SOUTH32 Illawarra Metallurgical Coal

APPIN MINE AREA 9 LONGWALLS 901 TO 904 EXTRACTION PLAN

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DOCUMENT REVISION LOG

Persons authorising this Plan

Name	Title	Date
Gary Brassington	Manager Approvals	7 December 2020

Document Revisions

Revision	Description of Changes	Date
ICH Document		
1.0	Original Document	2 September 2014
2.0	Updated to South32 Template and to reflect EP variations.	7 December 2020

Persons involved in the review of this Plan

Name	Title	Company	Exp (yrs)	Date
Cody Brady	Principal Approvals	South32	5	Dec 2020
Gary Brassington	Manager Approvals	South32	25	Dec 2020

1. INTRODUCTION

1.1 Project Background

Illawarra Metallurgical Coal (IMC) a wholly owned subsidiary of South32 Ltd (South32) operates the Bulli Seam Operations (BSO) (Appin and West Cliff Collieries) extracting hard coking coal used for steel production.

On 22 December 2011 the Planning and Assessment Commission (PAC), under delegation of the Minister for Planning, approved BSO (MP 08_0150) under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act) to continue mining operations until 2041.

As a condition of this Project Approval, South32 is required to prepare an Extraction Plan to manage the potential subsidence effects, impacts and/or environmental consequences associated with the extraction of coal from the approved areas.

This Extraction Plan has been prepared to support the extraction of coal from Longwalls 901 to 904 of the Appin Area 9 (AA9) mining domain. This Extraction Plan has utilised the findings from previous assessments of the Study Area undertaken as part of the BSO Environmental Assessment (EA) in combination with Risk Assessments (RAs), current surveys, reports, and stakeholder consultation. The Extraction Plan structure is illustrated in **Figure 1**.

1.2 Scope

This Extraction Plan has been prepared in accordance with the BSO Approval (MP 08_0150) Condition 5, Schedule 3 as follows:

> 5. The Proponent shall prepare and implement an Extraction Plan for first and second workings within each longwall mining domain to the satisfaction of the Director-General. Each extraction plan must:
>
> A) be prepared by a team of suitably qualified and experienced persons whose appointment has been endorsed by the Director-General;
>
> B) be approved by the Director-General before the proponent carries out any of the second workings covered by the plan;
>
> C) include detailed plans of existing and proposed first and second workings and any associated surface development;
>
> D) include detailed performance indicators for each of the performance measures in Tables 1 and 2;
>
> E) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this approval;
>
> F) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 1 and 2, and manage or remediate any impacts and/or environmental consequences;
>
> G) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected public infrastructure, to manage the potential

subsidence and/or environmental consequences of the proposed second workings, and which:

- address in appropriate detail all items of key public infrastructure and other public infrastructure and all classes of other built features;
- has been prepared following consultation with the owner/s of potentially affected feature/s;
- recommends appropriate pre-mining mitigatory measures to reduce subsidence impacts;
- recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and;
- in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO1300 (or alternative standard agreed with the infrastructure owner) and provides for annual auditing of compliance and effectiveness during extraction of longwalls which may impact the infrastructure;

H) include a Water Management Plan, which has been prepared in consultation with OEH, SCA and NOW, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including:

- surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources and quality;
- a program to monitor and report stream flows and assess any changes resulting from subsidence impacts;
- a program to monitor and report groundwater inflows to underground workings; and
- a program to predict, manage and monitor impacts on groundwater bores on privately owned land;

I) include a Biodiversity Management Plan, which has been prepared in consultation with OEH and DPI (fisheries), which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats, endangered ecological communities, and water dependant ecosystems, including (for Appin Areas 7, 8 and 9):

- additional targeted surveys for threatened species, sufficient to identify any actions required to protect significant populations from potential impacts;

j) include a Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general, with a specific focus on cliffs and steep slopes;

k) include a Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders for both aboriginal and historic heritage, to manage the

potential environmental consequences of the proposed second workings on both aboriginal and non- aboriginal heritage sites and which:

- includes additional investigations (such as surveys and current register searches) for aboriginal heritage items (including previously known sites) and historic heritage items, sufficient to identify the significance (including 'special significance') of all sites which may be impacted by subsidence and to identify any actions required to ensure that the performance measures in Table 1 are met; and
- is prepared in accordance with the relevant requirements for preparation of the heritage management plan required under condition 23 of Schedule 4;

l) include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure public safety in the mining area;

m) include a Subsidence Monitoring Program, which has been prepared in consultation with DRE, OEH, and SCA, to:

- provide data to assist with the management of the risks associated with subsidence;
- validate the subsidence predictions;
  - analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and
  - inform the contingency plan and adaptive management process;

n) include a Regional Seismic Event Monitoring Program, which has been prepared in consultation with DRE, and which includes analysis of outcomes and proposed triggers for review of potential correlations with mining operations;

o) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in tables 1 and 2, or where any such exceedance appears likely.

p) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 33 of Schedule 4; and

Q) include a program to collect sufficient baseline data for future Extraction Plans.

1.3 Objectives

The objectives of this Extraction Plan are to identify sensitive environmental and built features within the Longwalls 901 to 904 Study Area and to manage the potential impacts and/or environmental consequences of the proposed second workings to ensure compliance with the BSO Approval Conditions.

1.4 Study Area

The Study Area for the Extraction Plan is defined in accordance with MSEC (2012) as the surface area predicted to be affected by the proposed mining of Longwalls 901 to 904 and encompasses the areas bounded by the following limits:-

- A 35º angle of draw line from the maximum depth of cover, which equates to a horizontal distance varying between 345 m and 510 m around the limits of the proposed extraction areas for Longwalls 901 to 904, and
- The predicted limit of vertical subsidence, taken as the 20 mm subsidence contour, resulting from the extraction of the proposed Longwalls 901 to 904.

Additionally, features potentially sensitive to far field movements, which includes horizontal, valley closure and upsidence movements that may be outside the 20mm subsidence zone or 35º angle of draw line have been assessed.

The location of the Longwalls 901 to 904 Study Area within the BSO is shown in **Figure 2**. The General Arrangement of Longwalls 901 to 904 is shown in **Figure 3**.

2. REPORT STRUCUTRE

The Extraction Plan is comprised of a main report and supporting Management Plans, prepared by Cardno on behalf of South32.

Each Management Plan is also supported by specialist consultant reports. A list of the consultants and relevant reports is provided in **Table 4**.

The relationship between these documents is shown in **Figure 1**.

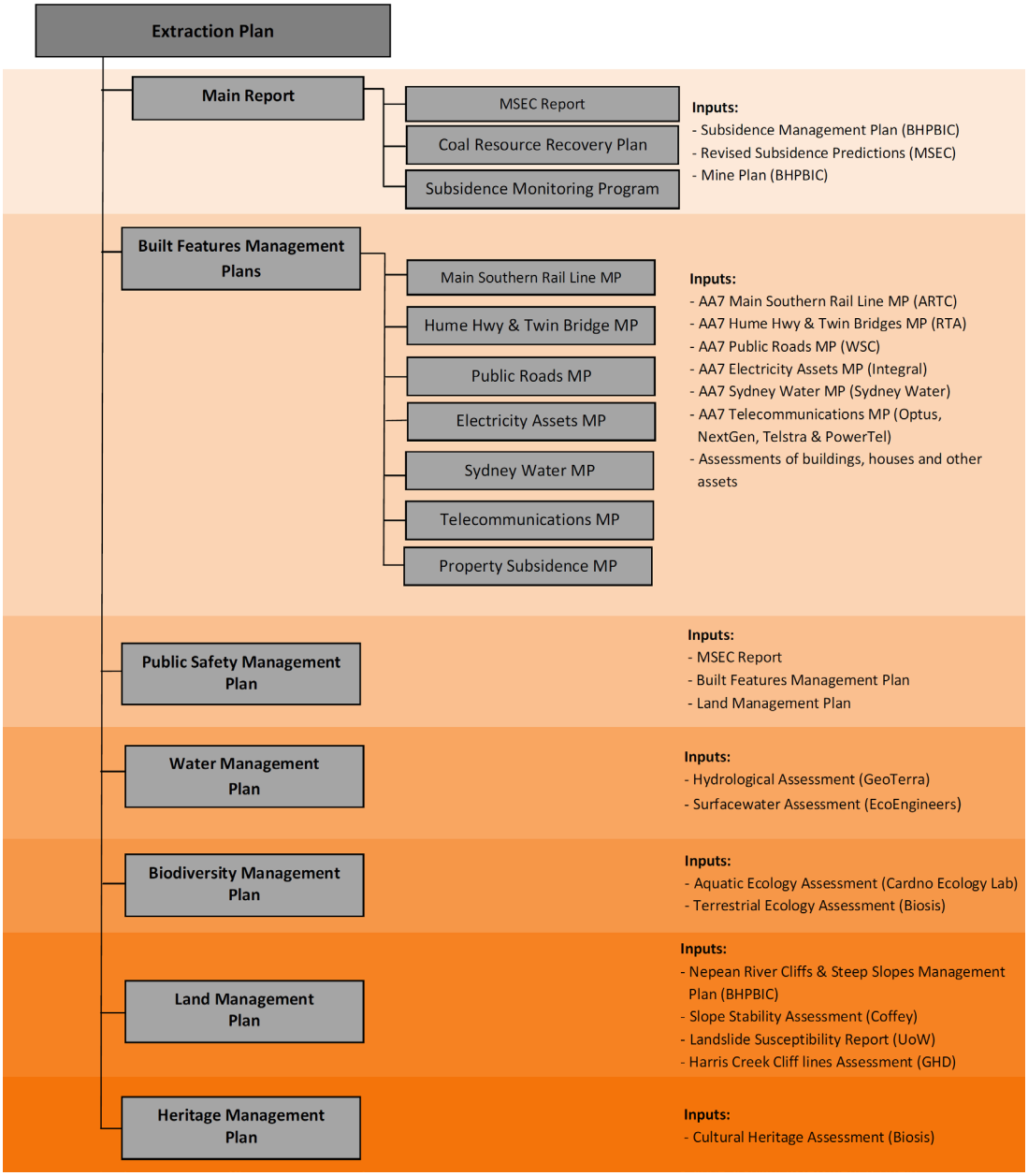


Figure 1 Extraction Plan Structure

3. THE RESOURCE

The Appin Area 9 (AA9) mining area lies in the southern part of the Permo-Triassic Sydney Basin, within which the main coal bearing sequence is the Illawarra Coal Measures of Late Permian age. The Illawarra Coal Measures contain several seams, the uppermost of which is the Bulli Seam.

South32 plan to extract high quality coking coal from the Bulli Seam within AA9 as detailed in the BSO EA (**Figure 2**). A typical stratigraphic section of the Study Area and further description of the resource can be found in **Appendix A: Subsidence Predictions and Impact Assessment**.

3.1 Longwall Layout

The layout and dimension of the proposed longwalls has been modified from the layout of the BSO EA. The BSO EA layout within AA9 comprised longwalls having overall lengths varying between 2,032 m and 2,152 m, overall void widths varying between of 305 m and 325m with chain pillars of 45 m.

Two important objectives which formed part of the longwall layout optimization were:

- Setback from the Nepean River and the cliffs within the valley, so as to minimise potential for impact, and
- Minimisation of the volume of sterilised coal which could be efficiently extracted while meeting the stream impact minimisation criteria from the BSO EA and the requirements of the Project Approval.

The depth of cover directly above the proposed longwalls varies between a minimum of 490 m, above the western end of Longwall 901 and a maximum of 580 m, above the western end of Longwall 904. Surface depth contours can be found in MSEC (2020) Drawing No. 1138-02 Annex A.

The Bulli Seam floor within the Study Area generally dips from the south to the north. The seam thickness within the proposed longwall goaf areas varies between 2.6 m and 3.2 m. The proposed longwall dimensions are provided in **Table 1**.

Table 1 Geometry of the Proposed Longwalls 901 to 904

Longwall	Overall Void Length Including Installation Heading (m)	Overall Void Width Including First Workings (m)	Overall Tailgate Chain Pillar Width (m)
901	2029	305	-
902	2152	305	45
903	2292	305	45
904	2032	324	45

3.2 Extraction Sequence

Extraction of longwalls will occur in a staged process commencing with Longwall 901 and continuing consecutively to Longwall 904. The actual/scheduled mining of Longwalls 901 to 904 is provided below in **Table 2**.

Table 2 Expected Schedule for Longwall Extraction 901 to 904

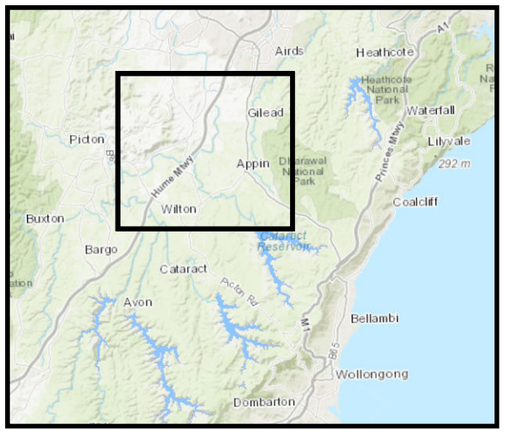
Longwall	Start	Finish
901	19/01/2016	08/09/2017
902	12/05/2018	03/04/2019
903	01/11/2019	01/03/2021
904	26/04/2021	27/05/2022

BULLI SEAM OPERATIONS

Appin Area 9
Longwalls 901-904
Figure 2

SOUTH32

- Appin Longwalls 901 - 904
- 600 m Study Area
- Mining Areas
- IMC Pit Top
- Railway Lines
- Rivers
- Creeks
- Metropolitan Special Areas



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Author: B.Agland

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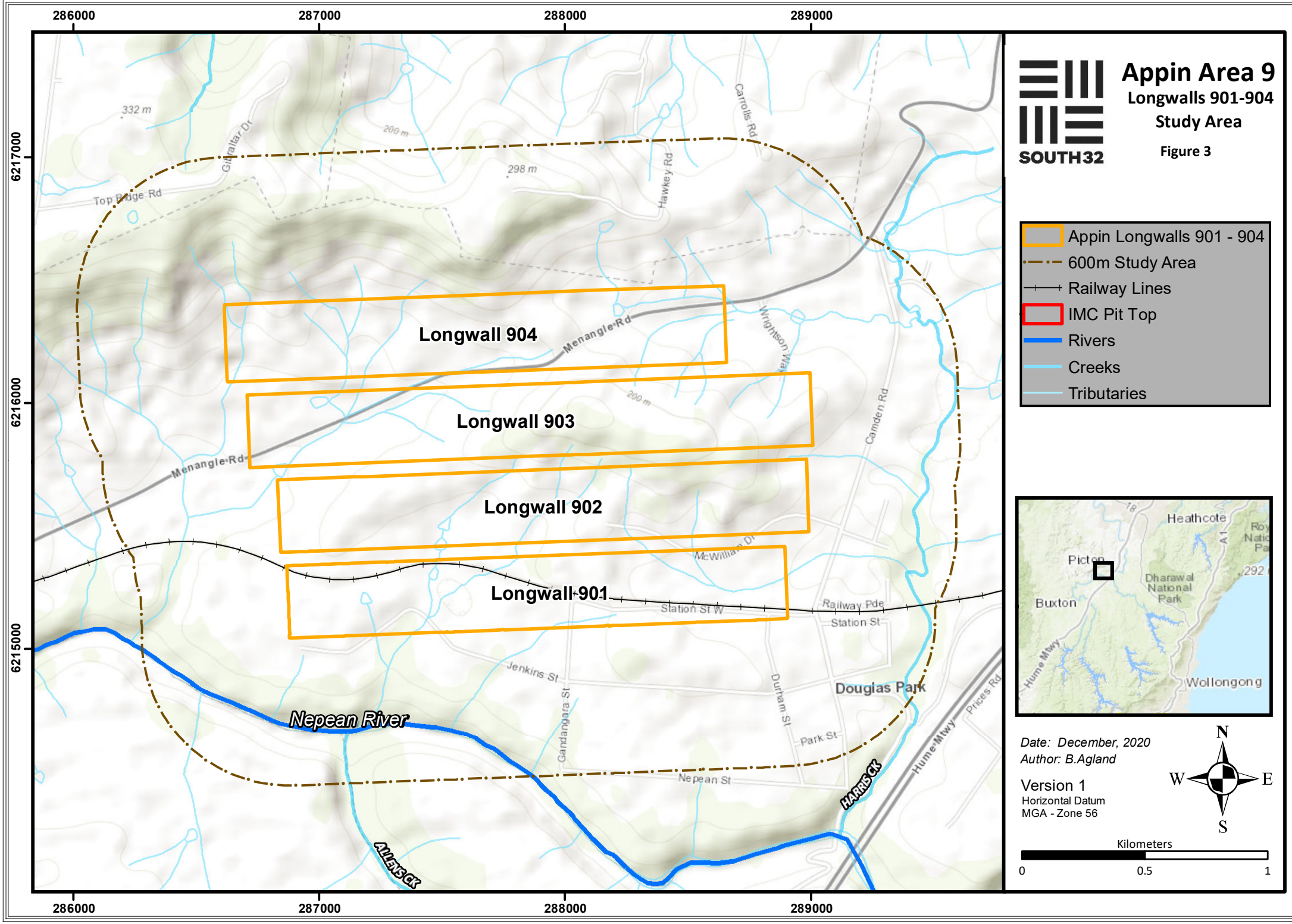
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Appin Area 9
Longwalls 901-904
Study Area
Figure 3
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Longwall 904
Longwall 903
Longwall 902
Longwall 901
Appin Longwalls 901 - 904
600m Study Area
Railway Lines
IMC Pit Top
Rivers
Creeks
Tributaries
Menangle Rd
Top Ridge Rd
Gibraltar Dr
Hawkey Rd
Carrolls Rd
Wrightson Way
Camden Rd
McWilliam Dr
Station St W
Railway Pde
Station St
Jenkins St
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4. STATUTORY REQUIREMENTS

4.1 BSO Approval

Condition 5, Schedule 3 of the BSO Approval requires the preparation and implementation of an Extraction Plan for first and second workings within each mining domain to the satisfaction of the Director-General of the Department of Planning, Industry and Environment (DPIE) (refer **Section 1.2**). This Plan has been prepared in accordance with the requirements of this Condition.

Each Management Plan (attached to this report) also addresses the relevant Performance Measures (Condition 1 & 3, Schedule 3) and has been prepared in accordance with the requirements for Management Plans detailed in Condition 2, Schedule 6. The required reporting and review of the Management Plans is also documented in each Plan and is in accordance with the requirements of Conditions 3 to 10, Schedule 6.

Notwithstanding the above, due consideration has been given to all the BSO Approval Conditions in the preparation of this Extraction Plan, including those relating to auditing, rehabilitation and environmental management.

4.2 Legislation and Guidelines

This Extraction Plan has been designed to conform to the requirements of the relevant advisory documents and guidelines and any other legislation that is applicable under the EP&A Act. The following Acts may be applicable:

- Contaminated Land Management Act, 1997
- Dangerous Goods Act, 1975
- Mining Act, 1992
- Biosecurity Act, 2015
- Rail Safety National Law (NSW), 2012
- Roads Act, 1993
- Protection of the Environment Operations Act, 1997
- Biodiversity Conservation Act, 2016
- National Parks and Wildlife Act, 1974
- Environmental Protection Biodiversity and Conservation Act, 1999
- WaterNSW Act, 2014
- Coal Mine Health and Safety Amended Act, 2010
- Crown Lands Management Act, 2016
- Dams Safety Act, 2015
- Energy and Utilities Administration Act, 1987
- Fisheries Management Act, 1994
- Water Management Act, 2000

- Work Health and Safety Act, 2011.

Further details of advisory documentation and guidelines can be found in the relevant Management Plans attached to this document.

4.3 Relevant Leases and Licences

The following licences or permits may be applicable to South32's operations in AA9:

- Mining Leases as per **Table 3**.
- Environmental Protection Licence (EPL) 2504 which applies to BSO, including Appin and West Cliff Mines. A copy of the licence can be accessed at the EPA website via the following link http://www.epa.nsw.gov.au/prpoeo/index.htm
- BSO Mining Operation Plan (MOP) 1/10/2020 to 30/09/2024 (V1.3).
- All relevant Occupational Health, Safety, Environment and Community approvals.
- Any additional leases, licences and approvals resulting from the BSO Approval.

Table 3 Appin Mine Leases, Licences and other Reference Documents

Mining Lease - Document Number	Start	Finish
CCL 767	29 Oct 1991	08 Jul 2029
CCL 388	22 Jan 1992	22 Jan 2034
ML 1382	20 Dec 1995	20 Dec 2037
ML 1433	24 Jul 1998	23 Jul 2019[1]
ML 1678	27 Sep 2012	26 Sep 2033

The project is located within the mining tenements listed in **Table 3**.

[1] Application for the renewal of Mining Lease 1433 which was lodged with the NSW Department of Planning and Environment – Division of Resources and Geoscience (Division) on 18 July 2018.

5. PLAN ADMINISTRATION

Each Management Plan contains provisions relating to the review of the plan and the roles and responsibilities associated with the plan. This section provides generic guidance about the administration of the Extraction Plan.

5.1 Consultant Suitability and Endorsement

In accordance with Condition 5 (a), Schedule 3, the suitably qualified and experienced experts that have prepared this Extraction Plan and supporting Management Plans are listed in **Table 4**.

Table 4 List of Specialist Consultants

Consultant	Contribution
Cardno	Lead Consultant
Mine Subsidence Engineering Consultants	Subsidence Impact Assessment
Biosis Research	Biodiversity Assessment and Heritage Assessment
Cardno	Aquatic Biodiversity Assessment
Coffey	Slope Stability Assessment
University of Wollongong	Landslide Susceptibility Report
GHD	Harris Creek Clifflines Assessment
EcoEngineers	Surface Water Assessment
GeoTerra	Hydrological Assessment
Heritage Computing	Groundwater Modelling

Cardno is the principal consultant for the preparation of the Extraction Plan. Cardno has indepth knowledge of the coal mining industry and extensive experience gained through working on mining related projects including preparation of Major Approvals, Extraction Plans, MOPs, Annual Environmental Management Reports (AEMRs), Subsidence Management Plans (SMPs) and Rehabilitation and Closure Plans.

Cardno is ISO9001-2008 certified and applies a systematic approach employing requisite policies concerning Project Engagement, Safe Work Methods, Document and Cost Control and both Local and Group Work Instructions to ensure quality at all times.

5.2 Distribution

South32 will make the Extraction Plan and other relevant environmental documentation publicly available on the South32 website (Condition 11, Schedule 6).

Individual Management Plans will be developed in consultation with, and copies will be provided to, the relevant Government agencies and stakeholders as detailed in the appropriate Plan.

5.3 Consultation

The draft Extraction Plan and associated Management Plans were provided for agency review on 20 June 2012. The following agencies were consulted:

- DoPE (now Department of Planning, Industry and Environment [DPIE])
- Mine Subsidence Board (now Subsidence Advisory NSW [SA NSW])
- NSW Office of Environment & Heritage (now Biodiversity and Conservation Division [BCD])
- NSW Trade & Investment – Division of Resources and Energy (now Mining, Exploration and Geosciences [MEG])
- NSW Trade & Investment – Fisheries (now DPI – Fisheries)
- NSW Trade & Investment – NSW Office of Water (now DPIE Water)
- Sydney Catchment Authority (now WaterNSW)

Agency feedback on the draft Extraction Plan was received with **Table 5** providing details of feedback and associated responses.

The proposed variation to the Extraction Plan Approval to extend the finishing end of Longwall 904 by 61 m was provided to Agencies for comment on 29 October 2020.

No feedback or information requests were received from any agencies contacted which included BCD, DPI, DPI Fisheries, Resource Regulator and WaterNSW.

5.4 Review and Update

In accordance with Condition 5 of Schedule 6 of the Appin Mine approval, the Extraction Plan will be reviewed, and if necessary revised, within three months, of:

- the submission of an Annual Review;
- the submission of an incident report;
- the submission of an Independent Environmental Audit (IEA) report; or
- any modification to the conditions of the Appin Mine approval (unless the conditions require otherwise).

If deficiencies in the Environmental Management System (EMS) or this Extraction Plan are identified in the interim period, the plans will be modified as required. This process has been designed to ensure that environmental documentation continues to meet current environmental requirements, including changes in technology and operational practice, and expectations of stakeholders.

Table 5 Agency Feedback and Responses

COMMENT	RESPONSE	REFERENCE
Biodiversity and Conservation Division		
Water loss as a result of undermining has the potential to affect environmental flows down the Nepean River. It is argued that there will be no net loss of flow to the catchment, however, it appears that no flow monitoring has actually been implemented in any of the tributary streams above Longwalls 901 to 904. Therefore it is currently impossible to assess the accuracy of these comments or to confirm if streams are ephemeral as claimed or seasonal, which has implications for aquatic life.	Flow monitoring in the Nepean River is undertaken upstream and downstream of the mining area. Water levels in the Nepean River through the mining area are also monitored. Observational monitoring of streams will also take place within the mining area. The monitoring regime allows water flows and quality to be recorded before, during and after extraction. Monitoring locations and trigger values are included in the TARP (Table 7.1, Water Management Plan); with further details at Section 5.1 Surface Water Assessment (Ecoengineers, 2012). Due to ongoing concerns from OEH about the definitions of ephemeral streams - the Water Management Plan has been modified to define streams using the Strahler Stream Order System.	Refer: Water Management Plan – Section 3.3 Surface Water Assessment (Ecoengineers, 2012) – Section 5.1
It is acknowledged that some fracturing will occur along drainage lines, however, it is stated that there will be no significant net loss of water. This is unsubstantiated and there is clearly a risk of damage to the Nepean River tributaries.	Based on the predicted systematic and non-systematic subsidence movements (MSEC 2012) any bedrock below the watercourses are likely to fracture as a consequence of subsidence induced strains. It is predicted that surface flows captured by the surface subsidence fracture network which do not connect to a deeper aquifer or the mine workings will re-emerging further downstream. This prediction is based on an assessment of the depth of subsidence induced fracturing from the surface and measurements of catchment yield during the mid to late stage recession and base flows downstream of mining areas.	Refer: Subsidence Assessment (MSEC, 2012) – Section 5.3 Surface Water Assessment (Ecoengineers, 2012) – Section 2.4 & 2.7 Water Management Plan (BHPBIC, 2012) – Section 4.1.3.3

	A number of studies have determined the depth of the surface fracture network to be restricted to approximately 15m to 20m below the surface e.g. Georges River and Marhnyes Hole monitoring (BHPBIC 2006). A research site has been established over Longwall 9 at Dendrobium Mine. This site will investigate the development of fracture networks, including any surface/shallow fracture networks. The hydraulic conductance of these fracture networks will also be determined at this site and compared to pre-mining conditions. The findings of this research will be used to update the assessments for Area 9.	
It is unclear whether baseflow measurements have been undertaken and whether there is quantitative data to back up the statement that there would be nonsignificant changes to baseflow within the Nepean River as a result of seepage, as the seepage would be insignificant comparative to the volume of water flowing within the river.	No observable change to seeps, springs or baseflow to the Nepean River were noted despite regular inspections of the gorge during extraction of Longwalls 16, 17 and 20 at Tower Colliery, or from Longwalls 701, 702, 703, 704 and 705 at Appin Area 7. As shown in Figure 8 of the Groundwater Assessment, water level declines up to 1m in NGW5 and 6m in NGW6 were observed during extraction, between Longwall 702 and the Nepean River. These changes could have reduced the regional groundwater gradient toward the river, and therefore baseflow seepage to the river. Groundwater modelling has been undertaken by Heritage Computing (2010), which indicates that old and current mine workings in the "Appin" area have caused negligible changes in groundwater baseflow to streams and that approximately 5.3ML/day of baseflow enters the entire Nepean River catchment.	Refer: Groundwater Assessment (Geoterra, 2011) – Section 8.5
Based on the depths of the boreholes within Area 9 itis unclear whether any of the boreholes/piezometers actually monitors the Hawkesbury sandstone aquifer and could be	The Hawkesbury Sandstone outcrops within the walls and floor of the Nepean River gorge and can be up to 170m thick. Four open standpipe piezometers (NGW series) were installed by BHPB in June	Refer: Groundwater Assessment (Geoterra, 2011) – Sections 4.4 & 4.6

used to assess whether the TARP triggers will actually be satisfied at any level of change.	2004 in or near the Study Area in the Hawkesbury Sandstone to 10m below the base of the Nepean River gorge. An additional five vibrating wire piezometer array bores were installed in 2008 (EAW Series) down to 798m below surface. These installations are multi-level piezometers which record water pressures at multiple depths through the Hawkesbury Sandstone.	
Baseline and ongoing data on flow, water quality, ground water levels and quality should be forwarded periodically to OEH for independent assessment.	Schedule 6, Condition 2(b) of the Project Approval (08_0150) requires an Annual Review to be undertaken to the satisfaction of the Director General of the DoPE that incorporates monitoring results. This Review would be forwarded to OEH for consideration, allowing assessment of baseline and ongoing data. Additionally, BHPBIC publishes regular project environmental performance reports on its website, in accordance with Schedule 6, Condition 2 of the Project Approval (08_0150). End of Panel reports would be prepared and submitted to the relevant government agencies on completion of extraction from each longwall.	Refer: Subsidence Monitoring Program – Section 7.1
Some amendments to the vegetation communities maybe required due to potential future additional listings with the Commonwealth (i.e. moist shale woodland; Western Sydney dry rainforest).	Noted	N/A

6. APPENDICES

Appendix A: Subsidence Predictions and Impact Assessment

Appendix B: Subsidence Monitoring Program

Appendix C: Water Management Plan

Appendix D: Biodiversity Management Plan

Appendix E: Land Management Plan

Appendix F: Heritage Management Plan

Appendix G: Public Safety Management Plan

Appendix H: Built Features Management Plan

Appendix I: Coal Resource Recovery Plan