AngloAmerican

Dawson Mine

Supporting Information for Environmental Authority Amendment

Environmental Authority EPML00565813

Contents

1 Executive Summary

Anglo Coal (Dawson) Pty Ltd and Mitsui Moura Investment Pty Ltd (the **EA Holders**) hold environmental authority EPML00565813 that currently authorises the Dawson Central and North Mine (**DCN**) activities subject to conditions (the **current EA**). Anglo Coal (Dawson Management) Pty Limited (**Anglo**) operates the DCM on behalf of the EA Holders.

Prior to 2014, the environmental authority that authorised the DCM (**previous EA)**, incorporated water storage in residual voids as a final rehabilitation outcome. The previous EA is provided in Appendix A. This condition had been continued in the transitional environmental authority in force after the commencement of the *Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012* (Qld) (the **Greentape Reduction Act**). It appears that as a result of an inadvertent omission in the course of an EA amendment application in 2014, the conditions that authorised water storage in residual voids was not incorporated into the subsequent EA. However, the plan of operations and other mine planning documents for the site continued to correctly maintain this final land outcome.

Following discussions with the Department's Director General in relation to the impacts of the apparent omission on the estimated rehabilitation cost decision for the DCN, the Department indicated that it was open to Anglo to lodge an amendment application to rectify the apparent omission. It was agreed that the application would include a technical groundwater assessment to confirm that once the water levels in residual voids stablise, the voids will act as 'groundwater sinks' and there is no likelihood the voids will overflow. Given the expected water quality, the water filled voids will be considered Non-Use Management Areas (**NUMAs**), however Anglo is committed to research to demonstrate the water filled voids can deliver value post mining.

This amendment application seeks to:

- Amend 'Table H1 – Rehabilitation requirements' of the Current EA to include an express reference to NUMAs comprising of water storage in residual voids.
- Amend 'Table H1 – Rehabilitation requirements' of the Current EA remove alternative rehabilitation outcomes for other mine domains that will not be adopted in the PRCP.

The proposed amendments:

- do not increase the scale or intensity of the Dawson Mine activities;
- do not increase the risk of environmental harm; and
- do not result in significantly different impacts to environmental values compared to the rehabilitation objectives in the current EA.

2 Introduction

DCN comprises Mining Leases (**ML**) ML5591, ML5592, ML5593, ML5596, ML5597, ML5598, ML5599, ML5600, ML5601, ML5603, ML5604, ML5606, ML5607, ML5611, ML5630, ML5643, ML5644, ML5646, ML5650, ML5656, ML80032, ML80034, ML80070, ML80142, ML80146 (the Mine) and exploration leases; EPC578, EPC894, EPC895, EPC988, EPC989, EPC1068, EPC1086.

Prior to 2014, the environmental authority that authorised the DCM (**previous EA)**, incorporated water storage in residual voids as a final rehabilitation outcome. The previous EA is provided in Appendix A. This condition had been continued in the transitional environmental authority in force after the commencement of the *Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012* (Qld) (the **Greentape Reduction Act**). It appears that as a result of an inadvertent omission in the course of an EA amendment application in 2014, the conditions that authorised water storage in residual voids was not incorporated into the subsequent EA. However, the plan of operations and other mine planning documents for the site continued to correctly maintain this final land outcome.

Relevantly, amendments to the *Environmental Protection Act 1994* (Qld) (**EP Act**) because of the commencement of the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (Qld) (**MERFP Act**) introduced new procedures and obligations in relation to mine planning and progressive rehabilitation. Under the new regime, the plan of operations (2018-2020) for the Mine has expired and the EA Holders are going through a transitional process to prepare a progressive rehabilitation and closure plan (**PRCP**) and an accompanying schedule to the PRCP (**PRCP Schedule**).

DCN is lawfully continuing to operate without a plan of operations or a PRCP, until a PRCP is approved. It is intended that, consistent with the expired plan of operations and the previous EA the PRCP will include water storage in residual voids as a final outcome which shall be classified as NUMAs due to the predicted water quality post closure.

To align the Current EA with the previously approved outcomes and PRCP and remedy the omission of this express final outcome of water storage in residual voids from Table H1 of the Current EA, the EA Holders are seeking an EA amendment to the Current EA to:

- reinstate the condition expressly authorising water storage in residual voids (as NUMAs) as a rehabilitation outcome; and
- make other administrative changes to remove alternative rehabilitation outcomes for other mine domains that will not be adopted in the PRCP.

The proposed NUMAs will be:

- **Safe and stable** – NUMAs will be geotechnically and erosionally stable;
- **Non-polluting** – Void will act as a groundwater sink and does not overtop (detailed in Section 5 and supported by Groundwater technical assessment findings provided in Appendix F;

Further, DCN is subject to the *Thiess Peabody Coal Pty Ltd Agreement Act 1962* (**TPC Act**), enacted to authorise coal mining at DCN. Section 31 of the TPC Act requires and authorises the Company (ie DCN) to undertake or forego various actions, including actions relating to rehabilitation and water management. The *Thiess Peabody Mitsui Coal Pty Ltd Agreements Act 1965* provides for a change of ownership details and the establishment of a railway but does not repeal or change the rehabilitation and water management provisions of the earlier TPC Act. While subsequent legislation has been enacted to regulate these topics specifically, including the EP Act and the Water Act 2000 (Water Act), DCN may be entitled to rely upon the TPC Act for aspects of the rehabilitation and water management at DCN. The basis for this is the application of the maxim *generalia specialibus non derogant* (the general provision does not impliedly repeal or amend the specific provision), which has been accepted by the High Court of Australia. Where the TPC Act is invoked to regulate rehabilitation and water management at DCN, this is noted in this PRCP.

3 Description of Proposed Amendment

The DCN mining leases (the project area) and indicative locations of proposed NUMAs is shown in Figure 1.

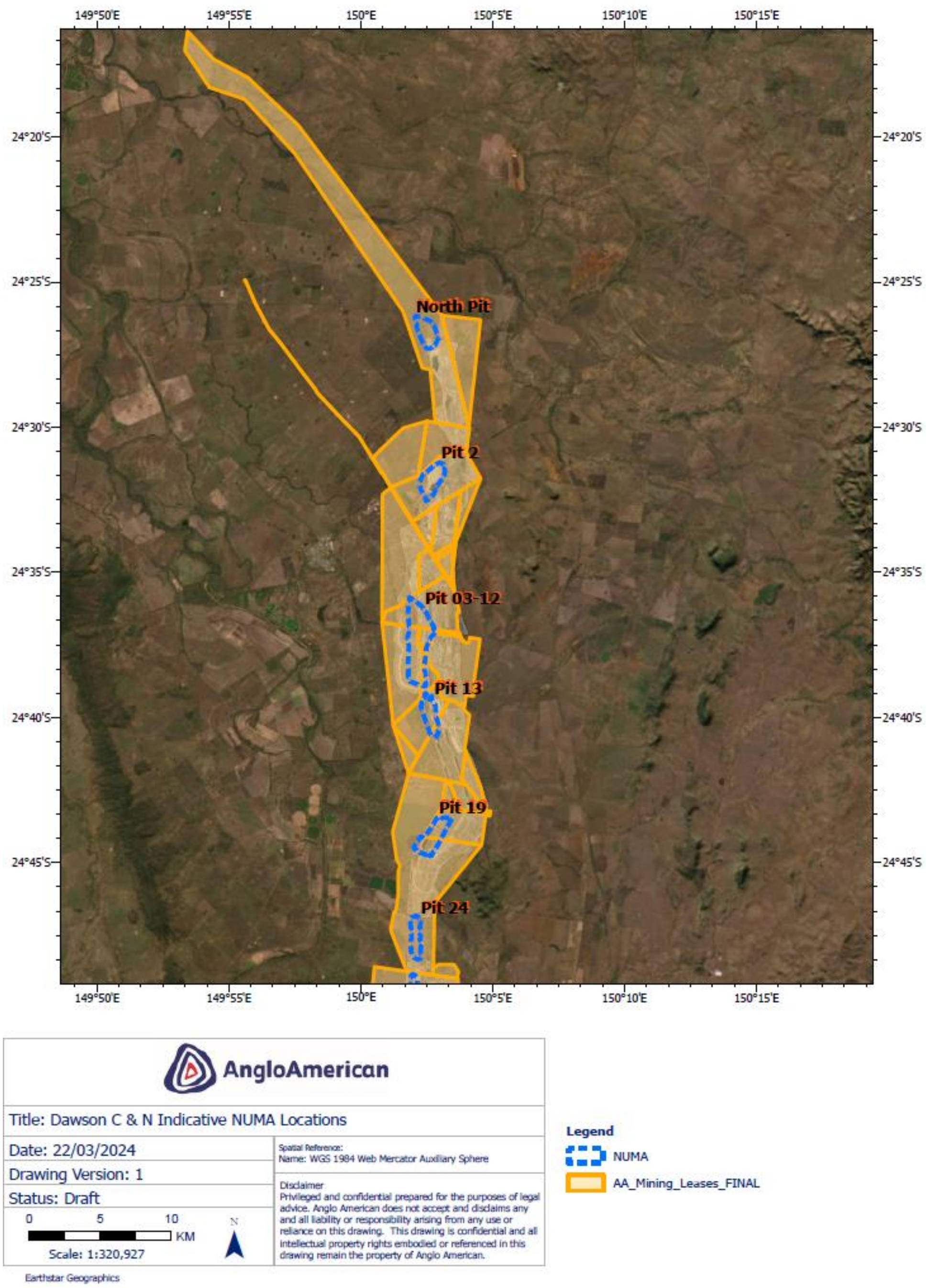


Figure 1 Dawson C & N Indicative NUMA Locations

Anglo is seeking an amendment to ‘Table H1 – Rehabilitation requirements’ of the current EA to:

- reinstate the condition contained in Table H1 of the previous (pre-2014) environmental authorities authorising water storage in residual voids as a final rehabilitation outcome. These areas will be classified as NUMAs due to the expected final water quality;
- remove semi-evergreen vine thicket and hardwood plantations as potential rehabilitation objectives as these post mining land uses will be not adopted in the PRCP; and
- adjust the naming of the other two objectives for consistency with the neighbouring Dawson South Mine. These changes are administrative in nature with no change to indicators or completion criteria.

Table H1 of the Current EA is reproduced in Appendix B with the proposed changes reflected in ‘mark up’.

The proposed NUMAs (See Figure 1, Appendix C, Appendix D), will include the portion of the residual void below the pit lake level plus a buffer. The remainder of the final void will be rehabilitated to sustain a post mine land use. A summary of the NUMAs, and their approximate sizes, to be included in the DCN final landform is provided in Table 1. The total area of the NUMAs is within the previously authorised area of water storage in residual voids (1650ha).

Table 1 Summary of NUMAs in the DCN final landform

NUMA	Location	Approximate size (ha)
North Pit	Dawson North	194
Pit 2	Dawson North	222
Pit 3-12	Dawson Central	630
Pit 13	Dawson Central	180
Pit 19	Dawson Central	267
Pit 24	Dawson Central	157

4 Assessment Level of Amendment

An amendment application for an EA may be:

- A minor amendment (condition conversion) to convert all the EA conditions to standard conditions;
- A minor amendment (threshold or PRCP threshold); or
- A major amendment, which is an amendment that is not a minor amendment.

Under Section 228 of the EP Act, the administering authority must decide whether the EA Amendment is a major or minor amendment. Section 3.1 of the ‘Major and minor amendment guideline (ESR/2015/1684, Version 11.00, dated 26th September 2023) provides support by way of criteria to be met to satisfy the administering authority that the amendment can be considered as minor.

If any of the criteria in Section 3.1.1 will not be met for the proposed amendment, it will be assessed as a major amendment. The relevance of each of these criteria to this application is detailed below in Table 1.

Table 2 Minor amendment (Threshold) Criteria

Minor amendment (threshold) criteria	Relevance to application
(a) is not a change identified in the authority as a standard condition, other than (i) a condition conversion; or (ii) a change that is not a condition conversion but replaces a standard condition of the EA with a standard condition for the ERA to which the EA relates; or (iii) a change that will not result in a change to the impact of the relevant activity on an environmental value; and	Not applicable Application does not involve a change to a standard condition, the DCN EA is a site specific EA.
(b) does not significantly increase the level of environmental harm caused by the relevant activity; and	Criteria can be met Section 5 of this document demonstrates that the application does not significantly increase the level of environmental harm caused by the relevant mining activity. Detailed assessments, discussed further in section 5, have shown that the proposed NUMAs have no potential for overtopping and will remain as groundwater sinks in the post mining phase and hence there will be no seepage of final void lake water away from the final voids and no potential for contamination of surround aquifers. Further, the proposed amendment is a reinstatement of a previously approved EA condition.
(c) does not change any rehabilitation objectives in the EA in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the EA; and	Criteria can be met Application does not involve any changes to rehabilitation objectives in the EA that would result in significantly different impacts on environmental values. As detailed above, section 7 of this document contains detailed environmental assessment that demonstrate that the proposed NUMAs have no potential for overtopping and will remain as groundwater sinks in the post mining phase and hence there will be no seepage of final void lake water away from the final voids and no potential for contamination of surround aquifers.

Minor amendment (threshold) criteria	Relevance to application
	Further, the application proposes rehabilitation objectives permitted under previously approved EA for the site.
(d) does not significantly increase the scale or intensity of the relevant activity; and	Criteria can be met The proposed amendment will not increase the scale or intensity of the operation.
(e) does not relate to a new relevant resource tenure for the EA that is— **(i) a new mining lease; or** **(ii) a new petroleum lease; or** **(iii) a new geothermal lease under the Geothermal Energy Act 2010; or** **(iv) a new greenhouse gas injection and storage lease under the Greenhouse Gas Storage Act 2009; and**	Not applicable Application does not relate to a new resource tenure for an EA.
(f) increases the existing surface area for the relevant activity by 10% or less; and	Not applicable Application does not propose changes that increase the existing surface are for the relevant activity.
(g) for an EA for a petroleum activity: **(i) involves constructing a new pipeline that does not exceed 150km in length; and** **(ii) involves extending an existing pipeline by no more than 10% of the existing length of the pipeline; and**	Not applicable The application relates to an EA for a resource activity, not a petroleum activity.
(h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or greenhouse gas permit— the amendment application seeks an EA that is subject to the standard conditions for the relevant activity, to the extent it relates to the permit. The amendment application will only be assessed as a minor amendment (threshold) if all of the criteria above will be met under the amended EA.	Not applicable The application relates to an EA for a resource activity, not a exploration or greenhouse gas permit.

5 Likely Impact of Proposed Amendment on Environmental Values

In accordance with Section 226A(f) of the EP Act, an assessment of the likely impact of the proposed amendment on the environmental values is required, including-

i. A description of the environmental values likely to be affected by the proposed amendment; and,
ii. Details of emissions or releases likely to be generated by the proposed amendment; and
iii. A description of the risk and likely magnitude of impacts on the environmental values; and
iv. Details of the management practices proposed to be implemented to prevent of minimise adverse impacts; and
v. If a PRCP schedule does not apply for each relevant activity-details of how the land the subject of the application will be rehabilitated after each relevant activity ends.

Anglo's management practices including those required under the Current EA will not change a result of this amendment. DCN will continue implement its existing management plans and operating procedures to prevent and minimise environmental impacts.

5.1 Description of Environmental Values, Emissions and Releases

The proposed amendment is a reinstatement of previously approved post-mining land outcomes namely, water storage in residual voids. The proposed amendment will not result in a change to scale or intensity of the DCM (i.e. no change to the coal extraction rate, no new infrastructure and no new ground disturbance), or a change to the risk or magnitude of potential impacts on environmental values. This is detailed further below.

Air and acoustics

No air emissions, noise emissions, vibration or blasting will result from the proposed amendment. The operation will continue to be managed in accordance with the current EA Schedule B – Air and Schedule D – Noise conditions.

Ecology and land

No new infrastructure or ground disturbance will result from the proposed amendment, therefore there will be no impacts to ecological values or land as a result of the amendment. The operation will continue to be managed in accordance with the current EA land aspects of Schedule H – Land and Rehabilitation.

Waste

No additional waste will result from the proposed amendment. Waste from the operation will continue to be managed in accordance with the current Waste Management Plan and EA Schedule C – Waste conditions.

Water

Detailed environmental assessments have been completed to ensure that the reinstatement of water storage in final voids will not result in an increase in environmental impacts. The results of the assessments are summarised below.

Final Void Water Balance Modelling

Final void lake water balance modelling was undertaken to predict the final void lake water level and water quality (Total Dissolved Solids - TDS) in the post mining phase. The final void water balance modelling report is included in Appendix E . The modelling results indicate that the final void lake water levels will increase over time and reach the maximum equilibrium water levels shown in Table 3. The salinity of the final void lake water will increase over time due to evaporative concentration. The predicted Total Dissolved Solids (TDS) levels of the lake water after 100 years are well in excess of the guideline values for TDS in livestock drinking water (5,000 mg/L) (Livestock drinking water guidelines – Australia and New Zealand, 2023). The predicted maximum void lake water levels are well below the overflow levels of the final voids and hence the void lakes will not overflow to the downstream environment.

Table 3 Final Void Water Balance Modelling Results

Mining Area	Void ID	Pit Lake Equilibrium Level (m AHD)			Min Freeboard^ RL (m)	Predicted water quality (TDS*)
		Min	Median	Max		
North	**North Pit**	17	21	27	109	17,000
Central	**Pit 2**	72	73	76	50	12,000
	Pit 3-12	53	54	57	38	11,000
	Pit 13	81	83	92	44	15,000
	Pit 19	85	87	92	43	12,000
	Pit 24	92	93	99	32	29,000

^ to surface overflow

* in mg/L after 100 years

Groundwater Assessment

A Groundwater assessment including modelling of groundwater level recovery in the final void areas in the post mining phase was undertaken to understand any impacts as a result of the amendment. The report findings are included in Appendix F. The report concluded that the final voids will remain groundwater sinks in the post mining phase and hence there will be no seepage of final void lake water away from the final voids and no potential for contamination of surrounding aquifers.

****any other relevant details from KCB report to be inserted once available.***

Flood Modelling

None of the NUMAs for DCN are in floodplains. The Kianga Ck diversion is located close to the NUMA Pit 3-12. The diversion is rated for a 0.01% AEP event. Flood modelling confirmed the NUMA will remain isolated from the diversion if an event this size was to occur. The 0.1% AEP flood extents in relation to the DCN final landform in Figure 2 and Figure 3.

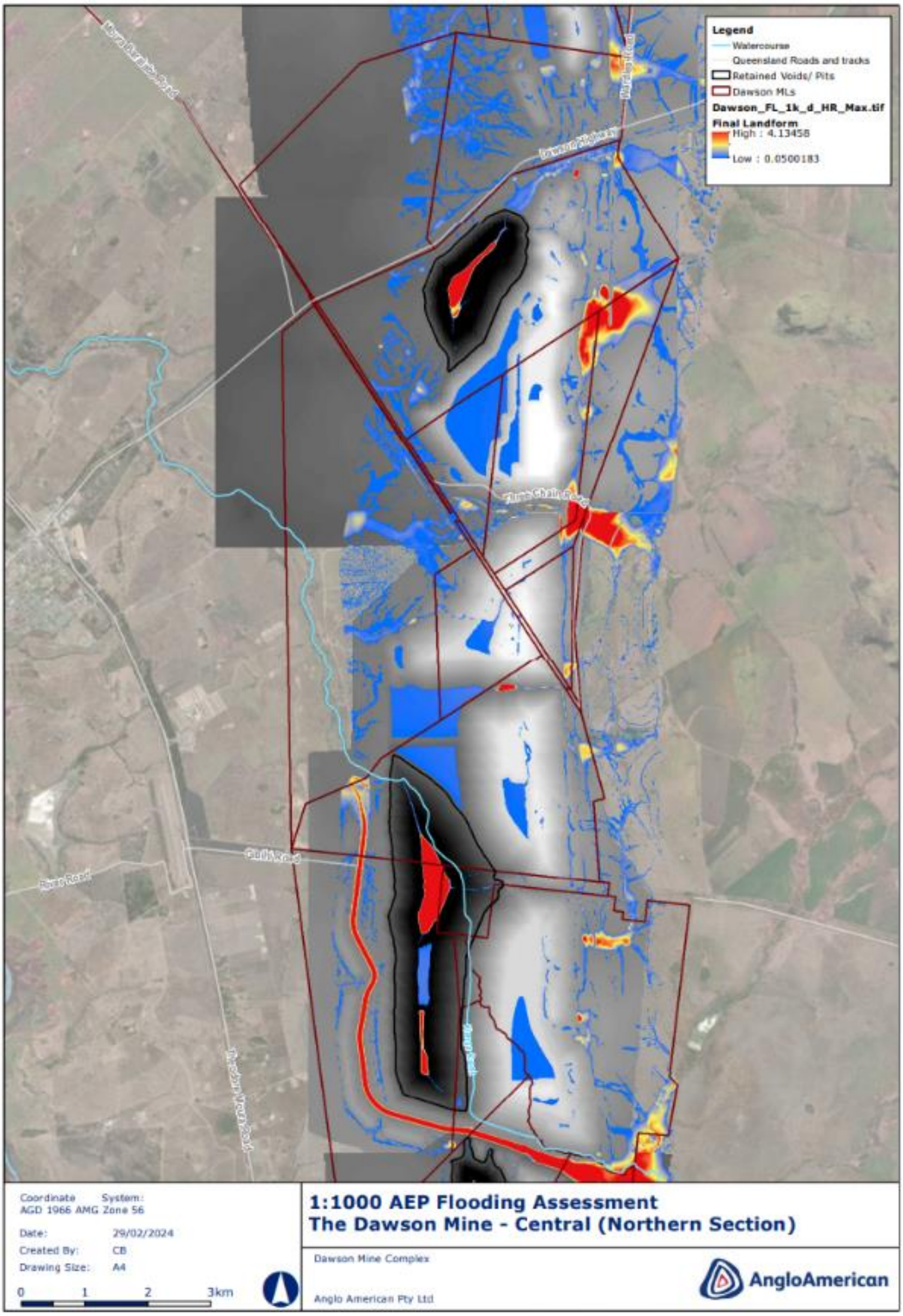


Figure 2 0.1% AEP flooding event in Kianga Ck Diversion in proximity to NUMA Pit 3-12

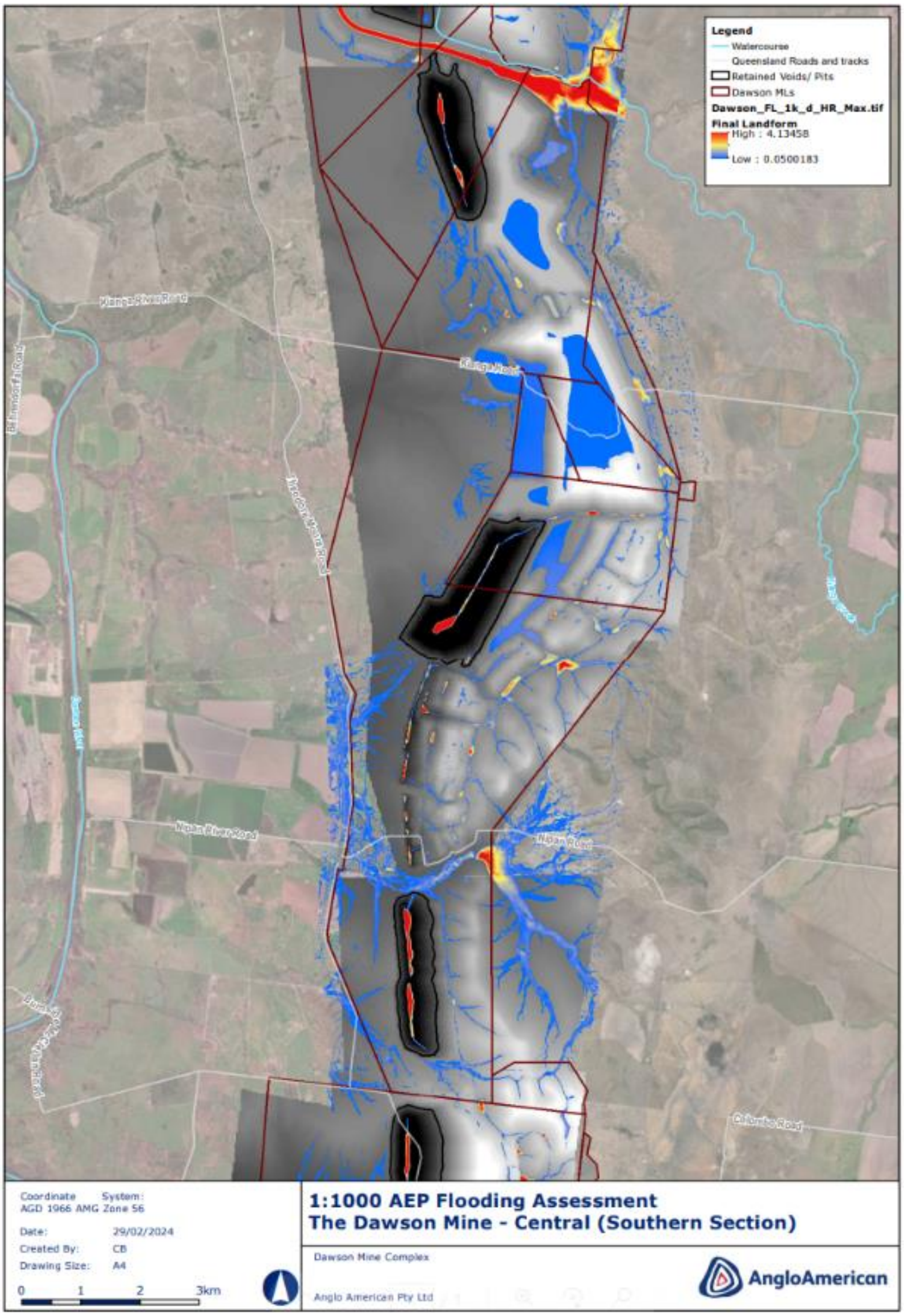


Figure 3 0.1% AEP Flooding Assessment (Southern Section)

Rehabilitation

The proposed amendment to EA Table H1 includes the specific rehabilitation requirements for final void NUMAs. The proposed rehabilitation goals for the final void NUMAs are to be stable and non-polluting. The groundwater assessment and final void water balance modelling results indicate that the proposed final void NUMAs will comply with these objectives and the associated completion criteria (refer to results summary in Table 3, Appendix E and Appendix F).

5.2 Standard Criteria

As set out in Schedule 4 of the EP Act, a number of standard criteria are required to be considered when assessing environmentally relevant activities under the Act. The ones most relevant to this application are discussed below:

- **the precautionary principle;**

The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage. It is considered that no scientific uncertainty exists in the proposed application, as it does not involve any novel management practices and is supported by a contemporary and cohesive technical report.

- **intergenerational equity;**

This standard criteria ensures advocation for the interests of future generations. It is considered that the proposed amendment involves no increase in the potential for undesirable impacts to future generations, given the adherence to the principal of ‘safe, stable and non-polluting’ and the technical assurance of the void’s hydraulic behaviour over time.

- **conservation of biological diversity and ecological integrity;**

There is no potential risk, directly or indirectly, to biological diversity and ecological integrity from the proposed amendment.

- **any Commonwealth or State government plans, standards, agreements or requirements about environmental protection or ecologically sustainable development;**

In March 2022, the Office of the Queensland Mine Rehabilitation Commissioner released a research brief entitled “Best practice approaches for rehabilitation and management of mine voids”. This document states that while backfilling may help minimise some closure risks, it may not always be possible or practical and that voids becoming filled with water can be used to generate potential opportunities for post-mining uses. If possible to achieve a ‘stable’ condition, a water-filled void is a legitimate land outcome. That is the case here.

- **any relevant environmental impact study, assessment or report;**

The application includes technical reports, by suitably qualified and experienced professionals, that supports the conclusions derived herein.

- **the character, resilience and values of the receiving environment;**

Risks to the environmental values of the receiving environment have been assessed and described in the supporting technical reports. No significant impacts are predicted, and the long-term outcome is considered to pose no threat to the surrounding environment.

- **the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument;**

As stated in the abovementioned research brief regarding the best practice approaches for rehabilitation and management of mine voids, it is not always possible or practical to backfill mine voids. In this case, it would significantly impact the viability of the mine to change the post-mining outcomes for the residual void at this stage of the mine life.

- **the public interest;**

It is understood that the general management of multiple mine voids across the state is of interest to the public of Queensland. It is considered a reasonable and defensible approach for a mine as large and old as DCN, which has rehabilitation outcomes generally in-keeping with established perceptions of best-practice, to retain safe, stable, water-filled voids. The continued viability of the mine is also in the public interest. It would significantly impact the viability of the mine to change the post-mining outcomes for the residual void at this stage of the mine life.

6 Review of EA Amendment Application Requirements

EP Act Requirement for an EA Amendment Application

As per section 226 of the EP Act, an amendment application must meet certain requirements to be considered a 'properly made application' under section 227AAA of the EP Act. This supporting information document, and the application overall, have been developed to meet the content requirements for an EA Amendment application, as outlined in section 226A and section 227AA of the EP Act.

The relevance of these requirements to this application, as well as how this supporting information document addresses any relevant requirements, is detailed below in Table 4.

Table 4 – Requirements of EA Amendment Application

EP Act Requirements	Where addressed
As per s226 – requirements of amendment application generally	
(1) An amendment application must — **(a) be made to the administering authority; and**	This amendment application is made to Department of Environment and Science and Innovation (**DESI**) as the administering authority.
(b) be in the approved form; and	The application will be submitted via Online Services.
(c) be accompanied by the fee prescribed by regulation; and	The prescribed application fee will be paid upon submission of the application.
(d) describe the proposed amendment; and	The proposed amendment is described in Section 3.
(e) describe the land that will be affected by the proposed amendment; and	The proposed amendment does not apply to a specific piece of land, rather it applies generally to

EP Act Requirements	Where addressed
	the GM EA and associated mining lease.
(f) include any other document relating to the application prescribed by regulation	Not Applicable. There are no other documents that have been prescribed under a regulation.
(2) However, subsection (1)(d) and (e) does not apply to an application for a condition conversion.	Not Applicable. This application is not for a condition conversion.
As per s226A - requirements for amendment applications for environmental authorities	
(1) If the amendment application is for the amendment of an environmental authority, the application must also — **(a) describe any development permits in effect under the Planning Act for carrying out the relevant activity for the authority; and**	Not Applicable A development permit under the Planning Act is not required for the mining activities authorised by the environmental authority.
(b) state whether each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity; and	Not Applicable The application relates to a site-specific EA and eligibility criteria do not apply.
(c) if the application states that each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity—include a declaration that the statement is correct; and	Not Applicable The application relates to a site-specific EA and eligibility criteria do not apply.
(d) state whether the application seeks to change a condition identified in the authority as a standard condition; and	Not Applicable The current EA does not contain any standard conditions and this amendment application does not seek to change or include a standard condition.
(e) if the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit; and	Not Applicable This amendment application does not relate to a new relevant resource tenure for the authority.
(f) include an assessment of the likely impact of the proposed amendment on the environmental values, including— **(i) a description of the environmental values likely to be affected by the proposed amendment; and**	An assessment of the likely impact of the proposed amendment on relevant environmental values is included in Section 5.

EP Act Requirements	Where addressed
(ii) details of emissions or releases likely to be generated by the proposed amendment; and **(iii) a description of the risk and likely magnitude of impacts on the environmental values; and** **(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and** **(v) if a PRCP schedule does not apply for each relevant activity—details of how the land the subject of the application will be rehabilitated after each relevant activity ends; and**	An assessment of emissions or releases likely to change because of the amendment is provided as Section 5. The environmental risks and impacts that are affected by the scope of the amendment is described in Section 5. Management practices proposed to be implemented are as detailed n Section 5. No PRCP Schedule is in place for the DM EA.
(g) include a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity;	No additional waste that wasn't already contemplated by the Current EA is expected to be generated by the proposed amendment. Refer to Section 5 for details.
(h) include details of any site management plan or environmental protection order that relates to the land the subject of the application.	Not Applicable There are no site management plans (approved under Chapter 7, Part 8 Contaminated Land of the EP Act) or environmental protection orders (under Section 368 of the EP Act) relating to the land the subject to this application.
(2) Subsection (1)(f) does not apply for any amendment application for an environmental authority if- **(a) either—** **(i) the process under chapter 3 for an EIS for the proposed amendment has been completed; or** **(ii) the Coordinator-General has evaluated an EIS for the proposed amendment and there are Coordinator-General's conditions that relate to the proposed amendment; and**	Not Applicable An EIS has not be completed for the amendment application, and is not considered to be warranted, as detailed in Section 4.
(b) an assessment of the environmental risk of the proposed amendment would be the same as the assessment in the EIS mentioned in paragraph (a)(i) or the evaluation mentioned in paragraph (a)(ii).	Not Applicable An EIS has not be completed for the amendment application, and is not considered to be warranted, as detailed in Section 4.
(3) Also, subsection (1)(a), (d), (e), (f), (g) and (h) does not apply to an application for a condition conversion.	Not Applicable. This application is not for a condition conversion.

EP Act Requirements	Where addressed
(4) Despite subsection (1)(f), (g) and (h), if the amendment application is for an environmental authority for the prescribed ERA mentioned in the Environmental Protection Regulation 2019, schedule 2, section 13A— **(a) it need only include the matters mentioned in subsection (1)(f)(i) to (iv), (g) and (h) to the extent the matters relate to fine sediment, or dissolved inorganic nitrogen, entering the water of the Great Barrier Reef or Great Barrier Reef catchment waters; and** **(b) subsection (1)(f)(v) does not apply for the amendment application.**	Not Applicable The amendment application does not relate to the prescribed ERA listed as section 13A of the EP Regulation (namely commercial cropping and horticulture in Great Barrier Reef catchment).
As per s227AA - requirements for amendment applications – underground water rights	
(1) This section applies for an amendment application if— **(a) the application relates to a site-specific environmental authority for—** **(i) a resource project that includes a resource tenure that is a mineral development licence, mining lease or petroleum lease; or** **(ii) a resource activity for which the relevant tenure is a mineral development licence, mining lease or petroleum lease; and** **(b) the proposed amendment involves changes to the exercise of underground water rights**	Not Applicable Although the amendment application does relate to a site-specific EA for a resource activity, it does not involve any change to the exercise of underground water rights).

Appendix A Pre-2014 Dawson Central and North EA

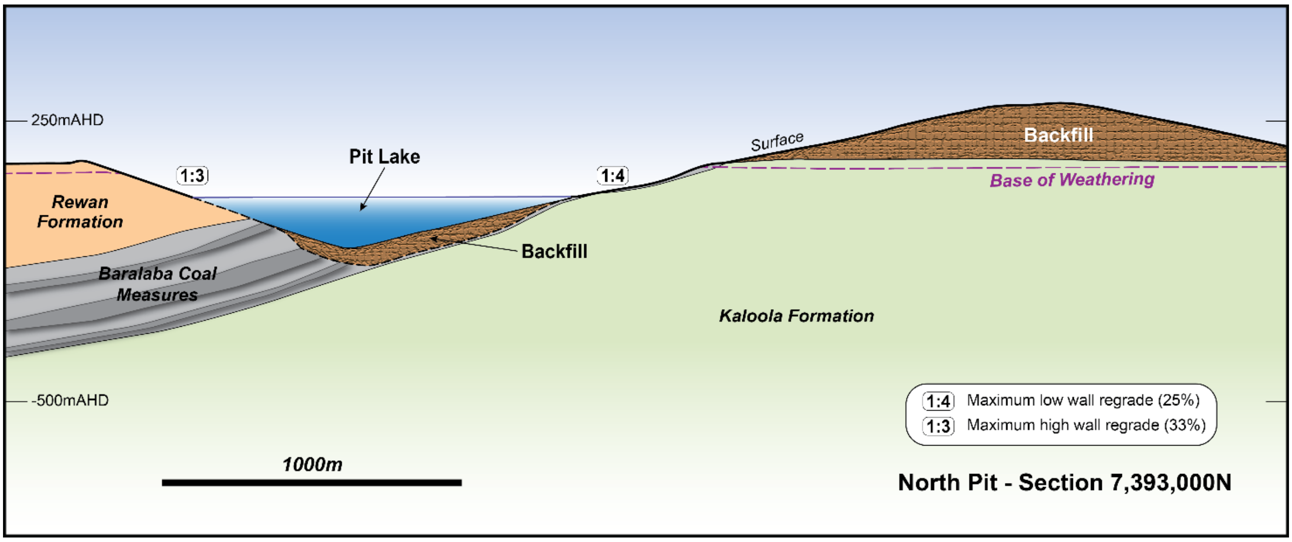
Appendix B EA Table H1 Tracked Changes

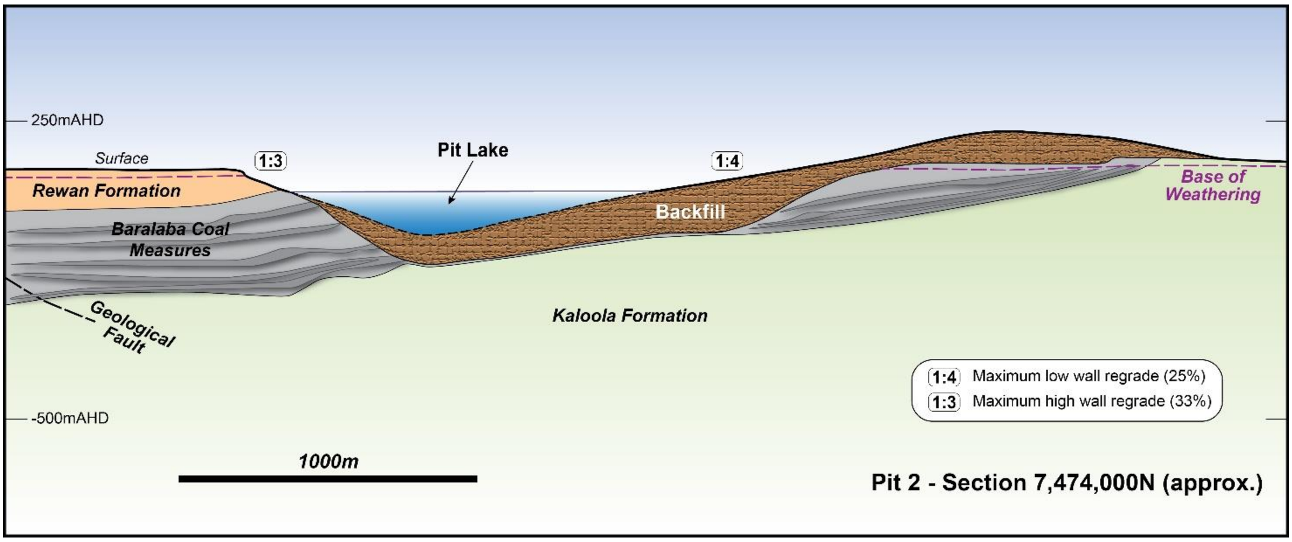
Table H1 – Rehabilitation requirements

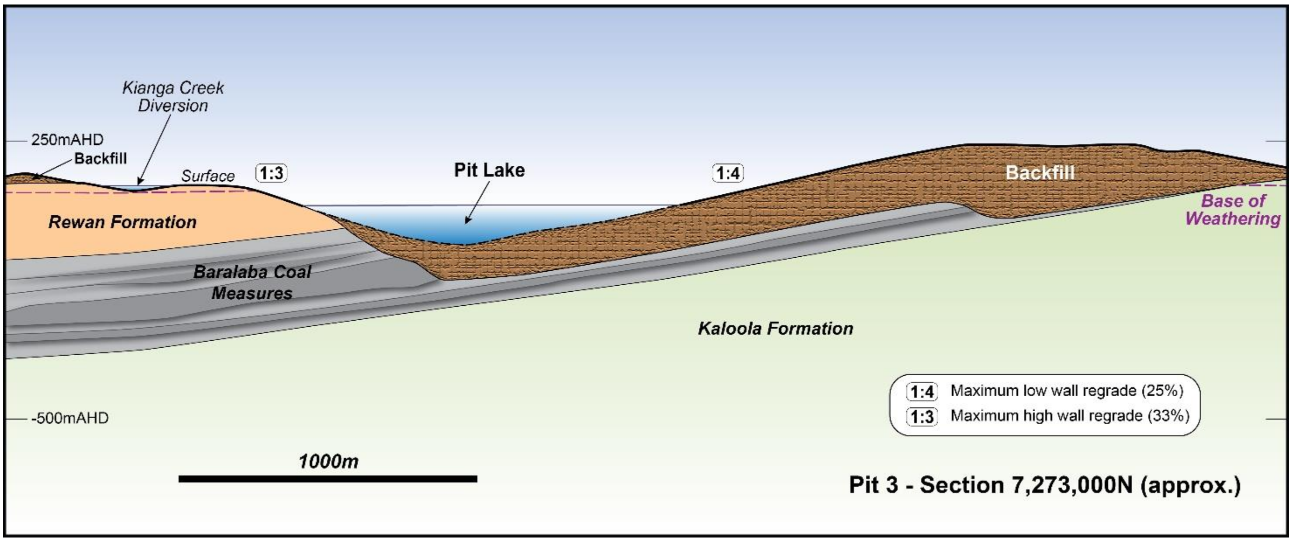
Mine Domain	**Mine Feature Name**	**Rehabilitation Goal**	**Rehabilitation Objectives**	**Indicators**	**Completion Criteria**
All Domains, with the exception of the Final Voids	All	Safe, stable, self-sustaining, non-polluting	~~Creation of native bushland ecosystem (3-5 yrs)~~ Bushland	Native plant species richness (total no. in RE)	15
				Non-eucalypt trees (stems per ha)	200
				Tree canopy cover (%)	30
				Native shrub cover (%)	20
				Native perennial grass cover (%)	20
				Organic litter cover (%)	~~60~~ ≥40
			~~Creation of semi evergreen vine thicket (3-5 yrs)~~	~~Cover of non-target species~~	~~<5~~
				~~Tree canopy cover (%)~~	~~30~~
				~~Native shrub cover (%)~~	~~10~~
				~~Organic litter cover (%)~~	~~5~~
			~~Creation of hardwood plantation (5 yrs)~~	~~Eucalypt density (stems per hectare)~~	~~850~~
				~~Mean annual increment (m^3/ha)~~	~~5~~
			Agriculture ~~(5 yrs)~~	Grass cover (%)	~~40-60~~ ≥40
				Biomass (kg/ha)	1000

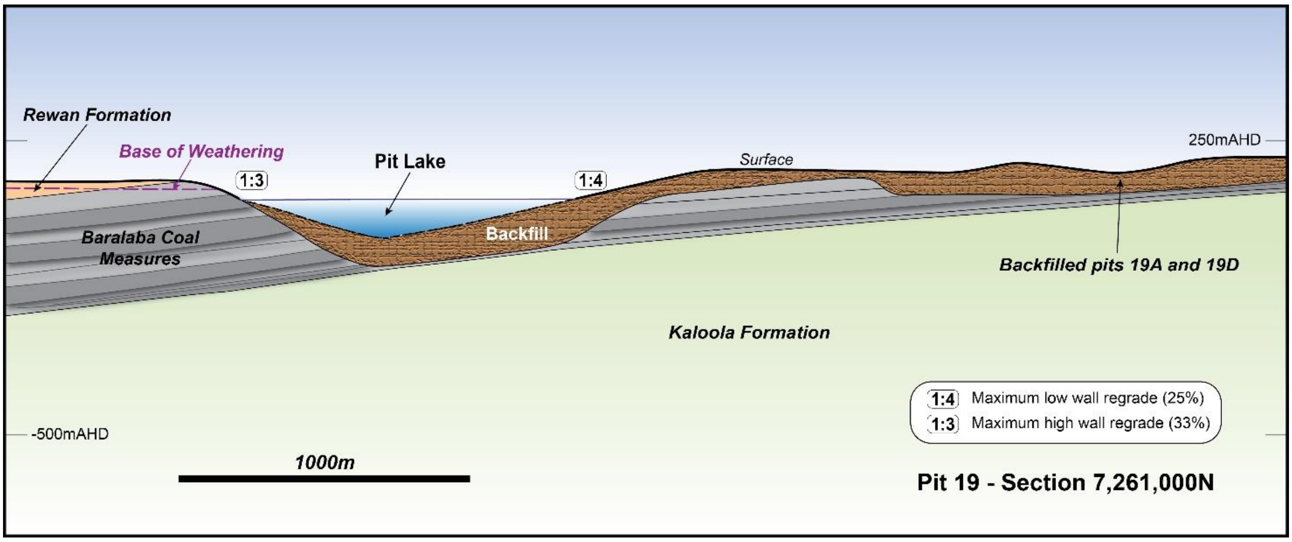
Mine Domain	Mine Feature Name	Rehabilitation Goal	Rehabilitation Objectives	Indicators	Completion Criteria
Final Void Non-use Management Area (NUMA) [see also Figure 2]	Residual Void	Safe and stable	Safe for humans and livestock	Geotechnically and erosionally stable	a) Maximum NUMA extent no greater than 1650ha projected surface area; b) Exposed coal seam is capped;
		Non-polluting	Void is a groundwater sink and does not overtop	Void modelling and monitoring	c) The void will not cause environmental harm outside of the relevant tenure boundary; d) The void water quality and quantity will not cause harm to the surrounding environment; e) Water levels within the residual voids are not predicted to exceed: a. North Pit - 66mRL b. Pit 2 - 116mRL c. Pit 3-12 - 94mRL d. Pit13 - 132mRL e. Pit 19 - 132mRL f. Pit 24 - 129mRL
		Self-sustaining	Not Applicable	Not Applicable	Not Applicable

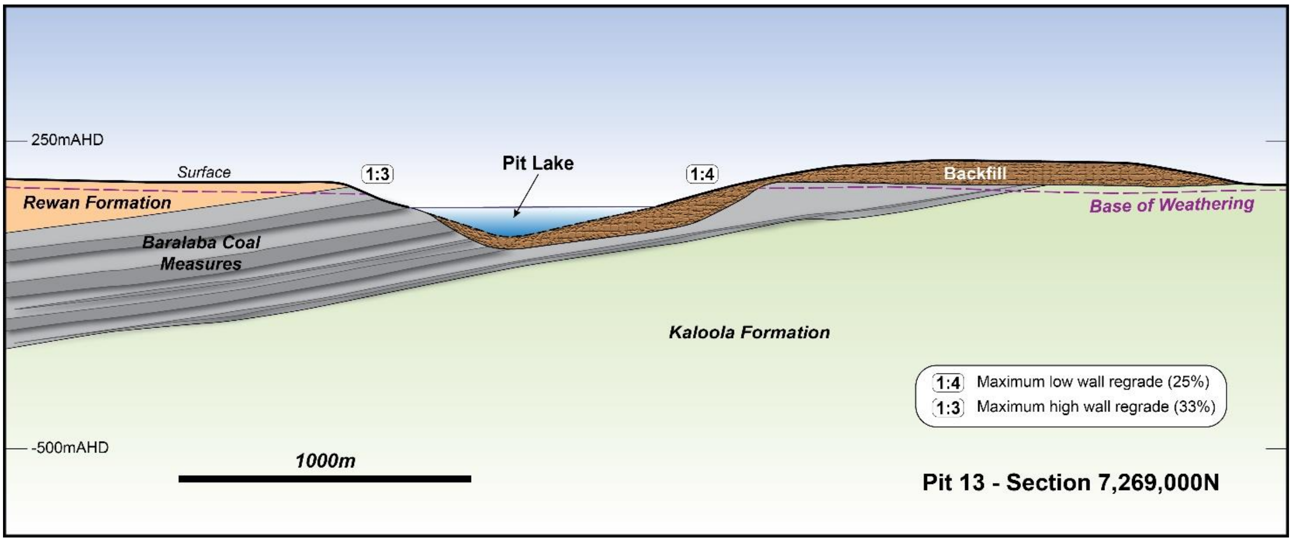
Appendix C NUMA conceptual sections

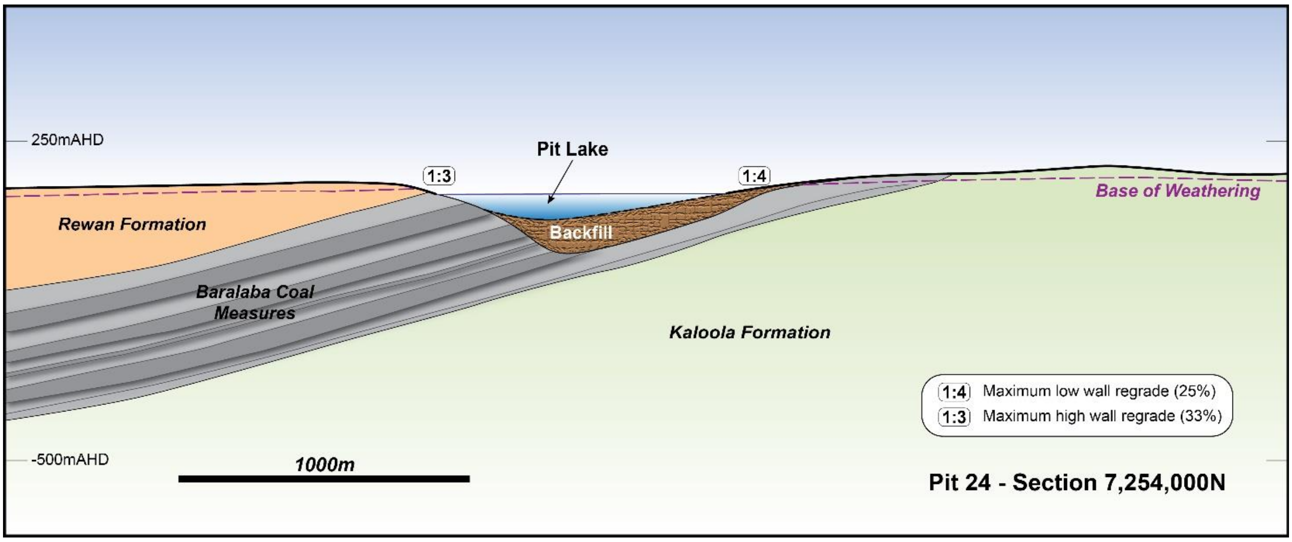




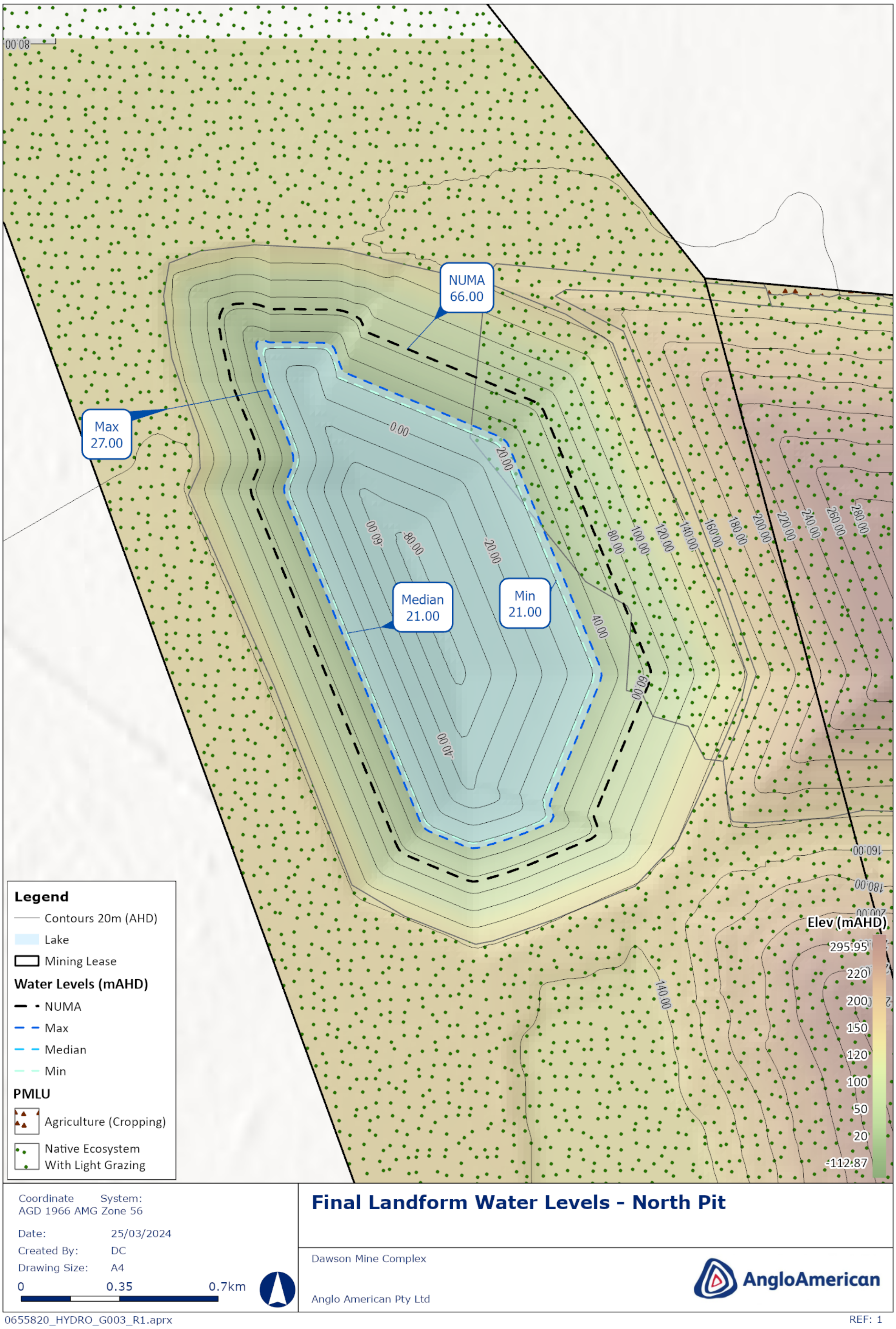


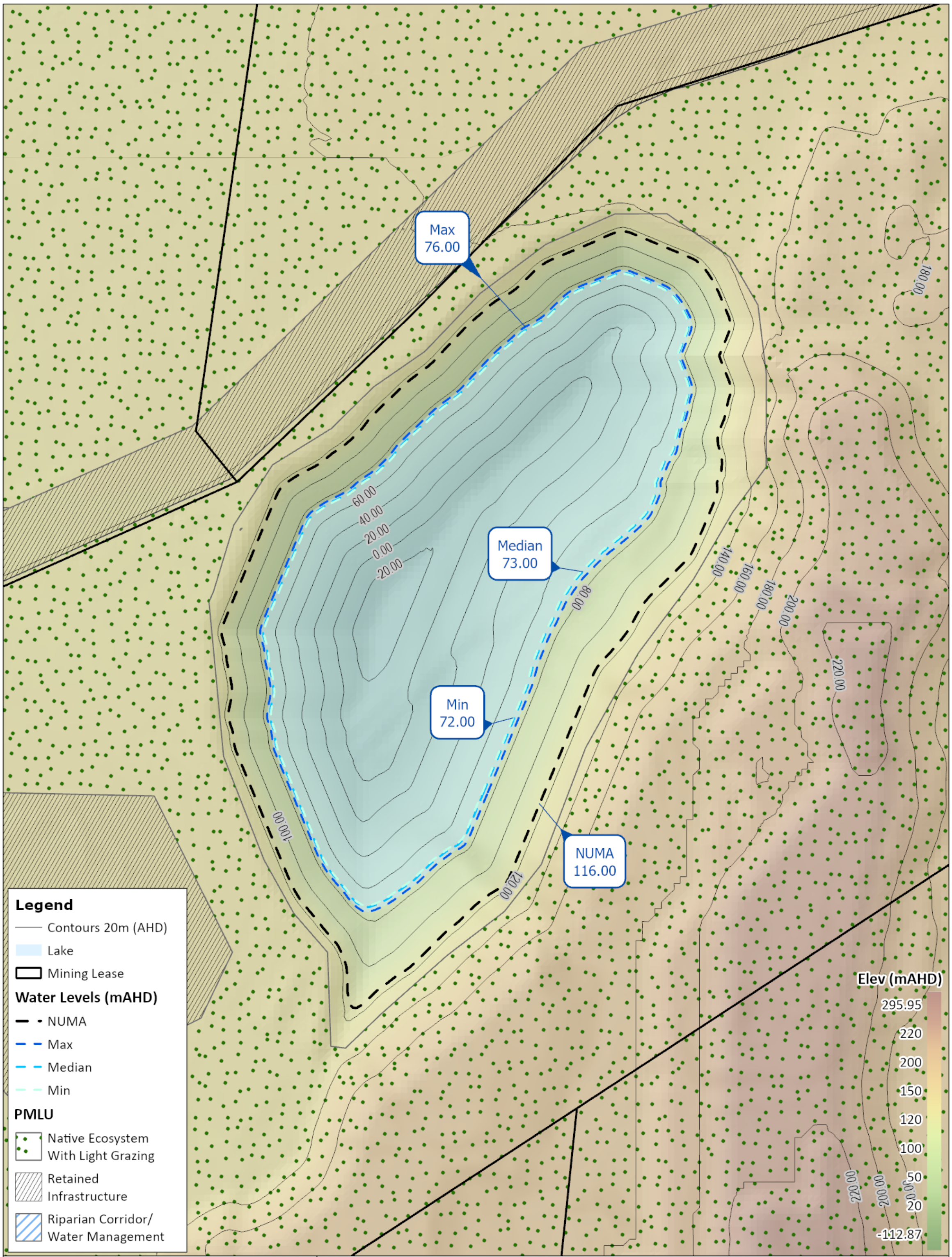

Rewan Formation
Base of Weathering
1:3
Pit Lake
1:4
Surface
250mAHD
Baralaba Coal Measures
Backfill
Backfilled pits 19A and 19D
Kaloola Formation
1:4 Maximum low wall regrade (25%)
1:3 Maximum high wall regrade (33%)
-500mAHD
1000m
Pit 19 - Section 7,261,000N


250mAHD
Surface
1:3
Pit Lake
1:4
Backfill
Rewan Formation
Base of Weathering
Baralaba Coal Measures
Kaloola Formation
1:4 Maximum low wall regrade (25%)
1:3 Maximum high wall regrade (33%)
-500mAHD
1000m
Pit 13 - Section 7,269,000N


250mAHD
Pit Lake
1:3
1:4
Base of Weathering
Rewan Formation
Backfill
Baralaba Coal Measures
Kaloola Formation
1:4 Maximum low wall regrade (25%)
1:3 Maximum high wall regrade (33%)
-500mAHD
1000m
Pit 24 - Section 7,254,000N

Appendix D NUMA Water Levels





Coordinate System: AGD 1966 AMG Zone 56

Date: 25/03/2024

Created By: DC

Drawing Size: A4

0 0.3 0.6km

Final Landform Water Levels - Pit 2

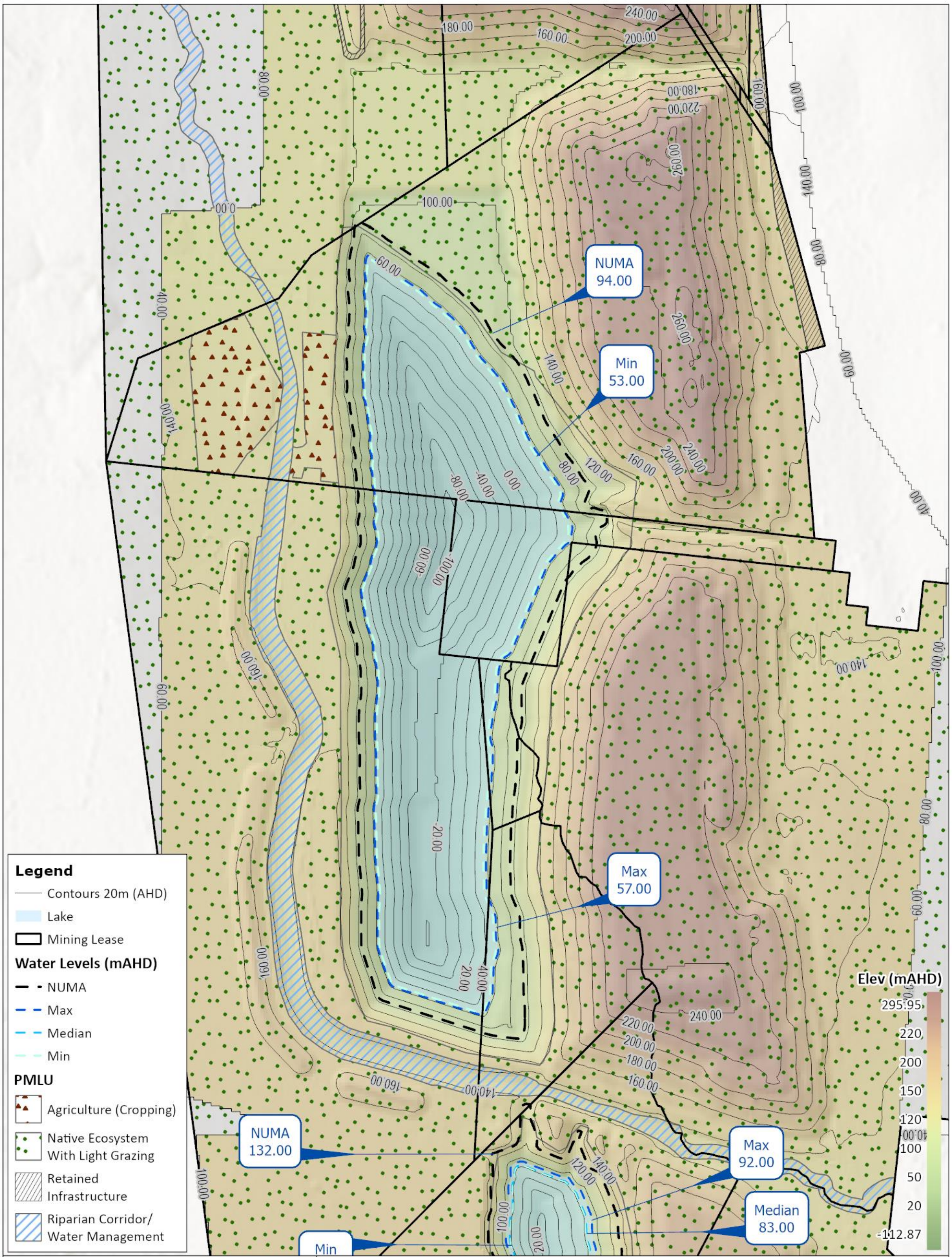
Dawson Mine Complex

Anglo American Pty Ltd

AngloAmerican

0655820_HYDRO_G003_R1.aprx

REF: 2



Coordinate System: AGD 1966 AMG Zone 56

Date: 25/03/2024

Created By: DC

Drawing Size: A4

0 0.7 1.4km

Final Landform Water Levels - Pit 03-12

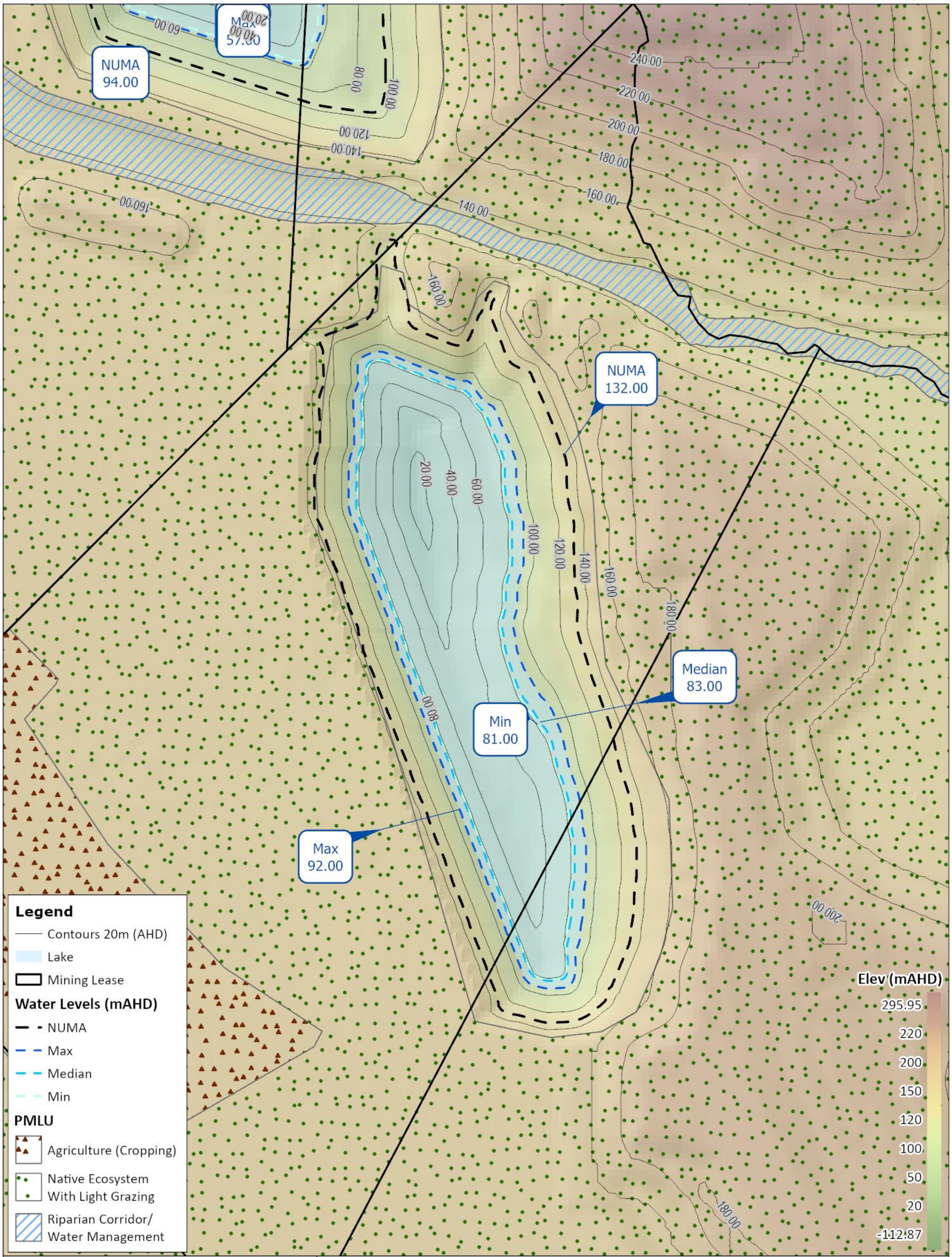
Dawson Mine Complex

Anglo American Pty Ltd

AngloAmerican

0655820_HYDRO_G003_R1.aprx

REF: 3



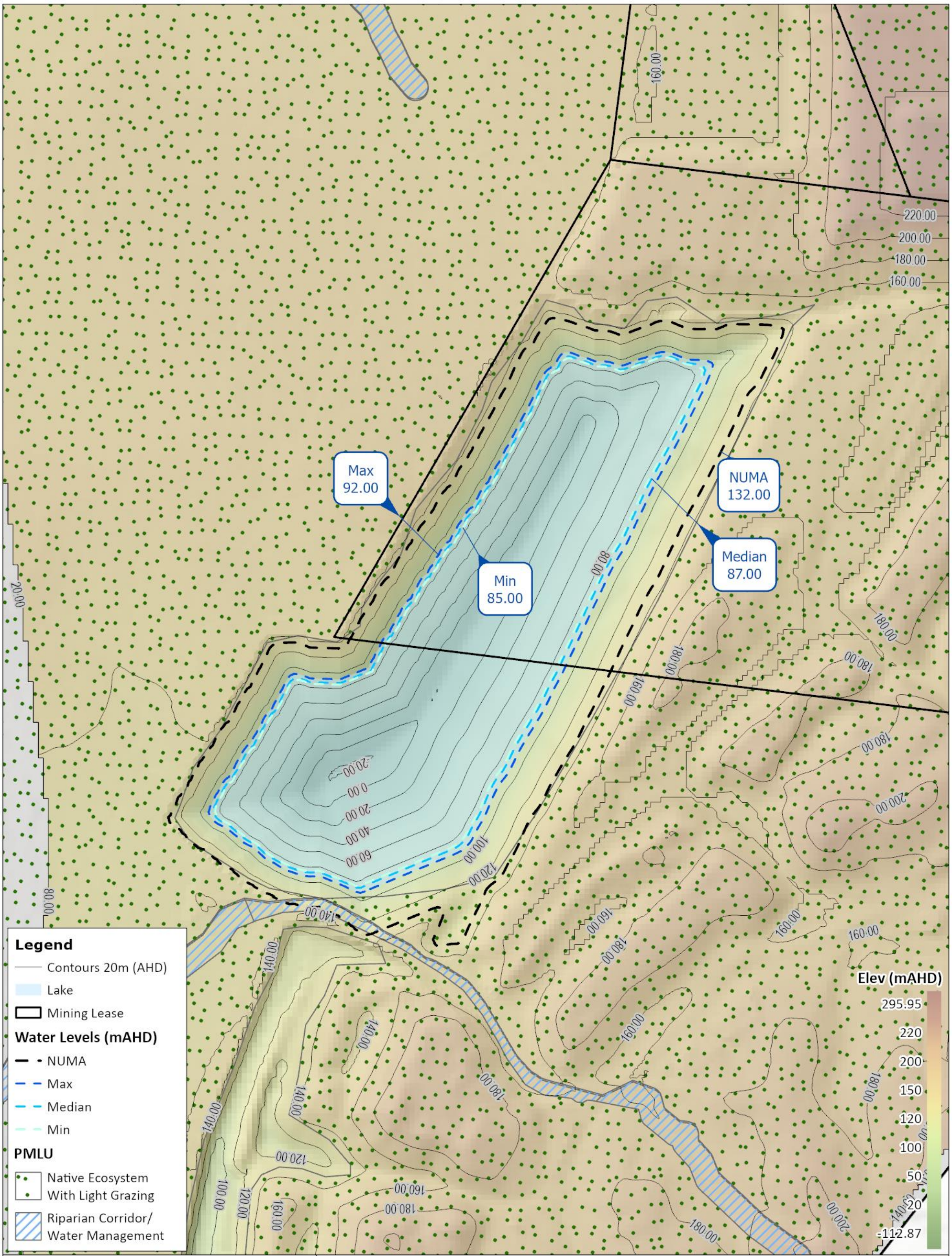
Final Landform Water Levels - Pit 13

Dawson Mine Complex

Anglo American Pty Ltd

0655820_HYDRO_G003_R1.aprx

REF: 4



Coordinate System: AGD 1966 AMG Zone 56

Date: 25/03/2024

Created By: DC

Drawing Size: A4

0 0.4 0.8km

Final Landform Water Levels - Pit 19

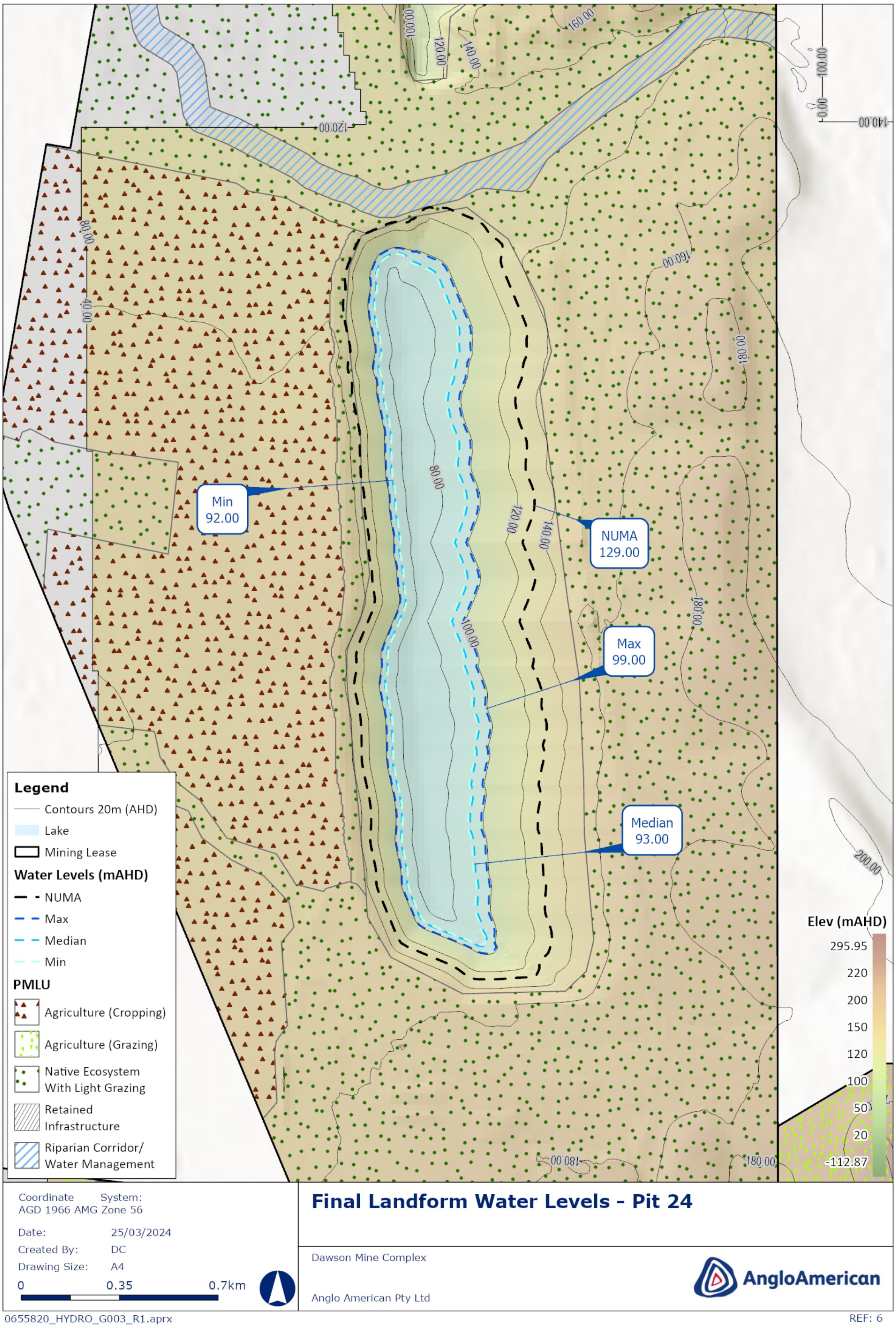
Dawson Mine Complex

Anglo American Pty Ltd

AngloAmerican

0655820_HYDRO_G003_R1.aprx

REF: 5


Min
92.00
NUMA
129.00
Max
99.00
Median
93.00
Legend
Contours 20m (AHD)
Lake
Mining Lease
Water Levels (mAHD)
NUMA
Max
Median
Min
PMLU
Agriculture (Cropping)
Agriculture (Grazing)
Native Ecosystem With Light Grazing
Retained Infrastructure
Riparian Corridor/ Water Management
Elev (mAHD)
295.95
220
200
150
120
100
50
20
-112.87
Coordinate System:
AGD 1966 AMG Zone 56
Date: 25/03/2024
Created By: DC
Drawing Size: A4
0 0.35 0.7km
Final Landform Water Levels - Pit 24
Dawson Mine Complex
Anglo American Pty Ltd
AngloAmerican
0655820_HYDRO_G003_R1.aprx
REF: 6

Appendix E Dawson Voids Water Quality Water Balance Modelling

Dawson Voids Water Quality Water Balance modelling

Post-Closure Water Quantity and Quality

PREPARED FOR
AASC

DATE
28 March 2024

REFERENCE
0655820

DOCUMENT DETAILS

DOCUMENT TITLE	Dawson Voids Water Quality Water Balance modelling
DOCUMENT SUBTITLE	Post-Closure Water Quantity and Quality
PROJECT NUMBER	0655820
Date	28 March 2024
Version	01
Author	Nathan Wang
Client name	AASC

DOCUMENT HISTORY

				ERM APPROVAL TO ISSUE		
VERSION	REVISION	AUTHOR	REVIEWED BY	NAME	DATE	COMMENTS
Draft	0	Nathan Wang	Chris Gimber	Chris Gimber	28-02-2024	Draft only- to be updated
Draft	1	Nathan Wang	Chris Gimber	Chris Gimber	28-03-24	Issued to client

SIGNATURE PAGE

Dawson Voids Water Quality Water Balance modelling

Post-Closure Water Quantity and Quality

0655820

[Double click to insert signature]	[Double click to insert signature]
Nathan Wang	**Chris Gimber**
Managing Consultant	Partner

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

Acronyms	Description
ACCESS	Australian Community Climate and Earth System Simulator
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ASL	Above sea level
AWBM	Australia Water Balance Model
DCN	Dawson Central / North Mine
DEM	Digital Elevation Model
DESI	Department of Environment, Science and Innovation
GIS	Geographic Information System
IPCC	Intergovernmental Panel on Climate Change's
mg/L	milligrams per litre
ML	Mining Lease
QA/QC	Quality Assurance / Quality Control
RCP	Representative Concentration Pathways
RL	Reduced Level
SRES	Special Report on Emission Scenarios
TDS	Total Dissolved Solids
TSF	Tailing Storage Facilities
°C	Degrees Celsius
µS/cm	Micro siemens per centimetres

1. MODEL APPROACH AND ASSUMPTIONS

The Post-Closure Water Quantity and Quality model for the Dawson Mining Complex (Dawson) was developed utilizing Goldsim software version 14.0 (Goldsim, 2021) and its contaminant transport module. Primary components influencing the hydrological equilibrium, inclusive of variables like precipitation, evaporation, and parameters inherent to the Australia Water Balance Model (AWBM), were derived from the 2022 update of the water balance model conducted by KCB. The groundwater flow inputs were simulated using a hydrogeological model, the specifics of which were furnished by KCB (see reference). Additionally, geochemical source terms pertaining to total dissolved solids (TDS) were integrated to proactively assess the water quality within each void.

1.1 CONCEPTUAL MODEL

Figure 1 shows the conceptual model of the water balance during post-closure. The key inflows and outflows are:

- Inflow
  - Precipitation on the water surface
  - Surface runoff from the surrounding catchments
  - Surface runoff and baseflow from the pit shell not inundated by the pit lake
  - Baseflow and seepages from the surrounding catchment and spoils
  - Groundwater inflow
- Outflow
  - Evaporation from the free water surface
  - Groundwater outflow (where relevant)

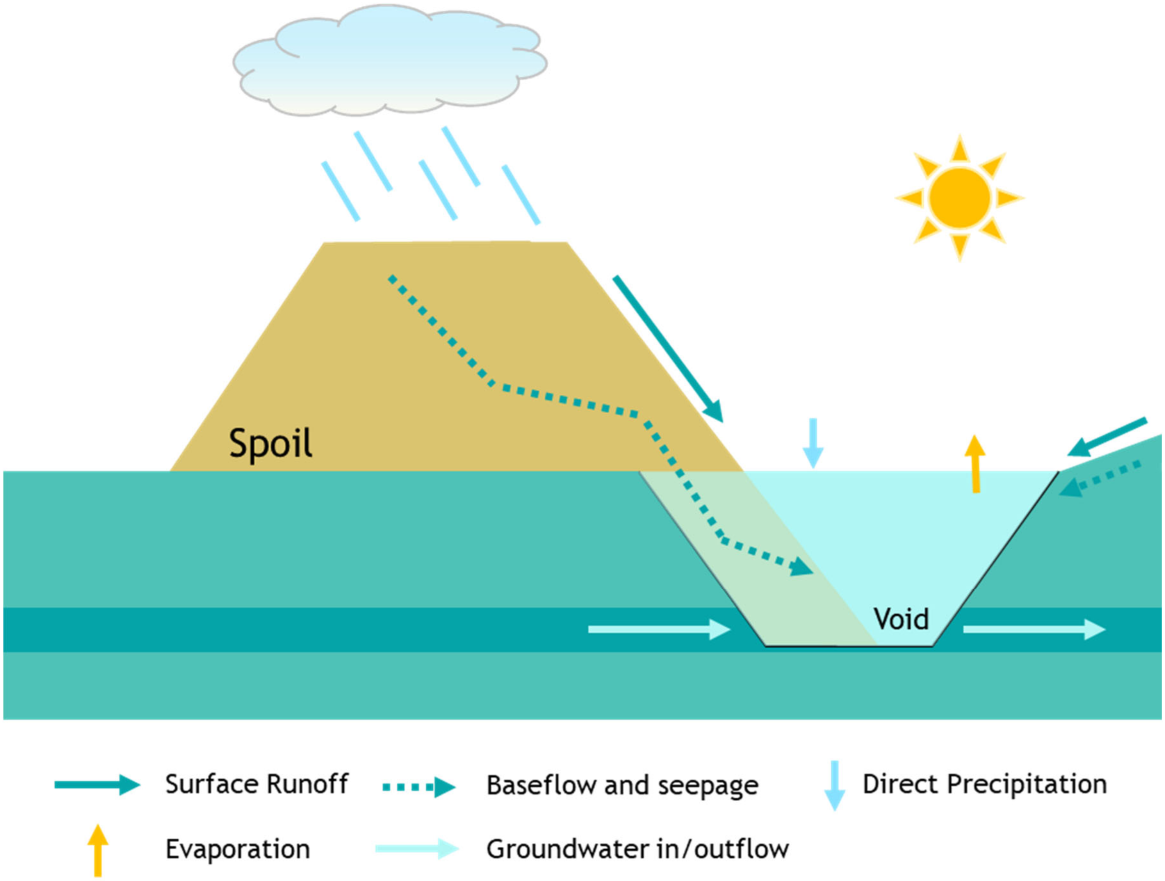


FIGURE 1-1 CONCEPTUAL FLOW DIAGRAM OF DAWSON VOIDS WATER BALANCE AND QUALITY MODEL.

1.2 MODEL SETUP AND ASSUMPTIONS

In the water balance model, water flow and storage change were calculated for each void based on the following equation:

$$S_t = S_{t-1} + RO_s + RO_b + GW_i + P - E - GW_o$$

Where:

S_t=Water volume of the void at time step t;

RO_s = inflow of surface runoff;

RO_b = inflow of baseflow, including seepage from surrounding spoils;

GW_i = groundwater inflow;

P= direct precipitation;

E= evaporation;

GW_o= Groundwater outflow.

The computation of direct precipitation and evaporation from the water surface was predicated on the temporal variation in the surface water area. Within the modeling framework principal inflows encompassing surface runoff and baseflow were determined utilizing the AWBM. The model employed three surface stores to emulate distinct runoff areas within the catchment. Saturation overland flow was conceptualized as the residual rainfall surplus subsequent to the replenishment of the catchment's surface storage capacity. The extent of rainfall abstraction was contingent upon the antecedent moisture conditions of the catchment. The model executed the water balance assessment for each distinct area on a daily basis. At each time increment, rainfall contributed to each of the three surface stores, while evaporation was subtracted from each store. In instances where the stored water exceeded the designated capacity, surplus water translated into runoff. A portion of the excess runoff could potentially recharge the baseflow store, contingent upon the presence of a baseflow component. A schematic representation of the AWBM model is depicted in Figure 2. The parameters utilized in the AWBM, as detailed in Table 1, were derived from the updated Dawson water balance model of 2022.

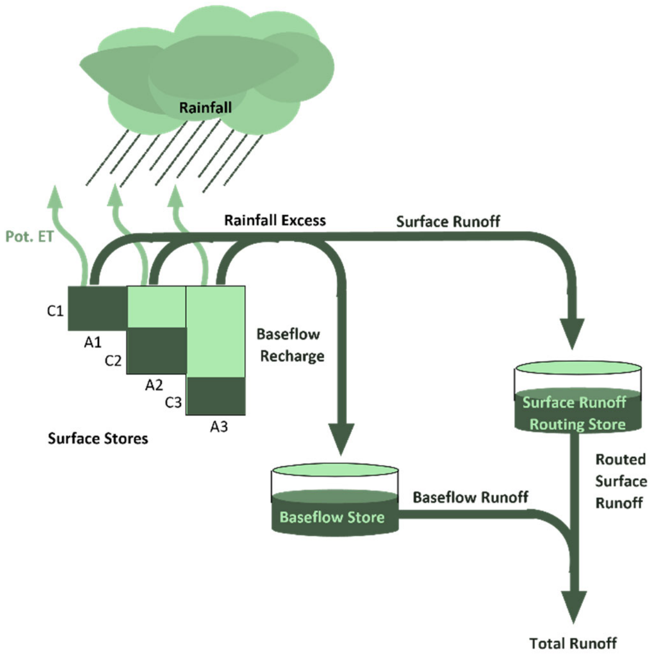
The following assumptions were relevant to the assessment, and justification is provided below:

1. Each void was treated as an isolated entity in the water balance model, with interactions assessed through the groundwater model inputs to the water balance model.

2. Two land types were adopted for the hydrology model based on the catchment response - spoil and pit wall.

3. The water representation within each void encompasses both the unconfined water within the void and the pore water within the waste rock positioned in the pit shell. The water level was determined by considering the storage curve of each pit shell, accounting for both the unconfined water and pore water. However, the computation of evaporation exclusively considered the surface area of the unconfined water.

4. The pore water level in the waste rock within each pit follows the movement of the free water level in each void, maintaining a consistent relationship between them.



.

FIGURE 1-2 SCHEMATIC DIAGRAM OF AWBM

In the computation of water quality, the mass load, derived from the integration of water quality source terms and flow rates, was incorporated into each water stream. The intricate calculations pertaining to mass loading and its release into the water column were entirely adopted from the 2022 update of the water balance model. (Engeny, 2023).

TABLE 1-1 AWBM PARAMETERS

Parameter	Unit	Mining Pit	Rehabilitated	Spoil
C1	mm	12	30	15
C2	mm	38	80	55
C3	mm	0	200	120
A1	-	0.1	0.134	0.134
A2	-	0.9	0.433	0.433
A3	-	0	0.433	0.433
BFI	-	0	0.5	0.5
Kb	-	0	0.95	0.95
Ks	-	0	0	0

1.3 MODEL SCENARIOS

Model scenarios were conducted with different catchment sizes derived from the final landform and climate data:

Scenario 1: Flow from original Catchment only.

Scenario 2: Flow from original Catchment, with baseflow from spoils nearby (e.g. pit shell area).

Scenario 3: Flow from original Catchment, with baseflow from spoils nearby (e.g. pit shell area) under climate change condition.

1.4 MODEL INPUTS

1.4.1 WATER BALANCE MODEL

The description of water balance inputs including catchment size, geometric information of voids, groundwater flow, along with climate data were summarized in Table 1-2 The coefficients used in AWBM model adopted from the 2022 water balance model were listed in Table 1-2.

TABLE 1-2 WATER BALANCE INPUTS

Input	details	source
Precipitation and evaporation	Historic data covers the period of January 1889 to January 2023 (134 years).	SILO database facility hosted by the Queensland Department of Environment and Science (DES).
Groundwater flow	Timeseries of in/outflow	predicted by a hydrogeologic model and provided by KCB
Geometric information	Storage curve of eight voids, catchment size	Derived from the digital elevation model (DEM) of the final landform

1.4.1.1 CLIMATE INPUT

Inputs for precipitation and evaporation in the Dawson north, center, and south regions were compiled based on long-term historical rainfall and Morton evaporation time-series obtained from the SILO Data Drill service. The SILO Data Drill service extracts gridded climate data interpolated from point observations hosted by the Bureau of Meteorology (BoM). A dataset spanning 134 years, from 1889 to 2023, was utilized in the Monte Carlo model run, incorporating repeated and shifted historical data. The catchment's evaporation was determined by applying a constant ratio of 0.95 to the daily lake evaporation time series. The monthly averages of precipitation and lake evaporation are presented in Table 1-3.

TABLE 1-3 MONTHLY AVERAGE OF PRECIPITATION AND LAKE EVAPORATION APPLIED TO THE DAWSON SITE.

Month	Precipitation			Lake Evaporation		
	North	Center	South	North	Center	South
	mm	mm	mm	mm	mm	mm
Jan	98	96	100	200	200	200
Feb	91	86	91	167	167	167
Mar	68	63	62	163	163	163
Apr	38	36	36	126	125	124
May	33	32	34	93	93	92
Jun	34	34	37	72	71	70
Jul	29	28	30	81	80	79
Aug	21	21	23	108	108	107
Sep	27	27	29	141	140	140
Oct	53	53	55	178	177	176
Nov	67	69	71	192	191	191
Dec	94	88	90	206	206	206
Annual	652	635	657	1728	1722	1713

1.4.1.2 CLIMATE CHANGE SCENARIOS

In the context of the Intergovernmental Panel on Climate Change's (IPCC Fifth Assessment Report AR5), novel Representative Concentration Pathways (RCPs) were introduced to supersede the preceding emission scenarios outlined in the Special Report on Emission Scenarios (SRES)(IPCC, 2013). Diverging from the SRES, the four endorsed RCPs delineate trajectories of greenhouse gas concentrations, as opposed to emissions trajectories. These scenarios, namely RCP2.6, RCP4.5, RCP6, and RCP8.5, corresponding to radiative target forcing levels of +2.6, +4.5, +6.0, and +8.5 W/m^2, respectively, derive their nomenclature from the radiative forcing target for the year 2100. This target is predicated on the forcing exerted by greenhouse gases and other agents, relative to pre-industrial levels (Van et. al., 2011). Figure 3 depicts the concentrations of all forcing agents, expressed in parts per million (ppm) of CO2-equivalence, across the four RCP scenarios.

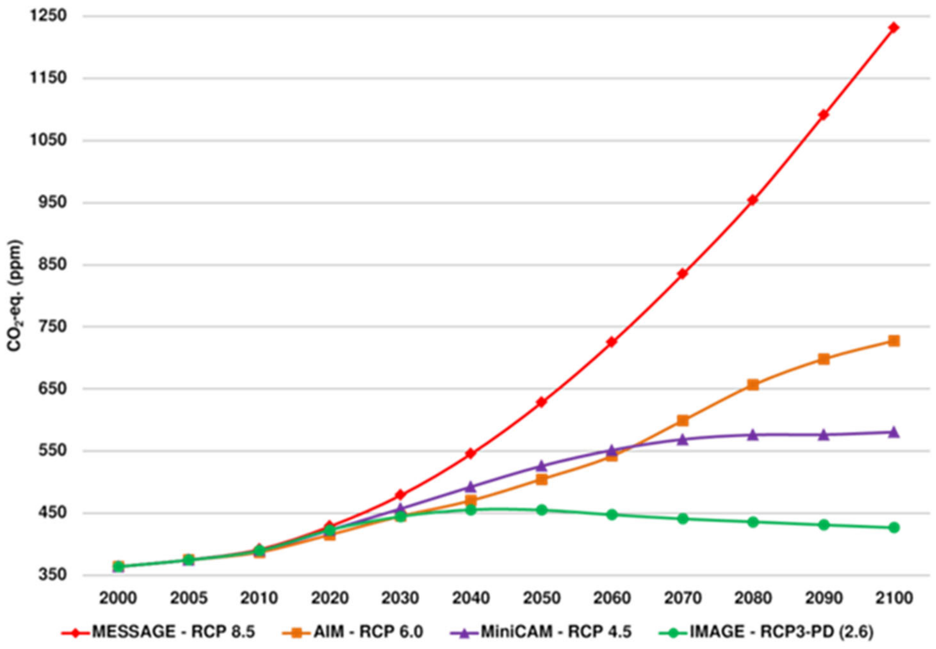


FIGURE 1-3 ALL FORCING AGENTS' ATMOSPHERIC CO2-EQUIVALENT CONCENTRATIONS ACCORDING TO FOUR RCP SCENARIOS.

The Queensland Future Climate Dashboard presented downscaled climate data corresponding to two climate change scenarios, namely RCP8.5 and RCP4.5. Each scenario entailed the provision of 12 model outcomes pertaining to alterations in precipitation and evaporation within the central Queensland region. Within this array of models, the predictions derived from the Australian Community Climate and Earth System Simulator (ACCESS) model, specifically ACCESS1-3 under the RCP 8.5 scenario, were employed in this investigation to assess the impact of climate change on the Dawson void. The percentage shifts in precipitation and evaporation from the year 2020 to 2100 are delineated in Table 1-4 and Table 1-5. These percentage alterations were subsequently applied to the historical climate data inputs within the specified scenario.

TABLE 1-4 CHANGE OF PRECIPITATION PREDICTED BY ACCESS 1-3 MODEL UNDER RCP8.5 SCENARIO FROM 2020 TO 2100.

Month	**2020-2039**	**2040-2059**	**2060-2079**	**2080-2099**
	% change	% change	% change	% change
Jan	2.7	-4.5	9	15
Feb	2.7	-4.5	9	15
Mar	-9.1	-15	-31	-10
Apr	-9.1	-15	-31	-10
May	-9.1	-15	-31	-10
Jun	1.2	16	-33	-23
Jul	1.2	16	-33	-23

Month	2020-2039	2040-2059	2060-2079	2080-2099
	% change	% change	% change	% change
Aug	1.2	16	-33	-23
Sep	40	-5.6	-10	-33
Oct	40	-5.6	-10	-33
Nov	40	-5.6	-10	-33
Dec	2.7	-4.5	9	15

TABLE 1-5 CHANGE OF EVAPORATION PREDICTED BY ACCESS 1-3 MODEL UNDER RCP8.5 SCENARIO FROM 2020 TO 2100.

Month	2020-2039	2040-2059	2060-2079	2080-2099
	% change	% change	% change	% change
Jan	13	26	28	34
Feb	13	26	28	34
Mar	12	22	36	39
Apr	12	22	36	39
May	12	22	36	39
Jun	11	17	36	40
Jul	11	17	36	40
Aug	11	17	36	40
Sep	3.6	20	32	43
Oct	3.6	20	32	43
Nov	3.6	20	32	43
Dec	13	26	28	34

1.4.1.3 GROUNDWATER FLOW

The associations between water level and groundwater flow rates for each pit shell were provided by KCB and are visually depicted in Appendix B. According to the data, the overarching trend suggests a rise in groundwater inflow as water levels decrease, with the exception of pits in the South mining area. Significantly, Pit 25 and Pit 28 exhibit a projected increase in groundwater inflow concurrent with the elevation of water levels.

1.4.1.4 CATCHMENT SIZE AND STORAGE CURVE

The catchment size, area of each void, elevation of bottom and crest of each void were all delineated and derived from the final landform DEM file received. The summarized information for each void are listed in Table 1-6.

Since the voids are generally surrounded by backfill of the mining shell, base flow from the waste rock placed in the mining pit was assumed to report the final void even the surface landscape of these area is not part of the catchment of the void for scenarios 2 and 3. The extra spoil size of each void was derived from the final landscape surface and prime surface after mining, and listed in Table 1-6.

TABLE 1-6 GEOMETRIC INPUTS OF EACH VOID AND CORESPONDING CATCHMENT

Void name	Catchment size	Extra Spoil size	Max surface area	Max depth
	ha	ha	ha	m
Northern Pit	282	558	344	221
Pit 2	402	371	242	163
Pit3-12	1307	823	634	208
Pit 13	581	370	188	121
Pit 19	814	1225	275	157
Pit 24	120	351	160	68
Pit 25	184	170	162	88
Pit 28	170	600	152	94

1.4.1.5 STORAGE CURVE

The water area-depth curves for the voids were derived using the DEM file representing the final landform. These curves were employed to calculate the free water surface in the model for evaluating evaporation loss. However, the calculation of the void's water level utilized a distinct storage curve. Since most voids are situated on partially filled mining pits, the water level is influenced by the high porosity of the waste rock surrounding the final void. In brief, the assumption was made that the pit would receive all the inflow, and the surface of the free water in the void would ascend in tandem with the water table in the waste rock. In this study, the storage curve considered both the free water column and the pore water in the waste rock within the pit shell. A uniform porosity of 0.4 was assumed and applied to all waste rock in the pit. The storage curves for each void, representing the void alone and the void with additional pore water, have been graphically presented for each void in Appendix A.

1.4.2 WATER QUALITY MODEL

Table 8 consolidates the constant TDS values allocated to runoff from individual sub-catchments, along with values for precipitation and groundwater inflow. The entirety of this data is derived from the 2022 water balance model update conducted by KCB, which is based on a calibrated operational site water balance model.

TABLE 1-7 WATER QUALITY INPUTS

Water type	TDS (mg/L)
Land use Runoff water quality	
Mining Pit	6000
Spoil	6000
Rehabilitated spoil	4000
Other water	
Precipitation	30
Groundwater	8000

2. MODEL RESULTS

2.1 WATER LEVEL

The model outcomes indicate that the water levels in all voids will stabilize after varying durations under the different scenarios assessed. The projected minimum, median, and maximum equilibrium water levels for three scenarios have been documented in Table 2-1. Additionally, the minimum freeboard required to prevent overflow, listed in Table 2-2 for three scenarios, and the estimated time needed to attain equilibrium water levels, presented in Table 11. The changes in water levels for each void post-mining are illustrated in Appendix C.

As per the model results, there is no chance of future overflow in these voids based on the current model configuration. In general, water levels are low for all the voids, especially if only the original catchment size were considered. The minimum predicted freeboard is 32 meters in Pit 24, while the North pit is anticipated to have the largest freeboard, exceeding 100 meters in all three scenarios. Under the climate change scenario, an elevated evaporation rate is expected to expedite the attainment of water level equilibrium for most voids, excluding Pit 2, Pit 3-12, and Pit 28, as these voids possess smaller surface area/volume ratios.

TABLE 2-1 MINIMUM, MEDIAN AND MAXIMUM EQUILIBRIUM WATER LEVEL PREDICTED FOR EACH VOID.

Mining Area	Void ID	Equilibrium Level (m AHD)								
		Scenario 1			Scenario 2			Scenario 3		
		Min	Med	Max	Min	Med	Max	Min	Med	Max
North	North Pit	7	10	15	17	21	27	0	2	7
Center	Pit 2	71	72	75	72	73	76	50	51	55
	Pit 3-12	52	53	56	53	54	57	20	22	25
	Pit 13	75	77	85	81	83	92	59	61	70
	Pit 19	66	68	73	85	87	92	49	52	59
	Pit 24	89	90	94	92	93	99	82	84	89
South	Pit 25	71	73	76	76	78	81	61	63	67
	Pit 28	78	79	80	79	80	83	72	75	77

TABLE 2-2 MINIMUM FREEBOARD PREDICTED FOR EACH VOID.

Mining Area	Void ID	Min Freeboard to Surface Overflow RL (m)		
		Scenario 1	Scenario 2	Scenario 3
North	North Pit	121	109	129
Center	Pit 2	51	50	71
	Pit 3-12	39	38	70
	Pit 13	51	44	66
	Pit 19	62	43	76
	Pit 24	37	32	42
South	Pit 25	59	54	68
	Pit 28	50	47	53

TABLE 2-3 ESTIMATED TIME TO REACH WATER LEVEL EQUILLIBRIUM FOR EACH VOID.

Mining Area	Void ID	Estimated Time to Reach Equilibrium (years.)		
		Scenario 1	Scenario 2	Scenario 3
North	North Pit	120	240	80
Center	Pit 2	240	200	280
	Pit 3-12	300	240	320
	Pit 13	250	280	60
	Pit 19	450	450	150
	Pit 24	100	100	80
South	Pit 25	280	320	100
	Pit 28	320	120	300

2.2 WATER QUALITY

The water quality is anticipated to exhibit a sustained upward trend in each void. This trend is attributed to the concentrating effect induced by the high evaporation rate. The projected TDS concentrations for each void after 100 years are presented in Table 2-4. Generally, a higher TDS corresponds to a greater surface area/volume ratio of the void. Concentration of TDS predicted in Scenario 3 are higher than other two scenarios because climate change condition has the highest evaporation rate. Concentration predicted by Scenarios 1 and 2 are similar. The changes in TDS for each void are graphically represented in the plot found in Appendix D.

The water quality computation employed in this study relies on straightforward assumptions, including a fully mixed water column and conservative mass loading. Nevertheless, the TDS of the water does not indefinitely increase; it precipitates out as a salt when it reaches the saturation limit. Based on the ionic composition this is not expected to occur for any salt species until at least 100,000 mg/l, and widespread precipitation is not expected until concentrations approach mid 200,000 mg/l. Furthermore, the simplistic assumption of a fully mixed water body is not applicable in these deep voids. Stratification is expected to occur in the water column, and a concentration gradient will exist between the free water body and the pore water of the spoil in the pit shell. To accurately predict water quality at various locations within each void, a more sophisticated model must be employed.

TABLE 2-4 PROJECTED TDS CONCENTRATIONS FOR EACH VOID AFTER 100 YEARS

Mining Area	Void ID	TDS after 100 years (mg/L)		
		Scenario 1	Scenario 2	Scenario 3
North	North Pit	18,000	17,000	24,000
Center	Pit 2	12,000	12,000	16,000
	Pit 3-12	11,000	11,000	14,000
	Pit 13	15,000	15,000	22,000
	Pit 19	12,000	12,000	16,000
	Pit 24	30,000	29,000	48,000
South	Pit 25	19,000	18,000	32,000
	Pit 28	9,000	10,000	12,000

3. SUMMARY

Key findings of this study include:

1. No overflow is anticipated in any of the voids across all scenarios, with the minimum predicted freeboard consistently exceeding 30 meters.

2. Water levels projected in Scenario 2 marginally surpass those in Scenario 1, attributed to the higher inflow rate. The predicted water quality exhibits similarities between these two scenarios.

3. Under climate change conditions, voids were projected to have the lowest water levels and the highest concentrations of TDS, due to a high evaporation/precipitation ratio.

4. The stabilization of water levels is forecasted to take 100-450 years under historical climate conditions. For most voids, the time needed for equilibrium is expected to decrease under climate change conditions due to a heightened evaporation rate. However, Pit 2, Pit 3-12, and Pit 28 are anticipated to require similar or longer periods for water level stabilization under climate change conditions, owing to a lower surface area/volume ratio.

5. The concentration of TDS is predicted to continuously rise in all voids based on current assumptions. Nonetheless, a more intricate model will be necessary to accurately predict changes in water quality across all voids.

6. The diverse predicted TDS concentrations in each void are primarily contingent upon the ratio of base flow (groundwater inflow) to total inflow and the surface area/volume ratio specific to each void.

Reference:

Engeny. 2023. *Anglo American Steelmaking Coal-water balance model 2022 update*, Dawson Mining complex 2023.

GoldSim Technology Group (2021), GoldSim (Version 14.0), https://www.goldsim.com, October 2021.

IPCC. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press. Cambridge, United Kingdom and New York, NY, USA.

Van Vuuren, D.P., Edmonds, J., Kainuma, M., Raihi, K., Thomson, A., Hibbard, K. Hurtt, G.C., Kram, T. Krey, V., Lamarque, J.F., et al. 2011. The representative concentration pathways: an overview. Climatic Change. Vol. 109.

APPENDIX A STORAGE CURVE

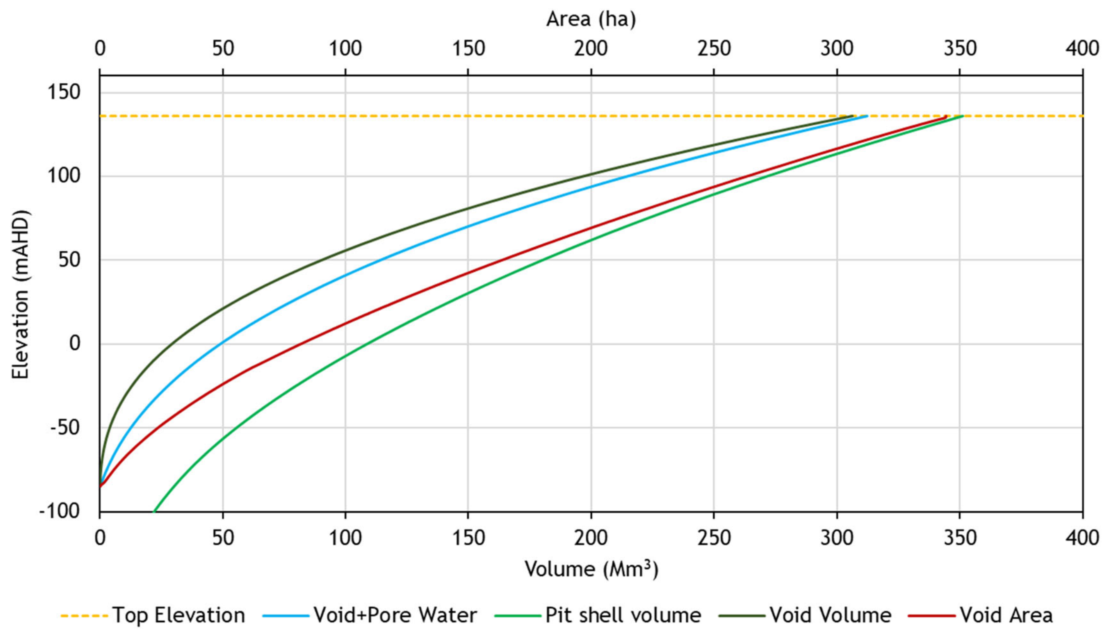


FIGURE A1: STORAGE CURVE OF NORTH PIT SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

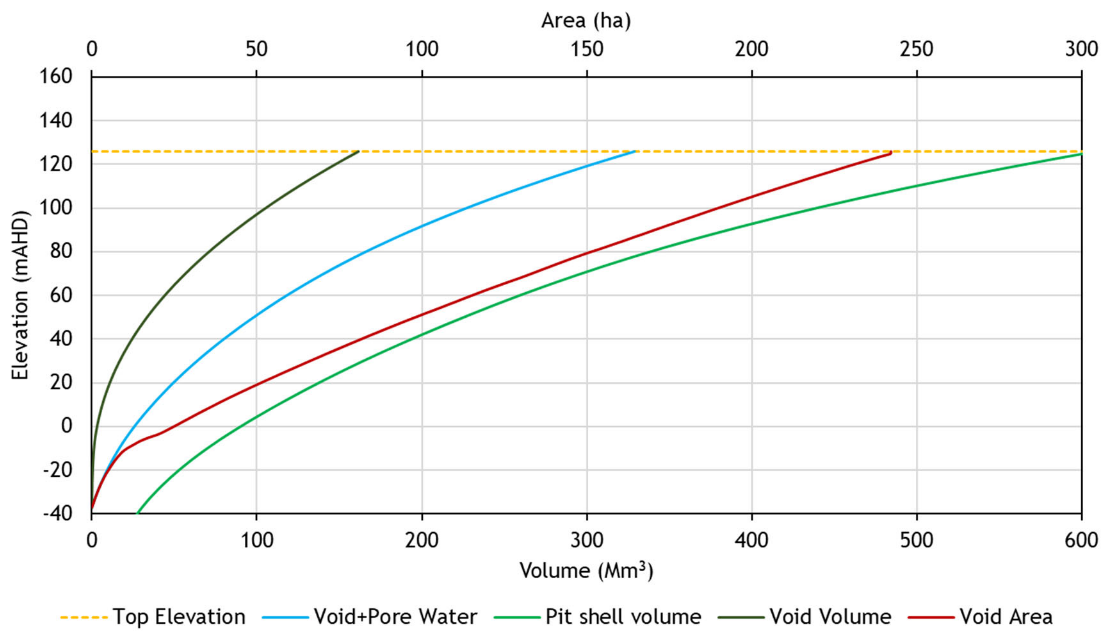


FIGURE A2: STORAGE CURVE OF PIT 2 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

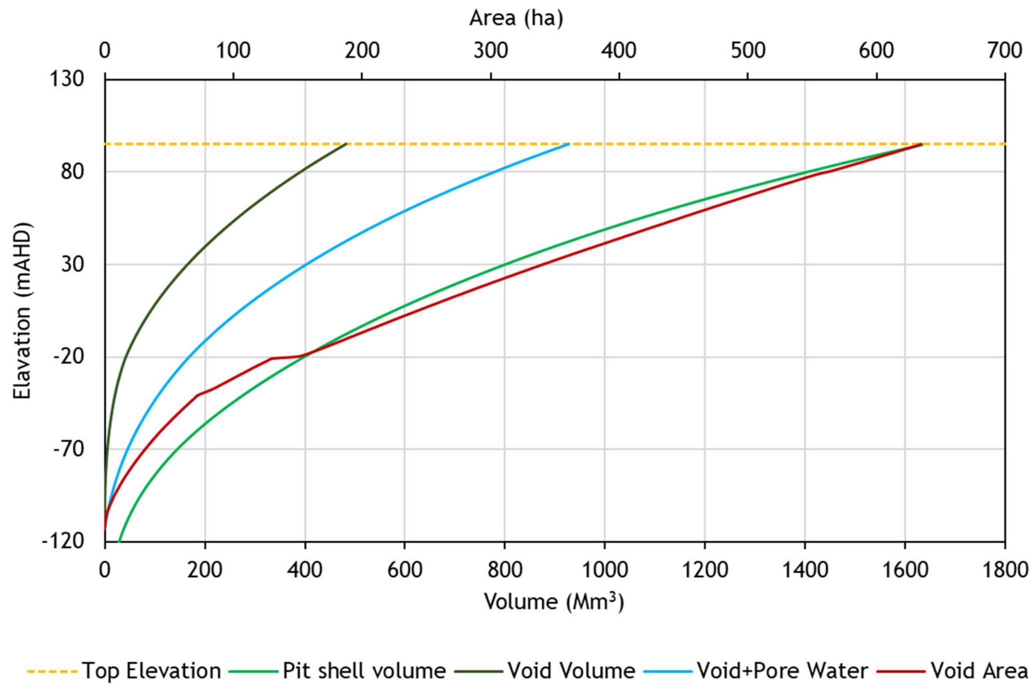


FIGURE A3: STORAGE CURVE OF PIT 3-12 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

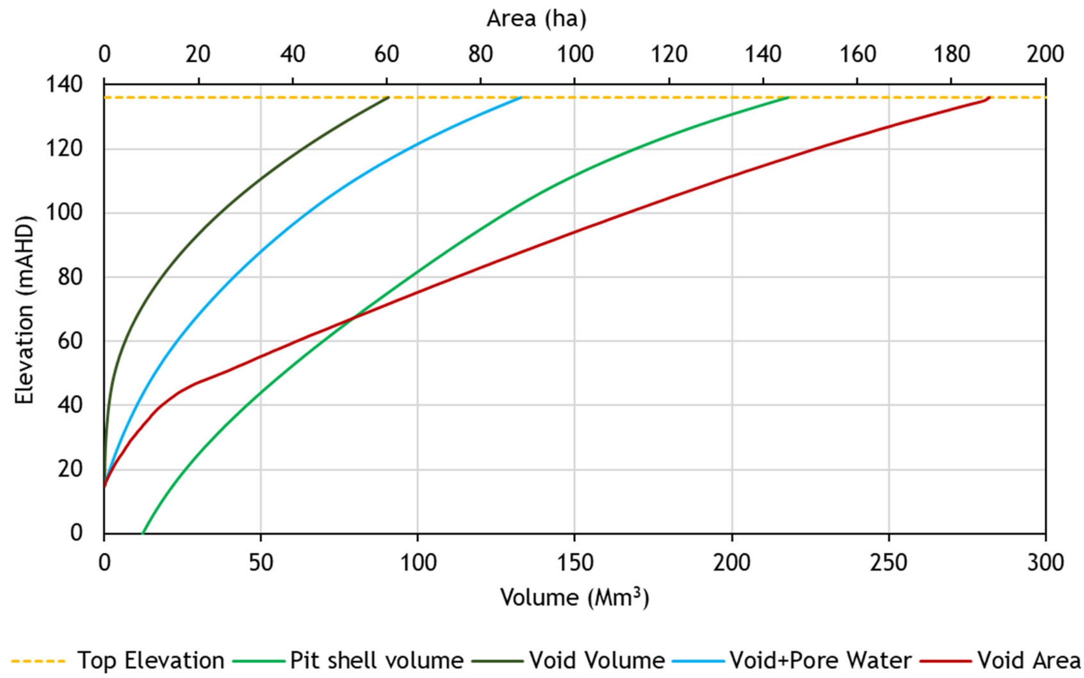


FIGURE A4: STORAGE CURVE OF PIT 13 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

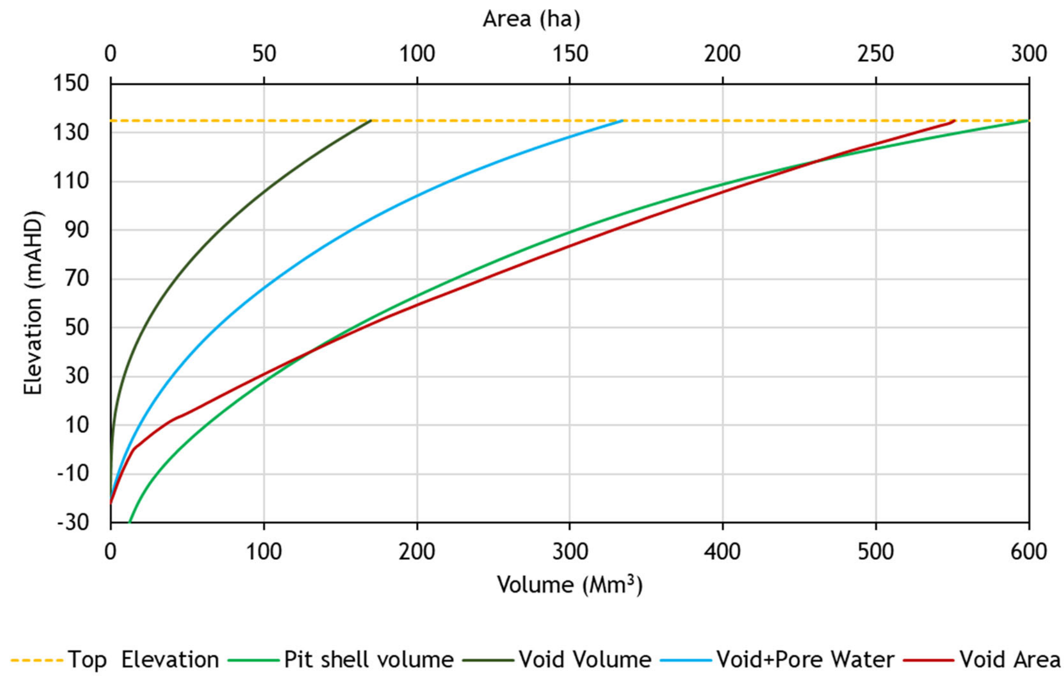


FIGURE A5: STORAGE CURVE OF PIT 19 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

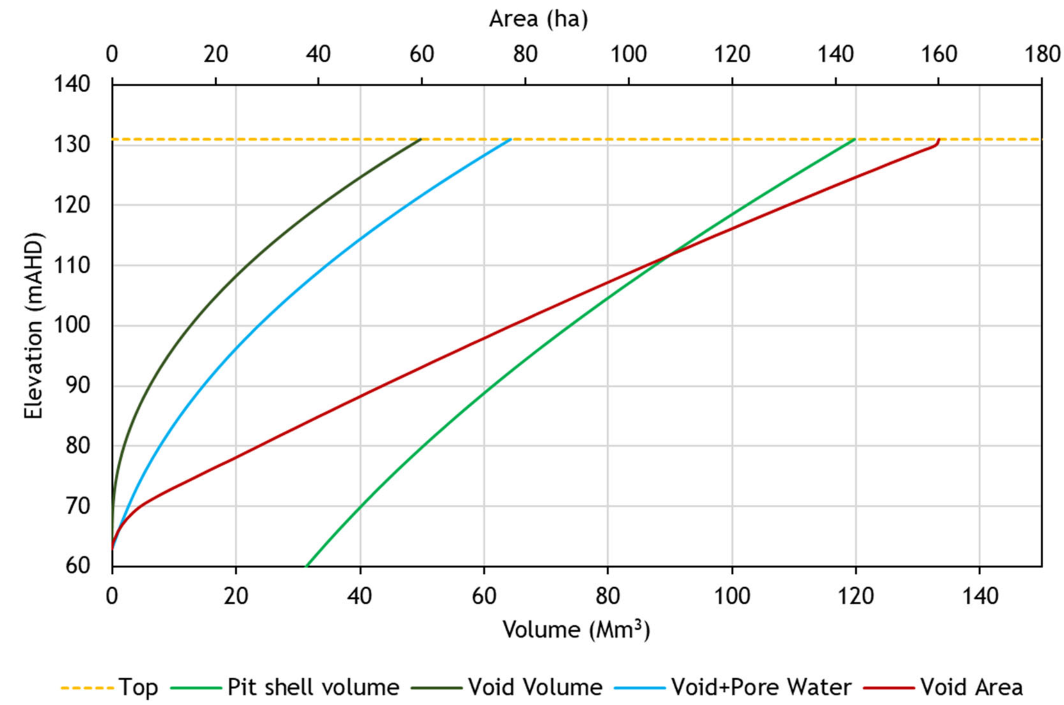


FIGURE A6: STORAGE CURVE OF PIT 24 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

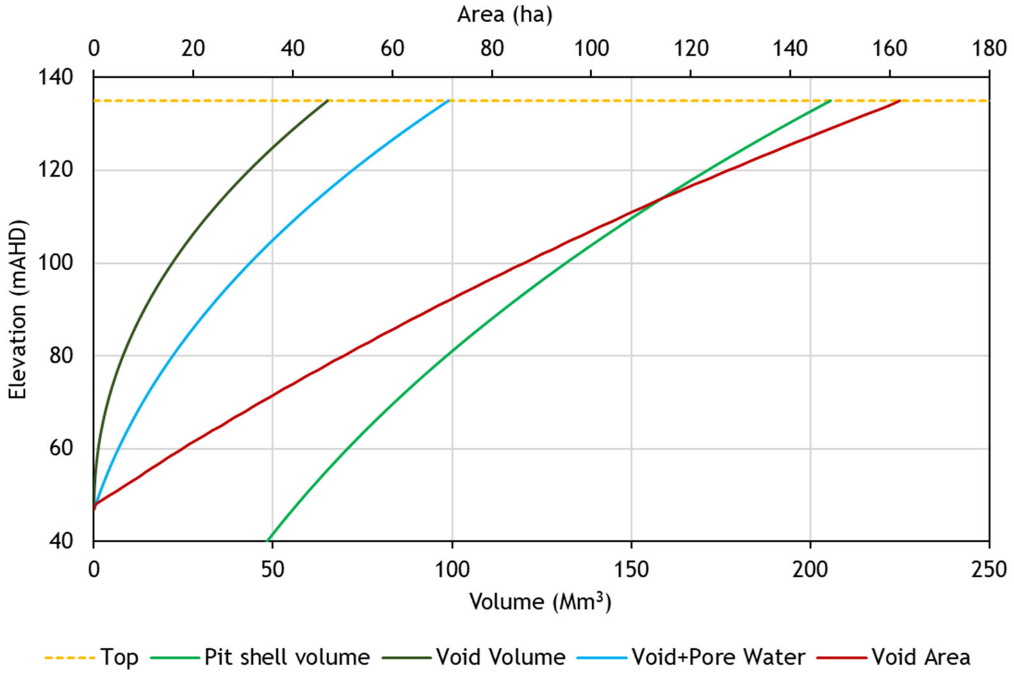


FIGURE A7: STORAGE CURVE OF PIT 25 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

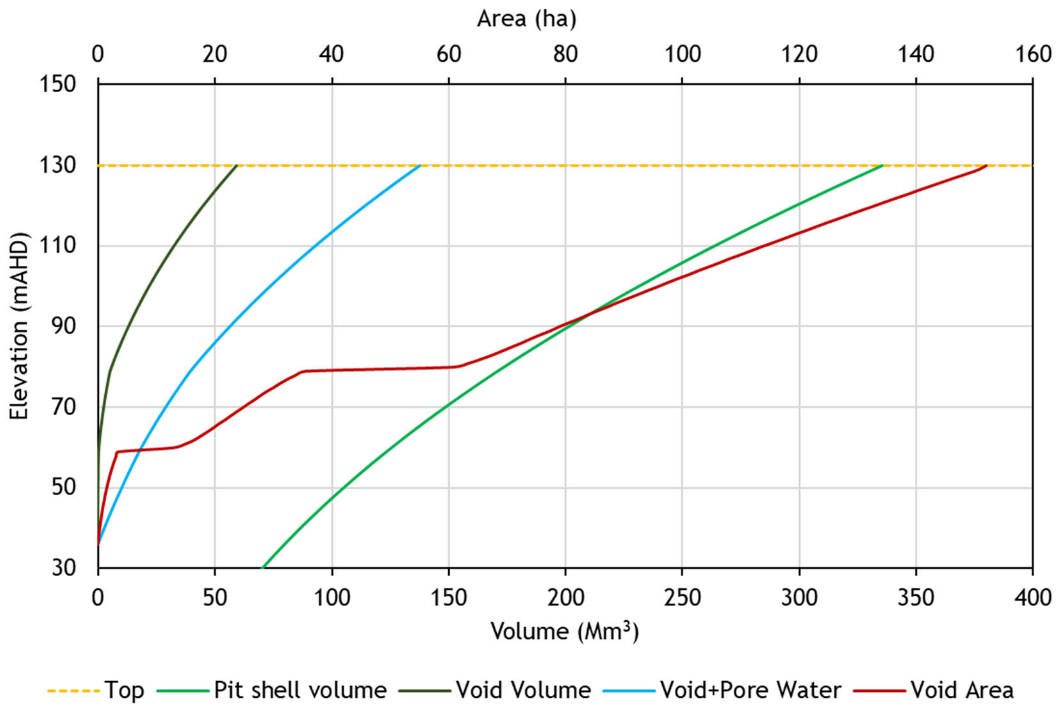


FIGURE A8: STORAGE CURVE OF PIT 28 SHELL AND VOID, WITH AN ASSUMPTION OF POROSITY 0.4 FOR WASTE ROCK IN PIT.

APPENDIX B GROUNDWATER INFLOW

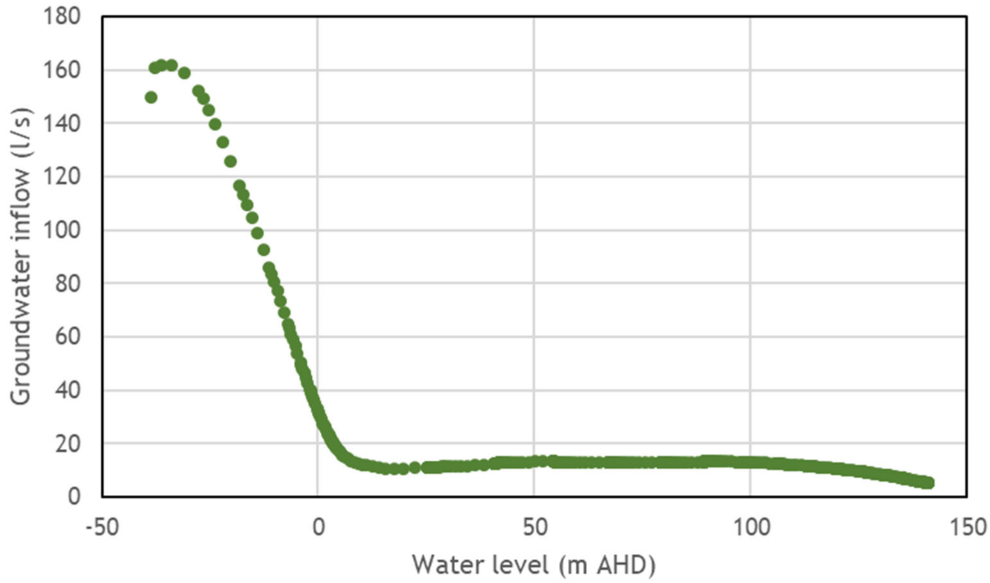


FIGURE B1: WATER LEVEL – GROUNDWATER RELATIONSHIP OF NORTH PIT SHELL.

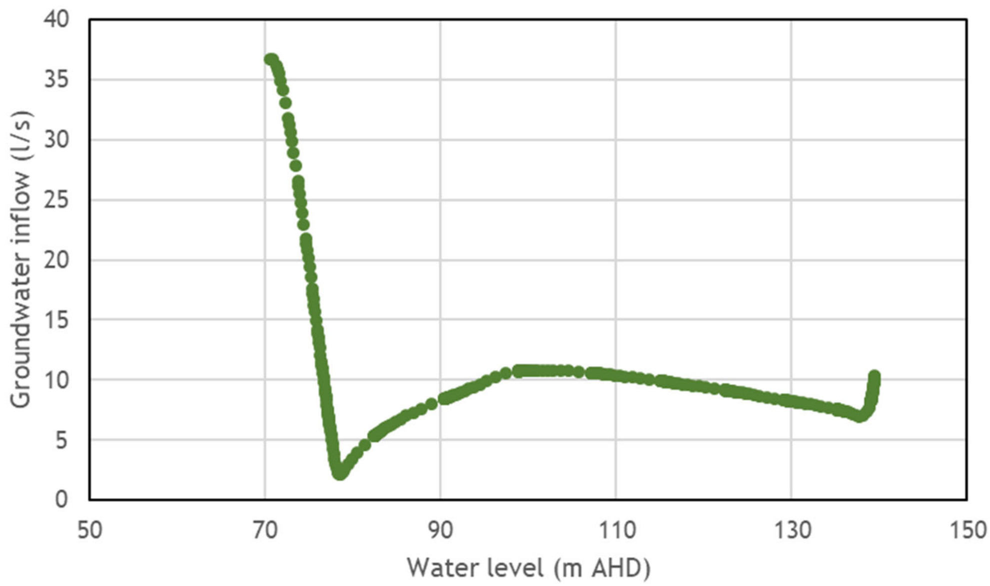


FIGURE B2: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 2 SHELL.

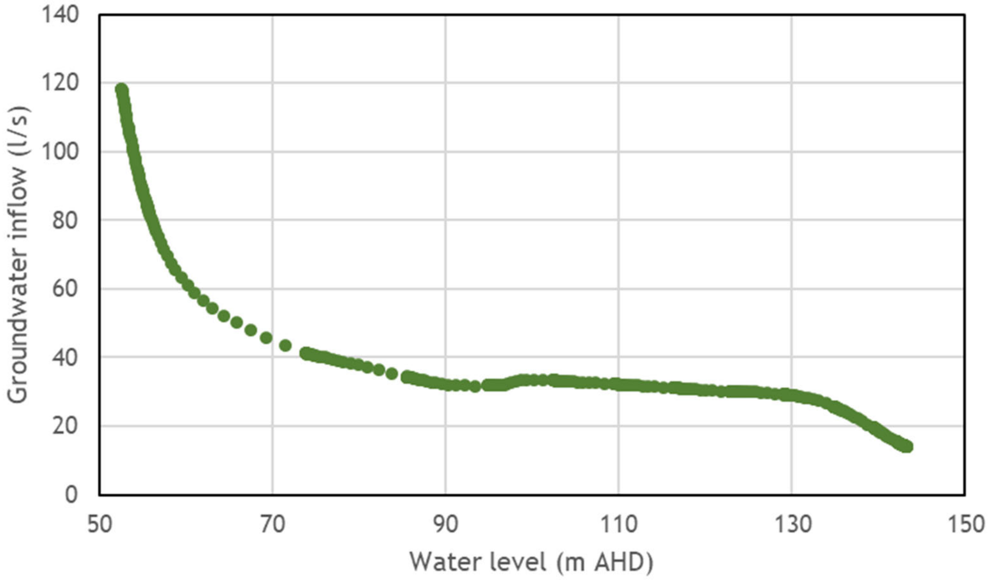


FIGURE B3: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 3-12 SHELL.

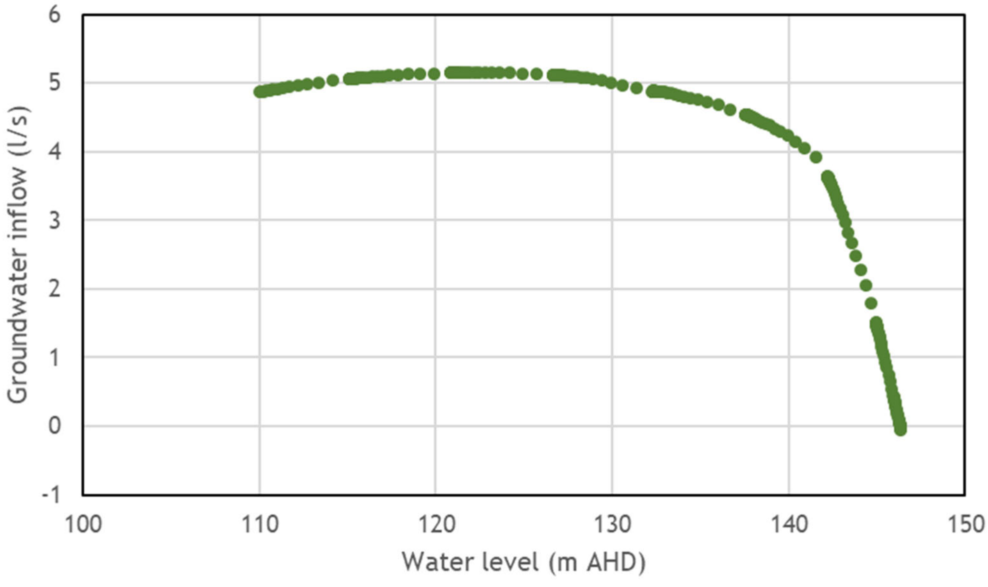


FIGURE B4: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 13 SHELL.

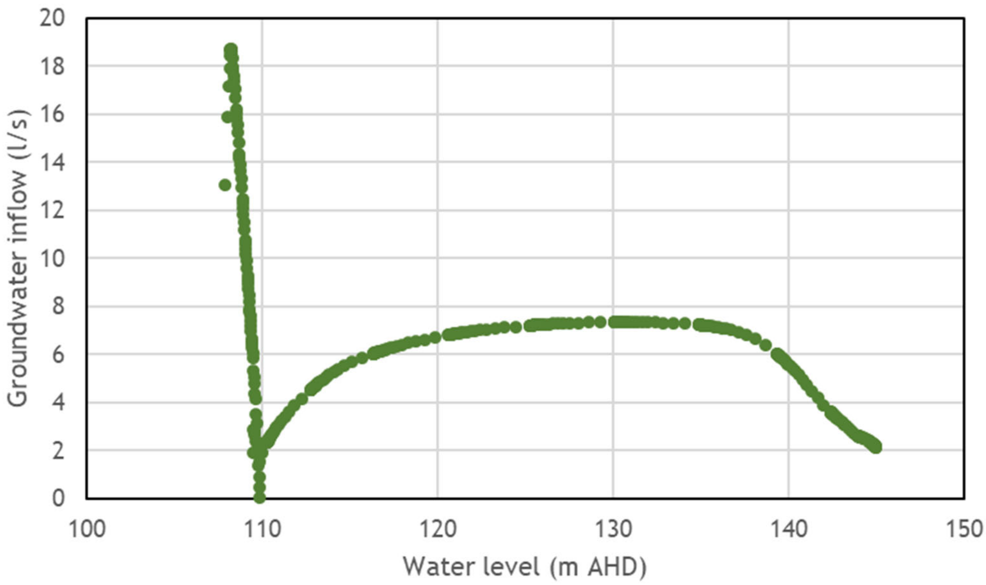


FIGURE B5: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 19 SHELL.

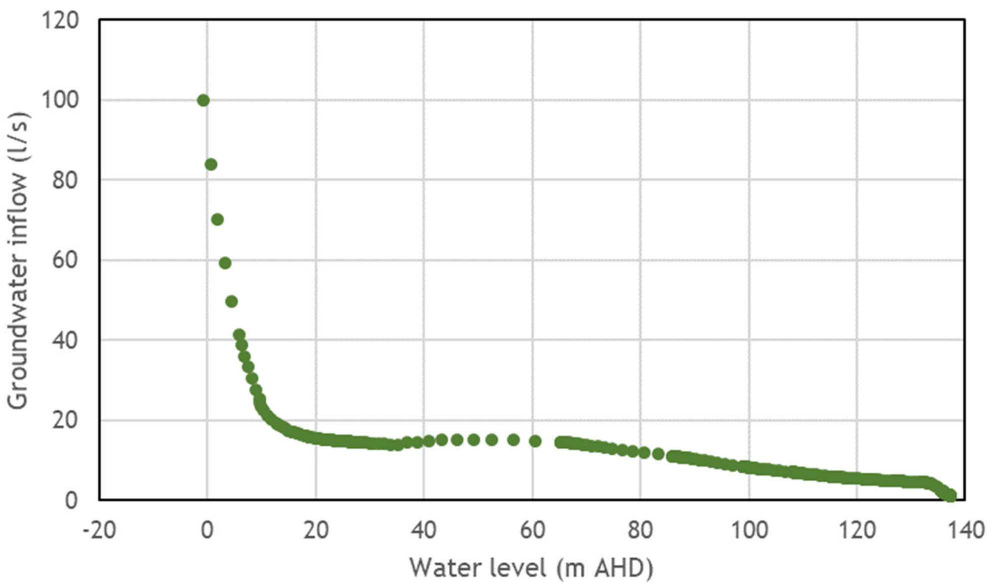


FIGURE B6: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 24 SHELL.

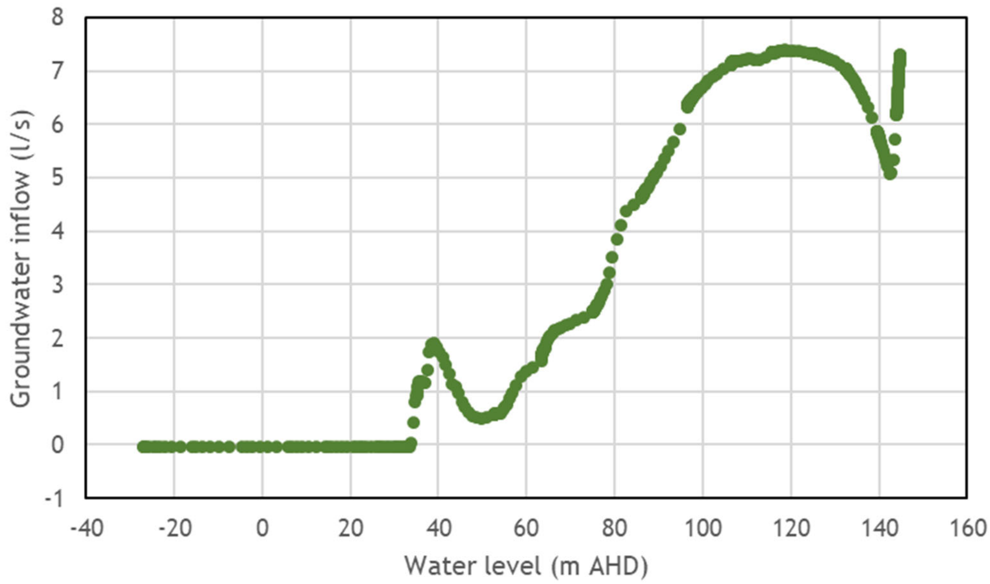


FIGURE B7: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 25 SHELL.

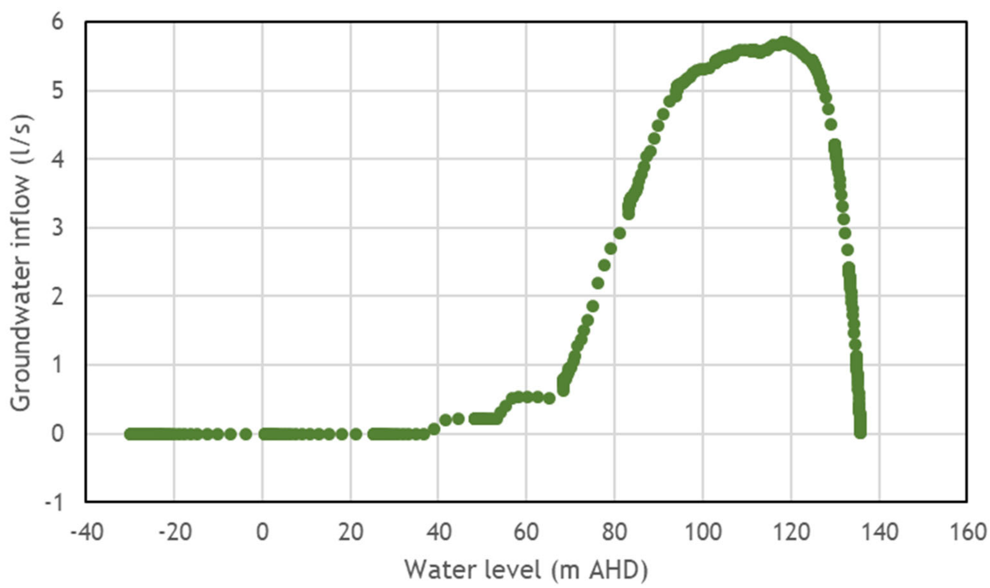


FIGURE B8: WATER LEVEL – GROUNDWATER RELATIONSHIP OF PIT 28 SHELL.

APPENDIX C WATER LEVEL RESULTS

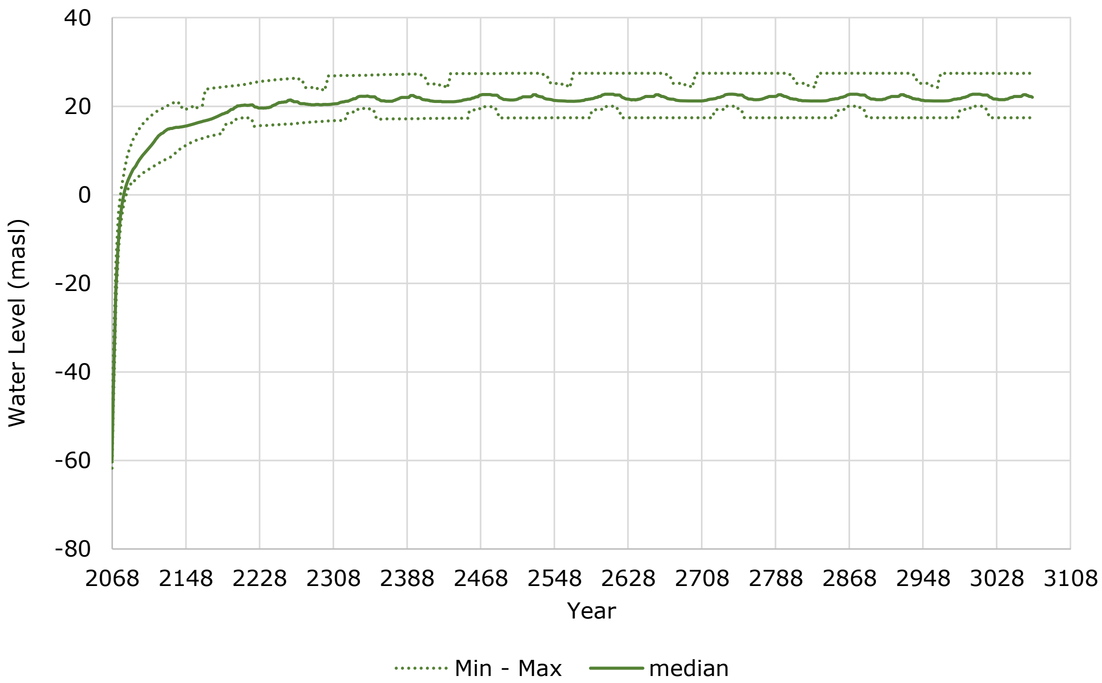


FIGURE C 1.1: PREDICTED WATER LEVEL FOR NORTH PIT - SCENARIO1

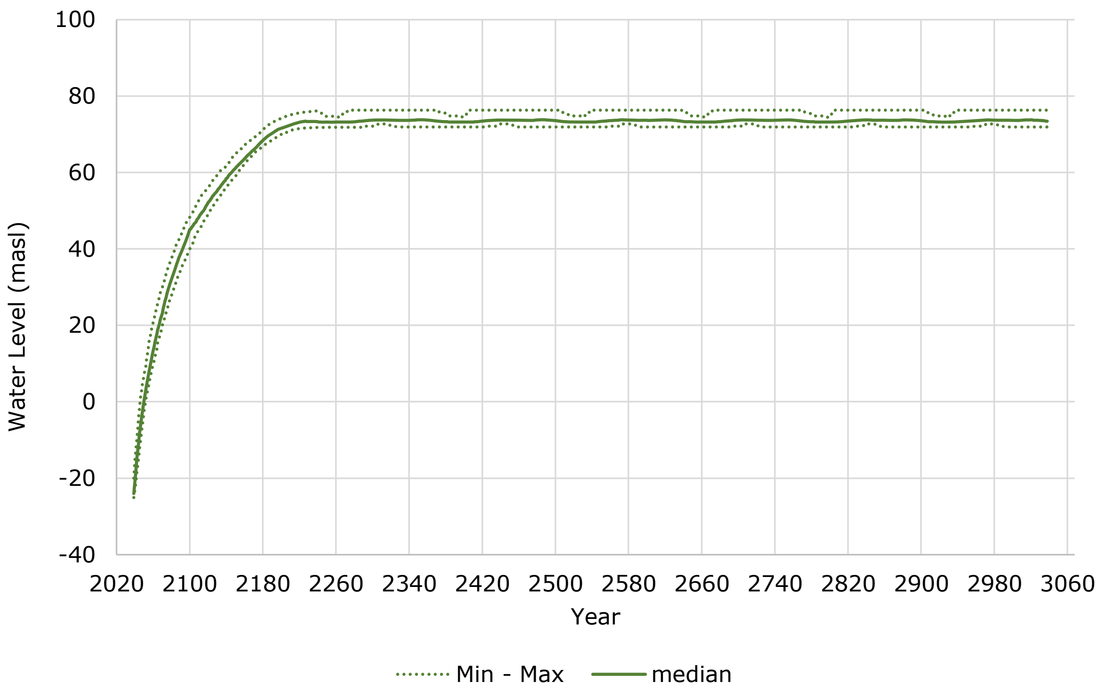


FIGURE C 1.2: PREDICTED WATER LEVEL FOR PIT 2 - SCENARIO1

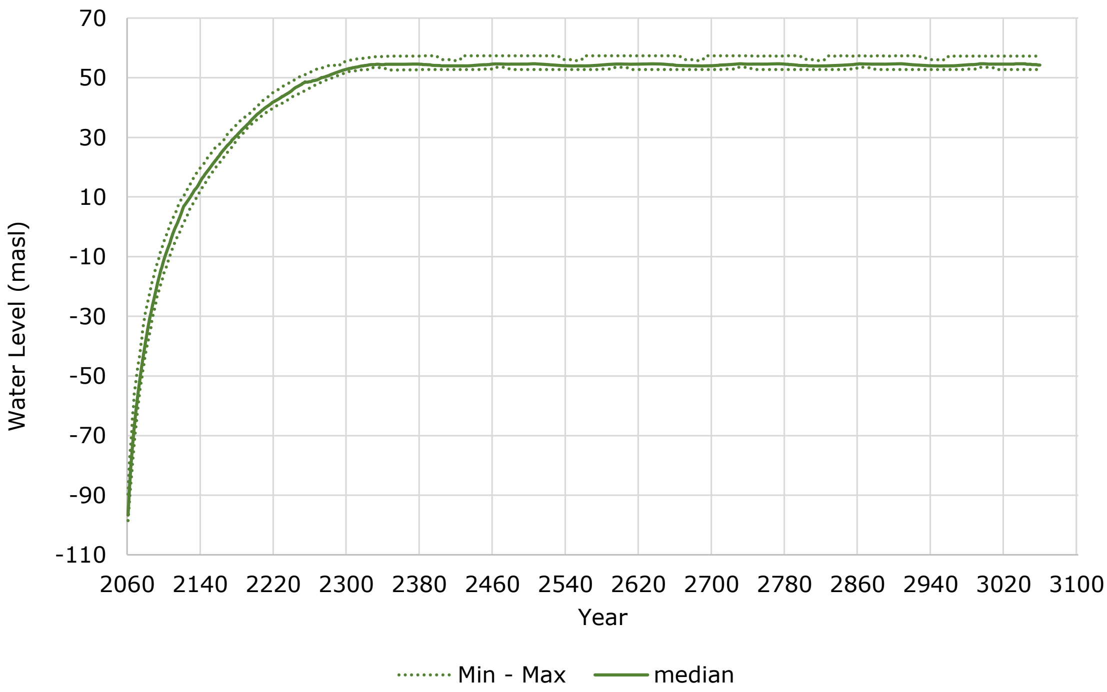


FIGURE C 1.3: PREDICTED WATER LEVEL FOR PIT 3-12 - SCENARIO1

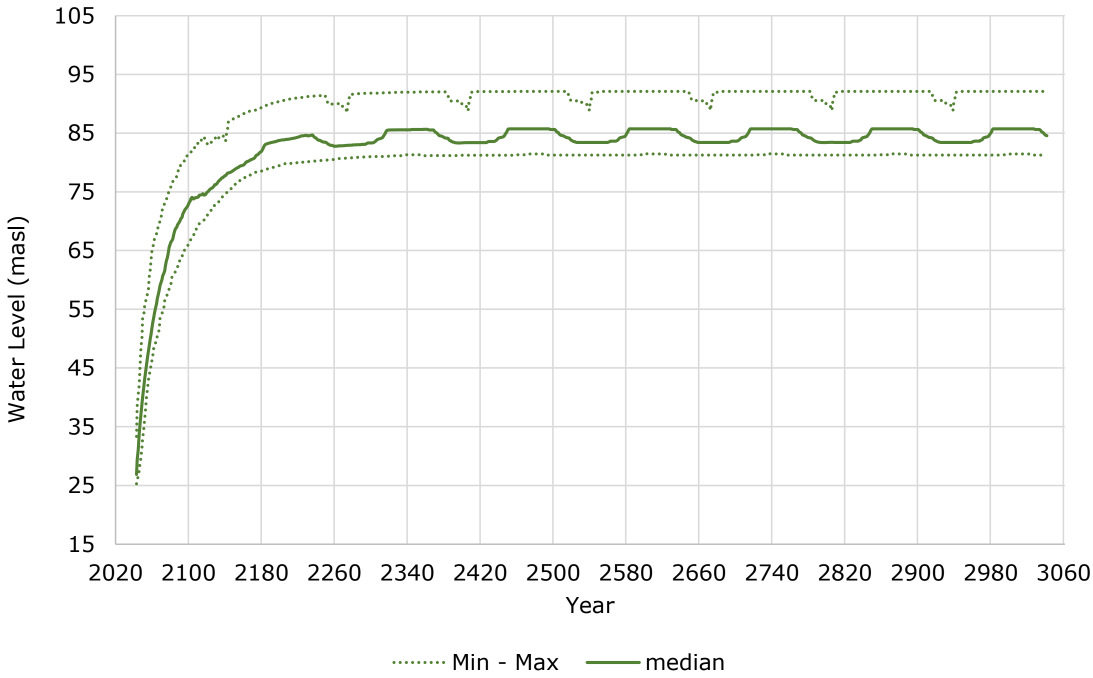


FIGURE C 1.4: PREDICTED WATER LEVEL FOR PIT 13 - SCENARIO1

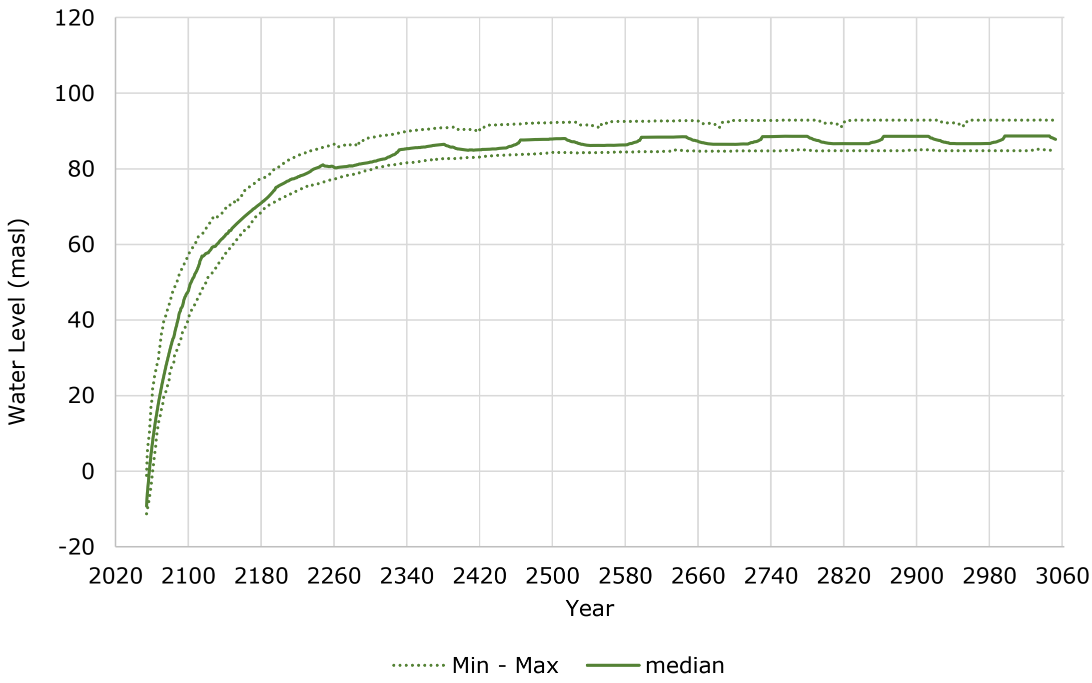


FIGURE C 1.5: PREDICTED WATER LEVEL FOR PIT 19 - SCENARIO1

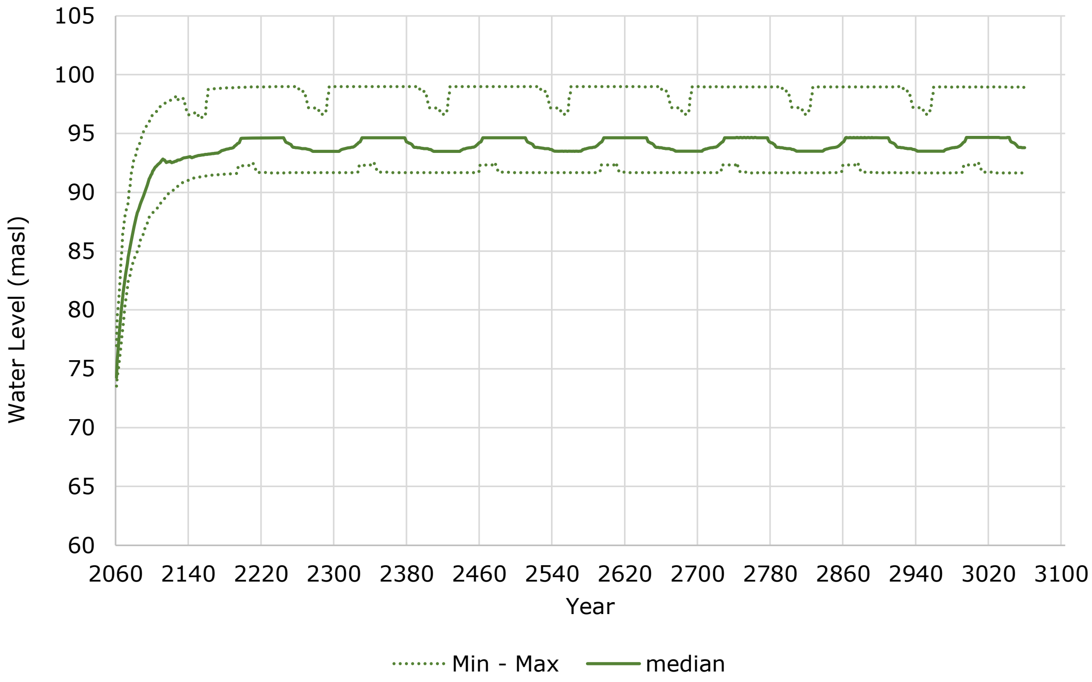


FIGURE C 1.6: PREDICTED WATER LEVEL FOR PIT 24 - SCENARIO1

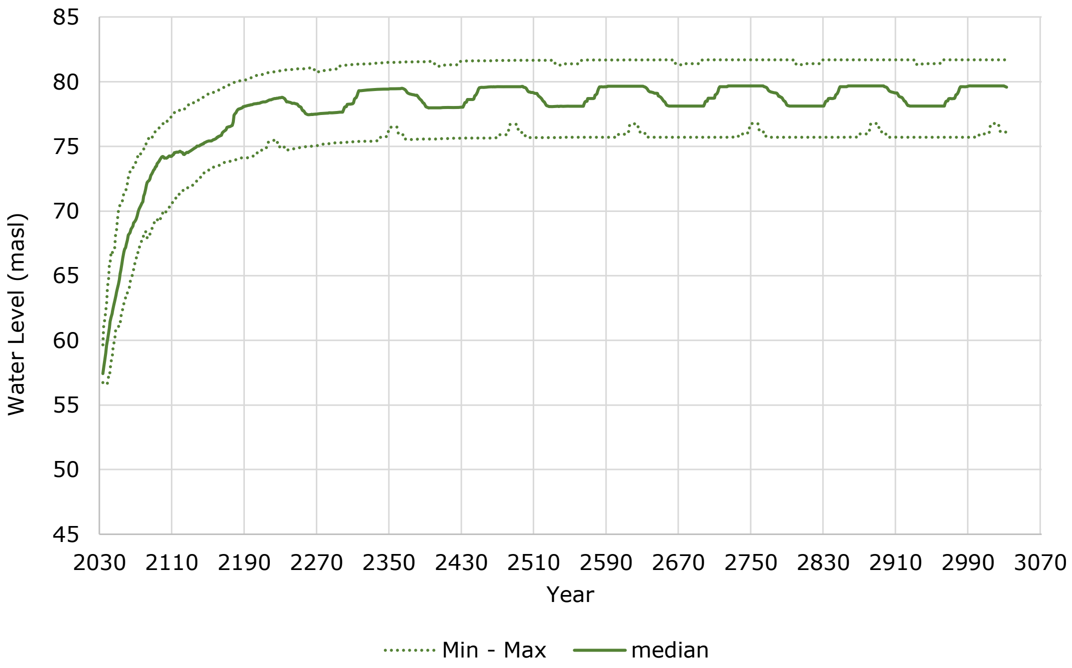


FIGURE C 1.7: PREDICTED WATER LEVEL FOR PIT 25 - SCENARIO1

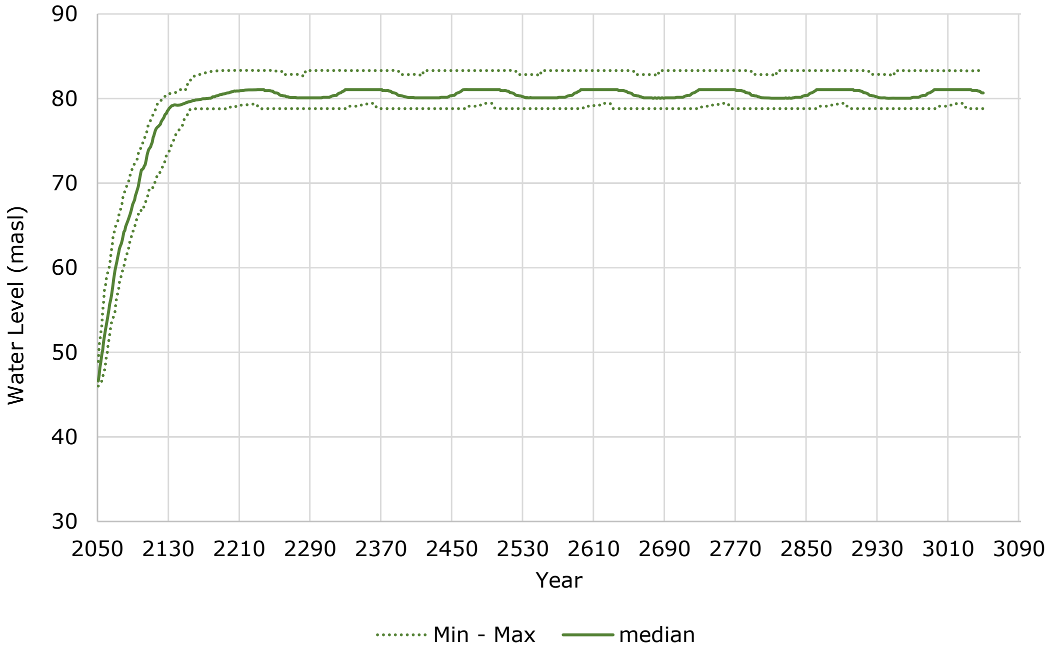


FIGURE C 1.8: PREDICTED WATER LEVEL FOR PIT 28 - SCENARIO1

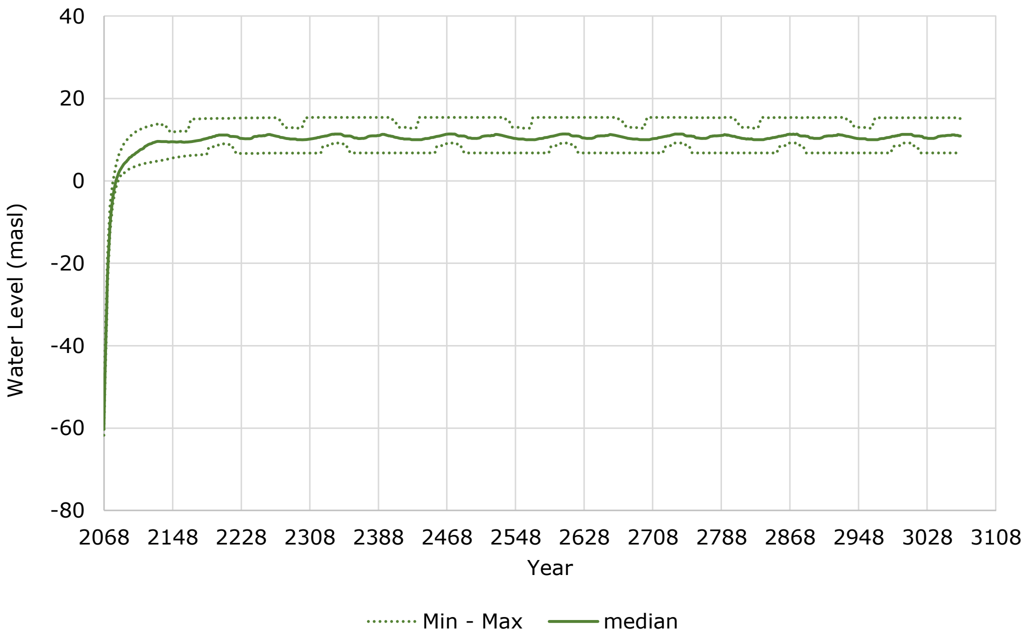


FIGURE C 2.1: PREDICTED WATER LEVEL FOR NORTH PIT - SCENARIO2

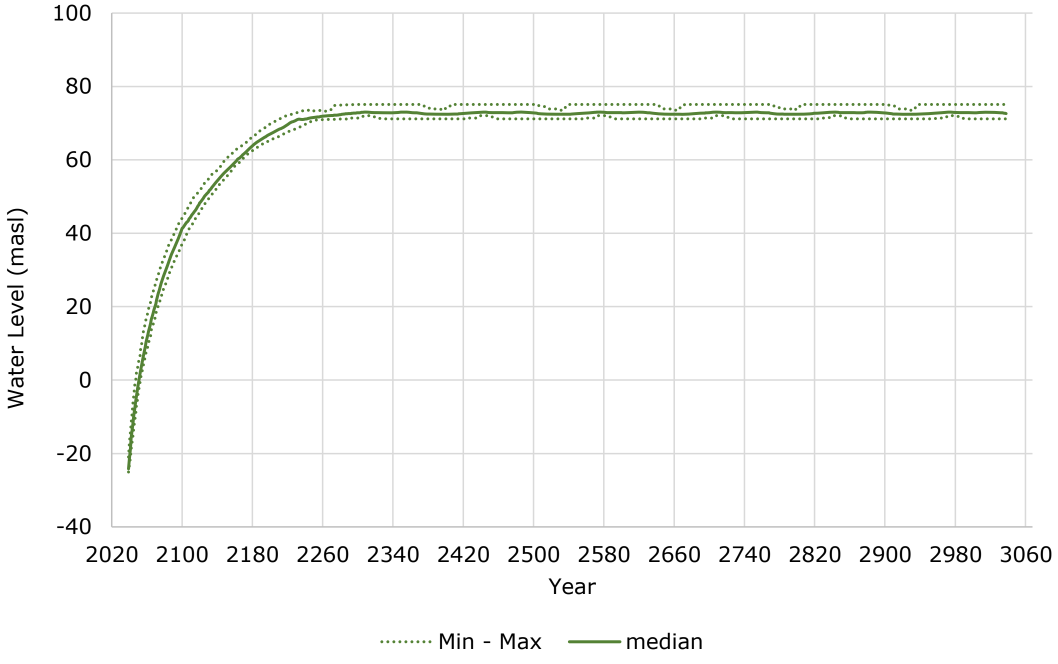


FIGURE C 2.2: PREDICTED WATER LEVEL FOR PIT 2 - SCENARIO2

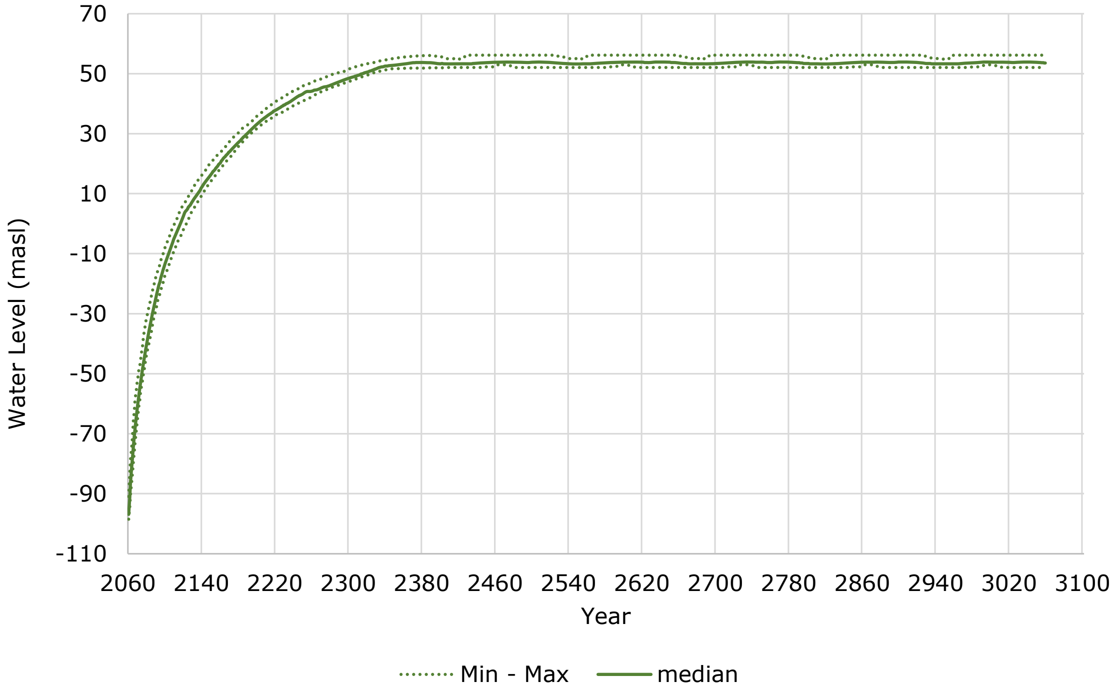


FIGURE C 2.3: PREDICTED WATER LEVEL FOR PIT 3-12 - SCENARIO2

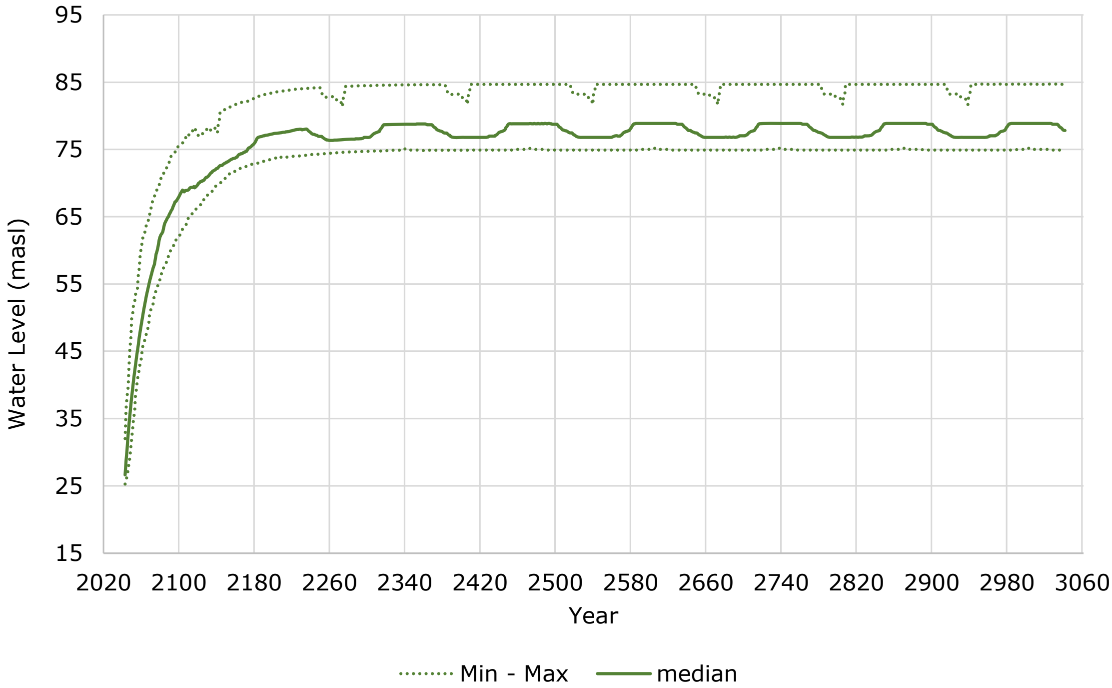


FIGURE C 2.4: PREDICTED WATER LEVEL FOR PIT 13 - SCENARIO2

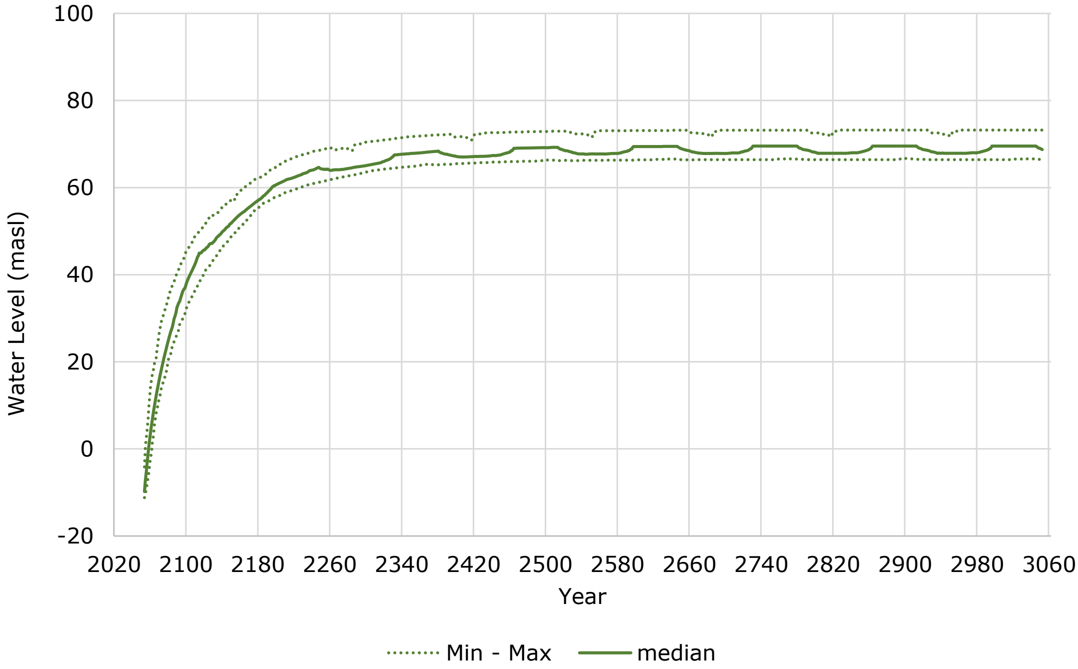


FIGURE C 2.5: PREDICTED WATER LEVEL FOR PIT 19 - SCENARIO2

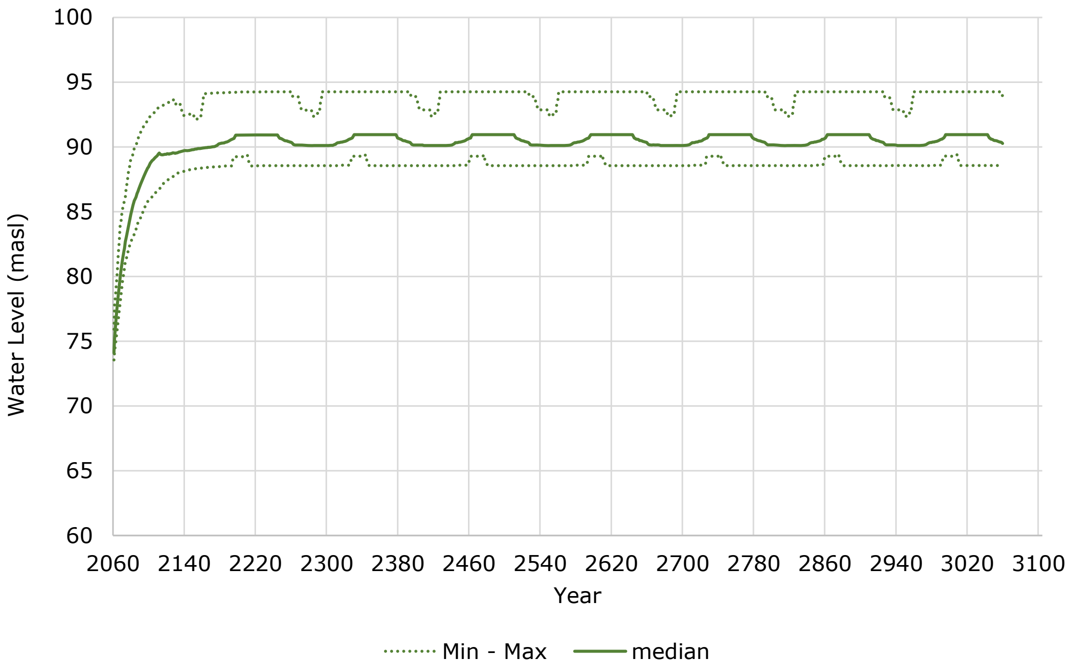


FIGURE C 2.6: PREDICTED WATER LEVEL FOR PIT 24 - SCENARIO2

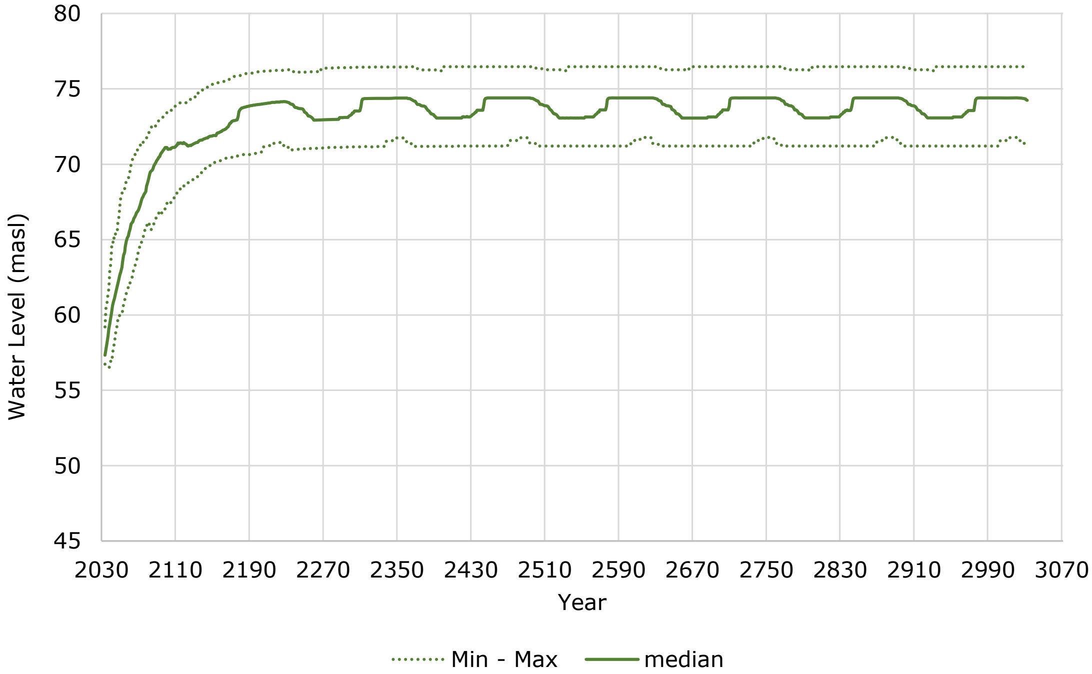


FIGURE C 2.7: PREDICTED WATER LEVEL FOR PIT 25 - SCENARIO2

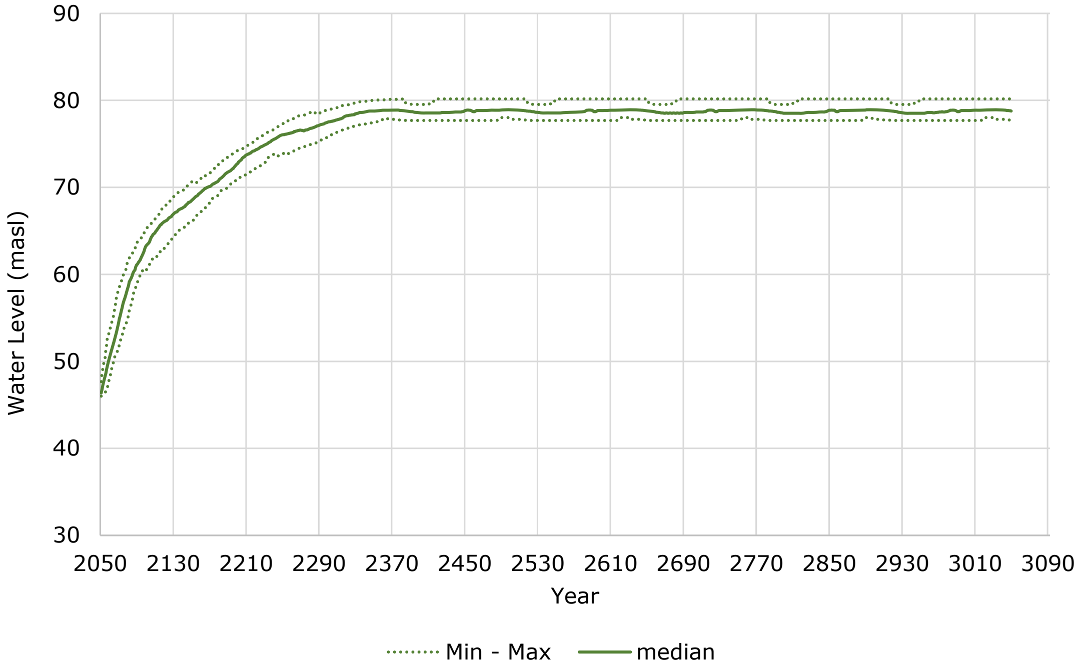


FIGURE C 2.8: PREDICTED WATER LEVEL FOR PIT 28 - SCENARIO2

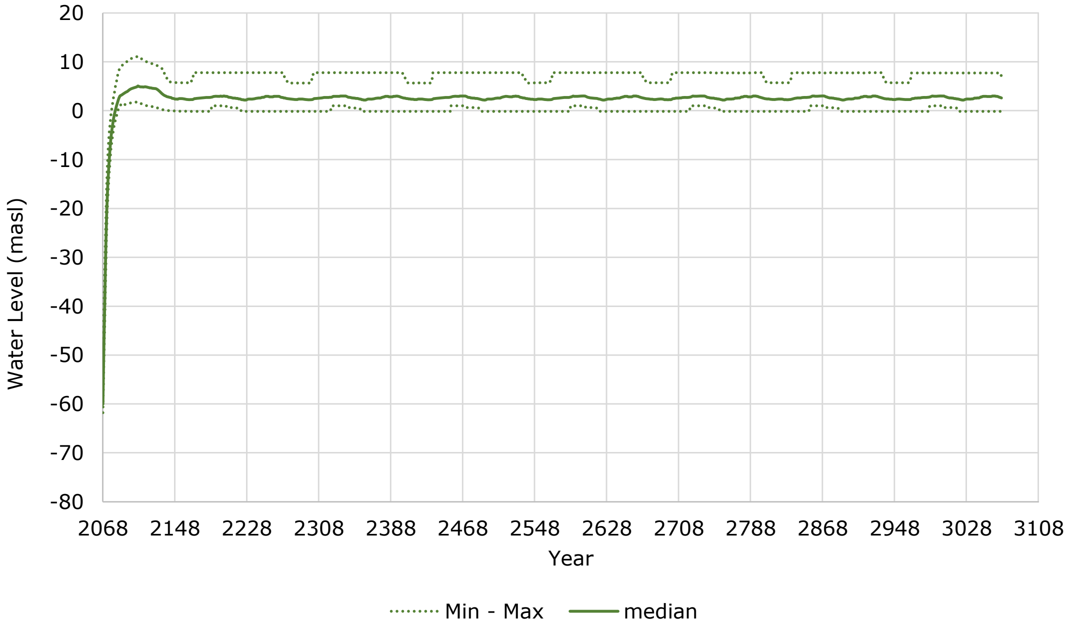


FIGURE C 3.1: PREDICTED WATER LEVEL FOR NORTH PIT - SCENARIO3

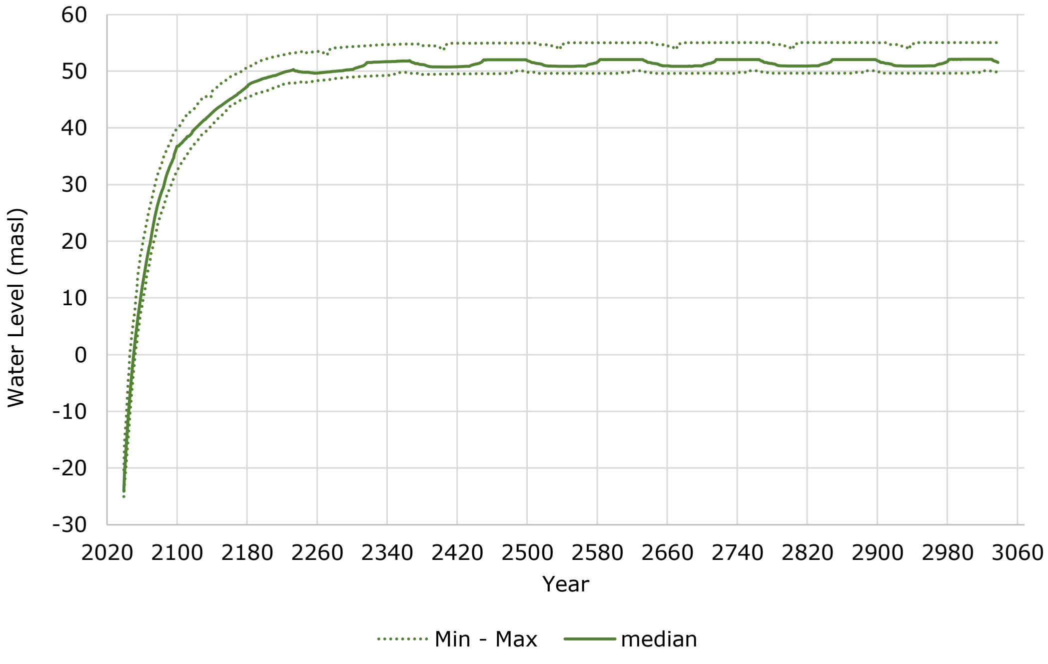


FIGURE C 3.2: PREDICTED WATER LEVEL FOR PIT 2 - SCENARIO3

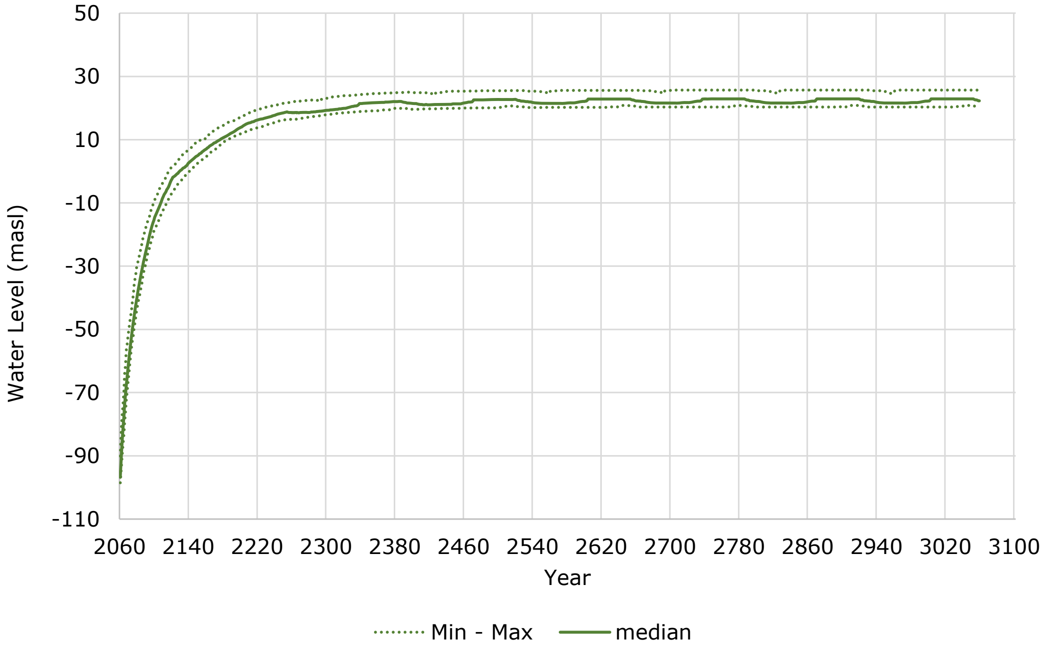


FIGURE C 3.3: PREDICTED WATER LEVEL FOR PIT 3-12 - SCENARIO3

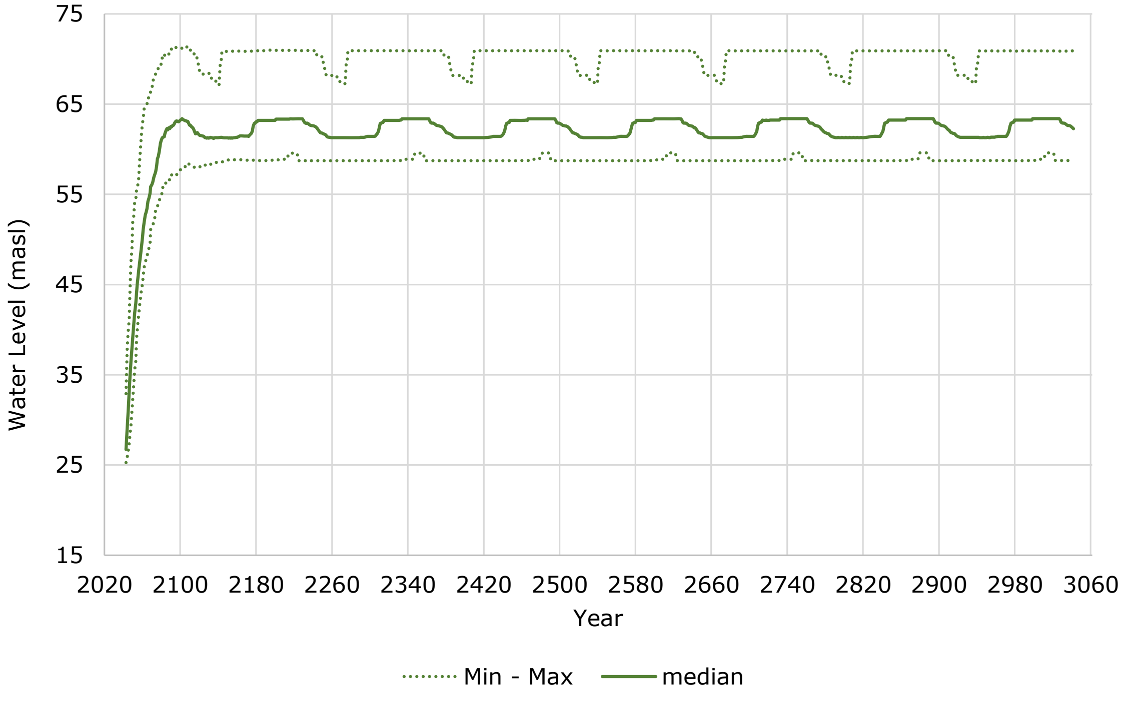


FIGURE C 3.4: PREDICTED WATER LEVEL FOR PIT 13 - SCENARIO3

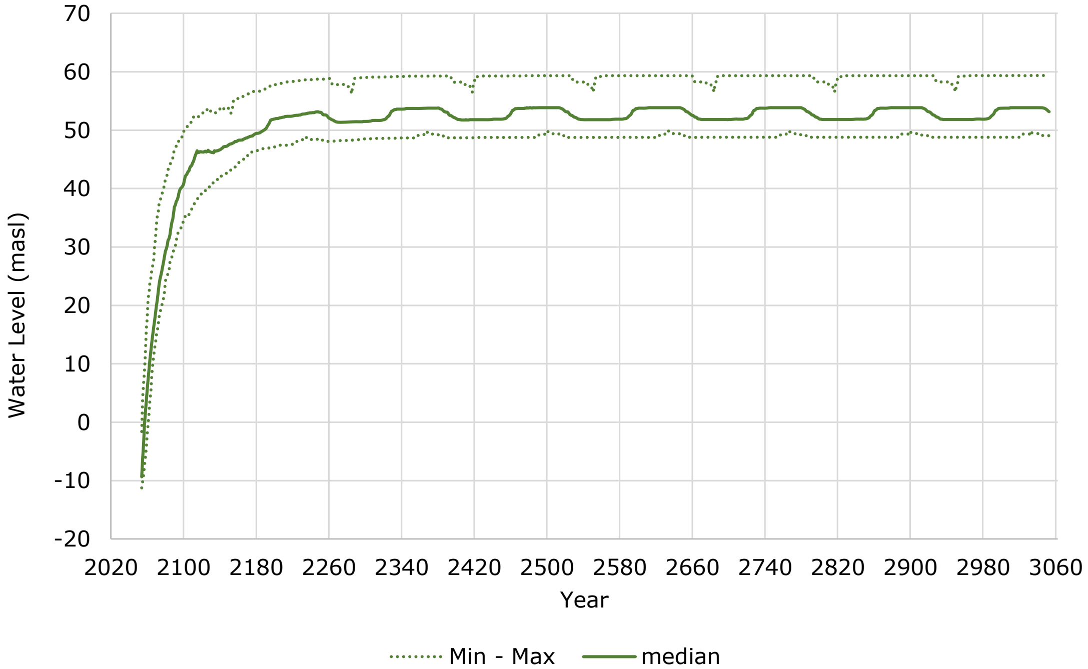


FIGURE C 3.5: PREDICTED WATER LEVEL FOR PIT 19 - SCENARIO3

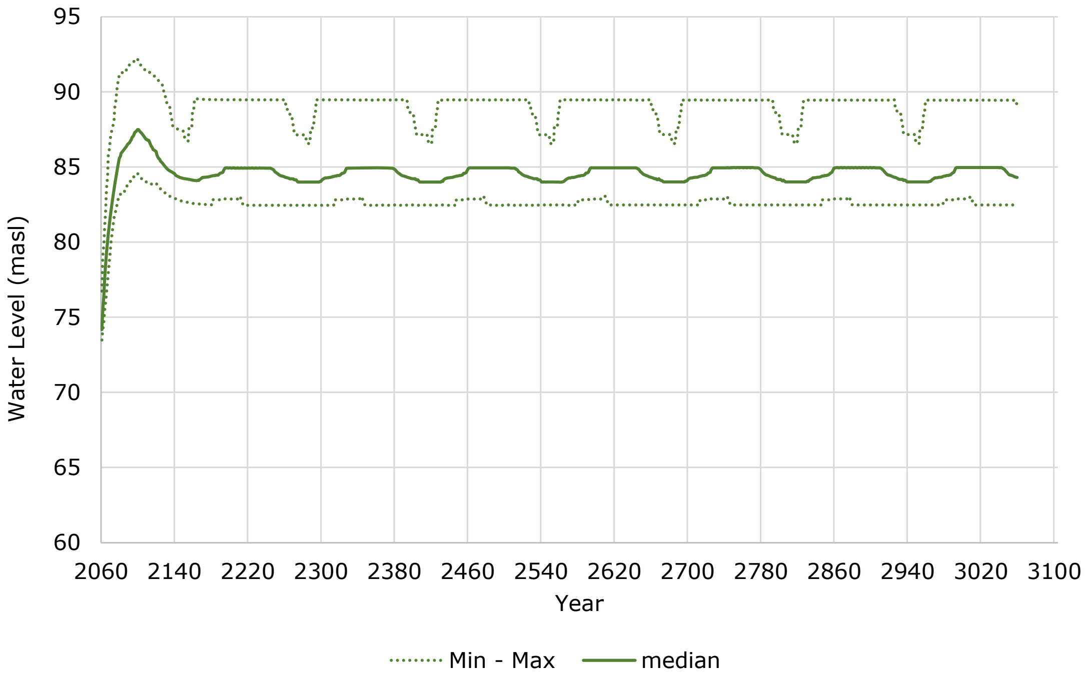


FIGURE C 3.6: PREDICTED WATER LEVEL FOR PIT 24 - SCENARIO3

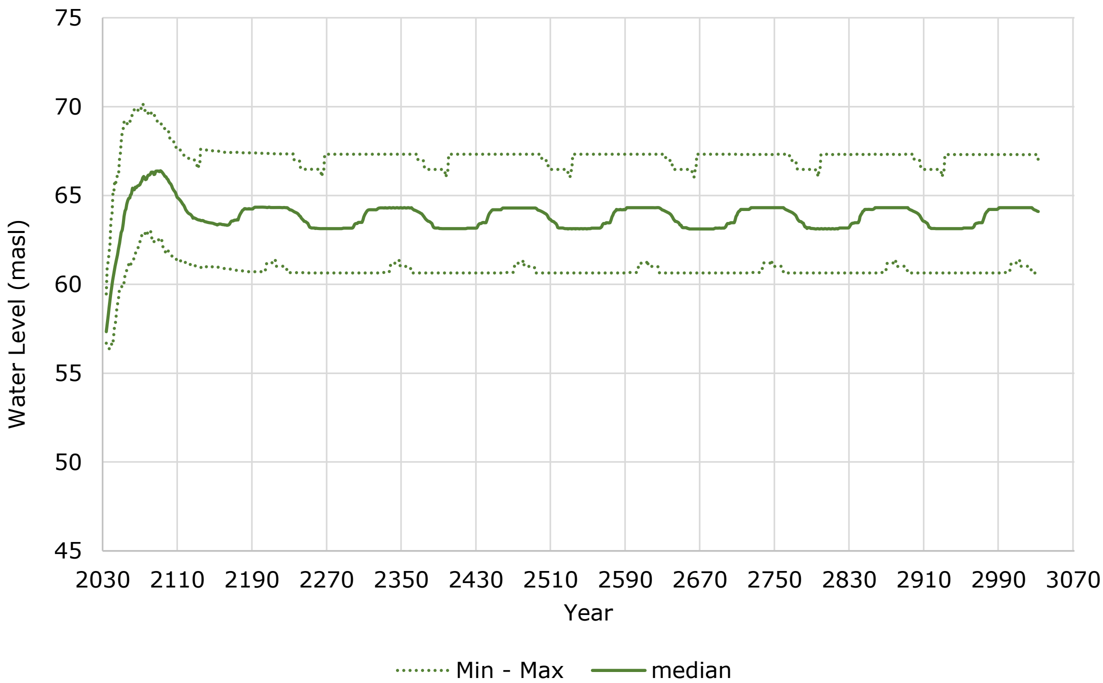


FIGURE C 3.7: PREDICTED WATER LEVEL FOR PIT 25 - SCENARIO3

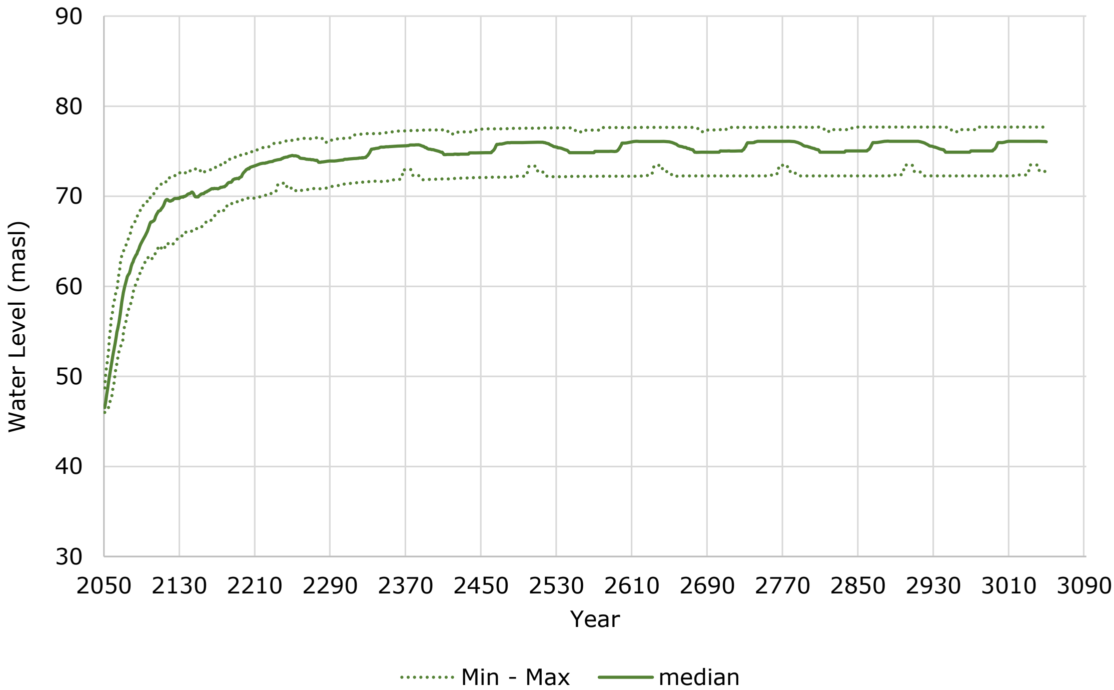


FIGURE C 3.8: PREDICTED WATER LEVEL FOR PIT 28 - SCENARIO3

ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
The Netherlands
New Zealand
Peru
Poland
Portugal
Romania
Senegal
Singapore
South Africa
South Korea
Spain
Switzerland
Taiwan
Tanzania
Thailand
UAE
UK
US
Vietnam

ERM's Melbourne
L8, 501 Swanston St
Melbourne, VIC 3000

T: 03 9696 8011

www.erm.com

Appendix F Dawson Central & North PRCP Groundwater Assessment Summary

8 April 2024

Anglo American
11/201 Charlotte St
Brisbane QLD 4000

Katy Steele
Environmental Approvals Manager

Dear Ms. Steele:

Dawson Central North PRCP Groundwater Assessment
Summary Letter

1 INTRODUCTION

KCB Australia Pty Ltd (KCB) have been commissioned by ERM to complete a numerical groundwater model to inform the hydrogeological assessment, to support Anglo American Steelmaking Coal's (SMC) Dawson Central/North (DCN) Progressive Rehabilitation and Closure Plan (PRCP).

SMC are required to prepare a PRCP for submission to the Queensland Government. A PRCP is an element of the Queensland Government's Mined Land Rehabilitation Policy (State of Queensland 2021a) and the EP Act. The EP Act (State of Queensland 2022b) requires that all areas disturbed within the relevant mining tenure are rehabilitated to a post-mining land use (PMLU), or managed as a non-use management area (NUMA).

This summary document outlines the approach and findings of the hydrogeological assessment and groundwater modelling completed to support the PRCP. Further detail can be found in KCB's full technical report for this project (KCB, 2024).

2 OVERVIEW

Description of the Project

DCN is an operating open pit coal mine, located to the east of the Moura township in Central Queensland's Bowen Basin. DCN is located within a number of mining leases across an existing mine which operates under Environmental Authority EPML00565813. The mining activities include a number of open pits; a mining industrial area; run of mine; out of pit stockpiles; tailings storage facilities; surface water dams and ponds; and waterway diversion channels and drains.

The mining complex lies over the Baralaba Coal Measures and coal resources are primarily produced from the Permian-age reserves contained in five major seams (Seams A to F). The mining complex extends over 25 mining leases and comprises of three distinct operating areas; Dawson North (DN), Dawson Central (DC) and Dawson South (DS); which are aligned in a north-south orientation along the strike of the coal seams and extend over a distance of approximately 50 km (Figure 2.1).

KCB Australia Pty Ltd.
Level 3, 150 Mary St ▪ Brisbane QLD 4000 ▪ Australia
t +617.3004.0244 ▪ www.klohn.com

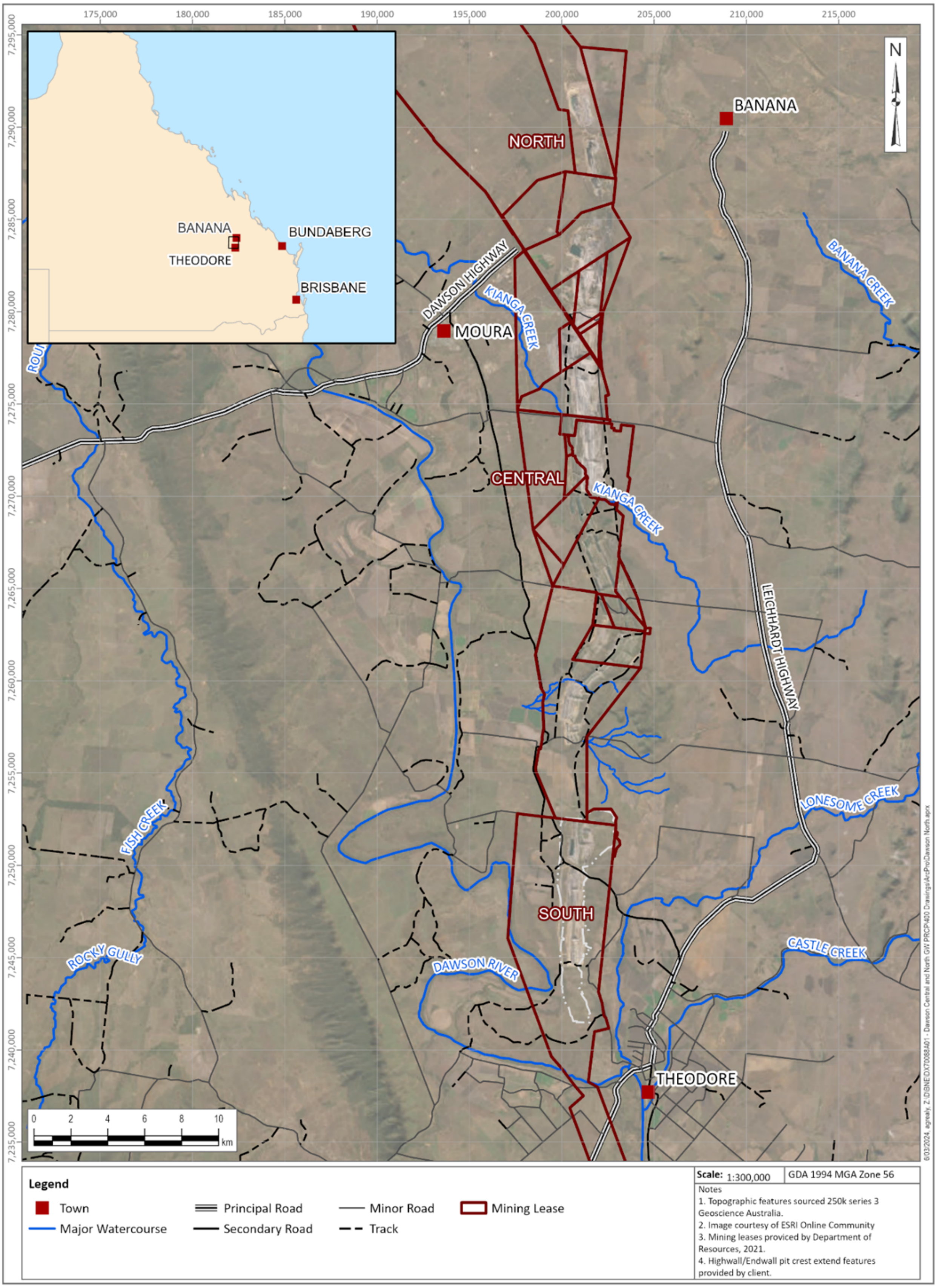


Figure 2.1 Location of the Dawson Mine Complex

DS operations are subject to a separate Environmental Authority. DCN currently produces a mixture of coking, soft coking and thermal coal which is processed and then transported 150 km by rail to the Barney Point Terminal and RG Tanna Coal Terminal for export (JBT 2018b). Dawson's open cut mining operations are planned to continue until 2071. There will be a total of six pits which will be left as final voids post closure. These include the Northern Pit, Pit 2, Pit 3, Pit 13, Pit 19 and Pit 24.

Hydrogeology Context

DCN is located in the Dawson River catchment and surface water flow across the area is from south to north, and west to east towards the south. Local creeks drain toward the Dawson River.

Hydrostratigraphic units in the vicinity of DCN include Quaternary alluvium, associated with surface water courses; Tertiary sediments; Tertiary basalt; the Triassic Rewan Group; and Permian coal measures. Permanent groundwater is observed in the Rewan Group and Permian coal measures; while within DCN, limited groundwater is observed within the Quaternary alluvium, Tertiary sediments and Tertiary basalt. The regional groundwater flow direction is roughly east to west, and localised groundwater flow is from north to south as a result of mining activities and associated dewatering (from CSG, underground and open cut operations).

Groundwater use by third parties, within a 5 km radius of the Project area, have been identified. The majority of the registered bores on the Department of Regional Development, Manufacturing and Water (DRDMW) groundwater bore database are for monitoring and exploration purposes. These bores are screened across various hydrostratigraphic units. A number of bores are screened in the Quaternary alluvium and are for water supply purposes in the vicinity of the township of Banana.

Groundwater Dependent Ecosystem (GDE) mapping of the Fitzroy basin indicates that there is low confidence terrestrial GDEs located adjacent to the Dawson River which is within 5 km of DCN.

Groundwater Modelling

A 3D numerical groundwater flow model was developed using MODFLOW-USG software to represent the conceptual hydrogeological model for DCN, and surrounds, to simulate the provide projected post-mining groundwater conditions. The model was used to predict potential changes to groundwater levels for more than 1,000-years post-closure of the open pit mining.

Model calibration was completed using groundwater levels, recorded over time, from bores within and surrounding DCN. Prediction of groundwater level drawdown was conducted based on the proposed open pit mining schedule provided by SMC. The updated groundwater model was able to achieve a good calibration between the measured/observed water levels and the model-predicted water levels for the transient calibration period. The model calibration metrics are acceptable and within the requirements of the Australian Groundwater Modelling Guidelines. The transient hydrograph comparisons between simulated and measured water levels show that the model is able to match the general trends and responses observed in the data record, including the shallower hydrostratigraphic units which could potentially be impacted by mining activities.

The model calibration is considered robust. The calibrated groundwater model was used to predict groundwater inflows, changes in groundwater levels and the associated groundwater level drawdown extent in response to the proposed mine closure design.

Impact Assessment

A bore review identified that the majority of the water supply bores are abstracting from the water table within the alluvium of the Dawson River, Banana Creek, Lonesome Creek and Kianga Creek. There are 17 groundwater users abstracting from the deeper aquifers of the Gyandra, Rewan, Barfield and Banana Formations. The water supply bores are located in and around the township of Banana. These bores are accessing aquifers of the Gyandra subgroup to the east of the project area and are stratigraphically below the Baralaba Coal Measures.

In the majority of bores drawdown of less than 5 m is predicted. The groundwater within the Baralaba Coal Measures outcrop to the west of the town of Banana and the groundwater impacted by DCN is not considered to be hydraulic connected to the aquifers accessed by the water supply bores around Banana. Drawdown is not predicted/expected to impact the groundwater users in Banana. Post-mining groundwater levels are predicted to progressively recover.

The surficial hydrostratigraphic units (e.g. Quaternary alluvium, Tertiary sediments), may potentially be a periodic water source to mapped low confidence terrestrial GDEs and/or surface watercourses of the Dawson River. At the end of operations the groundwater elevation in the alluvium adjacent to Dawson River is estimated at 90 m AHD to 100 m AHD. This represents the period with the maximum drawdown and with the highest potential for cumulative groundwater impacts. The drawdown impact on the surrounding hydrostratigraphic units, including the alluvials, progressively decreases post closure as the groundwater levels rebound/recover. During this period of rebound, pit lakes will form in selected voids. The potential for impact on mapped low confidence terrestrial GDEs also decreases in the post-closure period as the groundwater levels recover. The groundwater levels in the alluvial layer (Layer 2 of the model) adjacent to the Dawson River recover to between 110 m AHD and 120 m AHD once the remaining voids have reached their respective equilibrium water elevations.

The groundwater flux predictions for the 1,000-year post mine closure indicate that the remaining voids will be a sink to the surrounding groundwater environment and there is therefore little risk of change in groundwater quality expected (the void water levels are predicted to remain lower than the surrounding groundwater environment).

Particle tracking has been simulated to provide an understanding of the potential for migration of the more saline water out of the pit void/spoils areas to the receiving environment. Particle seeds were placed at the perimeter of the voids from start of the closure period and particle tracking was undertaken using forward particle tracks through to the 1,000-year period (to assess the potential flow from the areas).

The forward particle tracking confirms that flow from the void areas will be constrained to the zone around the voids (Figure 2.2). Some inter-void flow through the high conductivity spoils will occur as the system rebounds and voids fill at different rates until the eventual equilibrium void elevations are reached. The general post-closure groundwater flow remains toward the voids.

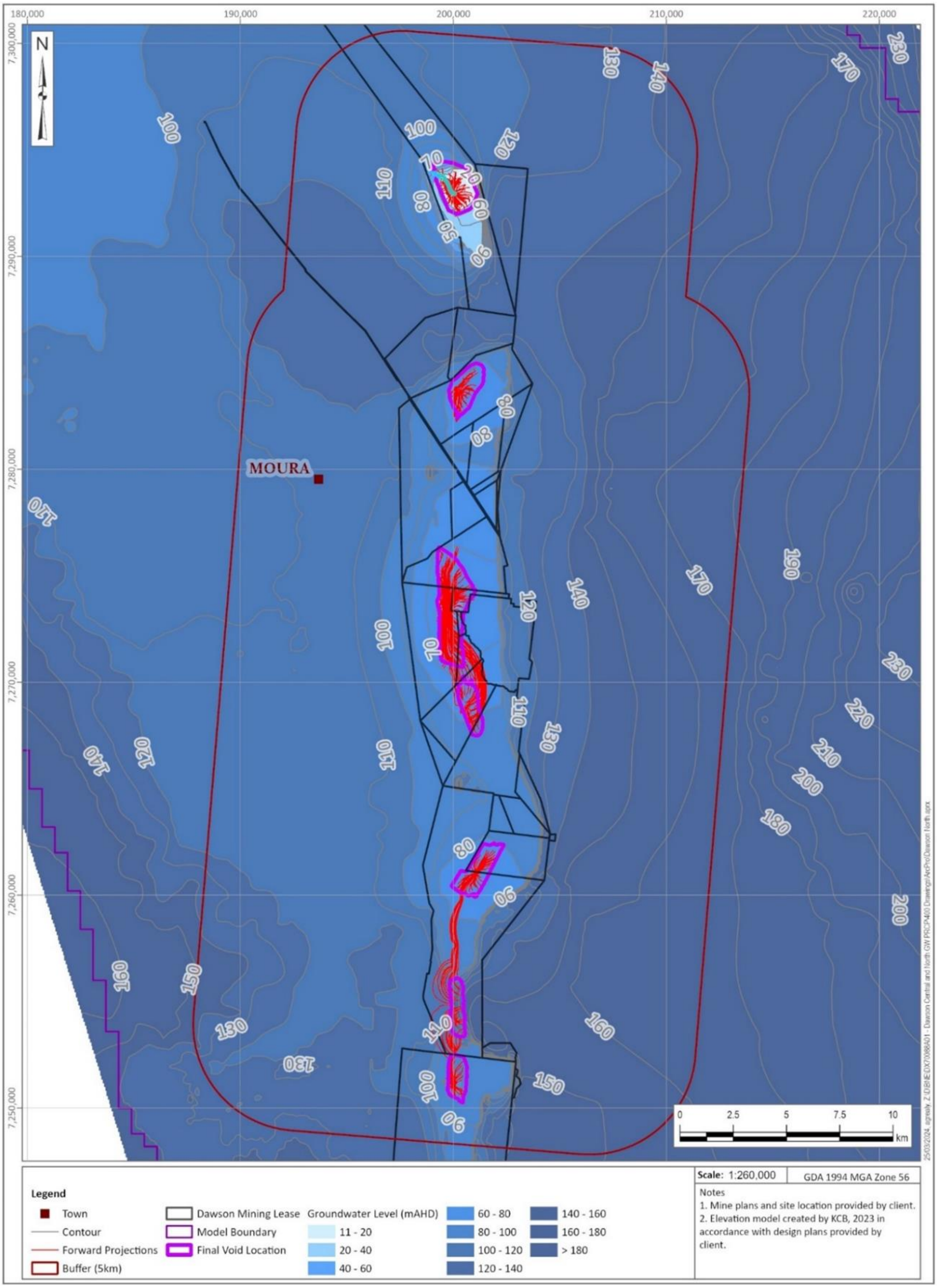


Figure 2.2 Forward Particle Tracking in Post-Closure Period

3 SUMMARY

A hydrogeological assessment and numerical modelling exercise was completed to assess the potential post-closure groundwater impacts from Dawson. Based on these results, the operational period will have the most pronounced influence on the groundwater system, with groundwater levels recovering after closure, as the six final voids in the Dawson Central and North area reach their final equilibrated water levels. The assessment has also shown that after closure, the final voids will collectively act as a groundwater sink and that groundwater flows from these voids are not anticipated in the post-mining period simulated (1,000 years).

4 CLOSURE

This letter is an instrument of service of Klohn Crippen Berger (KCB). The letter has been prepared for the use of Anglo American Steelmaking Coal (Client) for the specific application to the Dawson Central and North PRCP and may be published or disclosed by the Client to relevant Queensland Government departments.

KCB has prepared this letter in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered; however, the use of this letter will be at the user's sole risk absolutely and in all respects, and KCB makes no warranty, express or implied. This report may not be relied upon by any person other than the Client or Queensland Government without KCB's written consent.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

1. This summary letter is to be read in full, with sections or parts of the letter relied upon in the context of the whole letter. Relevant technical detail is contained in the full technical report.
2. This summary letter is a selection of key elements of the letter. It does not include details needed for the proper application of the findings and recommendations in the letter.
3. The observations, findings and conclusions in this letter are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
4. The letter is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
5. KCB should be consulted regarding the interpretation or application of the findings and recommendations in the summary letter.
6. This letter is electronically signed and sealed, and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

Yours truly,

KCB AUSTRALIA PTY LTD.

Brent Usher, PhD RPGeo
Senior Hydrogeochemist, Principal

AC:BU