

Figures 4.14 to 4.23 provide photos taken from selected points surrounding the Stage 2 Site, as well as a cross-sectional representation of the topography between the photo point at the Stage 2 Site and the approximate field of view. The photos included on **Figures 4.14 to 4.16, 4.18 and 4.23** were taken on 20 September 2014 prior to a series of showers passing through the region which impacted on visibility and photo quality. The photo included on **Figure 4.17** was taken on 10 October 2013 and the photos included on **Figures 4.19** (Melliodora Place), **4.21** and **4.23** taken on 7 April 2014. The photos used on **Figures 4.19 and 4.20** (Pippin Place) were obtained from Google Earth Street View.

4.4.2.3.2 Zone A: Hassans Walls, Second Lookout and Hassans Walls Road

Views of the quarry from Hassans Walls have long been known and discussed, with the current quarry extraction plan reflecting the retention of visual screening of the extraction area (see **Figure 4.14**). Similar and perhaps clearer views of the quarry are available from ‘Second Lookout’ to the east of Hassans Walls (see **Figure 4.15**). Between Hassans Walls and Second Lookout are walking trails from which the quarry is clearly visible. Views of the quarry are also available on the descent of Hassans Walls Road although vegetation provides a relatively effective screen and the circuitous nature of the road precludes observation for drivers.

Although at least 6.5km from the Stage 2 Site, the secondary processing area, Yorkeys Creek stockpile area, extraction area Access Road and western face of the current extraction area are visible. Notably, the retention of a ridge to the north of the Stage 1 extraction area (the “Northern Ridge”) identified on **Figures 4.14 and 4.15** provides a visual screen to the extraction area to the south of this. The ridge beyond the extraction area forms part of the Stage 2 extension of the extraction area.

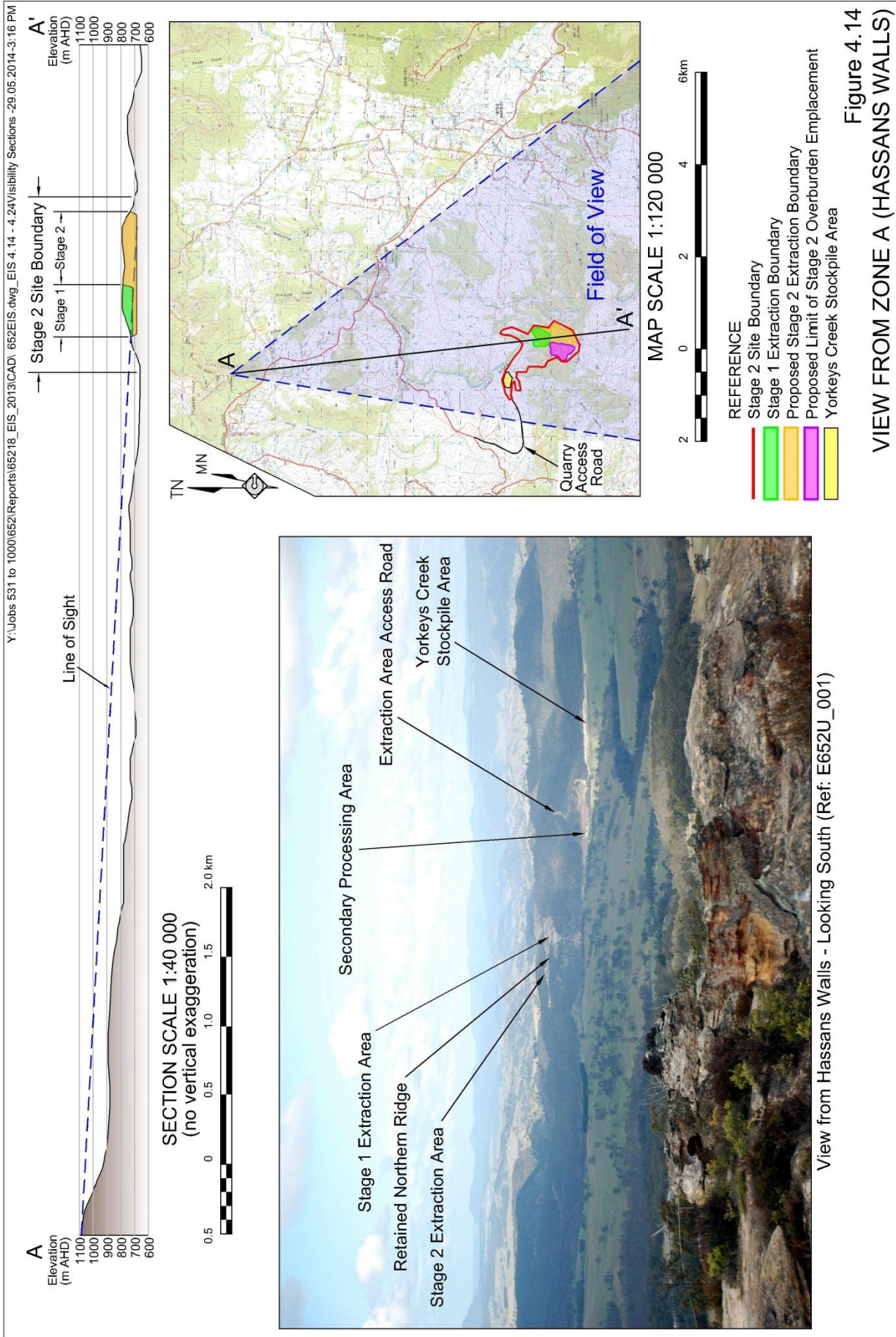
4.4.2.3.3 Zone B: Bells Line of Road

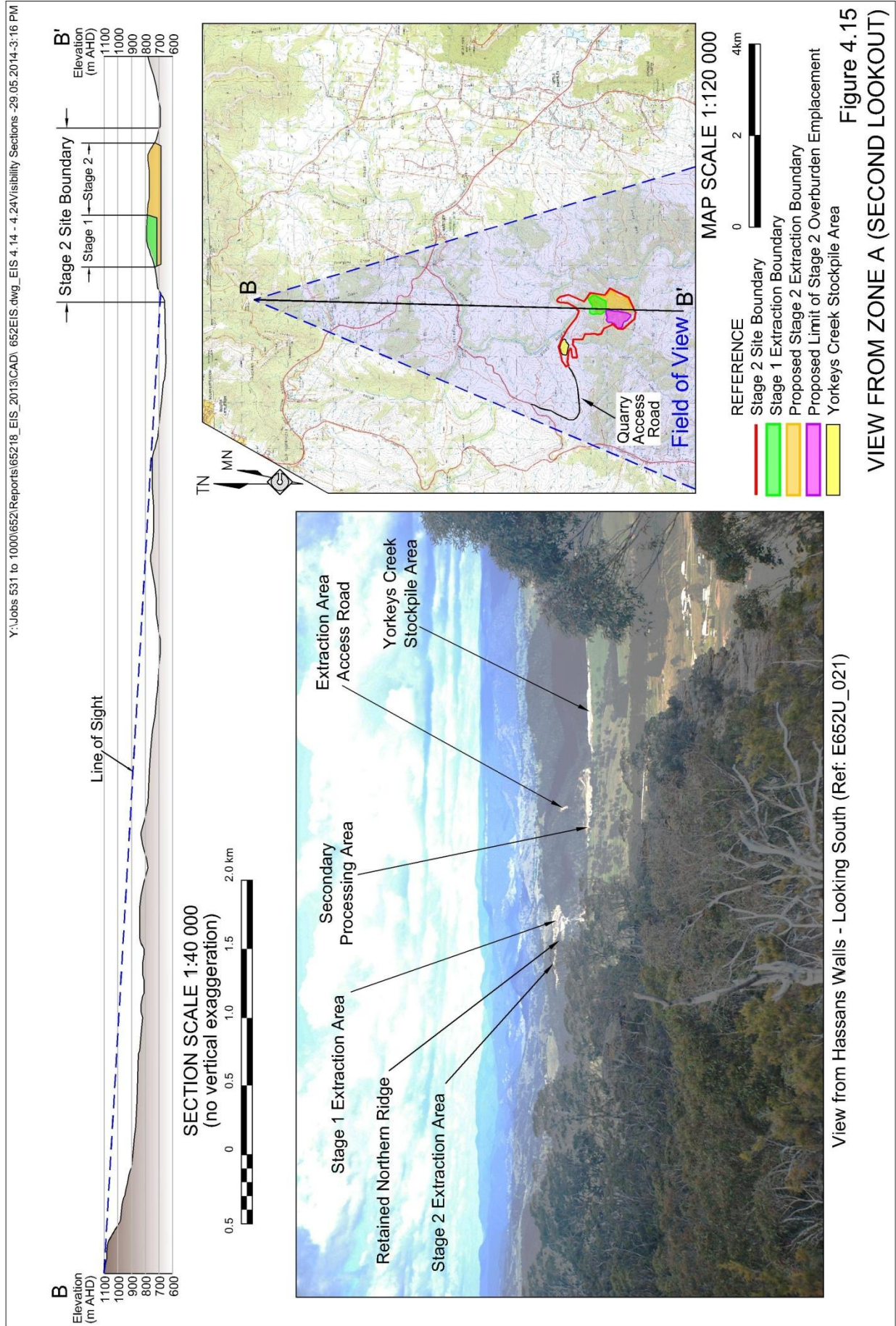
Views of the Stage 2 Site are obscured from most potential vantage points to the north and northeast along Bells Line of Road and various residential communities located along this road, e.g. Clarence, Dargan. One notable exception is provided at the Monkey Creek Café, located approximately 1km southeast of Dargan on Bells Line of Road, where distant views (14km) of the extraction area are available (see **Figure 4.16**). The ridge beyond the extraction area forms part of the Stage 2 extension of the extraction area.

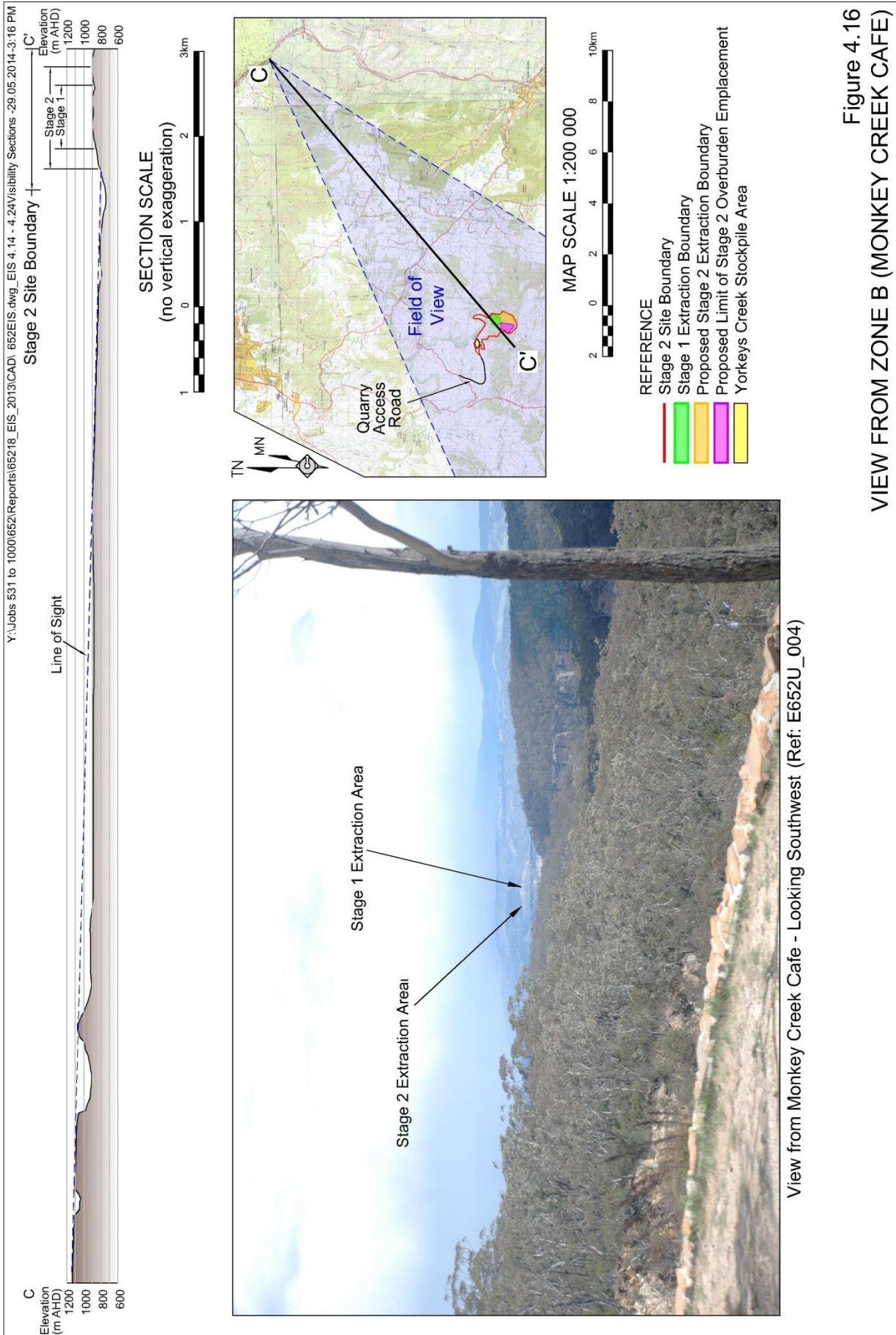
The Stage 2 Site would also be visible from the edge of the escarpment to the south of Bells Line of Road, however, as this area is largely inaccessible it has not been considered.

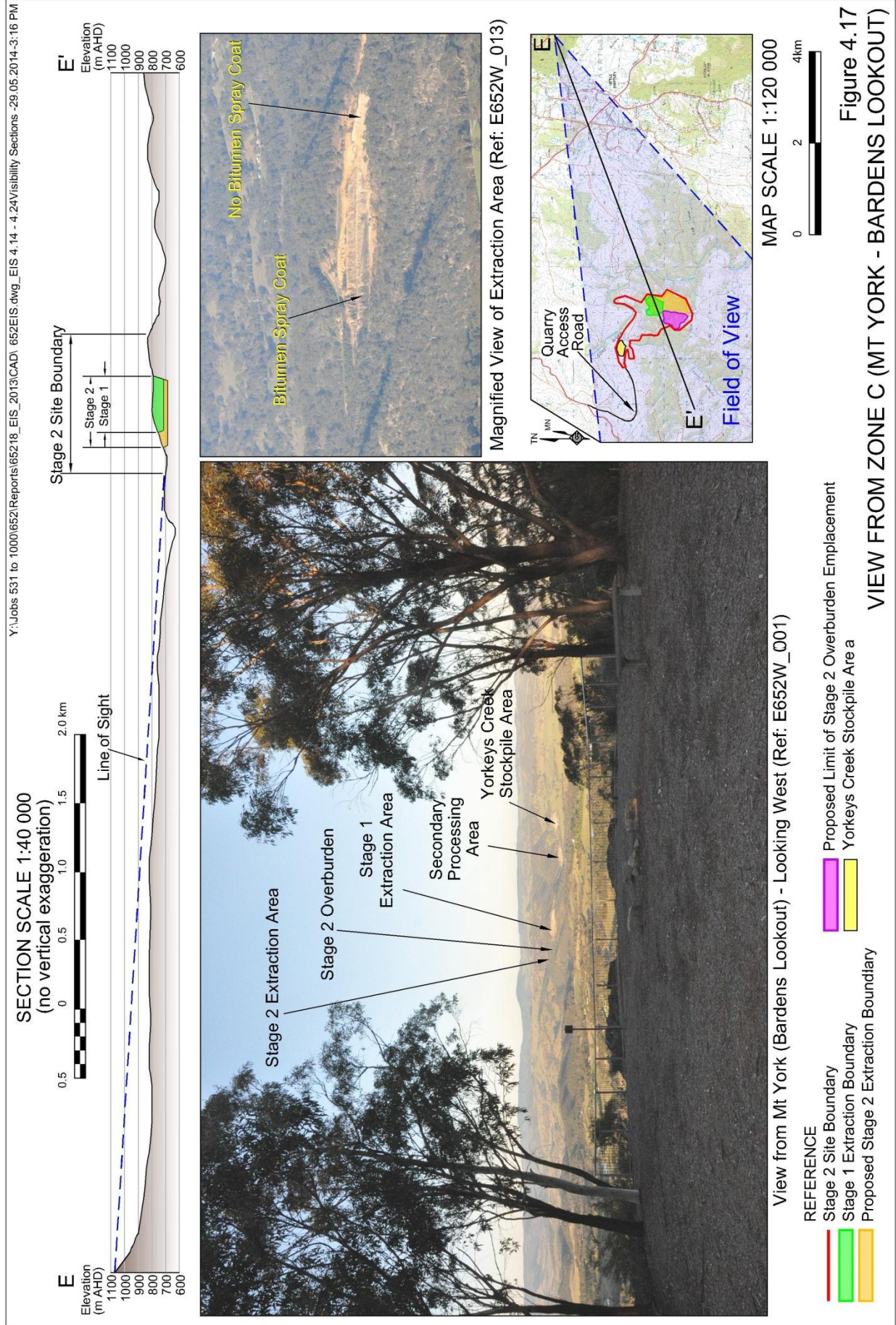
4.4.2.3.4 Zone C: Mount York and Mount York Road

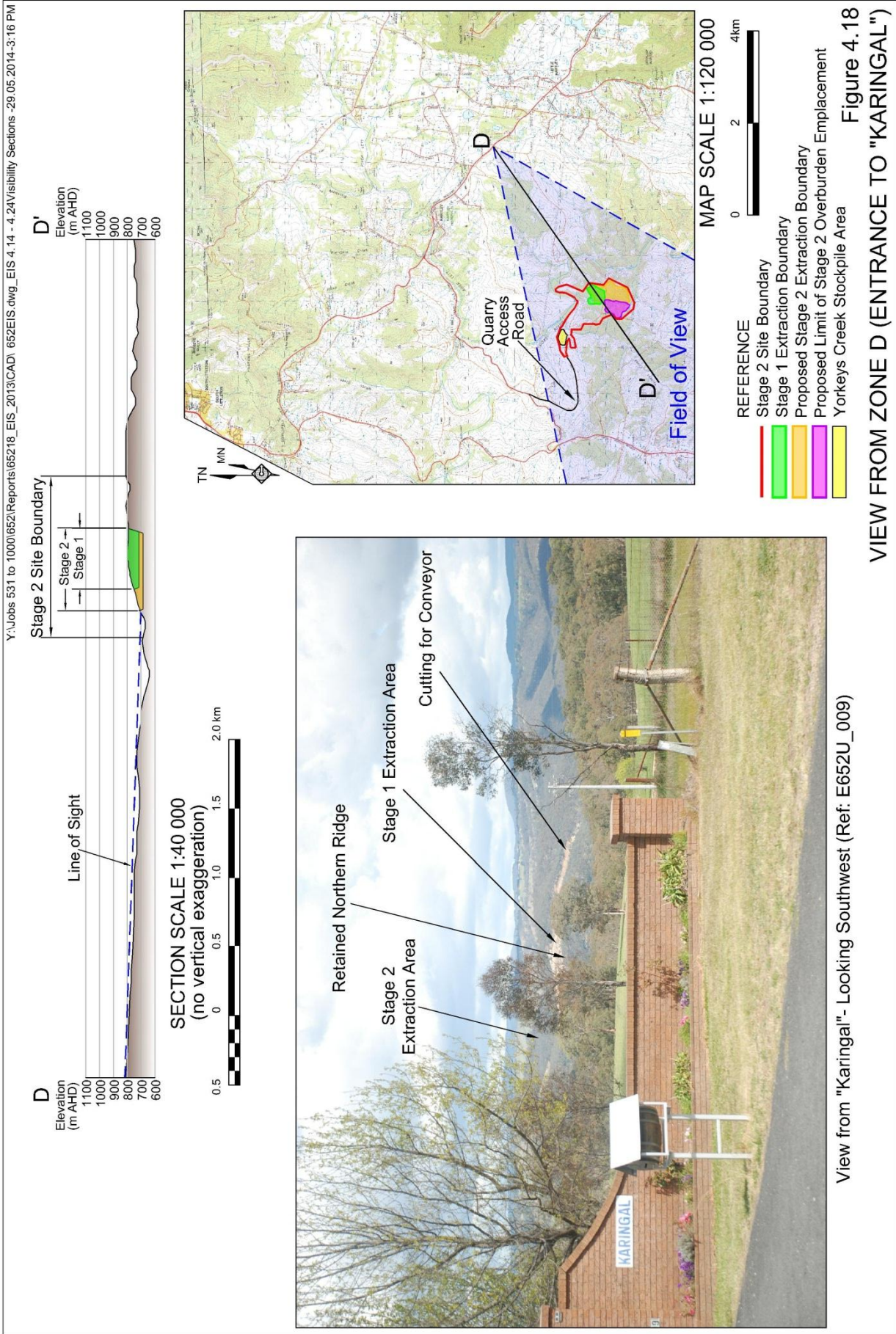
This historic site has clear and unimpeded views of the quarry from the main lookout, Bardens Lookout (see **Figure 4.17**) and walking trails along the southern side of Mount York Road.

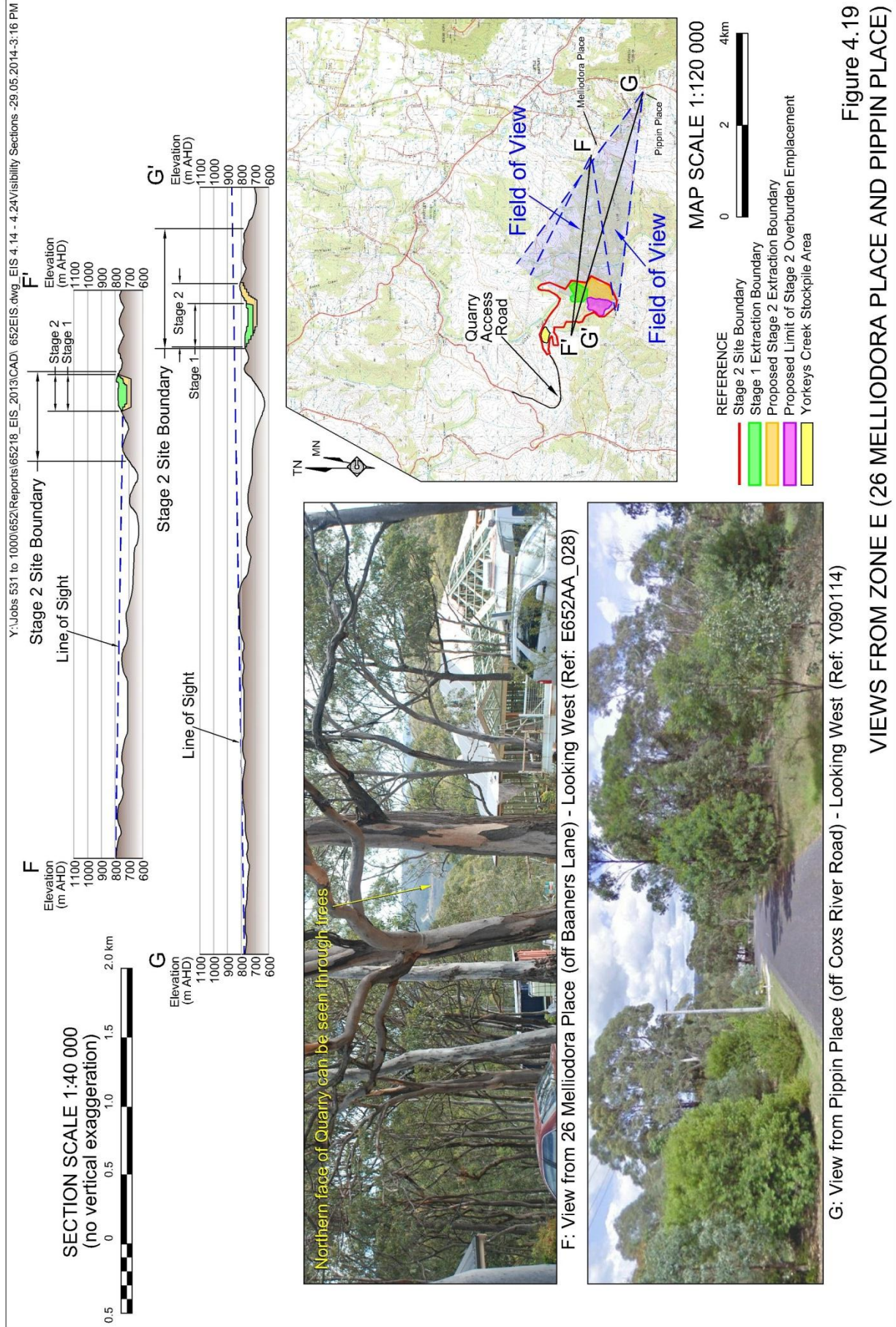


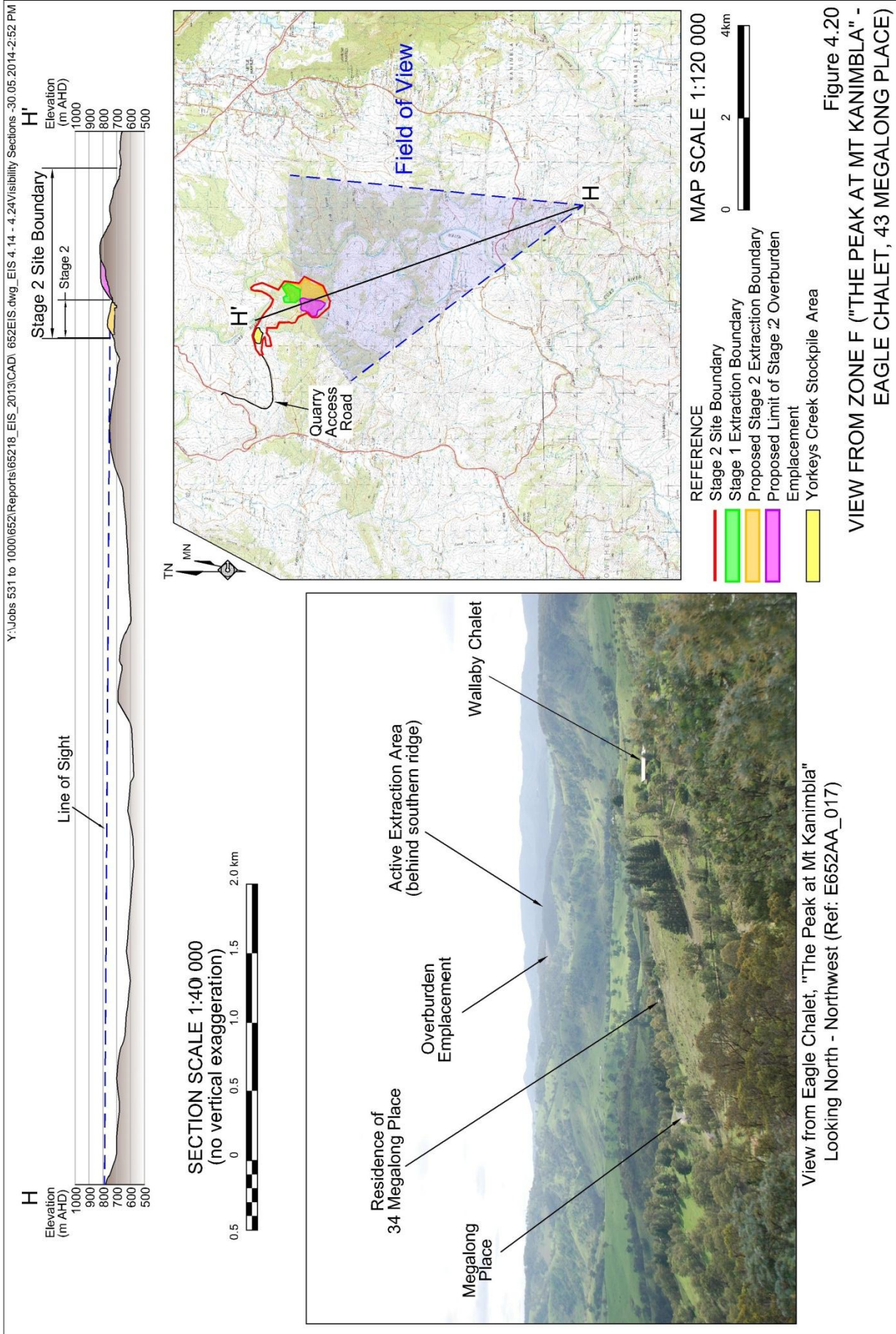












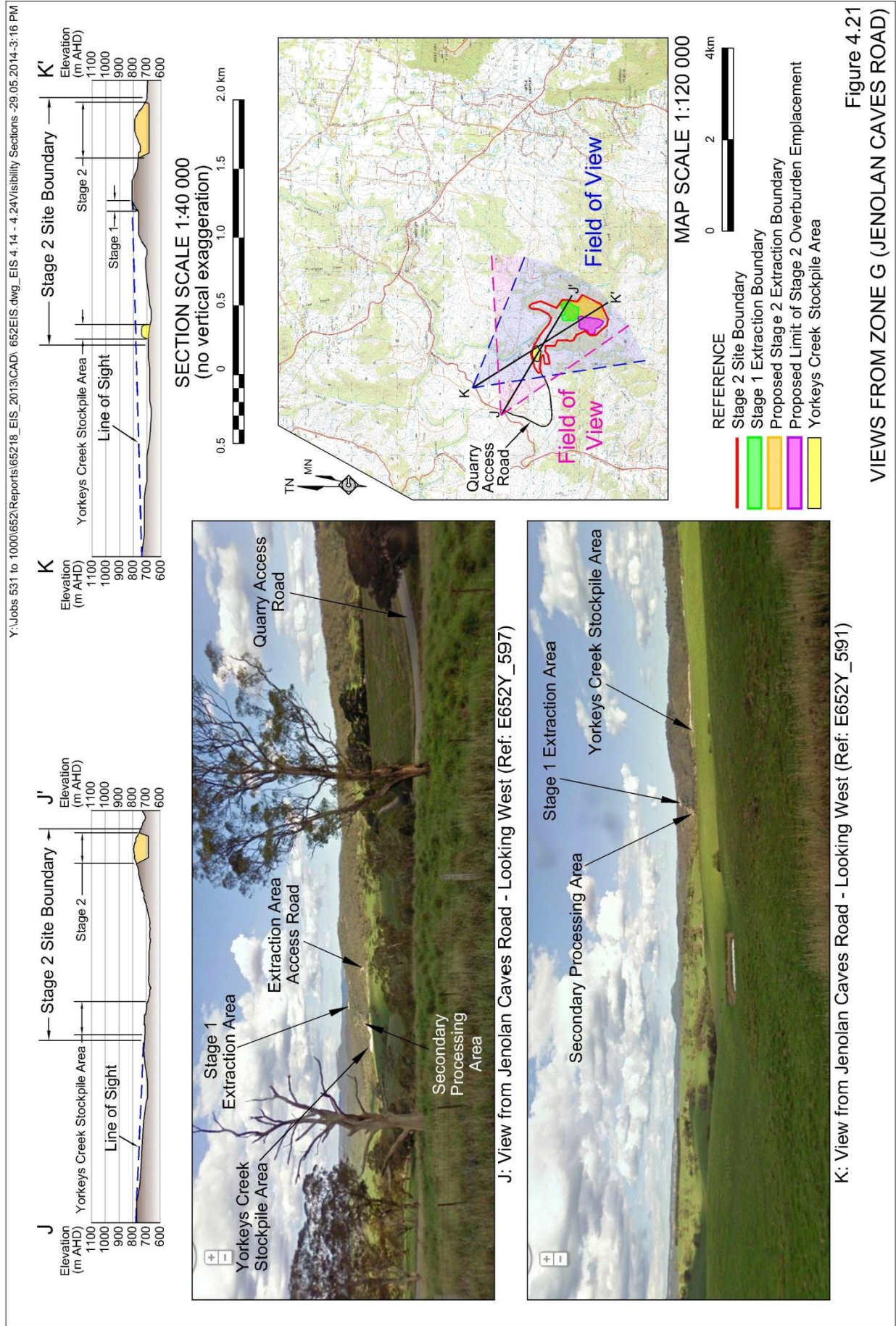


Figure 4.21
 VIEWS FROM ZONE G (JENOLAN CAVES ROAD)

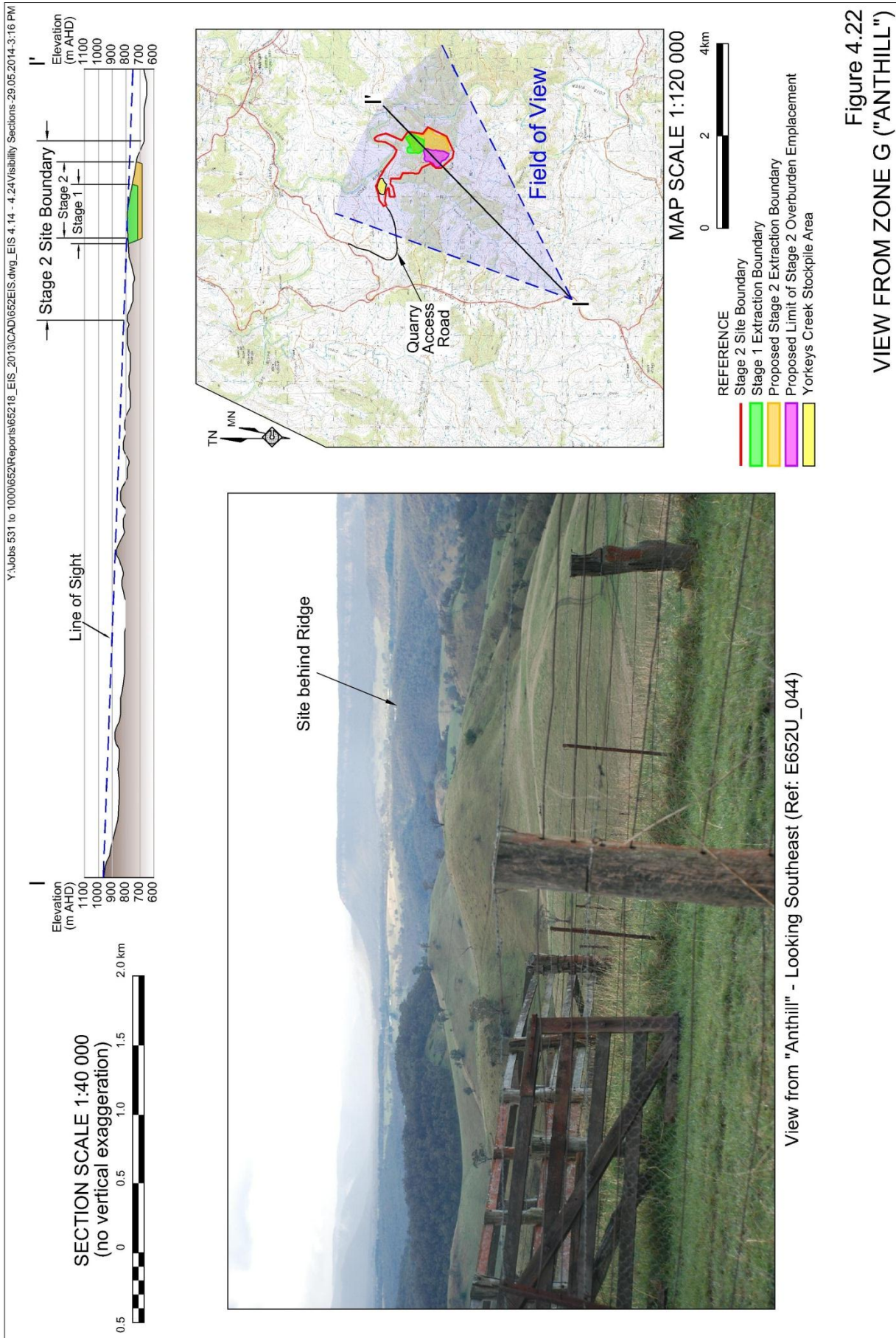
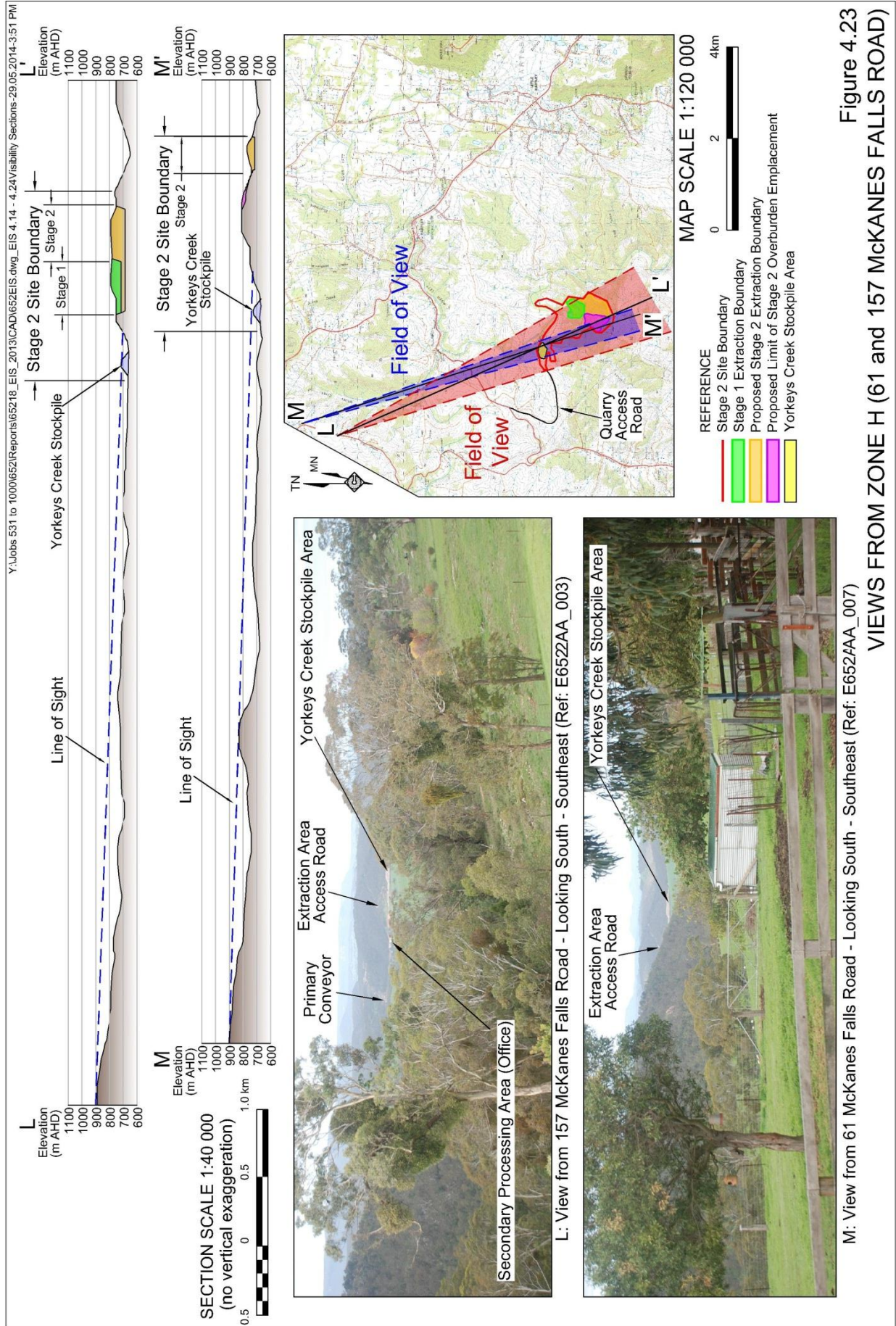


Figure 4.22
 VIEW FROM ZONE G ("ANTHILL")



The secondary processing area, Yorkeys Creek stockpile area, and western face of the current extraction area are all visible (at a distance of approximately 6.5km to 7.0km). Notably, the application of a bituminous film to the western face of the extraction area reduces the contrast and therefore visual impact of this feature (see magnified photo inset of **Figure 4.17**). Retention of the Northern Ridge identified on **Figures 4.14** and **4.15** also provides a visual screen to the primary crushing station. The north-south oriented ridges to the south of the extraction area (left side in the photo) form part of the Stage 2 extension of the extraction area. These are referred to throughout this and future sections as the Central and Southern Ridges and play an important part in the reduction and mitigation of impacts.

4.4.2.3.5 Zone D: Great Western Highway

Between (approximately) Browns Gap Road and Mid Hartley Road, the Stage 2 Site can be viewed from the highway and roadside. Views from buildings (primarily) on the southern side of the highway are also available, however, road side vegetation provides an effective screen, in particular to buildings on the northern side of the highway. **Figure 4.18** provides the visual outlook towards the Stage 2 Site from the driveway of the “Karingal” property which covers the majority of the land adjoining the Great Western Highway from which the Stage 2 Site is visible. Notably, “Karingal” is owned by HPC (the company from which the Applicant leases the land on which the Stage 2 Site is located and therefore project- related).

On descent of Mt Victoria Pass, occasional views of the current extraction area are available, however, these are only fleeting as vehicles wind down the slope. Similarly, occasional views are available from vehicles descending River Lett Hill, with views also available from the properties on the southern side of the highway on River Lett Hill.

4.4.2.3.6 Zone E: Little Hartley (Roads and Residences)

The main thoroughfares of Little Hartley, Coxs River Road and Baaners Lane, along with the many small access roads to the rural residential style development of this area (e.g. Bonnie Hill Drive, Bonnie Blink Drive, John Grant Road, Melliadora Place off Baaners Lane and Morris Place, Cranbrook Park Road, Pippin Place, Blackheath Creek Road off Coxs River Road) were inspected.

The Stage 2 Site cannot be viewed from the section of Coxs River Road which passes through Little Hartley or the local roads that diverge from it. **Figure 4.19** provides a Google Earth street view image of the view from Pippin Place, considered to be the location most likely to afford views of the Stage 2 Site off Coxs River Road, which illustrates this assessment. The Stage 2 Site is visible from a property at the end of Melliadora Place, with fleeting and obscured views also available for the Stage 2 Site from John Grant Road to the immediate south of the intersection with Melliadora Place. **Figure 4.19** provides the visual outlook towards the Stage 2 Site, obscured by mature trees, from the driveway entrance to 26 Melliadora Place. Notably, the owners of this property are constructing a residence at a slightly lower elevation where the intervening vegetation effectively screens the extraction area of the Stage 2 Site.

4.4.2.3.7 Zone F: Kanimbla (Coxs River Road / Kanimbla Drive / Megalong Place)

To the south of the Stage 2 Site, distant views of the overburden emplacement are occasionally available from the Kanimbla locality, either from Coxs River Road or several elevated vantage points on some properties of Kanimbla Drive and Megalong Place. **Figure 4.20** provides the visual outlook and cross-sectional interpretation (Section H) of the Stage 2 Site from the Eagle Chalet of “The Peak at Mt Kanimbla” luxury chalets (43 Megalong Place). Eagle Chalet is located at an elevation of approximately 790m AHD and is adjacent to The Peak Trigonometric station at 800m AHD. Visible from Eagle Chalet, at a distance of 6.2km, is the upper lifts of the overburden emplacement. A view obscured by vegetation is also available from the Wallaby Chalet, as well as the main residence of 43 Megalong Place.

Similar views of the Stage 2 Site would be available from several other elevated locations of Megalong Place.

4.4.2.3.8 Zone G: Jenolan Caves Road

Between the Coxs River and intersection with McKanes Falls Road, views of the quarry, primarily the Yorkeys Creek stockpile area and extraction area access road are available. **Figure 4.21** provides representative views on approach to the Stage 2 Site entrance from the east and west, taken from Google Earth street view. The extraction area is not currently visible and it is not expected that the Stage 2 extension of the extraction area would be visible.

Beyond the intersection of McKanes Falls Road, intervening topography screens both the Stage 1 and proposed Stage 2 activities. A view from the driveway of the “Anthill” property, one of the more elevated positions on Jenolan Caves Road illustrates this (see **Figure 4.22**).

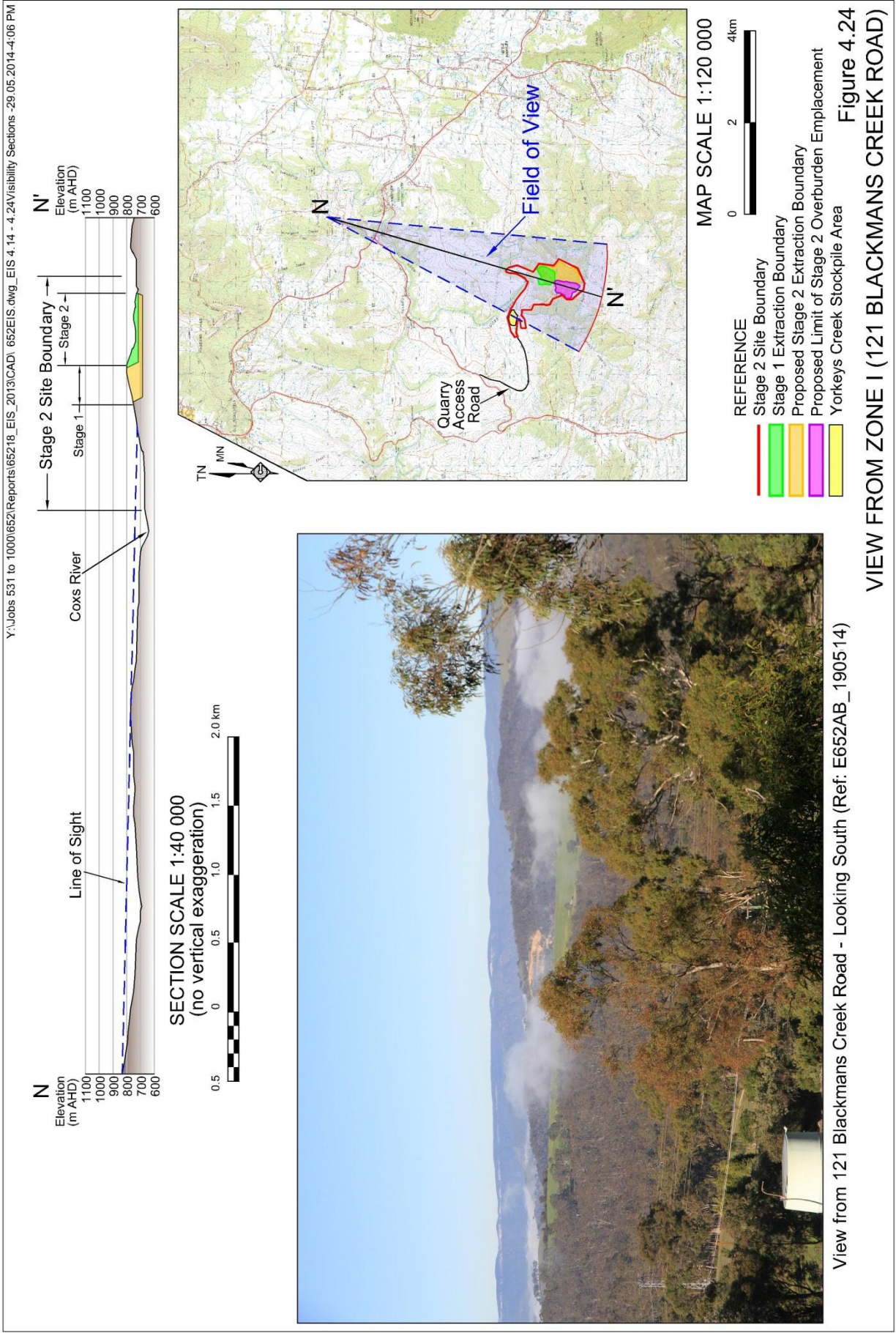
4.4.2.3.9 Zone H: McKanes Falls Road

Views of the extraction area and overburden emplacement are and will continue to be screened by intervening topography. However, the Yorkeys Creek stockpile area, some cleared areas of the secondary processing area, primary conveyor to the secondary processing area and extraction area Access Road are visible from a distance of between 4.5km and 5km from some residences of McKanes Falls Road. **Figure 4.23** provides the visual outlook and cross-sectional interpretation of the Stage 2 Site from 61 and 157 McKanes Falls Road.

4.4.2.3.10 Zone I: Blackmans Creek Road

Blackmans Creek Road intersects with the Great Western Highway opposite Jenolan Caves Road at the base of River Lett Hill. From elevated vantage points on properties along Blackmans Creek Road, the completed western face of the approved extraction area is visible. **Figure 4.24** provides the visual outlook and cross-sectional interpretation of the Stage 2 Site from 121 Blackmans Creek Road. There are two notable features of the view available from 121 Blackmans Creek Road.

1. The retained Northern Ridge screens all views of the current extraction area and primary crushing station.
2. The effectiveness of the bituminous film application over the completed quarry face is evident. The section of the completed face where the film has not been applied cannot be accessed by the equipment used in the application.



4.4.3 Potential Changes to Visual Amenity

4.4.3.1 Introduction

As a consequence of the Proposal, it is considered as unlikely that the quarry would become visible from additional vantage points to those nominated in Section 4.12.2 and illustrated on **Figures 4.14 to 4.24**. However, the area of exposure that would be visible from these locations is likely to increase and the following reviews what are likely to be the main changes to the visibility of the Stage 2 Site and therefore visual amenity of the local setting.

4.4.3.2 Zone A: Hassans Walls, Second Lookout and Hassans Walls Road

As the extraction area extends through the ridges to the south of the Stage 1 extraction area (the “Central Ridge” and “Southern Ridge”), the exposed area of the quarry visible from the north, i.e. from Hassans Walls, Second Lookout and Hassans Walls Road would be increased (at least temporarily). The upper lifts and eastern edge of the overburden emplacement would also become visible.

Notably, the ridge to the north of the Stage 1 extraction area (the “Northern Ridge”) which currently screens some views of the extraction area from Hassans Walls and other elevated vantage points to the north would continue to provide a visual screen of the northern extension area along the existing north-south oriented ridge. Other design features and controls to be implemented by the Applicant to reduce the exposure and impact on visual amenity of the Stage 2 Extension are discussed in Section 4.12.4.

4.4.3.3 Zone B: Bells Line of Road

There would be very minimal change to the views of the Stage 2 Site currently available (at significant distance) from the isolated points on Bells Line of Road.

4.4.3.4 Zone C: Mount York and Mount York Road

Clear unimpeded views of the southern wall of the Stage 1 extraction area are available from both major lookouts and walking trails on the southern side of Mount York Road. The Stage 2 Extension would potentially increase the area of the extraction area exposed to views from these lookouts. The upper lifts of the proposed overburden emplacement would also become visible. As is discussed further in detail in Section 4.4.4, the Applicant has gone to considerable effort to develop strategies to both reduce the area of exposed quarry operations from vantage points within Zone C (refer to Section 4.4.4.2), as well as reduce the impact of any residual views of the quarry operations (both in terms of overall exposure and longevity) (refer to Section 4.4.4.3).

4.4.3.5 Zone D: Great Western Highway

Viewed on a similar orientation as from Zone A (River Lett Hill) and Zone C (Hartley), the extension of the extraction area and overburden emplacement would increase the exposed areas visible from these vantage points. While closer to the Stage 2 Site than equivalently oriented views from Zones A and C, the likely change in visual amenity is not considered to be as great given the elevation of views from Zone D are lower allowing for greater screening by

intervening topography and vegetation. Furthermore, views from vehicles travelling on the Great Western Highway are likely to remain fleeting rather than constant due to the alignment of the road surface and presence of vegetation (both natural and planted following initial approval of the quarry).

4.4.3.6 Zone E: Little Hartley (Roads and Residences)

The extension of the extraction area and overburden emplacement would continue to be screened by topography and vegetation, i.e. operations would remain unseen from Coxs River Road, associated local roads and residences.

As the extraction area is extended to the east and south, the area exposed to views from 26 Melliodora Place would increase. The vegetation which surrounds the site of the residence under construction would, however, continue to provide a visual screen of Stage 2 Site operations. Furthermore, the owners of 26 Melliodora Place noted the effectiveness of the application of a bituminous film over the completed quarry faces in reducing the visibility of the Stage 2 Site further when consulted on 7 April 2014 (refer to Section 3.2.2.5.1).

4.4.3.7 Zone F: Kanimbla (Coxs River Road / Kanimbla Drive / Megalong Place)

As the extraction area is extended to the south, the Southern Ridge which currently screens the extraction area would be removed exposing the elevated locations of the Kanimbla locality to views of the extraction area. The increased elevation of the overburden emplacement and excavation of the Southern Ridge would also result in larger areas of this structure being visible from vantage points within this zone.

4.4.3.8 Zone G: Jenolan Caves Road

The increase in visibility of the quarry from vantage points on Jenolan Caves Road would be similar to those available from the Hassans Walls Lookout. Notably, intervening topography is likely to screen any view of the extended overburden emplacement and exposure of the extraction area extension is not likely to be as significant given the reduce elevation of the vantage points when compared to Hassans Walls.

4.4.3.9 Zone H: McKanes Falls Road

As it is the intention of the Applicant to reduce the volume of material stockpiled on the Yorkeys Creek stockpile area (the most visible aspect of the Stage 2 Site), the exposure of Stage 2 Site operations will reduce over time. Section 4.4.4.3 reviews proposed measures that would be implemented to reduce the visual impact of the Yorkeys Creek stockpile area and secondary processing area.

4.4.3.10 Zone I: Blackmans Creek Road

The quarry-related disturbance that is or may be visible from vantage points on Blackmans Creek Road is categorised as either:

- disturbance associated with the approved quarry operation; or
- disturbance associated with the proposed extension.

Current measures to minimise the visibility of the approved quarry operations, most notably the completed western face of the extraction area would be maintained. As illustrated on **Figure 4.24**, the application of a bituminous film over the completed extraction face is effective in reducing the visibility of the extraction area (a lack of access to the benches of the western extraction face has to date prevented the completion of the bituminous film application over a small section). Regardless of whether the proposed extension proceeds, this view of the Stage 2 Site would remain. The Applicant remains committed, however, to identifying a method of either applying the bituminous film to this section of the completed face or some other measure to reduce the visibility.

4.4.3.11 Lighting Impacts

The Proposal includes an increase in the operating hours to include the evening period of 6:00pm to 10:00pm, although it is noted there would be no increase in activities from that currently undertaken in the early morning period (5:00am to 7:00am). As a consequence, the Proposal could result in the lights used within the extraction area being visible from vantage points surrounding the Stage 2 Site. Notably, evening operations within the secondary processing area currently occur, although the level of lighting may increase to account for the continuation of processing operations until 10:00pm.

4.4.3.12 Conclusion

There are unlikely to be significant changes to the visibility of the Stage 2 Site viewed from Zones B, D, G and H. In fact, a reduction in the volume of material stored within the Yorkeys Creek stockpile area over time should actually reduce the visual exposure of operations on the Stage 2 Site from Zone H.

The area of exposure potentially visible from some vantage points within Zone E, e.g. Melliodora Place, would increase, however, given the screening provided by intervening vegetation, this increase should remain relatively unobtrusive.

The most significant changes to the visibility of the Stage 2 Site from vantage points surrounding the Stage 2 Site, would most likely be from Zones A, C and F. As a consequence, the identification and implementation of design features, operational controls and safeguards to reduce the impact of the Stage 2 Extension on local visual amenity has concentrated on those views available from these zones. Successful reduction in impact achieved for these locations would similarly reduce the impact at other vantage points.

4.4.4 Environmental Controls and Management

4.4.4.1 Visibility Management Objectives

The management of the impact of the Proposal on local visual amenity would be undertaken to achieve two objectives.

1. To reduce the area of the extraction area and overburden emplacement visible from the various vantage points surrounding the Stage 2 Site at any one time.
2. To mitigate the effect of any exposed areas of the Stage 2 Site from the various vantage points surrounding the Stage 2 Site at any one time.

The following provides a discussion of the various design features, controls and management that would be implemented by the Applicant to achieve these objectives.

4.4.4.2 Controls and Management to Reduce Areas of Exposure

Reducing the area of the Stage 2 Site exposed from vantage points surrounding the Stage 2 Site would be achieved primarily through the design and sequence of the extraction area and overburden emplacement. The following summarises the key features of Proposal design aimed at reducing the area of the quarry exposed.

Stage 2 Extension Design

- The primary crushing station would remain in the current location which is not visible from any of the visual zones (Zones A to I) surrounding the Stage 2 Site.
- No further extension of, or modification to the secondary processing area and Yorkeys Creek stockpile area is proposed. In fact, a gradual reduction in the volume of products contained within the Yorkeys Creek stockpile area is planned which would reduce the size of these stockpiles visible from Zones A, C, G and H.

A program to crush and reprocess 40 000t of scalps contained within the Yorkeys Creek stockpile area has been commissioned and the Applicant is aiming to process at least 100 000t of stockpiled scalps annually. This should ensure that the volume of process by-product stockpiled is at least stabilised at current volumes (refer to Section 2.9.2 for information on annual by-product generation). Periodically larger campaigns to supply larger road or other infrastructure projects should lead to the reduction and ultimate removal of the stockpile.

- The Northern Ridge, currently excised from the Stage 1 extraction area to screen views from Zone A, would remain undisturbed should the Proposal be approved. This would continue to screen views of the lower benches of the extraction area from Zones A, G and H.
- The eastern perimeter of the extraction area has been restricted to ensure that elevated sections of the Central and Southern Ridges are retained to the northeast (between the extraction area and Zones C, D and E).
- The extension of the overburden emplacement would be primarily contained within two gullies to the south and west of the existing overburden emplacement. These gullies are screened to the north (Zones A, E, G and H) by natural topography. The lower elevations of these gullies area also screened to the northeast and east (Zones C, D and E) by the Central and Northern Ridges.

Stage 2 Extraction Area Extension Sequence (see also Figure 2.6)

- Initial extraction would occur in the southern portion of the extension area to the southwest of the most elevated point of the Southern Ridge. This would leave a visual barrier in place to the visual vantage points within Zones C and D.

- The area to the south of the most elevated point of the Southern Ridge would be excavated first, daylighting to the south before the active face is progressed to the north (see Stages A, B and C of **Figure 2.6**). This sequencing of the extraction area would ensure that a more elevated section of the Southern Ridge always remains between the extraction area and visual vantage points to the northeast (Zones C and D)
- A similar method of screening the extraction activities would be provided to the north through the retention, for as long as possible, of the most elevated section of the Central Ridge (see Stage C of **Figure 2.6**).
- Screening of extraction activities to the north would be further enhanced through the alignment of the active extraction face along an approximate northeast-southwest axis.
- The sequence has been designed to reach the terminal western face as quickly as possible such that the targeted impact minimisation measures described in Section 4.12.4.3 can be applied as soon as possible over the life of the Proposal.

Stage 2 Overburden Emplacement Extension Sequence (see also Figure 2.6)

- The initial extension of the Stage 2 overburden emplacement would increase the elevation of the overburden emplacement by approximately 30m, to an elevation equivalent to the extraction area access road. Once the maximum elevation of the overburden emplacement is obtained, overburden placement would revert to the lower benches of the overburden emplacement.
- The extension is sequenced in this way to allow for the most exposed section of the overburden emplacement (visible from Zones A, C, D and F) to be completed and rehabilitated prior to the Central and Southern Ridges being removed to their full extent. This would avoid the area of exposure being maximised later in the life of the Proposal.

The measures proposed to reduce the exposure of active or disturbed areas of the Stage 2 Site have focussed on the visual zones to the northwest, north, northeast and east, as these make up the majority of visual vantage points. It is noted that these measures would not mitigate views of the Site from the south. Section 4.4.4.3 reviews the various management measures and controls to be implemented to reduce the impact of those components or activities on the Stage 2 Site which cannot be screened or removed from view.

4.4.4.3 Controls and Management to Reduce Impacts of Exposure

Controls and management measures to reduce the impact of exposed disturbance would be more targeted and largely build upon measures currently in place at the quarry. The following considers each of the components that would be visible, the zones from which views of these would be available and the methods of mitigating the visual impacts.

Secondary Processing Area (and Primary Conveyor)

While generally screened from view from most vantage points due to its low elevation, the stockpiles, conveyors and other components of the secondary processing area would be visible from Zones C and H (see **Figures 4.17** and **4.23**). The following visual impact mitigation measures would be implemented.

- The profiled slopes between the administration centre and extraction area Access Road (see **Plate 4.1**) would be benched, covered with soil (or other appropriate growth medium) and vegetated with grass or other groundcover.
- The vegetation established on the completed northern face and fill slope between the extraction area and secondary processing area (see **Plates 4.2** and **4.3**), would be retained and maintained.

Yorkeys Creek Stockpile Area

The stockpile of fill and road pavement materials contained within this area is visible from Zones A, C, G and H (see **Figures 4.14, 4.15, 4.17, 4.21** and **4.23**). The Applicant proposes to implement both a short-term and long-term strategy for mitigating this impact.

- Long-term Visual Impact Reduction Strategy

Through reprocessing of the material contained within the stockpiles, and modifications to the scalps processing of raw throughput to the processing operations, the Applicant would improve the marketability of the products including:

- specialty aggregates;
- fill sand;
- road base;
- select fill; and
- specialty sands and other products.

As discussed in Section 2.11.1, an increase in the hours of operation available for processing (to 10:00pm) would provide greater scope for the processing of scalps in an efficient and cost-effective manner.

As the Applicant increases sales, the volume of material contained within the stockpile would be reduced over the life of the Proposal. The Applicant notes that proposed road works projects on the Great Western Highway such as the Forty Bends upgrade are likely to require in excess of 250 000t of fill material. The logical source of these materials due to quality and proximity would be the Austen Quarry. This project alone could account for 30% to 40% of the currently material stockpiled.

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Plate 4.1: Unvegetated slopes of the Secondary Processing Area
(Ref: E652W_009)

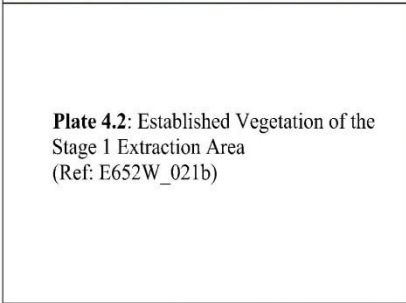


Plate 4.2: Established Vegetation of the Stage 1 Extraction Area
(Ref: E652W_021b)



Plate 4.3: Established grass coverage of Northern Extraction Face
(Ref: E652S_027)



Plate 4.4: Rehabilitation of the Overburden Emplacement
(Ref: E652P_026)



Short-term Visual Impact Reduction Strategy

- While markets for the various products are identified and developed, the Applicant proposes to maintain a cover of grassy vegetation on the outer slopes of the stockpiled material. The Applicant is currently investigating the use of seeded spray for use on the exposed walls and steep slopes.
- In addition, the Applicant has committed to planting multiple rows of trees on the ridgeline to the immediate north to provide additional screening of the stockpile area.
- Trials of various methods for establishing and maintaining grass cover on the stockpiles are planned for spring 2014, with confirmation of the proposed approach to be made prior to spring 2015.

Stage 1 Extraction Area (Completed Western Face)

Views of the completed western faces of the extraction area are, and would continue to be visible from Zones A to E and I (see **Figures 4.14 to 4.19 and 4.24**). However, as the western extraction area face is completed (or where it is to remain inactive for extended periods), a bituminous film would be applied to reduce the contrast between the pale rhyolite and darker background vegetation. The insets of **Figures 4.17 and 4.24** illustrate the effectiveness of the bitumen in reducing the contrast created by the exposed rock wall and therefore visibility.

The Applicant is also investigating the use of seeded spray for the exposed quarry walls.

Stage 2 Extraction Area Extension

As the extraction area is extended, temporary views of extraction of the central and southern ridge would be available from the visual zones to north (Zones A, D and I).

Longer term or permanent views of the extraction activities within the Stage 2 extraction area would be limited to Zones C, E and F. The primary method of reducing the visual impact of the extraction area from vantage points within these zones would be as follows.

- Application of bituminous film to terminal extraction faces, or faces unlikely to be worked for extended periods of time. The photo insets of **Figures 4.17 and 4.24** illustrate the effectiveness of this method in reducing the visual impact of the extraction area.
- Progressive rehabilitation of the completed benches of the extraction area. As the extraction area reaches the outer perimeter, a layer of overburden (for water retention) followed by soil would be placed on the final bench. The bench would then be seeded with native groundcover, shrub and tree species.
- Where the use of floodlights are required within the extraction area, these would be directed downwards and towards the west, wherever possible. Special attention would be paid to lighting of internal haul roads within the extraction area to ensure that lights are not directed towards the east or south.

Overburden Emplacement Extension

- The overburden emplacement area is currently visible from Zone F (see **Figure 4.24**) and would become visible from Zones C, D, E and I as the elevation increases from 780m to 810m AHD. In order to mitigate the impact resultant from the development of the overburden emplacement, the Applicant would sequence the development and rehabilitation of the overburden emplacement as follows. The initial component of the overburden emplacement to be completed would be the upper lifts. Immediately on completion, these lifts would be profiled, covered with soil and seeded with groundcover species to reduce the contrast between the overburden and surrounding vegetation.
- The initial revegetation would be followed by direct seeding or planting of tree and shrub species commensurate with those of the surrounding vegetation communities. **Plate 4.4** illustrates that the Applicant has been successful to date in establishing vegetation over rehabilitated land.
- On completion of the upper lifts, overburden placement would revert to the lower elevation benches, following the same program of bench completion, profiling, soil application, groundcover establishment then tree planting.
- Placement of overburden would be avoided after 6:00pm as far as practicable. If required, floodlights would be positioned to direct light downwards and towards the north or west.

General Visual Impact Mitigation Strategies

The following more general visual impact mitigation strategies would be implemented.

- The tree plantings along Jenolan Caves Road would continue to be maintained, with water or fertiliser provided under extreme conditions to ensure survival and growth.
- Emissions of dust would be minimised on the Stage 2 Site through the application of water to trafficked areas, stockpiles and conveyor transfer points (see also controls of Section 4.8.5).
- Maintenance of the Stage 2 Site in a tidy and orderly manner.
- Lighting plant (both permanent and temporary) would be selected and located such that the light:
 - is not directed towards Jenolan Caves Road;
 - is not directed to the south or east when placed within the extraction area or on the overburden emplacement; and
 - minimises the ‘lume’ created by the lights.

The Applicant would also continue to investigate additional or alternative impact mitigation measures to reduce the impact of the Proposal on visual amenity. The use of the bituminous film on the extraction faces is an excellent example of the Applicant's adoption of this 'adaptive management' approach. For several years, various options for reducing the visual contrast of the extraction area faces were investigated before the current approach was adopted and implemented.

4.4.5 Assessment of Residual Impacts

4.4.5.1 Area of Exposure

With respect to the first objective of visual amenity management nominated in Section 4.4.4.1, i.e. to reduce the area of the extraction area and overburden emplacement visible from the various vantage points surrounding the Stage 2 Site at any one time, the proposed design features, operational controls and management measures would be effective. Views of the Stage 2 Site from vantage points within Zones B, E, G, H and I would remain largely unchanged and in fact should be improved as a result of both the short-term and long-term visual impact management strategies proposed for the Yorkeys Creek stockpile area.

An increase in the visibility of the Stage 2 extension to the extraction area and overburden emplacement would be unavoidable from some vantage points, most notably those within Zones A, C, D and F.

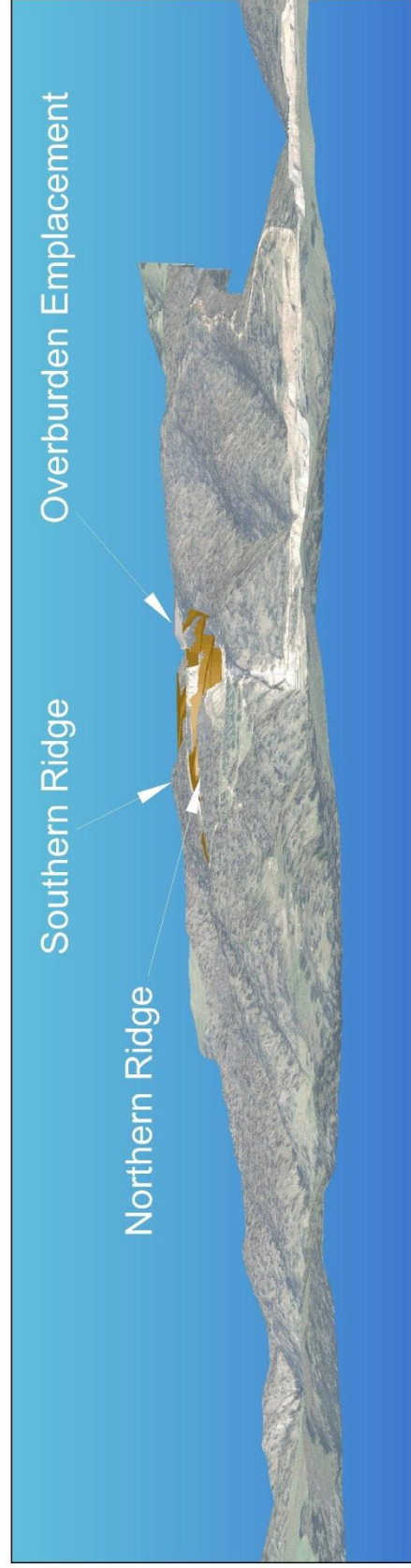
Zones A, C and D

To illustrate the progressive exposure of the Stage 2 Site from Hassans Walls (Zone A) and Mt York (Zone C²), Groundwork Plus prepared a series of 3-Dimensional interpretations from these vantage points based on the existing and future topography (at each stage of the extraction sequence). **Appendix 5** provides the original images provided by Groundwork Plus and **Figures 4.25** and **4.26** combine these to match the extraction stages of **Figure 2.6**. **Figure 4.27** provides the final predicted view of the Stage 2 Site from Hassans Walls and Mt York.

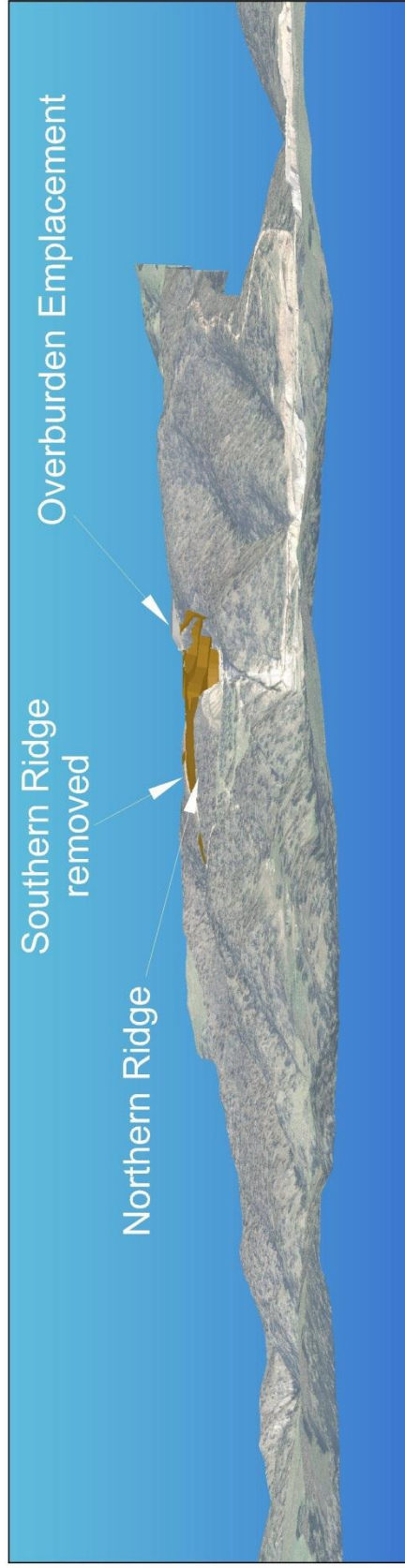
Figures 4.25 to **4.27** demonstrate that while the Stage 2 extraction area and overburden emplacement would be visible from vantage points to the north and northeast, the sequencing of operations would minimise the area of exposed disturbance at any given time. This minimisation in the area exposed at each stage would be achieved by maximising the effective screening provided by natural topography, e.g. the Northern, Central and Southern Ridges. It is noted that the images presented in **Figures 4.25** to **4.27** do not attempt to illustrate how the management measures discussed in Section 4.4.4.3 would reduce the visual impact of proposed Stage 2 Extension, most notably progressive rehabilitation and application of the bituminous film to completed or inactive extraction faces,. These figures are presented solely to illustrate how extraction area design and sequencing minimises the area of exposed quarry.

² The exposure of the Stage 2 extraction area and overburden emplacement from Zone C is indicative of the view which might be available from vantage points within Zone D (in the Little Hartley to Hartley section of the Great Western Highway), albeit more fleeting as viewed from a vehicle and obscured by roadside vegetation.

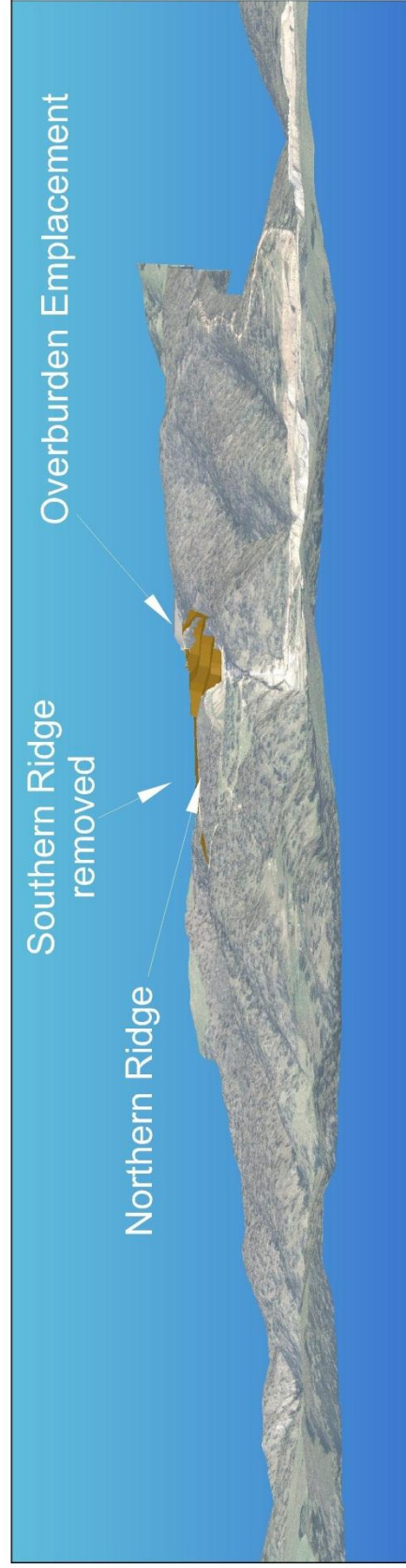
Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\ 652EIS.dwg_EIS 4.25 Exposure -25.09.2014-1:51 PM



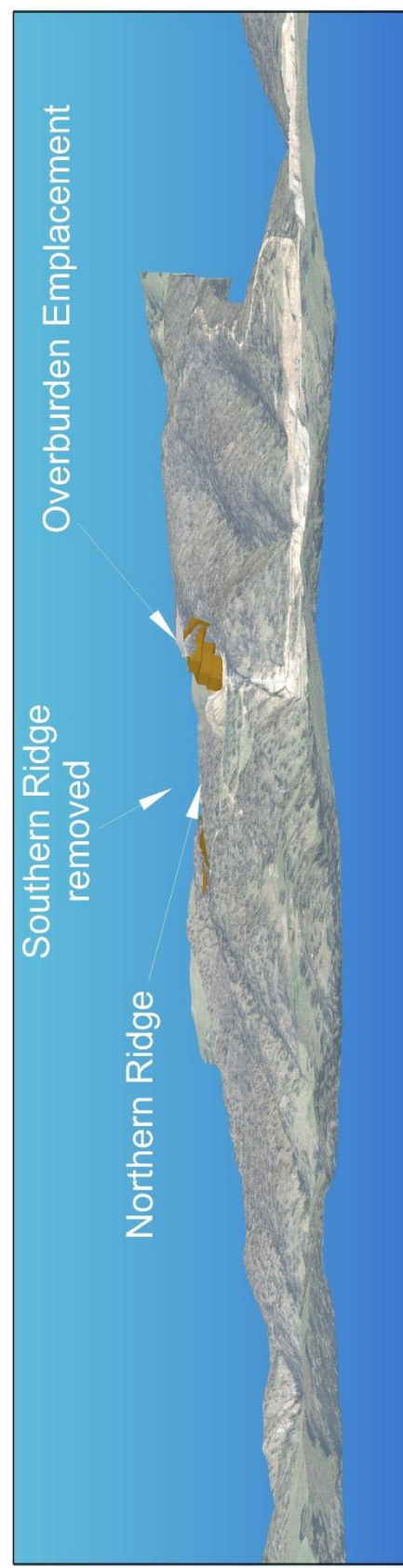
Stage A



Stage C



Stage D



Stage F

- REFERENCE
- Extraction Area
 - Overburden Emplacement
 - Vegetation

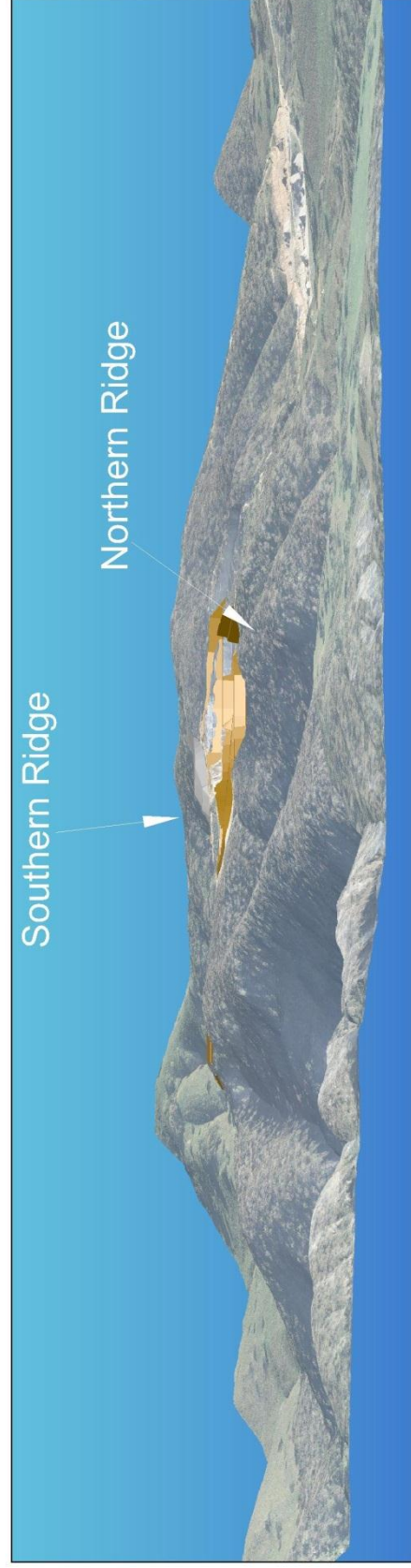
- Notes 1: Refer to Figure 4.14 for location of Vantage Points and approximate Field of View
 2: The horizon and foreground has been removed for clarity
 3: Colouration of the extraction area and overburden emplacement has been chosen to emphasise these features in this figure. Management measures as discussed in Section 4.4.4.3 would reduce the visual impact significantly

Figure 4.25
 PROGRESSIVE EXPOSURE OF THE
 STAGE 2 EXTENSION FROM HASSANS WALLS

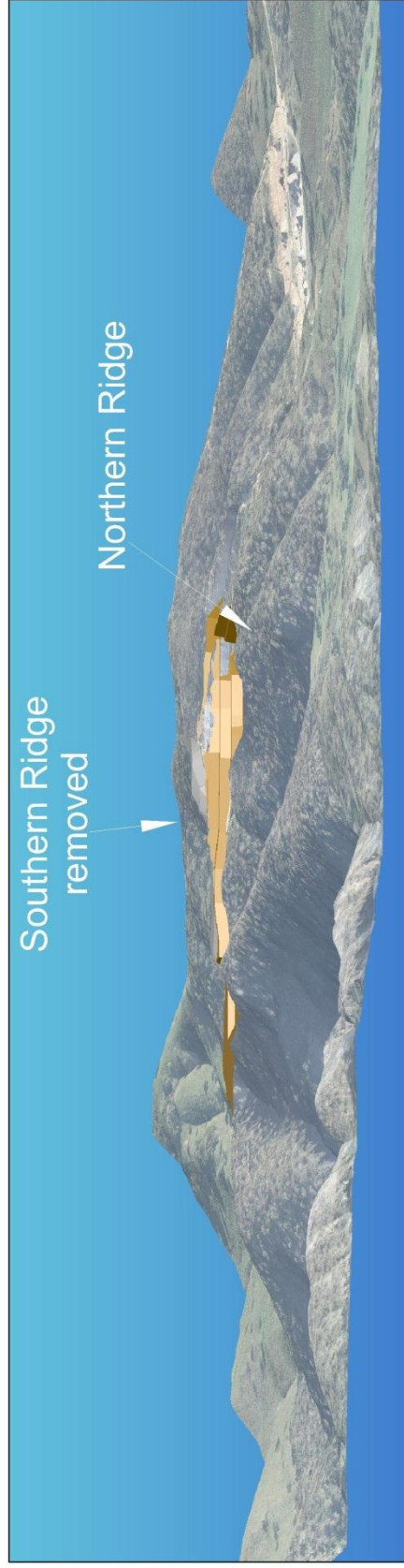
Source: Groundwork Plus (see Appendix 5)

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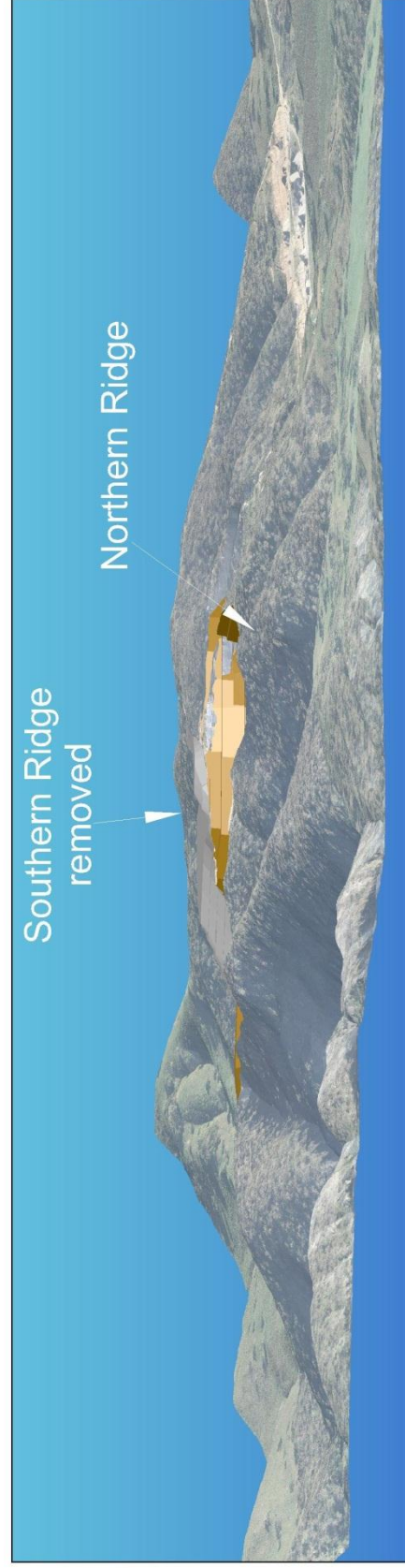
Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\ 652EIS.dwg_EIS 4.26 Exposure -25.09.2014-1:51 PM



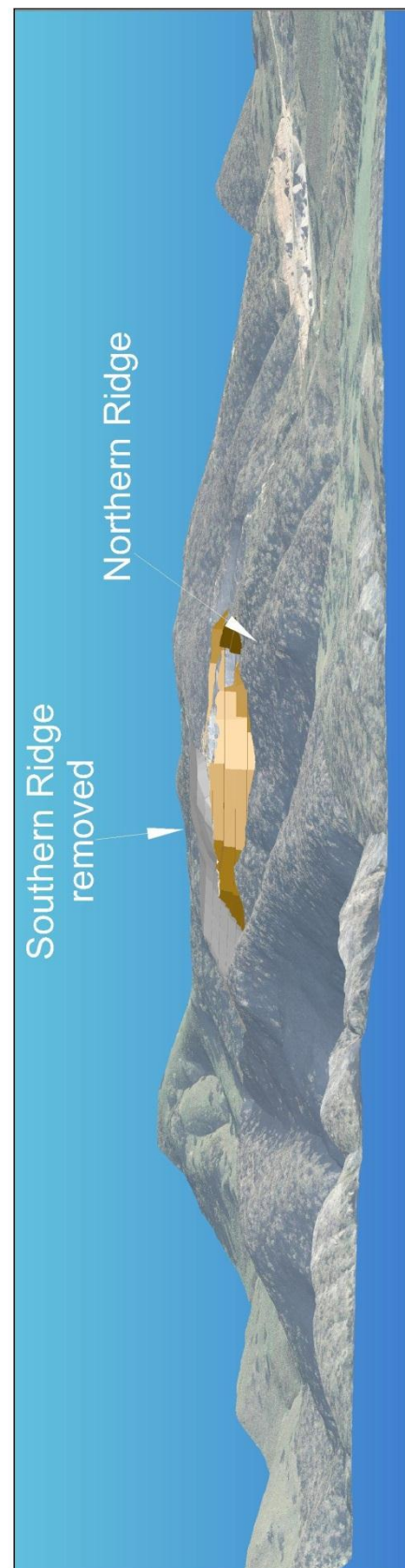
Stage A



Stage D



Stage E



Stage F

- Notes 1: Refer to Figure 4.17 for location of Vantage Points and approximate Field of View
 2: The horizon and foreground has been removed for clarity
 3: Colouration of the extraction area and overburden emplacement has been chosen to emphasise these features in this figure. Management measures as discussed in Section 4.4.4.3 would reduce the visual impact significantly

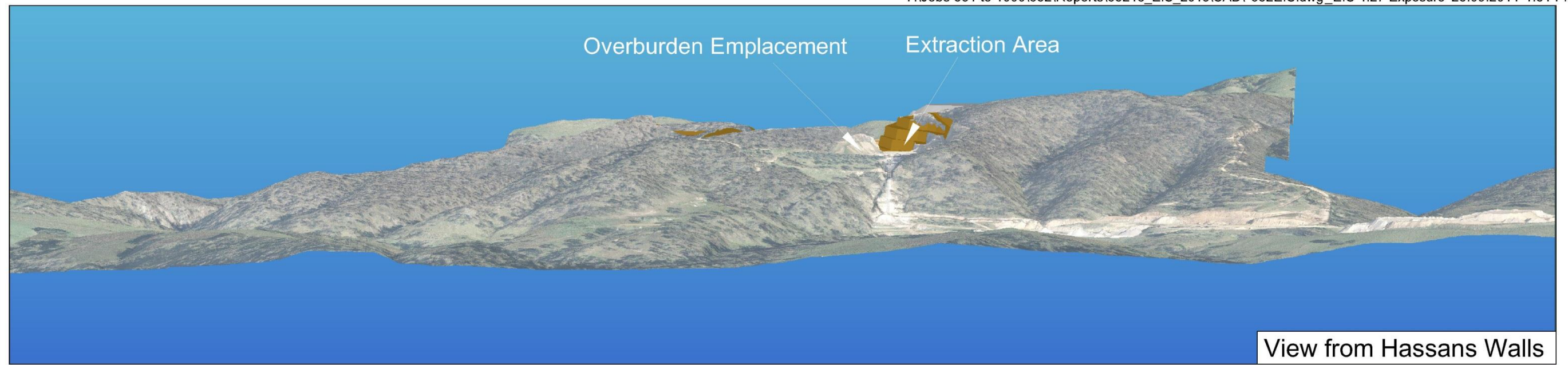
- REFERENCE
-  Extraction Area
 -  Overburden Emplacement
 -  Vegetation

Figure 4.26
 PROGRESSIVE EXPOSURE OF THE
 STAGE 2 EXTENSION FROM MOUNT YORK

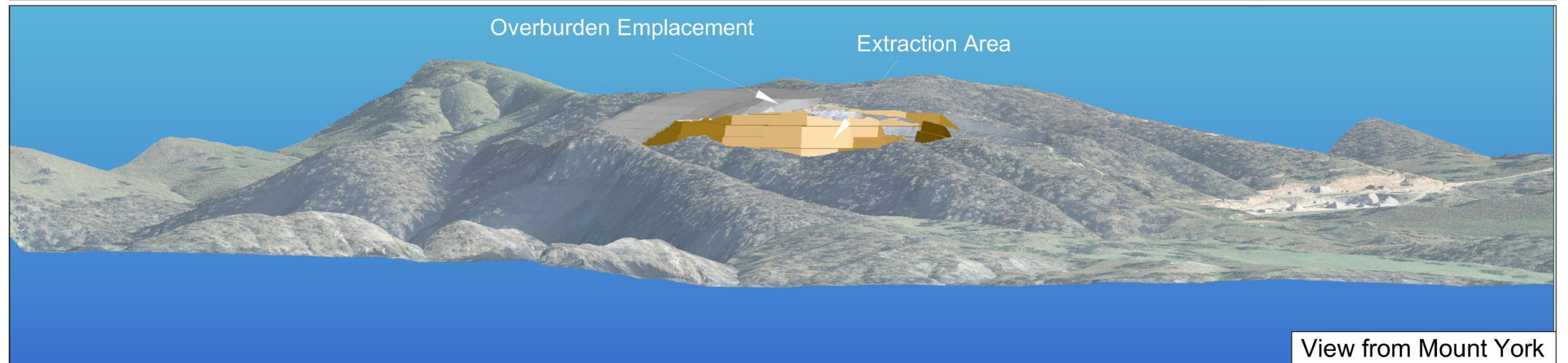
Source: Groundwork Plus (see Appendix 5)

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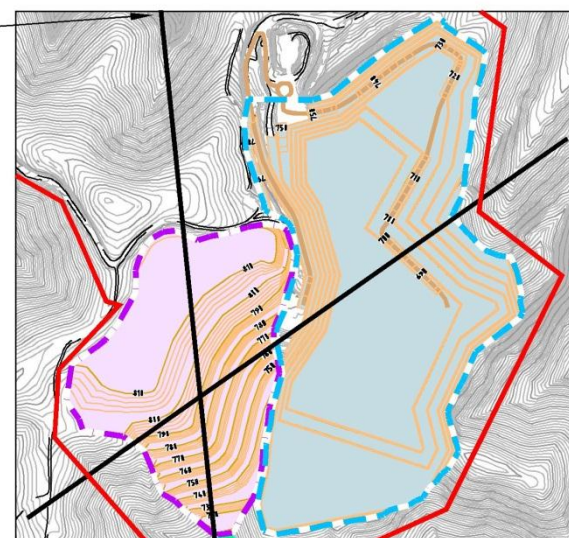
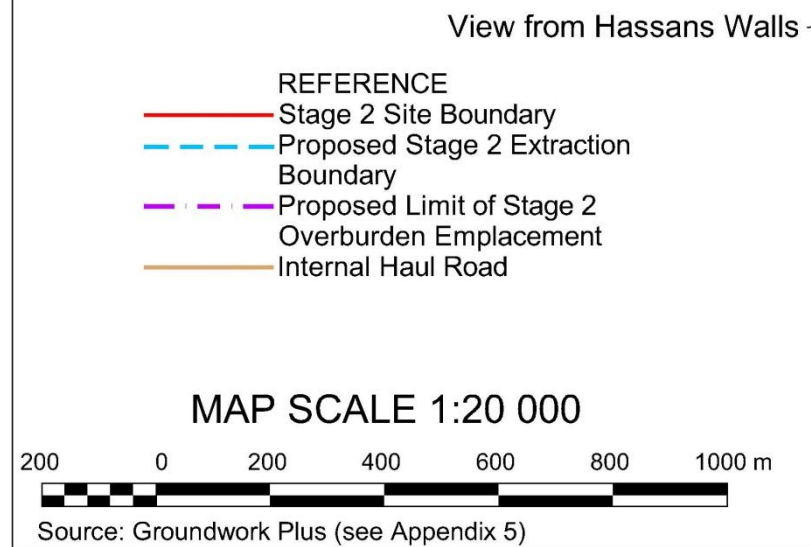
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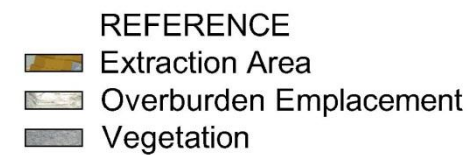
View from Hassans Walls



View from Mount York



View from Mount York



- Notes 1: Refer to Figures 4.14 and 4.17 for location of Vantage Points and approximate Field of View
 2: The horizon and foreground has been removed for clarity
 3: Colouration of the extraction area and overburden emplacement has been chosen to emphasise these features in this figure. Management measures as discussed in Section 4.4.4.3 would reduce the visual impact significantly

Figure 4.27
 PREDICTED FINAL VIEWS FROM
 HASSANS WALLS AND MOUNT YORK

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As discussed in preceding sections, the vantage points of Hassans Walls and Mt York provide the greatest visual exposure of the Stage 2 Site from the north and northeast. The impact minimisation measures effective for these vantage points would be equally if not more effective from those vantage points with more distant or obscured views within Zones A to E, and G to I.

Zone F

Groundwork Plus also prepared a series of interpreted visual montages from “The Peak at Mt Kanimbla” (Eagle Chalet) (see **Appendix 5**). **Figure 4.28** presents the interpreted view of the Stage 2 Site from this location as the extraction area and overburden emplacement are progressively developed and rehabilitated.

Figure 4.28 illustrates that over the life of the Proposal, the area of the Stage 2 extraction area and overburden emplacement visible from vantage points within Zone F would increase. As is also illustrated by **Figure 4.28**, however, progressive rehabilitation and management of the extraction faces of the Stage 2 Site is likely to reduce the impact of this increase in exposed quarry operations.

At distances such as those to the vantage points of Zone F (~6km), visibility is most affected by contrast, e.g. between the paler coloured rock and darker vegetation which surrounds it and less by the actual activities undertaken. This is exemplified by the owners of 43 Megalong Place identifying the disturbance associated with the Stage 1 overburden emplacement but misidentifying this as a road or farm track. The reduced visibility of the Stage 1 extraction area from Hassans Walls and other vantage points after the application of a black bituminous film (see insets to **Figures 4.17** and **4.23**) is also illustrative of this.

4.4.5.2 Impact of Exposure

With respect to the first objective of visual amenity management nominated in Section 4.4.4.1, i.e. to reduce the area of the extraction area and overburden emplacement visible from the various vantage points surrounding the Stage 2 Site at any one time, the proposed design features, operational controls and management measures would be effective.

While it is concluded in Section 4.4.5.1 that the area of exposed disturbance on the Stage 2 Site would be reduced as far as possible, the area of exposed disturbance would be increased as a result of the Proposal. Assuming the implementation of the various mitigation measures nominated in Section 4.4.4.3, however, the impact of this increase in exposure would be reduced to the greatest extent considered feasible, thereby achieving the second objective noted in Section 4.4.4.1, i.e. to mitigate the effect of any exposed areas of the Stage 2 Site from the various vantage points surrounding the Stage 2 Site at any one time. Supporting this assessment, the following is noted.

- The visual amenity of the secondary processing area and Yorkeys Creek stockpile area would be progressively improved through a reduction in the area currently disturbed or lacking vegetation.
- The application of the bituminous film to terminal or inactive extraction area faces is effective in reducing the visual contrast and therefore impact of these features of the quarry.

- A focus on progressive rehabilitation would ensure that the visual impact of the overburden emplacement and (to a lesser extent) terminal faces of the extraction area would be reduced as quickly as possible.
 - **Plate 4.4** demonstrates the ability of the Applicant to successfully revegetate sections of the Stage 1 overburden emplacement.
 - **Figure 4.28** provides the interpreted views of the Stage 2 Site when viewed from Zone F, considering the planned progressive rehabilitation and bituminous film application.
- Impacts of night lighting would be managed through selection and placement of lights to minimise the overall ‘lume’ and ensure the direction of lighting is away from those visual zones with direct views of the extraction area and overburden emplacement.
- The Applicant would continue to implement an adaptive management approach to identifying and mitigating impacts on visual amenity.
- The Applicant would continue to manage dust and light emissions such that these do not impact on local visual (or general) amenity.
- The establishment of the proposed Biodiversity Offset Area (BOA), while not specifically mitigating the visual impact of the extraction area and overburden emplacement, would ensure that that the areas surrounding the Stage 2 Site are protected from future clearing or modification which would impact on local visual amenity.

4.4.6 Monitoring

The Applicant would undertake a series of annual photographs from vantage points within each of the Zones nominated and compare (in the case of Hassans Walls and Mt York) against the sequence of impact presented **Appendix 5** and **Figures 4.25 to 4.28**. These photos, along with a discussion as to compliance with the impact predicted, would be included in the annual reporting to be completed for the Proposal and submitted to DP&E and other agencies.

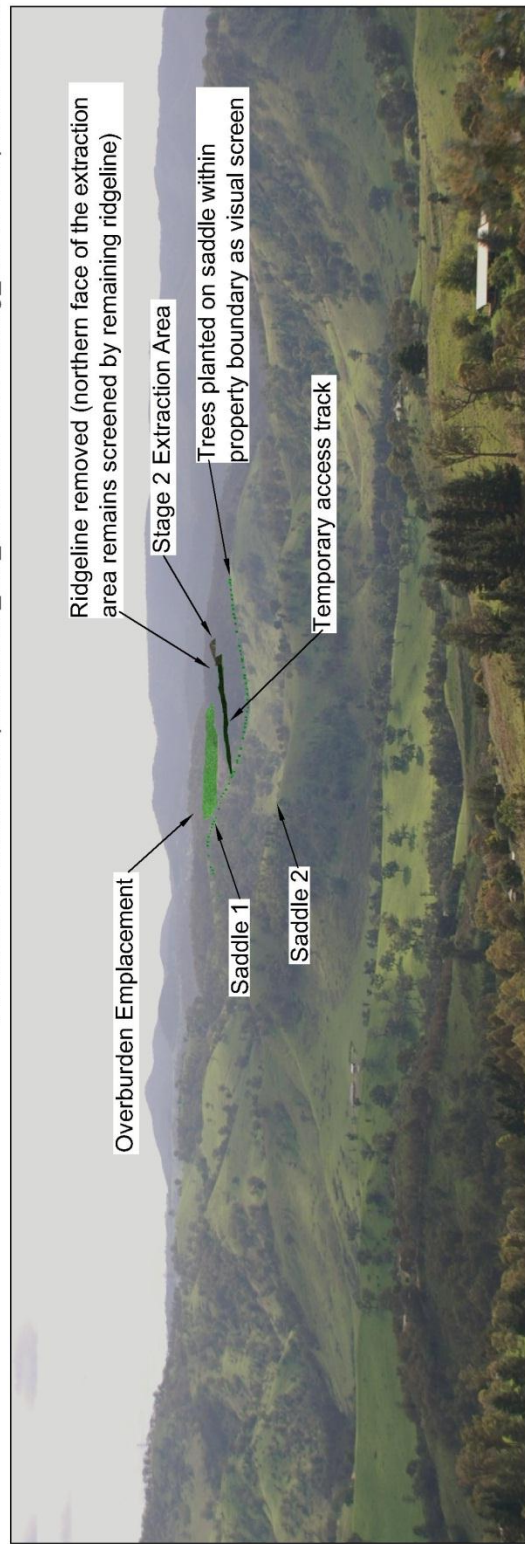
4.5 SURFACE WATER

4.5.1 Introduction

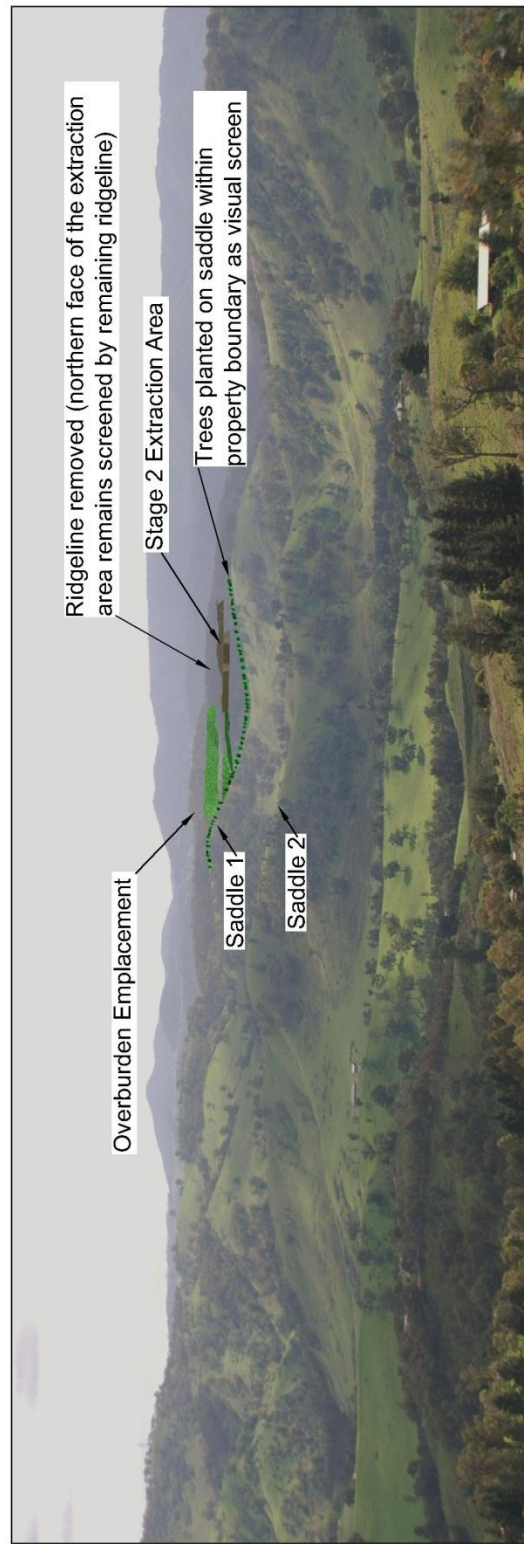
The DGRs issued for the Proposal identified “*Soil and Water*” as a key issue requiring that the “*EIS include*”:

- *a detailed assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including:*
 - *detailed modelling of potential groundwater impacts;*
 - *impacts on riparian, ecological, geomorphological and hydrological values of watercourses, including environmental flows, in particular Coxs River;*

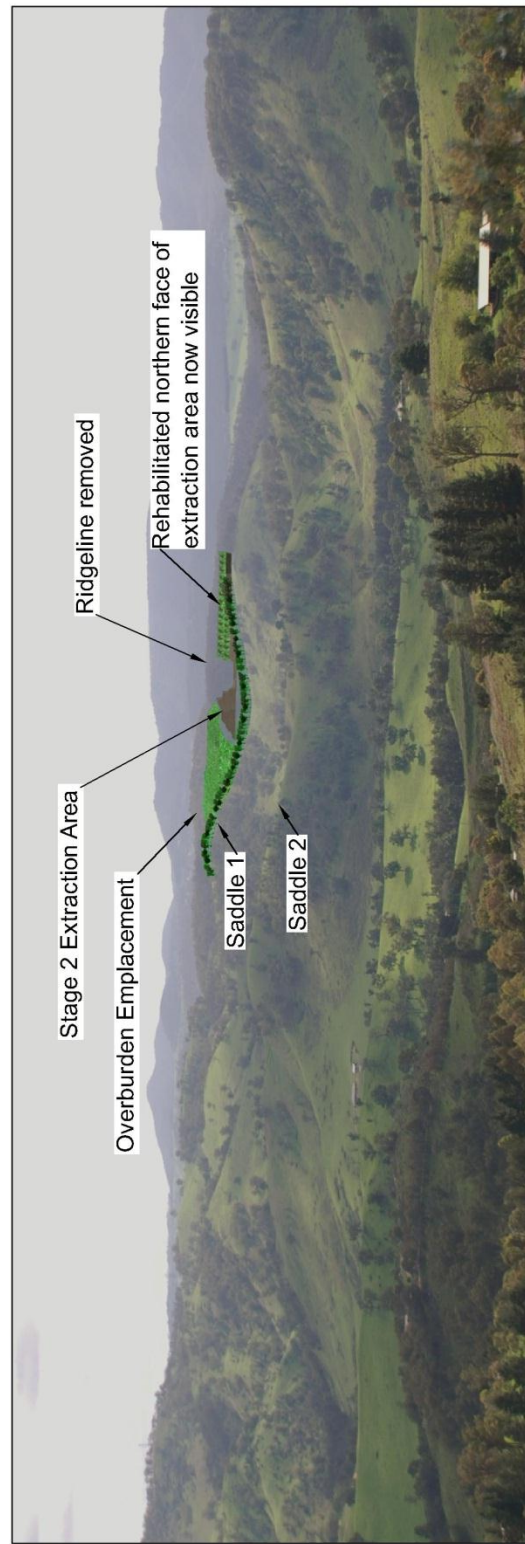
Y:\Jobs 531 to 1000\652\Reports\65218_EIS_2013\CAD\ 652EIS.dwg_EIS 4.28 Exposure -30.05.2014-3:34 PM



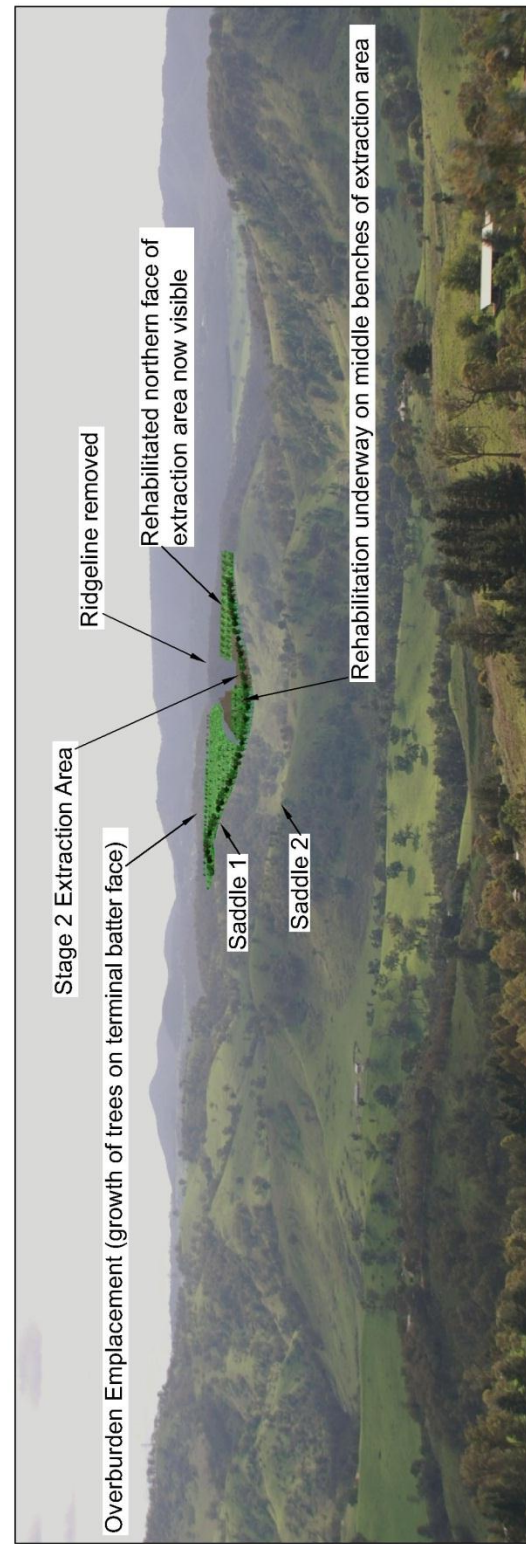
Stage A



Stage C



Stage E



Stage F

Notes 1: Refer to Figure 4.20 for location of Vantage Point and approximate Field of View

2: Colouration of active areas and rehabilitation is indicative only

Figure 4.28
**PROGRESSIVE EXPOSURE OF THE STAGE 2
 EXTENSION FROM "THE PEAK AT MT KANIMBLA"**

Source: Groundwork Plus (see Appendix 5)

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- *whether the development can operate to achieve a neutral or beneficial effect on water quality in the drinking water catchment, consistent with the provisions of State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011;*
- *a detailed assessment of the potential impacts of the development on:*
 - *the quantity and quality of regional water supplies;*
 - *regional water supply infrastructure; and*
 - *affected licensed water users and basic landholder rights (including downstream water users);*
- *a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;*
- *identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000;*
- *demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP) or water source embargo;*
- *a detailed description of the proposed water management system (including upgraded sewage system), water monitoring program and other measures to mitigate surface and groundwater impacts; and*
- *a flood impact assessment, which identifies impacts on local and regional flood regimes and resultant impacts on infrastructure and public safety, including any measures proposed to mitigate potential flood impacts.*

Additional matters for consideration in preparing the EIS were also provided in the correspondence attached to the DGRs from the NSW Office of Water (NOW) which amongst several more general water impact and assessment related requests included a request for a predictive assessment of the impact of the Proposal that includes identification of all surface water sources, descriptions of dependent ecosystems and users, and an assessment of predicted impacts to all users, hydrogeological features and water quality. Requirements were also provided by the Sydney Catchment Authority and Lithgow City Council. A consolidated list of the identified requirements and where each is addressed is presented in **Appendix 3**.

Based on the risk analysis undertaken for the Proposal (Section 3.3.1 and **Table 3.9**), the potential impacts relating to surface water and their risk rankings (in parenthesis) after the adoption of pre-existing or standard mitigation measures are as follows.

- Reduced flows to Yorkeys Creek and Coxs River (medium risk)
- Reduced availability of water to downstream users (low risk).
- Reduced volume of water available to local flora and fauna resulting in:
 - stress and possible reduction in viability of native vegetation (low risk); or
 - degradation of riparian or aquatic vegetation / ecosystems (medium risk).

- Discharge of dirty or contaminated water to local creeks and tributaries causing pollution of downstream waters (medium risk).
- Contamination of soil resources and limitation of future land use from discharge of dirty or contaminated water (low risk).
- Health-related impacts to people due to the consumption of contaminated water (low risk)
- Health-related impacts to livestock due to the consumption of contaminated water (low risk)
- Soil erosion causing loss of agriculturally productive capacity (medium risk).
- Erosion causing decreased availability of soil for rehabilitation (medium risk).

A review of the attributed risk levels, following the adoption of the recommended operational safeguards and controls, is provided in Section 6.2.1 and **Table 6.1**.

The surface water impact assessment for the Proposal was undertaken by Messrs Shane Stuart and Prasanna Rao of Groundwork Plus. The assessment is presented as Part 2 of the *Specialist Consultants Studies Compendium* and is referred to hereafter as “Groundwork Plus (2014)”. This subsection of the EIS provides a summary of the surface water impact assessment, concentrating on those matters raised in the DGRs and related requirements provided by various government agencies.

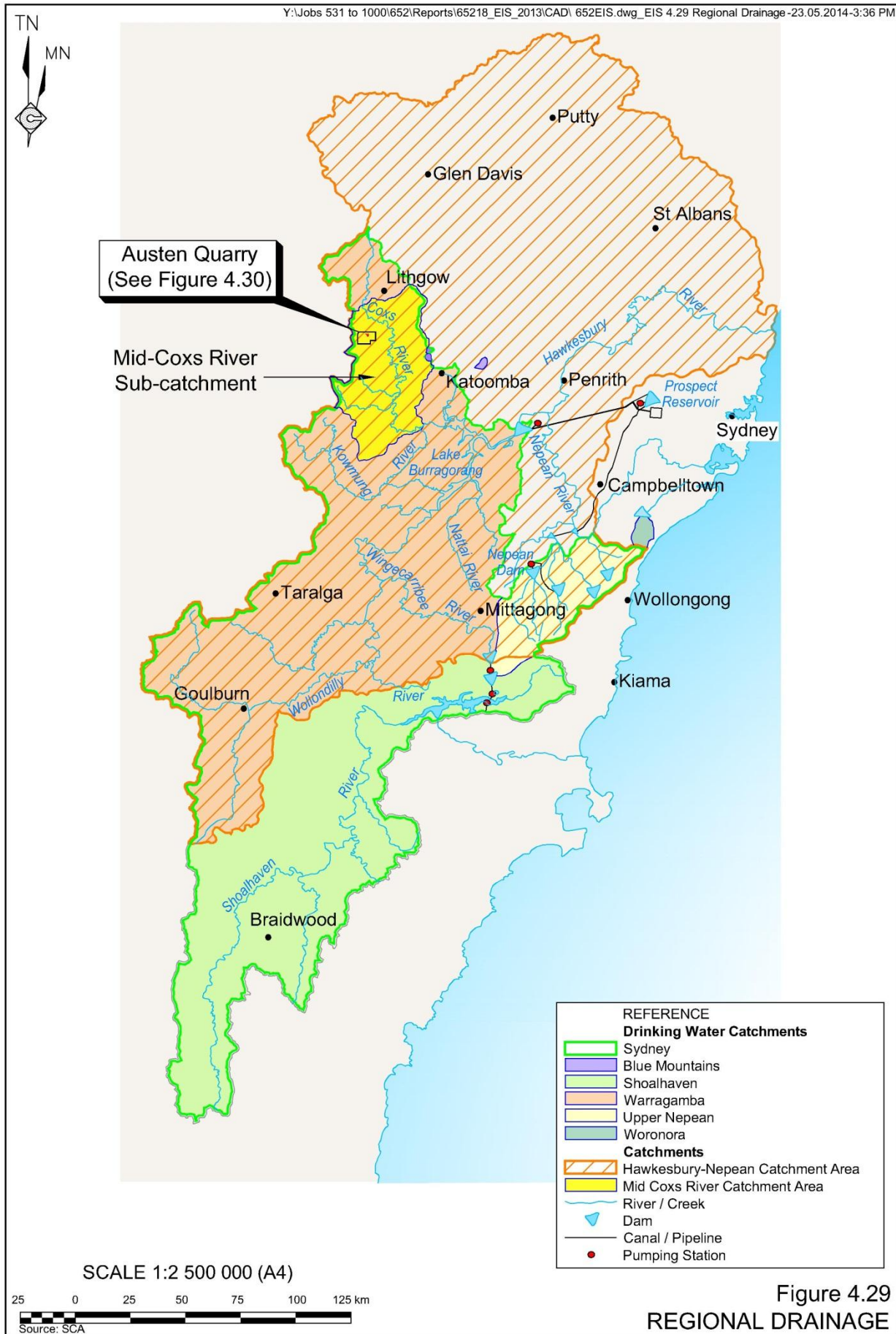
4.5.2 The Existing Environment

4.5.2.1 Regional Catchments and Drainage

The Stage 2 Site is located within the Mid Coxs River catchment of the Hawkesbury-Nepean catchment. The Hawkesbury-Nepean catchment includes a number of significant creeks and rivers which drain runoff from the Mulwaree River in the south to the Capertee and McDonald Rivers in the north to the Pacific Ocean. The Mid Coxs River catchment also forms part of the Warragamba sub-catchment of the Sydney Drinking Water Catchment, as defined by the *State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011*, which provide the drinking water supply to Greater Metropolitan Sydney. **Figure 4.29** identifies the relevant regional catchments noted above.

The Coxs River is the most significant regional drainage feature and with its headwaters at Gardiners Gap, within Ben Bullen State Forest, flows through the Megalong Valley and parts of the Greater Blue Mountains Area with a catchment of approximately 2 630km². The river flows in a generally southerly direction and joined by 15 main tributaries including the Little, Jenolan, Kedumba, Kowmung and Wollondilly rivers, before reaching its confluence with the Warragamba River to form Lake Burragarang (behind Warragamba Dam), the largest of Sydney’s water supply reservoirs.

The majority of the mid-catchment is highly degraded as the land has been extensively cleared and some creeks are highly modified by urban developments (CSIRO Land and Water, 2000). Flow within the Coxs River is influenced by Lake Wallace and Lake Lyell upstream of the Stage 2 Site which impound water for the City of Lithgow and Wallerawang Power Station.



The segment of the Coxs River between the Stage 2 Site and Lake Burragorang has high public access and is utilised for recreational fishing, non-motor boating and irrigation water supply.

4.5.2.2 Local Catchments and Drainage

Figure 4.30 presents the local catchments draining the Stage 2 Site and Quarry Access Road. Three of these drain runoff directly into the Coxs River (via ephemeral flows within incised gullies of the local topography) and the fourth to Yorkeys Creek which in turn flows into the Coxs River.

Coxs River North

This catchment drains an area of approximately 107ha and incorporates seven mapped watercourses which flow into the Coxs River via a series of small ephemeral streams. This catchment has been highly modified by the existing extraction area and overburden emplacement (affecting five of the seven watercourses) and secondary processing area (affecting the remaining two mapped watercourses) of the Stage 2 Site, as well as by previous clearing in the northern section adjoining the Coxs River for grazing. Areas of relatively undisturbed vegetation occur on the slopes and ridge tops between the secondary processing area and extraction area Access Road (which drain onto the secondary processing area), as well as to the northeast of existing extraction area which drain into the Coxs River. Two dams (SD1 and SD2) located to the north of the extraction area are maintained by the Applicant for the storage of water captured within the extraction area and transferred for use in dust suppression as required.

The proposed extension to the Stage 1 extraction area would increase the area of disturbance within this catchment.

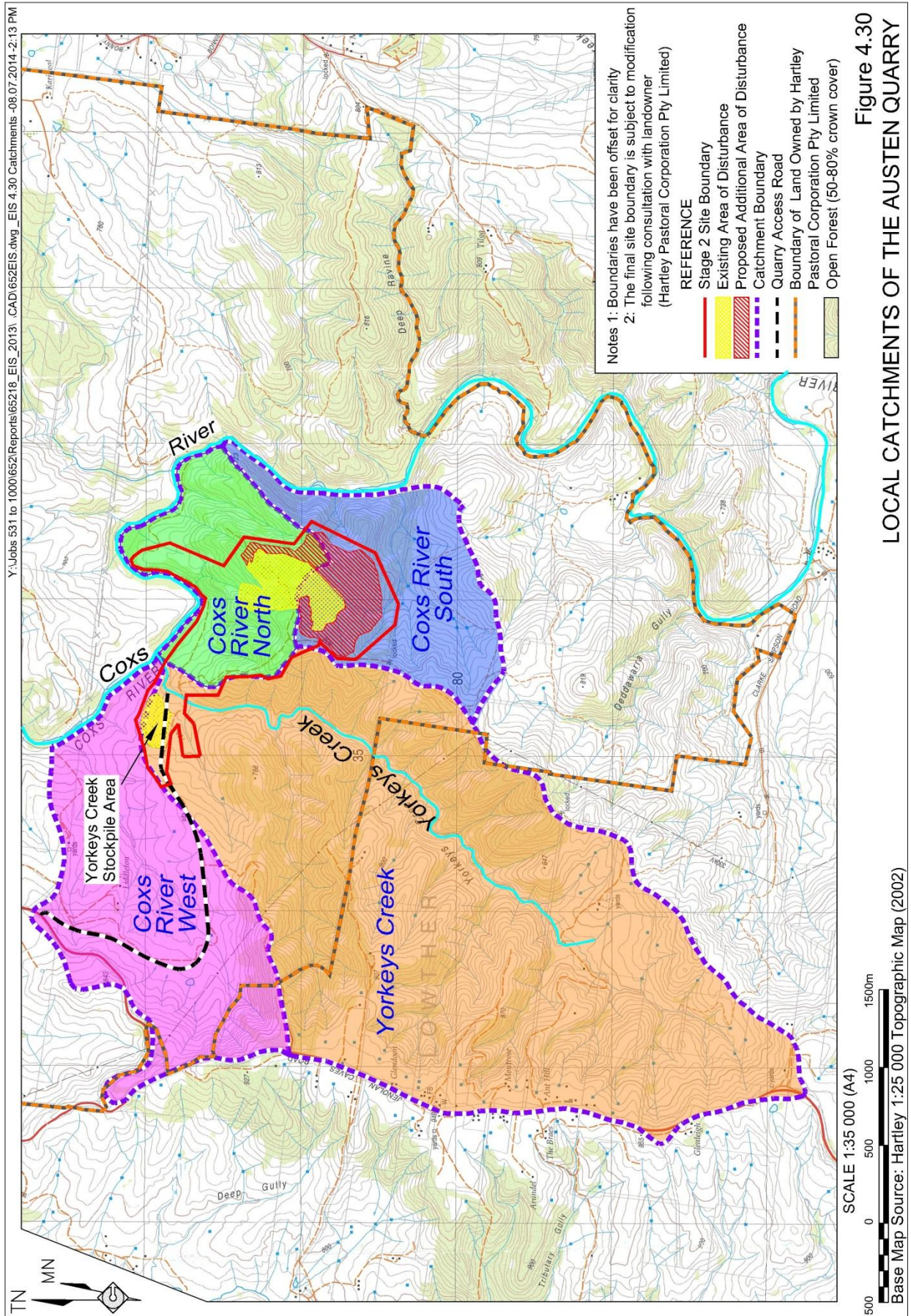
Coxs River South

This catchment drains an area of approximately 145ha via two main drainage pathways. The larger area, incorporating the existing overburden emplacement and a large proportion of the proposed Stage 2 extraction area flows to the Coxs River via an easterly-oriented stream. This larger drainage system contains 1st and 2nd order streams within the Stage 2 Site which combine to form a 3rd order stream to the east before discharging into the Coxs River. The smaller system flows into the Coxs River, north (upstream) of the larger drainage via an easterly flowing 2nd order stream and is largely outside the Stage 2 Site.

The majority of additional disturbance associated with the Proposal would be located within this catchment.

Coxs River West

This catchment has been largely cleared by the landowner for agricultural activities (grazing) and is traversed by the Quarry Access Road and associated water management infrastructure. No changes within this catchment are proposed.



Yorkeys Creek

Yorkeys Creek is a tributary of the Coxs River that consists of a shallow, ephemeral, erosional, freshwater stream. This catchment drains an area of approximately 761ha. The upper catchment is relatively undisturbed with only a small area historically cleared for grazing. The lower section in the vicinity of the Stage 2 Site has been modified to accommodate the secondary processing area, Yorkeys Creek crossing and Yorkeys Creek stockpile area. Water capture in two dams (SD5 and SD6) within this catchment on the Stage 2 Site is used for dust suppression. These dams are also used for accepting excess water captured on the secondary processing area.

No major changes within this catchment are proposed, although some minor modifications in the form of diversion of overflow from SD5 direct to Yorkeys Creek may be undertaken.

4.5.2.3 Stage 2 Site Catchments, Drainage and Surface Flows

Figure 4.31 presents the catchments draining the Stage 2 Site, as defined by Groundwork Plus (2014) based on level of disturbance, current use and existing stormwater management controls. For further information on the activities within each of these catchments, refer to *Section 3.2.1* and *Table 6* of Groundwork Plus (2014). **Table 4.12** presents the areas and peak runoff volumes determined by Groundwork Plus for each of these catchments in accordance with *Table 6.1* of *Managing Urban Stormwater: Soils and Construction – Volume 2E* (DECC, 2008b) and based on the following data and assumptions.

- Soils and exposed surfaces would have high runoff potential and have been assigned to Soil Hydrologic Group D.
- The 95th percentile 5-day rainfall event has been used by virtue of the longevity of the Proposal and sensitive nature of the receiving waters (within the Sydney Drinking Water Catchment). This is equivalent to 56.4mm (for Lithgow)
- A conservative volumetric runoff coefficient (C_V) value of 0.74 has been assumed for all disturbed and undisturbed catchments of the quarry.

4.5.2.4 Water Quality

The Applicant has undertaken monitoring of water quality within the Coxs River, Yorkeys Creek and selected water storages within the Stage 2 Site since 2003. The water quality results are presented in *Sections 3.3* and *8* of Groundwork Plus (2014). With respect to the receiving waters, for which quality criteria are to be established, there is limited chemical data available for background water quality of Yorkeys Creek. However, a comparison of the physico-chemical data indicates that the water quality of Yorkeys Creek is very similar to that of the Coxs River with only a slightly greater variation in EC and turbidity recorded.