the Southern Extension Project. As extensively detailed in the EA and subsequent responses, the Southern Extension Project has been designed in consideration of the key determinative matters previously raised through PAC assessment and determinations on previous mining proposals at Invincible. Specifically, this has included the siting and design of the Southern Extension Project to minimise potential impacts on areas of comparatively diverse ecological and habitat value to the north-east of the existing Invincible mine site. Specifically this is detailed in Sections 1.3 (Project design), Section 3.7.3 (Design refinements of the Southern Extension Project), Section 6.2.3 (Compatibility with surrounding land uses), Section 6.8 (Blasting), Section 6.15 (Visual) and Section 6.18 (Rehabilitation) of the EA. These issues are further addressed in the Response to Submissions Report Part A, in particular Section 3.2 (Conservation).

Further information was provided to DP&E dated 10 May 2017, which included a detailed justification for mining within 300m of the closest pagoda structure, and other geo diverse features including an isolated cliff line. The proposed mining within 300m of the pagoda structure is justified on the basis that the proposed Southern Extension Project delivers higher net benefits for the State than the Southern Extension Project would with the incorporation of the 300m exclusion. In addition, the loss of the target resource in this area would significantly impact on the viability of the Southern Extension Project to provide the nut coal supply required for the Shoalhaven Starches Plant and limit the ability to supply Mount Piper with coal for energy production. Furthermore, the loss of the overburden as a result of restricting mining in this area would reduce the ability to utilise this material in the rehabilitation of the entire Invincible mine site as detailed in the EA.

It is important to note that the Southern Extension Project is substantially different to previous proposals for mining at this site. Specifically, the Southern Extension project involves:

- Open cut mining in a substantially smaller targeted area then previous proposals, being only 49 hectares (ha) of total disturbance area, 90% less than the 794 ha of disturbance previously proposed by previous proponents for the Consolidation Project and 60% less than the 152 ha proposed in the Modification 4 Project.
- Substantially less proposed open cut area within 300m of Pagodas and Geodiverse structures, being only 6 ha compared to the 456 ha proposed in the previous Consolidation Project and 57 ha in the Modification 4 Project.

The previous determination of the 300m setback was largely based on identified impacts to a range of threatened species, notably the Broad-headed snake. It is also of relevance to note, that the previous assessment and determination by the PAC was undertaken without the aid of a quantitative framework for the assessment of biodiversity impacts and associated mitigation options. For the Southern Extension Project this is now provided by the NSW Framework for Biodiversity Assessment process.

The Office of Environment and Heritage (OEH) have provided in principle agreement to proposed offsetting for potential impacts on assumed Broad- headed snake habitat, which is linked to the pagoda structures in proximity to the Southern Extension Area. Specifically, OEH submission on the EA dated 4 November 2016 stated:

> *"The Broad-headed Snake was not recorded within the Southern Extension Area. The BAR indicates that while winter refuge habitat does not occur within the Project Area summer foraging habitat does occur. As the closest known record is 1.5 kilometres to the north-east of the Project Area a precautionary approach has been adopted and it has been considered that the species may occur in what has been described as marginal habitat within the Southern Extension Area.*
>
> *Tree hollows within 500 metres of sandstone outcrops were buffered by 24 metres to map the potential summer habitat for the Broad-headed Snake within the Southern Extension Area.*
>
> *OEH supports the approach taken to determine the offset requirement for the species."*

Further to this, OEH provided confirmation in correspondence dated 2 June 2017 for the use and quantum of offsets for the Broad- headed snake, stating

> *"The total cost of the supplementary measure calculated and supported by OEH for the required 388 credits is $194,000."*

In this regard, the key merit issue underpinning the previous PAC's imposition of a 300m has been effectively dealt with as part of the Southern Extension Project.

1.2 Overview of Response

This report provides further information regarding the specific issues raised by DP&E and the project justification more broadly. Specifically, this report details the practicalities of the proposed rehabilitation of the full extent of the Southern Extension Area, to demonstrate that the mining and rehabilitation of the identified areas of steeper slopes can be achieved as the risks have been identified and can be managed, as previously agreed by DRG. Furthermore, the proposed mining of the full extent of the Southern Extension Area is considered to result in a comparatively more effective final landform, in the context of contributing to an improved final landform and minimising medium to long term landscape impacts relative to the existing approved final landform.

The report also examines the primary material that has given rise to the findings and recommendations made by the PAC in relation to the Coalpac Consolidation Project and the Coalpac Modification Projects. The report examines how this material relates to the protection of pagoda structures and associated landforms as it relates to the Southern Extension Project.

It is noted that whilst each of these former projects also included mining in the Southern Extension Area, there are significant differences between those earlier projects and the Southern Extension Project.

Differences in terms of the magnitude of potential impacts, nature of impacts and the assessment policies applicable to the approval projects means the driver for the 300m setback from pagodas for the earlier projects has limited applicability to the Southern Extension Project. As is outlined in subsequent sections, the Southern Extension Project's impacts on the high conservation value of the pagoda landforms are temporary and limited in terms of their magnitude over the short term.

2.0 Mining and Rehabilitation of Steeper Slope Areas.

In general terms, it is acknowledged that open cut mining in steep terrain has the potential to cause up-slope instability through the loss of buttressing. Mining of steep slopes can also present difficulties in re-establishing a final landform due to, predominately, erosive risks associated with the re-establishment of steep slopes in the final landform, but also physical constraints in recreating the final landform due to technical limitations for plant operating in steep slope environments. In the context of the Southern Extension Project these potential issues are discussed below.

2.1 Slope Stability Concerns

As has been demonstrated by the mining of the West Pit Area at Invincible, it is possible to mine steep slopes (defined as being greater than 20°) with no impacts on slopes up slope from the mined area. The Southern Extension Area does not present the same constraints as were present in the West Pit Area in terms of steep slopes above the mining area. The areas of steep slope within the Southern Extension Area, and the terrain directly above is generally flat or gently sloping as it forms part of the ridge crest. Parts of the Southern Extension Area will abut steep slopes (particularly the southern faces of the two ridges on the eastern side of the Southern Extension Area) however these areas do no slope towards the pit and instead slope towards the east-west running drainage lines. This is significant in that areas up slope from the pit edge in the Southern Extension Area do not rely on the buttressing provided by the downslope area being mined and therefore do not pose a risk of slumping towards the pit.

While the geotechnical stability of the slope would require monitoring, the past experience from mining at Invincible indicates there are no geotechnical concerns regarding the mining of a number of areas of steeper slope within the existing mined areas of Invincible. This conclusion is supported by the Geotechnical assessment provided with the Response to Submissions Report A for the Southern Extension Project, which determined that existing highwalls have all been identified as being geotechnically stable.

2.2 Ability to Rehabilitate the Southern Extension Area

Section 6.18 of the EA specifically details the rehabilitation strategy for the Southern Extension Project and includes specific criteria and objectives for this rehabilitation. Of note is the commitment that rehabilitation would result in slopes that do not (over the length of the slope) exceed 18°. This is consistent with other approved open cut mining proposals in NSW and would be achieved through further detailed planning and refinement of the conceptual final landform outlined in the EA and in accordance with the MOP/Rehabilitation Management Plan approval process with DRG.

The Final Landform Options report for the Southern Extension Area identified refined preferred final landform option (Final Landform Option 1) which results in slopes of less than 20° across the proposed final landform. While the pre-mining landform in these areas included slopes of up to 35°, the eastern parts of the Southern Extension Area contain higher stripping ratios (in the order of 10:1) meaning for the overall Southern Extension Project there is a surplus of overburden material relative to that required to rehabilitate the Southern Extension Area back to the pre-mining landform and to fully rehabilitate the remainder of the existing Invincible mine site with no or only minimal disturbance of existing rehabilitation.

This surplus can be used to extend the slope length of the rehabilitated ridgelines in the eastern parts of the Southern Extension Area such that the rehabilitated final landform can be developed to have slopes not exceeding 18° (refer to Final Landform Option 1 in the Final Landform Options report).

Final Landform Option 1 is technically feasible and can be achieved with low erosion risk through the incorporation of conventional drainage controls, which would be further detailed in relevant management plans for the Southern Extension Project (i.e. Water Management Plan and Rehabilitation Management Plan). As supported by the submission from DRG, the potential risks for achieving the proposed EA final landform across the Southern Extension Area have been identified and there is a high degree of confidence regarding the ability to successfully rehabilitate the eastern parts of the Southern Extension Area such that the final landform and vegetation communities in this area would be difficult to discern from the adjacent un-mined areas over the medium term (30-50 years) as committed to in the EA.

Rehabilitation of the former West Pit Area at Invincible was identified by DP&E as a reason why mining and rehabilitation may be problematic in the steeper parts of the eastern side of the Southern Extension Area. The issues associated with the rehabilitation of the West Pit Area are further assessed in the Final Landform options report. In summary, the key differences in the context of rehabilitation are:

- The presence of the conservation area (as established under the existing Invincible project approval) below the West Pit Area and the steep slopes above, coupled with the steep rehabilitated landform in this area presented operational constraints for the spreading of topsoil and salvaged timber and rocks. This in-turn resulted in slow establishment of vegetation in the reformed landscape. These physical constraints do not apply to the Southern Extension Area and the rehabilitated landform will have significantly lower slopes than the steepest areas in the West Pit Area (as detailed in the Final Landform Options report). The proposed slope design in Final Landform Option 1 is amenable to being properly worked with dozers and there is a high degree of confidence in the ability to rehabilitate these slopes.
- The West Pit Area is a prominent part of the visual landscape for vehicles travelling north along the Castlereagh Highway adjacent to the existing Invincible mine site. Exposed mining areas and the slow-to-rehabilitate West Pit Area are visually prominent and still remains so, several years after rehabilitation has commenced. This is contrasted to other lower slope areas of the West Pit where shrub and tree growth is already providing significant visual impact mitigation. As shown in Figure 6.33 of the EA, parts of the north facing slopes in the eastern areas of the Southern Extension Area will be visible for a short section of the Castlereagh Highway for vehicles travelling south, over 2 km north of the Southern Extension Area. While visible, these areas will occupy a significantly smaller field of view than the West Pit Area does for north travelling vehicles and will be less visually prominent.
- The north facing slopes in the Southern Extension Area, which would be visible, have generally lower slopes than the southern sides of the steep slope areas (around 15°) and the rehabilitation of these slopes poses less technical difficulties than the slightly steeper south facing slopes in this area. It is noted that the steeper southern facing slopes of the Southern Extension Area are not visible from areas surrounding the Southern Extension Area aside from intermittent views from the Castlereagh Highway and from isolated areas within the Ben Bullen State Forest. As detailed in the EA, these views are largely either shielded by existing vegetation along the Castlereagh Highway, or are less than the current visibility of the existing Invincible mine site. As the Southern Extension Project includes the progressive rehabilitation of the Southern Extension Area, the visual impacts associated with visible areas of the northern side of these slopes will be short term in duration and visual signs of mining in the Southern Extension Area from the Castlereagh Highway will be minimal within a short duration after mining is completed.

Visual impacts in relation to the conservation/landscape value of the pagoda landforms are discussed further in **Section 3.3**.

Overall, there are no technical reasons why the eastern parts of the Southern Extension Area cannot be rehabilitated successfully. As outlined previously, the submissions from the DRG, who regulate rehabilitation of mine sites under the *Mining Act 1992*, did not raise any concerns regarding the ability to rehabilitate the Southern Extension Area and did not raise any objections to the proposed Southern Extension Project subject to the following:

- *Progressive rehabilitation of disturbed area should be a requirement of the activity approval.*

- *Proponent to submit a Progressive Rehabilitation Proposal as part of Mining Operations Plan/Rehabilitation Management Plan outlining rehabilitation works to be undertaken during the term, including timeframes when activity will be undertaken. This should form part of a 'Statement of Commitments' for approval prior to commencement.*

- *Rehabilitation of the proposed Southern Extension Area and all existing disturbance areas at Invincible (by reshaping mining areas to remove voids and revegetating the reshaped landform with locally endemic woodland and forest communities) is to be detailed in a new Mining Operations Plan (MOP)/Rehabilitation Management Plan (RMP) prepared in accordance with the Division's Guidelines.*

As discussed in Section 6.17 of the EA, the detailed design of the final landform and rehabilitation practices require approval under the MOP/Rehabilitation Management Plan required under the Mining Leases applicable to the Invincible operations. The MOP/Rehabilitation Management Plan will include rehabilitation monitoring requirements and Trigger Action Response Plans appropriate to ensure timely action is taken in the event that rehabilitation practices do not fully meet desired outcomes. The MOP/Rehabilitation Management Plan must be approved by the Secretary of the Department of Planning and Environment prior to any mining operations in the Southern Extension Area commencing and this approval process would necessarily consider details of the approach to the rehabilitation of the eastern part of the Southern Extension Area.

Further, security will be required under the terms of the Invincible Mining Leases to cover the anticipated rehabilitation costs associated with the rehabilitation identified in the MOP. The approach to calculating anticipated rehabilitation costs was updated in 2017 and the approval process of the MOP for the Southern Extension Project will required an updated rehabilitation cost estimate for the entire Invincible site using the new approach. In addition to the above measures, annual reporting of rehabilitation is required under the terms of the Mining Lease and project approval and regular audits of operations by both regulators and independent auditors are carried out. The combined effect of these regulatory processes is that there is greater scrutiny over the implementation of rehabilitation commitments and appropriate mechanisms in place to ensure appropriate action is undertaken, if required.

2.3 Rehabilitation Implications for the Existing Invincible Disturbance Area.

The PAC Determination Report for the Coalpac Modification Report identified that that project could not be justified on the basis that it is required to meet the existing rehabilitation commitments for existing approved disturbance at Invincible. As the PAC noted, Coalpac (then) and Castlereagh Coal (now) are required to meet the rehabilitation requirements for the Invincible site irrespective of whether proposals for additional mining are approved. This has been understood and reinforced by Castlereagh Coal through the EA and again through the Response to Submissions Report Part A. Notwithstanding, the proposed mining of the full extent of the Southern Extension Project provides an opportunity for the development of an improved final landform across both the Southern Extension Area and the existing Invincible mine site.

This has a range of benefits such as improving the overall final landform across the Invincible site, as well as avoiding the need to disturb existing rehabilitated areas and other areas of approved disturbance at Invincible.

The following sections discuss the benefits associated with the Southern Extension Project and detail the impacts associated with meeting the existing rehabilitation commitments under the current Invincible Project approval, and the relative merits of Final Landform Option 3b as identified in the Final Landform Options report (and utilised by DP&E to define an area of striction on mining).

2.3.1 Relative Merits of Southern Extension Project on Rehabilitation Outcomes

While the Southern Extension Project is not required to rehabilitate the existing Invincible mine site, it will result in significantly better rehabilitation outcomes across the Invincible mine site, if the full extent of proposed mining within the Southern Extension Area is approved. The benefits in terms of rehabilitation outcomes are as follows:

- The surplus overburden (refer to **Section 2.3.3**) associated with mining the full extent of the proposed Southern Extension Area enables:
    - existing voids to be filled with minimal disturbance of established rehabilitation and avoids the disturbance of currently vegetated and undisturbed steep slope areas to the south of the Eastern Void, which is currently authorised under the existing consent (refer to **Section 2.3.2**)
    - reduced slope grades in rehabilitation areas across the Invincible mine site
- The removal of future and ongoing subsidence impacts in the Southern Extension Area associated with past mining in the Ivanhoe No. 2 Underground (as detailed in Section 3.7.1.2 of the EA) and
- The rehabilitation timeframe can be progressed in a timely manner due to it be undertaken progressively as part of the Southern Extension Project, which seeks to complete the filling of the exiting voids early in the life of the Project (aside from the Northern and Eastern voids which are required for operational water storage) as detailed in the EA.

While mining the Southern Extension Area involves additional disturbance, this disturbance is in areas that have lower biodiversity richness than the areas within and adjacent to the areas necessary to disturb as part of the approved Invincible rehabilitation. Further, the Southern Extension Project only involves additional disturbance in the Southern Extension Area and the small areas between the Southern Extension Area and the South Pit that is currently approved to be disturbed as part of the existing operations (refer to **Figure 2.1**). This is in contrasts to the Previous Coalpac Modification Project (and, to a greater degree, with the Coalpac Consolidation Project) which included mining to the east of the Eastern Void (refer to **Plate 1**) and north of the Northern Void comprising approximately 57ha of areas of higher biodiversity richness and considerable visual character. Unlike the previous projects and existing Invincible open cut mining areas, the additional impacts associated with the Southern Extension Project do not encroach further on the more spectacular and visually prominent pagoda formations (refer to **Plates 1, 2** and **3**). The pagoda formations to the east of the Southern Extension Area are much smaller in scale and are not visually prominent in the landscape. As can be seen from the Visual Montage in Figure 6.33 of the EA, there are no pagodas visible in the landscape to the south and east of the Southern Extension Area.

The Southern Extension Project does not encroach on the higher biodiversity value gullies in the escarpment located between the pagodas and clifflines. Further, the biodiversity impacts associated with this additional disturbance in the Southern Extension Area will be fully offset in accordance with the NSW Framework for Biodiversity Assessment process which includes specific considerations of potential impacts on threatened species (refer to **Section 3.2.2**).

Accordingly, while the better rehabilitation outcomes of the existing disturbance at Invincible comes at the expense of biodiversity impacts in the Southern Extension Area, the improved landscape outcomes in relation to higher conservation value areas is considered to outweigh these costs, particularly given the biodiversity impacts themselves are fully offset in accordance with the NSW Framework for Biodiversity Assessment process. To the extent that there are additional impacts on the landform adjacent to the pagoda landscapes to the east of the Southern Extension Area, these impacts will be temporary and will not impact on the long term conservation values of the Ben Bullen State Forest area.

2.3.2 Impacts Associated with Existing Rehabilitation Commitments

As discussed in Section 3.7.1.1 of the EA, if the Southern Extension Project does not occur, the existing disturbed areas of Invincible will be progressively rehabilitated over time and in accordance with existing commitments and approval. Due to the manner in which previous mining operations were undertaken at Invincible, there is currently insufficient overburden in emplacement areas to fill all of the voids currently present on the site without disturbing some of the areas that have already been rehabilitated. Reshaping and revegetation works to fully rehabilitate the site are likely to take several years. In general, the rehandling of topsoil associated with disturbance of already rehabilitated areas is a generally avoided practice due to typically poorer rehabilitation success following re-disturbance. The re-disturbance of existing established rehabilitation would be necessary for the rehabilitation of Southern/Renown Pits and the Eastern Void if the Southern Extension Project wasn't approved or if there is insufficient overburden from the Southern Extension Project due to restriction of mining within the Southern Extension Area.

Further, the current consent authorises disturbance in currently undisturbed areas to the south of the Eastern Void closer to the pagoda formations (refer to **Figure 2.1**). Due to the deficit of overburden, without the full extent of mining proposed for the Southern Extension Project, the completion of rehabilitation of the remaining voids in the existing Invincible mine site would:

- Involve further disturbance closer to prominent pagoda formations and
- Result in a combination of steeper slopes in the rehabilitated final landform and re-disturbed rehabilitation.

Much of the rehabilitation disturbance will occur around the Eastern Void (refer to **Plate 1**) however the already shaped areas that are awaiting topsoil spreading (refer to **Plate 2**) are also likely to require reshaping to obtain the material volumes necessary to rehabilitate the existing Invincible mine site. The slopes likely to be created under this rehabilitation scenario would almost certainly be similar to or greater than the slopes which DP&E have identified are of concern in the Southern Extension Area.

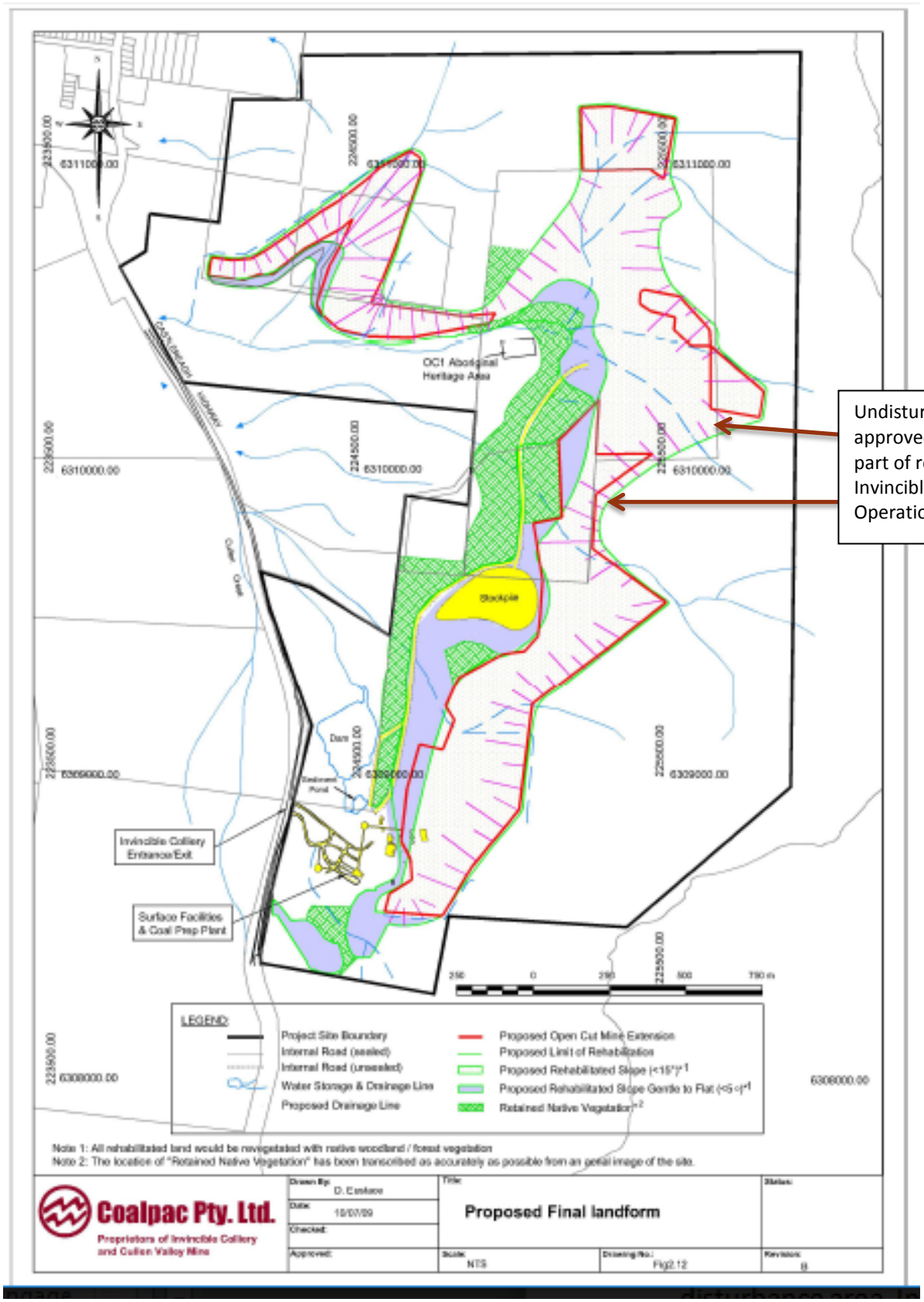


Figure 2.1 Approved Final Landform under Current Consent

■ Plate 1 - Eastern Void Area showing areas above approved for disturbance to achieve final landform under current consent

■ Plate 2: Shaped Overburden at Northern End of Renown/South Pit

As can be seen from **Plate 1**, **Plate 2**, and **Plate 3**, the un-rehabilitated open cut operations immediately to the east of these formations are visually incompatible with the landscape and conservation values identified by the previous PAC reports into the previous mining proposals at Invincible.

Due to constraints associated with past mining operations and rehabilitation by the previous owners, the rehabilitation of these areas if the Southern Extension Project does not proceed to its full extent will likely result in additional disturbance of vegetation in close proximity to these high value landscape features in accordance with the existing consent. Further, the deficit of overburden material is likely to require the creation of steep slopes in the landform with associated rehabilitation risks. Both outcomes will create additional and potentially prolonged impacts on the landscape and biodiversity values in this area to the east and north of the existing Invincible mine site, which have been identified as significant through previous assessments and PAC determinations (refer to **Section 3.0** for further details).

■ Plate 3: Pagoda Formations adjacent to Renown/South Pit Void

2.3.3 Final Landform Option 3b – Implications for Rehabilitation of Existing Invincible Disturbance Area

At the request of the DP&E, the Final Landform Options report considered an option of not mining the steeper parts of the Southern Extension Area. Final Landform Option 3a (not mining the steep slopes of the southern ridge) and Final Landform Option 3b (not mining the steep slope of both the northern and southern ridges) were considered. While these options only required mining to avoid slopes above 20°, the constraints imposed on mining associated with these exclusions effectively sterilised all mining in the Final Landform Option 3b exclusion area.

Not mining the Final Landform Option 3b exclusion area would sterilise approximately 92,000 t of Lithgow Seam coal (equating to approximately 46,000t of nut coal) and approximately 500,000t of thermal coal. The implications of this loss of coal are significant as the total target coal resource within the Southern Extension Area is 2.7Mt.

Further, the potential restriction on mining results in impacts on the viability of the Southern Extension Project and the ability to meet its primary objective of providing an effective supply of nut coal to Shoalhaven Starches Plant. Significantly it is noted that the loss of target nut coal, at supply rate of 85,000 tonnes per annum, represents a reduction of approximately 50% of a year's supply to Shoalhaven Starches from the Southern Extension Project in isolation.

This mine plan change would reduce the life of mine (mining at a rate to provide 85,000tpa nut coal and ramp down in final year) to less than three years should all nut coal be sourced from Invincible. Given that Shoalhaven Starches are faced with short to medium term projections indicating a potential 60 per cent increase in gas prices by late 2017, there are significant cost pressures on Shoalhaven Starches, and other manufacturing operations in NSW. As such, without the ability to access a cost effective source of energy, such as that provided by the full extent of the Southern Extension Project, there is significant pressure on the ongoing competitiveness of the Shoalhaven Starches Plant.

As identified in both the 10 May 2017 response regarding the 300m exclusion area and the Final Landform Options report, the exclusion of the eastern parts of the Southern Extension Area would have significant implications for the rehabilitation of the remainder of the Invincible site due to the reduced overburden available to fill the existing Invincible mine site and Southern Extension Area.

If the Final Landform Option 3b exclusion area was to be applied (as per the current draft DP&E recommendation), the impact on the final landform is significant as the total volume of available overburden reduces significantly (6 Mm^3). With a total waste volume of 7.9 Mbcm, this totals only 9.5 Mm^3 of spoil at a 20% swell. Specialist mine planning experts (Palaris) have reviewed the mine plan options and advise that the total waste required is shown in **Table 2.1** below and totals 11.5 Mm^3 for the remaining areas or a 10.6 Mm^3 if the Northern Void is rehabilitated through dozer push alone.

Table 2.1 Option 3b Rehabilitation Overburden Requirement

Area	Overburden Requirement (Mm^3)	Comments
Southern Extension Area	8.8	
Renown/South Pit	1.3	
Northern Void	0.9	Majority can be pushed by dozer using existing overburden.
Eastern Void	0.5	
Total	**11.5**	**10.6 Mm^3 required if all of Northern Void rehabilitated through Dozer Push**

If the Northern Void is able to be fully rehabilitated through dozer push, there is a shortfall of 1.1 Mm^3 across the entire site under Final Landform Option 3b. This is contrasted against the overall surplus of overburden from the full extent of the Southern Extension Area, which would be used to reduce the slopes within the conceptual final landform, whilst achieving an improved landform across the existing Invincible mine site.

While Final Landform Option 3b assists in meeting some (approximately 0.7 Mm^3) of the overburden deficit under existing rehabilitation commitments, the rehabilitation of the existing Invincible mine site under this scenario would necessitate similar rehabilitation requirements such as use of materials from approved additional disturbance areas to the east of the existing Invincible mine site and rehandle of existing rehabilitation as discussed in **Section 2.3.2** above.

2.3.4 Summary of Rehabilitation Benefits Associated with the Southern Extension Project

The rehabilitation outcomes achieved through the proposed mining of the full extent of the Southern Extension Area relative to the other options considered result in:

- Less additional disturbance around the more visually prominent and biodiversity rich areas of the pagoda landscape to the east of the Invincible mine site
- Earlier rehabilitation of the Invincible disturbance area to a landform that is similar to the pre-mining landform as detailed in the mining stage plans detailed in the EA
- Improved final landform and landscape outcomes, particularly in relation to areas adjacent to the higher biodiversity and visually prominent pagoda formations to the east of the existing open cut mining disturbance area
- Greater certainty in rehabilitation outcomes through integration with the proposed mining operations as part of the Southern Extension Project.

These outcomes are achieved at a lower cost to Castlereagh Coal as the rehabilitation costs form part of the overall operations, rather than requiring additional work which may not be fully covered by the income generated by mining under Final Landform Option 3b. As discussed in the EA, and further detailed in the response dated 10 May 2017, these rehabilitation outcomes are achieved at an overall cost benefit to the State and local region even taking into account the costs associated with rehabilitation and biodiversity offsetting costs.

3.0 Landscape Values and the Conservation Significance of the Pagoda Landscape

As outlined in **Section 1.0**, it is understood that DP&E have referenced previous assessment and determinations of the PAC in relation to past mining proposals at Invincible, as part of its draft recommendation to restrict mining in the eastern extent of the Southern Extension Area. In particular this has included reference to the overall landscape value of the pagoda landscapes in proximity to Invincible and previous determinations in relation to the appropriateness of setbacks to these features from mining.

It is imperative that the assessment of Southern Extension Project relates to the merits of the current proposed modification in the context of its overall benefits to the State. As established in Section 6.12 of the EA, and further detailed in a subsequent response dated 10 May 2017, the Southern Extension Project as proposed in the EA, delivers higher net benefits for the State than the Southern Extension Project would with the incorporation restrictions on mining as recommended by DP&E.

The relevant merit issues relating to the final landform required through mining the full extent of the Southern Extension Area have been addressed in detail in **Section 2.0**. In addition, the proposed rehabilitation through the mining of the full extent of the Southern Extension Area would result in a comparatively better final landform across the Invincible mine site through comparatively lower impacts on biodiversity and the surrounding landscape than the approved operations, as well as improve overall slopes across the entire landform – key issues raised by DP&E in relation to the full extent of mining across the Southern Extension Area.

Moreover, as detailed in Sections 1.3, Section 3.5 and Section 3.7 of the EA the design of the Southern Extension Project has considered the previous assessment and determination of previous mining proposals at Invincible to develop a project that balances impacts to identified values and features surrounding Invincible whilst still enabling a viable mining operation to meet the supply objectives for the Shoalhaven Starches Plant to be achieved.

Notwithstanding this approach to project design and assessment, this section provides further detail underpinning the relevant aspects of the PAC assessment and determinations for previous mining proposals at Invincible and their applicability to the Southern Extension Project as proposed in the EA.

The PAC Determination on the Coalpac Modification Report included the following discussion on the risks presented by previous mining proposals on pagoda landforms:

> ***Risks and Impacts from mining on the Pagoda Landform Complex***
>
> *The PAC Review identified a number of risks to the Pagoda Landform from mining. These risks were categorised as:*
>
> - *Risks to structures; from blasting, slope instability, subsidence and highwall pillar failure or other highwall impacts;*
> - *Risks to flora and fauna; including direct impacts, indirect impacts (such as noise, dust and lighting) and destruction of habitat; and*
> - *Risks to the visual value of the pagoda landform; from structural damage to the pagodas or cliffs, proximity of the open cut pits and clearing of forest below the pagodas and limitations to the rehabilitation in replacing key elements of the landform.*

The PAC Review gave careful and detailed consideration to each of these risks. Ultimately, the Review PAC recommended that:

- *highwall mining not be permitted under the pagodas or escarpment in the project area; and*
- *a minimum setback distance of 300 m be maintained from the open-cut highwall to the pagodas and the escarpments.*

The Review Report explains that a 300m setback would:

- *provide a significantly improved habitat buffer for listed threatened fauna species that use the pagoda landform;*
- *lessen the risk to the pagodas and escarpment from blasting and slope instability; and*
- *lessen the visual impact on the landform.*

3.1 What Constitutes a 'Pagoda Landform'

To understand the above recommendations in relation to their applicability to the Southern Extension Project, it is first necessary to identify what constitutes a Pagoda Landform as defined in previous PAC assessments, and understand the regulatory context in which the 300m set back was recommended by previous PACs.

A key issue for the refusal of the Coalpac Modification Project was the potential impacts of that project on the 'Pagoda Landform Complex'. The PAC Determination Report noted the following at page 9 of the Report (PAC, 2014):

Descriptions of the Pagoda Landform Complex and consideration of its significance are covered in detail in the PAC's Review Report and in the Department of Planning and Infrastructure's assessment of the previous Coalpac Consolidation Project. In short, the PAC's Review of the Coalpac Consolidation Project found that:

- *"the pagodas cannot be considered as structures in isolation ... they are part of a landform consisting of multiple pagoda structures and intervening sections of cliffs, with steep slopes and dissecting gullies below''*
- *The pagodas are "a unique landform on a world scale ... "; have limited distribution, "provide critical habitat for some flora species and key habitat features for threatened fauna"; and "contain significant items of Aboriginal cultural heritage"*
- *"the pagoda landform should be afforded special significance status and the highest possible level of protection". [PAC Review Coalpac Consolidation Project, p 76]*

The full text of the section of the PAC Review Report into the Coalpac Consolidation Report referred to in the above extract from the PAC Determination Report for the Modification Project is set out below:

6.2.2 Significance of the Pagodas Themselves and the Pagoda Landform

The pagodas cannot be considered as structures in isolation. As noted above, they are part of a landform consisting of multiple pagoda structures and intervening sections of cliffs, with steep slopes and dissected gullies below.

The paper by Washington and Wray (2011) clearly identifies the pagodas as a unique landform on a world scale, identifies that their distribution is limited to a small section of the western edge of the Great Dividing Range, and notes that significant mining-induced impacts have already occurred to many of the formations located outside of the reserve system. Protection of the pagodas in the vicinity of the proposed project has long been on the agenda of the conservation movement of NSW. The title of the proposed area for reservation (Gardens of Stone Stage II) indicates the importance attached to these features.

As noted above the pagodas also provide critical habitat for some flora species and key habitat features for threatened fauna including species identified under the relevant State and Commonwealth legislation. They also contain significant items of Aboriginal cultural heritage.

The Commission has previously canvassed the process for allocating levels of significance to particular natural features. [NSW Planning Assessment Commission 2010, Bulli Seam Operations Review Report, NSW Planning Assessment Commission, Sydney pp.101-102 which followed on from the work in Southern Coalfield Inquiry Report (NSW Department of Planning 2008)] *It noted that the process inevitably involves some degree of subjectivity, but that subjectivity decreases as the assessment approaches either end of the significance spectrum.*

Based on the scientific literature, the international significance of the pagoda structures, the importance of the habitat, multiple submissions on the EA and at the public hearings, and the Commission's own observations during both aerial and ground inspections, the Commission concludes that the significance of the pagoda landform is at the top of the scale and thus the pagoda landform should be afforded special significance status and the highest possible level of protection.

The Commission also notes that DRE supports this level of protection:

'…the applicant needs to demonstrate the rock pagoda features will not incur mining-induced damage and most importantly, pillar stability is such that there is no risk of further subsidence after mining is complete.'[DRE (Mine Subsidence Board), letter to PAC, 7 December 2012]

***Recommendation 45:** The Commission recommends that the pagodas and the associated escarpments be considered natural features of special significance and that they be fully protected from any mine-induced impacts.*

The recommendation in Washington and Wray (2011) regarding conservation significance of pagodas is as follows (underlined sections are for emphasis):

However, just as Australia has been slow to acknowledge its wealth of biodiversity, the pagodas show that we have been similarly slow to recognise the significance of our geodiversity, and the platy pagodas are certainly a distinct and significant part of Australia's geodiversity. The formation of platy pagodas has yet to be full explained, but their geomorphic significance is not in doubt. <u>We believe that pagodas and their associated sandstone landforms (such as slot canyons) are important and significant parts of the sandstone geodiversity of the Greater Blue Mountains World Heritage Area and adjacent unprotected areas.</u> This is of significance given the Commonwealth Government plans to renominate this World Heritage Area for geodiversity in the future (currently it is listed only for biodiversity). <u>Pagodas deserve full and expanded recognition as a significant part of the geodiversity and geoheritage of the Blue Mountains region. Their natural aesthetic beauty, their biodiversity, and their significant geomorphological values mean they deserve enhanced recognition and conservation into the future</u>.[emphasis added]

As can be seen from the above two extracts, the Washington and Wray (2011) paper focusses on the significance of the pagoda structures and associated sandstone landforms such as slot canyons (as geoheritage and geodiversity features) rather than the broader landscape features referred to in the PAC Review Report into the Coalpac Consolidation Report. It is important to note here that the conservation values relate to their "*natural aesthetic beauty, their biodiversity, and their significant geomorphological values"*. While it is noted that a number of submissions on the previous Coalpac projects and the Southern Extension Project extend these conservation values to include the lower slopes and wooded slopes and alluvial flats below the pagodas, Recommendation 45 in the PAC Review Report into the Coalpac Consolidation Report is limited to the '*pagodas and the associated escarpments'*.

While it references the PAC Review Report into the Coalpac Consolidation Report as justification for its position, the PAC Determination Report into the Coalpac Modification Project significantly expands on the areas considered to comprise the Pagoda Landform and also warrant this high level of protection:

In finalising its assessment of the Coalpac Consolidation Project in 2013 the Department agreed with the PAC's findings and recommendation, stating:

> *" ... the Department believes that the PAC's classification of the pagoda landform as a natural feature of special significance is appropriate and agrees that these features warrant the highest level of protection."* *[Department of Planning and Infrastructure's Coalpac Consolidation Project Director-General's Environmental Assessment Report, June 2013 p 36]*
>
> *"the Department is satisfied that the only reasonable way to define the pagoda landform complex must include the pagoda rock formations on the plateaus, the wet gullies, and the wooded slopes below the pagodas. In other words, the pagodas cannot be considered in isolation. Consequently, the Department does not accept the definitions used by Coalpac for SPLs* [Significant Pagoda Landforms] *and Sandstone Outcrops. Instead, the Department believes that the definition of the pagoda landform should be generally consistent with the areas mapped as "pagoda country" by Washington* & *Wray which includes the various components that make up the pagoda landform complex (i.e. pagodas, gullies, and slopes)."*
>
> *The Office of Environment and Heritage (OEH) has also consistently acknowledged the importance of the pagodas. In 2012 the OEH provided mapping of the pagoda landforms and escarpments, as geodiversity features. This mapping acknowledges all the features, i.e. it did not classify or distinguish the features. The OEH considered a range of potential standoff distances, based on different known habitat requirements.*
>
> *The Commission accepts the findings of the 2012 PAC Review, the OEH and the Department of Planning and Infrastructure's 2013 Assessment Report, that the pagoda landform complex is a natural feature of special significance and that the features warrant the highest level of protection, i.e. they should be fully protected from risks of mine induced impacts."*

The Department's definition of pagoda landforms is much broader than that adopted by PAC Review into the Coalpac Consolidation Project. The PAC identified the pagoda landform as entailing cliffs, with steep slopes and dissecting gullies below; that is, the steep tallus slopes below the pagodas and cliffs and the incised gully areas between these formations. Prior to the Department's revised recommendation report, the Pagoda landscape did not extend to wooded slopes beyond those immediately below the pagodas and clifflines. At no point has a formal definition extended to slopes and terrain unrelated to the pagoda formations or associated clifflines, i.e. it does not extend to ridge lines extending from terrain containing pagodas where there ridges are not considered tallus nor are they associated with gullies dissecting the pagoda formations. Additionally, the reference to steep slopes does not capture all steep slopes in reasonable proximity to pagodas, the steep slopes must be associated with the pagoda formation itself to form part of the escarpment feature associated with pagoda features.

The above distinction is important in the context of the Southern Extension Project as the Southern Extension Area does not include any pagodas nor does the area contain any dissecting gullies between pagoda formations. While the eastern part of the Southern Extension Area does include a ridge which contains a pagoda higher in the landform, the Southern Extension Area does not include any tallus or steep slopes immediately below or associated with the pagodas. The ridge lines and drainage lines in the eastern part of the Southern Extension Area are not unique in the broader terrain and are not at all dissimilar to dry woodland ridges and ephemeral gullies located throughout the broader Blue Mountains region. This is to be contrasted to the terrain immediately to the east of the existing Invincible mine site which could be characterised as containing features which would meet the definition of the pagoda landform; indeed, parts of the already mined areas associated with the Eastern Void would arguably be considered to form part of the Pagoda Landform (refer to **Plate 2**).

The Southern Extension Area itself does not contain any features '*that warrant the highest level of protection'* as defined in previous PAC assessments and determinations. To the extent that the Southern Extension Area is adjacent to areas of the Pagoda Landscape, the features of this landform do not contain the incised gullies and other geodiverse features associated with pagodas to the north and east of Invincible. As discussed further below, the impacts of the Southern Extension Project on the values of the landform immediately adjacent to the Southern Extension Area have considered the previously defined 300m setback (refer to **Section 3.2.1**), are fully offset (refer to **Section 3.2.2**), are managed though the application of conservative blast impact criteria (refer to **Section 3.2.3**), and have limited visual impact relative to other areas (refer to **Section 3.3**).

3.2 Pagoda Setbacks

3.2.1 Assessment of Biodiversity Impacts Associated with Previous Mining Proposals

The terrain associated with the pagoda and cliffline structures is a good example of the features that are associated with the high biodiversity value of pagoda landscapes, namely the pagodas and clifflines themselves and the steep slopes and wetter incised gullies between the formations. These areas are to be distinguished from the areas to the immediate east of the Southern Extension Area which, although containing pagoda structures, do not contain the same degree of biodiversity richness due to the lack of incised gullies between the formations and that the pagodas themselves are not prominent in the landscape.

Recommendation 47 from the PAC Review into the Coalpac Consolidation Project provided as follows:

> *"to provide adequate protection for threatened species and other fauna that use the pagoda landform, a minimum setback distance of 300m be maintained from the open-cut highwall to the pagodas and the escarpments. This will provide a significantly improved habitat buffer for the listed threatened species that utilise the pagoda landform**..."***

The PAC Determination Report for the Coalpac Modification Project summarised the PACs consideration of the Coalpac Consolidation Project as follows:

> *The PAC Review gave detailed consideration to the flora and fauna associated with the Pagoda Landform Complex and also sought and received further information from the NSW Office of Environment and Heritage. In relation to the Coalpac Consolidation Project, the PAC found that:*

- *"The pagoda landform in the project area provides essential habitat components for a number of listed threatened fauna species and is potential habitat for some non-listed species that are of public significance, such as the Superb lyrebird;*

- *These species use both the pagodas and the lower gully and forest floor areas for their breeding, shelter and foraging needs on either a seasonal or daily basis;*

- *... a full 500m setback (as per TSDP [Threatened Species Profile Database] requirements) would eliminate much of the open-cut ... This suggests that open cut mining may not be the optimum use for this area which has high scenic, conservational and recreational value."* ***[PAC Review Coalpac Consolidation Project, p 89]***

*Ultimately the PAC Review recommended that "to provide adequate protection for threatened species and other fauna that use the pagoda landform, a minimum setback distance of 300m be maintained from the open-cut highwall to the pagodas and the escarpments. This will provide a significantly improved habitat buffer for the listed threatened species that utilise the pagoda landform**...**"* [PAC Review Coalpac Consolidation Project, Recommendation 47, p 91]

One of the key threatened species considered in relation to the habitat value of the pagoda landforms was the Broad-headed Snake (Hoplocephalus bungaroides). The Broad-headed Snake is listed as an Endangered Species in the NSW Threatened Species Conservation Act 1995. This species is also listed as vulnerable under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999.

The OEH submission referred to above related to the consideration of the Coalpac Consolidation Project on biodiversity impacts in 2012. This assessment process predated the current NSW Framework for Biodiversity Assessment process and required the standoff zones considered on the habit features of certain threatened species, in particular the Broad-headed snake. The 300m setback recommendation ultimately identified by the PAC was based on potential impacts on the foraging habitat of Broad-headed snake which is typically restricted to 300-500 m from its winter habitat which can include features associated with pagodas. Threatened bat species which also reside in fissures and overhangs in the pagodas also have a foraging range similar to that of the Broad-headed snake (these habitat requirements are discussed in detail in the Biodiversity Assessment Report in Appendix 6 of the EA).

It must be stressed here that these standoff zones considered for the Coalpac Consolidation Project by OEH related to potential impacts on threatened species; the stand-off distance did not define the pagoda landform complex boundaries. That 300m setback was recommended as a standoff distance for the Coalpac Consolidation Project was largely based on the magnitude of impact from this Project on areas of potential habitat for the key threatened species being considered. **Table 3.1** compares the impact areas associated with the Coalpac Consolidation Project, Coalpac Modification Project and the Southern Extension Project. As can be seen the Coalpac Consolidation Project included potential disturbance of approximately 456ha of land within 300m of mapped geodiverse features, which is an order of magnitude above the relative area of the Southern Extension Area within 300m of the closest pagoda and isolated cliff line features.

Table 3.1 Comparison of Proposed Impact Areas

	Consolidation Project*	Modification 4 Project*	Southern Extension Project*
Total area of Proposed Open Cut Mining Disturbance	794 ha	152 ha	49 ha
Proposed Open Cut Within 300m of Pagodas and Geodiverse Structures	456 ha (57%)	57 ha (37.5%)	6 ha (12%)
Total Area of Proposed Highwall Mining	294 ha	189 ha	N/A
Proposed Highwall Within 300m of Pagodas and Geodiverse Structures	269 ha (91%)	163 ha (86%)	N/A
Total area of Proposed Mining Within 300m of Pagodas and Geodiverse Structures	724 ha (66%)	220 ha (65%)	6 ha (12%)

*Numbers in brackets indicates percentage of proposed mining within 300m of pagodas or geodiverse structureS

Given this magnitude of impact, potential impacts on local populations of threatened species reliant on these areas for foraging habitat were likely to be significantly impacted by Consolidation Project, particularly given the disturbance, in some cases, removed potential habitat on all sides of the geodiverse features. While the impacts associated with the Coalpac Modification Project were less than the Consolidation Project, approximately 57 ha of that project that were within 300m of the pagodas. Again, this is a potentially significant impact on local populations of the threatened species considered by OEH in their 2012 advice.

Notwithstanding the application of a setback approach to managing impacts associated with the earlier mining proposals, the significantly reduced scale of impacts associated with the Southern Extension Project relative to the earlier mining proposals considered by the PAC and the availability of an agreed framework to quantitatively assessment biodiversity impacts mean that a standard 300m offset from pagodas for the purpose of mitigating biodiversity impacts has limited applicability to the Southern Extension Project. More specifically, the applicability of a 300m setback to the Southern Extension Project has been detailed in the previous 10 May 2017 submission to DP&E, which is outlined in the following section

3.2.2 Assessment of Biodiversity Impacts Associated with the Southern Extension Project

Aside from one instance, the limit of disturbance associated with mining in the Southern Extension Area is set back at least 300m from all pagoda formations. The setback from one single pagoda was reduced to approximately 210 m following further investigations which identified that winter habitat features for the Broad-headed snake were generally absent at this pagoda feature (refer to Appendix 6 of the EA).

Potential impacts on the Broad-headed snake associated with the Southern Extension Project have been considered in the Biodiversity Assessment Report in accordance with the NSW Framework for Biodiveristy Assessment process. The offset requirements for the Broad-headed snake are based on potential foraging habitat within 500 m of all potential winter habitat (i.e. pagoda structures). Notwithstanding the general absence of winter habitat for the species at the nearest of the pagodas, the Biodiversity Assessment Report (BAR) have conservatively assumed that this pagoda does provide potential habitat for this species and applies a 500m foraging habitat for consideration under the FBA. The approach to assessing offset requirements in relation to the Broad-headed snake are discussed in Section 6.0 of the BAR (Appendix 6 of the EA) and Response to Submissions Part A. This approach to the assessment of any potential residual impacts on this key species has been supported by the OEH in their submission on the Southern Extension Project including the subsequent extensive consultation and agreement relating to the proposed offsetting for the Broad-headed snake (refer to **Section 1.1**).

Potential impacts on other threatened species, including the Large-eared pied bat, are calculated as inputs to ecosystem credit requirements in accordance with the NSW Framework for Biodiveristy Assessment process. The determination of the number of ecosystem credits required due to impacts associated with a project has regard to a range of factors including impacts on threatened species, vegetation communities and the landscape values of the area being impacted. The offset requirements are identified through credits requirements determined based on thorough quantitative biometric survey techniques. This quantitative process replaces the previous qualitative process for biodiversity assessment and mitigation and provides that if the proponent can obtain and surrender the appropriate credit requirements determined by the BioBanking Credit Calculator, the proponent is considered to have fully offset all biodiversity impacts. The Credit requirements for the Southern Extension Project are identified in Table 8 of the Additional Information provided to the Department of Planning on 10 May 2017. These offset credit requirements can be fully satisfied through the proposed Hillcroft BioBanking Site and the Supplementary Measures for the Broad-headed snake.

3.2.3 Protection of Pagodas and Associated Landscapes from Blasting Impacts and Ensuring Slope Stability

3.2.3.1 Management of Potential Blasting Impacts

Further, as discussed in Sections 3.7 and Section 6.8 of the EA, extensive project design consideration has been undertaken to minimise any potential impacts on pagoda structures from blasting. The pagoda and cliff line structures in close proximity to the Southern Extension Area have been subject to a detailed geotechnical assessment to determine stability and risk of impacts from blasting (refer to Appendix 9 of the EA). The geotechnical assessment identified conservative blast vibration criteria designed to ensure protection of these pagoda structures and clifflines over the life of the Southern Extension Project. As detailed in Appendix 9 of the EA, these conservative blast criteria can be met through appropriate blast design, primarily through control of the blast size, along with comprehensive baseline and ongoing condition monitoring. Accordingly, setbacks from the pagodas and clifflines are not necessary to manage potential blast impacts, as they can be actively managed to manage impacts to the pagoda and cliff line structures in closest proximity to the Southern Extension Area.

3.2.3.2 Slope Stability

Unlike previous proposals, the Southern Extension Project does not include any highwall mining or underground mining; as such, the Southern Extension Project will not have any subsidence impacts on the pagodas.

As discussed in **Section 2.1** and **Section 2.2**, the Southern Extension Project does not present slope stability risks for areas upslope of the proposed highwall crest.

3.3 Visual Impacts

The pagodas and associated landforms are visually spectacular. The 'natural aesthetic beauty' of the pagoda formations was specifically identified by Washington and Wray (2011) as a reason warranting a high degree of protection for these features. As identified in the PAC Determination report on the Coalpac Modification Project, mining presents a range of potential risks to the visual character of the defined pagoda landform, including:

- through structural damage to the pagodas or cliffs
- proximity of the open cut pits and clearing of forest below the pagodas
- limitations to the rehabilitation in replacing key elements of the landform.

As discussed in **Section 3.2.1**, the Southern Extension Project differs from the previous mining proposals at Invincible in that it does not include further encroachment on the defined pagoda landscape.

The Eastern Void and Renown Pit/Southern Void areas of the existing Invincible mine site are located closest to the prominent pagoda formations to the east of the current Invincible workings (refer to **Plate 1** to **Plate 3**). These pagoda areas are visually prominent in the landscape and are considered to be some of the more visually spectacular landforms visible from the Castlereagh Highway. The pagoda formations to the east of the Southern Extension Area are much smaller in scale and are not visually prominent in the landscape. As can be seen from the visual montage in Figure 6.33 of the EA, there are no pagodas visible in the landscape to the south and east of the Southern Extension Area. In this regard, the Southern Extension Project, while extending the overall area of disturbance associated with mining, does not itself have a significant impact on the visual character of the pagoda landform, as there are only limited opportunities where the additional disturbance can be viewed in the context of broader pagoda landform, including from the ridge line to the south of the Southern Extension Area and publically accessible elevated areas in Ben Bullen State Forest. In both circumstances, the existing mining disturbance remains visually prominent and is more proximate to the visually spectacular elements of the pagoda landform which give rise to the conservation value of the pagoda formations.

Overall, the Southern Extension Project is considered to have limited impact on the visual attributes of the pagoda landscape. These impacts will be temporary in nature and the improved rehabilitation and landform outcomes for the existing disturbance areas associated with the Southern Extension Project while have a net positive benefit for the visual character surrounding the more visually spectacular components of the pagoda landform in both the short term (through reduced disturbance) and the long term (through improved landform design). These benefits are considered to outweigh the relatively minor temporary visual impacts associated with the additional disturbance of mining the full extent of the Southern Extension Area.

3.4 Overall Impacts on Conservation Values

Impacts on conservation values must be considered in terms of both short term and long term impacts. In considering these impacts, the specific short term and long term conservation values of a particular landform need to be identified and considered. **Table 3.2** identifies the short term and long term benefits associated with the conservation of the pagoda landforms in the context of the Southern Extension Project.

Table 3.2 Conservation Values Associated with Pagoda Landforms

Benefit	Details	Comments
Biodiversity Values	Breeding and foraging habitat. High levels of biodiversity due to diversity of habitats and vegetation communities associated with the variable landform.	Southern Extension Project does not impact on higher biodiversity areas as previously identified through specific definitions utilised to inform previous PAC assessment and determinations. Short term biodiversity impacts are fully offset in accordance with FBA requirements which have been agreed in principle by OEH. Negligible long term impacts as the Southern Extension Area and existing disturbance areas are rehabilitated to vegetation communities and landforms consistent with the pre-mining environment. There is potential for the offset areas associated with past Invincible approvals to be added to future areas reserved under the *National Parks and Wildlife Act 1974* which would increase the area of lower slopes under conservation.
Geomorphic and geoheritage values	Unique slaty pagoda formations are conserved for both future study and recreational enjoyment.	The areas in proximity to the Southern Extension Area do not share the specific geodiverse features characteristic of areas to the north and east of Invincible as previously identified through the technical studies informing previous PAC assessments and determination. The location of the Southern Extension Project and incorporation of specific blast management measures minimise any impacts (short or long term) on the pagoda structures
Visual Amenity	Pagoda formations and complexes which are prominent in the landform have aesthetic appeal.	The Southern Extension Project will not impact on the pagoda structures themselves or the pagoda landscape. The mining in the Southern Extension Area will have limited impacts on the aesthetic appeal of pagoda landscape due to the absence of visually prominent pagodas in the immediate vicinity of Southern Extension Area.

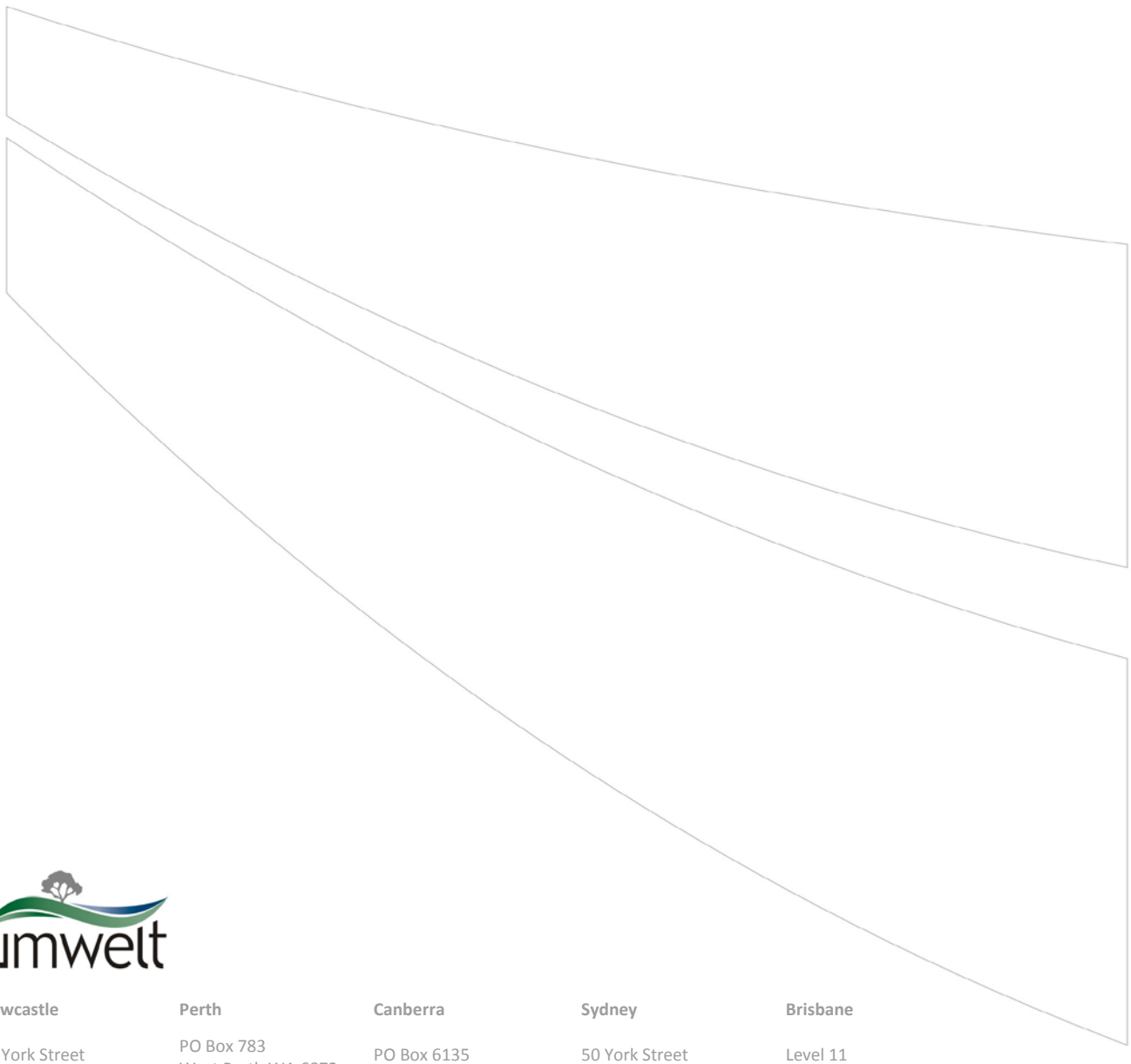
Benefit	Details	Comments
Recreational values	Bushwalking, birdwatching, photography	The Southern Extension Project itself would have limited impact on recreational activities. Short term impacts would be limited to the exclusion from the Southern Extension Area and temporary exclusion zones associated with managing flyrock risk from blasting. Long term impacts overall neutral to positive given the improved rehabilitation outcomes for existing disturbance areas and the removal of subsidence cracking and potholes in the Southern Extension Area which are currently potentially hazardous and have potential to expand in the medium to long term.
Tourism	The visually spectacular pagoda formations and associated biodiversity values have potential to act as drawcards for domestic and overseas tourists.	To the extent that the Southern Extension Project would operate as a deterrent to tourism, the disturbance and visual impacts associated with the existing open cut mining would operate as a greater deterrence due to its proximity to the more visually spectacular and prominent pagoda formations. As discussed in this response, the Southern Extension Project will have net positive benefits on the rehabilitation of the existing disturbance areas meaning any impacts on tourism values will be negligible or slightly positive in both the short and long term.

Overall, the Southern Extension Project will have some limited short term impacts on the visual amenity associated with the pagoda landforms and result in a small loss of biodiversity values associated with disturbance in the Southern Extension Area. Both impacts are temporary and the biodiversity impacts will be fully offset in accordance with the NSW Framework for Biodiversity Assessment process. The Southern Extension Project is also predicted the have positive short term impacts on the visual amenity of the existing Invincible mine site and the adjacent pagoda landforms due to the comparatively more effective rehabilitation outcomes relative to the Final Landform Option 3b alternative as currently recommended by DP&E.

The Southern Extension Project will have overall neutral to positive long term benefits due to the commitment to fully rehabilitate the Southern Extension Area and the improved rehabilitation outcomes for existing Invincible mine site provided by the additional overburden generated by the Southern Extension Project. Once fully rehabilitated, the Southern Extension Area and existing Invincible mine site will have landform characteristics consistent with the pre-mining landform.

4.0 References

Washington & Wray The Geoheritage and Geomorphology of the Sandstone Pagodas of the North-western Blue Mountains Region (NSW)



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