Supporting Information

Blair Athol Coal Mine

Application to Amend Environmental Authority
EPML00876713

Prepared for Orion Mining Pty Ltd | June 2023

TerraCom

SGMenvironmental

This page is intentionally blank

Supporting Information

Blair Athol Coal Mine

Application to Amend Environmental Authority EPML00876713

Prepared for Orion Mining Pty Ltd | 12 June 2023

Project number:	21B031
Document title:	Supporting Information | Blair Athol Coal Mine
Revision:	V1-2
Date:	12 June 2023
Client:	Orion Mining Pty Ltd
Project manager:	T Rohde
Author:	D Borombovits

Legal Name:	SGM Environmental Pty Limited		
Address:	PO Box 5622, Stafford Heights, Qld 4053		
ACN:	621 989 866	ABN:	65 621 989 866
Representative:	Timothy Rohde	Phone:	+61 7 3148 6288
Email:	trohde@sgmenvironmental.com		

Honest | Trust | Innovation | Safety

Document history and status

Revision	Date	Description	By	Review	Approved
V0-1	17/01/23	Draft	G Greening	T Rohde	T Rohde
V0-2	30/05/23	Draft	D Borombovits	T Rohde	T Rohde
V1-2	12/06/23	Final	D Borombovits	TerraCom	T Peterson

Table of contents

Photograph

No table of figures entries found.

Figure

Table

Important note about your report

This Report is provided for the exclusive use of the Client pursuant to the Scope of Works 24 May 2022, which requires us to provide Services relating to an application to amend environmental authority EPML00876713 and a supporting information document.

This Report is provided to the Client on the terms and conditions set out in the Standard Terms of SGM Environmental Pty Limited (SGME, we, us or our).

We derive data in this Report from information (or confirmation of the absence thereof) sourced from the Client and their subconsultants, designated laboratories and / or information that has been made available in the public domain at the time or times outlined in this Report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the supporting information document and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this Report.

SGME has prepared this Report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to any applicable standards, guidelines, procedures and practices outlined in the Scope of Works as at the date of issue of this Report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this Report, to the extent permitted by law.

This Report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by SGME for use of any part of this Report in any other context.

The supporting information document are based on a desktop assessment of data that has been measured by the Client and their subconsultant and other third parties.

SGME does not accept any Liability whatsoever for, or in respect of, any use of, or reliance upon this Report by any person contrary to the above or our Standard Terms.

1.0 Introduction

1.1 Blair Athol Coal Mine

Blair Athol Coal Mine (the Mine) is a historic open-cut coal mining operation approximately (~) 240 kilometres (km) south-west of Mackay, and ~17 km north-west of Clermont in Central Queensland.

The Mine is owned and operated by Orion Mining Pty Limited (the Proponent), a wholly owned subsidiary of TerraCom Limited (TerraCom), under environmental authority (EA) EPML00876713 and mining lease (ML) 1804.

Previously, the Mine was owned and operated by Rio Tinto; who placed it into care and maintenance in 2012. Through an Asset Sale Agreement, the Proponent acquired the Mine in 2017. Recommencement of mining has allowed TerraCom to efficiently reshape and restore mining disturbance while cost-effectively retrieving remnant coal resources.

1.2 Purpose and scope

TerraCom is applying for amendment to reflect pre-approval of residual void not in stable condition. The purpose of this report is to support the application for an amendment (the amendment) to EA EPML00876713 (the supporting information document).

1.2.1 Definition of land in a stable condition

The definition of land in stable condition is given in section 111A of the *Environmental Protection Act 1994* (EP Act), where:

> *Land is in a stable condition if —*
>
> *the land is safe and structurally stable, and*
>
> *there is no environmental harm being caused by anything on or in the land, and*
>
> *the land can sustain a post-mining land use (PMLU).*

A non-use management area (NUMA), under section 112 of the EP Act, is an area of land the subject of a PRC plan that cannot be rehabilitated to a stable condition after all relevant activities for the progressive rehabilitation and closure plan (PRC plan) carried out on the land have ended.

1.2.2 Pre-approval of the residual void not in stable condition

Appendix A is a letter dated 27 November 2020 from Juliana McCosker (Manager — Environmental Services) to TerraCom. The letter was in response to three management plans that were submitted by TerraCom to the department to determine if they constitute a land outcome document for the purpose of developing a transitional PRC plan.

The letter stated that:

> *The department acknowledges the pre-approval of the residual voids and proposes that Condition F4 of the EA EPML00876713 is amended to reflect that the voids themselves will not be able to sustain vegetation. However, their inability to sustain a PMLU still needs to be demonstrated.*

1.2.3 Pre-lodgement meeting

A pre-lodgement meeting was held on 13 October 2022. The following information was requested to support the proposed amendment:

- residual void outcome;
- other disturbance domains; and
- completion criteria for proposed rehabilitation outcomes.

Details are provided in Table 1.

Table 1 Requirements for information to support an EA amendment

Supporting information	Report reference
Residual void outcome	
Specific areas of the residual void that will not support a use, and those that have potential to support a PMLU.	Section 4.1.1
Further discussion on how the extent of the residual void and the catchment reporting to it have been minimised.	Section 4.1.2
Landform design for the residual void.	Section 4.1.3
With regards to location, include: • whether the residual void will be located in a floodplain; and • underlying land use and tenure eg state forest, unallocated state land (USL).	Section 4.1.4
Engagement with relevant stakeholders.	Section 4.1.5
Interaction with groundwater and whether the residual void is a sink or a source to surrounding aquifers.	Section 4.1.6
Other disturbance domains	
PMLU for all disturbance domains (including completion criteria).	Section 4.2.1
Final landform design — including area (ha), location.	Section 4.2.2
Information on additional approvals that may be required; for example, licencing for permanent watercourse diversions.	Section 4.2.3
Completion criteria	
To fully implement the proposed amendment, specific completion criteria / indicators must be proposed to make sure rehabilitation objectives (ie safe, stable, non-polluting) for the NUMA and PMLU are met.	Section 4.3

2.0 Environmental values

An *Environmental Management Plan* (EMP) was prepared in 2017 that included an assessment of environmental values and potential risks (TerraCom 2017).

The following sections describe environmental values in relation to the amendment including:

- existing environment;
- potential impacts to environmental values; and
- risk and magnitude of impacts.

The amendments do not change any rehabilitation objectives stated in EA (EPML00876713) in a way that results in significantly different impacts on environmental values than those previously permitted.

2.1 Air

2.1.1 Existing environment

TerraCom assessed air quality components for the EMP (TerraCom 2017). Environmental values of air quality are represented by high local air quality, with some elevated particulate levels during dry periods from fire and surrounding agricultural lands.

The sources of air pollution include dust generated from equipment and mining activities. Air pollution in the surrounding area is localised and limited to specific activities, for example, dust from the domestic coal screening and crushing facility; soil cultivation; smoke and other contaminants from grass / bush fires and occasional dust storms.

2.1.2 Potential impacts to environmental values

There are no potential impacts to air environmental values as a result of the amendment.

2.1.3 Risk and magnitude of impacts

There are no potential impacts.

2.2 Water

2.2.1 Existing environment

The Mine is located at the top of the Bath Creek tributary of Sandy Creek, in the foothills of the Drummond Range. Sandy Creek is a sub-catchment within Theresa Creek Catchment in the north-western corner of Fitzroy Basin.

Catchment area upstream is approximately 65,000 hectares and is comprised of a number of ephemeral creeks; Breaker, Bath and Washpool Creeks. These creeks join within the mining lease and flow downstream as Bath Creek. Infrequent and unreliable rainfall patterns within the catchment result in sporadic flows, preceded by long dry periods.

Environmental values for Breaker Creek, Bath Creek and Washpool Creek include:

- protection of aquatic ecosystems;

- suitability for stock and wildlife water; and
- protection of cultural and spiritual values.

Diversion of Bath, Washpool and Breaker Creeks has been necessary to enable mining of the Blair Athol coal measures. West Dam collects clean water runoff from Washpool Creek in the northern extent of the Mine. With development of the large open-cut pit, water is diverted around it by the northern boundary drain, along the eastern diversion where it meets Bath Creek before flowing into the environmental dam and discharged off lease via the original Bath Creek Channel.

2.2.2 Potential impacts to environmental values

Hydrology investigations done by WRM (2023a) predicts that:

- residual void water becomes hypersaline;
- modelled average long-term residual void water level of ~276.6 meters Australian Height Datum (AHD);
- modelled maximum long-term residual void water level of ~282 m AHD; and
- the residual void reaches equilibrium approximately 23 m below spill point to the surrounding environment.

2.2.3 Risk and magnitude of impacts

There is a very low risk of the residual void overtopping because water balance modelling shows that it reaches equilibrium well below the spill point.

2.3 Groundwater

2.3.1 Existing environment

Three groundwater aquifer systems were present prior to commencement of mining:

1. the coal measures;
2. the basalt area in the north; and
3. shallow alluvial aquifers associated with the natural creek system.

Groundwater has been encountered in all coal seams during exploration drilling, but groundwater occurrence is more pervasive in Seams 3 and 4 (Terrenus 2009). Coal seams are water-bearing units, but are not aquifers as yields are too low and short lived.

The shallow unconfined Tertiary basalt aquifer is the most significant aquifer within the Mine and surrounding area. It is located within discrete isolated fractures across the north and northeast of the mining lease. Groundwater elevation ranges from approximately 322 m RL (reduced levels; relative to AHD) to about 307 m RL and flows generally towards the Mine (Terrenus 2009). Groundwater is known to exist in underlying sedimentary units; however, transmissivity of these units is low.

Observed groundwater elevations in the Tertiary basalt are between 305-325 m AHD, and observed groundwater levels in the Blair Athol coal measures are between 295-315 m AHD (Oasis Hydrogeology 2023).

The shallow alluvial aquifer system within the mining lease has largely been removed by open-cut mining. These systems were localised and associated with Washpool and Bath Creeks prior to disturbance. They are no longer present within the Mine and cannot be reinstated at end of mining as it is not possible to re-establish hydraulic conductivity from the final landform.

Salinity of the basalt aquifer ranges from 260 to 860 mg/L (median 482 mg / L; Terrenus 2009), with measured average baseline total dissolved solids updated to 405 mg/L by Terracom (2018).

2.3.2 Potential impacts to environmental values

The residual void forms a long-term groundwater sink based on the minimum observed groundwater level of 295 m AHD. Maximum modelled water level is about 23 metres below the spill point and about 13 metres below minimum observed groundwater level. Because the residual void would act as a sink for groundwater, salinity that accumulates will not migrate to surrounding aquifers.

2.3.3 Risk and magnitude of impacts

There is a low risk to groundwater environmental values as a result of the amendment because the residual void will act as a sink preventing migration to surrounding aquifers.

2.4 Acoustic

2.4.1 Existing environment

TerraCom assessed the noise component, including acoustic environmental values for the EMP (TerraCom 2017). The nearest town is Clermont, located 17 km to the south-east. Mining has no discernible effect on noise and vibration levels in town.

Major sources of noise from mining are as follows:

- blasting operations;
- large mobile equipment such as haul trucks, loaders and dozers;
- process plant operations; and
- dragline operations.

2.4.2 Potential impacts to environmental values

There are no potential impacts to acoustic environmental values as a result of the amendment.

2.4.3 Risk and magnitude of impacts

There are no potential impacts.

2.5 Waste

2.5.1 Existing environment

Industrial waste is managed in accordance with *Environmental Protection (Waste Management) Regulation 2000* and *Environmental Protection (Waste Management) Policy 2000*. Environmental values are associated with the health and well-being of the local community and maintenance of ecological processes diversity.

Waste is managed by implementing the hierarchy of management principles:

1. avoidance;
2. reuse;

3. recycling;
4. waste to energy; and
5. disposal.

Management of waste is discussed in the EMP (TerraCom 2017).

2.5.2 Potential impacts to environmental values

There are no potential impacts to environmental values from waste as a result of the amendment.

2.5.3 Risk and magnitude of impacts

There are no potential impacts.

2.6 Land

2.6.1 Existing environment

ML 1804 is held over a diverse range of land tenures. The predominant land tenure is USL and areas of State Forest, Rail Corridor, Reserve and Freehold Land.

A wide diversity of pre-mining land uses has occurred on the mining lease:

- Blair Athol township;
- More than 100 years of open-cut and underground mining;
- crops and grazing;
- designated stock routes; and
- a historic cemetery.

Undisturbed topography consists of gently sloping country derived from metamorphosed sedimentary rocks intersected by volcanic intrusions mostly to the north of the mining lease. Human development of the landscape is typical of Central Queensland, where large areas have been cleared for low intensity grazing and broad acre field crops. Only small remnant areas of native woodland vegetation remain, mostly on upper slopes and along watercourses.

2.6.2 Potential impacts to environmental values

There are no potential impacts to environmental values for land other than those already approved; *Condition F17 (Residual void outcome)*, which include provisions for a residual void. There are no proposed impacts to surrounding surface water or groundwater.

2.6.3 Risk and magnitude of impacts

There are no potential impacts.

3.0 Residual voids

The following sections describe inability of the residual void to sustain a PMLU, and the location, size, and extent of the NUMA.

3.1 Inability to sustain a PMLU

3.1.1 Hydrology and water quality behaviour

WRM Water & Environment Pty Limited (WRM) (2023a) was engaged by SGME on behalf of TerraCom to assess residual void hydrology and long-term water quality behaviour (500 years) (Appendix B).

Due to topography, rainfall runoff reports to the residual void, which forms the lowest elevation. WRM (2023a) found that the residual void:

- reaches equilibrium after ~75 years and oscillates between 270-282 m AHD;
- maximum modelled water level is ~23 m below the pit spill point, and there is no risk of overtopping;
- salinity increases over time because of the closed-loop system with no mechanism for salt removal;
- salinity concentration exceeds 40,000 microsiemens per centimetre (µS/cm) after ~300 years, and 90,000 µS/cm at 500 years.

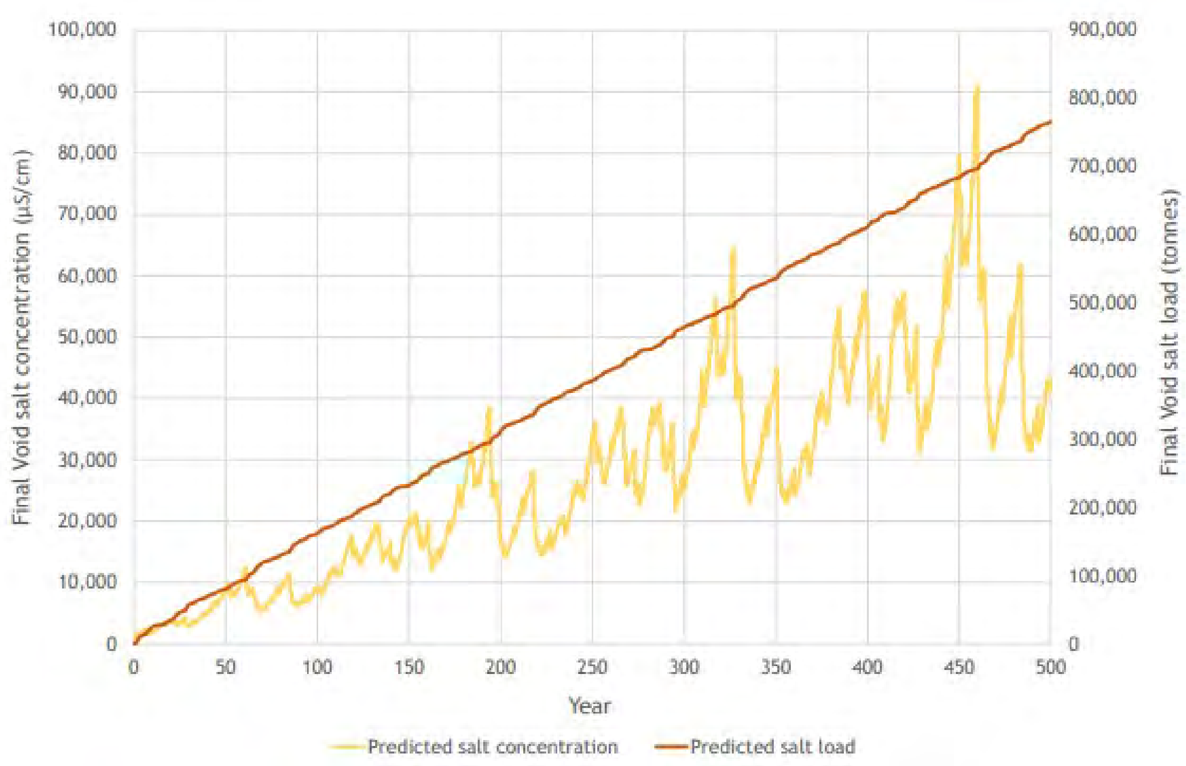


Figure 1 Modelled salinity concentration and load

3.2 Location, size and extent of the residual void unable to support a PMLU

The area of the residual void that is unable to support a PMLU is peak modelled water level plus the one in 2,000 annual exceedance probability (AEP) storm surge boundary (Figure 2; WRM 2023a). Final void location, size and extent are in Figure 6.

J:\1549-04 BAC PRCP\GIS\QGIS\TUFLOW_Configuration.qgz (Issued: 17 May 2023)

Project	Client		Legend
Application to Amend Environmental Authority (EPML00876713)	Orion Mining Pty Limited	wrm water+environment	Watercourse; Railway; Mine lease boundary; Indicative final void water level (0.05% AEP); Dam

Figure	Title	Design:	WRM Water + Environment	17.05.2023
2	Indicative final void water level during a 0.05% AEP storm surge	Scale:	N / A	
		CRS:	GDA94 / MGA zone 55	

4.0 Additional information

The following additional information was requested following the pre-lodgement meeting (Section 1.2.3).

4.1 Residual void outcome

4.1.1 Area of the residual void that will not support a PMLU

Area of the residual void that will not support a PMLU due to concentration of salinity is described in Section 3.2.

4.1.2 Extent of the residual void and catchment that reports to it has been minimised

A key factor towards meeting the final PMLU objective is to reduce residual void and future mining foot prints. The size of the residual void is being reduced through a spoil placement program that is aligned with the PRC plan.

The *Disposal Plan: Overburden, Interburden, Spoil, Coal Washery Rejects and Tailings* (SGME 2020) details strategies used by TerraCom to manage potentially acid forming (PAF) material and waste. Specific strategies designed to minimise the residual void are discussed below.

Compliance with *Condition F14* of the EA will be possible by disposal of coal washery wastes and spoil with exchangeable sodium percentage (ESP) >30% into the residual void and covering it with a minimum of one metre of spoil (ie with ESP <15%) prior to rehabilitation.

It is unknown whether enough spoil will be generated by mining to substantially backfill the residual void because the mining plan has not been finalised and spoil volumes are unknown. Should excess spoil become available, sequential backfilling of the residual void will be done to minimise their size and extent. However, due to the geometry of coal measures, namely their shallow dip and basinal nature, it is unlikely that complete residual void backfilling can occur. Consequently, focus for rehabilitation is the creation of a safe and stable landform by filling as much of the residual void as possible and develop pit walls with appropriate factors of safety.

4.1.3 Landform design for the residual void

Reshaping simulations have been done at several stages from 2019 using various mining surfaces, including surveyed surfaces and planned post-mining surfaces. Modelling design principles have not changed significantly during this time:

- final reshaped surface should be less than or equal to 8.5 degrees (15%); and
- the mining lease boundary has not changed.

Using the post-mining surface generated from the mine schedule, a final landform was simulated using the above grade constraint (15%) and quantified using DeswikEnviro tools. Adjustments were made to the active mining area surface to reduce near-vertical faces to a more realistic repose angle of 38 degrees (61.5%) with additional cut and fill reshaping (Figure 3). Cross sectional views of typical residual voids are in Figure 4.

Further information on final landform design is in Section 4.2.2.

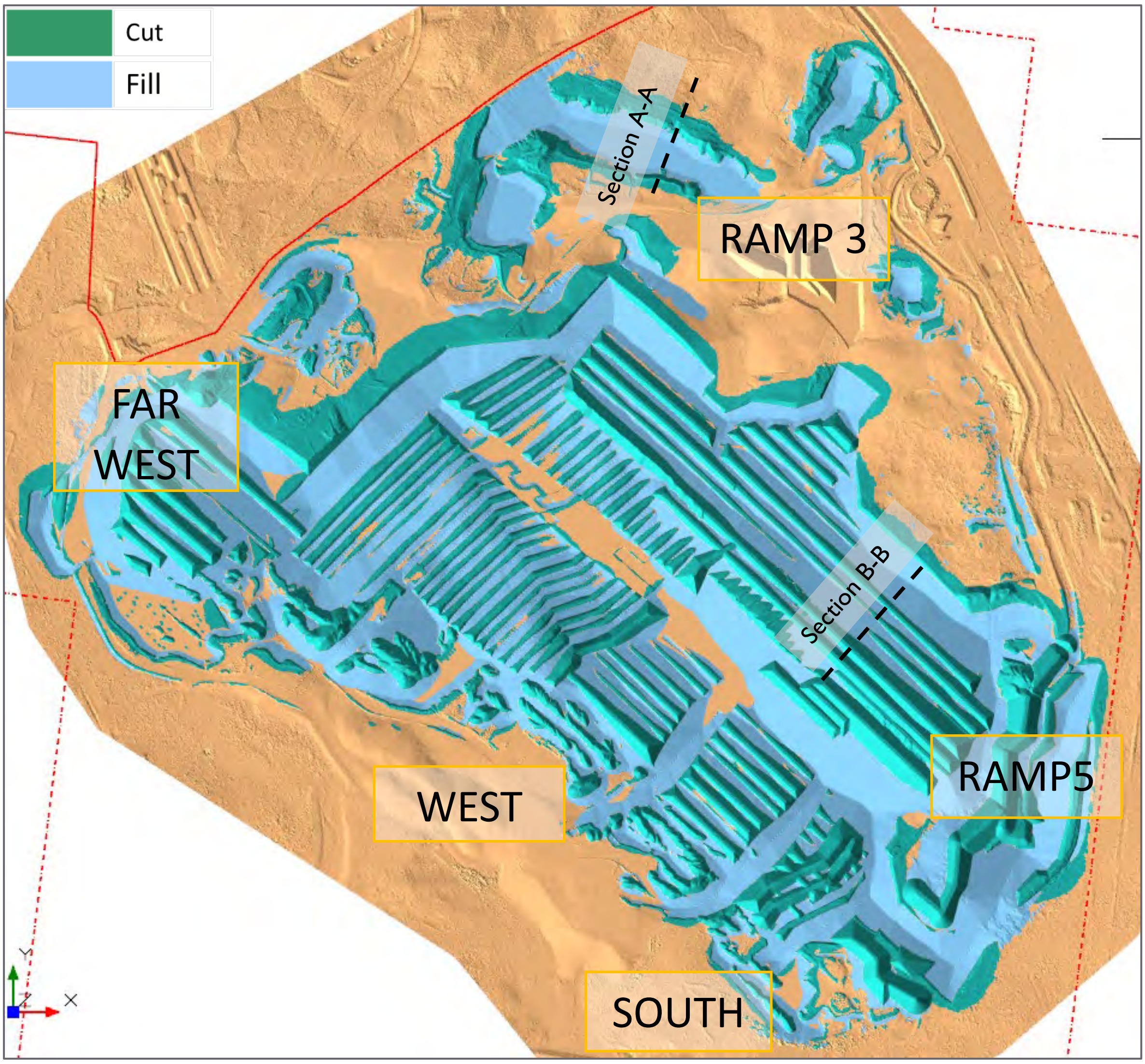
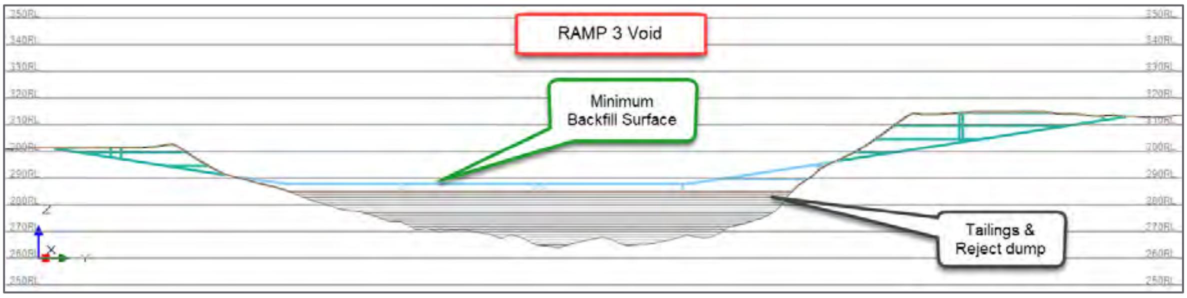


Figure 3 Final reshape cut and fill (Deswik 2022)



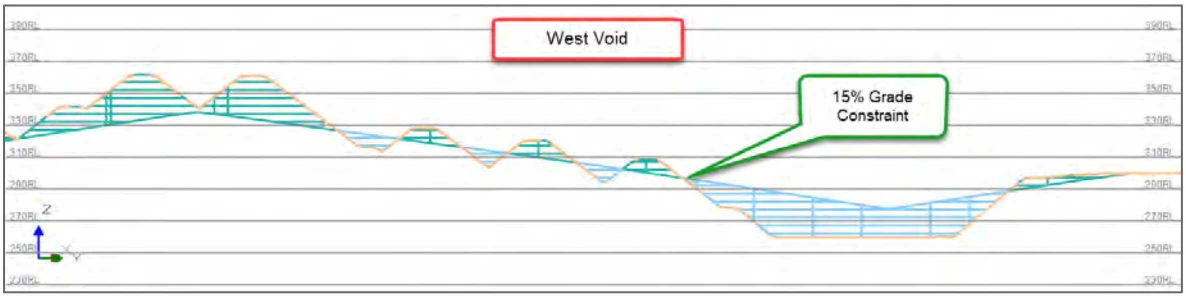


Figure 4 Cross sectional view of representative mining voids (Deswik 2022)

4.1.4 Location

4.1.4.1 Floodplain

Section 41C of *Environmental Protection Regulation 2019* (EP Regulation) states decision considerations for a void located wholly or partly in a flood plain as:

> "A void is considered to be in a flood plain if modelling shows that, when all relevant activities carried out on the land have ended, the land is the same height as, or lower than, the level modelled as the peak water level 0.1% annual exceedance probability (AEP) for a relevant watercourse under the guideline *Australian Rainfall and Runoff* (2019) (ARR)."

Hydrologic and hydraulic modelling was done by WRM (2023a) to assess flooding characteristics for the 0.1% AEP design flood and peak maximum flood (PMF) as per DES (2019 & 2020) and EP Regulation requirements.

WRM have made the assumption that final landform will comply with *Condition F16(d)* of EA EPML00876713 and that the eastern and western diversion drains will convey at least the 0.1% AEP event, prior to end of mining.

The final landform will not significantly modify stream catchments downstream and flooding risk is very low. Hence, risk of the final landform contributing to flooding or erosion in the downstream environment is low and final landform stability will not be impacted from flooding. The following is of note:

- The Mine is located within the flood extent of a relevant watercourse defined by DES (2019). The diversion drains are needed to stop floodwater ingress into the final landform.
- Flooding is characterised by channelised flows within the eastern and western diversion drains, with some overbank flows along the western diversion drain. Flows are generally deep and exhibit high velocities, particularly in the confined sections along the eastern diversion drain. It is recommended that erosion protection is considered for diversion drains.

4.1.4.2 Underlying land use and tenure type

The Mine is located on the historic Blair Athol township, which was a coal mining town with operations dating back to the 1860s. Blair Athol township was closed in the mid-1970s to construct the Mine, and residences were transferred to Clermont. The historic cemetery reserve for Blair Athol township remains.

The pre-mining land use was:

- Blair Athol township;
- historic mining operations;
- cropping and grazing;
- designated stock routes; and
- a cemetery reserves.

The underlying tenure type includes:

- Freehold;
- Lands lease;
- Railway;
- Reserve;
- State Forest; and
- State Land.

4.1.5 Engagement with relevant stakeholders

Previous correspondence indicated a preference to returning land, other than the residual void, to a condition that reflects the adjacent State Forest. Sadly, the previous correspondent has passed away. TerraCom has restarted community consultation with representatives of State Forest, and State Land within the Department of Environment and Science (DES). Representatives of State Forest have indicated a preference towards returning all disturbance, other than the residual void to forestry. Representatives of State Land have indicated a preference towards grazing. There is ongoing discussion with relevant representatives to decide an agreed PMLU.

4.1.6 Interaction with groundwater, and whether the residual void will act as a sink or source to surrounding aquifers

hydrogeologist.com.au has been engaged by SGME on behalf of TerraCom to prepare a groundwater assessment (Oasis Hydrogeology 2023) (Appendix C).

hydrogeologist.com.au found that:

- extensive hydrogeology data and information has been analysed and reported over many years; therefore, groundwater conditions are well understood;
- observed groundwater elevations in the Tertiary basalt are between 305-325 m AHD, and observed groundwater elevations in the Blair Athol Coal Measures are between 295-315 m AHD;
- residual void is a groundwater sink; and
- residual void will not impact on local groundwater quality as water in the residual void will not migrate away from the sink.

4.2 Other disturbance domains

4.2.1 PMLU for all disturbance domains

The PMLU for all other disturbance domains includes:

- grazing; and
- forestry.

The location and extent of each PMLU is still being determined through community consultation. Areas that are located on State Forest must be returned to forestry.

Completion criteria for each PMLU (grazing and forestry) will be finalised through the approval of the PRC plan, and is not the purpose of the application for an amendment of the EA.

4.2.2 Final landform design

The landform design report has been attached in Appendix D. Design outcomes are presented as an elevation map in Figure 5.

The mine plan that was used for landform design aims to maximise mining of the coal resources contained within the mining lease.

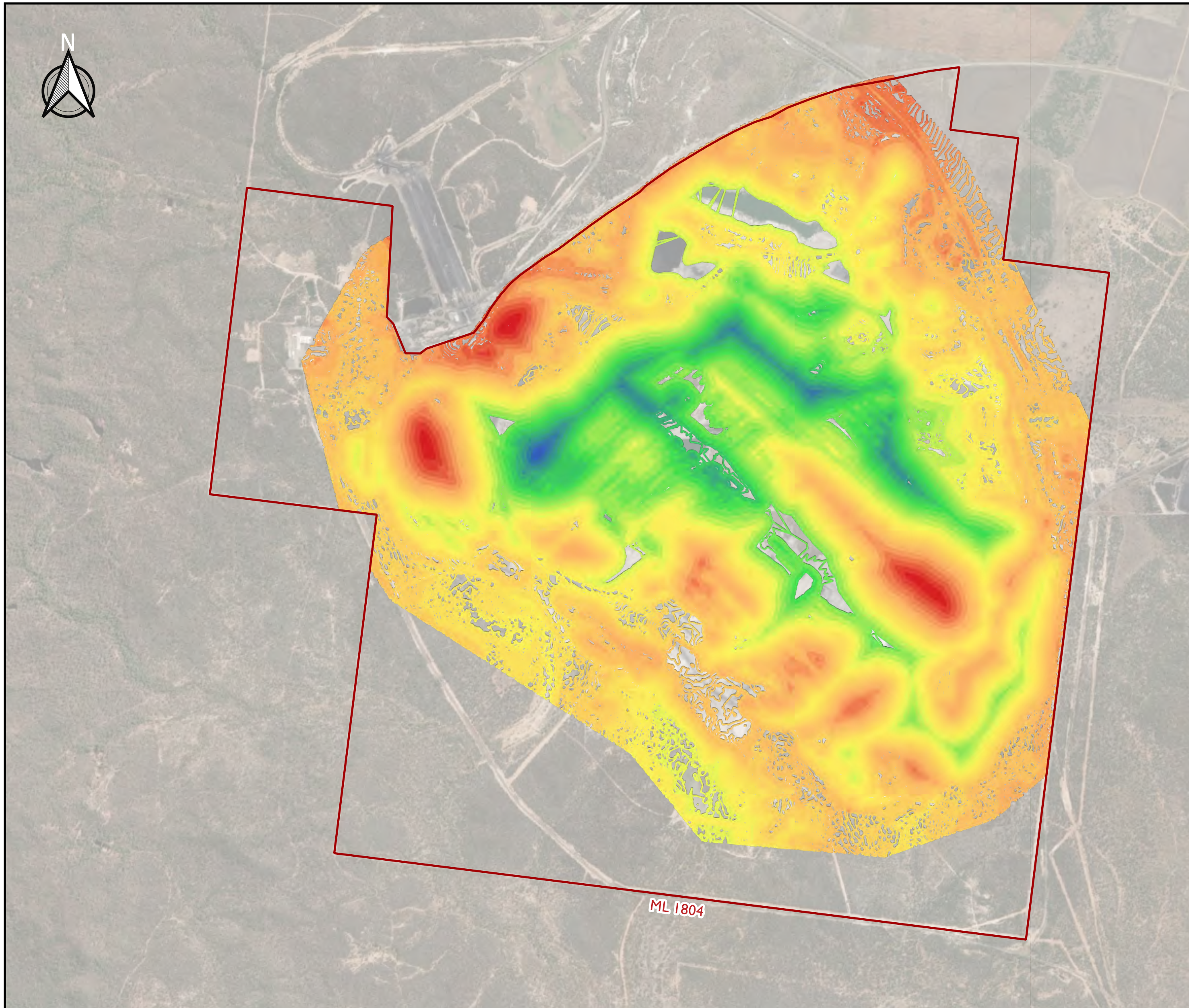
Using the post-mining surface generated from the mine schedule, a final landform was simulated using a 15% grade constraint and quantified using DeswikEnviro tools. Final landform has been generated using the modelled post-mining surface from "BA 90D FY22 20210621 V1.5 Rev2.3.dcf", a schedule and haulage (LHS) model used as part of the 2021 Life of Mine (LOM) planning process. The surface was generated using the "Min Dist" haulage scenario.

The landform design has been developed to be generally water shedding with only areas near the residual void being water retaining. The residual void has been designed to comply with *Condition F17* of EA EPML00876713.

Development of the landform design has relied on several assumptions including swell factor of excavated and dumped material. Small variations can result in differences in the as-dumped profile including size and shape of the residual void.

Additionally, the mining sequence can change in response to market demands or operational challenges. Therefore, some variation in the current proposed final landform design can be expected as mining progresses and will be updated as required via the appropriate amendment process.

Further information on landform design for the residual void is in Section 4.1.3.



LEGEND

ML 1804

LOM final landform (elevation)

246 - 251.1 m	297 - 302.1 m
251.1 - 256.2 m	302.1 - 307.2 m
256.2 - 261.3 m	307.2 - 312.3 m
261.3 - 266.4 m	312.3 - 317.4 m
266.4 - 271.5 m	317.4 - 322.5 m
271.5 - 276.6 m	322.5 - 327.6 m
276.6 - 281.7 m	327.6 - 332.7 m
281.7 - 286.8 m	332.7 - 337.8 m
286.8 - 291.9 m	337.8 - 342.9 m
291.9 - 297 m	342.9 - 348 m

Scale 1 : 40 000

0 1 2 km

Project	Client
Application to Amend Environmental Authority (EPML00876713)	Orion Mining Pty Limited

Figure	Title	
5	LOM Final Landform - Elevation Map	Design: SGM Environmental Pty Ltd 29.05.2023 Scale: 1 : 40,000 CRS: GDA94 / MGA zone 55

SGMenvironmental

4.2.3 Additional approvals required

Watercourses will be retained, as no significant difference to residual void water quality is achieved by their removal (WSP 2020). Beneficial flows to Bath Creek downstream of the Mine are preserved; minimising impacts to downstream surface water systems resulting from interception by the final void.

No additional approvals are currently being sought.

4.3 Completion criteria

There is ongoing discussion regarding the extent of each PMLU as well as completion criteria (Section 4.1.5).

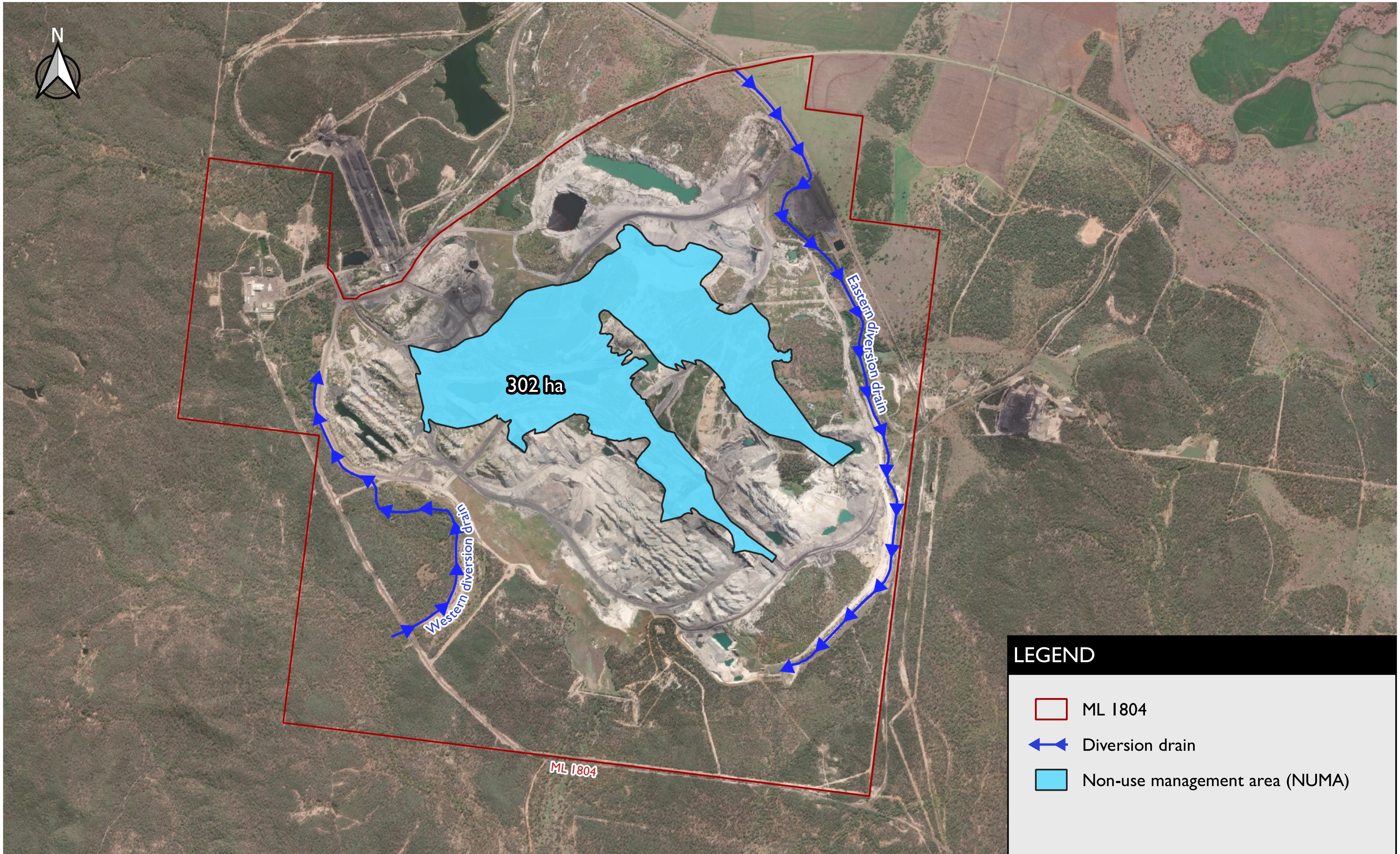
Completion criteria for each PMLU (grazing, and forestry) will be finalised through approval of the PRC plan, and is not the purpose of the application for an amendment of the EA.

5.0 Proposed amendment

The proposed amendment is to *Condition F4* of the EA. The current condition, proposed change, and brief justification is described in Table 2.

Table 2 Proposed amendment and relevant conditions of the EA

Condition number	Current condition	Proposed change	Justification
F4	Rehabilitation landform criteria All areas disturbed by mining activities must be rehabilitated in a manner that ensures it is: (a) safe for humans and wildlife; (b) stable; (c) able to sustain vegetation; and (d) non-polluting.	Rehabilitation landform criteria All areas disturbed by mining activities, ***except for the residual void depicted in Figure 6***, must be rehabilitated in a manner that ensures it is: (a) safe for humans and wildlife; (b) stable; (c) able to sustain vegetation; and (d) non-polluting.	The purpose of the amendment of *Condition F4* is to reflect that the void itself will not be able to sustain vegetation.
F17	Residual void outcome Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority.	Residual void outcome Residual voids must not cause any serious environmental harm to land, surface waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself and subject to any other condition within this environmental authority.	The residual void will not be returned to a stable condition under *Section 111A* of the EP Act which requires the land to be able to sustain a PMLU. Notwithstanding, the residual void will not cause any serious environmental harm in accordance with this condition.



Project: Application to Amend Environmental Authority (EPML00876713)	Client: Orion Mining Pty Limited
Figure: 6	Title: Residual Void Location, Size and Extent
Design: SGM Environmental Pty Ltd Scale: 1 : 40,000 CRS: GDA2020 / MGA zone 55	Date: 05.07.2023 Author: L McDonald

SGMenvironmental

6.0 Conclusion

TerraCom is seeking to amend *Condition F4* of the EA to reflect the pre-approval of the residual void not being able to sustain vegetation, which was acknowledged in Appendix A.

The proposed change to *Condition F4* does not:

- change any rehabilitation objectives stated in the EA in a way that results in significantly different impacts on environmental values than the impacts previously permitted under the authority; or
- significantly increase the scale or intensity of the relevant activity; or
- involve an addition to the surface area for a relevant activity.

References

DES 2019, Queensland Government Department of Environment and Science, November 2019, *Guideline – Progressive rehabilitation and closure plans (PRC plans).*

DES 2020, Queensland Government Department of Environment and Science, March 2020, *Information sheet – Voids in floodplains.*

Deswik 2022, *Reshape Assumptions Report 21-1823-V1*, prepared for TerraCom Limited by Deswik Pty Limited.

Oasis Hydrogeology 2023, *Blair Athol Coal Mine: PRCP Groundwater Assessment*, prepared for TerraCom Limited by Oasis Hydrogeology Pty Ltd (trading as hydrogeology.com).

SGME 2020, *Disposal Plan: Overburden, Interburden, Spoil, Coal Washery Rejects and Tailings*, prepared for TerraCom Limited by SGM Environmental Pty Limited.

TerraCom 2017, *Environmental Management Plan: Blair Athol Coal Mine,* prepared by TerraCom Limited.

Terrenus 2009, *Groundwater Review: Blair Athol Coal Mine*, prepared for TerraCom Limited by Terrenus Limited.

WRM 2023a, *Final Void Hydrology Report: Blair Athol Coal Mine,* prepared for TerraCom Limited by WRM Water & Environment Pty Ltd.

WRM 2023b, Supplementary figure to *Final Void Hydrology Report: Blair Athol Coal Mine,* prepared for TerraCom Limited by WRM Water & Environment Pty Ltd.

WSP 2020, *Residual Void Management Plan: Blair Athol Coal Mine*, prepared for TerraCom by WSP Pty Ltd.

Appendix A

Letter acknowledging pre-approval of residual voids

This page is intentionally blank.

Queensland Government

Department of
Environment and Science

Ref EPML00876713 – Blair Athol Mine

27 November 2020

TerraCom Limited
PO Box 131
CLERMONT QLD 4721

Attn: Renee Herreygers, Manager - Tenements

Email: rherreygers@terracomresources.com

Dear Renee,

I refer to the Rehabilitation Management Plan (RMP), Residual Void Management Plan (RVMP) and Mine Closure Management Plan (MCMP) submitted to the Department of Environment and Science (the department) on 30 October 2020 in accordance with the conditions in the environmental authority (EA) EPML00876713 for the Blair Athol Mine.

The department has reviewed the aforementioned provided management plans to determine if they constitute a land outcome document (LOD) for the purposes of developing a transitional Progressive Rehabilitation and Closure Plan (PRCP).

In accordance with section 750 of the *Environmental Protection Act 1994* (EP Act), the EA for the Blair Athol Mine is automatically a LOD. If there is an inconsistency between any LODs, the document appearing first in the list mentioned in the LOD definition of the EP Act prevails to the extent of the inconsistency.

Condition F4 of the EA EPML00876713 states that '*all areas disturbed by mining activities must be rehabilitated in a manner that ensures it is (a) safe for humans and wildlife; (b) stable; (c) able to sustain vegetation; and (d) non-polluting*'. This is inconsistent with the RMP, RVMP and MCMP, which state that all areas significantly disturbed by mining activities, excluding residual voids and infrastructure areas, will be rehabilitated to a stable landform with a post mining land use (PMLU) of native ecosystem.

Business Centre Coal
99 Hospital Road
Emerald QLD 4720
Telephone (07) 4987 9320
Website www.des.qld.gov.au
ABN 46 640 294 485

The department acknowledges the pre-approval of the residual voids and proposes that Condition F4 of the EA EPML00876713 is amended to reflect that the voids themselves will not be able to sustain vegetation. However, their inability to sustain a PMLU still needs to be demonstrated.

The post mining land outcomes for the infrastructure areas, water management structures and watercourse diversions are also not clear in the RMP, RVMP and MCMP.

Based on the above, it has been determined that the RMP, RVMP and MCMP submitted to the department on 30 October 2020 are insufficient as LODs for the purposes of developing a transitional PRCP.

PRCP Requirements

The proposed PRCP for the Blair Athol Mine should describe how all infrastructure on site will be decommissioned and/or removed, and the underlying land rehabilitated unless the landowner has agreed in writing to retain the infrastructure post mining. The EA holder must be able to demonstrate how the retained infrastructure will support the PMLU. For example, the dams must be rehabilitated so that the water quality is suitable for stock and/or habitat.

The rehabilitation requirements of the watercourse diversions based on the relevant water licence will need to be described in the proposed PRCP.

The information provided in the RMP, RVMP and MCMP on residual void hydrology and water quality does not adequately demonstrate that the residual voids cannot be rehabilitated to be safe, stable, non-polluting and able to sustain a PMLU.

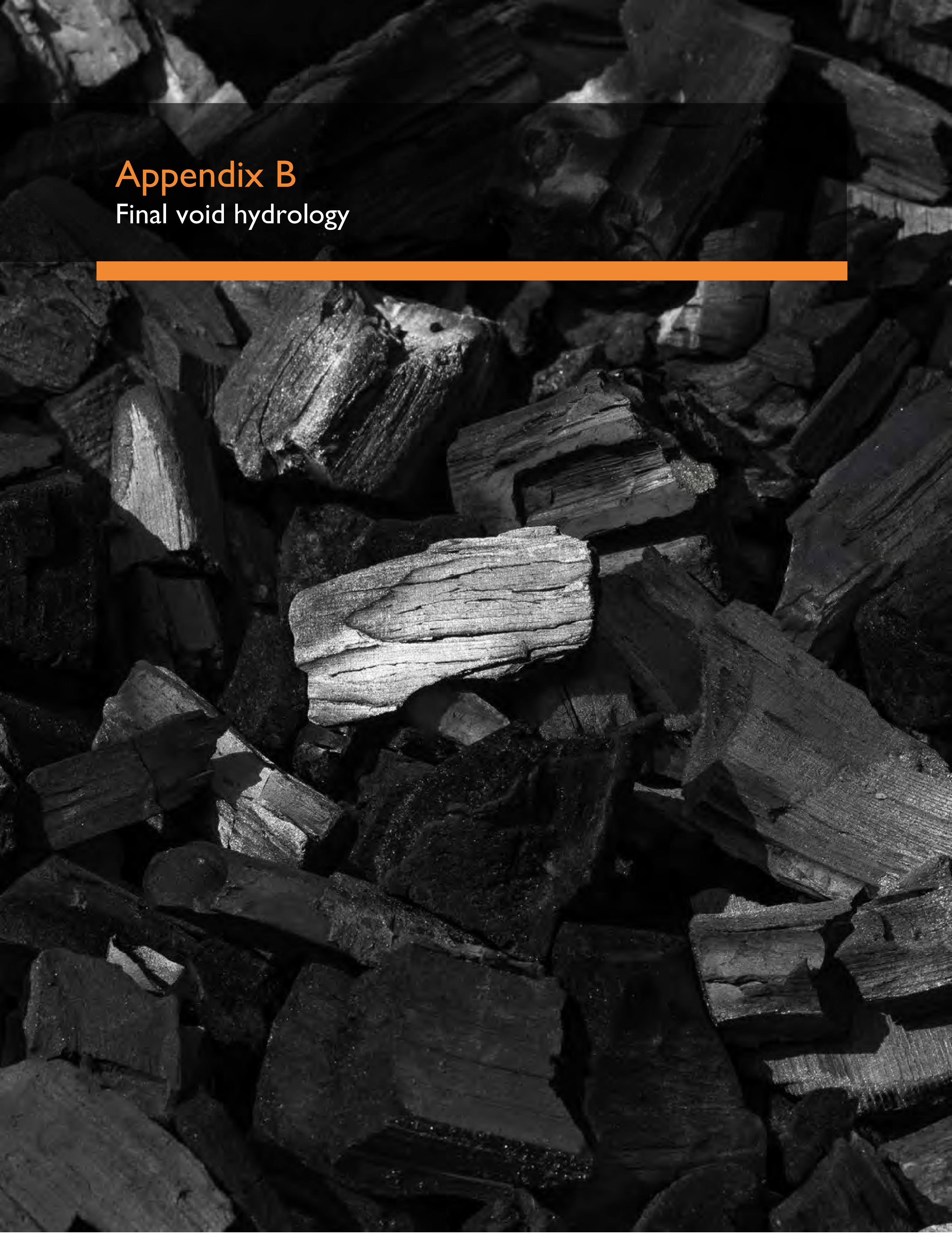
For residual voids, the proposed PRCP for the Blair Athol Mine must include revised modelling to enable a better understanding of the long term void water quality, which is based on the final mine plan simulated over a 500 year period.

Should you have any further enquiries, please contact Gillian Naylor, Manager, Assessment (Coal), of the department on telephone 0472 802 721.

Yours sincerely

Juliana McCosker
Manager – Environmental Services

Appendix B
Final void hydrology



This page is intentionally blank.

Final void hydrology report

Blair Athol Coal Mine

Terracom Resources

1549-02-C1, 16 February 2023

For and on behalf of WRM Water & Environment Pty Ltd
Level 9, 135 Wickham Tce, Spring Hill
PO Box 10703 Brisbane Adelaide St Qld 4000
Tel 07 3225 0200

Matthew Briody
Principal Engineer

Contents

List of Figures

1 Introduction

WRM Water & Environment Pty Ltd (WRM) was engaged by SGM Environmental (on behalf of Terracom Resources) to undertake a void hydrology assessment to support the Progressive Rehabilitation and Closure (PRC) Plan for the Blair Athol Coal Mine (BAC). The BAC Mine is operated by Terracom Resources (Terracom).

WRM has modelled the long-term final void hydrology and water quality behaviour of the BAC final void over a 500-year period post-closure to inform whether the final void would be safe, stable and non-polluting. This report outlines the methodology and assessment of the expected final void pit lake behaviour, which has been modelled using the GoldSim water balance simulation software.

2 Final void geometry

The final landscape of BAC is a depressed landform. This depressed landform has formed from historic mining, incorporating in-pit backfilled spoil which sits atop a mined pit shell. A digital elevation model (DEM) of the mined pit shell and the final landform (i.e. the final surface expected at the end of the mine life) was provided by TerraCom.

Due to the topography of the site, any rainfall/runoff which flows through the site reports to the final void which would form at the lowest elevation. This water would be stored within the final landform, as well as in the backfilled spoil both below and adjacent to the final landform, which has the potential to store water within the spoil pore space. WRM previously undertook investigations (for Glencore at the neighbouring Clermont operation) into estimating the percentage of pore storage within the in-pit spoil at BAC, using site observations over a period of around 6 months in 2020. The spoil pore storage was estimated to be 2.5%. This spoil pore capacity has been adopted for this study.

For this study, a hybrid stage-storage curve was generated to account for the volume of water stored within the final void and the sub-surface volume of water stored within the backfilled spoil in the pit shell below and beside the final landform. Figure 2.1 shows the hybrid stage-storage curve derived for the final void.

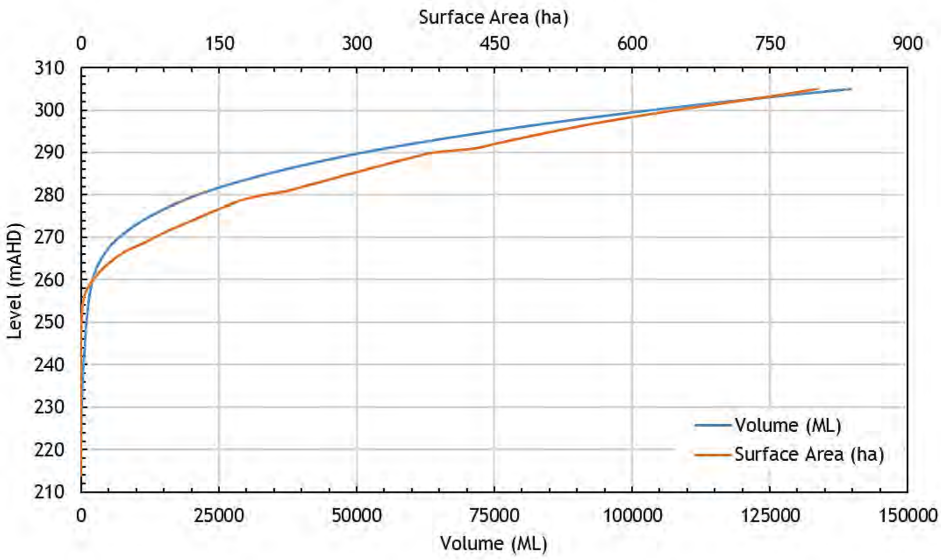


Figure 2.1 - Final void stage-storage and surface area curve

3 Model configuration

3.1 MODELLING APPROACH

The GoldSim water balance simulation model was used to simulate the long-term void water level behaviour, salinity, and the interaction of the pit lake water with the surrounding groundwater table. Water levels in the residual voids would vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff, and groundwater.

The GoldSim model was used to simulate the generation, movement, and loss of water on a daily time-step within the final void, over a 500-year period. The volume of water in the void was calculated at each time step as the sum of direct rainfall to the void surface, catchment runoff, and groundwater inflows, less evaporation losses. The model also tracks the quantity of salt captured and stored within the system.

Key components of the model are summarised in the following sub-sections, including descriptions of key model inputs, assumptions, and sensitivity parameters.

3.2 RAINFALL AND EVAPORATION

Long-term daily rainfall and evaporation data for the area from January 1889 to December 2021 (133 years) obtained from the Department of Environment and Science (DES) SILO database forms the basis of the simulation (DES, 2022).

Morton's Lake evaporation has been used to estimate evaporation losses from storages. Figure 3.1 shows the long-term monthly averages for Morton's lake evaporation and rainfall data.

The 133 years of SILO rainfall and evaporation data was repeated three times to create an indicative long-term (500 year) climate sequence.

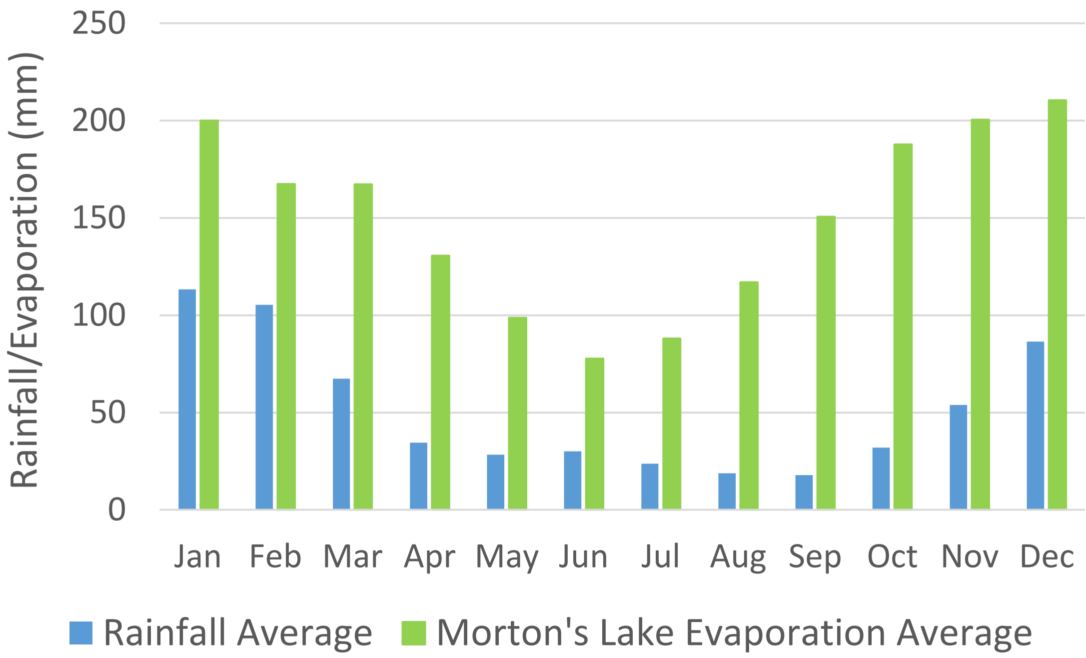


Figure 3.1 - Distribution of monthly rainfall and evaporation (SILO 1889 - 2021)

Evaporation from the final void pit lake is impacted by the final void geometry. The pit walls shade the pit lake which reduces the hours of direct sunlight on the pit lake and reduces evaporation. The depth of the pit lake below natural surface can reduce wind velocities, which increases humidity at the pit lake surface and reduces evaporation. A pit evaporation factor is applied to the daily evaporation to account for these factors.

The shape of the pit lake at BAC changes as the water level increases. Initially, the lake is contained within the 'pit' footprint. As the water level increases, the pit lake takes on a shape that is more like a conventional lake rather than a pit lake. However, due to the mine having a 'depressed' landform, the pit lake may still have some sheltering effects from wind.

To simulate this variation in the pit lake shape, the evaporation rate has been varied through the use of a pan factor. The pan factor has been applied to the pit lake in the following way:

- Pan factor of 0.7 when the water level is at the floor of the final landform (approximately 246 mAHD - 59 m below the pit crest);
- as the water level increases, the evaporation factor increases linearly to 0.8 at 275 mAHD (30 m below the pit crest) when the pit lake shape begins to reflect conventional lakes; and
- as the water level increases above 275 m AHD, the pan factor increases linearly to 1 at 305 mAHD (the pit overflow level).

3.3 CATCHMENT RUNOFF

3.3.1 Catchment areas

The final landform catchment area has been generated using the final landform surface provided by Terracom. The landuse areas outside of the long-term void lake were generated using the latest aerial of the site, which differentiates mining from undisturbed areas.

The final void catchment has been characterised into the following land use types:

- natural/undisturbed, representing areas in their natural state;
- spoil, representing infrastructure, overburden, stockpile and haul roads; and
- rehabilitated spoil, representing established rehabilitated spoil areas.

The area covered by the maximum water level of the void pit lake has been assumed as spoil. All other disturbed areas within the mine footprint have been assumed as rehabilitated spoil, as it is understood that these areas will be rehabilitated post-mining.

Figure 3.2 shows the catchment boundary and land uses assumed for the final void. The catchment and land use values used in the GoldSim model are shown in Table 3.1.

Table 3.1: Final void catchment and land use areas (ha)

Catchment	Undisturbed	Rehabilitated spoil	Spoil	Total
Final void	72.2	1,186.7	291.6	1550.5

3.3.2 AWBM parameters

Catchment runoff has been modelled using the AWBM rainfall-runoff model. The adopted rainfall runoff parameters are based on Water Solutions (2012). The AWBM parameters from the model have been summarised in Table 3.2.

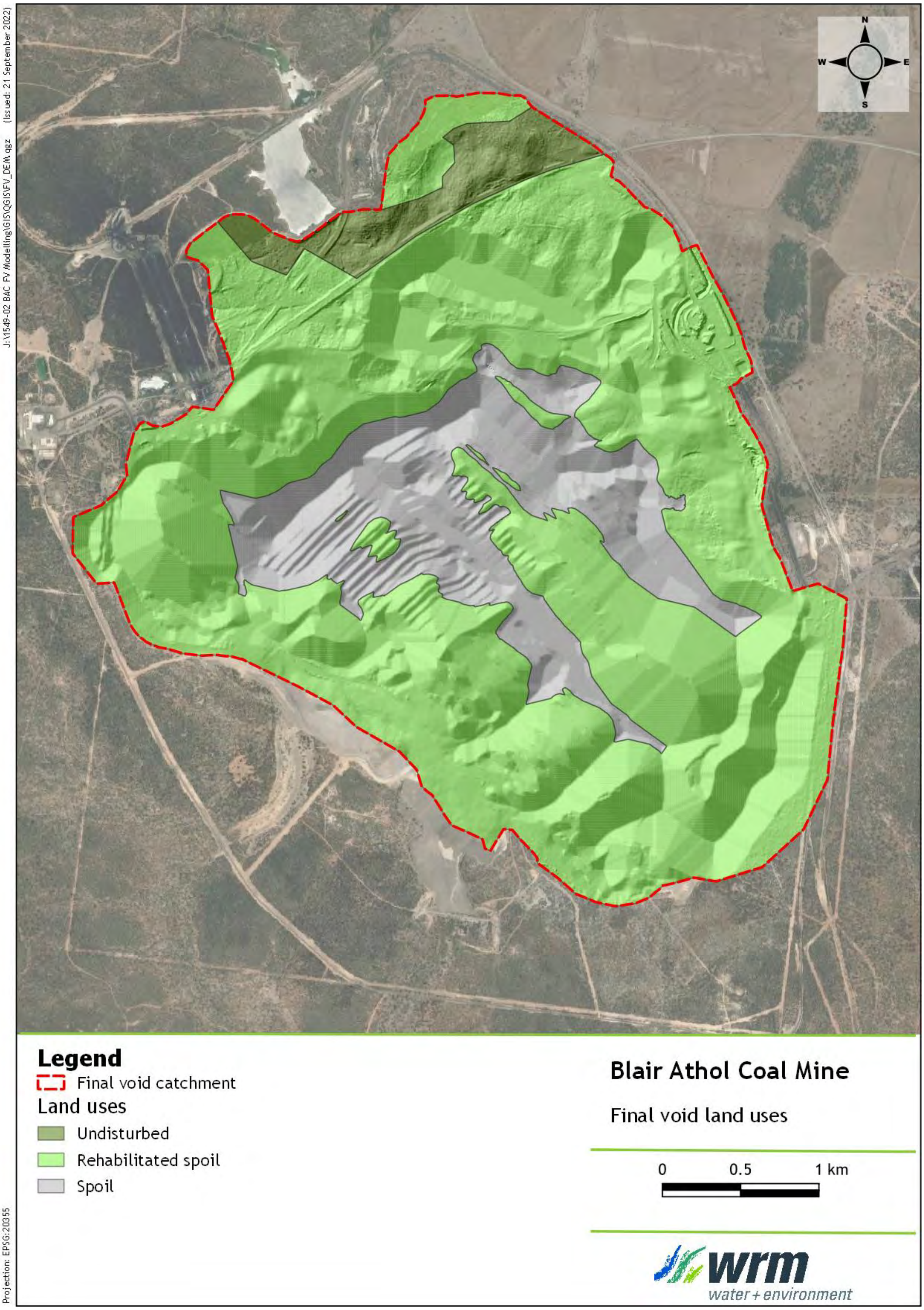


Figure 3.2 - Final void site catchment/land uses

Table 3.2: Adopted AWBM parameters

Parameter	Undisturbed	Spoil/Dump	Rehab spoil
A1	0.2	0.1	0.1
A2	0.4	0.9	0.9
A3	0.4	0	0
C1 (mm)	70	12	12
C2 (mm)	105	38	125
C3 (mm)	210	0	0
C_{avg} (mm)	140	35.4	113.7
BFI	0	1	0.3
K_{base}	0	0.997	0.997
K_{surf}	0	0	0
Cv	9%	25%	14%

3.4 SALINITY OF THE PIT LAKE

Sources of salinity in the final void pit lake include:

- runoff and seepage from the final void catchments; and
- groundwater inflows.

The water balance model was configured to use salinity as an indicator of water quality. This was achieved by assigning representative electrical conductivity (EC) concentrations to runoff from catchments and other sources of water.

The adopted salinity values for different land uses are based on Water Solutions (2012) as well as recent water quality monitoring data and are shown in Table 3.3. The adopted salinity for groundwater has been sourced from Terracom (2018), which measured average baseline total dissolved solid levels of 405 mg/L (i.e. approximately 735 µS/cm) in the basalt aquifer at BAC.

Salinity from baseflow (seepage) through the spoil and the rehabilitated spoil is the same as surface flow. We recommend geochemistry of the spoil be assessed to understand the potential salinity generation from spoil for both surface and baseflow.

Table 3.3: Adopted salinity concentrations

Landuse	Salinity (µS/cm)	Source
Natural/Undisturbed	290	Average result of surrounding natural waterways taken in 2019/2020 (Ecological Services, 2019, 2020)
Spoil	4,150	Average result of salinity measurements from Ramp 1 Transfer in 2019/2020
Rehab Spoil	500	Water Solutions (2012)
Groundwater	735	Terracom (2018)

3.5 GROUNDWATER INTERACTION

Groundwater inflow rates have been assumed as per JBT Consulting (2012) with the inflow rate estimated at 3 - 5 L/s (i.e. approximately 350 kL/d).

Hydrogeologist.com.au (2023) completed a groundwater assessment for the BAC. The assessment noted that groundwater elevations observed in the surrounding Tertiary basalt ranged from 305 mAHD - 325 mAHD and groundwater elevations observed in the Blair Athol Coal Measures ranged from 295 - 315 mAHD. The minimum observed groundwater level of 295 mAHD is referenced in Section 4 below.

4 Final void results

4.1 OVERVIEW

The final void was modelled using the assumptions outlined in Section 3 and the results are outlined in Section 4.2. In addition, an extreme event analysis was undertaken on the final void and is analysed in the results are outlined in Section 4.3.

4.2 FINAL VOID MODEL RESULTS

4.2.1 Long-term water level behaviour

The final void water level for the base case was modelled over a 500-year period and is shown in Figure 4.1. The model results show:

- The final void initially rapidly collects water, rising from its starting level (approximately 229 mAHD) up to the void floor (at 246 mAHD) within a year. This represents the sub-surface storage of the void (i.e. backfilled spoil under the final void) reaching capacity, before the void collects water above the backfilled surface and forms a permanent pit lake;
- The final void reaches equilibrium after about 75 years, with the void oscillating between approximately 270 and 282 mAHD.
- The final void forms a long-term groundwater sink based on the minimum observed groundwater level of 295 mAHD (as shown on Figure 4.1).
- The maximum modelled water level is about 23 metres below the pit overflow level and about 13 metres below the minimum observed groundwater level.

Table 4.1 shows a summary of the storage details of the residual voids and the results of the water balance modelling.

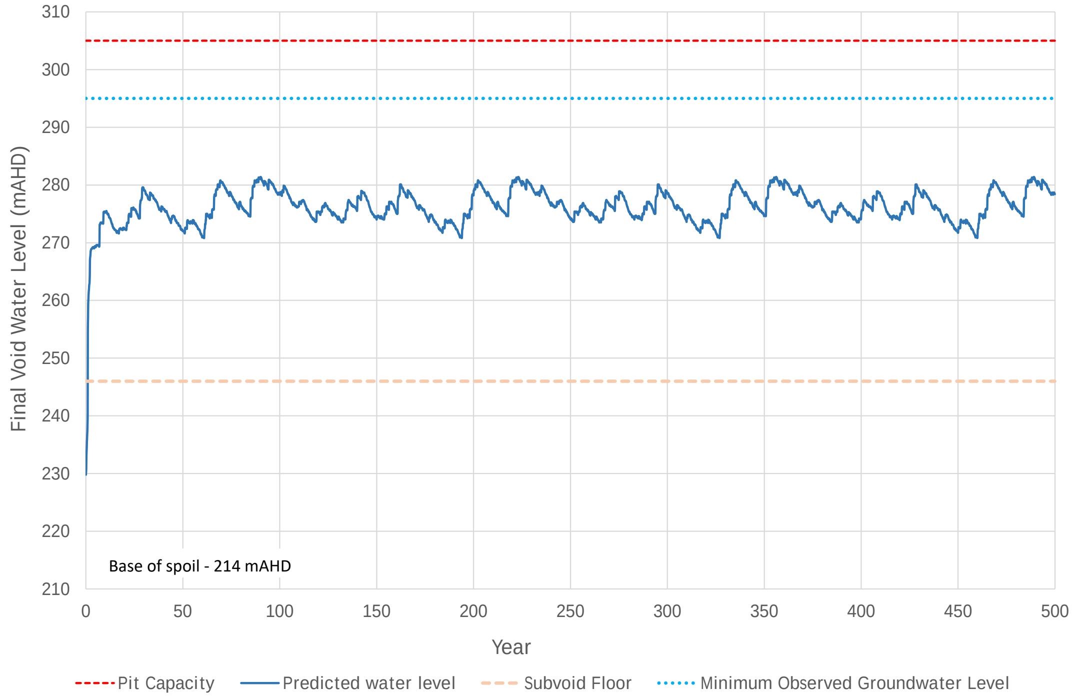


Figure 4.1 - Final void long-term predicted void water level

Table 4.1 - Final void modelling results summary

Void	Elevation (mAHD)					
	Void sub-floor level	Final landform floor level	Overflow level	Minimum observed groundwater level	Modelled average long-term water level	Modelled peak long-term water level
Final Void	214.0	246.0	305.0	295.0	276.6	282.0

4.2.2 Long-term salinity

The long-term salinity of the final void progressively increases with time. This is expected for closed-loop systems with no mechanism for salt removal.

The model results show the following:

- The salinity of the pit lake progressively increases, rising to over 40,000 µS/cm after about 300 years and reaching a maximum salinity of approximately 90,000 µS/cm. The salt load progressively increases, reaching to about 750,000 tonnes after the 500-year modelled period.

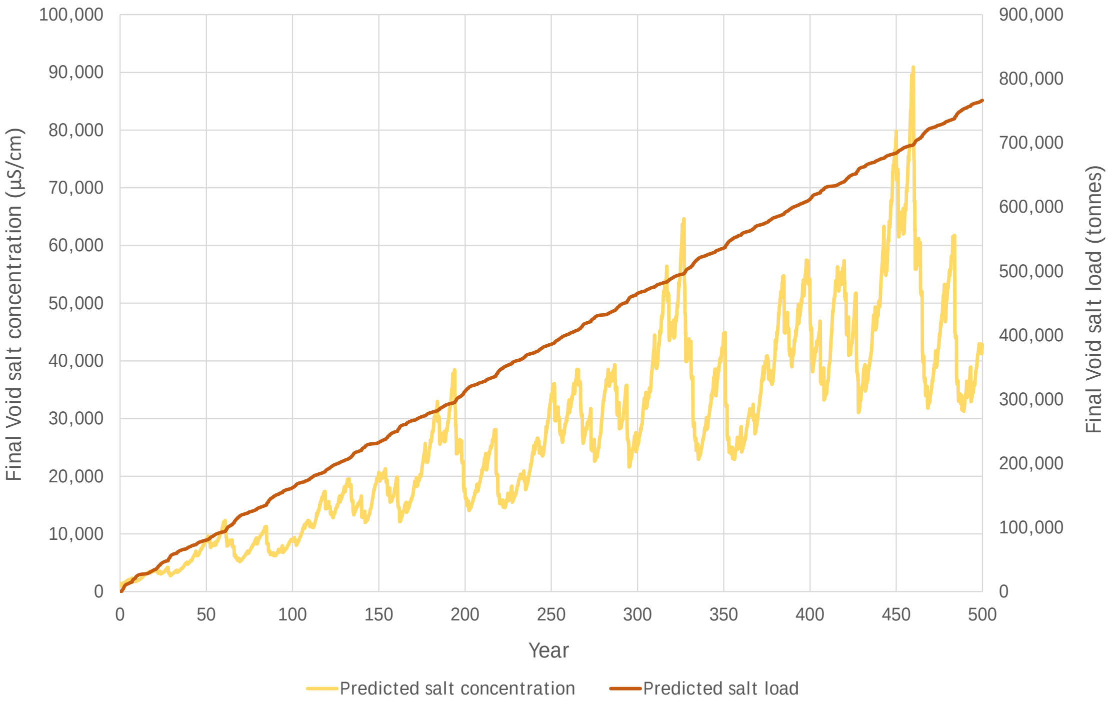


Figure 4.2 - Final void long-term predicted salinity concentration and load

4.3 STORM EVENT BEHAVIOUR

4.3.1 Methodology

An assessment of the impact of storm events on the water level in the final void has been undertaken. The potential for discharge of void water has been assessed for the following design rainfall events using 72-hour (3 day) rainfall depths:

- 1 in 100 annual exceedance probability (AEP) (or 1% AEP);
- 1 in 1,000 AEP (or 0.1% AEP); and
- 1 in 2,000 AEP (or 0.05% AEP).

The maximum water level simulated in the final void water balance modelling was conservatively adopted as the initial condition for the storm event analysis. As outlined in Table 4.1, this was 282 mAHD (i.e. approximately 25,500 ML).

Design rainfall depths for the above events were estimated using standard procedures in Australian Rainfall and Runoff (ARR) (Ball *et al.*, 2019). The runoff generated from the storm events have been conservatively calculated assuming 100% of runoff reports to the void (i.e. no losses) from the surface catchment reporting to the void (1,550 ha).

4.3.2 Results

The results of the storm event analysis are outlined in Table 4.2. The results show that even during a storm event with rainfall depths equivalent to the 1 in 2,000 AEP 72-hour storm, there would be a minor impact on the level of water in the final void. Simulated water level increases for such an event are in the order of 3.1 m. The 1 in 2000 AEP design event peak water level is therefore 20 m below the void crest and 10 m below the minimum observed groundwater level.

Table 4.2 - Final void modelling results summary

Storm Event (AEP)	Rainfall Depth (mm)	Runoff Volume (ML)	Final Volume (ML)	Final Level (mAHD)	Water Level Change (m)
1%	327	5,070	30,651	283.9	1.9
0.1%	489	7,582	33,163	284.8	2.8
0.05%	545	8,450	34,031	285.1	3.1

5 Summary

A GOLDSIM water balance model was developed to assess the long-term water level and salinity behaviour at the BAC final void. The final landscape at BAC forms a depressed landform, with a significant volume of sub-surface storage within backfilled spoil. A hybrid stage-storage curve using a spoil pore capacity of 2.5% was used in this analysis, based on previous investigations undertaken by WRM at BAC.

The final void was modelled for a 500-year period following mine closure. The final void model results showed the following:

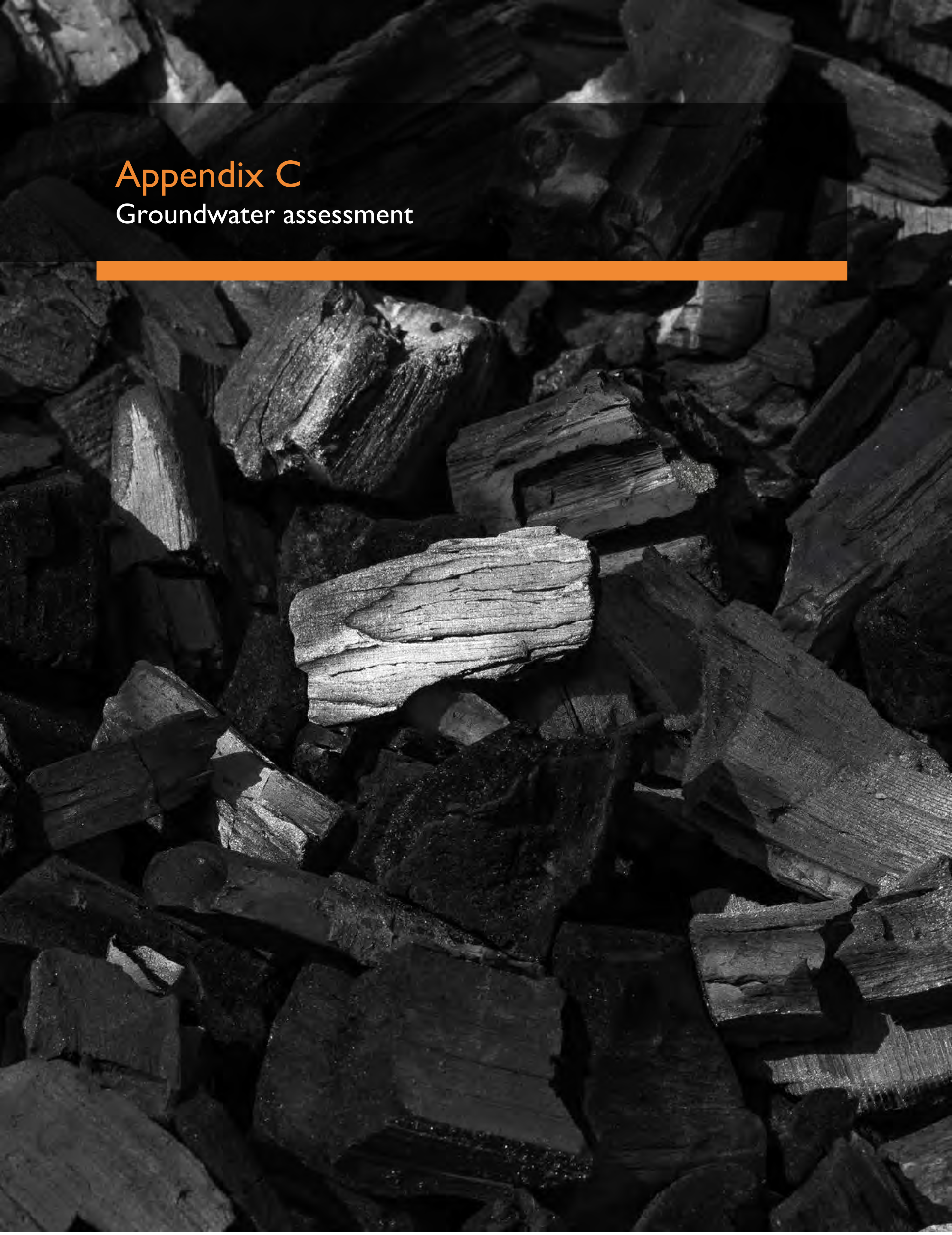
- the final void rises above the sub void floor and forms a permanent pit lake after approximately 1 year;
- the final void reaches equilibrium after about 75 years, with the void oscillating between approximately 270 and 282 mAHD;
- the final void forms a long-term groundwater sink based on the minimum observed groundwater level of 295 mAHD;
- the maximum modelled water level is about 23 m below the void overflow level and about 13 m below the minimum observed groundwater level; and
- the salinity of the pit progressively increases over the simulation, reaching a maximum salinity of approximately 90,000 µS/cm.

An extreme storm event analysis was undertaken on the final void, conservatively assuming 100% runoff and an initial water level at the maximum level modelled over the 500-year period. The extreme storm analysis showed that an extreme event does not have a significant impact on the final void, with a 1 in 2000 AEP 3-day storm increasing the final void water level by 3.1m. This level is 20 m below the void crest and 10 m below the minimum observed groundwater level.

6 References

Ball J et al, 2019	*Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia.*
DES, 2022	The Department of Environment and Science (DES) SILO climate data. (2022). Retrieved 22 July, 2022, from https://legacy.longpaddock.qld.gov.au/silo/
Ecological Services Professional, 2019	*Blair Athol Mine Receiving Environment Monitoring Program 2019 Report,* Prepared for Orion Mining Pty Ltd. June 2019.
Ecological Services Professional, 2020	*Blair Athol Mine Receiving Environment Monitoring Program 2020 Report,* Prepared for Orion Mining Pty Ltd. July 2020.
GoldSim, 2017	'GoldSim Version 12 User's Guide' Volume 1 & 2, GoldSim Technology Group, Issaquah, Washington USA, February 2017
Hydrogeologist.com.au	*Blair Athol Coal Mine PRCP Groundwater Assessment.* Prepared for Terracom Ltd. Project number 4031. 16 January 2013.
JBT Consulting, 2012	*Blair Athol Mine Closure Groundwater Investigation*
Terracom, 2018	*'Residual Void Management Plan - Blair Athol Coal Mine'* Prepared by WSP on behalf of Terracom Mining, June 2018
Water Solutions, 2012	*RTCA - Blair Athol Coal/Clermont Coal Mine OPSIM Water Management Update & Review 2012*

Appendix C
Groundwater assessment



This page is intentionally blank.

REPORT ON

BLAIR ATHOL COAL MINE
PRCP GROUNDWATER ASSESSMENT

For: Terracom Ltd

Project number: 4031

Date: 16/01/2023

ABN: 50 627 068 866 www.hydrogeologist.com.au info@hydrogeologist.com.au

1/149 Boundary Road, Bardon. QLD. 4065 P.O. Box 108, The Gap. QLD. 4061

Table of contents

Table of contents (continued)

Figure list

Table list

Blair Athol Coal Mine – PRCP Groundwater Assessment

Prepared for

Terracom Ltd

1. Introduction

hydrogeologist.com.au has been commissioned by SGM Environmental (SGM) to prepare a groundwater assessment to support the Progressive Rehabilitation and Closure Plan (PRCP) for the Blair Athol Coal Mine (BAC).

1.1. Background

Blair Athol Coal Mine (BAC) is an open cut coal mine located approximately 20 km northwest of Clermont in central Queensland (Figure 1). BAC open cut pits, overburden emplacement areas, coal stockpiles, a coal handling plant (CHP) and water management infrastructure are located on Mining Lease (ML) 1804.

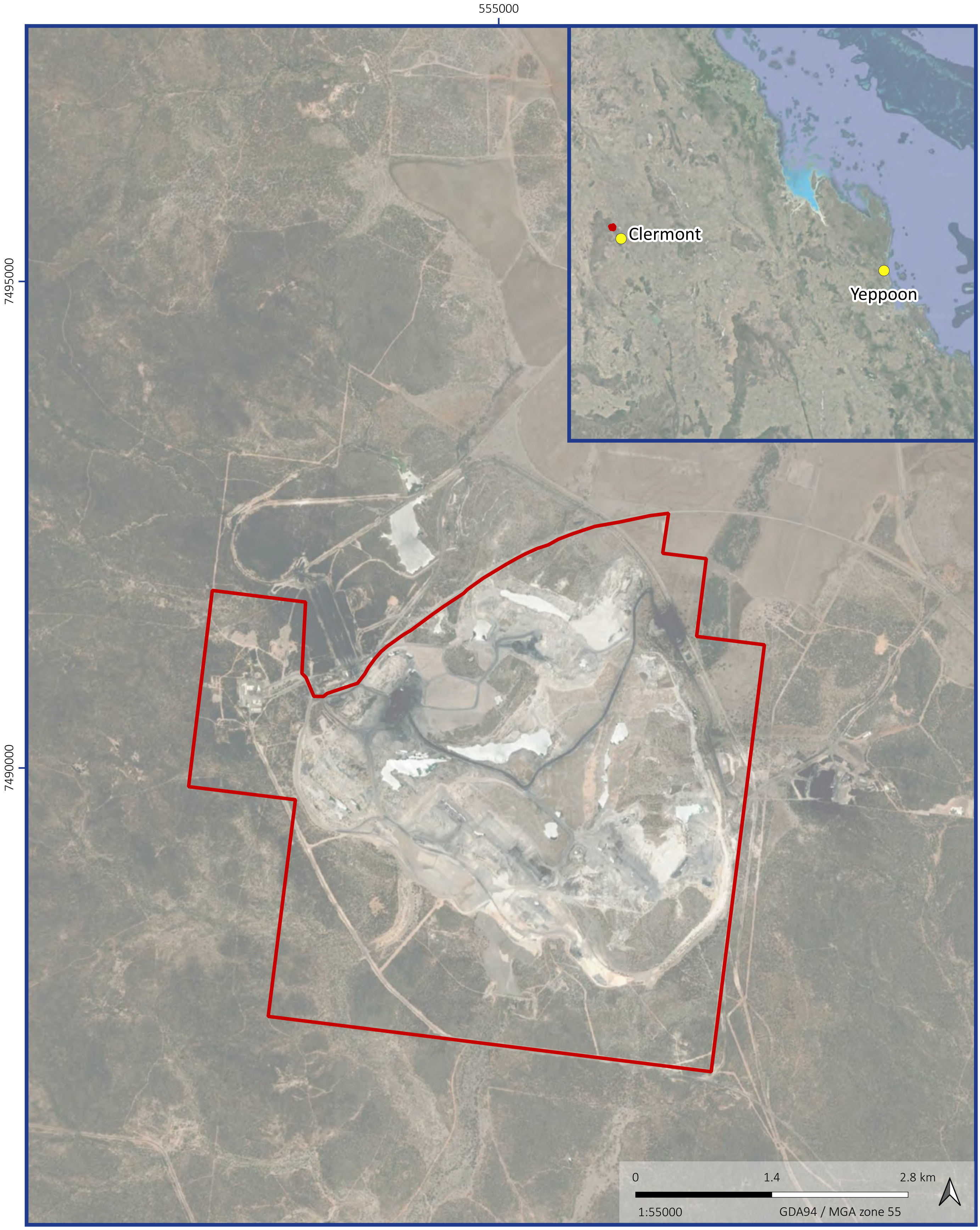
Terracom Limited (Terracom) operates BAC in accordance with Environmental Authority (EA) EPML00876713, effective as of 9 August 2019.

Mining at BAC commenced in 1978 by Rio Tinto, who operated the mine until it was placed under care and maintenance in 2012. In 2017, BAC was sold to Terracom. Mining activity at BAC recommenced in 2018, with the mine currently producing approximately 2.5 million tonnes (Mt) of thermal coal per year.

1.2. Report structure

This report is structured as follows:

- Section 1 – Introduction: provides an overview of the project and the assessment scope.
- Section 2 – Project Setting: describes the environmental and geological setting of the project including local topography and drainage, climate and local geology.
- Section 3 – Hydrogeology: describes the existing groundwater regime for the project site and surrounding area.
- Section 4 – Post-mining Land Use: provides a description of the proposed post-closure plan and the predicted effects on the local groundwater regime. This section also presents an assessment of the post closure groundwater conditions.
- Section 5 – Conclusions.



Project location

Legend

Blair Athol Coal Mine Progressive Rehabilitation and Closure Plan

Figure 1

Mining lease

12/12/2022

hydrogeologist.com.au

2. Project setting

2.1. Climate

The climate at the project site is hot and semi-arid, and is characterised by hot wet summers and mild, dry winters.

An interpolated site-specific dataset was downloaded from the DES Scientific Information for Land Owners (SILO) database for the BAC site (at location -22.70°S, 147.55°E). The data is a grid point data set, meaning that the data has been interpolated for this location from station data. A summary of the temperature, rainfall and evaporation from the SILO dataset is shown in Table 1.

Table 1 Climate averages

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean min temp (°C)	18.0	17.6	17.0	12.1	7.3	3.1	3.2	3.8	8.2	12.3	16.4	18.5	14.7
Mean max temp (°C)	37.5	36.8	35.4	32.4	29.3	25.7	25.9	29.7	32.3	35.2	36.6	38.1	29.4
Mean rainfall (mm)	107.3	101.7	67.1	34.0	28.4	28.4	24.3	17.5	16.7	32.8	55.7	87.4	600.7
Mean evaporation (mm)	232.4	187.0	192.9	151.4	116.1	91.9	102.3	135.0	179.4	225.3	235.5	252.0	2,102.3

The annual average rainfall for the area is approximately 600 mm and the annual average evaporation is approximately 2,100 mm. Rainfall predominantly falls between November to March. Monthly evaporation rates exceed monthly rainfall for all months of the year, highlighting a net evaporative loss over a year.

Recent rainfall has been put into a historical context using the Cumulative Rainfall Departure (CRD) method. CRD is calculated by subtracting the long-term average monthly rainfall from the actual monthly rainfall, to provide a monthly departure from the average conditions. A rising trend indicates periods of above average rainfall, whilst a falling trend indicates periods of below average rainfall. The CRD graph, shown below in Figure 2, indicates that BAC has generally experienced a period of below average rainfall since mid-2012.

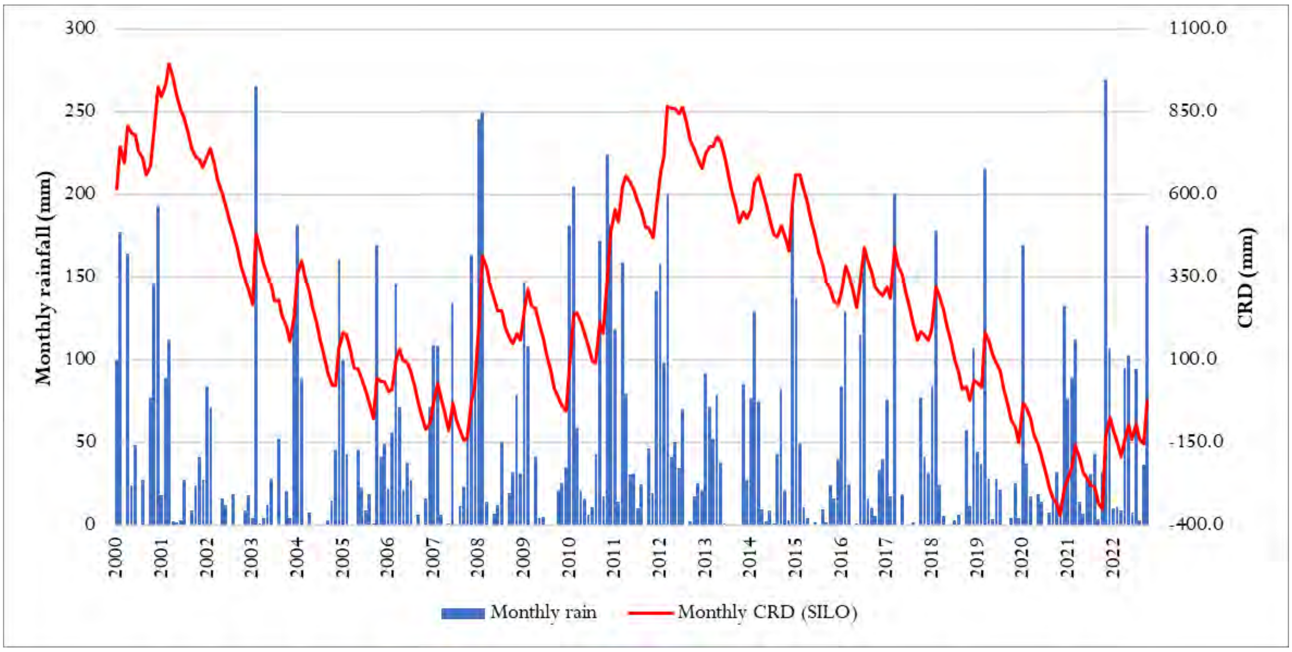


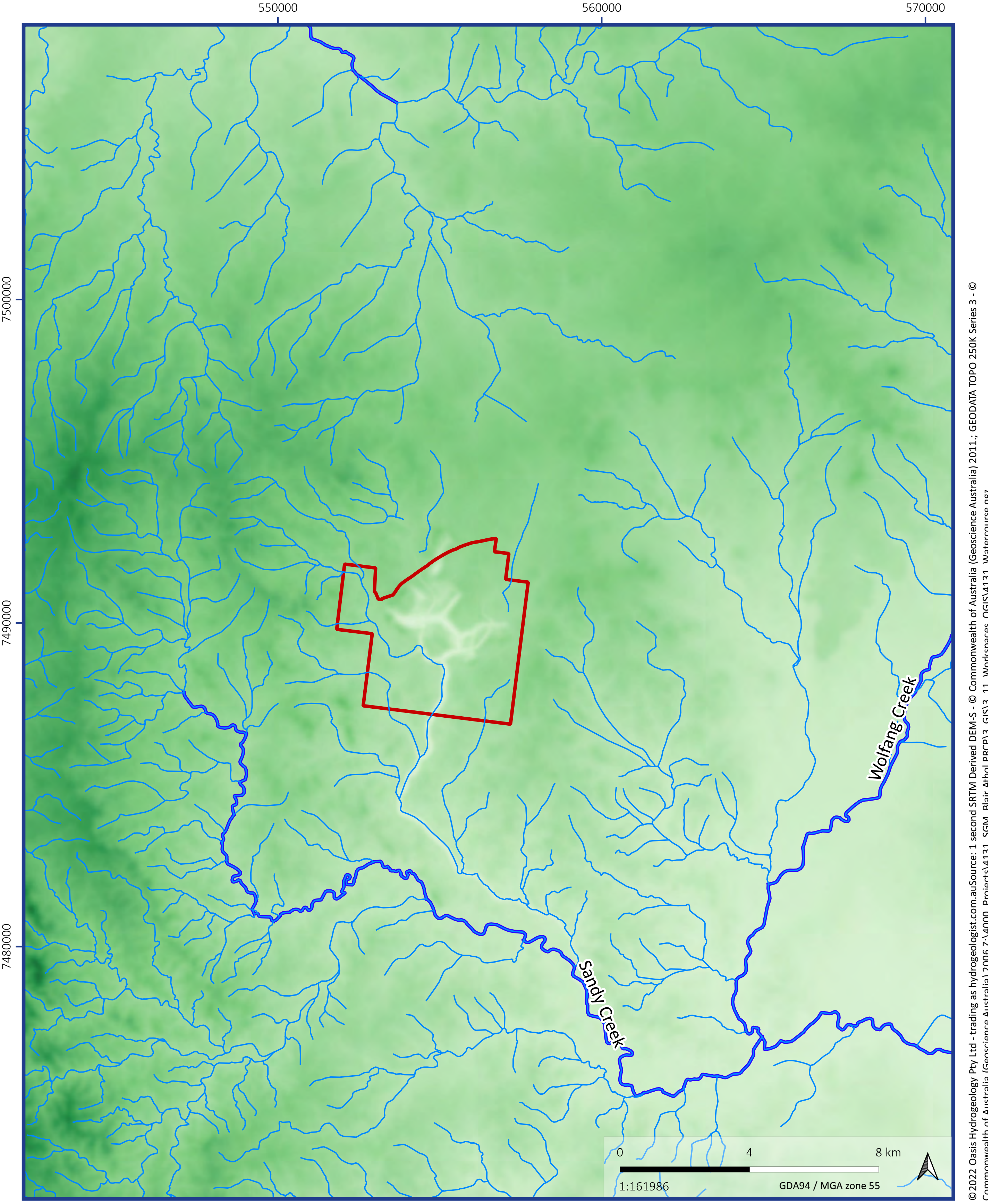
Figure 2 Cumulative rainfall departure – 2000 to 2022

2.2. Topography and drainage

The local topography and surface drainage are shown in Figure 3.

The regional topography is generally flat, rising in the Drummond Ranges to the west of BAC. Within the project site, the terrain gently slopes to the south.

The site is drained by overland sheet flow and minor drainage features. Bath Creek and Washpool Creek run through the lease area and drain from the north and north-east respectively, before discharging into Sandy Creek approximately 9 km south-east of the site. All creeks and drainage features in the area are ephemeral.



Topography and Drainage

Legend

Blair Athol Coal Mine Progressive Rehabilitation and Closure Plan

Figure 3

12/12/2022

Legend	
Mining lease	
Watercourse	
Minor drainage	

Elevation (mAHD)

- 200
- 275
- 350
- 425
- 500

hydrogeologist.com.au

2.3. Geology

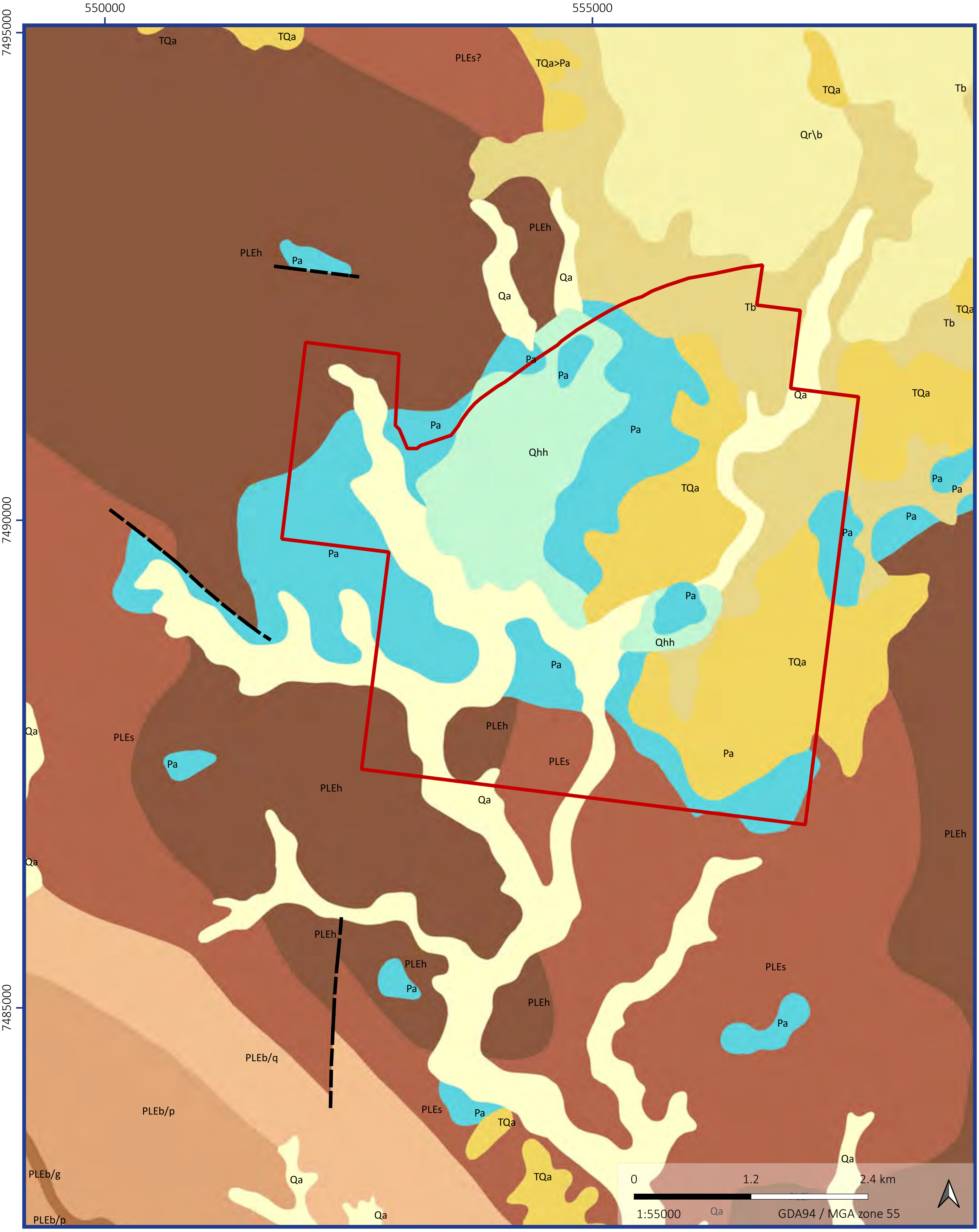
The surface geology in the BAC site and its surrounds is shown in Figure 4.

BAC is located within the Blair Athol Basin, an isolated Permian aged geological basin near the western edge of the northern Bowen Basin. The site geology is comprised of five main lithological units (as shown in Figure 5), listed below from youngest to oldest:

- Tertiary and Quaternary alluvial deposits (TQa and Qa) developed within the ephemeral streams that drain the site, including Bath Creek and Washpool Creek.
- Tertiary basalt (Tb) in the north and east of the ML, with an average thickness of 18 to 22 m within the lease.
- Permian Blair Athol Coal Measures (Pa) which comprise:
  - the upper coal measures, which include sandstone, siltstone, mudstone, conglomerate, as well as the four main coal seams of the basin (referred to as Seams 1, 2, 3 and 4); and
  - the lower coal measures, which include basal conglomerate, sandstone, siltstone, and mudstone with an estimated maximum thickness of 130 to 150 m.
- Early to middle Devonian arenites, present as a small basement trough in the southern part of the basin.
- Proterozoic/Cambrian Anakie Metamorphic Group, comprising schist, phyllite and metabasalt.

As noted by JBT (2012), the basement metamorphics, Blair Athol Coal Measures, Tertiary basalts and Quaternary alluvium all occur at surface in different areas of the BAC ML (Figure 4).

Figure 6 presents a schematic cross-section of the Blair Athol Basin and illustrates the general basin geometry and location of the coal seams.



Surface geology

Legend

Blair Athol Coal Mine Progressive Rehabilitation and Closure Plan

- Mining lease
- Fault

Figure 4

- Basalt (PLEb/g)
- Pelite (PLEB/p)
- Foliated quartzite (PLEb/q)
- Blair Athol Coal Measures (Pa)
- Coarse-grain, foliated quartzite (PLEh)
- Alluvium (Qa)
- Gravel, sand and silt (Qhh)
- Colluvium - (Qr\b)
- Metamorphic arenite (PLEs)
- Basalt - (Tb)
- Alluvium - (TQa)
- Alluvium /Blair Athol Coal Measures - (TQa>Pa)

12/12/2022

hydrogeologist.com.au

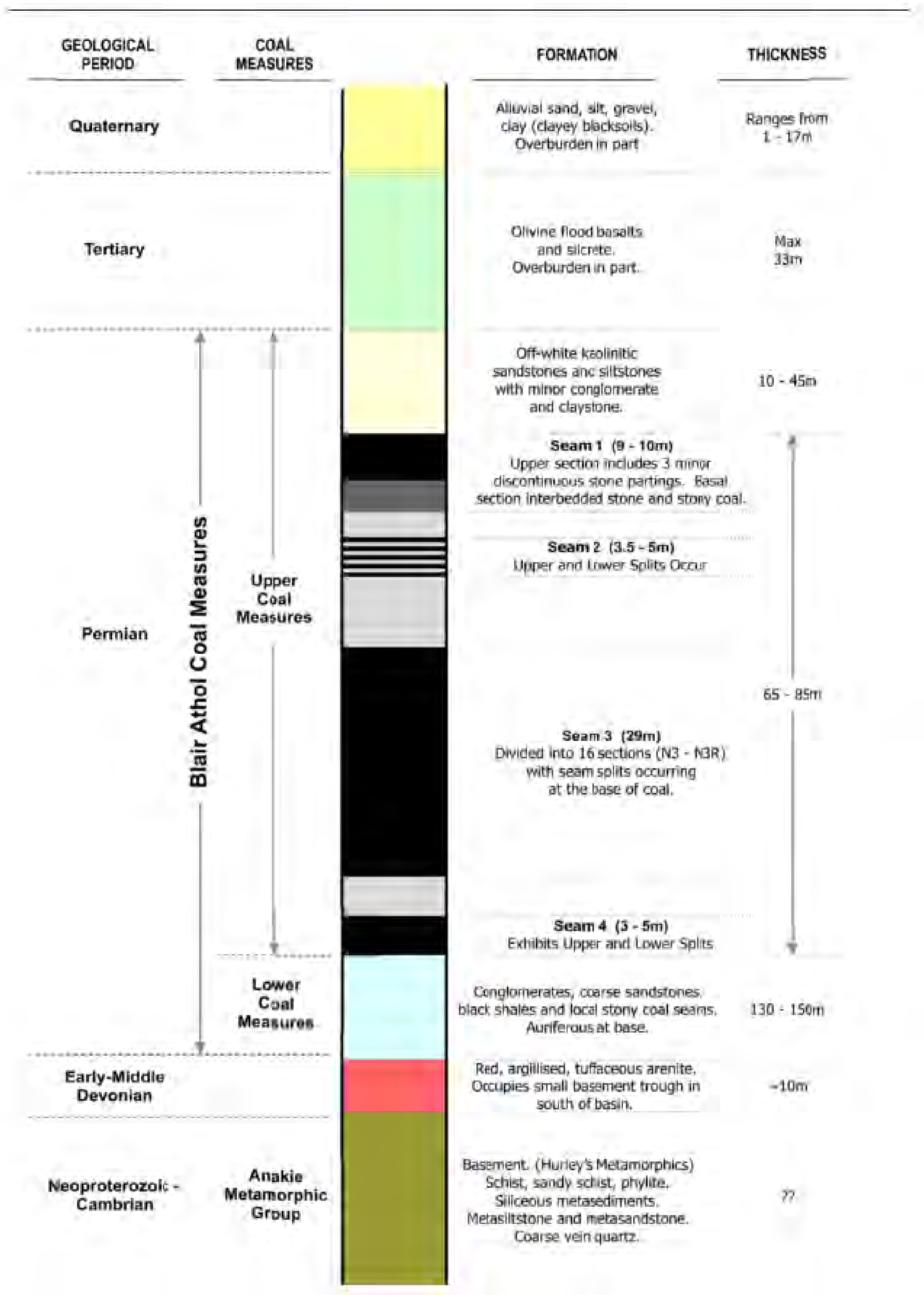


Figure 5 Stratigraphy within the mine area (Source: JBT, 2012)

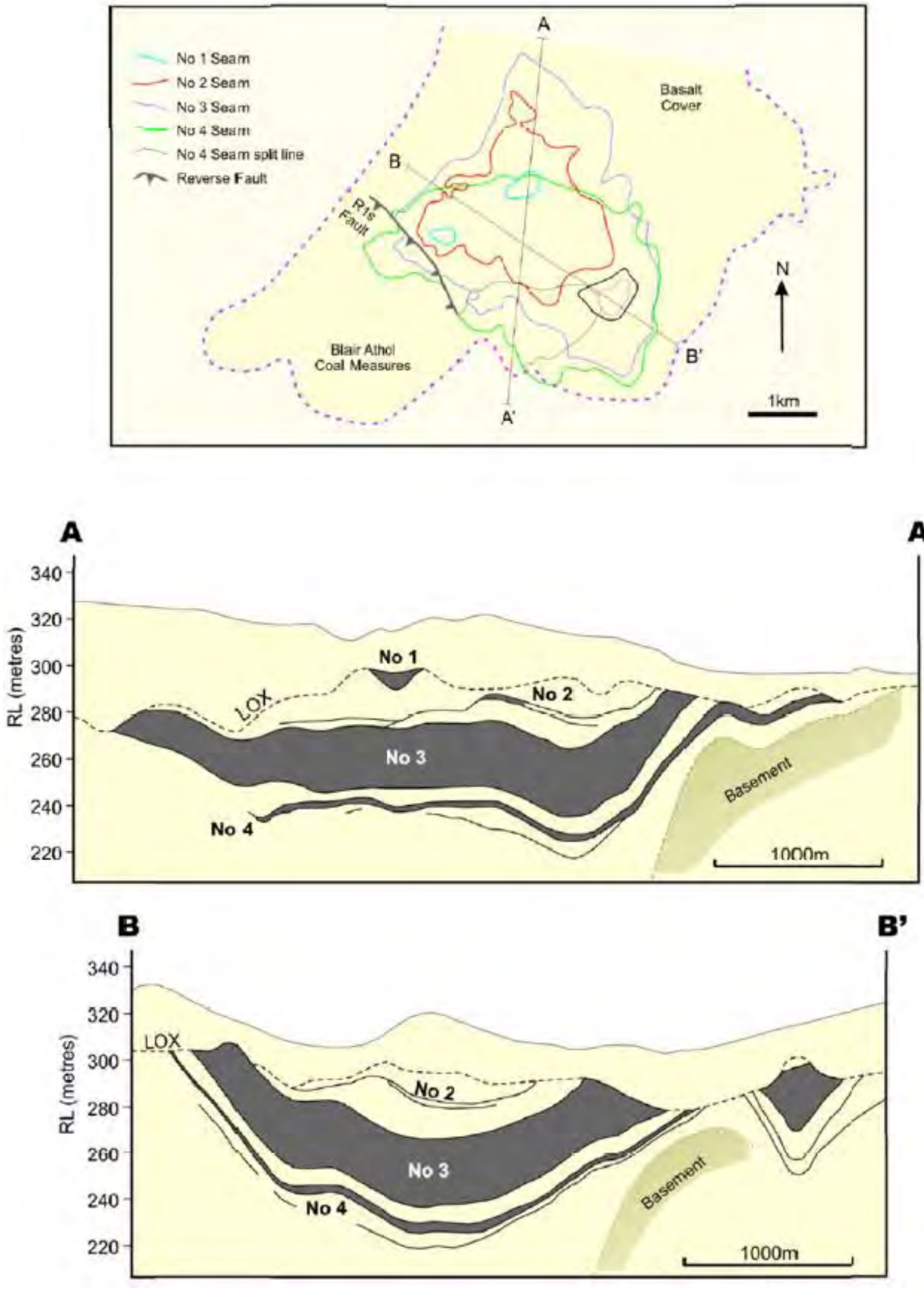


Figure 6 Geological cross-section (Source: JBT, 2012)

3. Hydrogeology

3.1. Previous studies

A number of hydrogeological studies have been completed for Blair Athol. The following studies undertaken at BAC were reviewed:

- Coffey (1980). Groundwater Appraisal – Blair Athol Coalfield. This report outlines the results of hydrogeological test-work carried out at BAC to determine the dewatering requirements for the commencement of mining.
- Coffey (1993). Stage 2 Groundwater Assessment at Blair Athol Coal Mine. This report outlines the results of hydrogeological test-work carried out at BAC to assess the potential for groundwater supply at the site.
- Rio Tinto Coal Australia (2006). Blair Athol Mine – Groundwater Monitoring. This internal report outlines the rationale behind the monitoring network installed at BAC.
- MatrixPlus (2007) Groundwater monitoring bore installation. This report contains a brief overview of the regional and site hydrogeology, followed by a description of the drilling and installation of groundwater and geotechnical monitoring bores.
- Terranus (2009). Groundwater review – Blair Athol Coal Mine. This report was prepared to provide a summary of the groundwater conditions at the site.
- JBT (2012). Blair Athol Mine Closure Groundwater Investigation. This report discussed the conceptual groundwater model over time (pre-mining, during mining and post-closure).
- Terracom (2019). Groundwater Monitoring Program. This document outlines the groundwater monitoring infrastructure and procedures.
- Terracom (2020). Groundwater Monitoring Program. This document outlines the groundwater monitoring infrastructure and procedure as required under the EA.
- WRM (2022). Final Void Hydrology Report – Blair Athol Coal Mine [Draft]. This report outlines the proposed final void geometry at closure and the long-term site water balance post-closure.

3.2. Conceptual understanding

The local groundwater regime is illustrated in Figure 7. The conceptual model can be summarised as follows:

- Rainfall provides direct recharge to the local groundwater system. Infrequent rainfall patterns result in episodic flow and short periods of potential recharge to the groundwater system during surface water flow events.
- Unconsolidated alluvial material is mapped along some of the creeks and drainage features present across the BAC site. As the creeks and drainage features are ephemeral, the presence of groundwater within the alluvium is sporadic and related to rainfall events when the creeks and drainage features flow.
- The Tertiary basalt is the only geological unit considered to be an aquifer, with the remainder of the units considered to be aquitards (namely, units that contain water but have very low yields). High yields have been locally in the Blair Athol Coal Measures where faulting or fracturing has resulted in the development of secondary porosity.
- The direction of groundwater flow reflects topography.
- The excavation of the open pits has locally dewatered the coal seams within the Blair Athol Coal Measures, creating groundwater sinks. Inflow into the open pits occurs from the Tertiary basalt and the Blair Athol Coal Measures.
- Mined-out areas are progressively backfilled with spoil, which is directly recharged by rainfall, which forms a localised aquifer.

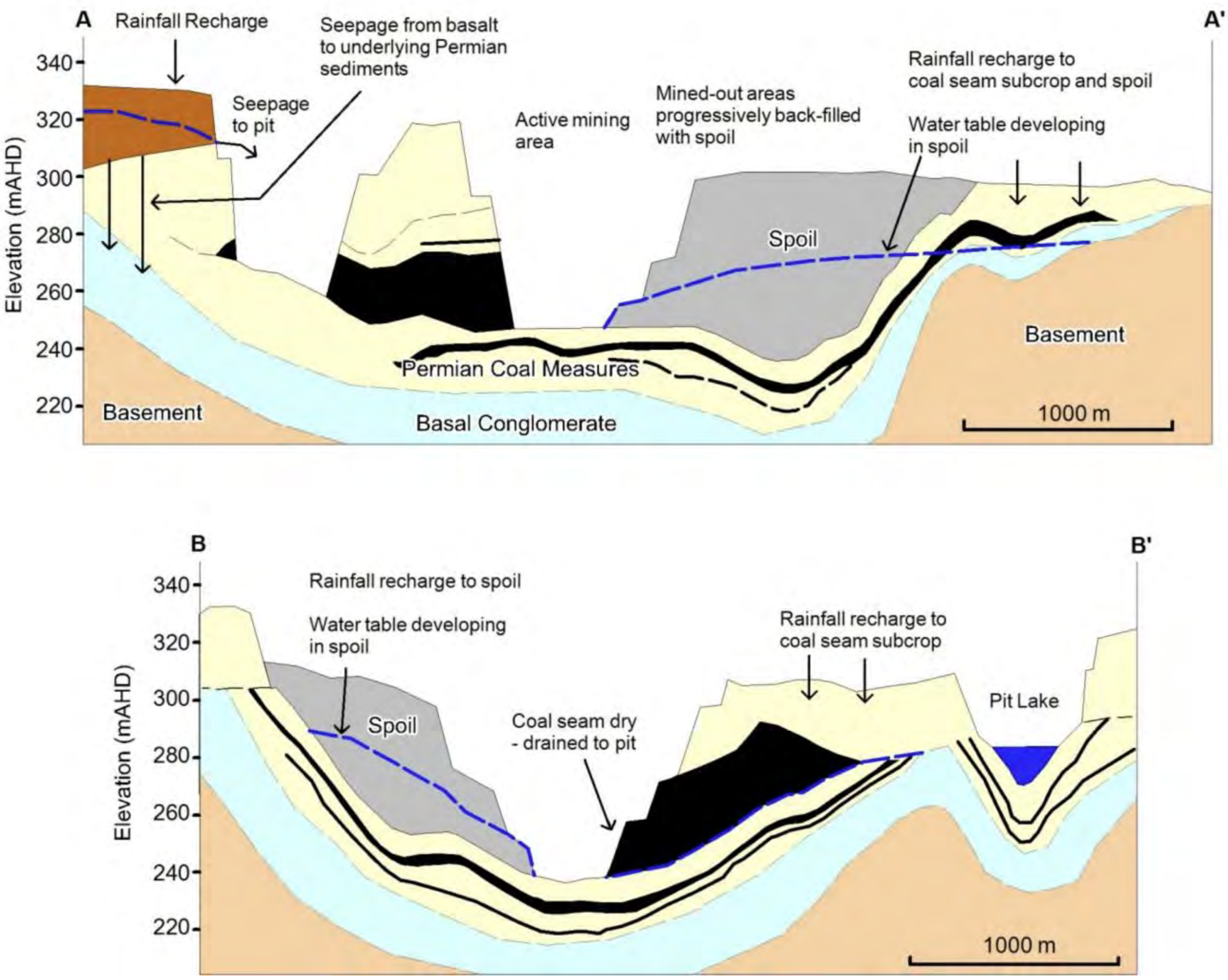


Figure 7 Conceptual groundwater model cross-sections (Source: JBT, 2012)

3.2.1. Alluvium

Unconsolidated alluvial sediments are mapped along Bath Creek and Washpool Creek. Groundwater is present within the alluvial sediments following rainfall events and this groundwater flows in the direction of surface drainage (generally, to the south and south-west).

Groundwater within the alluvium recharges the underlying Tertiary basalt and Blair Athol Coal Measures.

There are no BAC groundwater monitoring bores constructed within the alluvial sediments.

3.2.2. Tertiary basalt

Tertiary basalt is found and intersected within the northern and eastern areas of the ML, where basalt flows infilled drainage channels present in the Permian topography. The basalt located within the BAC ML represents the marginal extent of this basalt flow, resulting in the basalt cover being relatively thin within the ML and thickening towards the north and north-east.

The Tertiary basalt is the most significant aquifer in the region and is accessed by local landholders for stock watering and domestic water supply purposes. Groundwater within the Tertiary basalt occurs within discrete, isolated fracture systems that are poorly connected. As a result, pumping from one fracture system has little to no impact on water levels within adjacent fracture systems within the aquifer (JBT, 2012).

As the uppermost aquifer, the Tertiary basalt is generally recharged via rainfall, with a minor amount of localised recharge occurring from seepage associated with the minor extent of overlying alluvium.

Figure 8 presents a groundwater level hydrograph of the monitoring bores screened within the Tertiary basalt. As the Tertiary basalt is recharged by rainfall events, the overall trend in groundwater levels seen in Figure 8 reflect the historical rainfall trends discussed in Section 2.1. The decline in groundwater level seen in the monitoring bores screened in the Tertiary basalt reflects the below-average rainfall that has been seen at BAC since mid-2012 (see Figure 2).

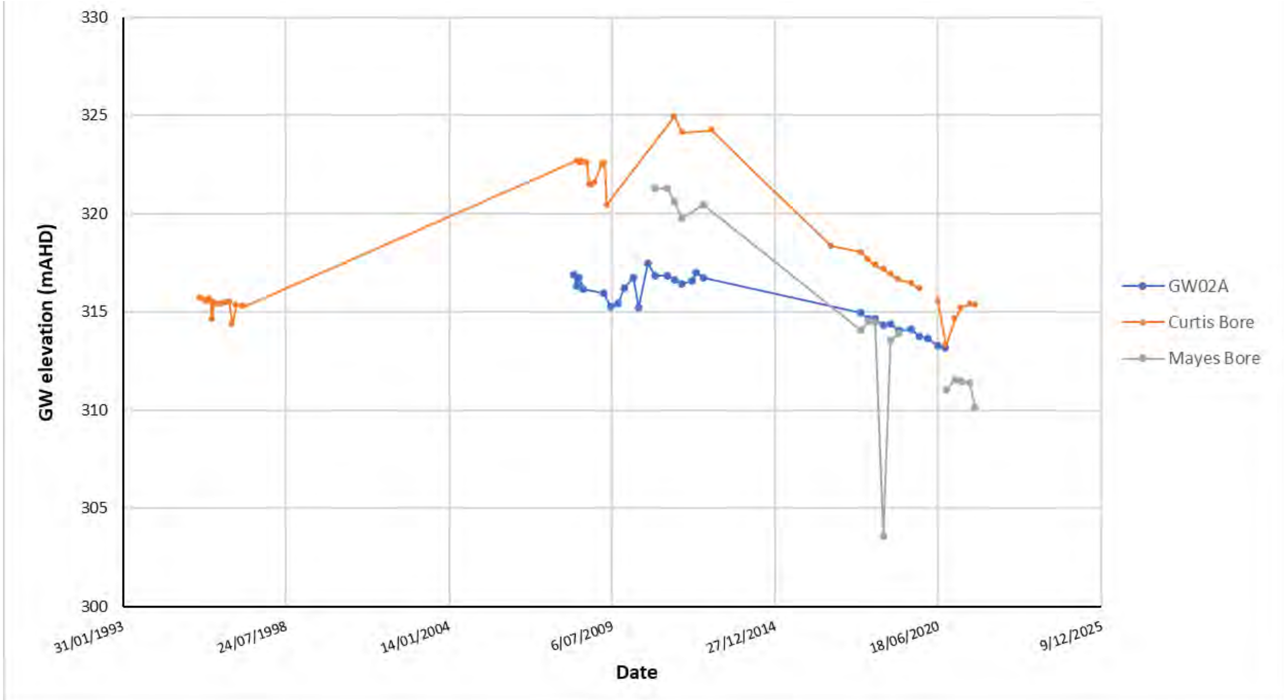


Figure 8 Groundwater level hydrographs – Tertiary basalt

3.2.3. Permian Blair Athol Coal Measures

The Permian Blair Athol Coal Measures are present across the site. The Blair Athol Basin is considered to be a relatively isolated groundwater system (JBT, 2012) with coal seams dipping towards the centre of the basin. While groundwater is present throughout the Blair Athol Coal Measures, it is considered an aquitard due to the low yields. However, localised areas of high yield are seen in the Blair Athol Coal Measures where localised faulting or fracturing has resulted in the development of secondary porosity.

While groundwater is intercepted in all of the coal seams, it is most pervasive in Seams 3 and 4. Seams 1 and 2 are considered to be dry due to dewatering associated with historical mining activity.

Recharge to the Blair Athol Coal Measures occurs primarily as seepage from the overlying Tertiary basalt and through direct recharge from rainfall where the Blair Athol Coal Measures are present at the surface.

A sandstone and conglomerate unit is present at the base of the Blair Athol Coal Measures, occurring below Seam 4 and immediately above the Proterozoic basement. Whilst poorly understood, the conglomerate/sandstone unit is believed to be a regional aquifer within the Blair Athol region (Terranus, 2009) however this aquifer is not utilised due to poor water quality (as discussed in Section 3.3 below). Figure 9 presents a groundwater level hydrograph for the sandstone /conglomerate unit present at the base of the Blair Athol Coal Measures. Groundwater elevations within the conglomerate/sandstone unit reflect the historical rainfall trend, illustrating the influence of rainfall recharge within the Blair Athol Coal Measures.

Groundwater levels seen in GW02A (screened within the Tertiary basalt) are higher than that seen in GW02B (screened within the Permian conglomerate). This hydraulic gradient indicates that the Tertiary basalt provides recharge to the underlying Blair Athol Coal Measures.

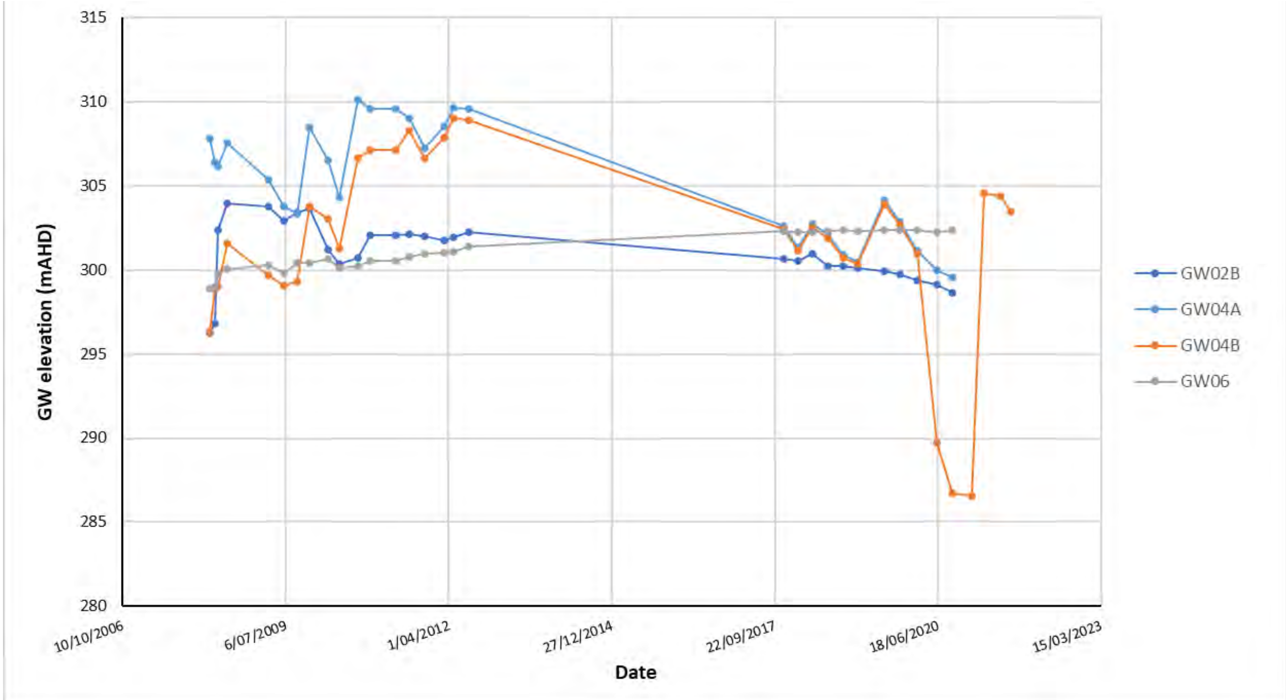


Figure 9 Groundwater level hydrographs – Permian conglomerate

Figure 10 presents a groundwater level hydrograph for GT02, which is screened within Seam 4 of the Blair Athol Coal Measures. The hydrograph indicates that groundwater levels within Seam 4 are historically relatively stable, with a minor increase seen in the groundwater elevation over the period that BAC was in care and maintenance. The significant decrease in groundwater elevation since 2018 corresponds to the resumption of mining at BAC and associated dewatering of the coal seams.

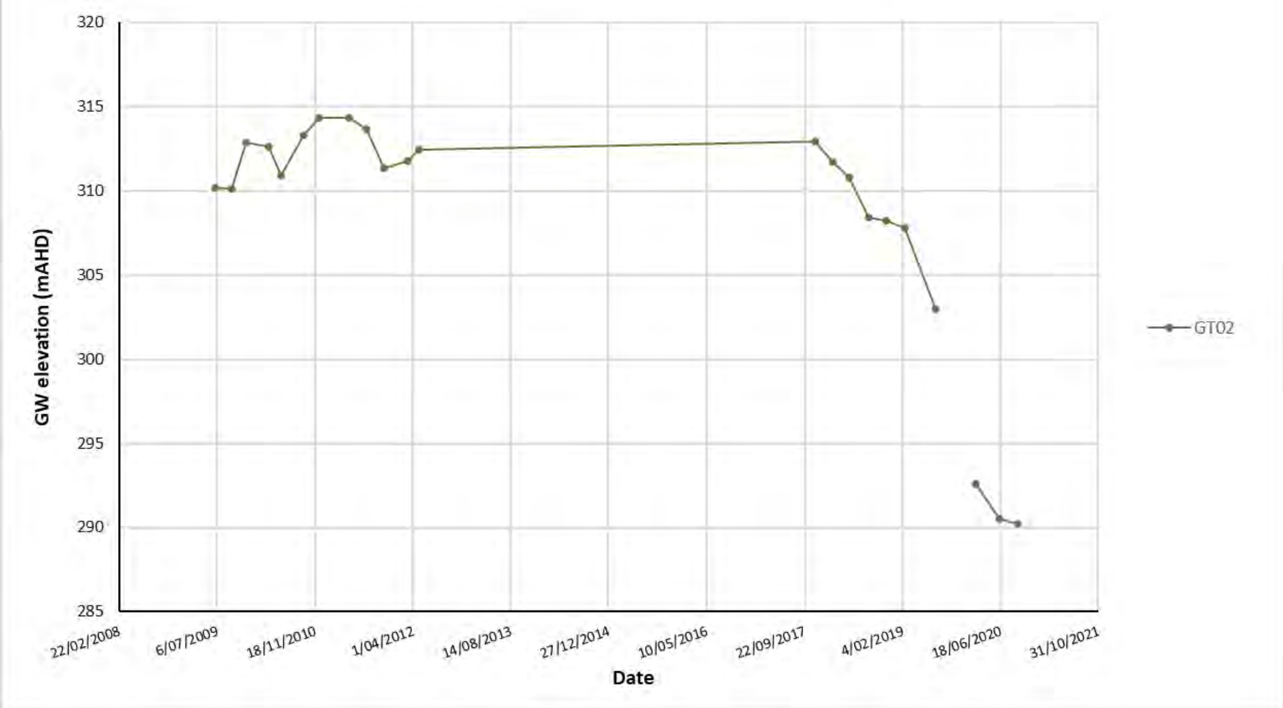


Figure 10 Groundwater level hydrograph –Seam 4

3.2.4. Proterozoic basement

The Proterozoic basement occurs at or close to surface on the western and southern areas of the BAC ML, and to the east of BAC between BAC and the nearby Clermont Coal Mine. Terranus (2009) notes that the Proterozoic basement is believed to be a very 'tight' hydrogeological unit (i.e., with a very low porosity and hydraulic conductivity). As such, the Proterozoic basement is believed to restrict vertical groundwater movement and act as a hydraulic basement to the other groundwater units in the region.

Recharge to the Proterozoic basement occurs through seepage from the overlying Blair Athol Coal Measures and via direct rainfall recharge in areas where the Proterozoic basement is present at the surface. However, due to the very low hydraulic conductivity of the Proterozoic basement, much of the rainfall on basement outcrop areas reports as runoff to the surface drainage system (JBT, 2012).

There are no BAC groundwater monitoring bores constructed within the Proterozoic basement.

3.2.5. Spoil and tailings

Mined out areas are progressively backfilled with spoil. The spoil is comprised of overburden and interburden that has been removed to access the coal seams.

The spoil is directly recharged by rainfall, which forms a localised groundwater table within the spoil. The hydraulic properties of spoil are highly variable and are influenced by factors such as the permeability of the overburden and interburden material, the dumping pattern of the backfill operation, the degree of compaction within the spoil, and settlement of the spoil with time.

Figure 11 presents a groundwater level hydrograph of GW10, a monitoring bore screened within the spoil. Initially, the groundwater elevation within the spoil increased, representing the influence of rainfall recharge and the development of the localised water table within the spoil. Since the resumption of mining at BAC in 2018, the groundwater elevation in the spoil has slowly decreased, illustrating the influence of dewatering associated with mining activity.

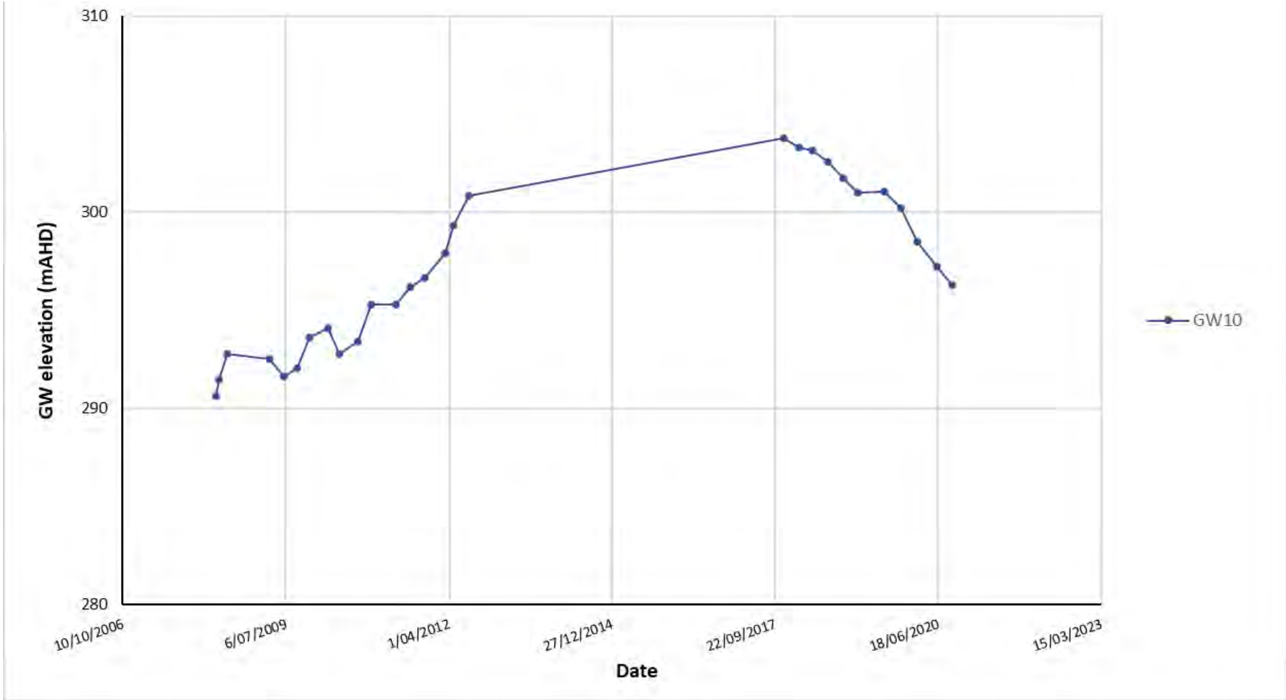


Figure 11 Groundwater level hydrographs – Spoil

Tailings at BAC were deposited as a slurry (comprising approximately 40 – 60% solids [Terranus, 2009]) into the tailings storage facility (TSF). In 2018 and 2019, the TSF was capped with an average of 3 m of spoil cover and rehabilitated (Terracom, 2020). The TSF is considered to be a locally perched aquifer (JBT, 2012).

Recharge to the TSF occurs from rainfall. However, as the elevation of the TSF lies below the base of the basalt aquifer (Terranus, 2009), it is not possible for the TSF to influence the quality or elevation of groundwater within the Tertiary basalt aquifer.

3.3. Groundwater quality

Groundwater at BAC is classified as slightly acidic to slightly alkaline, with pH ranging from 6.2 to 8.2. Groundwater is typically fresh to moderately saline, with measured electrical conductivity (EC) values ranging from 487 to 13,258 µS/cm. Within the Tertiary basalt, groundwater is typically fresh. Groundwater within the Blair Athol Coal Measures is typically slightly brackish to moderately saline, with higher EC values observed within the coal seams. Groundwater present within the spoil is typically neutral and brackish.

The major ion chemistry of the groundwater at BAC varies across the site, with two distinct water types reflecting the influence of the various host rocks present.

Groundwater within the Tertiary basalt, or within the Blair Athol Coal Measures where they underlie the Tertiary basalt, is a magnesium-calcium bicarbonate water type. This is reflective of rainfall recharge into the shallow basalt aquifer with a short residence time. The presence of this water type within the Blair Athol Coal Measures underlying the Tertiary basalt indicates that the Blair Athol Coal Measures are partially recharged via downward seepage from the Tertiary basalt.

Groundwater within the Blair Athol Coal Measures is a sodium-chloride water type, reflecting a deeper aquitard with an extended residence time. Mixed water types are also present due to the mixing that occurs between the different groundwater units. Groundwater quality within the spoil shows a range of water types (JBT, 2012), indicating the influence of the lithology of the backfill material on the groundwater chemistry.

3.4. Groundwater monitoring network

Terracom maintains the BAC groundwater monitoring network in accordance with the BAC EA. The current groundwater monitoring network is outlined in Terracom (2020). Details of the groundwater monitoring network are listed in Table 2, and the location of the groundwater monitoring bores are shown in Figure 12.

Two EA compliance bores (Curtis Bore and Mayes Bore) monitor the Tertiary basalt as it is the only aquifer suitable for domestic and stock watering purposes. The two EA compliance bores are located outside the ML.

The Groundwater Management Plan (GWMP) lists a further eight monitoring bores in addition to the two EA compliance bores. These bores are monitored to ensure that mining activities do not cause any environmental harm to the aquifers present at BAC. Five of the monitoring bores are located within the ML, with three located outside the extent of the ML. The monitoring bores are not used or pumped for mining operations and there are no production bores installed at BAC.

In accordance with the requirements of the BAC EA and as outlined in the current GWMP (Terracom, 2020), the groundwater monitoring program includes the following:

- Groundwater levels recorded on a quarterly basis. This data is used to enable natural groundwater level fluctuations (such as seasonal responses to rainfall) to be distinguished from potential groundwater level impacts due to drawdown resulting from mining activities.
- Groundwater quality monitoring is undertaken on a quarterly basis to detect any changes in groundwater quality due to mining activities. In accordance with the BAC EA, groundwater samples are analysed for a suite of parameters including pH, EC, total dissolved solids (TSS) and total sulfate.

Table 2 Details for groundwater quality monitoring bores

Bore	Aquifer	Easting	Northing	RL (mAHD)	Depth (m)	Screen interval (m)
GW01B	Permian conglomerate	556021	7492053	327	27.66	33 – 39
GW02A	Tertiary basalt	555284	7492697	329	60	21 – 27
GW02B	Permian conglomerate	555284	7492697	329	60.3	53 – 59
GW04A	Permian conglomerate	557069	7490417	314	15.8	11 – 14
GW04B	Permian conglomerate	557069	7490417	314	46.58	39 – 45
GW06	Permian conglomerate	553976	7491409	318	36	28 – 34
GW10	Spoil	555711	7489930	328	72	-
Curtis Bore	Tertiary basalt	557350	7491750	325	24.80	-
GT02	Coal Seam 4	555631	7488834	318	40.59	-
BA Station (Mayes Bore)	Tertiary basalt	558120	7493142	324	-	-

The groundwater quality limits set out within the EA are listed below in Table 3.

Table 3 EA compliance groundwater quality limits

Parameter	Units	Limit (as per EA Table K2)
Depth to water	m	2 m non-seasonal decrease in standing water level when not affected by pumping
pH	-	Between 6.5 to 9.0, or background levels at BA Station (whichever is lower/higher)
Electrical conductivity (EC)	µS/cm	2000, or background levels at BA Station (whichever is higher)
Total suspended solids (TSS)	mg/L	1000, or background levels at BA Station (whichever is higher)
Total sulfate	mg/L	500, or background levels at BA Station (whichever is higher)

Groundwater monitoring network

Blair Athol Coal Mine Progressive Rehabilitation and Closure Plan

Figure 12

13/01/2023

hydrogeologist.com.au

Legend

- Mining lease
- Monitoring Bore
- Compliance bore

4. Post-mining land use

4.1. Current and potential future uses of groundwater

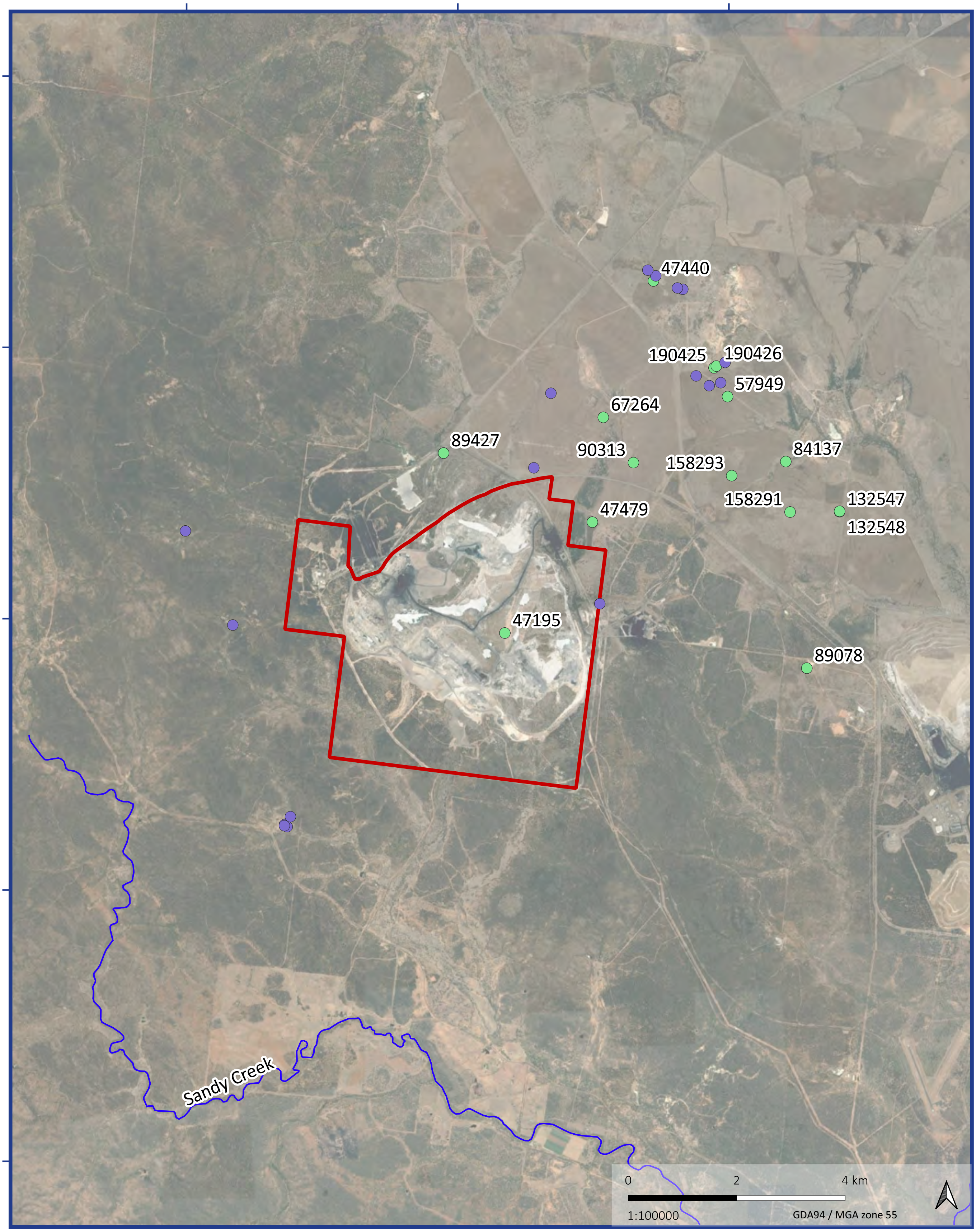
A search was undertaken of the Department of Regional Development, Manufacturing and Water (DRDMW) groundwater database of registered groundwater bores. Information stored in the database includes bore location, groundwater levels, construction details, stratigraphic logs, hydrogeological testing, and groundwater quality.

The registered groundwater bores located within a 5 km radius of the ML are shown in Figure 13. A total of 32 registered groundwater bores were identified, of which 15 are registered as existing (17 are listed as abandoned and destroyed). Nine registered groundwater bores are utilised for water supply, and four registered groundwater bores are utilised for mining monitoring purposes. The usage of two registered groundwater bores (RN 84137 and RN 89427) is unknown.

One registered groundwater bore utilised for water supply purposes (RN 47195, or the Venus SRF bore) is located within the extent of the ML. The remaining registered groundwater bores are located outside the extent of the ML.

Landholders in the region utilise the Tertiary basalt aquifer for stock and domestic purposes. The existing registered groundwater bores are located to the north-east of BAC, as this is where the basalt increases in thickness. No existing registered groundwater bores are located to the south or west of BAC due to the absence of the Tertiary basalt in this area.

Yields from the Tertiary basalt aquifer are variable and are in the order of 0.5 L/s to 10 L/s. Due to the fractured nature of the Tertiary basalt aquifer, yield and drawdown response is dependent on the connectivity of the fracture system, which is not easily predicted. As the Tertiary basalt present at BAC has been either mostly removed, or is absent, the potential for impacts to users of groundwater from this aquifer is expected to be low.



Registered groundwater bores

Legend

Blair Athol Coal Mine Progressive Rehabilitation and Closure Plan

Mining lease

Figure 13

Registered water bores within 5 km

16/01/2023

Abandoned and Destroyed

Existing

hydrogeologist.com.au

4.2. EVs and water quality objectives

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water) provides a framework for the protection of environmental values (i.e., uses) associated with Queensland groundwaters. Under this framework, environmental values for specific catchments and drainage basins have been formalised through a process of statutory declaration. Environmental values formalised in this way are listed in Schedule 1 of the EPP Water. For other waters, a site-specific assessment of the potential environmental values is required.

The BAC ML and its surrounds are located within Drainage Basin 130 (i.e., the 'Fitzroy Basin'). The Fitzroy Basin comprises seven sub-basins. The ML is located within the Lower Nogoa Groundwaters of the Nogoa River sub-basin. The declared environmental values for the Lower Nogoa Groundwaters are:

- aquatic ecosystems;
- industrial use;
- irrigation supply;
- farm supply and use;
- stock water;
- recreational use, including swimming;
- drinking water supply; and
- cultural and spiritual values.

The EPP Water also establishes water quality objectives (WQOs) to protect the relevant groundwater environmental values. WQOs are quantitative measures or narrative statements established to protect relevant environmental values. WQOs comprise water quality indicators and corresponding water quality guidelines. The water quality indicators are the physical, chemical, or biological properties that can be quantitatively measured, while the water quality guidelines are the quantitative measure for an indicator.

WQOs vary across the Fitzroy Basin and are defined based on groundwater chemistry zones (GCZs). The BAC ML intersects two separate GCZs. The applicable GCZs for BAC are Zones 4 and 9. The WQOs for these zones are provided in Table 4 and Table 5.

Table 4 WQOs for groundwater resources within Zone 4

Water quality indicator	Unit	Deep*			Shallow*		
		20th percentile	50th percentile	80th percentile	20th percentile	50th percentile	80th percentile
EC	µS/cm	765	938	1243	625	740	1012
Hardness	mg/L	152	219	437	118	251	321
Ph	-	7.50	7.70	8.00	7.81	7.95	8.28
Alkalinity	mg/L	250	315	400	266	289	357
Ca	mg/L	25	48	65	26	48	52
Mg	mg/L	16	31	67	13	33	49
Na	mg/L	76	98	137	57	82	143
Cl	mg/L	65	100	215	35	51	100
SO_4	mg/L	6	13	20	6	8	18
HCO_3	mg/L	325	399	487	324	348	435
NO_3	mg/L	0.50	1.00	5.35	8.14	22.00	27.62
SiO_2	mg/L	31	34	43	28	38	40
F	mg/L	0.100	0.105	0.200	0.028	0.110	0.200
Fe	mg/L	0.010	0.135	1.400	0.003	0.020	0.044
Mn	mg/L	0.010	0.020	0.060	0.003	0.010	0.024
Zn	mg/L	0.010	0.010	0.010	0.020	0.040	0.060
Cu	mg/L	0.010	0.010	0.010	-	-	-
Sodium adsorption ratio (SAR)	-	1.70	2.50	4.80	1.53	2.30	6.56
Residual alkali hazard (RAH)	meq/L	0.74	2.09	2.69	0.68	2.25	2.88

Note: ** Groundwater WQOs are given for two depths (shallow less than (<) 30 m below ground (mbGL) and deep greater than (>) 30 mbGL).*

Table 5 WQOs for groundwater resources within Zone 9

Water quality indicator	Unit	Deep*			Shallow*		
		20th percentile	50th percentile	80th percentile	20th percentile	50th percentile	80th percentile
EC	µS/cm	18117	19800	20372	526	642	889
Hardness	mg/L	4491	4685	5074	139	165	243
pH	-	6.90	7.10	7.35	6.80	7.40	7.90
Alkalinity	mg/L	535	542	618	106	129	182
Ca	mg/L	353	365	437	18	21	30
Mg	mg/L	888	920	963	22	26	39
Na	mg/L	3024	3091	3216	47	65	91
Cl	mg/L	6030	6870	6907	70	95	143
SO4	mg/L	1216	1240	1325	32	47	55
HCO3	mg/L	645	658	671	126	157	210
NO3	mg/L	0.00	0.55	1.00	0.00	0.70	3.30
SiO2	mg/L	-	-	-	19	22	30
F	mg/L	-	-	-	0.110	0.140	0.224
Fe	mg/L	0.037	0.170	8.585	0.000	0.010	0.065
Mn	mg/L	0.635	1.150	1.455	0.000	0.010	0.010
Zn	mg/L	-	-	-	0.010	0.030	0.060
Cu	mg/L	-	-	-	0.001	0.020	0.030
Sodium adsorption ratio (SAR)	-	18.43	19.5	20.45	1.63	2.20	2.48
Residual alkali hazard (RAH)	meq/L	-	-	-	0.00	0.00	0.05

*Note: * Groundwater WQOs are given for two depths (shallow less than (<) 30 m below ground (mbGL) and deep greater than (>) 30 mbGL).*

4.3. Final landform

The proposed final landform will be a "depressed landform", with areas of mining activity partially backfilled with spoil (WRM, 2022). Due to the proposed topography, rainfall and runoff are predicted to report to the final void. This water will be stored within the final landform, as well as within the pore space of the backfilled spoil below and adjacent to the final landform (WRM, 2022).

A final void hydrology investigation was completed by WRM in September 2022 (WRM, 2022). The key levels of interest determined in this investigation were:

- the proposed elevation to which mining will occur (~214 mAHD);
- the elevation of the final void (~246 mAHD);
- the elevation at which the final void will spill to surface water (~305 mAHD);
- an assumed post closure groundwater inflow rate of 3 – 5 L/s (JBT, 2012);
- the modelled average long-term pit lake water level (~276.6 mAHD); and
- the modelled maximum long-term pit lake water level (~282 mAHD, approximately 23 m below the final void spill level).

Water within the final void is projected to rapidly rise within the first year to the base of the final void. This recovery represents filling of the pore space of the backfilled spoil under the final void, before water begins to collect within the final void, forming a permanent pit lake.

The water elevation within the final void is projected stabilise after a period of approximately 75 years and is projected to oscillate between approximately 270 mAHD and 282 mAHD.

4.4. Post-mining site hydrogeology

Within the first year of the cessation of mining activity, the backfilled spoil below the final void is predicted to rapidly fill with water from groundwater seepage, surface runoff and rainfall. This will result in the spoil forming a localised aquifer. Once the spoil reaches saturation, a pit lake will develop within the final void.

As the modelled maximum long-term pit lake water level (282 mAHD) is below the groundwater elevations observed in the Tertiary basalt (305 mAHD to 325 mAHD - Figure 8) and the Blair Athol Coal Measures (295 mAHD to 315 mAHD - Figure 9 and Figure 10) , the final void is predicted to act as a permanent sink. As a result, salinity within the pit lake is predicted to increase over time.

As there is no connectivity between the alluvium and the final void, no flow from the residual void into the alluvium is expected post-mining.

Groundwater from the Tertiary basalt and the Blair Athol Coal Measures will seep into the spoil and pit lake post-closure. WRM (2022) have assumed a constant groundwater inflow rate to the pit void of 3 L/s to 5 L/s. Due to the fractured nature of the Tertiary basalt, with each fracture storing a finite volume of water, the seepage rate from the Tertiary basalt is expected to decrease over time as the pit lake level increases, with temporal increases in the rate of seepage following periods of rainfall recharge.

Post-mining, the TSF is expected to remain a locally perched aquifer. Minimal seepage is predicted to occur through the floor of the TSF into the underlying spoil and then into the Blair Athol Coal Measures (JBT, 2012). The rate of groundwater seepage is expected to decrease post-closure as the tailings progressively dewater and the TSF cap minimises rainfall recharge.

4.5. Post-mining groundwater quality

Potential sources of groundwater contamination at BAC post-closure include the final void and the TSF, and areas associated with mining activity such as those that involve chemical and/or hydrocarbon use and storage.

The salinity of the pit lake within the final void is predicted to increase over time (WRM, 2022). However, due to the final void acting as a sink, there is highly unlikely to be impact on the local groundwater quality as water will not be able to migrate away from the pit lake. Baseline groundwater salinity of the Blair Athol Coal Measures has shown it to be slightly brackish to moderately saline. Consequently, it is not expected that residual salts accumulating in the pit lake will cause a significant increase in the salinity of groundwater.

Terracom (2020) notes that testing of coarse and fine rejects indicates that the material stored at the TSF is classified as both potentially acid forming (PAF) and non-acid forming (NAF). Additionally, Terracom (2020) notes that the seepage chemistry indicates that seepage from beneath the TSF is pH neutral. This indicates that the inherent buffering capacity of the rejects and tailings to self-neutralise is occurring. This process of self-neutralisation is expected to continue post-closure. Furthermore, as the elevation of the TSF lies below the base of the Tertiary basalt aquifer, there is unlikely potential for seepage from the TSF into the Tertiary basalt.

5. Conclusion

Extensive hydrogeology data and information for BAC has been analysed and reported over many years. The groundwater conditions for the BAC site are well understood.

The water elevation within the final void is projected stabilise after a period of approximately 75 years and is projected to oscillate between approximately 270 mAHD and 282 mAHD.

The observed groundwater elevations in the Tertiary basalt are between 305 mAHD to 325 mAHD and observed groundwater elevations in the Blair Athol Coal Measures are between 295 mAHD to 315 mAHD. On this basis the final void at BAC is predicted to act as a groundwater sink.

The salinity of the pit lake within the final void is predicted to increase over time. As the final void will behave as a groundwater sink, there is highly unlikely to be impact on the local groundwater quality as water in the pit lake will not be able to migrate away from the sink.

6. References

Coffey, 1980. Groundwater Appraisal – Blair Athol Coalfield. Prepared for Blair Athol Coal Pty Ltd. Report No. B9433/2D. July 1980.

Coffey, 1993. Stage 2 Groundwater Assessment at Blair Athol Coal Mine. Prepared for BAC. Report No. G351/2-AB. October 1993.

JBT Consulting (JBT), 2012. Blair Athol Mine Closure Groundwater Investigation. Prepared for Rio Tinto Coal Australia. JBT01-018-002. December 2012.

Matrix Plus Consulting Pty Ltd (Matrix), 2007. Blair Athol Coal – Groundwater Monitoring Bore Installation. Prepared for Rio Tinto Coal Australia. Project No. RTB705. 26 October 2007.

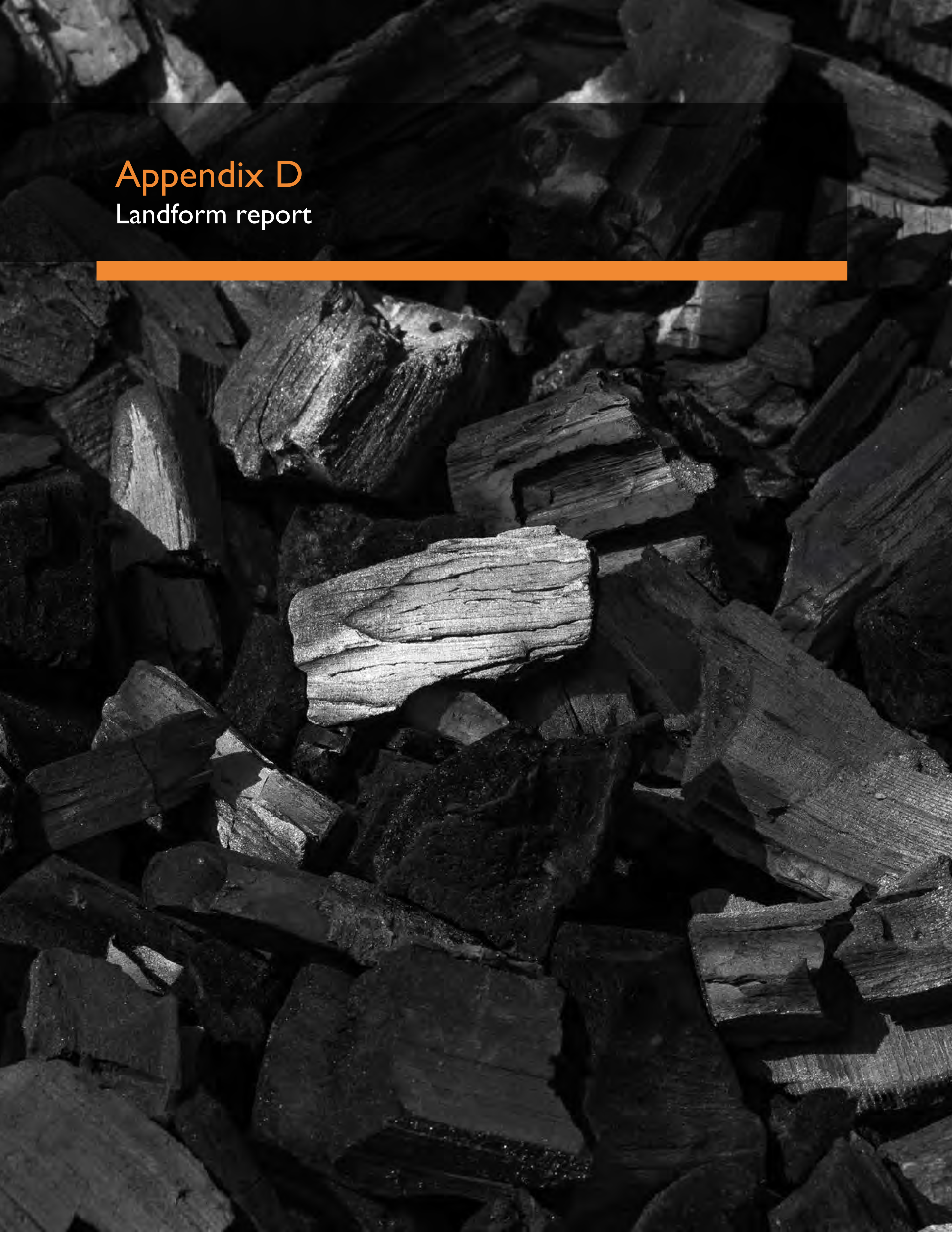
Rio Tinto Coal Australia (RTCA) 2006. Blair Athol Mine - Groundwater Monitoring. Internal report. 21 June 2006.

Terracom, 2019.Groundwater Monitoring Program 2019.

Terracom, 2020. Groundwater Monitoring Program. October 2020.

Terrenus Earth Sciences, 2009. Blair Athol Coal Mine Groundwater Review. Prepared for Rio Tinto Coal Australia. Job No. 09-011-24, Report No. R001. 16 June 2009.

WRM Water & Environment Pty Ltd (WRM), 2022. Final Void Hydrology Report – Blair Athol Coal Mine. Prepared for Terracom Resources. Draft 1549-02-C. 30 September 2022.



Appendix D
Landform report

This page is intentionally blank.

Terracom

RESHAPE ASSUMPTIONS REPORT 21-1823-V1

RELEASE DATE:	9TH JUNE 2022
DOCUMENT VERSION:	1.4

DOCUMENT DETAILS

Copyright

Confidentiality

You must always treat this report and any accompanying materials as confidential. If we have entered a confidentiality / non-disclosure agreement, or another agreement containing confidentiality obligations relating to this document or the accompanying materials, those obligations also apply.

Disclaimer

This document may not be used or relied upon by anyone other than you, or for any other reason than the intended purpose outlined herein. Deswik accepts no duty of care or liability in respect of any such use or reliance.

Release Details

Report Name:	Reshape Assumptions Report
Report Number:	21-1823-V1
Client Name:	Terracom
Author:	Ian Neilsen

Revision Details

Date	Version	Modified By	Comments
11th August 2021	1.0	Ian Neilsen	Initial draft
11th August 2021	1.1	Anthony Walker	Internal review
25th August 2021	1.2	Ian Neilsen	Finalise document
17th March 2022	1.3	Ian Neilsen	Update smoothed progressive rehab estimate
8th June 2022	1.4	Ian Neilsen	Included annual reshape closure estimates

EXECUTIVE SUMMARY

This report outlines the reshape modelling conducted as part of Life of Mine Planning support for Blair Athol Mine from FY22 to closure. Using the Post Mining surface generated from the mine schedule, a final landform was simulated using a 15% grade constraint and quantified using Deswik.Enviro tools. The post mining reshape physicals results are summarised in Figure 1-1 for spatial layout of the reporting domains.

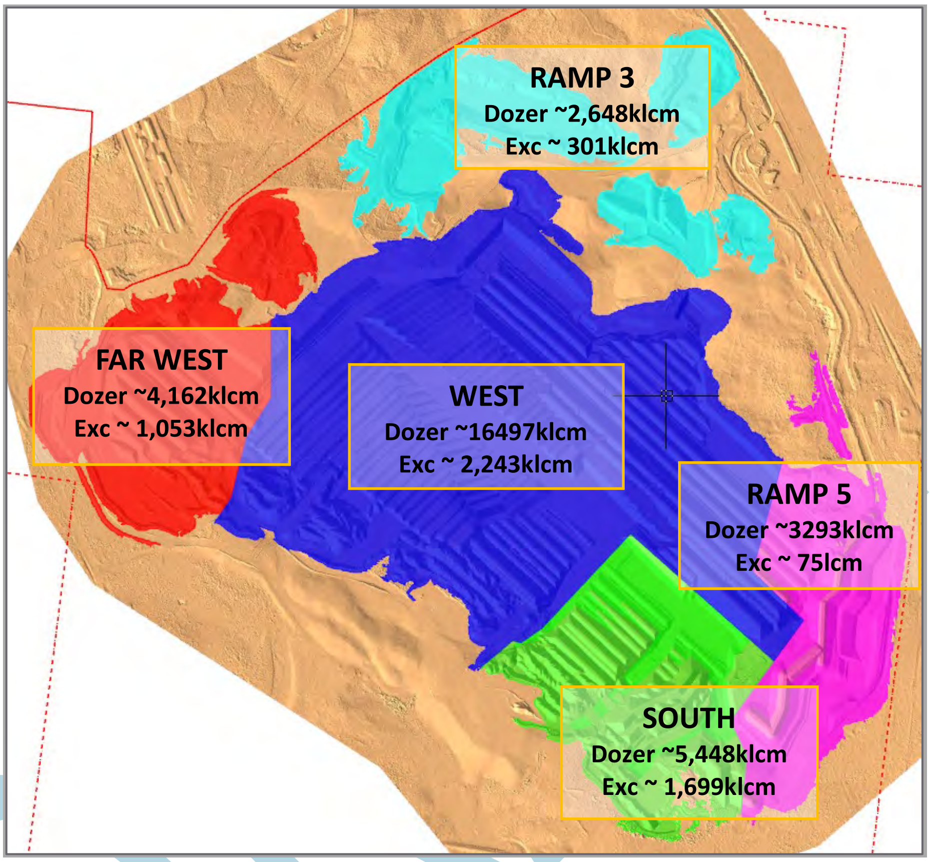


Figure 1-1 - Modelling Results

Progressive Reshaping has also been estimated based on area release from the mine schedule and manually constraining several voids used for water storage and tailings & reject dumping. The progressive reshaping effort is approximately **1.4Mlcm** per year of mine operation and is consistent with current reshape budget estimates. Once mining operations cease, the reshaping effort remaining is approximately 19.8Mlcm of dozer push and dragline reshape and 4.0Mlcm of longer haul quantity. The progress and final reshape physicals are summarised in Table 1.

Table 1 - Progressive and Final Reshape Physicals

	Dozer Total (klcm)	Dozer Avg Dist (m)	Dozer Avg Grade (%)	Exc Total (klcm)	Exc Avg Dist (m)	Total Cut Volume (klcm)	Total Cut Volume (klcm)	Total Cut Volume (klcm)
Progressive Reshape	12,686	116	-25%	1,368	752	-	-	**14,054**
Closure Reshape	6,808	161	-21%	3,955	811	13,025	85	**23,788**
TOTAL	19,494	132	-24%	5,323	796	**13,025**	**85**	37,842

TABLE OF CONTENTS

1. INTRODUCTION

This report details the reshape modelling process followed at Blair Athol and the results generated. A brief overview of the process undertaken:

- **Reserves**
  - Generate mining solids to establish an economic mining footprint
- **Schedule**
  - Mine scheduling to determine a practical sequence
- **Dump Design**
  - Dump design and simulation using mine schedule to determine a Post Mining Surface
- **Reshape**
  - Simulate reshaping of the Post Mining Surface to achieve rehabilitation or closure objectives
  - Estimate annual progressive reshaping areas based on operating area availability. The annual areas are then used to re-run a final reshape model to improve cut fill balance for each period.
- **Review**
  - Quantify reshaping effort and review for any efficiencies or opportunities

1.1. PREVIOUS MODELLING

Reshaping simulations for Blair Athol Mine have been conducted at several stages from 2019 using a various mining surfaces, including surveyed surfaces and planned post mining surfaces. The previous modelling activities are summarised in Table 2. The modelling design principles have not changed significantly during this time, briefly:

- Final reshaped surface should be less than or equal to 8.5 degrees (15%)
- Lease area has not changed

Table 2 - Historical Reshape Modelling List

Reshape Date (date of closure)	Surface Type	Final Reshape Quantity (mlcm)	Progressive Reshape Quantity (mlcm)
March 2019	Survey Surface	18.0	-
December 2019	Survey Surface	18.0	-
May 2020	Survey Surface	18.7	-
December 2020	Survey Surface	18.5	-
June 2021	Survey Surface	19.6	-
June 2021	Budget Surface @2.2mtpa	20.1	2.0 for FY21
June 2022	Budget Surface @2.6mtpa	20.0	2.0 for FY22
June 2023	Budget Surface @2.8mtpa	20.0	3.0 for FY22-23
June 2032	**LOM Surface @2-2.6mtpa**	**23.8**	**14.1 for FY22-FY31**

2. MODEL SETTINGS

This report details the model settings and outputs from the following files:

Reshape File: "LOM21 Reshape 220305 - Progressive - v1 RL285.dcf"

2.1. POST MINING SURFACE

The reshaping results for Blair Athol have been generated using the modelled post mining surface from "BA 90D FY22 20210621 V1.5 Rev2.3.dcf", a schedule and haulage (LHS) model used as part of the 2021 Life of Mine (LOM) planning process. The surface was generated using the "Min Dist" haulage scenario.

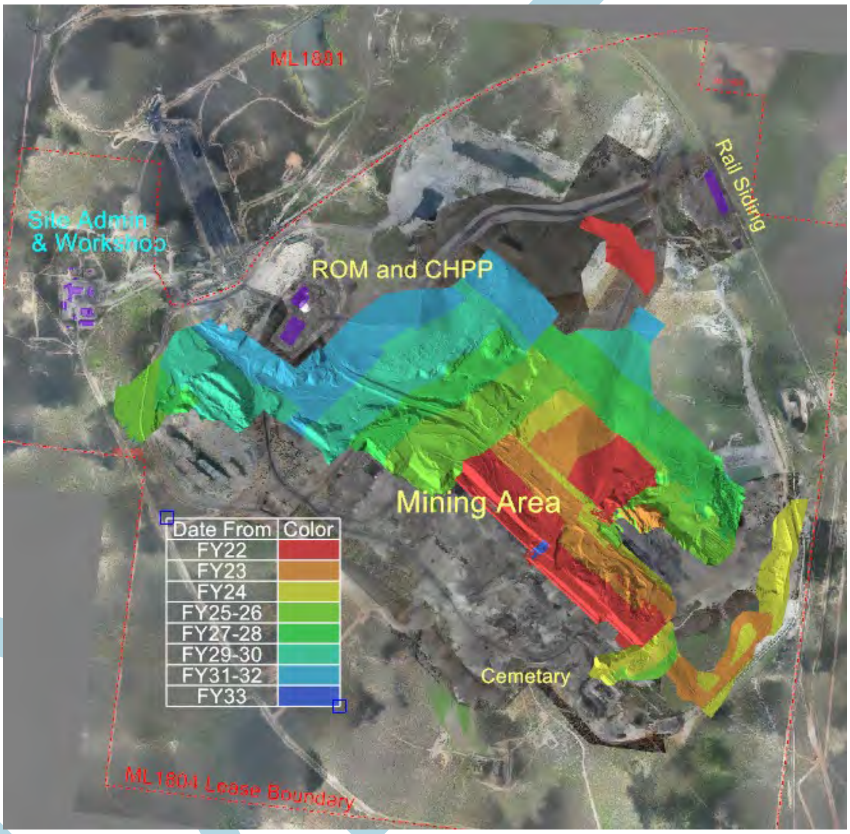


Figure 2-1 - Life Of Mine Progress Plot

2.2. RESHAPE MODEL EXTENTS

Seven model domains have been constructed for reshape modelling, refer to Figure 2-2. Please note that the modelling domains have been deliberately named so as not to coincide with the Reporting Areas, see Figure 2-3:

1. COMBINED: covers the dragline operating area for LOM
2. NORTHWEST: covers a spoil dump that is separable from the COMBINED modelling domain
3. NORTHEAST: covers minor pit areas to the east of the COMBINED domain
4. NORTH1: covers a legacy mining void (Ramp3) that is planned for tailings/reject dumping
5. NORTH2: covers a legacy mining void that is planned for reject dumping
6. NORTH3: covers a legacy mining void
7. NORTH4: covers a dozer push pit area that is also planned for reject dumping

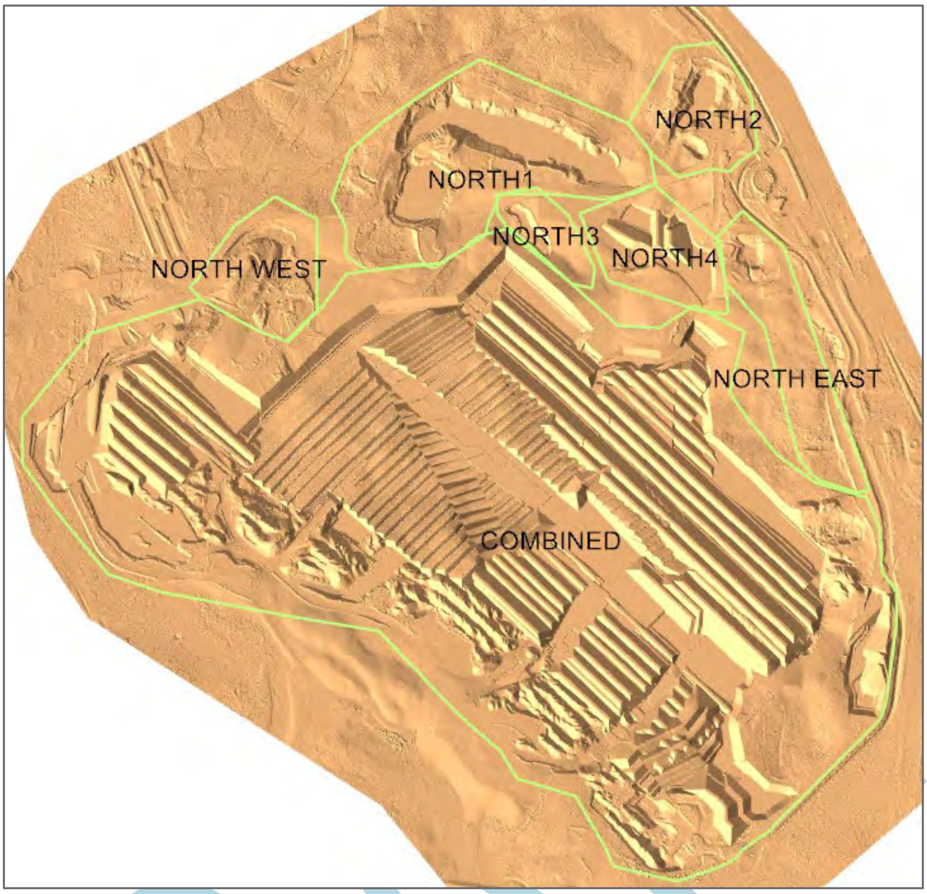


Figure 2-2 - Modelling Domains

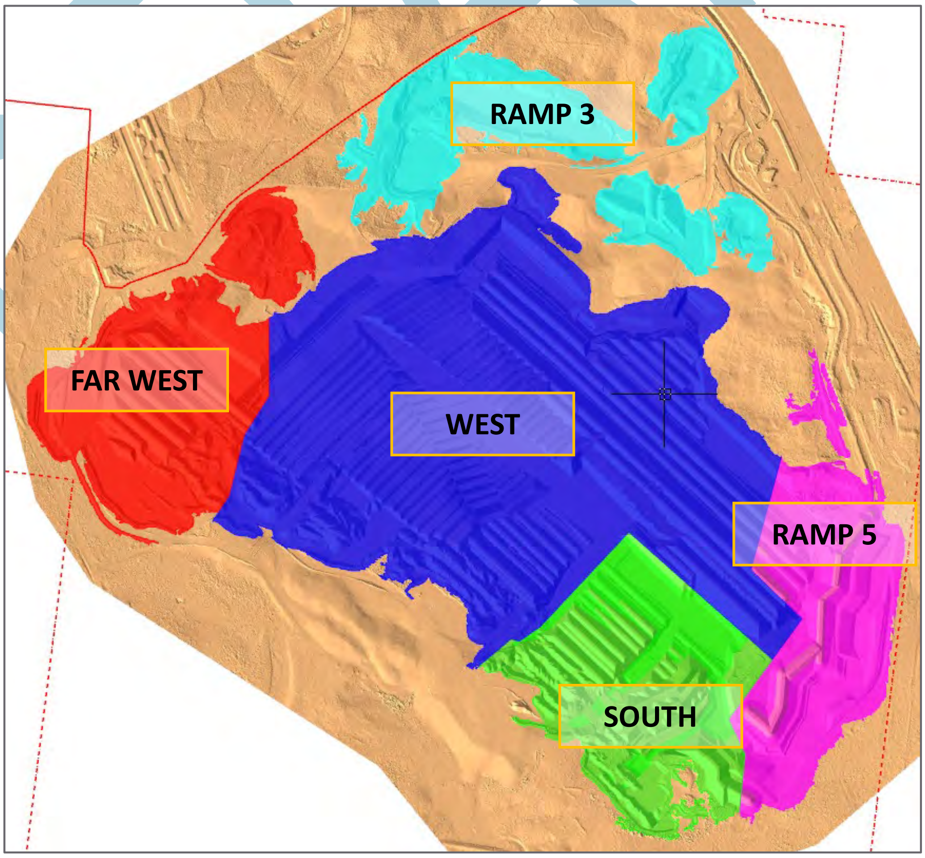


Figure 2-3 - Reporting Domains

2.3. SURFACE PREPARATION

Using the Post Mining surface generated from the LHS model, two main edits were conducted, as follows:

1. The combined tailings and reject volume was estimated for each pit in North 1, North 2 and North 4 modelling domains and the surface updated to this level, as seen in Figure 2-4.
2. In the active mining area that is being modelled, an adjustment was made to the surface to reduce near-vertical faces generated as part of the block dumping simulations back to a more realistic repose angle of 38 degrees (see Figure 2-5).

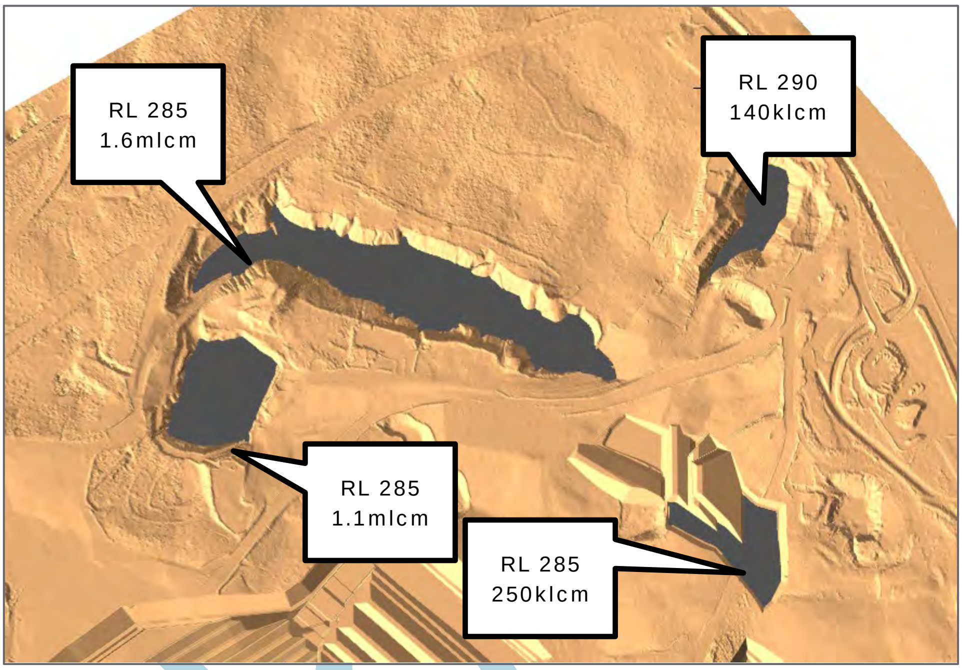


Figure 2-4 - Provisions for Tailings & Reject Dumping

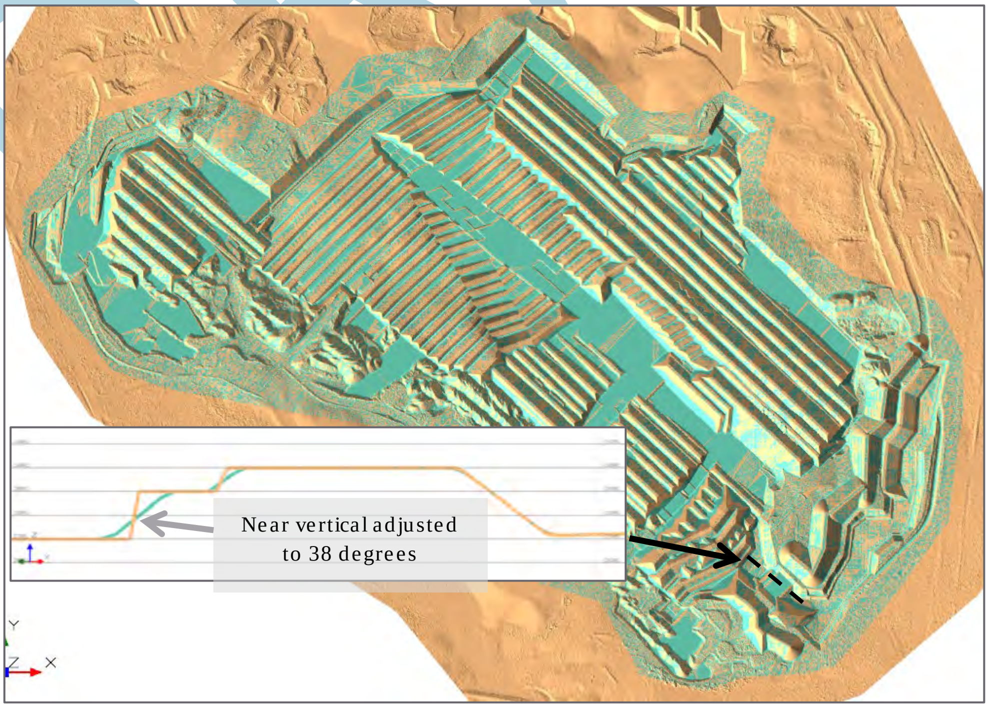


Figure 2-5 - Post Mining Surface Smoothed Area

2.4. RESHAPE MODEL SETTINGS

Each domain features a similar setup with settings added as required for each domain. The specific settings for each model domain can be found in APPENDIX A:.

Briefly the main setting controls include:

- 10m grid sizing (see Figure 2-6)
- 8.5degree grade constraint (see Figure 2-7)
- Use of sub areas to maximise cut fill balance of progressive reshaping areas (see Figure 2-8) identified in the initial reshape model (with no sub areas active).
- Use backfill surfaces (where required to cover tailings & reject dumps with minimum 3m cover)
- Output layers and settings (see Figure 2-9). Outputs generated are:
    - ➢ Reshaped surface for modelled area
    - ➢ Cut and Fill solids cropped up to 0.3m and minimum area of 100m2
    - ➢ Cut and Fill solids are split into blocks 50m x 50m x 5m thickness with solids less than 10m3 removed from the model. The following attributes are written to each solid to assist with reporting and dozer volume estimation:
        - o ID
        - o Bench
        - o XBlock
        - o YBlock

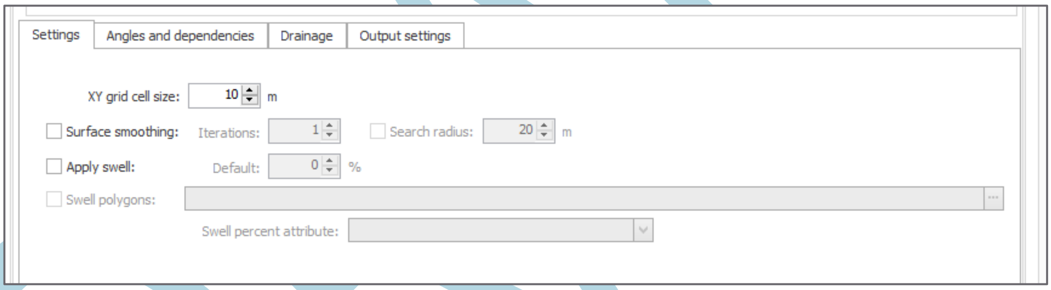


Figure 2-6 - Modelling Grid Size

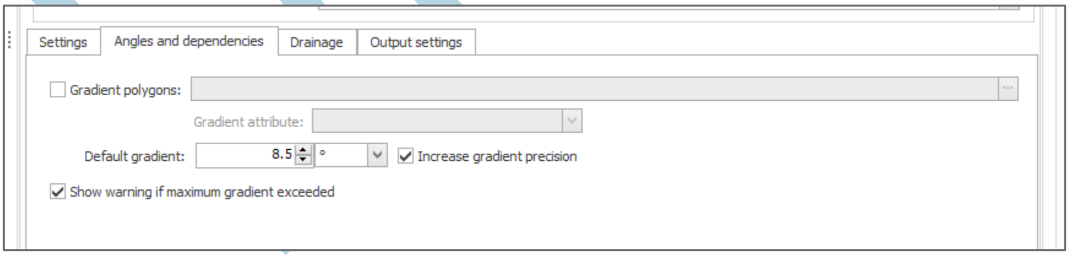


Figure 2-7 - Modelling Grade Constraint Settings

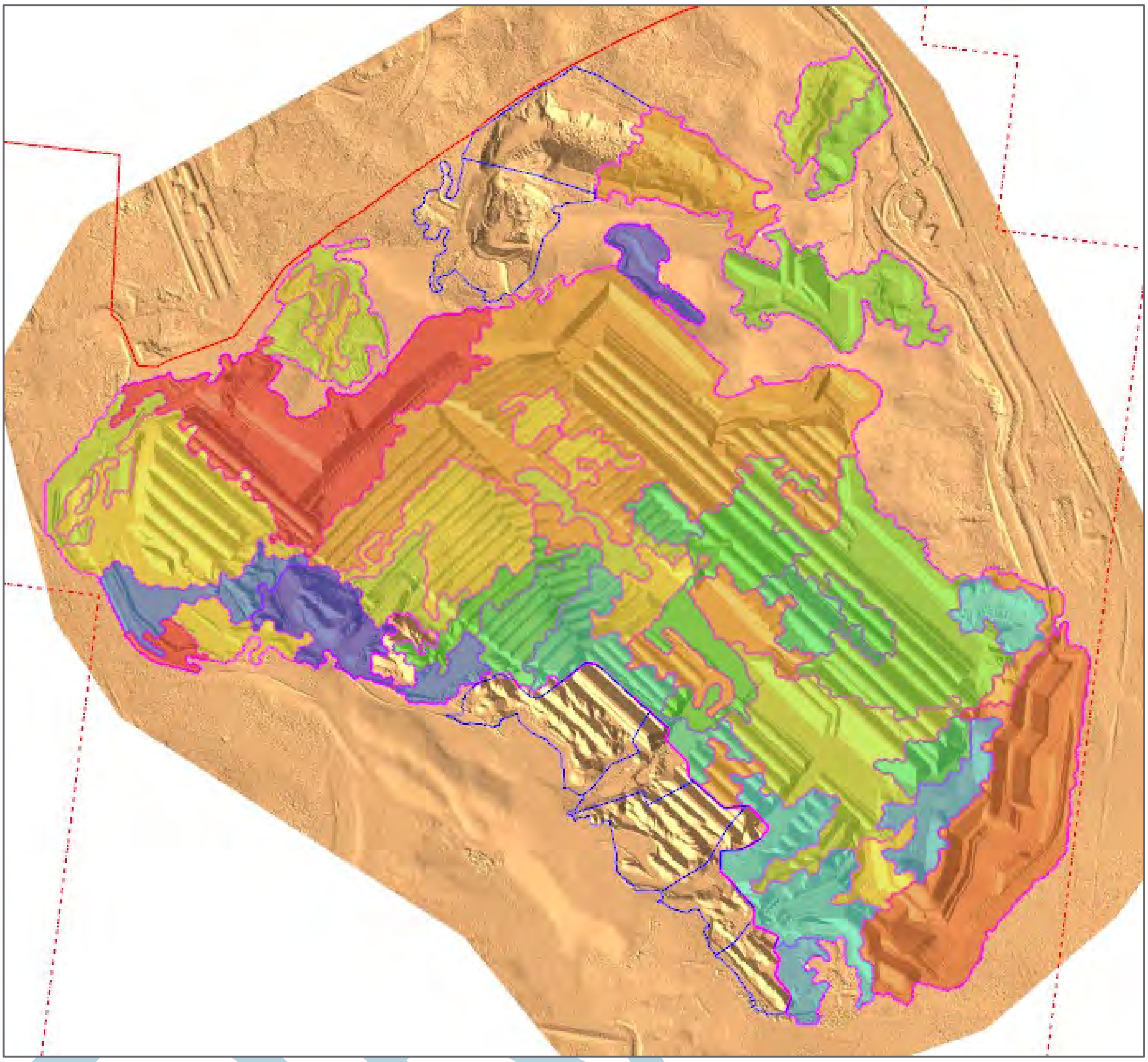


Figure 2-8 - Sub Areas

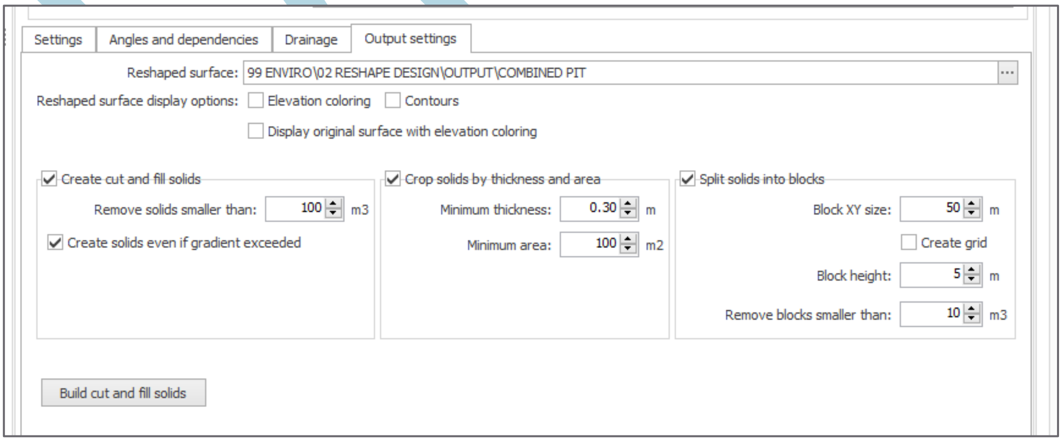


Figure 2-9 - Modelling Output Settings

2.5. DOZER MODELLING

Dozer push is estimated using the split solids generated from the reshape simulation, by connecting the Cut solids to the shortest Fill solid until either the Cut volume is depleted or the Fill volume in consumed and the next shortest fill block connected. Dozer push connectors are limited to 350m and 17degrees maximum push angle. The following fields are generated for reporting:

For Cut Solids

- Filled Blocks
- Dozer Volume Cut
- Dozer Total Distance
- Dozer Weighted Average Distance
- Dozer Weighted Average Grade %
- Fully Cut
- Total Volume Cut
- Other Equip Volume Cut
- Other Equip Total Distance
- Other Equip Weighted Average Distance
- Other Equip Weighted Average Grade %

For Fill Solids

- Volume Filled (Dozer)
- Fully Filled
- From Cut Blocks
- Volume Filled (Total)
- Volume Filled (Other Equip)

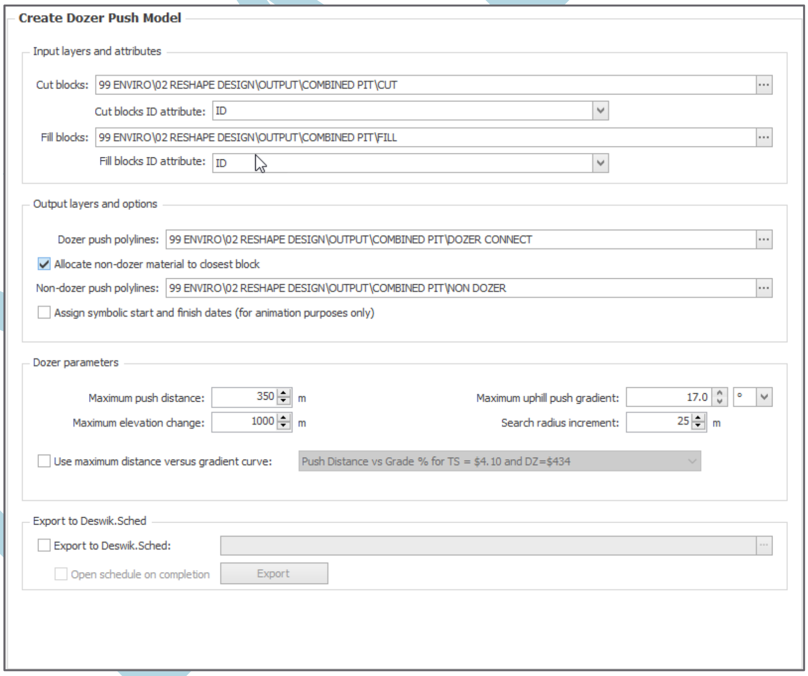


Figure 2-10 - Dozer Push Model Settings

3. MODEL OUTPUTS

Using the settings described in Section 2 of this report the following results can be reported, briefly:

- Table 3 below provides a summary of the quantities by reporting area.
- Figure 3-1 shows distribution of dozer push volumes by average distance
- Figure 3-2 provides an overview of the reshaping solids (Cut & Fill)
- Figure 3-3 illustrates a sectional view of a backfilled void
- Figure 3-4 illustrates a sectional view of a typical mining void
- Figure 3-5 displays the final reshaped landform by elevation
- Figure 3-6 indicates the final reshaped landform gradient

Table 3 – Final Reshape Quantities by Reporting Area

	Dozer/Dragline Total (lcm)	D/D Avg Dist (m)	D/D Avg Grade (%)	Exc Total (lcm)	Exc Avg Dist (m)
FAR WEST	4,166	114	-24%	1,058	1,017
RAMP 5	2,980	118	-18%	310	517
RAMP3	3,298	117	-26%	74	414
SOUTH	5,523	106	-28%	1,718	1,110
WEST	16,552	114	-27%	2,164	491
TOTAL	**32,519**	**113**	**-26%**	**5,324**	**796**

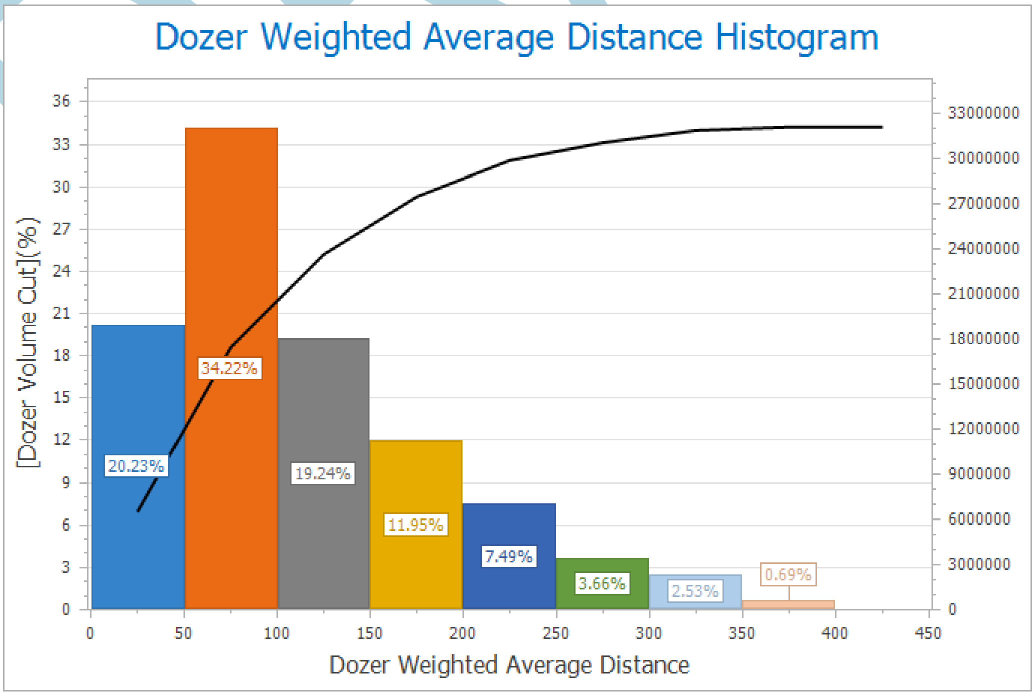


Figure 3-1 - Dozer Push distance distribution

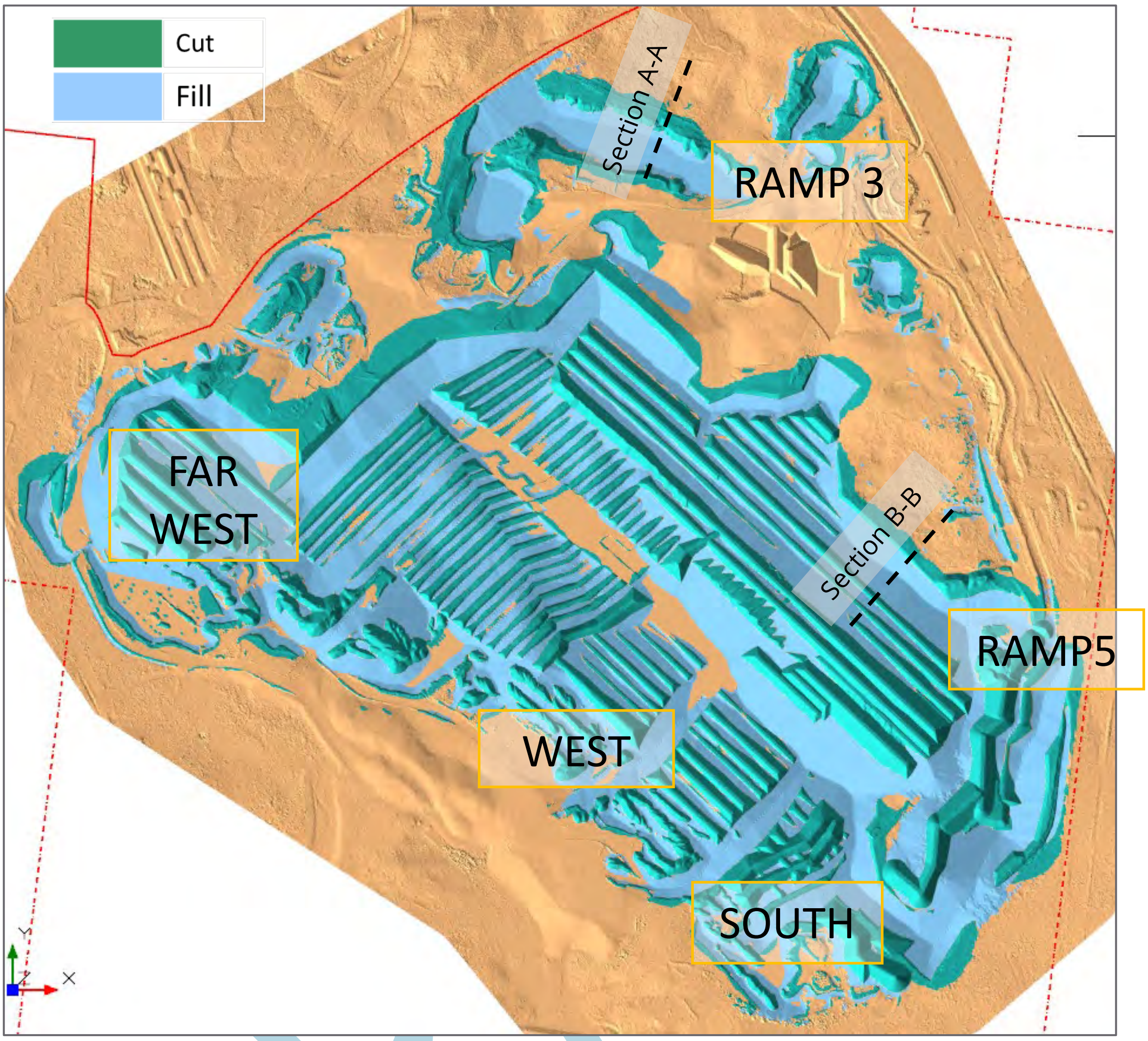


Figure 3-2 - Reshape Solids Overview

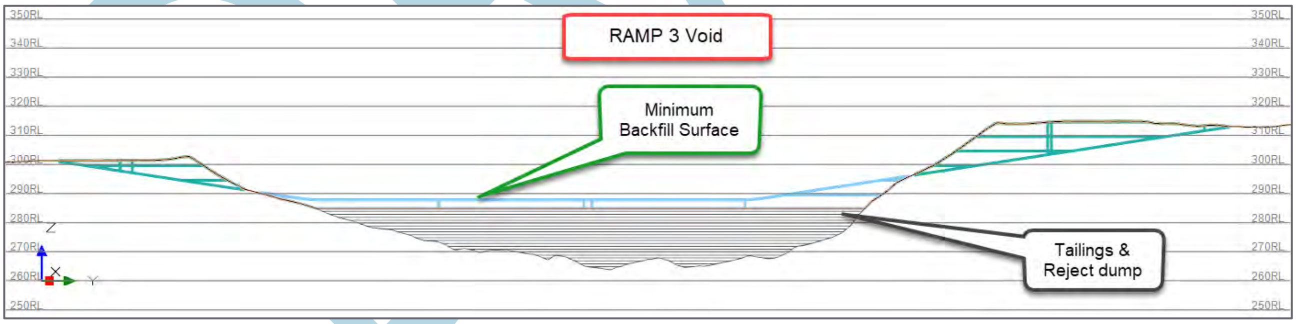


Figure 3-3 - Section A-A

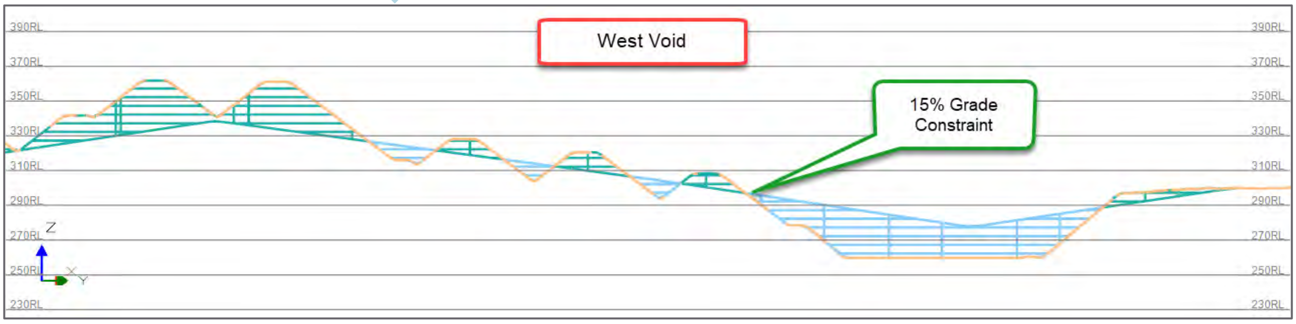


Figure 3-4 - Section B-B

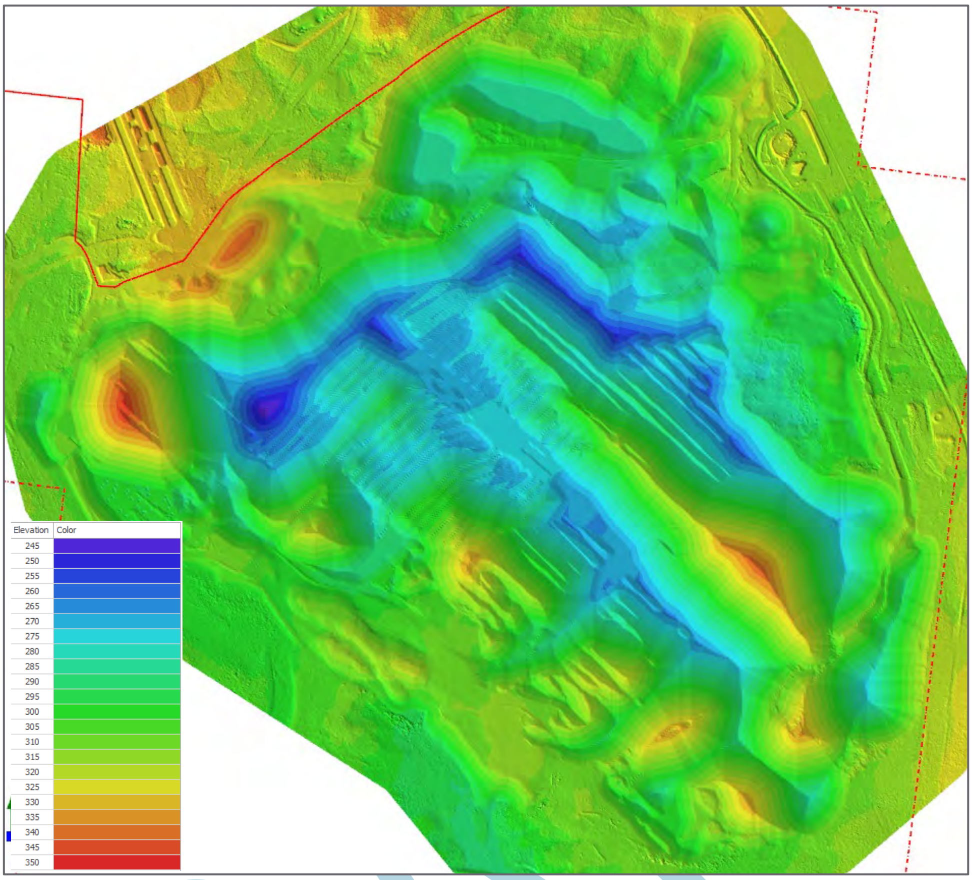


Figure 3-5 - Reshaped Landform Elevations

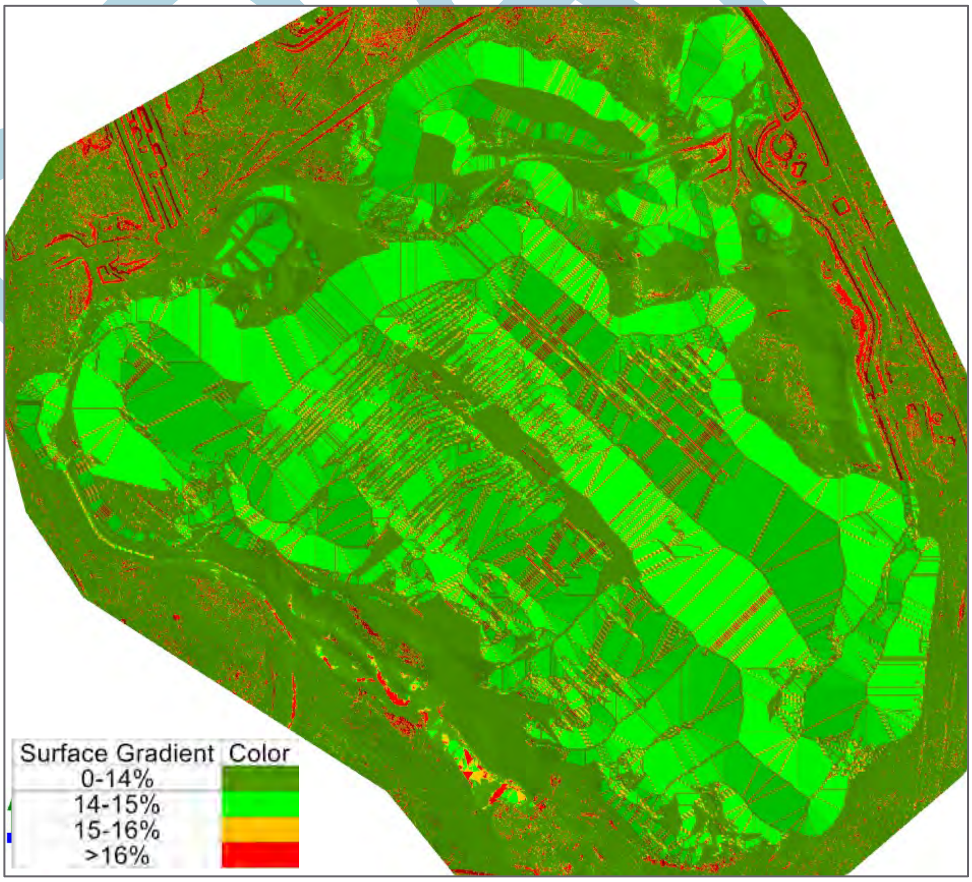


Figure 3-6 - Reshaped Landform Gradient

3.1. PROGRESSIVE RESHAPING ESTIMATION

Progressive areas for reshaping have been identified using annual polygons from the LHS model. Completed mining area and completed dumping area yearly dates were written to the Reshape Cut & Fill solids and used to constrain the availability of the reshaping solids. *It should be noted that the reshaping activities have been conceptually sequenced based on availability only and have not been specifically scheduled using equipment constraints*. The annual progressive reshape quantities are shown in Table 4, with the spatial progress displayed in Figure 3-7. All quantities stated per period are within the estimated production capacities of site equipment, as it is anticipated that site production equipment will be used on reshaping activities to maximise equipment utilization.

Table 4 - Progressive Reshape Quantities

Financial Year	Dozer Total (lcm)	Dozer Avg Dist (m)	Dozer Avg Grade (%)	Exc Total (lcm)	Exc Avg Dist (m)	Dragline Total (lcm)	Dragline Avg Dist (m)
FY22 - progressive	1,398	67	-25%	62	733	-	-
FY23 - progressive	1,398	91	-25%	22	1,024	-	-
FY24 - progressive	1,171	77	-23%	65	1,502	-	-
FY25 - progressive	1,398	99	-29%	222	834	-	-
FY26 - progressive	1,318	93	-27%	90	793	-	-
FY27 - progressive	1,398	94	-24%	28	428	-	-
FY28 - progressive	701	164	-28%	1	371	-	-
FY29 - progressive	1,088	173	-22%	188	492	-	-
FY30 - progressive	1,318	167	-21%	594	755	-	-
FY31 - progressive	1,498	167	-29%	96	560	-	-
FY32 -closure	1,977	145	-23%	550	576	4,308	82
FY33 -closure	4,831	168	-21%	3,406	848	8,717	86
Grand Total	**19,494**	**132**	**-24%**	**5,324**	**796**	**13,025**	**85**

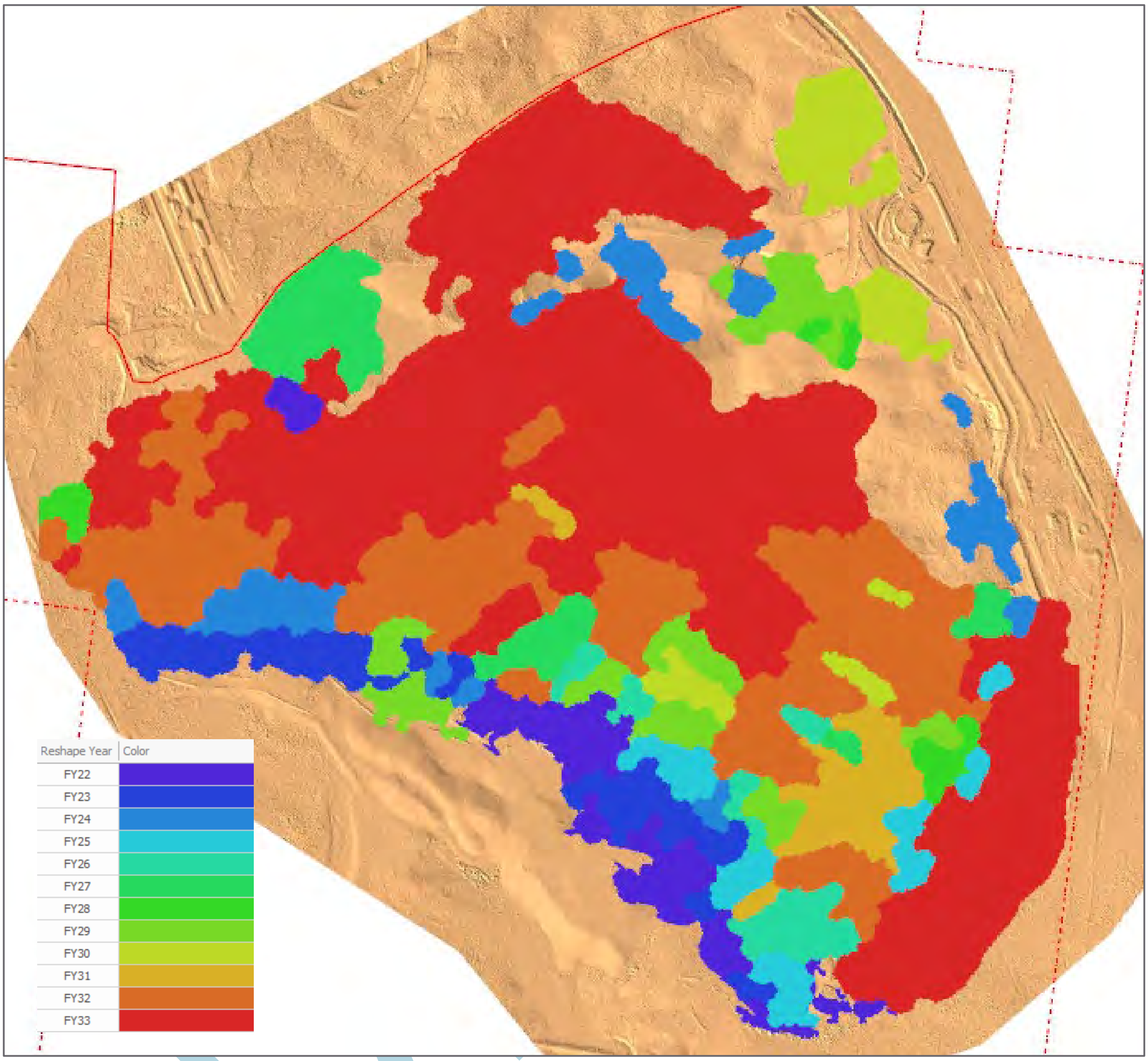


Figure 3-7 - Reshape Progress

3.2. ANNUAL CLOSURE ESTIMATE

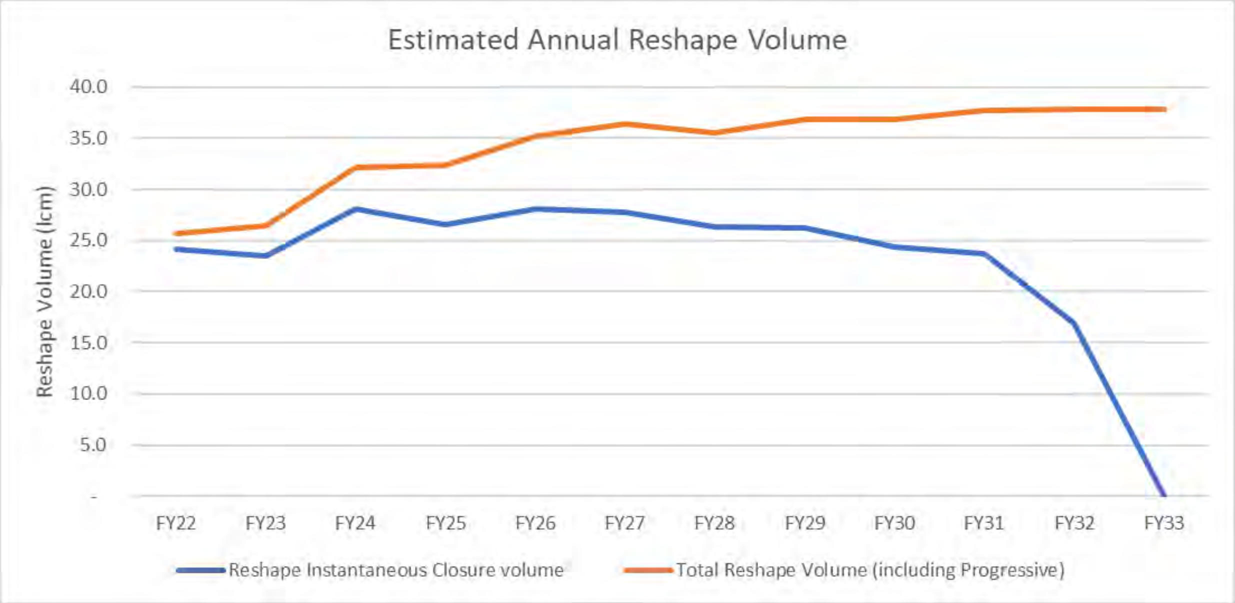
Additional reshape estimates captured at the end of each financial year have also been modelled. These reshape results have not been optimized to maximise dozer push and are used to indicate the evolution of instantaneous closure at any point of the mine life. Table 5 below supplies that estimated quantities for the reshape at the end of each financial year

Table 5 - Annual Reshape Estimates

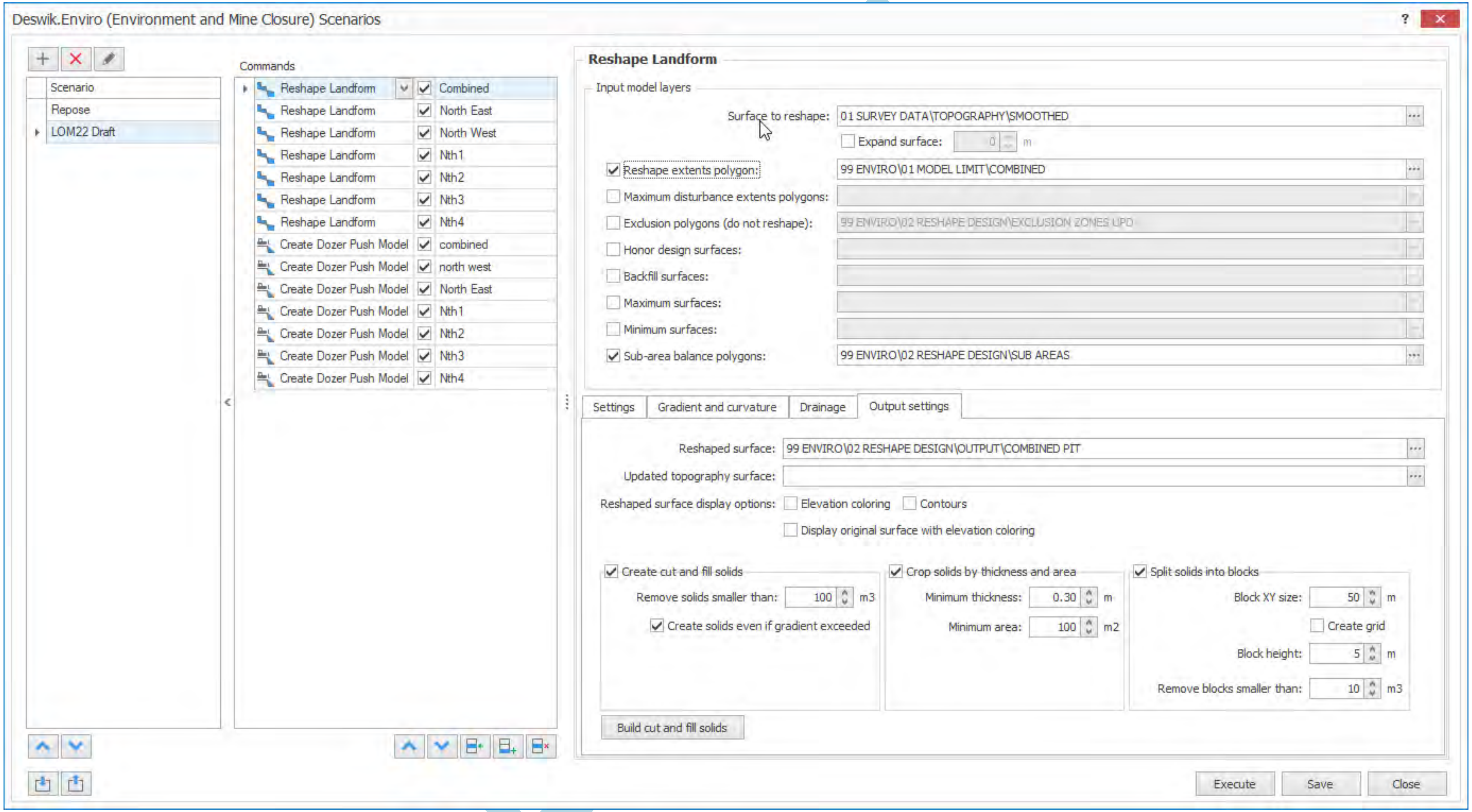
	Total Reshape Volume (mlcm)	Cumulative Progressive Reshape estimate (mlcm)	Cumulative Closure Reshape estimate (mlcm)	Reshape Instantaneous Closure volume (mlcm)
FY22	25.66	1.46	-	24.20
FY23	26.41	2.88	-	23.53
FY24	32.17	4.12	-	28.05
FY25	32.29	5.74	-	26.56
FY26	35.19	7.14	-	28.05
FY27	36.36	8.57	-	27.79
FY28	35.56	9.27	-	26.29
FY29	36.82	10.55	-	26.27
FY30	36.84	12.46	-	24.38
FY31	37.73	14.05	-	23.68
FY32	37.84	14.05	6.84	16.95
FY33	16.95	14.05	23.79	0.00

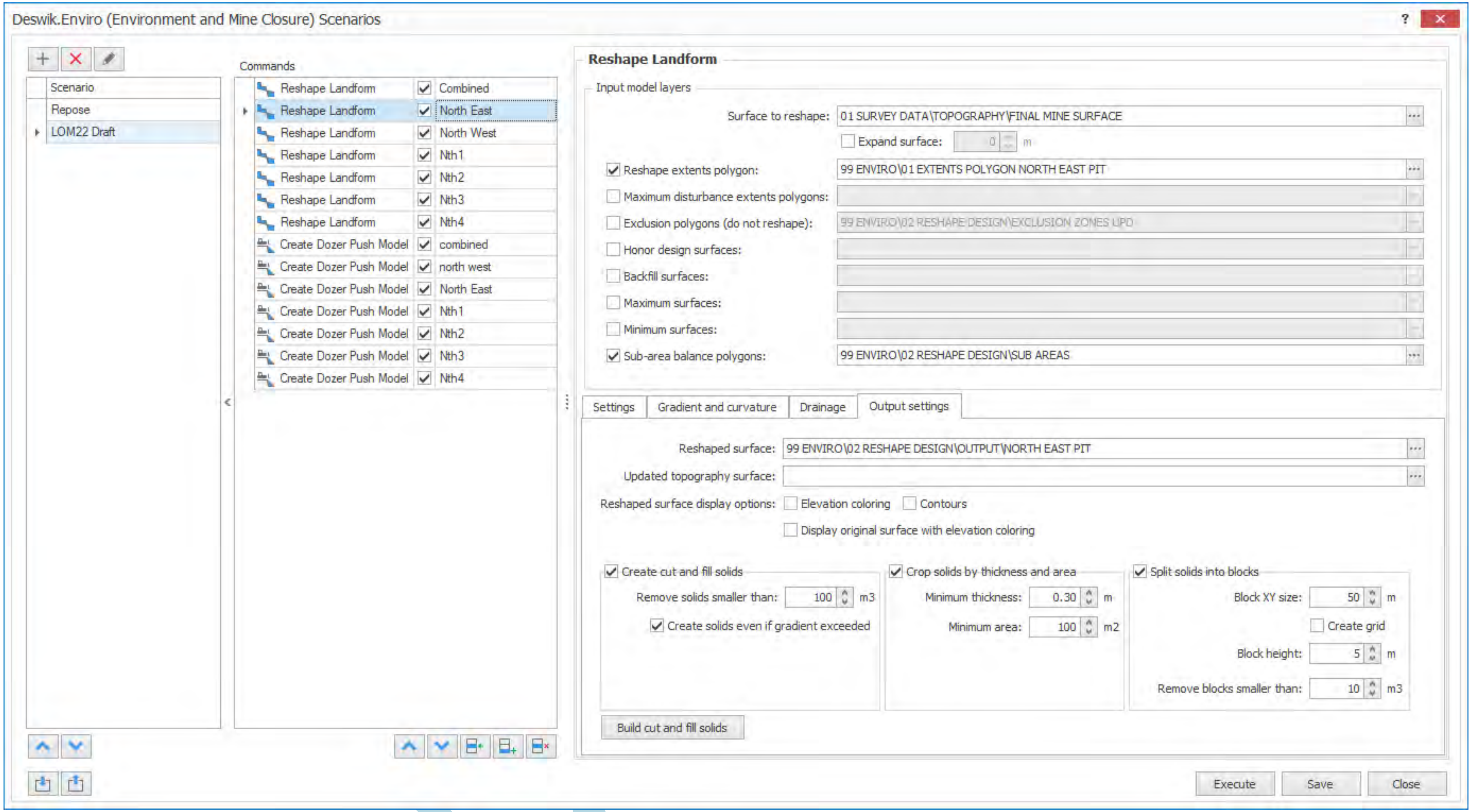
Figure 3-8 below indicates the trend of reshape estimates over the life of mine, with reshape volumes increasing during periods where mining alignments and/or dumping areas are modified.

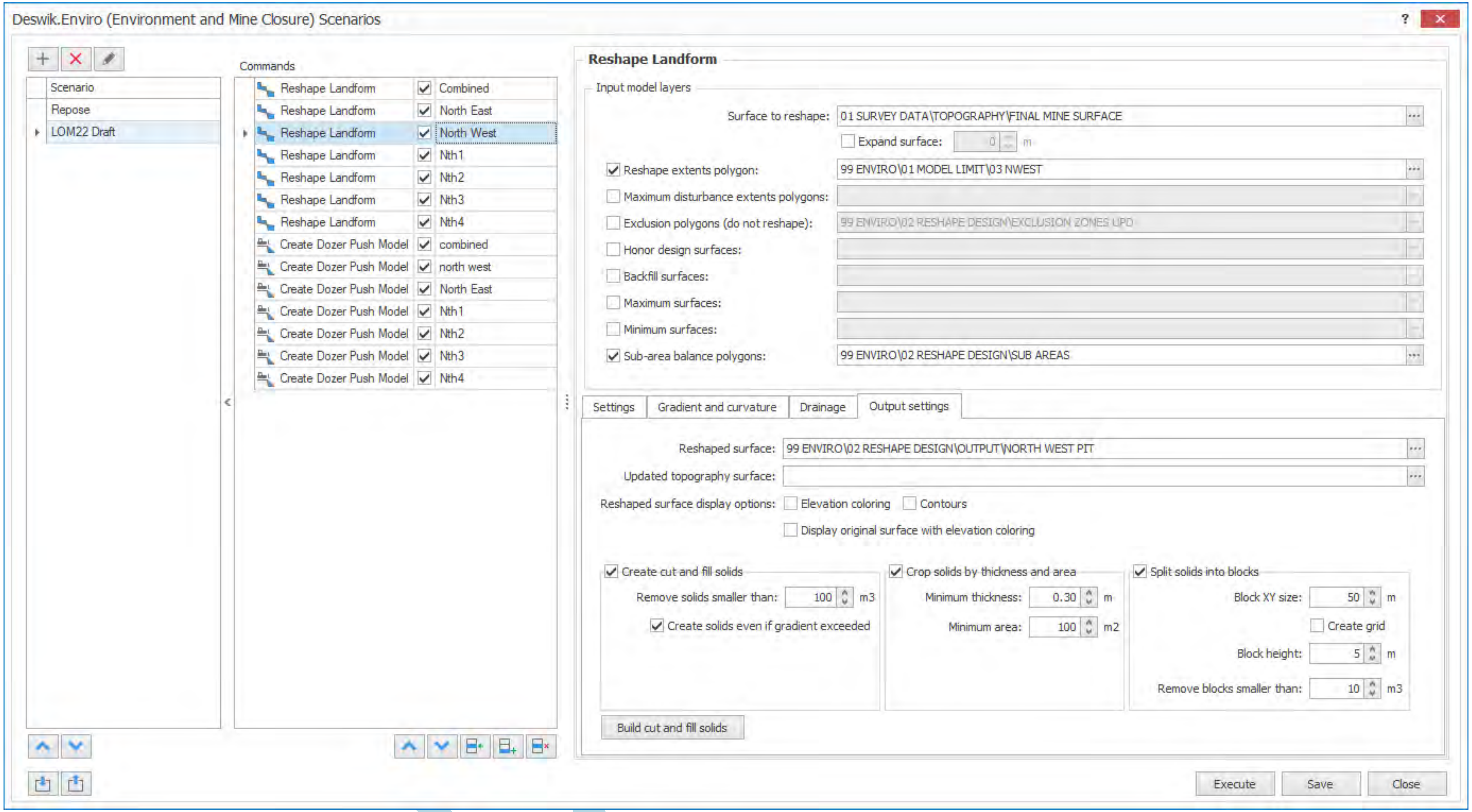
Figure 3-8 - Annual Reshape Estimates

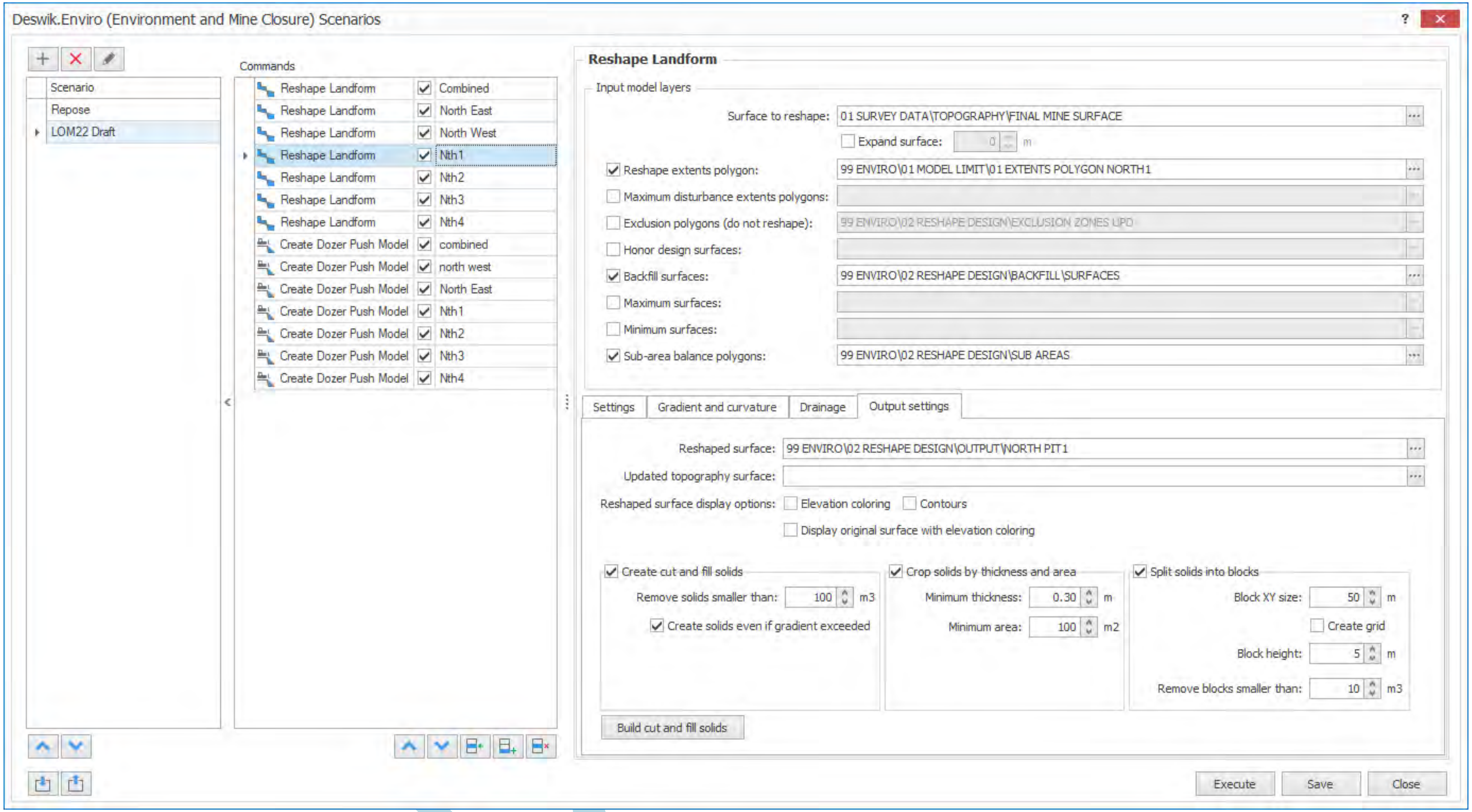


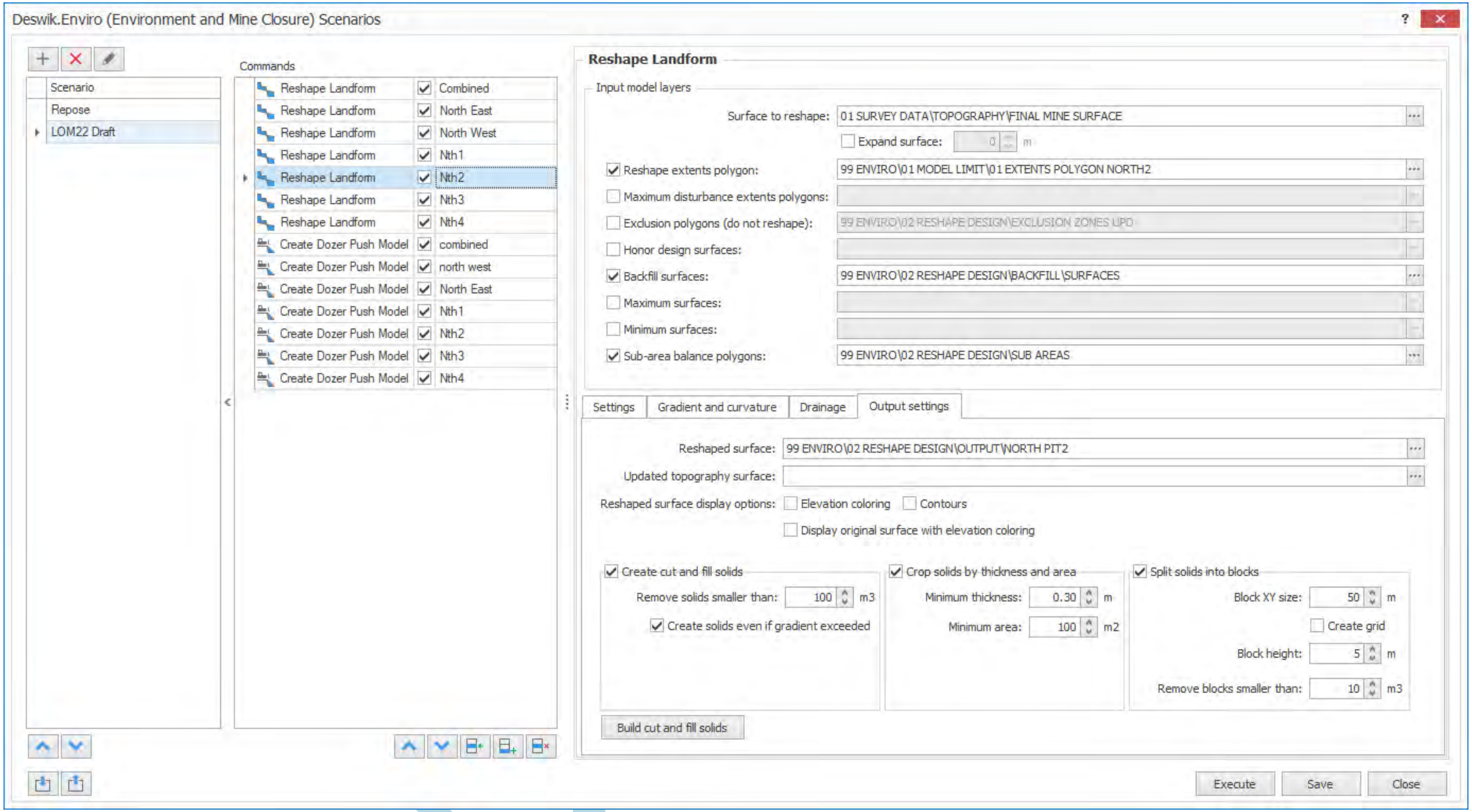
APPENDIX A: DETAILED MODEL SETTINGS

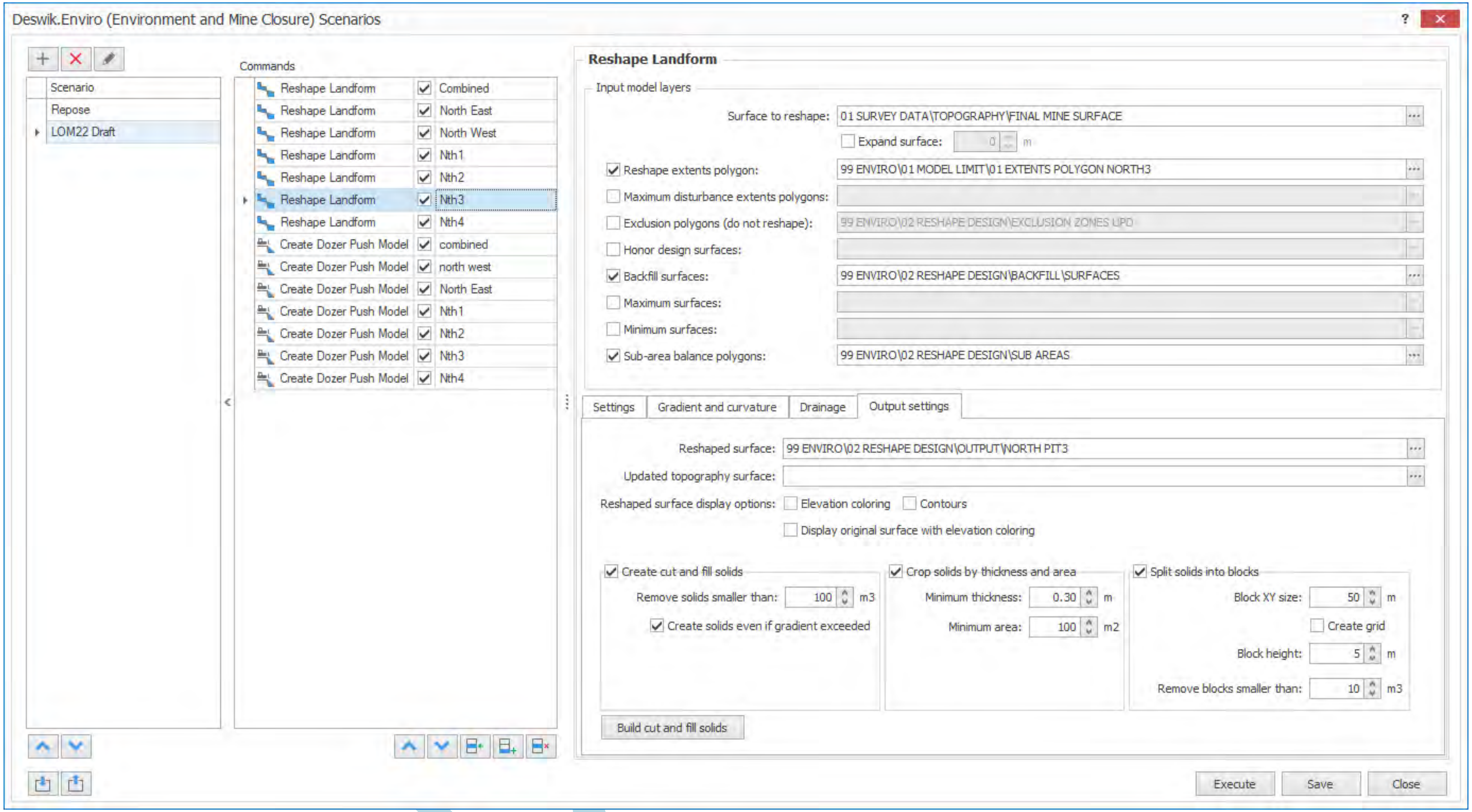


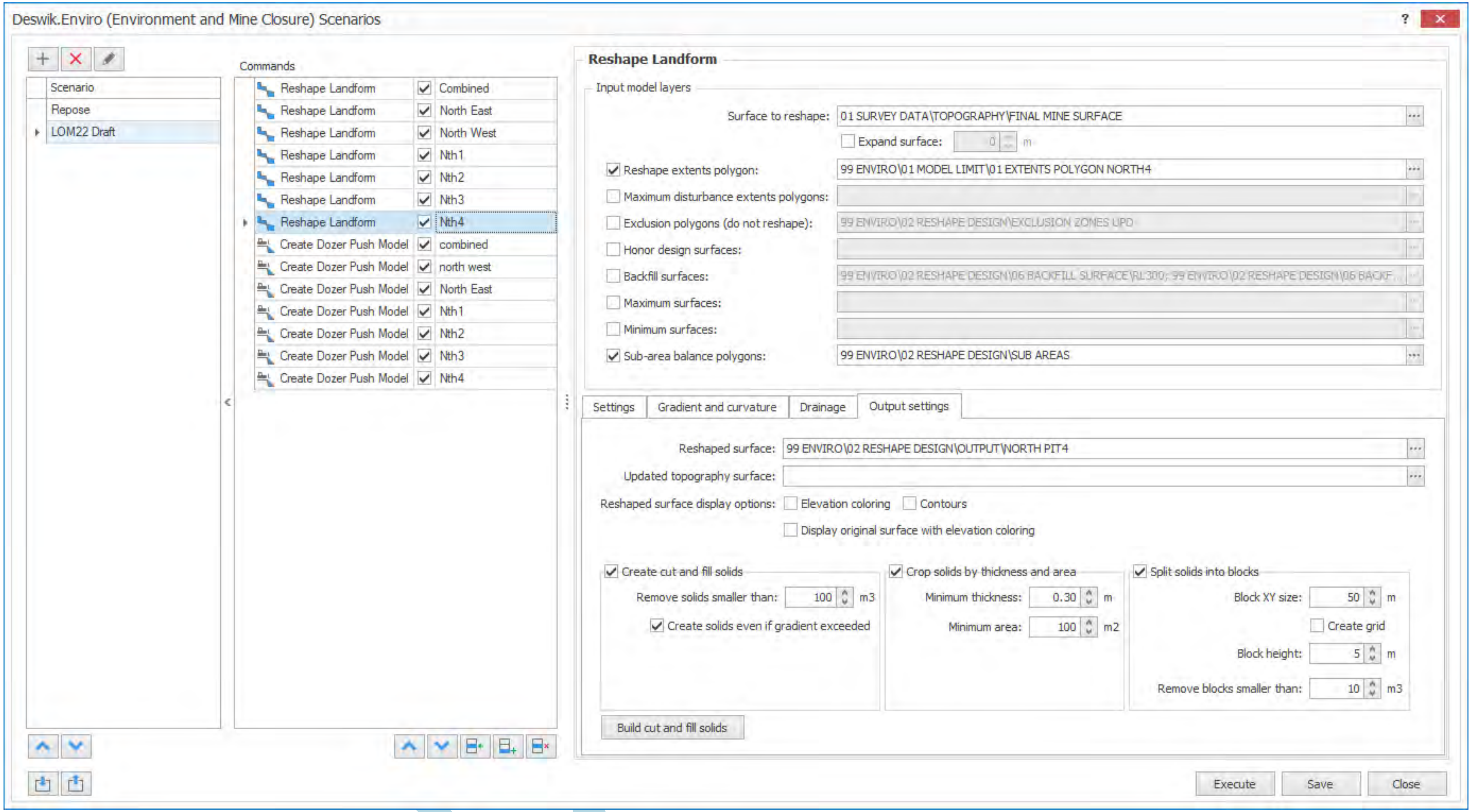

Deswik.Enviro (Environment and Mine Closure) Scenarios
Scenario
Repose
LOM22 Draft
Commands
Reshape Landform Combined
Reshape Landform North East
Reshape Landform North West
Reshape Landform Nth1
Reshape Landform Nth2
Reshape Landform Nth3
Reshape Landform Nth4
Create Dozer Push Model combined
Create Dozer Push Model north west
Create Dozer Push Model North East
Create Dozer Push Model Nth1
Create Dozer Push Model Nth2
Create Dozer Push Model Nth3
Create Dozer Push Model Nth4
Reshape Landform
Input model layers
Surface to reshape: 01 SURVEY DATA\TOPOGRAPHY\FINAL MINE SURFACE
Expand surface: 0 m
Reshape extents polygon: 99 ENVIRO\01 EXTENTS POLYGON NORTH EAST PIT
Maximum disturbance extents polygons:
Exclusion polygons (do not reshape): 99 ENVIRO\02 RESHAPE DESIGN\EXCLUSION ZONES UPD
Honor design surfaces:
Backfill surfaces:
Maximum surfaces:
Minimum surfaces:
Sub-area balance polygons: 99 ENVIRO\02 RESHAPE DESIGN\SUB AREAS
Settings
Gradient and curvature
Drainage
Output settings
Reshaped surface: 99 ENVIRO\02 RESHAPE DESIGN\OUTPUT\NORTH EAST PIT
Updated topography surface:
Reshaped surface display options: Elevation coloring Contours
Display original surface with elevation coloring
Create cut and fill solids
Remove solids smaller than: 100 m3
Create solids even if gradient exceeded
Crop solids by thickness and area
Minimum thickness: 0.30 m
Minimum area: 100 m2
Split solids into blocks
Block XY size: 50 m
Create grid
Block height: 5 m
Remove blocks smaller than: 10 m3
Build cut and fill solids
Execute
Save
Close


Deswik.Enviro (Environment and Mine Closure) Scenarios
Scenario
Repose
LOM22 Draft
Commands
Reshape Landform Combined
Reshape Landform North East
Reshape Landform North West
Reshape Landform Nth1
Reshape Landform Nth2
Reshape Landform Nth3
Reshape Landform Nth4
Create Dozer Push Model combined
Create Dozer Push Model north west
Create Dozer Push Model North East
Create Dozer Push Model Nth1
Create Dozer Push Model Nth2
Create Dozer Push Model Nth3
Create Dozer Push Model Nth4
Reshape Landform
Input model layers
Surface to reshape: 01 SURVEY DATA\TOPOGRAPHY\FINAL MINE SURFACE
Expand surface: 0 m
Reshape extents polygon: 99 ENVIRO\01 MODEL LIMIT\03 NWEST
Maximum disturbance extents polygons:
Exclusion polygons (do not reshape): 99 ENVIRO\02 RESHAPE DESIGN\EXCLUSION ZONES UPD
Honor design surfaces:
Backfill surfaces:
Maximum surfaces:
Minimum surfaces:
Sub-area balance polygons: 99 ENVIRO\02 RESHAPE DESIGN\SUB AREAS
Settings
Gradient and curvature
Drainage
Output settings
Reshaped surface: 99 ENVIRO\02 RESHAPE DESIGN\OUTPUT\NORTH WEST PIT
Updated topography surface:
Reshaped surface display options: Elevation coloring Contours
Display original surface with elevation coloring
Create cut and fill solids
Remove solids smaller than: 100 m3
Create solids even if gradient exceeded
Crop solids by thickness and area
Minimum thickness: 0.30 m
Minimum area: 100 m2
Split solids into blocks
Block XY size: 50 m
Create grid
Block height: 5 m
Remove blocks smaller than: 10 m3
Build cut and fill solids
Execute
Save
Close


Deswik.Enviro (Environment and Mine Closure) Scenarios
Scenario
Repose
LOM22 Draft
Commands
Reshape Landform Combined
Reshape Landform North East
Reshape Landform North West
Reshape Landform Nth1
Reshape Landform Nth2
Reshape Landform Nth3
Reshape Landform Nth4
Create Dozer Push Model combined
Create Dozer Push Model north west
Create Dozer Push Model North East
Create Dozer Push Model Nth1
Create Dozer Push Model Nth2
Create Dozer Push Model Nth3
Create Dozer Push Model Nth4
Reshape Landform
Input model layers
Surface to reshape: 01 SURVEY DATA\TOPOGRAPHY\FINAL MINE SURFACE
Expand surface:
Reshape extents polygon: 99 ENVIRO\01 MODEL LIMIT\01 EXTENTS POLYGON NORTH1
Maximum disturbance extents polygons:
Exclusion polygons (do not reshape): 99 ENVIRO\02 RESHAPE DESIGN\EXCLUSION ZONES UPD
Honor design surfaces:
Backfill surfaces: 99 ENVIRO\02 RESHAPE DESIGN\BACKFILL\SURFACES
Maximum surfaces:
Minimum surfaces:
Sub-area balance polygons: 99 ENVIRO\02 RESHAPE DESIGN\SUB AREAS
Settings
Gradient and curvature
Drainage
Output settings
Reshaped surface: 99 ENVIRO\02 RESHAPE DESIGN\OUTPUT\NORTH PIT1
Updated topography surface:
Reshaped surface display options: Elevation coloring Contours
Display original surface with elevation coloring
Create cut and fill solids
Remove solids smaller than: 100 m3
Create solids even if gradient exceeded
Crop solids by thickness and area
Minimum thickness: 0.30 m
Minimum area: 100 m2
Split solids into blocks
Block XY size: 50 m
Create grid
Block height: 5 m
Remove blocks smaller than: 10 m3
Build cut and fill solids
Execute
Save
Close


Deswik.Enviro (Environment and Mine Closure) Scenarios
Scenario
Repose
LOM22 Draft
Commands
Reshape Landform Combined
Reshape Landform North East
Reshape Landform North West
Reshape Landform Nth1
Reshape Landform Nth2
Reshape Landform Nth3
Reshape Landform Nth4
Create Dozer Push Model combined
Create Dozer Push Model north west
Create Dozer Push Model North East
Create Dozer Push Model Nth1
Create Dozer Push Model Nth2
Create Dozer Push Model Nth3
Create Dozer Push Model Nth4
Reshape Landform
Input model layers
Surface to reshape: 01 SURVEY DATA\TOPOGRAPHY\FINAL MINE SURFACE
Expand surface: 0 m
Reshape extents polygon: 99 ENVIRO\01 MODEL LIMIT\01 EXTENTS POLYGON NORTH2
Maximum disturbance extents polygons:
Exclusion polygons (do not reshape): 99 ENVIRO\02 RESHAPE DESIGN\EXCLUSION ZONES UPD
Honor design surfaces:
Backfill surfaces: 99 ENVIRO\02 RESHAPE DESIGN\BACKFILL\SURFACES
Maximum surfaces:
Minimum surfaces:
Sub-area balance polygons: 99 ENVIRO\02 RESHAPE DESIGN\SUB AREAS
Settings
Gradient and curvature
Drainage
Output settings
Reshaped surface: 99 ENVIRO\02 RESHAPE DESIGN\OUTPUT\NORTH PIT2
Updated topography surface:
Reshaped surface display options: Elevation coloring Contours
Display original surface with elevation coloring
Create cut and fill solids
Remove solids smaller than: 100 m3
Create solids even if gradient exceeded
Crop solids by thickness and area
Minimum thickness: 0.30 m
Minimum area: 100 m2
Split solids into blocks
Block XY size: 50 m
Create grid
Block height: 5 m
Remove blocks smaller than: 10 m3
Build cut and fill solids
Execute
Save
Close


Deswik.Enviro (Environment and Mine Closure) Scenarios
Scenario
Repose
LOM22 Draft
Commands
Reshape Landform Combined
Reshape Landform North East
Reshape Landform North West
Reshape Landform Nth1
Reshape Landform Nth2
Reshape Landform Nth3
Reshape Landform Nth4
Create Dozer Push Model combined
Create Dozer Push Model north west
Create Dozer Push Model North East
Create Dozer Push Model Nth1
Create Dozer Push Model Nth2
Create Dozer Push Model Nth3
Create Dozer Push Model Nth4
Reshape Landform
Input model layers
Surface to reshape: 01 SURVEY DATA\TOPOGRAPHY\FINAL MINE SURFACE
Expand surface: 0 m
Reshape extents polygon: 99 ENVIRO\01 MODEL LIMIT\01 EXTENTS POLYGON NORTH3
Maximum disturbance extents polygons:
Exclusion polygons (do not reshape): 99 ENVIRO\02 RESHAPE DESIGN\EXCLUSION ZONES UPD
Honor design surfaces:
Backfill surfaces: 99 ENVIRO\02 RESHAPE DESIGN\BACKFILL\SURFACES
Maximum surfaces:
Minimum surfaces:
Sub-area balance polygons: 99 ENVIRO\02 RESHAPE DESIGN\SUB AREAS
Settings
Gradient and curvature
Drainage
Output settings
Reshaped surface: 99 ENVIRO\02 RESHAPE DESIGN\OUTPUT\NORTH PIT3
Updated topography surface:
Reshaped surface display options: Elevation coloring Contours
Display original surface with elevation coloring
Create cut and fill solids
Remove solids smaller than: 100 m3
Create solids even if gradient exceeded
Crop solids by thickness and area
Minimum thickness: 0.30 m
Minimum area: 100 m2
Split solids into blocks
Block XY size: 50 m
Create grid
Block height: 5 m
Remove blocks smaller than: 10 m3
Build cut and fill solids
Execute
Save
Close


Deswik.Enviro (Environment and Mine Closure) Scenarios
Scenario
Repose
LOM22 Draft
Commands
Reshape Landform Combined
Reshape Landform North East
Reshape Landform North West
Reshape Landform Nth1
Reshape Landform Nth2
Reshape Landform Nth3
Reshape Landform Nth4
Create Dozer Push Model combined
Create Dozer Push Model north west
Create Dozer Push Model North East
Create Dozer Push Model Nth1
Create Dozer Push Model Nth2
Create Dozer Push Model Nth3
Create Dozer Push Model Nth4
Reshape Landform
Input model layers
Surface to reshape: 01 SURVEY DATA\TOPOGRAPHY\FINAL MINE SURFACE
Expand surface: 0 m
Reshape extents polygon: 99 ENVIRO\01 MODEL LIMIT\01 EXTENTS POLYGON NORTH4
Maximum disturbance extents polygons:
Exclusion polygons (do not reshape): 99 ENVIRO\02 RESHAPE DESIGN\EXCLUSION ZONES UPD
Honor design surfaces:
Backfill surfaces: 99 ENVIRO\02 RESHAPE DESIGN\06 BACKFILL SURFACE\RL300; 99 ENVIRO\02 RESHAPE DESIGN\06 BACKF...
Maximum surfaces:
Minimum surfaces:
Sub-area balance polygons: 99 ENVIRO\02 RESHAPE DESIGN\SUB AREAS
Settings
Gradient and curvature
Drainage
Output settings
Reshaped surface: 99 ENVIRO\02 RESHAPE DESIGN\OUTPUT\NORTH PIT4
Updated topography surface:
Reshaped surface display options: Elevation coloring Contours
Display original surface with elevation coloring
Create cut and fill solids
Remove solids smaller than: 100 m3
Create solids even if gradient exceeded
Crop solids by thickness and area
Minimum thickness: 0.30 m
Minimum area: 100 m2
Split solids into blocks
Block XY size: 50 m
Create grid
Block height: 5 m
Remove blocks smaller than: 10 m3
Build cut and fill solids
Execute
Save
Close

SGM Environmental Pty Limited (SGME) is a boutique consulting firm of experienced industry experts working with our clients and their stakeholders to develop and deliver innovative solutions to complicated challenges that create enduring value.

SGME was established to provide services in soil science, geochemistry, mine closure and Environmental management, planning & approvals cost efficiently. When you engage SGME you engage a partner to your business, priding themselves on:

Honest – Straight-up and no nonsense.

Trust – We say what we mean and we will deliver on our promises. We will advocate strongly for you.

Innovation – We will always look for new ways to help and create enduring value because that is what friends do when they work together.

Safety – We do it right so we all go home safely.

Australian Location

PO Box 5622, Stafford Heights, Qld 4053

Tel +61 7 3148 6288

Email admin@sgmenvironmental.com

Web sgmenvironmental.com