Glendell Mine Modification 6

Modification Report
Mt Owen Pty Limited
January 2026

Executive Summary

Background

Glendell Mine (Glendell) is a coal mining operation located approximately 20 km north-west of Singleton in the Upper Hunter region of NSW. Glendell is a component of Mount Owen/Glendell Operations (MGO), a mining precinct which also includes the Mount Owen and Ravensworth East Mines and the Mount Owen Coal Handling and Preparation Plant. MGO is managed by Mt Owen Pty Limited (MOPL), which is a subsidiary of Glencore Coal Pty Limited.

MGO (including Glendell) is a participant in the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS). The GRAWTS is a network of infrastructure that enables transfer of water and tailings between neighbouring Glencore-managed operations (namely MGO, Integra Underground Mine, Liddell Mine and Ravensworth Operations).

Glendell operates under Development Consent DA 80/952 granted under the *Environmental Planning and Assessment Act 1979* (EP&A Act). DA 80/952 (as modified) enables mining operations to be undertaken until 30 June 2026.

Due to MGO being a participant in the GRAWTS, there are multiple synergies between Glendell and the surrounding established Glencore-managed operations. MOPL is seeking a modification to DA 80/952 to enable the continued use of Glendell's existing assets to support the surrounding operations that participate in the GRAWTS.

The Modification

The proposed Modification to DA 80/952 includes:

- Use of Barrett Pit as a mine water storage, including for water received via the GRAWTS; and
- Continuation of existing approved activities at the Glendell Mine Infrastructure Area (MIA).

These activities are proposed until 31 December 2039, which represents the duration of currently approved mining operations at sites participating in the GRAWTS. This will fulfil the objective of utilising Glendell's assets to benefit surrounding mining operations that participate in the GRAWTS.

The Modification is sought under Section 4.55(2) of the EP&A Act.

Barrett Pit Water Storage

The proposed use of Barrett Pit as a water storage may involve transfer of water both into and out of Barrett Pit. This water may include water that has been shared with the Mount Owen Mine by other participants in the GRAWTS (pursuant to existing approvals).

Water will be transferred to and from Barrett Pit primarily using existing infrastructure. If any other ancillary infrastructure is required for this purpose, such infrastructure will be located within the approved disturbance boundary of DA 80/952.

Water management infrastructure will remain operational for the duration of the period that Barrett Pit is used as a water storage (i.e. to 31 December 2039). The decommissioning of such infrastructure and rehabilitation of Barrett Pit will occur following completion of water management activities.

Continued Use of Glendell MIA

The Glendell MIA is approved to be used for ancillary mining activities including operational management, communications, services, training, administration and plant maintenance. The Glendell MIA does not include any coal handling or processing infrastructure.

The Modification seeks approval to continue use of these existing facilities until 31 December 2039. It does not propose construction of additional infrastructure at the Glendell MIA.

Impact Assessment

Barrett Pit Water Storage

The Barrett Pit is approved to remain as a final void, as indicated by the approved conceptual final landform shown in Appendix 6 of DA 80/952. Under the approved development scenario, this void would receive passive inflows (i.e. groundwater seepage and catchment runoff) and form a final void lake. As the Modification proposes to use the Barrett Pit as a water storage, it may result in greater volumes in the void than the approved development scenario. As such, the primary environmental risks for assessment are:

- Whether additional storage volumes may result in seepage to the surrounding aquifers;
- Whether additional storage volumes may increase the risk of uncontrolled discharges (overflows); and
- Whether there are any impacts on water quality.

To assess these risks, a Salt and Water Balance Assessment (SWBA) has been undertaken by ATC Williams and a Groundwater Impact Assessment (GIA) has been undertaken by Umwelt. Both these assessments utilised numerical modelling that considered mining operations across the wider GRAWTS (i.e. not limited to Glendell only).

The Permian (bedrock) aquifer has limited utility for environmental and water supply purposes due to its low yield and high salinity. The alluvial aquifers surrounding Glendell are of greater interest from an environmental perspective, but are nonetheless categorised as a 'less productive groundwater system' under the NSW Aquifer Interference Policy.

The GIA estimated that the base of the weathered zone (regolith) is approximately 50 mAHD. The predicted water levels in Barrett Pit are significantly lower than this elevation and therefore connectivity to alluvial aquifers is not expected.

Although no seepage is expected towards the alluvial aquifers, GIA modelling predicts a minor increase in seepage towards the Permian aquifer. The salt balance within the SWBA predicted that the total dissolved solids (salinity) (TDS) of water stored in Barrett Pit will decrease from ~5,500 to ~3,000 mg/L during the proposed period of water storage.

In comparison, the coal seams typically exhibit TDS of around 6,320 mg/L and interburden exhibits TDS of around 5,850 mg/L (Umwelt, 2025). As such, seepage of water from Barrett Pit to the Permian strata is not expected to degrade the water quality of the receiving aquifer.

The water balance predicted that the Barrett Pit may store approximately 37 GL of water under wet climatic conditions (95th percentile rainfall). Given that the Barrett Pit has an estimated storage capacity of 91 GL, there is sufficient freeboard to contain large storm events. As such, the Modification is not expected to result in overflows from Barrett Pit.

Therefore, the proposed use of Barrett Pit as a water storage is not expected to result in any seepage to the surrounding watercourses or alluvial aquifers. Conversely, the SWBA and GIA predict the following positive impacts:

- The ability to store water in Barrett Pit will reduce storage within the nearby Bayswater North Pit (also within MGO), which will reduce the risk of seepage out of that void; and
- Higher water levels in Barrett Pit will assist in the post-mining recovery of the groundwater heads in the surrounding aquifers, resulting in lower drawdown of the alluvium and impacts on stream baseflows.

Water levels in Barrett Pit are predicted to be lower than the long-term equilibrium level (~26mAHD), as previously assessed for Modification 2 to DA 80/952. As such, the water level in the final void will rise after cessation of water storage activities, as would occur under the approved development scenario.

Rehabilitation of the final void will occur after Barrett Pit is no longer required as a water storage. It is likely that the Barrett Pit will need to be dewatered to facilitate the rehabilitation process, and that water will be returned after the final landform is established. Even if this water is returned to the Barrett Pit after rehabilitation, the water level immediately after mine closure will be below the predicted long-term equilibrium. After mine closure, the water level within the Barrett Pit would rise under natural processes until equilibrium is reached. The Modification will not alter the catchment or geometry of the approved final void and will therefore not affect the natural processes that influence the long-term equilibrium level.

No additional surface disturbance is required for the proposed use of Barrett Pit as a water storage, and the operation of ancillary infrastructure (e.g. pumps) is not expected to generate significant noise or dust emissions.

Continued Use of Glendell MIA

Since the Glendell MIA is used primarily for administrative and maintenance activities (as opposed to coal processing), the continued use of this infrastructure is unlikely to contribute significantly to cumulative noise or dust impacts. The Glendell MIA has been considered in previous assessments of cumulative impacts for Glendell and the post-mining impacts of activities at the MIA will be significantly less than the contribution of Glendell during previous mining operations.

The Modification will not involve any additional groundwater disturbance or construction activities at the MIA. The Modification will only alter the timeframe for rehabilitation of the MIA to agricultural grassland. However, a related subsidiary of Glencore entity conducts grazing activities on mine-owned 'buffer lands' (i.e. land not used for mining operations). Although the Modification would postpone the commencement of post-mining agricultural land uses at the MIA until after December 2039, overall agricultural productivity is unlikely to be significantly affected due to grazing continuing on Glencore buffer lands.

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Appendix A Water and Salt Balance Assessment
Appendix B Groundwater Impact Assessment

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	Name	**Position**	**Signature**	**Date**
Prepared by	AW	Principal Environmental Scientist		15/01/2026
Reviewed by	DW	Principal Environmental Scientist		15/01/2026
Approved by	DW	Principal Environmental Scientist		19/01/2026

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1. Introduction

This section introduces the development, the applicant and the Modification.

1.1 Background

Glendell Mine (Glendell) is a coal mining operation located approximately 20 km north-west of Singleton in the Upper Hunter region of NSW (see **Figure 1**). Glendell is a component of Mount Owen/Glendell Operations (MGO), a mining precinct which also includes the Mount Owen and Ravensworth East Mines and the Mount Owen Coal Handling and Preparation Plant (CHPP). MGO is managed by Mt Owen Pty Limited (MOPL), which is a subsidiary of Glencore Coal Pty Limited (Glencore).

MGO is a participant in the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS), which is a network of infrastructure that enables transfer of water and tailings between neighbouring Glencore-managed operations (namely MGO, Integra Underground Mine, Liddell Mine and Ravensworth Operations). The GRAWTS enables surplus water at a particular site to be used for operational purposes at other sites within the scheme. The water sharing facilitated by GRAWTS has the benefits of reducing reliance on external water sources and the need for off-site discharges under the Hunter River Salinity Trading Scheme.

Glendell operates under Development Consent DA 80/952 granted under the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approved development includes a single open cut mining area (Barrett Pit) and ancillary infrastructure. DA 80/952 (as modified) enables the following activities to be undertaken:

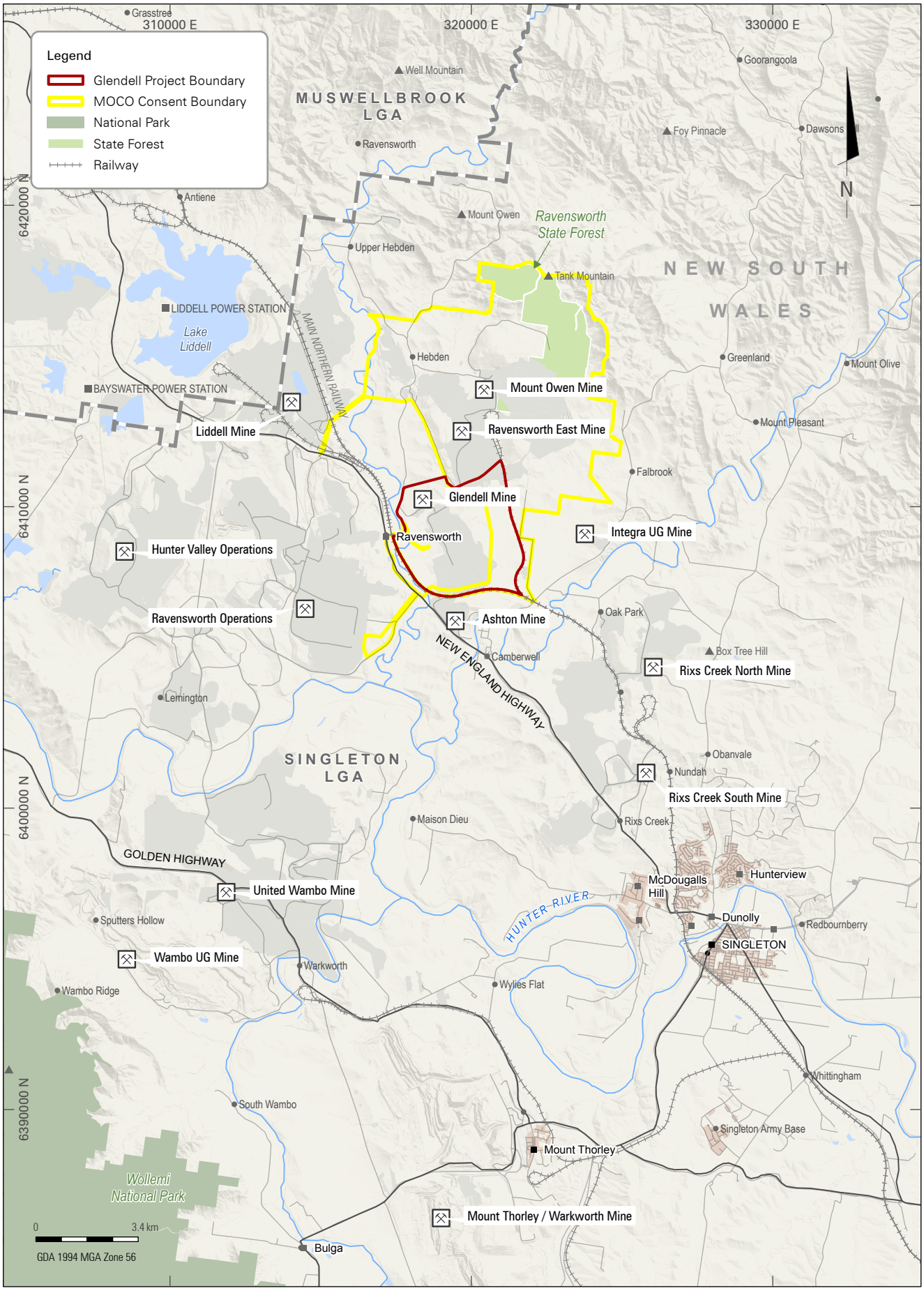
- Extraction of up to 4.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal using truck and excavator mining methods;
- Hauling of Run of Mine (ROM) coal to Mount Owen Mine (Mount Owen) for processing and transportation;
- Hauling of overburden and materials to and from Ravensworth East Mine;
- Transportation of up to 1 Mtpa of product coal to domestic power stations by conveyor;
- Ancillary surface infrastructure including offices, workshop, access roads, services and water management infrastructure; and
- Diversion of Bettys Creek and Swamp Creek.

The approved activities under DA 80/952 are conceptually illustrated in **Figure 2**. DA 80/952 permits mining operations to be undertaken until the end of June 2026.

MOPL is seeking a modification to DA 80/952 to enable:

- The use of Barrett Pit as a mine water storage, including for water received via the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS) (the Modification). The use of Barrett Pit as a water storage is proposed until 31 December 2039, which represents the duration of currently approved mining activities at sites participating in the GRAWTS. The GRAWTS is described in **Section 1.2.2**; and
- The continuation of existing approved activities at the Glendell Mine Infrastructure Area (MIA) until the end of mining operations at sites that are participants in the GRAWTS (i.e. until 31 December 2039).

Although there are multiple synergies between Glendell and the other components of MGO, the Mount Owen and Ravensworth East Mines and Mount Owen CHPP are subject to a separate Development Consent (SSD-5850). The Modification does not involve changes to the activities approved under SSD-5850.



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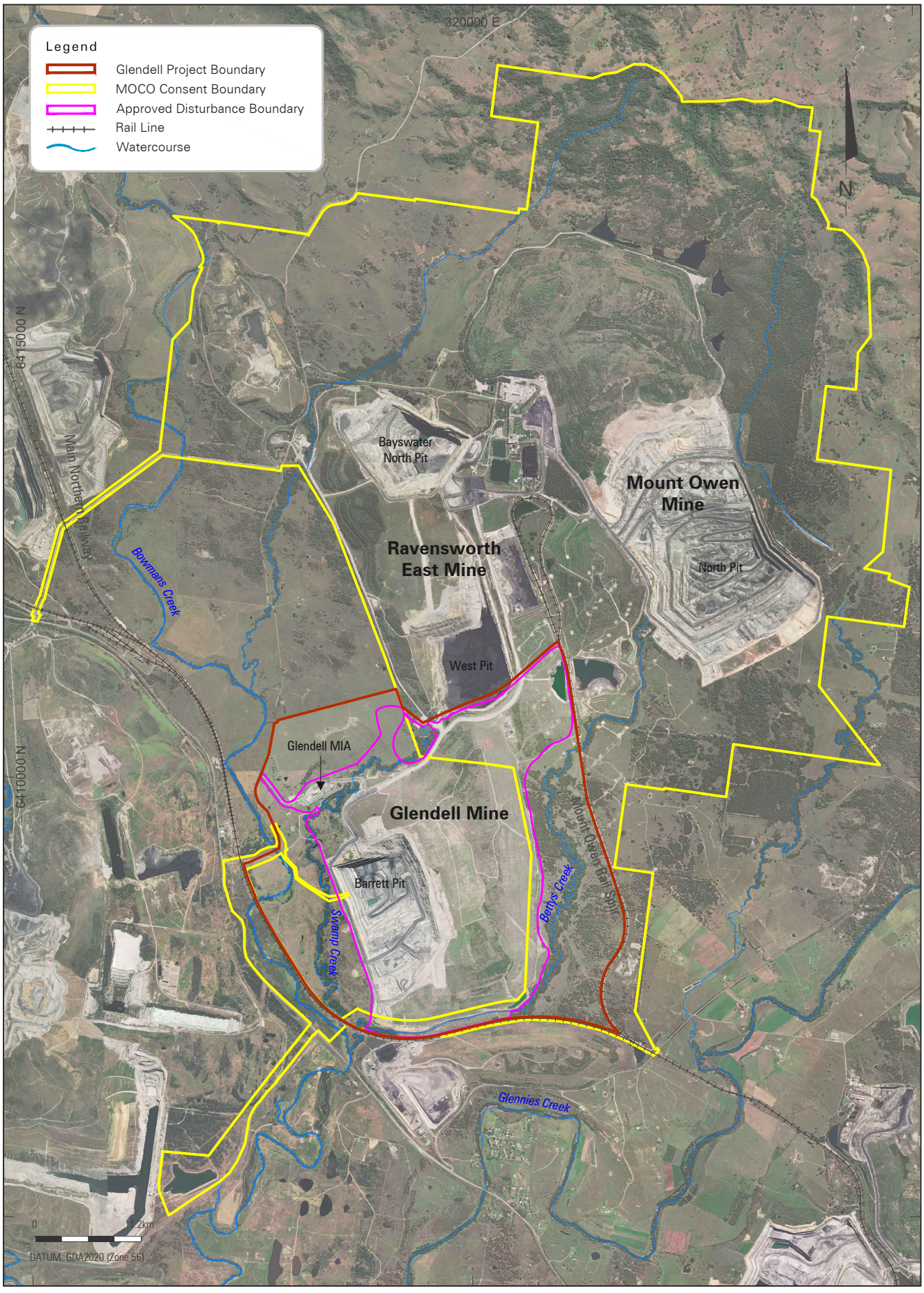
GLENCORE

xenith

GLENDELL MINE

Regional Locality

FIGURE 1



3172GLEN 004 - Approved Development (23/12/2025)

GLENDELL MINE

GLENCORE

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Approved Development Layout

FIGURE 2

1.2 Approvals History

1.2.1 Glendell Mine

DA 80/952 was originally granted on 2 May 1983 under the then section 101 of the EP&A Act. DA 80/952 originally permitted mining operations to be undertaken until 2013 (i.e. 30 years of mining).

DA 80/952 has subsequently been modified on five occasions.

Modification 1 (MOD1) to DA 80/952 facilitated the processing of Glendell's coal at the neighbouring Liddell Mine and was granted in 1997.

Modification 2 (MOD2) was approved on 25 February 2008 and instituted significant changes to the mine plan and coal processing arrangements. MOD2 effectively superseded the development described in the original development consent and MOD1. As such, the currently approved development is represented by the activities approved through MOD2 and subsequent modifications to DA 80/952 (summarised in **Table 1**).

MOD2 also facilitated the integration of the Glendell and Mount Owen water management systems. As a result, MOPL has consent to transfer water between Glendell and Mount Owen. DA 80/952 therefore enables Glendell to receive water from or transfer water to the other GRAWTS participants via Mount Owen.

DA 80/952 (as modified) allows for mining operations to be carried out until the end of June 2026. 'Mining operations' is defined in the consent as including the removal and emplacement of overburden and extraction, processing, handling, storage and transport of coal on site. The conditions of DA 80/952 will continue to apply after this date in all other respects, including those changes proposed for the Modification (see **Section 3**).

Table 1 Approved Activities under DA 80/952

Modification	Description	Date Modified
MOD2	This modification proposed the following alterations: › Increase in production rate to 4.5 Mtpa of ROM coal; › Extension of mine life to 30 June 2024; › Alterations to the approved mine plan (without increasing the disturbance area or height of overburden emplacement areas); › Change in mining method to excavator and truck operations; › Use of an internal haul road to transport ROM coal to the Mount Owen Complex (MOC) Mine Infrastructure Area; › Use of internal haul road for movement of overburden and materials to and from Ravensworth East Mine; › Integration of water management infrastructure with the system at MOC; › Integration of rejects and tailings management with the system at MOC; › Transportation of up to 1 Mtpa of product coal to domestic power stations using the Ravensworth East conveyor; › Relocation of the access road off Hebden Road;	25 February 2008

Modification	Description	Date Modified
	› Alterations to the Bettys Creek and Swamp Creek diversions; › Addition of a 200 ML mine water dam and pipeline; and › Relocation of offices, workshop and ancillary surface infrastructure.	
Modification 3 (MOD3)	› This modification proposed the realignment of a 2.7 km section of an existing 132 kV Ausgrid powerline and associated activities	1 December 2016
Modification 4 (MOD4)	› This modification proposed a minor expansion of the open cut mining area (Barrett Pit) to recover an additional 2.5 Mt of ROM coal.	4 March 2020
Modification 5 (MOD5)	› This modification sought to extend the approved period of mining operations at Glendell by an additional two years (i.e. to 30 June 2026).	1 July 2024

1.2.2 GRAWTS

The GRAWTS is a network of infrastructure that enables transfer of water and tailings between neighbouring Glencore managed operations (including MGO, Integra Underground Mine, Liddell Mine and Ravensworth Operations).

By enabling water sharing, the GRAWTS improves the performance of its participating sites from a water management perspective. For example, surplus water at a particular site can be used to satisfy operational purposes at other sites within the scheme. The water sharing facilitated by GRAWTS has the benefits of reducing reliance on external water sources and the need for off-site discharges under the Hunter River Salinity Trading Scheme. Water sharing through the GRAWTS has been established through various modifications to the planning approvals of its participating sites, including the following modifications relevant to MGO:

- Modification 1 to SSD-5850 (Mount Owen) and Modification 7 to PA 08_0101 (Integra Underground Mine), which facilitated the construction of a pipeline to transfer water from Integra Underground to Mount Owen;
- Modification 6 to SSD-5850, which facilitated the construction of the Narama Pipeline, which enables transfer of water between Ravensworth Operations and Mount Owen;
- Modification 7 to SSD-5850, Modification 4 to PA 09_0176 (Ravensworth Operations) and Modification 8 to DA 305-11-01 (Liddell Mine), which removed any pre-existing volumetric limits on water transfers between these three operations; and
- Modification 10 to SSD-5850, which facilitated transfer of water from Mount Owen to Integra Underground.

Glendell's development consent (DA 80/952) has not directly been modified as part of any previous applications associated with the GRAWTS. However, MOD2 integrated the water management systems of Glendell and Mount Owen. As such, Glendell participates in the GRAWTS through its synergies with Mount Owen.

1.3 Modification Overview

The Modification seeks approval to use the Barrett Pit as a water storage and transfer point during the post-mining phase. This includes transfer of mine water into and out of the Barrett Pit.

The Glendell MIA includes administration buildings, a workshop, storage facilities, communications and services infrastructure, and carpark. The Modification proposes the continuation of the existing approved activities at the Glendell MIA to support the surrounding mining operations within the GRAWTS.

The use of Barrett Pit as a water storage and continued use of the Glendell MIA is proposed until 31 December 2039. This period represents the duration of approved mining activities at the sites which participate in the GRAWTS. The Modification is described in **Section 3**.

1.4 Objectives of the Modification

MOPL has identified that the Barrett Pit would have utility as a water storage and transfer point (following cessation of mining operations). The proposed use of the Barrett Pit would yield the following benefits:

- The Barrett Pit occupies a central location within the GRAWTS and would be an efficient water staging point for water that MGO transfers to and from neighbouring sites; and
- The additional storage provided by the Barrett Pit will assist in management of surplus water during wet climatic conditions.

The continued use of the Glendell MIA beyond the period of mining operations under DA 80/952 would allow the ongoing use of this facility to support other operations within the MGO complex and the GRAWTS.

1.5 Applicant

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https://www.glencore.com.au/operations-and-projects/coal/current-operations/mt-owen-glendell-open-cut

1.6 Document Purpose

This Modification Report supports an application to modify DA 80/952 under Section 4.55(2) of the EP&A Act. This Modification Report has been prepared to satisfy Clauses 99 and 100 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) and with regard to the form and content requirements of the '*State Significant Development Guidelines – Preparing a Modification Report*' (Department of Planning, Infrastructure and Environment, 2022).

1.7 Document Structure

The Modification Report is structured as follows:

- **Section 2** outlines the environmental and planning context for the Modification;
- **Section 3** describes the Modification;
- **Section 4** summarises the regulatory framework applicable to the Modification;
- **Section 5** summarises the stakeholder engagement conducted for the Modification;
- **Section 6** discusses the potential environmental impacts of the Modification and the proposed management and mitigation measures to minimise these impacts;
- **Section 7** evaluates the merits of the Modification;
- **Section 8** lists the reference material used in the preparation of this document; and
- **Section 9** defines the abbreviations used in this document.

2. Strategic Context

This section outlines the strategic context that is relevant to the Modifications, including the relevant environmental and planning considerations and relevant government policies.

2.1 Environmental Context

2.1.1 Land Use

Glendell is located within an industrial setting, with surrounding land uses dominated by coal mining and power generation. Neighbouring Glendell are several Glencore operated mines including other components of MGO, Integra Underground Mine, Ravensworth Operations and Liddell Coal Operations (LCO) (see **Figure 1**). The locality of these operations forms the Greater Ravensworth Area mining precinct, with the associated land being predominantly owned by subsidiaries of Glencore.

Ashton Mine and Rix's Creek North Mine are third-party owned mines located to the south of Glendell. These are owned by Ashton Coal Operations Pty Ltd and Bloomfield Collieries Pty Ltd, respectively.

AGL Macquarie operates the Bayswater Power Station located approximately 10 km north-west of Glendell. AGL Macquarie also owns the Liddell Power Station, located approximately 8 km north-west of Glendell. Liddell Power Station was decommissioned in the 2023 and the owner is currently exploring option to use the site for renewable energy purposes.

The major transport corridors in the region are the New England Highway and the Main Northern Rail Line. Both these corridors traverse to the west of Glendell.

The nearest settlement is the village of Camberwell, located approximately 1.1 km south of Glendell. Camberwell consists predominantly of mine-owned residences, although a small number of properties remain under private ownership.

The nearest major townships are Singleton and Muswellbrook, both of which are more than 10 km from Glendell.

2.1.2 Land Ownership

Appendix 1 of DA 80/952 provides the Schedule of Land at Glendell (i.e. the parcels of land that the Development Consent applies to). The Modification does not alter the Schedule of Land for this development.

All of the land subject to DA 80/952 is owned by subsidiaries of Glencore, except for one parcel of Crown land near the southernmost extent of the Glendell Project Boundary. The Modification does not involve any activities on Crown land.

2.2 Planning Constraints

2.2.1 Flood Prone Land

Glendell is not located within any flood prone land identified under the *Singleton Local Environmental Plan 2013* (Singleton LEP).

The Glendell mining area is bounded by Swamp Creek, Bettys Creek and Bowmans Creek (which are tributaries of the Hunter River). The 100-year average recurrence interval (ARI) flood extents of these watercourses were modelled by Umwelt (2014). The 100 year ARI flood extent of Swamp Creek is located near the western limit of Barrett Pit and the Glendell MIA but does not encroach upon these areas relevant to the Modification.

2.2.2 Bushfire Prone Land

Land prone to bushfire is assessed based on level of risk and separated into three vegetation category types as follows:

- Vegetation category 1 represents the highest bushfire risk and includes forests, woodlands, heaths and timber plantations;
- Vegetation category 2 represents the lowest risk and includes rainforests, remnant vegetation and land that is actively managed; and
- Vegetation category 3 is the most recently introduced category and falls between categories 1 and 2. Vegetation category 3 includes grasslands and shrublands.

Most of the bushfire prone land at Glendell is mapped as Vegetation Category 3. Due to it being a cleared area, the land occupied by Barrett Pit is not mapped as bushfire prone land.

2.2.3 Mine Subsidence Districts

Glendell is located within the Patrick Plains Mine Subsidence District (MSD). Section 15 of the *Coal Mine Subsidence Compensation Act 2017* (CMSC Act) states that the approval of Mine Subsidence NSW is required for the erection or alteration of an "improvement" within an MSD. The Modification will not involve any changes to the existing infrastructure at Glendell. Therefore, the Modification does not give rise to any requirements under the CMSC Act.

2.2.4 Other Matters

The Environment Protection Authority (EPA) maintains a register of contaminated land in NSW. Glendell is not located on or near a notified contaminated site. The Modification will be undertaken entirely on land that is currently used for mining operations. Therefore, the risk of land contamination due to previous land uses is not applicable to the Modification.

The Modification is not located on or near any land mapped as a landslide risk area.

2.3 Planning Considerations

2.3.1 Government Policies

In January 2025, the NSW EPA published the guidelines entitle '*NSW Guide for Large Emitters: Guidance on How to Prepare a Greenhouse Gas Assessment as Part of the NSW Environmental Planning Processes'* (GHG Guide) which outlines the climate change assessment requirements for '*large emitters'* (NSW EPA, 2025). The GHG Guide applies to proposed developments that satisfy the following criteria for a '*large emitter*':

- The project proposal requires development assessment and approval, or a change to an approval, under the EP&A Act*;*
- The project involves one or more scheduled activities under Schedule 1 of the *Protection of the Environment Operations Act* (POEO Act) and/or will be carried out at an existing licensed premises; and
- The project is likely to emit 25,000 tonnes (t) or more of Scope 1 and 2 emissions carbon dioxide equivalent (CO_2-e) in any financial year during the operational life of the project (based on planned operational throughput and as designed).

In the case of modifications, the 25,000 t threshold applies to any additional emissions over and above those of the existing development.

The Modification would only generate greenhouse gas (GHG) emissions through electricity consumption for pumping of water. The Scope 2 GHG emissions from this activity are expected to be well below 25,000 t CO_2-e. Therefore, the GHG Guide does not apply to the Modification.

2.3.2 Cumulative Impact

GRAWTS is a network of water and tailings infrastructure that connects multiple operations, including MGO, Integra Underground, LCO and Ravensworth Operations. Some of these participating sites also have approval to transfer water with other developments outside of the GRAWTS. The surface water and groundwater assessments have considered the full extent of operations within the GRAWTS. As such, the impact predictions in **Sections 6.1** and **Section 6.2** represent the cumulative water impacts of the Modification and other surrounding developments.

The contribution of the Modification to cumulative dust and noise impacts is expected to be immaterial, as the Modification only involves the operation of water pumps.

2.3.3 Planning Agreements

Glendell impacts on council infrastructure and services have been addressed through development contributions in accordance with Schedule 2, Condition 12 of DA 80/952. Accordingly, DA 80/952 does not require Glendell to enter into a planning agreement.

The Modification will not involve a construction phase or increase the operational workforce at MGO. As such, it will not result in increased demand for council infrastructure or services.

3. Modification Description

This section describes the activities proposed by the Modification.

3.1 Proposed Activity

3.1.1 Barrett Pit Water Storage

The Modification proposes the post-mining use of the Barrett Pit as a water storage and transfer point. This may involve transfer of water both into and out of Barrett Pit, including water shared with Mount Owen. Given that Mount Owen has existing approvals to share water with the neighbouring site via the GRAWTS, the Barrett Pit may be used to manage water transferred to or from Mount Owen via the GRAWTS. However, the Modification is not seeking approval for transfer of water between different sites, as the necessary transfer pathways are already approved.

The Barrett Pit is approved to remain as a final void, as indicated by the approved conceptual final landform shown in Appendix 6 of DA 80/952. Under the approved development scenario, this void would receive passive inflows (i.e. groundwater seepage and catchment runoff) and form a final void lake. In this regard, the proposed storage of water within Barrett Pit does not differ from the approved development scenario. However, the Modification is seeking approval to actively pump water into and out of Barrett Pit during the post-mining phase (whereas the approved scenario only includes passive inflows).

MOD2 to DA 80/952 integrated the water management systems of Glendell and Mount Owen. Consistent with DA 80/952 (as modified), Barrett Pit will only directly transfer water to and from other storages within MGO.

The Water Resources Assessment for MOD2 (Umwelt, 2007) predicted that the final void lake will reach a long-term equilibrium level of 26 mAHD. This predicted level is 44 m below the surrounding land surface, which indicates there is a significant amount of freeboard to contain large storm events. The water balance modelling undertaken for the Modification (see **Section 6.1**) predicts that water levels will not exceed 26 mAHD in the period that Barrett Pit is proposed to be used as a water storage and transfer point.

Water will be transferred to and from Barrett Pit primarily using existing infrastructure. If any other ancillary infrastructure is required for this purpose, such infrastructure will be located within the approved disturbance boundary (see **Figure 2**).

The use of the Barrett Pit as a water storage and transfer point is proposed until 31 December 2039. This represents the current limit of approved mining operations associated with the GRAWTS.

Rehabilitation of the final void will occur after Barrett Pit is no longer required as a water storage. It is likely that the Barrett Pit will need to be dewatered to facilitate the rehabilitation process, and that water will be returned after the final landform is established. After mine closure, the water level within the Barrett Pit would rise under natural processes until equilibrium is reached.

Ancillary water management infrastructure will remain operational for the duration of Barrett Pit being used as a water storage (i.e. potentially until 31 December 2039). The decommissioning of such infrastructure and rehabilitation of Barrett Pit will occur following completion of water management activities.

A geotechnical assessment has been undertaken by DAS Mining Solutions (2025) which has confirmed that the Barrett Pit, in its current configuration, will be geotechnically safe for storage of water.

3.1.2 Glendell MIA

The Glendell MIA is approved to be used for ancillary mining activities including operational management, communications, services, training, administration and plant maintenance. These activities support the other mining operations at MGO (as approved under SSD-5850), as well as the wider GRAWTS. The Glendell MIA does not include any coal handling infrastructure.

Given the synergies between MGO and the GRAWTS, the Modification seeks to confirm that approved ancillary activities at the Glendell MIA will continue until 31 December 2039, to continue serving Mount Owen and the neighbouring mining operations that participate in the GRAWTS.

3.2 Comparison to the Approved Development

Table 2 outlines the key characteristics of the approved development, and identifies the changes proposed by the Modification.

Table 2 Proposed Modifications to Glendell DA 80/952

Aspect	Approved Development	The Modification
Land Use	Coal mining and ancillary activities	No change.
Duration of Mining Operations	Mining operations until end of June 2026	No change (see explanation in **Section 4.2**)
Mining Method	Open cut mining	No change
Production rate	Maximum production rate of 4.5 Mtpa of ROM coal	No change
Surface infrastructure	Offices, bathhouse, workshop, fuel storages, vehicle wash bays, powerlines, access roads and water management infrastructure	No change to approved surface infrastructure. Ongoing use of the Glendell MIA facilities until 31 December 2039
Tailings management	Coal extracted from Glendell is processed at the Mount Owen CHPP. The resultant reject materials are managed in accordance with SSD-5850, which includes transfer of tailings to other sites via the GRAWTS.	No change
Water management	Water captured within mining areas is stored in mine water dams and reused for operational purposes. Ability to transfer water to and receive water from Mount Owen.	Use of the Barrett Pit Void as a post-mining water storage and water transfer point until 31 December 2039.

Aspect	Approved Development	The Modification
Final landform	Conceptual final landform is shown in Appendix 6 of DA 80/952. Approved final land uses are grassland for grazing and bushland for wildlife habitat	No change
Operating hours	24 hours per day, 7 days per week	No change
Workforce	Approximately 150 full time equivalent (FTE) personnel	No change

3.3 Alternatives Considered

3.3.1 Do Nothing

Under the 'Do Nothing' scenario, mining operations at Glendell would cease at the end of June 2026, followed by mine closure and rehabilitation activities. Barrett Pit and associated overburden emplacement area would require landform establishment and rehabilitation to achieve the rehabilitation objectives for Glendell detailed in DA 80/952. The Barrett Pit would naturally form a final void lake due to passive groundwater inflows and rainfall runoff.

Although the Barrett Pit would also accumulate water under the 'Do Nothing' scenario, this would occur due to natural processes and does not serve any water management objective. The water balance undertaken for this Modification (see **Section 6.1**) indicates that material quantities of water will be transferred to Barrett Pit under median or wetter climatic conditions. Under a 'Do Nothing' scenario, those quantities of water would need to be stored elsewhere within the GRAWTS. Whilst the GRAWTS would still be able to adequately manage predicted mine water make under the 'Do Nothing' scenario, the improved water management efficiency facilitated by using Barrett Pit would be foregone.

4. Statutory Context

This section provides a summary of the legislative provisions relevant to the Modification.

4.1 Overview

Table 3 summarises the regulatory framework that is relevant to the Modification. The aspects of the regulatory framework that warrant greater analysis are discussed further in **Section 4.2**.

Table 3 Relevant Legislation Provisions

Aspect	Relevant Provisions	Applicability to Modification
Power to modify approval	Section 4.55(2) of the EP&A Act	The consent authority has the power to modify the existing approval under Section 4.55(2) if the modified development is considered substantially the same development for which consent was originally granted (as explained in **Section 4.2.1**).
Permissibility	Singleton LEP	Glendell is located on land zoned as RU1 Primary Production. The Singleton LEP provides that open cut mining is permitted (with consent) on land within zone RU1. Although the Modification relates to the post-mining use of Barrett Pit, this activity can be characterised as ancillary to open cut mining. Therefore, the Modification is permissible on land zoned as RU1.
Gateway process	Clause 103 of the EP&A Regulation Clause 2.24 of the *State Environmental Planning Policy (Resources and Energy) 2021* (Resources and Energy SEPP)	The Modification does not fall within the definition of 'mining or petroleum development' because no new mining leases are required. Accordingly, the Gateway process does not apply to the Modification.
Matters for consideration	Section 4.55(3) of the EP&A Act Part 2.3 of the Resources SEPP	The consent authority must consider the matters under Section 4.15(1) of the EP&A Act that are relevant to the Modification. Part 2.3 of the Resources SEPP prescribes additional matters that must be considered for mining proposals.
Other Approvals	Section 48 of the *Protection of the Environment Operations Act 1997* (POEO Act)	Operations at Glendell are conducted in accordance with Environment Protection Licence (EPL) 12840 granted under the POEO Act. This EPL will be held for the duration of the activities proposed for the Modification, and the Modification will not require any variation to the EPL conditions.
	Sections 5 and 6 of the *Mining Act 1992* (Mining Act)	Mining activities associated with the Modification will be located wholly within existing mining leases granted under the Mining Act.

Aspect	Relevant Provisions	Applicability to Modification
	Part 2 of the *Mining Act 1992* (Mining Act)	Water access licences (WALs) are required for taking water that is subject to a Water Sharing Plan. The requirement for WALs is triggered when water is initially captured or extracted by mining operations. The proposed pumping of water to and from Barrett Pit does not give rise to any further licensing requirements.
	Sections 89, 90 and 91 of *Water Management Act 2000* (WM Act), Section 4.41 of EP&A Act	The Modification will not require any changes to water use approvals, water management work approvals or activity approvals under the WM Act.
	Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)	The Modification does not involve any additional land disturbance and is not expected to result in discharges of mine water to the surrounding environment. As such, it is not expected to significantly impact any protected matters under the EPBC Act.

4.2 Key Regulatory Matters

4.2.1 Power to Modify

Section 4.55(2) of the EP&A Act gives a consent authority the power to modify a development consent. This power to modify is limited by the requirement for the modified development to be 'substantially the same development'. Section 4.55(2)(a) states that the consent authority may exercise its power to modify if:

> *"it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which consent was originally granted and before that consent as originally granted was modified (if at all)".*

Although Section 4.55 states that the modified development is to be compared to the 'original development' (i.e. before modifications), there is an exception for consents that have been modified under Section 75W. Clause 3BA(6) under Schedule 2 of the *Environmental Planning and Assessment Regulation (Savings, Transitional and Other Provisions) Regulation 2017* (EP&A Transitional Regulation) relevantly states (emphasis added):

> *"(6) In the application of section 4.55(1A) or (2) or 4.56(1) of the Act to the following development, the consent authority need only be satisfied that the development to which the consent as modified relates is substantially the same development as the development authorised by the consent (as last modified under section 75W."*

DA 80/952 was originally granted under Section 101 of the EP&A Act, which was provision under Part 4. Although the former Section 75W of the EP&A Act related primarily to modification of Part 3A approvals, Clause 8J(8) of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) allowed for development consents granted under Section 101 of the EP&A Act to be modified under Section 75W. Accordingly, MOD2 and MOD3 were granted under the former Section 75W of the EP&A Act.

The practical consequence of Clause 3BA(6) of the EP&A Transitional Regulation is that MOD2 and MOD3 are considered part of the approved development when considering if the modified development would be 'substantially the same development'.

The approved development under DA 80/952 (including MOD2 and MOD3) includes the containment, transfer and storage of mine water to minimise environmental impacts. The Modification proposes the use of Barrett Pit as an additional water storage and transfer point during the post-mining phase of the development. This additional water management activity is not materially different in character or scale to existing Glendell water management activities approved under DA 80/952. Furthermore, the Modification will not alter the following key characteristics of the approved development:

- Approved Disturbance Boundary;
- Mining footprint and methods;
- Production rates;
- Duration of mining operations (see **Section 4.2.2**); and
- Operating hours and workforce.

4.2.2 Duration of the Development

Condition 5 of Schedule 2 of DA 80/952 states:

> *5. Mining operations may take place until the end of June 2026.*
>
> *Note: Under this consent, the Applicant is required to rehabilitate the site and provide offsets to the satisfaction of the Secretary and Resources Regulator. Consequently, this consent will continue to apply in all other respects other than the right to conduct mining operations until the site has been rehabilitated and the offsets provided to a satisfactory standard.*

As explained in the 'Note' within the extract above, this condition only limits the undertaking of 'mining operations'. Activities which fall outside the definition of 'mining operations' may be undertaken beyond the end of June 2026.

The definition of 'mining operations' under DA 80/952 includes "…*the removal and emplacement of overburden and extraction, processing, handling, storage and transport of coal on site".* The proposed use of Barrett Pit for water management activities and the ancillary activities at the Glendell MIA do not fall within this definition of 'mining operations'.

The 'Note' in Condition 5 of Schedule 2 of DA 80/952 explains that *"consent will continue to apply in all other respects other than the right to conduct mining operations until the site has been rehabilitated and the offsets provided to a satisfactory standard"*. Therefore, this condition does not need to be modified to facilitate the proposed activities until 31 December 2039.

5. Stakeholder Engagement

This section outlines the stakeholder engagement completed for the Modification.

5.1 Regulatory Stakeholders

MOPL has consulted with NSW Department of Planning, Housing and Infrastructure (DPHI) to confirm the appropriate approvals pathway and scope of assessment for this Modification. DPHI has been consulted through the following engagement methods:

- Briefing meeting on 10 November 2025; and
- Scoping Request submitted on 9 December 2025.

MOPL has also consulted with the NSW Resources Regulator (RR), NSW Environment Protection Authority (EPA) and the NSW Department of Climate Change, Energy, the Environment and Water – Water Group (DCCEEW-Water) to ascertain any specific assessment requirements from those stakeholders. **Table 4** summarises the consultation undertaken with regulatory stakeholders, the issues raised and where those issues are addressed in this document.

Table 4 Regulatory Stakeholder Engagement Summary

Stakeholder	Consultation Method	Date(s)	Comments Raised for the Modification	Where Addressed
DPHI	Briefing Scoping Request	10/11/25 9/12/25	Need to consult with RR, EPA and DCCEEW-Water	**Section 5.1**
RR	Briefing	25/11/25	Implication of Modification on rehabilitation schedule	**Section 6.3.6**
EPA	Briefing	10/12/25	› Justification for the modified approval period sought › Assessment of water impacts from water storage in Barrett Pit › Consideration of post-mining GHG impacts	**Section 3.1** **Sections 6.1 & 6.2** **Section 6.3.2**
DCCEEW-Water	Briefing	12/12/25	› Groundwater assessment to be prepared in accordance with the DPE (2022) *Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical guideline.* › Confirmation that adequate water licencing is in place for the Modification	**Section 6.2**, **Appendix B** **Section 6.2.2**

Stakeholder	Consultation Method	Date(s)	Comments Raised for the Modification	Where Addressed
			› Consideration of water quality stored in Barrett Pit	**Sections 6.1.2.3; 6.2.2.2**

5.2 Community Stakeholders

Although the Modification is not expected to result in any off-site impacts, MOPL has consulted with community stakeholders as a matter of courtesy. Community consultation has been undertaken through the following methods:

› Meeting of the MGO Community Consultative Committee (CCC) on 16 October 2025; and
› Meetings of the Aboriginal Heritage Working Group on 11 June and 4 December 2025.

The CCC includes an active representative from Singleton Council.

6. Impacts, Management and Mitigation

The potential environmental impacts of MOD 6 have been assessed as part of this Modification Report. This section presents the results of the environmental assessments completed in respect of MOD 6 and outlines the measures that will be implemented to manage and mitigate potential impacts.

6.1 Surface Water

6.1.1 Background

ATC Williams completed a Water and Salt Balance Assessment (WSBA) to consider potential impacts of the Modification on the surrounding surface water resources. This assessment focuses on the proposed use of the Barrett Pit as a water storage in the post-mining phase. The proposed continuation of activities at the Glendell MIA has not been considered in the WSBA as that component of the Modification does not involve additional surface water impacts. The WSBA is provided in **Appendix A**.

Given that the Modification proposes the transfer of mine water into a final void, the key environmental risks that require assessment are:

› Whether additional storage of water may increase the risk of uncontrolled discharges (overflows); and
› Whether there are any impacts on water quality.

These risks have been assessed using a water balance model (including a salt balance) developed for the GRAWTS. This modelling has also assessed whether storage of water in Barrett Pit will affect the overall performance of the GRAWTS.

The surface water resources in the vicinity of Glendell are the subject of water sharing plans (WSPs) enacted under the WM Act. The relevant WSPs are:

› *Water Sharing Plan for the Hunter Regulated River Water Source 2016*; and
› *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2022*.

WALs are required to account for water taken from sources subject to a WSP. As such, the WSBA has considered whether the Modification will give rise to additional water licensing requirements.

The HRSTS enables discharge of saline water to the Hunter River during periods of high or flood flows. Entities seeking to discharge need to obtain HRSTS credits, with can be obtained through auctions held biennially. Glendell does not directly participate in the HRSTS, as there are no licensed discharge points at the premises. However, Glendell may share water via the GRAWTS, which does include discharge points at Liddell Mine and Ravensworth Operations. As such, the WSBA considered whether the Modification will alter discharge requirements.

6.1.2 Assessment of Impacts

6.1.2.1 Water Balance

The WSBA incorporates a water balance undertaken using the GoldSim modelling package. Due to the synergies between Glendell and its neighbouring operations, this water balance encompasses the entire GRAWTS which accounts for all approved transfers of water and tailings between the participating sites.

Long-term climatic data for the period 1892 to 2020 was generated using the Bureau of Meteorology's SILO system. This historical climate period has been adopted to align with timescale of the Hunter River Integrated Quantity-Quality Model. The climatic data obtained from SILO was compared to site-specific rainfall measured at the MGO meteorological station, indicating good correlation.

The water balance was simulated for the 13.5 year period from 1 July 2025 to 31 December 2039. Accordingly, the historical climatic dataset was organised into 13.5 year increments of climatic data, known as 'realisations'. The water balance was modelled for all possible realisations to assess the performance of GRAWTS under a wide range of climatic conditions. Full details of assumptions adopted for the water balance model are provided in Section 4.2 of the WSBA (see **Appendix A**).

Water balance modelling was undertaken for both the approved development scenario (i.e. without water transfers to Barrett Pit) and the Modification scenario. The results show that the total inflows and outflows are almost identical under the two scenarios. This outcome was expected given that the Modification will not alter the catchment area of the water management system.

The water balance also predicts that the Modification will not alter demand for external water resources or discharger volumes under the HRSTS, when compared to the approved development scenario.

6.1.2.2 Key Storage Levels

Although the Modification is not predicted to affect total water volumes within the GRAWTS, it may affect how water is distributed amongst different storages.

The Bayswater North Pit (BNP) is a completed mining area located to the north of Barrett Pit.

Due to its proximity, the Barrett Pit has been identified as a suitable storage for any volumes that need to be dewatered from BNP. For assessment purposes, the water balance has assumed that water will be transferred from BNP to Barrett Pit when the water level in the former reaches 70mAHD. The water balance predicts that transfers from BNP to Barrett Pit will occur under median or wetter climatic conditions. These results indicate the use of Barrett Pit as a water storage will enable more freeboard to be maintained within BNP under wetter climatic conditions.

Due to the predicted water transfers from BNP to Barrett Pit, the Modification may significantly increase volumes stored in Barrett Pit compared to the approved development scenario. **Figure 3** compares the predicted storage volumes in the Barrett Pit for the approved development and Modification scenarios. The Barrett Pit is expected to store 4 GL more water under median climatic conditions and 12 GL more water under wet conditions (95th percentile rainfall).

Under 95th percentile rainfall conditions, the maximum storage volume in Barrett Pit is predicted to be approximately 37 GL. Given that the Barrett Pit has an estimated storage capacity of 91 GL, there is sufficient freeboard to contain large storm events. As such, the Modification is not expected to result in overflows from Barrett Pit.

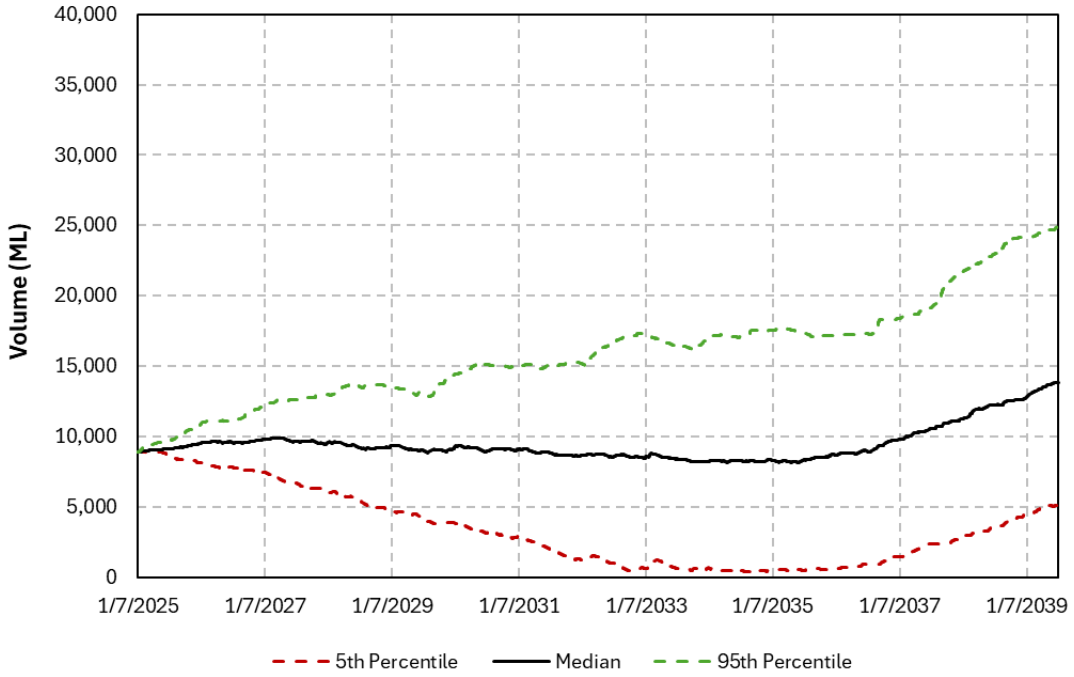
Furthermore, the estimated maximum water level at the end of the proposed water storage is approximately 15.7 mAHD. This is lower than the long-term equilibrium level predicted by the Water Resources Assessment for MOD2 (Umwelt, 2007).

Following the use of Barrett Pit as a water storage (i.e. after 31 December 2039), it is likely that dewatering of the void will be necessary to facilitate rehabilitation activities. Those volumes of mine water will be stored elsewhere within the GRAWTS whilst the final void is being rehabilitated. It is likely that water will be returned to the final void after rehabilitation is complete but will not exceed the volumes stored prior to rehabilitation. As such, the water level immediately after mine closure will be below the predicted long-term equilibrium.

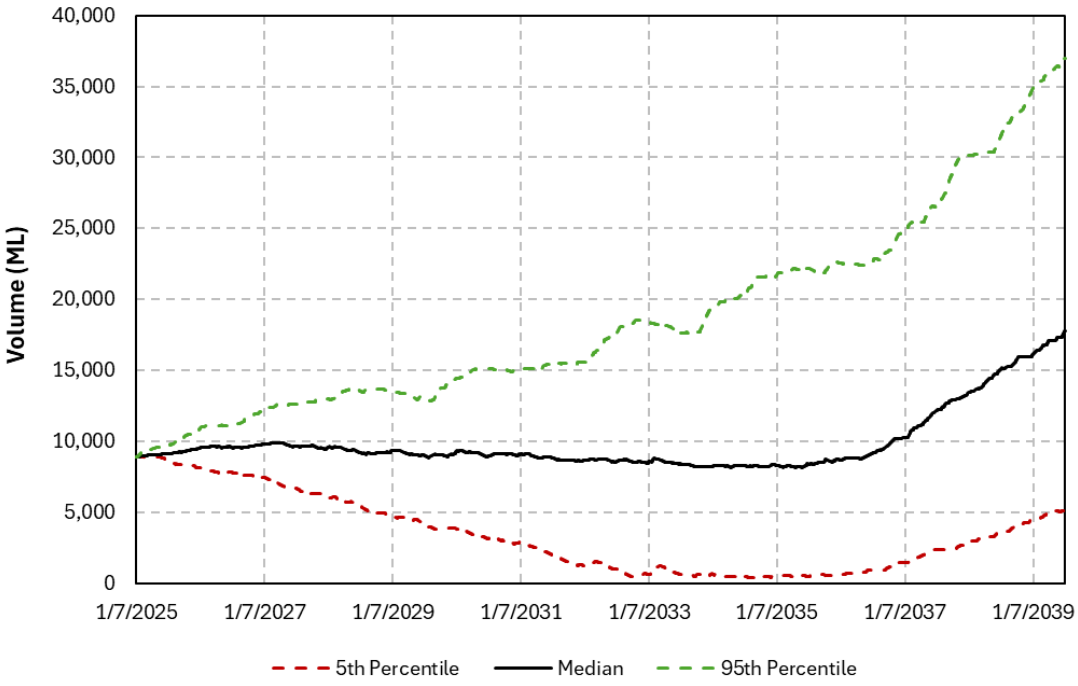
After mine closure, the water level would rise under natural processes until equilibrium is reached. The Modification will not alter the catchment or geometry of the approved final void, and therefore will not affect the natural process that influence the long-term equilibrium level.

Figure 3 Predicted Storage Volumes in Barrett Pit

Approved Development Scenario



Modification Scenario



Source: ATC Williams (2025)

6.1.2.3 Water Quality

The salt balance within the GoldSim model predicts that the electrical conductivity (EC) of water stored in Barrett Pit will gradually decrease over the simulation period. There is no material difference in EC values between the approved development and Modification scenarios. The predicted EC for the water stored under the Modification scenario is shown in **Figure 4**.

The Modification is not expected to result in any outward seepage of water (see **Section 6.2.2**) or overflows from the Barrett Pit. Although the salt balance predicts declining salinity in Barrett Pit (see **Figure 4** the more pertinent outcome is that mine water is not expected to discharge into the surrounding environment.

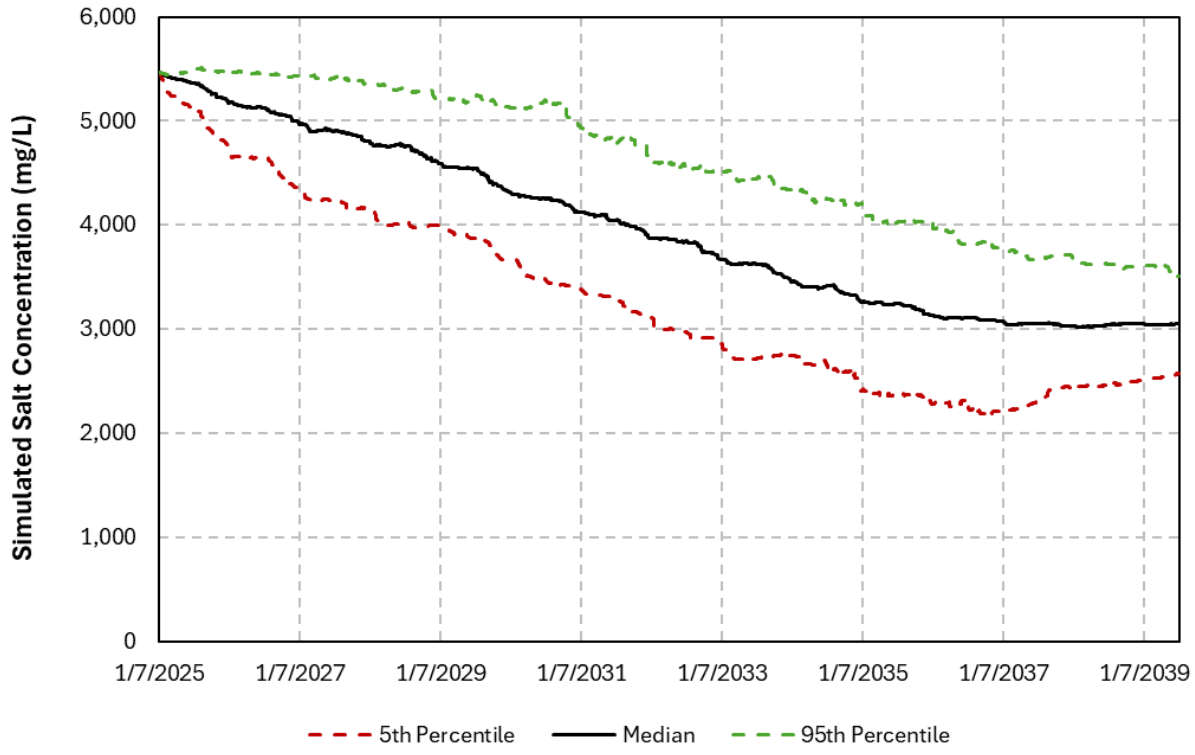
6.1.2.4 Water Licensing

The water balance predicts that the Modification will not increase the demand for external water sources within the GRAWTS. The Barrett Pit will only be used to store mine water when there is a surplus within the GRAWTS, as opposed to being an additional water demand. That is, no raw water will be sourced specifically for the purpose of filling Barrett Pit.

WALs are also required for water that is passively taken (such as runoff captured by storages). However, the Modification also will not result in additional passive take as Barrett Pit is already located within the catchment of the MGO water management system.

Therefore, the Modification does not give rise to any additional water licensing requirements beyond those of the approved development.

Figure 4 Predicted Electrical Conductivity in Barrett Pit Water Storage



Source: ATC Williams (2025)

6.1.3 Mitigation and Management Measures

Existing water management practices are outlined in the MGO Water Management Plan (WMP), which was approved on 13 November 2025. The WMP will be updated to include the proposed transfer of water to and from the Barrett Pit. The approved WMP already includes a commitment to monitor volumes of water transferred between storages, which will be extended to include transfers involving Barrett Pit. These recorded volumes inform annual site water balance which is reported in the Annual Review.

In the absence of predicted discharges to the surrounding environment, no additional mitigation measures are required for the Modification. Similarly, no additional WALs or HRSTS discharge credits are required as the Modification does not alter water take or discharge requirements from the approved development scenario.

6.2 Groundwater

6.2.1 Background

Umwelt completed a Groundwater Impact Assessment (GIA) to consider whether the Modification has the potential for adverse effects on surrounding groundwater resources. The proposed continuation of activities at the Glendell MIA will not involve additional groundwater impacts and as such, this component of the Modification was not considered in the GIA. The GIA is provided in **Appendix B**, with the key findings summarised below.

The groundwater systems in the vicinity of Glendell occur within the following hydrostratigraphic units:

- Quaternary alluvium along Swamp Creek, Bettys Creek and Bowmans Creek; and
- Permian strata (bedrock) of the Wittingham coal measures and Maitland group.

Glendell (and the wider MGO) also includes overburden emplacements which are considered separately from the Permian aquifer. Although overburden emplacements are comprised of the same rock materials as the Permian aquifer, the disturbed nature of backfilled material results in higher hydraulic conductivities.

Alluvial aquifers are generally the most important groundwater systems from an environmental and water supply perspective. However, the alluvial aquifers near Glendell are characterised as 'less productive groundwater systems' according to the criteria in the *NSW Aquifer Interference Policy* (DPI, 2012) (AIP). Permian aquifers generally have limited utility for environmental and water supply uses due to their low yield and high salinity. As such, the primary matter for assessment is whether the proposed storage of mine water in Barrett Pit may result in seepage to the surrounding alluvial aquifers.

The potential groundwater impacts of the Modification have been assessed using a numerical groundwater model (MODFLOW-USG). The modelling and reporting of groundwater impacts has been undertaken in accordance with:

- DPE (2022a), *Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical Guideline* (Groundwater Documentation Guidelines);
- DPE (2022b), *Minimum Groundwater Modelling Requirements for SSD/SSI Projects*; and
- Barnett et al (2012), *Australian Groundwater Modelling Guidelines*.

The MODFLOW-USG model used in the GIA is a regional model that includes the surrounding developments with the potential to contribute to cumulative water impacts. These developments include:

- All sites participating in the GRAWTS (namely MGO, Ravensworth Operations, Liddell Mine and Integra Underground Mine);
- Rix's Creek North Mine;
- Ashton Mine (including its open cut and underground workings); and
- Part of Hunter Valley Operations.

The MODFLOW-USG model was calibrated against monitoring data from 451 groundwater bores.

The GIA has been integrated with the WSBA to reflect the effects of pumping on water levels within voids. For conservatism, the GIA has adopted the maximum water levels predicted by the WSBA water balance model.

6.2.2 Assessment of Impacts

6.2.2.1 Groundwater Heads and Fluxes

Based on the water transfers predicted by the water balance model (see **Section 6.1.2**), the groundwater model predicts that the water level in Barrett Pit will rise to approximately 12 mAHD at the end of 2039. In comparison, the approved development (i.e. no Modification) scenario was expected to result in a water level of approximately -7 mAHD at the end of 2039. The base of weathering (i.e. regolith) is estimated to be at 50 mAHD. Due to the predicted water levels being significantly below the base of weathering, there is not expected to be a direct connection between the stored mined water and the surrounding regolith and alluvium. That is, mine water is not expected to seep from Barrett Pit to the alluvial aquifers.

Although there is expected to remain a hydraulic gradient from the alluvium and regolith towards Barrett Pit, the proposed transfers of water will result in smaller hydraulic gradients. This will facilitate the following outcomes:

- Inflows to Barrett Pit from the Permian aquifer are predicted to decrease by up to 33 ML/year;
- Groundwater heads in the surrounding strata will exhibit faster post-mining recovery; and
- Groundwater heads in the alluvium are predicted to be up to 0.28 m higher, and therefore reduced impacts on stream baseflows are expected.

It should be noted that these positive outcomes are relative to the approved development scenario, where groundwater would only recover due to natural processes.

Although there will be a hydraulic gradient from the alluvium towards Barrett Pit, there is expected to be hydraulic gradient from Barrett Pit towards the Permian aquifer. That is, the Barrett Pit will behave as a groundwater 'sink' for the alluvial aquifers and as a 'source' for the Permian aquifer. Outward seepage from Barrett Pit is predicted towards the workings of Ashton Mine and Integra Underground to the south. Given that the Modification will increase water volumes in Barrett Pit, there is expected to be greater seepage to the Permian aquifer. However, the change in seepage is predicted to be negligible (<1 ML/year).

6.2.2.2 Water Quality

The salt balance (see **Section 6.1.2**) predicts that the salinity of water stored in Barrett Pit will generally decline, with Total Dissolved Solids (TDS) in the range of ~3,000 to ~5,500 mg/L. In comparison, the coal seams typically exhibit TDS of around 6,320 mg/L and interburden exhibits TDS of around 5,850 mg/L (Umwelt, 2025). As such, seepage of water from Barrett Pit to the Permian strata is not expected to degrade the water quality of the receiving aquifer.

The Modification will not adversely affect the water quality of the alluvial aquifer, as there is no expected seepage towards the alluvium.

6.2.2.3 Other Water Users (including Environmental Users)

Four registered landowner bores are located within 2 km of the Barrett Pit. Due to their shallow depths, it is inferred that these bores are targeting the alluvium or regolith. The proposed storage of water within Barrett Pit is expected to increase surrounding groundwater levels compared to the approved development scenario. As such, the Modification will not result in additional drawdown at private landowner bores.

The Groundwater Documentation Guidelines (DPE, 2022a) require consideration of high priority groundwater development ecosystems (GDEs) mapped under a WSP or the Bureau of Meteorology GDE Atlas. The Hunter Unregulated WSP does not identify any high priority GDEs. The GDE Atlas maps the following GDEs along the alluvial aquifers of Bowmans Creek, Bettys Creek and Swamp Creek:

- Spotted Gum / Narrow-leaved Ironbark / Red Ironbark shrub / grass open forest; and
- Swamp Oak / Weeping Grass grassy riparian forest.

These mapped areas of GDEs are located within the zone of depressurisation resulting from mining operations at Glendell. However, the groundwater table in these areas is likely to be below the rooting depth of these terrestrial GDEs. Since the Modification will result in faster post-mining recovery of groundwater heads, it will not exacerbate impacts on GDEs (if any).

6.2.2.4 Water Licencing

The Hunter Unregulated WSP applies to the alluvial aquifers in the vicinity of Glendell. The alluvial aquifers associated with Bettys Creek, York Creek and Swamp Creek form part of the Jerrys Water Sources, whereas the Glennies Creek alluvial aquifer falls within the Glennies Water Source.

The *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* applies to the Permian aquifer in the vicinity of Glendell.

The proposed storage of water within Barrett Pit will assist in reducing the effects of depressurisation due to completed mining activities. As explained in **Section 6.2.2.1**, the Modification is predicted to reduce inflows to Barrett Pit as well as incidental take from the alluvial aquifers. By increasing groundwater heads within the alluvium, the Modification will also reduce impacts on baseflows (relative to the approved development scenario). As such, the Modification does not give rise to any additional water licencing requirements.

6.2.2.5 Minimal Impact Considerations

The alluvial and Permian aquifers in the vicinity of Glendell meet the AIP's criteria for 'less productive groundwater sources'. Notwithstanding, Umwelt has conservatively assessed impacts to alluvial aquifer against the minimal impact considerations for 'highly productive groundwater sources'. The minimal impact considerations are addressed in Section 6.3.2 of **Appendix B**.

Umwelt has concluded that the Modification meets the Level 1 minimal impact considerations for the following reasons:

- Storage of water within Barrett Pit will increase groundwater levels and heads, and therefore not result in greater than 2 m of drawdown; and
- Seepage to the Permian aquifer will be less saline than the receiving water quality, and there is no seepage expected towards the alluvium.

6.2.3 Mitigation and Management Measures

The Proponent currently undertakes groundwater monitoring in accordance with the MGO Groundwater Management and Monitoring Plan (GMMP), approved on 3 October 2023. The GMMP will be updated following approval of the Modification with additional monitoring measures (if required) to confirm the predictions of the GIA (i.e. that seepage only occurs to the Permian aquifer). The update of the GMMP will be undertaken in consultation with the relevant regulatory authorities.

Additional groundwater monitoring bores (if required) can be installed as exempt development pursuant to clause 2.13 of the Resources and Energy SEPP.

6.3 Other Environmental Aspects

6.3.1 Air Quality

The proposed use of the Barrett Pit as a water storage and transfer point involves the use of pumping stations and pipelines. These activities will not generate significant particulate matter (dust) emissions.

The Glendell MIA does not include any coal handling or processing facilities. This area is used predominantly for operational management, maintenance, training and administrative activities. None of the approved activities at the MIA are likely to generate significant quantities of particulate matter.

Furthermore, dust emissions from Glendell were considered in the assessment of cumulative air quality impacts for the MOCO Project (SSD-5850) (Pacific Environment, 2014). The post-mining emissions resulting from the Modification will be negligible compared to Glendell's assessed contribution during mining operations.

6.3.2 Greenhouse Gas

The Modification will generate GHG emissions through energy consumption associated with transfer of water and ongoing use of the Glendell MIA. The Scope 1 & 2 emissions due to those activities are not expected to exceed 25,000 t CO_2-e in any financial year. Accordingly, the requirements of the GHG Guide (see **Section 2.3.1**) do not apply.

The Barrett Pit is approved to remain as a final void under DA 80/952. As such, post-mining fugitive emissions would occur under the approved development scenario. Given that the Modification will not enlarge the Barrett Pit, the quantity of post-mining fugitive emissions will not increase. In fact, inundation of coal seams (with water) is recognised as a means of reducing fugitive emissions. Therefore, the Modification will have at least a neutral (and possibly beneficial) effect on post-mining fugitive emissions.

The potential climate change impacts on the locality have been considered with reference to the '*Hunter Climate Change Snapshot*' (NSW DCCEEW, 2025) which summarises the latest climate projections for regions from the NSW and Australian Regional Climate Modelling (NARCLiM) project. The projected impacts of climate change across the Hunter Region, as modelled by the NARCLiM project include:

- Increase in average temperature and number of hot days per year;
- Decrease in the number of cold nights;
- Rainfall is projected to remain variable, however climate change will likely influence rainfall patterns and decrease the average winter rainfall; and
- Increase in severe fire weather days per year.

As noted above, the GHG emissions from the Modification are minor and are not anticipated to materially contribute to climate change or result in any associated impacts on the locality. Given the cumulative and globally dispersed nature of GHG emissions, no discernible or measurable localised climate impacts can be directly attributed to the Modification.

6.3.3 Noise

The water management infrastructure required for transferring water to and from Barrett Pit will generate noise emissions, but those noise levels will be negligible in the context of surrounding mining operations. The approved activities at the Glendell MIA are also not likely to contribute materially to cumulative noise levels.

Noise emissions from Glendell were considered in the noise impact assessment undertaken for the MOCO Project (Umwelt, 2014). The post-mining noise levels generated by the Modification will be negligible compared to the assessed contribution from Glendell during mining operations.

6.3.4 Biodiversity

The Modification does not involve any ground disturbance beyond the area approved for disturbance under DA 80/952. As such, the Modification will not result in any additional direct impacts to biodiversity values. As noted in **Section 6.2.2.3**, the Modification is not predicted to result in additional impacts to GDEs.

6.3.5 Heritage

The Modification is not expected to result in any impacts to Aboriginal or historic heritage values, as it does not involve surface impacts beyond the approved disturbance boundary for DA 80/952. Heritage values at MGO are managed in accordance with the following approved management plans:

- MGO Aboriginal Cultural Heritage Management Plan (approved on 20 December 2024); and
- MGO Historic Heritage Management Plan (approved on 9 January 2025).

Both these plans include protocols for dealing with previously unrecorded heritage items (or 'unanticipated finds'). These protocols will be implemented if any heritage items are unexpectedly encountered when carrying out the Modification.

6.3.6 Rehabilitation

The approved final landform for Glendell is shown in Appendix 6 of DA 80/952.

The Glendell MIA is required to be rehabilitated to grassland, as the final land use is proposed to be agriculture. The Modification will not alter this outcome, although it will postpone rehabilitation of the MIA until after 31 December 2039.

The proposed use of Barrett Pit as a water storage and transfer point also postpones rehabilitation of the adjacent overburden emplacement area (OEA) until after 31 December 2039. Under the approved final landform, this OEA is required to be rehabilitated to grassland, with treed vegetation along the upper slopes of the re-shaped void. Condition 37 of Schedule 3 of DA 80/952 requires that at least 250 ha of treed rehabilitation is provided within the final landform. The proposed use of Barrett Pit as a water storage will not affect the ability to achieve this area of treed vegetation during the rehabilitation phase. To date, MOPL has established approximately 90% of the treed rehabilitation required by Condition 37 of Schedule 3 of DA 80/952.

Therefore, the Modification will not affect the Proponent's ability to achieve the approved final landform. However, it will extend the timeframe for certain lands to be rehabilitated to grassland or woodland. A subsidiary of Glencore conducts grazing activities on mine-owned 'buffer lands' (i.e. land not used for mining operations). Although the Modification would postpone the commencement of post-mining agricultural land uses at the MIA and OEA, overall agricultural productivity is unlikely to be significantly affected due to grazing continuing on Glencore buffer lands.

6.3.7 Traffic

Given that the Modification does not propose a construction phase or an increase in the Glendell workforce, no additional traffic generation will occur. Deliveries to Glendell are also expected to be much lower in the post-mining phase than during mining operations.

6.3.8 Social

Given that the Modification does not propose a construction phase or an increase in workforce, it will not result in additional demands on social infrastructure or services.

7. Evaluation

This section provides comment on the principles of ecologically sustainable development (ESD) and evaluates the merits of the Modification.

7.1 Ecologically Sustainable Development

ESD principles are described in Section 6(2) of the *Protection of the Environment Administration Act 1991*. **Table 5** lists these principles and explains how the modified development would continue to satisfy them.

Table 5 Principles of Ecologically Sustainable Development

Principle	Application to the Modified Development
The precautionary principle — namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	The potential impacts of the Modification have been assessed in accordance with contemporary regulatory expectations. The Modification is not expected to result in serious or irreversible environmental damage.
Inter-generational equity — namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.	The Modification will not affect the ability to achieve the approved final landform or proposed post-mining land uses for Glendell.
Conservation of biological diversity and ecological integrity — namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.	The Modification will not result in any additional vegetation disturbance beyond the approved disturbance area under DA 80/952. Once the activities proposed by the Modification are complete, disturbed areas will be rehabilitated in accordance with the approved final landform.
Improved valuation, pricing and incentive mechanisms — namely, that environmental factors should be included in the valuation of assets and services.	The Proponent bears the cost of implementing the necessary environmental management measures.

7.2 Merit Evaluation

The objective of the Modification is to maximise the utility of the existing features at Glendell, including the MIA and Barrett Pit. It has been identified that the Barrett Pit can be used as a water storage and transfer point, and that this would facilitate more efficient water management within the GRAWTS. The Glendell MIA also has facilities which would be of value to MGO and the wider GRAWTS. The proposed use of these facilities will avoid the need for other infrastructure (e.g. training facilities, control buildings, workshops, services infrastructure) to serve the same purpose.

The groundwater and water balance models have concluded that the proposed storage of mine water in Barrett Pit will not result in seepage or overflow of mine water to the surrounding environment. Water levels in Barrett Pit are also proposed to be less than the predicted long-term equilibrium under current approvals. This means that the Modification will only affect water levels in the short to medium term, and that the void water level will continue to rise naturally after the Modification is complete.

8. References

- ATC Williams (2026), *Glendell Mine Modification 6 - Water and Salt Balance Assessment*.
- Barnett et al (2012), *Australian Groundwater Modelling Guidelines*.
- Department of Planning and Environment (2022a), *Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical guideline*.
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- Mt Owen Glendell Operations (2024), *MGO Aboriginal Cultural Heritage Management Plan*.
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- Umwelt (2007), *Water Resources Assessment for Modification of Glendell Mine Operations*.
- Umwelt (2014), *Noise Impact Assessment, Mount Owen Continued Operations Project*.
- Umwelt (2014b), *Surface Water Assessment: Mount Owen Continued Operations Project*.
- Umwelt (2026), *Mount Owen and Glendell Operations: MOD6. Groundwater Impact Assessment*.

9. Abbreviations

Abbreviation	Meaning
AHD	Australian Height Datum
AIP	*NSW Aquifer Interference Policy* (DPI-Office of Water, 2012)
CCC	Community Consultative Committee
CHPP	Coal Handling and Preparation Plant
CMSC Act	*Coal Mine Subsidence Compensation Act 2017*
DPHI	Department of Planning, Housing and Infrastructure
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Transitional Regulation	*Environmental Planning and Assessment Regulation (Savings, Transitional and Other Provisions) Regulation 2017*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
FTE	Full time equivalent
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse gas
Glencore	Glencore Coal Pty Limited
GRA	Greater Ravensworth Area
GRAWTS	Greater Ravensworth Area Water and Tailings Scheme
Groundwater Document Guidelines	*Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical Guideline* (DPE, 2022a)
HVO	Hunter Valley Operations
km	Kilometre
kV	Kilovolt
Large Emitters Guide	*NSW Guide for Large Emitters* (EPA, 2025)
LCO	Liddell Coal Operations
m	metres
MGO	Mount Owen/Glendell Operations

Abbreviation	Meaning
MIA	Mine Infrastructure Area
Mining Act	*Mining Act 1992*
MOC	Mount Owen Complex
MOPL	Mt Owen Pty Limited
Mount Owen	Mount Owen Mine
MSD	Mine Subsidence District
Mtpa	Million tonnes per annum
NARCliM	NSW and Australian Regional Climate Modelling
POEO Act	*Protection of the Environment Operations Act 1997*
Resources and Energy SEPP	*State Environmental Planning Policy (Resources and Energy) 2021*
ROM	Run of mine
Singleton LEP	*Singleton Local Environment Plan 2013*
SWBA	Salt and Water Balance Assessment
TDS	Total Dissolved Solids

Appendix A
Water and Salt Balance Assessment

REPORT

MT OWEN PTY LIMITED
ABN: 83 003 827 361

Glendell Mine Modification 6

Water and Salt Balance Assessment

123011-02R01-rev3
JANUARY 2026



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EXECUTIVE SUMMARY

ATC Williams Pty Ltd has been engaged by Xenith Consulting Pty Ltd to prepare a Water and Salt Balance Assessment in support of a modification to the existing approval (DA 80/952) for the Glendell Mine (the Modification).

Glendell Mine is a component of Mount Owen Glendell Operations (MGO), a mining precinct which also includes the Mount Owen and Ravensworth East Mines and Coal Handling and Preparation Plant (CHPP). Glendell Mine (as a component of MGO) is a participant in the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS), which is a network of infrastructure that enables transfer of water and tailings between neighbouring Glencore-managed operations (namely MGO, Integra Underground Mine, Liddell Mine and Ravensworth Operations [RAV]). The GRAWTS enables surplus water at a particular site to be used for operational purposes at other sites within the scheme. The water sharing facilitated by GRAWTS has the benefits of reducing reliance on external water sources and the need for off-site discharges under the Hunter River Salinity Trading Scheme.

Under current approvals, the Barrett Pit at Glendell Mine will passively form a lake over time through runoff and groundwater inflows. The Modification proposes to use the Barrett Pit as a water storage, thereby enabling active transfer of water into and out of the void, including water from other GRAWTS sites.

The purpose of this Water and Salt Balance Assessment is to evaluate the impacts of changes to the water and salt management on site as a result of the Modification. This report considers water and salt balance modelling that forecasts the water supply and discharge requirements during the Modification operational phase. Groundwater predictions (Umwelt, 2025) for the Modification have enabled assessment of potential surface water impacts compared to the existing approved operations with regard to impacts on the site water balance leading to licensed release via the Hunter River Salinity Trading Scheme. Water balance modelling has indicated that results for supply reliability, spill risk and licensed discharges will remain practically unchanged for the Modification.

Other mining operations relevant to the assessment of cumulative impacts in the vicinity of the Modification include RAV, Liddell Coal Operations, Integra Underground Mine, Hunter Valley Operations, Ashton Mine and Rix's Creek Mine. These mines operate in accordance with the *Water Management Act 2000* and discharge of water is undertaken in accordance with the relevant Development Consent and the Environmental Protection Licence for each site as well as the Hunter River Salinity Trading Scheme. With the implementation of the various controls under these regulatory systems, the cumulative impacts on downstream water users associated with the proposed Modification are considered to be negligible.

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1 INTRODUCTION

1.1 Glendell Mine and Modification Overview

Glendell Mine (Glendell) is a coal mining operation located approximately 20 kilometres (km) north-west of Singleton in the Upper Hunter region of New South Wales (NSW), refer **MAP 1**. Glendell is a component of Mount Owen Glendell Operations (MGO), a mining precinct which also includes the Mount Owen and Ravensworth East Mines and a Coal Handling and Preparation Plant (CHPP). MGO is managed by Mt Owen Pty Limited (MOPL), which is a subsidiary of Glencore Coal Pty Limited (Glencore). Glendell operates under Development Consent DA 80/952 granted under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The approved development under DA 80/952 (as modified) includes the following activities:

- Extraction of up to 4.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal using truck and excavator mining methods;
- Hauling of ROM coal to Mount Owen Mine for processing and transportation;
- Hauling of overburden and materials to and from Ravensworth East Mine;
- Transportation of up to 1 Mtpa of product coal to domestic power stations by conveyor; and
- Ancillary surface infrastructure including offices, workshop, access roads, services and water management infrastructure.

A number of mines operate in the immediate vicinity including; Ravensworth Operations (RAV), Liddell Coal Operations, Integra Underground Mine, Hunter Valley Operations, Ashton and Rix's Creek (refer **MAP 1**).

Glendell (as a component of MGO) is a participant in the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS), which is a network of infrastructure that enables transfer of water and tailings between neighbouring Glencore-managed operations (namely MGO, Integra Underground Mine, Liddell Coal Operations and RAV). The GRAWTS enables surplus water at a particular site to be used for operational purposes at other sites within the scheme. The water sharing facilitated by GRAWTS has the benefits of reducing reliance on external water sources and the need for off-site discharges under the Hunter River Salinity Trading Scheme (HRSTS).

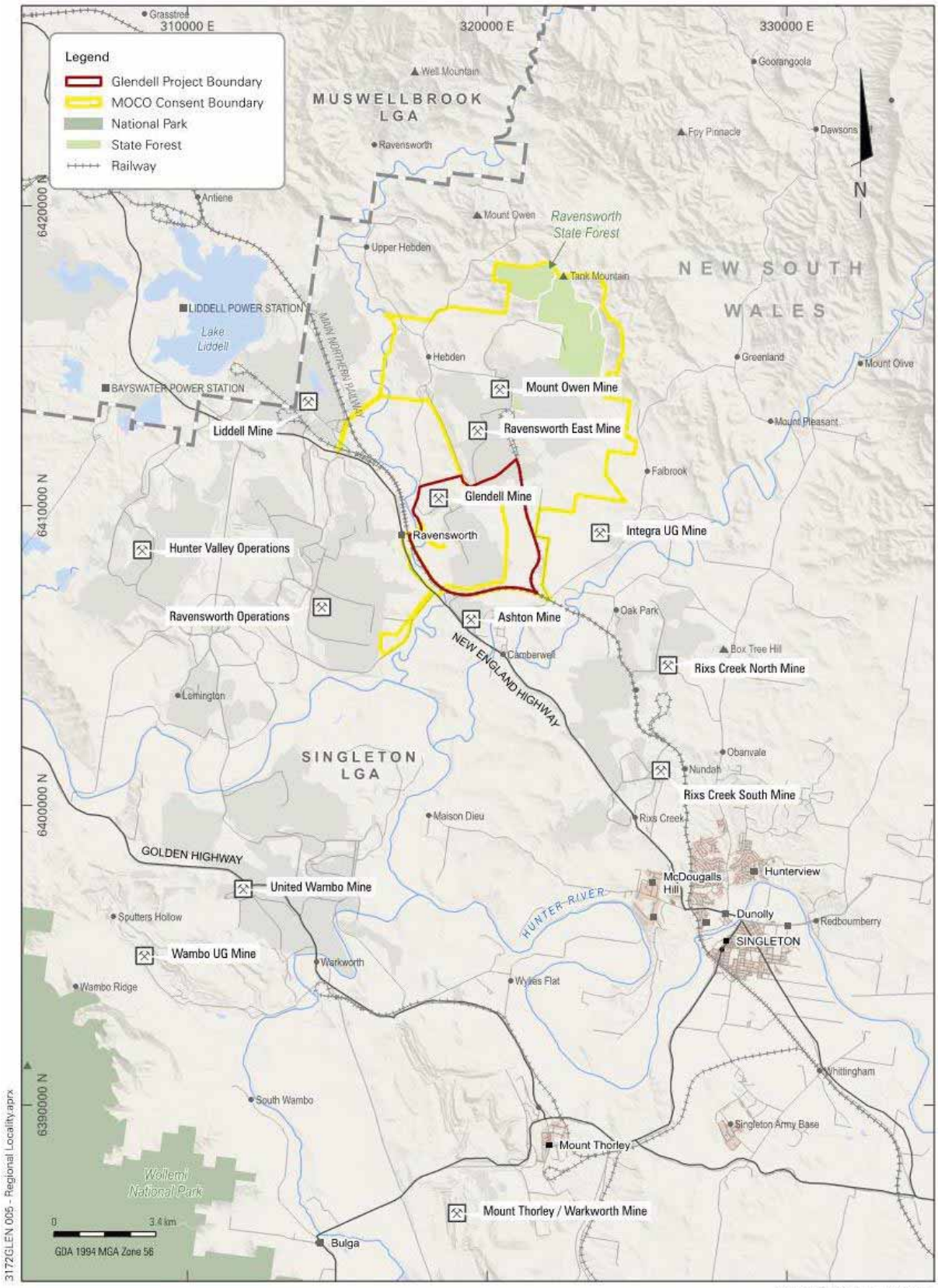
MOPL is seeking a modification to DA 80/952 to enable the use of Barrett Pit as a mine water storage, including for water shared to and from the GRAWTS via Mount Owen Mine (the Modification) – refer **MAP 2**. The use of Barrett Pit as a water storage is proposed until 31 December 2039, which represents the duration of currently approved mining activities at sites participating in the GRAWTS. The Modification will have no impact on approved coal processing or transportation at MGO, which is undertaken pursuant to Development Consent SSD-5850 (for the Mount Owen Continued Operations Project). The Modification does not affect any aspects of SSD-5850.

The Modification also proposes the continuation of existing approved activities at the Glendell mine infrastructure area until 31 December 2039. This component of the Modification does not involve additional water impacts and therefore has not been considered further in this assessment.

This Water and Salt Balance Assessment supports the Modification application under section 4.55(2) of the EP&A Act. Although the Barrett Pit is approved (under DA 80/952) to remain as a final void and will naturally form a lake, this assessment considers whether the proposed pumping of water into Barrett Bit may result in additional impacts to the surrounding surface water resources.

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MAP 1: GLENDELL REGIONAL LOCALITY



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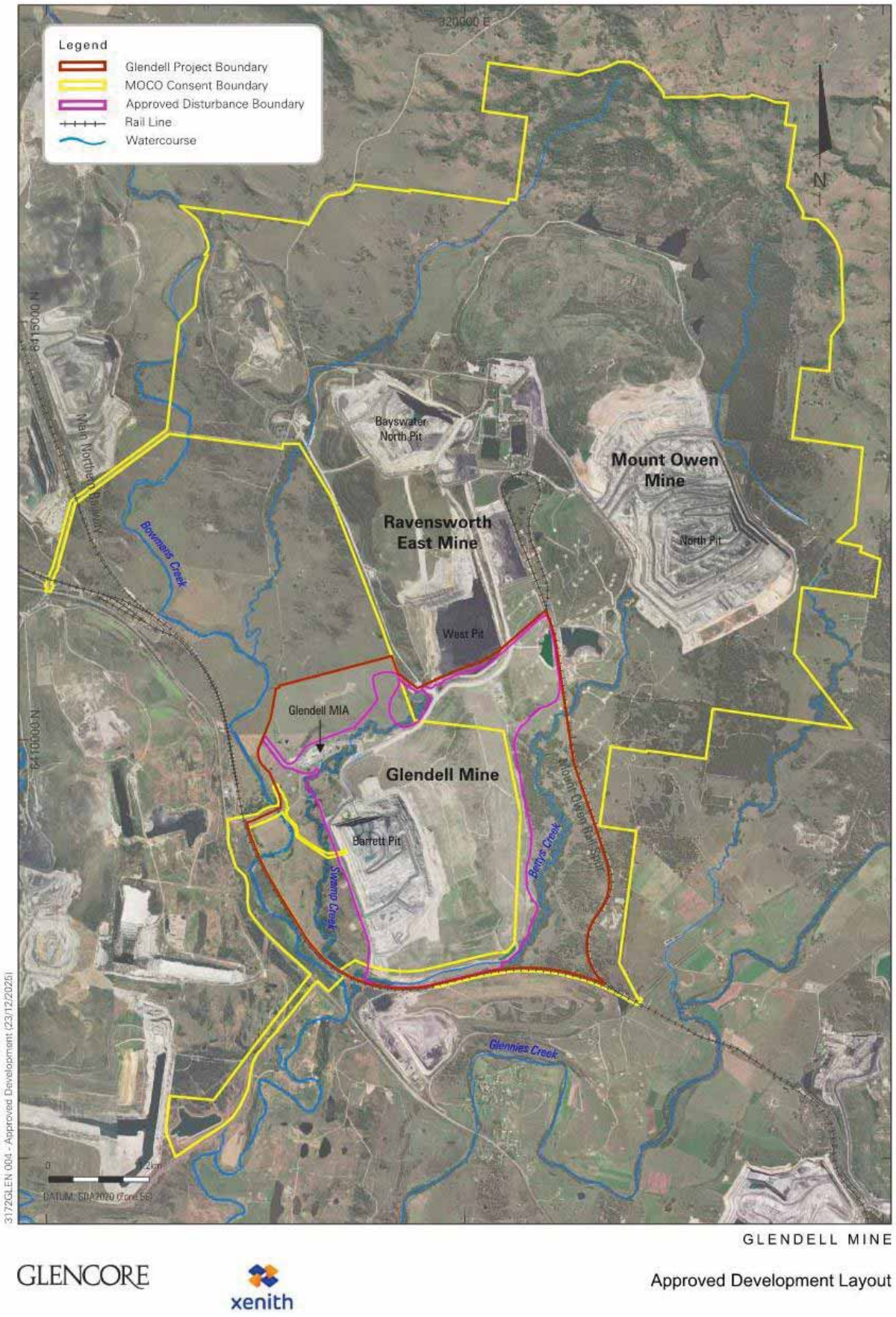
GLENDELL MINE

Regional Locality

GLENCORE xenith

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MAP 2: GLENDELL APPROVED DEVELOPMENT LAYOUT



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1.2 Scope of Work

MGO requested ATC Williams Pty Ltd (ATCW) to prepare a Water and Salt Balance Assessment, contained herein, in support of the Modification application to DA 80/952. The purpose of this assessment is to evaluate the impacts of changes to the water and salt management on site as a result of the Modification. The assessment is structured as follows:

Section 2 Description of surface water resources within and surrounding Glendell.

Section 3 Summary of the existing approved site water management system and the proposed site water management system for the Modification.

Section 4 Description of the site water and salt balance model including a summary of the data input and assumptions and key model results for the approved operation and the Modification.

Section 5 Assessment of potential impacts to surface water resources.

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2 SURFACE WATER CONTEXT

2.1 Surface Water Resources

2.1.1 Regional Overview

Glendell is located within the Hunter River catchment, which covers an area of approximately 21,500 square kilometres (km^2), and includes the major towns of Newcastle, Singleton and Muswellbrook (refer **MAP 1**). The Hunter River flows in a south-easterly direction approximately 4 km to the east of Glendell at its nearest location and is regulated by two major storages operated by WaterNSW: the Glenbawn and Glennies Creek Dams. The Glenbawn Dam is located approximately 37 km north of Glendell, while the Glennies Creek Dam is located approximately 19 km east, north-east of Glendell. Glenbawn Dam has an operating capacity of 750,000 megalitres (ML) with water supplied to the surrounding region for agricultural and industrial purposes. Glenbawn Dam also serves a flood mitigation function with an additional 120,000 ML available for flood storage. Glennies Creek Dam has a capacity of 283,000 ML and provides water supply for irrigation, environmental flows, stock, industry and household needs in the Hunter Valley.

2.1.2 Local Surface Water Systems

The drainage network in the vicinity of Glendell is generally characterised by steep gullies which emanate from areas of higher topography in the surrounding hills to the alluvial floodplains adjacent to the Hunter River. Glendell is located within the catchments of Bowmans Creek and Glennies Creek. Both Bowmans Creek and Glennies Creek flow into the Hunter River south of Glendell. The Bowmans Creek catchment includes the subcatchments of Stringybark Creek, Yorks Creek, Swamp Creek and Bettys Creek. The Glennies Creek catchment includes the subcatchment of Main Creek. Bettys Creek has been the subject of three approved diversions known as the Upper, Middle and Lower Bettys Creek diversions. Both Yorks Creek and Swamp Creek have also been the subject of approved diversions.

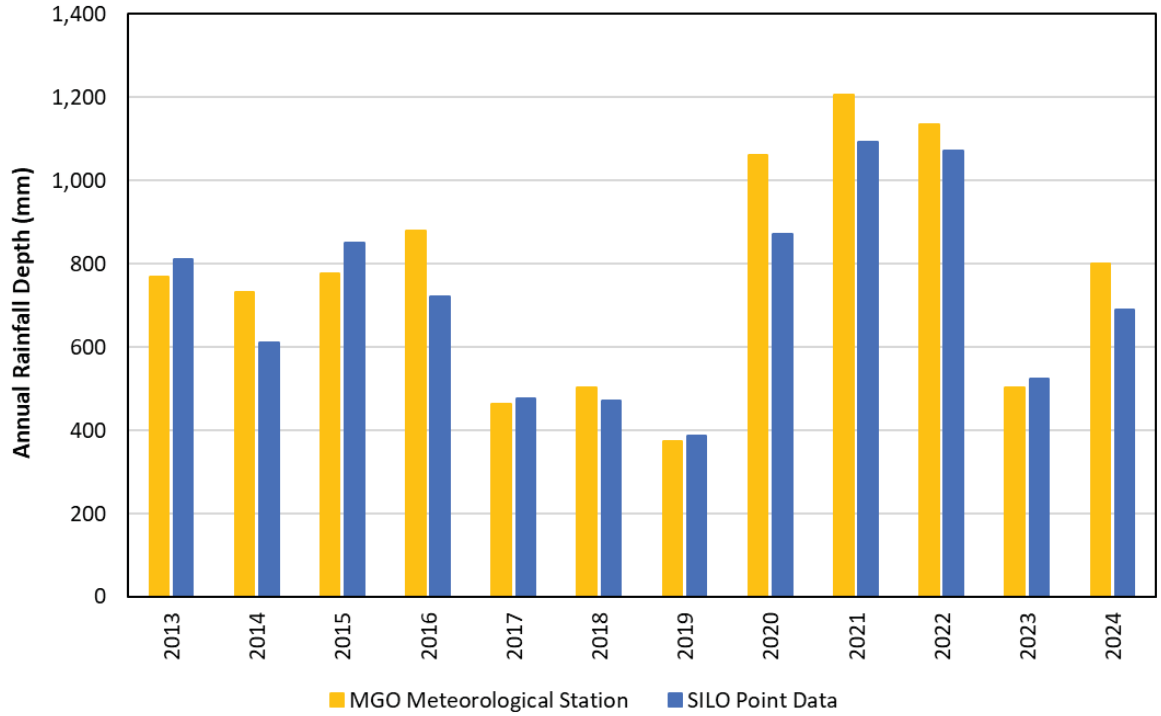
2.2 Rainfall and Evaporation

MGO maintain a meteorological station (M1) located at MGO. The total annual rainfall recorded at the MGO station and Scientific Information for Land Owners (SILO) Point Data[1] is presented in **GRAPH 1** for the period January 2013 to December 2024.

[1] The SILO Point Data is a system which provides synthetic daily climate data sets for a specified point by interpolation between surrounding point records held by the Bureau of Meteorology (BoM) – LongPaddock (2025). Selected point co-ordinates: 32.2ºS, 149.65ºE.

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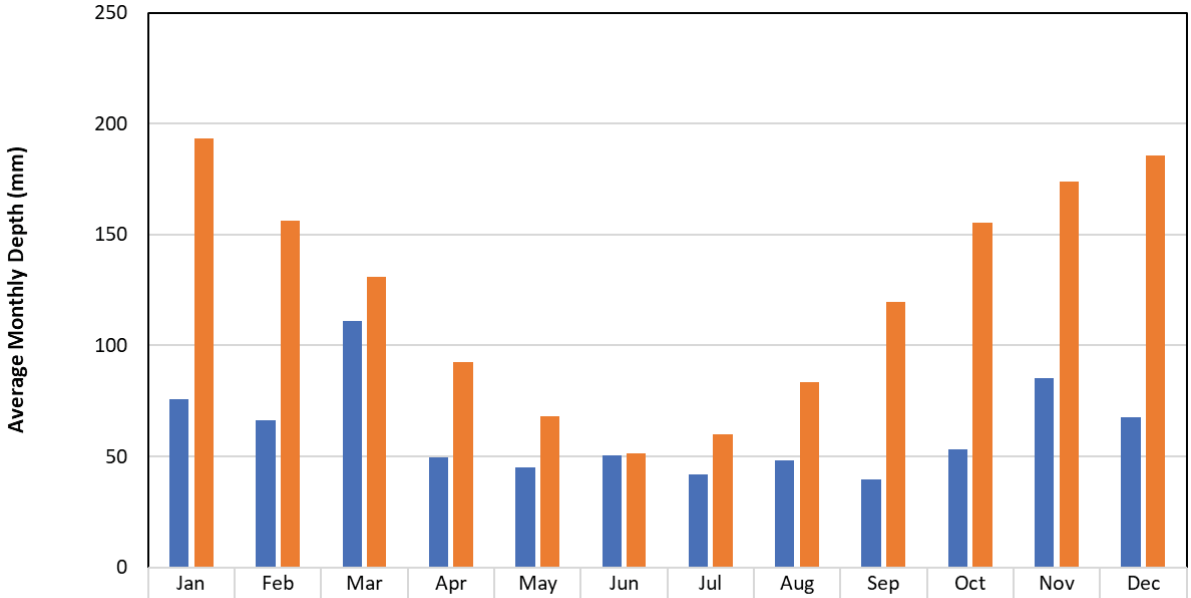
GRAPH 1: TOTAL ANNUAL RAINFALL



As shown in **GRAPH 1** the total annual rainfall calculated from SILO Point Data was generally within or close to the range of total annual rainfall recorded at the MGO meteorological station.

Average monthly rainfall and pan evaporation, calculated from long-term data obtained from the SILO Point Data for the Glendell location, is illustrated in **GRAPH 2**. The data shows that rainfall is typically spread throughout the year, although monthly totals tend to be higher in the summer months. Based on the SILO Point Data, the long-term (136 years) average annual rainfall at Glendell is 667 mm, while long-term average annual pan evaporation is 1,528 mm – i.e. average annual pan evaporation is more than two times that of average annual rainfall.

GRAPH 2: SILO POINT DATA - AVERAGE MONTHLY RAINFALL AND PAN EVAPORATION



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	75.8	66.2	111.2	49.6	44.9	50.7	42.0	48.1	39.7	53.3	85.3	67.7
Evaporation	193.2	156.4	130.9	92.4	68.0	51.5	60.1	83.4	119.8	155.3	173.7	185.5

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2.3 Surface Water Compliance

The water management system at Glendell is integrated with that of the wider MGO complex. Water management at MGO is undertaken in accordance with the approved MGO Water Management Plan (MGO, 2025). Several licences and permits apply to water management at MGO, primarily:

- Water Access Licences (WALs) issued under the *Water Management Act 2000*.
- Discharge credits held under the NSW *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.
- Environment Protection Licence (EPL) 4460 (Mount Owen Mine), EPL 10860 (Ravensworth East Mine) and EPL 12840 (Glendell Mine) issued under Part 3 of the NSW *Protection of the Environment Operations Act 1997* by the NSW Environment Protection Authority (EPA).

2.3.1 Water Access Licences

Surface water in the vicinity of Glendell is regulated by the *Water Sharing Plan for the Hunter Regulated River Water Source 2016* and the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2022* administered under the *Water Management Act 2000*.

MOPL holds a total of 1,917 unit shares for the Hunter Regulated River Water Source under the *Water Sharing Plan for the Hunter Regulated River Water Source 2016*, as follows:

- 1,056 units of Regulated River (High Security).
- 861 units of Regulated River (General Security).

2.3.2 Hunter River Salinity Trading Scheme

The HRSTS is managed by the EPA under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.

The HRSTS prohibits the discharge of saline water during periods of low flow in the Hunter River and controls discharge of saline water during periods of high flow such that specific salinity targets at various points in the river are not exceeded.

Glendell does not take part in the HRSTS directly, however, participants in the GRAWTS hold discharge credits as follows:

- MGO: 5 credits to mid 2026 (not modelled).
- RAV: 99 credits reducing to 69 credits in mid-2026, then zero credits from mid-2029.
- Liddell: 40 credits reducing to 15 credits in mid-2026, then zero credits from mid-2029.

Participants in the HRSTS are able to acquire HRSTS discharge credits at auction every two years. Credits are also able to be temporally traded between participants at any time per private negotiations. Each credit entitles the holder to a share of the available salt discharge capacity announced by WaterNSW during high flow periods. The amount of saline water that may be discharged from a given discharge licence holder is determined by reference to the salinity of the discharge waters, the river flow, the number of credits held and any overriding limit that may be applied as a condition of an EPL.

Although Glendell does not hold discharge credits, the HRSTS is relevant as surplus water may be transferred to the licensed discharge points in the GRAWTS.

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3 SITE WATER MANAGEMENT SYSTEM

3.1 Overview

Surface water management and monitoring at Glendell Mine is currently undertaken in accordance with the Water Management Plan (MGO, 2025) which outlines the:

- Water management strategy;
- Detailed performance criteria; and
- The MGO water and salt balance.

The Water Management Plan (MGO, 2025) is intended to be read in conjunction with the following plans:

- Erosion and Sediment Control Plan;
- Surface Water Management and Monitoring Plan;
- Groundwater Management and Monitoring Plan;
- Surface and Groundwater Response Plan; and
- Creek Diversion Management Plan.

3.2 Existing Operational Water Management System

The existing operational water management system at MGO involves a number of interlinked dams, pits and the West Pit tailings storage facility, their catchments, water treatment facilities (WTFs), the CHPP and water pumping systems. MGO defines three categories of water to effectively manage water across the complex and to mitigate any potential for environmental harm to occur:

- Clean water management system: includes a series of diversions and drains and clean water dams around the perimeter of the operation in order to capture and maximise diversion of upstream catchment runoff away from active mining areas.
- Dirty water management system: comprises a series of drains and sediment basins located to capture and manage runoff from disturbed areas.
- Mine water management system: includes dams and drains to capture and contain catchment runoff from mining areas and processing water (including tailings decant).

Open cut mining operations in the Mount Owen North Pit are dewatered by pumping mine water to TP2 for interim storage until being pumped on to the CHPP Raw Water Dam (RWD). The CHPP RWD is the supply point for both CHPP and dust suppression water demands. Tailings from the CHPP is pumped to West Pit along with tailings from the RAV CHPP. As tailings settles in West Pit, bleed water seeps northwards, through the waste rock emplacement, to Bayswater North Pit (BNP). Water from BNP is then pumped to the CHPP RWD to supply site water demands. The BNP has an imposed upper water level limit of 75 mAHD to avoid connectivity with surrounding creeks. Once water is pumped out of the Mount Owen North Pit, both TP2 and Dam 22 are able to pump to Barrett Pit for emergency water storage or Dam 22 can pump to Narama Dam at RAV for release via the HRSTS.

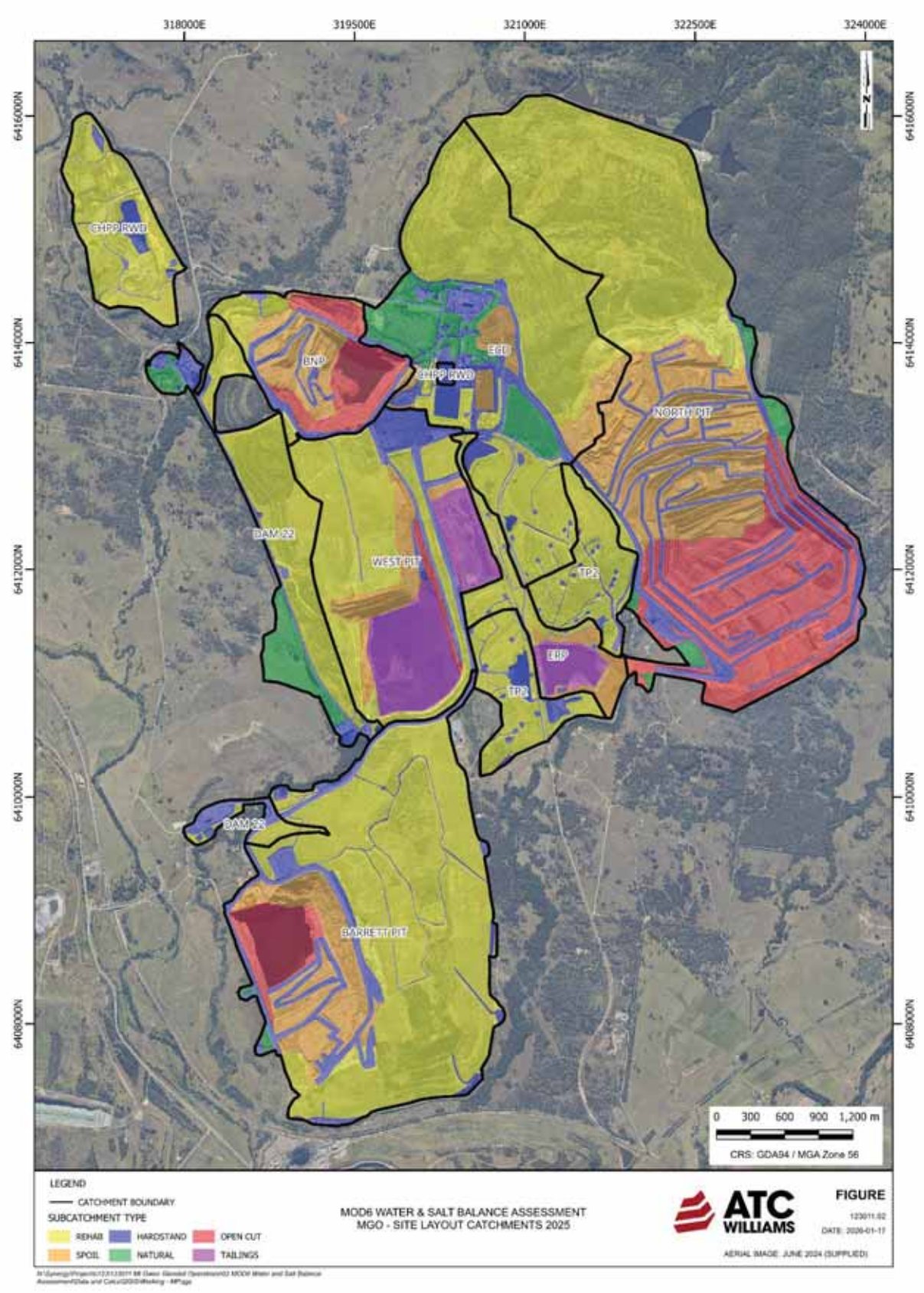
MAP 3 shows the locations of the key existing surface storages and their catchments while **DIAGRAM** 1 shows a schematic representation of the key modelled storages and linkages in the MGO water management system.

3.3 Proposed Operational Water Management System

The Modification proposes the use of Barrett Pit as a long term mine water storage. Due to the water level limit adopted for BNP, pumping infrastructure to allow pumping directly from BNP to Barrett Pit is proposed (refer **DIAGRAM 1**). All other water management system infrastructure will remain unchanged.

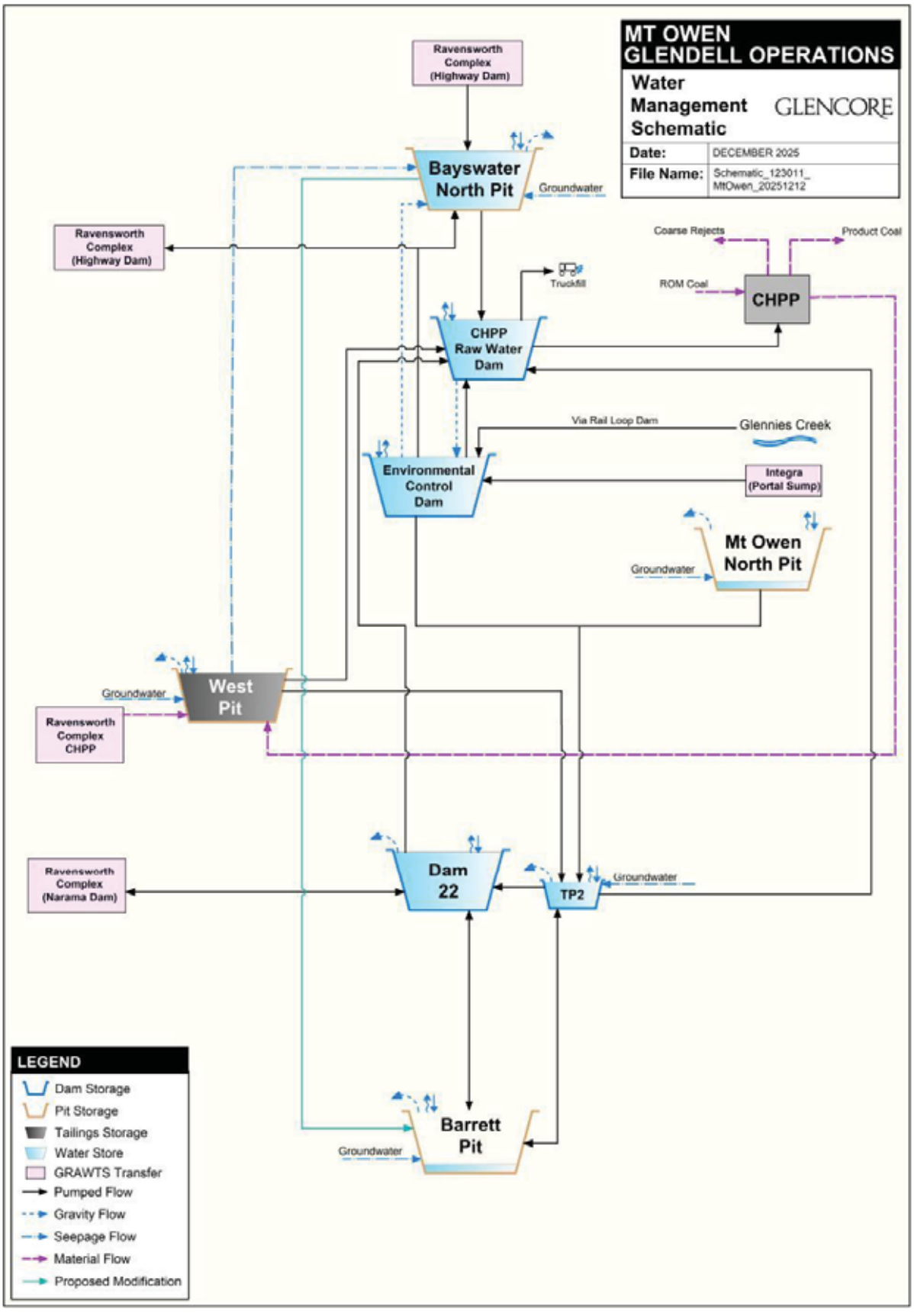
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MAP 3: MGO MODELLED STORAGES AND CATCHMENT AREAS 2025



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DIAGRAM 1: MGO WATER MANAGEMENT SCHEMATIC



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4 OPERATIONAL WATER AND SALT BALANCE MODELLING

The forecast MGO water and salt balance forms part of the Greater Ravensworth Area Water Balance Model (GRAWBM) which is used for planning and approvals.

4.1 Model Description

The water and salt balance model has been developed to simulate the storages and linkages shown for MGO in schematic form in **DIAGRAM 1**. Schematics for each of the GRAWTS participants are provided in **APPENDIX A**. The model has been developed using the GoldSim® simulation package. The model simulates the volume of water and salt mass held in and transferred between all simulated water storages. For each storage the model simulates:

Change in Storage = Inflow – Outflow

Where:

Inflow includes rainfall runoff, groundwater inflow, tailings reclaim water and all pumped inflows from other storages.

Outflow includes evaporation, spill, all pumped outflows to other storages or to a demand sink (e.g. CHPP, haul road dust suppression) and licensed release via the HRSTS.

The model operates on a 6-hourly time step. Model simulations begin on 1 July 2025 and finish on 31 December 2039 (13.5 years). The model simulates 129 “realizations” derived using the historical daily climatic record from 1892 to 2020. The realizations were formed by ‘moving’ along the historical record one year at a time with the first realization comprising the first 13.5 years in the record, the second advancing by one year in the record, the third advancing by two years and so on. The start and end of the historical record is ‘linked’ so that additional realizations which included years from both the beginning and end of the historical record were combined to generate additional climatic realizations. Using this methodology 129, 13.5 year realizations of daily rainfall and evaporation were formulated for use in the model simulations.

The historical climate period adopted in the water balance model aligns with the Hunter River Integrated Quantity-Quality Model (IQQM) simulations which have been undertaken using climatic data from 1892 to 2020 to simulate available water determinations (AWDs) in the Hunter Valley as well as other key water supply parameters (refer **Section 4.2.6**). Although the period of climatic data from 2021 to 2024 is not simulated in the water balance model, due to the need to align with the IQQM simulations, the period of climatic data from 1892 to 2020 comprises a wide range of climatic events including high, low and median rainfall periods.

The results from all realizations are used to estimate the probability of key salt and water balance predictions with and without the Modification.

4.2 Model Data and Assumptions

A summary of the data and key assumptions underpinning the model are provided in the sub-sections that follow. Data and key assumptions have been provided by GRAWTS participants and Glencore unless otherwise stated.

4.2.1 Rainfall Runoff Simulation and Catchment Areas

Rainfall runoff in the water balance model is simulated using the Australian Water Balance Model (AWBM) (Boughton, 2004). The AWBM is a nationally-recognised catchment-scale water balance model that estimates catchment yield (flow) from rainfall and evaporation.

Runoff parameters for the GRAWBM were sourced from the water balance models of the individual sites that comprise the GRAWTS. Those site-specific models are periodically calibrated to confirm the suitability of runoff parameters.

AWBM simulation of flow from seven different subcatchment types was undertaken, namely: undisturbed (natural) areas, hardstand (for example, roads and infrastructure areas), open cut pit, spoil waste rock, rehabilitated waste rock, stockpile areas and tailings. Model AWBM parameters are summarised in **TABLE 1**. Evaporation pan factors were set to 1 for hardstand, open cut pit and tailings

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areas and 0.85 for all other subcatchment types based on experience with similar projects. The tailings subcatchment was split into two sub-areas; wet beach (20% of the area) and dry beach (80% of the area) to allow for the different evaporative characteristics expected.

TABLE 1: MGO AWBM PARAMETERS

Parameter	Subcatchment Type					
	Natural	Hardstand	Open Cut Pit	Active	Rehabilitation	Tailings
C_1 (mm)	9.1	5	5	9	15	0
C_2 (mm)	92.2	5	22	85	120	20
C_3 (mm)	184.4	-	-	-	400	0
A_1	0.134	0.5	0.1	0.05	0.1	0.2
A_2	0.433	0.5	0.9	0.95	0.3	0.8
A_3	0.433	-	-	-	0.6	-
K_s (d^{-1})	0.5	0	0.2	0.1	0.2	0
BFI	0.25	0	0	0.7	0.7	0
K_b (d^{-1})	0.978	0.96	0.95	0.975	0.978	0.8

For water surface areas, rainfall was assumed to add directly to the storage volume with no losses.

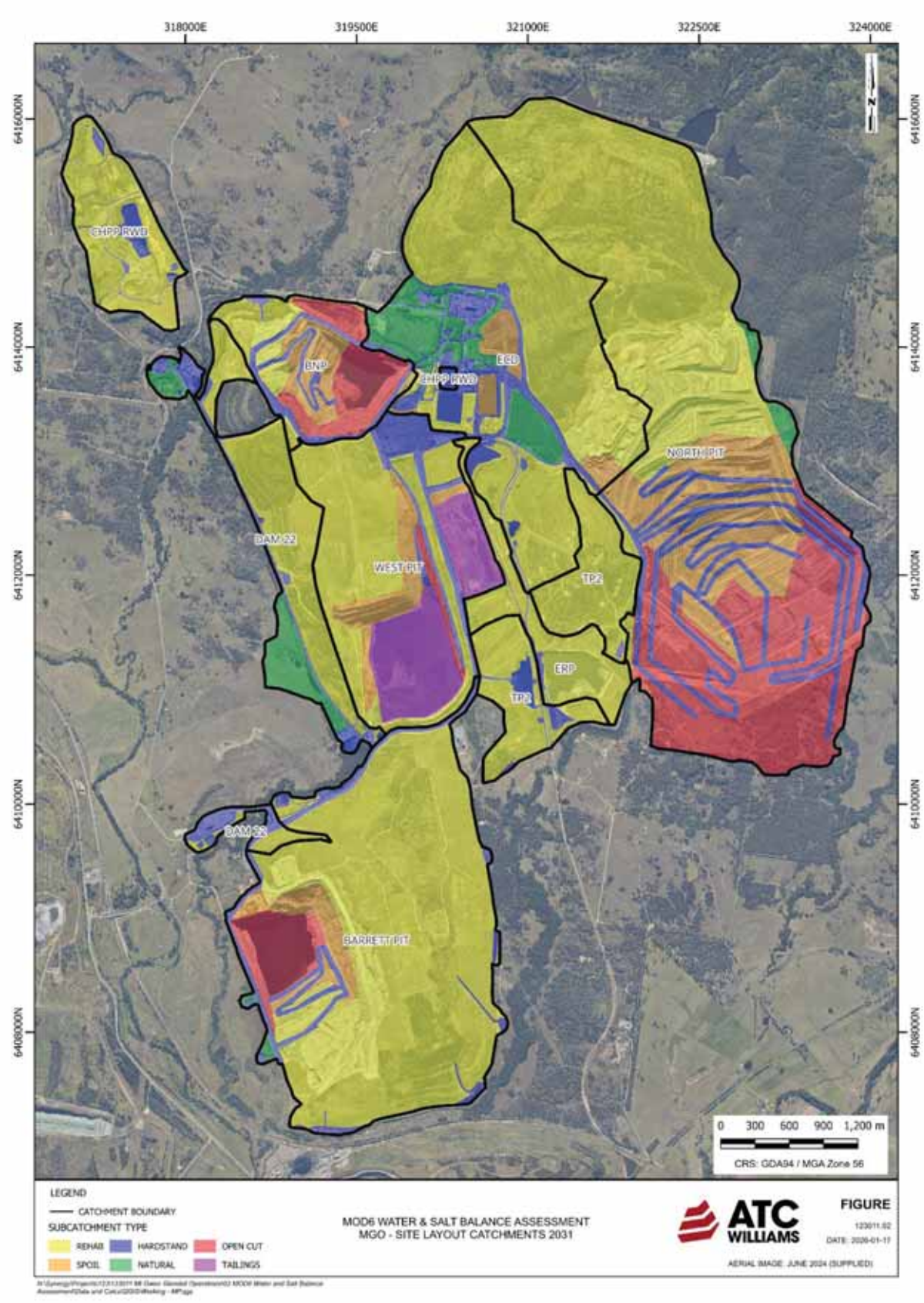
For each modelled storage, the catchment area was divided into subcatchment areas corresponding with the subcatchment types in **TABLE 1**. Catchment and subcatchment areas for the modelled storages at MGO were calculated from the 2025 site layout plan (refer **MAP 3**). Forecast catchment areas at MGO for 2031 and 2034 were calculated based on the approved mine plan (refer **MAP 4** and **MAP 5** respectively) and are summarised in **TABLE 2**. Catchment areas are assumed to vary linearly between the dates provided and constant thereafter. Catchment maps for each of the GRAWTS participants are provided in **APPENDIX B**.

TABLE 2: MGO CATCHMENT AREAS

Subcatchment Type	Catchment Area (ha)		
	2025	2031	2034
Hardstand	420	364	370
Natural	134	117	177
Open Cut Pit	317	356	275
Tailings	118	97	97
Active	407	270	299
Rehabilitation	1,570	1,865	1,920
TOTAL	**2,965**	**3,069**	**3,078**

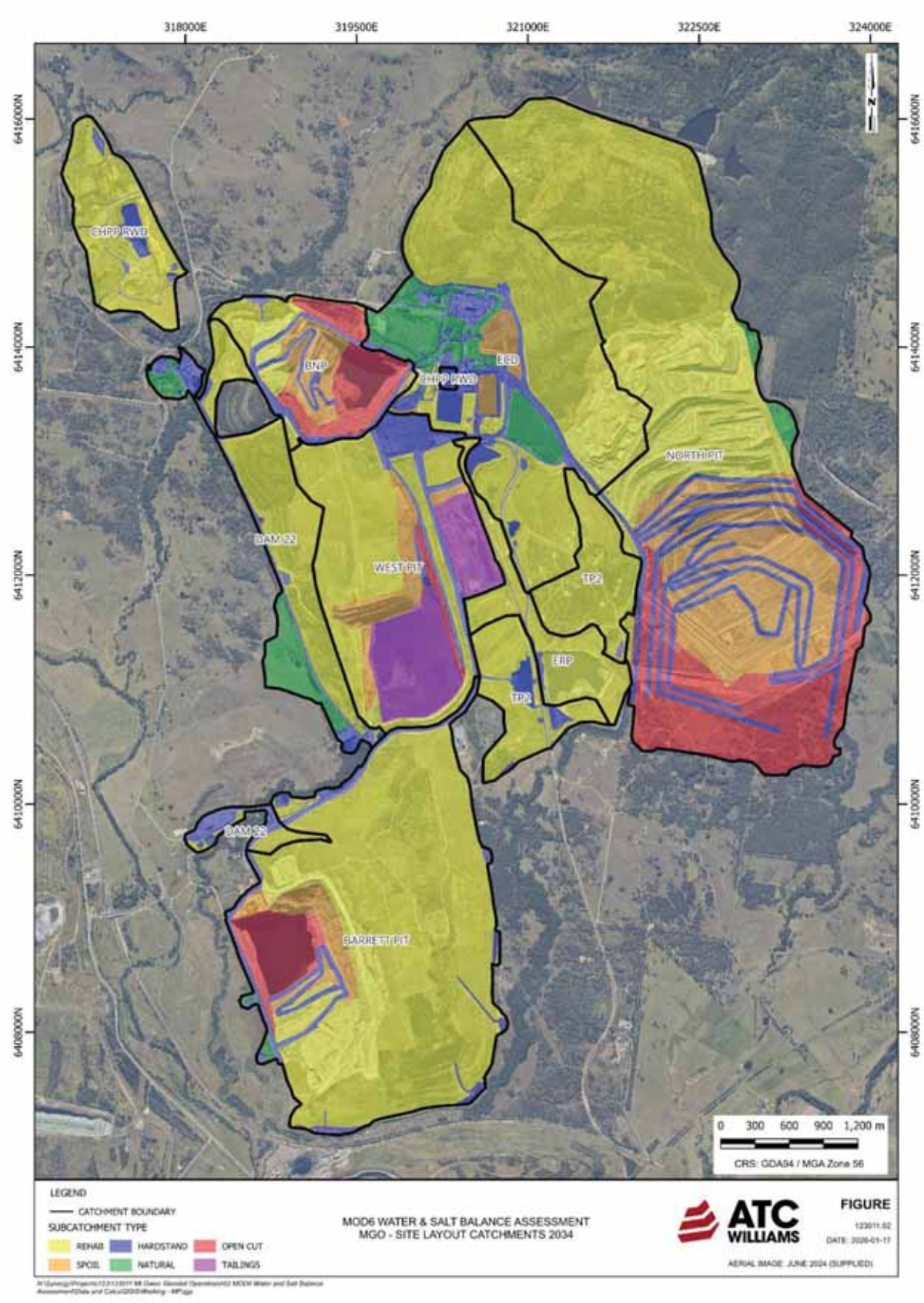
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MAP 4: MGO MODELLED STORAGES AND CATCHMENT AREAS 2031



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MAP 5: MGO MODELLED STORAGES AND CATCHMENT AREAS 2034



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4.2.2 Evaporation from Storage Surfaces

Storage volumes simulated by the model are used to calculate storage surface area (i.e. water area) based on storage level-volume-area relationships for each water storage. Where available, level-volume-area relationships based on as-built survey were adopted or estimated from information supplied. All level-volume-area relationships were provided to relevant GRAWTS personnel for confirmation prior to use in the WBM. The West Pit level-volume-area relationship was derived assuming both free water and spoil storage components. The spoil storage component was calculated using a pit shell surface provided by MGO personnel and a porosity of 12.5%.

The following pan factors were adopted for the estimation of evaporation from various water storage areas (as a multiplier on daily pan evaporation):

- tailings surfaces: 1.2; due to the darker tailings surface (based on experience with other operations);
- open cut pits: 0.8; due to shading effects and lower wind speed at depth (based on experience with other operations); and
- all other storages set as monthly values from data in McMahon et al. (2013) for Scone (located 46 km north, north-west of MGO) – refer **TABLE 3**.

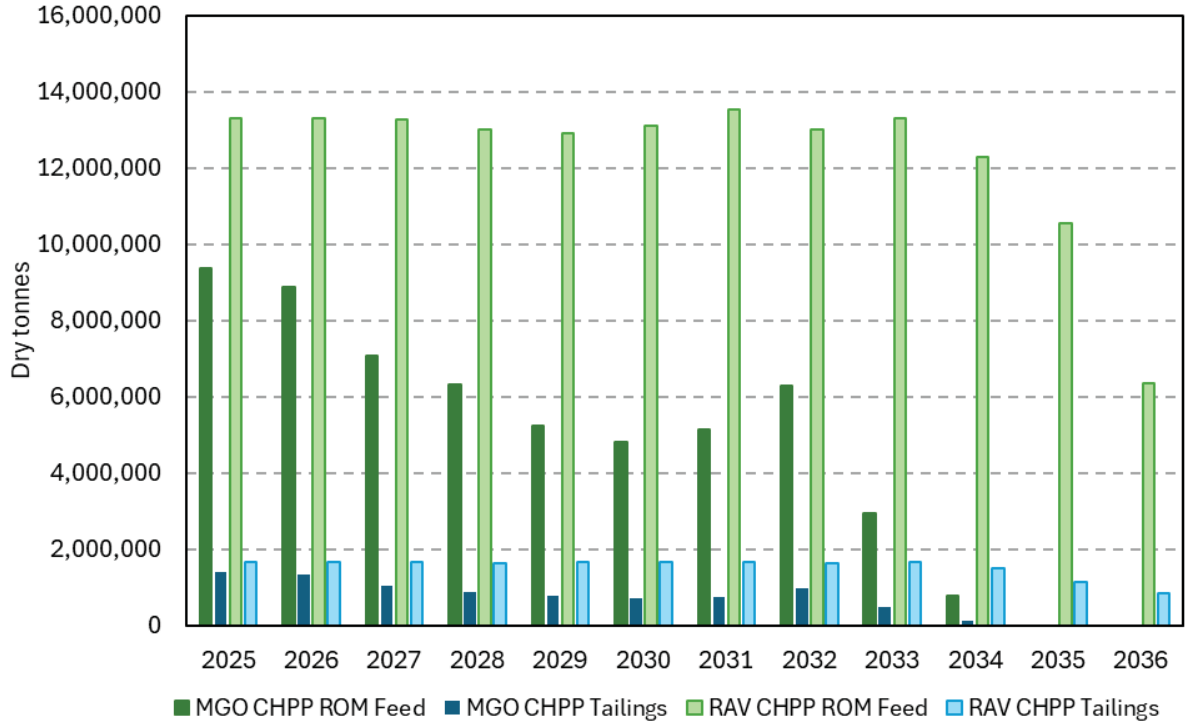
TABLE 3: MONTHLY PAN EVAPORATION FACTORS – OTHER STORAGES

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pan Factor	0.86	0.85	0.84	0.87	0.88	0.89	0.91	0.93	0.95	0.94	0.89	0.85

4.2.3 CHPP Demand and Tailings Disposal

Monthly planned dry ROM coal (CHPP feed) and dry tailings tonnages for both MGO and RAV are summarised in **GRAPH 3**. The other sites comprising the GRAWTS (Liddell and Integra Underground) are now in their closure phases.

GRAPH 3: PLANNED CHPP ROM COAL AND TAILINGS SCHEDULE



Relevant coal and rejects properties which affect the calculation of CHPP water demand are summarised in **TABLE 4**.

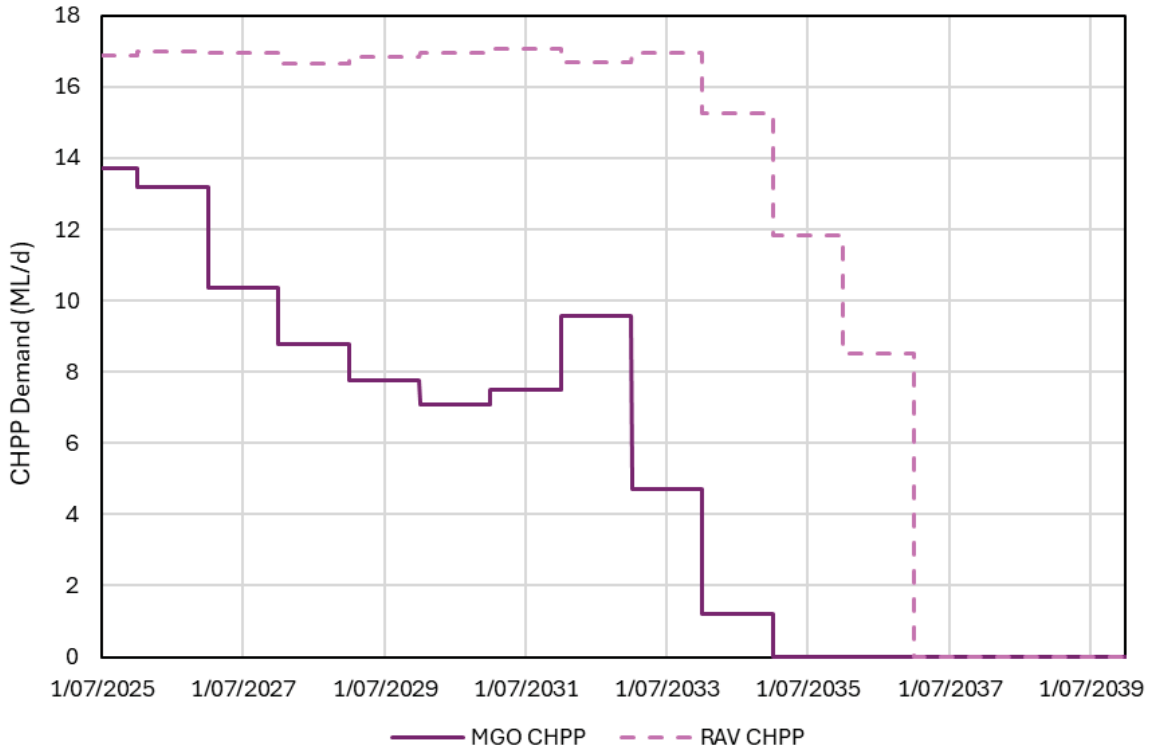
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TABLE 4: COAL AND REJECT PROPERTIES

Parameter	MGO	Ravensworth
ROM coal moisture (CHPP feed)	6%	6%
Product moisture	9.5%	9%
Coarse reject moisture	5%	9%
Thickened tailings underflow solids content	22%	22%

The planned tonnages shown in **GRAPH 3** as well as the coal and tailings moistures listed above were used to calculate future CHPP water demand in the model – this is summarised in **GRAPH 4**.

GRAPH 4: CALCULATED FORECAST CHPP WATER DEMAND



Reclaim of tailings bleed water and rainfall runoff from the tailings storages was included in the water balance model. The bleed rate for both MGO and Ravensworth tailings reporting to West Pit at MGO was assumed to be 53% of tailings water based on advice from MGO personnel.

4.2.4 Dust Suppression Water Demand

Haul road dust suppression demand at MGO was based on an average daily rate for each month based on previously recorded data and is shown in **TABLE 5**. On days where rainfall exceeded evaporation, zero demand was simulated. After open cut mining ceases, haul road demand was assumed to reduce to 10 ML/month (based on similar experience at Liddell, which is in a post-mining phase). The simulated haul road dust suppression demand at MGO is illustrated in **GRAPH 5**.

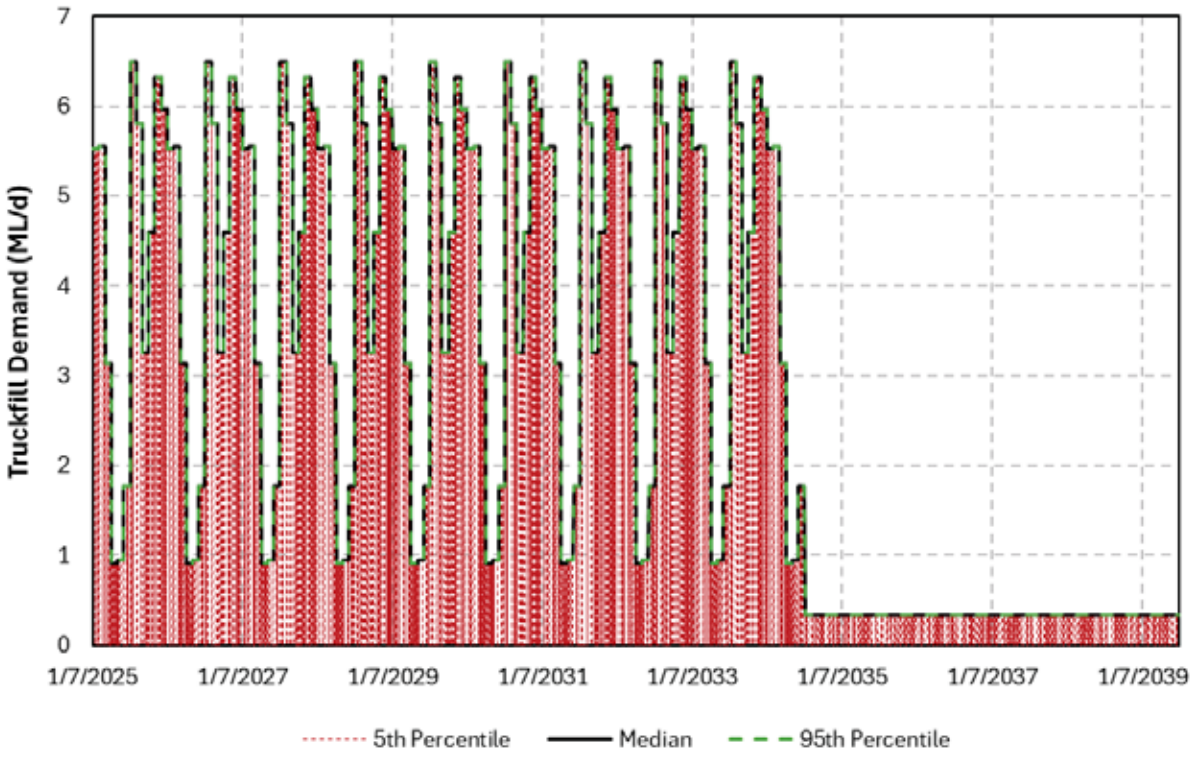
TABLE 5: AVERAGE DAILY HAUL ROAD DEMAND AT MGO

Month	MGO Average Daily Haul Road Demand (ML/d)
January	6.5
February	5.8
March	3.3

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Month	MGO Average Daily Haul Road Demand (ML/d)
April	4.6
May	6.3
June	6.0
July	5.5
August	5.5
September	3.1
October	0.9
November	0.9
December	1.8

GRAPH 5: SIMULATED HAUL ROAD DEMAND - MGO

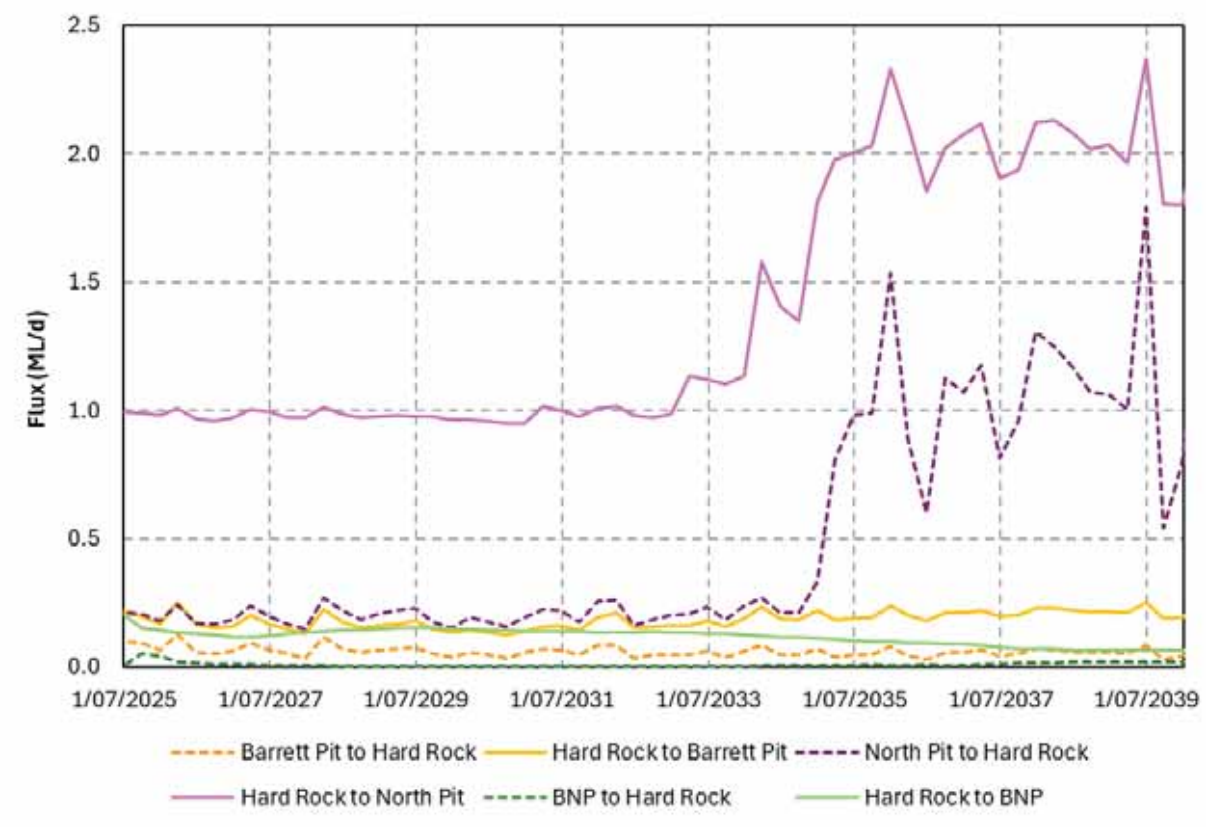


4.2.5 Groundwater Inflow

Modelled groundwater flux rates were obtained from numerical groundwater modelling undertaken by Umwelt (2025). **GRAPH 6** shows a plot of predicted flux rates for MGO for the period of the water balance model simulation. Note that Umwelt advised that the groundwater flux could be linearly interpolated between the end of stress period dates provided (Umwelt, 2025).

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GRAPH 6: MGO MODELLED GROUNDWATER FLUX RATES



4.2.6 Hunter River Supply

The Hunter River IQQM is used by the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) to forecast allowable extractions or AWDs through the water year (July to June), in accordance and in conjunction with the *Water Sharing Plan for the Hunter Regulated River Water Source 2016*. IQQM simulations were undertaken by DCCEEW using climatic data from 1892 to 2020 (the same period of data as used in the water balance model) to generate predictions of general security WAL AWDs, periods of off-allocation flow and the volume of water stored in Glenbawn Dam and Glennies Creek Dam (the two Hunter River major regulating storages), used in the estimation of AWD for High Security WALs.

Water extraction under WALs held for MGO were modelled (refer **Section 2.3.1**). Sourcing of water from the Hunter River to MGO was only simulated if the stored water volume on site was less than 1,000 ML. Carry over of general security WALs has been included per clause 53(6)(b) of the *Water Sharing Plan for the Hunter Regulated River Water Source 2016* although no carry over was assumed as at 1 July 2025 (i.e. model commencement).

4.2.7 Licensed HRSTS Discharge

In the event of an excess volume of water stored in the GRAWTS system water would be transferred from either Narama Dam at Ravensworth or South Cut at Liddell to the Hunter River during river discharge periods in accordance with the HRSTS.

Simulating periods available for licensed discharge involved firstly developing a relationship between river flow rate and river registers for declared “high” flow events. This was carried out using historical river registers sourced online, correlated against recorded Hunter River daily flows. This correlation was extended to “flood” flow events in the Hunter River (during which no daily discharge restriction applies). Hunter River flow rates at Liddell were simulated by the IQQM for the same period of historical climate data as used in the water balance model and these flows used with the above correlation relationship to simulate river registers. The HRSTS credits were simulated as shown in **Section 2.3.2**, with the rate of discharge dependent on the modelled salinity of the discharge storages.

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4.2.8 Seepage

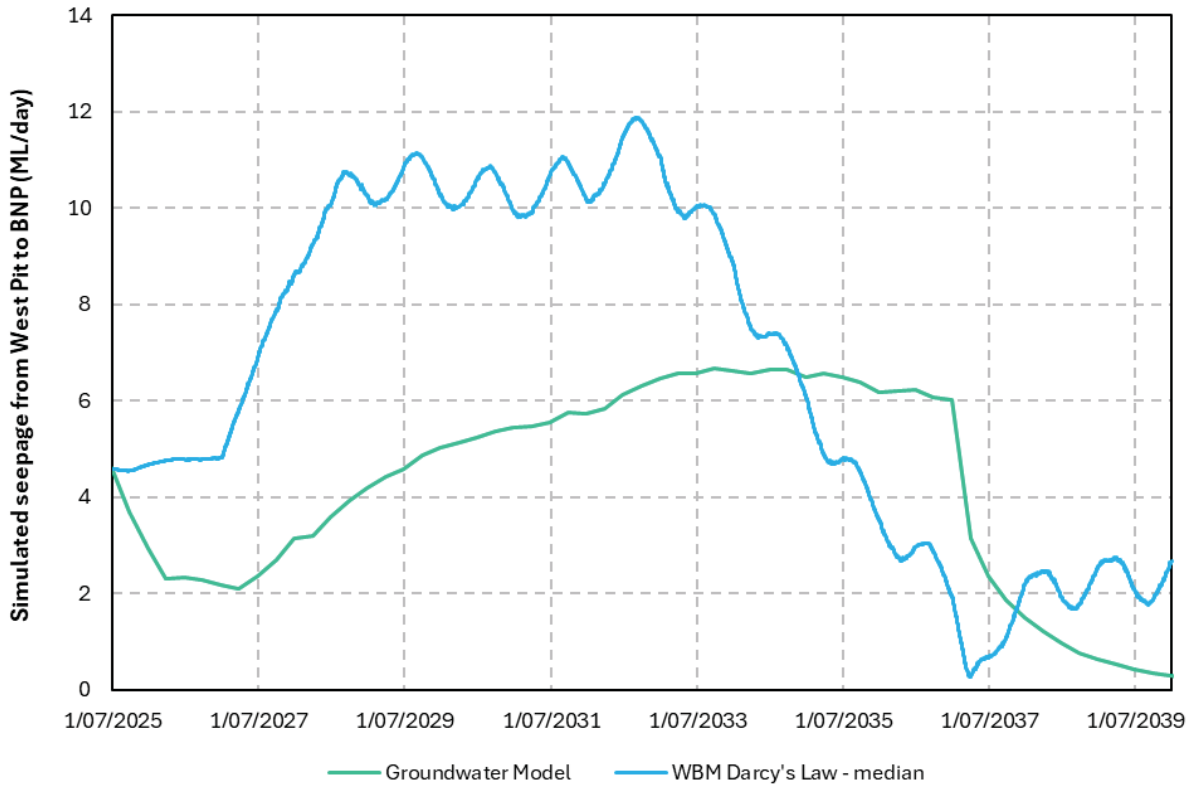
Seepage from the West Pit to BNP is simulated via the waste emplacement which separates these two voids, known informally as the 'West Pit Aquifer'. The rate of seepage was derived using Darcy's Law which allows for a changing seepage rate depending on the simulated water level in both West Pit and BNP. The following parameters were assumed:

- Cross sectional length = 850 m, i.e. width of northern portion of West Pit;
- Flow path length = 1,700 m, i.e. distance from West Pit to BNP; and
- Hydraulic conductivity of spoil = 100 m/d, as per calibration of MGO (WRM, 2024).

It is noted that the adopted hydraulic conductivity is higher than expected for waste rock material however, it is understood (from communication with MGO personnel) that preferential pathways in the West Pit Aquifer may explain the higher seepage observed on site.

Resulting seepage rates from West Pit to BNP were compared to the groundwater model predictions (Umwelt, 2025) for this flow to ensure the two models provided similar results (refer **GRAPH 7**).

GRAPH 7: SIMULATED WEST PIT AQUIFER SEEPAGE



4.2.9 Pumping Rates

Modelled pumped transfer rates for flows within MGO and to other GRAWTS sites are summarised in **TABLE 6**.

TABLE 6: MGO MODELLED PUMP TRANSFER RATES

Type	Source	Destination	Pump Rate (L/s)
Internal	Barrett Pit	TP2 and Dam 22	140
	TP2	CHPP RWD	120
	Dam 22	TP2	150
	Dam 22	CHPP RWD	130
	West Pit	TP2 and CHPP RWD	130

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Type	Source	Destination	Pump Rate (L/s)
	North Pit	TP2	75
	BNP	CHPP RWD	280
	ECD	CHPP RWD	230 (two pumps)
	ECD	TP2	125
	CHPP RWD	CHPP	240
	TP2	Barrett Pit	150
	BNP	Barrett Pit	200
External Pump In	Integra (Portal Sump)	ECD	120
	Ravensworth (Narama Dam)	Dam 22	75
	Ravensworth (Highway Dam)	BNP	500
	Glennies Creek	ECD (via Rail Loop Dam)	80
External Pump Out	BNP	Ravensworth (Highway Dam)	600
	West Pit	Ravensworth (Highway Dam)	150
	Dam 22	Ravensworth (Narama Dam)	80

4.2.10 Storage Operating Volumes

A number of operating volumes were adopted for modelling which affect when pumping to and from certain storages is triggered. **TABLE 7** provides a summary of the key adopted operating volumes for the MGO modelled storages. Advised or estimated storage capacities are also given for reference.

TABLE 7: ADOPTED OPERATING VOLUMES AND CONDITIONS

Storage	Volume	Modelled Operating Conditions
Barrett Pit	Pump Activation Volume = 500 ML	Transfers from Barrett Pit commence when volume exceeds pump activation volume and cease below the dead storage volume.
	Dead (unrecoverable) Storage Volume = 250 ML	
	Capacity = 91,007 ML	
TP2	Low Operating Volume = 174 ML	Transfers to TP2 prioritised when volume falls below Low.
	High Operating Volume = 348 ML	Transfers to TP2 cease when volume rises above High.
	Very High Operating Volume = 387 ML	Transfers to Barrett Pit commence when volume reaches Very High.
	Capacity = 436 ML	
Dam 22	Low Operating Volume = 11 ML	Transfers to Dam 22 commences when volume rises above High and ceases when volume falls to Low.
	High Operating Volume = 17.7 ML	
	Capacity = 29 ML	
CHPP RWD	Dead (unrecoverable) Storage Volume = 19.2 ML	CHPP supply ceases when dam is below this volume.
	Capacity = 99 ML	
ECD	Low Operating Volume = 61 ML	Transfers to CHPP RWD from Dam 22 commence when dam is below this volume.
	High Operating Volume = 91 ML	Transfers to TP2 and CHPP cease when volume rises above High.
	Very High Operating Volume = 126 ML	Transfers to BNP commence when volume reaches Very High.
	Capacity = 152 ML	

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Storage	Volume	Modelled Operating Conditions
West Pit	Dead (unrecoverable) Storage Volume = 10 ML	Transfers from West Pit cease when volume is below the dead storage volume.
	Capacity = 18,430 ML	
North Pit	Pump Activation Volume = 15 ML	Transfers from North Pit commence when volume exceeds pump activation volume and cease below the dead storage volume.
	Dead (unrecoverable) Storage Volume = 5 ML	
	Capacity = 13,943 ML	
BNP	Pump Activation Volume = 23,095 ML (equivalent to 70 mAHD)	Transfers to Barrett Pit commence when volume exceeds pump activation volume and cease below the pump deactivation volume.
	Pump Deactivation Volume = 22,886 ML	
	Capacity = 41,793 ML	

4.2.11 Initial Stored Water Volumes and Salinity

Initial stored water volumes and salinity for key modelled storages, from recent monitored data supplied by MGO personnel, are listed in **TABLE 8** for all MGO storages.

TABLE 8: MODELLED INITIAL STORED WATER VOLUMES IN MGO STORAGES

Storage	Initial Stored Water Volume (ML)	Initial EC (µS/cm)
Barrett Pit	8,870	8,540*
TP2	273	7,433
Dam 22	22.8	7,441
CHPP RWD	77.4	7,441
ECD	113	7,116
West Pit	214	5,000
North Pit	15.0	8,540*
BNP	17,153	8,540

* No data, assume equal to BNP

4.2.12 Salinity Values

Constant EC values were assigned to modelled system inflows on the basis of monitoring data and experience with similar projects. **TABLE 9** summarises modelled values. A conversion factor of 0.64 was used to convert monitored EC to TDS.

TABLE 9: MODELLED SOURCE SALINITY (EC) VALUES

System Inflow or Component		Modelled EC (µS/cm)
Runoff	Rehabilitated Waste Rock	1,000
	Undisturbed (Natural)	250
	Hardstand	1,500
	Waste Rock Emplacement	2,000
	Open Cut Pit	2,000
	Tailings	1,500
Tailings Bleed		4,000
Groundwater (Hard Rock)		10,000
Glennies Creek		270

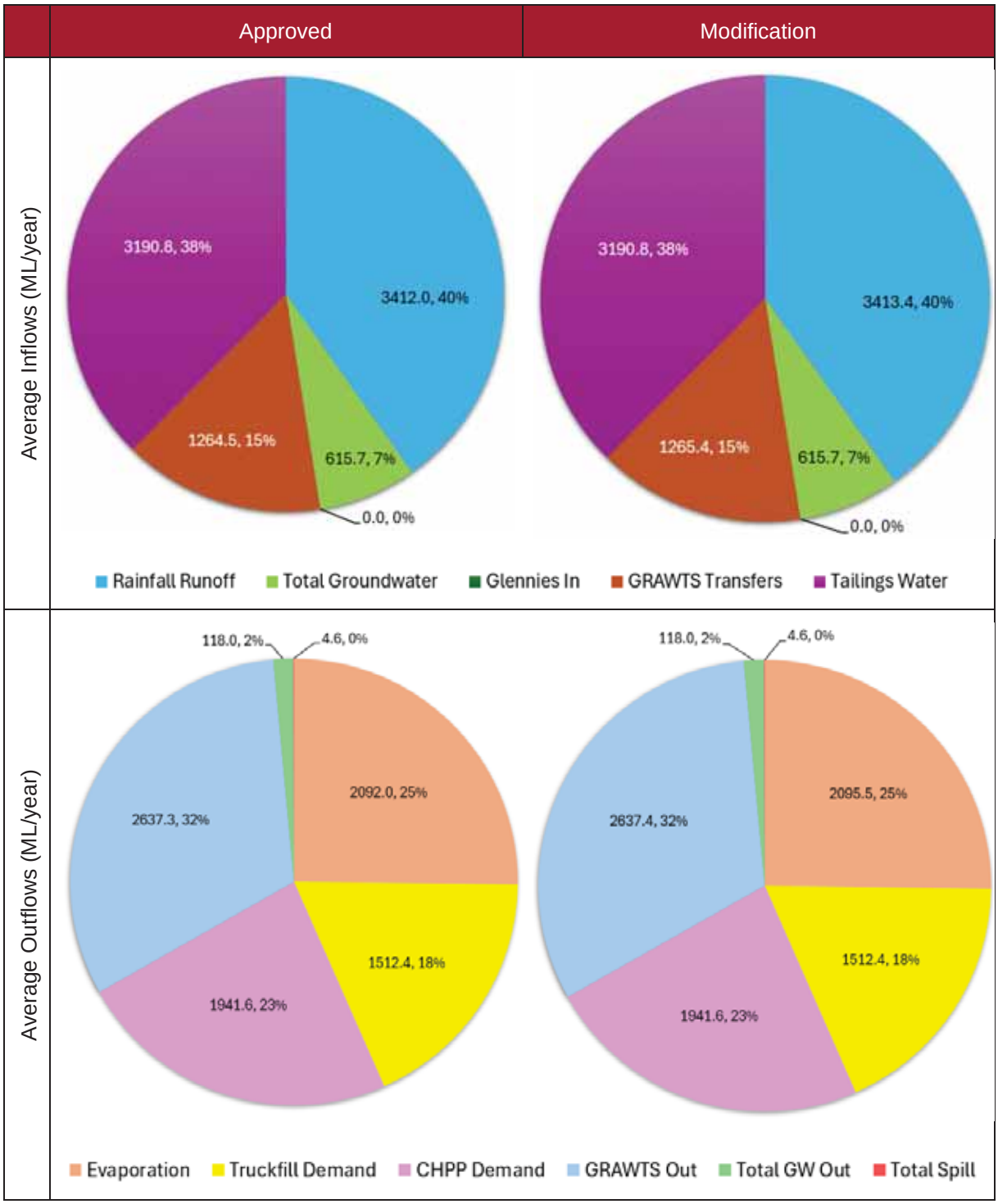
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4.3 Operational Water and Salt Balance Model Results

4.3.1 Overall Site Water Balance

Model predicted average inflows and outflows for approved operations and the Modification, the average calculated from all 129 realizations and averaged over the simulation period, are shown in **GRAPH 8**.

GRAPH 8: AVERAGE MODELLED SYSTEM INFLOWS AND OUTFLOWS



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Average model results indicate that results for both approved operations (i.e. without the Modification) and the Modification are similar with only minor differences in values and no change to percentages. **GRAPH 8** shows the rainfall runoff provides the highest system inflow (40%) closely followed by tailings bleed water (38%). Average outflows are highest for GRAWTS transfers out (32%), followed by evaporation (25%), CHPP demand (23%) and dust suppression demand (18%). It is of note that groundwater outflow is predicted for both cases (from RAV North Pit spoil to hardrock, per Umwelt [2025]) as well as some external spill.

4.3.2 Water Supply Reliability

No shortfalls of CHPP or dust suppression demands were simulated in any modelled realization (approved or with the Modification).

4.3.3 Licensed Release

Simulated forecast volumes for licensed release from the HRSTS show that there is no change between existing approved operations and the Modification (refer **TABLE 10**). HRSTS release is not simulated after mid-2029 as it is not presently known how many HRSTS credits will be held. Notwithstanding, the results indicate that discharge volumes are not affected by the Modification.

TABLE 10: SIMULATED LICENSED RELEASE VIA HRSTS FOR GRAWTS

	Simulated Average Annual Release (ML/year)		
	5th Percentile	Median	95th Percentile
Approved	200.6	464.2	940.2
Modification	200.6	464.2	940.2

4.3.4 External Spill

The only storage at MGO simulated to spill externally is Dam 22. **TABLE 11** shows there is no change to simulated external spill volumes between existing approved operations and the Modification.

TABLE 11: SIMULATED EXTERNAL SPILL FROM DAM 22

	Simulated Total Spill Volume (ML)		
	5th Percentile	Median	95th Percentile
Approved	0.2	4.1	11.4
Modification	0.2	4.1	11.4

4.3.5 Stored Water Volumes and Salinity

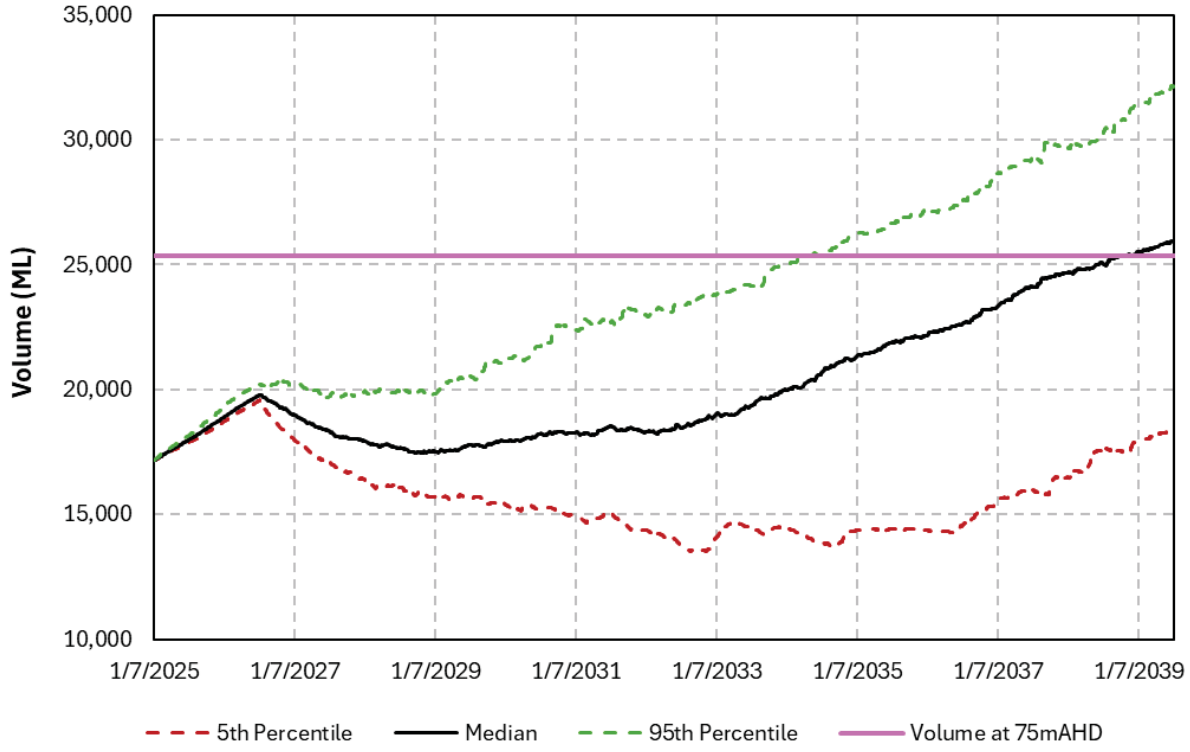
Given the minor changes to MGO water management system inflows and outflows for the approved and Modification cases, the only expected changes for model results are for water inventory. In particular, changes to stored water volumes in BNP and Barrett Pit are expected due to the introduction of a pump between these storages as a result of the Modification.

Simulated forecast water volumes in BNP for approved operations and the Modification are shown in **GRAPH 9** and **GRAPH 10** respectively as probability plots over the simulation period

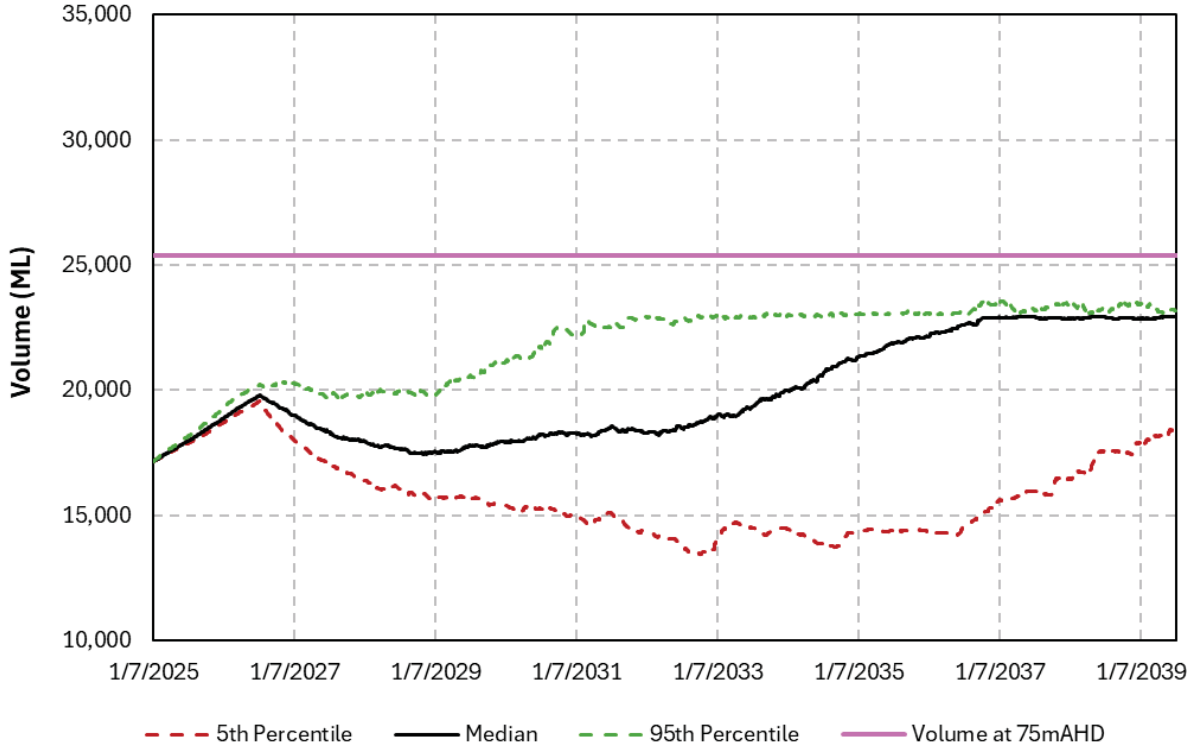
These probability plots show the range of likely total stored water volumes/levels, with the central black plot representing the median result and the green upper and red lower plots showing the 5th/95th percentile results. The 95th percentile results are only exceeded in 5% of modelled realizations. There is a predicted 90% chance that the total water volume/level will fall in between the 5th/95th percentile plots. It is important to note that none of these plots represents a single climatic realization – these probability plots are compiled from all 129 realizations - e.g. the median volume plot does not represent model forecast volume for median climatic conditions.

TAILINGS.WATER.WASTE.

GRAPH 9: SIMULATED BNP STORED WATER VOLUME - APPROVED



GRAPH 10: SIMULATED BNP STORED WATER VOLUME - MODIFICATION

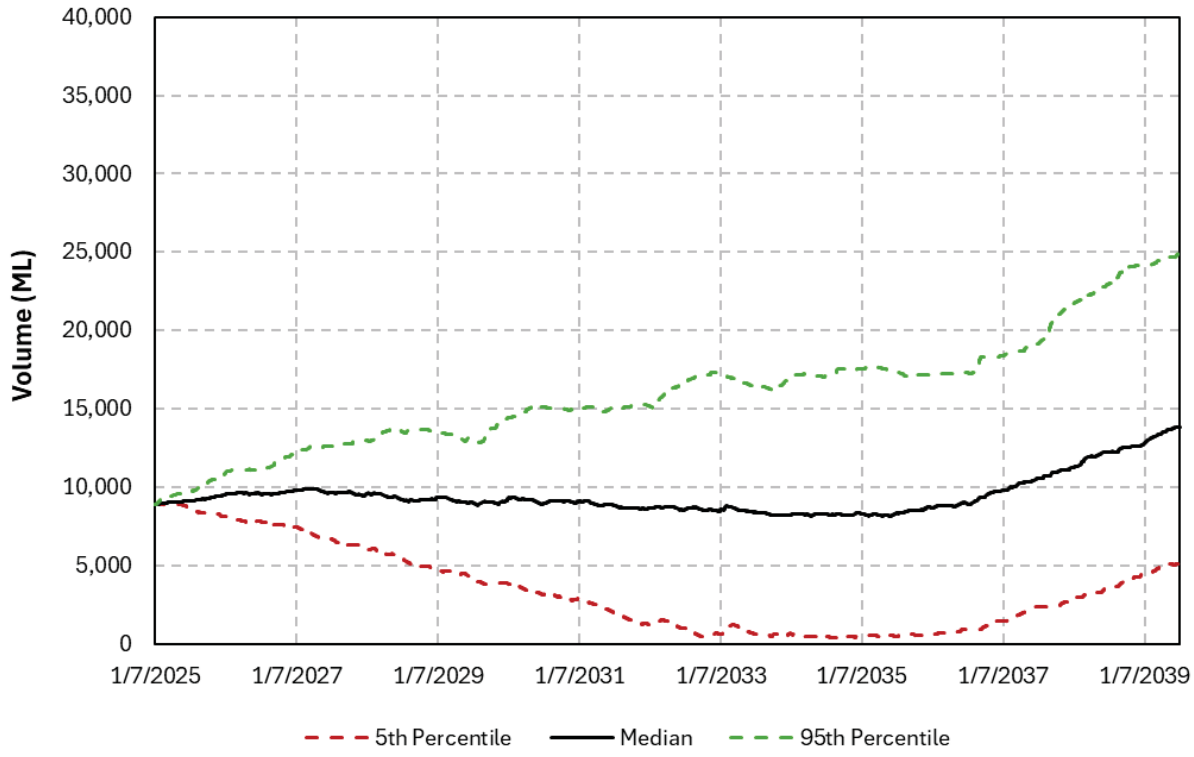


The existing approved operations case shows that for the median statistic, stored water volume in BNP will exceed the adopted management level of 75 mAHD (i.e. to avoid connectivity with surrounding creeks, refer **SECTION 3.2**). With the Modification, and the introduction of pumping from BNP to Barrett Pit, the water level in BNP can be managed such that the 95th percentile statistic for stored water volume in BNP can be maintained below the 75 mAHD level.

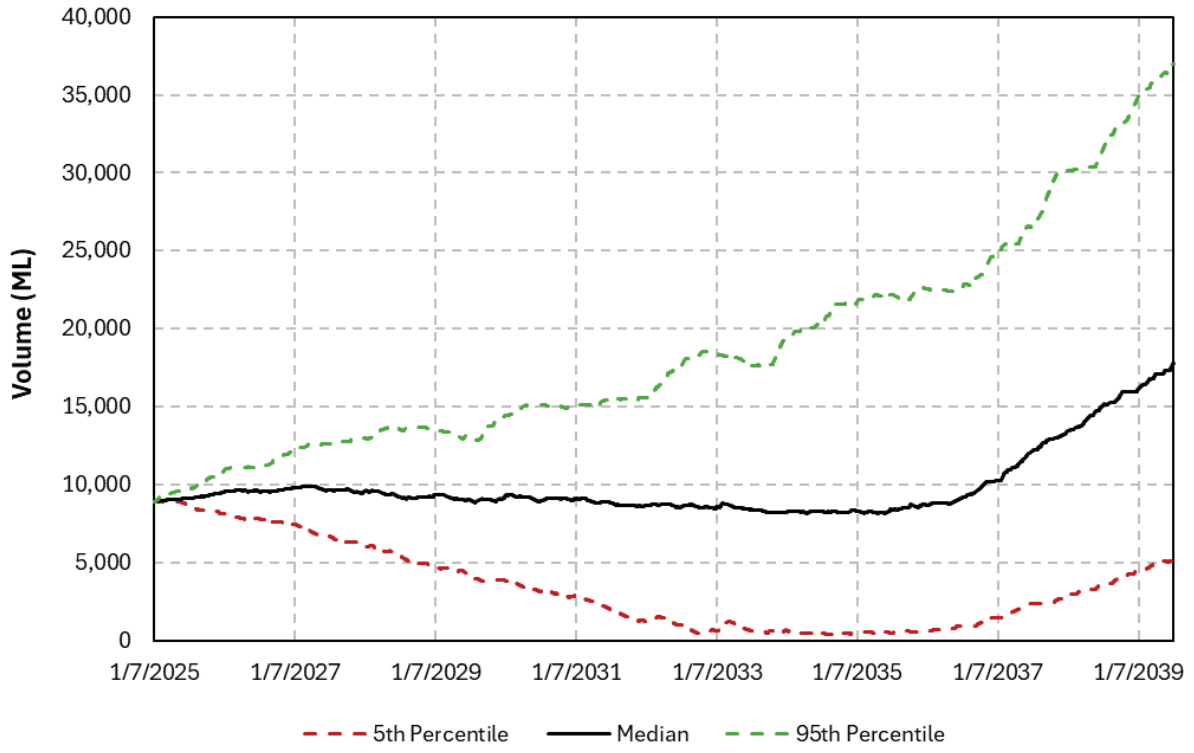
TAILINGS.WATER.WASTE.

Simulated forecast water volumes in Barrett Pit for approved operations and the Modification are shown in **GRAPH 11** and **GRAPH 12** respectively as probability plots over the simulation period

GRAPH 11: SIMULATED BARRETT PIT STORED WATER VOLUME - APPROVED



GRAPH 12: SIMULATED BARRETT PIT STORED WATER VOLUME - MODIFICATION

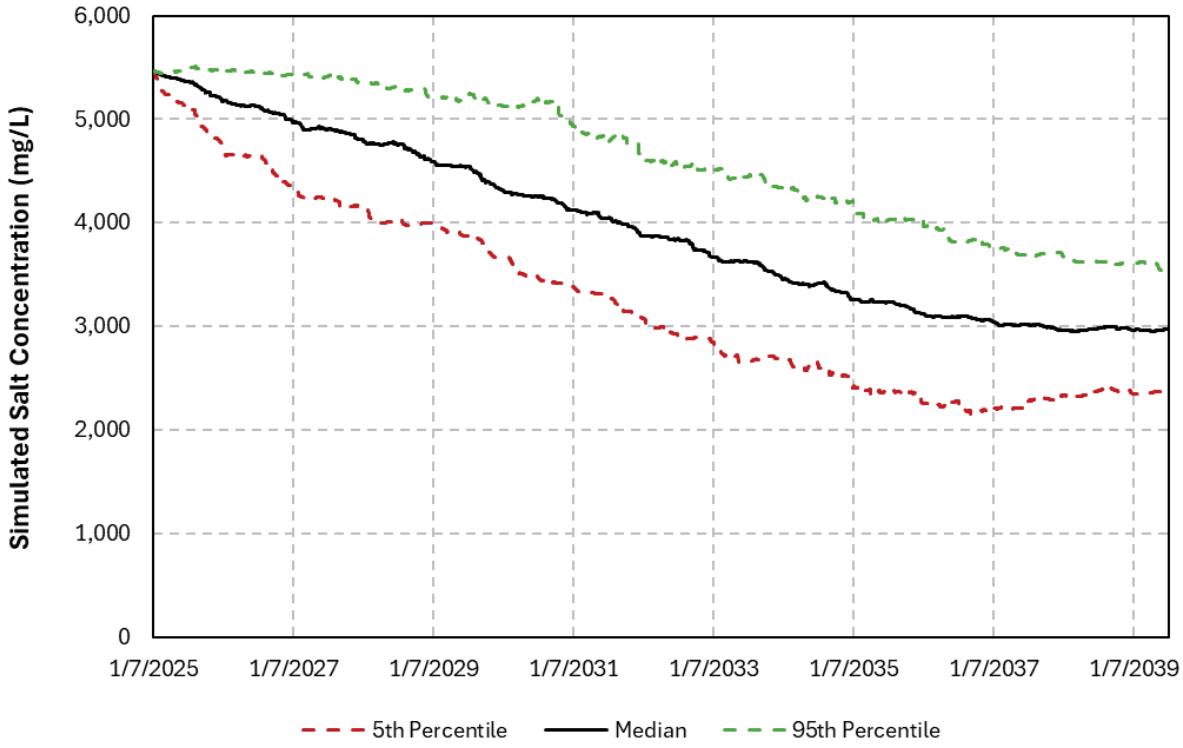


TAILINGS.WATER.WASTE.

GRAPH 11 and **GRAPH 12** show that with the Modification, the median statistic is likely to store approximately 4 GL more than approved operations as at the end of 2039. For the 95th percentile this increases to approximately 12 GL of difference between existing approved operations and the Modification as at the end of 2039. Barrett Pit is simulated as having a capacity of approximately 91 GL, hence this increase in stored water inventory is not expected to result in any changes to surface water impacts. The maximum volume simulated for the 95th percentile envelope is 37 GL (or 15.7 mAHD) compared to the previously predicted water level equilibrium for Barrett Pit which was 26 mAHD.

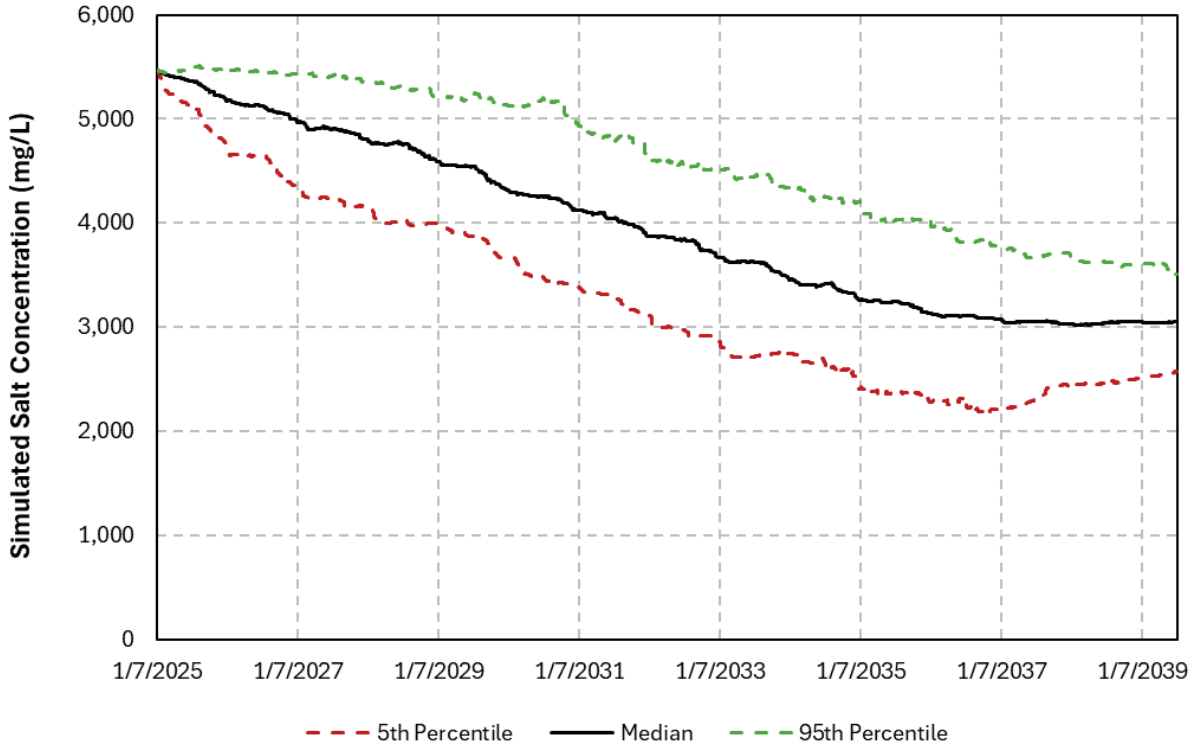
Simulated Barrett Pit salt concentration for approved operations and the Modification is shown in **GRAPH 13** and **Graph 14** respectively, again as probability plots over the simulation period.

GRAPH 13: SIMULATED BARRETT PIT STORED WATER SALT CONCENTRATION - APPROVED



TAILINGS.WATER.WASTE.

GRAPH 14: SIMULATED BARRETT STORED WATER SALT CONCENTRATION - MODIFICATION



Comparing **GRAPH 13** and **Graph 14** it can be seen that there are only minor differences to the simulated salt concentration in Barrett Pit over time for the Modification. This is to be expected as the total site inflows and outflows do not show a discernible change and hence salt load within the system will remain fairly consistent between the approved and with Modification case. Generally, predicted salt load is simulated to decrease over time in Barrett Pit.

TAILINGS.WATER.WASTE.

5 POTENTIAL SURFACE WATER IMPACTS ASSOCIATED WITH THE MODIFICATION

5.1 Licensed Discharge to the Hunter River

Water balance modelling has indicated that licensed release to the Hunter River will be similar between the approved and Modification cases hence the impact of the Modification on surrounding surface water resources is expected to be minimal. HRSTS discharges in the future will continue to be conducted in accordance with the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002*.

5.2 Potential Cumulative Impacts

Cumulative impacts have been described in a mining context by Franks, et al (2010) as:

"…arise from compounding activities of a single operation or multiple mining and processing operations, as well as the aggregation and interaction of mining impacts with other past, current and future activities that may not be related to mining."

In the context of surface water resources potentially impacted by the Modification there has been significant past development in the upstream, immediate and downstream catchment areas which, if considered from the time of European settlement, include widespread agricultural development and urbanisation. The effects of past development are inevitably incorporated into the baseline data and descriptions of surface water resources developed for MGO which are based on contemporary monitoring (MGO, 2025).

A number of mines operate in the immediate vicinity including; RAV, Liddell Coal Operations, Hunter Valley Operations, Ashton and Rix's Creek. These mines operate in accordance with the *Water Management Act 2000* and discharge and sourcing of water is undertaken in accordance with the relevant Development Consent and the EPL for each site. The water balance has demonstrated that the Modification does not alter predicted discharge volumes or requirements for external water sources. As such, the Modification will not increase Glendell's contribution to cumulative impacts.

TAILINGS.WATER.WASTE.

REFERENCES

[1] Boughton, W.C. (2004). "The Australian Water Balance Model", *Environmental Modelling and Software*, vol.19, pp. 943-956.

[2] LongPaddock (2025). *SILO | LongPaddock*. Queensland Government, retrieved December 10 from https://www.longpaddock.qld.gov.au/silo/.

[3] Franks, D. M., Brereton, D., Moran, C. J. (2010). *Managing the Cumulative Impacts of Coal Mining on Regional Communities and Environments in Australia*, Impact Assessment and Project Appraisal, 28:4, 299-312.

[4] McMahon, T.A., Peel, M.C., Lowe, L., Srikanthan, R. & McVicar, T.R., (2013). "Estimating actual, potential, reference crop and pan evaporation using standard meteorological data: a pragmatic synthesis", *Hydrology and Earth System Sciences*, vol. 17, pp. 1331-1363.

[5] Mt Owen Glendell Operations (2025). *Mount Owen Glendell Water Management Plan*, Version 7.0, effective 20/02/2025.

[6] Umwelt (2025). *Glendell Modification 6 Groundwater Impact Assessment*, DRAFT, December.

[7] WRM (2024). *West Pit Spoil Dump (West Pit Aquifer) – Preliminary calibration methodology and results*, memorandum reference: 1903-03-B1, 22 November.

CONDITIONS OF REPORT

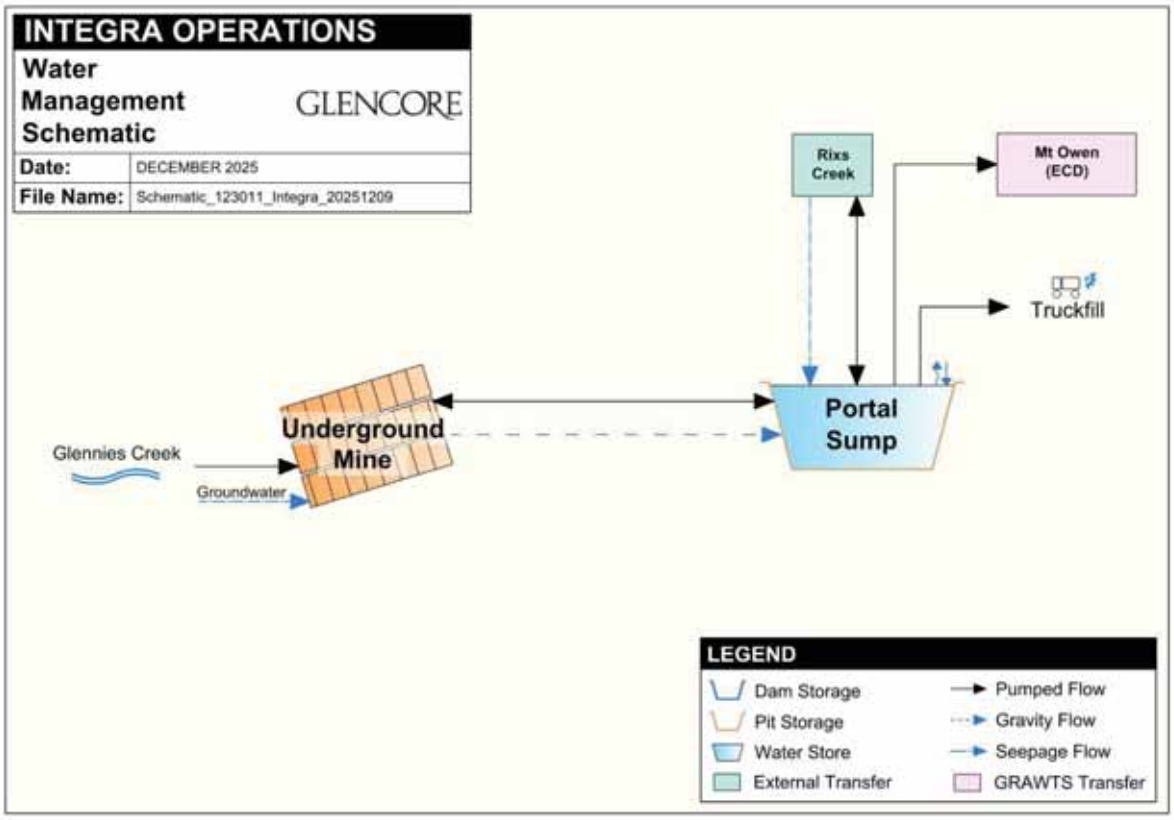
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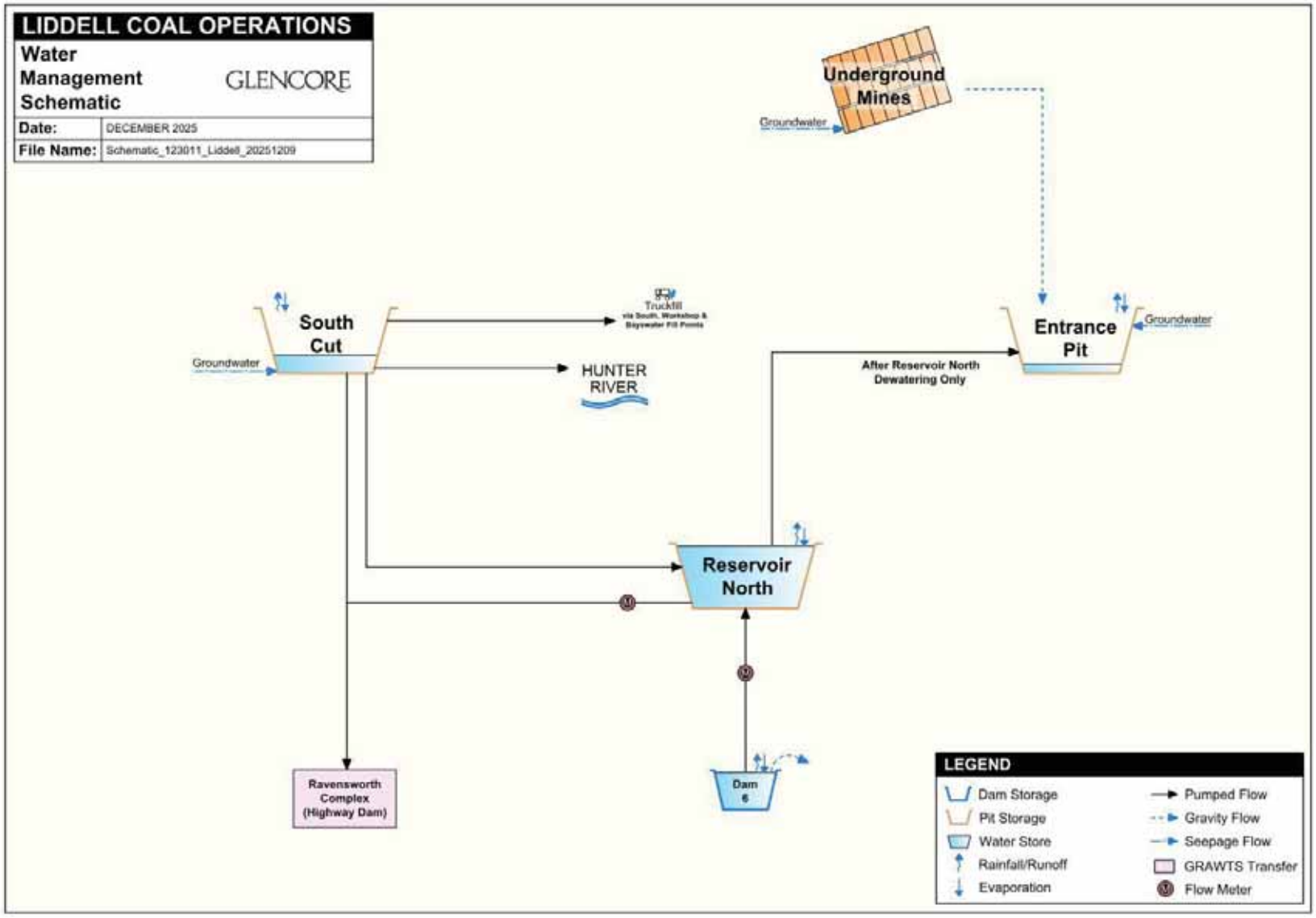
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TAILINGS.WATER.WASTE.

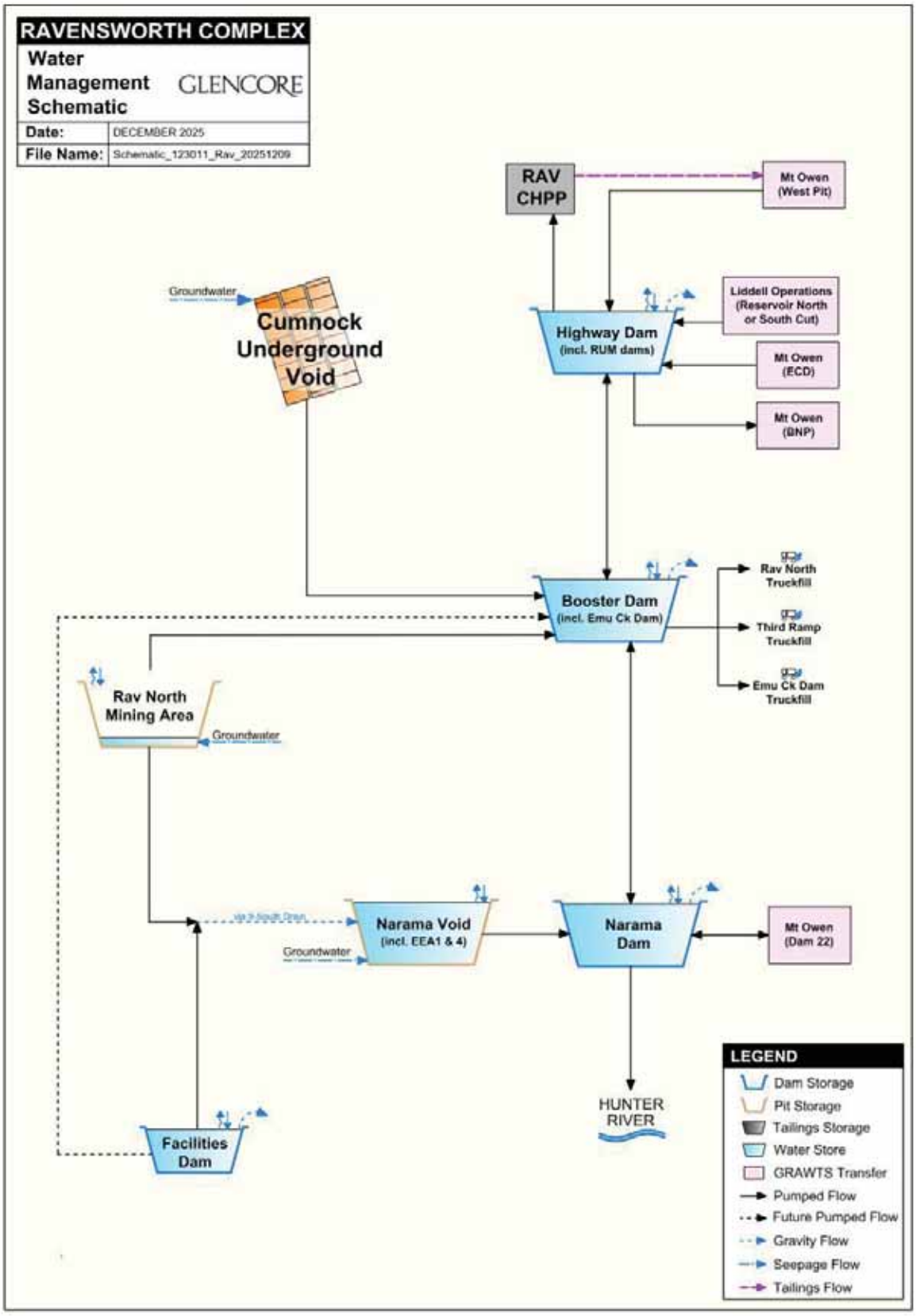
APPENDICES

APPENDIX A – WATER MANAGEMENT SCHEMATICS FOR GRAWTS PARTICIPANTS


INTEGRA OPERATIONS
Water Management Schematic
GLENCORE
Date: DECEMBER 2025
File Name: Schematic_123011_Integra_20251209
Rixs Creek
Mt Owen (ECD)
Truckfill
Underground Mine
Portal Sump
Glennies Creek
Groundwater
LEGEND
Dam Storage
Pit Storage
Water Store
External Transfer
Pumped Flow
Gravity Flow
Seepage Flow
GRAWTS Transfer

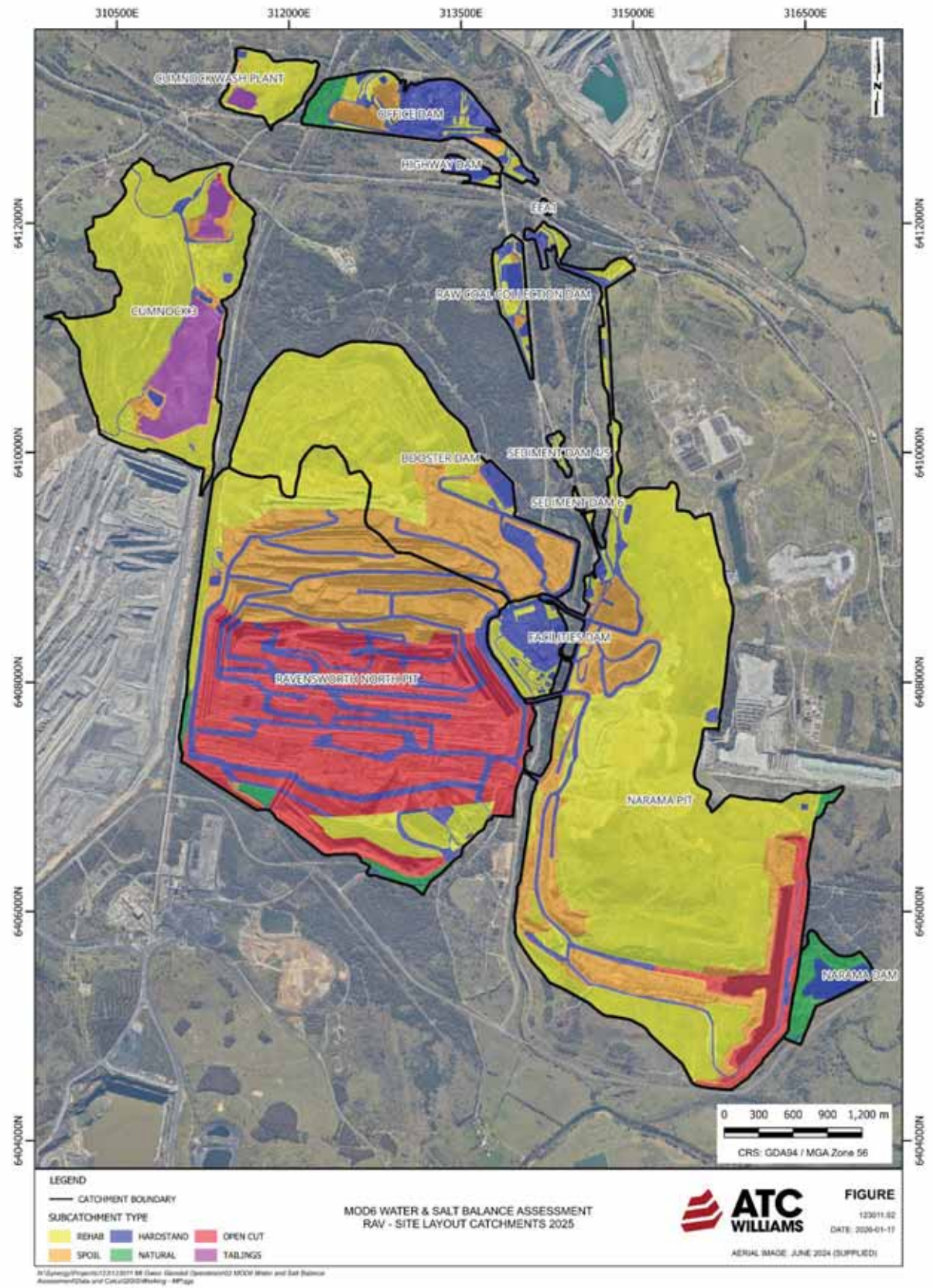


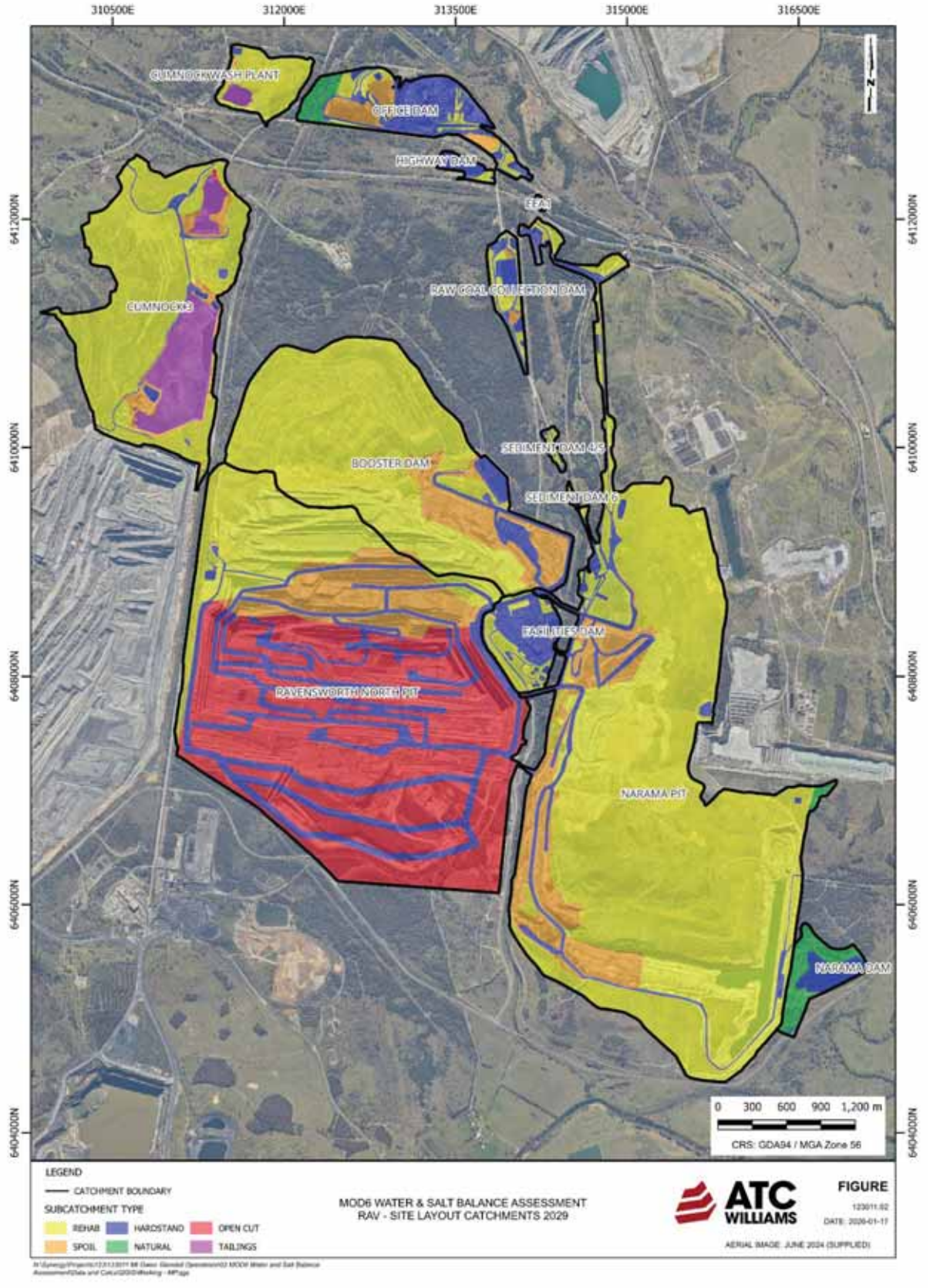
TAILINGS.WATER.WASTE.

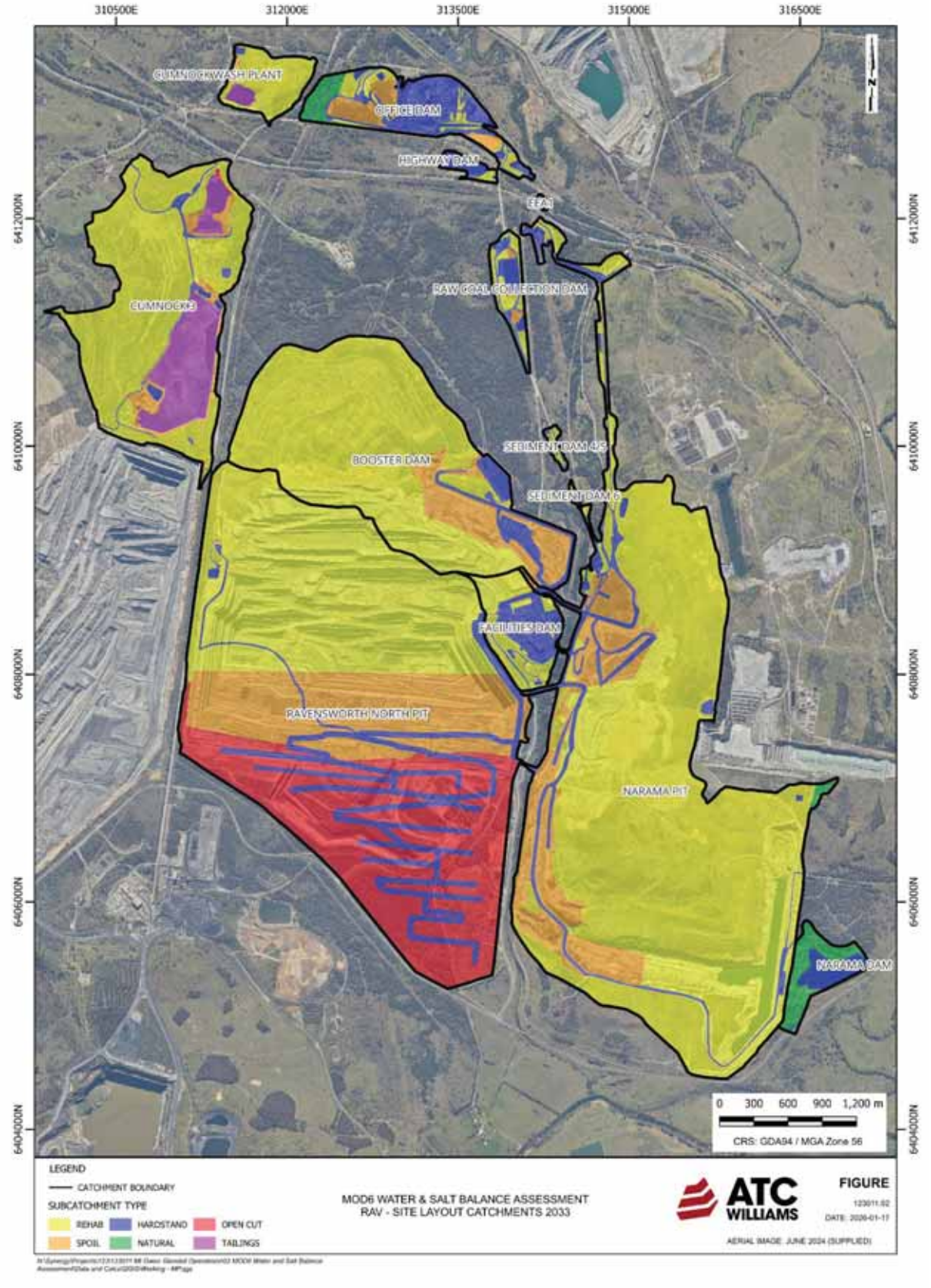

RAVENSWORTH COMPLEX
Water Management Schematic
GLENCORE
Date: DECEMBER 2025
File Name: Schematic_123011_Rav_20251209
RAV CHPP
Mt Owen (West Pit)
Groundwater
Cumnock Underground Void
Highway Dam (incl. RUM dams)
Liddell Operations (Reservoir North or South Cut)
Mt Owen (ECD)
Mt Owen (BNP)
Booster Dam (incl. Emu Ck Dam)
Rav North Truckfill
Third Ramp Truckfill
Emu Ck Dam Truckfill
Rav North Mining Area
Groundwater
Narama Void (incl. EEA1 & 4)
Groundwater
Narama Dam
Mt Owen (Dam 22)
HUNTER RIVER
Facilities Dam
LEGEND
Dam Storage
Pit Storage
Tailings Storage
Water Store
GRAWTS Transfer
Pumped Flow
Future Pumped Flow
Gravity Flow
Seepage Flow
Tailings Flow

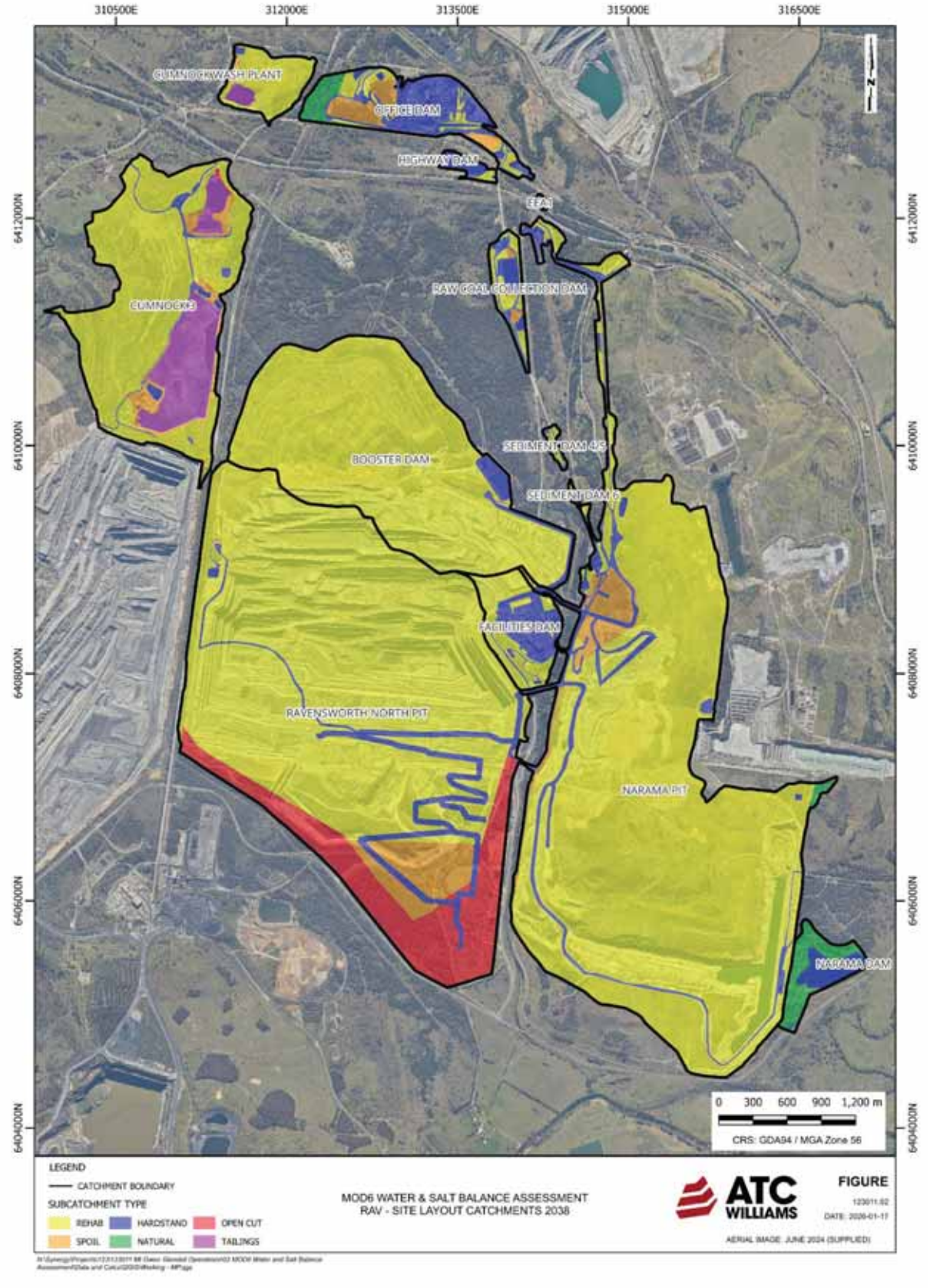
APPENDIX B – MODELLED STORAGES AND CATCHMENT AREAS FOR GRAWTS PARTICIPANTS

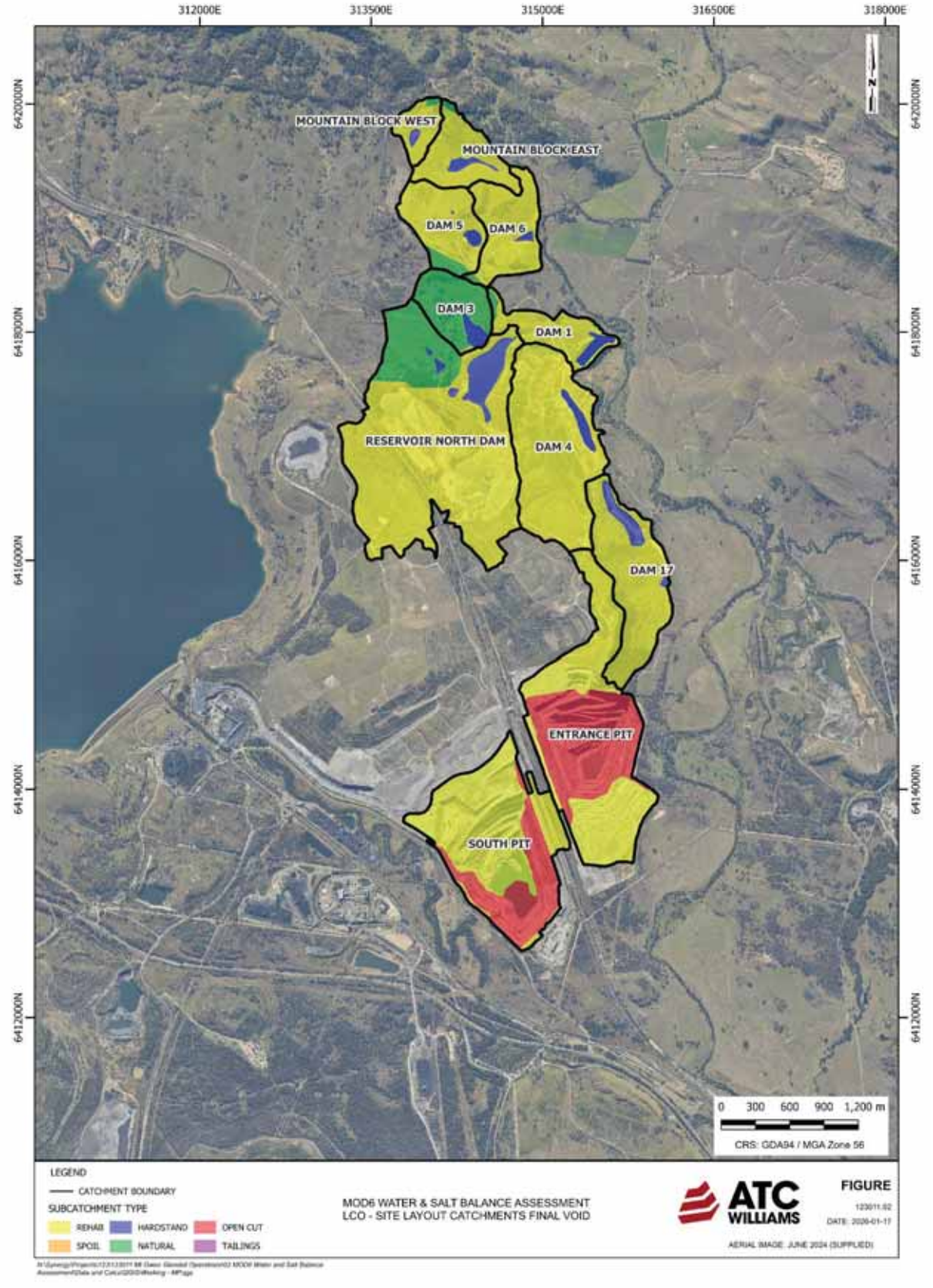
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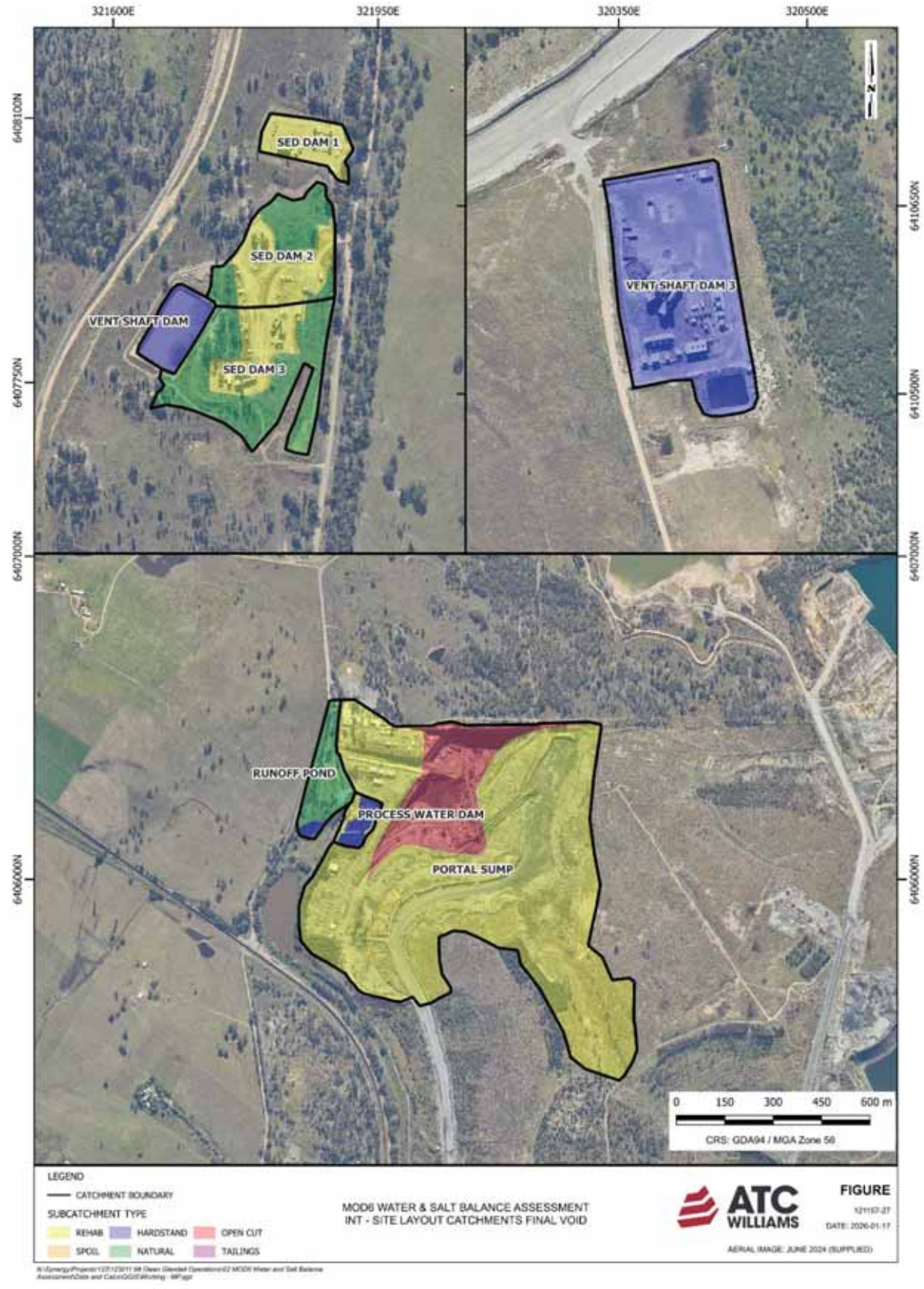

310500E
312000E
313500E
315000E
316500E
6412000N
6410000N
6408000N
6406000N
6404000N
CUMNOCK WASH PLANT
OFFICE DAM
HIGHWAY DAM
EA1
RAW COAL COLLECTION DAM
CUMNOCK 3
BOOSTER DAM
SEDIMENT DAM 4/5
SEDIMENT DAM 6
FACILITIES DAM
RAVENSWORTH NORTH PIT
NARAMA PIT
NARAMA DAM
0 300 600 900 1,200 m
CRS: GDA94 / MGA Zone 56
LEGEND
CATCHMENT BOUNDARY
SUBCATCHMENT TYPE
REHAB
HARDSTAND
OPEN CUT
SPOIL
NATURAL
TAILINGS
MOD6 WATER & SALT BALANCE ASSESSMENT
RAV - SITE LAYOUT CATCHMENTS 2025
ATC WILLIAMS
FIGURE
123011.02
DATE: 2026-01-17
AERIAL IMAGE: JUNE 2024 (SUPPLIED)


310500E
312000E
313500E
315000E
316500E
6412000N
6410000N
6408000N
6406000N
6404000N
CUMNOCK WASH PLANT
OFFICE DAM
HIGHWAY DAM
EEA
RAW COAL COLLECTION DAM
CUMNOCK 3
SEDIMENT DAM 4/5
BOOSTER DAM
SEDIMENT DAM 6
FACILITIES DAM
RAVENSWORTH NORTH PIT
NARAMA PIT
NARAMA DAM
N
0 300 600 900 1,200 m
CRS: GDA94 / MGA Zone 56
LEGEND
CATCHMENT BOUNDARY
SUBCATCHMENT TYPE
REHAB
HARDSTAND
OPEN CUT
SPOIL
NATURAL
TAILINGS
MOD6 WATER & SALT BALANCE ASSESSMENT
RAV - SITE LAYOUT CATCHMENTS 2029
ATC WILLIAMS
FIGURE
123011.02
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AERIAL IMAGE: JUNE 2024 (SUPPLIED)


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316500E
6412000N
6410000N
6408000N
6406000N
6404000N
CUMNOCK WASH PLANT
OFFICE DAM
HIGHWAY DAM
EEA1
RAW COAL COLLECTION DAM
CUMNOCK 3
SEDIMENT DAM 4/5
BOOSTER DAM
SEDIMENT DAM 6
FACILITIES DAM
RAVENSWORTH NORTH PIT
NARAMA PIT
NARAMA DAM
N
0 300 600 900 1,200 m
CRS: GDA94 / MGA Zone 56
LEGEND
CATCHMENT BOUNDARY
SUBCATCHMENT TYPE
REHAB
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NATURAL
TAILINGS
MOD6 WATER & SALT BALANCE ASSESSMENT
RAV - SITE LAYOUT CATCHMENTS 2033
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FIGURE
123011.02
DATE: 2026-01-17
AERIAL IMAGE: JUNE 2024 (SUPPLIED)


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6412000N
6410000N
6408000N
6406000N
6404000N
CUMNOCK WASH PLANT
OFFICE DAM
HIGHWAY DAM
EPA
RAW COAL COLLECTION DAM
CUMNOCK 3
BOOSTER DAM
SEDIMENT DAM 4/5
SEDIMENT DAM 6
FACILITIES DAM
RAVENSWORTH NORTH PIT
NARAMA PIT
NARAMA DAM
N
0 300 600 900 1,200 m
CRS: GDA94 / MGA Zone 56
LEGEND
CATCHMENT BOUNDARY
SUBCATCHMENT TYPE
REHAB
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OPEN CUT
SPOIL
NATURAL
TAILINGS
MOD6 WATER & SALT BALANCE ASSESSMENT
RAV - SITE LAYOUT CATCHMENTS 2038
ATC WILLIAMS
FIGURE
123011.02
DATE: 2026-01-17
AERIAL IMAGE: JUNE 2024 (SUPPLIED)


312000E
313500E
315000E
316500E
318000E
6420000N
6418000N
6416000N
6414000N
6412000N
N
MOUNTAIN BLOCK WEST
MOUNTAIN BLOCK EAST
DAM 5
DAM 6
DAM 3
DAM 1
RESERVOIR NORTH DAM
DAM 4
DAM 17
ENTRANCE PIT
SOUTH PIT
0 300 600 900 1,200 m
CRS: GDA94 / MGA Zone 56
LEGEND
CATCHMENT BOUNDARY
SUBCATCHMENT TYPE
REHAB
HARDSTAND
OPEN CUT
SPOIL
NATURAL
TAILINGS
MOD6 WATER & SALT BALANCE ASSESSMENT
LCO - SITE LAYOUT CATCHMENTS FINAL VOID
ATC WILLIAMS
FIGURE
123011.02
DATE: 2026-01-17
AERIAL IMAGE: JUNE 2024 (SUPPLIED)


321600E
321950E
320350E
320500E
6408100N
6407750N
6407000N
6406000N
6410650N
6410500N
SED DAM 1
SED DAM 2
VENT SHAFT DAM
SED DAM 3
VENT SHAFT DAM 3
RUNOFF POND
PROCESS WATER DAM
PORTAL SUMP
N
0 150 300 450 600 m
CRS: GDA94 / MGA Zone 56
LEGEND
CATCHMENT BOUNDARY
SUBCATCHMENT TYPE
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OPEN CUT
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NATURAL
TAILINGS
MOD6 WATER & SALT BALANCE ASSESSMENT
INT - SITE LAYOUT CATCHMENTS FINAL VOID
ATC WILLIAMS
FIGURE
121107-27
DATE: 2026-01-17
AERIAL IMAGE: JUNE 2024 (SUPPLIED)

Appendix B
Groundwater Impact Assessment

Glendell Modification 6

Groundwater Impact Assessment

Final

January 2026

Glendell Modification 6

Groundwater Impact Assessment

Final

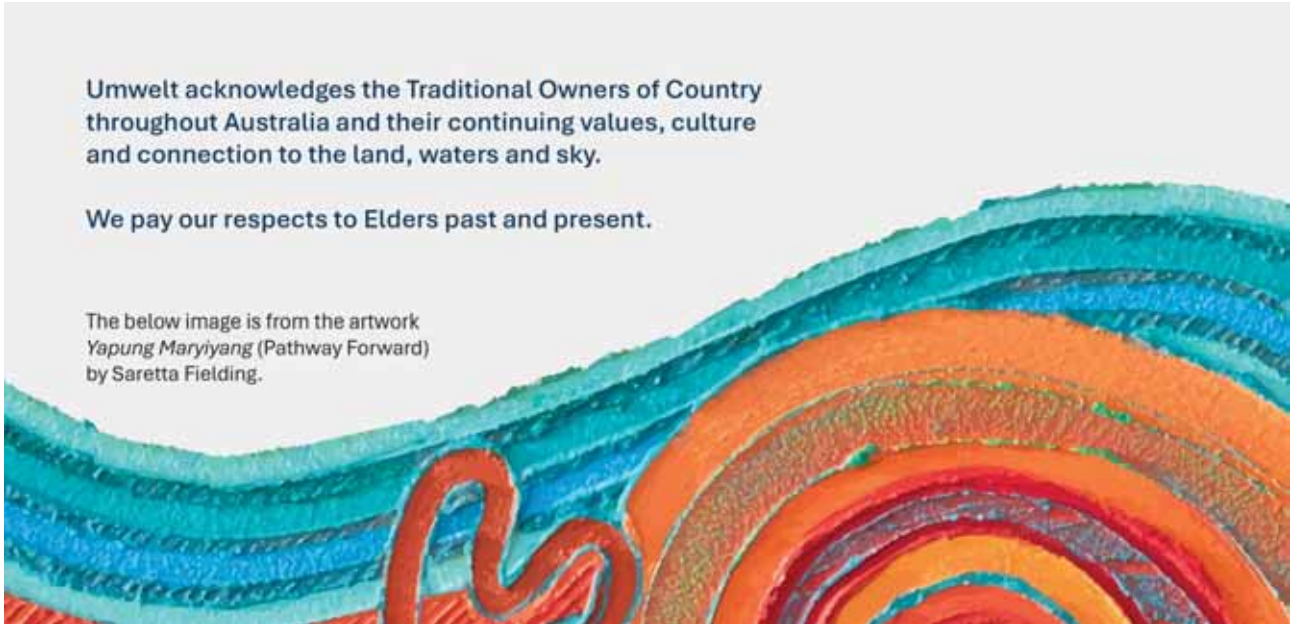
Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Glencore (on behalf of Xenith)

Project Director: Emma Koeman
Project Manager: Deni Hourihan
Technical Director: Claire Stephenson and David Holmes
Technical Manager: Mohammad Sedaghat
Report No.: R01
Date: January 2026

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V3	D. Hourihan, N. Krco, M. Sedaghat	19/01/2026	M. Sedaghat E. Koeman	19/01/2026

Executive Summary

Glendell Mine (Glendell) is a coal mining operation located approximately 20 km north-west of Singleton in the Upper Hunter region of NSW. Glendell is a component of Mount Owen/Glendell Operations (MGO). This Groundwater Impact Assessment (GIA) has been prepared to support the Modification 6 (MOD6) for the Glendell Consent Mod 6 involves the use of Barrett Pit as a water storage facility within the Greater Ravensworth Water and Tailings Scheme (GRAWTS). MGO is located at Hebden in the Hunter Valley, New South Wales, and is managed by Mt Owen Pty Ltd as a subsidiary of Glencore Coal Pty Limited.

The assessment was conducted in accordance with the NSW Aquifer Interference Policy, relevant Water Management Acts, and the Guidelines for Groundwater Documentation for SSD/SSI Projects (2022). The assessment involved representation of the conceptual groundwater model based on current site data, and updating the existing MGO groundwater model to reflect recent observed trends and predict changes associated with water storage in Barrett Pit. Model scenarios included predictive runs, sensitivity analyses, and particle tracking to assess groundwater flow pathways and potential impacts.

The hydrogeological setting comprises Quaternary alluvium and Permian coal measures. Alluvium is localised along Swamp Creek to the north and west of Barrett Pit, and Betty's Creek to the east. Shallow water table has been observed within the alluvium and the shallow weathered coal measures (regolith). Groundwater levels in the deeper coal seams of the Permian coal measures are depressurised in response to surrounding mining (i.e. Integra, Ashton, Rix's Creek mines). A slight recovery in groundwater levels in the Permian coal measures is observed to the north and is understood to be associated with a cessation of mining around Ravensworth East, Liddell Coal Operations and the northern parts of Ravensworth Operations mine.

The Barrett Pit has been approved to be retained as a final void, which will passively form a pit lake. Mining operation ceased at the Barrett Pit in 2023 and since cessation of mining, the pit lake levels have been recovering to the current approximate level of -33 mAHD. Under the proposed MOD 6 , the Barrett Pit will be utilised as a mine water storage facility for the GRAWTS system with water be pumped into the pit from the surrounding Liddell, Mount Owen, Glendell, Integra and Ravensworth coal mines. The additional water storage within the Barrett Pit is anticipated to increase the pit lake level up to 12 mAHD at end of storage in 2039, slightly higher than the natural recovered level of -7 mAHD predicted for 2039 but lower than the long term predicted recovery level.

The proposed water storage level is well below the pit crest, which is at around 70 mAHD, and it is also well below the base of weathering, which extends down to around 50 mAHD. Therefore, there is no potential for interaction between the mine water stored in the pit and shallow receptors associated with the alluvium and regolith. There is potential for a gradient of flow from the water storage to the adjacent coal measures where they are depressurised by surrounding mining. This is predicted to be minor, with less than 1 ML/year additional flux of groundwater from the Barrett Pit mine area to the surrounding coal measures.

It is noted that the storage of water within the pit increases groundwater levels in the coal measures around the pit, which would reduce depressurisation within connected overlying alluvium faster than under the approved passive pit lake recovery scenario. This would represent a positive change to groundwater conditions, with reduced groundwater gradients towards the void and associated

reductions in groundwater take. The updated model predicts a net reduction in alluvial groundwater take of up 1 ML/year of under the Jerry's Water Source and a reduced take of up to 33 ML/year from the North Coast Fractured and Porous Rock Water Source due to the modification.

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Appendices

Appendix A Model Hydrographs

1.0 Introduction

Glendell Mine (Glendell) is a coal mining operation located approximately 20 km north-west of Singleton in the Upper Hunter region of NSW. Glendell is a component of Mount Owen/Glendell Operations (MGO), a mining precinct which also includes the Mount Owen and Ravensworth East Mines and Coal Handling and Preparation Plant. MGO is managed by Mt Owen Pty Limited (MOPL), which is a subsidiary of Glencore Coal Pty Limited (Glencore). Glendell operates under Development Consent DA 80/952 granted under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The approved development under DA 80/952 (as modified) includes the following activities.

- Extraction of up to 4.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal using truck and excavator mining methods;
- Hauling of ROM coal to Mount Owen Mine for processing and transportation;
- Hauling of overburden and materials to and from Ravensworth East Mine;
- Transportation of up to 1 Mtpa of product coal to domestic power stations by conveyor; and
- Ancillary surface infrastructure including offices, workshop, access roads, services and water management infrastructure.

Glendell (as a component of MGO) is a participant in the Greater Ravensworth Area Water and Tailings Scheme (GRAWTS), which is a network of infrastructure that enables transfer of water and tailings between neighbouring Glencore-managed operations (namely MGO, Integra Underground Mine, Liddell Mine, Ravensworth Operations and Hunter Valley Operations). The GRAWTS enables surplus water at a particular site to be used for operational purposes at other sites within the scheme. The water sharing facilitated by GRAWTS has the benefits of reducing reliance on external water sources and the need for off-site discharges under the Hunter River Salinity Trading Scheme.

MOPL is seeking a modification to DA 80/952 to enable the use of Barrett Pit as a mine water storage, including for water shared from the GRAWTS via Mount Owen Mine (the Modification). The use of Barrett Pit as a water storage is proposed until 31 December 2039, which represents the duration of currently approved mining activities at sites participating in the GRAWTS. Barrett Pit is currently approved (under DA 80/952) to remain as a final void which will naturally form a pit lake.

Umwelt (Australia) Pty Ltd (Umwelt) were engaged by Xenith, on behalf of Glencore, to undertake a groundwater impact assessment (GIA) to support the modification application (MOD6) under section 4.55(2) of the EP&A Act. The GIA considers whether the proposed use of Barrett Pit as a water storage by pumping water into the pit will result in changed groundwater impacts relative to the existing approved operations which contemplate long term recovery of a pit lake within the mining void.

Work undertaken by Umwelt included field testing of Barrett Pit spoil (infiltrometer) and numerical groundwater modelling. The numerical modelling included iterative modelling in collaboration with ATC Williams surface water (GoldSim) modellers.

The Modification also proposes the continuation of existing approved activities at the Glendell mine infrastructure area until 31 December 2039. This component of the Modification does not involve additional water impacts and therefore has not been considered further in this assessment.

1.1 Existing Approved Operations

MGO comprises three open cut pits:

- Mount Owen (North Pit), approved under Development Consent SSD-5850
- Ravensworth East (Bayswater North Pit), approved under Development Consent SSD-5850
- Glendell (Barrett Pit), approved by Development Consent DA 80/952.

Operations at Glendell under DA 80/952 were first approved in 1983, with mining commencing in 2008. DA 80/952 has been modified on five occasions, with the most recent approval (Modification 5) approved in July 2024. The numerical groundwater model developed for GCOP has been used to assess the impacts of the Modification.

The most recent State Significant Development application undertaken for MGO was the Glendell Continued Operations Project (GCOP). This included an in-depth GIA undertaken by AGE (2019) and peer reviewed by Dr Noel Merrick of HydroAlgorithmics. The numerical model developed for GCOP was updated by Umwelt in 2024 and as part of this GIA to assess the impacts of the Modification.

A consolidated Groundwater Management and Monitoring Plan (GWMP) covers the combined MGO. Groundwater monitoring is conducted and reported on a quarterly basis in line with the requirements set out in the GWMP.

An integrated Rehabilitation Management Plan (RMP) is also in place, which sets out approved final landform design. The approved final landform includes final voids within Bayswater North Pit (BNP), North Pit and Barrett Pit that will form pit lakes/waterbodies. The approved final void is situated at the north-west highwall end of Barrett Pit.

Table 1.1 lists the current and historical areas at MGO. Only the Barrett Pit is subject to Glendell's development consent DA 80/952. The other mining areas are subject to SSD-5850 and will not be affected by the Modification.

Table 1.1 MGO Mine Activities

Mine	Name	Seam	Mining/Water
Glendell	Barrett Pit	Mining from Lemington Seam through Pikes Gully, Arties and Liddell Seams down to Barrett Seam	Mined from 2008 to 2023 and is partially backfilled.
Mt Owen	North Pit	From surface down through Lemington Seam to Lower Hebden Seam	Mining in North Pit commenced in 1993 and will continue to the end of operations.
Mt Owen	Eastern Railway Pit (ERP)	Ravensworth Seam	Small boxcut pit mined down to the Ravensworth Seam to around 70 mAHD (approximately 30 m depth). Used for tailings storage from 2012 to 2019. Dredging completed in 2025. Currently being dumped over to extend the WOOP dump.
Ravensworth East	BNP	From surface down through Ravensworth Seam down to Bayswater Seam	Mining commenced in 2000 and ceased in early 2024. Currently used for mine water storage.
Ravensworth East	East RWD	Small shallow boxcut pit north of Bayswater North Pit.	Formerly the RW Pit. RWD used for tailings storage from 2009 to 2015
Ravensworth East	West Pit	From surface down through Ravensworth Seam down to Bayswater Seam.	Mined from 2010 to 2014. Backfilled with spoil in the middle (between BNP and West Pit). West Pit used for in-pit tailings storage since 2014, with fill levels from 20.8 mAHD (2018) to an approved level of 89 mAHD (2036)
Ravensworth East	North Void	Historical open cut pit, mined to the Liddell Seam	Historical pit mined prior to 1990, then subsequently used for tailings and water storage until 2014.
Ravensworth East	TP1	-	Out of pit tailings storage from 2004 to 2019
Ravensworth East	Western Rail Dam	-	Area with minor ground disturbance and backfilled. Small dam present with water storage from 2008 to present.

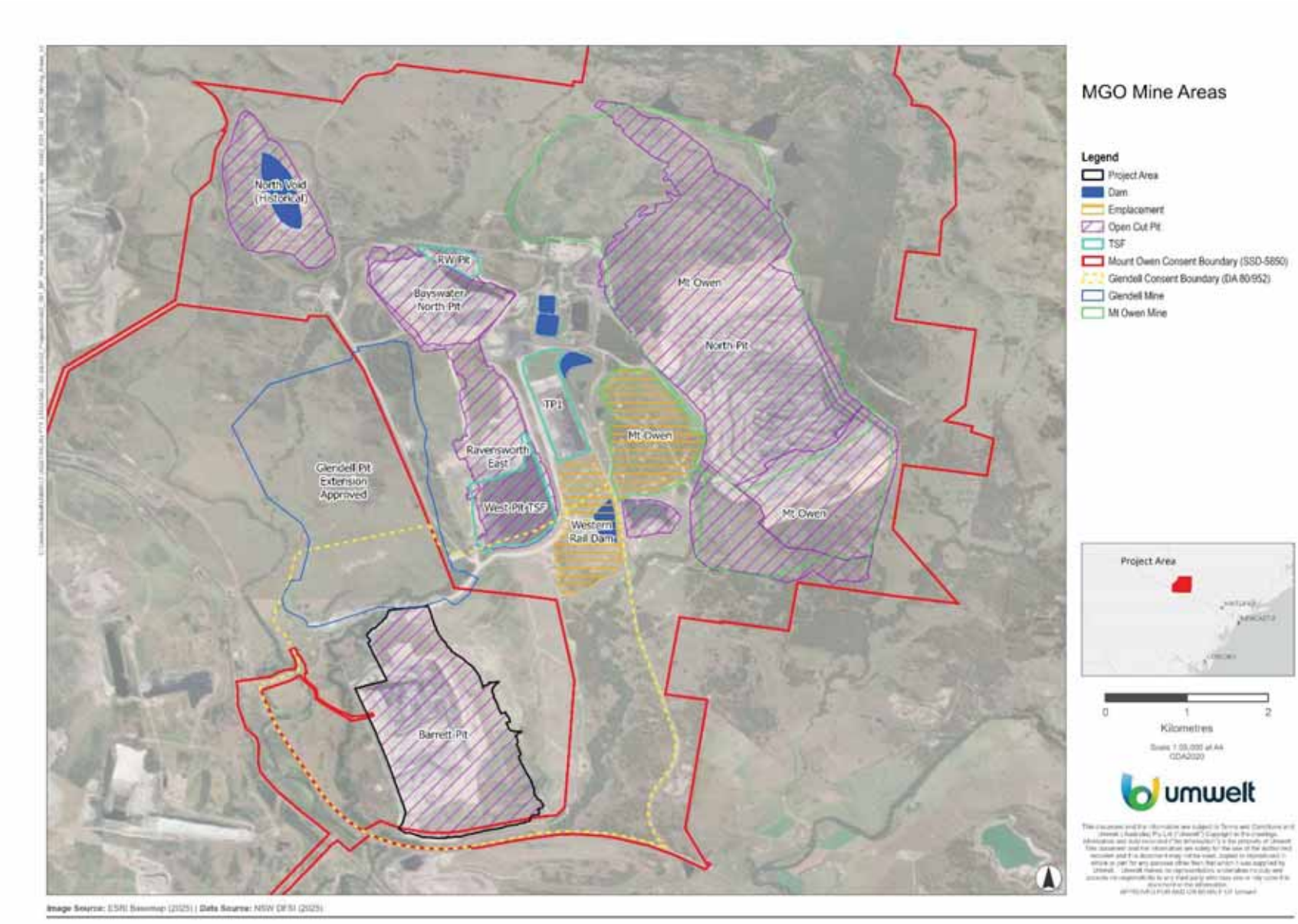


Figure 1.1 MGO Mine Areas

1.2 The Modification

The Modification to DA 80/952 seeks to enable the use of Barrett Pit as a mine water storage and water transfer point. The use of Barrett Pit as a water storage is proposed until 31 December 2039, which represents the duration of currently approved mining activities at sites participating in the GRAWTS.

This Groundwater Impact Assessment supports the modification application under section 4.55(2) of the EP&A Act. Although the Barrett Pit is approved (under DA 80/952) to remain as a final void and will naturally form a lake, this assessment considers whether the proposed pumping of water into Barrett Bit may result in additional impacts to the surrounding groundwater/surface water resources. It is proposed to increase the water level in Barrett Pit from the current level (2025) of around -35 mAHD, up to a maximum fill level of 12 mAHD.

Current modelling, based on the AGE (2019) model, predicts that groundwater levels will recover gradually within Barrett Pit, to -7 mAHD by 2039 and reach 35 mAHD at post closure equilibrium for the approved final void (refer **Section 5.0**). Therefore, the Modification represents a short-term increase in pit lake levels up to 2039, as shown in **Figure 1.2**. However maximum operational water levels will remain below the long-term final void pit lake predicted for approved operations. Total dissolved solids (TDS) levels within the final void were modelled to increase over time due to evapoconcentration effects to 5700 mg/L at equilibrium (GHD, 2019). The predicted TDS of the approved void pit lake when it had recovered to a height of 12mAHD was between 3500 and 4000 mg/L (GHD, 2019).

The Modification also proposes the continuation of existing approved activities at the Glendell mine infrastructure area until 31 December 2039. This component of the Modification does not involve additional water impacts and therefore has not been considered further in this assessment.

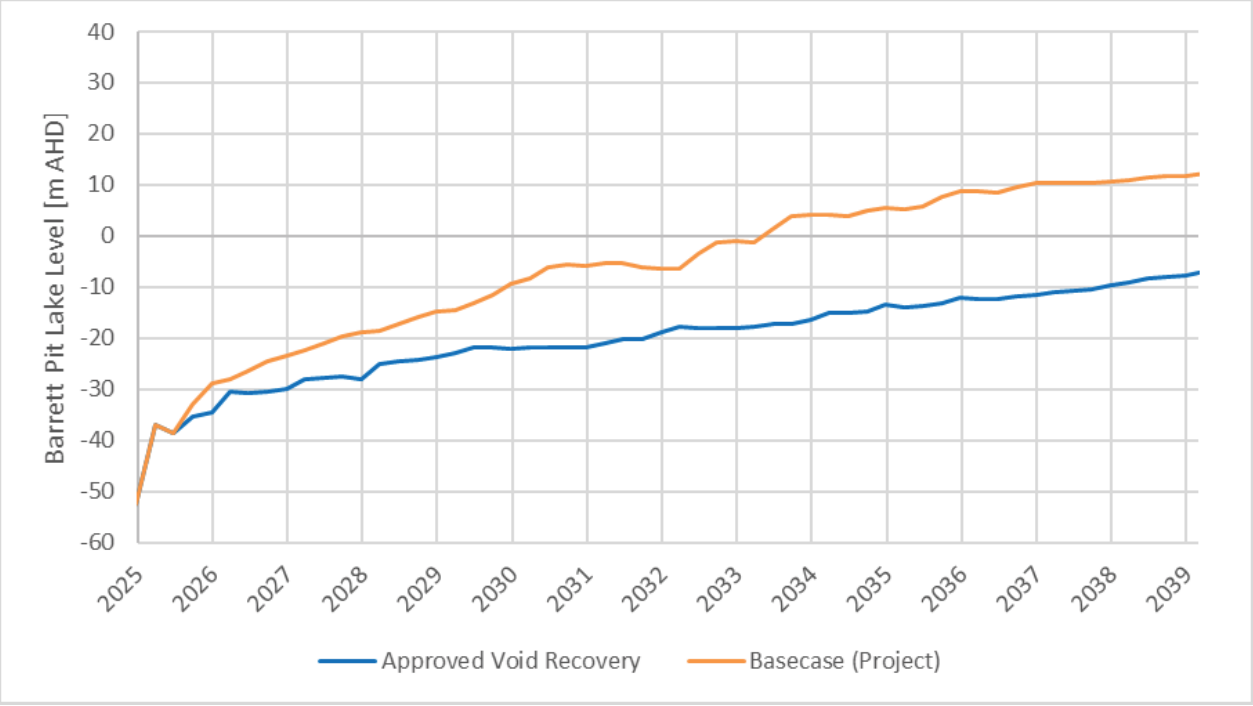


Figure 1.2 Modification Pit Lake Levels

1.3 Surrounding Mines

There are several mines surrounding MGO, including Glencore managed operations at Integra Underground Mine (Integra), Liddell Coal Operations (Liddell), and Ravensworth Mine, Yancoal's Ashton Mine and Bloomfield's Rix's Creek Mine (RCM). Integra and Liddell are currently in their closure phases. A summary of details for each mine area is included in **Table 1.2** and general mine locations shown in **Figure 1.3**.

Table 1.2 Surrounding Mine Activities

Mine	Mine Area	Seam	Mining/Water
LCO	South Pit	Mined to Hebden Seam	Pit on the western side of LCO. Mined to 2024. Includes dewatering points (8 South 2).
LCO	Entrance Pit	Mining from Lemington Seam through Pikes Gully, Arties, Liddell and Barrett Seams down to Hebden Seam	Mined from 1990 to 2024, progressively backfilled over time with active mining at the southern extent of the pit. Historical tailings/water storage within the north-eastern end of pit from 1995 to 2008. Water storage also current for Dam 4 and Dam 17, plus Reservoir Dam to the north.
LCO	Liddell Underground	Liddell Seam (LID), Liddell Middle Seam (MLD)	Underground workings to the south-east of Entrance Pit. Includes longwall mining plus first and second workings.
LCO	Hazeldene (Foy Brook)	Upper Liddell Seam (ULD), Pikes Gully Seam (PGS), Liddell Seam (LID)	Historical underground workings with Bord and Pillar plus second workings, mined until 1995.
LCO	Durham Open Cut and Underground	Mined down to Hebden Seam	Historical underground mining in the Liddell Seam, with subsequent open cut mining.
LCO	Mountain Block	Mined down to Hebden Seam	Historical open cut mined until 2000 and partially backfilled and rehabilitated. Water storage at Dam 6.
Integra	Integra Underground	Mining in Middle Liddell Seam	Longwall operations below MGO, that ceased in 2024.
Ravensworth	Narama West	Mining from surface down to Hebden Seam in places.	Mining commenced in 1980's and completed around 2014, with progressive backfilling and water storage at the southern extent.
Ravensworth	Ravensworth North	Mining from surface down to Hebden Seam	Mine life expected to at least 2034 with approval to undertake mining activities to 2039 (Approval PA 09_0176)

Mine	Mine Area	Seam	Mining/Water
Ravensworth	Ravensworth Underground Mine	Pikes Gully and Liddell Seam	Mined until 2014, with the operations were put into care and maintenance. Pikes Gully workings in LW1 to LW15, Upper Liddell Seam workings in LW501 to LW505. Situated below Ravensworth South Open Cut and Narama Open Cut Pit.
Ravensworth / HVO	Cumnock Colliery	Underground mine within the Liddell Seam	Historical underground Bord and Pillar workings. Used for underground water/tailings storage of mine water from Ravensworth Operations from around 2005 to 2010, with reported discharge of 686 ML/year for 2009.
Ashton	Open Cut	Mined to Barrett Seam	Mined from 2004 to 2013 with partial backfilling in the east. Open cut kept open for portal access to the underground workings to the west.
Ashton	Ashton Mine Complex	Longwall mining of Pikes Gully (PG) Seam followed by Upper and Lower Liddell Seam	Ashton longwall operations commenced in the PG Seam from LW1 to LW7A, with mining in the underlying Upper and Lower Liddell Seam with LW101 to LW104 in 2016.
Ashton	Ashton Ravensworth Underground	Middle Liddell Seam	Approved in 2024 to operate until 2032. To be mined from August 2022 to August 2026 (AGE,2021). LW501 to LW505.
Ashton	Ashton Ravensworth Underground	Pikes Gully Seam	Approved in 2024 to operate until 2032. To be mined from April 2025 to November 2029 (AGE,2021). LW401 to LW406.
Rix's Creek Mine (RCM)	Rix's Creek North Pit	Hebden Seam	1990 to 1998 then backfilled and used for water storage. Formerly part of Integra Mine.
RCM	West Pit (Pit 3)	Hebden Seam	Approved to extract coal until 24 March 2020. With recent approval under the Rix's Creek Continuation Project to mine until 2038.
RCM	Pit 2	Hebden Seam	Open cut pit active until 2005
RCM	South Pit	Upper Liddel Seam	Approved to be mined to 2024 with in-pit tailings storage (TSF4). Open cut at southern end to extend to Hebden Seam approved to 2038.
RCM	Camberwell Pit	Hebden Seam	Formerly Integra Mine – South Pit. Mined to 2018. Proposed Western Extension submitted as part of proposed mine modification.
RCM	Possum Skin Dam	Surficial (unlined)	Mined from 2004 and used for water storage. Area proposed to be mined as part of current modification application.

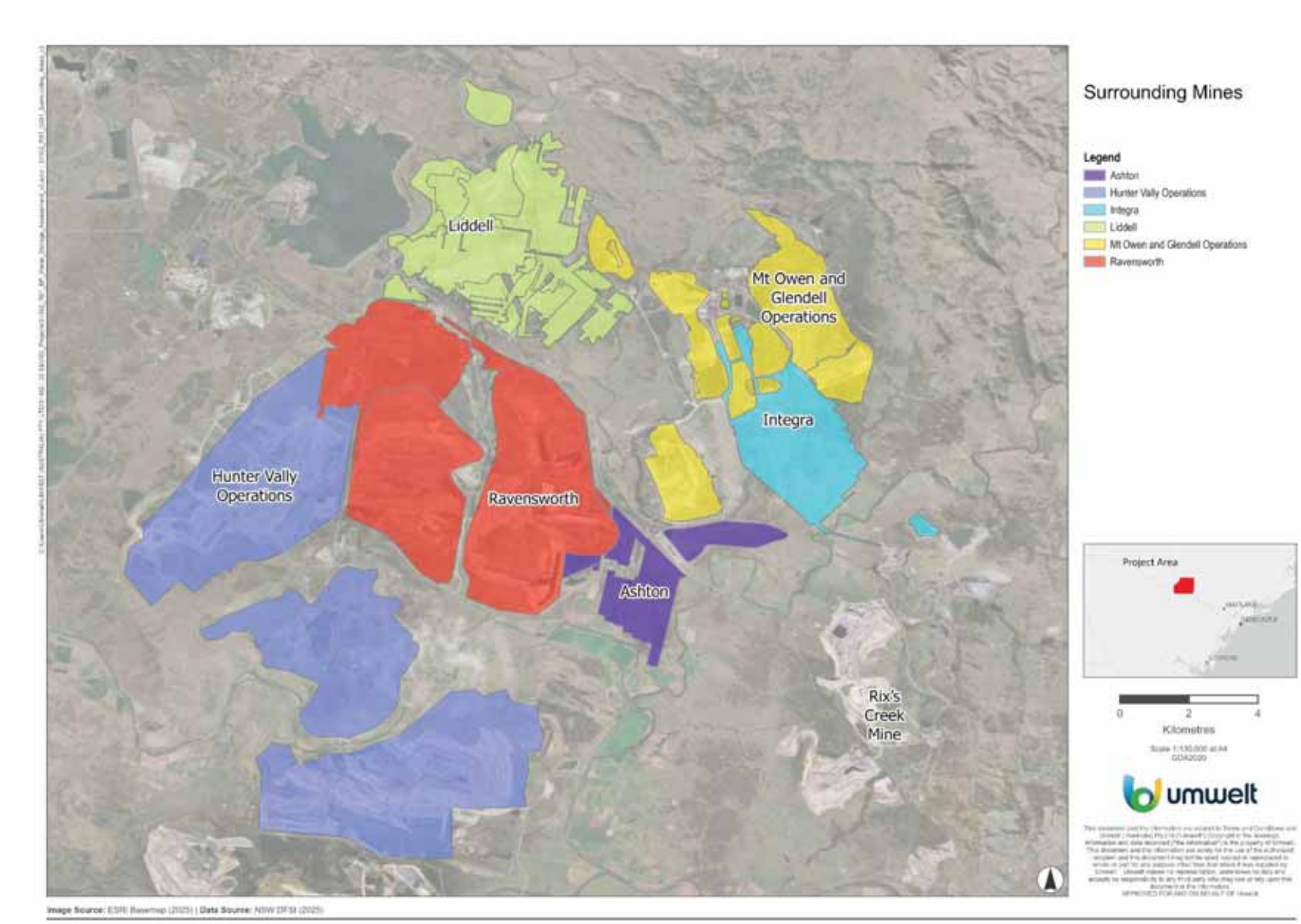


Figure 1.3 Surrounding Mines

2.0 Regulatory Setting

This section presents a summary of relevant NSW legislation, policy and guidelines relevant to the Site and MOD6 groundwater impact assessment.

2.1 NSW Environmental Planning and Assessment Act 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) covers environmental planning and assessment for the State of NSW. The Modification is sought under section 4.55(2) of the EP&A Act. This Groundwater Impact Assessment forms part of the Modification Report supporting the application under section 4.55(2) of the EP&A Act.

The NSW Department of Planning and Environment (DPE), now the Department of Planning, Housing and Infrastructure (DPHI), released the Guidelines for Groundwater Documentation for SSD/SSI Projects Technical guideline (NSW DPE, 2022), including:

- DPE 2022a - Guidelines for Groundwater Documentation for SSD/SSI Projects. Technical guideline.
- DPE 2022b - Minimum groundwater modelling requirements for Major Projects in NSW. Technical note prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Modelling Toolbox Project.

A summary of the groundwater assessment requirements for open cut mines is shown in **Table 2.1**. It should be noted that the Modification does not involve any additional mining or extraction. The Modification relates only to the storage of water within an existing final void, with storage levels expected to be below the long-term predicted pit lake level. Therefore, the level of assessment has been undertaken to reflect the relatively low potential risk due to the Modification, compared to a typical mine extension that is captured by the guidelines.

Table 2.1 Standard SSD/SSI Requirements Relevant for Open Cut Mines

Source	Guideline Inclusion	Relevant Section
Groundwater investigations (baseline data) requirements	Detailed groundwater investigations, including (but not limited to): • Groundwater monitoring network installed to target all identified groundwater sources that have the potential to be affected by the development, at a spatial density and overage that is based on an initial desktop review and conceptual understanding of groundwater system, a risk assessment and gap analysis (vertical and spatial coverage). The monitoring network should include bores installed to the full depth of the proposed excavation. • Estimates of hydraulic properties (hydraulic conductivity and storage properties) for lithology to be encountered by and overlying the development, measured at a number of test locations (spatially and	Previously undertaken as part of works by AGE (2019). Review and analysis of existing data presented in **Section 3.0**

Source	Guideline Inclusion	Relevant Section
	vertically) across the development area, using a range of appropriate testing methods (such as rising and falling head (slug) tests, packer tests, pumping tests, core tests). Presentation of this data, including test locations on a map, is also required. • Collation of data collected and recorded by others, including: ○ Data collected by other mining or exploration companies at exploration drill holes and/or monitoring bores. ○ Government monitoring network. ○ Bore census surveys to collect additional information from existing third-party users, including confirming details of construction, depth, pumping rate, reliance, groundwater quality.	
	Mapping and consideration of geological structures, including assessment of influence on groundwater flow.	**Section 3.3** and **Section 3.4**
	Ground-truthing and ecological assessment of high priority groundwater dependent ecosystems (including springs) mapped in the Water Sharing Plan(s) and Bureau of meteorology (BoM) groundwater dependent ecosystem (GDE) Atlas, including assessment of water reliance and resilience, as well as assessment of the source of the water that ecosystem relies on.	**Section 3.4.4** Refer main EIS report
	Discussion with local Aboriginal community to identify culturally significant sites that rely on water, as well as an assessment of the source of the water.	Refer main EIS report
	Baseline groundwater level monitoring in hydrostratigraphic units where the water affecting activities will occur and in units that have the potential to be affected, with monitoring preferred to be over a two-year period. The monitoring frequency should be suitable to detect groundwater level response to climate (rainfall, evapotranspiration) and existing water affecting activities. The monitoring data should be sufficient to allow assessment of vertical and lateral variations.	**Section 3.4.1**
	Baseline groundwater quality sampling from monitoring bores, analysed preferably by National Association of Testing Authorities (NATA) certified laboratory for a comprehensive suite including major ions, dissolved metals, salinity (as electrical conductivity), trace metals, nutrients and hydrocarbons with sufficient frequency to establish potential seasonal variation (for example, quarterly). Presentation of QA/QC is also required.	**Section 3.4.3**
	Assessment of potential surface water-groundwater interaction, including streamflow monitoring to estimate baseflow (where applicable) and use of standpipe to	Previously undertaken as part of works by AGE (2019).

Source	Guideline Inclusion	Relevant Section
	monitor shallow groundwater levels and assess whether watercourse is a losing or gaining system.	Review and analysis of existing data presented in **Section 3.0**
Groundwater Impact Assessments Requirements	Detailed conceptual hydrogeological model(s) including description and conceptual illustration of: • Hydrostratigraphy; • Geological structures and influence on groundwater flow; • The water table elevation and groundwater flow directions prior to and during operations and post-development; • Potentiometric surface and groundwater flow directions in confined aquifers prior to and during operations and post-development; • Identified groundwater dependent ecosystems and/or culturally significant sites, including dependence on groundwater; • Other groundwater users; • Surface water-groundwater interaction; • Multiple conceptual diagrams to illustrate the understanding; • Groundwater recharge and discharge zones; and, • Water balance, including a description of site water demands, • water disposal methods (e.g. Volume and frequency of any water discharges), water supply infrastructure and water storage structures.	Refer Section **3.5** Modification involves additional water storage only.
	Demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan. Assessment of associated impacts must also be included.	
	Fit for purpose modelling consistent with the expectations of the NSW Aquifer Interference Policy and industry best practice (Australian Groundwater Modelling Guidelines (Barnett, et al., 2012).	**Section 4.0**, modelling based on the AGE (2019) model for GCOP
	Peer review of numerical groundwater modelling.	Previously undertaken by Dr Noel Merrick for the AGE (2019) model.
	Details of water proposed to be taken (indirect and direct) from each groundwater source as defined by the relevant	Not applicable

Source	Guideline Inclusion	Relevant Section
	Water Sharing Plan and demonstration that the predicted water takes will be appropriately licensed.	
	Consideration of all stages of the development (construction, operation and closure).	Additional water storage only.
	Final landform assessment, including final void management, predicted post-mining water takes and impacts and rehabilitation measures.	No change to the final landform proposed, only temporary water storage within the existing void. Changes in water levels presented in **Section 5.0**
	Assessment of cumulative impacts considering other surrounding approved and proposed mining developments.	Changes in water levels presented in **Section 5.0**
	Assessment of potential water quality effects/risk of leachates from water storages, waste emplacement areas, and tailing storage areas as a result of the development.	Modification involves mine water storage within Barrett Pit, as discussed in **Section 1.2.** No changed to emplacement or tailings facilities.
	Assessment of potential acid rock drainage issues related to presence of potential acid forming (PAF) material and/or acid sulfate soils.	Acid sulfate soils are not present on site and no additional extraction is proposed. The presence of PAF material is discussed in **Section 3.4.3.**
	Presentation of a range of potential effects on groundwater quantity and associated impacts on receptors, using uncertainty analysis.	Modification does not include any increase in groundwater take relative to approved operations and is likely to reduce take to the extent that water levels in the Barrett Pit are higher than predicted for passive recovery.
	Clear documentation of assumptions used to conduct the assessment (for example the numerical modelling) such	**Section 4.0**

Source	Guideline Inclusion	Relevant Section
	that any change to the assumptions would change the predicted impacts.	
	Proposed surface and groundwater monitoring activities and methodologies.	**Section 7.0**
	Proposed management of surplus water.	Not applicable, Modification is for the management of water.
	Documentation of avoidance and mitigation measures.	**Section 7.1**
	Assessment of impacts against the Aquifer Interference Policy minimal impact considerations and identification of make good provisions, if required.	**Section 6.3**

2.2 NSW Water Management Act 2000

The *Water Management Act 2000* (WM Act) regulates the use and interference with groundwater in NSW. Under the WM Act, Water Sharing Plans (WSP) have been established to manage water resources in NSW.

Water extraction (take) from water sources regulated by a WSP require licensing under the WM Act. Groundwater intersected at MGO is licensed under three WSPs:

- *North Coast Fractured and Porous Rock Groundwater Sources 2016* (North Coast Fractured and Porous Rock WSP).
- *Hunter Unregulated and Alluvial Water Sources 2022* (Glennies Creek and Jerrys Water Source).
- *Hunter Regulated River Water Source 2016*.

MGO holds water licences under the *Water Act 1912* and *Water Management Act 2000*, as summarised in **Table 2.2**.

Table 2.2 Water Licences held by MGO

Licence	Licensed Activity	Source	Units
WAL41540	Groundwater extraction for dewatering of North Pit	North Coast Fractured and Porous Rock	140
WAL41542	Groundwater extraction for dewatering purposes of Eastern Rail Pit	North Coast Fractured and Porous Rock	220
WAL41541	Groundwater extraction for dewatering purposes of Ravensworth East pits	North Coast Fractured and Porous Rock	800
WAL7814, WAL704, WAL1118, WAL9521,	WAL7814 is shared for both MGO and Integra operations.	High Security Water Access Licences (Glennies Creek Management Zone)	1056

Licence	Licensed Activity	Source	Units
WAL11084, WAL10520 and WAL545			
WAL612, WAL613, WAL637, WAL705, WAL1119 and WAL1215		General Security Water Access Licences (Glennies Creek Management Zone)	858
WAL18310	Licence to pump 200 units and upper diversion of Swamp Creek	Unregulated River Licences (Jerrys Water Source)	200

2.3 Aquifer Interference Policy

Interference with groundwater within a regulated area requires assessment in accordance with the NSW Aquifer Interference Policy 2012. The Aquifer Interference Policy (AIP) clarifies the requirements for obtaining water licences for aquifer interference activities under NSW water legislation and establishes and objectively defines considerations in assessing and providing advice on whether more than minimal impacts might occur to a key water-dependent asset. This report addresses these assessment considerations, as presented in **Section 6.3**.

3.0 Existing Environment

This section presents background details of the site climatic conditions, surface water, geology, hydrogeology and groundwater users. This information was used to develop the conceptual groundwater model, as presented in **Section 3.5**.

3.1 Climate

Daily rainfall data is collected at site via rainfall station SX13-M2 which has data available from 2010. The site average monthly rainfall data for SX13-M2 is shown in **Table 3.1**. The climate within the MGO area is sub-tropical, with temperatures, rainfall and evaporation highest over the summer months of December to March. Rainfall is highest in March, with an average annual rainfall of 133.5 mm. The average annual rainfall from SX13-M2 since 2010 is 591.1 mm.

The table also includes the average rainfall based on Scientific Information for Landowners (SILO) point climate data for the MGO area (Latitude -32.40, Longitude 151.10). Data was derived from 01/01/1900 to 30/11/2025 to calculate the long-term average rainfall for the site. The average annual rainfall reported by SILO is 708.7 mm, which indicates a higher long-term average than the SX13-M2 site climate data collected since 2010.

Table 3.1 Long Term Average Rainfall Data (mm)

Source	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
SX13-M2 Average	49.2	68.3	113.5	41.7	29.0	28.5	40.1	23.8	33.2	48.4	57.2	58.4	591.1
SILO Long Term Average	79.9	76.2	75.1	52.7	47.1	54.4	45.1	41.8	44.4	54.0	64.3	73.9	708.7

Rainfall trends are shown as cumulative rainfall departure (CRD) in **Figure 3.1**. Due to the longer period of SILO data compared to the site data, the CRD has been calculated using the SILO dataset. A rising trend in slope in the CRD graph indicates periods of above average rainfall, whilst a declining slope indicates periods when rainfall is below average. A level slope indicates average rainfall conditions.

The CRD shows below average rainfall associated with the Tinderbox Drought between 2017 and early 2020. Above average rainfall was then experienced to late 2022, which was followed by a period of below average rainfall to early 2024. Overall, above average rainfall was recorded from early 2024 to November 2025.

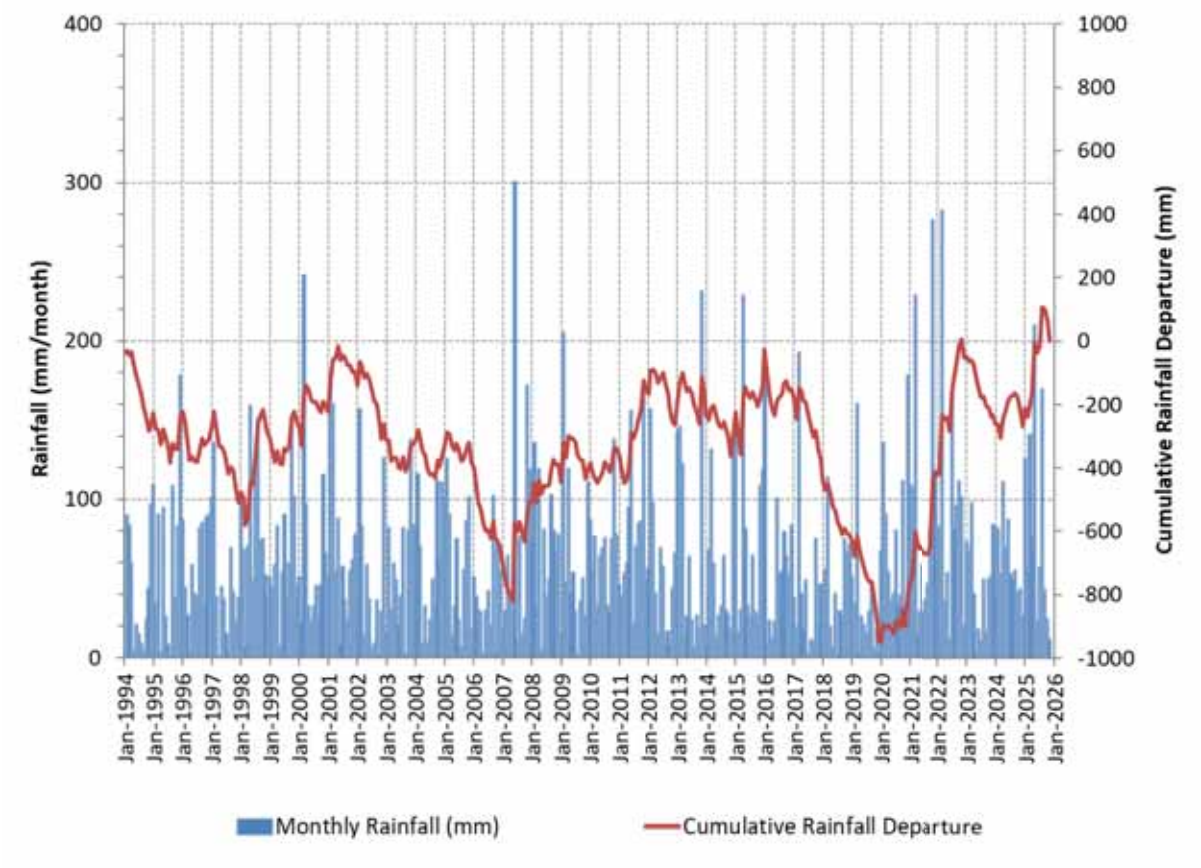


Figure 3.1 Cumulative Rainfall Departure and Monthly Site Rainfall

3.2 Surface Water

The main streams around Glendell include:

- Yorks Creek, Swamp Creek and Bettys Creek which flow into Bowmans Creek (also known as Foy Brook Creek), a tributary of the Hunter River.
- Main Creek which is a tributary to Glennies Creek (also known as Fal Brook).

Surface water monitoring is conducted at NSW Gauging stations 210044 and 210130 along Glennies Creek and Bowmans Creek, respectively. The monitored water levels in the creeks are shown in **Figure 3.2** and field electrical conductivity (EC) at the different creeks is shown in **Figure 3.3** compared to monthly rainfall.

The long-term average water level in Glennies Creek and Bowmans Creek at the monitoring points is 1.36 m and 0.45 m respectively (however it is noted that the low level in the Bowmans Creek data observed in 2018-early 2020 and 2023-24 reflect low-flow or cease-to-flow conditions). Rainfall events in April and May 2025 lead to spikes in water level of up to 2.69 m and 0.90 m in Glennies Creek and Bowmans Creek during May. This spike in water level was the largest in Glennies Creek since March 2017.

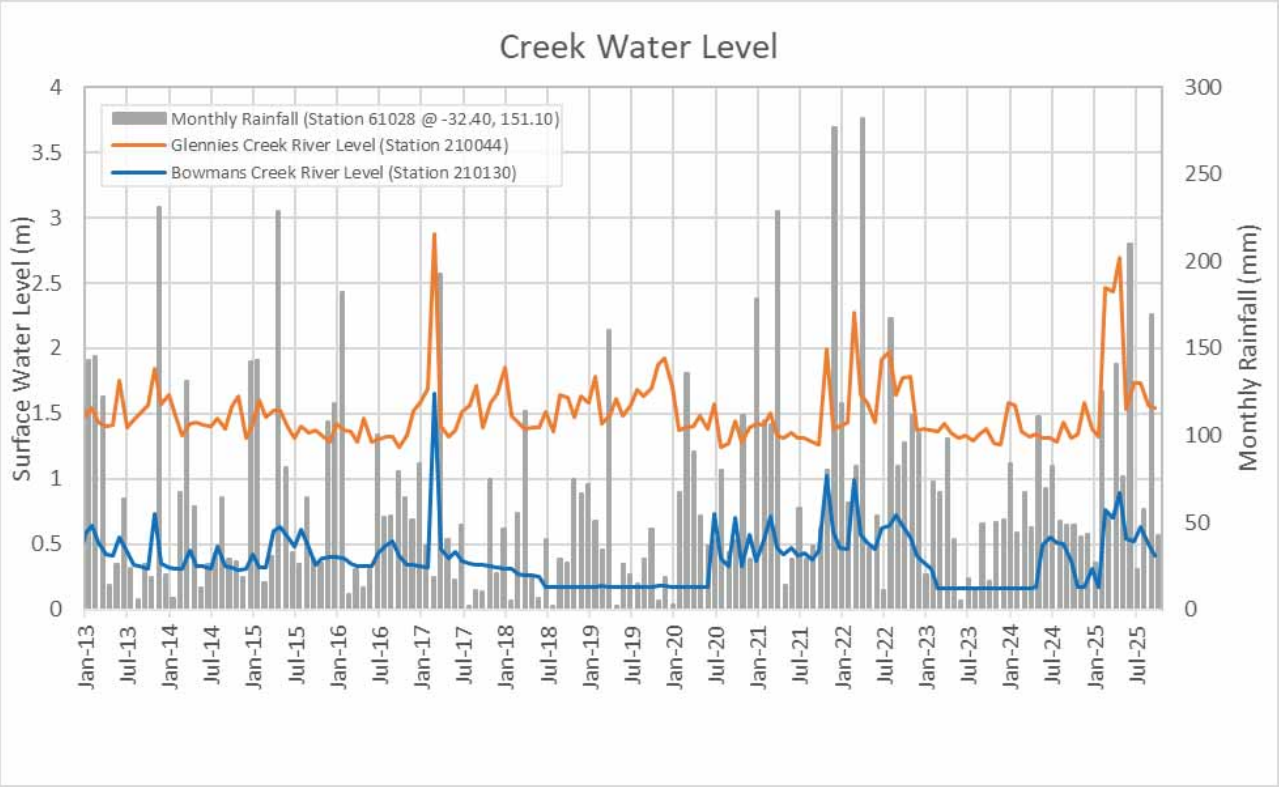


Figure 3.2 Creek Water Levels

The electrical conductivity (EC) in Glennies Creek and Bowmans Creek is variable (**Figure 3.3**) and is influenced by rainfall. Periods of lower rainfall correspond with higher EC and periods of higher rainfall contribute to lower EC readings. The average recorded EC values at Glennies Creek and Bowmans Creek is 436 µS/cm and 1,146 µS/cm respectively. In 2025, EC values ranged from 234 µS/cm to 649 µS/cm at Glennies Creek and 426 µS/cm to 866 µS/cm at Bowmans Creek (Foy Brook monitoring station).

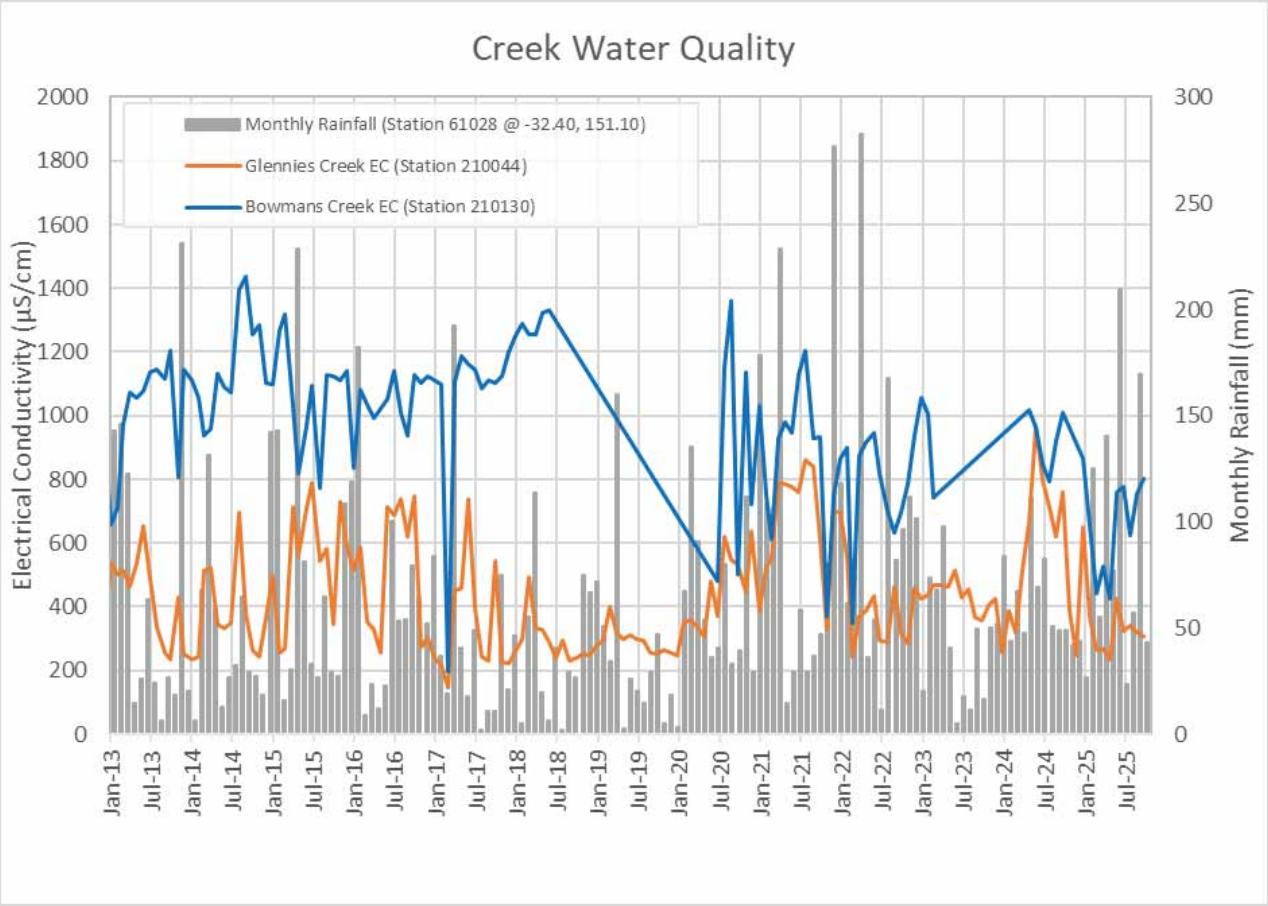


Figure 3.3 Creek Salinity

3.3 Geology

A summary of the stratigraphy surrounding MGO is shown in **Table 3.2** and the mapped surface geology for the surrounding area is shown in **Figure 3.4**.

The Modification area is within the Hunter Coalfields, towards the north-eastern extent of the Permian age Sydney Basin. The main geological units within MGO include:

- Quaternary alluvium.
- Permian Wittingham Coal Measures.
- Permian Maitland Group.

The surface geology within MGO mainly comprises the Wittingham Coal Measures Jerry Plains Subgroup at outcrop. Quaternary alluvial deposits are present along Bowmans Creek, Swamp Creek, Yorks Creek, Bettys Creek and Main Creek. The Saltwater Creek Formation and the Vane Subgroup of the Wittingham Coal Measures are also present to the northern and western extends of MGO respectively.

The Wittingham Coal Measures comprise sandstones, siltstones and coal measures, with minor interbedded conglomerates and tuffs. The Camberwell Anticline runs approximately north-west to south-east through the centre of the Barrett Pit. Formation of the anticline has resulted in fracturing,

faulting and jointing within the coal measures and surrounding interburden. A minor reverse fault referred to as the Cutback Fault is identified in the northern highwall of Barrett Pit, as marked up in **Figure 3.5.** As previously reported on by AGE (2019), the cutback fault is a reverse fault with approximately 3 m to 5 m displacement and dips approximately 12 degrees to the east.

Table 3.2 Summary of Regional Geology

Era	Stratigraphic Unit		Description
Quaternary	Anthropogenic stored water, pondage, reservoirs, canals (QH_hw)		Thinly laminated muds and silts with humic to biogenic debris (as bottom sediment to the overlying stored waters).
	Alluvium	Alluvial Valley Deposits (Q_av)	Silt, clay, (fluvially deposited) lithic to quartz-lithic sand, gravel.
		Alluvial terrace deposits (CZ_aths)	High-level sand and sandstone.
	Regolith		Weathered in-situ rock.
Permian	Wittingham Coal Measures	Jerry Plains Subgroup (Pwj)	Coarse-grained sandstone, fine- to medium-grained lithic (to quartz-lithic) sandstone, mudstone, coal seams and thin coaly partings, carbonaceous claystone, tuffaceous claystone and siltstone with fossil plant debris, pebble paraconglomerate. Coal seams of the Jerrys Plains Subgroup include Whybrow Seam, Redbank Creek Seam, Wambo Seam, Whynot Seam, Blakefield Seam, Glen Munro Seam, Woodlands Hill Seam, Arrowfield Seam, Bowfield Seam, Warkworth Seam, Mt Arthur Seam, Piercefield Seam, Vaux Seam, Broonie Seam and Bayswater Seam.
		Saltwater Creek Formation (Pwts)	Quartz-lithic sandstone with rare shaly partings and laminae, siltstone, tuffaceous claystone beds and sporadic thin coal plies.
		Saltwater Creek Formation – Sandstone (Pwts_s)	Quartz-lithic sandstone marker bed.
		Vane Subgroup (Pwv)	Light-grey, fine- to medium-grained quartz-lithic sandstone, laminated siltstone, siltstone with fossil plant fragments, carbonaceous claystone, tuffaceous claystone and mudstone, sporadic pebble paraconglomerate, coal seams with bright and dull bands. Coal seams of the Vane Subgroup include Lemington Seam, Pikes Gully Seam, Arties Seam, Liddell Seam, Barrett Seam and Hebden Seam.
	Maitland Group	Mulbring Siltstone (Pmtm)	Medium- to dark-grey siltstone, minor claystone, sporadic thin cherty beds (resistant), rare thin sandstone and limestone beds, sporadic marine fossils.
		Branxton Formation (Pmtb)	Conglomerate, sandstone, siltstone.
Carboniferous	Ungrouped Carboniferous units (Cus)		Sandstone, schist, phyllite, slate, chert, jasper, basalt, tuff and amphibolite.
	Seaham Formation (Curs)		Tillite, varved siltstone, tuff, red and green zeolitic mudstone with dropstones interbedded in thick-bedded lithic sandstone and conglomerate.

Era	Stratigraphic Unit	Description
	Mirannie Volcanic Member (Cursm)	Lithic rhyodacitic ignimbrite with distinctive crystals of pink quartz.
	Isismurra Formation (Curi)	Pink, purple or brown, thick- or cross-bedded, pebbly lithic sandstone, conglomerate, minor purple or buff siltstone and shale, and dacitic ignimbrite layers.
	Isismurra Formation – ignimbrite (Curi_i)	Red, unwelded ignimbrite. Purple unwelded rhyolitic ignimbrite. Beige welded ignimbrite.
	Martins Creek Ignimbrite Member (Curim)	Blue-grey, red-mottled welded andesitic ignimbrite with minor interbeds of beige to grey dacitic ignimbrite.
	Ayr Conglomerate Member (Curia)	Basal conglomerate, poorly sorted with interbeds and matrix of lithic arenite. Large amount of arc-derived clasts.
	Native Dog Member (Curin)	Massive, cliff-forming, buff lithoidal dacitic ignimbrite overlain by purple, red and green lithoidal ignimbrites and tuffs with interbedded lithic sandstone and conglomerate. Andesitic ignimbrite is present in the Western Brook district.
	Waverly Formation (Curw)	Pink-brown to green, medium- to coarse-grained, cross-bedded lithic sandstone, conglomerate and heavy mineral sandstone in the west. Increasing amounts of thin, laminated mudstone and minor oolitic/biogenic limestone to the east near Omadale Brook.
	Waverly Formation - andesite (Curw_a)	Pyroxene andesite.

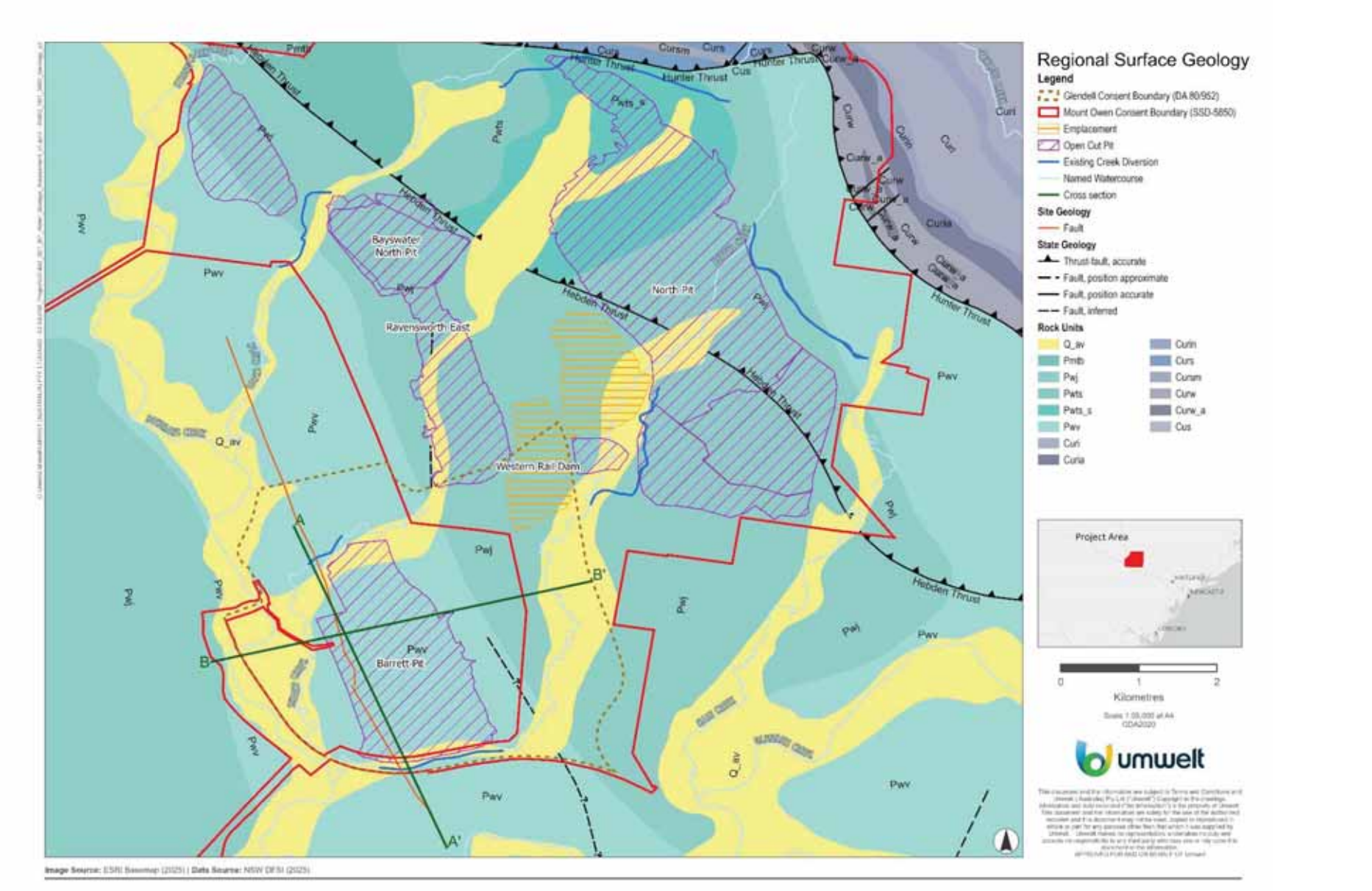


Figure 3.4 Regional Surface Geology



Figure 3.5 Barrett Pit Northern Highwall – Anticline and Fault Zone

3.4 Hydrogeology

This section presents a summary of the existing groundwater monitoring network near Barrett Pit, key hydrogeological units, groundwater quality, use and the conceptual ecohydrological models.

3.4.1 Groundwater Monitoring

A summary of the groundwater bore network within 2 km of the Barrett Pit is presented in **Table 3.3** below. Bore locations are shown in **Figure 3.6**.

Table 3.3 Bores within 2km of Barrett Pit

Bore	Mine	Type	Status	Easting	Northing	Ground Level mAHD	TOC height magl	Bore Depth mbgl	Screened Interval mbgl	Target Geology
GCP3S	Integra	MB	EX	320924	6408389	81	81.58	-	3.4 – 5.4	Betty's and Main Creek Alluvium
GCP40	Integra	MB	EX	321112	6409047	-	Unknown	-	5.0 – 6.0	Betty's and Main Creek Alluvium
GCP4S	Integra	MB	EX	320838	6409804	90	90.55	-	4.0 - 6.1	Betty's and Main Creek Alluvium
GCP3D	Integra	MB	EX	320838	6409800	81	81.54	-	40.0 – 48.5	Coal Measures
GCP4	Integra	-	EX	320839	6409599	90	-	36	-	Interburden
BC-SP10	MGO	MB	EX	318080	6409400	76.84	77.43	5.88	1-6	Alluvium
BC-SP11	MGO	MB	EX	318137	6409337	75.532	75.992	10.24	1 - 9.4	Alluvium
BC-SP12	MGO	MB	EX	318201	6409265	75.57	76.18	6.26	1 - 6.3	Alluvium
BC-SP13	MGO	MB	EX	318253	6409210	-	76.18	-	1 - 3.5	Alluvium
BC-SP14	MGO	MB	EX	318305	6409158	75.58	76.06	5.56	1 - 5.9	Alluvium
BC-SP15	MGO	MB	EX	318182	6409484	-	76.35	-	1-5	Alluvium
BC-SP16	MGO	MB	EX	318290	6409376	76.162	76.712	4.56	1 - 4.6	Alluvium
BC-SP17	MGO	MB	EX	318319	6409543	77.538	78.128	6.41	1 - 6.5	Alluvium
BC-SP18	MGO	MB	EX	317350	6411327	84.1465	84.8015	-	1 - 3.8	Alluvium
BC-SP19	MGO	MB	EX	317463	6411177	82.77	83.355	-	1 - 2.1	Alluvium
BC-SP20	MGO	MB	EX	318184	6409118	74.35	74.87	4.09	1 - 4.5	Alluvium
BC-SP21	MGO	MB	EX	318057	6409176	75.57	76.08	6.76	1 - 6.7	Alluvium
BC-SP22	MGO	MB	EX	317992	6409051	73.59	74.15	5.88	1-6	Alluvium
GNP11S	MGO	MB	EX	317817	6408381	71.794	72.394	5.23	3 - 5.8	Alluvium
GNPS-02	MGO	MB	EX	317564	6410220	-	78.9875	8.53	1 - 9.2	Alluvium
GNPS-06	MGO	MB	EX	317605	6411061	80.8775	81.4675	9.09	1 - 9.9	Alluvium
NPZ104	MGO	MB	EX	321028	6408055	-	88	-	1.8 - 6	Alluvium
NPZ106	MGO	MB	EX	321093	6408919	83.425	84.035	7.02	1.5 - 7	Alluvium
BC-SP03	MGO	MB	EX	317554	6411401	-	85.89	-	1 - 7.5	Regolith
BC-SP04	MGO	MB	EX	317610	6411324	85.11	85.66	-	1 - 8.9	Regolith
BC-SP05	MGO	MB	EX	317684	6411236	84.575	85.18	-	1.6 - 9.1	Regolith
BC-SP07	MGO	MB	EX	317681	6411448	-	88.14	-	1 - 10.2	Regolith
GA1	MGO	MB	EX	318379	6408259	72.5	73.1	5.8	0.6 - 6.35	Alluvium / regolith
GA2	MGO	MB	EX	318578	6407367	68.94	69.53	8.8	3.2 - 10.03	Alluvium/ regolith
GNP11D	MGO	MB	EX	317818	6408381	71.7885	72.4485	11.22	9.0 - 11.0	Regolith
GNPS-01	MGO	MB	AD	318403	6408621	-	74.013	-		Regolith
GNPS-05	MGO	MB	EX	317865	6409311	81.71	82.23	10.62	1 - 10.5	Regolith
NPZ12a	MGO	MB	AD	318440	6411519	-	112.25	-	To 97	Coal
NPZ13	MGO	MB	EX	318302	6409556	77.41	77.98	63.83	56 - 70	Coal

Bore	Mine	Type	Status	Easting	Northing	Ground Level mAHD	TOC height magl	Bore Depth mbgl	Screened Interval mbgl	Target Geology
NPZ14	MGO	MB	AD	319472	6407091	-	74.59	-	To 51	Coal
NPZ14a	MGO	MB	AD	319471	6407093	-	74.59	-	To 91	Coal
NPZ16	MGO	MB	EX	318193	6409141	75.01	75.7	48.12	To 60	Coal
NPZ16a	MGO	MB	EX	318184	6409127	-	75.7	-	To 173	Coal
NPZ13a	MGO	MB	EX	318302	6409556	77.4	77.98	126	To 134	Overburden
NPZ15	MGO	MB	EX	320784	6407934	81.123	81.633	59.89	57 - 60	Overburden
NPZ15a	MGO	MB	EX	320784	6407934	81.08	81.59	137.75	To 130	Overburden
GNP2-Art	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP2-Brt	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP2-Heb	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP2-LLd	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP2-MLd	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP2-PG	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP2-ULd	MGO	VWP	EX	317564	6410220	-	78.26	-		Coal
GNP5-Art	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP5-Brt	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP5-Heb	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP5-LLd	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP5-MLd	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP5-PG	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP5-ULd	MGO	VWP	EX	317865	6409317	-	86.26	-		Coal
GNP6-Art	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNP6-Brt	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNP6-Heb	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNP6-LLd	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNP6-MLd	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNP6-PG	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNP6-ULd	MGO	VWP	EX	317605	6411061	-	80.81	-		Coal
GNOH030-1	MGO	VWP	EX	317765	6410554	84.6	-	-	196	Barrett Seam?
GNOH030-3	MGO	VWP	EX	317765	6410554	84.6			187	Liddell Lower Seam/ Interburden
GNOH030-3	MGO	VWP	EX	317765	6410554	84.6	-	-	156.5	Liddell Upper Seam (Vane Subgroup)
GNOH030-4	MGO	VWP	EX	317765	6410554	84.6	-	-	94.5	Lower Pikes Gully Seam?
GNOH030-5	MGO	VWP	EX	317765	6410554	84.6	-	-	66.4	Upper Pikes Gully Seam?
GNOH032_S874	MGO	VWP	EX	318066	6409354	-	75.7	-		Coal
GNOH032-2	MGO	VWP	EX	318066	6409354	-	75.7	-		Coal
GNOH032-4	MGO	VWP	EX	318066	6409354	-	75.7	-		Coal
GNOH032-5	MGO	VWP	EX	318066	6409354	-	75.7	-		Interburden
GNOH031-1	MGO	VWP	EX	319347	6410706	95.2	-	-	216	Coal
GNOH031-2	MGO	VWP	EX	319347	6410706	95.2	-	-	195	Interburden
GNOH031-3	MGO	VWP	EX	319347	6410706	95.2	-	-	147	Coal
GNOH031-4	MGO	VWP	EX	319347	6410706	95.2	-	-	95	Interburden
GNOH031-5	MGO	VWP	EX	319347	6410706	95.2	-	-	80.5	Coal
GNOH031_S815	MGO	VWP	EX	319347	6410706	-	95.2	-		Coal
GNOH031_S858	MGO	VWP	EX	319347	6410706	-	95.2	-		Coal
GNP1-Art	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal
GNP1-Brt	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal
GNP1-Heb	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal
GNP1-LLd	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal
GNP1-MLd	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal
GNP1-PG	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal
GNP1-ULD	MGO	VWP	AD	318492	6408641	-	76.75	-		Coal

Bore	Mine	Type	Status	Easting	Northing	Ground Level mAHD	TOC height magl	Bore Depth mbgl	Screened Interval mbgl	Target Geology
GNP8-Brt	MGO	VWP	AD	319388	6407393	-	82.89	-		Coal
GNP8-Heb	MGO	VWP	AD	319388	6407393	-	82.89	-		Coal
GNP8-LLd	MGO	VWP	AD	319388	6407393	-	82.89	-		Coal
GNP8-MLd	MGO	VWP	AD	319388	6407393	-	82.89	-		Coal
GNP8-ULd	MGO	VWP	AD	319388	6407393	-	82.89	-		Coal

Note: Coordinates in GDA2020 Zone 56

MB Monitoring Bore

VWP Vibrating Wire Piezometer

AD Abandoned/destroyed

EX Existing

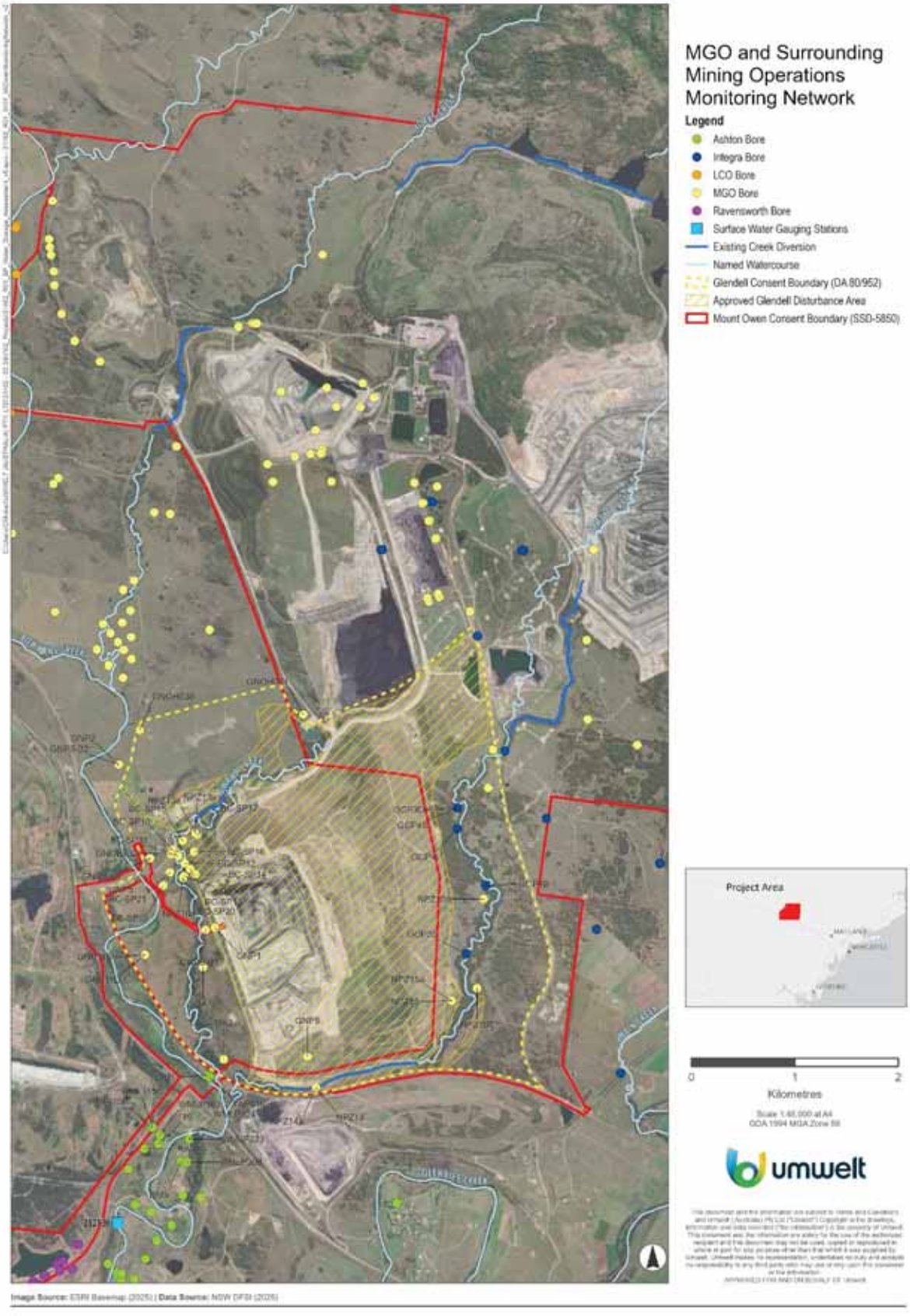


Figure 3.6 MGO and Surrounding Mining Operations Monitoring Network

3.4.2 Hydrostratigraphic Units

The main hydrogeological units within the Glendell area and immediate surrounds include:

- Quaternary alluvium, which occurs along Swamp Creek, Betty's Creek and Bowmans Creek; and
- Permian coal measures.

Further discussion on each unit is included below. Barrett Pit has also been largely backfilled with spoil, therefore discussion on the spoil is also included.

3.4.2.1 Quaternary Alluvium

Alluvial deposits are present along Swamp Creek, Bettys Creeks and Bowmans Creek. The alluvium along Bowmans Creek is up to around 18 m thick near the confluence with Hunter River to the south (Mackie, 2009). Field and desktop investigation into the Swamp Creek alluvium was undertaken by AGE (2019), including 38 test pits. AGE (2019) reported that the alluvium along Swamp Creek is between 1 m to 7 m thick, to a basal elevation of around 65 mAHD. Bettys Creek alluvium to the south of Barrett Pit is also thin, at around 1 m to 2 m thickness along the current creek diversion line.

The alluvial deposits comprise loams overlying silty and clayey sands with occasional sands and coarse gravels. Colluvial deposits along drainage lines are also present as a result of sheet wash and hill slope runoff.

As reported by AGE (2019), previously testing of alluvial bores along Bowmans Creek (GNP10S and GNP11S) within the basal gravels recorded a hydraulic conductivity of between 10 m and 30 m/day. It is anticipated that the hydraulic conductivity of the Swamp Creek alluvium will be lower due to the lower energy depositional environment and higher silt and clay content within the alluvium.

There are several groundwater monitoring bores within the Swamp Creek alluvium, including BC-SP10 to BC-SP17, BC-SP20 to BC-SP21. Bore GA1 is also located within regolith along the edge of the Swamp Creek alluvium. Bores BC-SP22, GA2, GNPS10S and GNPS11S are located to the northwest and west of Barrett Pit, within the Bowmans Creek alluvium and near Swamp Creek.

Groundwater levels along Swamp Creek are recorded at around 4.5 m below ground on average, ranging between 2 m to 7 m below ground level since monitoring commenced in 2013. As shown in **Figure 3.7**, groundwater elevations range between 69.5 mAHD and 73.8 mAHD and generally follow rainfall trends (CRD). Groundwater elevations are generally higher at upgradient bore BC-SP15 at around 73 mAHD in October 2025, and lower at downgradient bores BC-SP14 and BC-SP21 at around 71 mAHD, indicating a gradient of flow following topography, from the north-east towards the south-west. An exception to this is BC-SP20 that records more rapid changes in groundwater levels. This may relate to influence from Bowmans Creek flows and alluvium or bore conditions.

Figure 3.8 shows groundwater level trends for Bowmans Creek alluvium bores compared to Bowmans Creek surface water levels. The graph shows a slight short term response to streamflow events, but trends appear to largely follow long term rainfall trends (CRD). Groundwater elevations range between 80 mAHD at upstream bore GNP10S, down to 68 mAHD at downstream bore GNP11S. Groundwater levels are lower again at alluvium and regolith bore GA2 at around 64 mAHD. The groundwater levels show a gradient of flow that follows topography, from the north towards the south.

The alluvium along Swamp Creek is recharged from rainfall, with streamflow limited along Swamp Creek due to the small catchment area, while Bowmans Creek alluvium is recharged from rainfall and streamflow. Discharge includes downward seepage to underlying regolith, uptake by trees, and

potential private groundwater abstraction. There is also potential for baseflow contributions in localised areas and when groundwater levels are high enough to enable discharge.

Groundwater monitoring bores are present in the Bettys Creek alluvium to the east of Barrett Pit, at NPZ103, NPZ104, NPZ106 and NPZ106. There are no monitoring bores in alluvium to the south of Barrett Pit due to the limited alluvium to the south, as previously reported on by AGE (2019) however, monitoring of water levels in bores NPZ14/14a installed in the Liddell Lower and Hebden Seams indicate groundwater heads are blow the bed of any alluvium which may remain in this area following the diversion. **Figure 3.9** shows groundwater levels range between 90 mAHD (NPZ103) and 73 mAHD (NPZ104), with a gradient of flow following topography from the north towards the south.

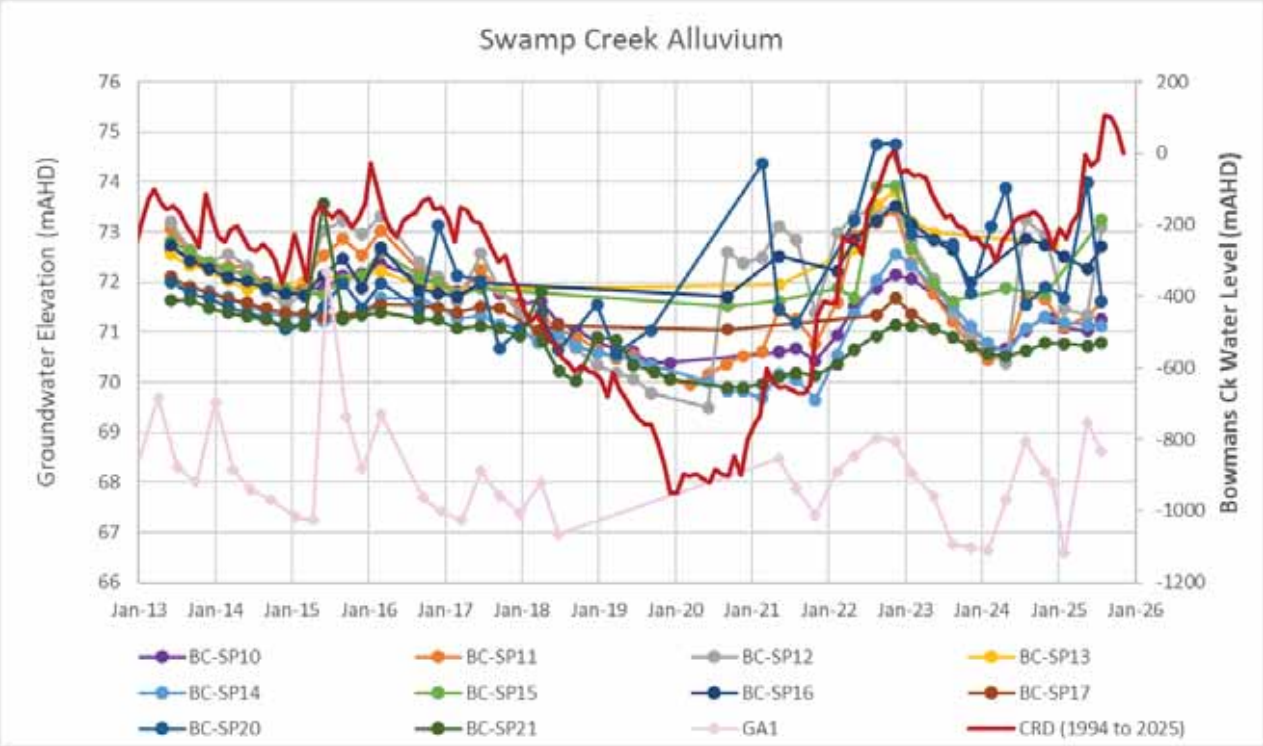


Figure 3.7 Hydrograph for Swamp Creek Alluvium vs CRD

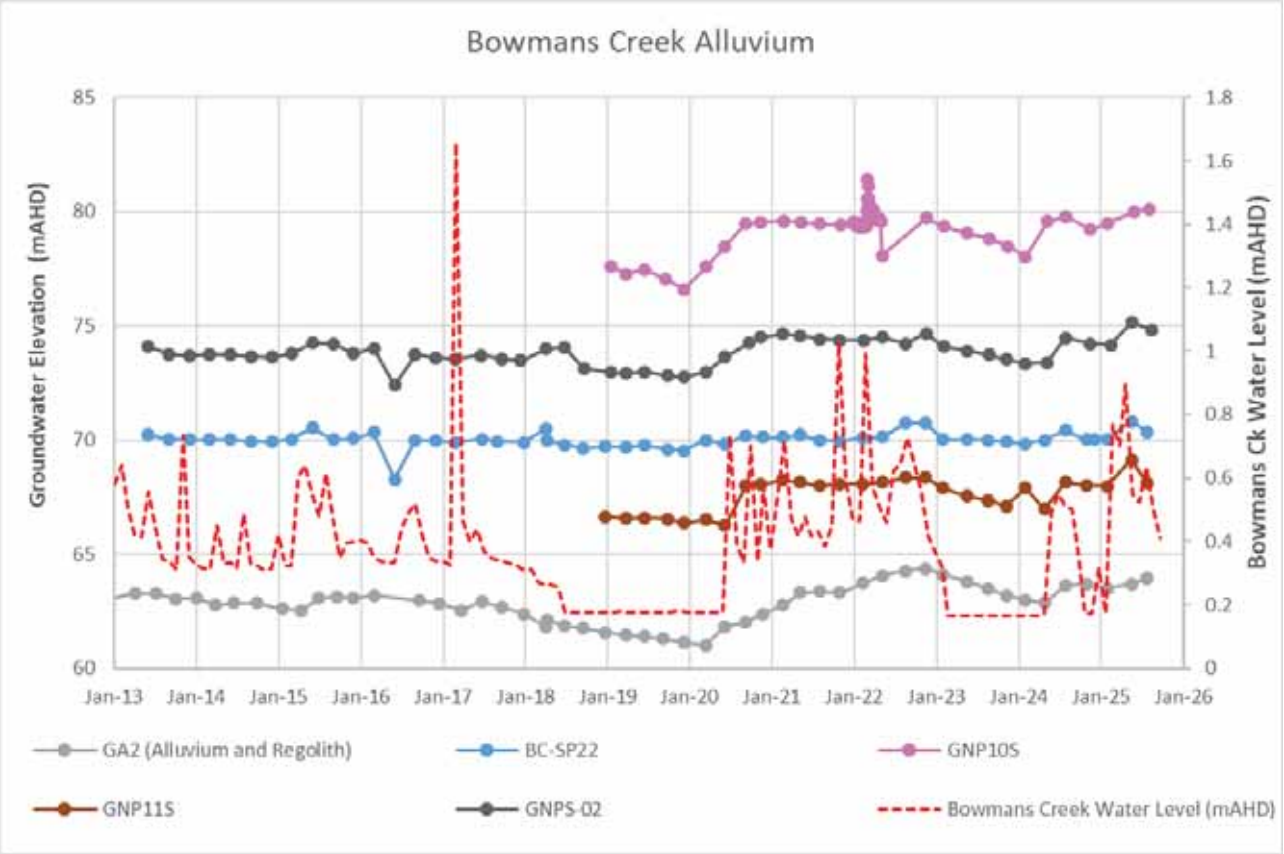


Figure 3.8 Hydrograph for Bowmans Creek Alluvium vs Bowmans Creek Levels

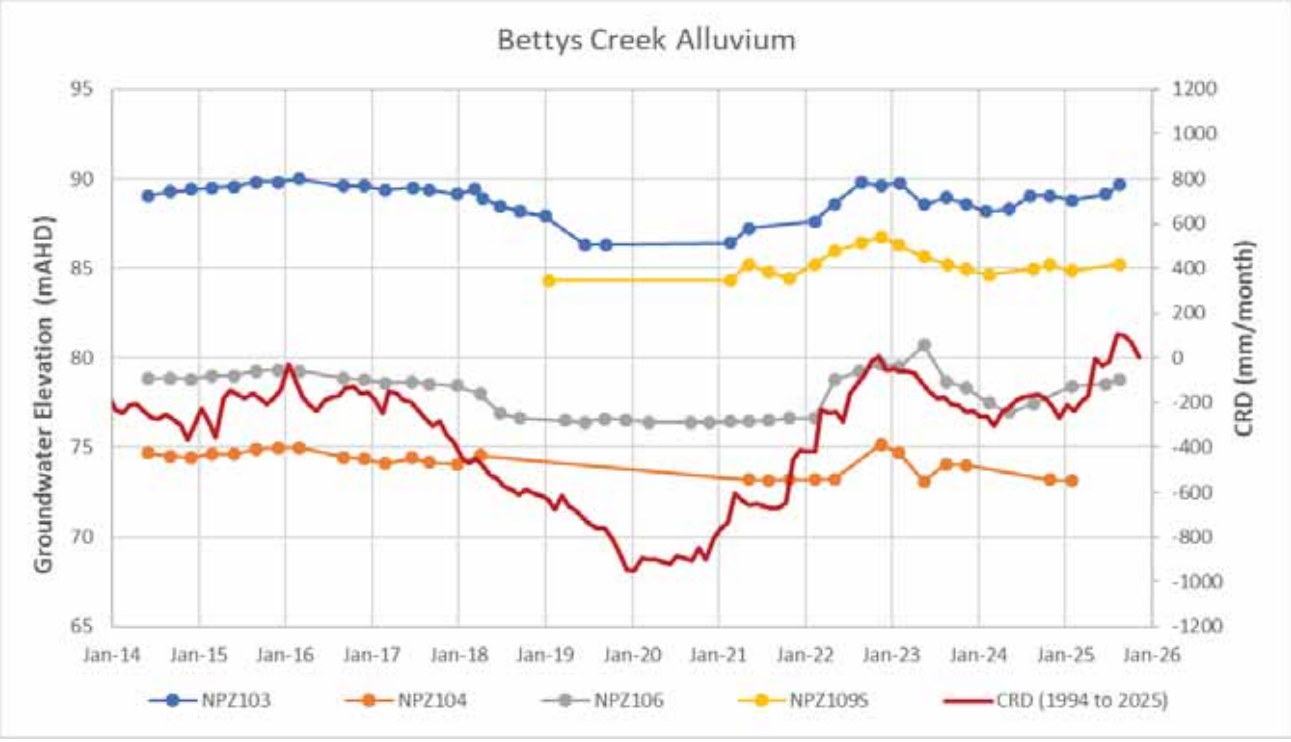


Figure 3.9 Hydrograph for Bettys Creek Alluvium vs CRD

3.4.2.2 Permian coal measures

Within the Glendell area the Permian age coal measures Wittingham Coal Measures are present at surface, which includes the Jerrys Plains Subgroup and older Vane Subgroup. The Vane Subgroup is present at surface along the Camberwell Anticline that runs through Barrett Pit. The coal measures dip to the west and east of Barrett Pit, with the younger Jerry's Plains Subgroup present at surface to the west at Ravensworth and to the east along the former Ravensworth East open cut area.

Within Barrett Pit, the coal measures comprise interbedded sandstone, siltstone, shale units that make up the overburden, and coal seams. The main coal seams in the pit include the Upper Pikes Gully Seam, Lower Pikes Gully Seam, Arties Seam, Liddell Upper (A, B seam splits) and Liddell Lower (D seam splits) and the Barrett Seam that formed the lowermost mined seam in the pit. These seams are also intersected within the Ashton Mine workings to the south, Ashton and Ravensworth to the west, and Integra Underground to the east.

Groundwater occurrence within the Permian coal measures is largely via secondary porosity, associated with fractures and cleats in the coal seams, fractures and faulting along the Camberwell Anticline, and weathering at surface. The depth of weathering (regolith) around Barrett Pit extends up to around 20 m based on available drill logs and previous reporting by AGE (2019).

Packer testing of the coal seam and interburden in the Glendell Pit Extension along Bowmans creek was completed by (SKM, 2012). The packer tests were completed on bores GNP5, GNP6, GNP7 and GNP8 with the hydraulic conductivity in the coal seam ranging from 9.5 x 1^{-6} m/day to 1.7 x 10^{-2} m/day. AGE (2019) presented an extensive range of hydraulic parameters collected within the Hunter Coalfields, based on research by Mackie (2009). As shown in **Figure 3.10** and **Figure 3.11**, there is a general reduction in hydraulic conductivity with depth, associated with the increase in pressure with depth.

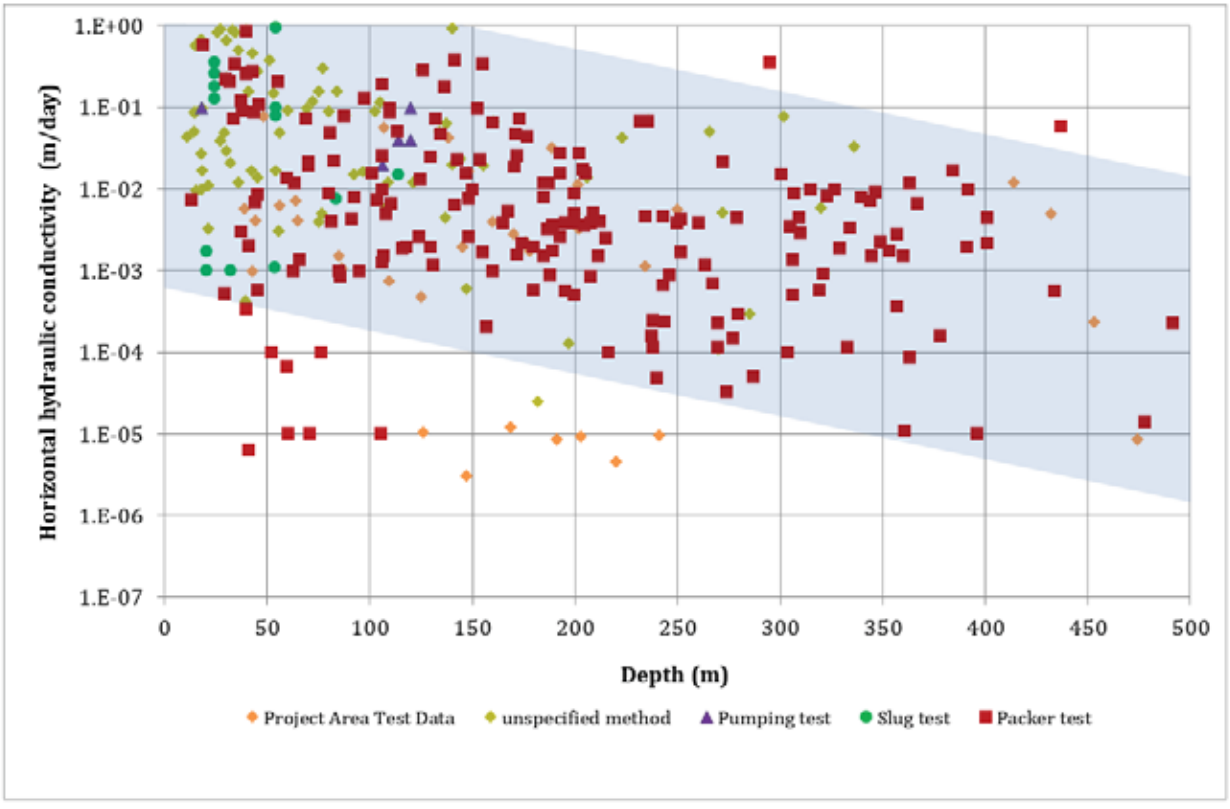


Figure 3.10 Hydraulic Conductivity with Depth – Permian Coal Seams (Source: AGE 2019)

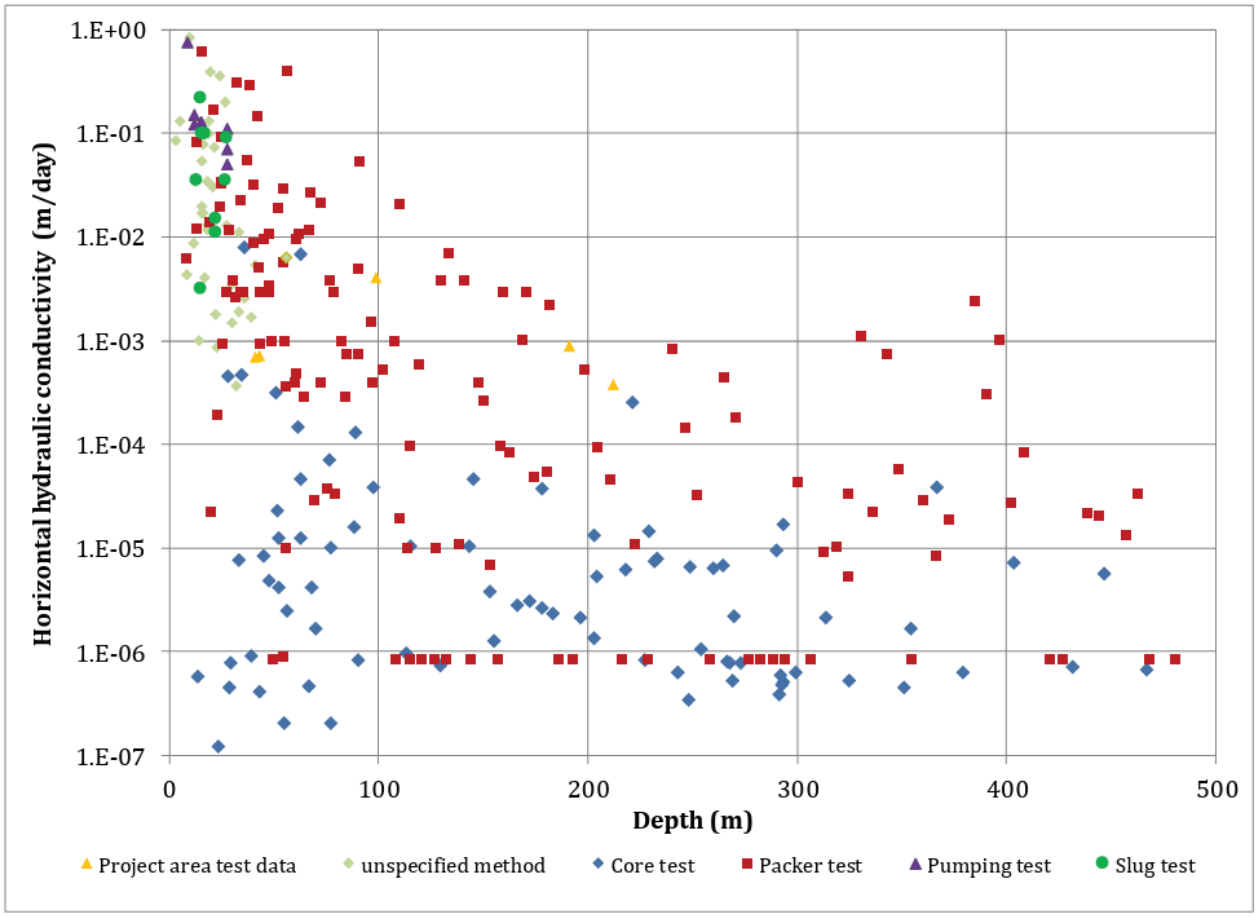


Figure 3.11 Hydraulic Conductivity with Depth – Permian Interburden (Source: AGE 2019)

Over time there have been a range of groundwater bores within the shallow Permian coal measures, and VWPs within the shallow to deep coal measures. Near Barrett Pit these include shallow bores GA1 and GA2 that are present within alluvium and potentially shallow weathered Permian (regolith). As previously discussed in **Section 3.4.2.1**,, groundwater levels within these two bores are at around 64 mAHD (GA2) and 68 mAHD (GA1). Groundwater levels at the two bores have been recorded between 1 m and 8 m below ground, indicating the regolith can be variably saturated around Barrett Pit.

Groundwater level monitoring is conducted around Barrett Pit at bores NPZ12, NPZ15/a, NPZ16/a as well as VWP GNOH030 located 1 km north of the pit. Bores NPZ14 and NPZ14a were situated at the southern end of Barrett Pit and monitored the Liddell Lower Seam and Hebden Seam, respectively, until 2012. Groundwater level trends for the monitoring points near Barrett Pit are shown in **Figure 3.12**.

The hydrograph shows groundwater levels at NPZ14/a were at around 25 mAHD in 2012. Groundwater levels for NPZ16a (Liddell Upper Seam) are at around -26 mAHD, compared to 49 mAHD in the shallower NPZ16 (Lemington Seam). Groundwater levels at NPZ15a (Liddell Lower Seam) are at around -43 mAHD, compared to 24 mAHD in the shallow overburden to 60 m depth at NPZ15. This shows depressurisation within the deeper coal seams, associated with recent underground mining at Integra, Liddell, Ravensworth and Ashton.

With cessation of mining at Integra and LCO, it is anticipated that groundwater levels will being to recover within the deeper mined seams over time. This recovery is visible in the GNOH030, with a

slight rise in groundwater levels observed for the Barrett Seam (GHOH030-1) and Lower Pikes Gully Seam (GNOH030-4). VWP GNOH030 is located 1 km north of Barrett Pit, near the Cutback Fault. The VWP is also situated 1.8 km south of Liddell Underground and 1 km east of Ravensworth Narama Open Cut Pit and underground workings, which all ceased active mine operations recently.

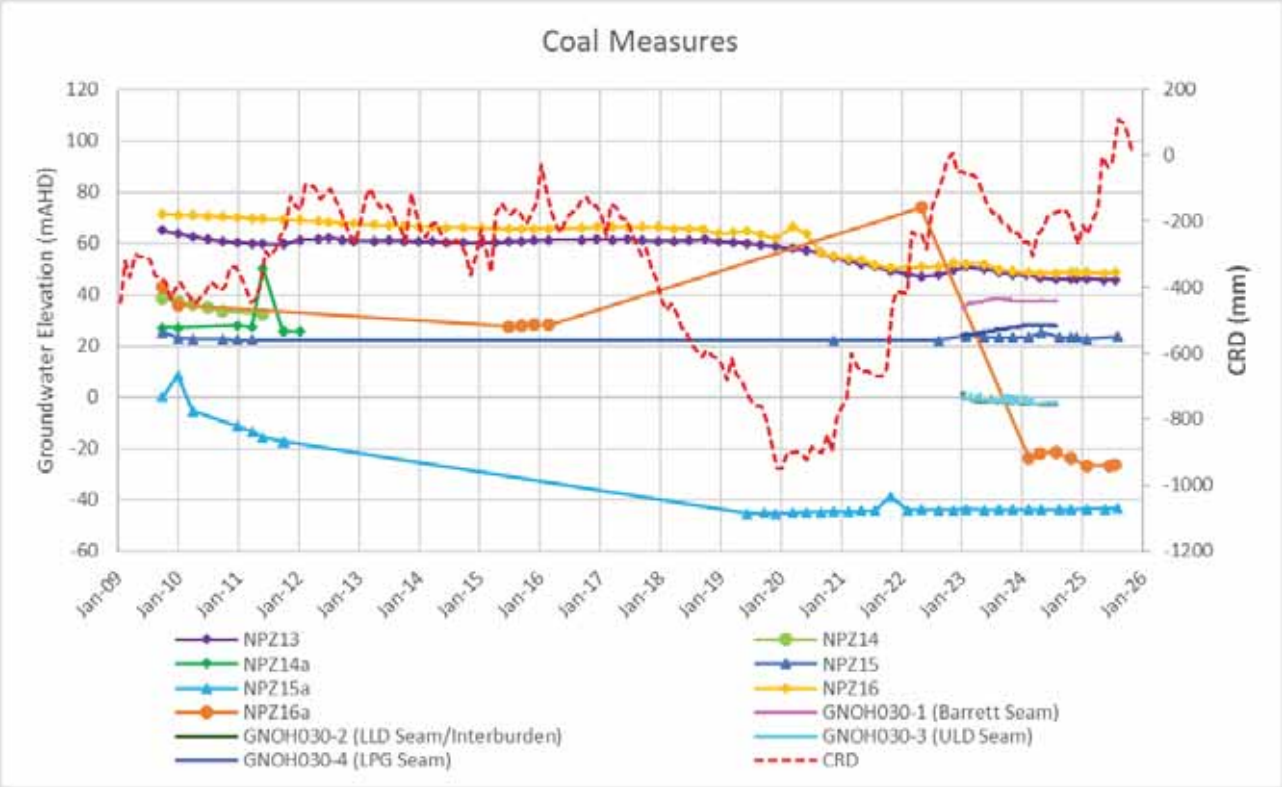


Figure 3.12 Hydrograph showing Coal Measures vs CRD

3.4.2.3 Spoil

Spoil material comprises the sandstone, siltstone and shale (overburden) that is excavated in order to access the coal seams. The spoil material is progressively backfilled within the pit and rehabilitated.

Infiltrometer testing was undertaken by Umwelt in August 2024, in order to test the rate of infiltration to spoil under saturated and unsaturated conditions at Barrett Pit. The testing was undertaken using a 50 mm ring installed into flat ground and (where required) sealed with bentonite. The seal was tested and once confirmed a Mariotte bottle was mounted to apply a constant water head, as shown in **Figure 3.13**. Saturated hydraulic conductivities were calculated for results from the single disk infiltrometer experiments using equations detailed in ISO 22282-5 Annex C.1 (International Organization for Standardization, 2012), as summarised in **Table 3.4**. The results generally show a higher hydraulic conductivity within the upper slope areas of around 8.8×10^{-3} m/day to 7.3×10^{-1} m/day. The testing indicates hydraulic conductivity reduces with the depth of emplacement and saturated conditions, to around 1.9×10^{-3} to 5.2×10^{-3} m/day.



Figure 3.13 Single Ring Infiltrometer with Mariott Bottle Setup at MGO_SPG_05E

Table 3.4 Infiltrometer Estimated Hydraulic Conductivity

Site	Easting	Northing	Location	Ground Conditions	Single Ring Infiltrometer Hydraulic conductivity	
					cm/s	m/day
MGO_SPG_01A	884339	6404527	Top of slope	Moist, free draining soil	2.45E-05	2.1E-02
MGO_SPG_08H	884765	6403854	Lower slope	Free draining soil	8.41E-04	7.3E-01
MGO_SPG_06F	884677	6404283	Lower slope	Free draining soil	1.02E-05	8.8E-03
MGO_SPG_04D	884709	6404294	Base of slope - saturated	Saturated ground	4.16E-06	3.6E-03
MGO_SPG_05E	884714	6404298	Base of slope - saturated	Saturated ground	2.22E-06	1.9E-03
MGO_SPG_07G	884721	6403843	Base of slope - saturated	Moist/wet ground	6.05E-06	5.2E-03

Groundwater monitoring bores are present within spoil at the backfilled Ravensworth East Pit, between BNP and West Pit. The bores include BHO009 and BNO011 and monitoring commenced around 2017, as shown in **Figure 3.14**. The hydrograph shows gradual recovery within the spoil over time. This recovery is influenced by rainfall trends, and also water storage within the connected BNP and West Pit.

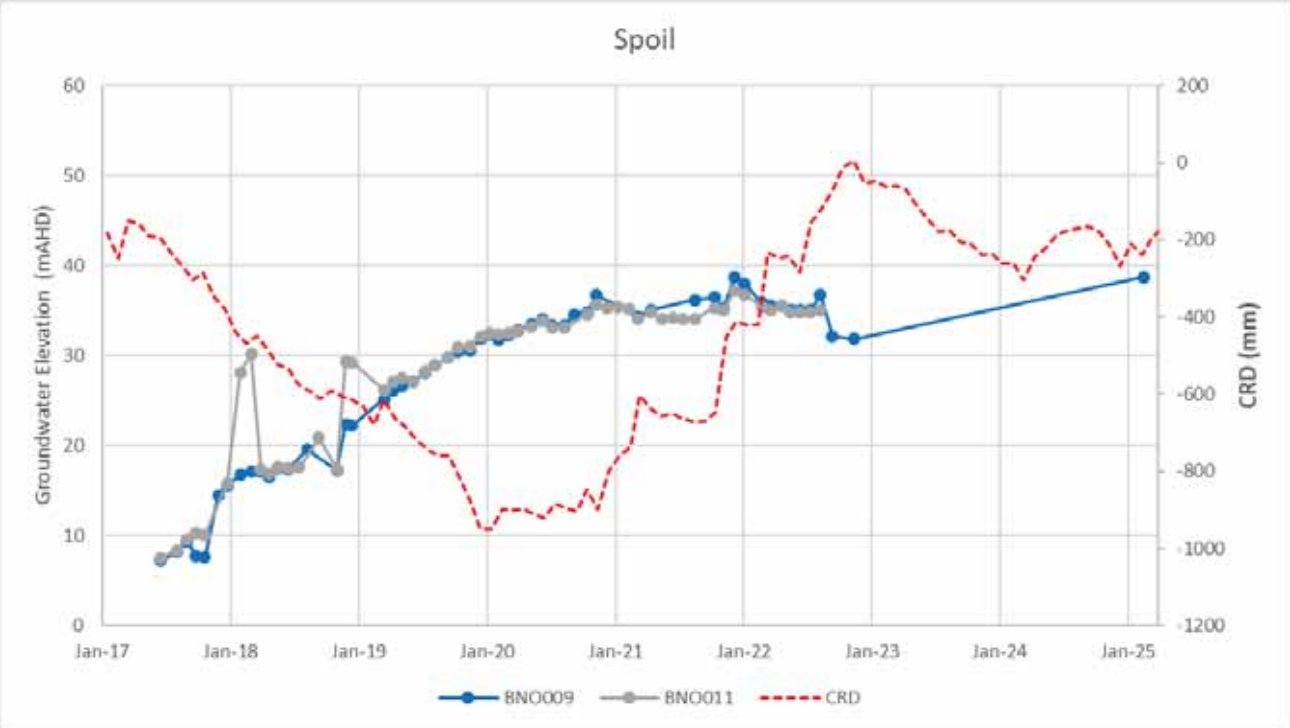


Figure 3.14 Hydrograph showing Spoil Water Levels – Ravensworth East

3.4.3 Groundwater Quality/Chemistry

3.4.3.1 pH

A geochemical assessment was completed for the Glendell operations as part of the GCOP investigations (EGI, 2019). EGI (2019) concluded that the vast majority of overburden/interburden, coal are expected to be non-acid forming (NAF) with excess acid neutralising capacity (ANC). Dilution and mixing during mining is expected to have been sufficient to mitigate ARD from any occasional thin zones of pyrite that may be present in pit walls and pit backfill, and prevent any significant impacts on downstream water quality.

Review of available mine water monitoring data indicates a generally slightly alkaline water an average pH of 8.63, ranging from 5.42 to 10.5 pH units. This data is consistent with the conclusions of the EGI (2019) assessment that potential for ARD and PAF is low.

3.4.3.2 Salinity

Water quality data from the major stratigraphic units and surface water monitoring points within MGO provides useful information relating to the potential for beneficial use of the groundwater. Salinity is a key constraint to water management and groundwater use and can be described by TDS concentrations. Where TDS data was not available it was calculated by multiplying 0.67 to electrical conductivity (EC).

Groundwater within the alluvial deposits can vary significantly due to drainage area, drainage sources, leakage from underlying coal measures, geology of the area and subsurface hydraulic gradients.

Water quality data for the Glennies Creek and Foy Brook Creek EC stations from 2020 indicate the average recorded EC values are 436 µS/cm and 1,146 µS/cm respectively.

Figure 3.15 **presents the salinity as TDS for the main groundwater sources and surface water surrounding MGO from the start of monitoring to December 2025. A summary of** Figure 3.15 **is that:**

- Swamp Creek surface water is brackish with an average TDS of 693 mg/L, ranging between 132 mg/L and 6,570 mg/L. Bowmans Creek surface water is brackish with an average TDS of 663 mg/L, ranging between 165 mg/L and 6,360 mg/L. Bettys Creek surface water is brackish with an average TDS of 951 mg/L, ranging between 2 mg/L and 6,020 mg/L
- Groundwater within the Quaternary alluvium is generally fresh to highly saline with an average TDS of 921 mg/L, ranging between 37mg/L and 15,879mg/L
- Groundwater within the coal seam aquifers is moderately saline to highly saline/brine with an average TDS of 6,320 mg/L, ranging between 7 mg/L and 48,642 mg/L
- Groundwater within the overburden/interburden strata is moderately saline to very saline with an average TDS of 5,850 mg/L, ranging between 121 mg/L and 19,075 mg/L
- Groundwater within the spoil is saline with an average TDS of 7,750 mg/L, ranging between 2,037 mg/L and 12,395 mg/L, and;
- Site mine water that includes Barrett Pit, Bayswater North Pit, West Pit, North Pit, Control Dams. Operational Dams and Transfer Dams has moderately saline water with an average TDS of 2,779 mg/L, ranging between 7 mg/L and 26,300 mg/L.

A summary table of water quality is also provided in **Table 3.5**.

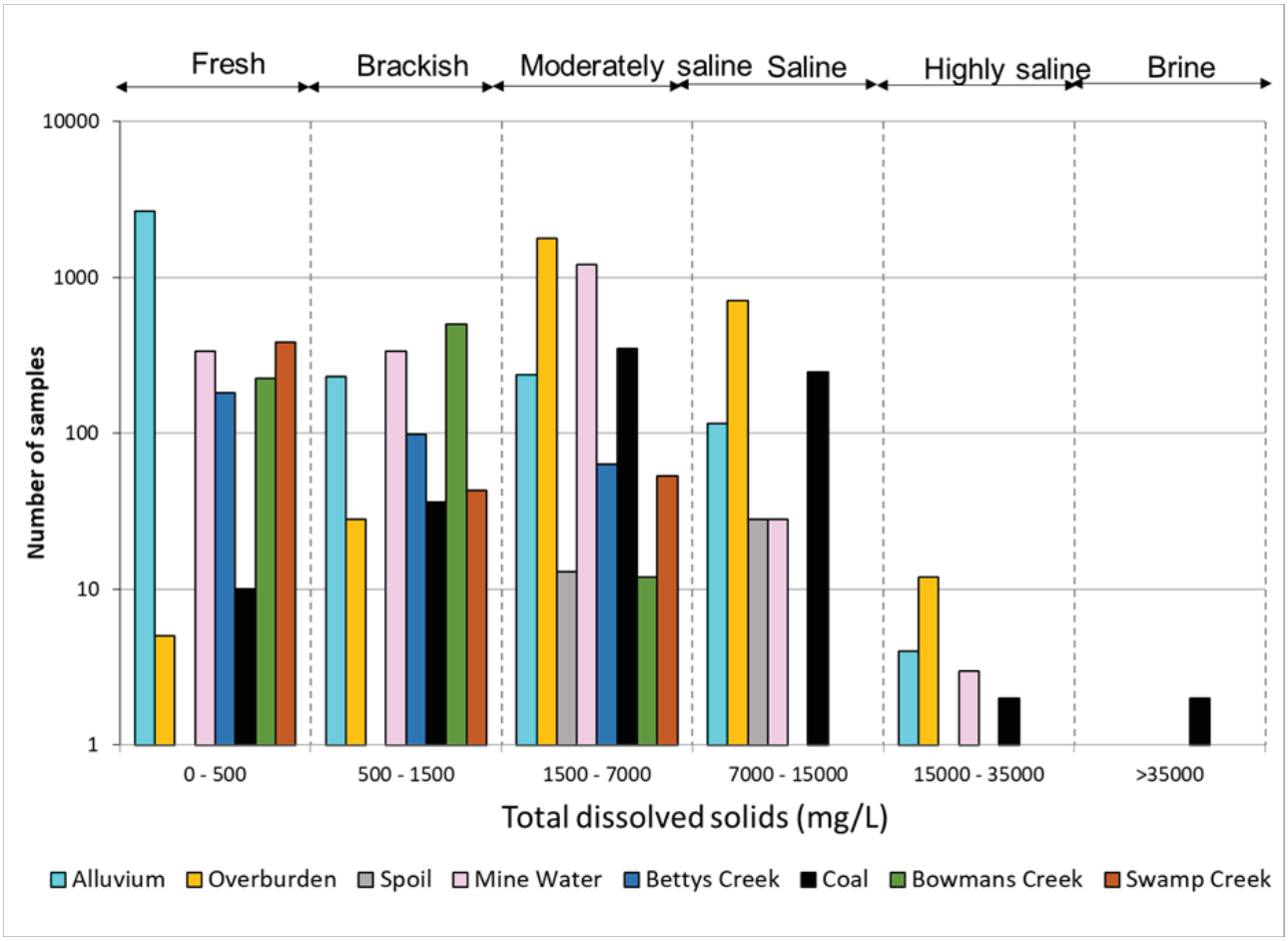


Figure 3.15 Food and Agriculture Organisation of the US (FAO) (2013) Salinity Ranking by Hydrogeological Unit, Mine Water and Creek Surface Water

A detailed analysis of groundwater aquifer quality was undertaken for the GCOP Groundwater assessment (AGE, 2019). A copy of a violin plot showing the variability within different Alluvial and Permian groundwater systems is reproduced in **Figure 3.16**.

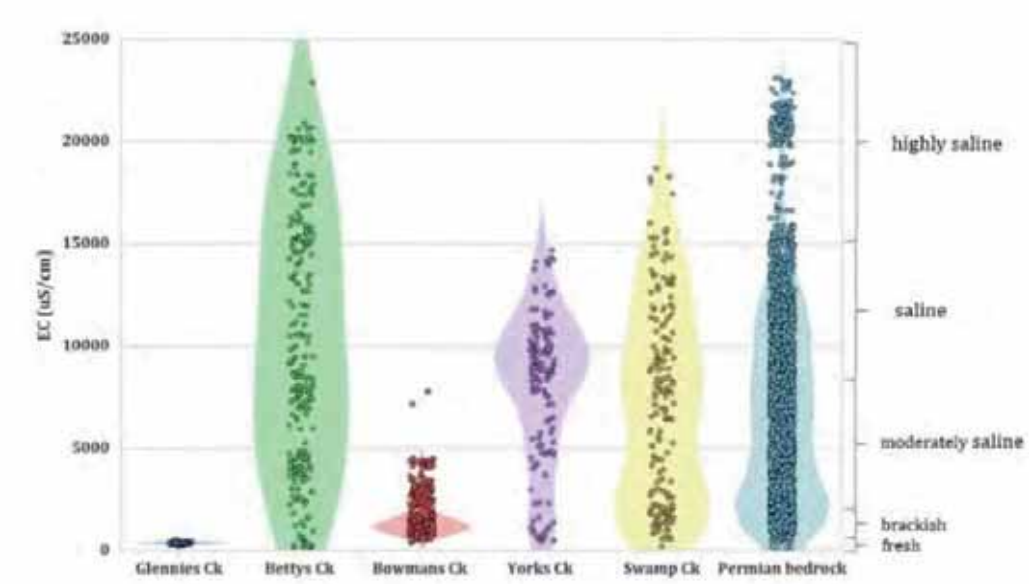


Figure 3.16 Electrical conductivity violin plot of groundwater monitoring data (AGE, 2019)

3.4.3.3 Water Type

The anion-cation balance for MGO monitoring bores within 2 km of the Barret Pit is shown on the Piper diagram in **Figure 3.17**, which shows the approximate groupings by water type for four groundwater sources, three creeks (Betty's Creek, Bowmans Creek and Swamp Creek) and three pits (Bayswater North, West Pit and Barret Pit).

The major ion concentrations were converted to milliequivalents and the ionic balance checked in order to ensure representative data was applied. Ionic balance error should be less than 5% and definitely less than 10% (Hiscock & Bense, 2014). Those with errors of greater than 10% have been removed prior to analysis. The ionic balance error has also been calculated using:

Error (%) = ((Σcations – Σanions) / (Σcations + Σanions)) * 100
(Equation 1)

Review of ionic balance identified that results for NPZ104, NPZ106, NPZ15a, GA2, GNP11D, and SC1 have exceeded the 10% error.

As shown in **Figure 3.17**, the alluvium bores plot in the Mixed and Na-K-Cl zone whilst the bores in the Permian coal plot in the Na-K-Cl zone. The regolith and overburden bores also plot in the Na-K-Cl zone. The regolith has a variation in Cl due to bore GA2 that has a higher Cl and Na+K concentration when compared to GA1 and GNP11D. The variation in alluvium is due to the low and non-dominant cation and anion concentrations in GNP11S and GNPS-02. Bores BC-SP21, BC-SP22, NPZ104 and NPZ106 are dominant in Cl and Na+K.

The Bettys Creek and Swamp Creek surface water types are Na-K-HCO3. Bowmans Creek surface water is a mix of water types that there are no dominant cations or anions.

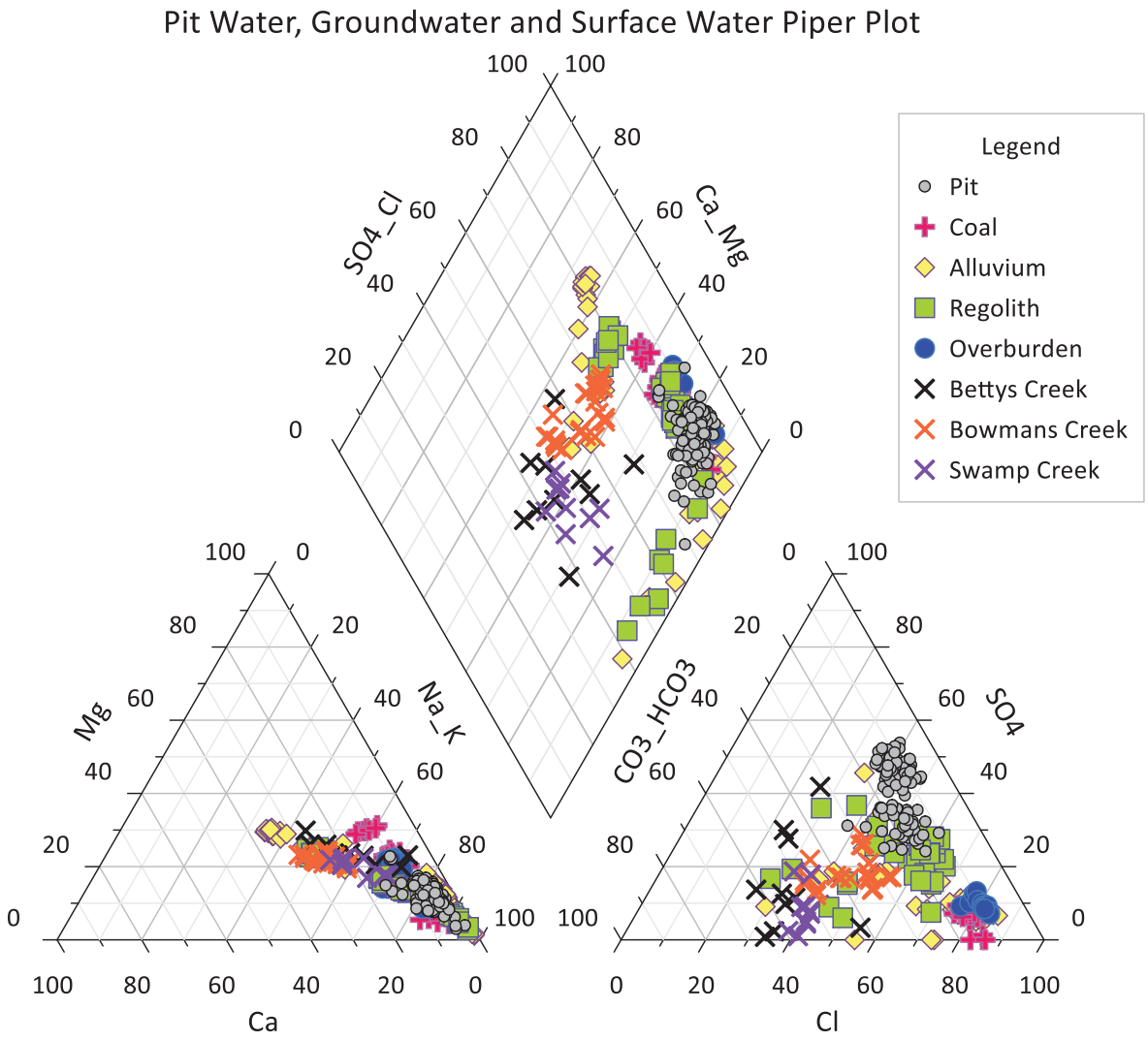


Figure 3.17 Piper Diagram of Monitoring Bores, Creeks and Pit Water within 2km of Barrett Pit

3.4.3.4 Water Quality Objectives and Use

To understand the groundwater resources near Glendell, available water quality data from the EMD has been compared to the:

- Australian Drinking Water Guidelines (ADWG) (NHMRC, 2011).
- ANZECC (2000) guidelines for freshwater aquatic ecosystems, short term irrigation, long term irrigation and stock water supply.

A summary of the available MGO site groundwater quality data is presented in **Table 3.5**, grouped by unit. Surface water quality data for Bowmans, Bettys and Swamp Creek are presented together.

As shown in **Table 3.5** groundwater in the Quaternary alluvium, Permian coal measures and spoil all exhibit neutral water quality on average, ranging between pH 7.07 and 7.17.

Groundwater quality in the alluvium is variable with most not suitable for drinking water. Alluvium groundwater on average exceeds the freshwater aquatic guidelines for EC, total aluminium, total copper, total lead, total nickel and total zinc. Alluvium groundwater is also generally not suitable for long or short term irrigation due to the average total aluminium concentration above 20 mg/L.

Alluvium groundwater is similarly not suitable for stock water due to the high total aluminium and high TDS for poultry, pigs, horses, dairy cattle and beef cattle. However it is noted that some bores do contain higher quality water (particularly adjacent to Bowmans Creek) which may be suitable for stock water and irrigation. While not included in the water quality analysis, aquifer water in the Glennies Creek alluvium is generally of a higher quality than the alluvium associated with Bowmans Creek and its tributaries.

Deep groundwater in the Permian coal measures is not suitable for drinking water and fresh water aquatic, due to the high TDS and EC. The Permian coal measures are suitable for short term irrigation. The high average total lead and manganese may hinder the use for long term irrigation, however the median values for these analytes are below the guideline levels. The Permian coal is not suitable for stock use on poultry, dairy cattle and beef cattle due to the high TDS (calculated average TDS of 5,679 mg/L).

Spoil water is not suitable for drinking water, fresh aquatic water, or stock use due to the elevated EC. No analysis for dissolved or total metals have been undertaken on spoil water samples.

Mine water is not suitable for drinking water and fresh water aquatic due to an elevated average TDS of 2,779 mg/L. Mine water is suitable for short and long-term irrigation however it would be dependent on the salinity tolerance of the vegetation that is being irrigated.

Surface water (Bowman Creek, Betty Creek and Swamp Creek) is not suitable for drinking water due the average TDS of 752mg/L is above the guideline. The fresh water aquatic guidelines are exceeded for EC (1,175 mg/L) when calculating from TDS. Surface water is possibly suitable for short and long term irrigation, however limited analysis has been undertaken on the total and dissolved metals. The TDS for surface water is suitable for stock water, however this is based on limited total and dissolved metal analysis.

Table 3.5 Water Quality Summary Table

Analyte	Unit	NHMRC Drinking Water	ANZECC (2000) Fresh Water Aquatic	ANZECC (2000) Short Term Irrigation	ANZECC (2000) Long Term Irrigation	ANZECC (20000) Stock Water	Surface Water[1]	Alluvium	Permian Coal Measure	Spoil	Mine Water [1,2]
pH (Field)	Av.	6.5 - 8.5[b]	6.5 – 8.5	6.0 - 8.5	6.0 - 8.5	-	7.81	7.07	7.17	7.08	8.63
	Med.						7.84	7.13	7.04	6.99	8.62
	Min.						5.00	5.68	4.40	6.60	5.42
	Max.						10.10	8.19	13.40	7.81	10.50
	Pop.						1662	633	3168	41	1906
EC (Field)	Av.	-	120 - 300	-	-	-	1191	5657	8874	11567	4357
	Med.						865	3740	8470	11950	4420
	Min.						4	186	10	3040	50
	Max.						10200	23700	72600	18500	34500
	Pop.						1660	633	3171	41	1903
Hardness	Av.	-	-	-	-	-	-	978	1320	-	614
	Med.						-	1240	1320	-	624
	Min.						-	400	1320	-	267
	Max.						-	1380	1320	-	943
	Pop.						-	5	1	-	4
TDS	Av.	600[b]	-	-	-	3,000 - 13,000[*]	752	6158	9620	-	2779
	Med.						506	5080	9620	-	2745
	Min.						2	13400	9620	-	7
	Max.						6570	2310	9620	-	26300

Analyte	Unit	NHMRC Drinking Water	ANZECC (2000) Fresh Water Aquatic	ANZECC (2000) Short Term Irrigation	ANZECC (2000) Long Term Irrigation	ANZECC (20000) Stock Water	Surface Water[1]	Alluvium	Permian Coal Measure	Spoil	Mine Water [1,2]
	Pop.						1678	5	1	-	1870
TSS	Av.	-	-	-	-	-	27	-	-	-	69
	Med.						11	-	-	-	18
	Min.						1	-	-	-	1
	Max.						1750	-	-	-	8030
	Pop.						1271	-	-	-	1486
Chloride	Av.	250[b]	-	-	-	-	104	1158	2942	-	1039
	Med.						85	306	2900	-	1020
	Min.						16	25	45	-	10
	Max.						498	8490	6990	-	1800
	Pop.						48	178	415	-	489
Calcium	Av.	-	-	-	-	1000	31	73	170	-	75
	Med.						33	57	165	-	71
	Min.						4	1	2	-	5
	Max.						97	399	569	-	241
	Pop.						48	178	415	-	490
Sodium	Av.	180[b]	-	-	-	-	94	732	1823	-	1414
	Med.						77	290	1710	-	1450
	Min.						20	41	63	-	34
	Max.						935	4620	5310	-	2330
	Pop.						48	178	415	-	277
Magnesium	Av.	-	-	-	-	-	20	91	205	-	123
	Med.						19	42	228	-	122
	Min.						3	1	1	-	7
	Max.						159	628	842	-	285
	Pop.						48	178	415	-	491
Sulphate	Av.	500[a] / 250[b]	-	-	-	1,000 – 2,400 (pigs)	71	215	494	-	1381
	Med.						40	140	472	-	1370
	Min.						3	6	1	-	5
	Max.						1090	800	2480	-	2940
	Pop.						47	169	391	-	491
Potassium	Av.	-	-	-	-	-	4	5	15	-	17
	Med.						3	3	12	-	16
	Min.						2	1	5	-	5
	Max.						14	42	69	-	42
	Pop.						47	178	415	-	274
Fluoride	Av.	1.5[a]	-	2	1	2	-	0.8	0.2	-	-
	Med.						-	0.6	0.2	-	-
	Min.						-	0.5	0.2	-	-
	Max.						-	1.6	0.2	-	-
	Pop.						-	5	1	-	-
Bicarbonate	Av.	-	-	-	-	-	174	394	815	-	585
	Med.						178	272	867	-	601
	Min.						44	52	1	-	34
	Max.						1060	1140	1310	-	1660
	Pop.						53	178	415	-	414
Ammonia	Av.	0.5[b]	0.9 [(pH 8)]	-	-	-	-	0.32	2.79	-	-
	Med.						-	0.04	2.47	-	-
	Min.						-	0.01	0.53	-	-

Analyte	Unit	NHMRC Drinking Water	ANZECC (2000) Fresh Water Aquatic	ANZECC (2000) Short Term Irrigation	ANZECC (2000) Long Term Irrigation	ANZECC (20000) Stock Water	Surface Water[1]	Alluvium	Permian Coal Measure	Spoil	Mine Water [1,2]
	Max.						-	1.73	7.39	-	-
	Pop.						-	8	16	-	-
Nitrate	Av.	50[a]	Refer to guidelines	-	-	400	-	0.50	0.65	-	5.43
	Med.						-	0.09	0.09	-	4.00
	Min.						-	0.01	0.01	-	0.01
	Max.						-	6.21	12.50	-	35.00
	Pop.						-	142	208	-	485
Nitrite	Av.	3[a]	Refer to guidelines	-	-	30	-	0.02	0.08	-	0.31
	Med.						-	0.01	0.01	-	0.18
	Min.						-	0.01	0.01	-	0.01
	Max.						-	0.53	3.10	-	3.59
	Pop.						-	142	208	-	201
Aluminium (t)	Av.	0.2[b c]	0.055	20	5	5	-	26.650	3.022	-	0.725
	Med.						-	7.785	0.310	-	0.130
	Min.						-	0.010	0.010	-	0.020
	Max.						-	385.000	392.00	-	11.200
	Pop.						-	178	411	-	29
Arsenic (t)	Av.	0.01[a]	As (III) 0.024 As (V) 0.013	2	0.1	0.5	-	0.008	0.003	-	0.012
	Med.						-	0.004	0.001	-	0.010
	Min.						-	0.001	0.001	-	0.002
	Max.						-	0.086	0.136	-	0.034
	Pop.						-	171	413	-	29
Barium (t)	Av.	2[a]	-	-	-	-	-	0.38	0.36	-	-
	Med.						-	0.21	0.11	-	-
	Min.						-	0.02	0.02	-	-
	Max.						-	5.55	8.30	-	-
	Pop.						-	175	410	-	-
Beryllium (t)	Av.	0.06[a]	-	0.5	0.1	-	-	0.002	0.001	-	-
	Med.						-	0.001	0.001	-	-
	Min.						-	0.001	0.001	-	-
	Max.						-	0.02	0.008	-	-
	Pop.						-	139	193	-	-
Boron (t)	Av.	4[a]	0.37	refer to guideline	0.5	7 (cattle)	-	0.08	0.15	-	-
	Med.						-	0.06	0.11	-	-
	Min.						-	0.05	0.05	-	-
	Max.						-	1.61	5.00	-	-
	Pop.						-	172	410	-	-
Cadmium (t)	Av.	0.002[a]	0.0002	0.05	0.01	0.01	-	0.0002	0.0003	-	-
	Med.						-	0.0001	0.0001	-	-
	Min.						-	0.0001	0.001	-	-
	Max.						-	0.0010	0.0165	-	-
	Pop.						-	139	154	-	-
Chromium (t)	Av.	0.05[a]	CrIII – ID Cr(VI) 0.001	1	0.1	1	-	0.024	0.006	-	-
	Med.						-	0.008	0.002	-	-
	Min.						-	0.001	0.001	-	-
	Max.						-	0.235	0.140	-	-
	Pop.						-	139	193	-	-
Cobalt (t)	Av.	-	-	0.1	0.05	1	-	0.026	0.005	-	0.006
	Med.						-	0.009	0.001	-	0.003

Analyte	Unit	NHMRC Drinking Water	ANZECC (2000) Fresh Water Aquatic	ANZECC (2000) Short Term Irrigation	ANZECC (2000) Long Term Irrigation	ANZECC (20000) Stock Water	Surface Water[1]	Alluvium	Permian Coal Measure	Spoil	Mine Water [1,2]
	Min.						-	0.001	0.001	-	0.001
	Max.						-	0.336	0.251	-	0.070
	Pop.						-	139	193	-	28
Copper (t)	Av.	2[a] / 1[b]	0.0014	5	0.2	1 (cattle)	-	0.024	0.011	-	0.008
	Med.						--	0.009	0.003	-	0.002
	Min.						-	0.001	0.001	-	0.001
	Max.						-	0.238	0.161	-	0.105
	Pop.						-	139	193	-	23
Iron (t)	Av.	0.3[b]	-	10	0.2	-	-	48.1	0.6	-	3.0
	Med.						-	37.4	0.2	-	0.2
	Min.						-	0.3	0.1	-	0.1
	Max.						-	204.0	6.3	-	54.0
	Pop.						-	17	29	-	22
Lead (t)	Av.	0.01[a]	0.0034	5	2	0.1	-	0.016	0.017	-	-
	Med.						-	0.005	0.002	-	-
	Min.						-	0.001	0.001	-	-
	Max.						-	0.131	0.607	-	-
	Pop.						-	139	193	-	-
Manganese (t)	Av.	0.5[a] / 0.1[b]	1.9	10	0.2	-	-	1.162	0.448	-	0.062
	Med.						-	0.616	0.141	-	0.019
	Min.						-	0.001	0.001	-	0.003
	Max.						-	8.560	22.900	-	0.973
	Pop.						-	178	414	-	29
Mercury (t)	Av.	-	0.0006	0.002	0.002	0.002	-	0.0001	0.0001	-	-
	Med.						-	0.0001	0.0001	-	-
	Min.						-	0.0001	0.0001	-	-
	Max.						-	0.0010	0.0001	-	-
	Pop.						-	139	193	-	-
Molybdenum (t)	Av.	0.05[a]	-	0.05	0.01	0.15	-	0.001	0.020	-	-
	Med.						-	0.001	0.020	-	-
	Min.						-	0.001	0.020	-	-
	Max.						-	0.002	0.020	-	-
	Pop.						-	5	1	-	-
Nickel (t)	Av.	0.02[a]	0.011	2	0.2	1	-	0.020	0.008	-	0.012
	Med.						-	0.008	0.004	-	0.009
	Min.						-	0.001	0.001	-	0.004
	Max.						-	0.187	0.177	-	0.074
	Pop.						-	139	193	-	29
Selenium (t)	Av.	0.01[a]	Total – 0.011 SeIV - ID	0.05	0.02	0.02	-	0.013	0.010	-	-
	Med.						-	0.010	0.010	-	-
	Min.						-	0.010	0.001	-	-
	Max.						-	0.080	0.050	-	-
	Pop.						-	178	415	-	-
Zinc (t)	Av.	3[b]	0.008	2	2	20	-	0.233	0.106	-	0.037
	Med.						-	0.057	0.065	-	0.007
	Min.						-	0.005	0.005	-	0.005
	Max.						-	9.440	2.410	-	0.371
	Pop.						-	174	410	-	13
	Av.	0.2[b c]	0.055	20	5	5	-	10	50	-	-

Analyte	Unit	NHMRC Drinking Water	ANZECC (2000) Fresh Water Aquatic	ANZECC (2000) Short Term Irrigation	ANZECC (2000) Long Term Irrigation	ANZECC (20000) Stock Water	Surface Water[1]	Alluvium	Permian Coal Measure	Spoil	Mine Water [1,2]
Aluminium (d)	Med.						-	10	50	-	-
	Min.						-	10	50	-	-
	Max.						-	10	50	-	-
	Pop.						-	5	1	-	-
Arsenic (d)	Av.	0.01[a]	As (III) 0.024 As (V) 0.013	2	0.1	0.5	-	1.4	1.0	-	-
	Med.						-	1.0	1.0	-	-
	Min.						-	1.0	1.0	-	-
	Max.						-	3.0	1.0	-	-
	Pop.						-	5	1	-	-
Barium (d)	Av.	2[a]	-	-	-	-	-	251.2	402.0	-	-
	Med.						-	191.0	402.0	-	-
	Min.						-	128.0	402.0	-	-
	Max.						-	455.0	402.0	-	-
	Pop.						-	5	1	-	-
Beryllium (d)	Av.	0.06[a]	-	0.5	0.1	-	-	1.0	1.0	-	-
	Med.						-	1.0	1.0	-	-
	Min.						-	1.0	1.0	-	-
	Max.						-	1.0	1.0	-	-
	Pop.						-	5	1	-	-
Boron (d)	Av.	4[a]	0.37	refer to guideline	0.5	7 (cattle)	-	74.0	80.0	-	-
	Med.						-	80.0	80.0	-	-
	Min.						-	50.0	80.0	-	-
	Max.						-	100.0	80.0	-	-
	Pop.						-	5	1	-	--
Cadmium (d)	Av.	0.002[a]	0.0002	0.05	0.01	0.01	-	0.10	0.10	-	-
	Med.						-	0.10	0.10	-	-
	Min.						-	0.10	0.10	-	-
	Max.						-	0.10	0.10	-	-
	Pop.						-	5	1	-	-
Chromium (d)	Av.	0.05[a]	CrIII – ID Cr (VI) 0.001	1	0.1	1	-	1.0	45.0	-	-
	Med.						-	1.0	45.0	-	-
	Min.						-	1.0	45.0	-	-
	Max.						-	1.0	45.0	-	-
	Pop.						-	5	1	-	-
Cobalt (d)	Av.	-	-	0.1	0.05	1	-	1.60	1.00	-	-
	Med.						-	1.00	1.00	-	-
	Min.						-	1.00	1.00	-	-
	Max.						-	3.00	1.00	-	-
	Pop.						-	5	1	-	-
Copper (d)	Av.	2[a] / 1[b]	0.0014	5	0.2	1 (cattle)	-	1.0	1.0	-	-
	Med.						-	1.0	1.0	-	-
	Min.						-	1.0	1.0	-	-
	Max.						-	1.0	1.0	-	-
	Pop.						-	5	1	-	-
Iron (d)	Av.	-	-	-	-	-	-	583.5	533.2	-	-
	Med.						-	50.0	50.0	-	-
	Min.						-	50.0	0.1	-	-
	Max.						-	34500.0	22000.0	-	-
	Pop.						-	178	391	-	-

Analyte	Unit	NHMRC Drinking Water	ANZECC (2000) Fresh Water Aquatic	ANZECC (2000) Short Term Irrigation	ANZECC (2000) Long Term Irrigation	ANZECC (20000) Stock Water	Surface Water[1]	Alluvium	Permian Coal Measure	Spoil	Mine Water [1,2]
Lead (d)	Av.	0.01[a]	0.0034	5	2	0.1	-	1.0	1.0	-	-
	Med.						-	1.0	1.0	-	-
	Min.						-	1.0	1.0	-	-
	Max.						-	1.0	1.0	-	-
	Pop.						-	5	1	-	-
Manganese (d)	Av.	0.5[a] / 0.1[b]	1.9	10	0.2	-	-	545.8	1.0	-	-
	Med.						-	507.0	1.0	-	-
	Min.						-	1.0	1.0	-	-
	Max.						-	1690.0	1.0	-	-
	Pop.						-	5	1	-	-
Mercury (d)	Av.	-	0.0006	0.002	0.002	0.002	-	0.100	0.100	-	-
	Med.						-	0.100	0.100	-	-
	Min.						-	0.100	0.100	-	-
	Max.						-	0.100	0.100	-	-
	Pop.						-	5	1	-	-
Molybdenum (d)	Av.	0.05[a]	-	0.05	0.01	0.15	-	1.40	12.00	-	-
	Med.						-	1.00	12.00	-	-
	Min.						-	1.00	12.00	-	-
	Max.						-	3.00	12.00	-	-
	Pop.						-	5	1	-	-
Nickel (d)	Av.	0.02[a]	0.011	2	0.2	1	-	1.8	1.0	-	-
	Med.						-	2.0	1.0	-	-
	Min.						-	1.0	1.0	-	-
	Max.						-	3.0	1.0	-	-
	Pop.						-	5	1	-	-
Selenium (d)	Av.	0.01[a]	Total – 0.011 SeIV – ID	0.05	0.02	0.02	-	10	10	-	-
	Med.						-	10	10	-	-
	Min.						-	10	10	-	-
	Max.						-	10	10	-	-
	Pop.						-	5	1	-	-
Zinc (d)	Av.	3[b]	0.008	2	2	20	-	6	5	-	-
	Med.						-	5	5	-	-
	Min.						-	5	5	-	-
	Max.						-	10	5	-	-
	Pop.						-	5	1	-	-

Notes:

Values below the limit of reporting were set at the limit for the calculations

^ Surface water results were calculated based on sample sites for sample locations at Bowmans Creek, Bettys Creek and Swamp Creek.

* Maximum concentration at which good condition might be expected, with 13,000 mg/L for sheep, 5,000 mg/L for beef cattle, 4,000 mg/L for dairy cattle, 6,000 mg/L for horses and 3,000 mg/L for pigs and poultry.

a NHMRC Health Guidelines for Drinking Water (2015)

b NHMRC Aesthetic Guidelines for Drinking Water (2015)

c NHMRC acid-soluble aluminium concentrations (2015)

1 Surface water and mine water EC and pH results are laboratory results. This is outside the holding time for pH.

2 Mine water includes Bayswater north pit, north pit, west pit, Barrett pit, environmental control dams, crushing plant dams, infrastructure dams, transfer dams, coal stockpile dam, sedimentation dam and pollution control dams.

Av. = Average, Med. = Median, Min. = Minimum, Max. = Maximum, Pop. = Population (number of samples).

3.4.4 Groundwater Use

This section presents a summary of groundwater use within proximity to the Modification.

3.4.4.1 Anthropogenic Use

A review of the NGIS database identified 27 registered bores within approximately 2 km of the Barrett Pit. The majority of the bores are used for groundwater monitoring, with only ten denoted as having water supply or unknown use. It appears that four of the bores may occur on privately owned land, as summarised in **Table 3.3**. Bores GW078054 and GW046787 are not associated with private houses and are therefore not associated with domestic use. Bores GW064515 and GW045084 both appear to be located within or associated with the Glennies Creek alluvium.

Table 3.6 Registered Bores on Private Land

State Bore ID	Easting	Northing	Bore Depth mbgl	Drilled Depth mbgl	FType	Note
GW078054	317122	6409486	16.2	16.2	HUSE – Water Supply	Status unknown. Located 1.3 km north-west (upgradient) of the Barret Pit
GW046787	317205	6409241	6.2	8	HUSE – Water Supply	Status unknown. Located 1.3 km north-west (upgradient) of the Barret Pit
GW064515	320397	6406064	5.5	5.5	HUSE – Water Supply	Installed in 1919, status unknown. Located 1.4 km south of Barrett Pit, and south of Aston Open Cut.
GW045084	322029	6406832	0	18.9	HUSE – Water Supply	Installed in 1976, status unknown. Located 1.9 km south-east of Barrett Pit, near Ashton Open Cut.

Note: HUSE House Use

3.4.4.2 Groundwater Dependent Ecosystems

A groundwater dependent ecosystem (GDE) is one in which the plant and/or animal community is dependent on the availability of groundwater to maintain its structure and function. The Commonwealth Government has established the National Atlas of Groundwater Dependent Ecosystems (GDE Atlas), based on the current knowledge of GDEs across Australia. The GDE Atlas provides information relating to three different groundwater dependent ecosystems, being:

- **Aquatic** – ecosystems that rely on the surface expression of groundwater–this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs.
- **Terrestrial** – ecosystems that rely on the subsurface presence of groundwater–this includes all vegetation ecosystems.
- **Subterranean** – ecosystems–this includes cave and aquifer ecosystems.

The Groundwater Dependent Ecosystem (GDE) Atlas mapping indicates the presence of Terrestrial GDE within 2 km of the Barrett Pit. The Terrestrial GDE mapped as present are described as:

- High potential GDE - River Red Gum/ River Oak grassy riparian woodland of the Hunter Valley
- High potential GDE - Swamp Oak/ Weeping Grass grassy riparian forest of the Hunter Valley

The mapping of the GDE Atlas terrestrial ecosystems was more recently updated within the DPE (2022) Probable Vegetation Groundwater Dependent Ecosystems–Hunter and Namoi regions were derived from the NSW Sharing and Enabling Environmental Data (SEED) portal (www.seed.nsw.gov.au). The mapping shows High Probability GDEs localised along Betty's Creek, Swamp Creek and Bowmans Creek (**Figure 3.17**).

High Ecological Value Aquatic Ecosystems (HEVAE) mapping also shows High Priority GDEs under the Hunter Unregulated and Alluvial Water Source Water Sharing Plan (Jerrys Water Source), as shown in **Figure 3.17**. This includes mapping of High Priority GDEs:

- Within the southern end of Barrett Pit, which have been removed through mining; and
- To the east of Barrett Pit, localised along Betty's Creek associated with Central Hunter Swamp Oak Riparian Forest.

The BoM GDE Atlas also indicates a high potential for aquatic GDEs along the Hunter River and its tributaries. High potential and moderate potential aquatic GDE are mapped along Glennies Creek, Bowmans Creek and the Hunter River within 2 km of the Barrett Pit.

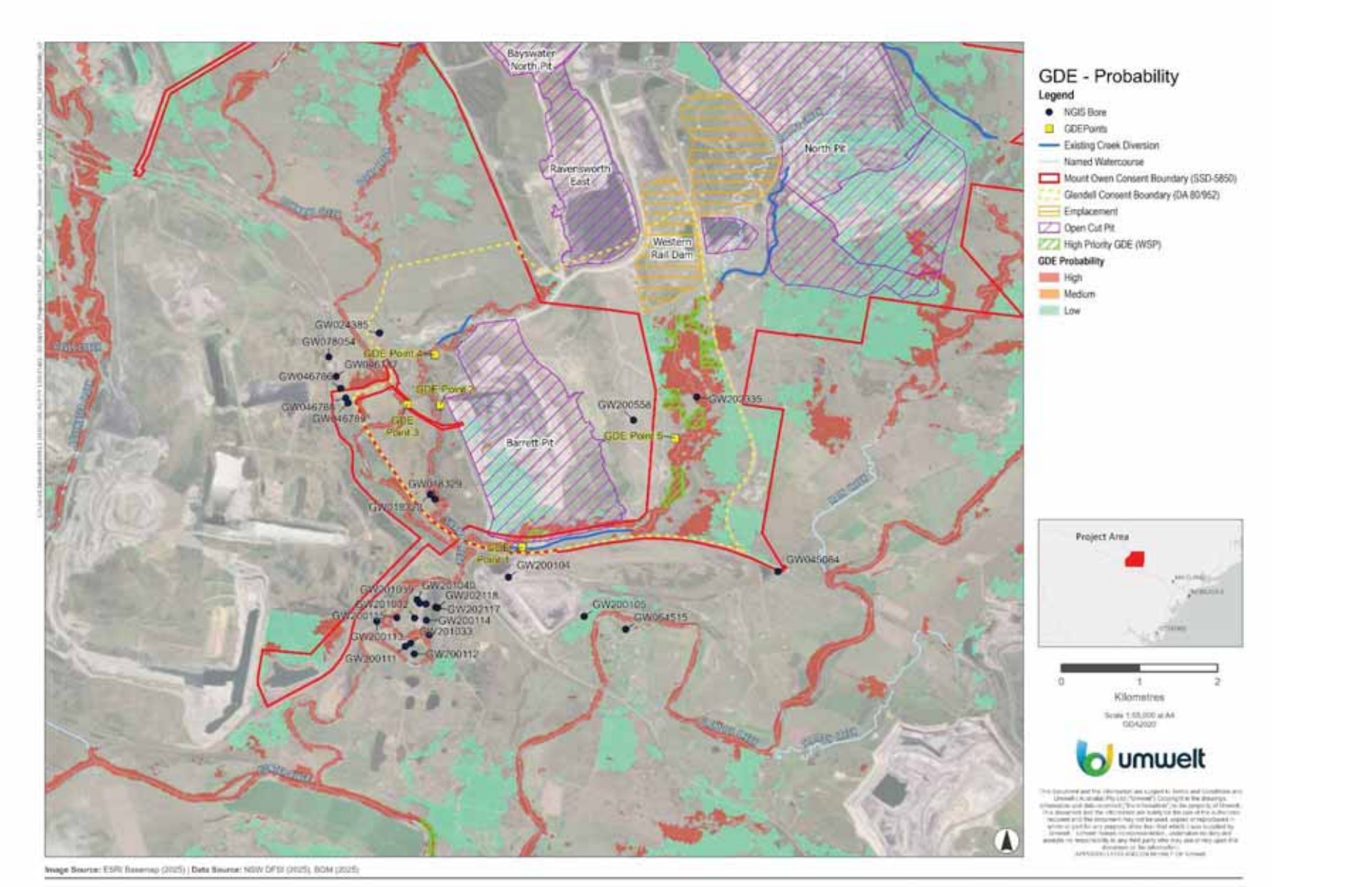


Figure 3.18 Groundwater Dependent Ecosystems Probability

3.5 Conceptual Ecohydrogeological Model

Conceptual ecohydrological models for the Barrett Pit and surrounds are shown in **Figure 3.18** (north to south) and **Figure 3.19** (west to east). The alignment of the cross sections are shown in **Figure 3.4**.

Barrett Pit is positioned along the north-south trending Camberwell Anticline, where the Vane Subgroup of the Wittingham Coal Measures occur at surface. The coal measures dip to the west and east, with the younger Jerrys Plains Subgroup present at surface. The coal measures are unconformably overlain by Quaternary age alluvium, which is localised along the creeks.

The main groundwater bearing units relevant to the Modification include alluvium, Permian coal measures and spoil:

- Alluvium – Present localised along Swamp Creek and Bowmans Creek to the north and west of Barrett Pit. Alluvium is also present along Betty's Creek to the west and minor alluvium is present near the diversion to the south of Barrett Pit. Fieldwork conducted along Swamp Creek, as reported by AGE (2019), indicates the alluvial sediments range in depth from 2 to 7 m, with a basal elevation of around 65 mAHD. The alluvium is variably saturated, with groundwater levels in Swamp Creek (where saturated) within 2 m to 7 m below ground (69.5 mAHD to 73.8 mAHD). Groundwater within Swamp Creek alluvium is recharged from rainfall and exhibits fresh to brackish water quality with an average TDS of 3,326 mg/L with Na-K-HCO_3 water type. Groundwater within Bowmans Creek and Bettys Creek alluvium is recharged from rainfall and streamflow. Water quality is fresh to brackish with an average TDS of 6,691 mg/L for Bettys Creek, and 2,243 mg/L for Bowmans Creek. Due to the shallow water levels, there is potential for baseflow contributions to creeks in localised areas and when groundwater levels rise (i.e. following peak rainfall events).
- Permian coal measures – The Permian coal measures comprise interbedded sandstone, siltstone, shale and coal. Groundwater occurrence is facilitated by secondary porosity, associated with weathering (regolith), fractures and cleats in the coal seams as well as areas of fracturing as observed along the Muswellbrook Anticline (Cutback Fault). Hydraulic testing of the Permian coal measures within the region shows a general decline in hydraulic conductivity with depth.
- Groundwater occurrence within the shallow weathered coal measures (regolith) is recorded around Barrett Pit. Bores GA1 and GA2 intersect the regolith and alluvium and indicate groundwater levels at around 68 mAHD and 64 mAHD, respectively.
- Groundwater within the Permian coal measures is influenced by mining within the region, with depressurisation of the deep coal seams in response to nearby underground mining. This includes Integra and Ashton (Pikes Gully and Liddell Seams) and Rix's Creek Mine (Hebden Seam) to the south. Initial groundwater level recovery is observed to the north of Barrett Pit, associated with cessation of mining around LCO, Ravensworth Underground and Ravensworth East.
- Groundwater within the coal measures is moderately saline to highly saline, with a TDS of around 6,320 mg/L for coal and 5,850 mg/L for interburden.
- Mine water quality generally records a lower average TDS of 2,779 mg/L, and similar water quality to the Permian coal measures. This is as expected as the mine water largely comprises ingress into the pits from the coal measures as well as surface water runoff captures and stored within mine areas.

- Spoil – Water levels within spoil are monitored at Ravensworth East and indicate recovery in levels in response to rainfall and water storage within the connected pits. A similar response is anticipated to occur within the backfilled spoil in Barrett Pit. Infiltration testing of the spoil at Barrett Pit indicates a hydraulic conductivity of up to 7.3×10^{-1} m/day within the less consolidated and unsaturated spoil, reducing to around 5.2×10^{-3} m/day in more consolidated and saturated spoil. Groundwater within spoil is generally saline with an average TDS of 7,750 mg/L.

The Barrett Pit has been approved to be retained as a final void, which will passively form a pit lake. Mining operation ceased at the Barrett Pit in November 2022 and since cessation of mining, the pit lake levels have been recovering to the current approximate level of -33 mAHD. Under the proposed Modification, the Barrett Pit will be utilised as a mine water storage facility including for water transfer via the GRAWTS system. The additional water storage within the Barrett Pit is anticipated to increase the pit lake level up to 12 mAHD at end of storage in 2039.

As shown in **Figure 3.20** and **Figure 3.19**, MOD 6 is predicted to increase groundwater levels within Barrett Pit in the short term (to 2039) compared to the natural rate of recovery within the pit. This is an increase from -7 mAHD up to 12 mAHD. The proposed water storage level is well below the pit crest, which is at around 70 mAHD, and it is also well below the base of weathering, which extends down to around 50 mAHD. Therefore, there is no potential for interaction between the mine water stored in the pit and shallow receptors associated with the alluvium and regolith.

There is potential for a gradient of flow from the water storage to the adjacent coal measures where they are depressurised by surrounding mining, including Ashton to the south and south-west and Integra to the east.

It is noted that the storage of water within the pit increases groundwater levels in the coal measures around the pit, which would reduce depressurisation within connected overlying alluvium. This is indicated for the Swamp Creek alluvium and Bowmans Creek alluvium within **Figure 3.18** and . This would represent a positive change to groundwater conditions, with increased water availability within the alluvium.

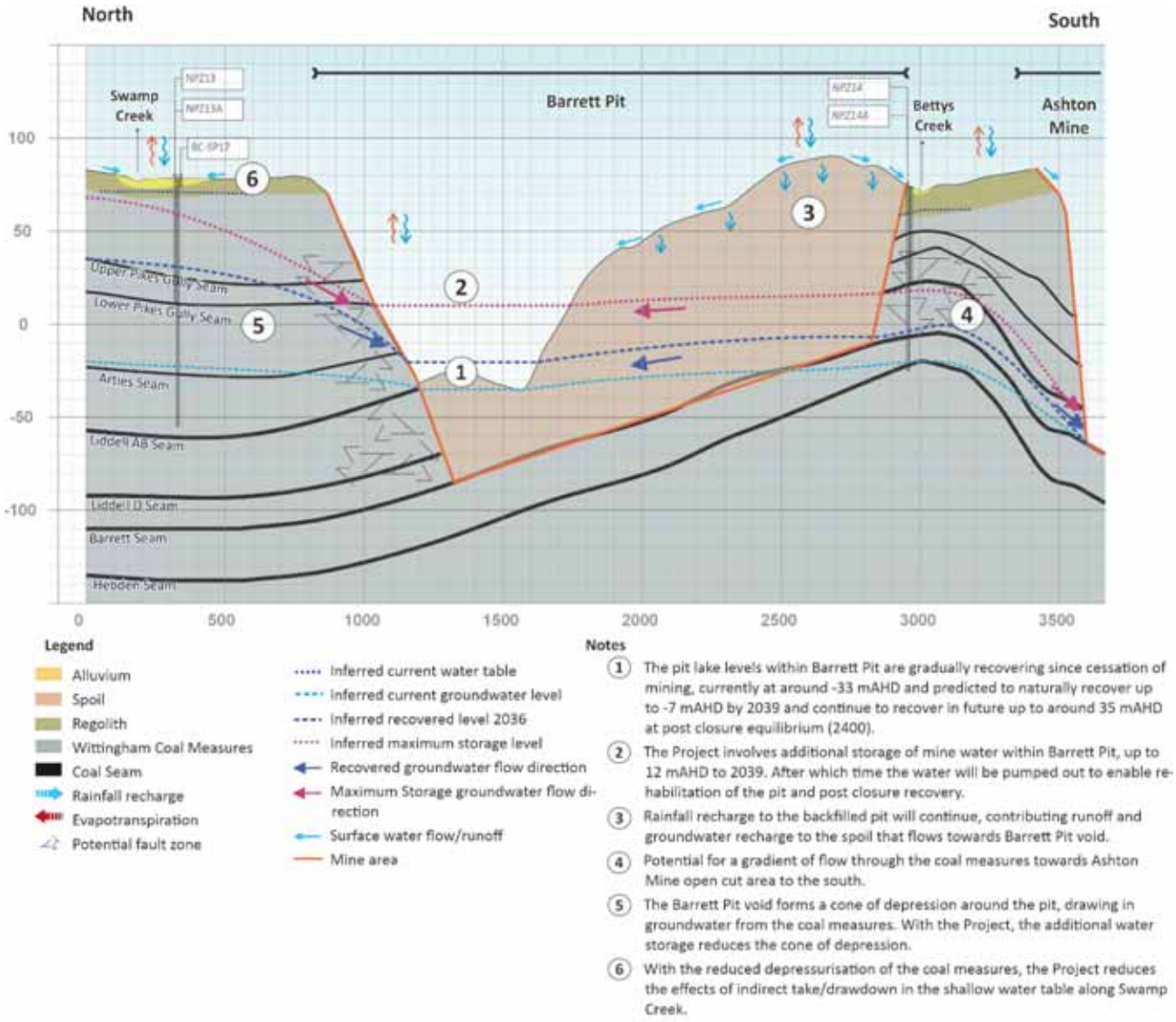


Figure 3.19 Conceptual Ecohydrological Model – North to South

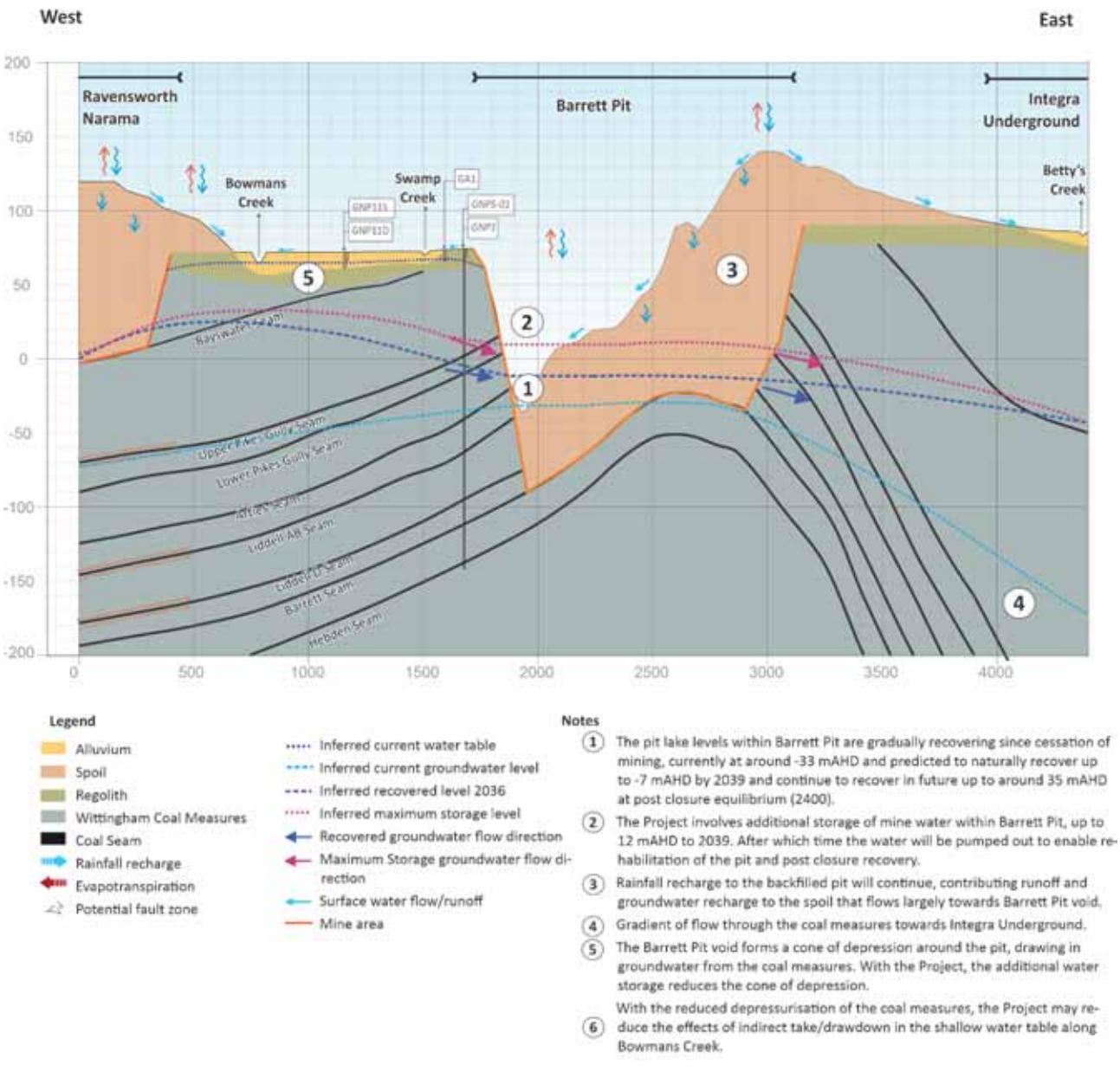


Figure 3.20 Conceptual Ecohydrological Model – West to East

4.0 Numerical Groundwater Model

This section provides background on the numerical groundwater modelling undertaken to represent the site water balance and predict groundwater flow associated with the Modification.

4.1 Existing Model Design

The GCOP numerical groundwater model, which replicates the approved mining operations in the region, was originally developed by AGE Consultants in 2019 as part of the GCOP (AGE, 2019). The model was calibrated using observed data up to April 2018 and underwent an independent peer review by Dr Noel Merrick in 2019 as part of the GCOP application.

The model domain was discretised and divided into 21 layers, with pinched out layers present dependent on geological mapping/structures. Model layers were created to separately represent Quaternary alluvium, surficial weathered Permian strata, coal seams, and non-coal overburden and interburden strata that separate the coal seams.

As reported by AGE (2019), the RCH (recharge) package of MODFLOW-USG was used to model recharge. Initial recharge rates for the model calibration were informed by a The Soil and Water Assessment Tool (SWAT) model developed for the catchment area in the region. The EVT (evapotranspiration) package of MODFLOW-USG was used to model evapotranspiration. Evapotranspiration was guided by a SWAT model occurring on the topmost layer with a maximum rate of 440 mm/year, decreasing linearly to zero at extinction depth of 2 m below the surface. The EVT values are spatially distributed uniformly throughout the model.

CHD (constant head) and GHB (general head boundary) packages of MODFLOW-USG were used to model constant head boundary and general head boundary conditions. Constant head boundary condition is assigned to the cells where Lake Liddell occurs in the area on the north-west boundary of the model while general head boundary condition (representing groundwater exchange inside/outside of the model) is applied to all cells in the boundary of the model except those with general head boundary cells. CHD was also used to replicate the voids in HVO, Liddel, and MGO sites.

Groundwater interaction with surface drainage was simulated using either the STR (stream) package, or the RIV (river) package of MODFLOW-USG. Major stream systems, including the Hunter River, Bowmans Creek, Glennies Creek were simulated using STR package, while other watercourses including Bayswater Creek, Betty's Creek, Main Creek and Station Creek, were simulated using RIV package.

The stream bed conductance was calculated from river width, length, riverbed thickness, and an estimated vertical hydraulic conductivity of the riverbed material. The vertical hydraulic conductivity of the stream bed was then adjusted during the calibration process. The stage height for rivers and creeks where perennial stream flow occurs (i.e. Hunter River and Glennies Creek) was internally calculated by MODFLOW-USG from available NSW government stream gauge data. The drain (DRN) package was utilized to represent both the open-cut and underground mining areas over time.

Umwelt updated the model in 2024 (Umwelt, 2024) to:

- Incorporate actual observed climatic conditions and approved mining activities to better represent conditions from 2018 to 2024, as well as the currently approved mine plan.
- Refine the void design to improve post-closure predictions based on the provided final landform surfaces.
- Include tailing storage facility (TSF), water storages, and dams associated with the main operational areas.
- Remove the horizontal flow boundary (HFB) package, as a review of available site observation data showed no clear evidence of a structural barrier to groundwater flow associated with the fault.
- The model structure (grid, extent, and layering), model timing and software remained the same, as discussed in the following sections. Modelling updates undertaken as part of this scope of work are discussed in **Section 4.2**.

4.1.1 Model Grid and Extent

The existing model extent, and spatial discretisation was kept the same as AGE (2019). The model's dimensions span approximately 22 km in width (from west to east) and 20.5 km in length (from north to south). The model encompasses the relevant mining activities and incorporates a spatial buffer to ensure that the boundaries of the model domain remain sufficiently distant from the mining activities, thereby minimizing the impact of assumed boundary conditions on the model outcomes. The model includes the full extents of the existing Glendell Mine as well as the full extent of MGO, Integra Underground Mine, Rix Creek North Mine (formerly Integra Open cut), LCO, Ashton Open Cut and Underground Mine, Ravensworth Operations and part of Hunter Valley Operations (HVO) North.

The model domain was discretised into 21 layers, with pinched out layers present dependent on geological mapping/structures. Model layers were created to separately represent Quaternary alluvium, surficial weathered Permian strata, coal seams, and non-coal overburden and interburden strata that separate the coal seams. The model domain is discretised into a total of 590771 (global) cells. Cell dimension and shape varies across the model. **Figure 4.1** shows the model extent and grid cells.

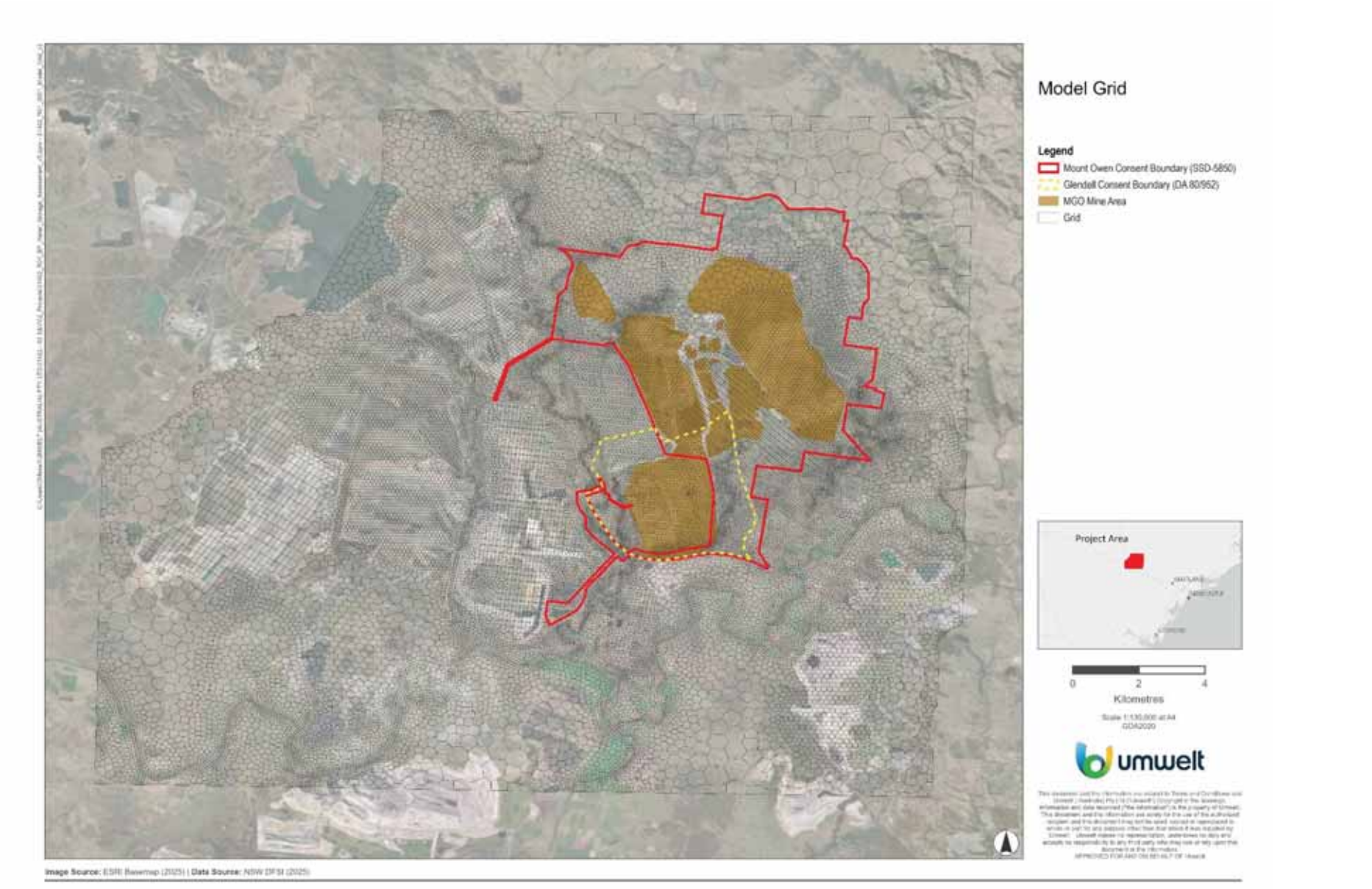


Figure 4.1 Model Grid

4.1.2 Model Layering

The model domain and layering was discretised into 21 layers by AGE (2019), as summarised in **Table 4.1**. No changes to the existing model layering were made by Umwelt (2024).

Table 4.1 Model Layers

Layer	Geology	Details
1	Alluvium	Pinched out layer (non-continuous layer), layer thickness ranges between 0.1 to 20.8 m thick with average of 7.0 m.
2	Regolith	Pinched out layer, layer thickness ranges between 0.1 to 24.7 m thick with average of 5.6 m.
3	Overburden	Layer thickness ranges from 1 to 146.6 m with average of 68.1 m.
4	Bayswater Seam	Layer thickness ranges from 1 to 47.2 m with average of 14.9 m.
5	Interburden (inc. Lemington)	Layer thickness ranges from 3.3 to 104.2 m with average of 83.5 m
6	Interburden (inc. Lemington)	Layer thickness ranges from 1 to 168.4 m with average of 105.4 m
7	Upper Pikes Gully Seam	Pinched out layer, layer thickness ranges between 0.4 to 3.5 m, with average of 2.0 m.
8	Interburden	Pinched out layer, layer thickness ranges between 0.4 to 3.5 m, with average of 2.1 m.
9	Mid and Lower Pikes Gully Seam	Pinched out layer, layer thickness ranges between 1.0 m and 3.5 m, with average thickness of 2.1 m.
10	Interburden	Layer thickness ranges from 1 to 31.2 m with average of 17.8 m.
11	Arties Seam	Pinched out layer, layer thickness ranges between 1.0 to 26.1 m, with average thickness of 8.1 m.
12	Interburden	Layer ranges from 3.5 to 39.5 m with average of 20.5 m.
13	Liddell AB Seam	Pinched out layer, layer thickness ranges between 5.5 m to 211.5 m, with average thickness of 7.5 m.
14	Liddell AB Seam	Pinched out layer, layer thickness ranges between 6.4 and 11.3 m, with average thickness of 7.5 m.
15	Liddell C Seam	Layer ranges from 12.5 m to 22.7 m with average of 15.0 m.
16	Liddell D Seam	Layer ranges from 12.5 m to 22.7m with average of 15.0 m.
17	Interburden	Layer ranges from 11.8 m to 26.0 m with average of 19.2 m.
18	Barrett Seam	Pinched out layer, layer thickness ranges between 2.2 to 4.6 m, with average thickness of 3.4 m.
19	Interburden	Layer ranges from 13.9 m to 21.4 m with average of 17.3 m.
20	Hebden Seam	Pinched out layer, layer thickness ranges between 4.7 to 7.7 m, with average thickness of 6.4 m.
21	Saltwater Creek Formation/ Basement	Constant thickness of 200 m

4.1.3 Software

The groundwater model was developed using MODFLOW-USG (Panday et al., 2017). MODFLOW-USG provides greater flexibility in model structure than traditional orthogonal grids, owing to the inclusion of Voronoi polygon geometry, which may be combined with orthogonal grids within the same domain as required. The model mesh was developed in AlgoMesh 2 (HydroAlgorithmics Pty Ltd, 2020). The model was calibrated using PEST_HP (Doherty J. , 2024) and associated PEST utilities (Doherty et al., 2021).

4.1.4 Model Timing

The model timing for the calibration model was not changed; however, the predictive model timeframe was updated slightly to reflect current mine plan timing. The model timing is detailed as follows:

- Pre-mining steady state: A steady state stress period preceded the transient simulation, to represent the pre-mining groundwater conditions to 1980.
- 1st transient calibration: four 5-years period followed by a 3-year period (1980 to 2003)
- 2nd transient calibration: twelve half year period (2003 to 2009)
- 3rd transient calibration: thirty-six quarterly period (2009 to 2018)
- 1st transient prediction: one hundred twenty-eight quarterly stress periods (2018 to 2050), increased from quarterly stress periods to 2045 in AGE (2019).
- The recovery model period was not available as part of the model handover from AGE. Therefore, Umwelt established the recovery model period to include:
- 2nd transient prediction: twenty half-year periods (2050 to 2060)
- 3rd transient prediction: twenty yearly stress period (2060 to 2080)
- 4th transient prediction: twelve 10 yearly stress period (2080 to 2200)
- 5th transient prediction: Seventeen 50-year stress period (2200 to 3050).

The recovery model final landform was developed based on the current final landform provided by Glencore for MGO, LCO and Ravensworth Operations. The landform was also updated to reflect the approved final landform for Rix's Creek Mine. Due to the distance from MGO, the existing AGE (2019) post closure landform and void model assumptions for HVO were maintained in the model. This included use of the constant head package (CHD) within HVO West Pit and Carrington Pit void (refer Figure 2 2).

4.2 Modification Model Updates

This section presents a summary of the groundwater model objectives, and details model updates made during the Umwelt 2024 update and those updates made for the purposes of MOD6.

4.2.1 Model Objectives

An existing numerical groundwater model was developed by AGE (2019) for GCOP and was peer reviewed by Dr Noel Merrick (refer Section **4.1**). This model included simulation of existing approved mining operations. No changes to the model structure and calibrated parameters were undertaken as part of the model update for the Modification, to ensure the integrity of the peer reviewed model was maintained. However, some specific changes have been made to the existing model to include contemporary observation data, changes to mine plans relative to approved and proposed mining at the time the GCOP model was developed and representation of water storage within Barrett Pit proposed for the Modification.

The objectives of the model updates were to:

- Predict groundwater level recovery within Barrett Pit under the Approved development scenario to provide a Basecase condition to inform the Modification surface water study.
- Predict the change in groundwater levels in response to additional water storage in Barrett Pit, incorporating cumulative impacts from MGO and surrounding mines.
- Predict any changes in groundwater flux due to the storage of water in Barrett Pit.
- Predict any potential adverse impacts to surrounding groundwater users.

4.2.2 Model Stress and Boundary Conditions Updates

4.2.2.1 Recharge

Rainfall recharge was applied to the model using the MODFLOW-USG recharge (RCH) package. Rainfall recharge varies spatially and is assigned to the model based on the geology zones (**Figure 4.2**)**.** The recharge is applied as a fraction of rainfall data, averaged for each stress period.

The original AGE (2019) model applied effective recharge based on the Soil and Water Assessment Tool (SWAT) with spatially variable multiplication factors applied. The recharge rate applied to spoil was maintained at 4% as per the AGE (2019) model.

Umwelt tested higher recharge rate over BNP spoil at 10% to match the observed levels in there. Umwelt also refined recharge into final voids in post closure recovery for Entrance Pit and South Cut final voids (at LCO) as shown in **Table 4.2**.

Rainfall recharge was represented in the predictive model from October 2025, as observed values were available to be used. In order to be consistent with the Modification surface water model, Umwelt averaged the same rainfall values as received from ATC Williams, from October 2025 onwards. The observed rainfall and average daily rainfall per stress period is shown in **Figure 4.3**

Table 4.2 Recharge Zones

Zone	Unit	Recharge Rate
1	Alluvium	7%
2	Regolith	0.6%
3	Permian overburden	0.05%
4	Permian interburden	0.05%

Zone	Unit	Recharge Rate
21	Saltwater Creek Formation	0.013%
-	Spoil (BNP)	10%
-	Spoil (other areas)	4%
-	LCO Entrance Void	111%
-	LCO Southern Void	113%
-	Voids (other areas)	130%

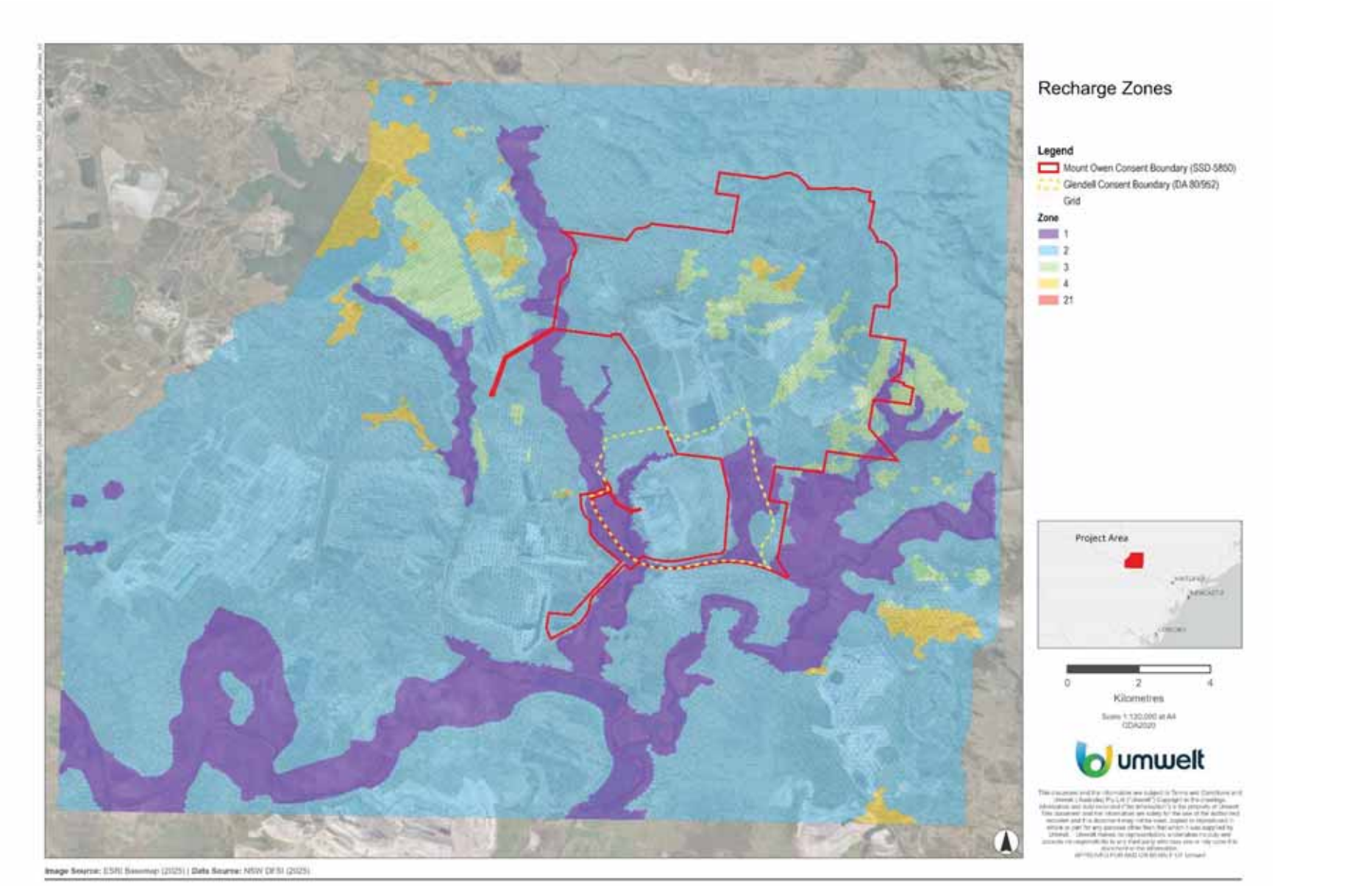


Figure 4.2 Recharge Zones

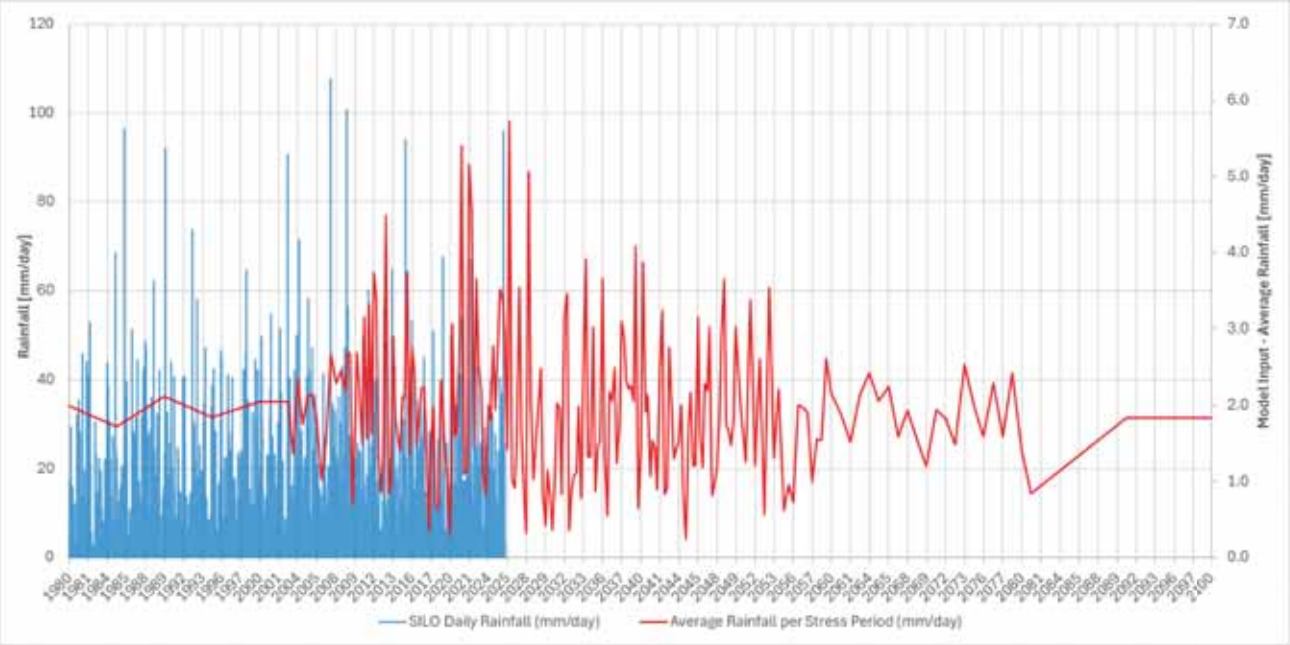


Figure 4.3 Modelled Recharge versus Observed Rainfall

4.2.2.2 Evapotranspiration

The evapotranspiration (EVT) package in MODFLOW-USG was used to simulate evapotranspiration from the shallow saturated zone. A uniform EVT rate was applied across the model domain, and the extinction depth was retained at 2 m, consistent with the assumptions adopted in AGE (2019) and the Umwelt (2024) model.

From 2018 onward, the applied EVT rate was updated using observed data, specifically the SILO Morton Actual Evapotranspiration dataset for the period 2018 to October 2025. For the predictive period, the EVT rates were aligned with those used in the Modification surface water model, following the same approach as for rainfall recharge. Pan Evaporation rate was applied over the voids while other areas keep receiving Morton Actual. These rates are showed in **Figure 4.4**.



Figure 4.4 Actual EVT (SILO) and Modelled EVT

4.2.2.3 River Package

Minor watercourses are simulated using river package (RIV) in the AGE (2019) model and Umwelt's updated model (2024). The existing RIV cells were maintained for Bayswater Creek, Betty's Creek, Main Creek and Station Creek. The model was updated to also include RIV cells for Yorks Creek and Swamp Creek at MGO.

Consistent with the approach by AGE (2019), the RIV package bed conductance was calculated from river width, length, riverbed thickness, and an estimated vertical hydraulic conductivity of the riverbed material. The stage height in the river package was set to zero for all river cells representing rivers/creeks throughout the time, as per assumptions by AGE (2019). **Figure 4.5** shows the river cells in the model.

The RIV package was also applied in the Umwelt (2024) model to represent water and tailings storage facilities at key locations that weren't previously included in the AGE (2019) model. This addition improved the model's ability to reproduce observed groundwater trends in areas influenced by these storages. In the most recent model update for the Modification, the West Pit TSF is no longer represented using the RIV package; instead, it has been incorporated using a GHB package to assure it accurately replicates the water level trend in the TSF.

A summary of the water tailings/water storage areas represented in the model using the RIV package and the assumptions applied is included in **Table 4.3**. The focus of the model was on key water storage areas to achieve the model objectives for MGO. Water storage facilities at other surrounding mines were not included.

Table 4.3 TSF/Dams modelled using RIV Package

Mine	Name		Layer	Stage/Head	Duration
MGO	RW Pit Dam	Former TSF within RW Pit, to the north of BNP.	2	0.2 m Stage	2008–2015
MGO	BNP SD2	Small sediment dam north of BNP.	2	0.2 m Stage	2011–2034
MGO	RWD	SP Dam near CHPP	2	0.5 m Stage	1995–2038
MGO	ECD 2	SP Dam near CHPP	2	0.5 m Stage	1995–2038
MGO	TP1	Tailings storage at TP1	2	0.2 m Stage	2004–2019
MGO	ERP	Tailings storage within ERP (in-pit)	2	0.2 m Stage	2008–2019
MGO	WRD (TP2)	Tailings storage at TP2	2	0.2 m Stage	2008–2019
MGO	NVS2	North Void area, initially operated as a TSF, with current water storage (in-pit)	2	1 m Stage	1995–2014
Mountain Block	Dam 5				Mountain Block
	Shallow in-pit dam	2	140.8 mAHD Head	1980–2039	
LCO	Reservoir Dam	Existing dam	2-19	125 mAHD Head	2009–2039
LCO	Dam 1	Within disturbed ground, adjacent to Bowmans Creek and historical (pre-1980's) open-cut workings that have been subsequently backfilled	1	107.6 mAHD Head	1980–2039
LCO	Dam 3	Small surface dam with embankment wall to south	2	138.6 mAHD Head	1990–2039
LCO	Dam 4	Existing mine water dam (in-pit)	2, 4	111 mAHD Head	2000–2039
LCO	Dam 17	Existing mine water dam (in-pit)	2, 4	114 mAHD Head	1990–2039
LCO	Historical Dam	Historical TSF/Dam within Entrance Pit (in-pit), with the extent of the dam	4-17	105 mAHD Head	1990–2007

Mine	Name		Layer	Stage/Head	Duration
		informed from historical aerial photographs accessed via Google Timelapse.			

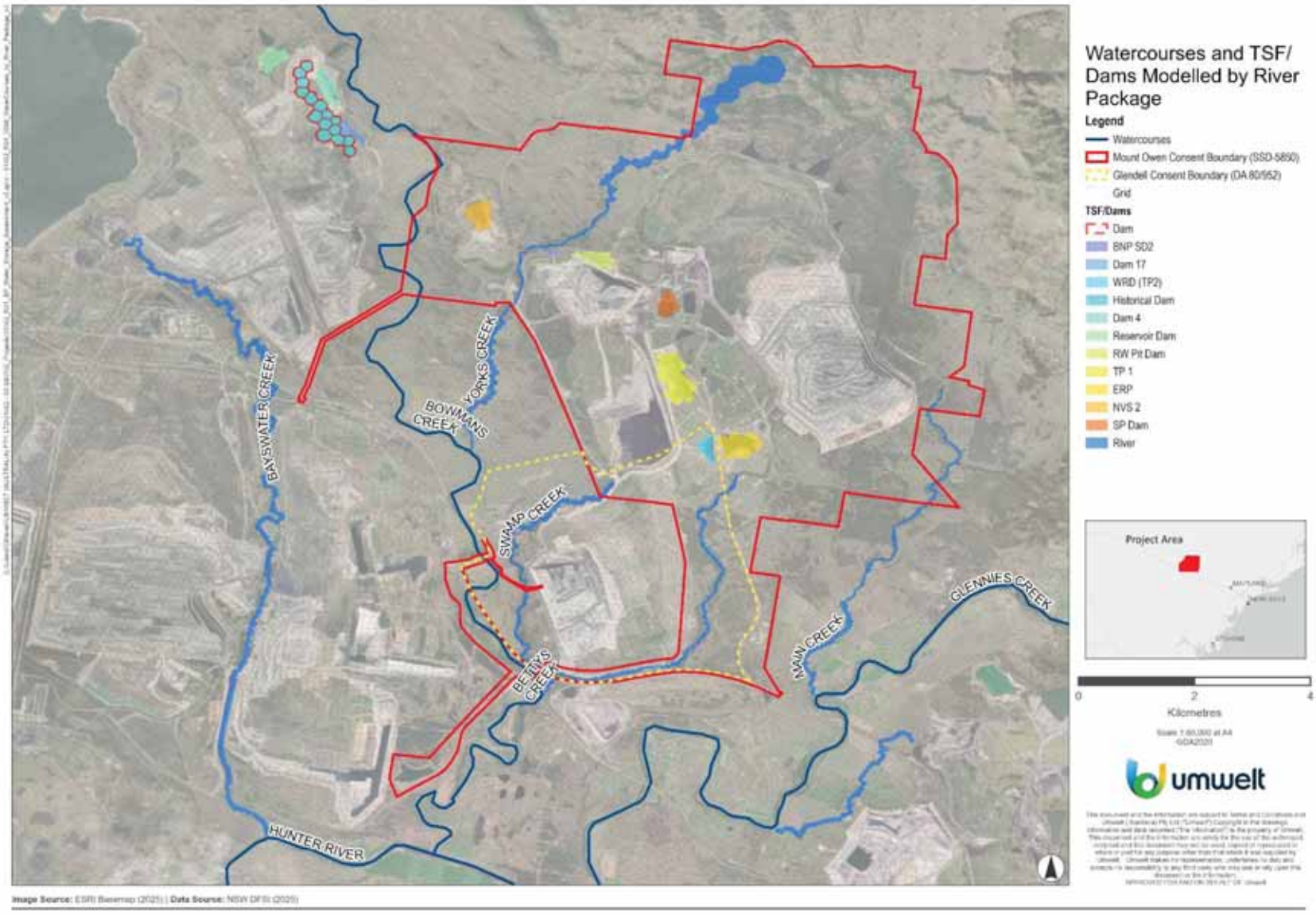


Figure 4.5 Watercourses and TSF/Dams Modelled by River Package

4.2.2.4 General Head Boundaries

GHBs applied to all the boundaries in the AGE (2019) model were maintained in the current model. GHB elevations from layer 1 through to the basement were assigned to replicate the regional flow gradient for this area, which is towards the north-east as reported in AGE (2019).

Umwelt updated the GHB package to incorporate the West Pit TSF into the model based on fill levels provided by Glencore, from 20 m AHD (2018) to 87.5 m AHD (2036). In the 2024 model update, this feature had been represented using the RIV package; however, switching to a GHB boundary in the Modification model update ensures that the head in the West Pit TSF consistently follows the specified time-varying water level trend.

The GHB package was also used to represent water storage in Barrett Pit and BNP and to constrain groundwater levels to observed trends from January to September 2025 for both pits.

4.2.3 Mine Areas

The model was updated to capture actual mine progression at MGO and surrounding mines up to 2025, and to account for current and foreseeable mining within these operations. Where no new information was available, the existing timing and extent of mining from the AGE (2019) model progression was used.

The model represented mine progression with the DRN package to dewater active mine areas, and the Time-Variant Materials (TVM) package to adjust cell parameters during and following mining. Maps showing the modelled mine progression are provided in **Figure 4.6** and **Figure 4.7**. Assumptions applied to the DRN and TVM packages for representing mining are summarised in in **Table 4.5**.

For open cut pits, the DRN package was applied from surface down to mined seam with a conductance of 100 m^2, consistent with the approach by AGE (2019). However, the model was updated to include actual pit progression from 2018 to 2025 and future mine progression based on current and foreseeable mine plans. The 2024 model update included an area previously mined to the north of North Pit, at North Void and Rix's Creek Mine that were not previously represented in the model. The current update refined open cut mine progression in North Pit, and Liddell's Entrance Pit and South Cut Voids.

For underground mine areas, the mine progression and timing was already updated from 2018 for Integra Underground to represent actual mine progression. Consistent with the AGE (2019) model the underground workings kept being represented with stacked drains with a drain conductance of 100 m2 within the mined seam and a reduced and variable drain conductance in layers above the longwall panels. These stacked drains were maintained in the model. The previous update by Umwelt (2024) included changes in hydraulic properties above longwall mining areas at Integra once the active mining/DRN cells were turned off, which was not previously represented in the model. This was applied as a change to horizontal (Kh) and vertical (Kv) hydraulic conductivity within the goaf zone and fractured zone above longwall panels. The ramp function, representing the reduction in fracturing with height above workings, that was applied in the last update was refined to better capture the fracturing effects above longwalls in the model. The model was sensitive to changes in properties above Integra Mine longwall panels, therefore manual and iterative testing was undertaken to determine parameter changes that could be run in the model and achieve the best fit to observed data at Integra Mine.

AGE (2019) represented historical bord and pillar workings at LCO at commencement of the model by applying specific yield (Sy) of approximately 50% within the historical mine areas. This assumption was maintained in the model; however, it is noted that an assumption of 50% may be higher than the actual void space represented in the model cell. The extent of historical underground workings at LCO were compared to current mine plans and identified some areas of mining omitted, this includes workings within the Pikes Gully Seam. Any areas of mining not captured in the model were added in the previous update. The current update applies new spoil hydraulic properties to improve the historical match as summarised in **Table 4.4**.

The AGE (2019) model also did not apply changes to hydraulic properties above longwall panels or second workings at LCO, Ravensworth or Ashton Mines. Effort was made to represent changes in hydraulic properties above the workings; however, the model was sensitive to changes and could not be effectively adjusted within the timeframe available. The model updates were focused on improving model fit at MGO. Further work could be undertaken to refine how surrounding mines are represented in the model in future but are not considered material to the assessment of impacts associated with changed void water management in Barrett Pit.

Table 4.4 Mine Area Property Changes

Mine Type	Details	DRN conductance (m^2/day)	Kh (m/day)	Kv (m/day)	Sy (%)	Ss (m^{-1})
Spoil Everywhere	Pits backfilled with spoil to the final landform surface (where provided). Backfill timing based on provided landform surfaces (i.e. Ravensworth) and where no information provided, assumed to be applied three years following active mining.	-	5	1	10%	1 x 10-4
Spoil LCO Entrance Pit			1			
Void	Void areas assigned based on final landform surface (where provided). Void properties maintained as per AGE (2019) parameters.	-	1000	1000	100%	1 x 10^{-5}
Bord and pillar/ Mains	Bord and Pillar at Cumnock, mains for Integra and any remaining workings for LCO not already captured in the model.	100	0.3	0.3	5%	8 x 10^{-6}
LCO Entrance – South Pit Underground Connection	Different properties teste to get the closest result	100	5	1	10%	1 x 10-4

Mine Type	Details	DRN conductance (m^2/day)	Kh (m/day)	Kv (m/day)	Sy (%)	Ss (m^{-1})
Longwall Goaf–Integra & LCO	Occur in Layer 14 and Layer 15 in Liddell Underground. Goaf within mined layer and layer above.	100	X 100	X 100	-	-
Longwall Fracturing - Integra & LCO	Layer 11 to Layer 14 to represent the change in hydraulic conductivity with fracturing above longwall mining. Ramp function applied with multiplication factor.	Variable (AGE 2019)	X 100	X 100	-	-
Longwall Fracturing - Integra	Layer 7 to Layer 10. Ramp function applied with multiplication factor.	Variable (AGE 2019)	X 50	X 50	-	-
Longwall Fracturing - Integra	Layer 6. Ramp function applied with multiplication factor.	Variable (AGE 2019)	X 10	X 10	-	-
Longwall Goaf -LCO	Occur in Layer 14 and Layer 15 in Liddell Underground. Goaf within mined layer and layer above.	1	X 100	X 100	-	-
Longwall Fracturing - LCO	Layer 11 to Layer 14 to represent the change in hydraulic conductivity with fracturing above longwall mining. Ramp function applied with multiplication factor.	0.01	X 100	X 100	-	-
Longwall Fracturing - LCO	Layer 9 to Layer 10. Ramp function applied with multiplication factor.	0.01	X 50	X 50	-	
Second Work Goaf - LCO	Layer 15 or 13	1	0.3	0.3	5%	-
Second Work Fracturing - LCO	Two layers above the second work mined layer, layers 14-13 or 12-11	0.01	X 100	X 100	-	-

Note: x 10 indicates a multiplication factor applied to the in situ calibrated parameters, with x 10 indicating an order of magnitude increase.

Within the model domain the surrounding mines utilise underground workings for water storage and water sources (dewatering). This has an influence on the observed groundwater levels and groundwater conditions, therefore was represented in the Modification model as summarised in **Table 4.5**.

Table 4.5 Underground Dewatering and Storage

Area	Location	Method	Assumptions
LCO	M49, Mt_Owen, HAZ_6, HAZ_1_2 and HAZ_3 (layer 15)	GHB/DRN package	To replicate underground dewatering at LCO, general head boundary (GHB) package set to the observed water level in underground workings as per AGE (2019) model assumptions. DRN package was used on M49 and HAZ_6.
Cumnock Colliery	Site 1 and 2 (layer 14)	WEL package	To replicate injection of water/tailings into Cumnock Colliery between 2005 to 2010, WEL package was applied at two locations with a rate of 350 ML/year (700 ML/year total) as per reported injection volumes.

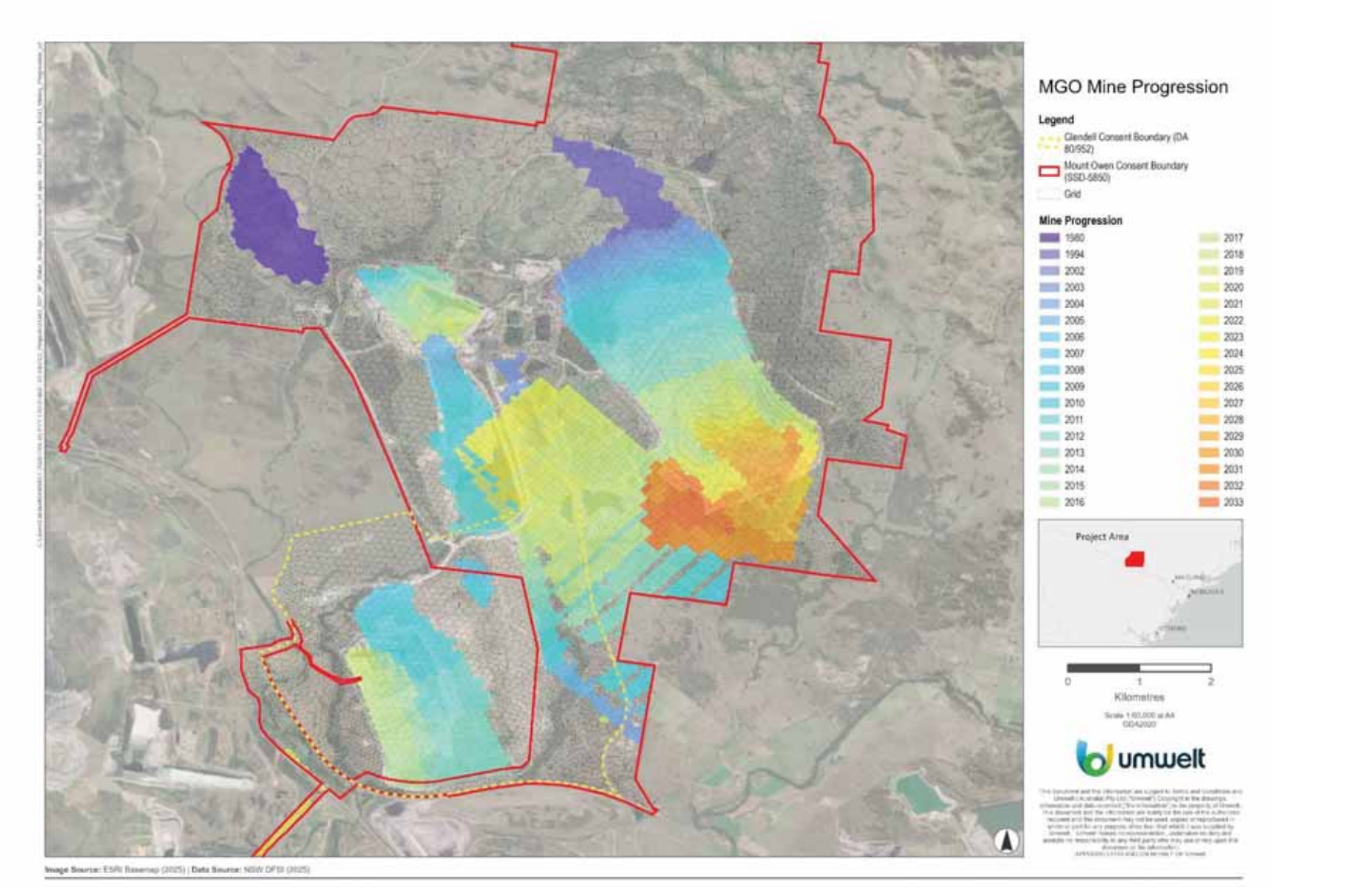


Figure 4.6 MGO Mine Progression

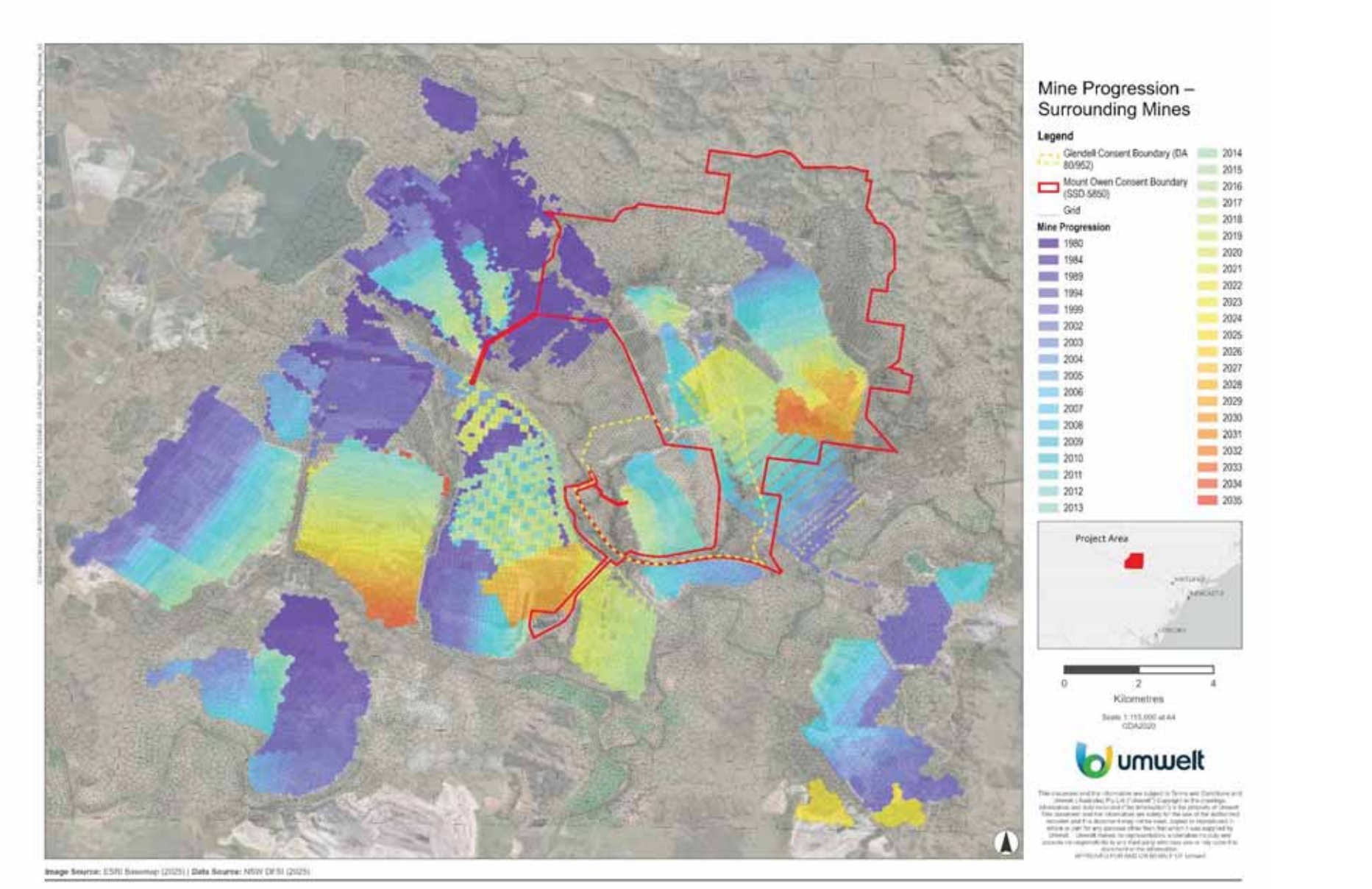


Figure 4.7 Mine Progression – Surrounding Mines

4.2.4 Water Storage and Voids

The AGE (2019) model represented the final voids at MGO (BNP, Barrett Pit and North Pit) LCO, Ravensworth and HVO using CHD package. The CHD package represents fixed water levels as defined in the model and these levels are applied constantly for the duration of the model as the package cannot be turned off. The approach to representing post closure groundwater conditions was updated to include the current final landform surfaces for MGO, LCO, Ravensworth Operations plus the approved final landform for Rix's Creek Mine. This landform was used to determine spoil backfilling levels within pits (TVM) and the EVT surface. The AGE (2019) assumption for final voids at HVO were maintained in the model due to the distance of these voids from operations at MGO.

As was already applied to the model updated by Umwelt in 2024, the final void locations were estimated based on the new approved final landform and applied to the model, as shown in **Figure 4.8**. The final void areas are given void properties, with a Kh and Kv of 1,000 m/day, Ss of 0-5 1/m and Sy of 100%. The void properties were assigned to the model layers corresponding with the final landform surface, which is variable across the model domain due to the model layer structure with pinched out layers.

Recharge was applied to the spoil and in situ rock as per the existing model assumptions, and enhanced recharge was applied to the final voids to factor in additional surface water runoff to final voids (**Table 4.2**). Umwelt updated Recharge over LCO Entrance and South voids and over the Bayswater spoil to enhance the fit in those areas during the Modification model update.

Xenith engaged ATC Williams to model water storage in Barrett Pit and BNP. This process involved Umwelt running the groundwater model with no recharge over the voids and reporting the voids' water budget to ATC Williams. ATC Williams then provided Umwelt with the modelled water levels based on their surface water analysis for different percentile scenarios (10th to 95th) and the maximum level scenario. After consultation with ATC Williams, Umwelt adopted the maximum level scenario for the basecase to ensure that the stored water level remains higher than the natural recovery level at all times. Additionally, Umwelt ran two high-percentile scenarios (95th and 90th) as sensitivity cases, as described in **Section 4.3**. The provided water levels are forced over the two pits using GHB package as explained in **Section 4.3**.

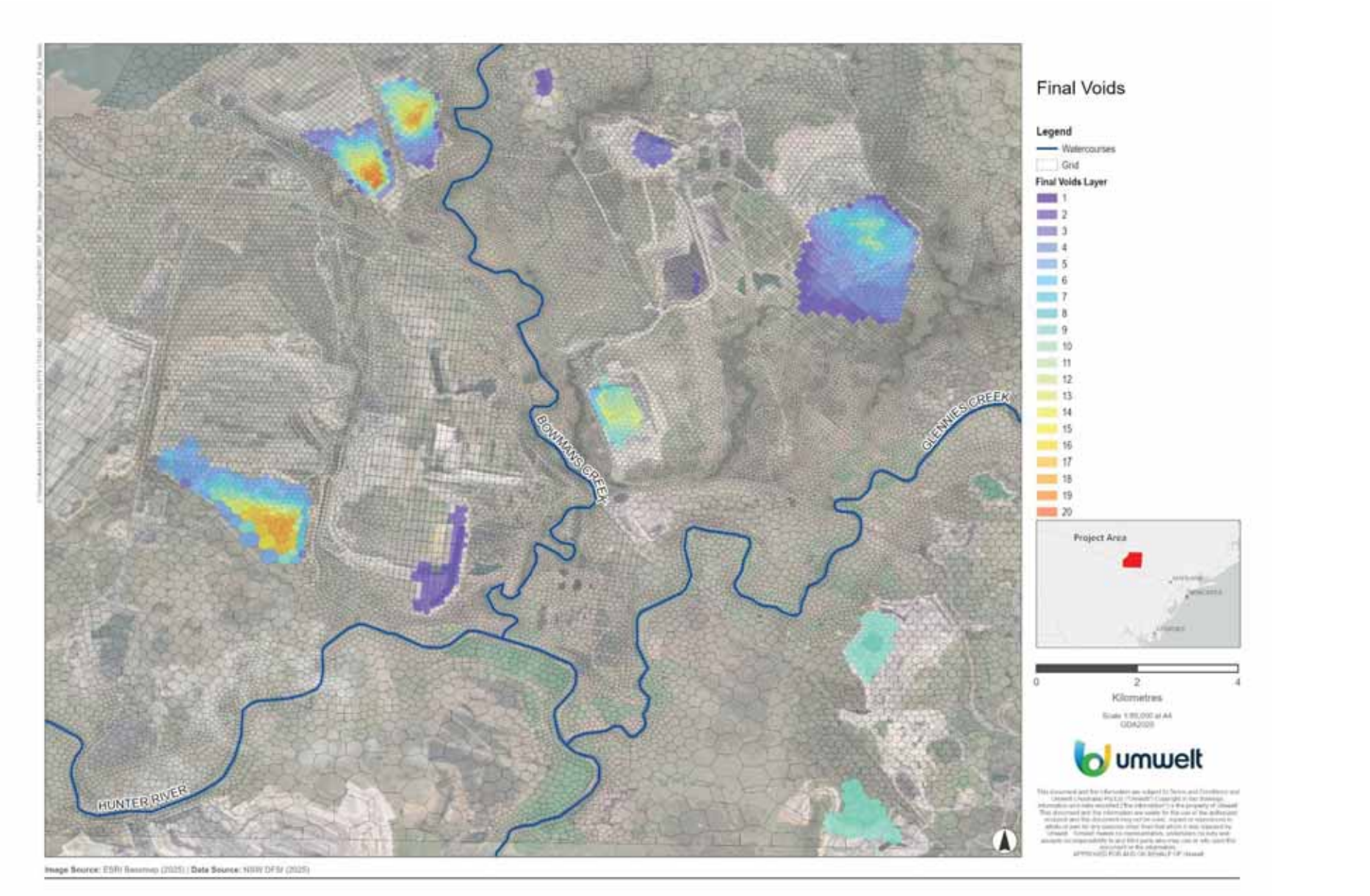


Figure 4.8 Final Voids

4.3 Model Runs and Sensitivity

The model was run with four scenarios:

- NULL – a model run that represents natural conditions for the full model timeframe but excludes any mining (historically or in future)
- Approved No MGO – represents all mining at surrounding operations but no previous or future mining at MGO. Required to extract MGO only impacts.
- Approved All Mining – represents all mining at MGO and surrounding mine operations.
- Approved plus Modification – approved scenario plus storing water from October 2025 following the levels received from surface water model.

It should be noted that mine water can be stored within the Bayswater North Pit (BNP) under current approvals. Storage volumes in Barrett Pit are intrinsically linked to the storage volumes in BNP, as the latter is the primary water storage which is predicted to be dewatered to Barrett Pit. As such, it has been necessary to consider water storage in BNP as part of the 'Approved plus Modification' scenario. This assumption also enables the predictions of the 'Approved plus Modification' scenario to reflect cumulative impacts in the future.

The results of the modelling will reflect groundwater 'mounding' in the vicinity of the BNP. This mounding would occur under the 'Approved All Mining' scenario and is not a consequence of the Modification. The Modification would result in difference storage volumes in BNP (due to dewatering to Barrett Pit), but these difference storage volumes would not significantly affect the degree of mounding predicted around BNP.

The GHB package was used to force the water levels over Barrett Pit and BNP the two pits in the Approved plus Modification case.

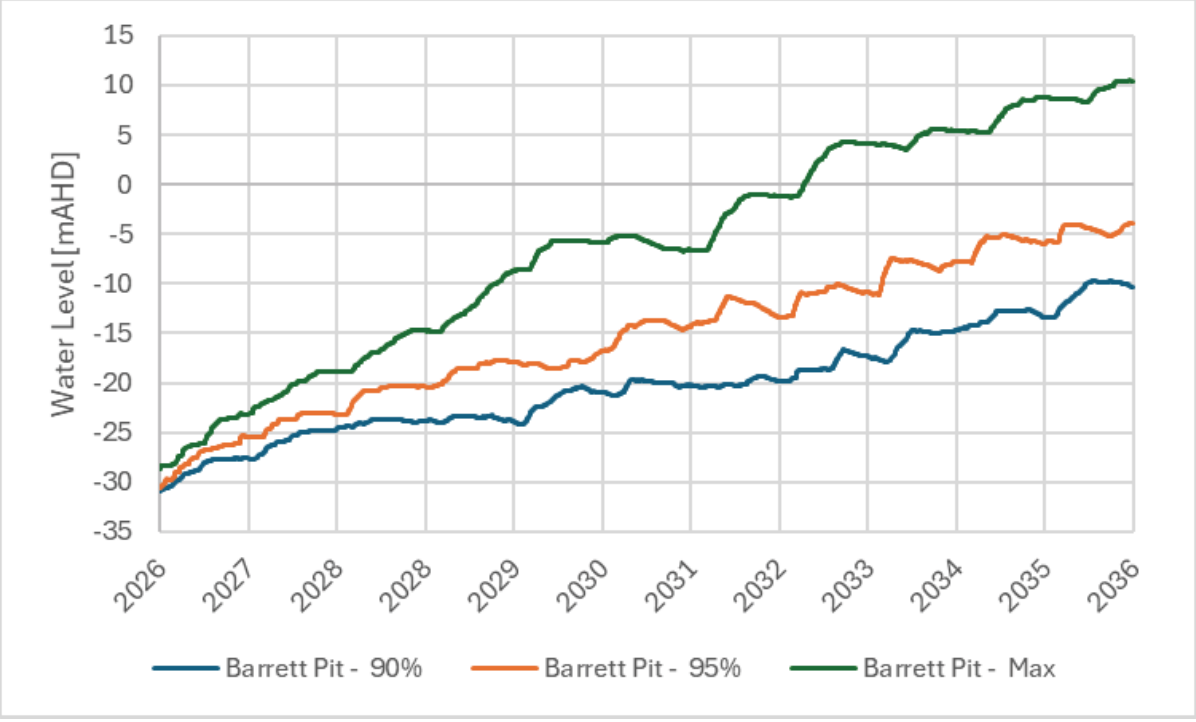


Figure 4.9 Water Storage Levels with Time for Barrett Pit

The model was also run with sensitivity analysis to assess how changes in hydrogeological properties and storage levels impact the Modification water level predictions. The sensitivity scenarios run for the calibration period and predictive period are shown in **Table 4.6**. The model verification results are presented based on the basecase run. However, where relevant, results from the sensitivity runs are included in the discussion.

Table 4.6 Sensitivity Runs

Run	Storage water level	Fault	Weathering
Basecase	Max	No	No
Case 1	95 percentile	No	No
Case 2	90 percentile	No	No
Case 3	Max	Yes – Barrett Fault Kh and Kz Multiplied to 10	No
Case 4	Max	Yes – Barrett Fault Kh and Kz set to 0.1 m/day	No
Case 5	Max	Yes – Barrett Fault + Ashton Fault Kh and Kz multiplied to 10	No
Case 6	Max	No	Yes – Kh,Kz,Sy increased 20% in layers with depth < 30 m
Case 7	Max	No	Yes – Kh,Kz,Sy decreased 20% in layers with depth < 30 m

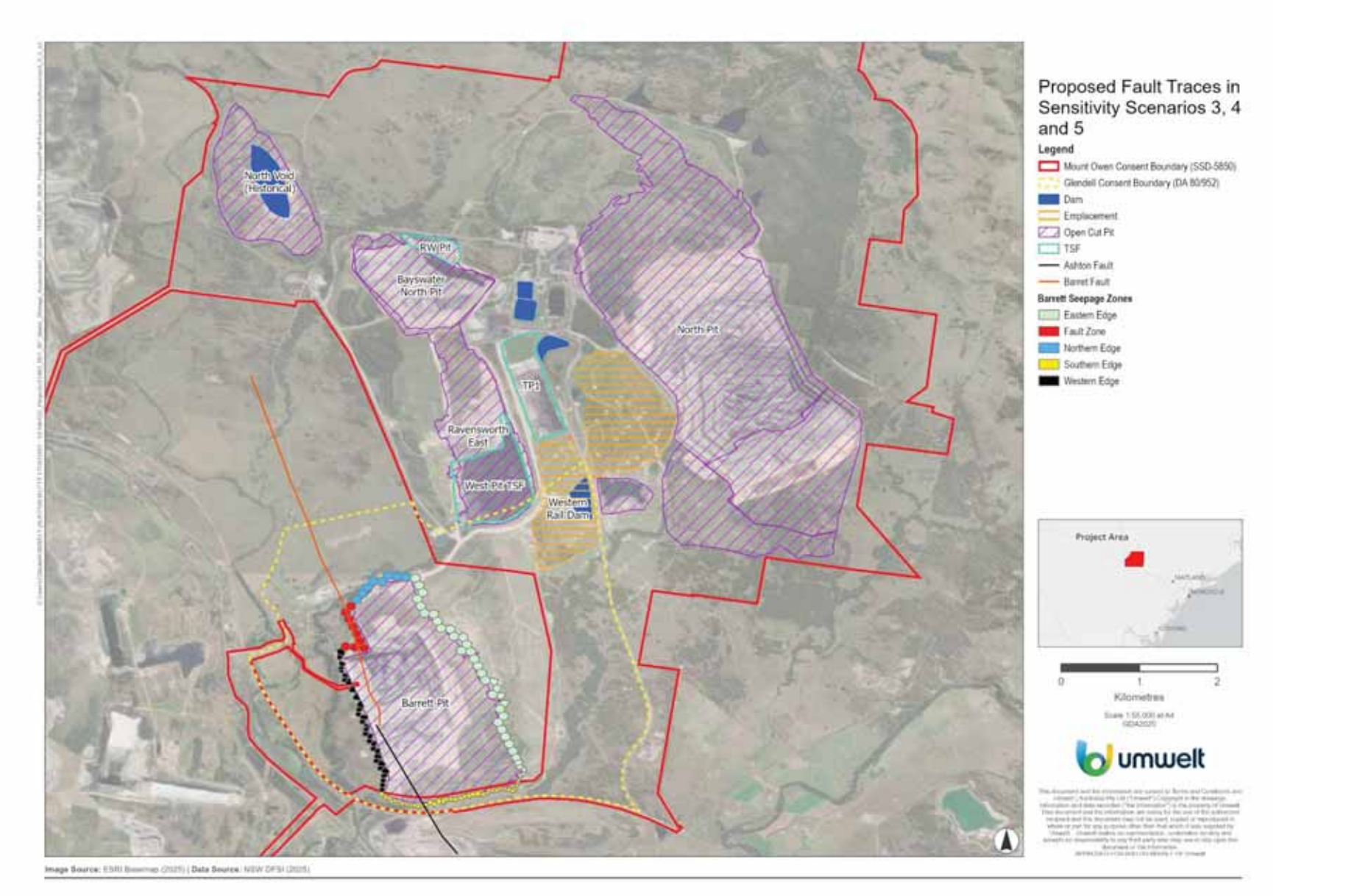


Figure 4.10 Proposed Fault Traces in Sensitivity Scenarios 3, 4 and 5 with Seepage Zones

4.4 Particle Tracking

The head gradients and cell-by-cell flows from the cumulative predictive/recovery groundwater model were used to simulate 3D advective particle tracking with mod-PATH3DU (Muffells, et al., 2022). Advective particle tracking was achieved using the 'Waterloo method'. Particles were released from the top of the model (layer 2) in January 2026 and were permitted to cross layer boundaries depending on the saturation and vertical gradients between the layers. Porosity was assumed to be 1% higher than the specific yield in the model.

4.5 Model Verification

The existing AGE (2019) model calibration extends to 2018. Umwelt (2024) extended verification of the basecase model performance with observed groundwater level data up to October 2024. Now it is extended to October 2025.

4.5.1 Observation Targets

The model verification process included 451 groundwater locations (bores and VWP sensors), including:

- 228 groundwater locations at MGO
- 36 groundwater locations at LCO
- 129 groundwater locations at Ravensworth Operations
- 57 groundwater locations at Integra Mine
- One registered private bore.

The observation targets were based on locations within the AGE (2019) model, with updates made in 2024 by Umwelt to include an additional 48 groundwater monitoring locations and additional groundwater level readings. The observation targets, along with their location, layer attribute, and site name, are listed in **Appendix B**.

4.5.2 Verification Statistics

A common industry standard to evaluate the calibration performance of a groundwater model is calculating the error between the modelled and observed groundwater levels using the root mean square (RMS) error, which is defined as:

$$RMS = \left[\frac{1}{n}\sum(h_m - h_o)_i^2\right]^{0.5}$$

where:

n = number of measurements

ho = observed groundwater level

hm = modelled groundwater level

RMS is assumed to be a good measure of error when errors are normally distributed. The acceptable value for the calibration criterion depends on the magnitude of the change in heads over the model domain. If the ratio of the RMS error to the total head range in the system is small, the errors are only a small part of the overall model response. This is assessed using the Scaled RMS, which divides the RMS by the observed head range.

The summary of transient verification statistics for MGO monitoring locations is presented in **Table 4.7**. This is presented for the full dataset range. The scaled unweighted RMS (SRMS) of 6.41% indicates a good match for the type of system being modelled as per the Australian Groundwater Modelling Guidelines (Barnett, et al., 2012). The AGE (2019) model calibration showed a residual mean of -0.42 and SRMS of 7.8%, indicating comparable model performance for MGO. Umwelt (2024) showed SRMS of 5.4%.

The observed versus modelled water levels are showing in the scatter graph in **Figure 4.11**. Ranges for observed and modelled levels and the average absolute residual for the bores is also included in **Appendix C**.

Table 4.7 Verification Statistics – Transient – MGO Bores

Unweighted Statistics	Site Monitoring Data
Residual Mean (m)	-0.9
Absolute Residual Mean [m]	14.93
RMS (m)	17.89
Scaled RMS (%)	6.41

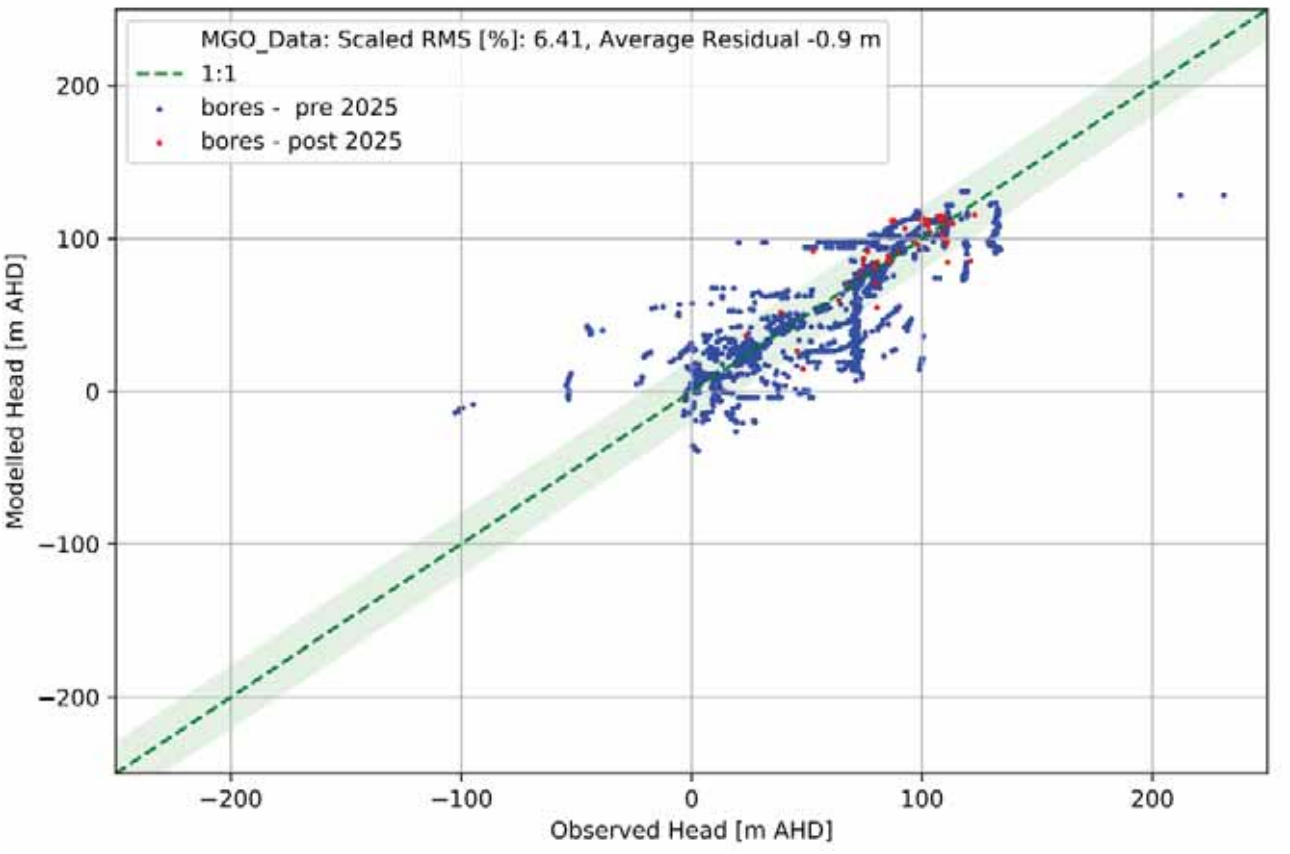


Figure 4.11 Model Verification Scatter Graph–MGO Bores

The summary of transient verification statistics for all bores within the model domain is presented in **Table 5.8**, and a scatter graph shown in **Figure 4.12**. The SRMS for all bores (unweighted) is 9.58%. This is slightly higher than previously reported RMS by Umwelt (2024) of 8.4% However, the SRMS is considered acceptable for the purpose of this assessment. A summary of the average residual for all bores is included in **Appendix C**.

Table 5.8 Verification Statistics – Transient – All Bores

Statistics	Site Monitoring Data
Residual Mean (m)	5.7
Absolute Residual Mean [m]	34.9
RMS (m)	55.0
Scaled RMS (%)	9.58

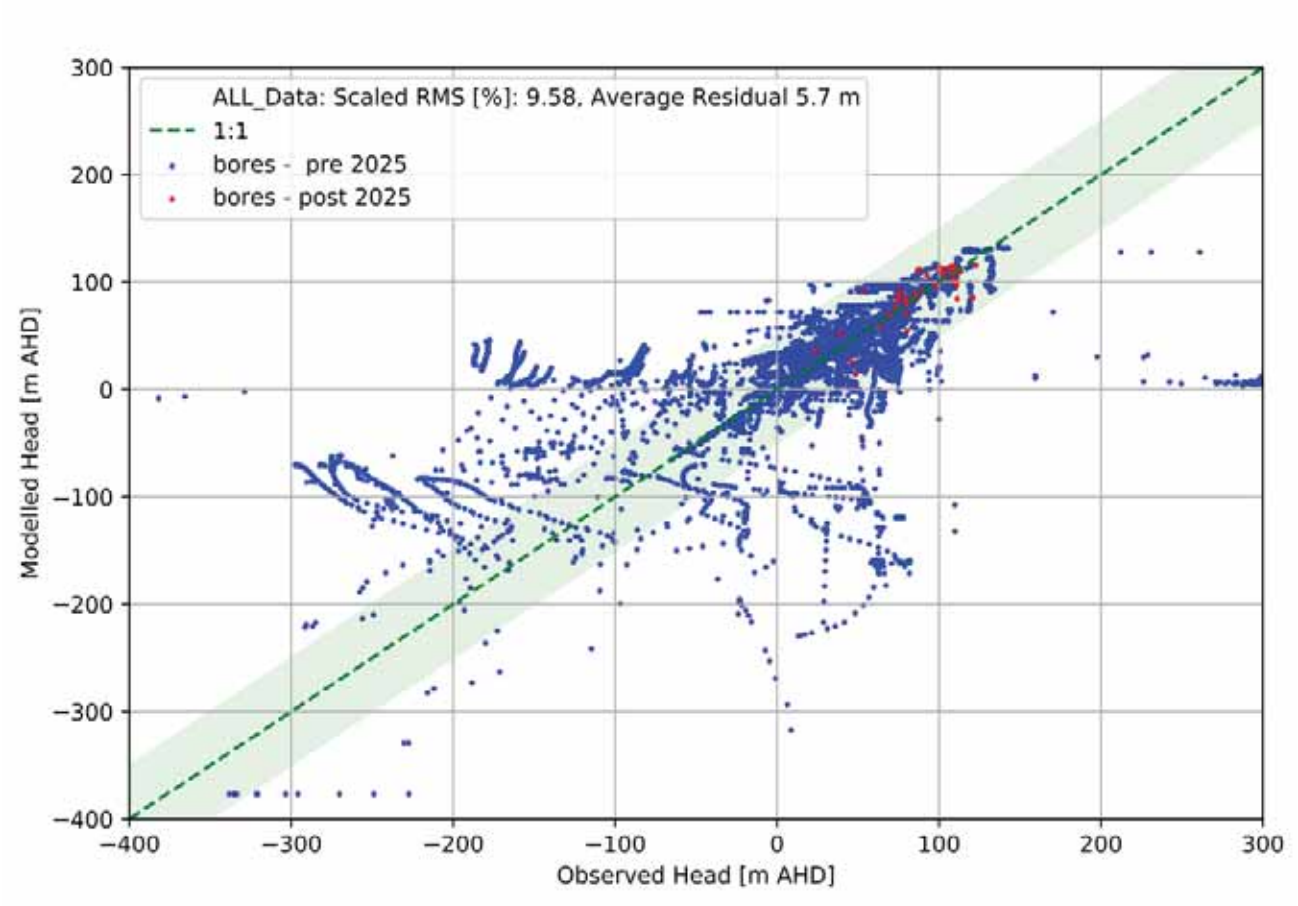


Figure 4.12 Model Verification Scatter Graph – All Bores

4.5.3 Groundwater Level Trends

Hydrographs for the verified modelled and observed water levels for the bores are shown in **Appendix D**. A selection of hydrographs around MGO are shown in **Figure 4.13** to **Figure 4.25**.

The model shows a good fit to observed trends in drawdown around North Pit, as shown in **Figure 4.13** for NPZ7/NPZ7a, and **Figure 4.14** for SMO057. The model shows a good fit to groundwater

elevations at most locations; however the model does under predict groundwater elevations in some of the deeper layers, at NPZ7a (Layer 6). The difference in groundwater elevation is consistent with previous predictions by AGE (2019) for NPZ7a and may relate to the approach of simplifying model layers (vertical discretisation), with bore depths not exactly aligning to layer depths.

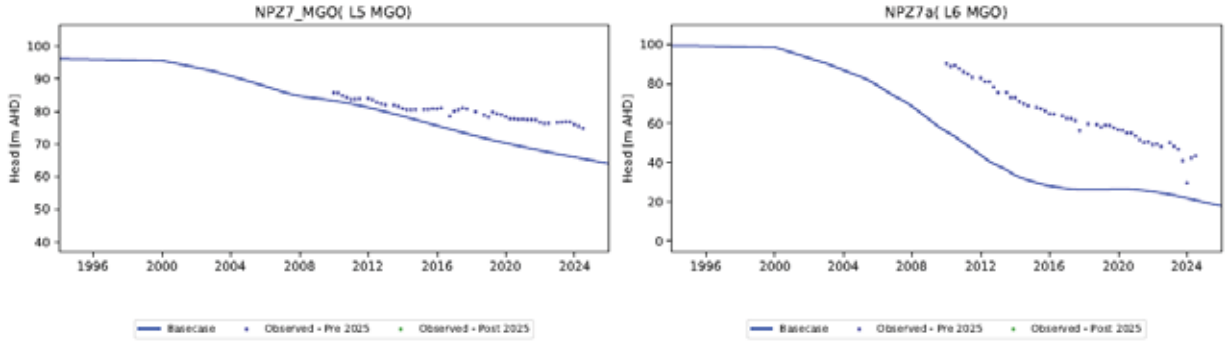


Figure 4.13 Hydrograph Modelled and Observed Groundwater Levels at NPZ7_MGO and NP7a (North Pit)

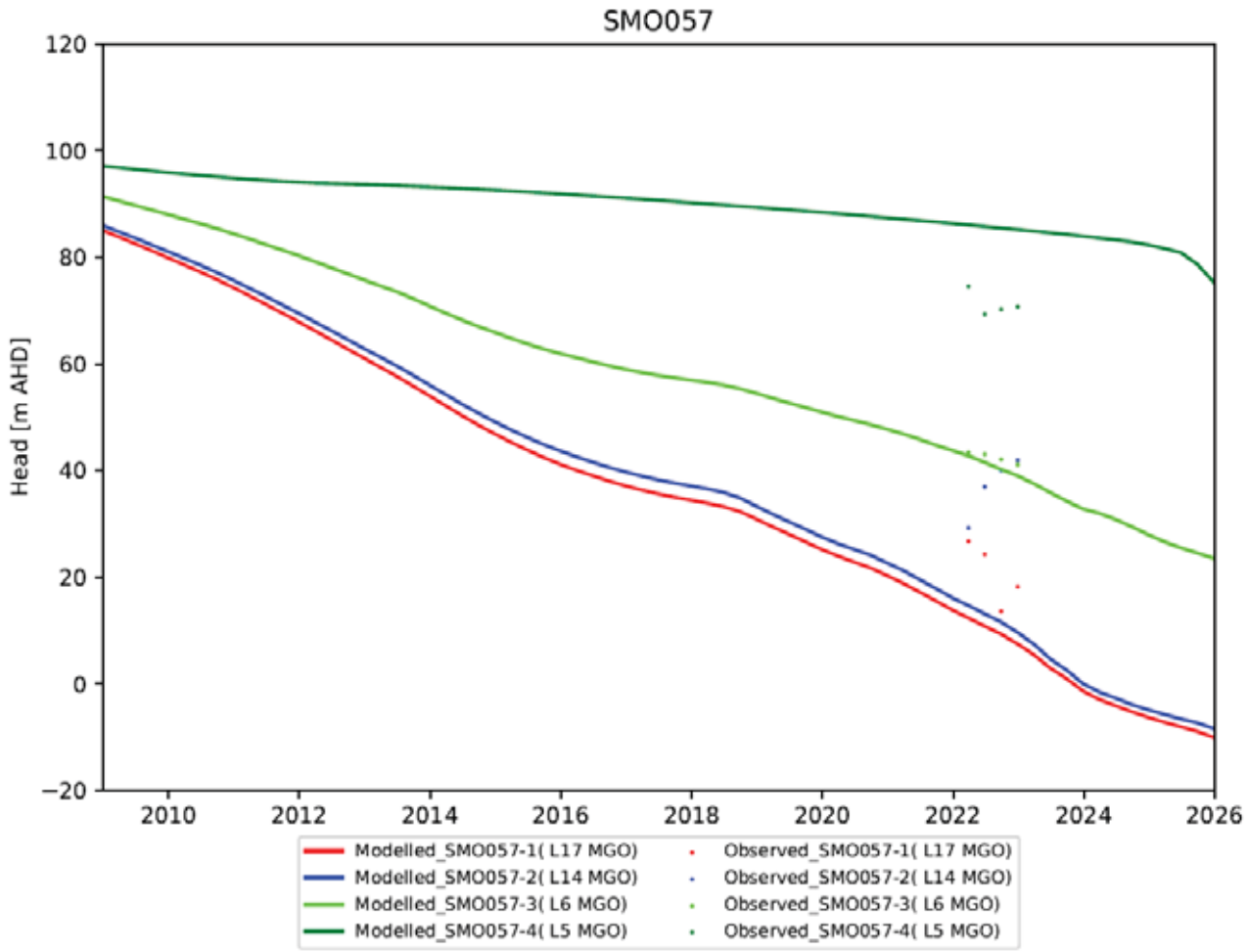


Figure 4.14 Hydrograph Modelled and Observed Groundwater Levels at SMO057 (North Pit)

The model shows a good fit to observed groundwater level trends at NPZ15 and NPZ16, with a good fit to groundwater elevations at NPZ16a. However, the model under-predicts groundwater elevations in

layer 6 (NPZ16) consistent with previous predictions by AGE (2019). This may relate to the model layering for layer 6.

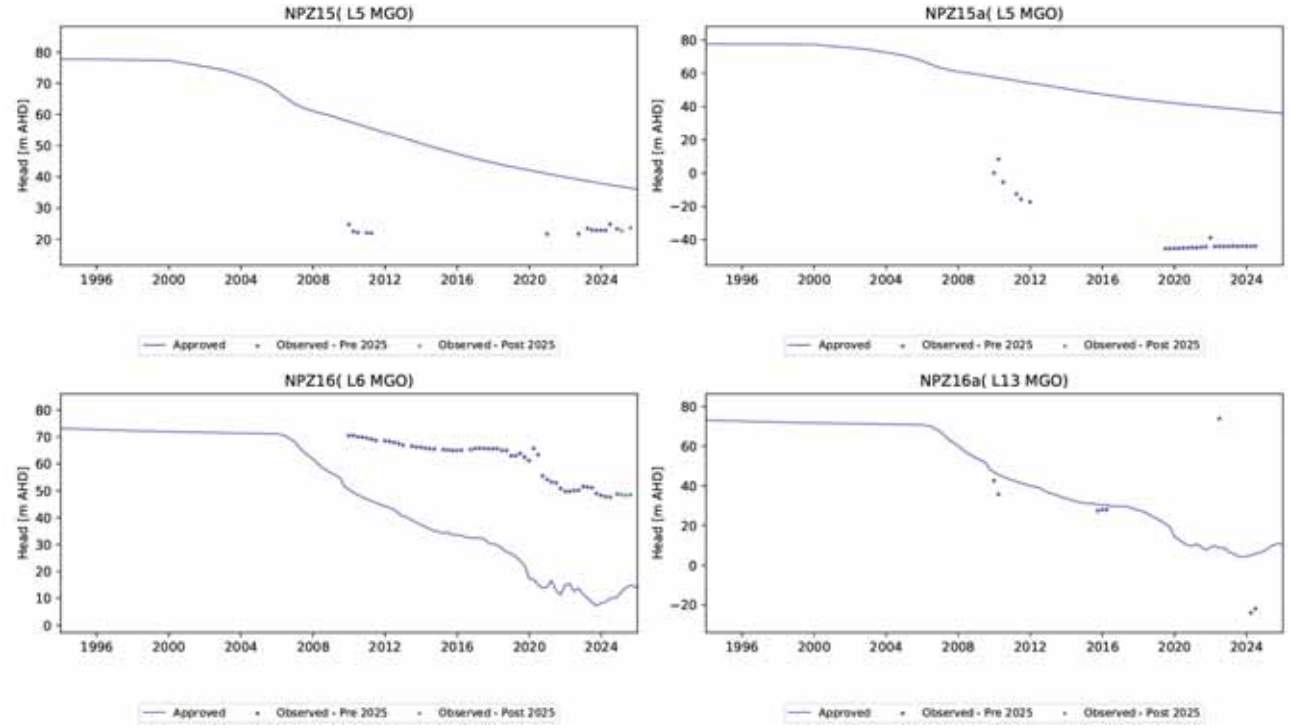


Figure 4.15 Hydrograph Modelled and Observed Groundwater Levels at NPZ16 and NPZ16a (Bettys Creek)

Bore NPZ14 and NPZ14a show a good fit to observed trends in groundwater levels, consistent with AGE (2019). However, consistent with AGE (2019) the model response to mining is slightly delayed compared to observed trends for NPZ14. This may relate to how historical mining was represented in the model near Barrett Pit, which was not changed in the updated model. However, this would not impact on how the model represents current groundwater conditions. This is indicated with **Figure 4.18** for shallow bores GA1 and GA2 that show a good fit between modelled and observed groundwater levels.

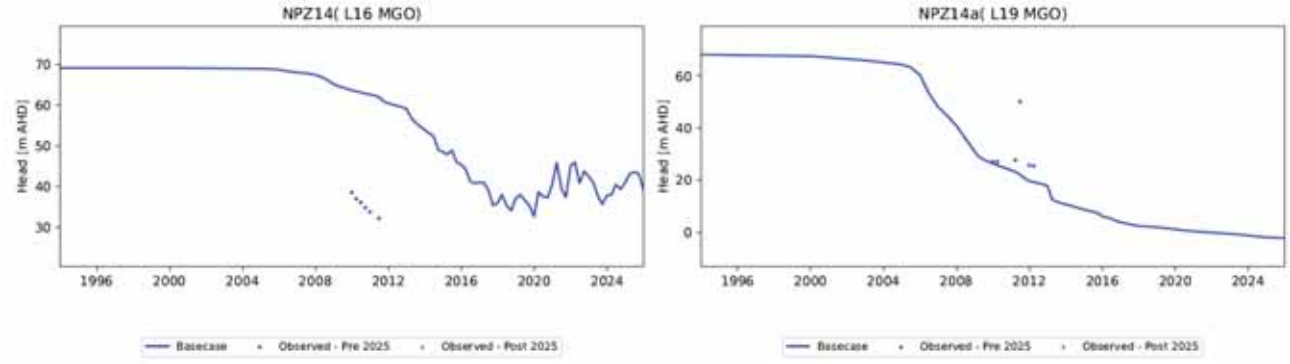


Figure 4.16 Hydrograph Modelled and Observed Groundwater Levels at NPZ14 and NPZ14a (Barrett Pit)

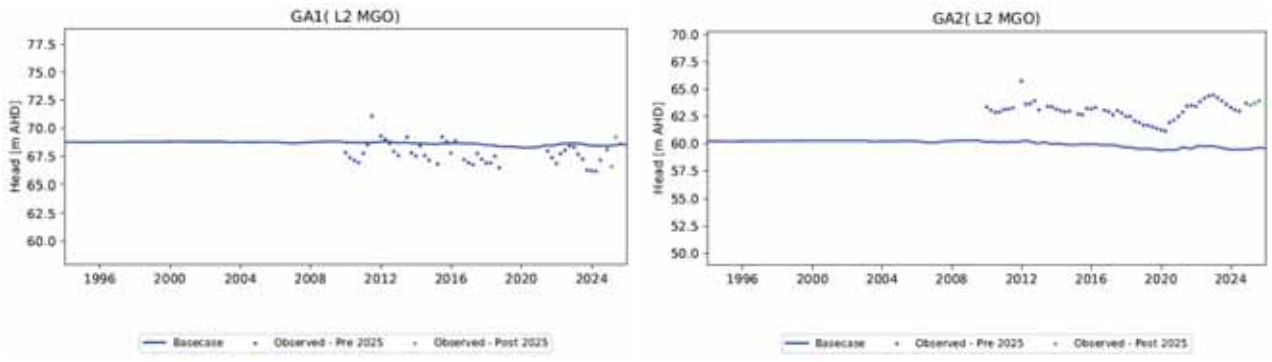


Figure 4.17 Hydrograph Modelled and Observed Groundwater Levels at GA1 and GA2 (Barrett Pit)

Figure 4.19 shows the modelled and observed levels for shallow bores along Swamp Creek. The results show a good fit in groundwater elevations and trends between modelled and observed conditions, with improvement in the groundwater level response to climatic conditions compared to AGE (2019).

It is noted that the model predicts unsaturated conditions (groundwater level below the model layer) for Layer 1 at BC-SP15 from around 2016. This is visible by the rapid changes in modelled water level and low elevations, well below the layer base.

Figure 4.20 shows that the model captures groundwater level trends and seasonality, with predicted groundwater elevations within 4 m of observed groundwater elevations for shallow bores along Yorks Creek.

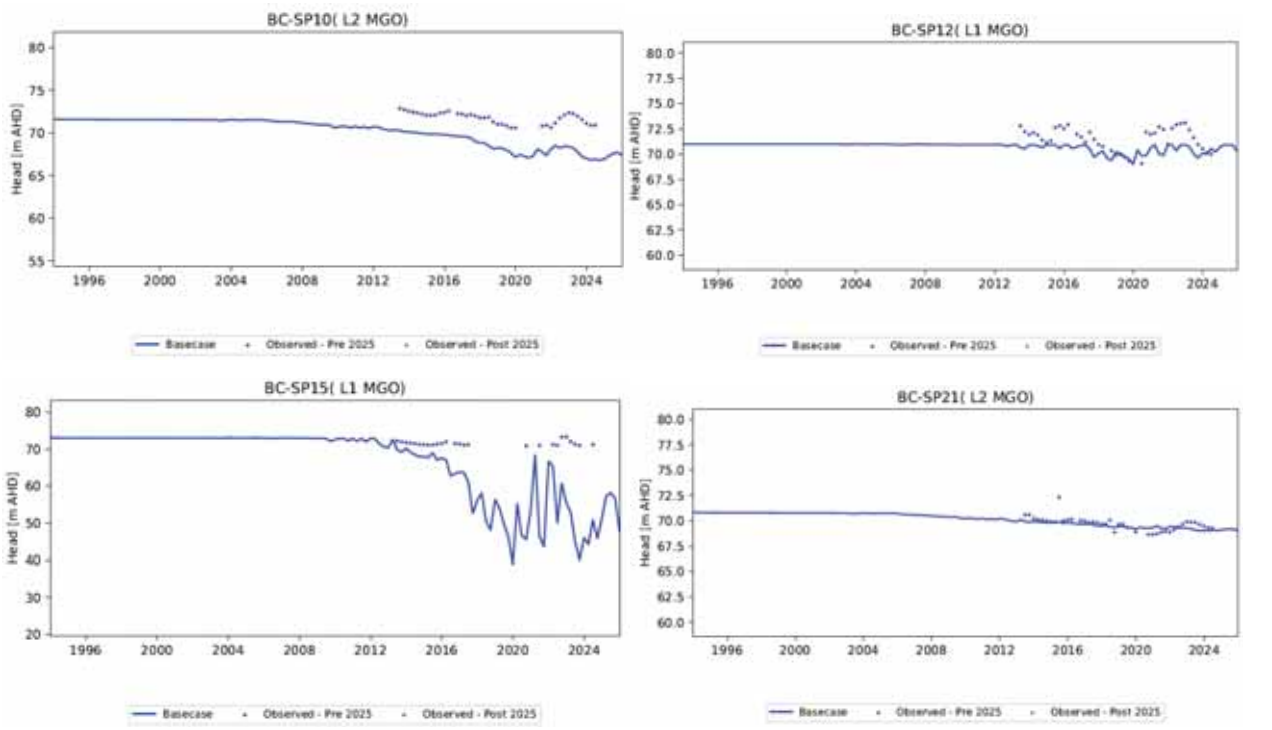


Figure 4.18 Hydrograph Modelled and Observed Groundwater Levels at BC-SP10, BC-SP12, BC-SP15 and BC-SP21 (Swamp Creek)

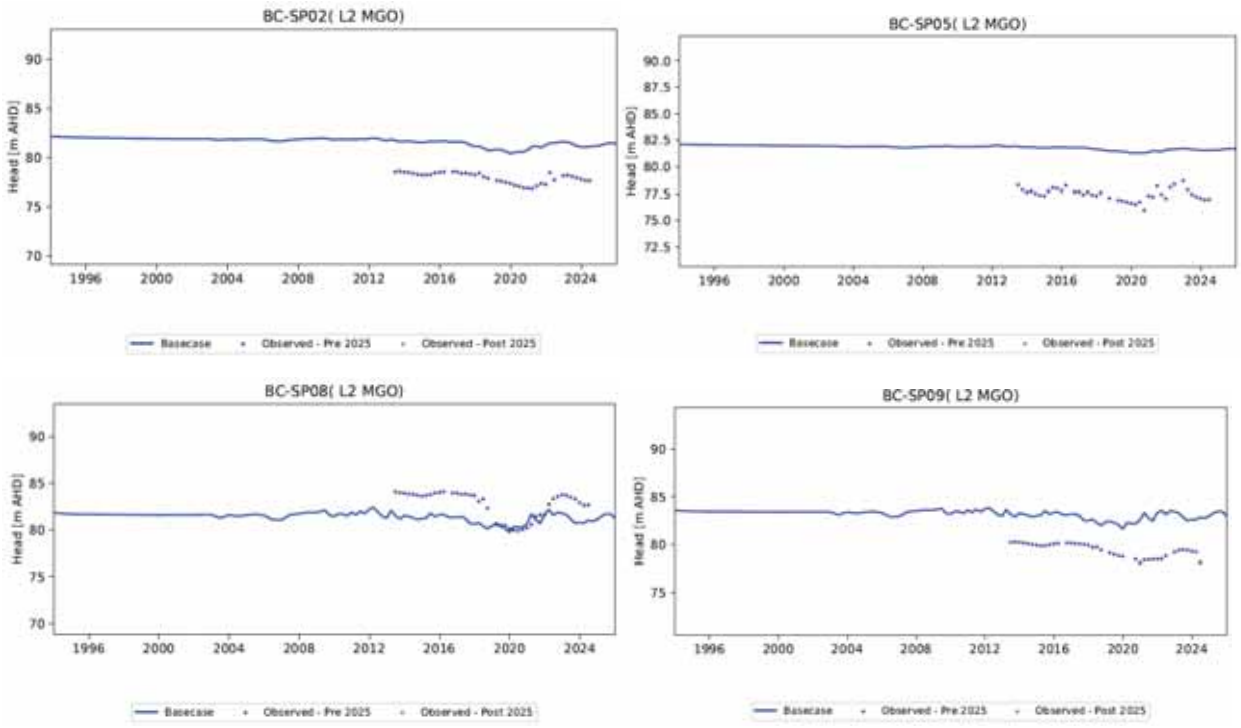


Figure 4.19 Hydrograph Modelled and Observed Groundwater Levels at BC-SP02, BC-SP05, BC-SP08 and BC-SP09 (Yorks Creek)

Figure 4.21 shows the modelled and observed groundwater levels for VWP GNOH031 located to the west of MGO West Pit. The model represents the general downward gradient observed in the VWP, with a good fit to groundwater elevations for model layers 5 and 6. However, the model over-predicts groundwater elevations for the deeper layers (L12 and Layer 14) where observed groundwater elevations are at around -50 mAHD and -100 mAHD, respectively. This is consistent with the model results by AGE (2019). There is no active mining in the immediate vicinity of the VWP. The observed trend may relate to mining at Integra mine, which is located approximately 1 km to the east of the VWP.

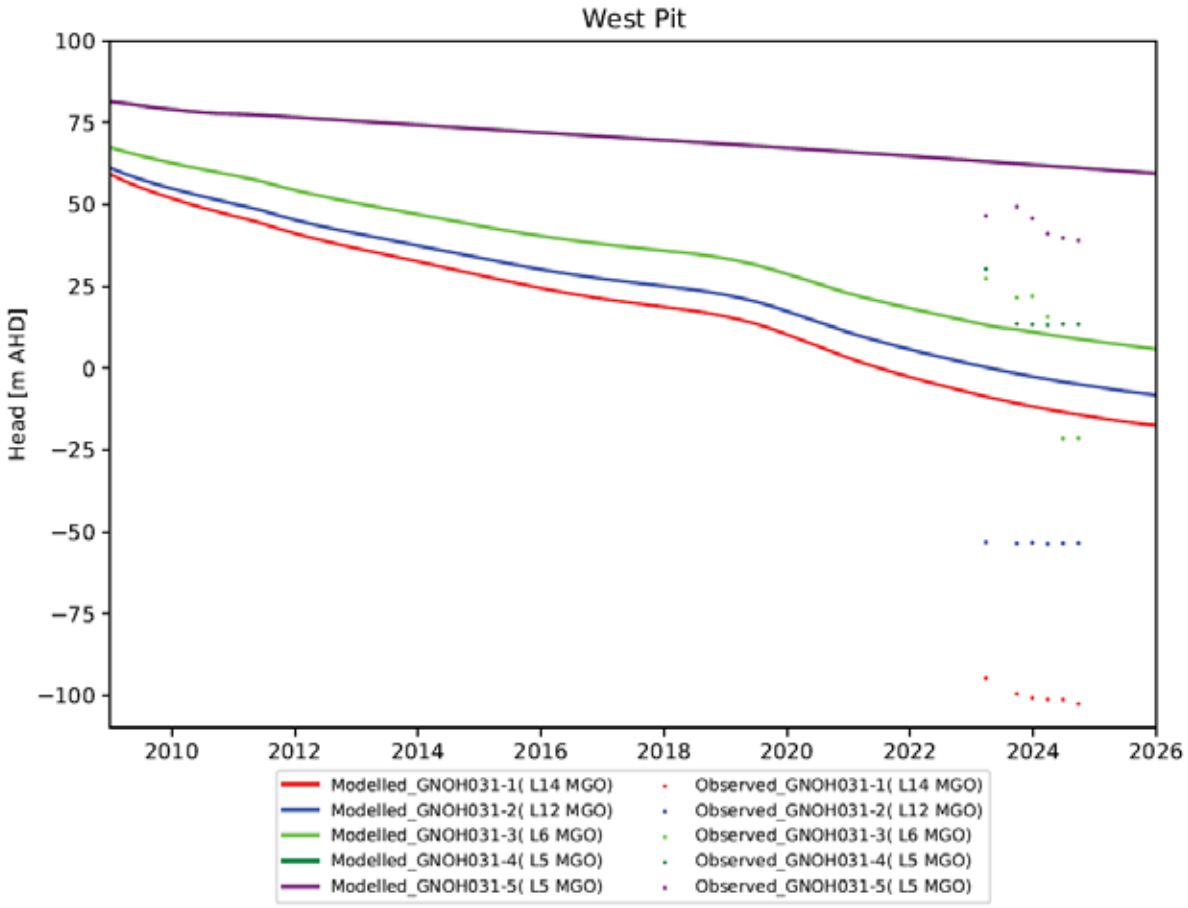


Figure 4.20 Hydrograph Modelled and Observed Groundwater Levels at GNOH031 (MGO West Pit)

Bore BNO004 is located to the east of BNP, targeting the Lemington Seam and interburden at around 150 m depth. Consistent with AGE (2019), the model under-predicts groundwater elevations by approximately 20 m. This may relate to the model layering, with Layer 5 approximately 90 m thick at this location.

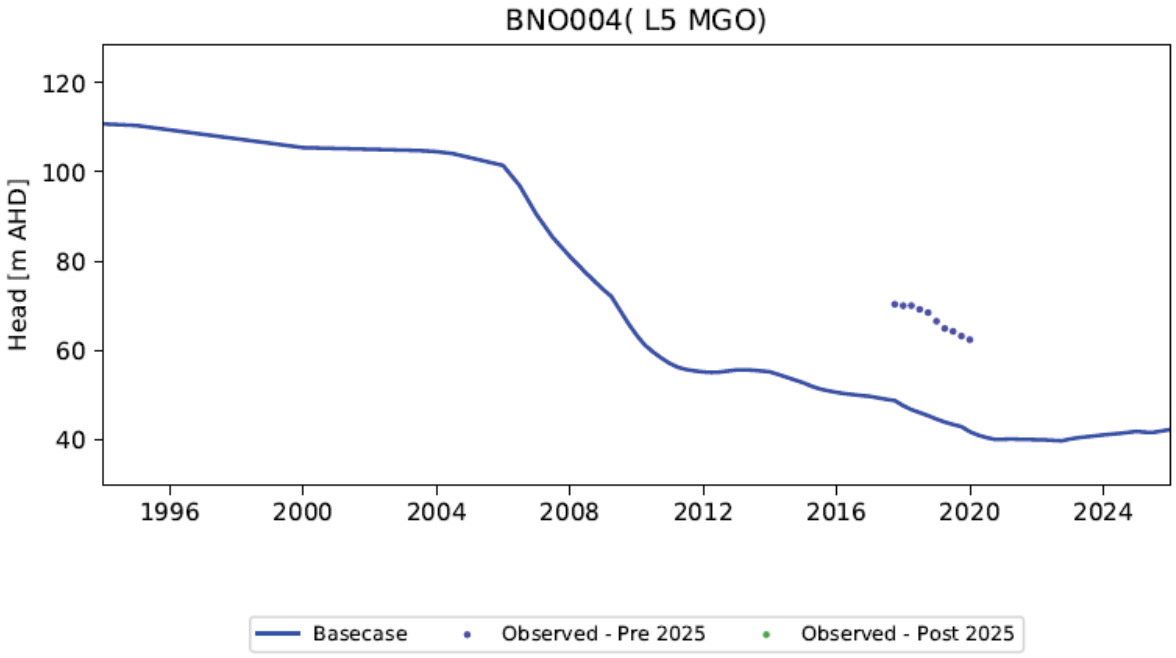


Figure 4.21 Hydrograph Modelled and Observed Groundwater Levels at BNO004

Figure 4.20 shows modelled groundwater levels within the spoil in Ravensworth East, with BNO011 near the end wall for BNP and bore BNO009 located approximately 350 m south. The model shows water level recovery within the spoil, with improved fit to observed spoil water levels and trends compared to the AGE (2019) model that predicts continued decline in groundwater levels. This likely relates to the change in the model to include tailings storage at West Pit TSF, as well as update to include observed rainfall recharge events. However, the observed water levels in the spoil increased more rapidly than the model predicted from approximately 2018 to 2020.

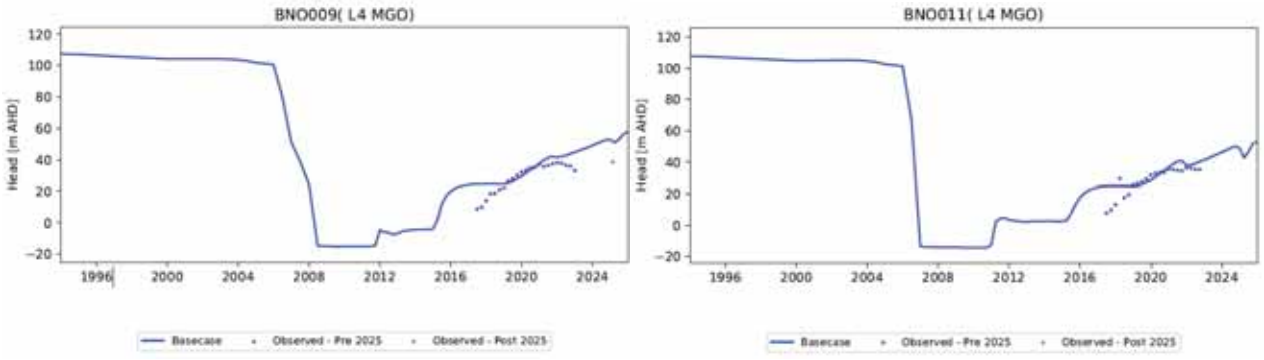


Figure 4.22 Hydrograph Modelled and Observed Groundwater Levels at BNO009 and BNO011

Figure 4.24 shows modelled and observed groundwater levels around historical open cut pit North Void, which is located north of Yorks Creek and east of Bowmans Creek. The modelled recovery at NV14A is overestimated by approximately 10m when compared to the observed data.

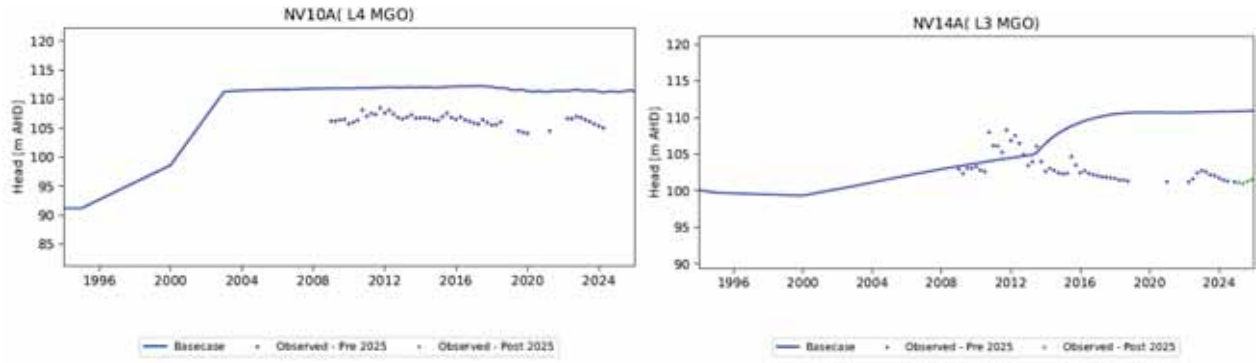


Figure 4.23 Hydrograph Modelled and Observed Groundwater Levels at NV10a and NV14a (Historical North Void)

Figure 4.25 shows modelled and observed groundwater elevations for VWP EXP19, which is located north-east of West Pit and at the northern most end of the Integra Mine underground workings. The graph shows that the model represents the observed downward gradient of flow in response to underground mining and shows a good fit to recent observed groundwater elevations within the deep sensors that are 356 m to 488 m below ground. It is noted that the model has a slight delay in response to mining compared to observed data, this may relate to dewatering activities not captured in the model, or timing of TVM changes. However, the model shows a good response to more recent observation data.

It is noted that there are limited monitoring points within the shallow overburden at the base of West Pit (Bayswater Seam, Layer 4). The closest is VWP GNOH031 to the west, which indicates depressurisation in the shallow overburden in response to underground mining at Integra Mine (refer **Figure 4.21**). This is important to note as the changes in rock properties below West Pit (due to Integra Mine longwall mining) would influence the movement of water associated with the TSF and spoil water recovery in Ravensworth East.

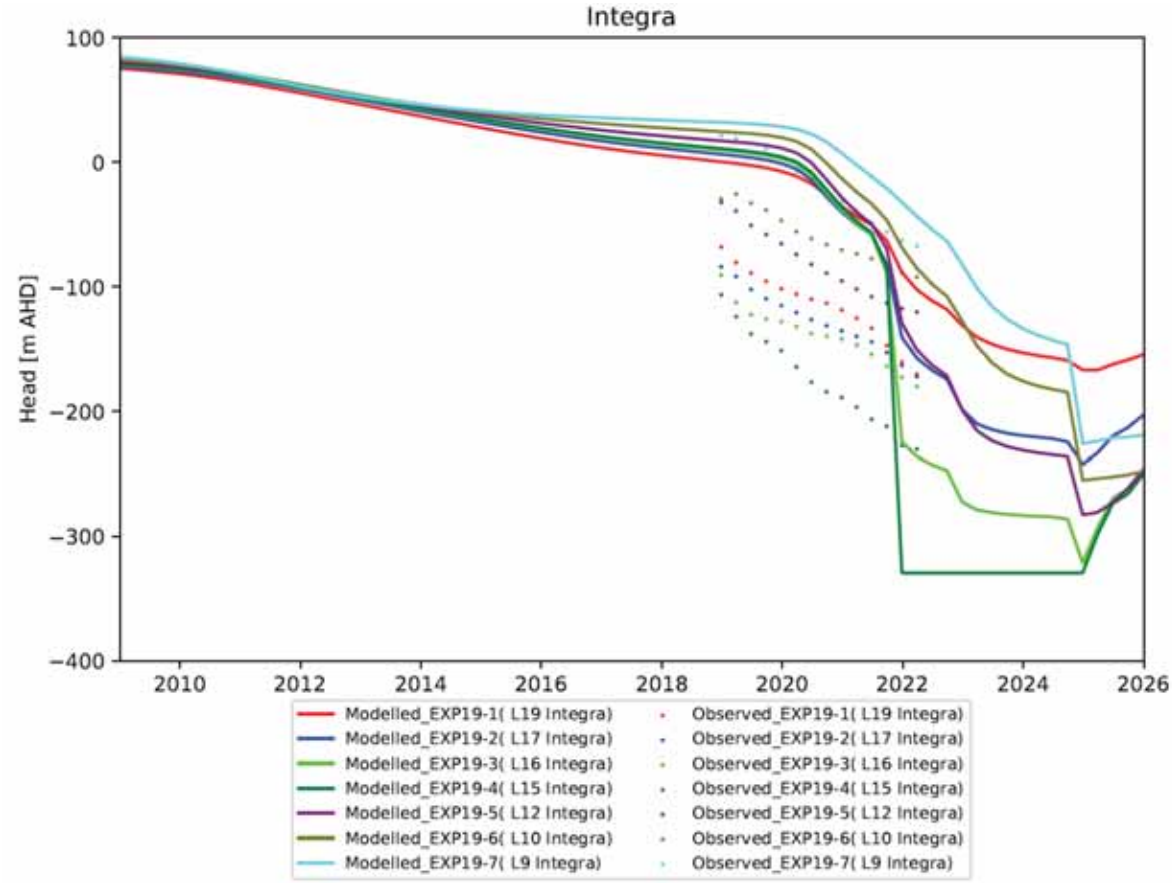


Figure 4.24 Hydrograph Modelled and Observed Groundwater Levels at EXP19 (Integra Mine)

4.5.4 Groundwater Heads

Predicted groundwater levels for the Modification model representing 2025 conditions are shown in **Figure 4.26** to **Figure 4.34** as summarised below:

- **Figure 4.26** shows the modelled water table for 2025. The map shows water elevation irrespective of model layer, and shows drawdown localised around active/recently active pits. This includes localised drawdown around Mount Owen Mine North Pit, BNP and Barrett Pit.
- **Figure 4.27** shows the predicted groundwater elevations for model layer 1, which represents the pinched out Quaternary alluvium. The map shows where the model layer is present, with transparent areas indicating pinched out cells. The model shows a gradient of flow from the north to the south along Bowmans Creek, and to the south-east along Bettys Creek and Main Creek.
- **Figure 4.28** shows the predicted groundwater elevations for model layer 2, which represents the pinched out regolith. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. The groundwater elevation adjacent and south of the Barrett Pit reaches a high of 60m AHD due to the nearby railway line. The gradient of groundwater flow is towards the Barrett Pit. The Barrett Pit groundwater elevations reach a low of -40m AHD.
- **Figure 4.29** shows the predicted groundwater elevations for model layer 3, which represents the overburden. The map shows where the model layer is present, with transparent areas indicating pinched out cells. The gradient of groundwater flow is towards the Barrett Pit. South of the Barrett Pit, groundwater flows south then east to the Ashton Coal Mine Emplacement area where

groundwater elevations reach a low of -80 mAHD. The Barrett Pit groundwater elevation reaches a low of - 40 mAHD.

- **Figure 4.30** shows the predicted groundwater elevations for model layer 4, which represents the Bayswater Seam. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. The map shows localised drawdown around the open cut pits, North Pit, BNP and Barrett Pit. The map shows a general gradient of flow to the Barrett Pit.
- **Figure 4.31** shows the predicted groundwater elevations for model layer 5, which represents the interburden. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. The map shows a general gradient of flow from the north (towards the Barrett Pit). Groundwater flow south of the Barrett Pit flows towards United Wambo which then migrates east where groundwater elevations reach a low of -80 mAHD. The Barrett Pit groundwater elevation reaches a low of - 40 mAHD.
- **Figure 4.32** shows the predicted groundwater elevations in model layer 15, which represents the Liddell Seam. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. The map shows a general gradient of flow from the Barrett Pit towards the north and east towards the deepest mined seam in Mount Owen Mine North Pit (MGO) with a low groundwater elevation of -310m AHD. The Barrett Pit groundwater elevation reaches a low of - 40 mAHD.
- **Figure 4.33** shows the predicted groundwater elevations for model layer 18, which represents the Barrett Seam. The map shows localised drawdown around the deepest mined areas to the east (MGO) and to the west (Ravensworth Operations). Groundwater levels at Barrett Pit are approximately - 30 mAHD with the general gradient of flow from the Barrett Pit towards the east.
- **Figure 4.34** shows the predicted groundwater elevations in model layer 20, which represents the Hebden Seam. This is the deepest mined seam in North Pit (MGO). The map shows localised drawdown around the deepest mined areas to the east (MGO) and to the west (Ravensworth Operations). Groundwater levels at Barrett Pit are approximately -30 mAHD with the general gradient of flow from the Barrett Pit towards the east (MGO).

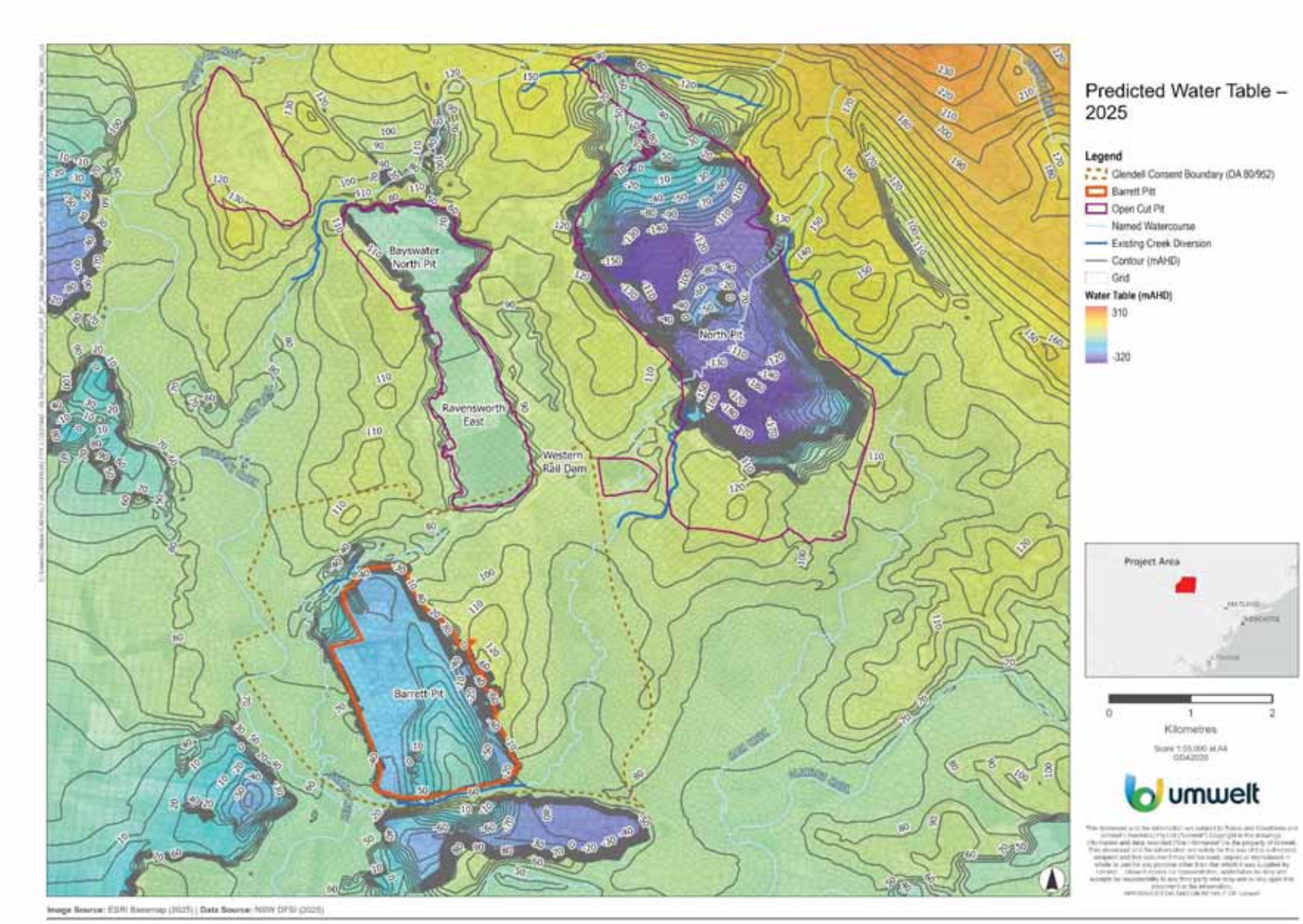


Figure 4.25 Predicted Water Table – 2025

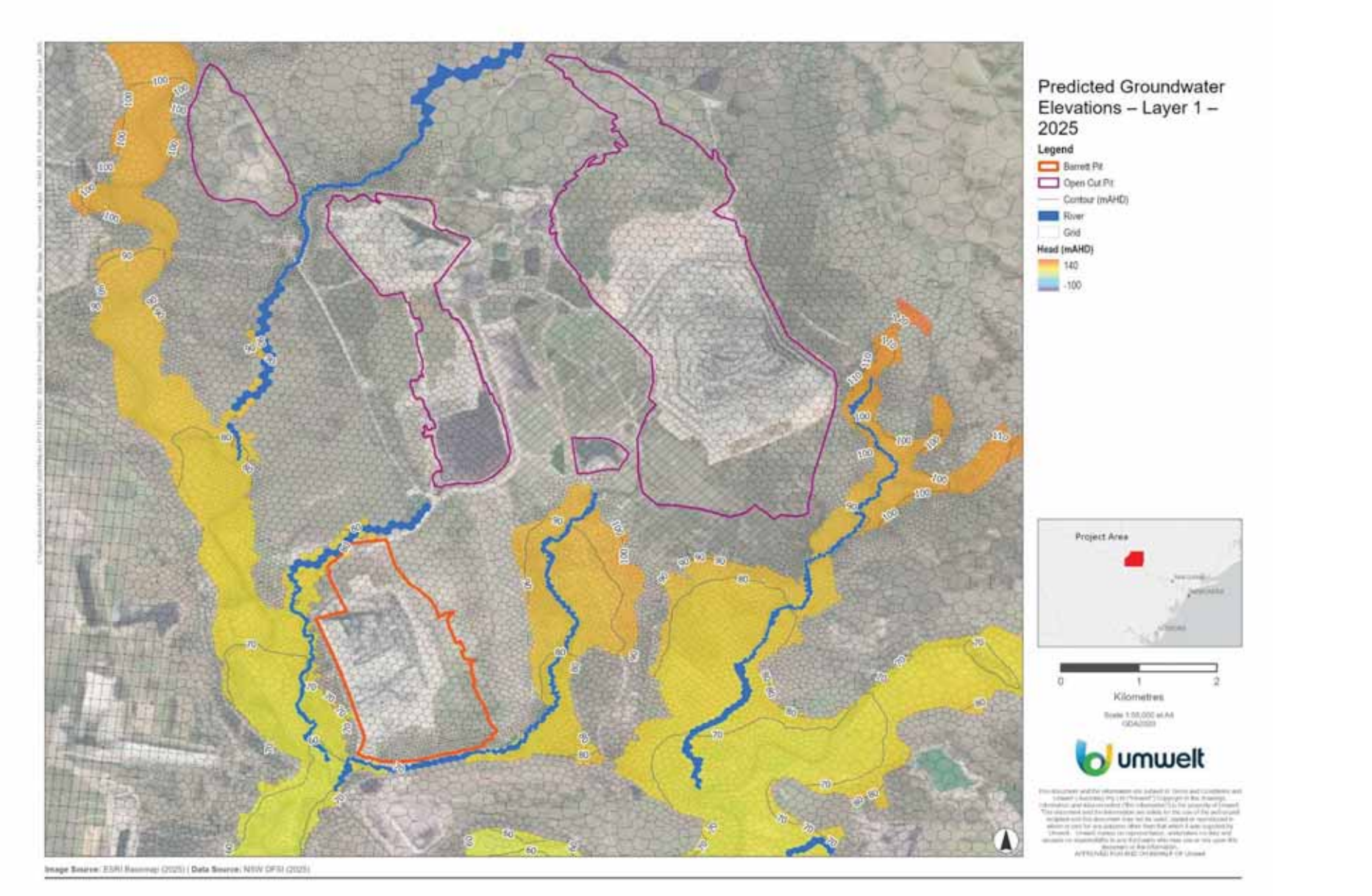


Figure 4.26 Predicted Groundwater Elevations – Layer 1 – 2025

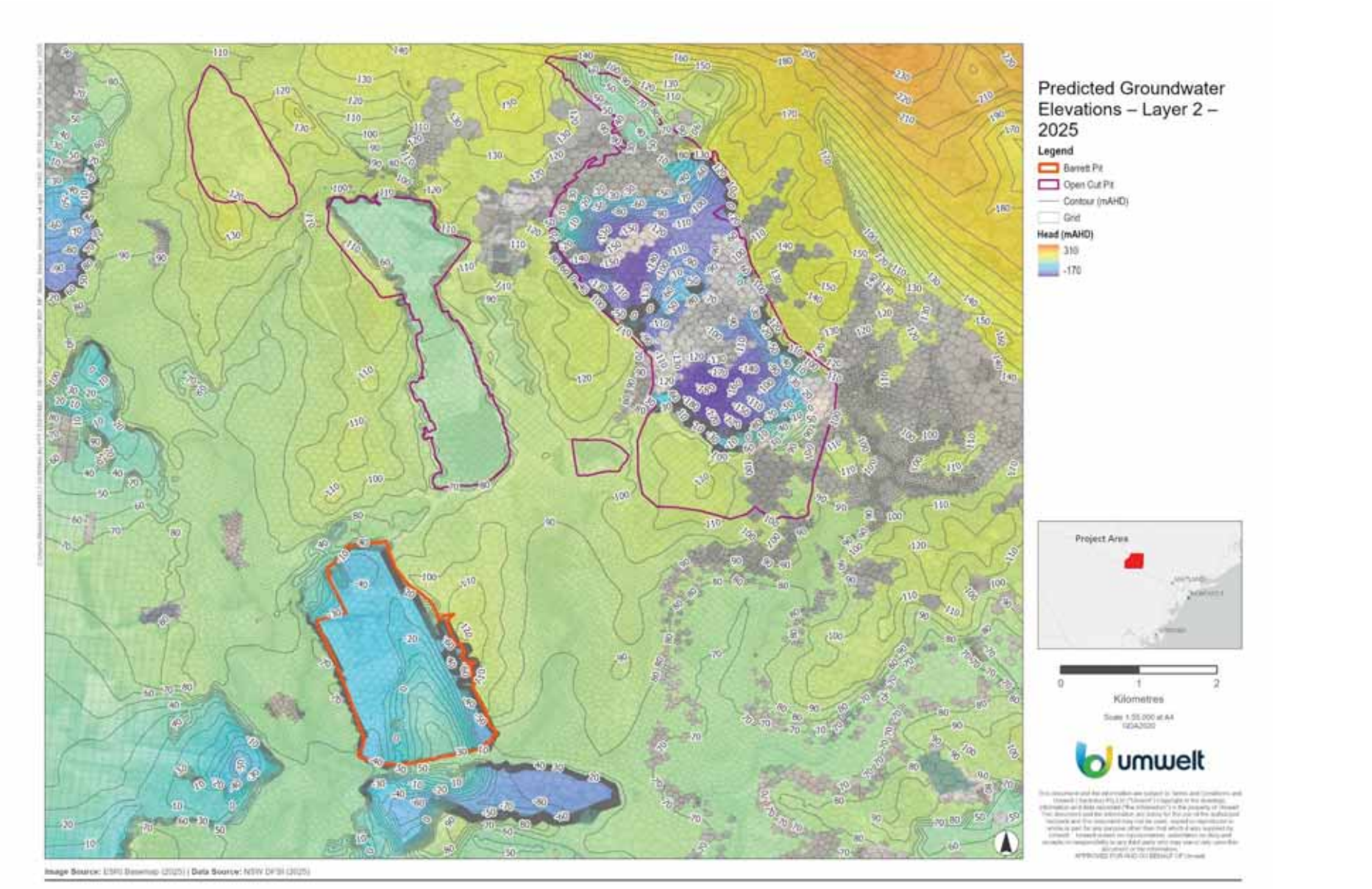


Figure 4.27 Predicted Groundwater Elevations – Layer 2– 2025

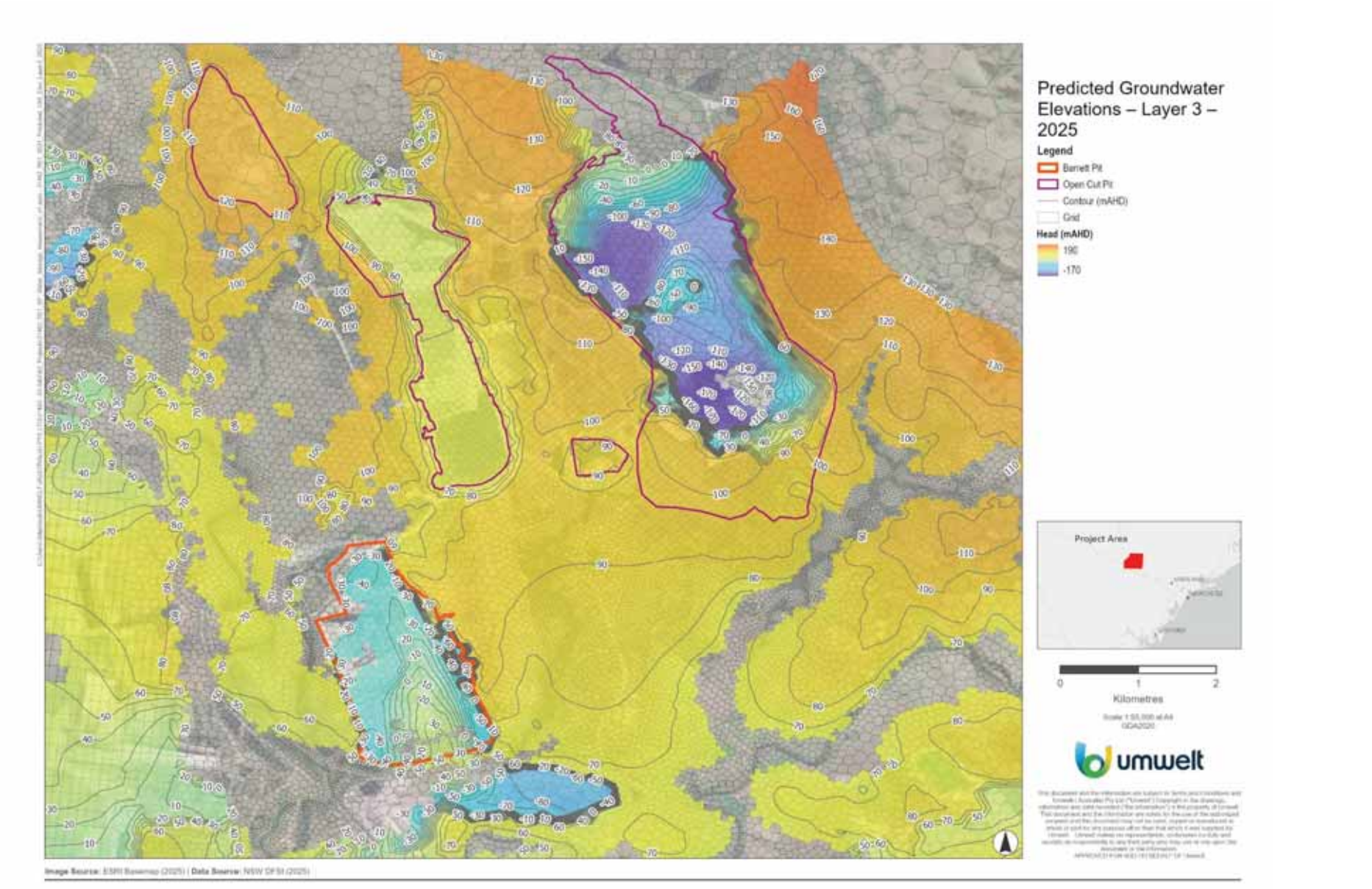


Figure 4.28 Predicted Groundwater Elevations – Layer 3 – 2025

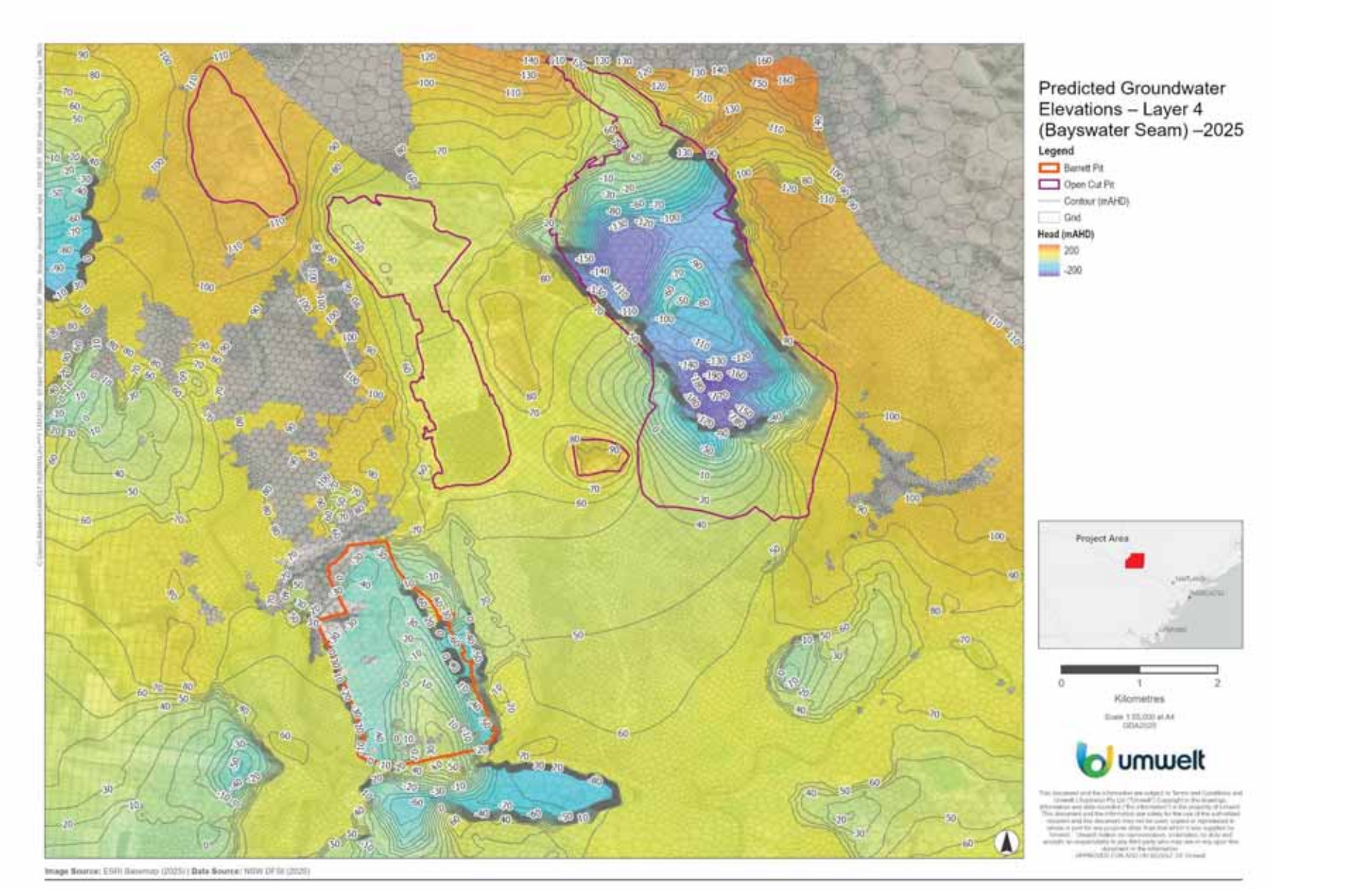


Figure 4.29 Predicted Groundwater Elevations – Layer 4 (Bayswater Seam)–2025

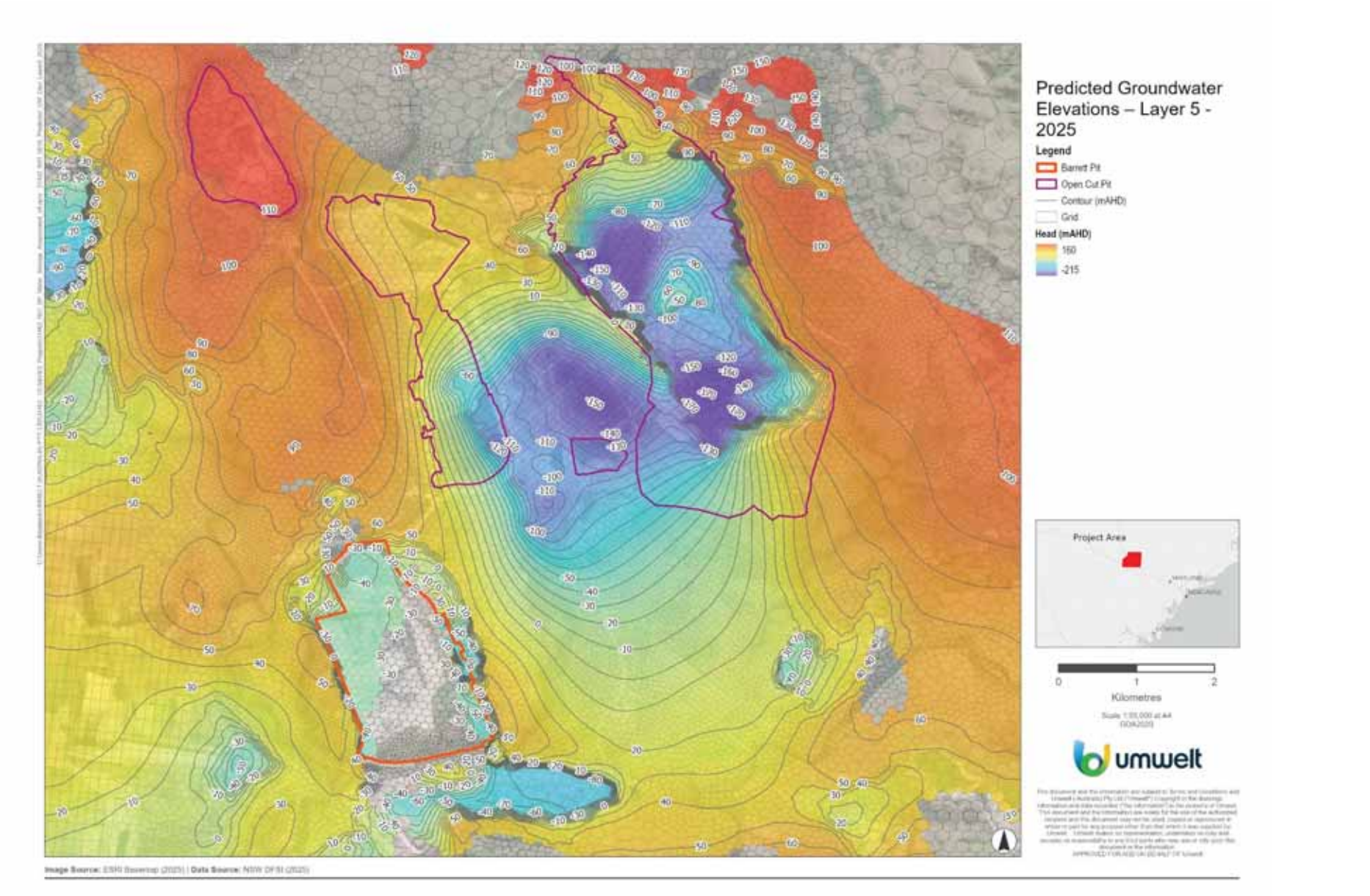


Figure 4.30 Predicted Groundwater Elevations – Layer 5–2025

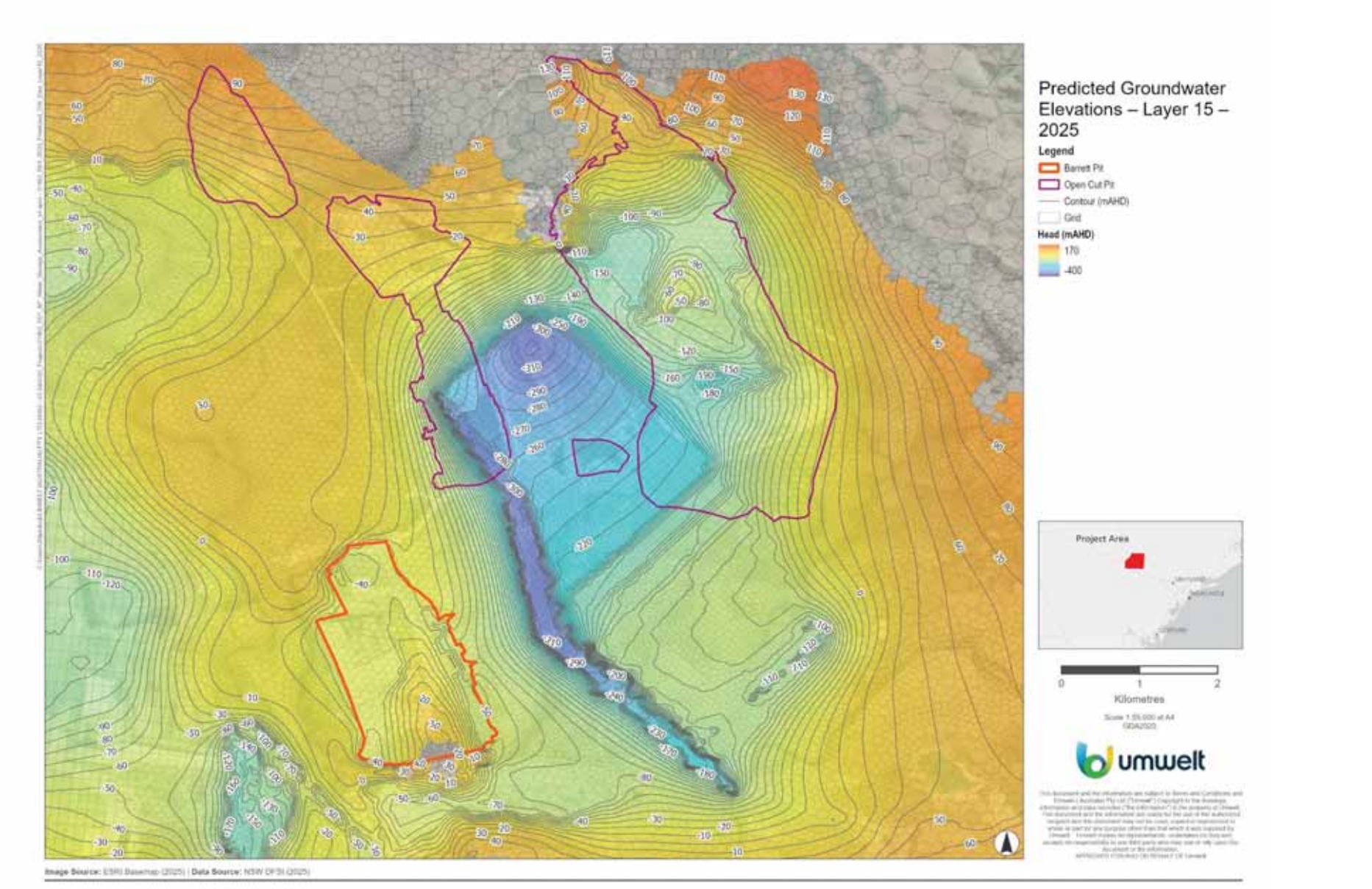


Figure 4.31 Predicted Groundwater Elevations – Layer 15 – 2025

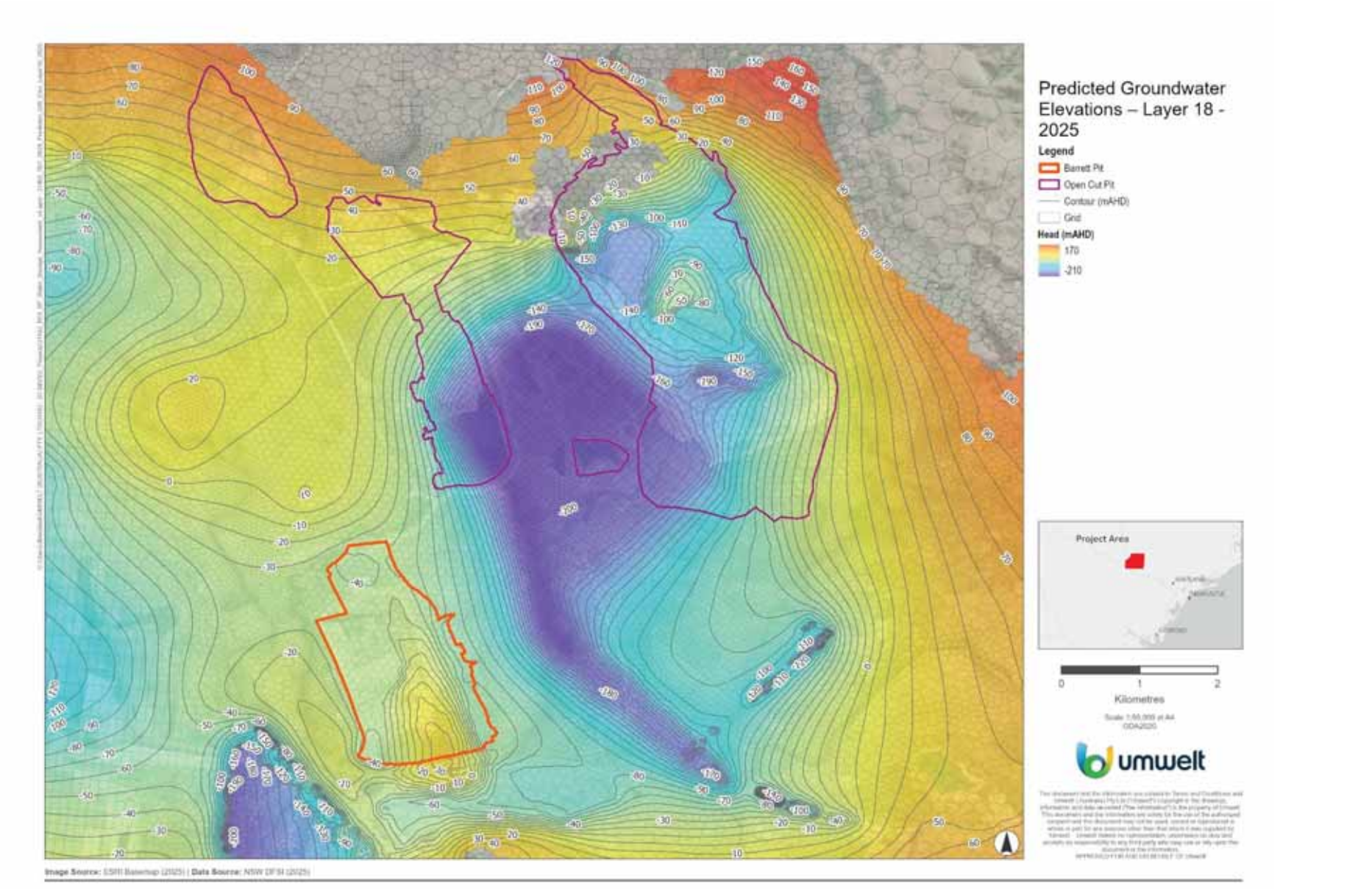


Figure 4.32 Predicted Groundwater Elevations – Layer 18 (Barrett Seam) – 2025

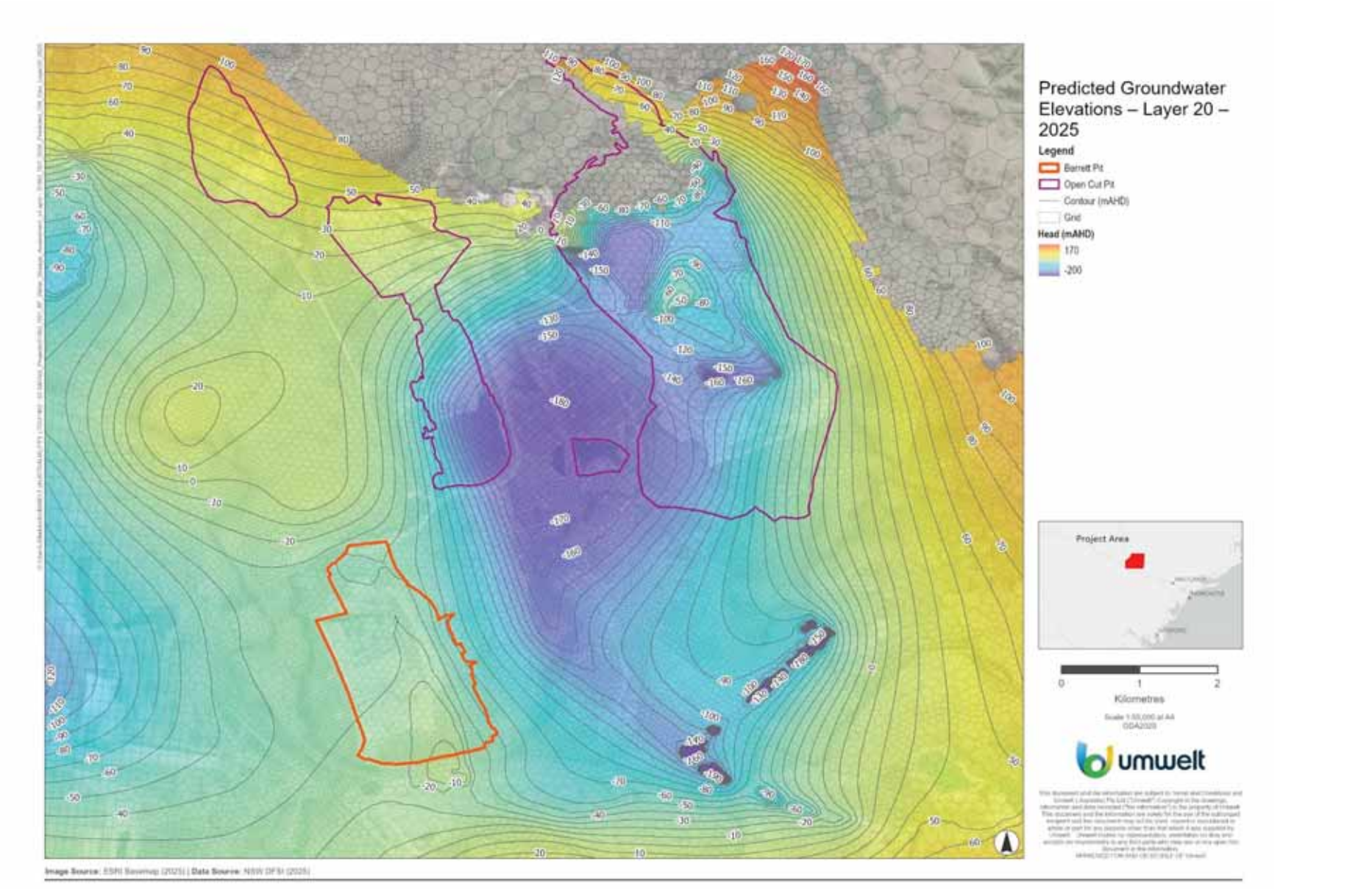


Figure 4.33 Predicted Groundwater Elevations – Layer 20 – 2025

5.0 Model Predictions

This section presents a summary of the remodelled predicted impacts for approved operations at MGO. These results were calculated by comparing the three model runs, Approved, Proposed Modification (Approved plus Storage in Barrett Pit and BNP), and no MGO (for indirect take/baseflow). For the purposes of this report, the predicted groundwater take is focused on the period of proposed water storage, from 2026 to 2039.

5.1 Predicted Mine Inflows

The predicted inflows to active mine areas (drain cells) for the Approved case are shown in **Figure 5.1**, and summarised in **Table 5.1** for the period 2026 to 2039. The predicted inflows are reflective of where model drain cells are active, therefore the predictions do not include passive groundwater inflows into mine areas/spoil. Therefore, the net flux of Permian groundwater entering the mined out open cut pits was also calculated, to indicate the volume of water entering the spoil/mine area behind the active drain cells. The total net flux for Approved and Modification cases is shown in **Table 5.1**. Note that the Table shows the maximum take from Permian (North Coast Fractured and Porous Rock Water Source) for licensing purposes, which is based on the maximum take from the drain cell or net flux change, whichever is greater. The Modification has minor to no impact on the predicted inflow to MGO active mine areas.

Table 5.1 indicates that the Modification has a relatively small impact on the total net flux. The maximum take from the Permian is reduced by approximately up to 33 ML/year (in 2027) as a result of the Modification. That is predominantly due to a lower head gradients towards the Barrett Pit when water is stored under the Modification case.

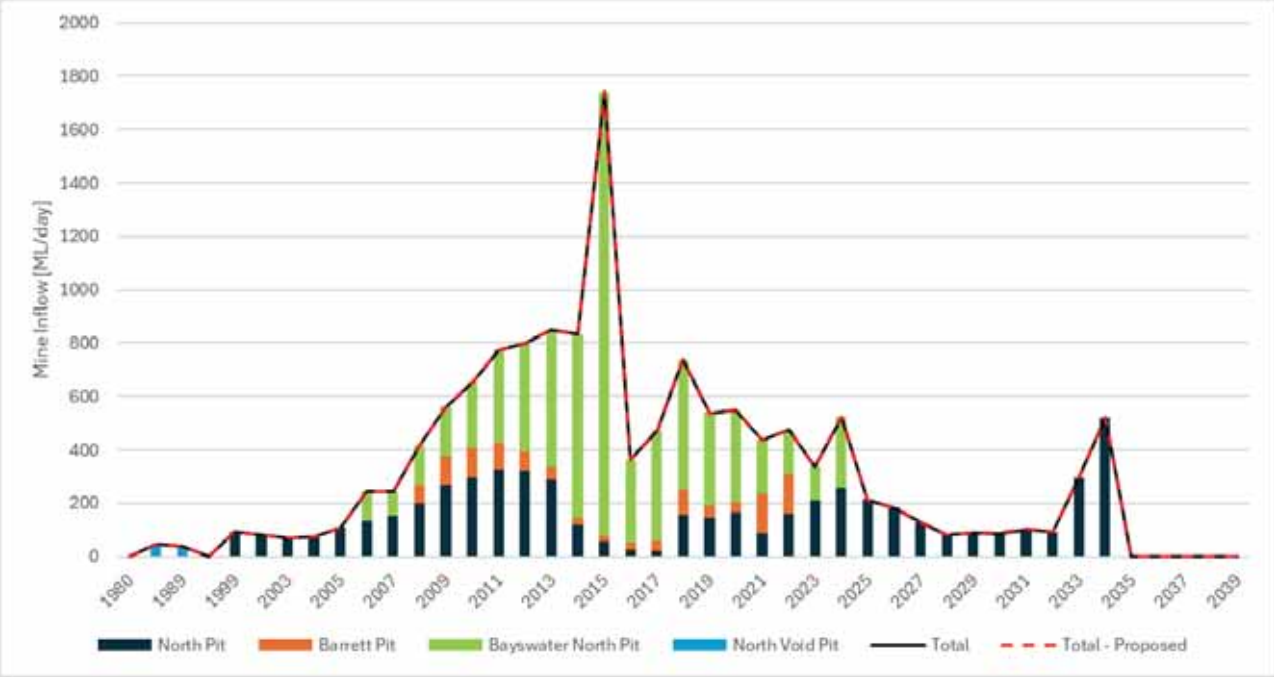


Figure 5.1 Predicted Mine Inflows – Approved

Table 5.1 Predicted Mine Inflows – Maximum Take for North Coast Fractured and Porous Rock (Permian) (ML/yr)

Year	Approved	Approved Plus Modification	Difference
2026	394	369	-25
2027	375	342	-33
2028	342	315	-27
2029	322	302	-20
2030	306	289	-17
2031	311	296	-15
2032	320	303	-17
2033	363	341	-22
2034	521	521	0
2035	406	384	-22
2036	441	417	-24
2037	392	367	-25
2038	386	363	-23
2039	395	372	-23
EOR	298	298	0

5.2 Predicted Change in Groundwater Levels

5.2.1 Head in End of Storage (2039)

Predicted groundwater levels for the Modification model at end of storage in 2039 are presented in the below section. Particle tracking has been added to model layer 2 to represent the flow groundwater from select points over time (2025 to 2039). The particle tracking indicates little to no horizontal movement of particles. The lack of movement of particles is a result of the intermittent saturation of the shallow weathered regolith the strata preventing effective hydraulic connectivity required for movement of particles. **Figure 5.2** to **Figure 5.9** as summarised below:

- **Figure 5.2** shows the predicted groundwater elevations for model layer 1, which represents the pinched out Quaternary alluvium. The map shows where the model layer is present, with transparent areas indicating pinched out cells. The model shows a gradient of flow from the north to the south along Bowmans Creek, and to the south-east along Bettys Creek and Main Creek.
- **Figure 5.3** shows the predicted groundwater elevations for model layer 2, which represents the pinched out regolith. The groundwater elevation within the Barrett Pit is approximately 20 mAHD. The gradient of groundwater flow is toward the pit from the north, east and west. The regolith is depressurised to the south of the Glendell Project Boundary. Groundwater elevations range from -80 mAHD to the south to 120m AHD to the north and east.
- **Figure 5.4** shows the predicted groundwater elevations for model layer 3, which represents the overburden. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. Within the Glendell Project area, groundwater flow is to the north from the spoil toward the pit. Groundwater heads immediately surrounding and in the vicinity of the Glendell Project area indicate groundwater flow is toward the Barret Pit from all directions with a cone of depression induced by the flow of groundwater from the surrounding strata into the pit. Groundwater elevations in the vicinity of the Glendell Project area range from 20 mAHD within the Barrett Pit to 90m AHD to the northeast.

  Figure 5.5 shows the predicted groundwater elevations for model layer 4, which represents the Bayswater Seam. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. Within the Glendell Project area, the gradient of groundwater flow is north from the spoil toward the pit lake. Groundwater heads immediately surrounding and in the vicinity of the Glendell Project area indicate groundwater flow is toward the Barret Pit from the north, east and west. The Bayswater seam is depressurised to the south of the Glendell Project area. Groundwater elevations range from -50 mAHD to the south to 80m AHD to the north.
- **Figure 5.6** shows the predicted groundwater elevations for model layer 5, which represents the interburden. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. The groundwater head shows a general gradient of flow from north of the Glendell Project area to a depression south and east of the Glendell Project area. Groundwater elevations range from -50 mAHD to the south to 80m AHD to the north.
- **Figure 5.7** shows the predicted groundwater elevations for model layer 15, which represents the Liddell Seam. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. Within the Glendell Project area, the gradient of groundwater flow is north from the spoil toward the pit lake. Groundwater heads immediately surrounding and in the vicinity

of the Barret pit indicate groundwater flow is toward the pit from the north and west. The Liddel Seam is depressurised to the south of the Glendell Project area. Groundwater elevations range from -50 mAHD to the south to 50m AHD to the north-east.

- **Figure 5.8** shows the predicted groundwater elevations for model layer 18, which represents the Barret seam. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. Within the Glendell Project area, the gradient of groundwater flow is north from the spoil toward the pit lake. Groundwater heads immediately surrounding and in the vicinity of the Barret pit indicate groundwater flow is generally from the north-west to the east. Groundwater elevations range from -180 mAHD in the southwest to 40 mAHD to the north.
- **Figure 5.9** shows the predicted groundwater elevations for model layer 20, which represents the Hebden seam. The map shows where the model layer is present, with transparent areas indicating a pinched out cells. Within the Glendell Project area, the gradient of groundwater flow is from north to south. Groundwater heads immediately surrounding and in the vicinity of the Barret pit indicate groundwater flow is generally from the north-west to the east. Groundwater elevations range from -30 mAHD to the south-east to 40m AHD to the north.

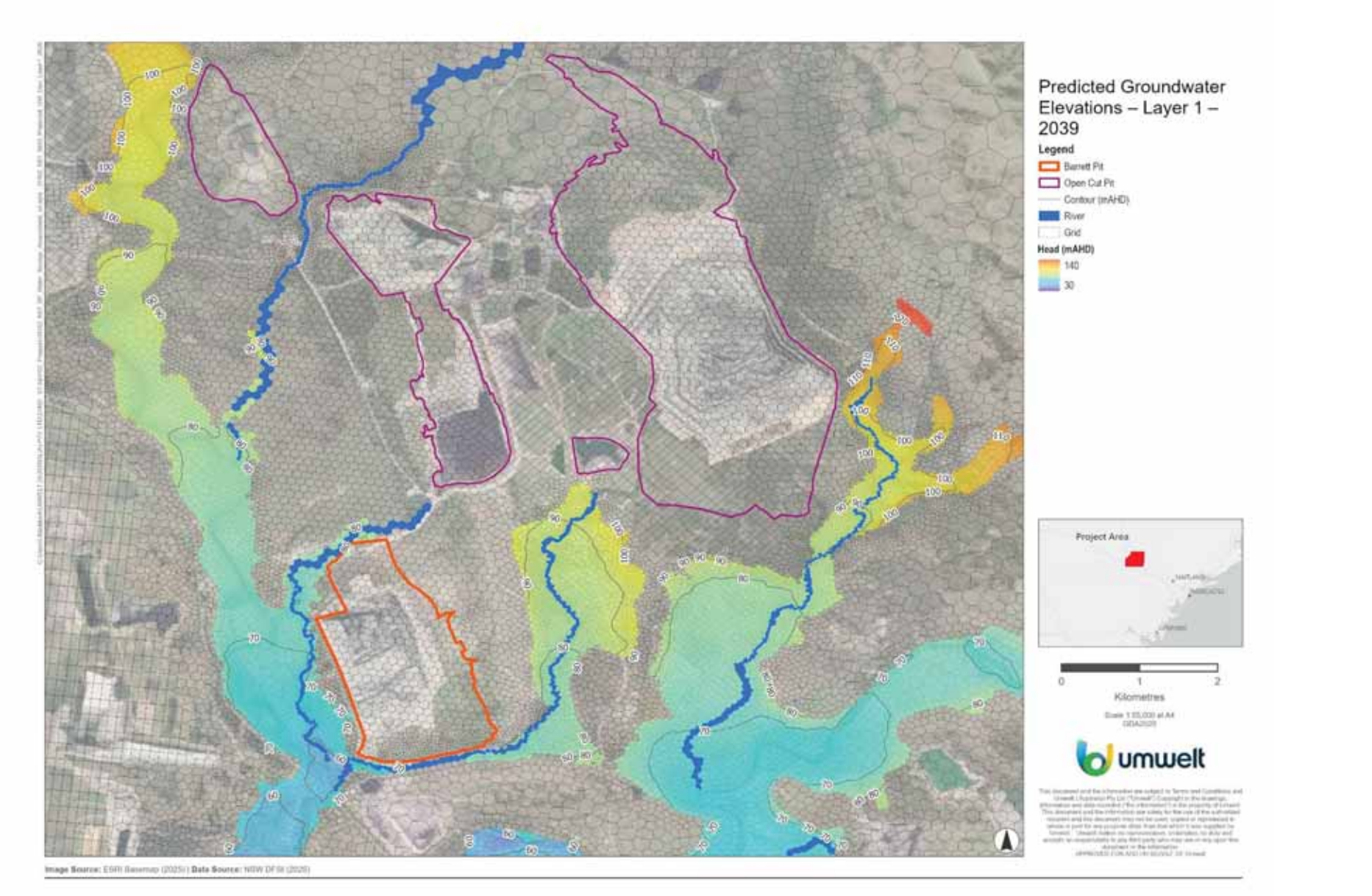


Figure 5.2 Predicted Groundwater Elevations – Layer 1 – 2039

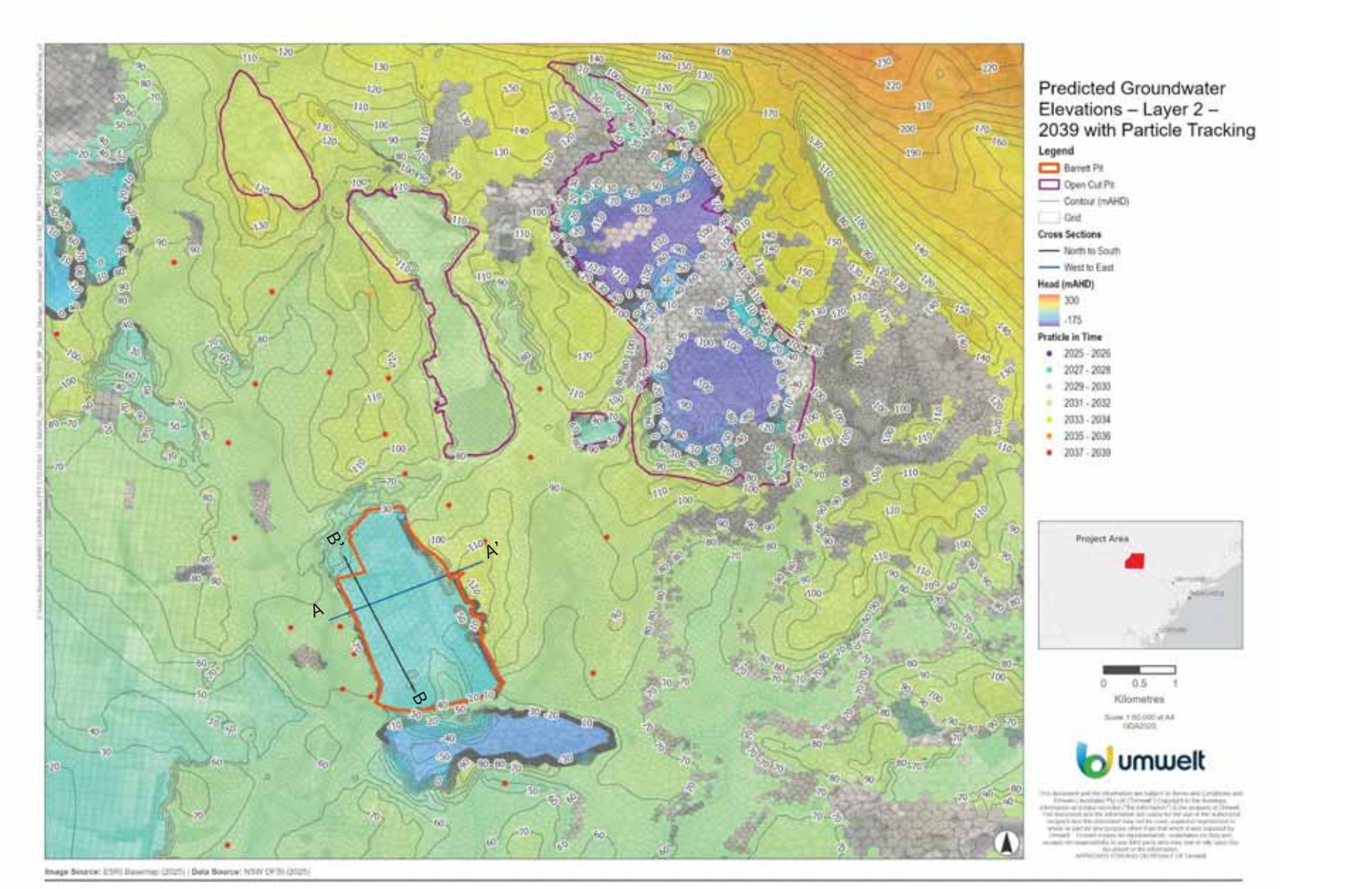


Figure 5.3 Predicted Groundwater Elevations – Layer 2 – 2039 with Particle Tracking

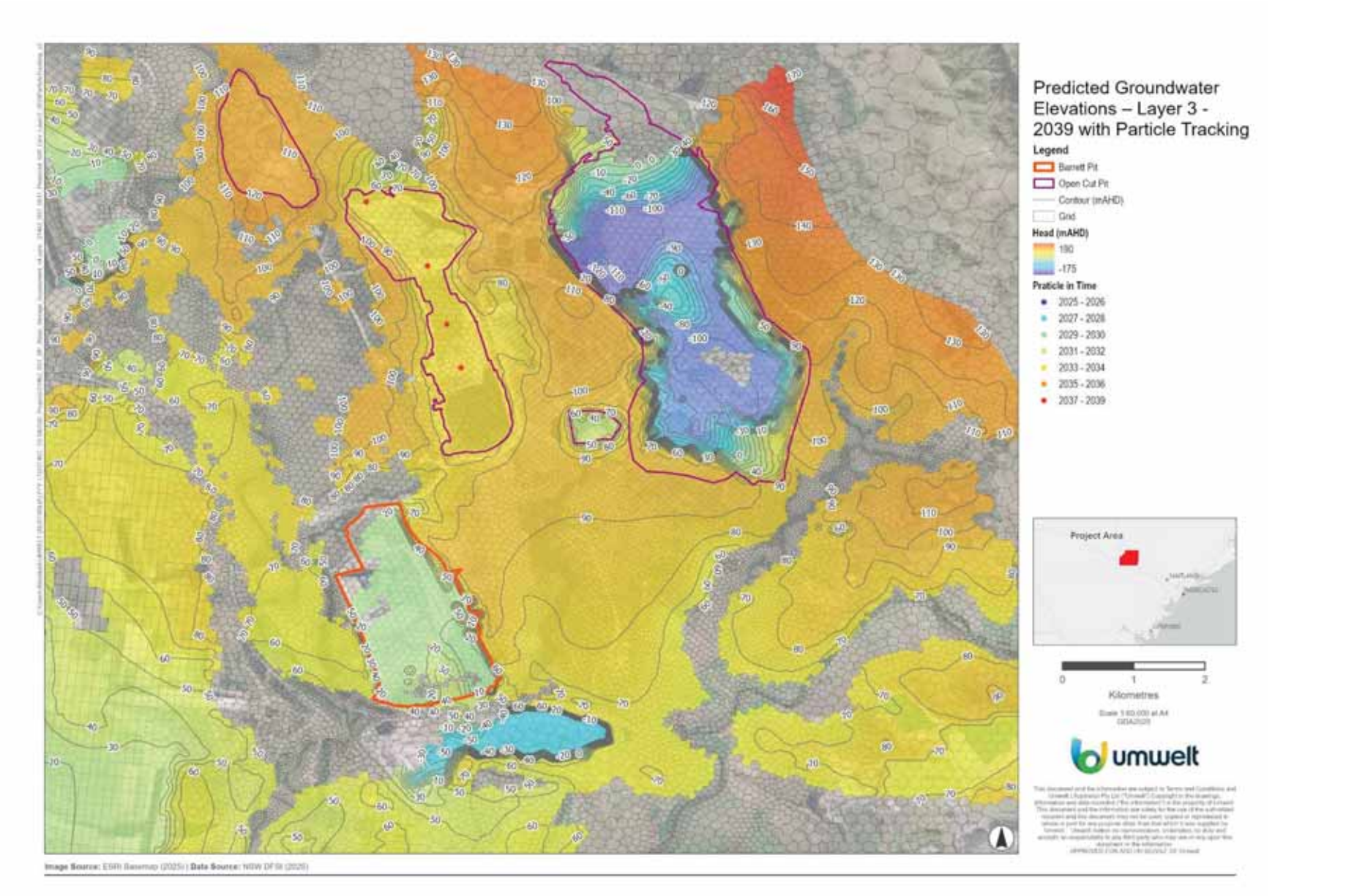


Figure 5.4 Predicted Groundwater Elevations – Layer 3 – 2039 with Particle Tracking

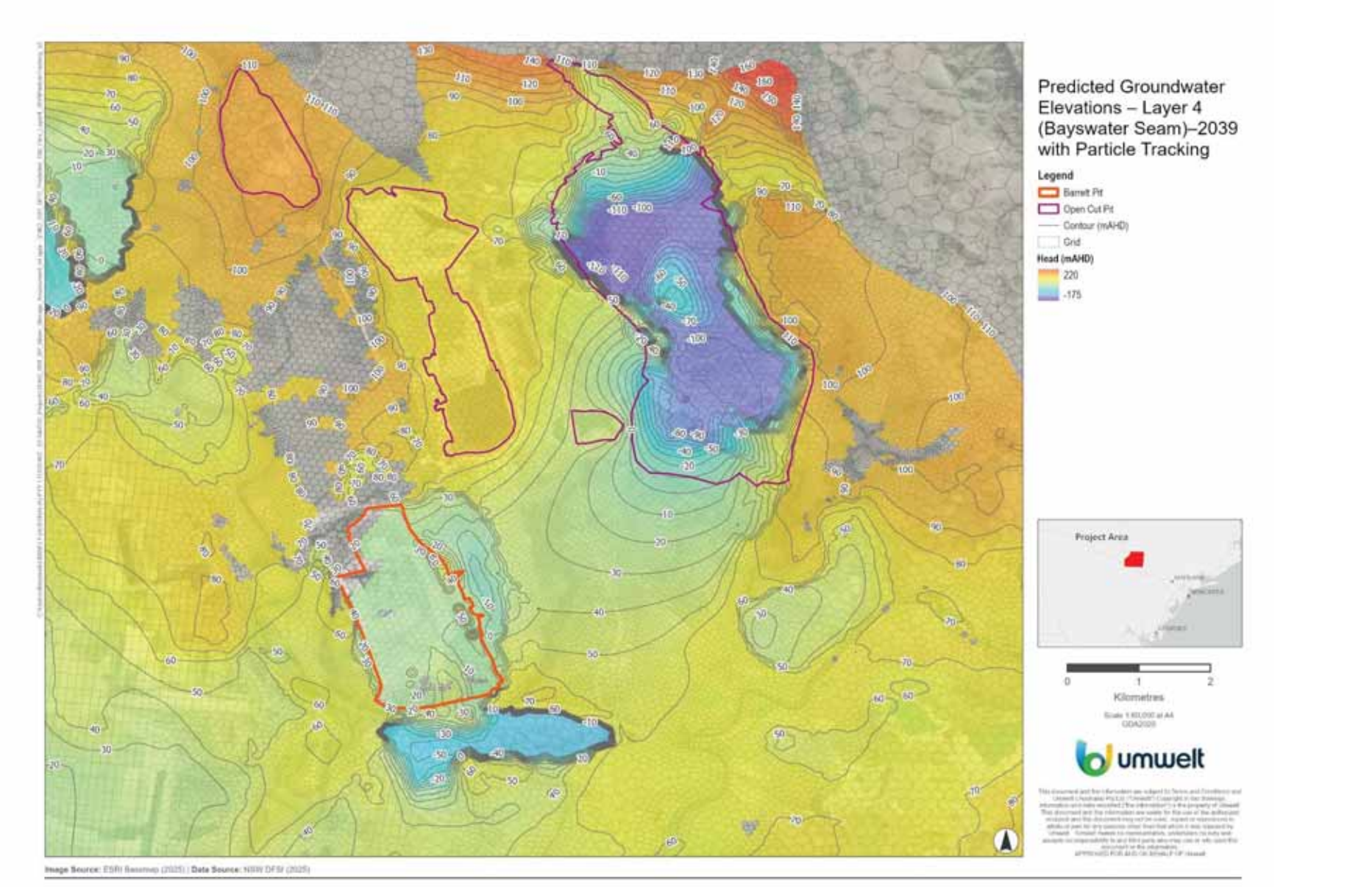


Figure 5.5 Predicted Groundwater Elevations – Layer 4 – 2039

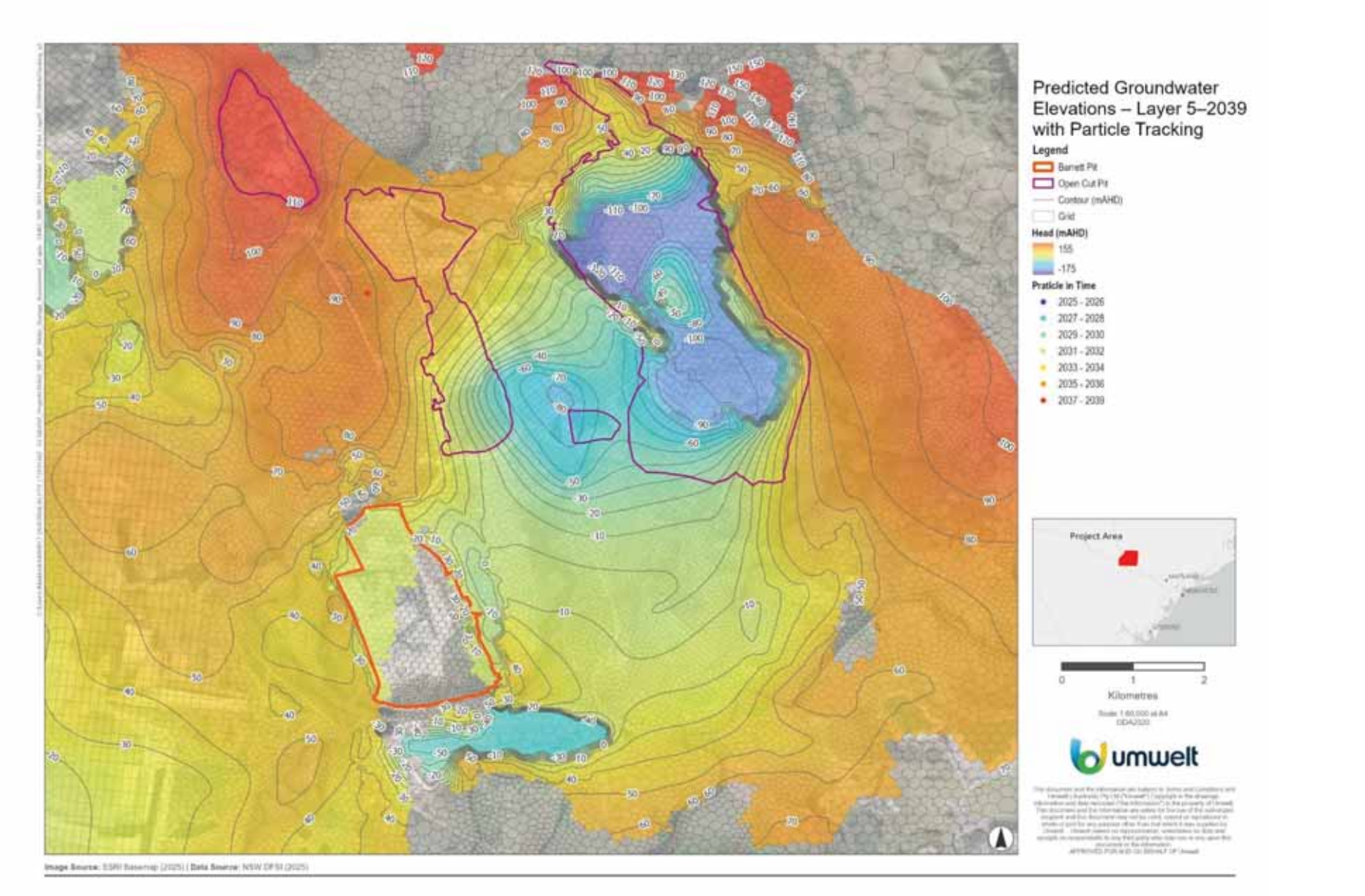


Figure 5.6 Predicted Groundwater Elevations – Layer 5 – 2039 with Particle Tracking

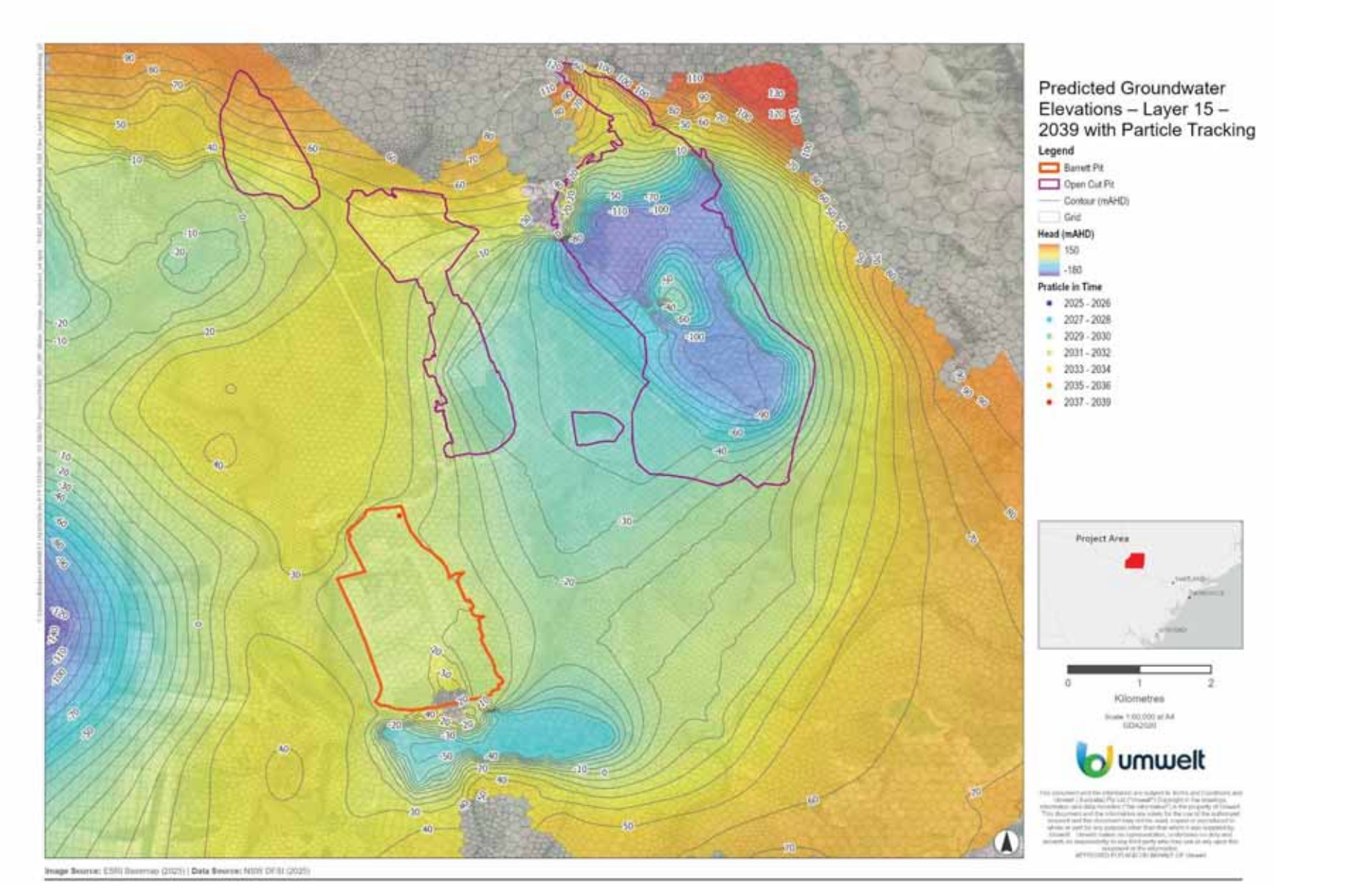


Figure 5.7 Predicted Groundwater Elevations – Layer 15 – 2039 with Particle Tracking

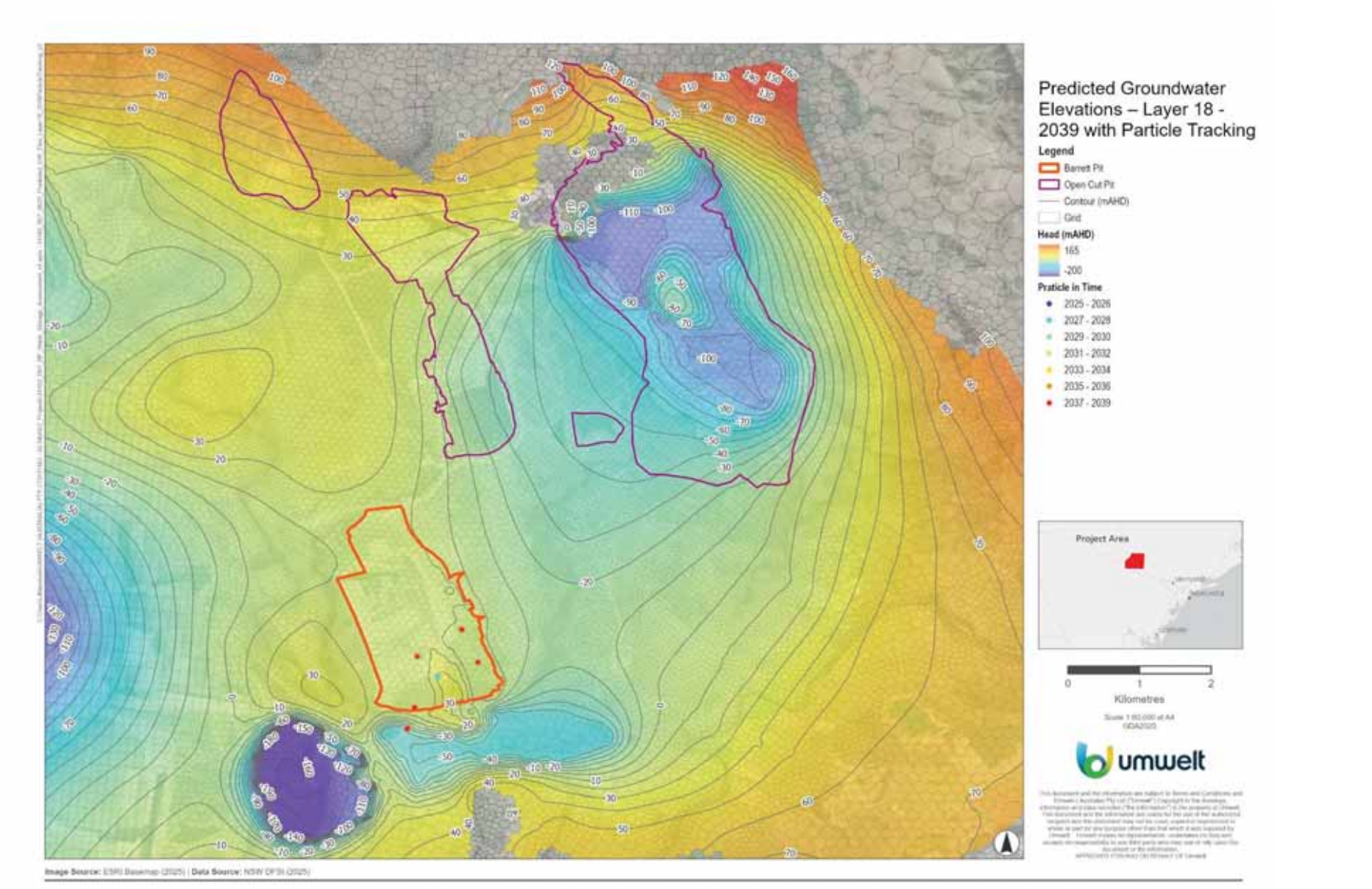


Figure 5.8 Predicted Groundwater Elevations – Layer 18 (Barrett Seam) – 2039

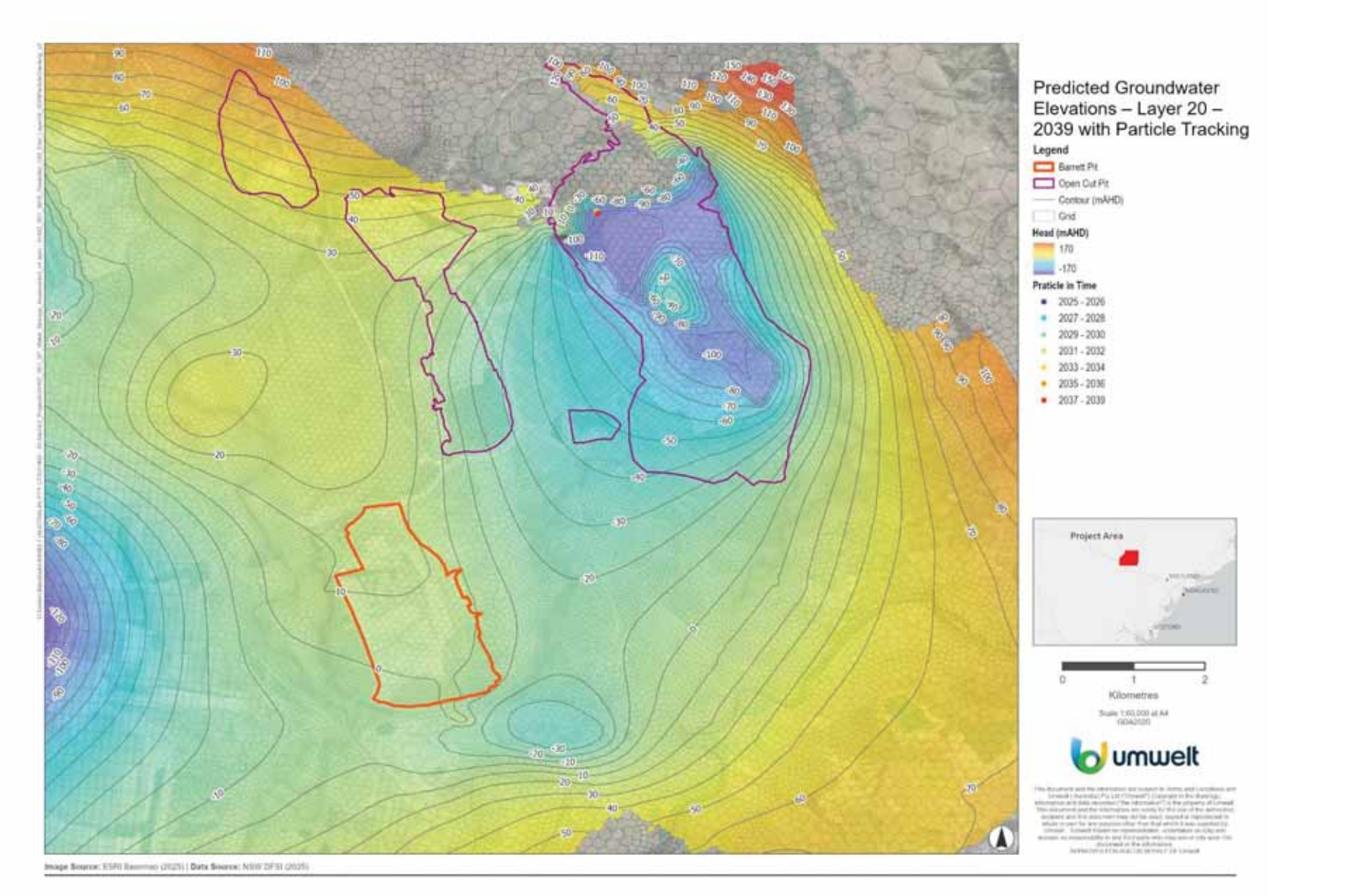


Figure 5.9 Predicted Groundwater Elevations – Layer 20 – 2039 with Particle Tracking

5.2.2 Predicted Groundwater Head Changes

As the changes associated with the increased water levels within the Barrett Pit are relative to approved natural recovery conditions, the Modification does not result in any predicted incremental drawdown relative to the Approved Scenario. As water levels rise within the Barrett Pit due to it being used as a water storage, groundwater heads in surrounding strata will increase faster than under a passive recovery scenario. **Figure 5.10** to **Figure 5.17** illustrate the maximum incremental difference in groundwater heads (referred to in this report as mounding) predicted in Layers 1,2, 3, 4, 5, 15,18, and 20, respectively. The mounding values are derived by subtracting the head values predicted by the Modification scenario from those of the Approved MGO scenario in every stress period to produce the maximum drawdown at any time in the model period. Positive 'mounding' values indicate that the groundwater heads under the Modification scenario would be higher than those under the Approved Scenario. Note these figures consider groundwater head changes as a result of storage within Barrett Pit and BNP as they are intrinsically linked. Mine water storage within BNP is also included under the current approval and groundwater head changed relating to BNP are therefore not directly related to the modification.

- **Figure 5.10** shows the maximum predicted mounding in alluvium (layer 1) where the alluvium is in proximity to MGO pits, specifically North Void, Barrett Pit and North Pit. A maximum mounding height of 0.28 m can be observed within the alluvium. There is no direct connection from the mine water storage and alluvium, with the maximum predicted storage level in Barrett Pit of 12 mAHD well below the base of alluvium level of 65 mAHD. The 'mounding' in layer 1 represents a relative reduction in drawdown in alluvium due to the reduced depressurisation of the underlying coal measures. Therefore, representing a positive change in groundwater conditions within the alluvium due to the Modification.
- **Figure 5.11** shows the maximum predicted mounding in the Regolith (Layer 2). A maximum mounding height of 30m could be observed in the Barrett Pit with a groundwater gradient to the west and north of the Barrett Pit. A groundwater mound of 10m could be observed at the BNP with a groundwater gradient to the south towards Ravensworth East Mine.

  Figure 5.12 shows the maximum predicted mounding in the overburden (Layer 3). A maximum mounding height of 30m could be observed in the Barrett Pit with a groundwater gradient to the north. A groundwater mound of 10m could be observed at the BNP with a groundwater gradient to the south towards Ravensworth East.
- **Figure 5.13** shows the maximum predicted mounding in the Bayswater Seam (Layer 4) due to the Modification. Groundwater mounding is localised around the BNP of 10m and Barrett Pit of 30m.

  Figure 5.14 shows the maximum predicted mounding in the interburden (Layer 5). A maximum mounding height of 35m could be observed in the Barrett Pit with a groundwater gradient to the west and north. A groundwater mound of less than 10m could be observed at the BNP.
- **Figure 5.15** shows the maximum predicted mounding in Liddell C Seam Section (Layer 15). A maximum mounding height of 35m could be observed in the Barrett Pit. Groundwater gradient extends west, north and east.
- **Figure 5.16** shows the maximum predicted mounding in Barrett Seam Section (Layer 18). A maximum mounding height of 25m could be observed in the Barrett Pit. Groundwater gradient extends west (Ravensworth Operations), north and east (MGO).

- **Figure 5.17** shows the maximum predicted mounding in the Hebden Seam (Layer 20). The extent of mounding around the Barrett Pit could reach 20m. It is noted that Barrett Pit is only mined down to the Barrett Seam (layer 18) in the model.

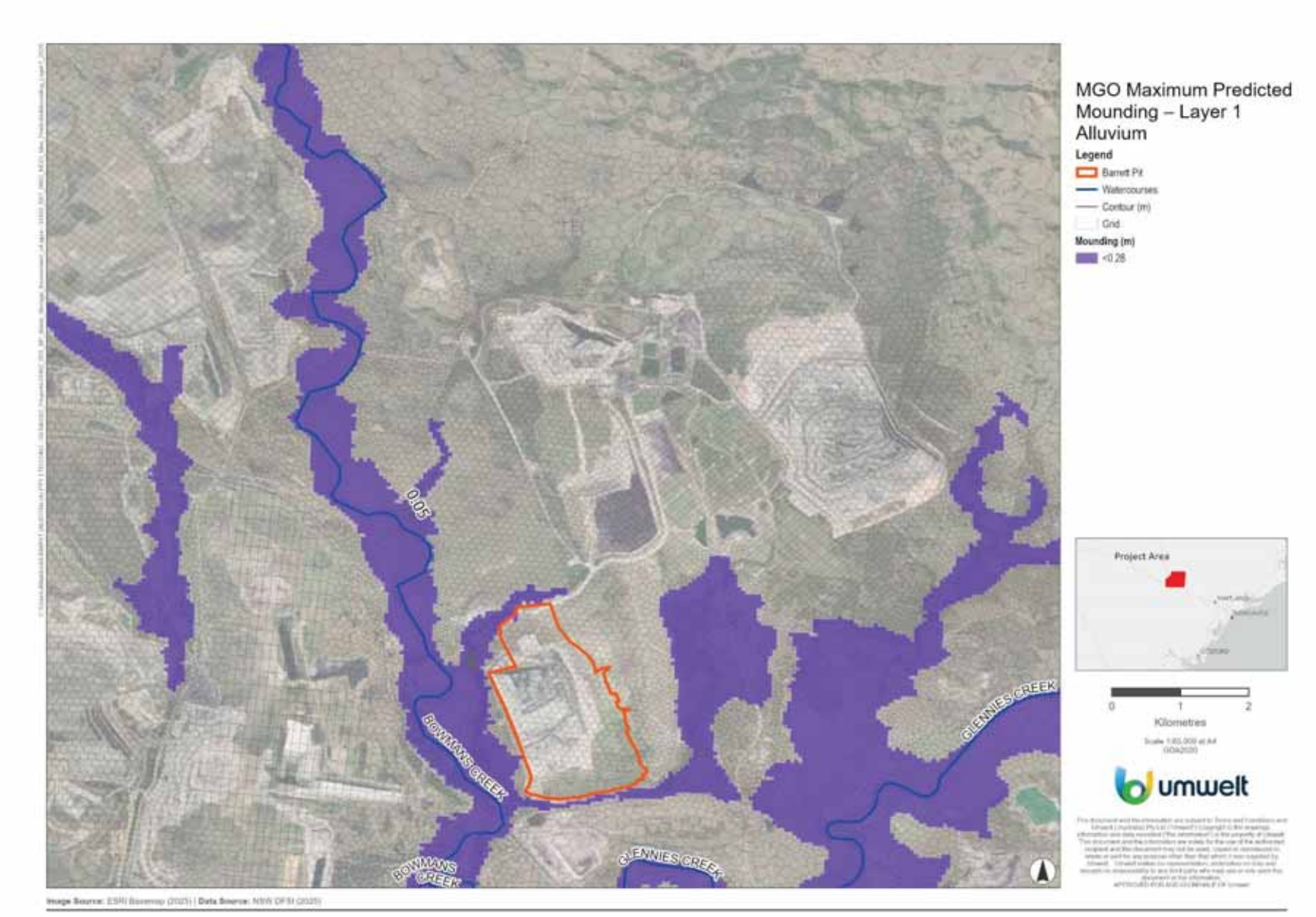


Figure 5.10 MGO Maximum Predicted Mounding – Layer 1 Alluvium

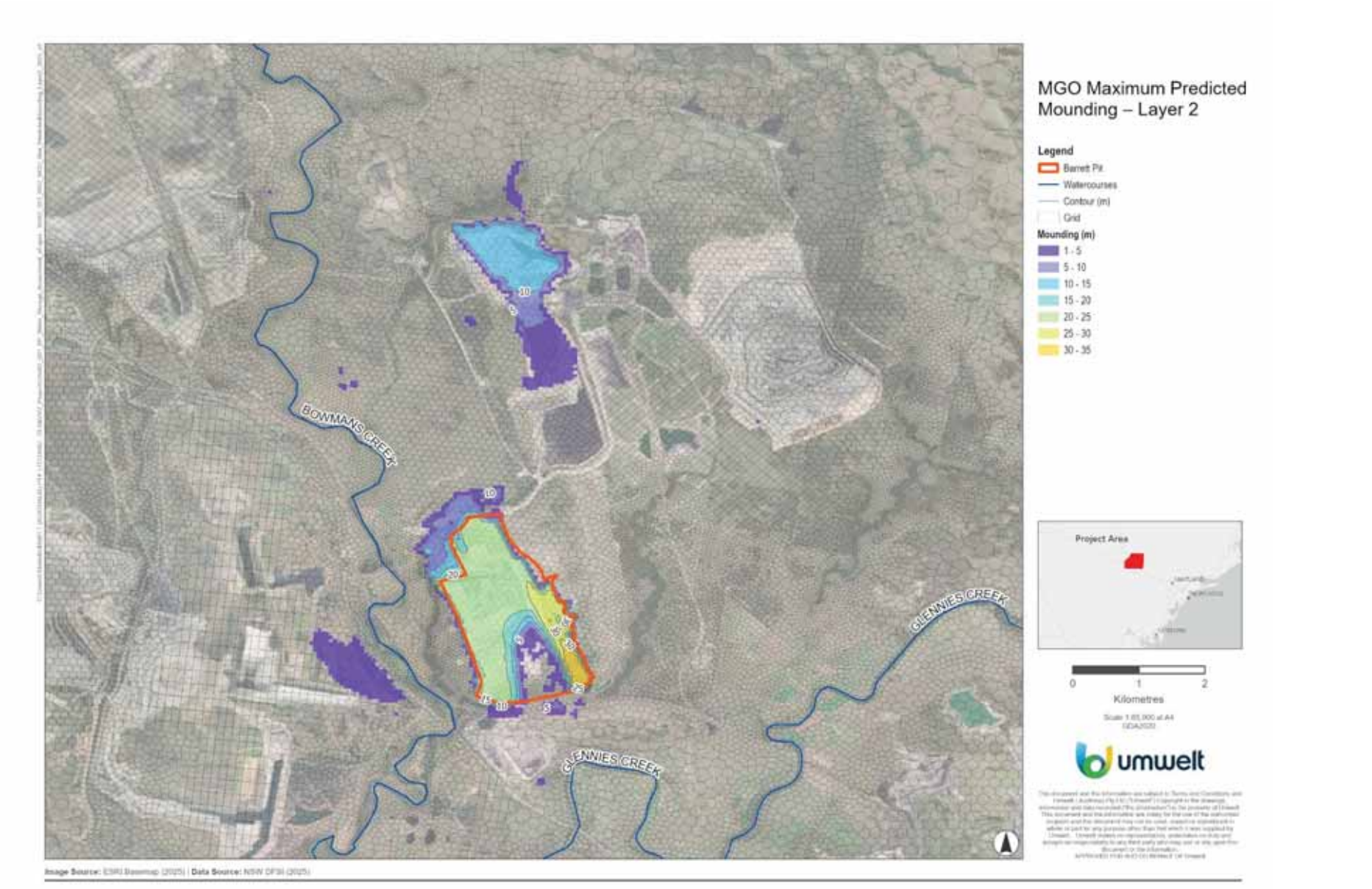


Figure 5.11 MGO Maximum Predicted Mounding – Layer 2

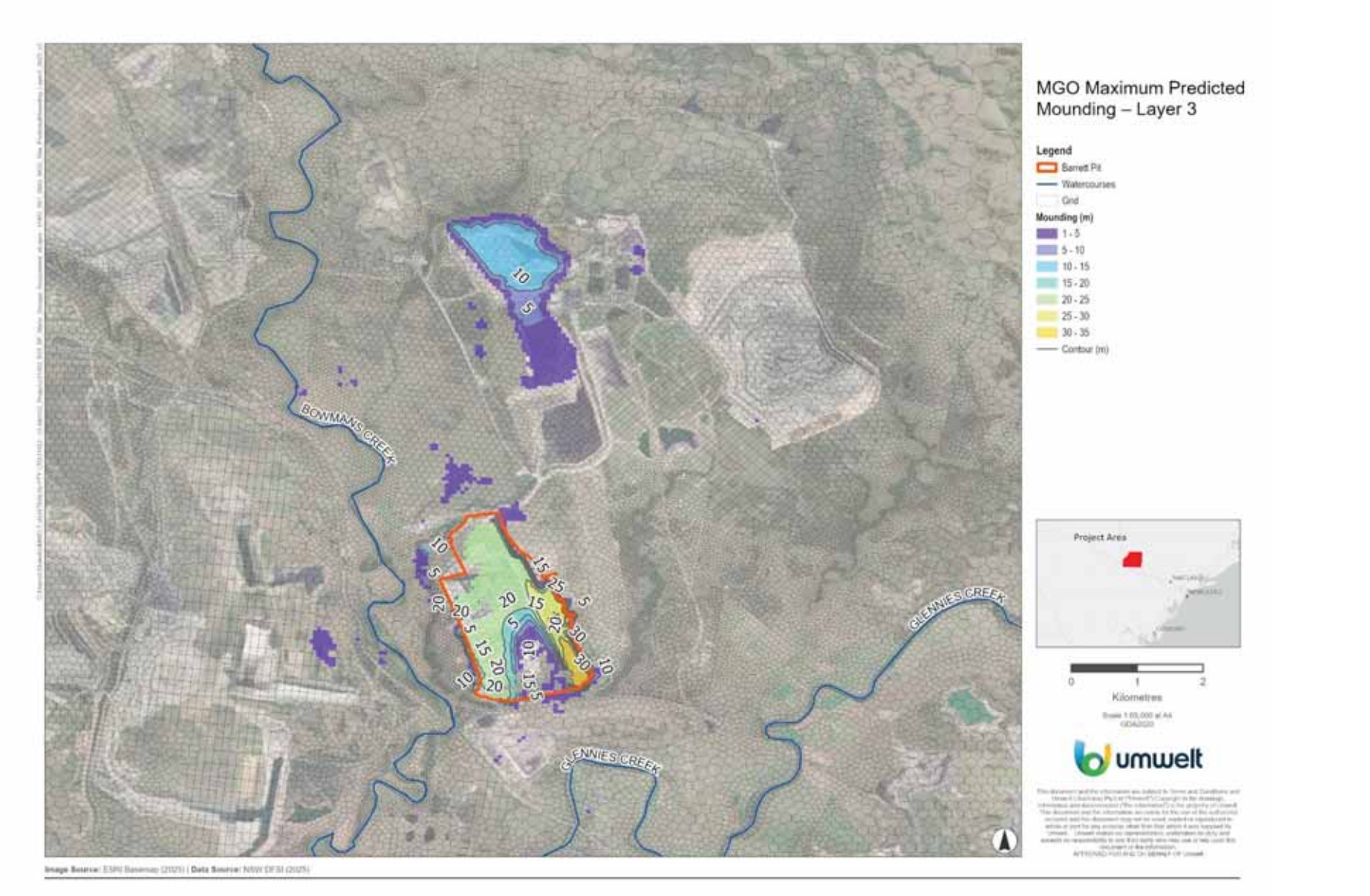


Figure 5.12 MGO Maximum Predicted Mounding – Layer 3

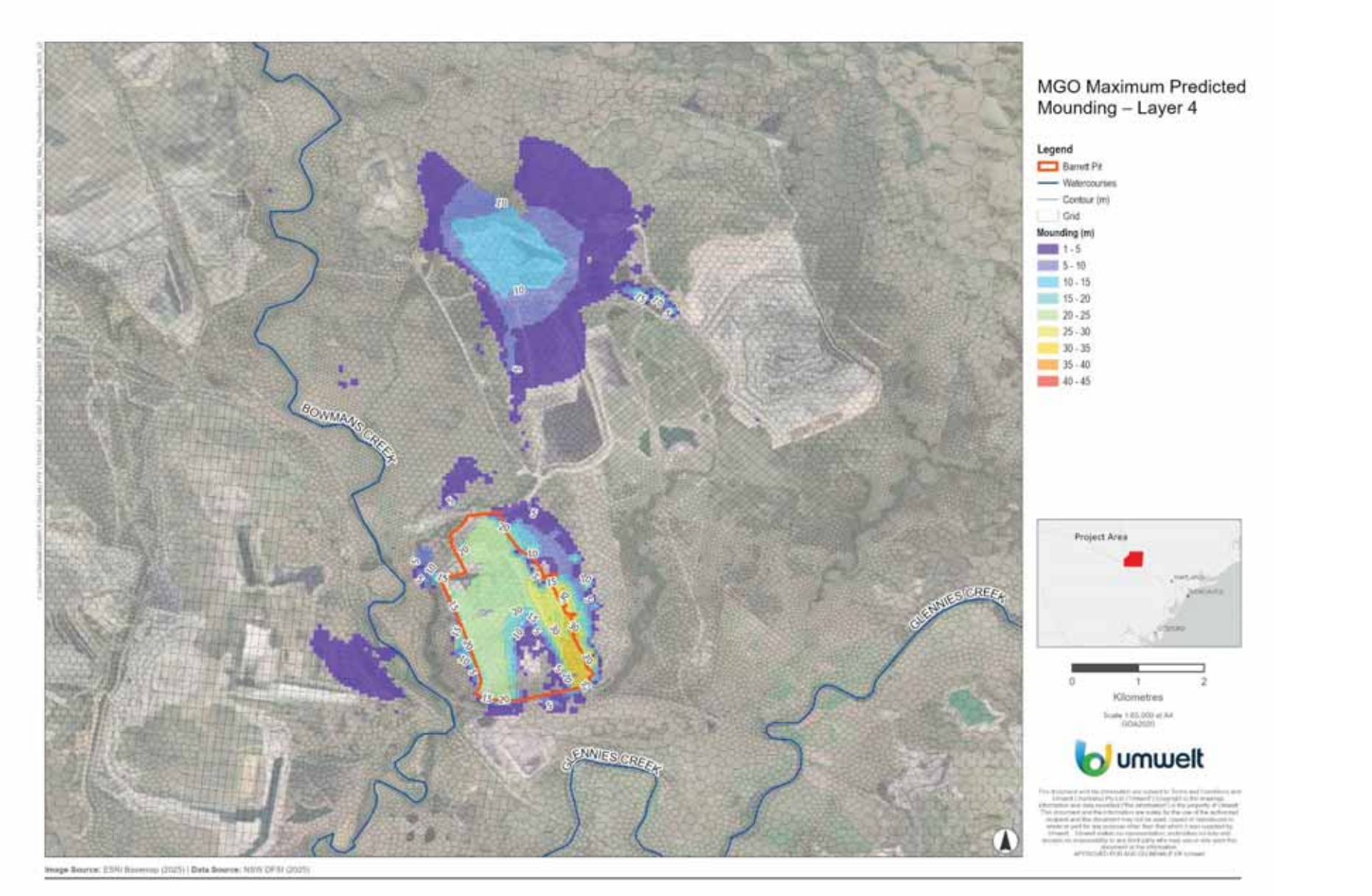


Figure 5.13 MGO Maximum Predicted Mounding – Layer 4

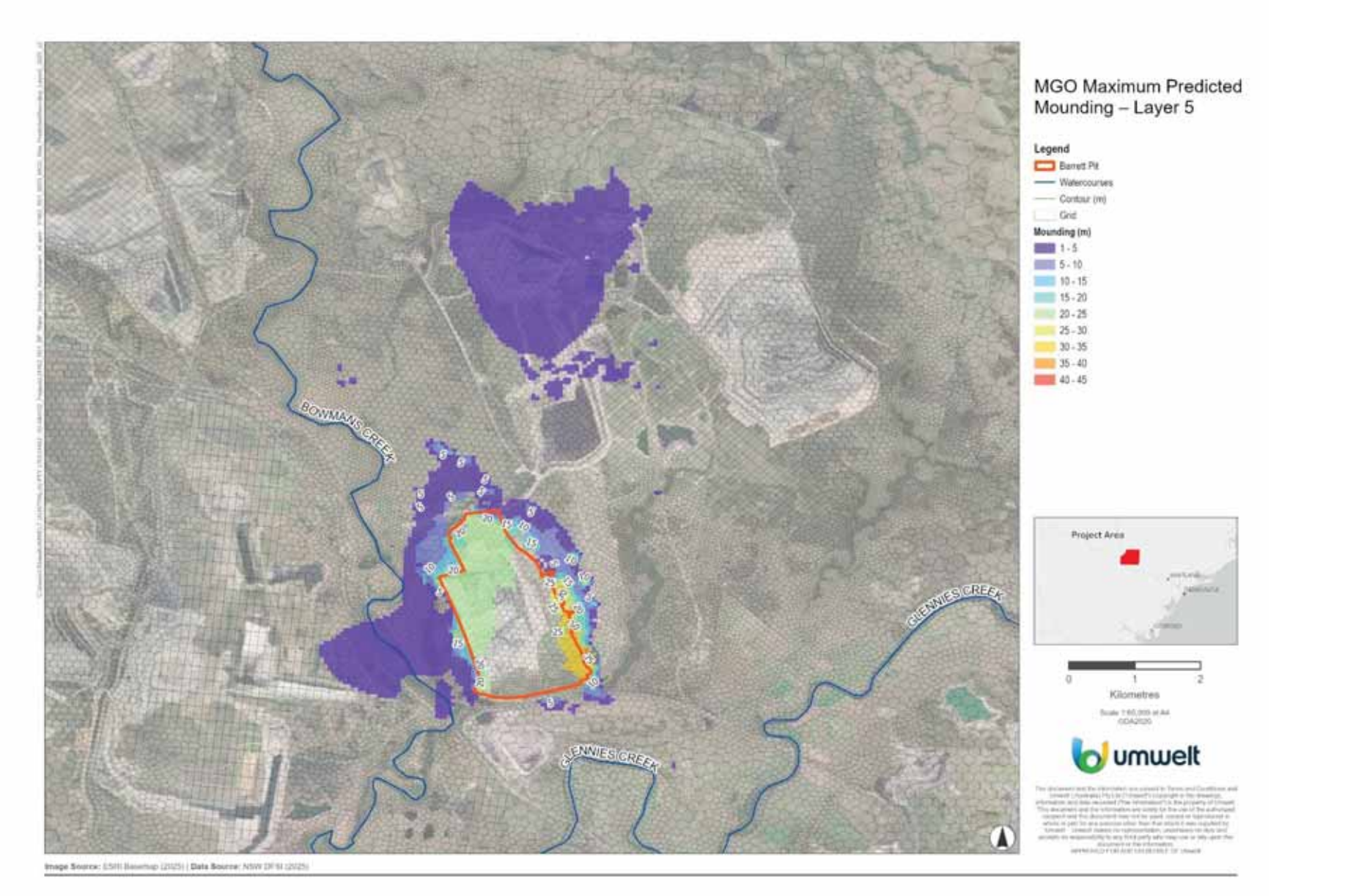


Figure 5.14 MGO Maximum Predicted Mounding – Layer 5

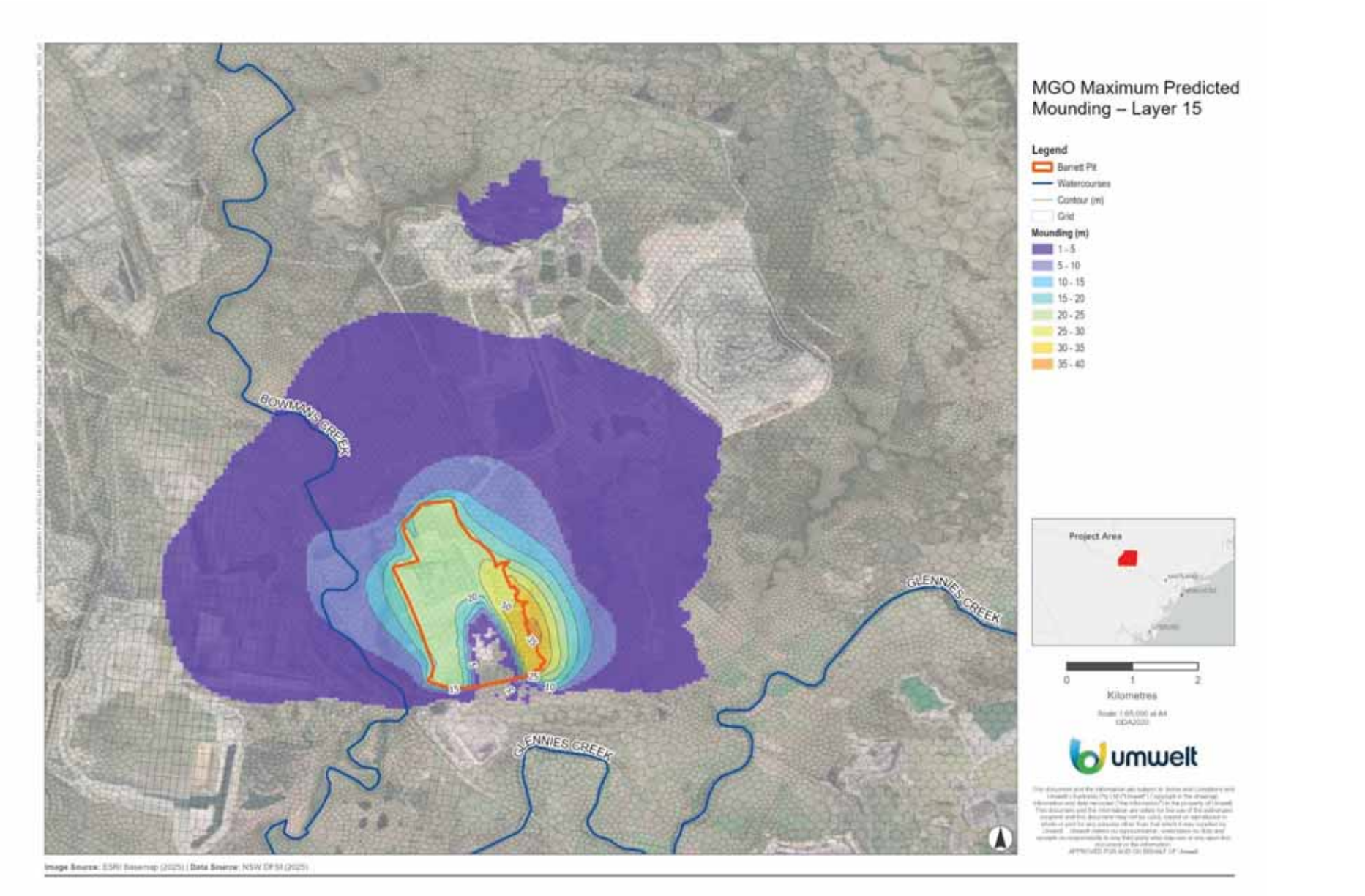


Figure 5.15 MGO Maximum Predicted Mounding – Layer 15

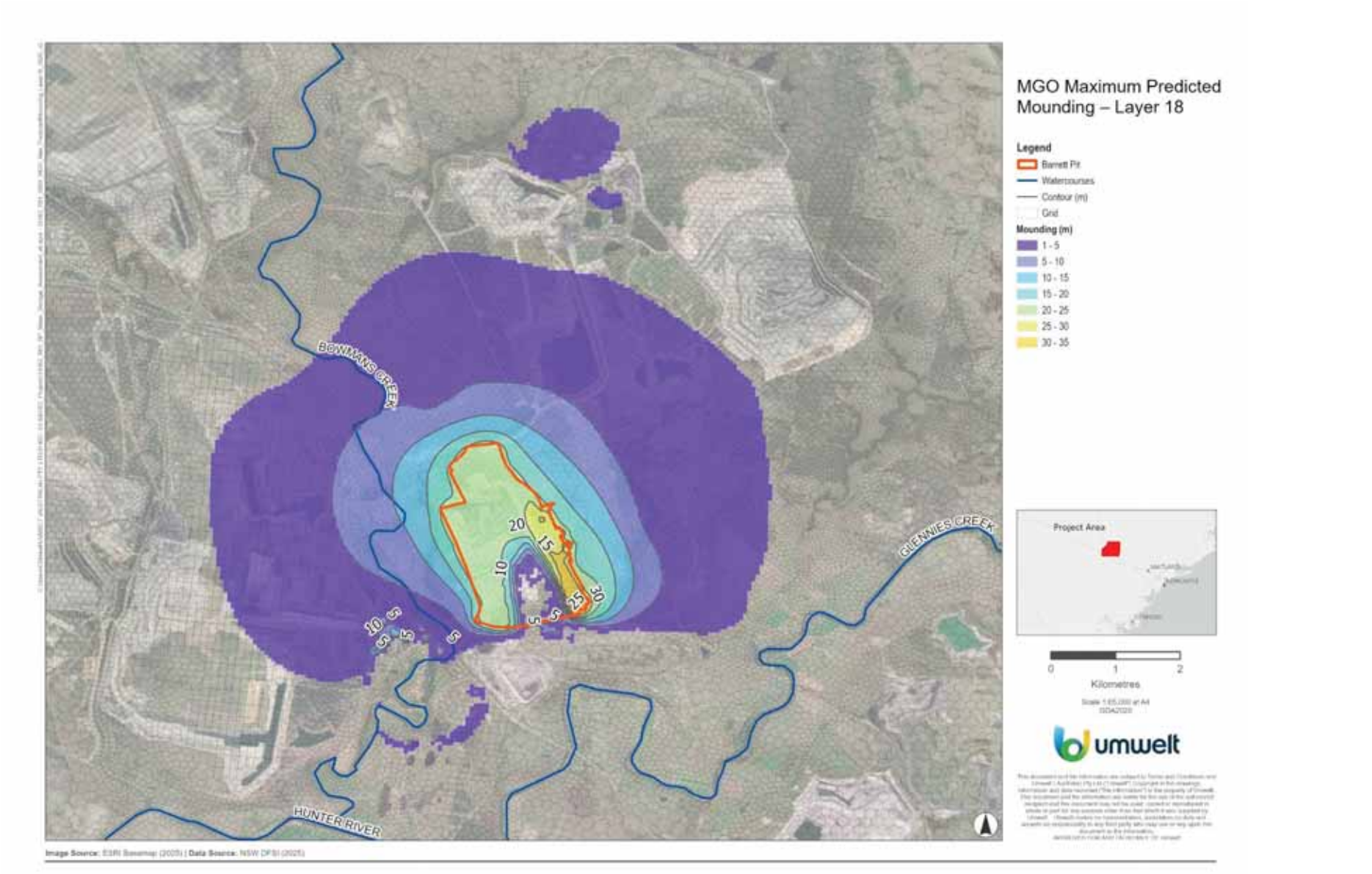


Figure 5.16 MGO Maximum Predicted Mounding – Layer 18

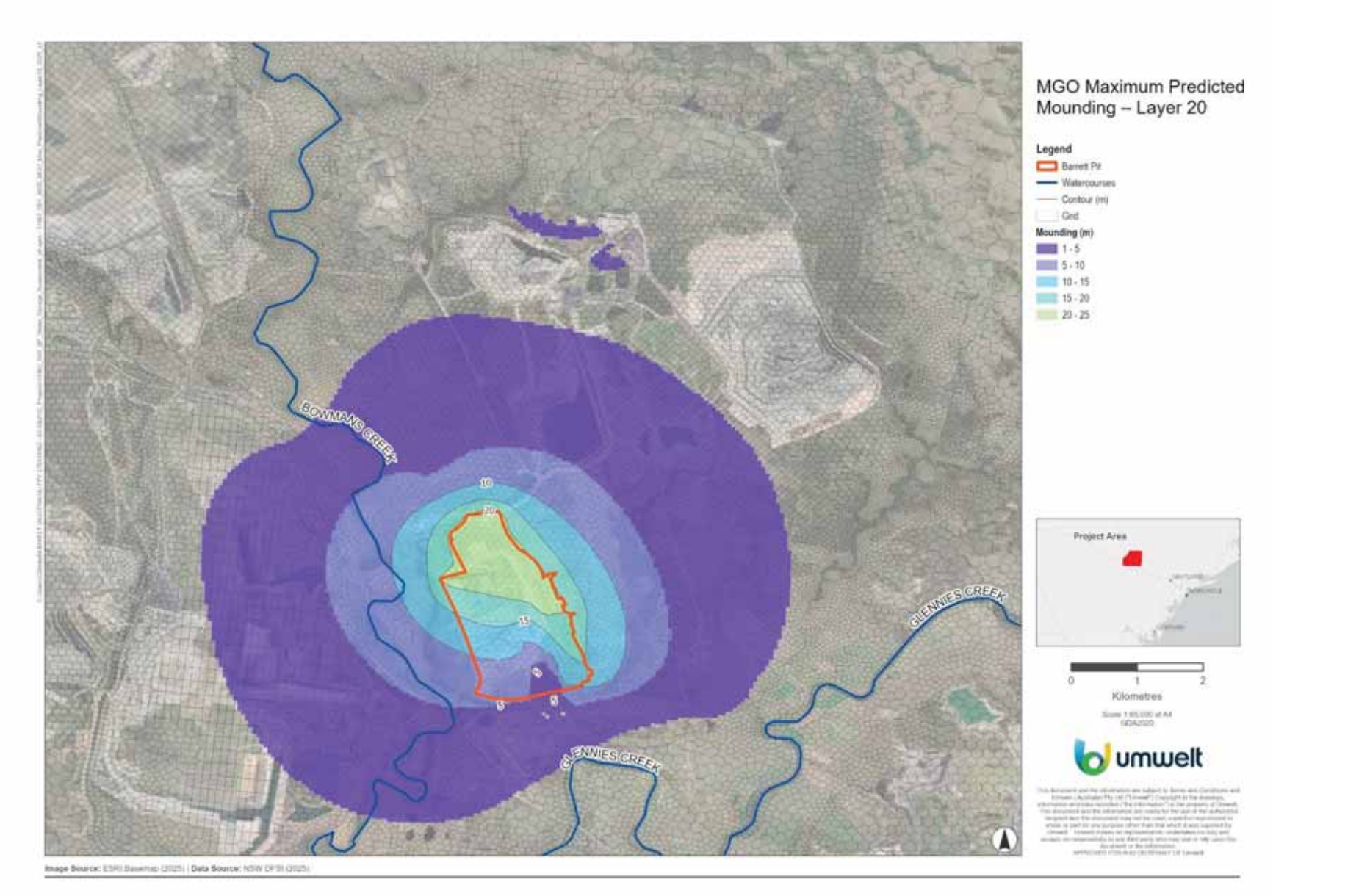


Figure 5.17 MGO Maximum Predicted Mounding – Layer 20

5.2.3 Head Profiles

Figure 5.18 and **Figure 5.19** show groundwater head profiles across Barrett Pit from west to east and from south to north, respectively (refer to **Figure 5.3**), at the end of the proposed use of Barrett Pit as a water storage (2039). As shown, the water level in the pit lake is approximately 12 m AHD, as expected. The profiles indicate potential groundwater inflow to the pit from the west and north, while seepage from the pit may occur towards the south (towards strata depressurised by mining at Ashton) and east (towards the Integra underground workings).

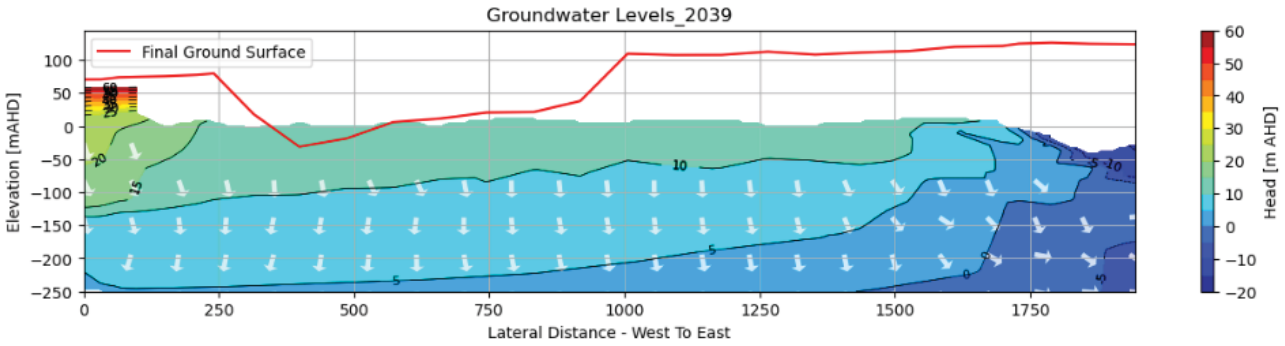


Figure 5.18 Head Profile across Barrett Pit – West to East (A-A`)

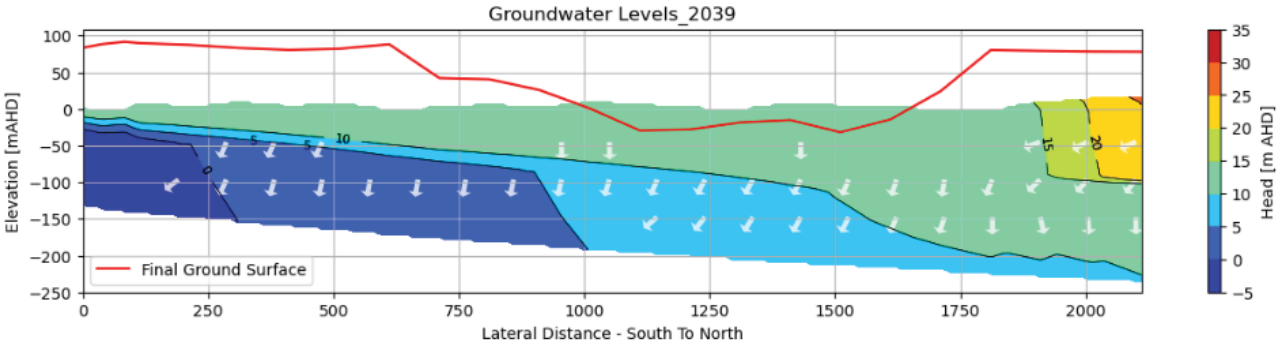


Figure 5.19 Head Profile across Barrett Pit – South to North (B-B')

5.3 Groundwater Flux Changes

5.3.1 Permian coal measures

With additional water storage within Barrett Pit, groundwater levels are higher for the Modification in comparison to the Approved scenario. This creates a change in the head gradient, and potential for additional flow of water from the Barrett Pit void out towards surrounding Permian coal measures. The direction of this flux is influenced by surrounding mining activities, with the gradient of groundwater flow (including through-flow within the pit lake) towards the areas of depressurisation due to mining. This includes towards Integra Mine to the east and Ashton Mine to the south and south-west.

Budget zones were created to quantify the change in flux in the Permian coal measures based on direction. The budget zone locations are shown in **Figure 4.10**. The flux volume was compared between the Modification and Approved model scenarios, with the net difference shown in **Figure 5.20.** shows that additional flux is to the North Permian Measures which have been depressurised by historical mining in the Barrett Pit. A maximum additional flux of water into the surrounding Permian coal measures of 0.29 ML/year is modelled to occur in 2053. At peak, 0.11 ML/year is towards the east, 0.13 ML/year is towards the south and 0.05 ML/year is towards the north.

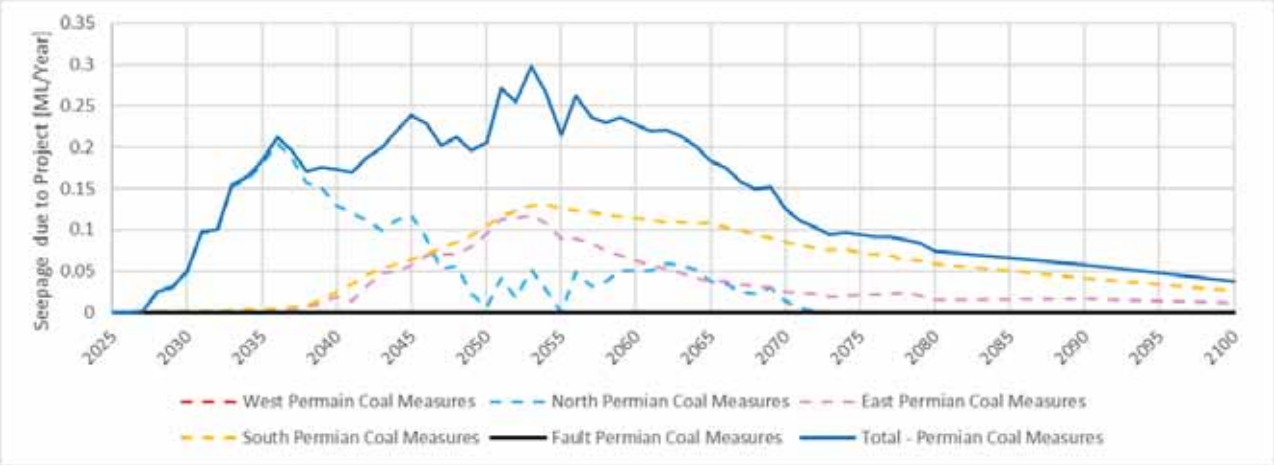


Figure 5.20 Seepage due to the Water Storage Modification

5.3.2 Alluvium

This section presents a summary of the predicted indirect take from alluvium associated with the remodelled approved mine activities at MGO and proposed water storage in Barrett Pit.

The indirect take of water from alluvium was estimated by comparing the net flux to alluvial zones (layer 1) for the Approved/Modification, and No MGO model runs. The increment difference is used to show the indirect take of water from alluvium due to MGO operations, as shown in **Figure 5.21**and **Figure 5.22** for Approved and Modification cases, and summarised for both in **Table 5.2** for the period 2026 to 2039.

The updated model predicts a net reduction (take) in alluvial groundwater from 2026 to 2039 for MGO activities however modelling predicts that the Modification will result in reduced take relative to approved operations. As shown in **Figure 5.21** and summarised in **Table 5.2**, there is up to 19.7 ML/year of groundwater take under the Jerry's Water Source in the Approved case. The predicted take from the Jerrys Water Sources occurs from Betty's Creek, Yorks Creek, Swamp Creek and Hunter

River. In the Modification case this is predicted to be slightly lower, down to 18.5 ML/Year. The predicted take from the Glennies Water source is also predicted to be slightly lower. As discussed earlier, there is no direct connection between the Barrett Pit water storage and alluvium.

The reduction in take relates to the reduced depressurisation of the Permian coal measures that underlie the alluvium. This results in a positive change, with less indirect take from alluvium under the Modification case.

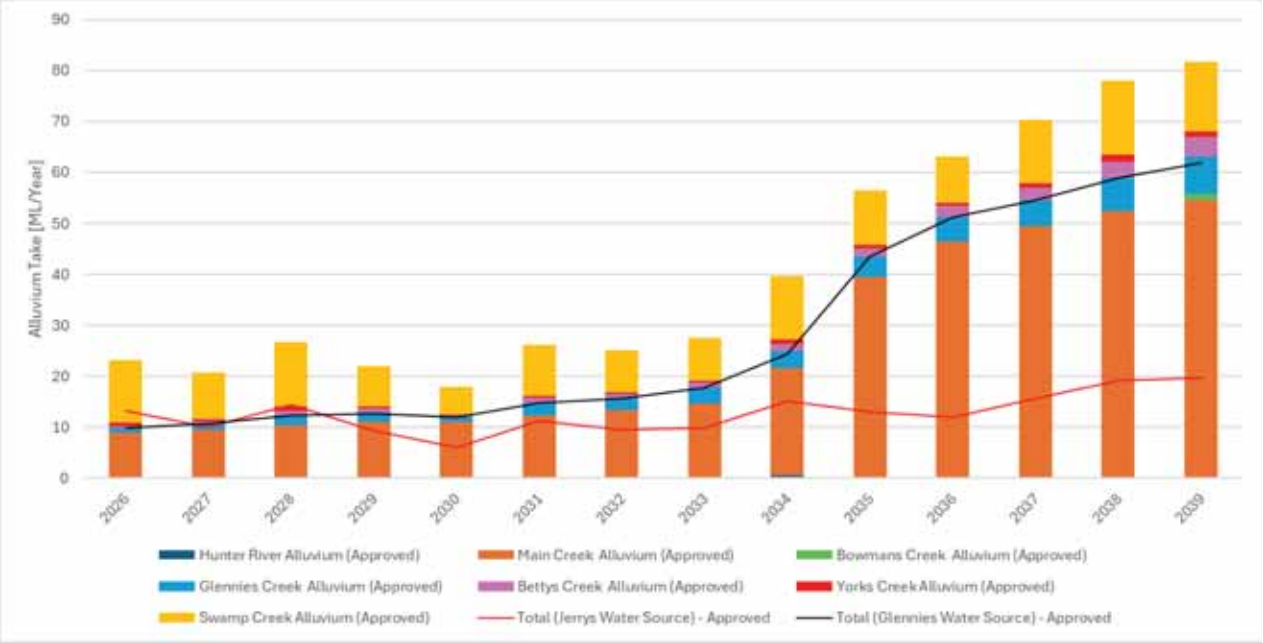


Figure 5.21 Predicted Indirect Take from Alluvium – MGO Approved

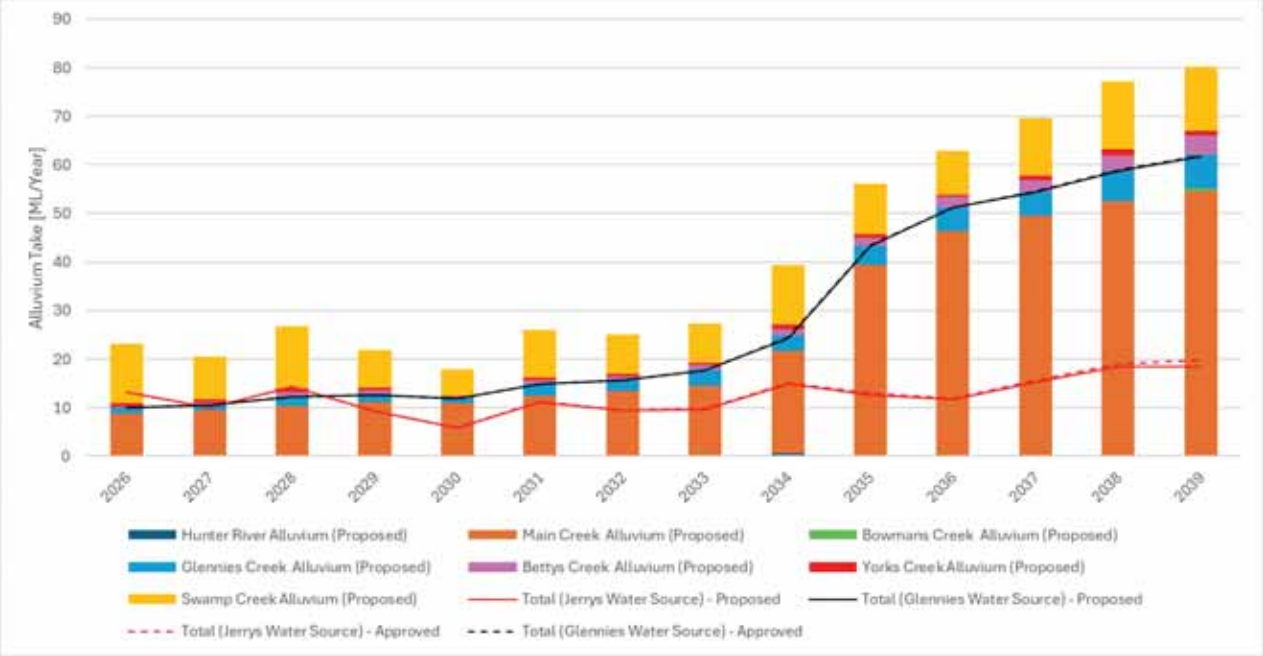


Figure 5.22 Predicted Indirect Take from Alluvium – MGO Modification

Table 5.2 Indirect Take – Hunter Unregulated and Alluvial Water Source

Year	Approved		Modification (approved plus MOD6)	
	Jerrys Water Source (ML/year)	Glennies Water Source (ML/year)	Jerrys Water Source (ML/year)	Glennies Water Source (ML/year)
2018	17	8	17	8
2019	9	8	9	8
2020	13	9	13	9
2021	17	9	17	9
2022	12	10	12	10
2023	9	10	9	10
2024	15	12	15	12
2025	10	13	10	13
2026	3	11	3	11
2027	10	15	10	15
2028	10	16	10	16
2029	10	18	10	18
2030	17	25	16	25
2031	13	43	13	43
2032	13	51	12	51
2033	15	54	15	54
2034	19	59	18	59
2035	20	62	19	62
2036	28	65	27	64
2037	17	63	16	63
2038	25	66	24	66
2039	23	67	22	66

Table 5.3 shows the change in alluvium take due to MOD6 across the different alluvium zones. As shown, the largest reductions in alluvium take attributable to the Modification occur in Swamp Creek and Glennies Creek, which are relatively close to the Barrett Pit, with maximum reductions of approximately 0.53 and 0.25 ML/year, respectively. There is negligible change to Hunter River Alluvium take due to the Modification.

Table 5.3 Changes in Alluvium Take due to the Water Storage Modification

Year	Glennies Water Source		Jerrys Water Source				
	Main Creek Alluvium (ML/year)	Glennies Creek Alluvium (ML/year)	Hunter River Alluvium (ML/year)	Bowmans Creek Alluvium (ML/year)	Bettys Creek Alluvium (ML/year)	Yorks Creek Alluvium (ML/year)	Swamp Creek Alluvium (ML/year)

Year	Glennies Water Source		Jerrys Water Source				
2026	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
2027	0.00	0.00	0.00	0.00	0.00	0.00	-0.02
2028	0.00	0.00	0.00	0.00	0.00	0.00	-0.05
2029	0.00	0.00	0.00	0.00	0.00	0.00	-0.05
2030	0.00	0.00	0.00	0.00	0.00	0.00	-0.05
2031	0.00	-0.01	0.00	0.00	0.00	0.00	-0.12
2032	0.00	-0.02	0.00	0.00	0.00	0.00	-0.12
2033	0.00	-0.03	0.00	0.00	0.00	-0.01	-0.16
2034	0.00	-0.05	0.00	0.00	-0.01	-0.01	-0.25
2035	0.00	-0.07	0.00	0.00	0.00	-0.02	-0.25
2036	0.00	-0.11	0.00	0.00	-0.01	-0.02	-0.26
2037	0.00	-0.17	0.00	0.00	-0.01	-0.03	-0.38
2038	0.00	-0.22	0.00	0.00	-0.01	-0.07	-0.53
2039	0.00	-0.25	0.00	-0.64	-0.01	-0.06	-0.48

5.3.3 Baseflow Changes

With groundwater drawdown in alluvium and regolith, there is potential for reduced baseflow contributions to overlying/adjacent creeks. The predicted net reduction in baseflow contributions for the Approved MGO activities and the Modification scenario, from 2026 to 2039, are shown in **Figure 5.23** and **Figure 5.24**, and summarised in **Table 5.4**.

The predicted surface water take is up to 82 ML/year from the Jerrys Water Source and up to 20 ML/year from the Glennies Water Source. The predicted baseflow take is very similar for the Approved and Modification cases, as shown in **Table 5.4**. However, the Modification will result in lower (up to 0.1-0.8 ML/year) baseflow take relative to approved operations due to lower gradients towards Barrett Pit.

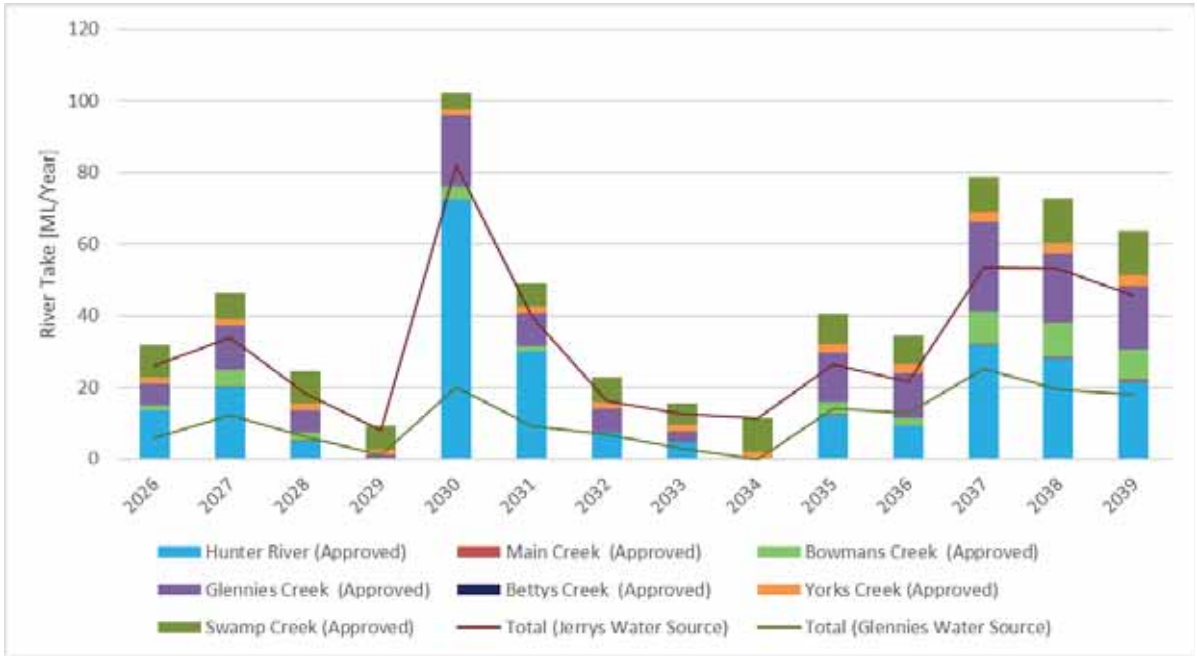


Figure 5.23 Predicted Baseflow Reduction – Approved

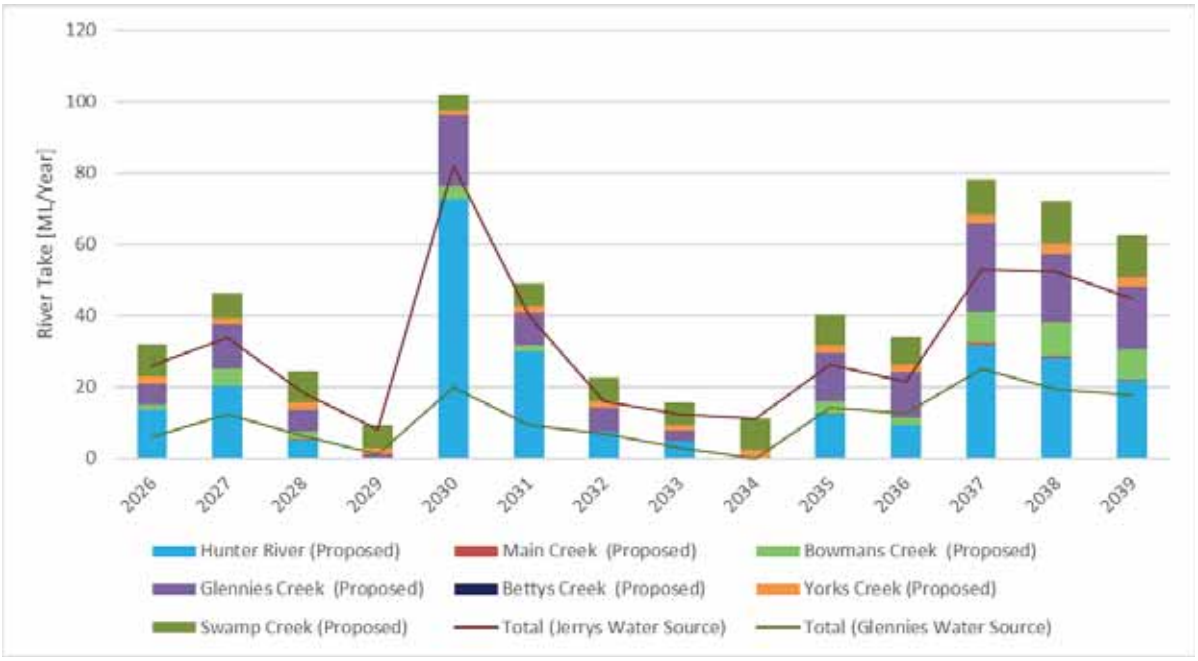


Figure 5.24 Predicted Baseflow Reduction – Modification

Table 5.4 Indirect Take – Baseflow Reductions

Year	Approved		Modification	
	Jerrys Water Source – Surface Water (ML/year)	Glennies Water Source – Surface Water (ML/year)	Jerrys Water Source – Surface Water (ML/year)	Glennies Water Source – Surface Water (ML/year)
2026	26.1	5.9	26.0	5.9

Year	Approved		Modification	
	Jerrys Water Source – Surface Water (ML/year)	Glennies Water Source – Surface Water (ML/year)	Jerrys Water Source – Surface Water (ML/year)	Glennies Water Source – Surface Water (ML/year)
2027	33.8	12.4	33.8	12.4
2028	18.5	6.1	18.4	6.1
2029	8.2	1.0	8.1	1.0
2030	82.1	20.0	82.1	20.0
2031	39.9	9.2	39.8	9.2
2032	16.1	6.8	16.0	6.8
2033	12.6	3.1	12.5	3.1
2034	11.4	0.0	11.1	0.0
2035	26.5	14.1	26.1	14.0
2036	21.8	12.8	21.4	12.7
2037	53.6	25.2	53.0	25.1
2038	53.2	19.6	52.5	19.4
2039	45.7	18.0	44.9	17.7

Table 5.5 shows the change in baseflow take due to MOD6 across the different watercourses. As shown, the largest reductions in baseflow take attributable to the Modification occur in Swamp Creek, which is relatively close to the Barrett Pit, with reduced baseflow of up to 0.54 ML/year relative to approved operations.

Table 5.5 Change in Water Take due to the Modification

Year	Glennies Water Source		Jerrys Water Source				
	Main Creek (ML/year)	Glennies Creek (ML/year)	Hunter River (ML/year)	Bowmans Creek (ML/year)	Bettys Creek (ML/year)	Yorks Creek (ML/year)	Swamp Creek (ML/year)
2026	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
2027	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
2028	0.00	0.00	0.00	0.00	0.00	-0.01	-0.03
2029	0.00	0.00	0.00	0.00	0.00	-0.01	-0.03
2030	0.00	0.00	0.00	-0.01	0.00	-0.02	-0.03
2031	0.00	-0.01	0.00	-0.01	0.00	-0.02	-0.07
2032	0.00	-0.01	0.00	0.00	0.00	-0.02	-0.10
2033	0.00	-0.03	0.00	0.00	0.00	-0.02	-0.10
2034	0.00	0.00	0.00	0.00	0.00	-0.04	-0.20
2035	0.00	-0.06	0.00	-0.05	0.00	-0.05	-0.25
2036	0.00	-0.09	0.00	-0.05	0.00	-0.04	-0.25
2037	0.00	-0.14	0.00	-0.09	0.00	-0.06	-0.38

Year	Glennies Water Source		Jerrys Water Source				
2038	0.00	-0.18	0.00	-0.14	0.00	-0.10	-0.50
2039	0.00	-0.21	-0.01	-0.17	0.00	-0.09	-0.54

5.4 Sensitivity Scenarios

The model was run with sensitivity analysis to assess to what extent changes in hydrogeological properties and also the storage levels may impact water level predictions and seepage rates under MOD6. The sensitive cases are described in **Table 4.6** in **Section 4.3**.

5.4.1 Sensitivity of Groundwater Head Changes

Figure 5.25 shows the extent of groundwater level increases greater than 1 m for the Modification, relative to the Approved case, in Layer 2. As shown, the basecase storage scenario results in a maximum increase in groundwater level extending up to approximately 1 km to the north of the Barrett Pit void. The extent of this relative increase (referred to in this report as mounding) in heads is around 500 m to the east and approximately 500 m to the south of the void. To the west, the increase is largely confined to the vicinity of the pit void; however, an isolated area of groundwater heads is predicted approximately 1.5 km west of the void within an area heavily influenced by retained mining voids further to the west.

As expected, scenarios with lower final water storage levels (i.e. Cases 1 and 2) result in a reduction in the extent of groundwater mounding, and the isolated mounding area to the west disappears. As shown in the figure, the presence of faults has little influence on the maximum extent of mounding in Layer 2, although it generally reduces the extent, particularly to the north of the pit. The extent of mounding in Cases 6 and 7 differs notably from the other scenarios, as the hydraulic properties have been modified across the entire model domain relative to the Approved basecase, which generally leads to an increase in the extent of groundwater mounding. In general, Case 6 with 20 percent increase in hydraulic properties in shallow areas gives a broader extent compared to Case 7.

The maximum groundwater mounding extents attributable to the modification are similar in the vicinity of BNP for most scenarios, except for Cases 6 and 7, where changes to hydraulic properties across the entire model domain result in notably different mounding extents.

Figure 5.26 shows the extent of groundwater level increases (mounding) greater than 1 m for the water storage scenarios, relative to the Approved case, in Layer 5. As shown, the basecase storage scenario results in a maximum increase in groundwater level extending up to approximately 2 km to the north of the current pit void. The extent of mounding is around 700 m to the east and approximately 500 m to the south. To the west the area of groundwater mounding is predicted to extend to as far as 1.7 km west of the void.

As expected, scenarios with lower final water storage levels (i.e. Cases 1 and 2) result in a reduction in the extent of groundwater mounding. As shown in the figure, the presence of faults has little influence on the maximum extent of mounding in Layer 5, although it generally reduces the extent, particularly to the north of the pit while it leads to appearance of isolated areas to with maximum mounding greater than 1 m in the south and north of the Barrett Pit. The extent of mounding in Cases 6 and 7 differs notably from the other scenarios, as the hydraulic properties have been modified across the entire model domain relative to the approved basecase, which generally leads to an increase in the extent of groundwater mounding. In general, Case 6 with 20 percent increase in hydraulic properties in shallow areas gives a broader extent compared to Case 7.

The maximum groundwater mounding extents attributable to the Modification are similar in the vicinity of BNP for most scenarios, except for Cases 6 and 7, where changes to hydraulic properties across the entire model domain result in notably different mounding extents

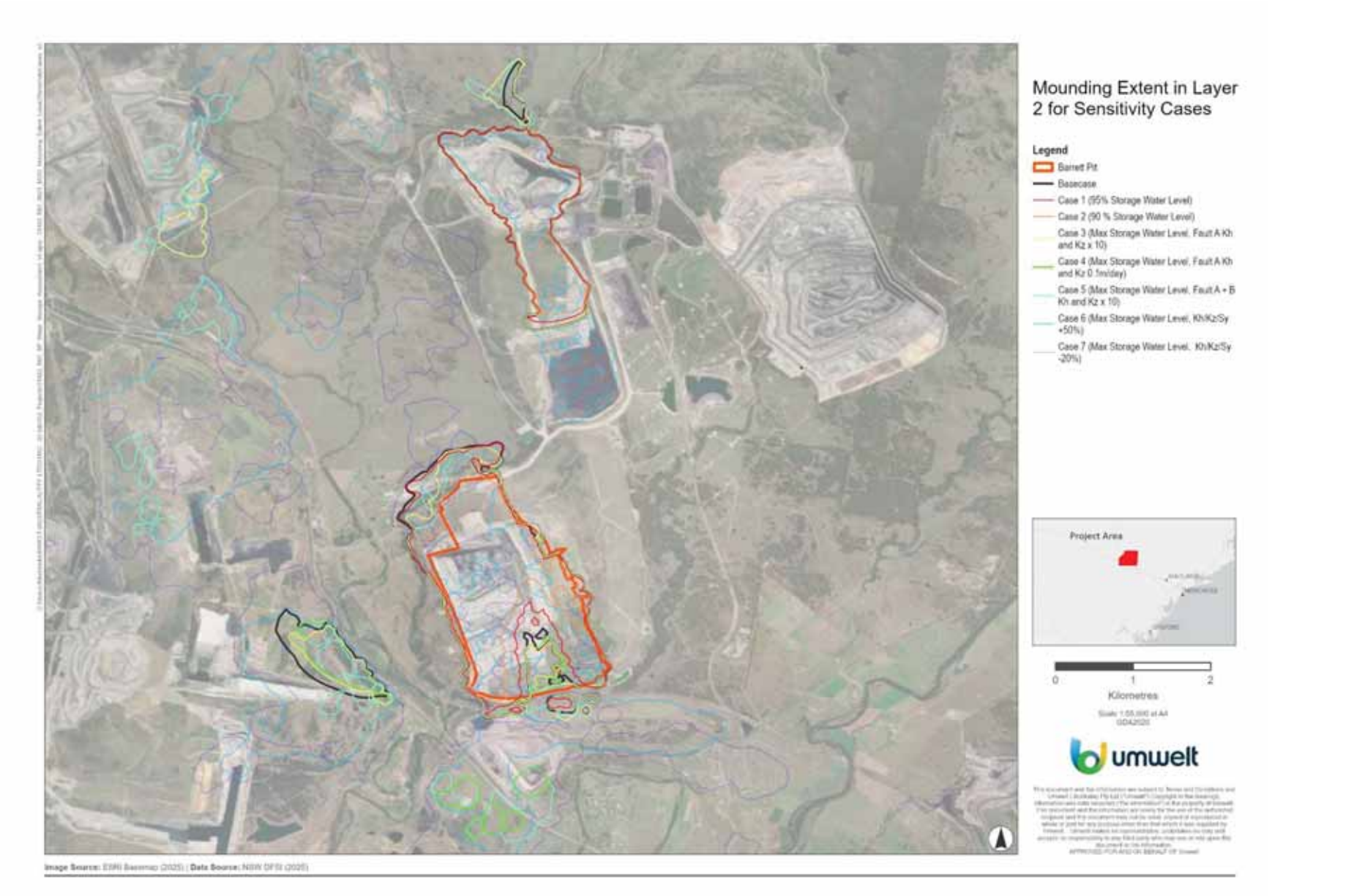


Figure 5.25 Mounding Extent in Layer 2 for Sensitivity Cases

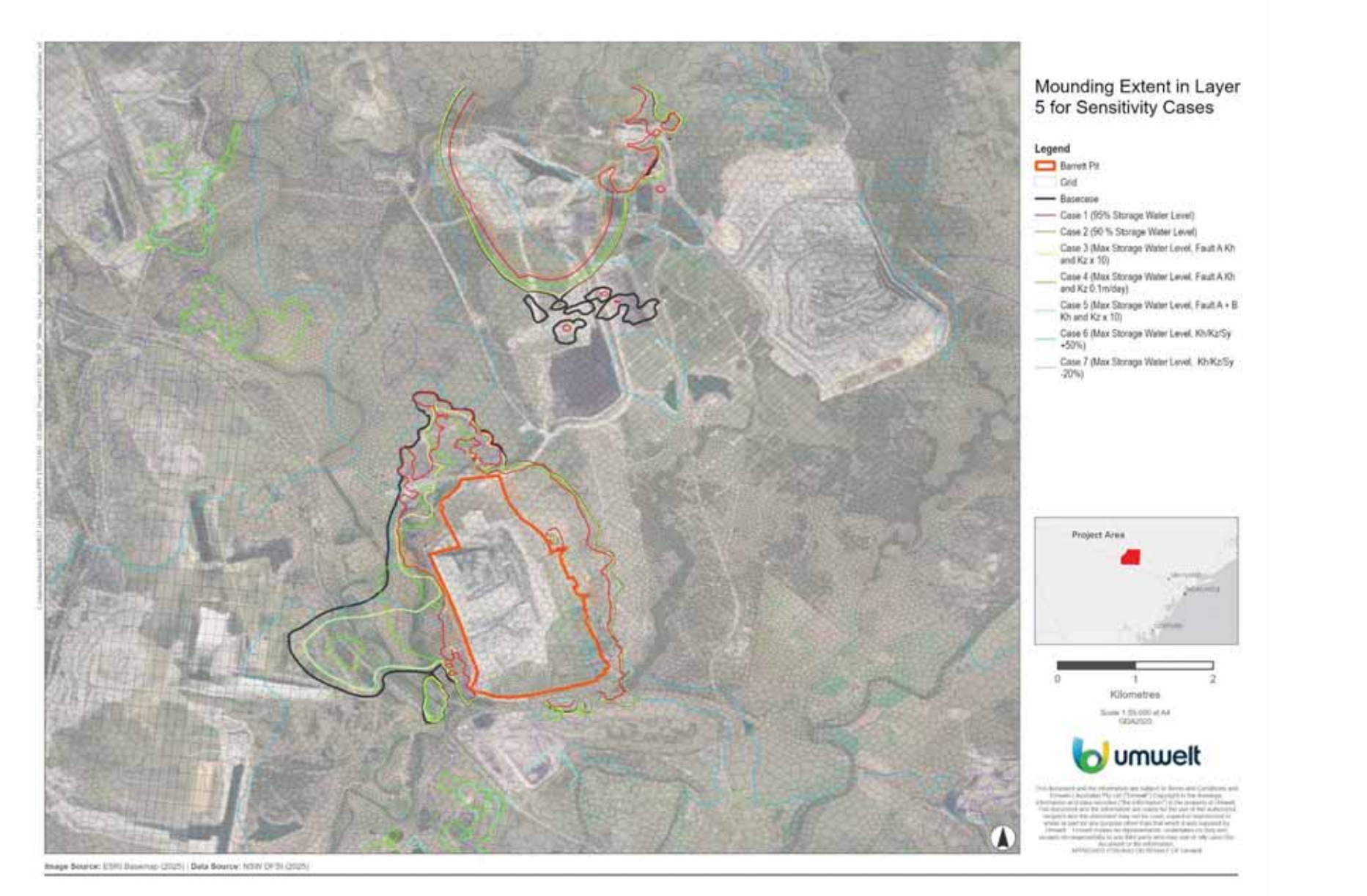


Figure 5.26 Mounding Extent in Layer 5 for Sensitivity Cases

5.4.2 Sensitivity of Groundwater Flux

Figure 5.27 shows flow out (seepage) from the Barrett Pit across the western edge of the pit for both the weathered zone (upper 30 m) and the Permian coal measures, extending from approximately 30 m below ground level to about 10 m AHD, which corresponds to the predicted Barrett Pit final water level at the end of the storage in 2039.

In the West—Weathered zone, the additional (incremental) pit seepage due to the Modification is small but persistent, rising from ~0 ML/yr in 2025 to ~0.01 ML/yr by 2050 and remaining in that range through 2080; Case 6 peaks at ~0.02 ML/yr, while Case 2 is lowest (~0.005 ML/yr).

In the West—Permian coal measures, incremental pit seepage is largely a short-lived early response (≤2030) of up to 0.012ML/year (Case 6) likely associated with initial resaturation of strata adjacent to flooded areas of the void. Transient spikes are predicted, with up to ~0.002 ML/yr predicted (Case 7) before dropping to ~0 ML/yr thereafter. In conclusion, the Modification introduces a sustained increase in seepage from the pit toward the west within the weathered profile, whereas additional seepage into the Permian coal measures is negligible beyond the initial years.

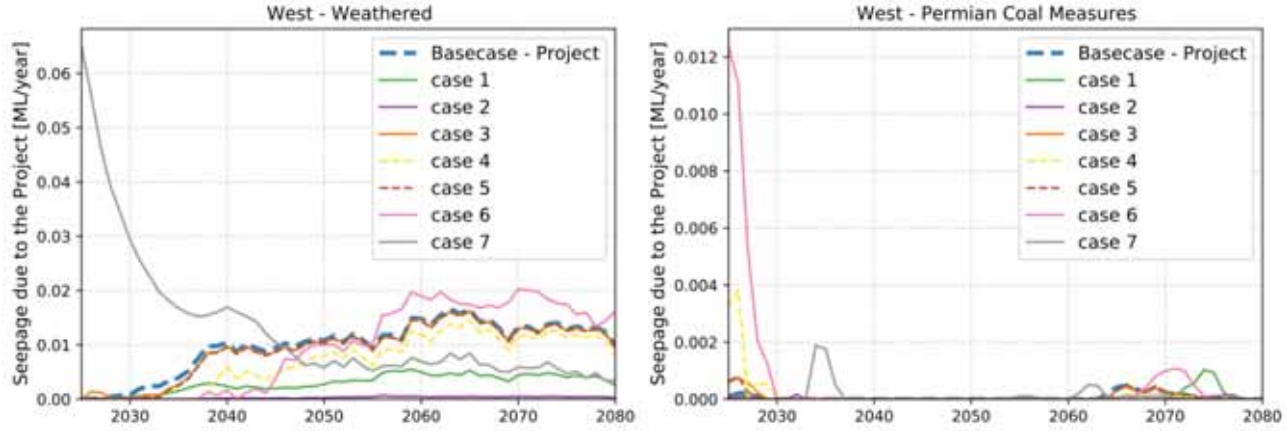


Figure 5.27 Flow Out of Barrett Pit (Seepage) to West due to the Modification – Sensitivity Cases

The additional seepage due to the Modification from Barrett Pit toward the east (**Figure 5.31**) is markedly different from the west. In the East—Weathered zone, seepage is very small, rising from near zero around 2030 to a peak of approximately 0.005–0.0065 ML/year between 2040 and 2050, before tapering to about 0.002 ML/year by 2080. In contrast, seepage to the East—Permian coal measures becomes dominant, remaining near zero until about 2035, then increasing sharply to peak values of 0.12 ML/year around 2054, and declining gradually but staying above 0.02 ML/year through to 2080. This delay in increased seepage is likely due to the dominant effect of groundwater movement towards the Integra underground workings during this which the rise occurring as groundwater levels recover in this area and the effects of the relative changes in water level in the Barrett Pit become more dominant. Compared to the west, where incremental seepage is concentrated in the weathered zone and negligible in the Permian coal measures beyond early spikes, the east shows an order-of-magnitude lower seepage in the weathered zone but a much larger and sustained increase in Permian coal measures with time, likely associated with the groundwater gradient towards areas depressurised by Integra (and Mount Owen Mine North Pit) . Overall, the Modification introduces higher relative flux toward the west within the weathered profile, whereas toward the east, additional seepage is dominated by long-term inflows to the Permian coal measures.

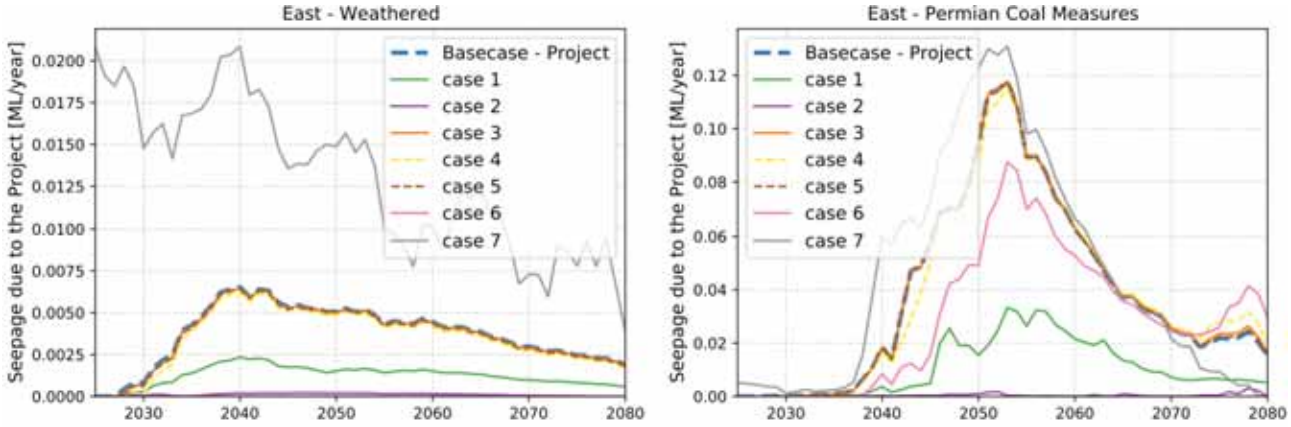


Figure 5.28 Flow Out of Barrett Pit (Seepage) to East due to the Modification – Sensitivity Cases

The additional seepage from Barrett Pit toward the south (**Figure 5.29**) shows a mixed pattern between shallow and deep zones. In the South—Weathered zone, additional seepage rises from near zero around 2030 to peaks of ~0.01 ML/year between 2040 and 2060, then declines gradually toward ~0.005 ML/year by 2080. Scenario variability is moderate, with Case 6 and Case 7 showing spikes above 0.02 ML/year. In contrast, additional seepage to the South—Permian coal measures is substantial and long-lived, starting near zero until ~2035, then increasing sharply to peak values of ~0.13 ML/year around 2054, before slowly declining but remaining above ~0.07 ML/year through 2080. As with flow to the East, this profile is likely attributable to the effects of groundwater flow in this area towards the areas depressurised by Ashton Mine. Compared to other directions, the south exhibits weathered zone additional seepage similar to the west (persistent but modest), while additional seepage to the Permian coal measures is even greater than the east, making the south the dominant pathway for long-term deep groundwater flow. Overall, the Modification introduces a minor increase in shallow seepage southward but a significant, sustained increase in deep seepage toward the Permian coal measures.

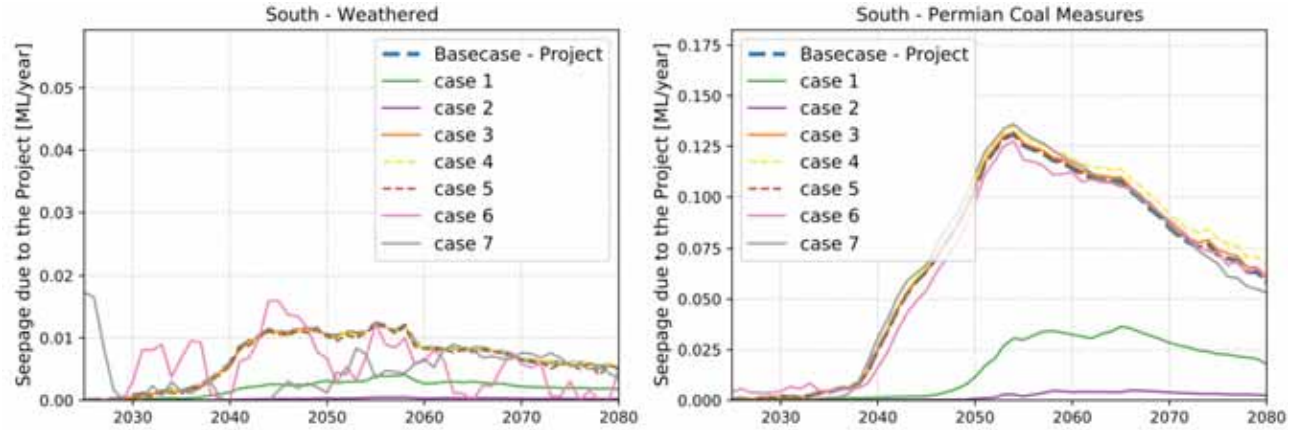


Figure 5.29 Flow Out of Barrett Pit (Seepage) to South due to the Modification – Sensitivity Cases

In the north, additional seepage due to MOD6 (**Figure 5.30**) is negligible within the weathered zone, remaining close to zero throughout the simulation period except for isolated spikes in a few scenarios (e.g., Case 7 reaching ~0.025 ML/year around 2027). Most cases stay below 0.005 ML/year, indicating

minimal long-term impact in shallow strata. In contrast, seepage into the Permian coal measures is substantial and sustained: starting near zero until ~2027, then rising sharply to peak at ~0.2 ML/year (Basecase) and ~0.37 ML/year (Case 7) reflecting the (relative) increased head gradient from the Barrett Pit towards the depressurised strata to the north. After peaking, the increase in seepage (relative to the Approved case) declines gradually but mostly remains above 0.05 ML/year until ~2070, tapering toward zero by 2080 when post mining water groundwater levels under a passive recovery (Approved Scenario) approach the modelled water levels under the Modification scenario. Overall, the area north of Barrett Pit exhibits negligible shallow seepage but significant and long-lived deep inflows, making the Permian coal measures the dominant pathway for Modification-induced seepage in this direction.

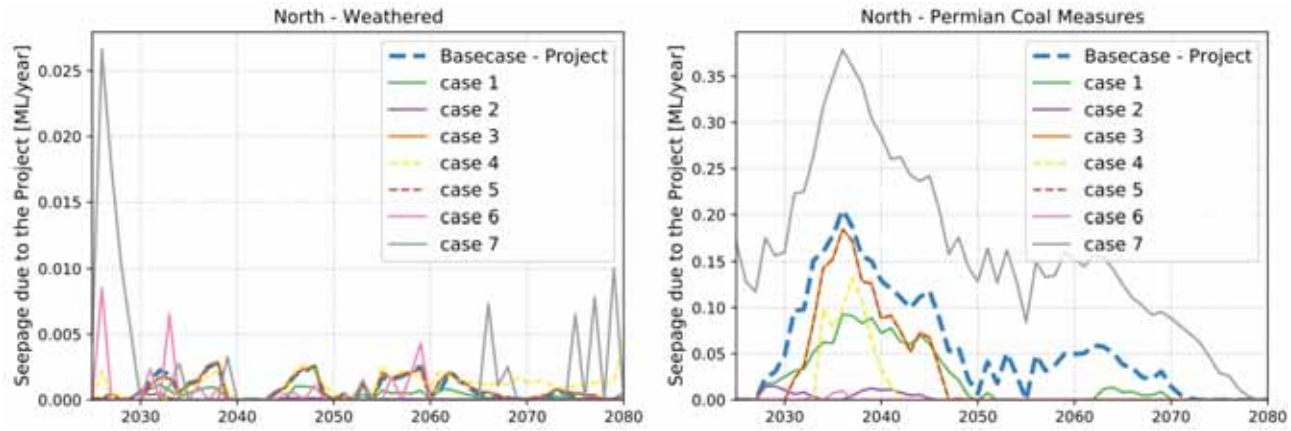


Figure 5.30 Flow Out of Barrett Pit (Seepage) to North (Excluding the Fault Zone) due to the Modification – Sensitivity Cases

Figure 5.31 illustrates the effect of faults on seepage in the shallow and weathered zones along the north-western boundary of the Barrett Pit, where the faults intersect the pit. In the fault zone, additional seepage due to the Modification shows contrasting behaviour between the Permian coal measures and the weathered zone. For the Permian coal measures, seepage remains negligible until around 2038, then gradually increases in scenarios where the fault is included, peaking at approximately 0.08 ML/year for Case 5 and up to ~0.12 ML/year for Case 4 by 2080, indicating a slow but persistent rise over time. In contrast, seepage within the weathered zone is larger and occurs earlier, with Case 4 dominating—peaking near 0.37 ML/year around 2040 before declining slightly but remaining above 0.20 ML/year through to 2080. Case 5 also shows substantial seepage, stabilizing around 0.18 ML/year after 2040. The basecase and other scenarios remain near zero in both zones. Overall, the fault acts as a conduit for Modification-induced seepage in the weathered zone, with long-term inflows significantly exceeding those in the Permian coal measures, where increases are slower and less pronounced.

In general, the seepage rates are consistent with the groundwater head profiles presented in **Section 5.2.3** which indicate relatively higher seepage rates towards the east and south compared to the west and the north-west, including the fault zone. Incremental flux rates associated with the Modification overall are however very small and 2 orders of magnitude lower than predicted peak mine inflows.

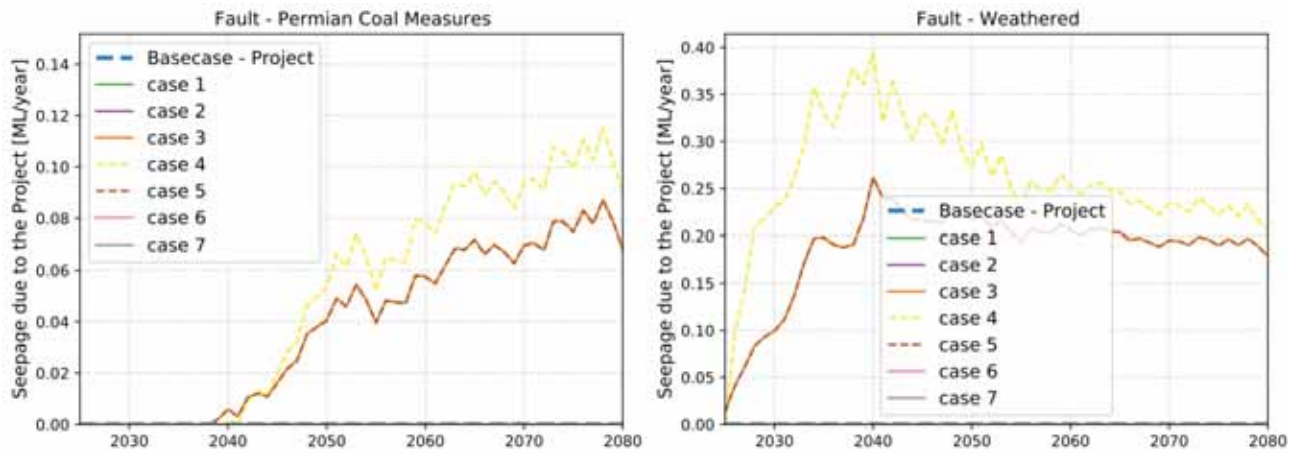


Figure 5.31 Flow Out of Barrett Pit (Seepage) to the Fault Zone due to the Modification – Sensitivity Cases

6.0 Impact Assessment

6.1 Impact to Water Quality

As discussed in **Section 1.2** the Modification seeks to enable the use of Barrett Pit as a mine water storage up until 31 December 2039. Under the Modification, water storage (mine water only) is predicted to result in a maximum pit lake level of up to 12 mAHD at end of active storage in 2039, which is significantly lower than the shallow aquifers of the alluvium and weathered regolith.

Maximum mine water storage levels in the Barrett Pit will remain well below the base of alluvium and there is no direct connection between the Barrett Pit water storage and the alluvium and weathered regolith. The predicted peak storage level is also lower than the maximum predicted pit lake water levels under the Approved scenario, however, the Modification will result in higher water levels within the Barrett Pit earlier relative to a passive recovery of the pit lake under the Approved scenario. This temporal change in relative water levels will result in a temporal change in head gradient from Barrett Pit water storage to surrounding Permian coal measures relative to approved operations. Modelling indicates a maximum additional flux of water into the surrounding coal measures of 0.29 ML/year. Of this, 0.11 ML/year is towards the east, 0.13 ML/year is towards the south and 0.05 ML/year is towards the north. This incremental flux is more than 2 orders of magnitude lower than predicted peak mine inflows and is considered to be negligible in the context of overall regional groundwater movement.

The Modification will not result in any increased drawdown in any areas and is predicted to result in faster recovery of groundwater heads in some areas due to the earlier recovery of groundwater levels associated with water storage in the BNP.

Water quality within the Barrett Pit water storage will change over time with pumping of mine water, groundwater inflows, recharge and evaporative processes. ATC Williams has undertaken a salt balance for the Modification which predicts that the TDS of stored water in Barrett Pit will decrease from 5,500 mg/L in 2025 to ~3,000 mg/L in 2039 under median rainfall conditions (ATC Williams, 2025).

Groundwater within the coal measures is moderately saline to saline, with an average TDS of around 6,320 mg/L for coal and 5,850 mg/L for interburden. Therefore, the additional flux of water from the Barrett Pit water storage is unlikely to induce degradation of groundwater quality in the receiving Permian coal measures.

6.2 Potential Impacts on Groundwater Users

The updated groundwater model predictions described in **Section 5.0** has identified no potential adverse impacts to impact on groundwater users or sensitive receptors as a result of the Modification. These potential impacts are discussed below in terms of impacts to water quality and on identified groundwater users, being GDE and landholder bores.

6.2.1 Impacts to Anthropogenic Users

Four landholder bores within privately owned land were identified within 2 km of the Barrett Pit. These bores are registered for water supply use and are inferred to target the alluvium and regolith (model

layer 1 to 4) based on the available bore depth details. Modelled head was extracted at these bores under the Approved and Modification scenarios. The relative head difference (referred to in this report as mounding) between the two scenario was calculated to determine the maximum potential impact. These modelled head extracts are presented in **Table 6.**

Table 6.1 Impacts to Anthropogenic Groundwater Users (Registered Landholder Bores)

State Bore ID	Easting	Northing	Bore Depth mbgl	Maximum Mounding due to Modification (m)
GW078054	317122	6409486	16.2	0.025
GW046787	317205	6409241	6.2	0.008
GW064515	320397	6406064	5.5	0.121
GW045084	322029	6406832	0	0.001

No increased reduction (drawdown) of water levels is predicted and the proposed relative increases in groundwater levels (mounding) will not have any material adverse impacts on bore operation and may result in minor benefits due to increases in groundwater levels and availability. The predicted changes are likely to be well within natural variability based on observations from comparable bores and are unlikely to be detectible. No impacts to anthropogenic groundwater users as a result of the Modification are anticipated.

6.2.2 Impacts to Groundwater Dependant Ecosystems

Potential GDEs have been identified around Glendell, as discussed in **Section 3.4.4.2**. This includes terrestrial and aquatic ecosystems associated with the Hunter River and its tributaries, including Betty's Creek, Swamp Creek and Bowmans Creek.

Shallow groundwater likely to support terrestrial and aquatic GDE is generally associated with the Quaternary alluvial deposits present along Swamp Creek, Bettys Creeks and Bowmans Creek. Based on the monitoring data available, groundwater levels within the alluvium, range between 2 m to 7 metres below ground level (mbgl).

The Modification will not result in any incremental drawdown relative to approved operations, either in temporal or absolute terms.

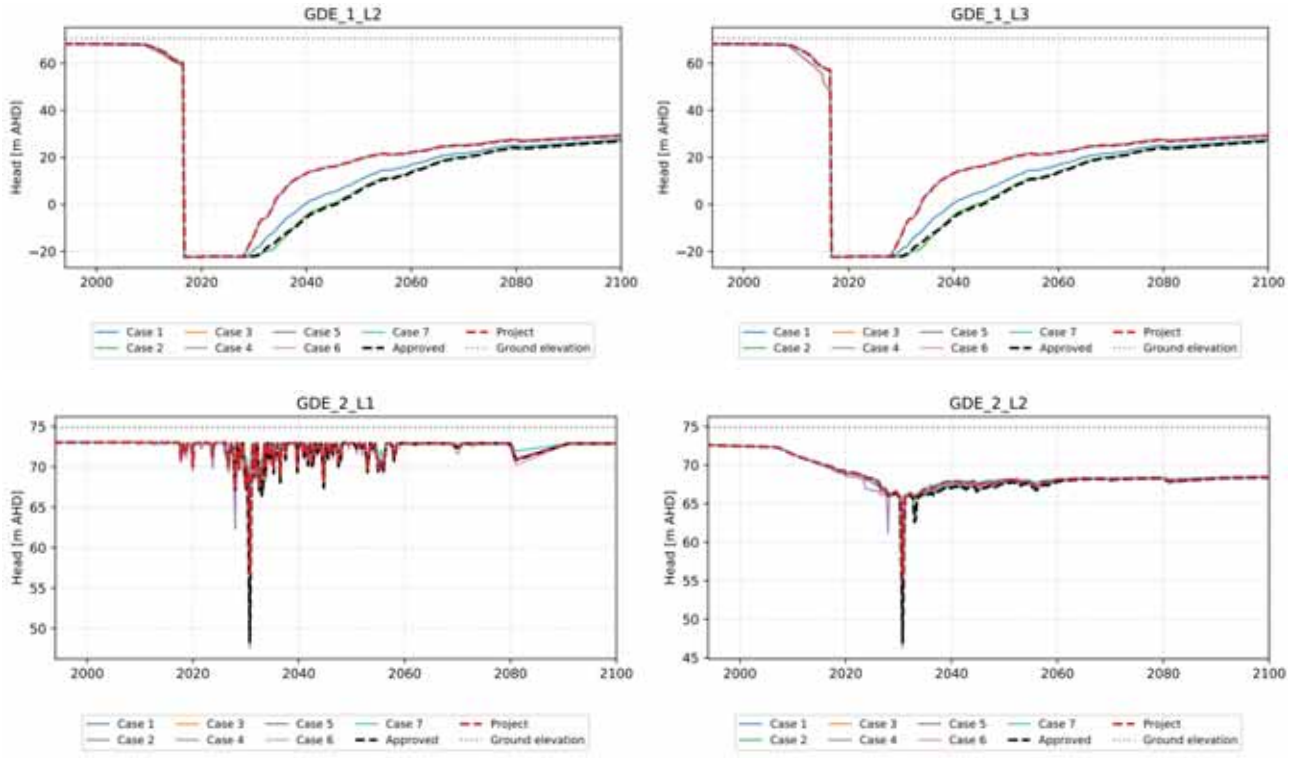
As presented in **Section 5.2.2,** the Modification will result in faster recovery of groundwater heads in areas impacted by mining. This relative increase in groundwater heads is a temporal effect with the Modification resulting in faster recovery than under a passive pit lake recovery scenario as contemplated for the Approved scenario. Alluvium is located in proximity to MGO pits, specifically North Void, Barrett Pit and North Pit. While there is no direct connection from the proposed Barrett Pit water storage and alluvium (and water levels in Barrett Pit will remain below the base of alluvium), a reduction in drawdown in alluvium is modelled due to the reduced depressurisation of the underlying coal measures.

Modelled head was extracted at five GDE points (shown in **Figure 3.17**) selected to determine potential impacts to mapped high-potential GDE. These GDE points are described below:

- GDE Point 1 – represents high potential GDE - Swamp Oak/ Weeping Grass grassy riparian forest of the Hunter Valley to the south of the Barrett Pit
- GDE Point 2 - represents high potential GDE - River Red Gum/ River Oak grassy riparian woodland of the Hunter Valley to the west of the Barrett Pit

- GDE Point 3 – represents high potential GDE - River Red Gum/ River Oak grassy riparian woodland of the Hunter Valley to the west of the Barrett Pit
- GDE Point 4 – represents high potential GDE - Swamp Oak/ Weeping Grass grassy riparian forest of the Hunter Valley to the south of the Barrett Pit
- GDE Point 5 - – represents high potential GDE - Swamp Oak/ Weeping Grass grassy riparian forest of the Hunter Valley to the south of the Barrett Pit

Figure 6.1 presents a series of graphs showing the modelled head extracted from the uppermost model layers at the five GDE points under the Approved, Modification and sensitivity scenarios. The graphs also show the approximate ground elevation at the sites, which provides an indication of the possible depth to water at each location. As presented in these figures, the modelled head under the Modification scenario is generally comparable to that of or greater than the Approved scenario. None of the predicted increases in groundwater levels suggest a change which would result in groundwater mounding that would have an adverse impact due to increased saturation within a shallow rooting zone or bring poorer quality groundwater within the rooting depth of groundwater dependent vegetation. The increased (relative) heads modelled under the Modification scenario would therefore represent a positive change, increasing the availability of shallow groundwater at these locations. The highest predicted increase relative to approved operations occurs at GDE Point 1, however it is noted that current and predicted groundwater levels at this location are at depths which are likely to be well below the rooting depth of vegetation in this area. Existing impacts from Approved operations represent potential worst case impact on GDE vegetation in this area in terms of depth to water and the relative increases in groundwater heads still result in groundwater levels in excess of 30m below ground level which is likely to remain below rooting depth. In this regard, the modelled head results extracted at the GDE points indicates the Modification is unlikely to impact alluvial groundwater resources to an extent which would have implications (positive or negative) on reliant GDEs.



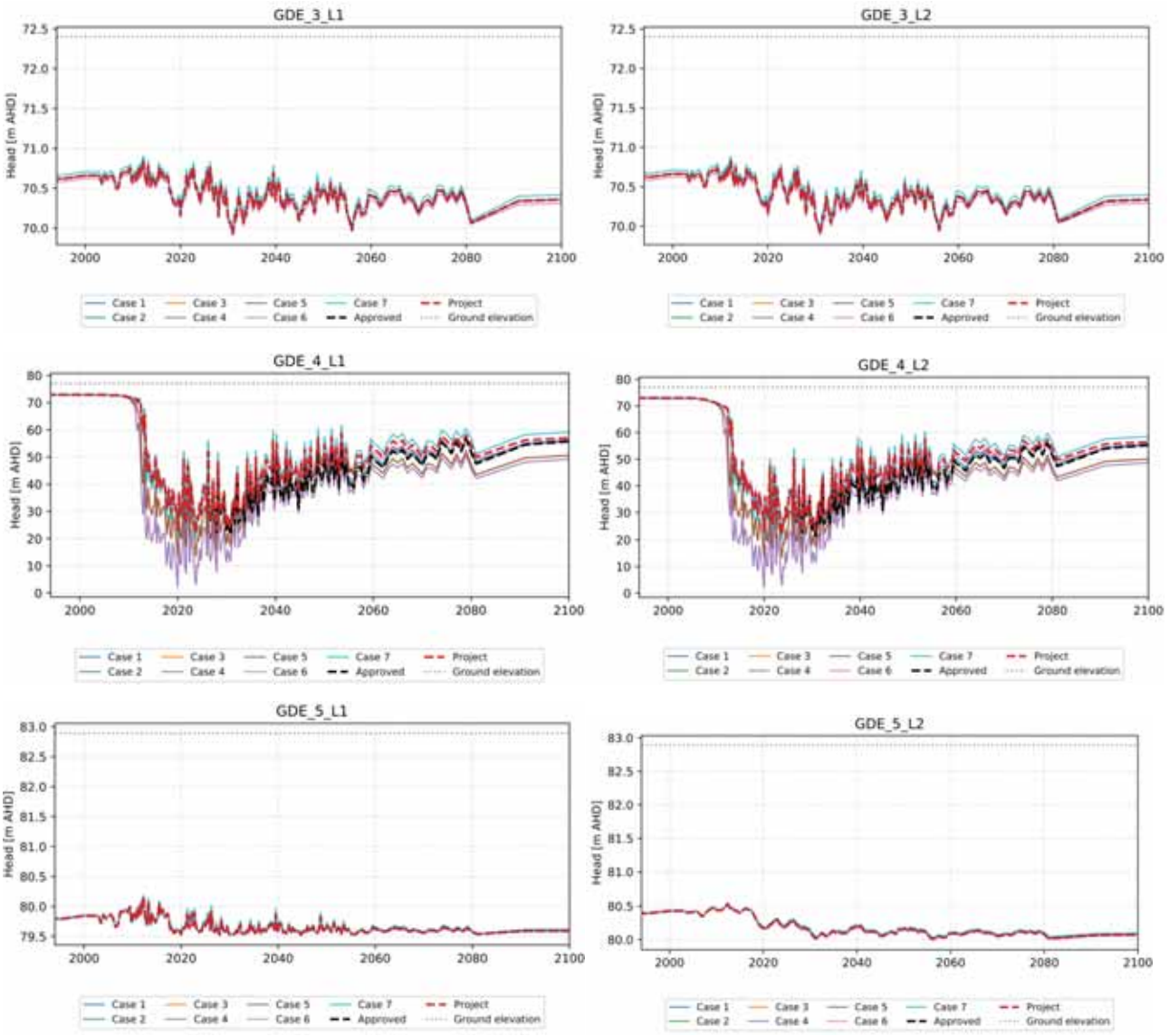


Figure 6.1 Predicted Groundwater Head in Top Two Layers at the GDE Points

6.3 Aquifer Interference Policy

6.3.1 Aquifer Interference Policy Assessment Framework

Groundwater of the Permian coal measures directly interacting with the Modification is regulated under the North Coast Fractured and Porous Rock Groundwater WSP. Groundwater associated with the Hunter Unregulated and Alluvial Water Sources is also present immediately surrounding the Glendell Project area.

Responses to requirements stipulated under Section 2 of the NSW Aquifer Interference Policy (NOW, 2012) (AIP) and the AIP Assessment Framework are included in **Table 6.2** based on the groundwater impact assessment.

Table 6.2 AIP Assessment Framework

No.	Requirement	Findings
1	Described the water source (s) the activity will take water from?	The Modification does not result in any additional take of groundwater compared to the Approved scenario.
2	Predicted the total amount of water that will be taken from each connected groundwater or surface water source on an annual basis as a result of the activity?	None
3	Predicted the total amount of water that will be taken from each connected groundwater or surface water source after the closure of the activity?	None
4	Made these predictions in accordance with Section 3.2.3 of the AIP? (Page 27)	Numerical groundwater modelling undertaken, but the Modification does not involve groundwater interception or take.
5	Described how and in what proportions this take will be assigned to the affected aquifers and connected surface water sources?	Not applicable
6	Described how any licence exemptions might apply?	Not applicable
7	Described the characteristics of the water requirements?	Not applicable
8	Determined if there are sufficient water entitlements and water allocations that are able to be obtained for the activity?	Not applicable

No.	Requirement	Findings
9	Considered the rules of the relevant water sharing plan and if it can meet these rules?	Not applicable
10	Determined how it will obtain the required water?	Not applicable
11	Considered the effect that activation of existing entitlement may have on future available water determinations?	Not applicable
12	Considered actions required both during and post-closure to minimise the risk of inflows to a mine void as a result of flooding?	No change to the approved final landform and void design.
13	Developed a strategy to account for any water taken beyond the life of the operation of the Project?	Not applicable, no change to the final void and post closure conditions.
14	Will uncertainty in the predicted inflows have a significant impact on the environment or other authorised water users? Items 14–16 must be addressed if so.	Not applicable

6.3.2 Minimal Impact Considerations

This section provides discussion of potential impacts of the Modification in terms of the AIP minimal impact considerations for the Hunter Unregulated and Alluvial Water Source (Jerrys Management Zone) and the North Coast Fractured and Porous Rock Groundwater Source.

As outlined in **Table 6.3** and **Table 6.3**, the predicted impacts are less than the Level 1 minimal impact considerations; therefore, these impacts are considered as acceptable under the AIP framework.

Table 6.3 Minimal Impact Considerations – Less Productive Alluvial Water Sources

Aquifer: Alluvial Water Source: Jerrys Water Source (Jerrys Management Zone)	
Category: Less Productive Groundwater Source (conservatively assessed against Highly Productive criteria)	
Level 1 Minimal Impact Considerations	**Assessment**
Water Table 1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or	Level 1 – Acceptable. High Priority GDEs under the WSP are mapped within the HEVAE mapping as being present along Betty's Creek to the east of Barrett Pit.

Aquifer: Alluvial Water Source: Jerrys Water Source (Jerrys Management Zone)	
(b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan. OR A maximum of a 2 m water table decline cumulatively at any water supply work.	The relevant WSP does not identify any high priority culturally significant sites. The Modification involves additional water storage, which results in reduction in drawdown in connected aquifers. Therefore, the Modification does not result in any adverse impacts to the shallow water table. The Modification meets the Level 1 minimal impact consideration classification.

Table 6.4 Minimal Impact Considerations – Less Productive Porous and Fractured Rock Water

Level 1 Minimal Impact Considerations	Assessment
Water Table: 1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site listed in the schedule of the relevant water sharing plan; or a maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site listed in the schedule of the relevant water sharing plan then appropriate studies will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work, then make good provisions should apply.	Level 1 – Acceptable. There are no high priority GDEs listed in the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 within 20 km of the Modification. The nearest high priority groundwater dependent ecosystem under the North Coast Fractured and Porous Rock Groundwater sources 2016 WSP is Parnell Spring in the Wollemi National Park, located approximately 20 km to the south-west. There are no listed high priority culturally significant sites in the North Coast Fractured and Porous Rock Groundwater Sources 2016 WSP. The Modification is considered to adequately satisfy the water table minimal impact considerations relating to less productive fractured rock water sources defined in the AIP.
Water Pressure:	Level 1 – Acceptable.

Level 1 Minimal Impact Considerations	Assessment
1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	The groundwater assessment for the Modification indicates minimal impacts to surrounding landholder bores with predicted minor (<0.15 m) increases in water level relative to the Approved scenario. The Modification is considered to adequately satisfy the water pressure minimal impact considerations relating to less productive fractured rock water sources defined in the AIP.
Water Quality: 1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.	Level 1 – Acceptable. The groundwater assessment for the Modification indicates that groundwater quality is unlikely to be impacted by the Modification and the beneficial use category will not be lowered assuming mine water storage only. The Modification is considered to adequately satisfy the water quality minimal impact considerations relating to less productive fractured rock water sources defined in the AIP.

7.0 Groundwater Monitoring

7.1 Groundwater Monitoring Program

7.1.1 Monitoring Network

Groundwater monitoring at MGO will be ongoing in accordance with the approved site Groundwater Management and Monitoring Plan (GWMP) (Glencore, 2023a). The monitoring program, including monitoring frequency and analytical suite, will be revised as part of the GWMP review following approval of the Modification. If deemed necessary to supplement the existing network, construction of additional monitoring sites will be dependent on accessibility, ground conditions and safety considerations.

7.2 Water Storage Monitoring

Water management of Barrett Pit shall be monitored to confirm that observed observations match Modification model predictions and ensure safe condition of the pit. The following water balance components should be monitored:

- Site rainfall data.
- Water transfers to and from Barrett Pit.
- Water level and volume within Barrett Pit. The WMP will be updated to following approval of the Modification

Observed water levels should be compared to predicted levels during routine annual water balance updates as required by the site Water Management Plan (Glencore, 2023b).

7.3 Groundwater Model Review

As documented in **Section 4.1**, the GCOP model (AGE, 2019) was updated by Umwelt in 2024 to include more recent observed trends, approved mine activities, mine planning, water storages and to remove the horizontal flow boundary package (HFB). Some specific model changes were made as part of this Modification GIA. This includes changes to the contemporary observation data, mine plans and representation of water storage within Barrett Pit as proposed for the Modification.

Review of the model fit should be undertaken on a three yearly basis as outlined in the GWMP, including review of observed to modelled groundwater levels and trends, pit storage water levels, mine inflows and mine progression. If required based on the review findings, the model will be updated to align to observed trends.

8.0 Conclusion

This GIA was prepared to support an application to modify Glendell Mine DA 80/952. The purpose of this assessment was to evaluate the hydrogeological implications of utilising Barrett Pit as a water storage facility. The assessment was prepared in accordance with the NSW Aquifer Interference Policy, relevant Water Management Acts, and the Guidelines for Groundwater Documentation for SSD/SSI Projects (2022).

An existing numerical groundwater model (the GCOP numerical groundwater model) was developed by AGE in 2019. The AGE (2019) model was updated by Umwelt in 2024 to reflect recent observed trends and predicted changes, refine the void design, include TSF, water storages, and dams associated with the main operational areas and remove the HFB package associated with the fault. A conceptual groundwater model was also updated using current site data to aid in the assessment.

The storage of mine water within the Barrett Pit under the Modification is anticipated to increase the pit lake level from around -33 mAHD (current level) to up to 12 mAHD at the proposed end of storage in 2039. This recovered level is slightly higher than the predicted natural recovered level of -7 mAHD in this same year. The projected storage level within the pit void remains below the pit crest and the base of weathering (regolith).

Model outputs predict only minor additional flux (<1 ML/year) from the Barrett Pit to adjacent coal measures where they are depressurised by mining. This change is negligible in the context of regional mining activities and does not represent a material impact on groundwater resources.

Storage of water within Barrett Pit increases groundwater levels in the coal measures around the pit, reducing depressurisation within connected overlying alluvium. This increases water availability within the alluvium and represents a positive change to groundwater conditions in that it accelerated recovery of groundwater systems depressurised by historical mining in Barrett Pit. A net reduction in predicted alluvial groundwater take of up to 1 ML/year and a reduced take of up to 33 ML/year from the North Coast Fractured and Porous Rock Water Source is expected due to the Modification.

Predicted changes in water levels are expected to have a neutral or a slightly positive impact for GDEs.

Minor changes (< ± 0.1m) to groundwater head are predicted at the private landholder bores located within 2km of Barrett Pit and there is considered no impacts to anthropogenic groundwater users as a result of the Modification. The Modification is expected to have a net positive impact on three of the four private landholder bores with a reduction of drawdown of the alluvium and shallow weathered regolith.

Water within Barrett Pit is saline and comparable to groundwater within the coal measures. As such, additional flux (<1ML/year) from Barrett Pit is unlikely to induce degradation of groundwater quality in the receiving Permian coal measures.

The risk assessment undertaken in accordance with the AIP Assessment Framework identified that the predicted impacts are less than the Level 1 minimal impact considerations. Therefore, predicted impacts of the Modification are considered acceptable under the AIP framework.

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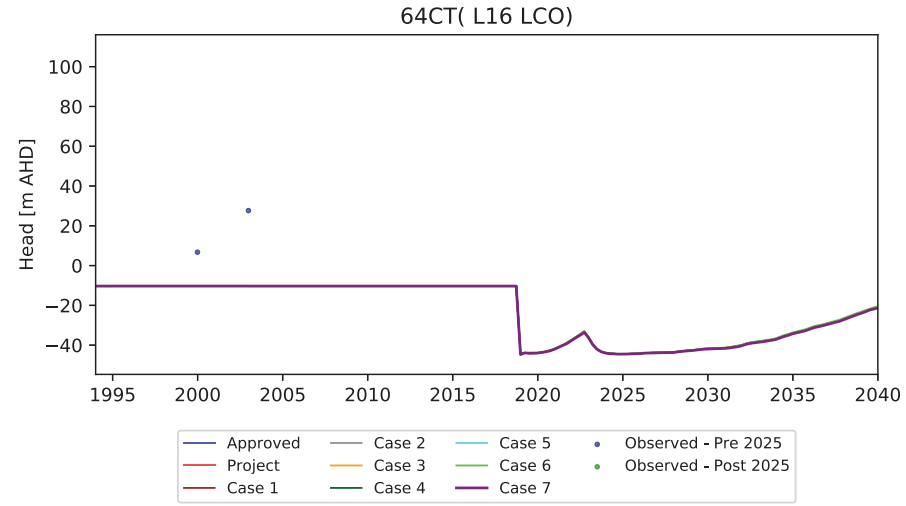
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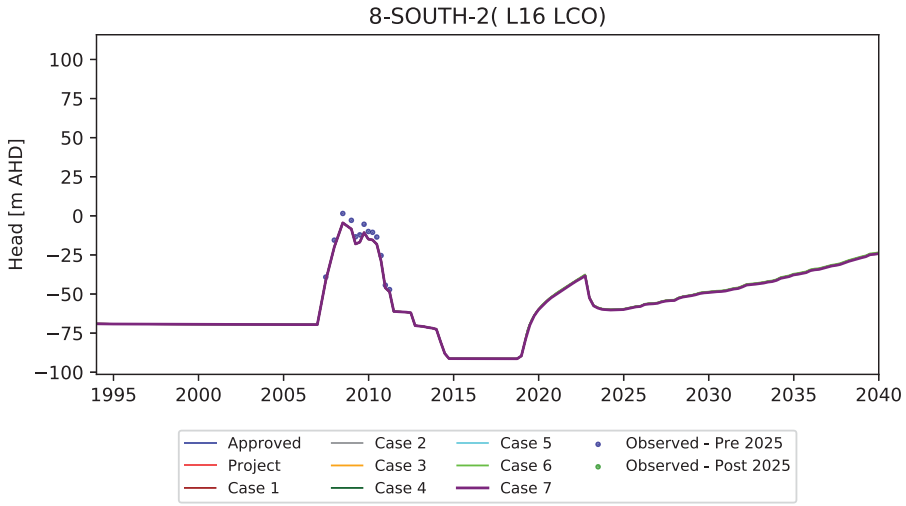
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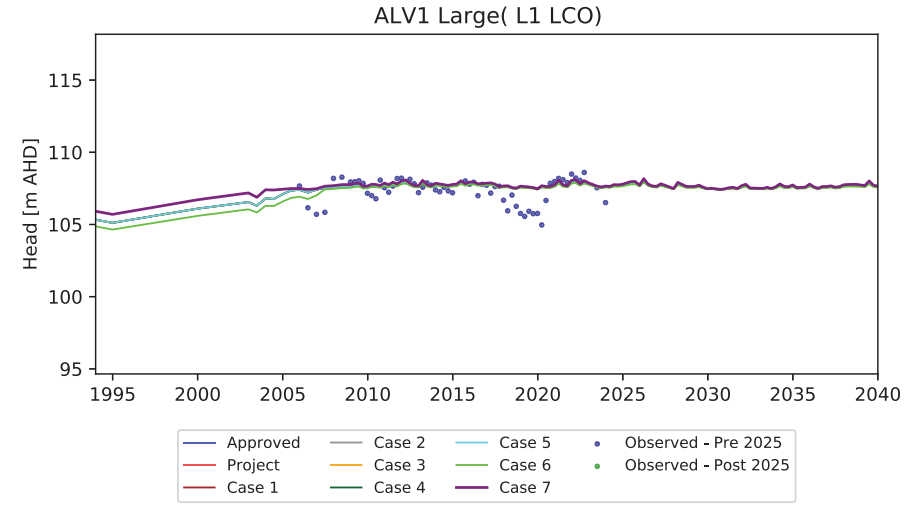
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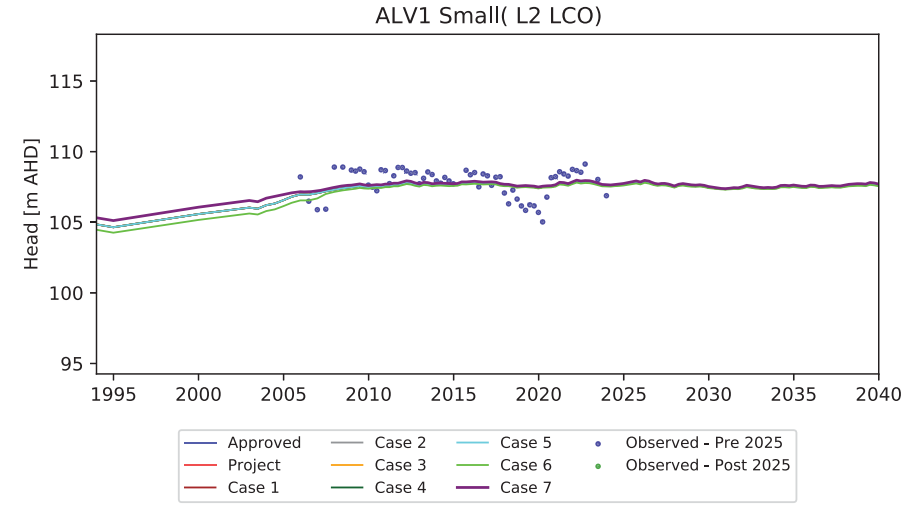
Model Hydrographs

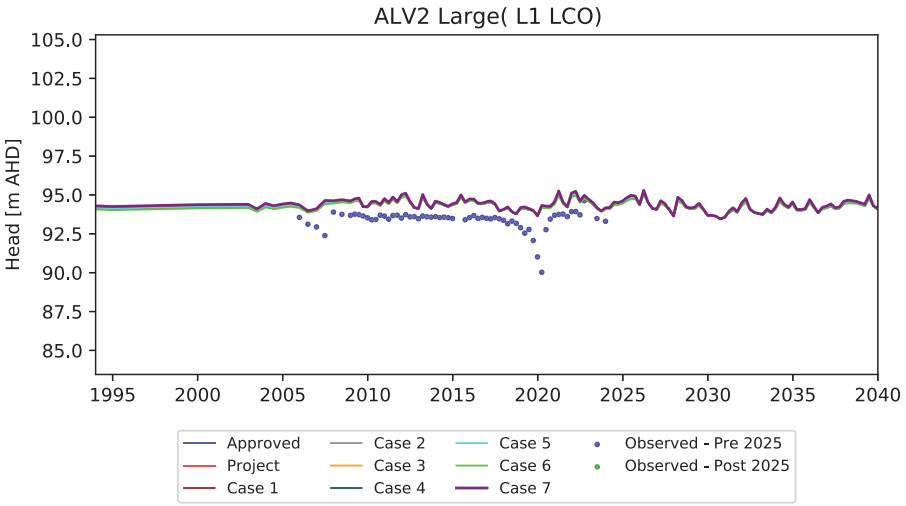


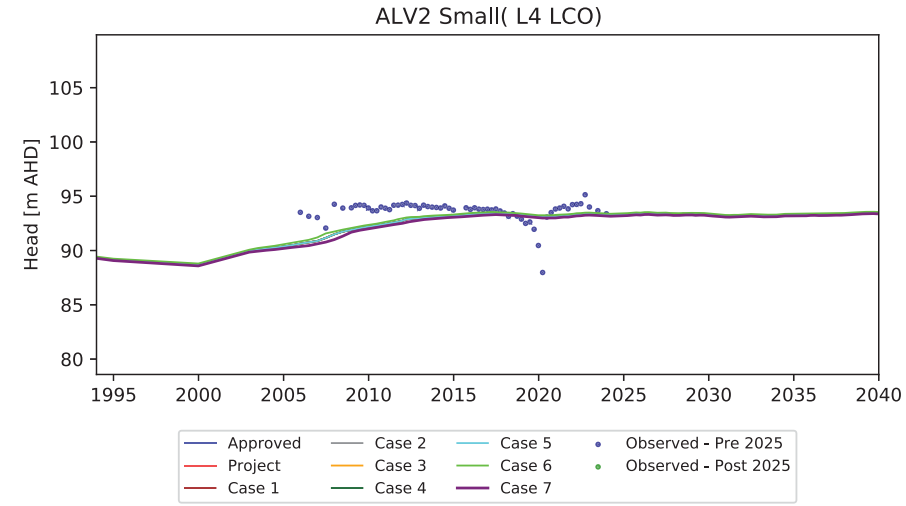

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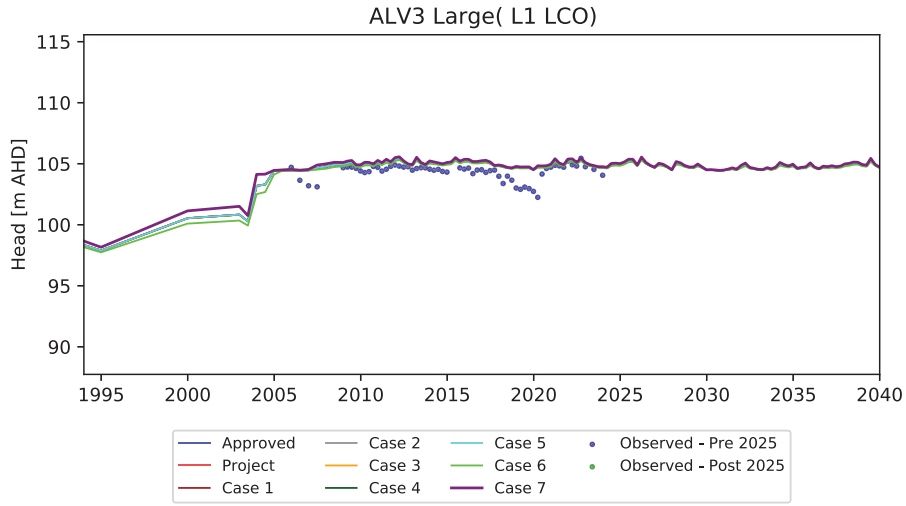

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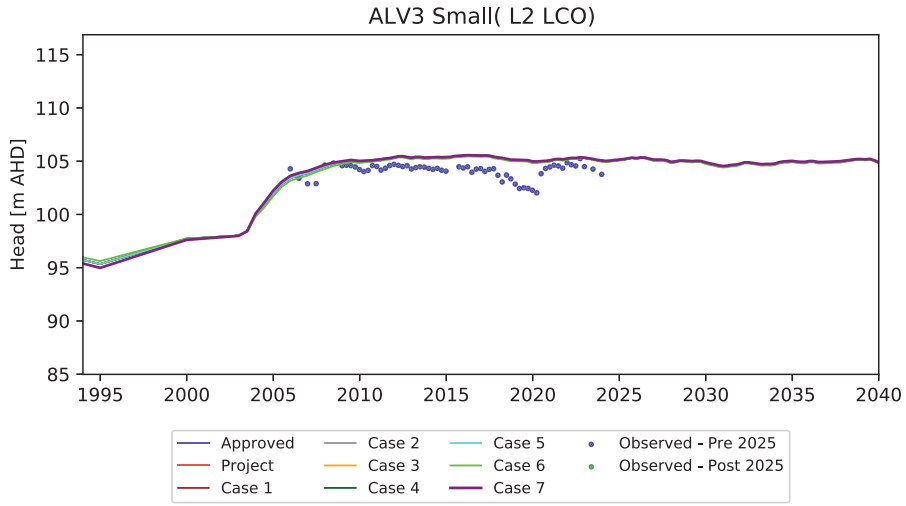

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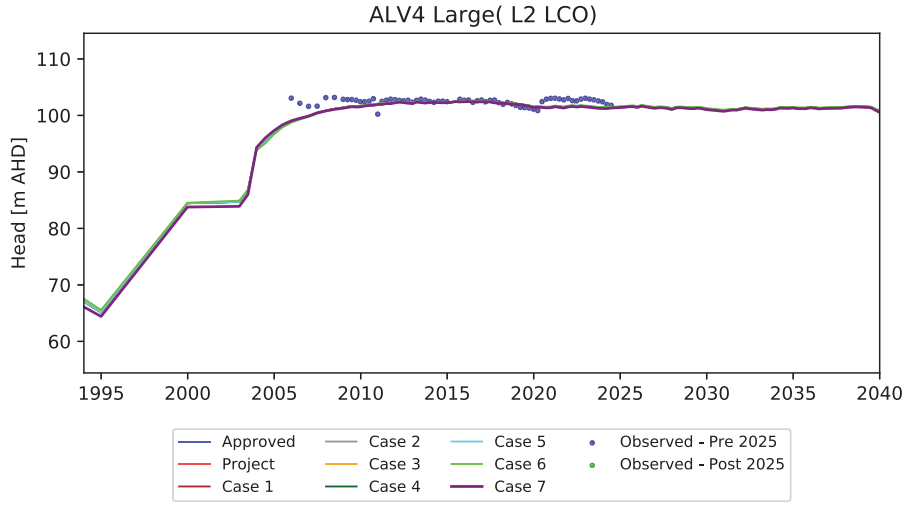

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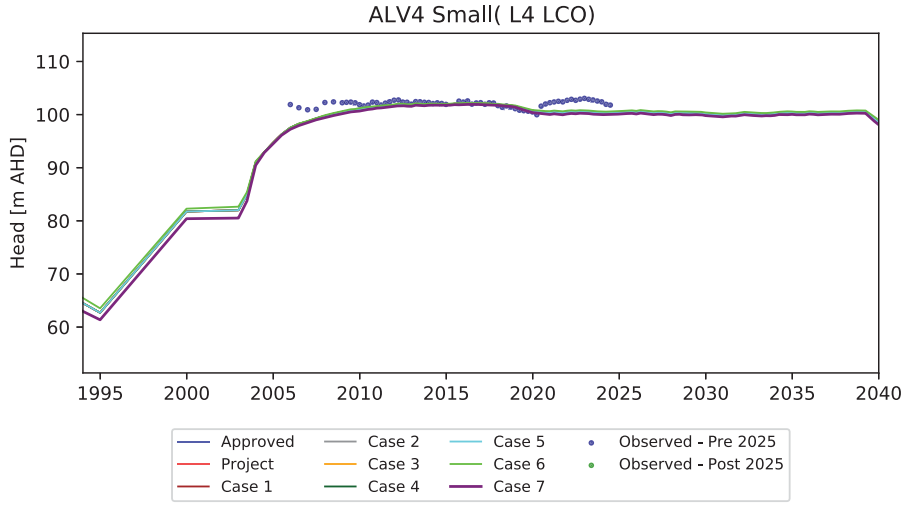

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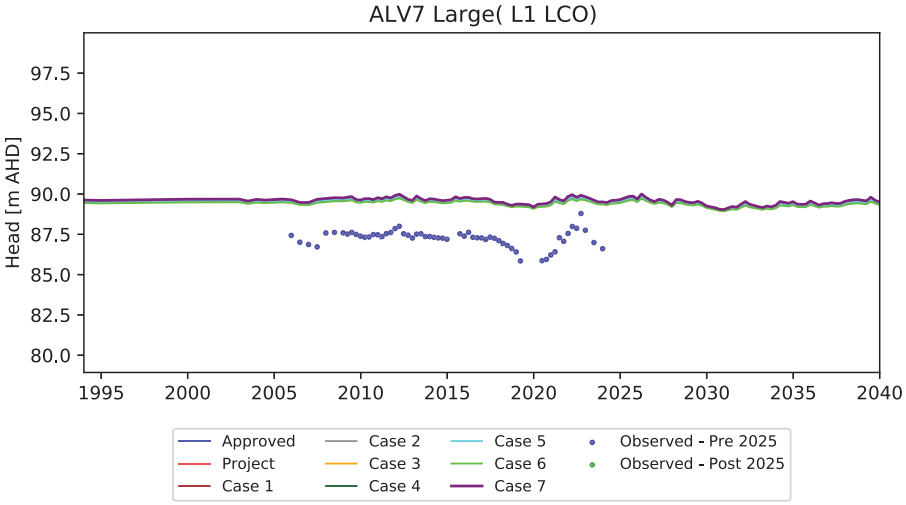

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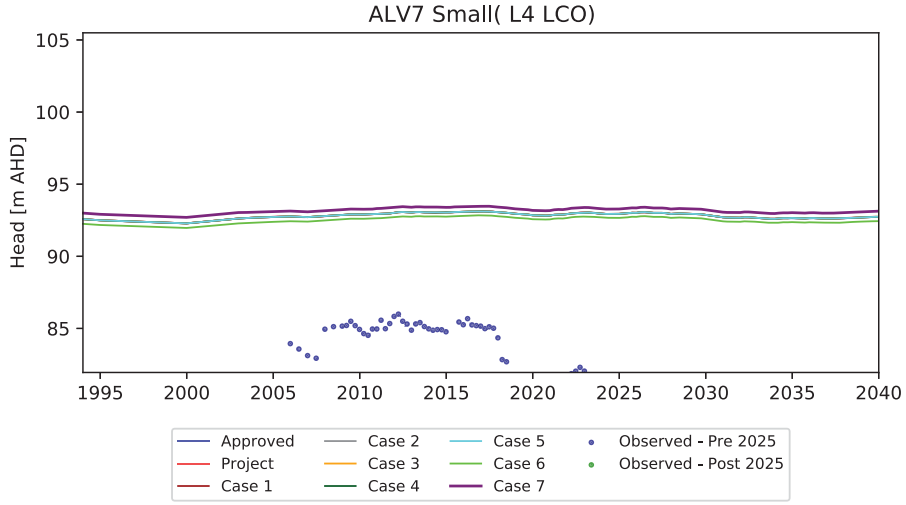

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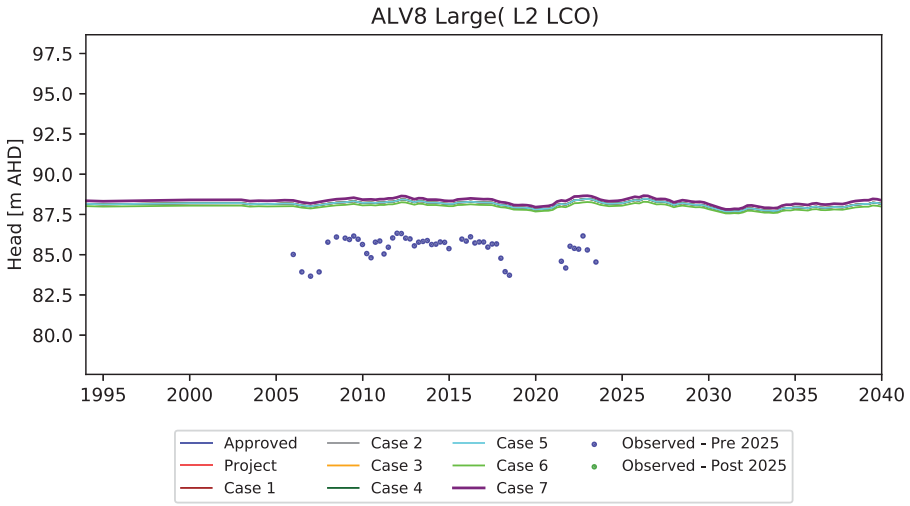

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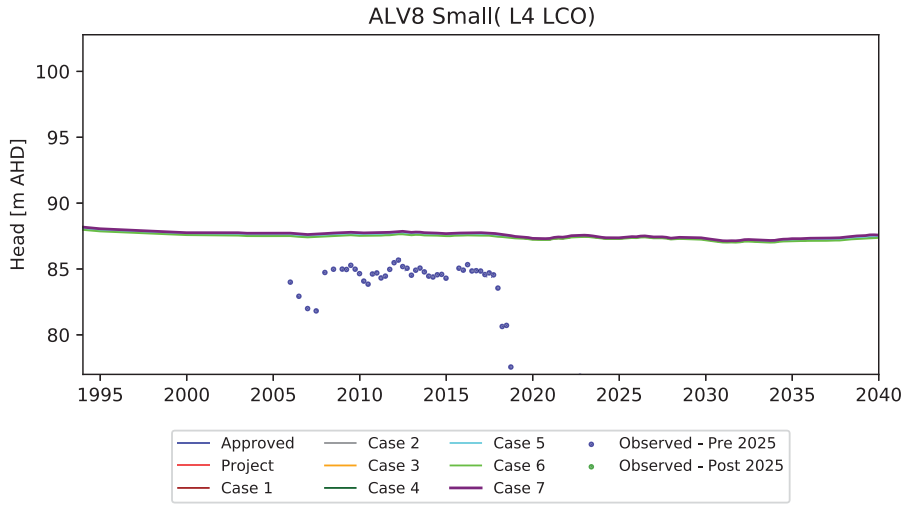

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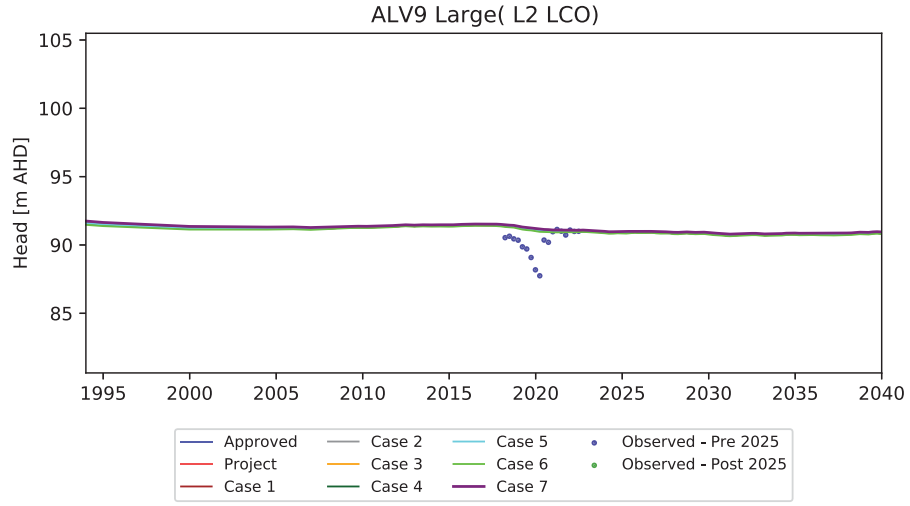

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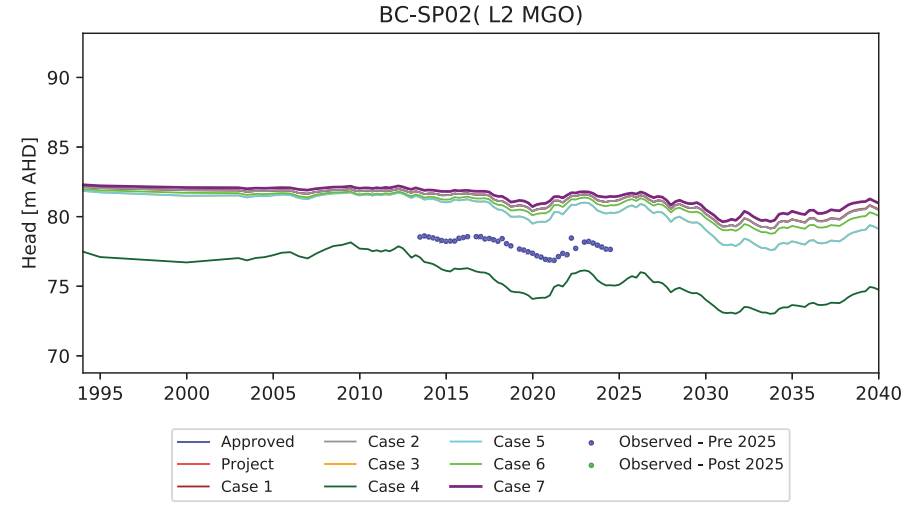

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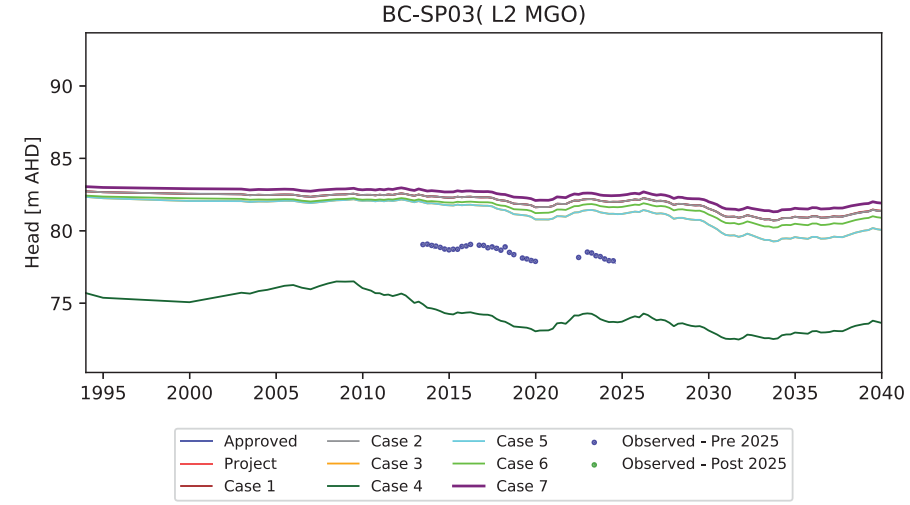

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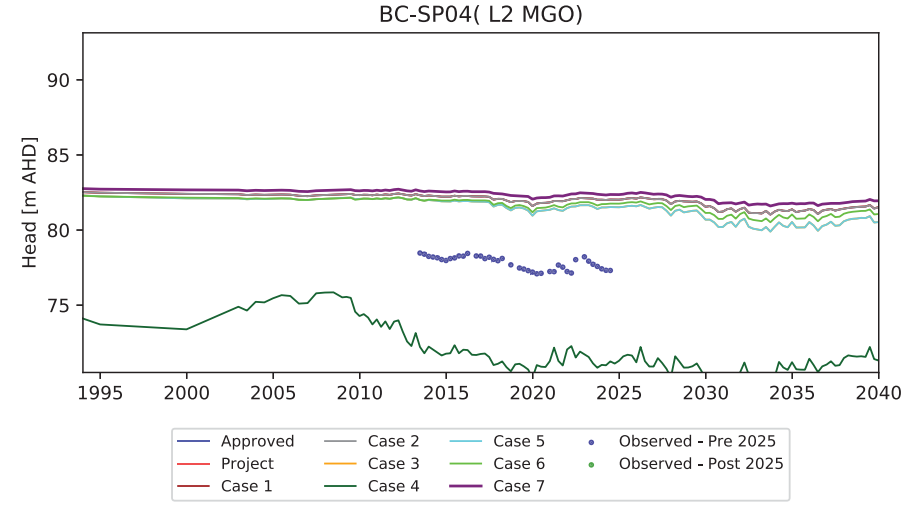

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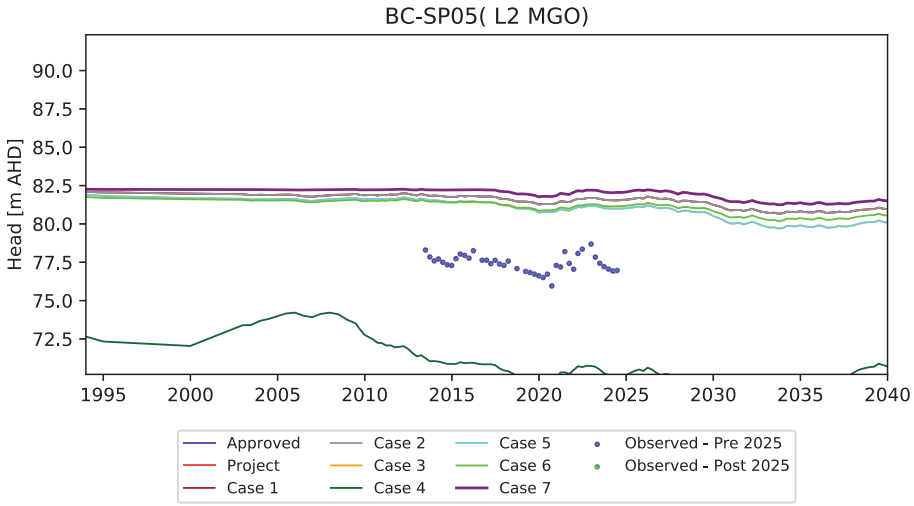

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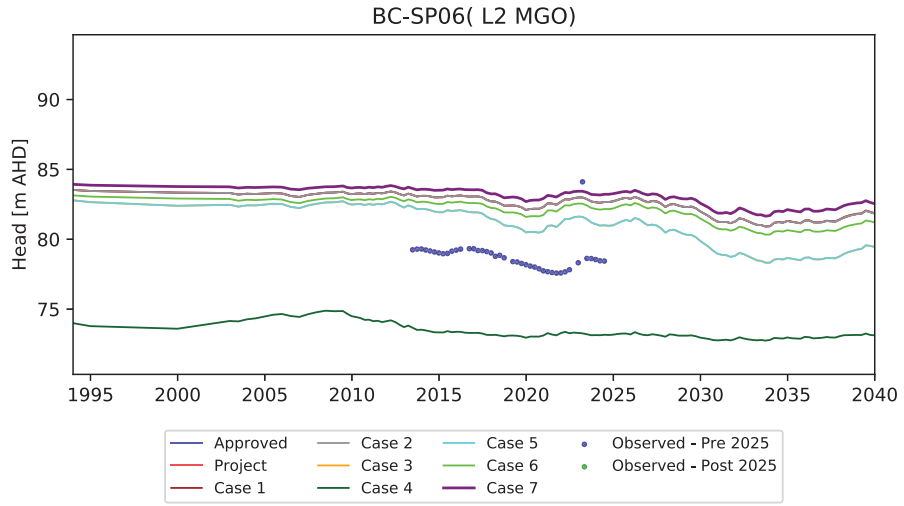

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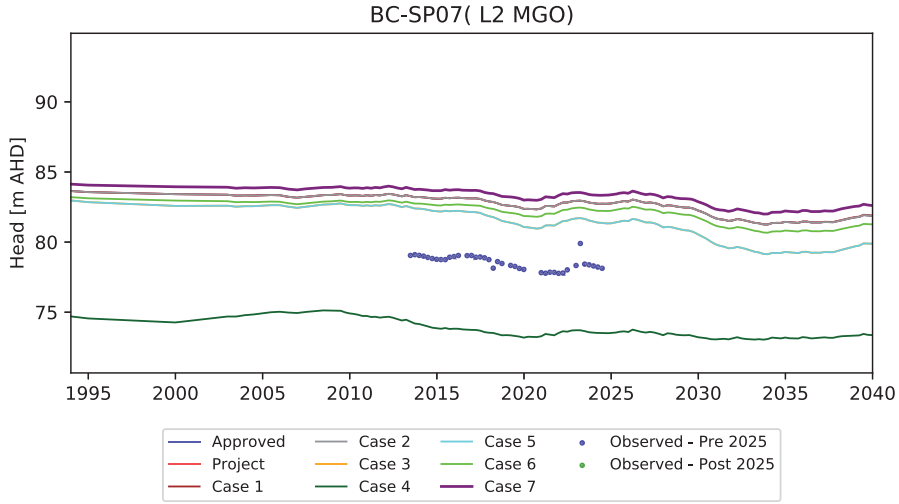

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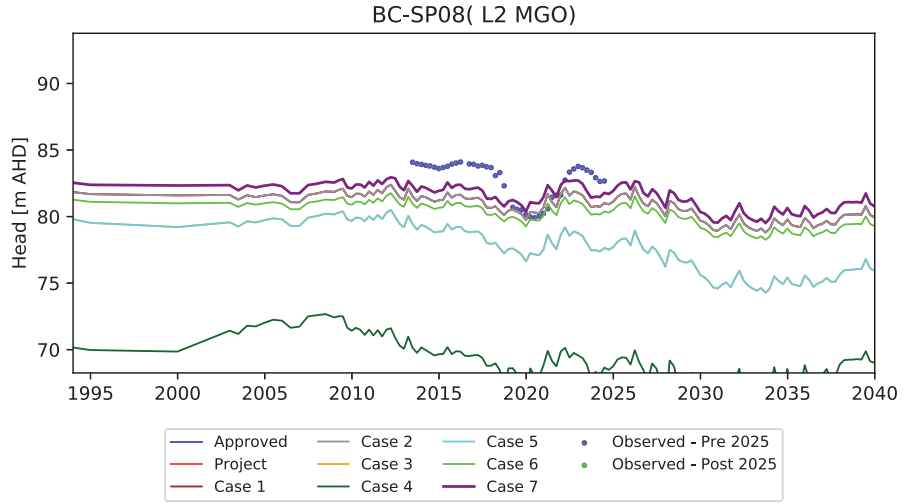

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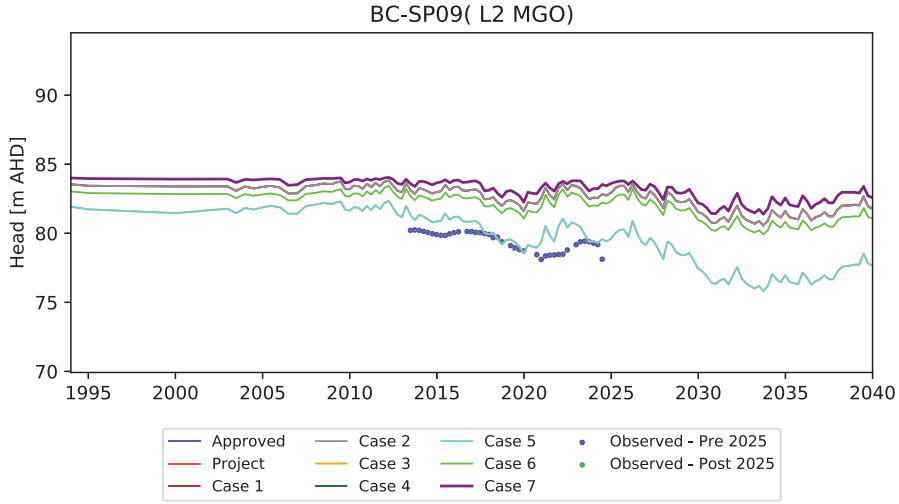

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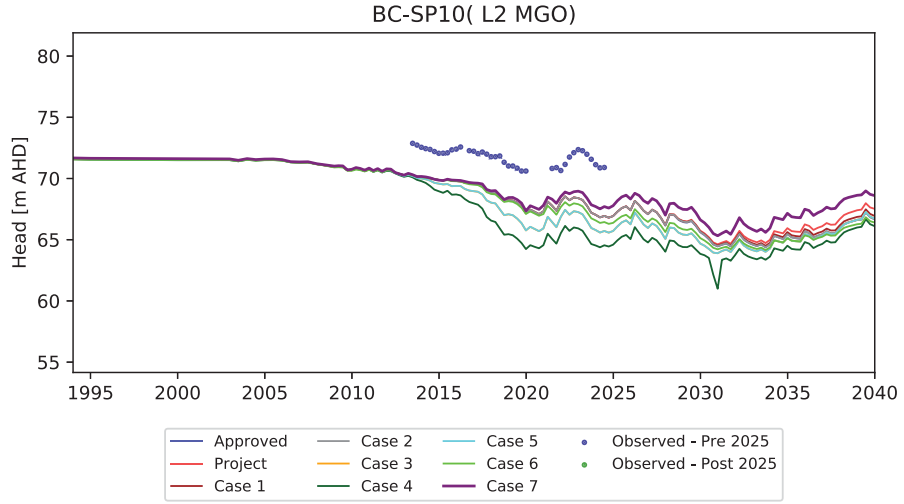

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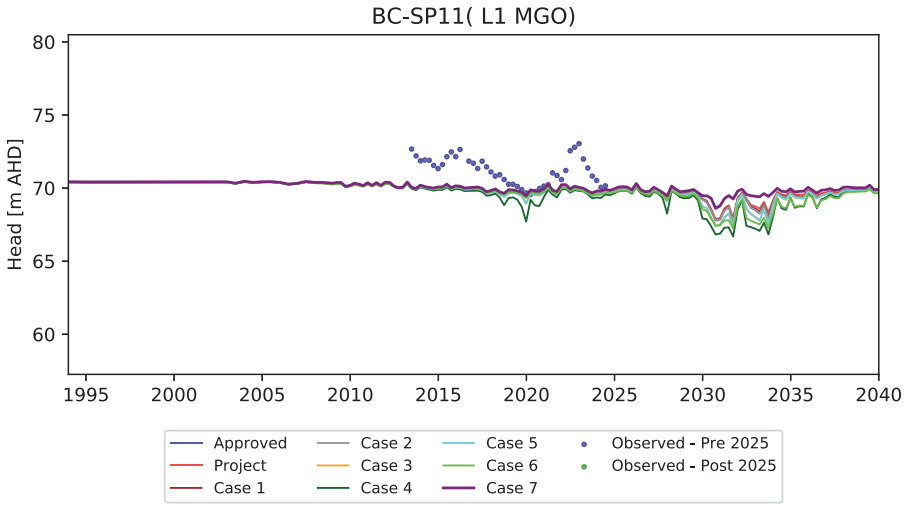

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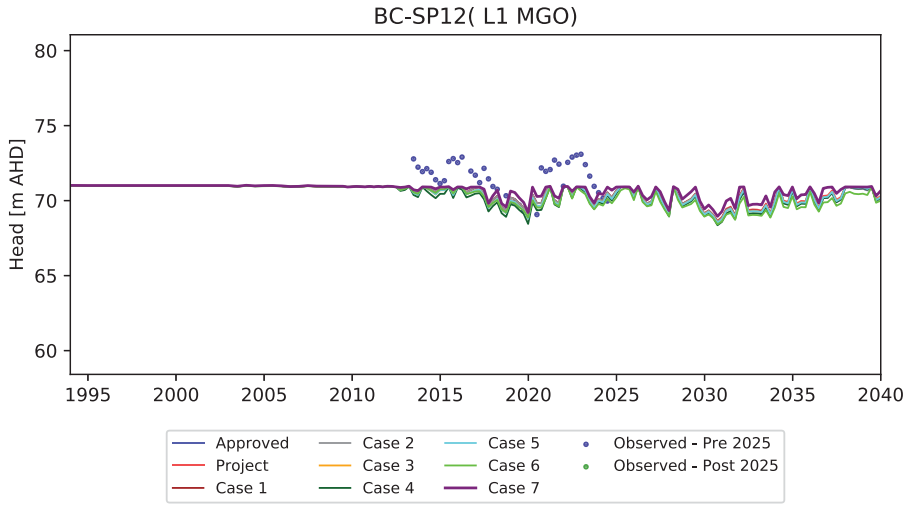

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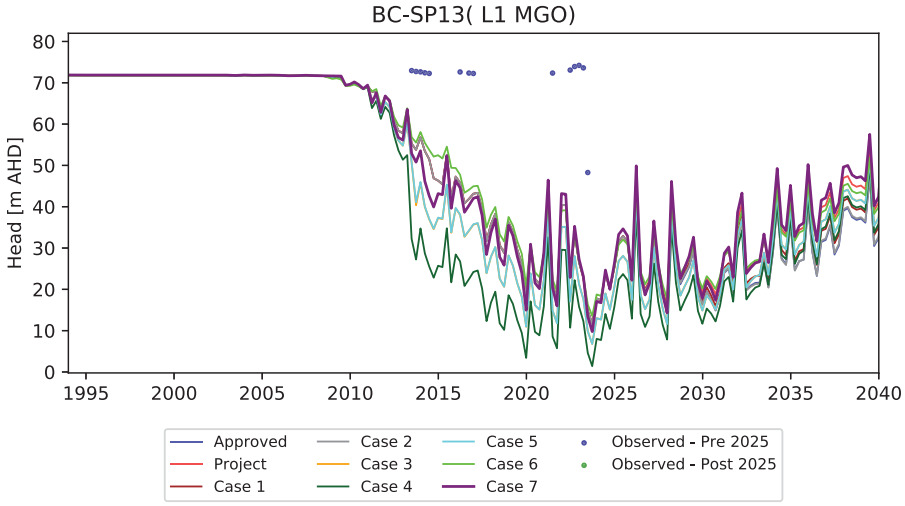

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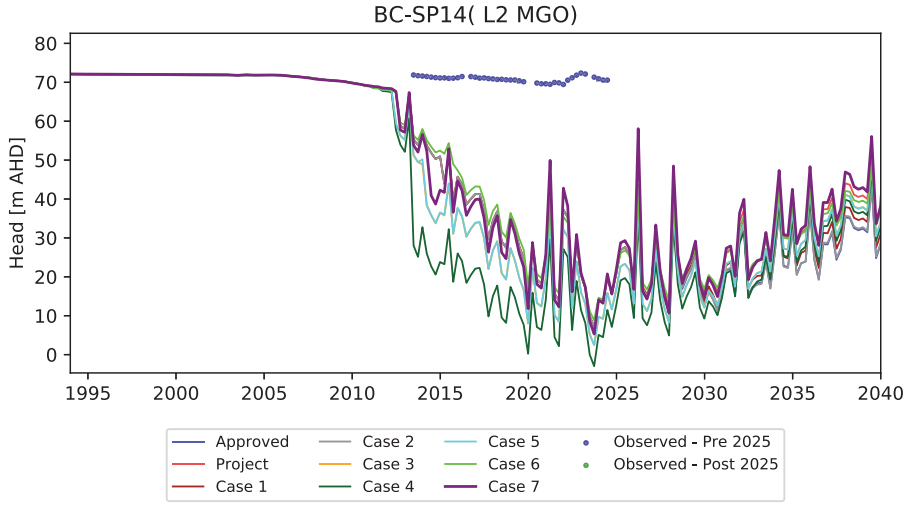

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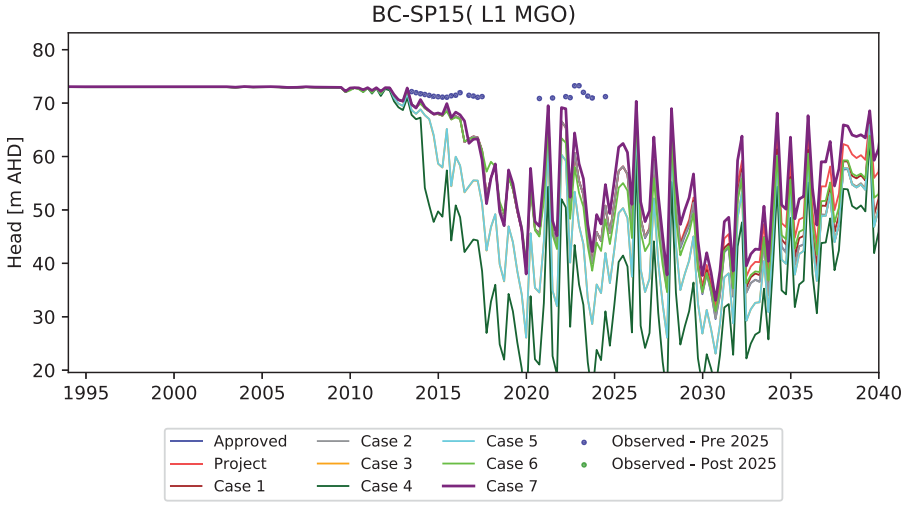

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Observed - Pre 2025
Observed - Post 2025

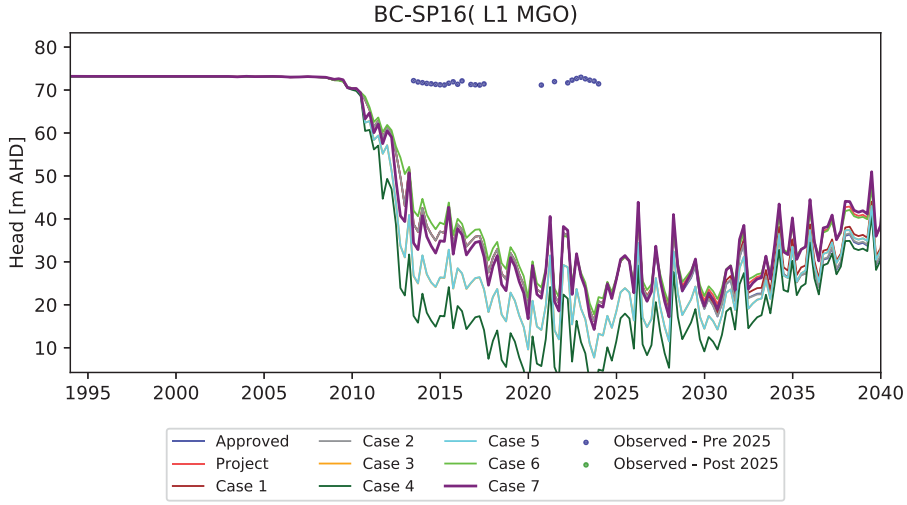

BC-SP11(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

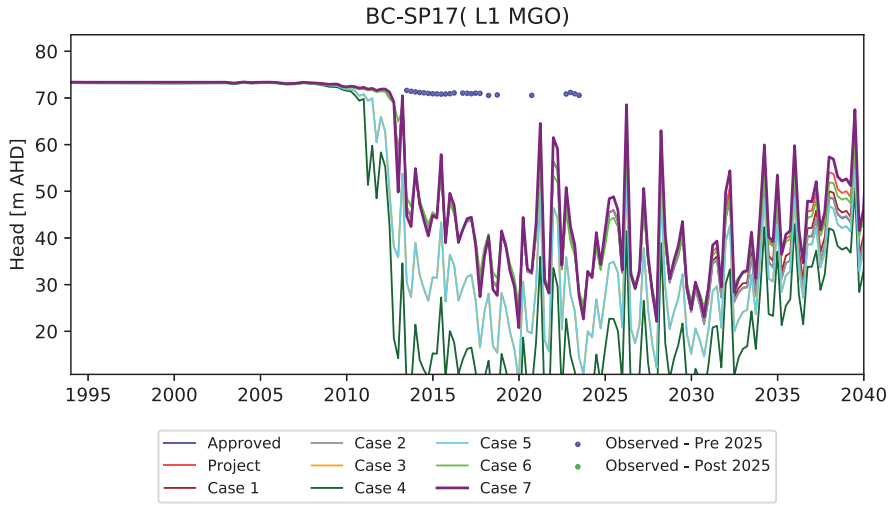

BC-SP12(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

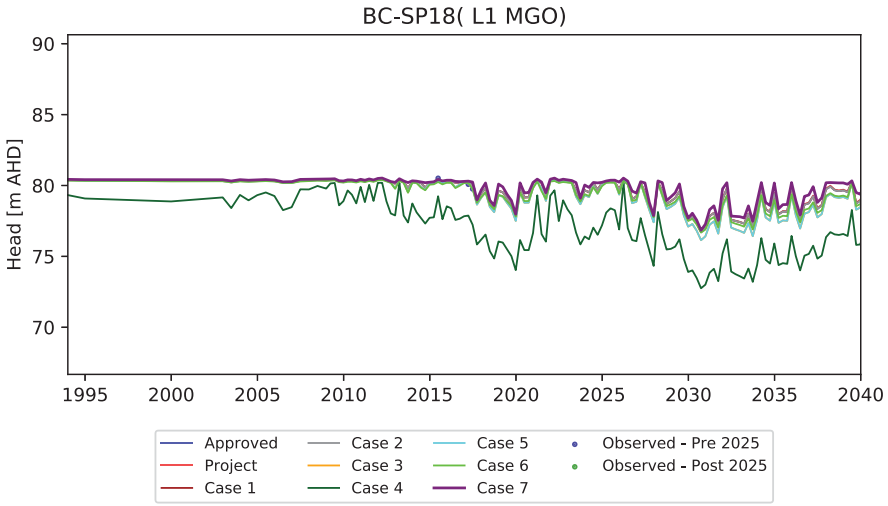

BC-SP13(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

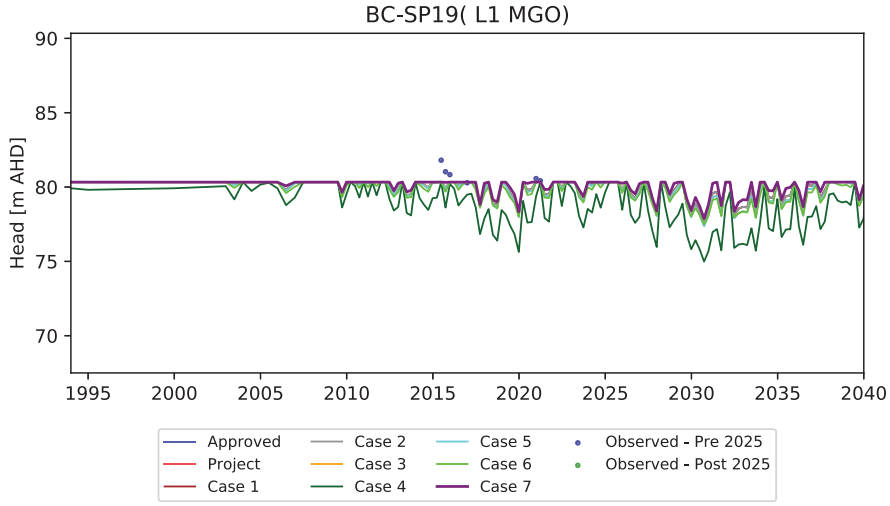

BC-SP14(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

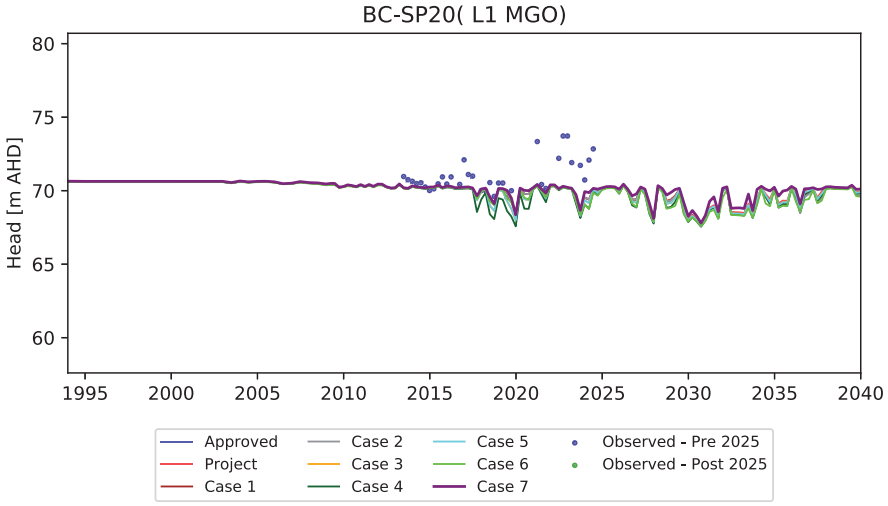

BC-SP15(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

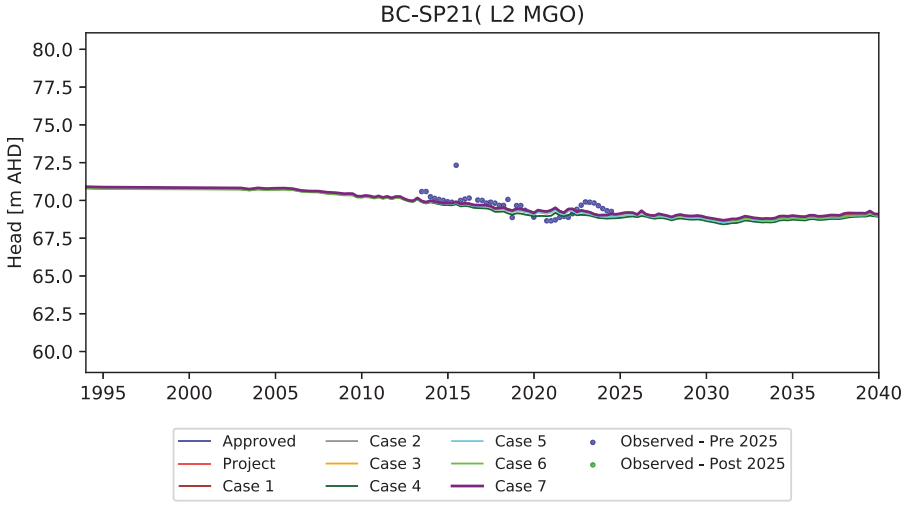

BC-SP16(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

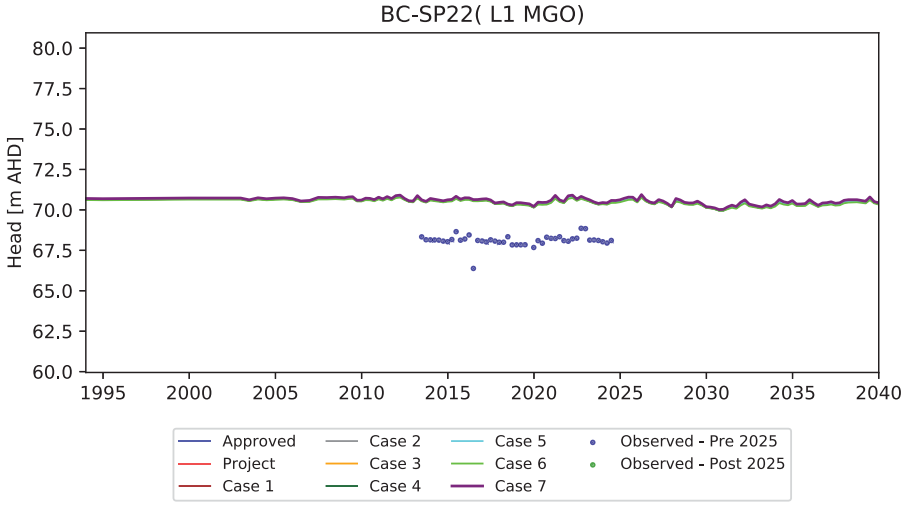

BC-SP17(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

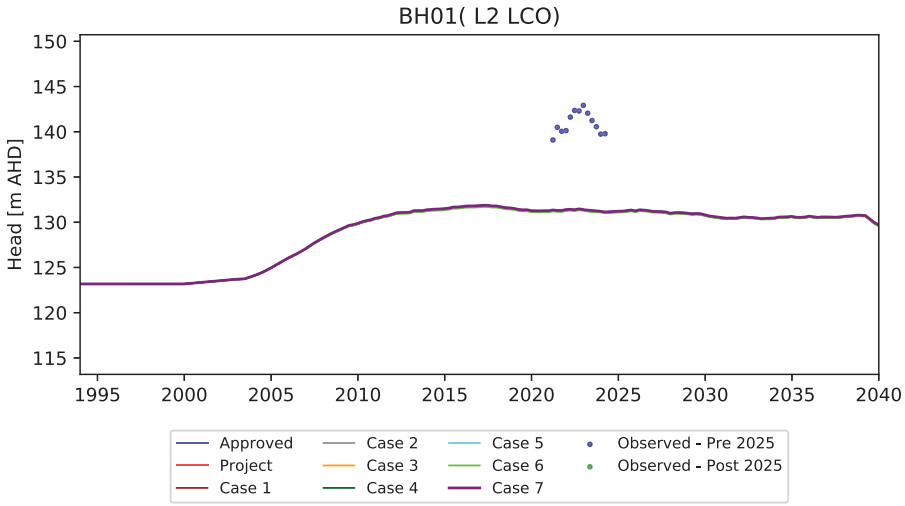

BC-SP18(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

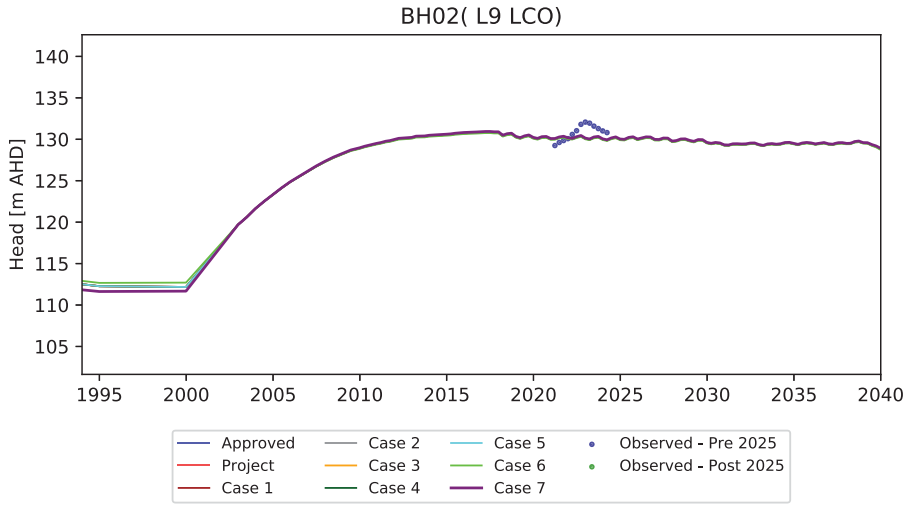

BC-SP19(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

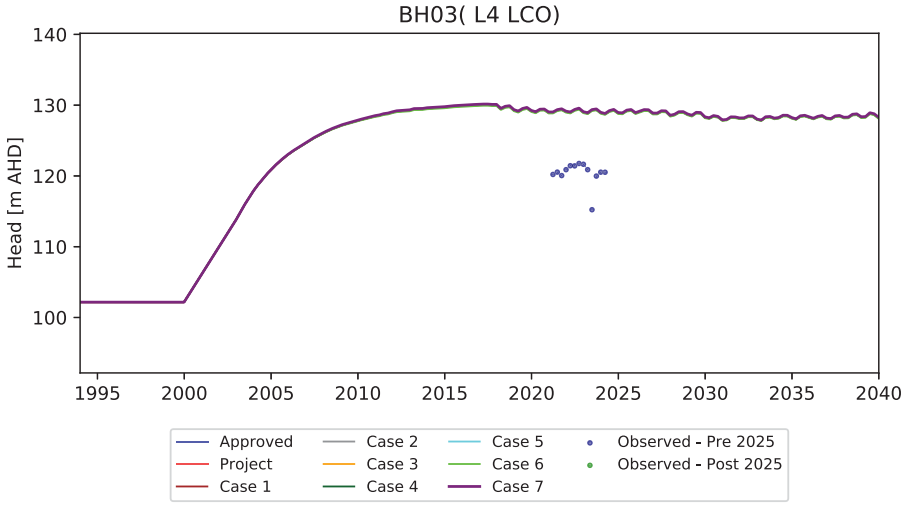

BC-SP20(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

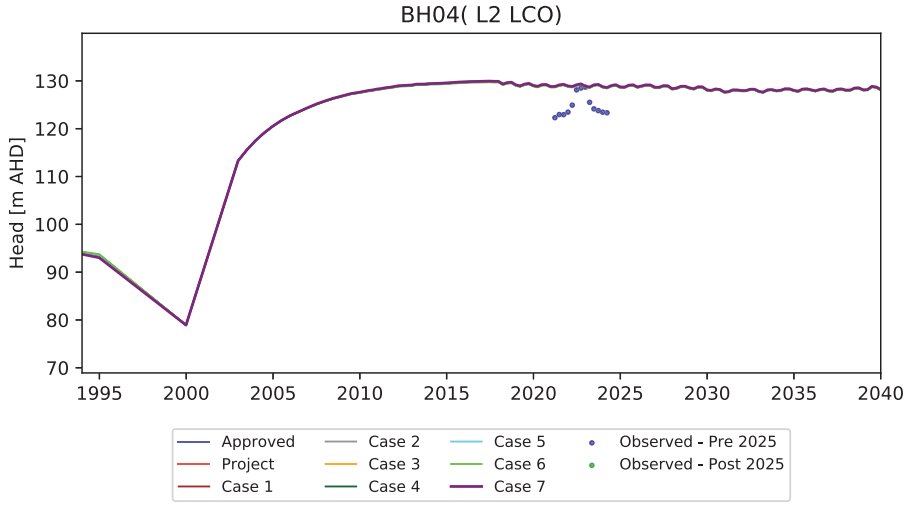

BC-SP21(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

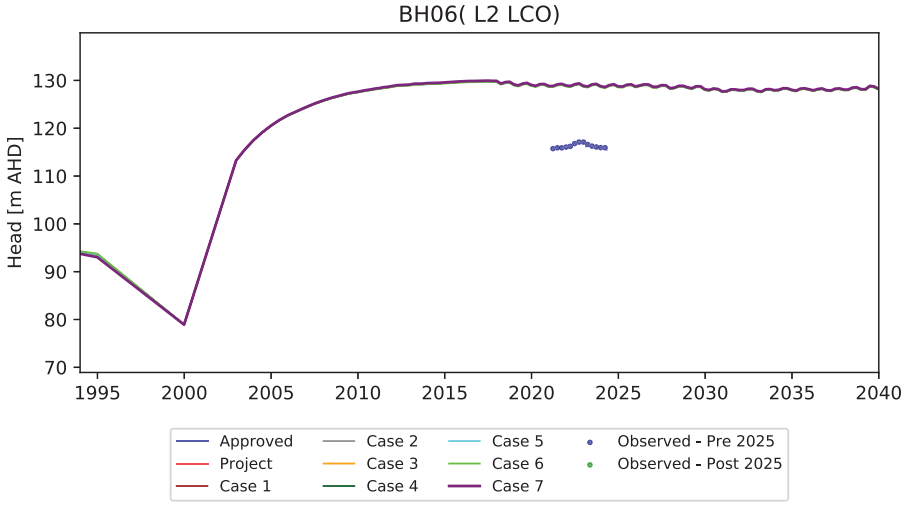

BC-SP22(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

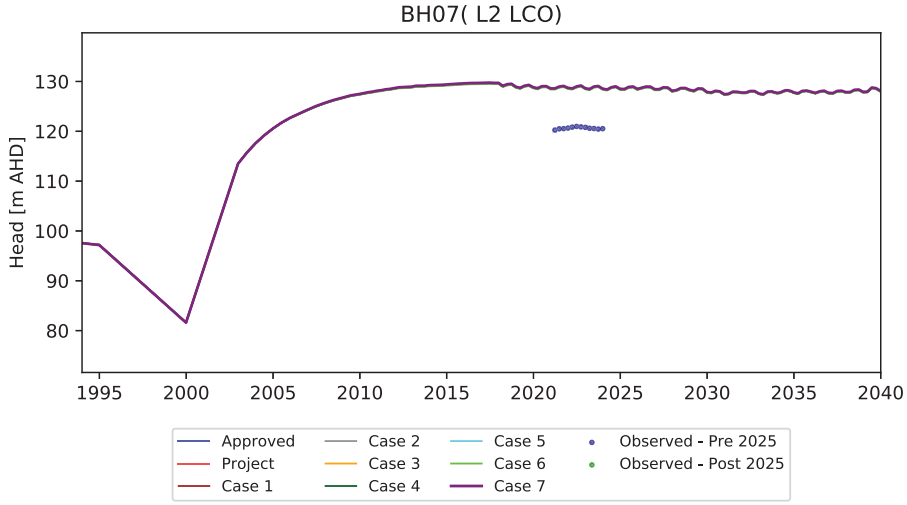

BH01(L2 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

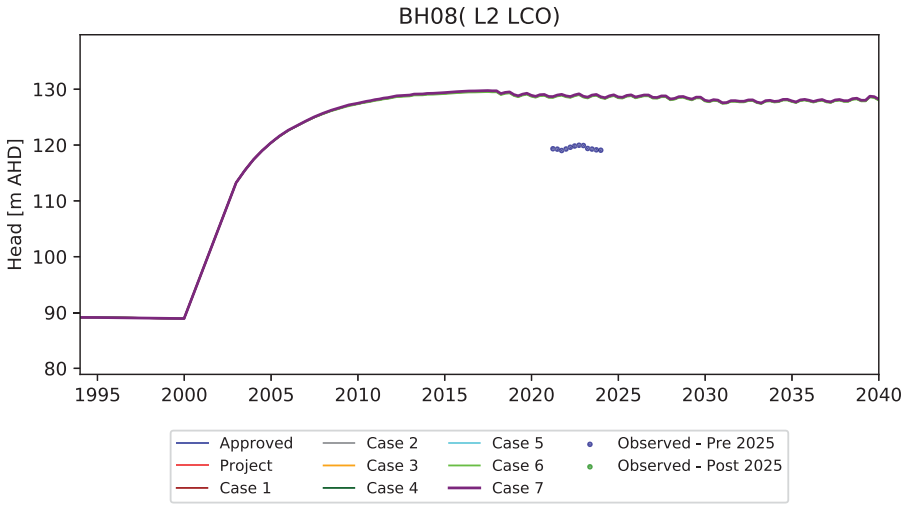

BH02(L9 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

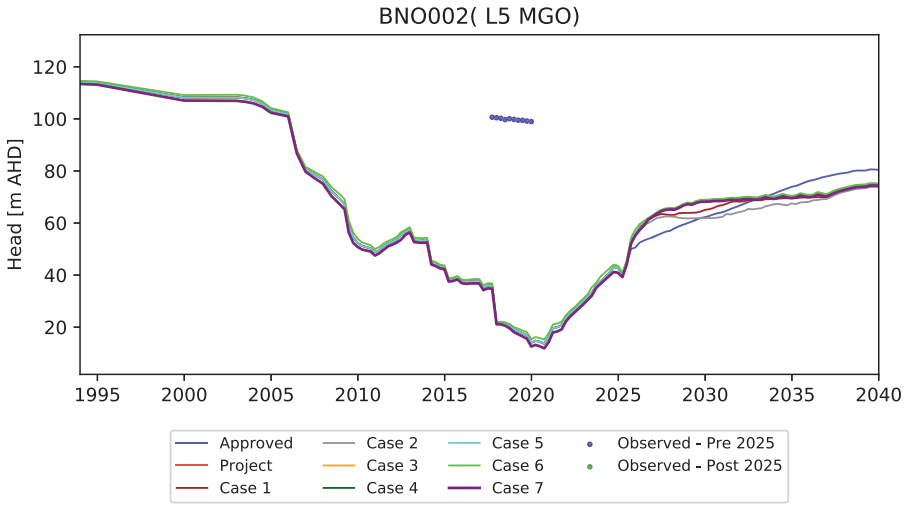

BH03(L4 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

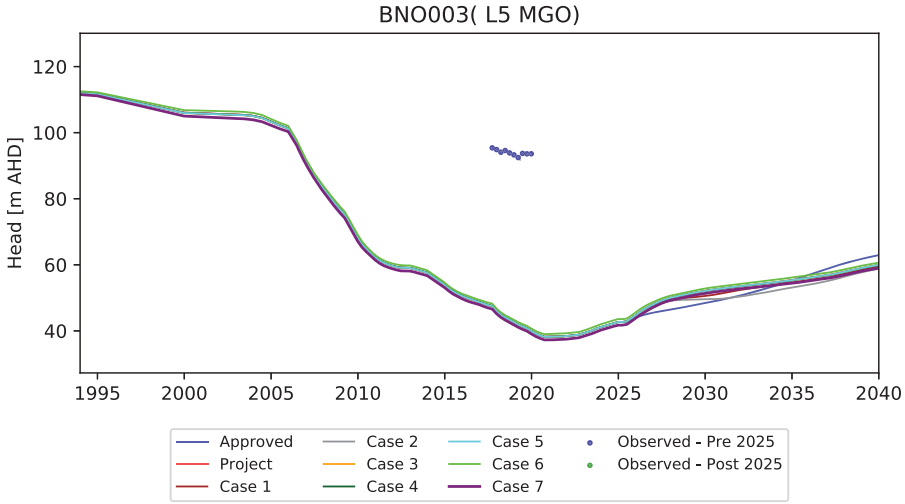

BH04(L2 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

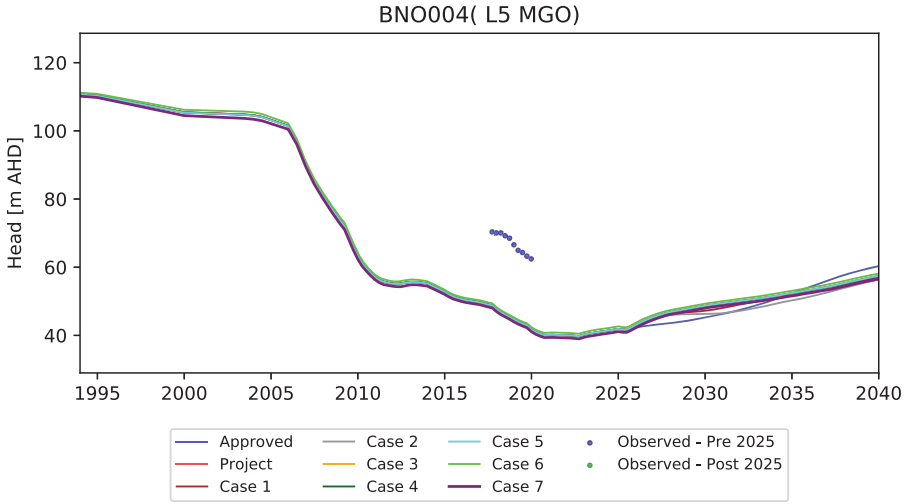

BH06(L2 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

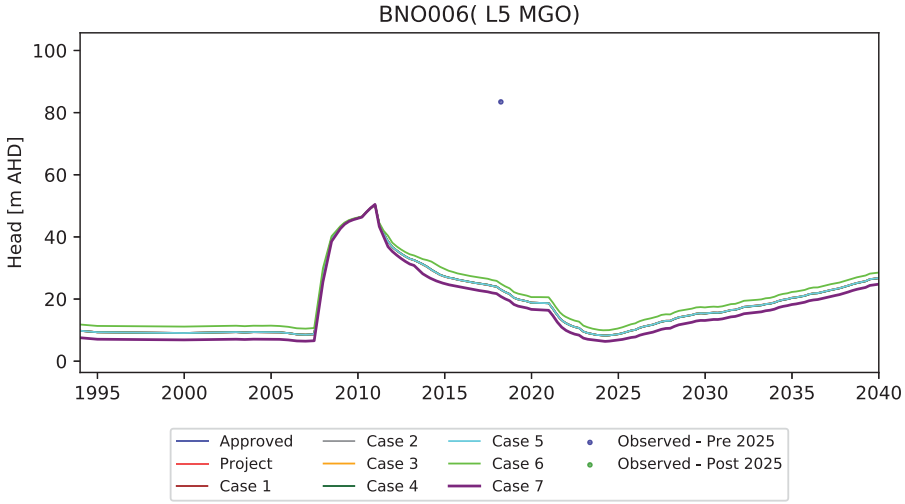

BH07(L2 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

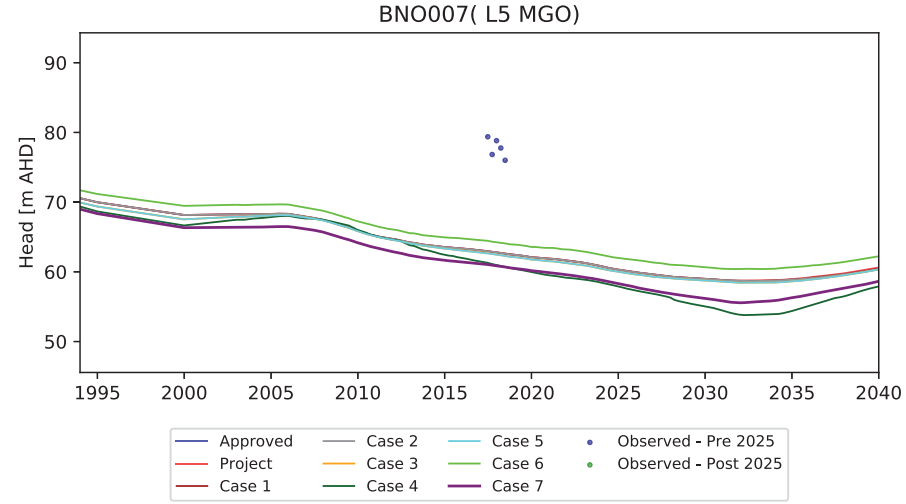

BH08(L2 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

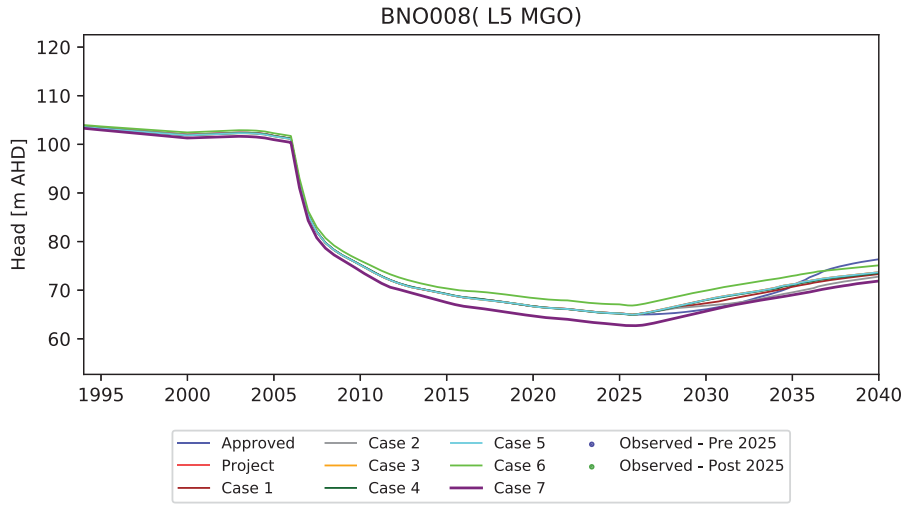

BNO002(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

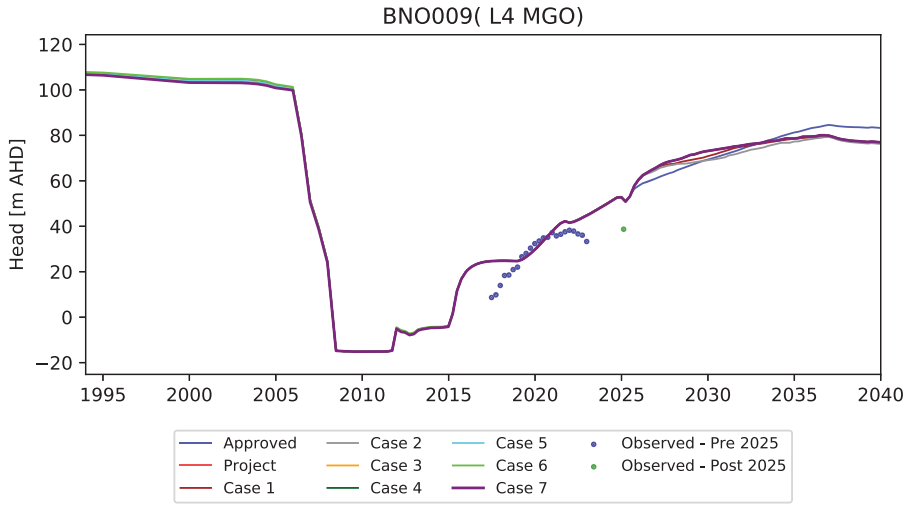

BNO003(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

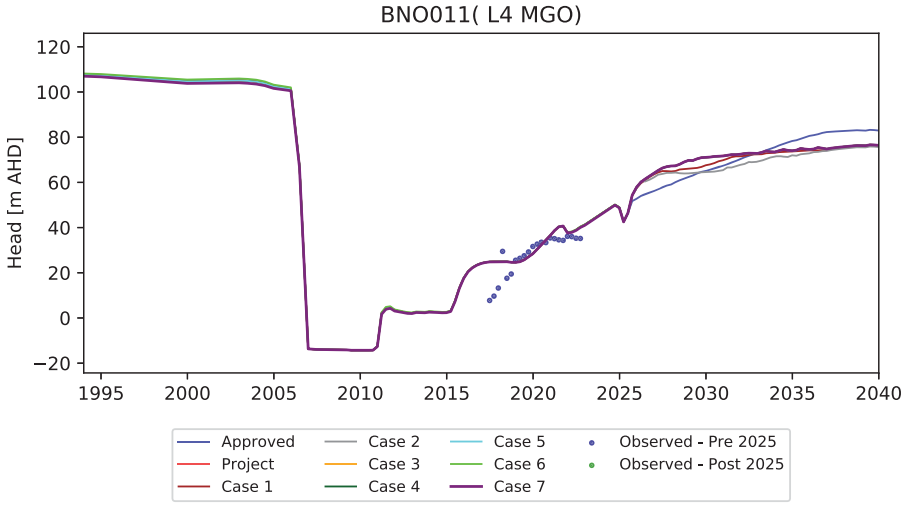

BNO004(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

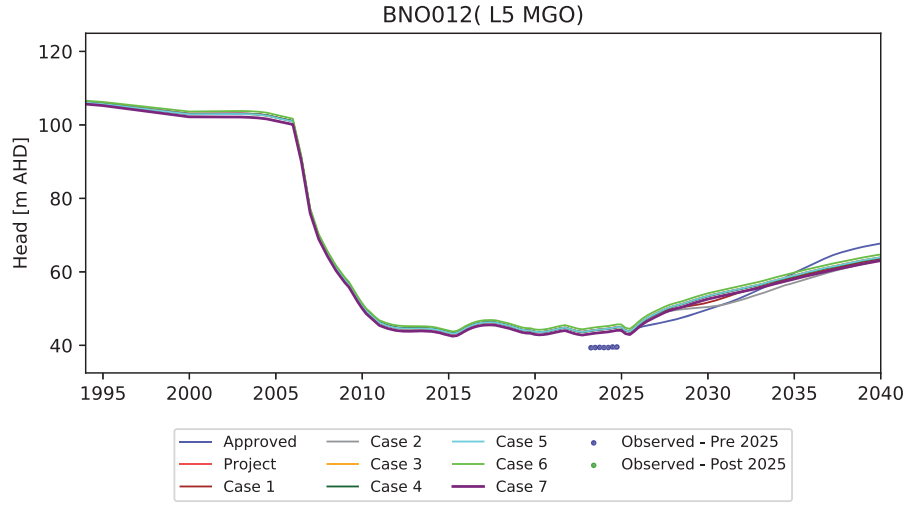

BNO006(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

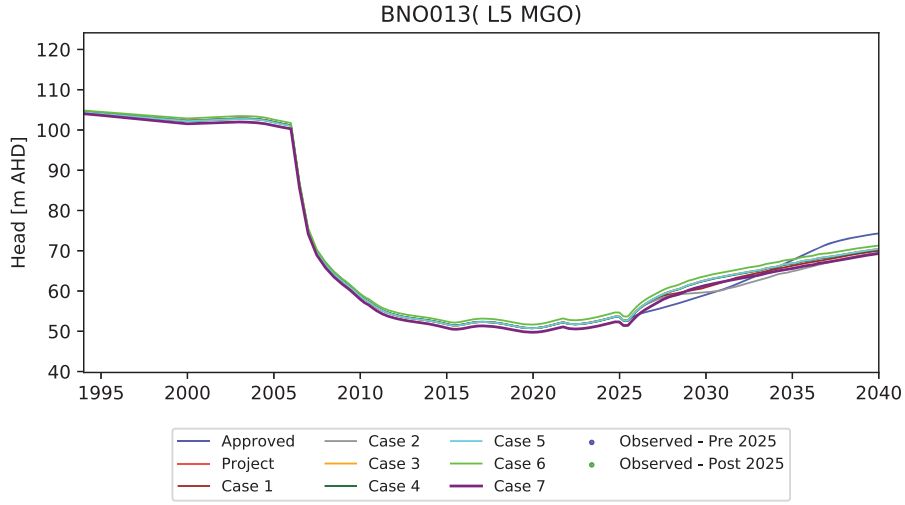

BNO007(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

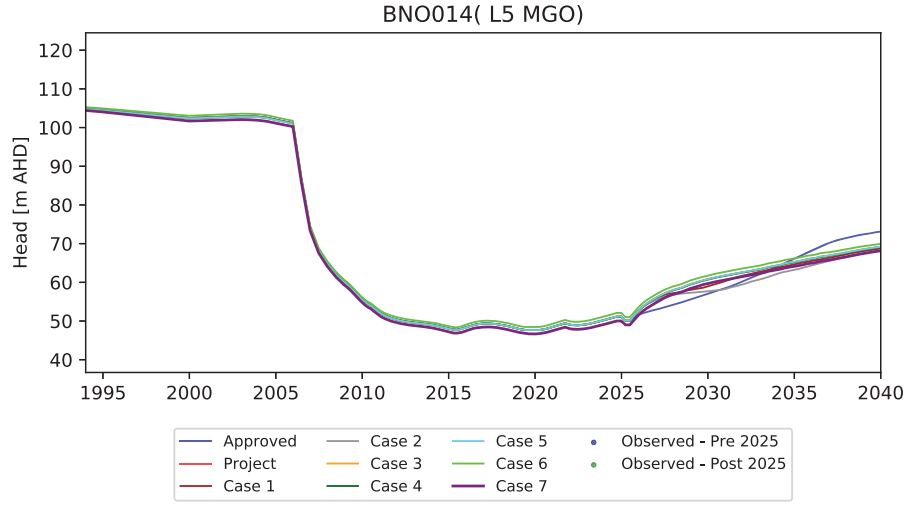

BNO008(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

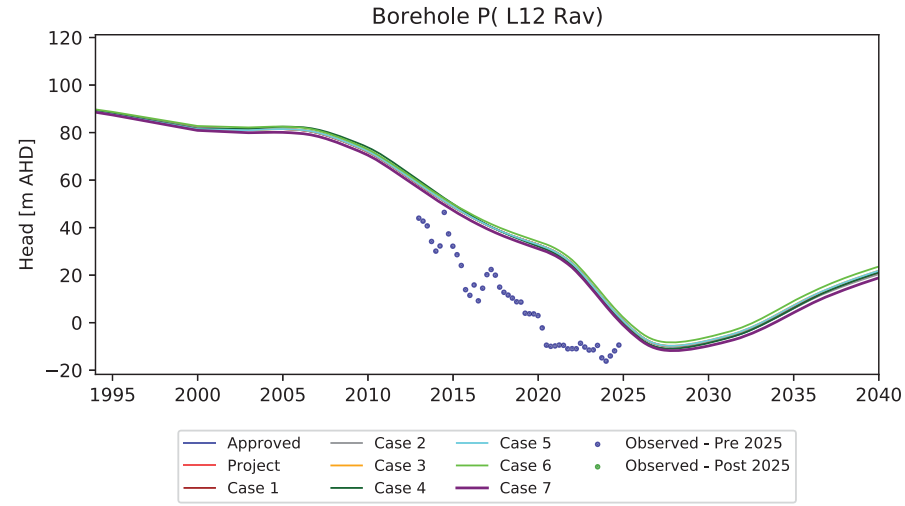

BNO009(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

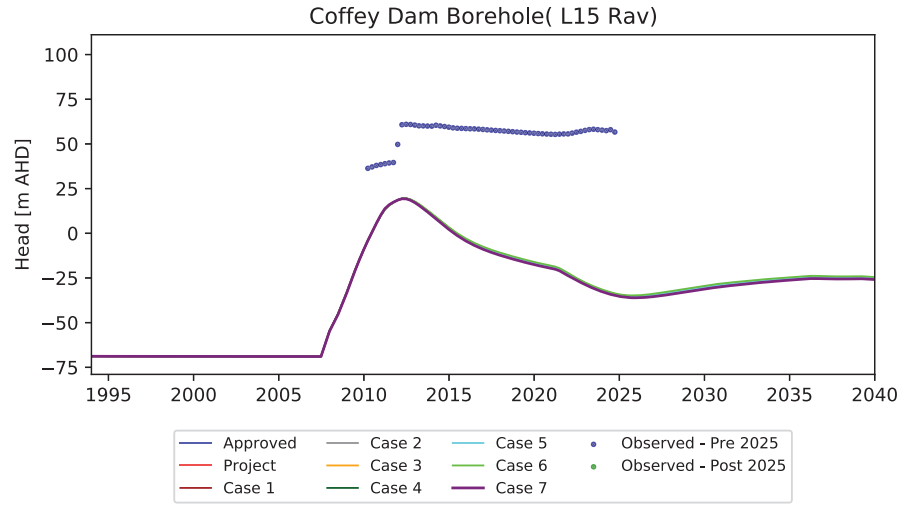

BNO011(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

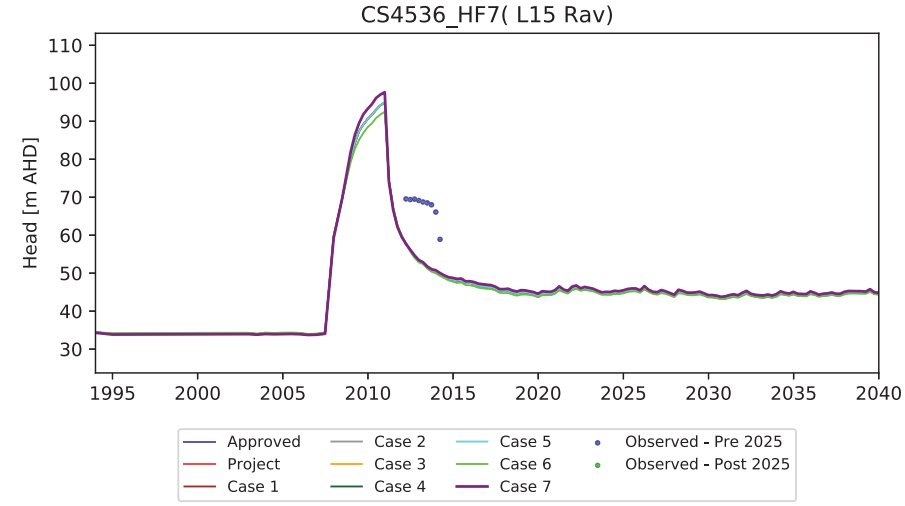

BNO012(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

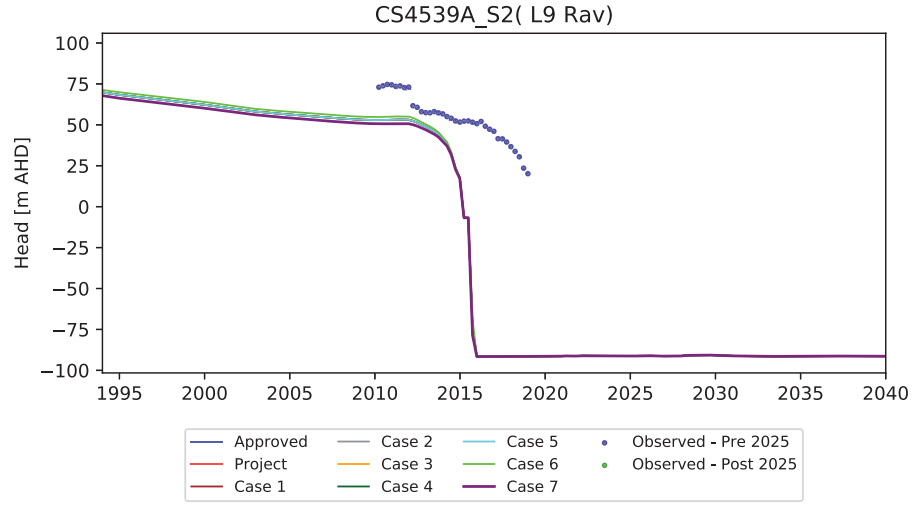

BNO013(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

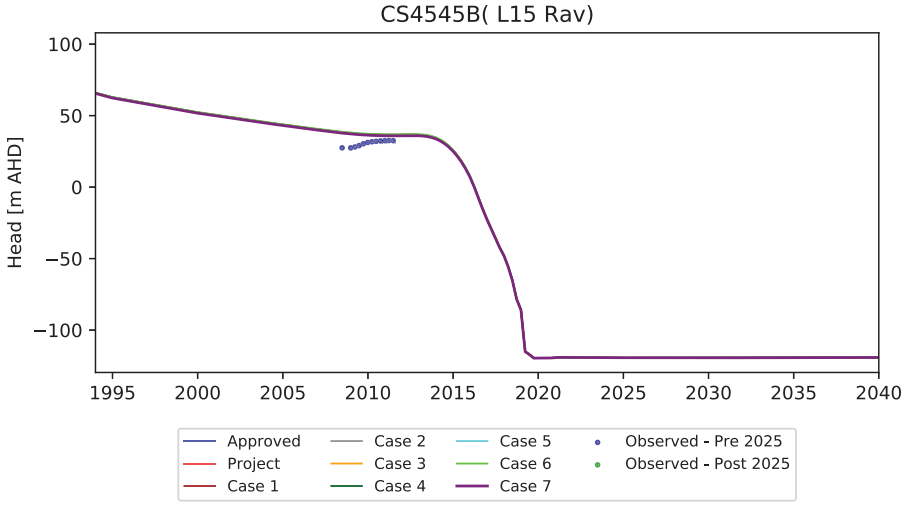

BNO014(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

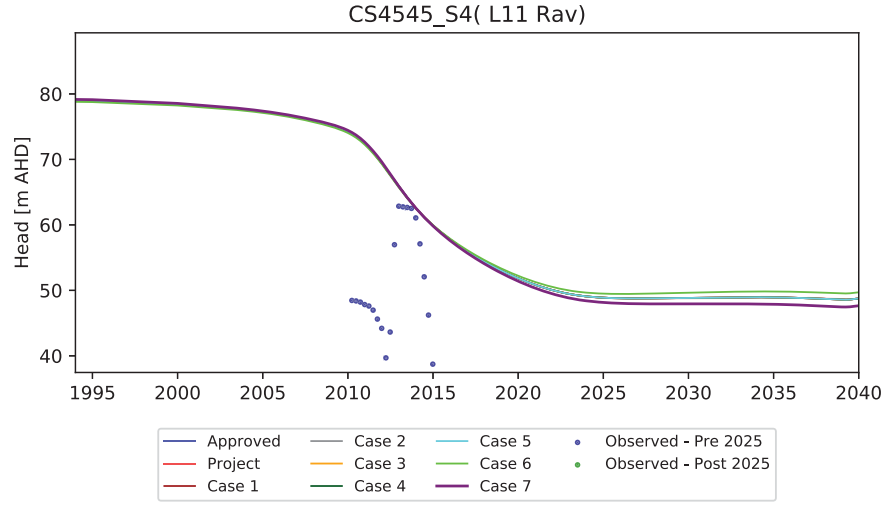

Borehole P(L12 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

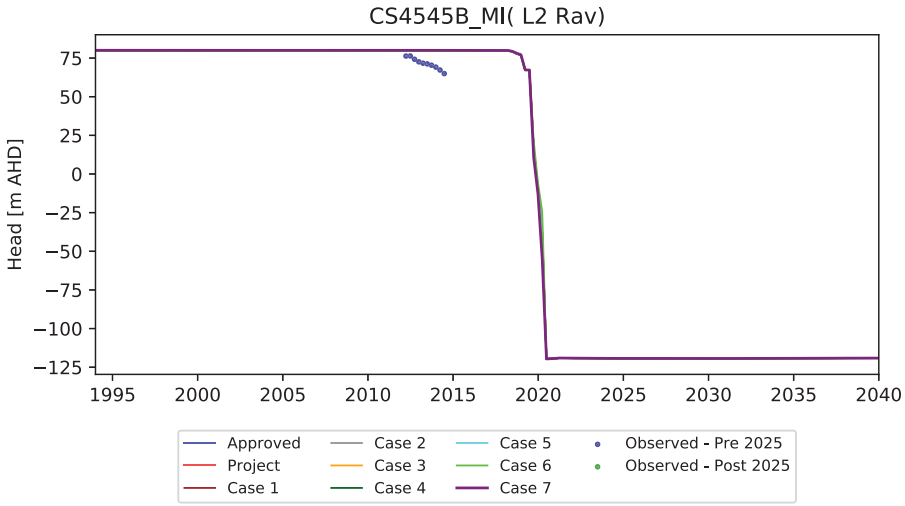

Coffey Dam Borehole(L15 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

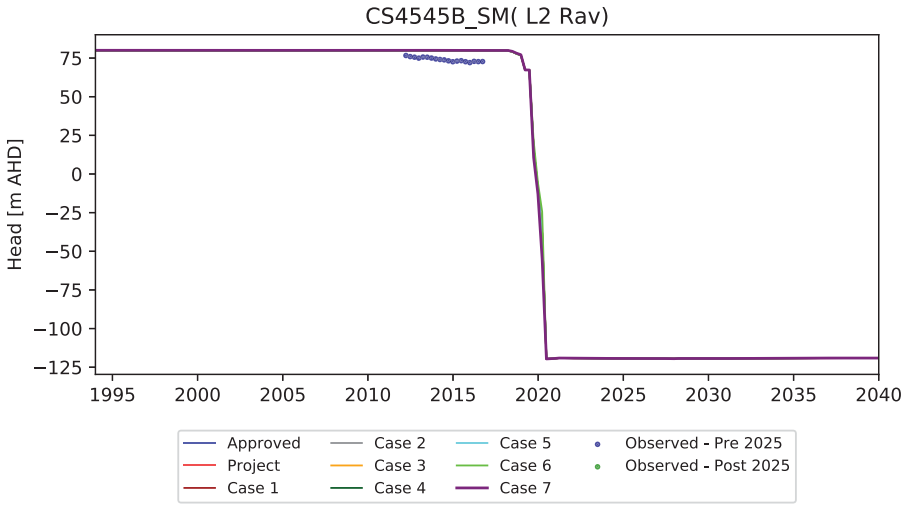

CS4536_HF7(L15 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

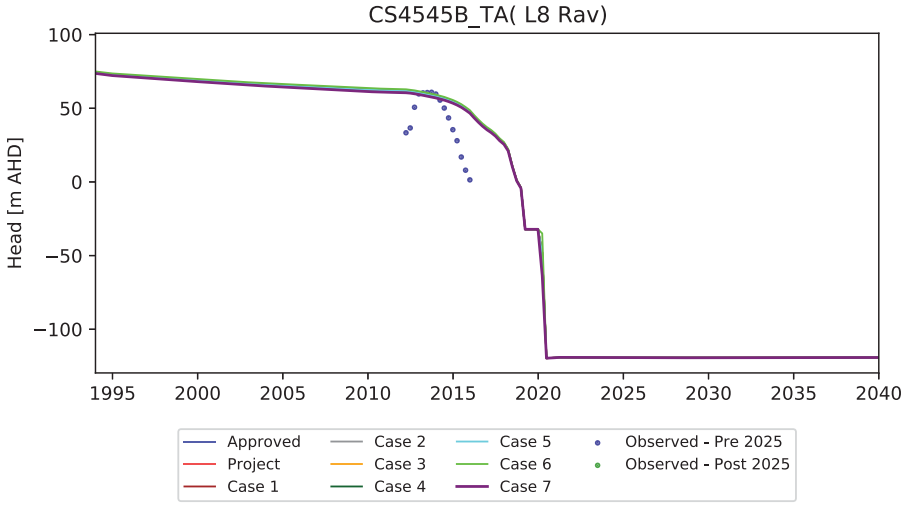

CS4539A_S2(L9 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

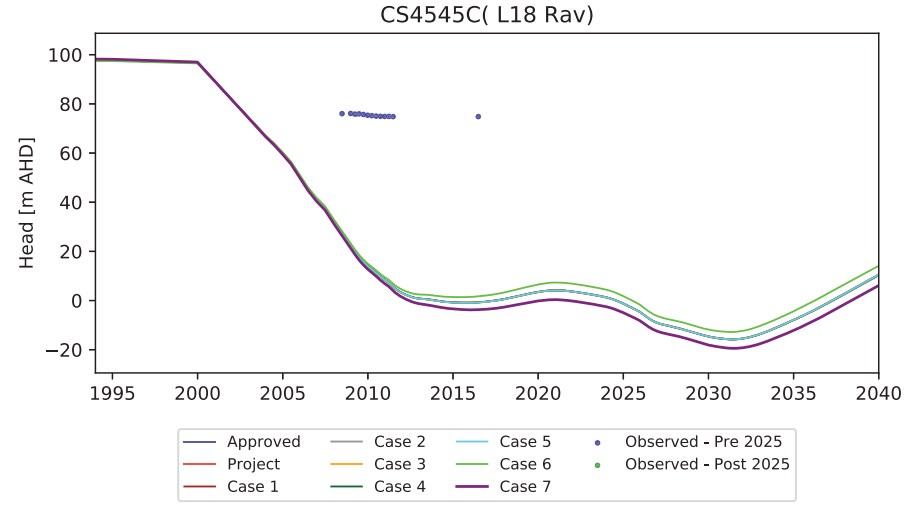

CS4545B(L15 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

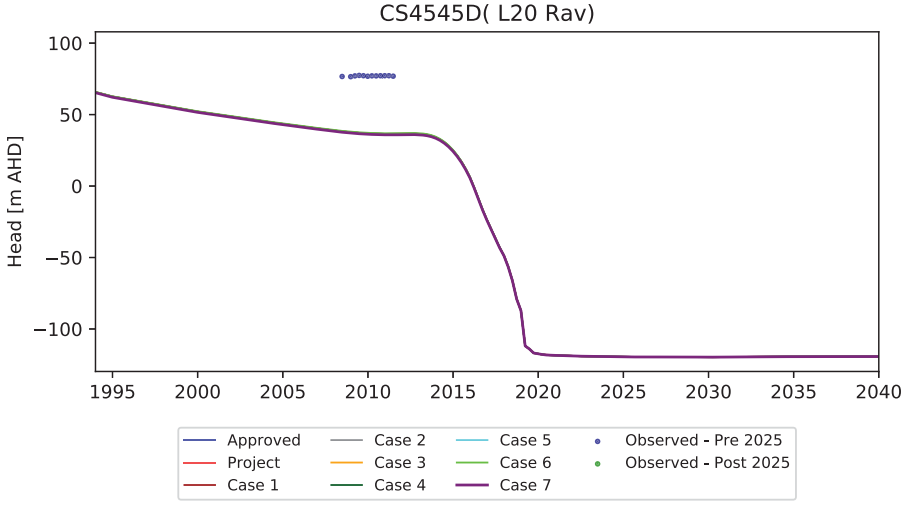

CS4545_S4(L11 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

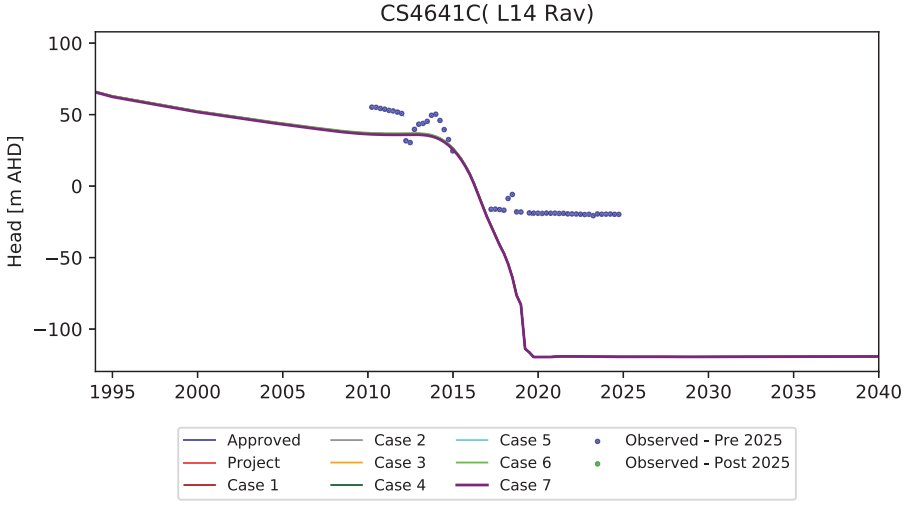

CS4545B_MI(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

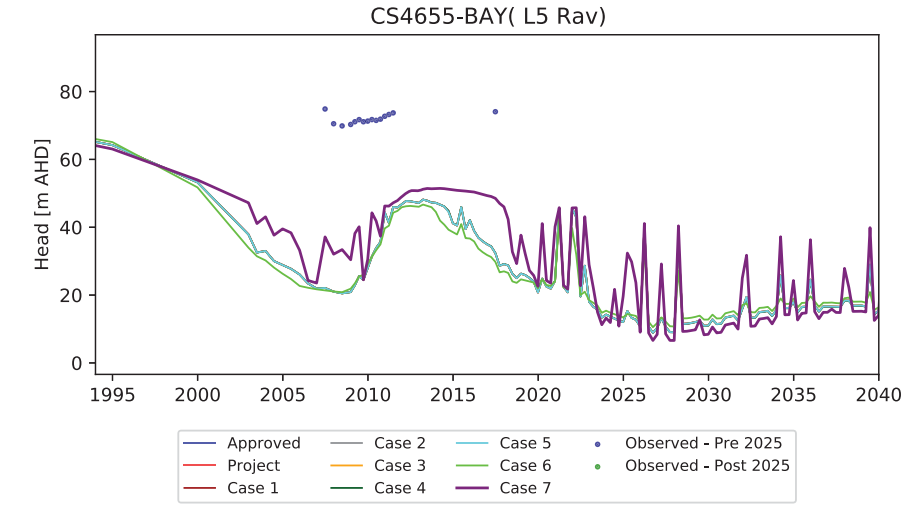

CS4545B_SM(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

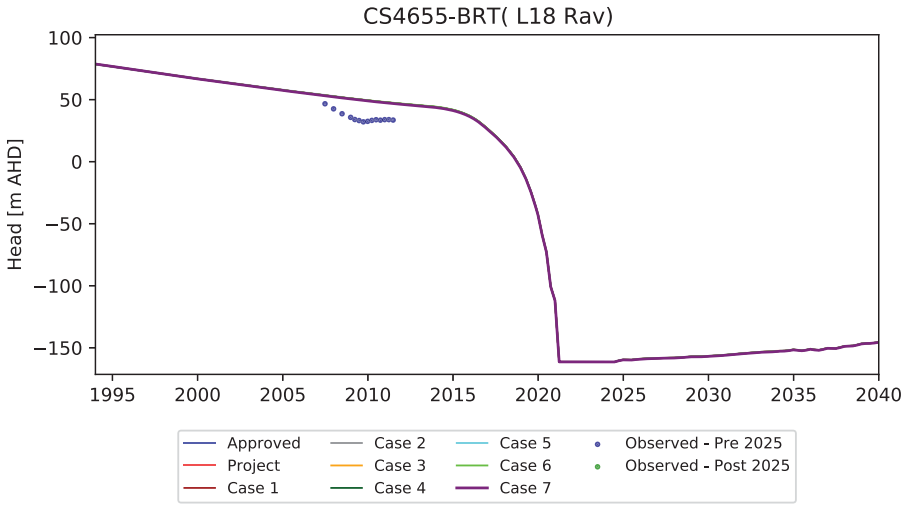

CS4545B_TA(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

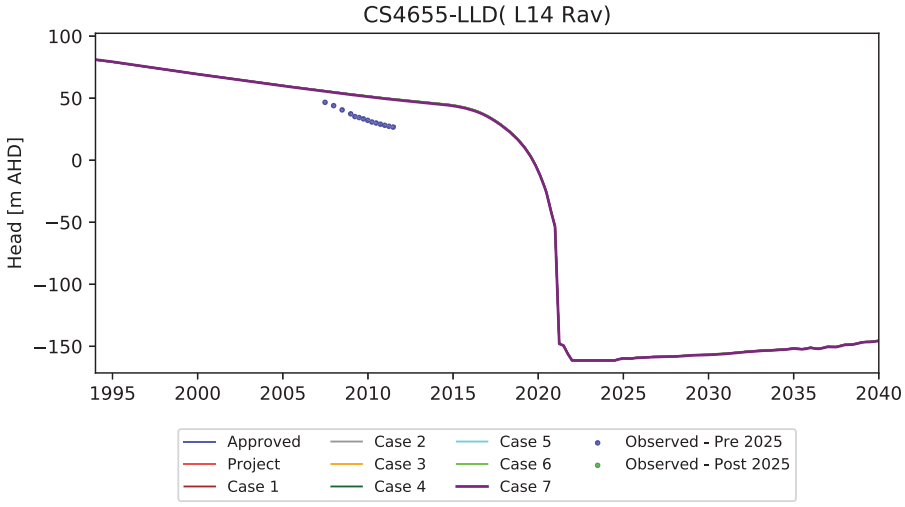

CS4545C(L18 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

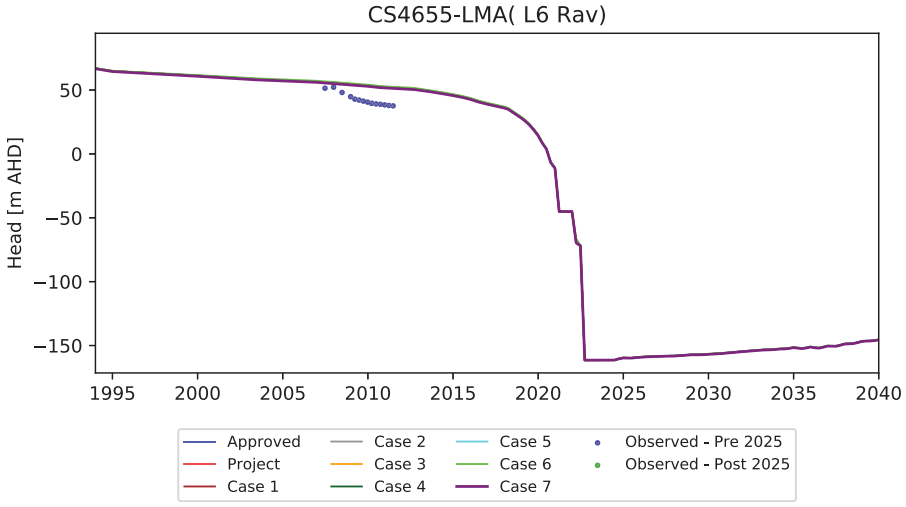

CS4545D(L20 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

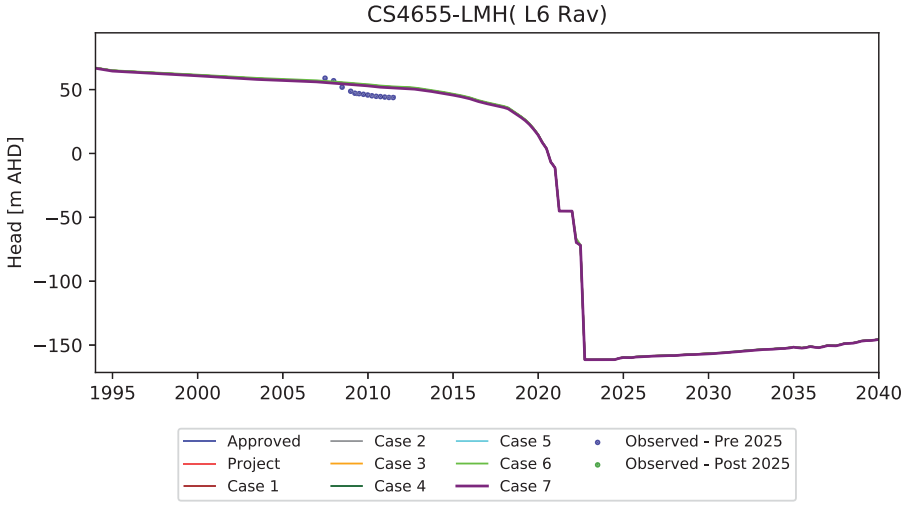

CS4641C(L14 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

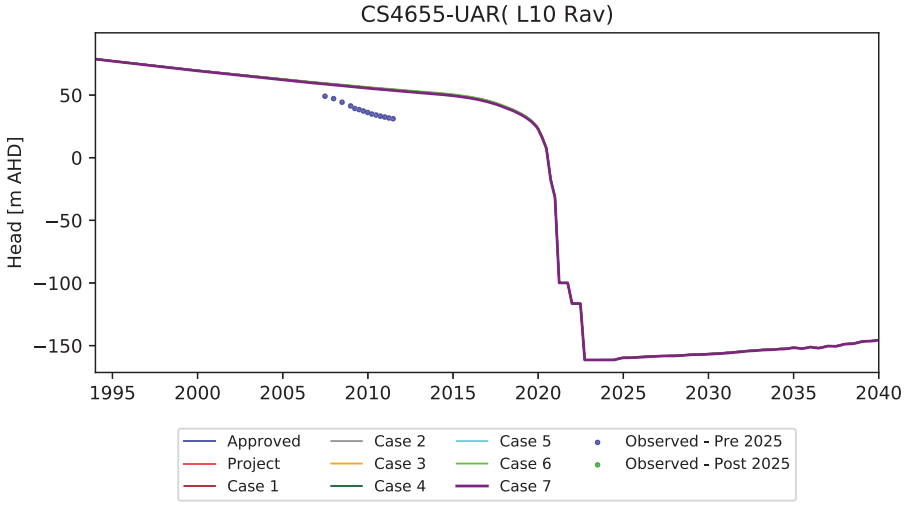

CS4655-BAY(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

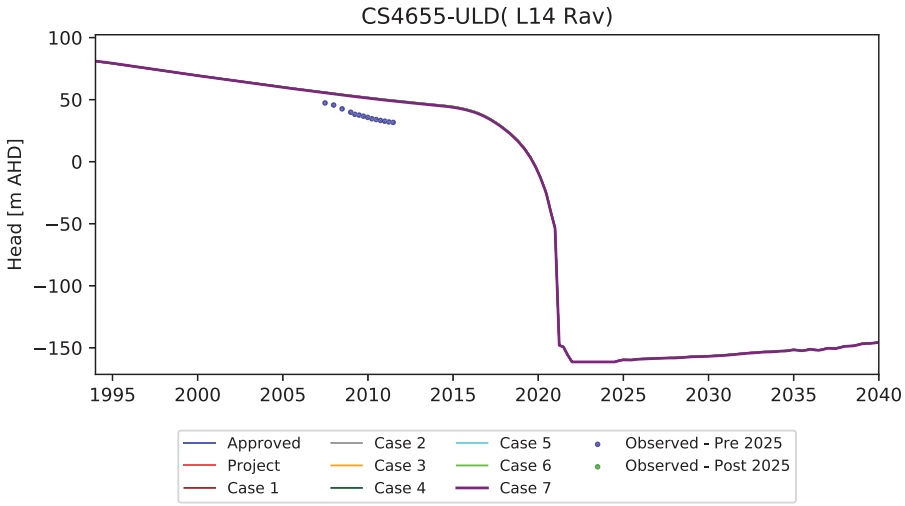

CS4655-BRT(L18 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

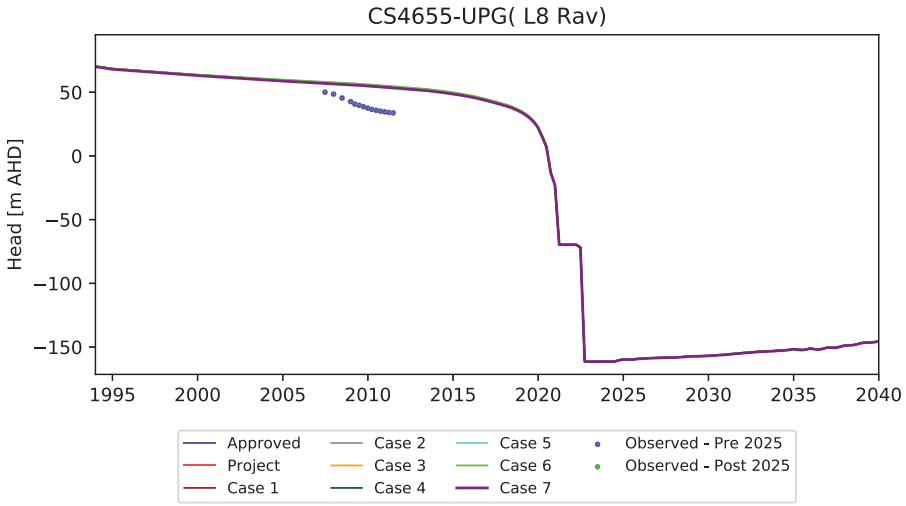

CS4655-LLD(L14 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

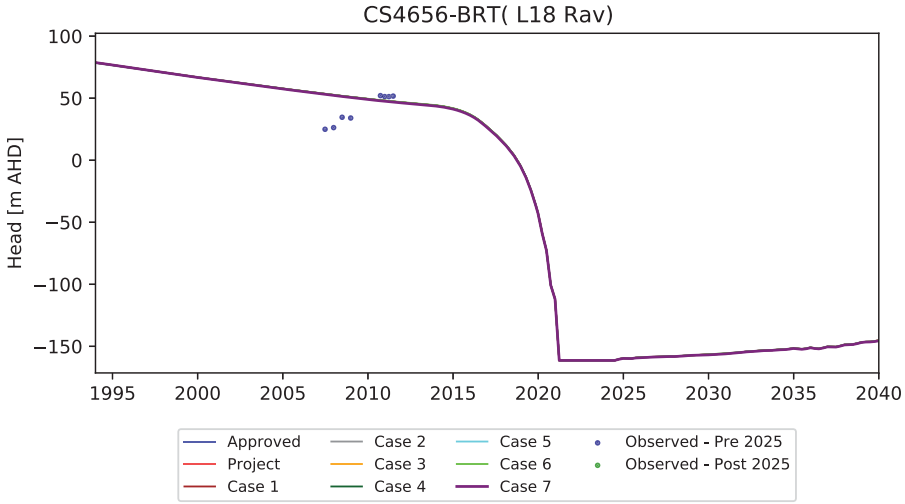

CS4655-LMA(L6 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

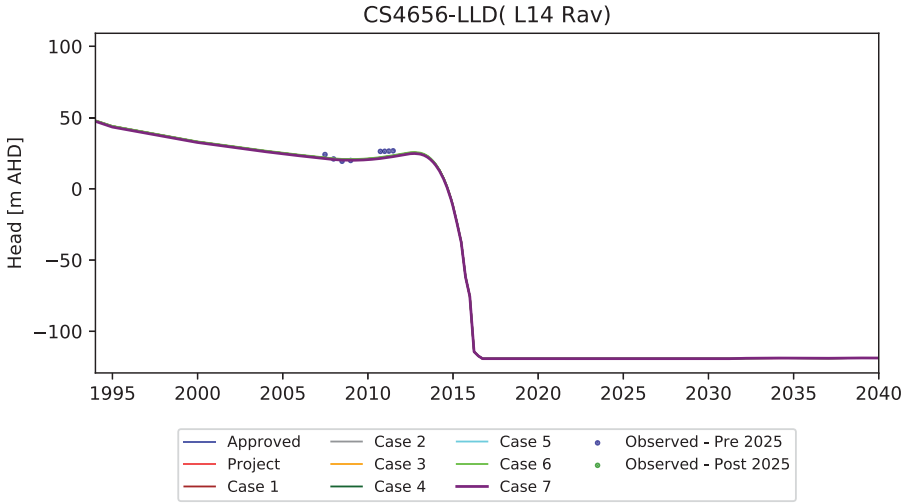

CS4655-LMH(L6 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

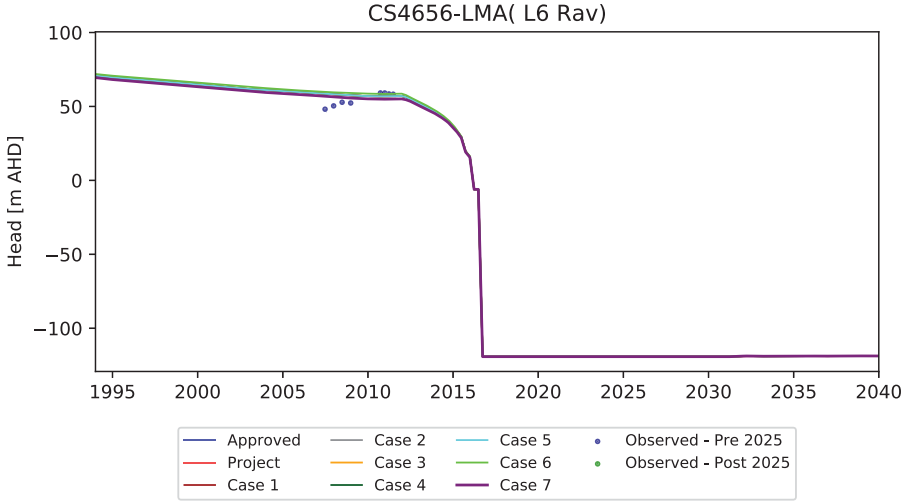

CS4655-UAR(L10 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

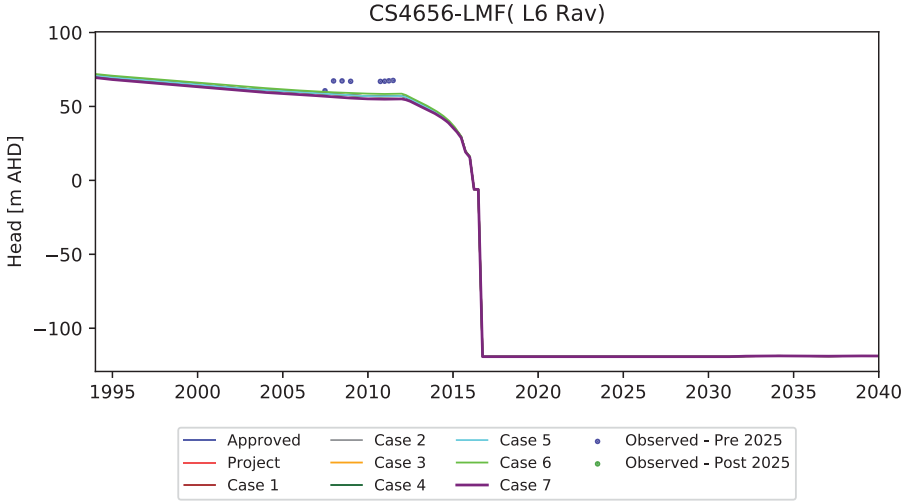

CS4655-ULD(L14 Rav)
Head [m AHD]
100
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

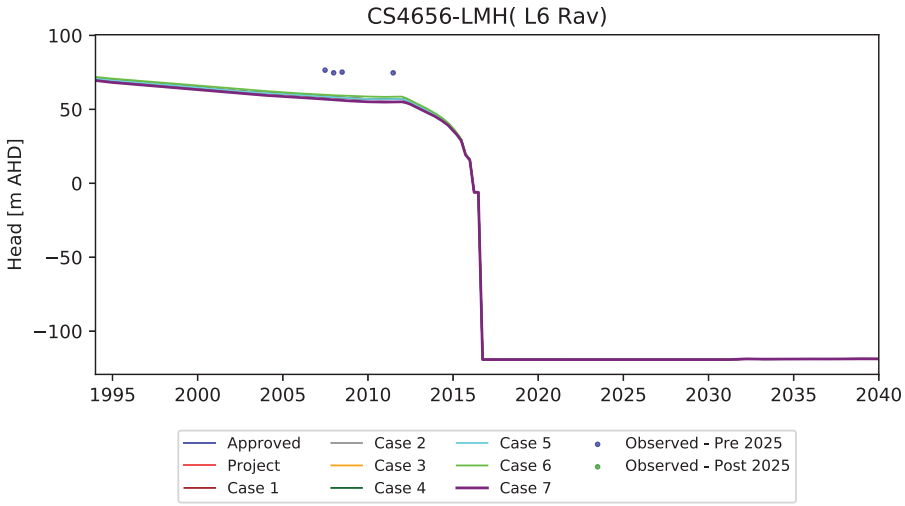

CS4655-UPG(L8 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

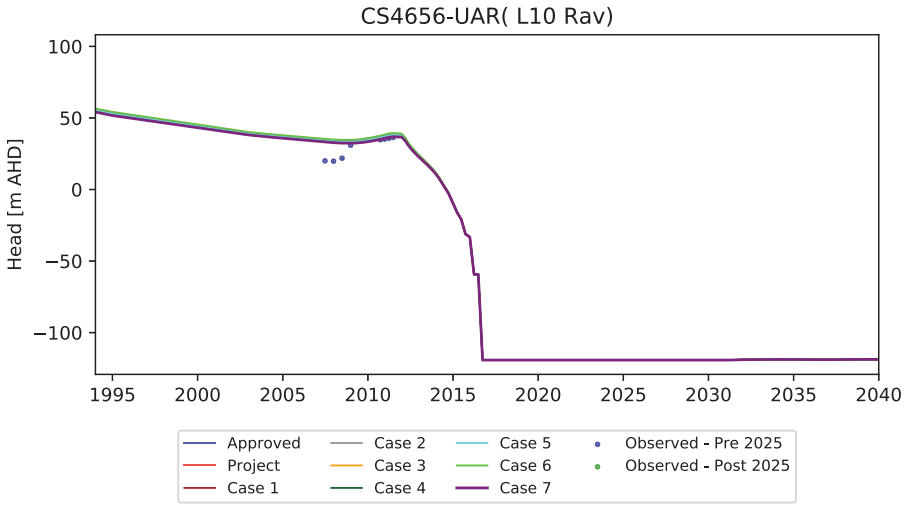

CS4656-BRT(L18 Rav)
Head [m AHD]
100
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

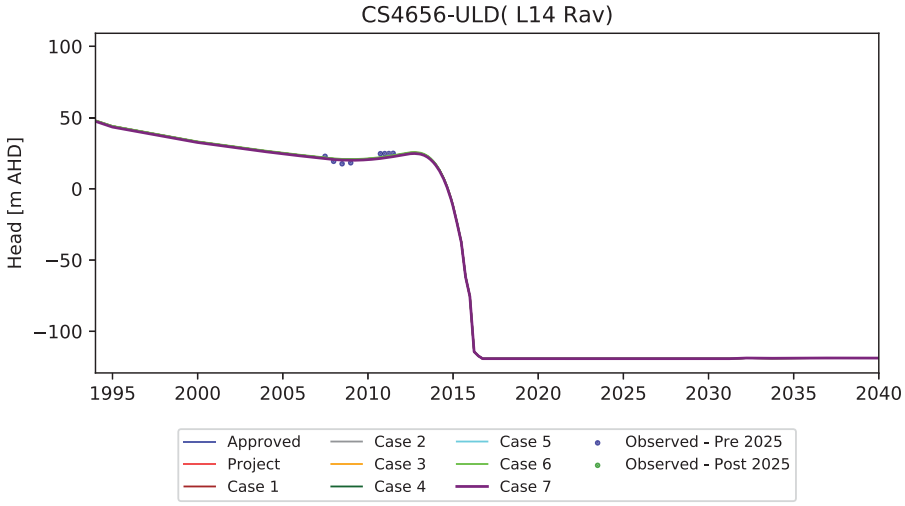

CS4656-LLD(L14 Rav)
Head [m AHD]
100
50
0
−50
−100
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

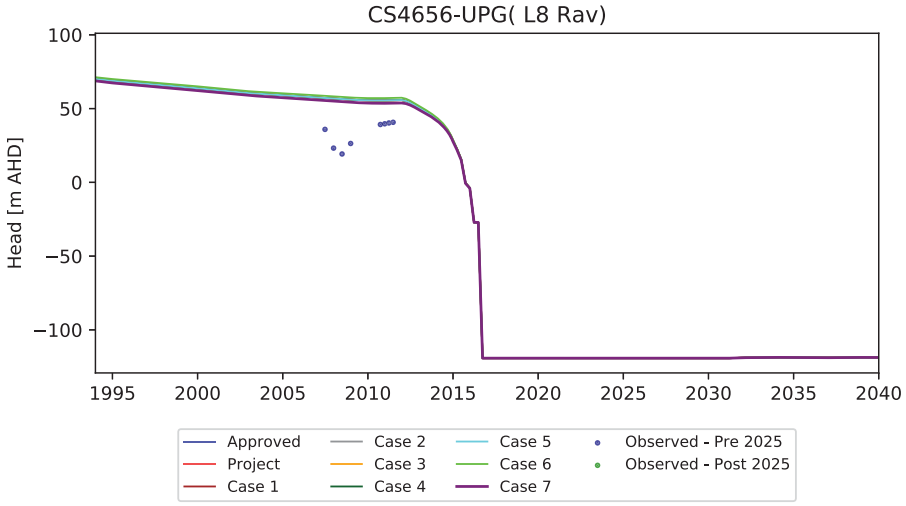

CS4656-LMA(L6 Rav)
Head [m AHD]
100
50
0
−50
−100
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

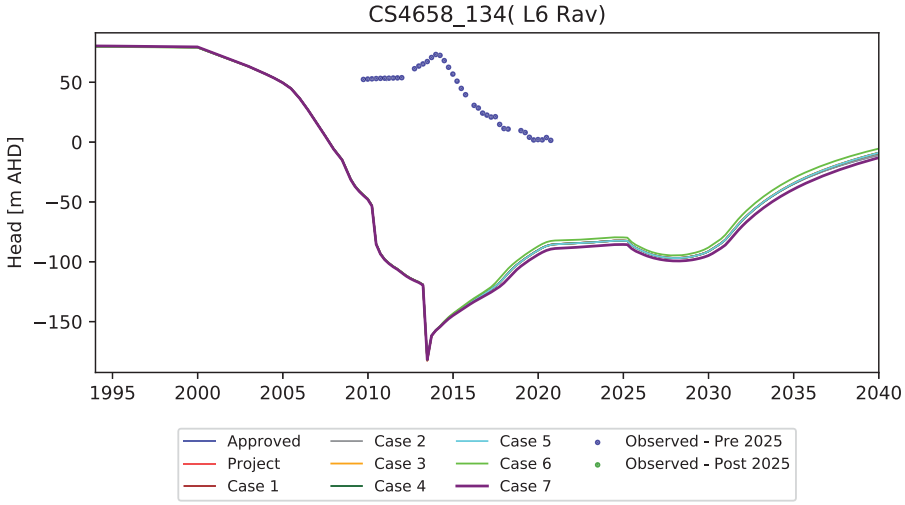

CS4656-LMF(L6 Rav)
Head [m AHD]
100
50
0
−50
−100
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

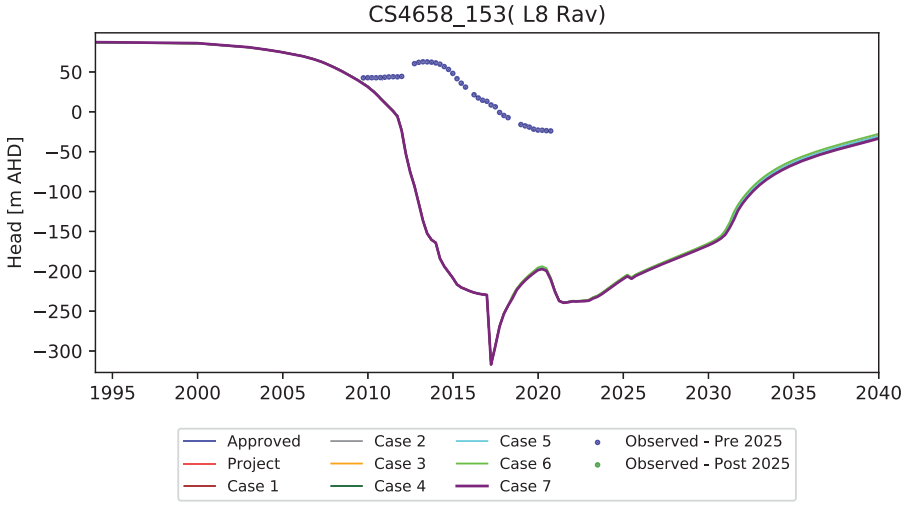

CS4656-LMH(L6 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

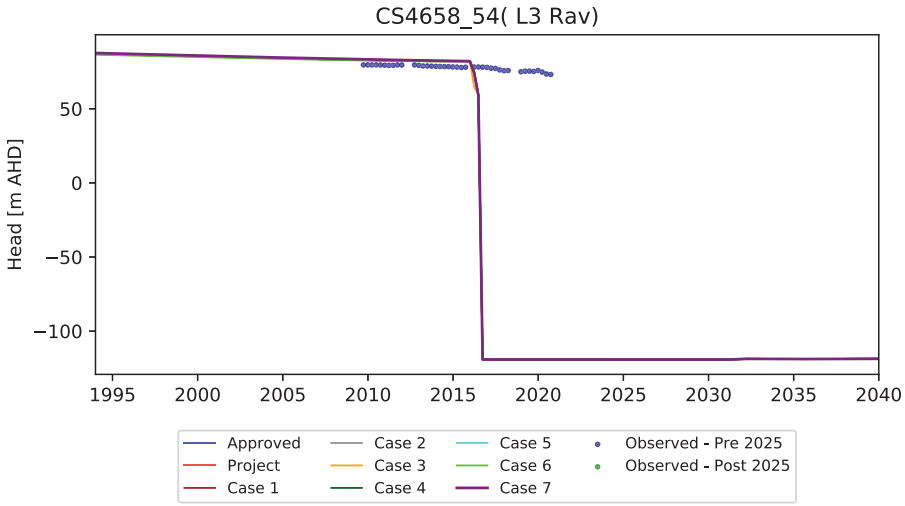

CS4656-UAR(L10 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

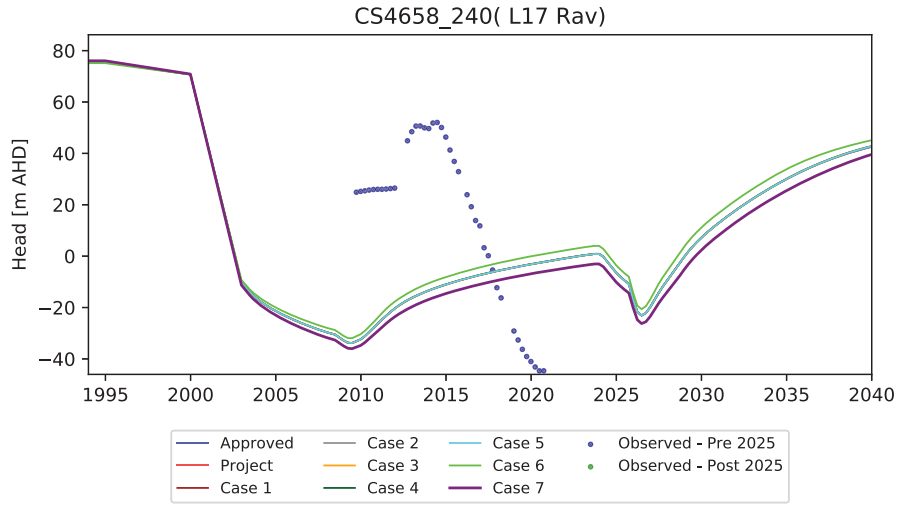

CS4656-ULD(L14 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

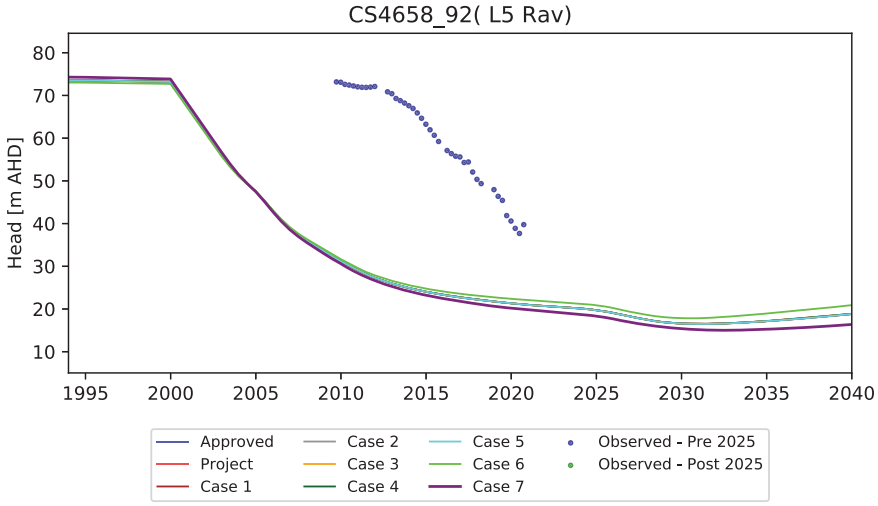

CS4656-UPG(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

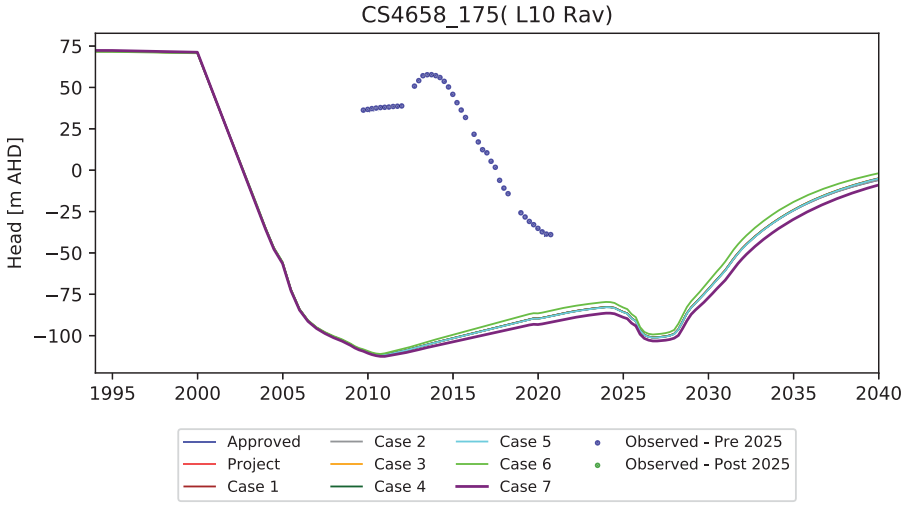

CS4658_134(L6 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

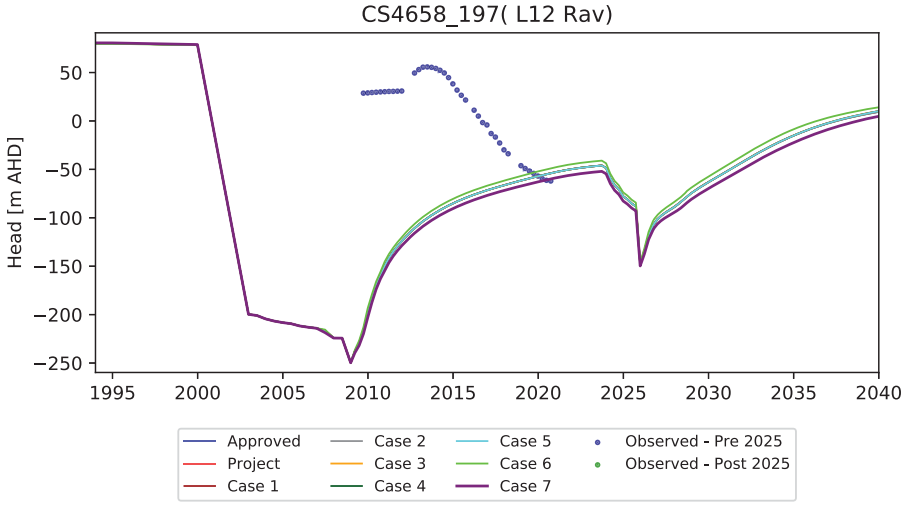

CS4658_153(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

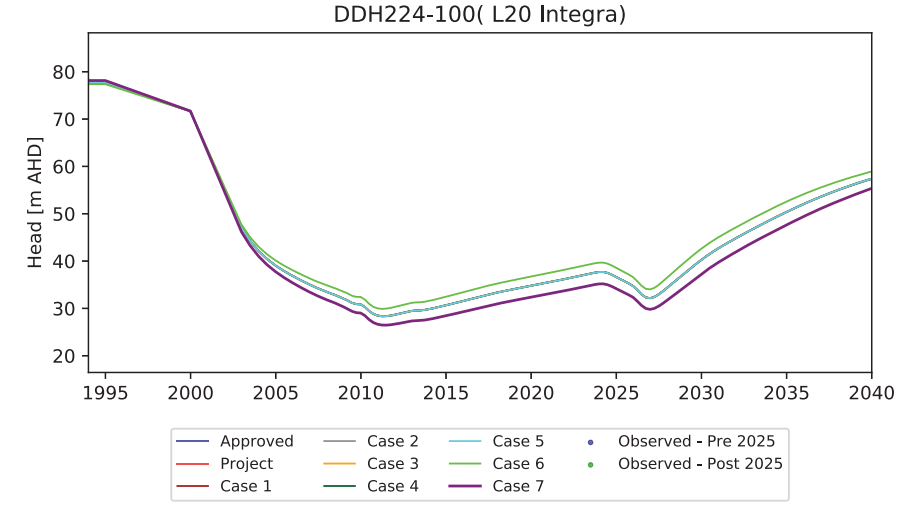

CS4658_54(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

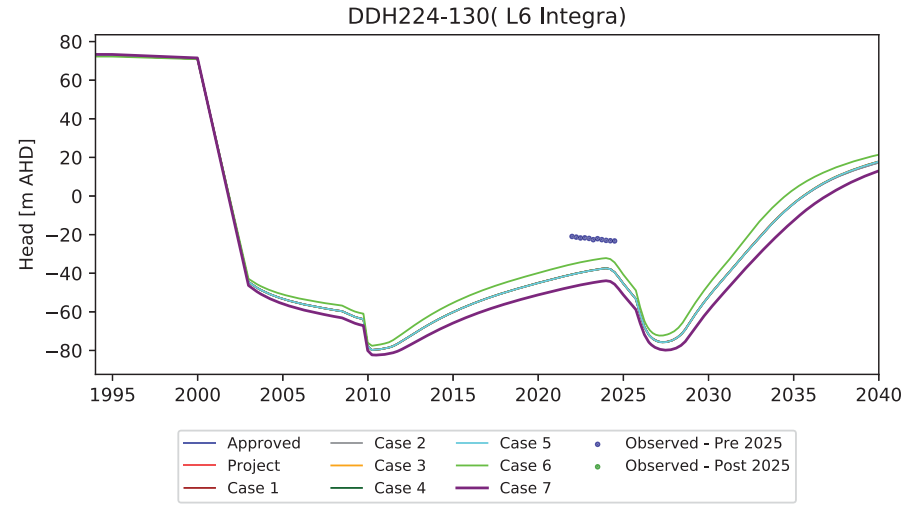

CS4658_240(L17 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

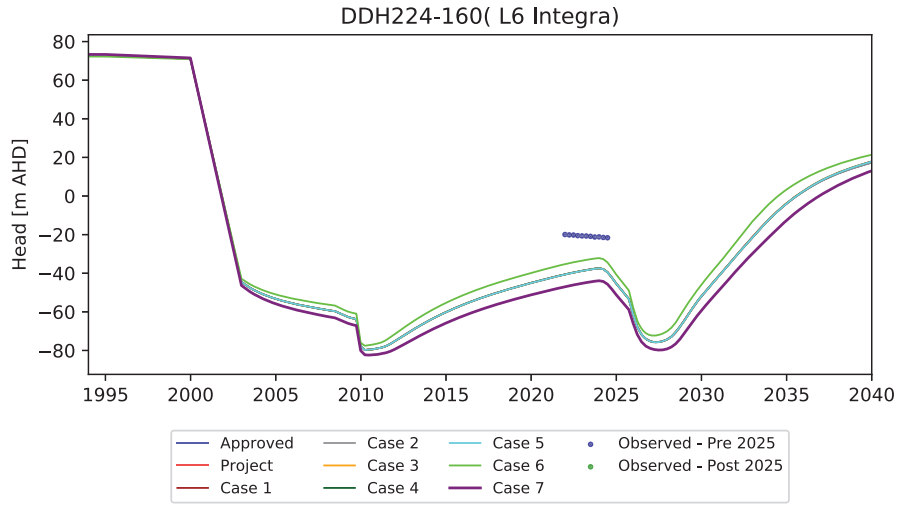

CS4658_92(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

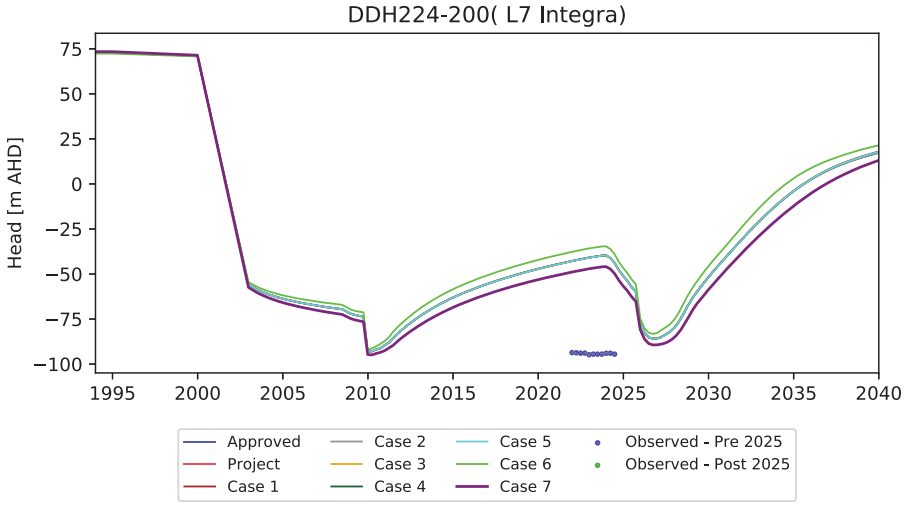

CS4658_175(L10 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

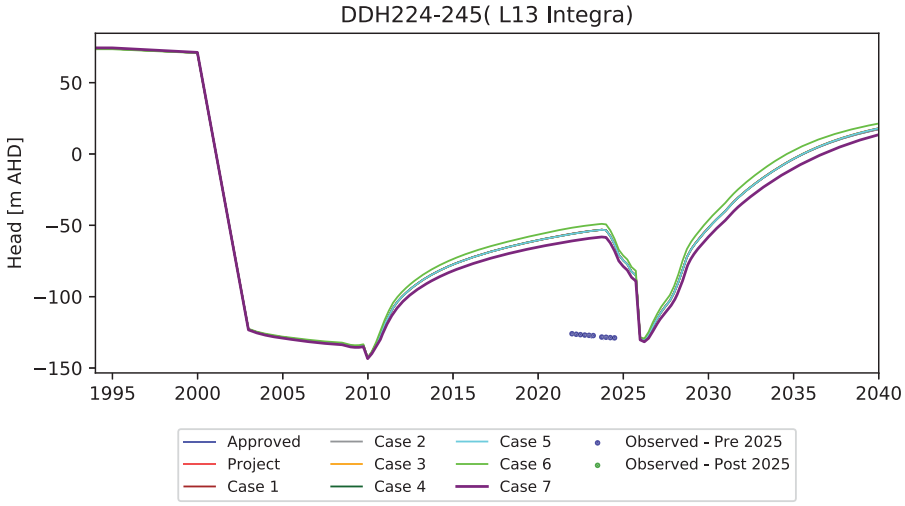

CS4658_197(L12 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

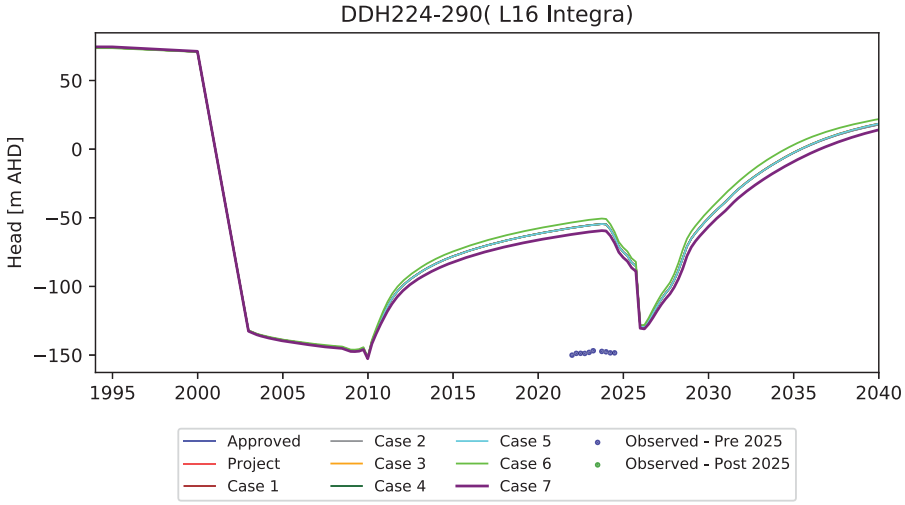

DDH224-100(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

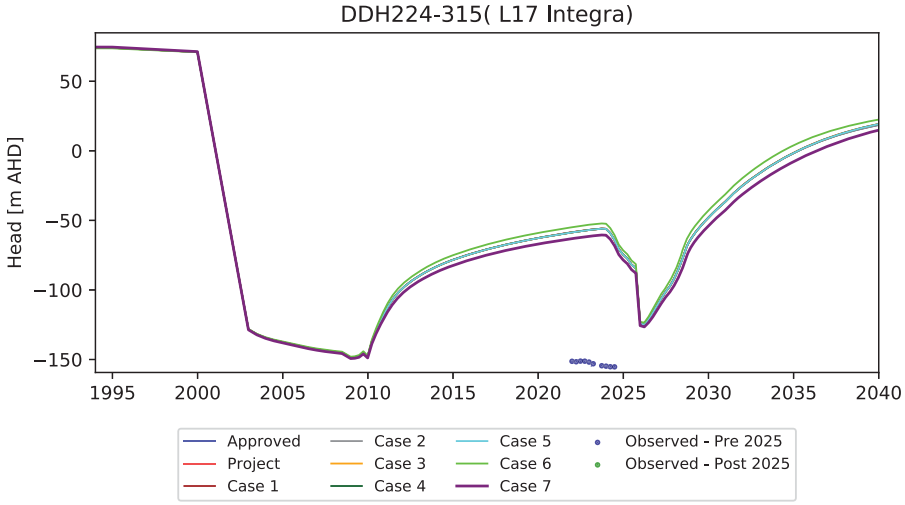

DDH224-130(L6 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

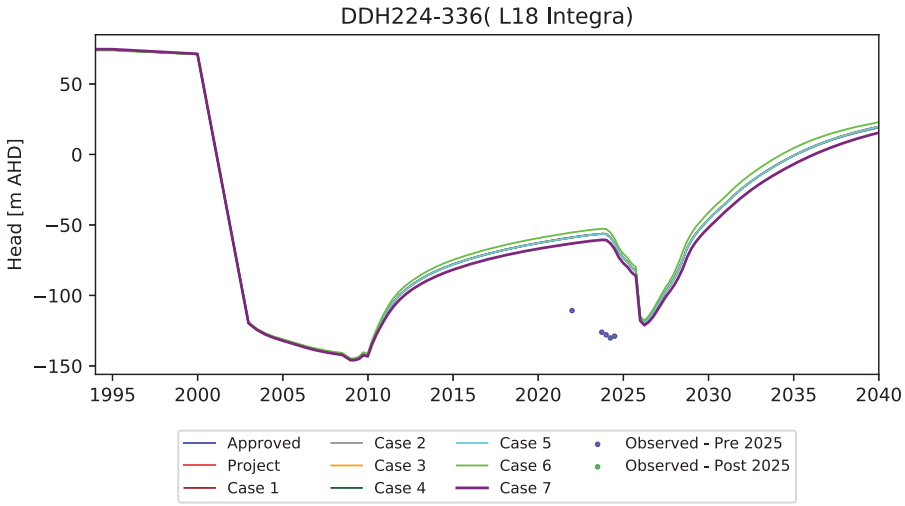

DDH224-160(L6 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

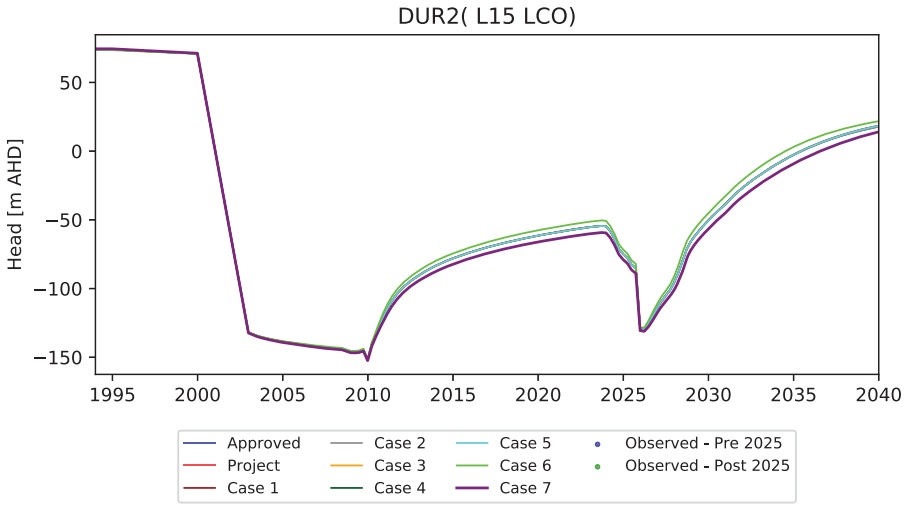

DDH224-200(L7 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

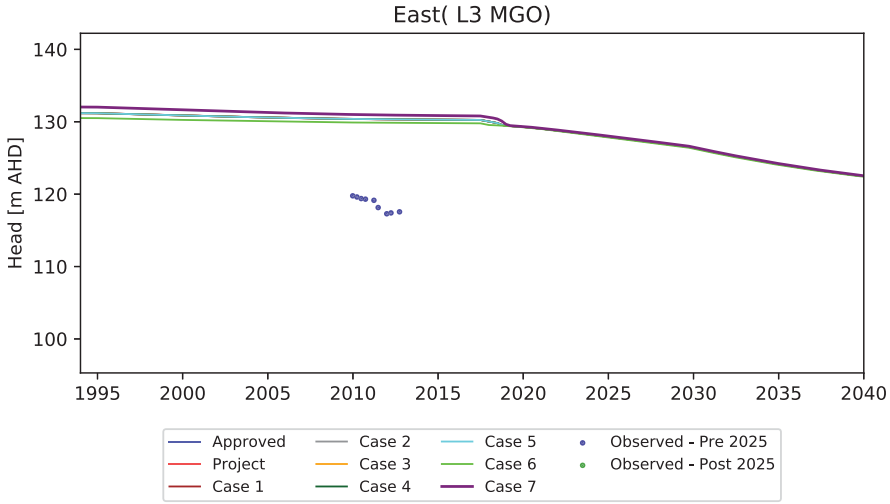

DDH224-245(L13 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

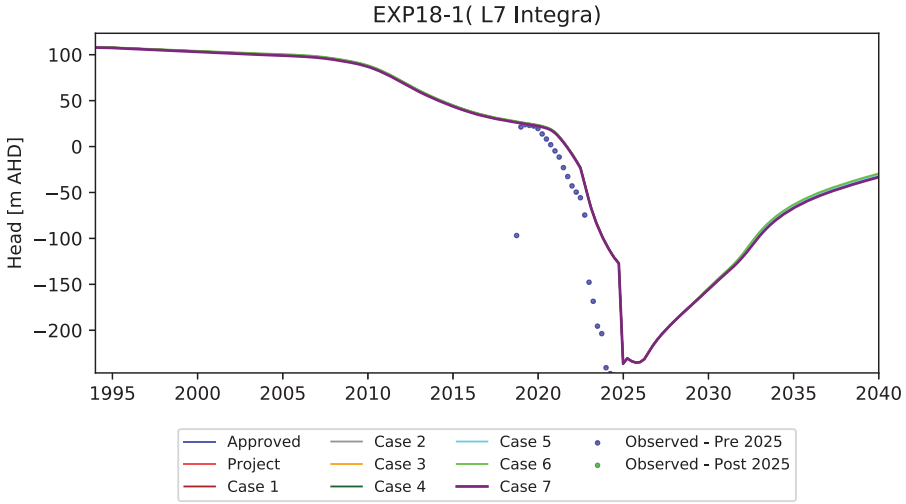

DDH224-290(L16 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

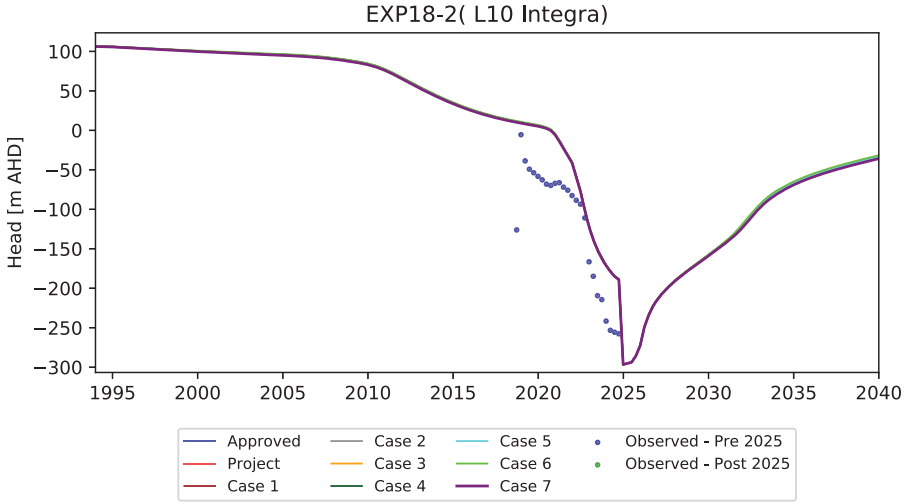

DDH224-315(L17 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

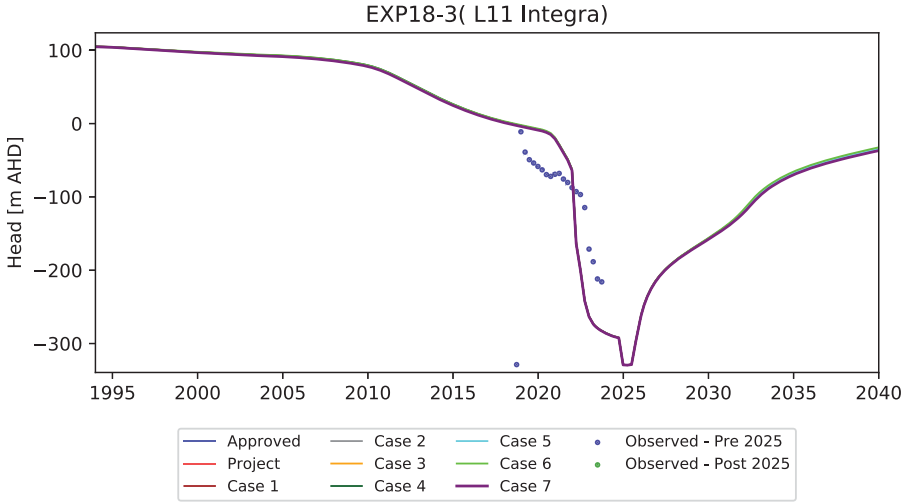

DDH224-336(L18 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

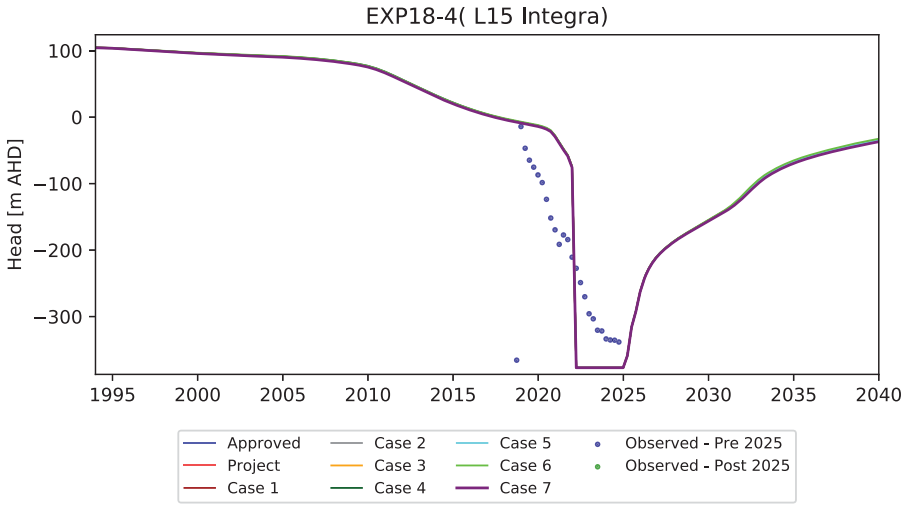

DUR2(L15 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

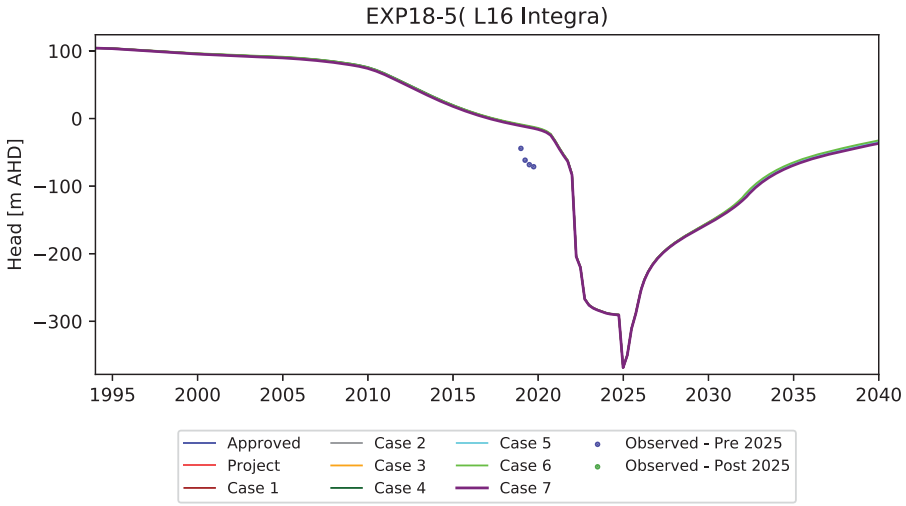

East(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

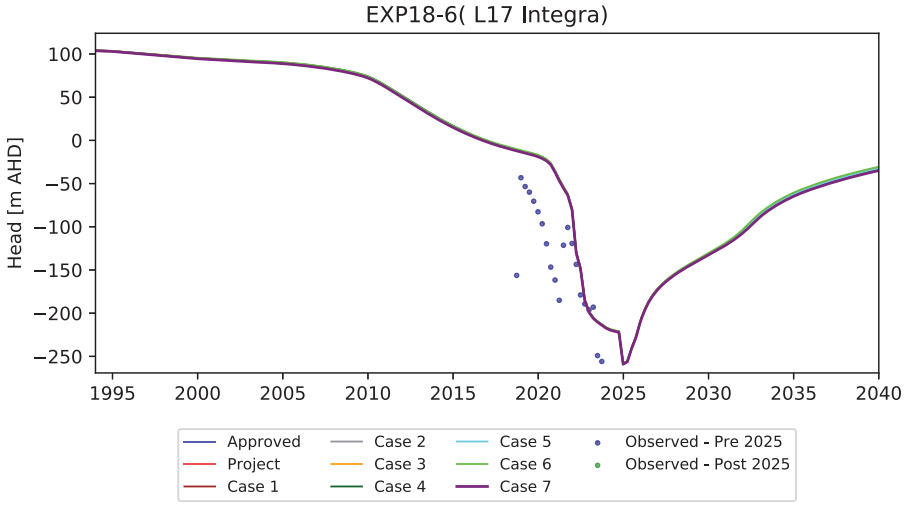

EXP18-1(L7 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

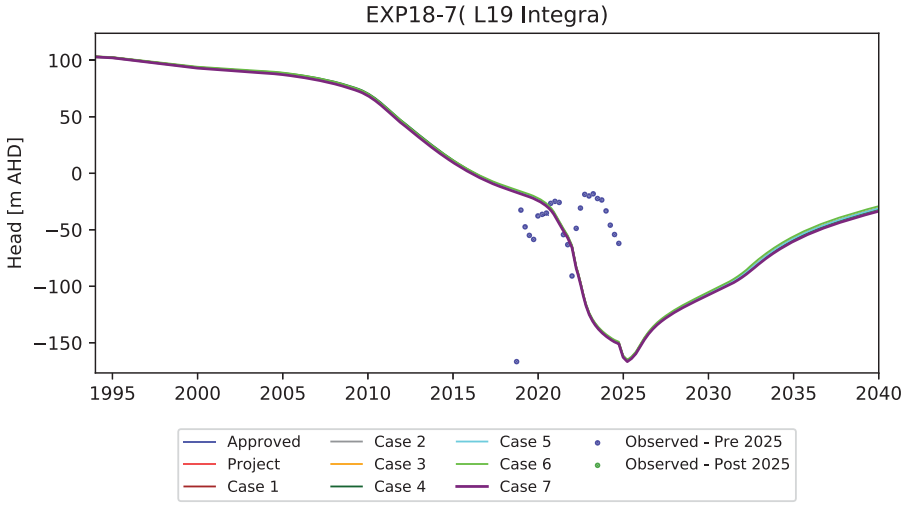

EXP18-2(L10 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

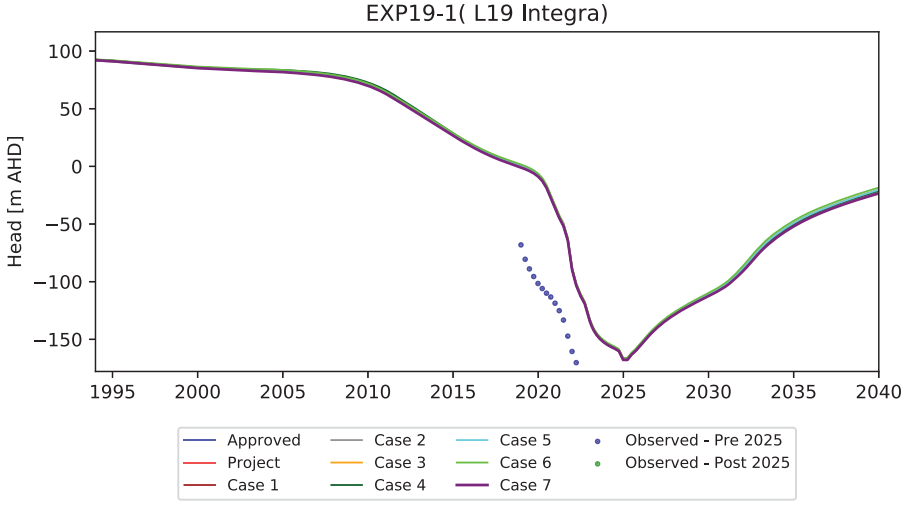

EXP18-3(L11 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

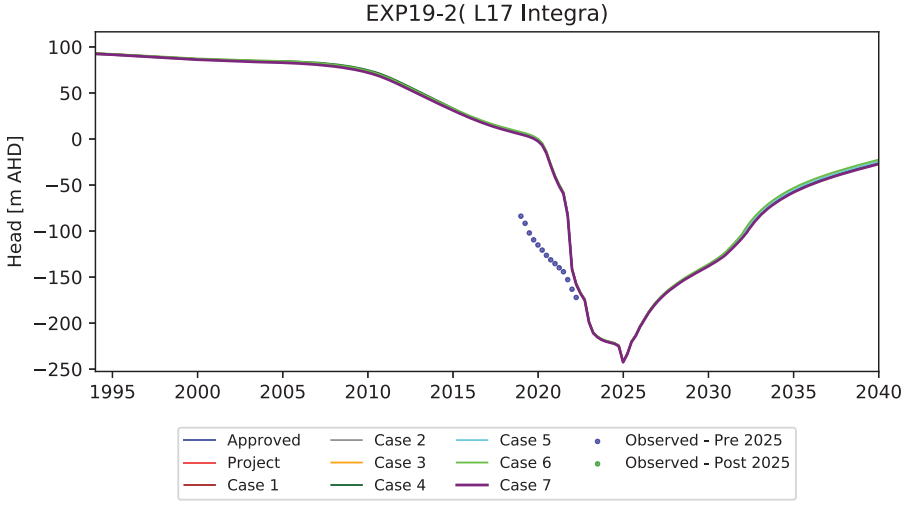

EXP18-4(L15 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

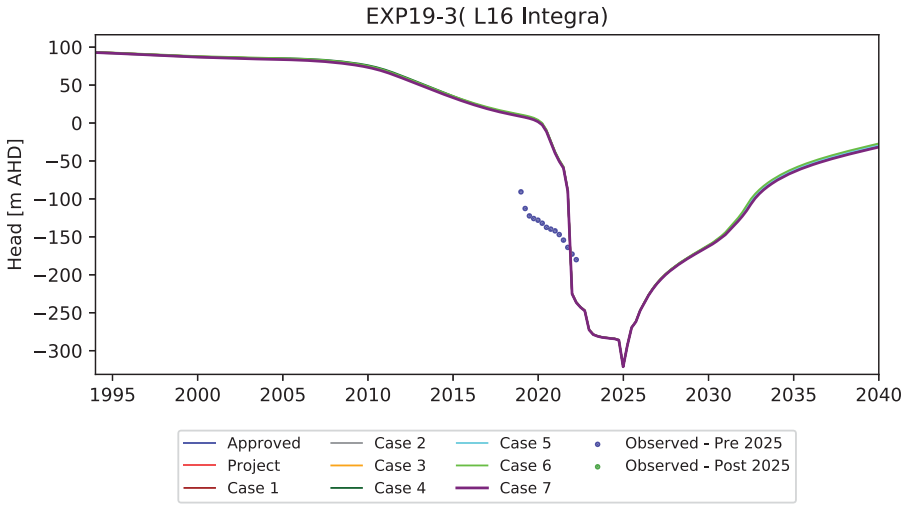

EXP18-5(L16 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

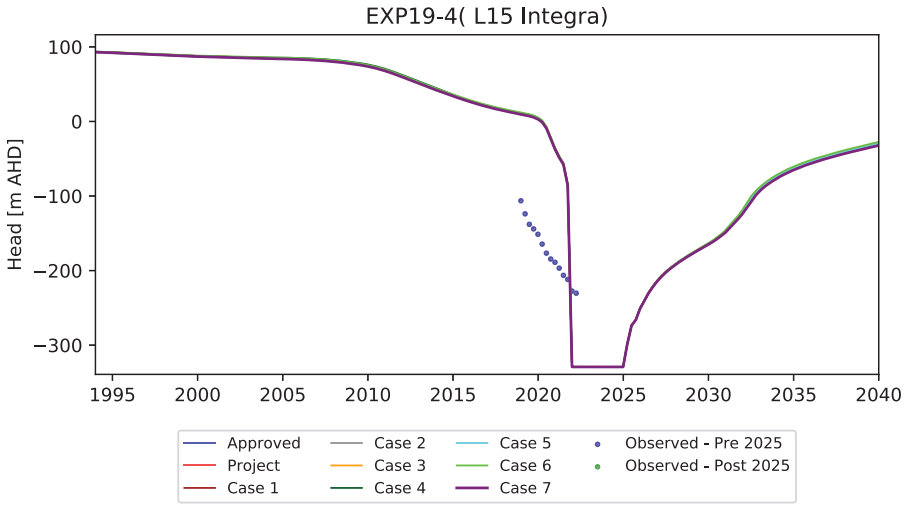

EXP18-6(L17 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

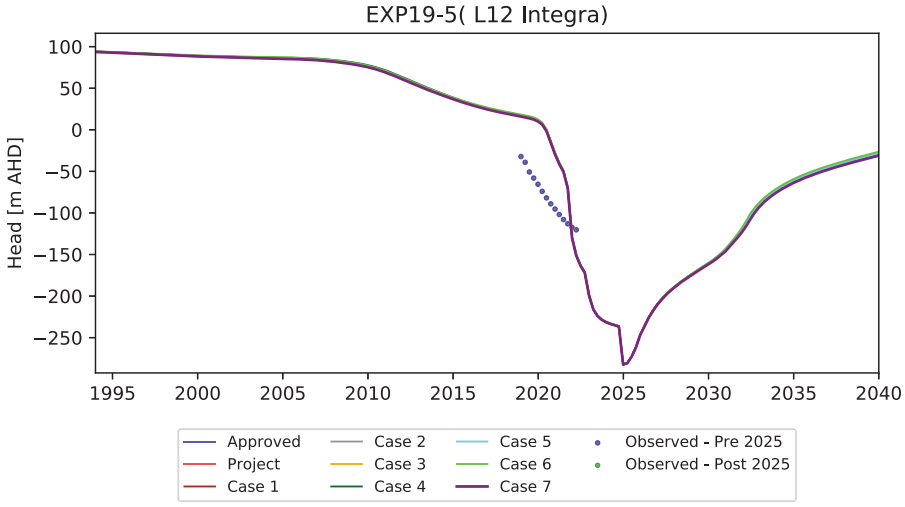

EXP18-7(L19 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

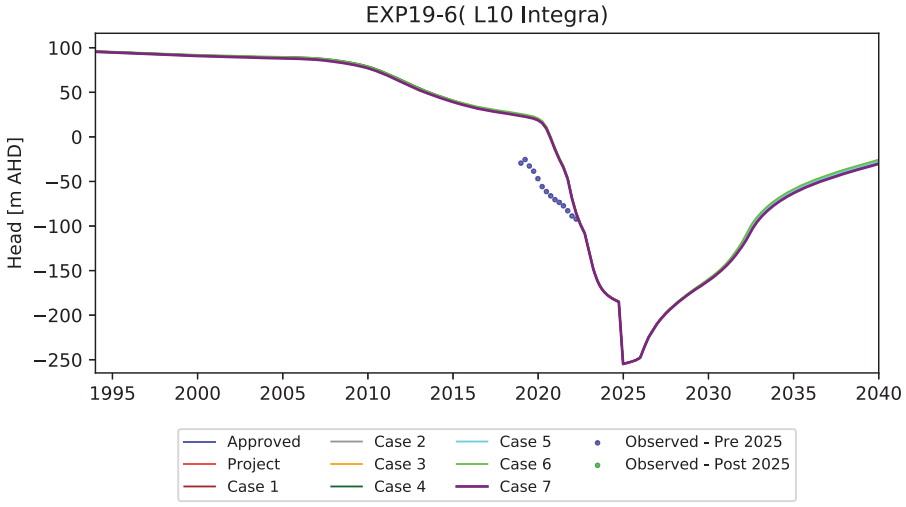

EXP19-1(L19 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

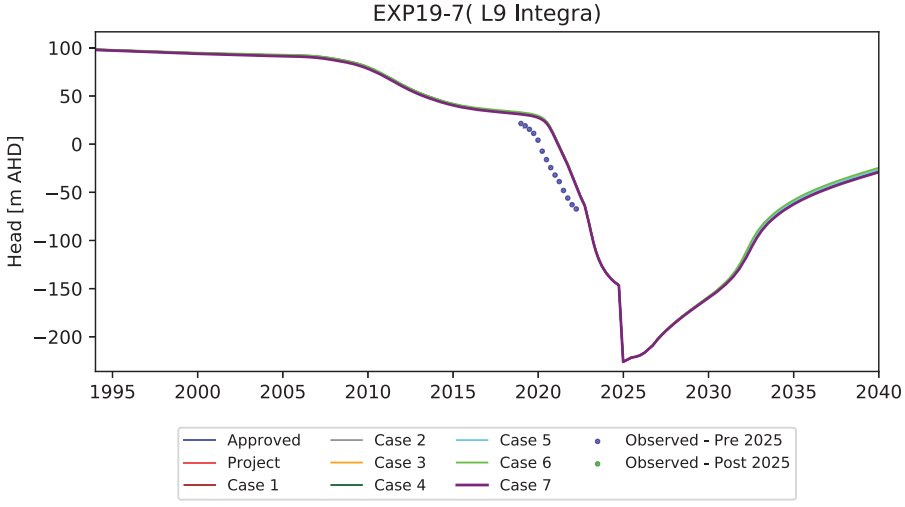

EXP19-2(L17 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

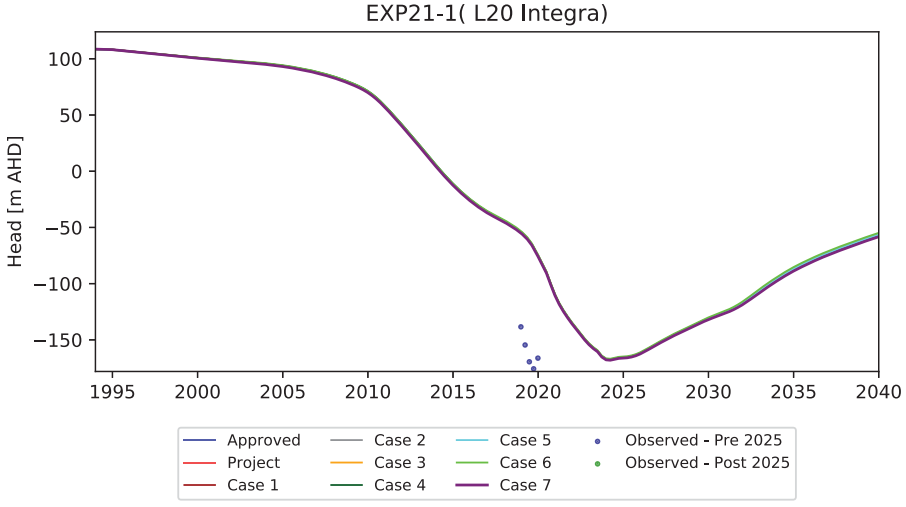

EXP19-3(L16 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

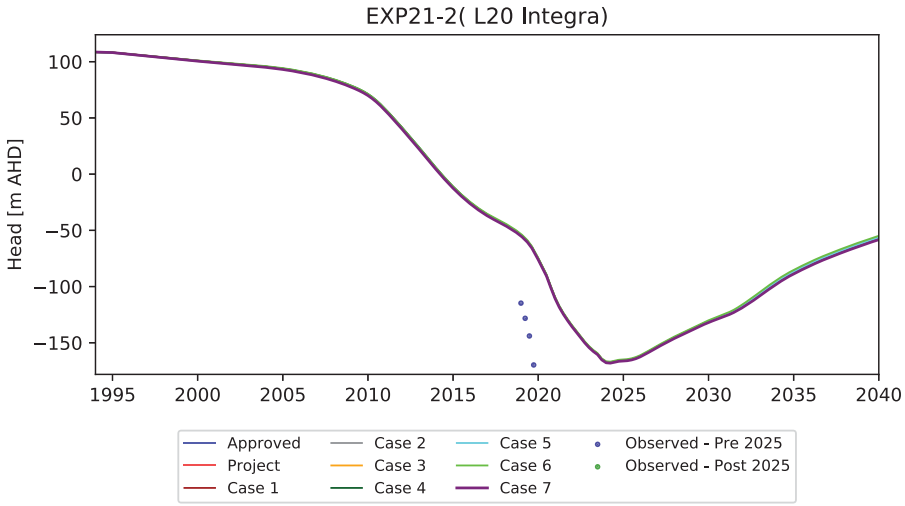

EXP19-4(L15 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

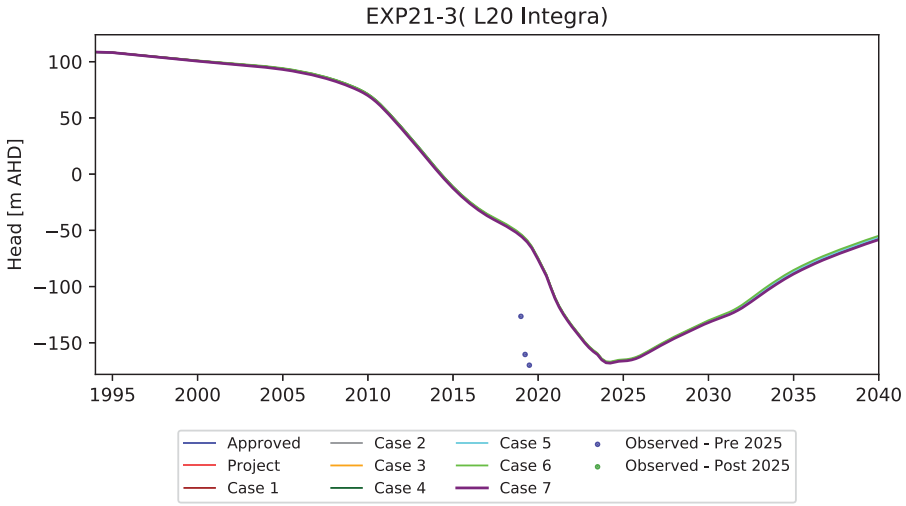

EXP19-5(L12 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

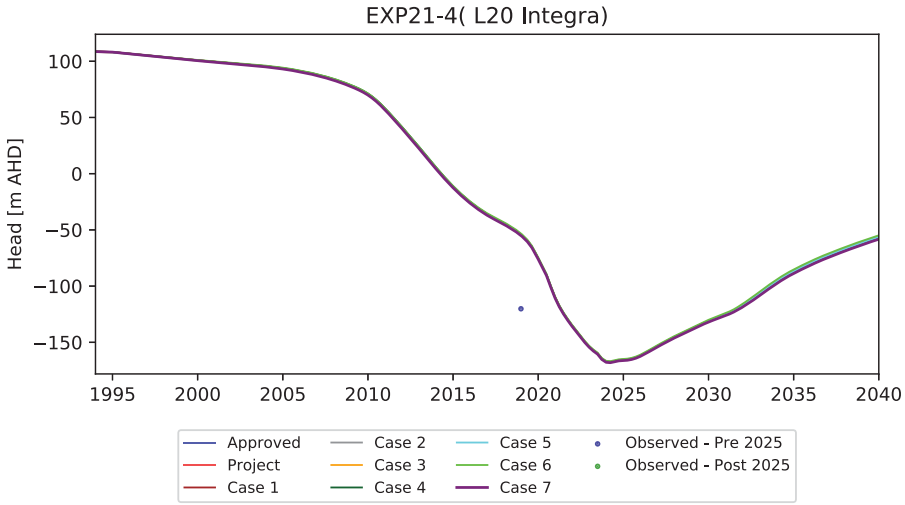

EXP19-6(L10 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

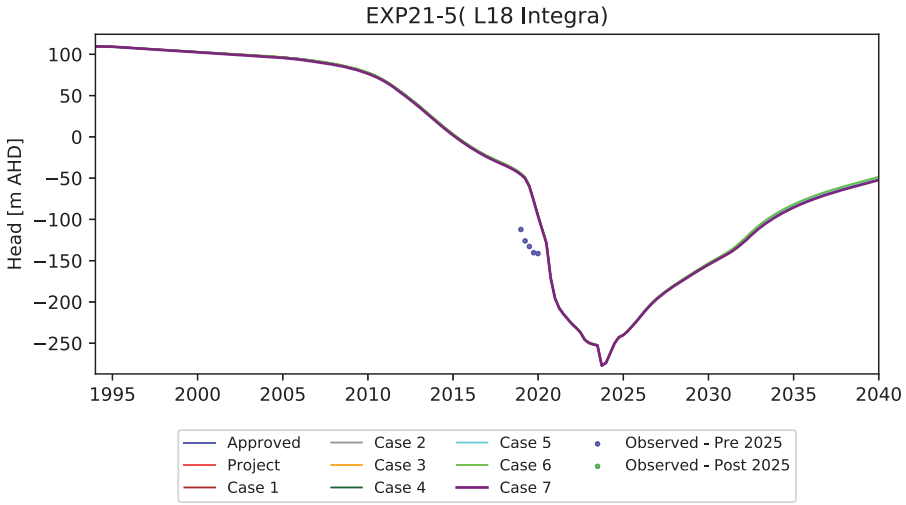

EXP19-7(L9 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

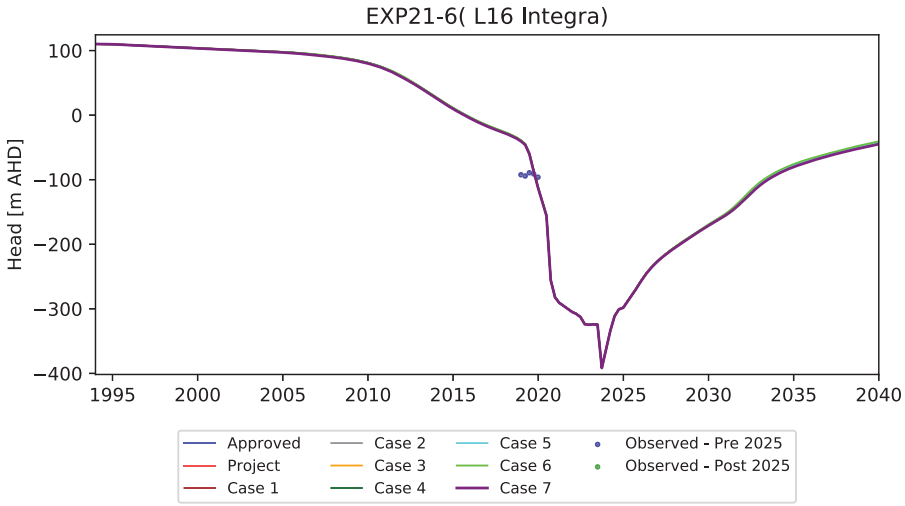

EXP21-1(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

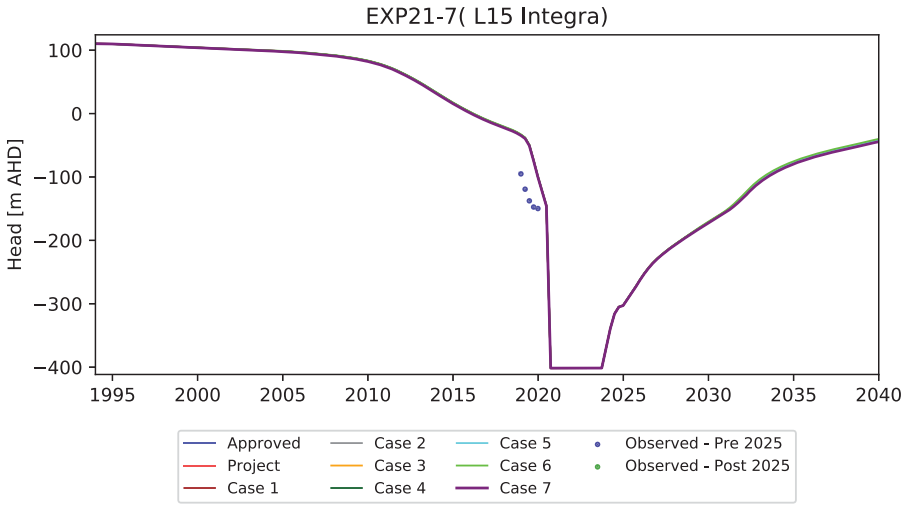

EXP21-2(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

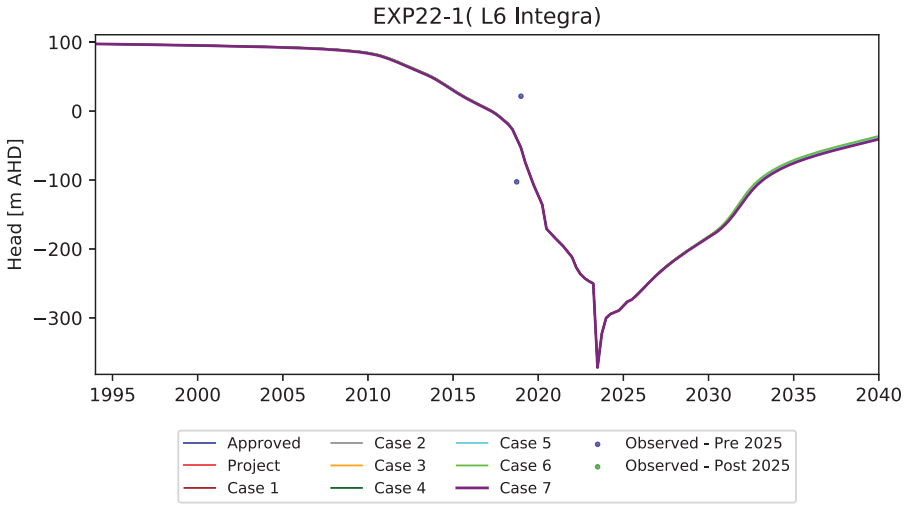

EXP21-3(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

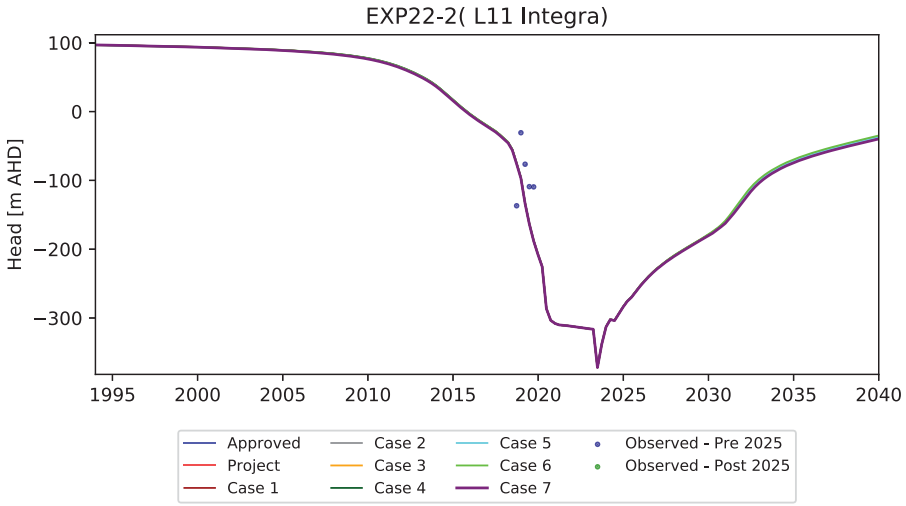

EXP21-4(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

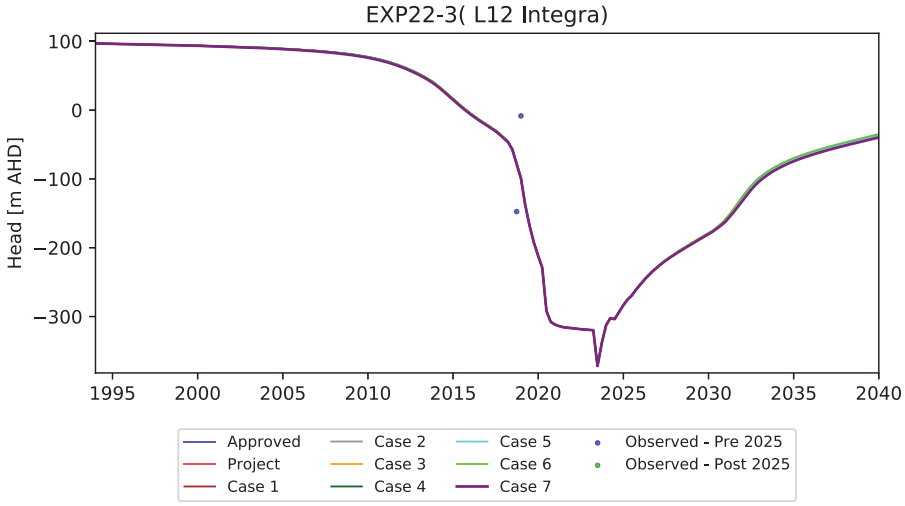

EXP21-5(L18 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

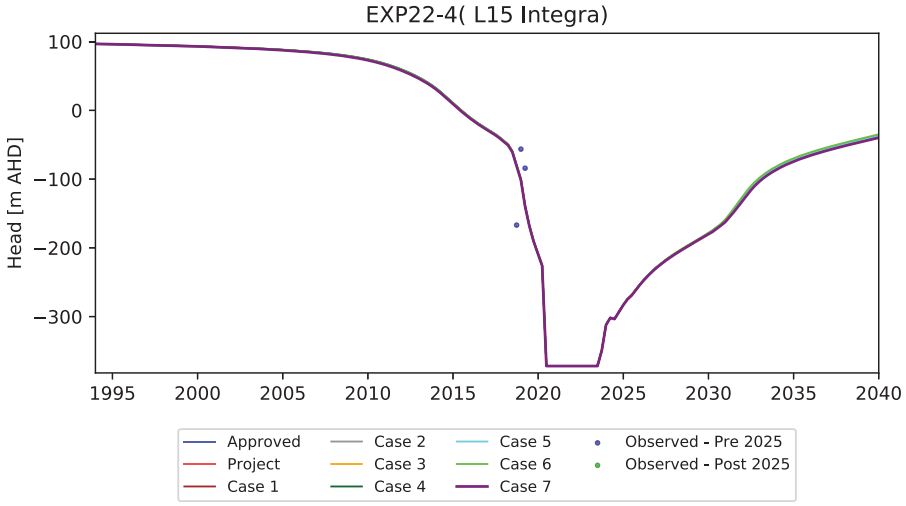

EXP21-6(L16 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

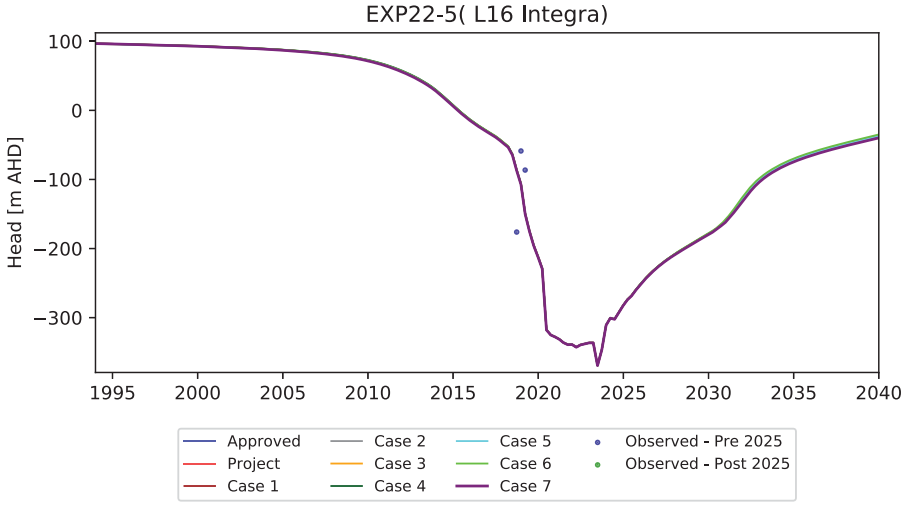

EXP21-7(L15 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

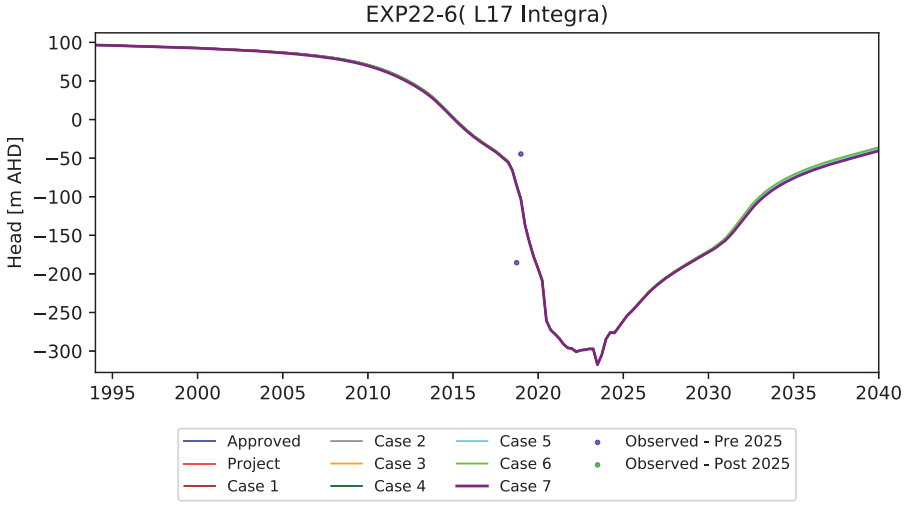

EXP22-1(L6 Integra)
Head [m AHD]
100
0
−100
−200
−300
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

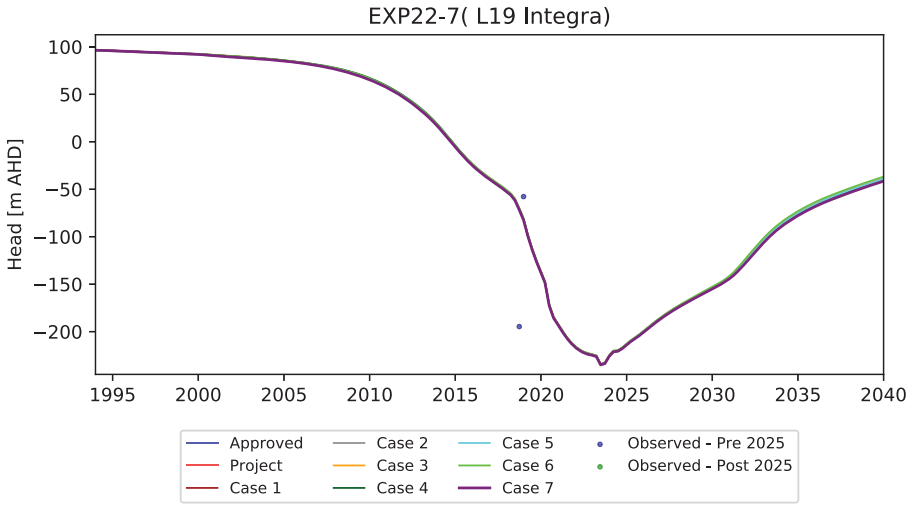

EXP22-2(L11 Integra)
Head [m AHD]
100
0
−100
−200
−300
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

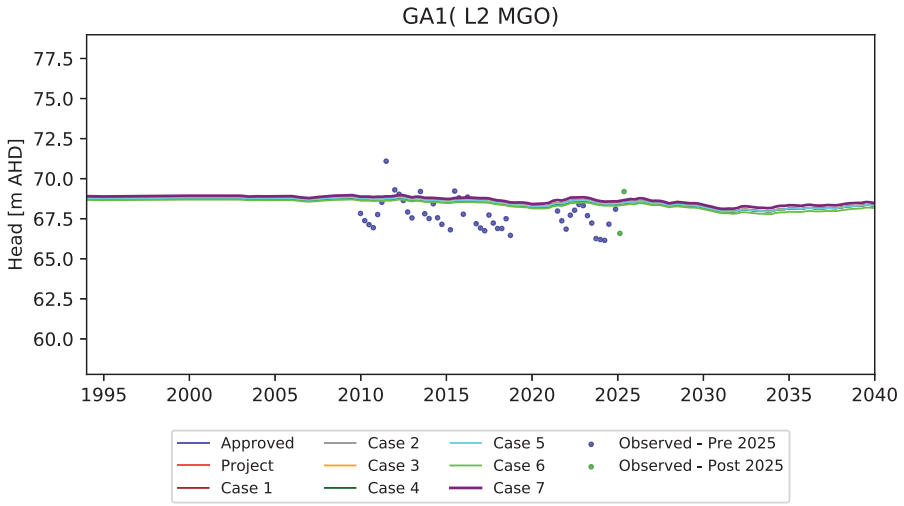

EXP22-3(L12 Integra)
Head [m AHD]
100
0
−100
−200
−300
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

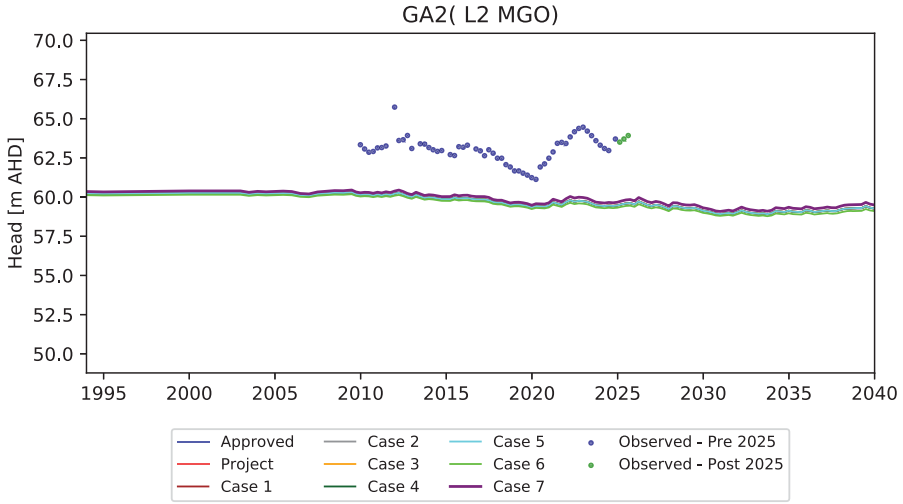

EXP22-4(L15 Integra)
Head [m AHD]
100
0
−100
−200
−300
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

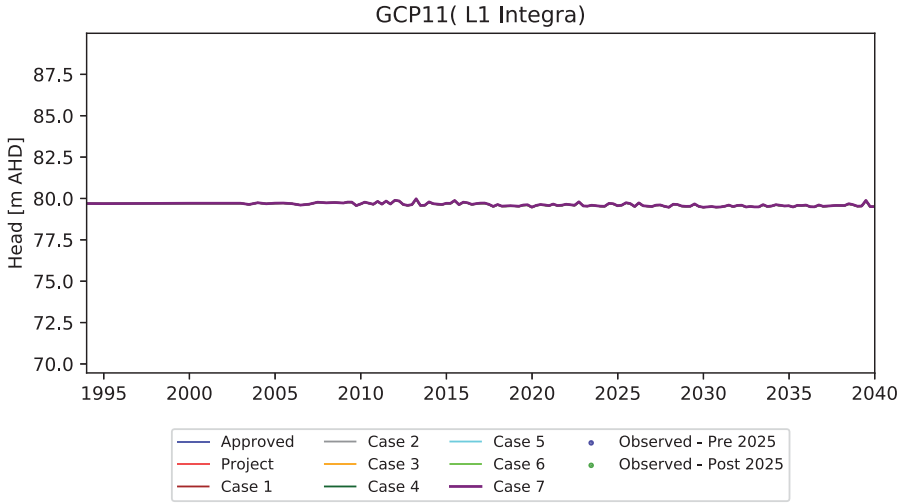

EXP22-5(L16 Integra)
Head [m AHD]
100
0
−100
−200
−300
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

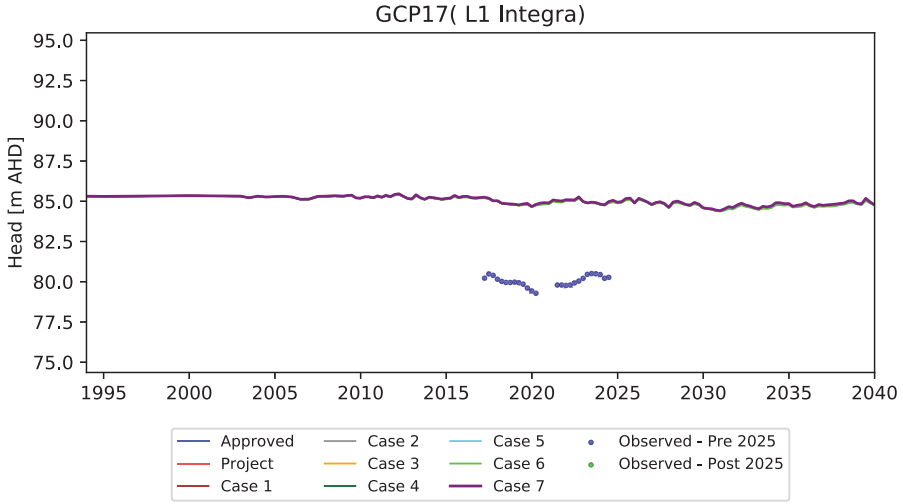

EXP22-6(L17 Integra)
Head [m AHD]
100
50
0
−50
−100
−150
−200
−250
−300
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

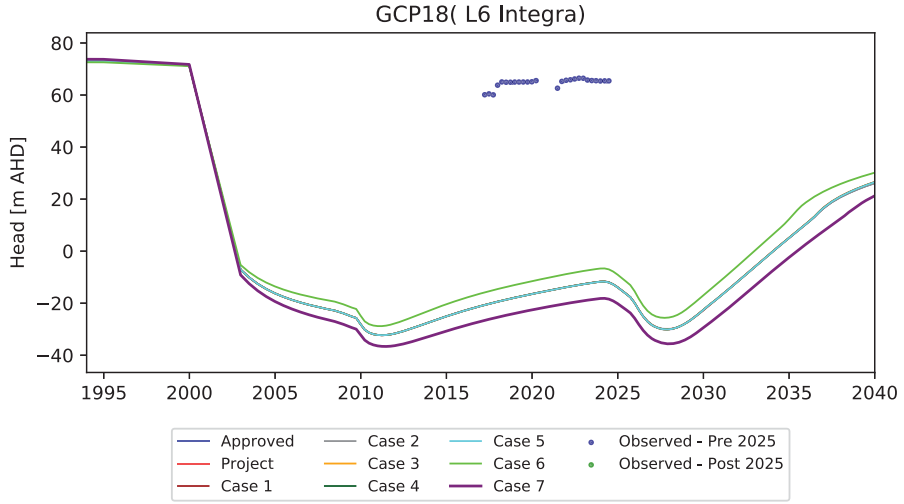

EXP22-7(L19 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

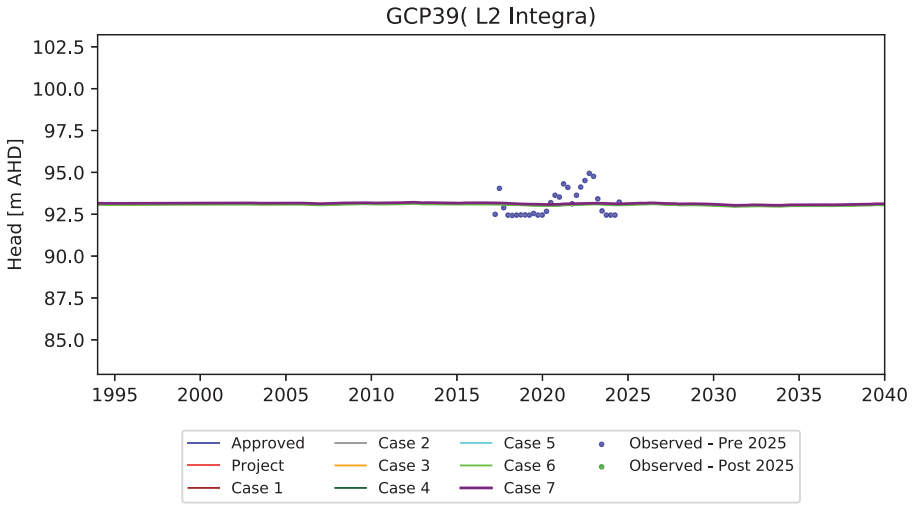

GA1(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

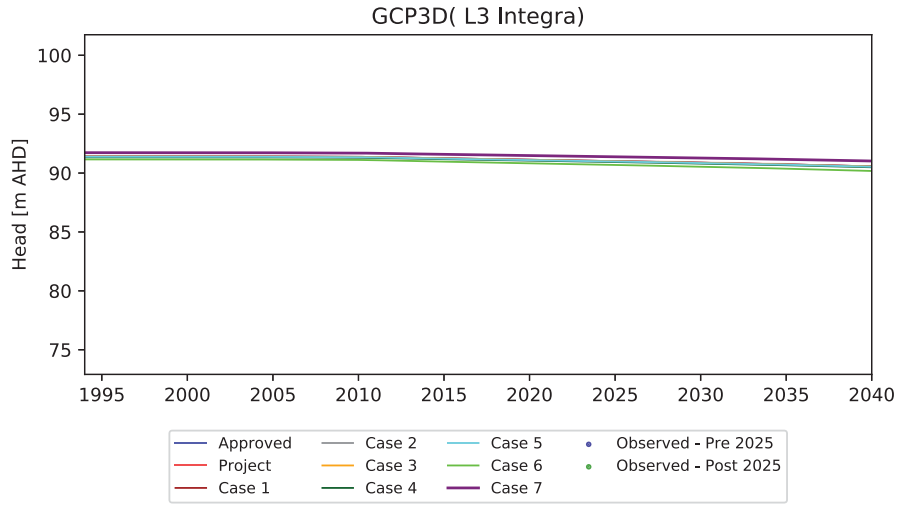

GA2(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

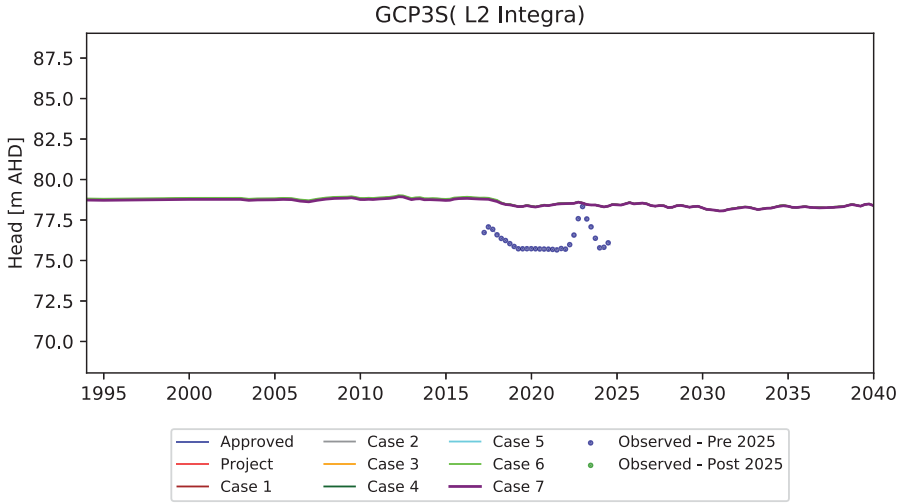

GCP11(L1 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

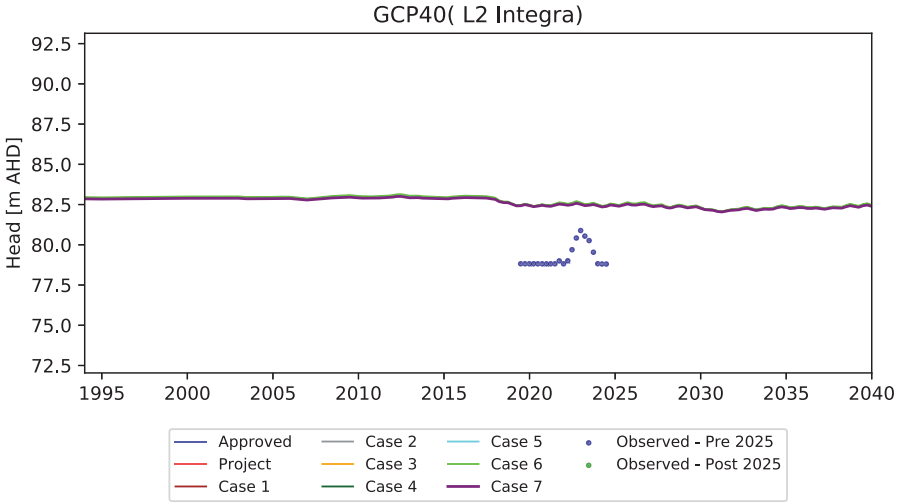

GCP17(L1 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

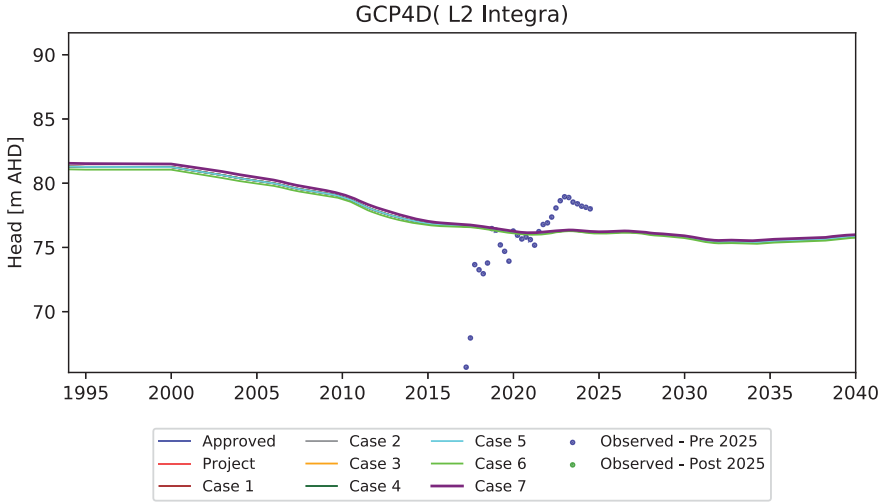

GCP18(L6 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

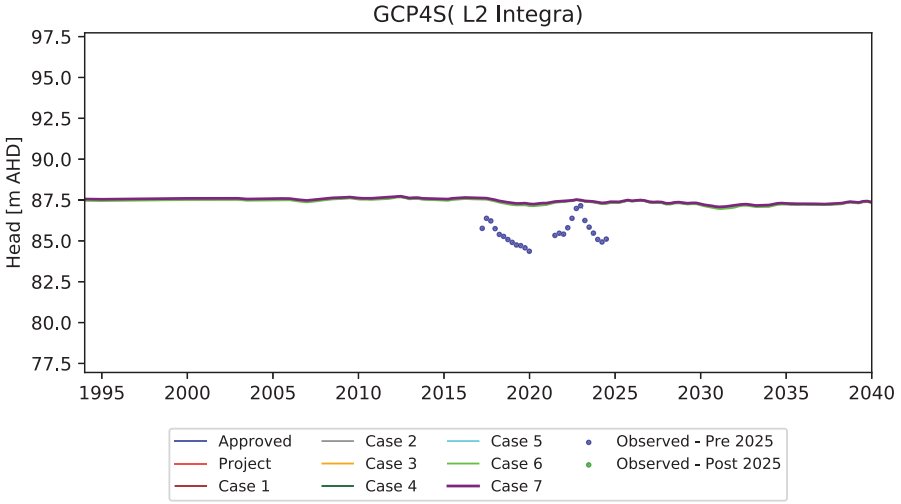

GCP39(L2 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

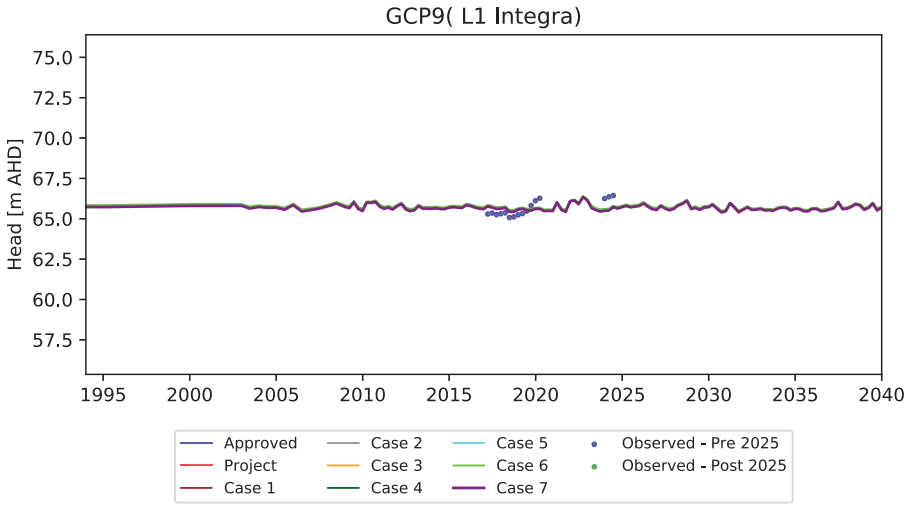

GCP3D(L3 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

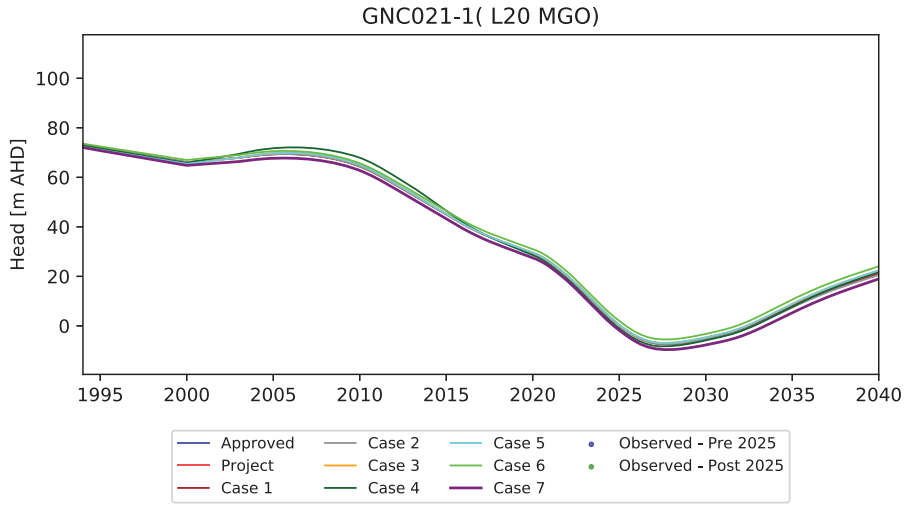

GCP3S(L2 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

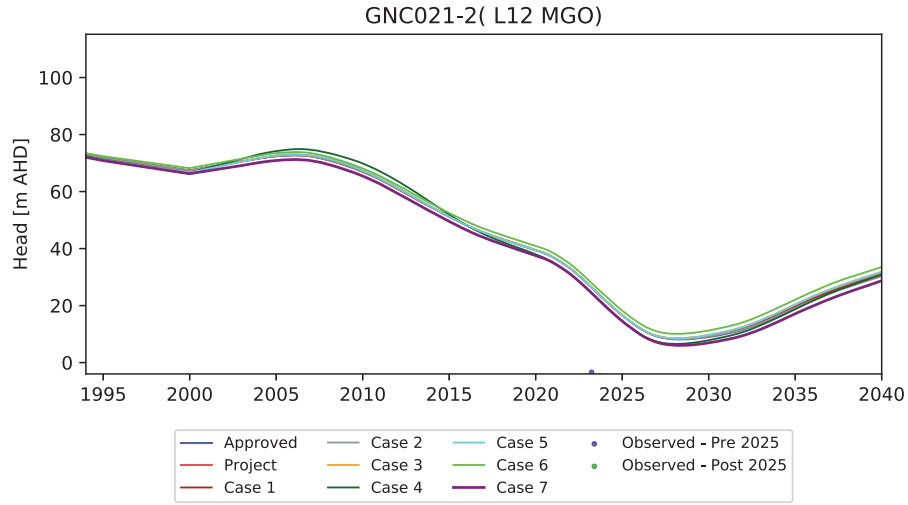

GCP40(L2 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

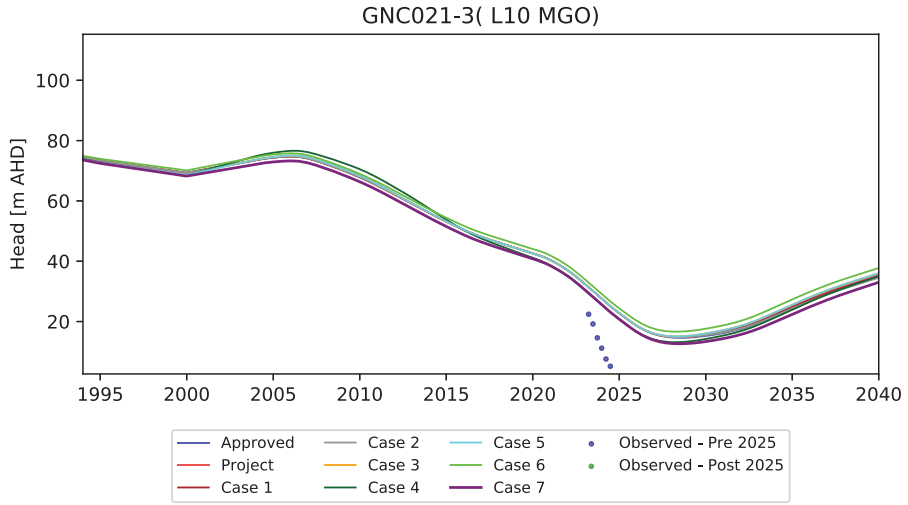

GCP4D(L2 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

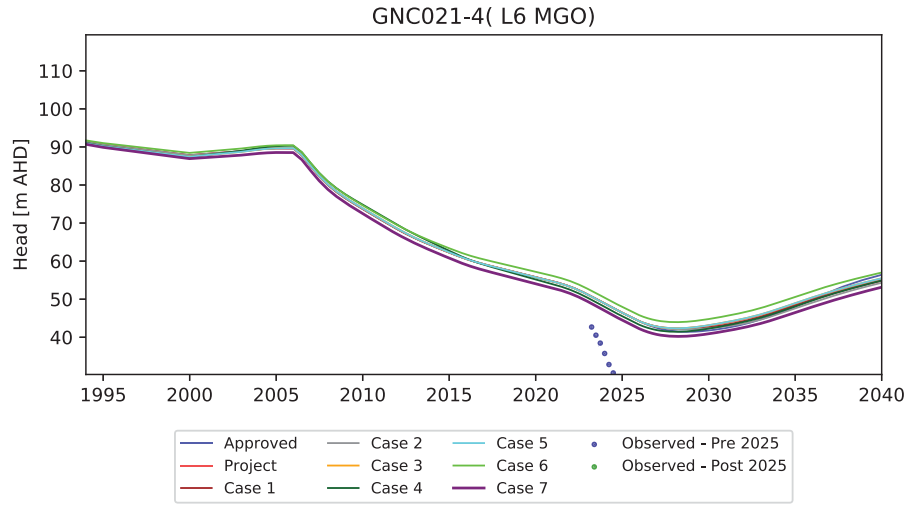

GCP4S(L2 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

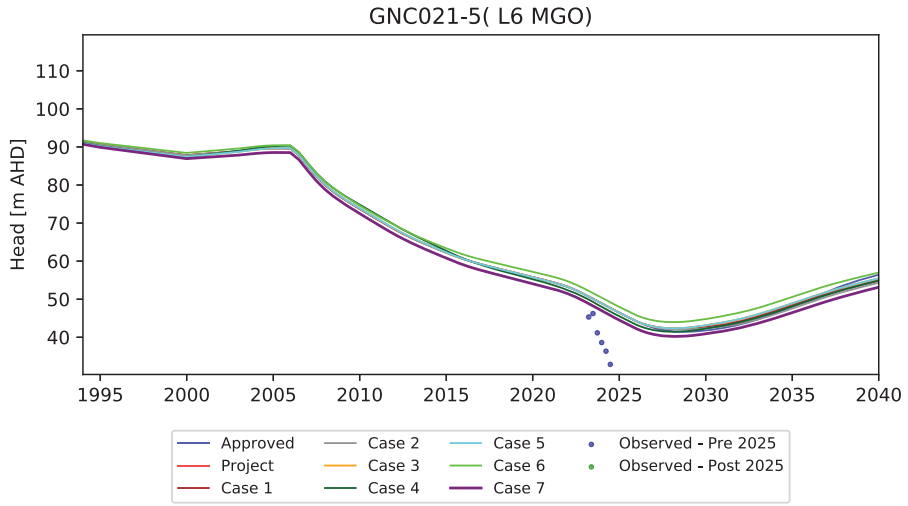

GCP9(L1 Integra)
Head [m AHD]
75.0
72.5
70.0
67.5
65.0
62.5
60.0
57.5
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

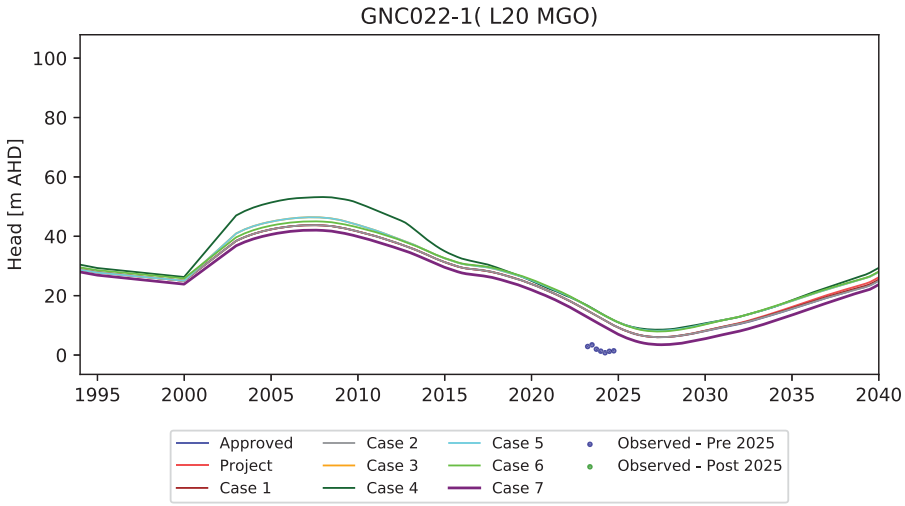

GNC021-1(L20 MGO)
Head [m AHD]
100
80
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

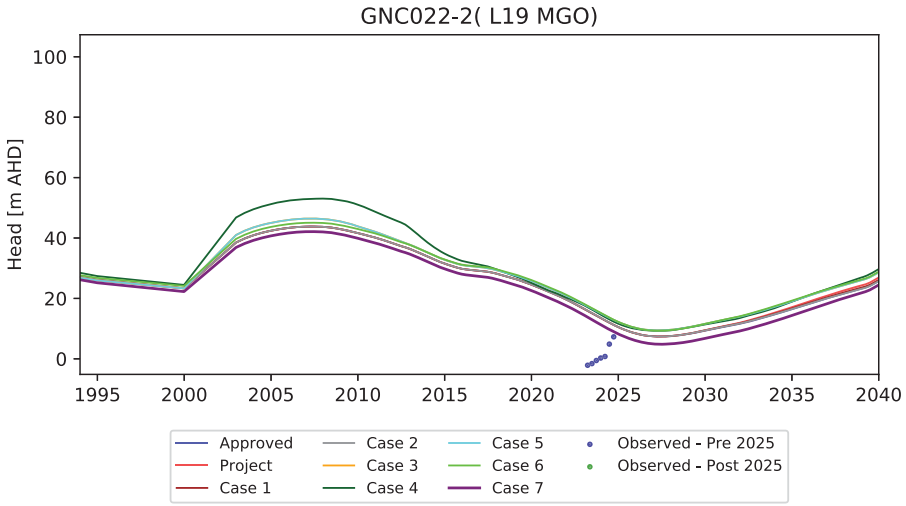

GNC021-2(L12 MGO)
Head [m AHD]
100
80
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

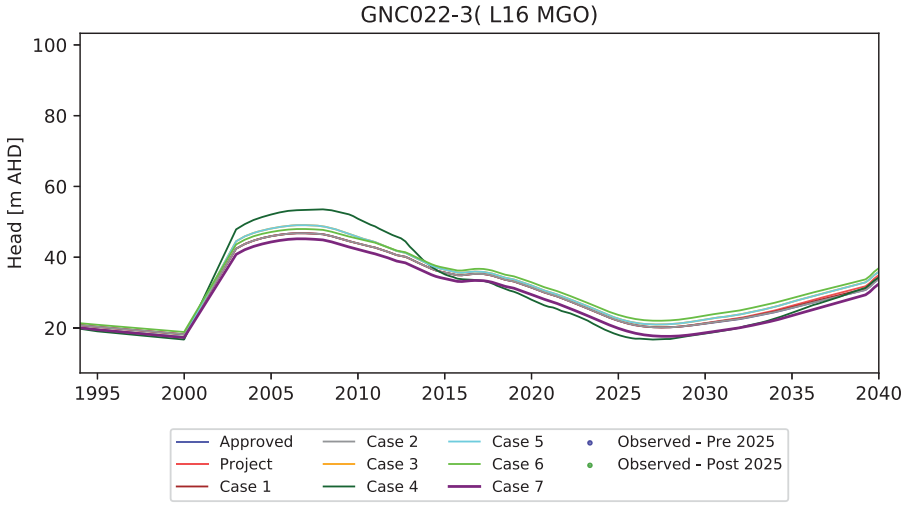

GNC021-3(L10 MGO)
Head [m AHD]
100
80
60
40
20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

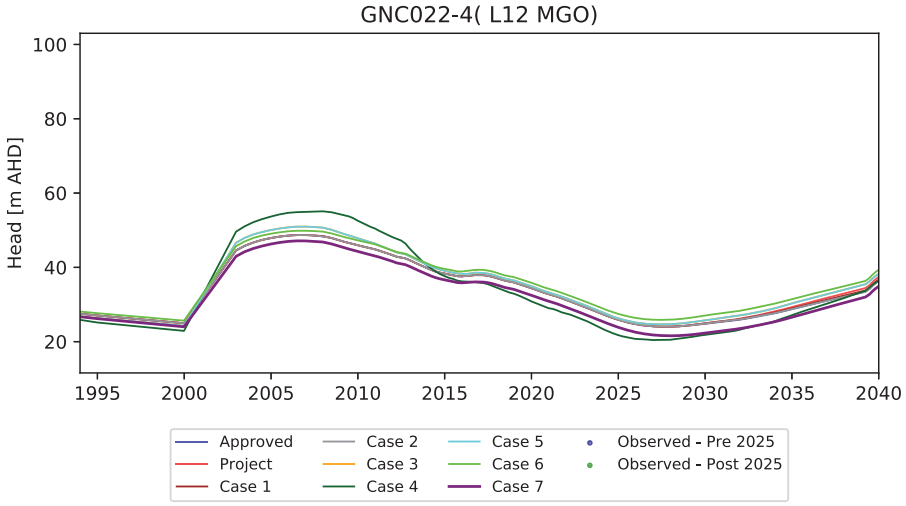

GNC021-4(L6 MGO)
Head [m AHD]
110
100
90
80
70
60
50
40
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

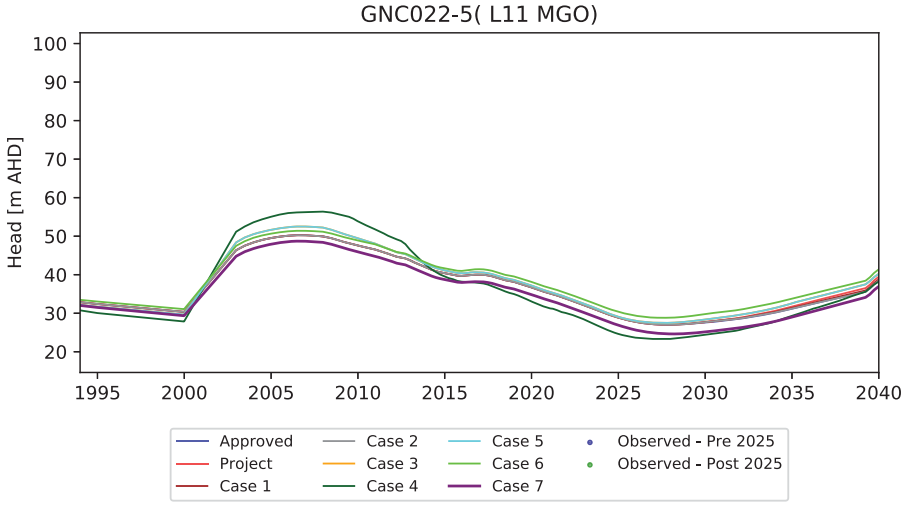

GNC021-5(L6 MGO)
Head [m AHD]
110
100
90
80
70
60
50
40
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

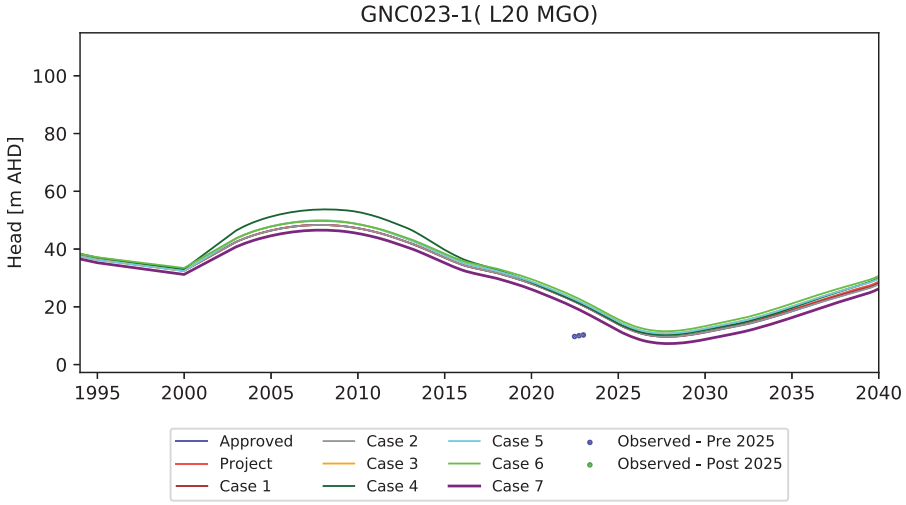

GNC022-1(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

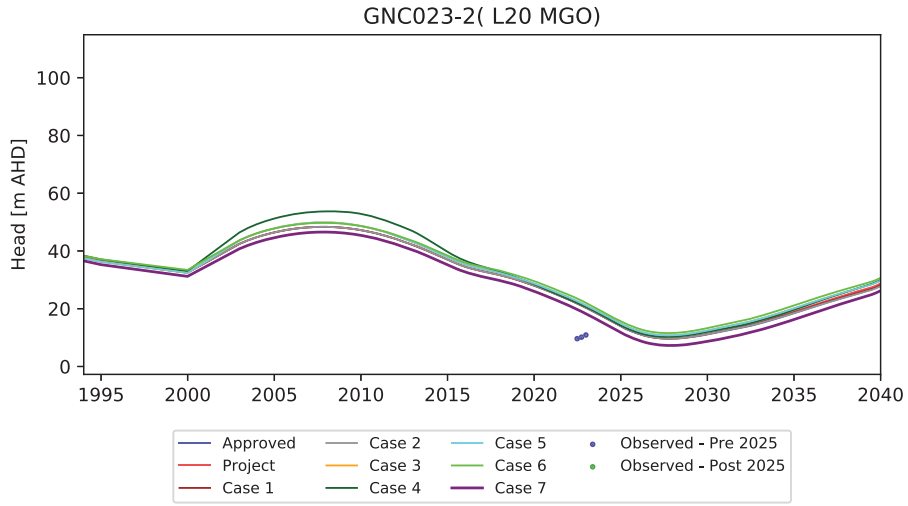

GNC022-2(L19 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

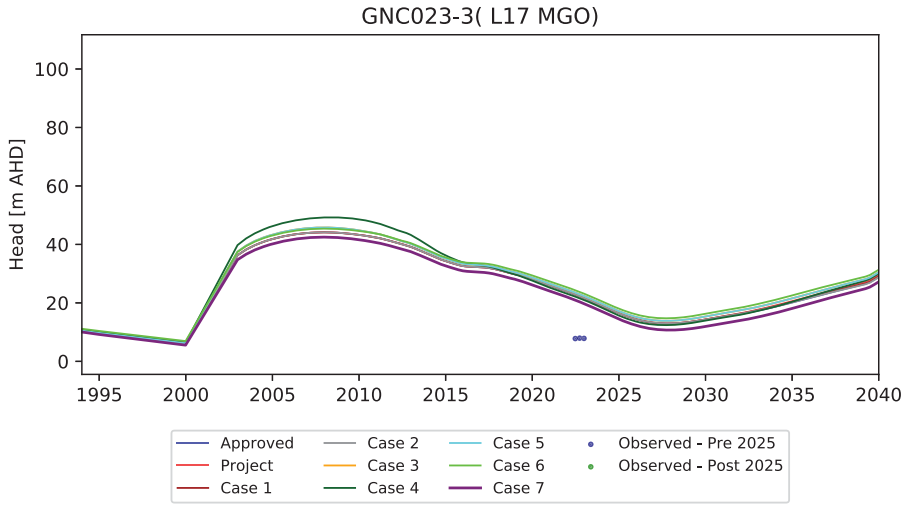

GNC022-3(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

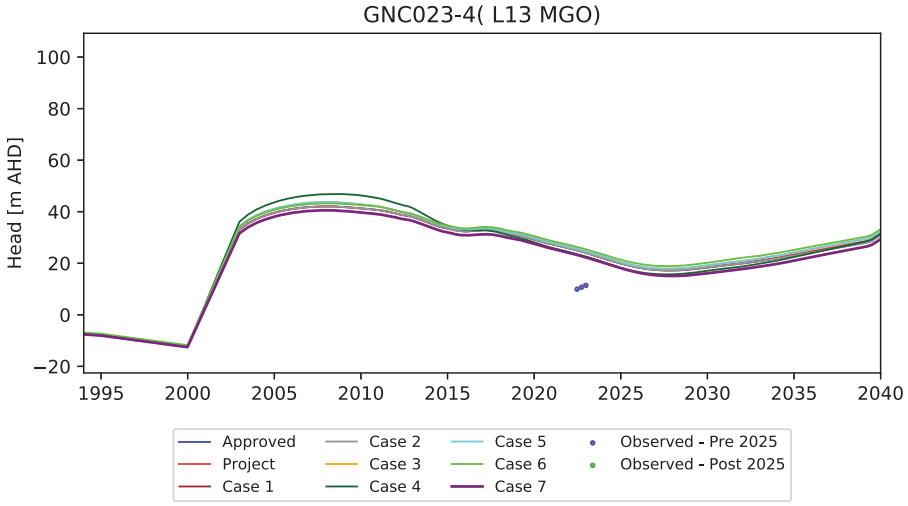

GNC022-4(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

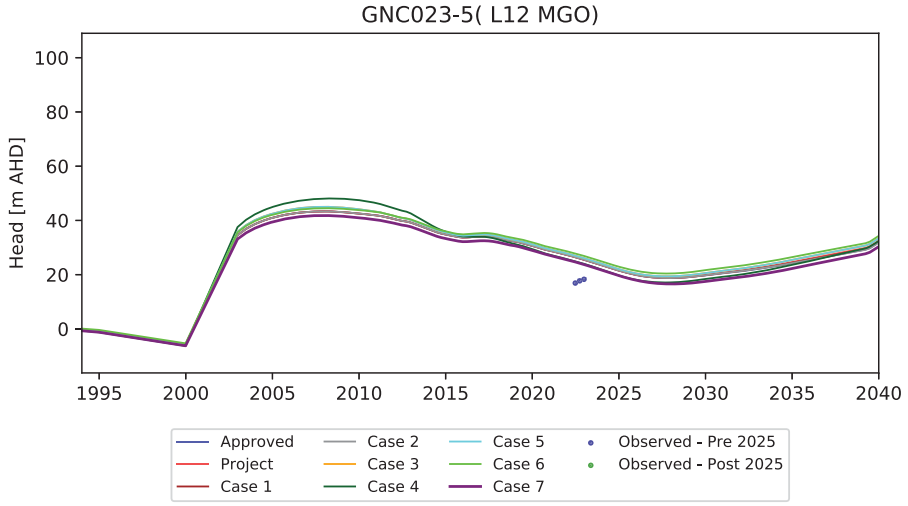

GNC022-5(L11 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

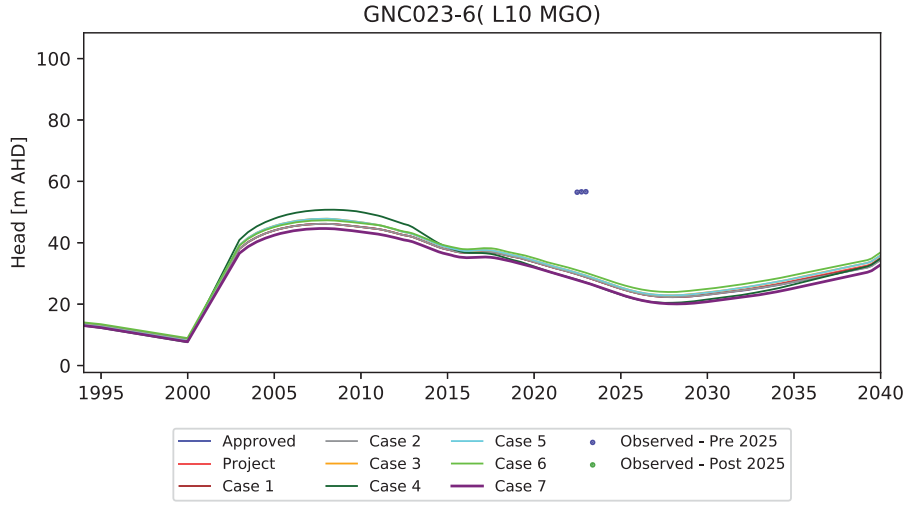

GNC023-1(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

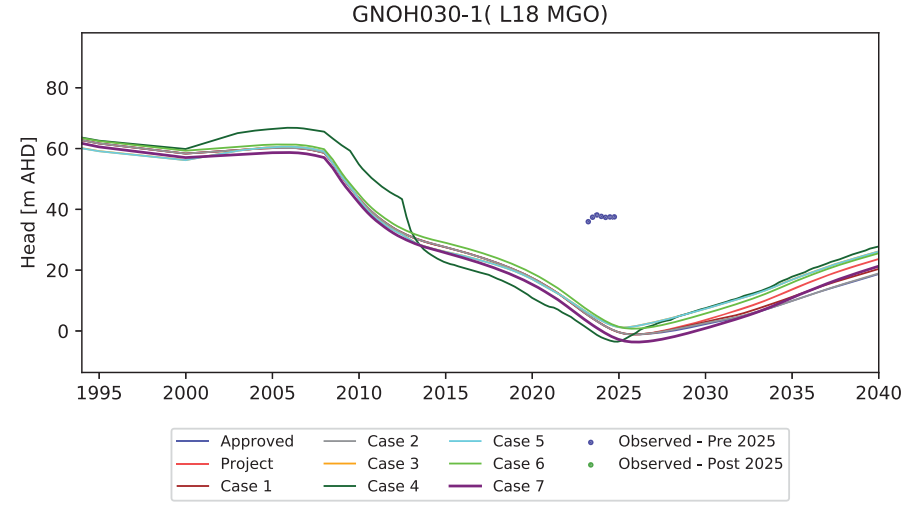

GNC023-2(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

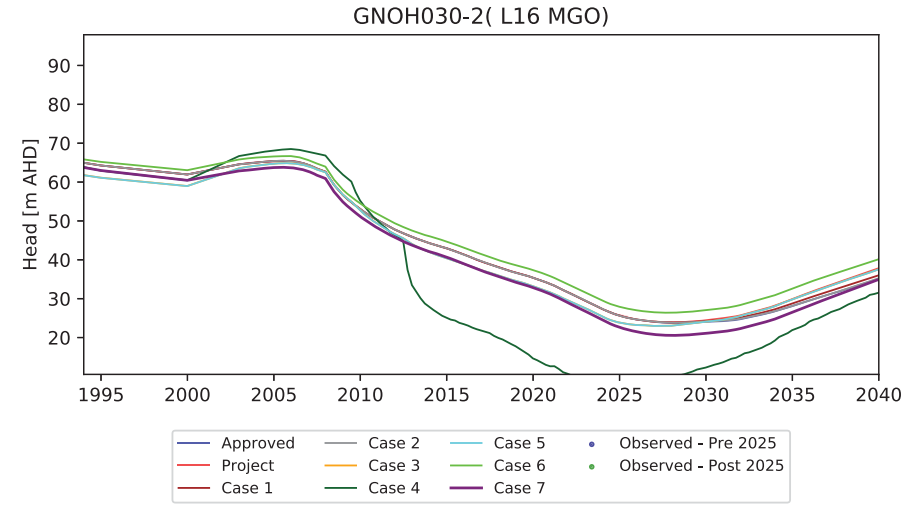

GNC023-3(L17 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

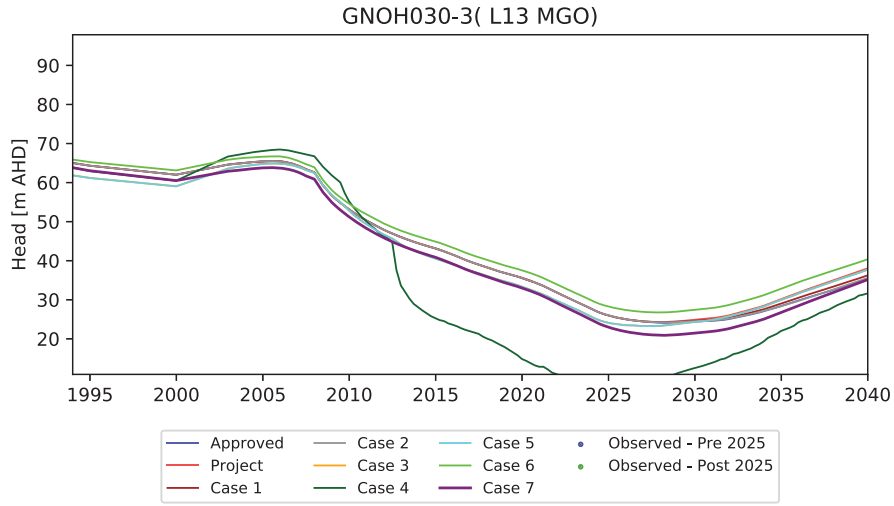

GNC023-4(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

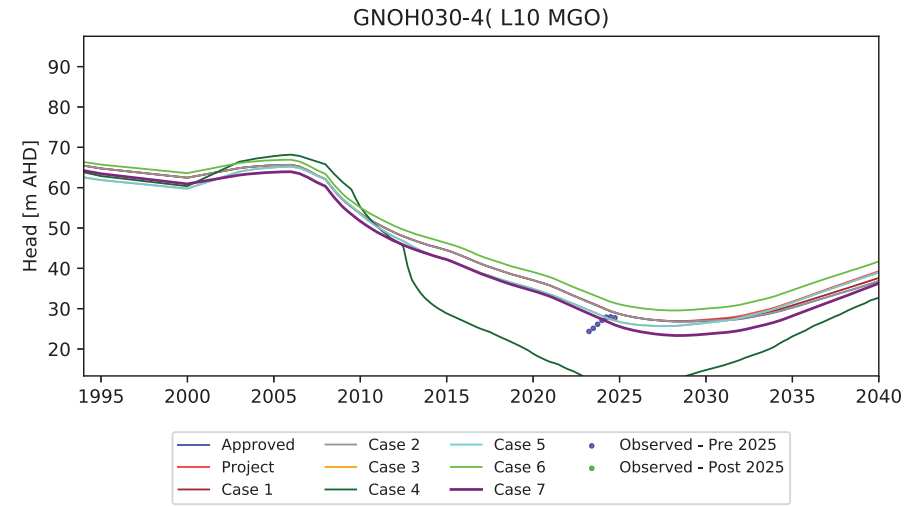

GNC023-5(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

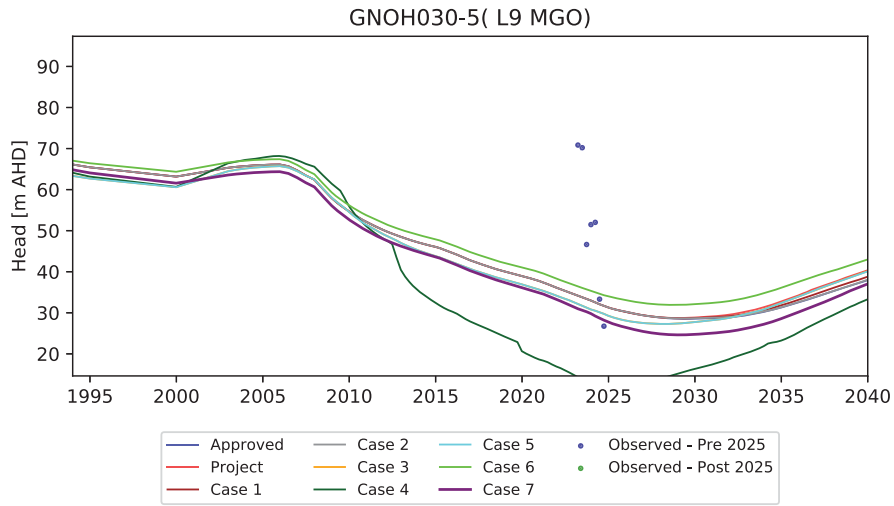

GNC023-6(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

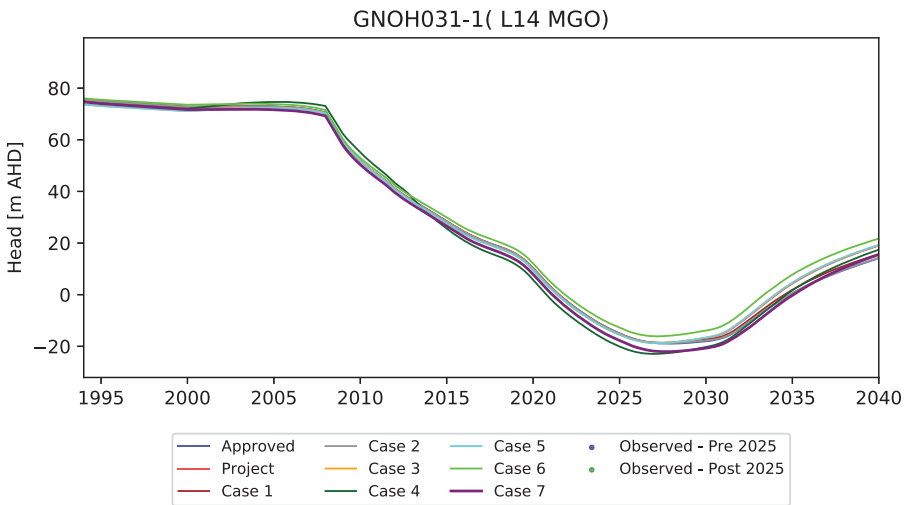

GNOH030-1(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

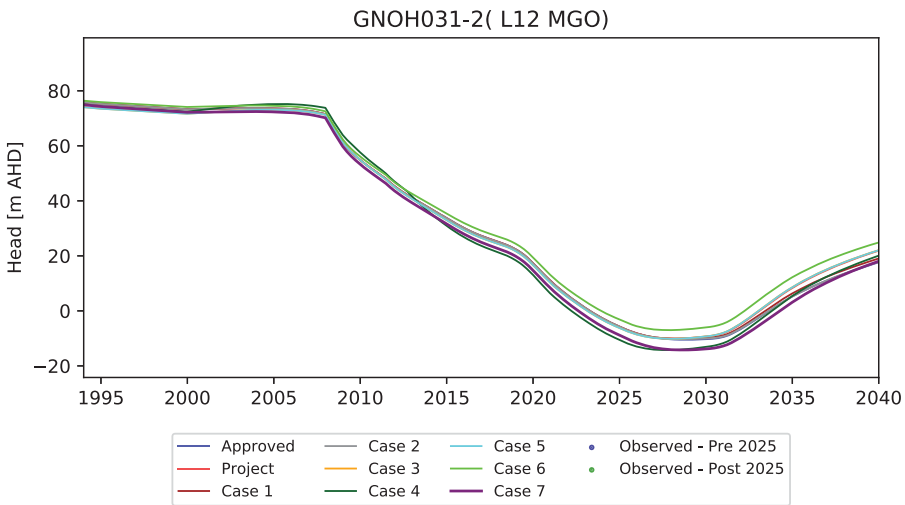

GNOH030-2(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

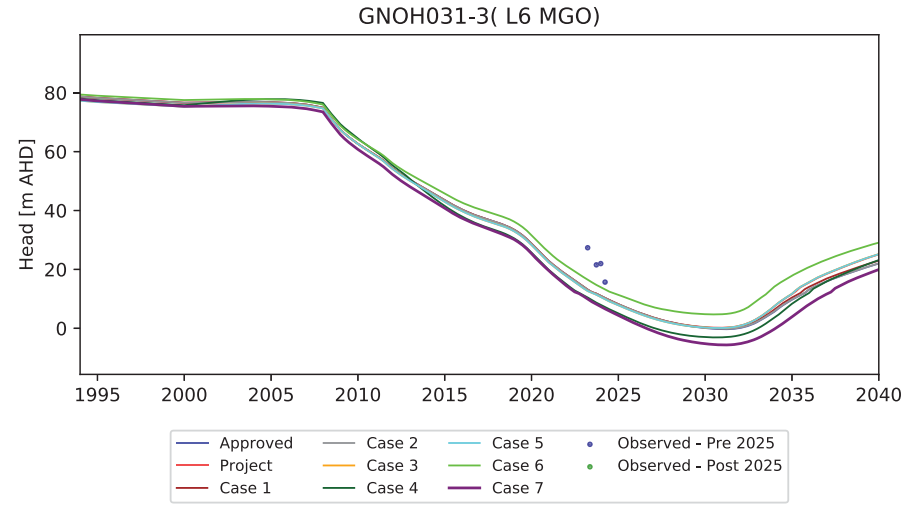

GNOH030-3(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

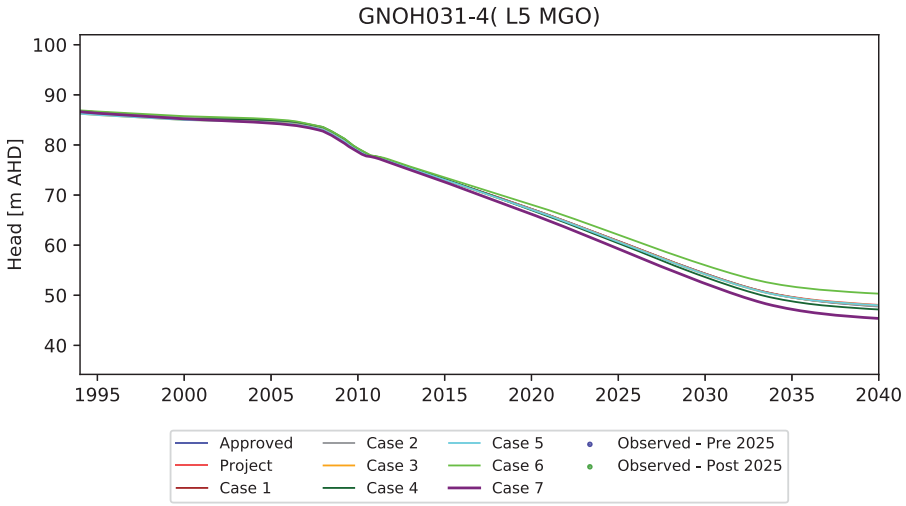

GNOH030-4(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

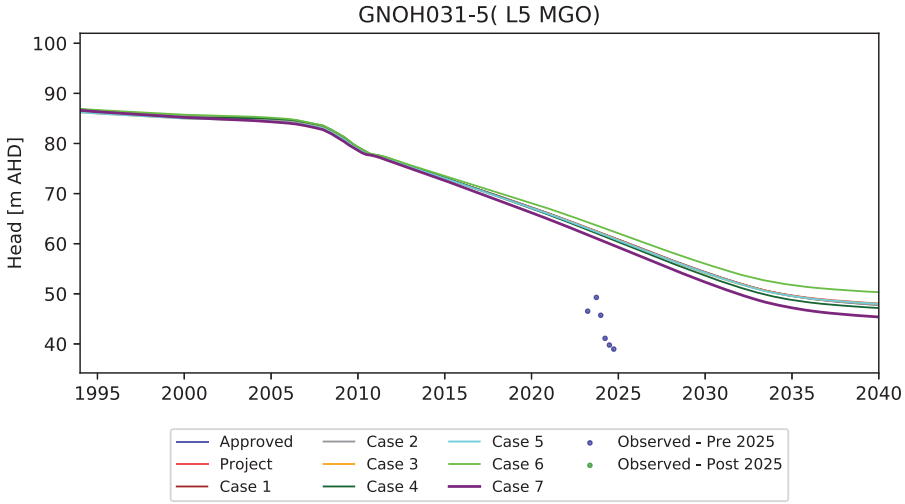

GNOH030-5(L9 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

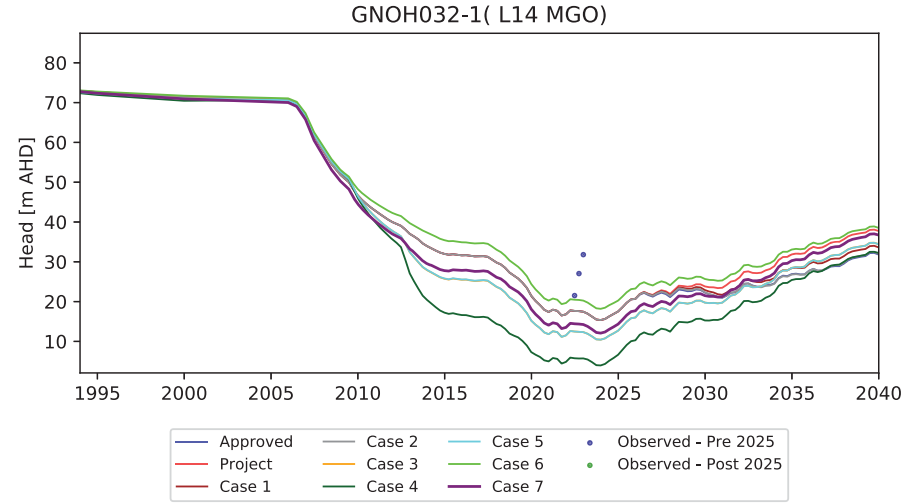

GNOH031-1(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

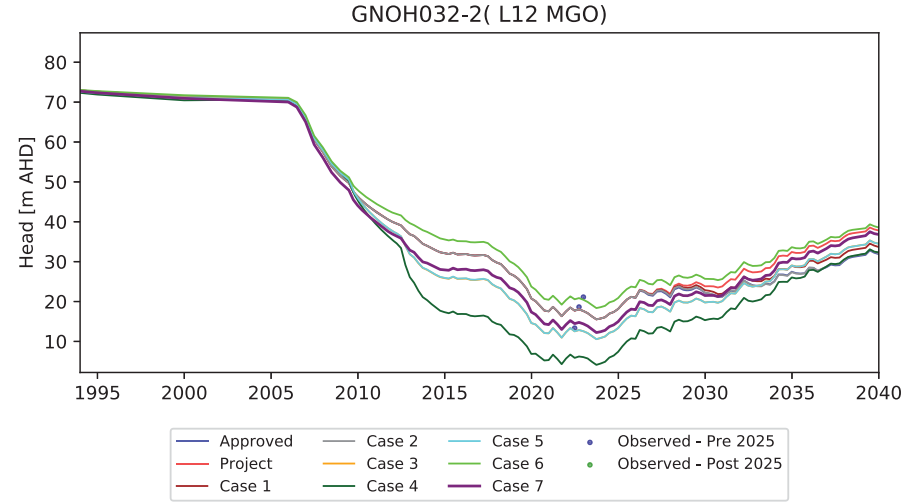

GNOH031-2(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

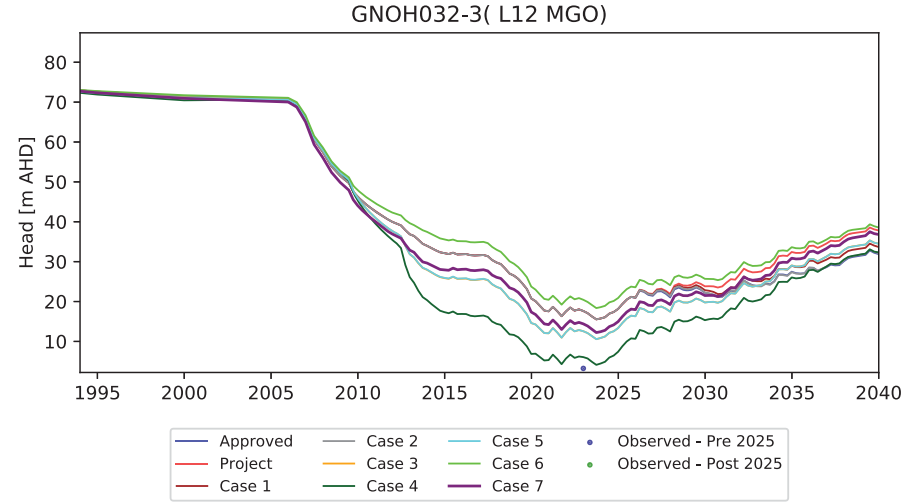

GNOH031-3(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

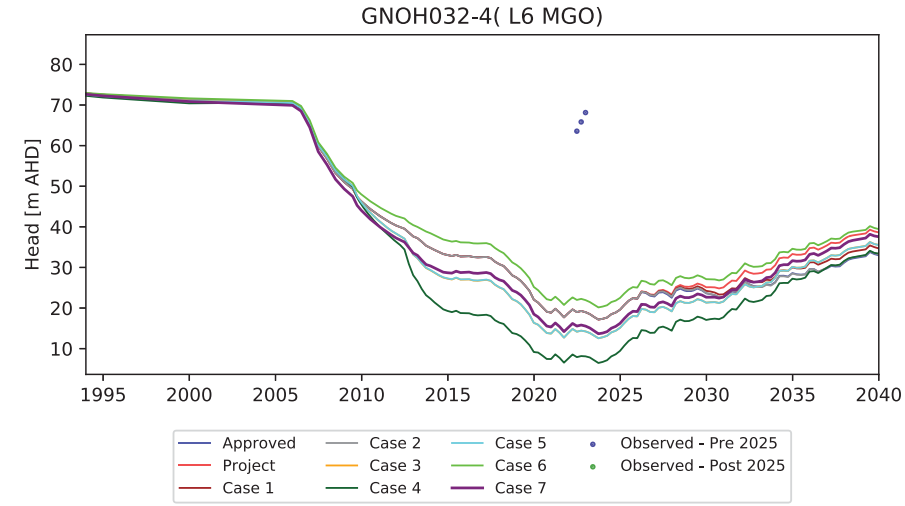

GNOH031-4(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

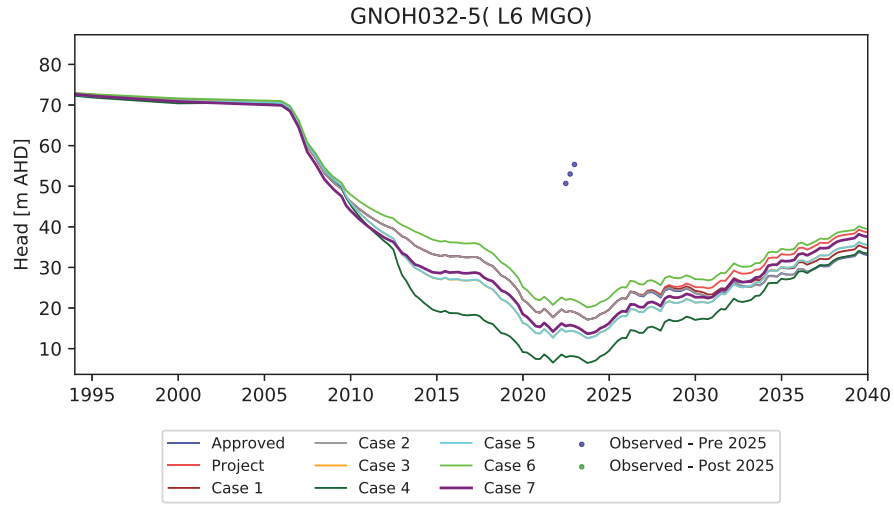

GNOH031-5(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

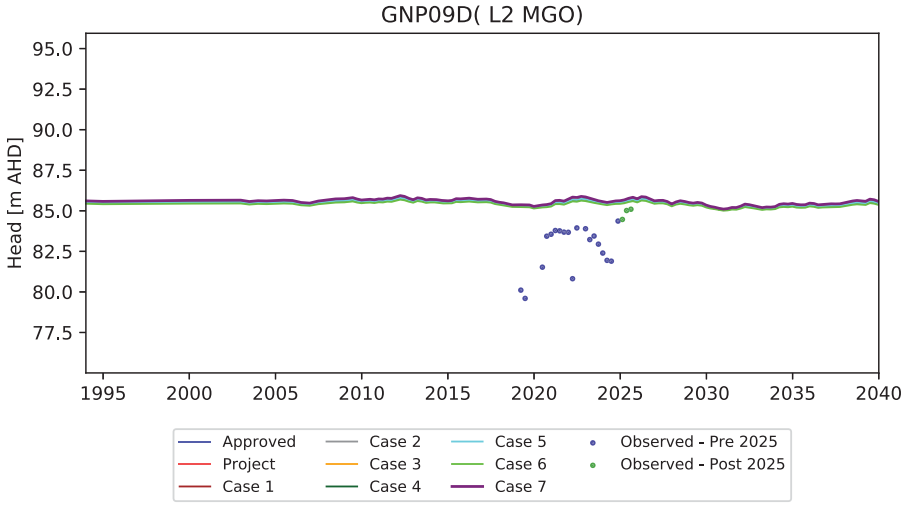

GNOH032-1(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

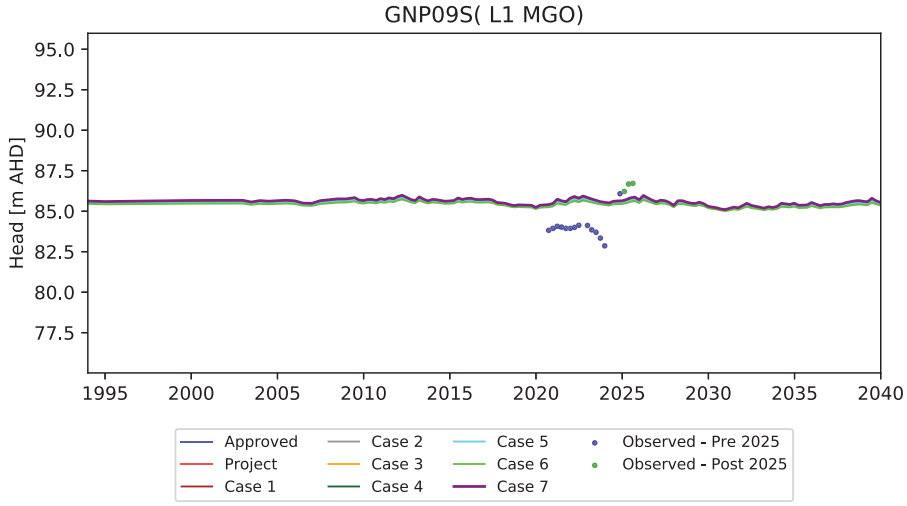

GNOH032-2(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

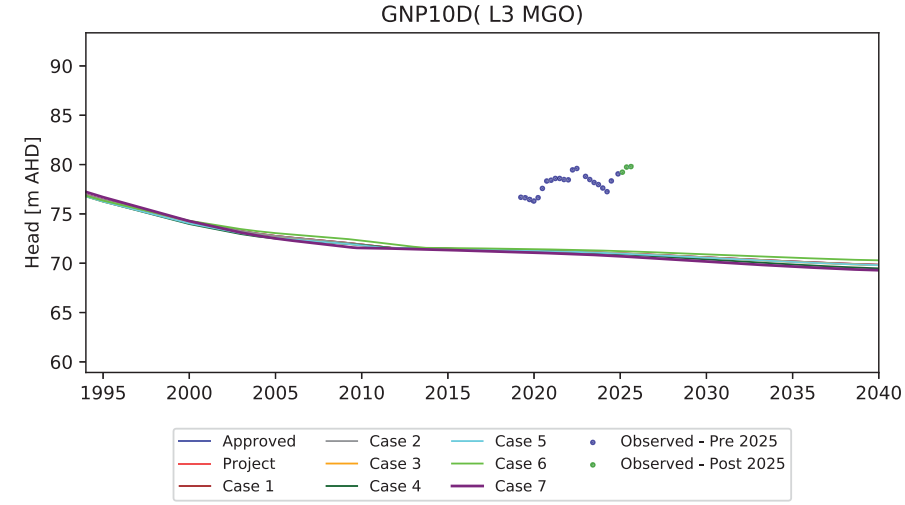

GNOH032-3(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

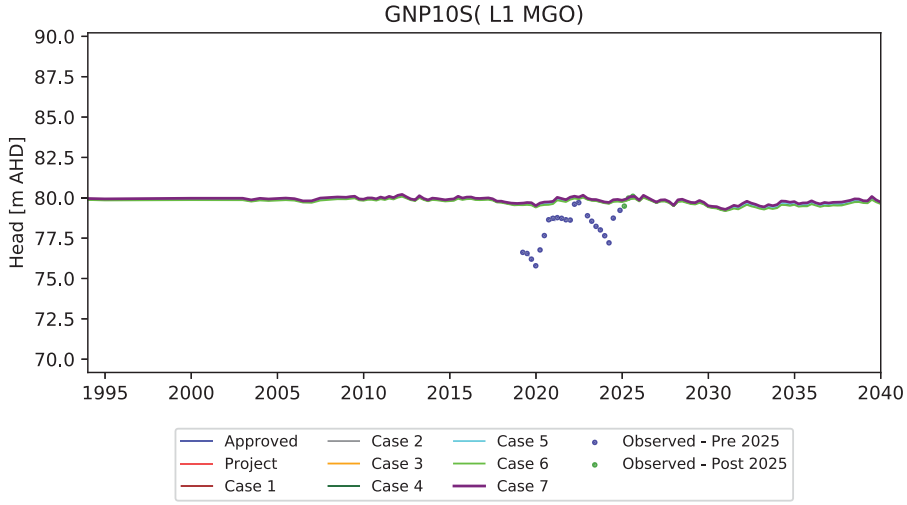

GNOH032-4(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

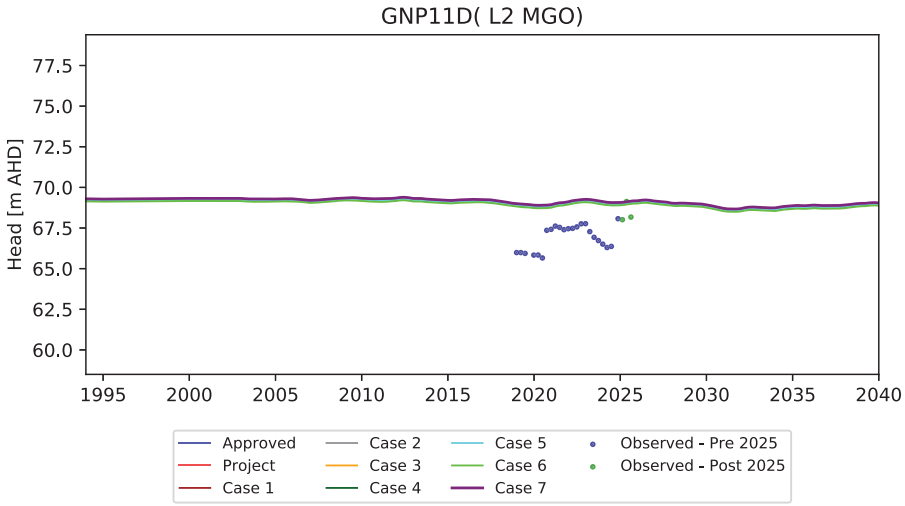

GNOH032-5(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

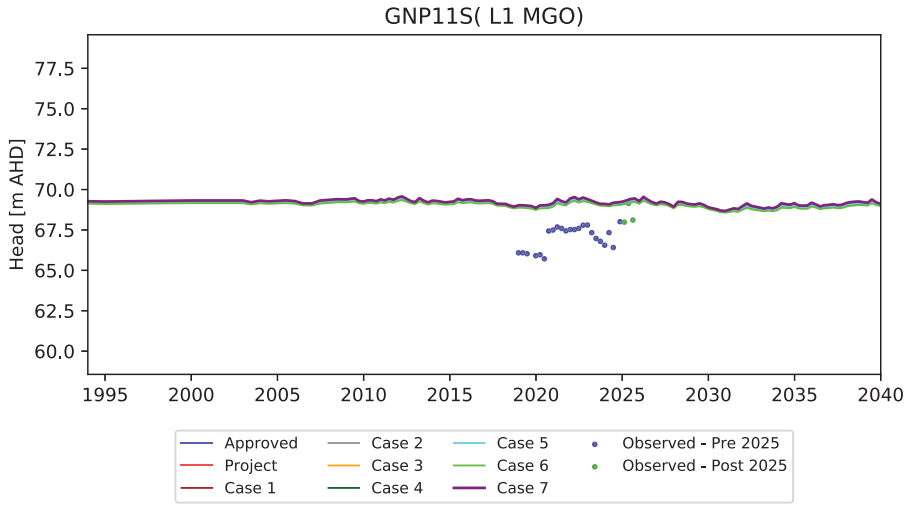

GNP09D(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

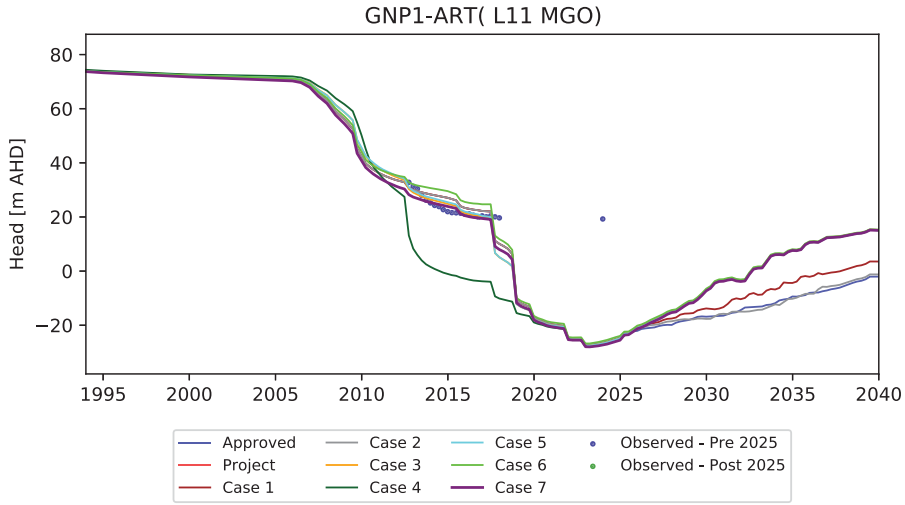

GNP09S(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

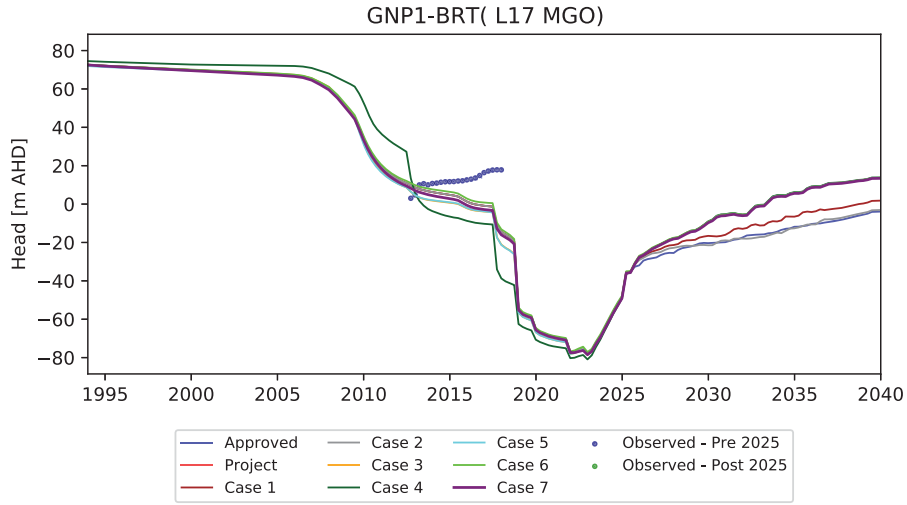

GNP10D(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

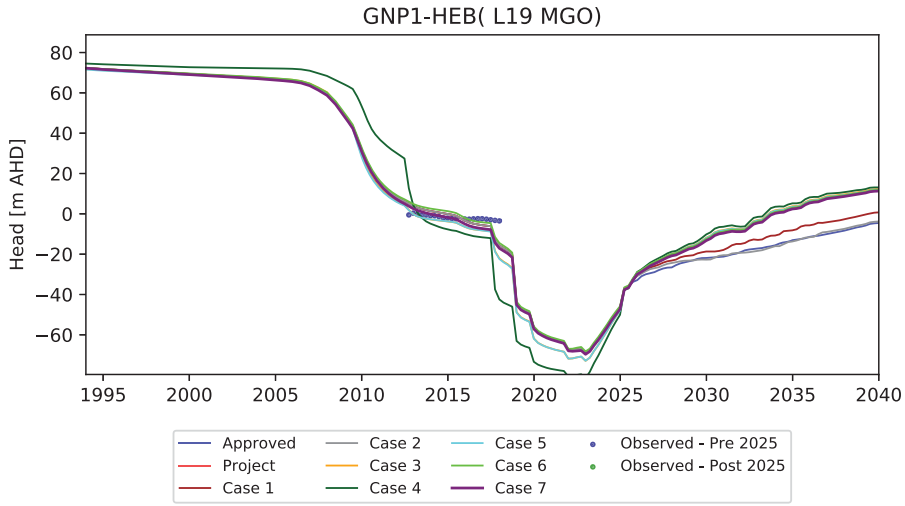

GNP10S(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

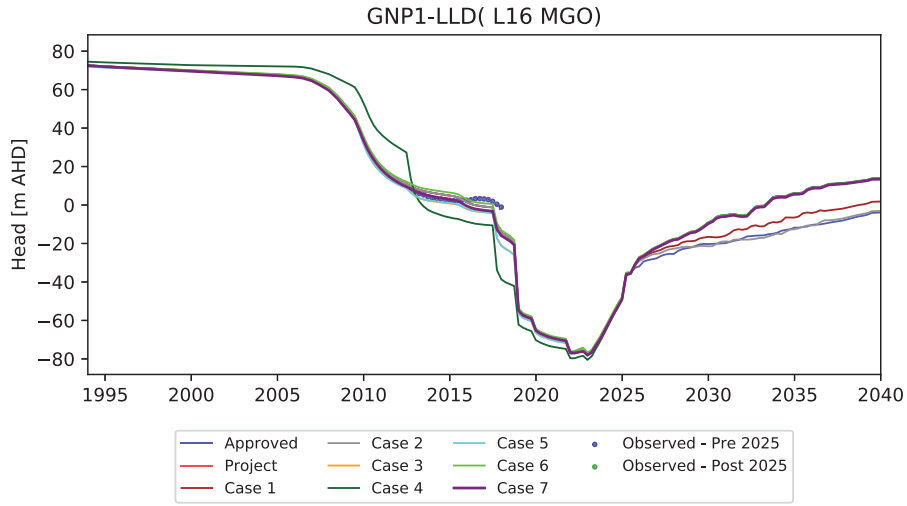

GNP11D(L2 MGO)
Head [m AHD]
77.5
75.0
72.5
70.0
67.5
65.0
62.5
60.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

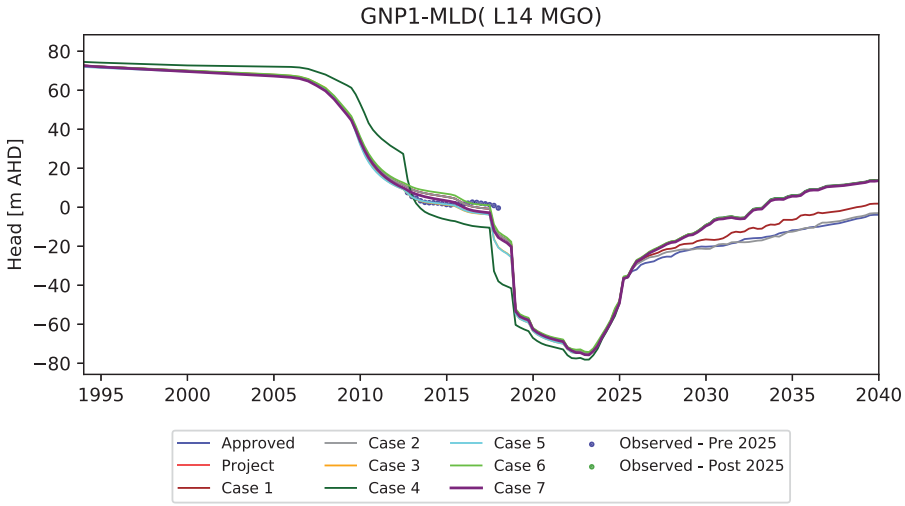

GNP11S(L1 MGO)
Head [m AHD]
77.5
75.0
72.5
70.0
67.5
65.0
62.5
60.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

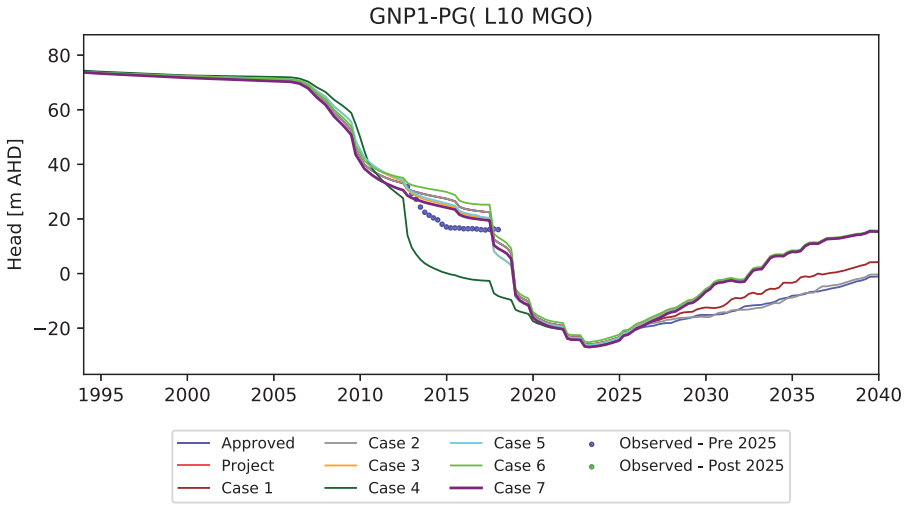

GNP1-ART(L11 MGO)
Head [m AHD]
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

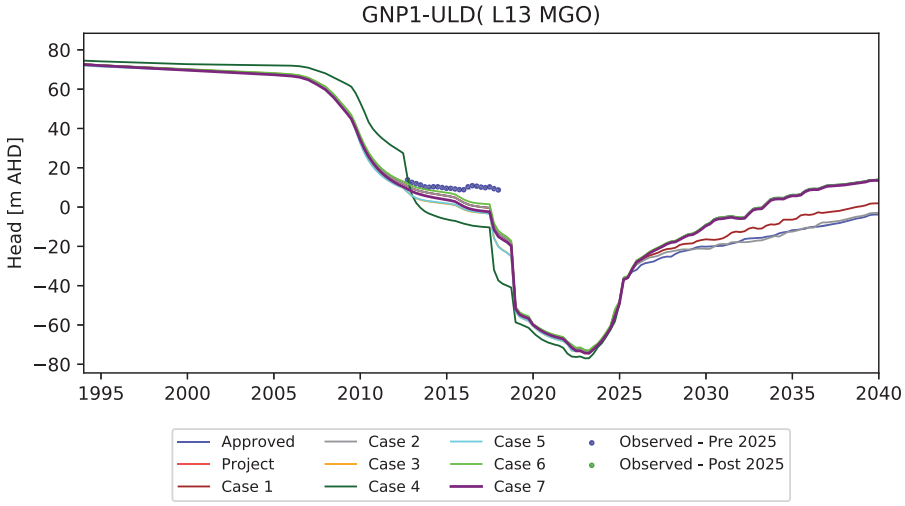

GNP1-BRT(L17 MGO)
Head [m AHD]
80
60
40
20
0
−20
−40
−60
−80
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

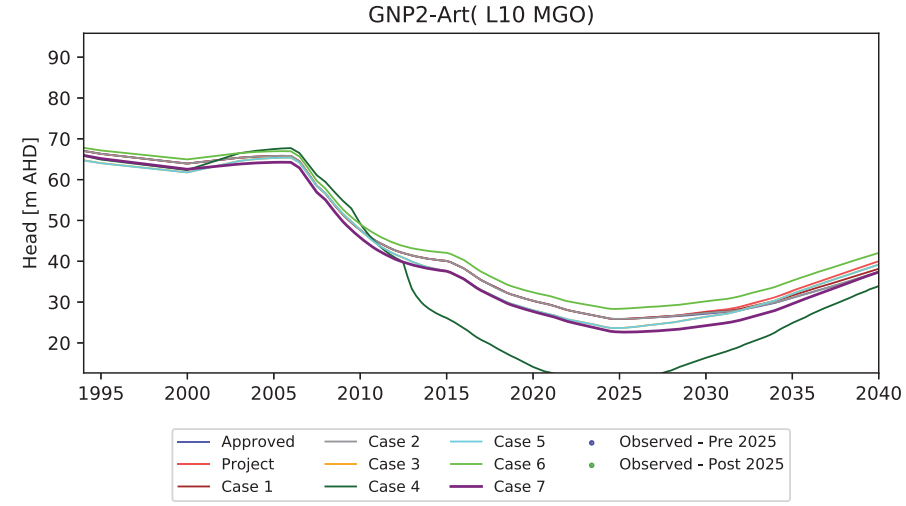

GNP1-HEB(L19 MGO)
Head [m AHD]
80
60
40
20
0
−20
−40
−60
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

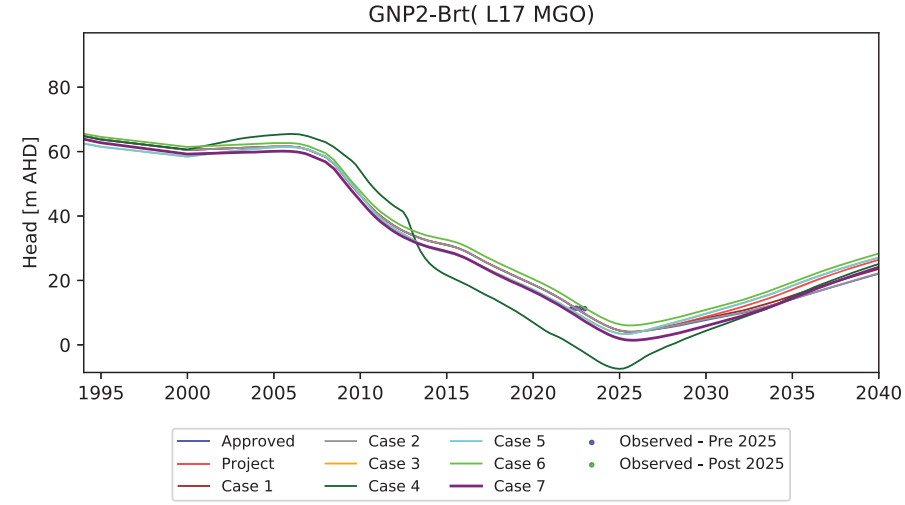

GNP1-LLD(L16 MGO)
Head [m AHD]
80
60
40
20
0
−20
−40
−60
−80
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

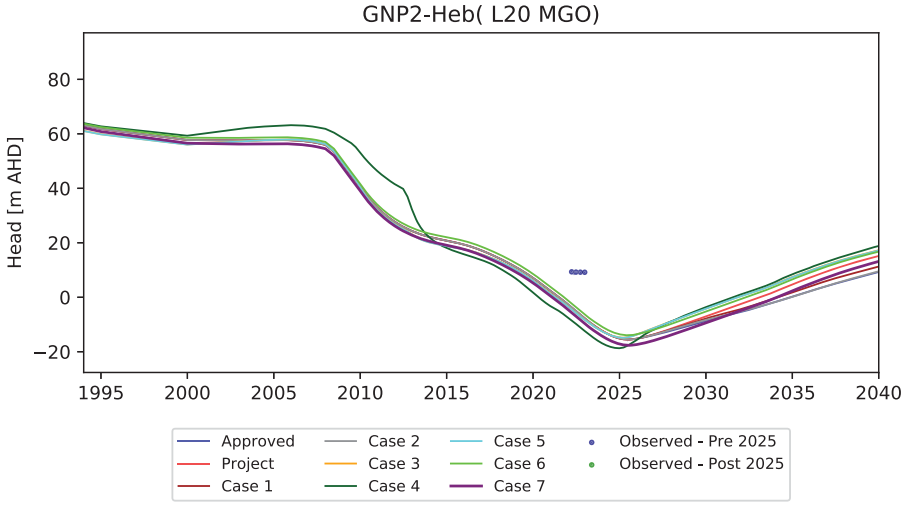

GNP1-MLD(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

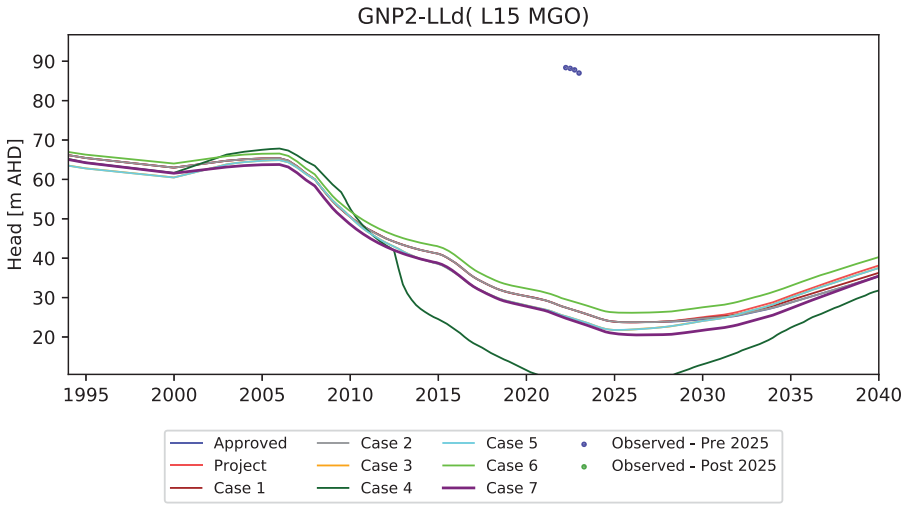

GNP1-PG(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

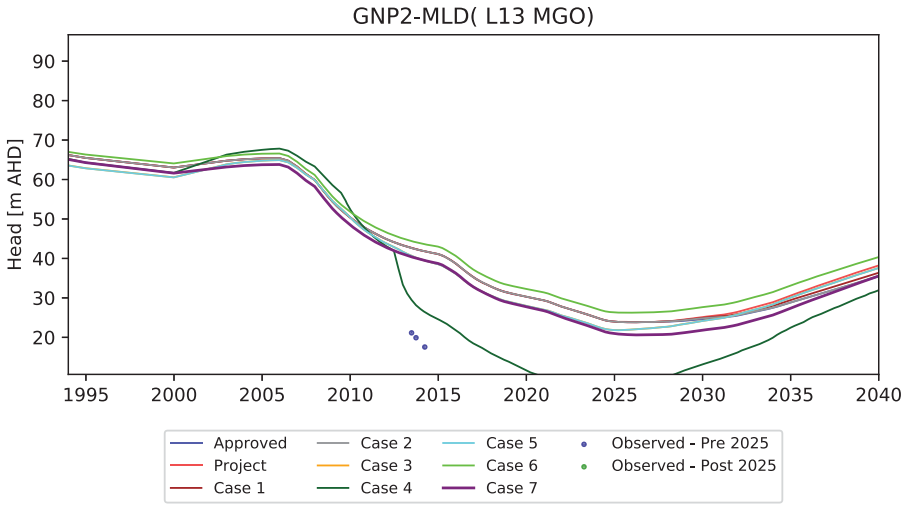

GNP1-ULD(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

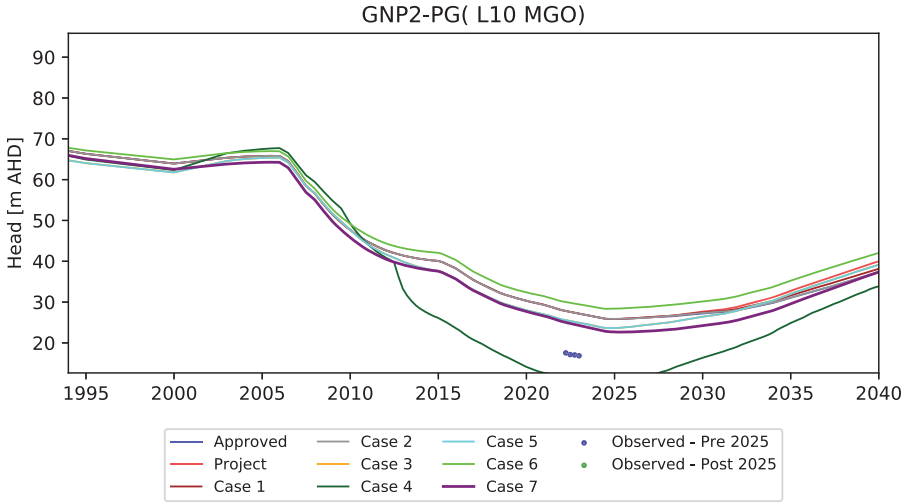

GNP2-Art(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

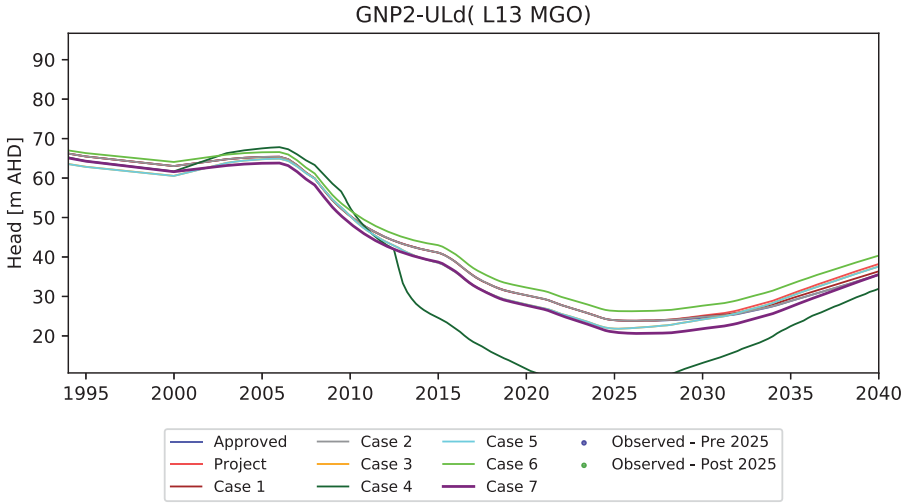

GNP2-Brt(L17 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

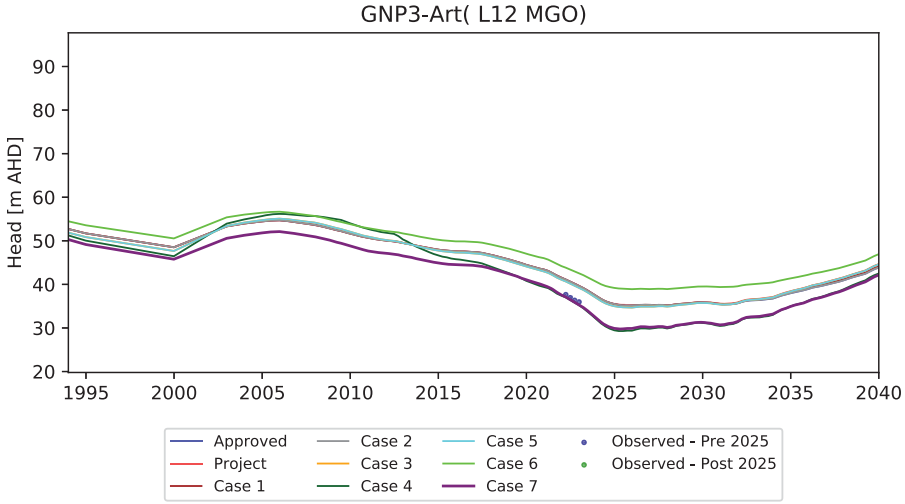

GNP2-Heb(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

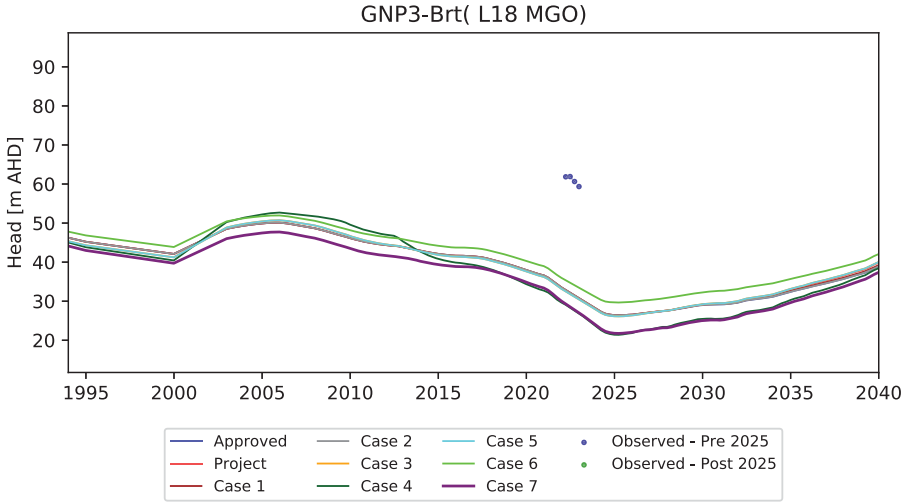

GNP2-LLd(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

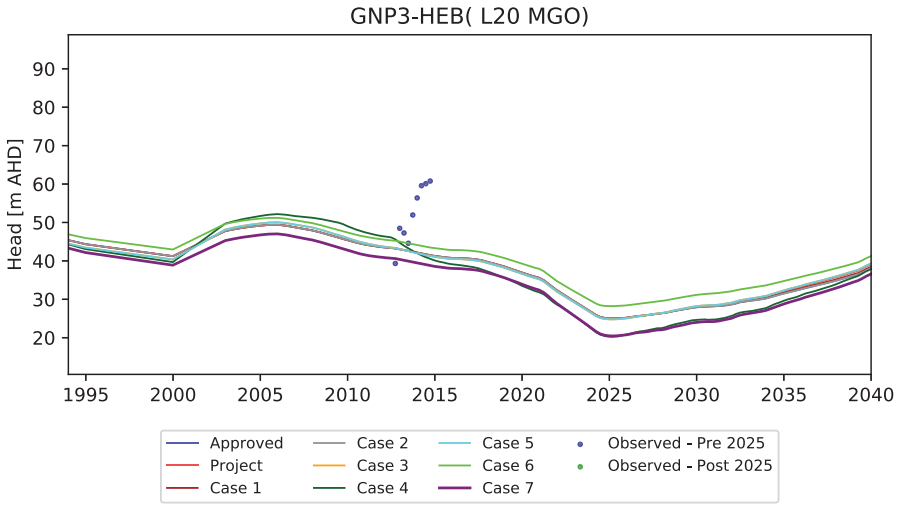

GNP2-MLD(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

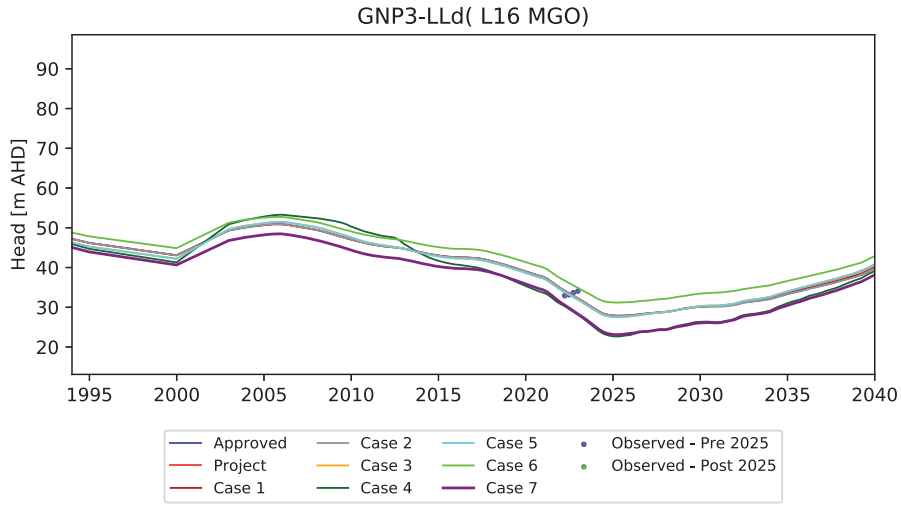

GNP2-PG(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

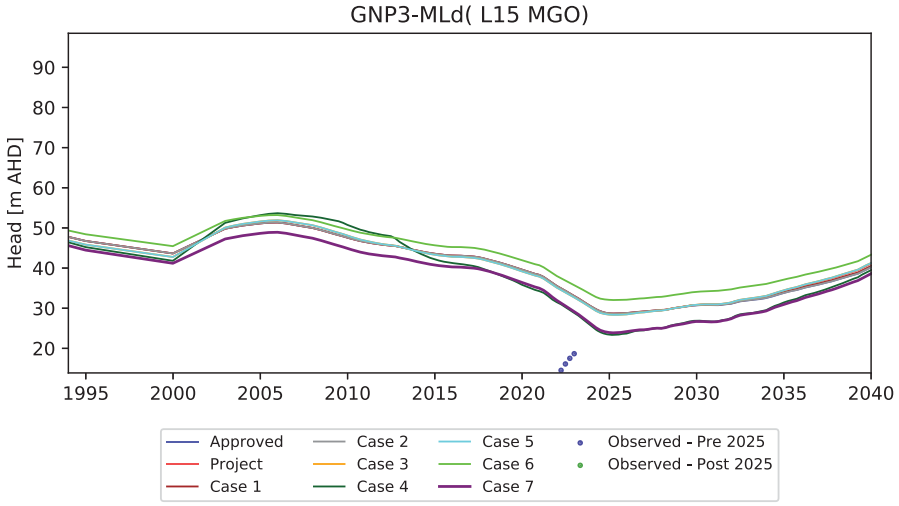

GNP2-ULd(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

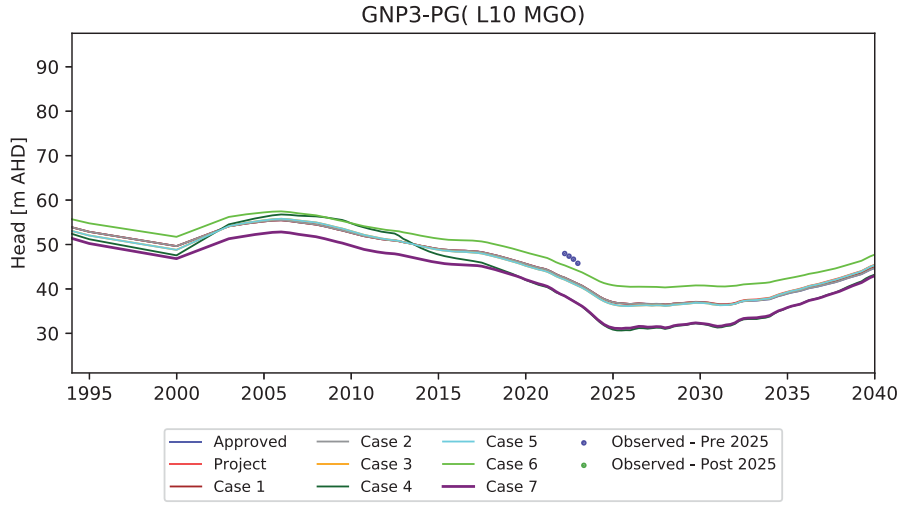

GNP3-Art(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

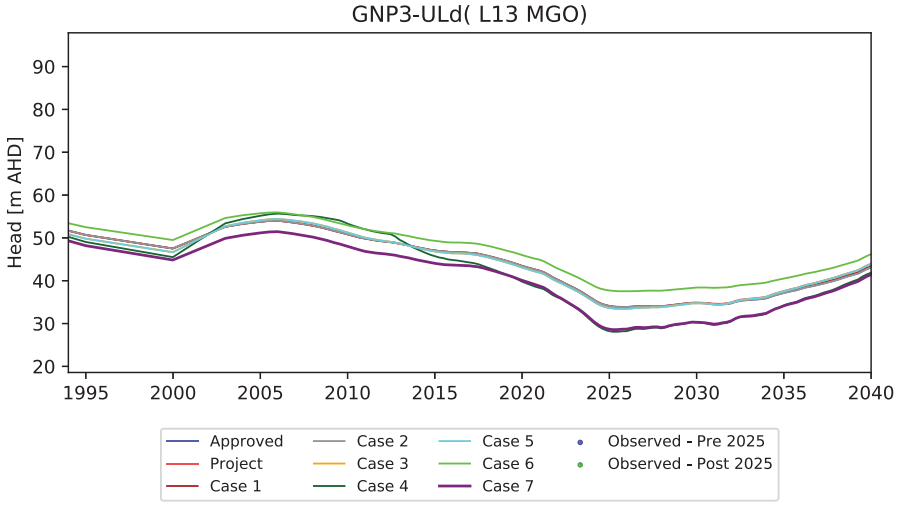

GNP3-Brt(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

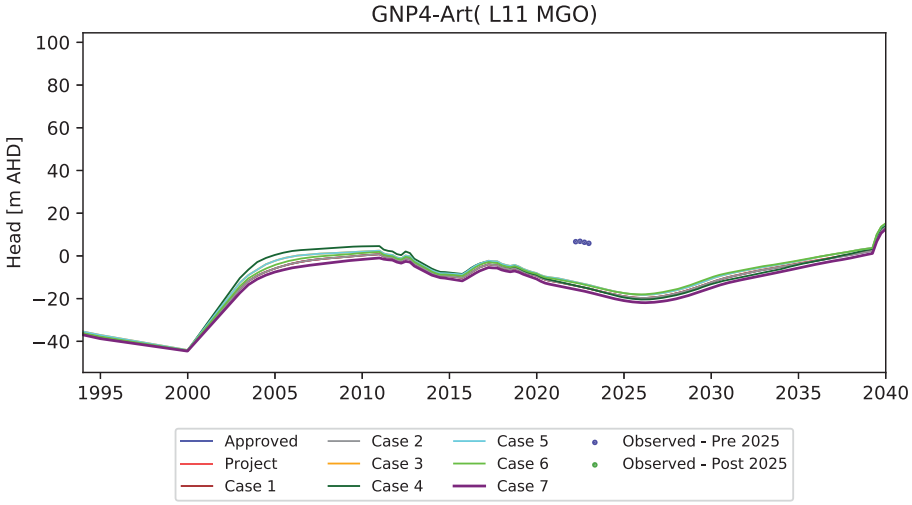

GNP3-HEB(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

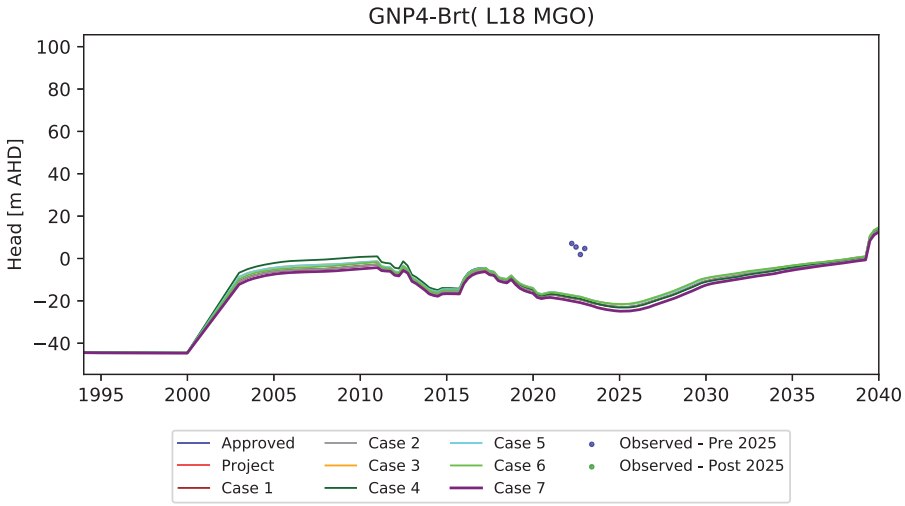

GNP3-LLd(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

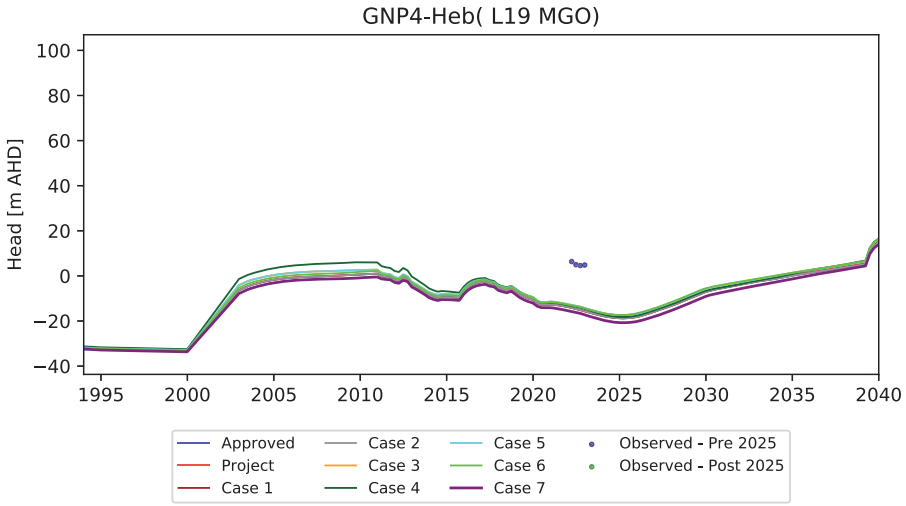

GNP3-MLd(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

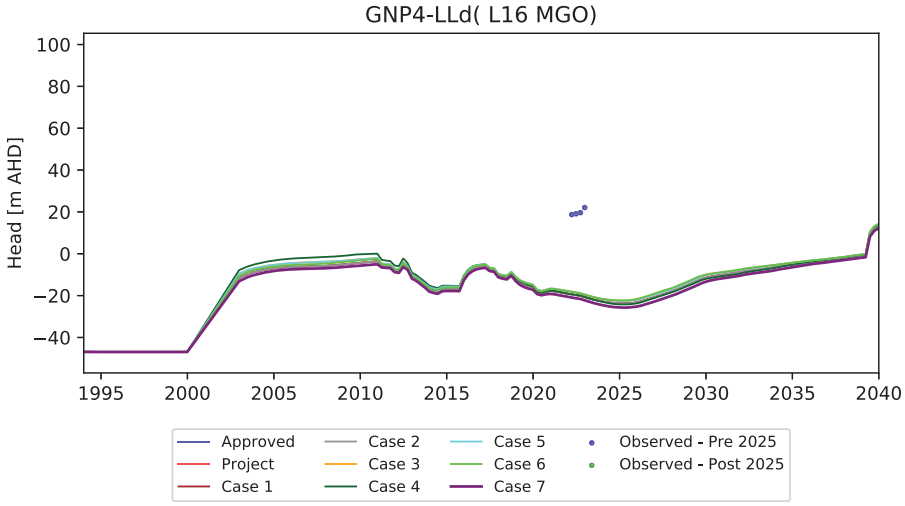

GNP3-PG(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

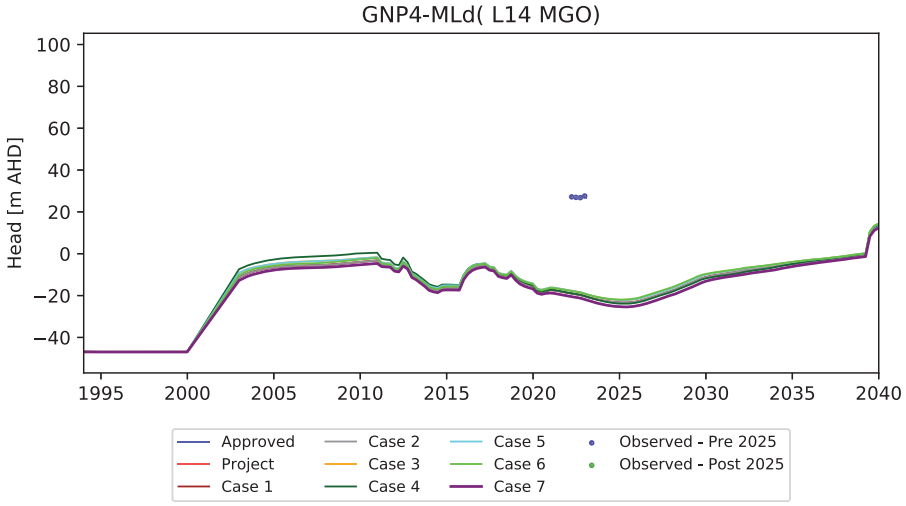

GNP3-ULd(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

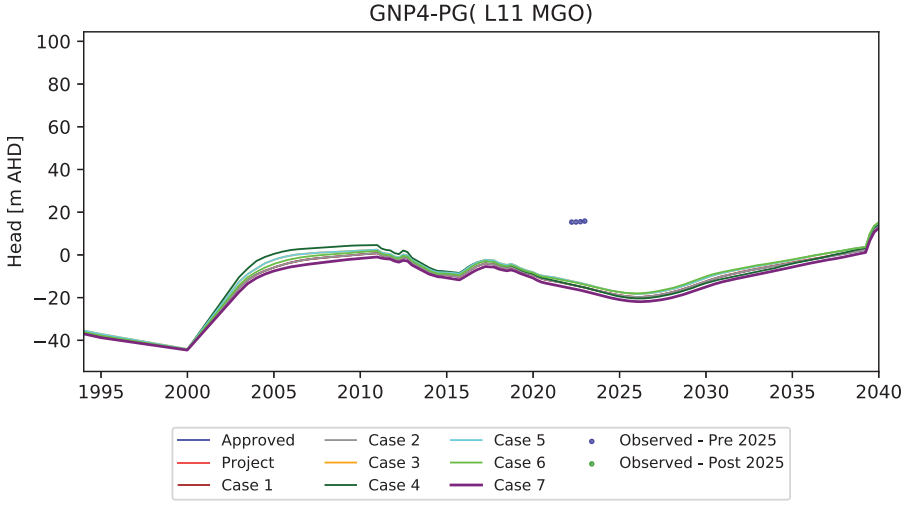

GNP4-Art(L11 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

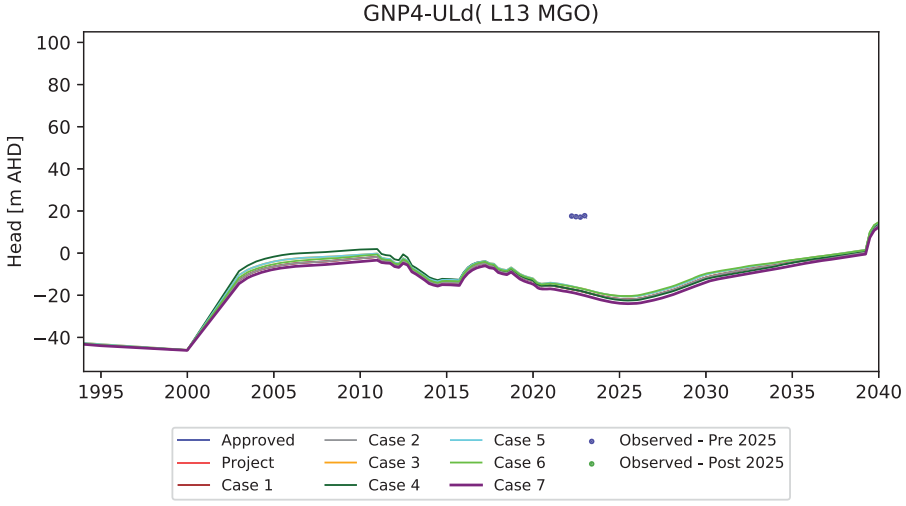

GNP4-Brt(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

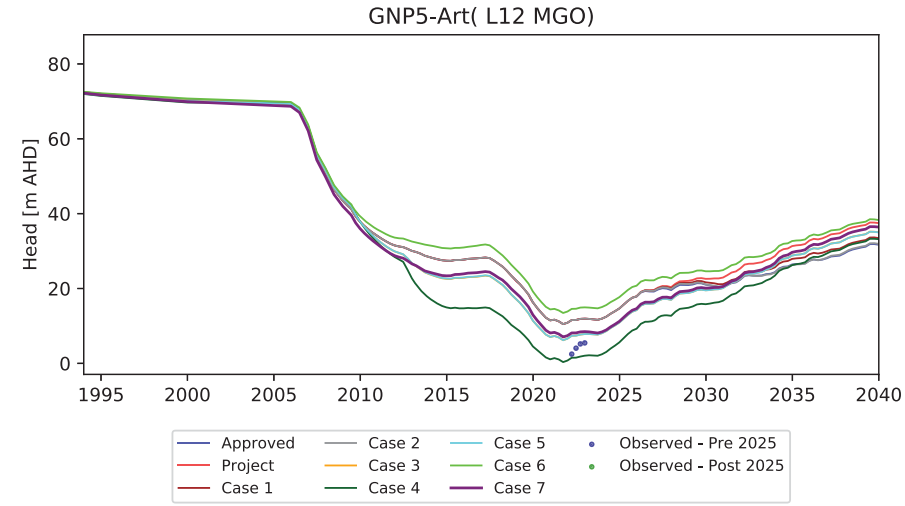

GNP4-Heb(L19 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

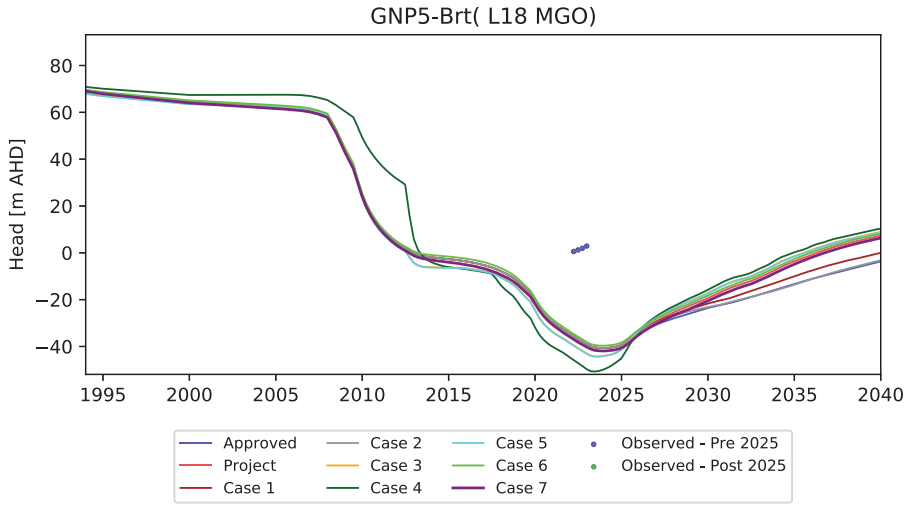

GNP4-LLd(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

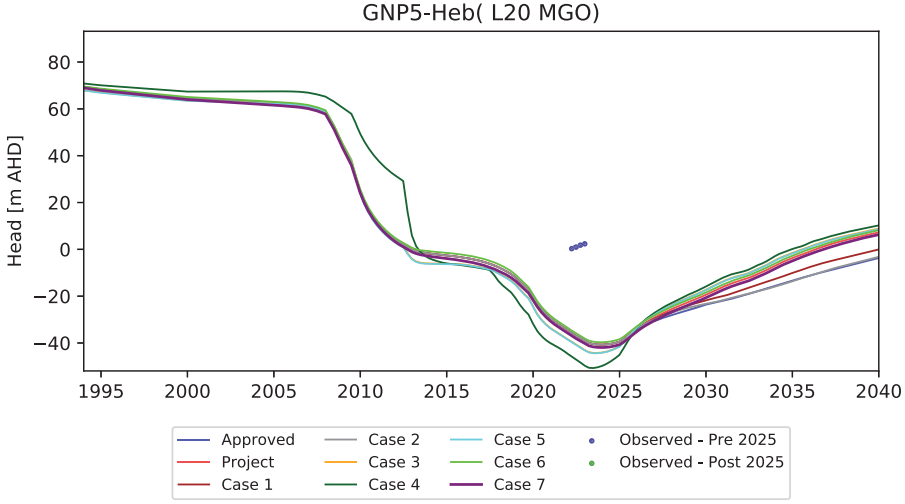

GNP4-MLd(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

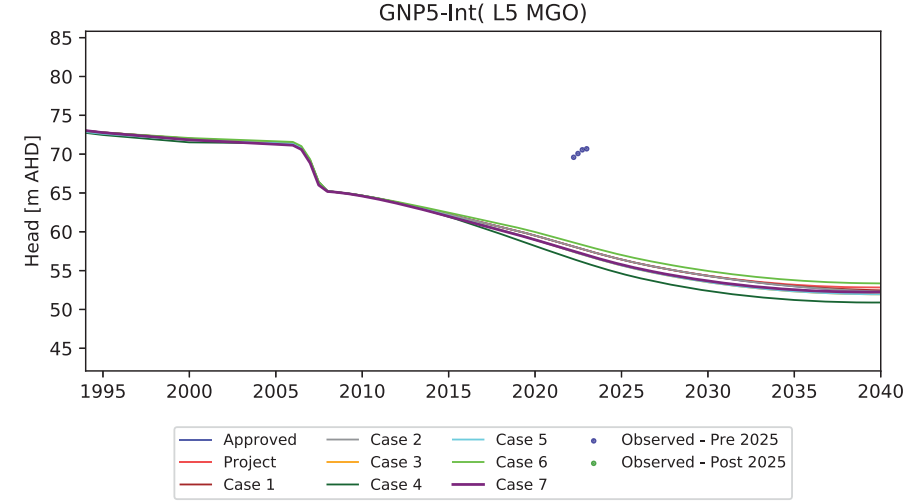

GNP4-PG(L11 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

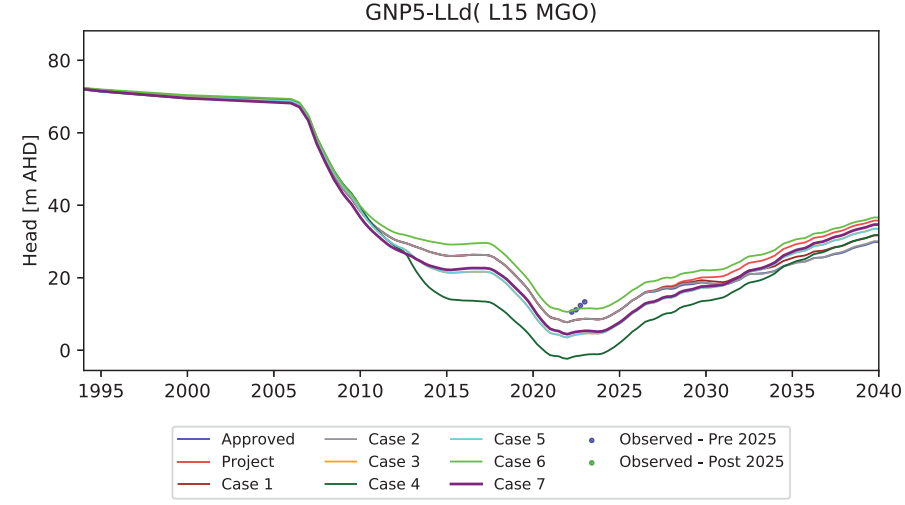

GNP4-ULd(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

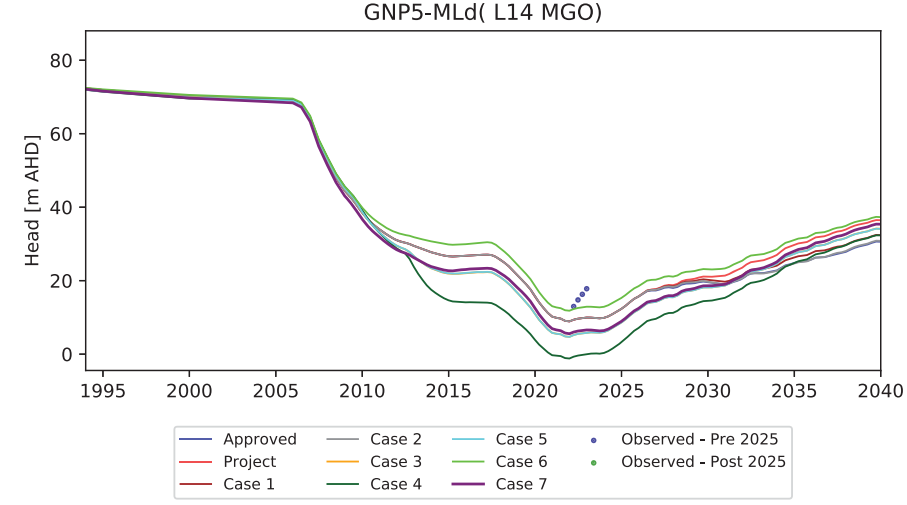

GNP5-Art(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

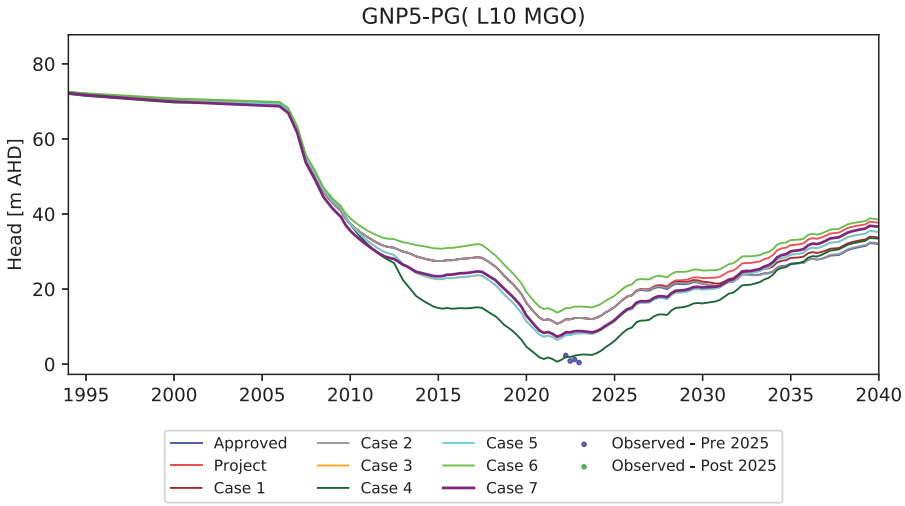

GNP5-Brt(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

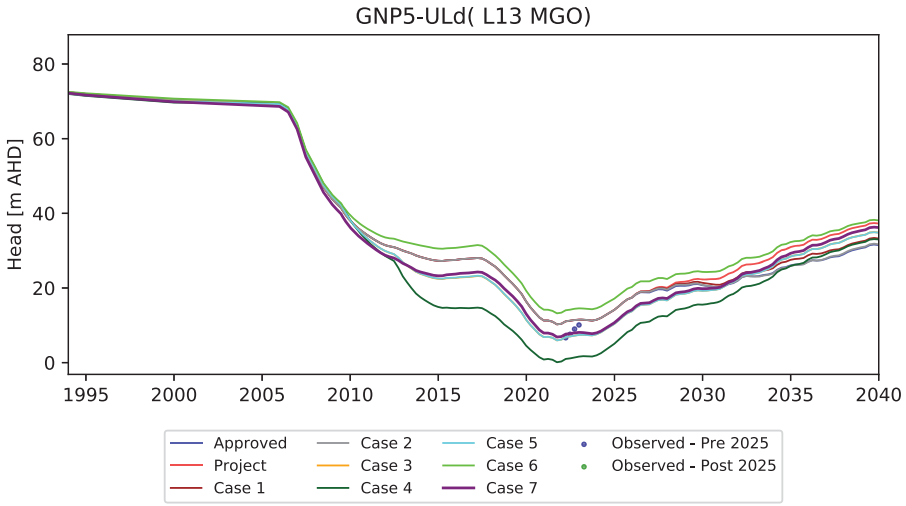

GNP5-Heb(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

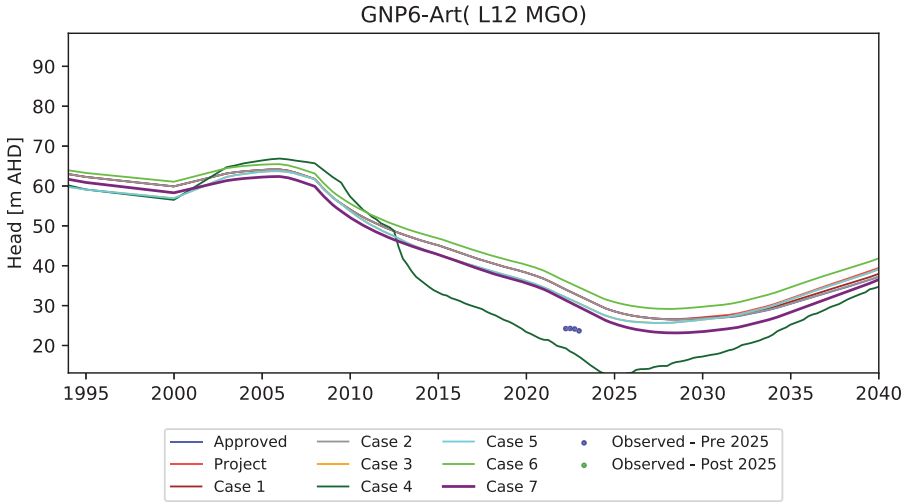

GNP5-Int(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

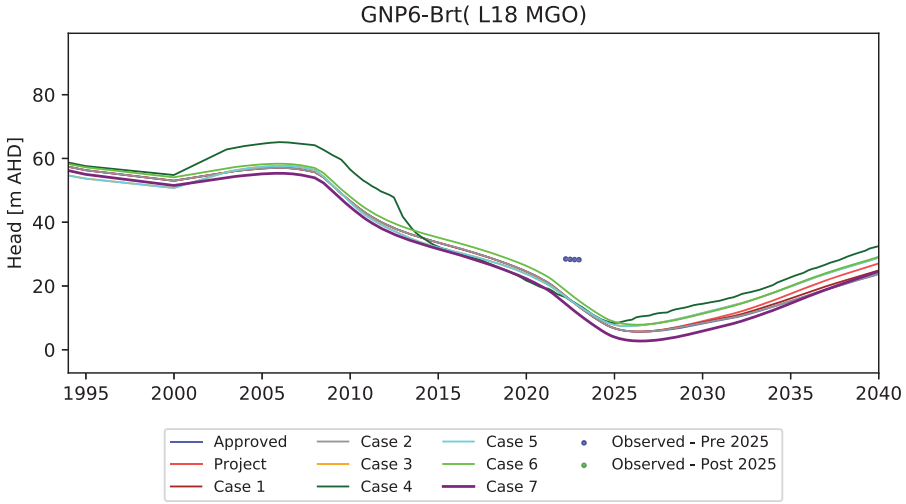

GNP5-LLd(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

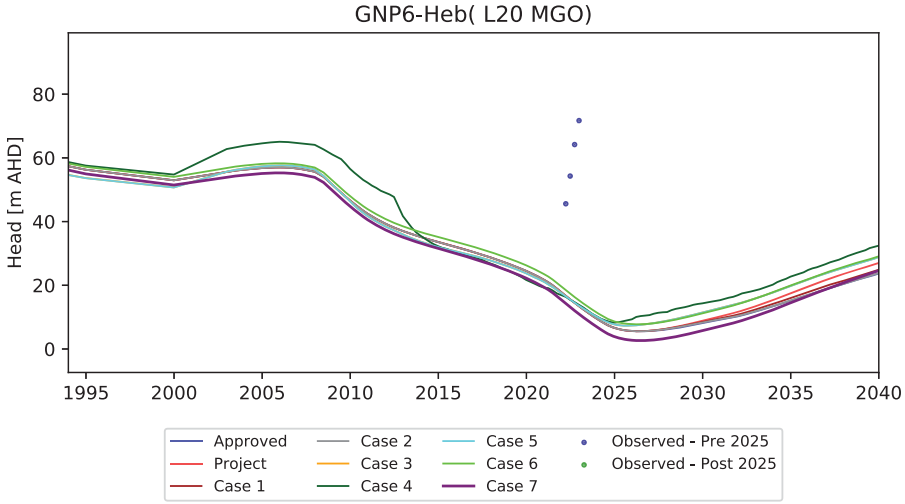

GNP5-MLd(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

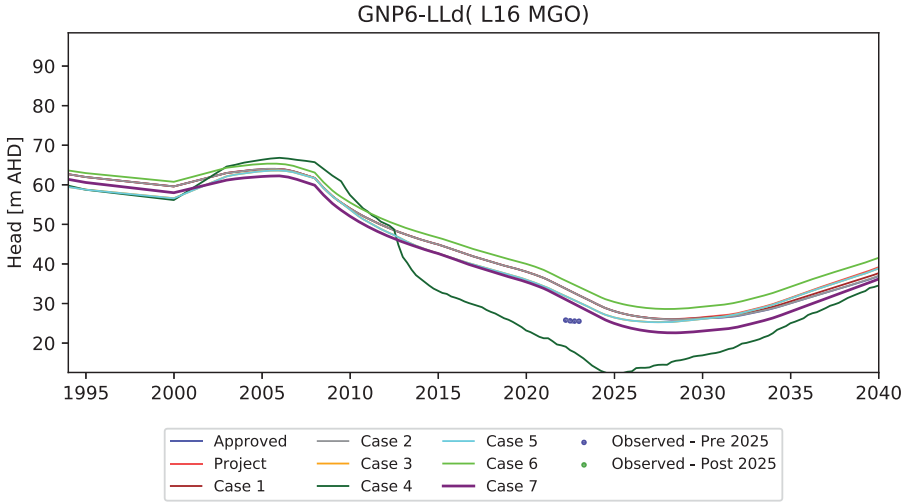

GNP5-PG(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

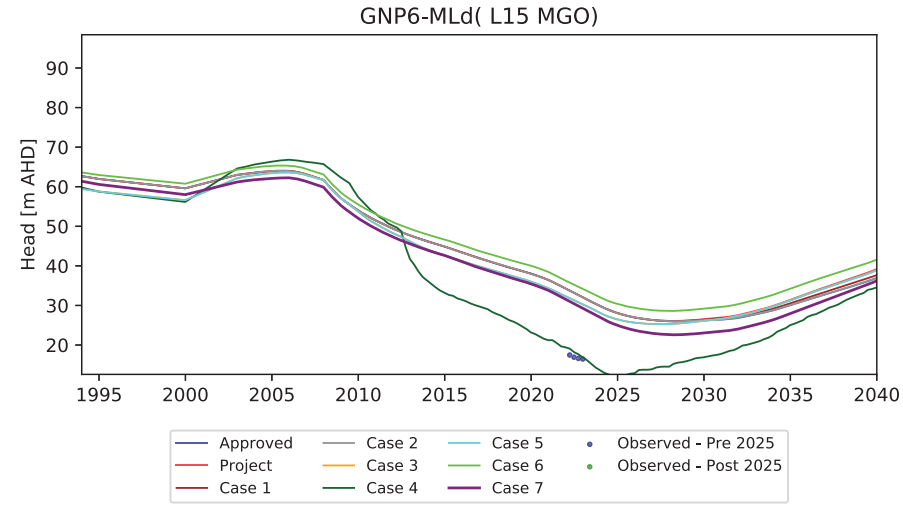

GNP5-ULd(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

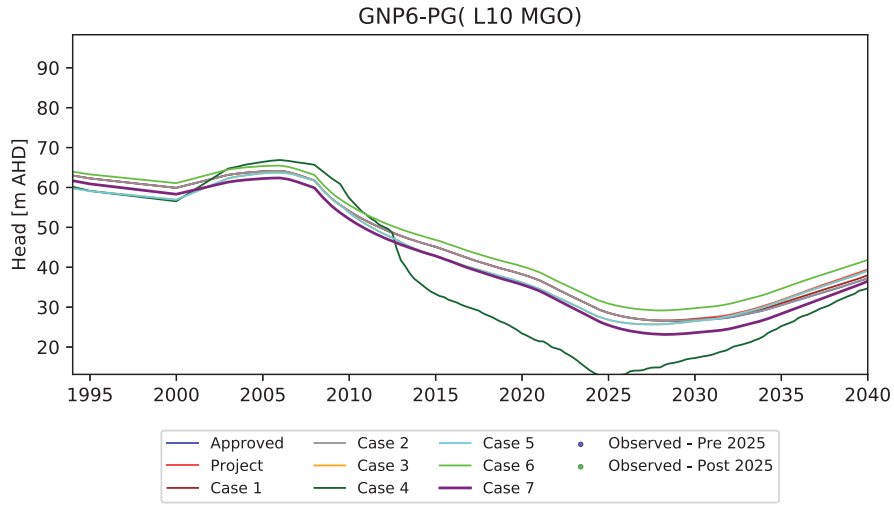

GNP6-Art(L12 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

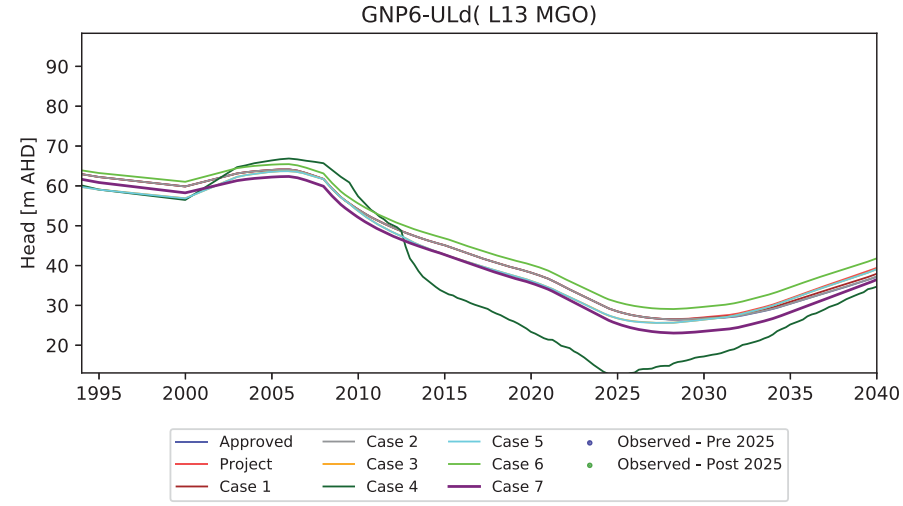

GNP6-Brt(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

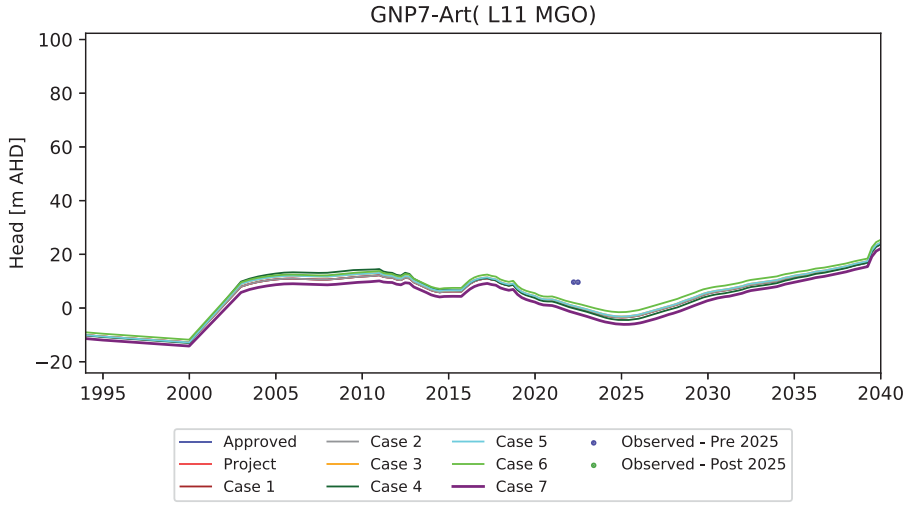

GNP6-Heb(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

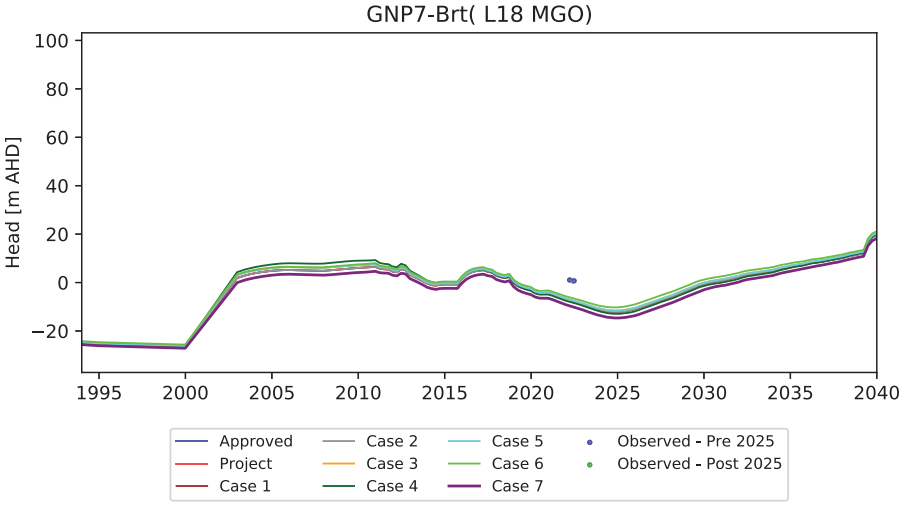

GNP6-LLd(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

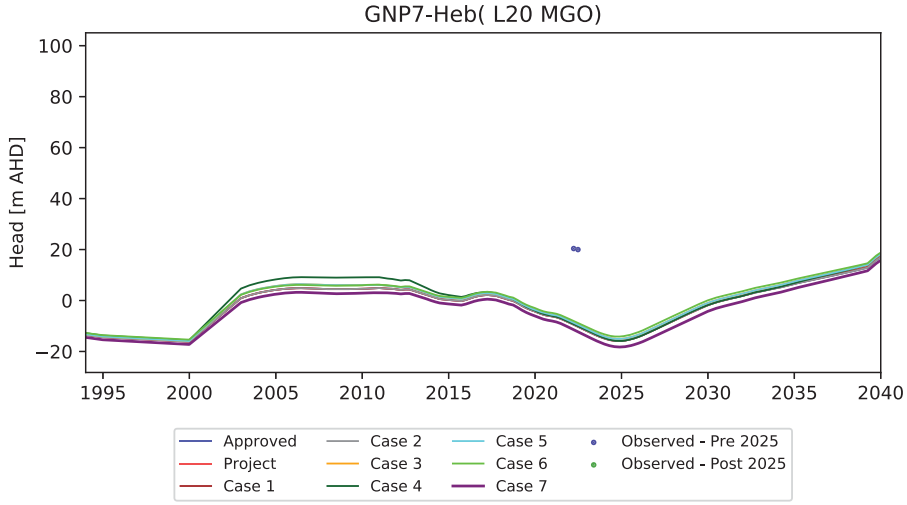

GNP6-MLd(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

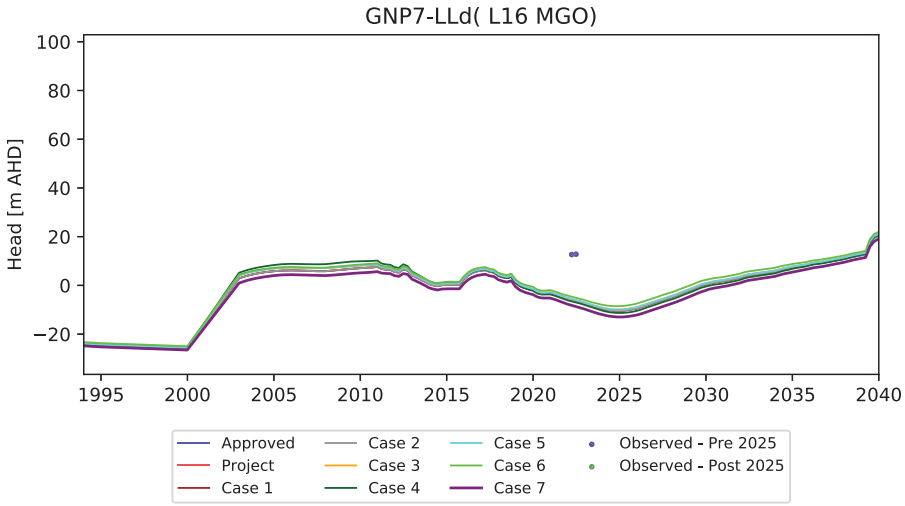

GNP6-PG(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

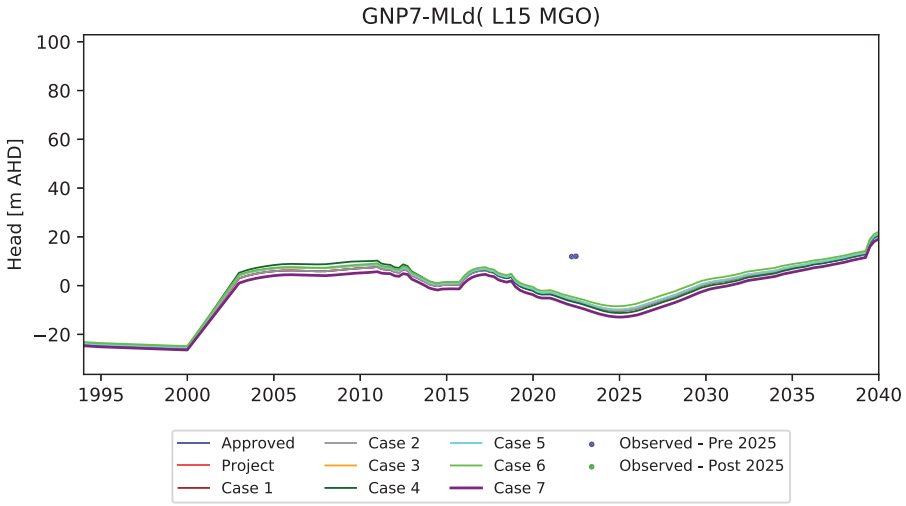

GNP6-ULd(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

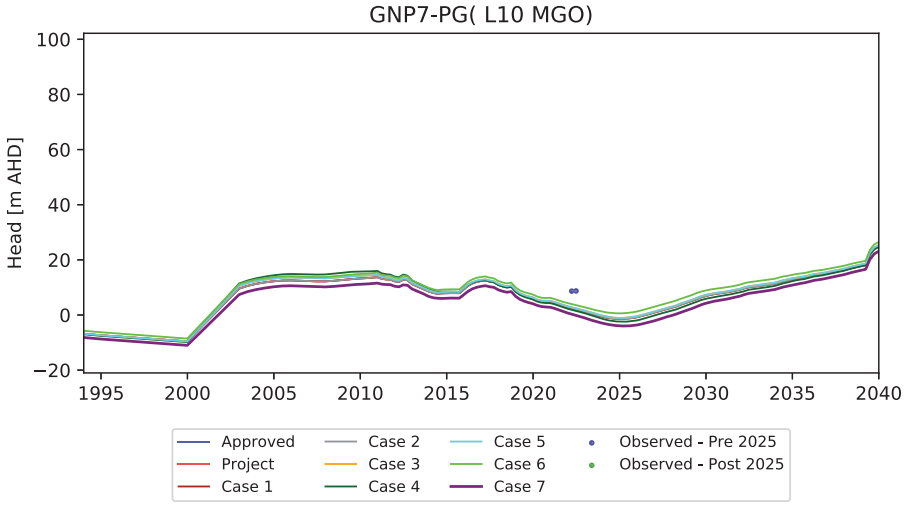

GNP7-Art(L11 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

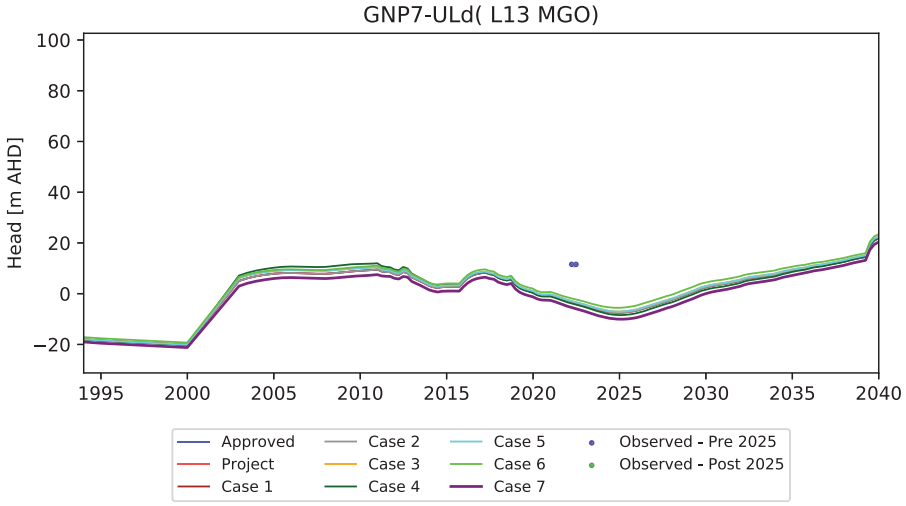

GNP7-Brt(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

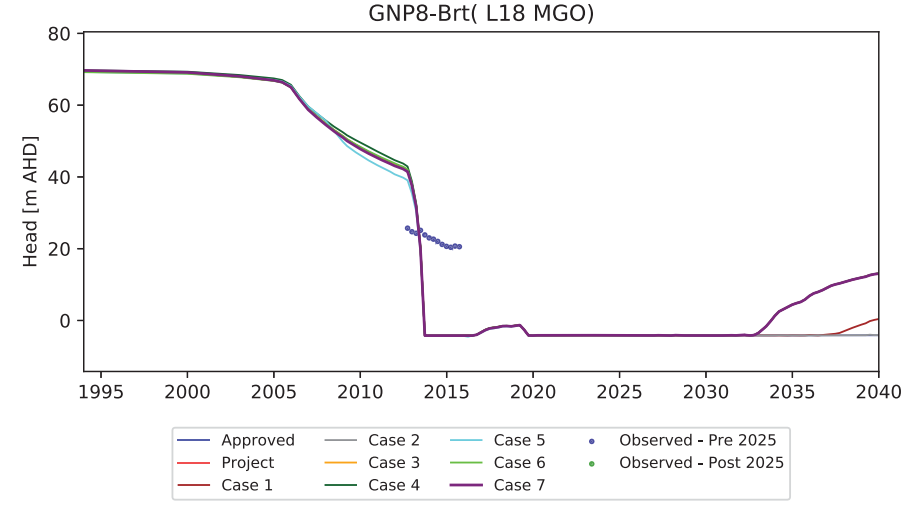

GNP7-Heb(L20 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

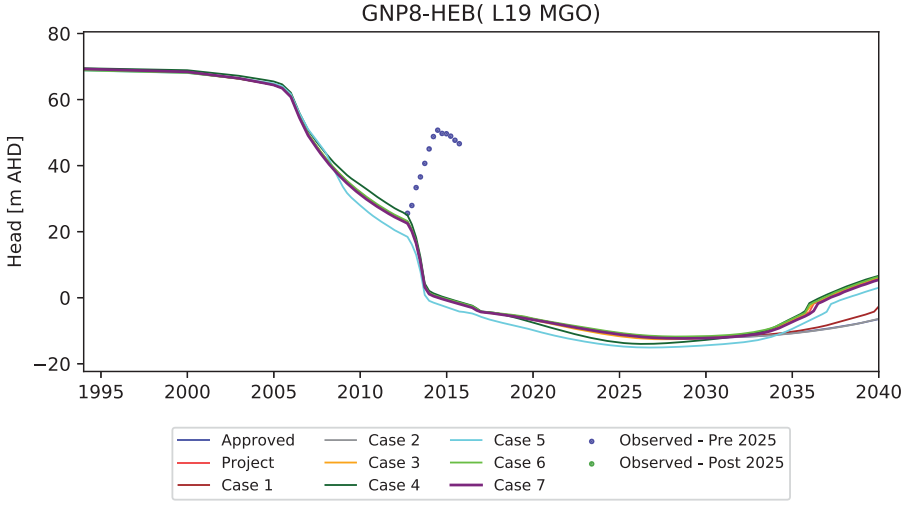

GNP7-LLd(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

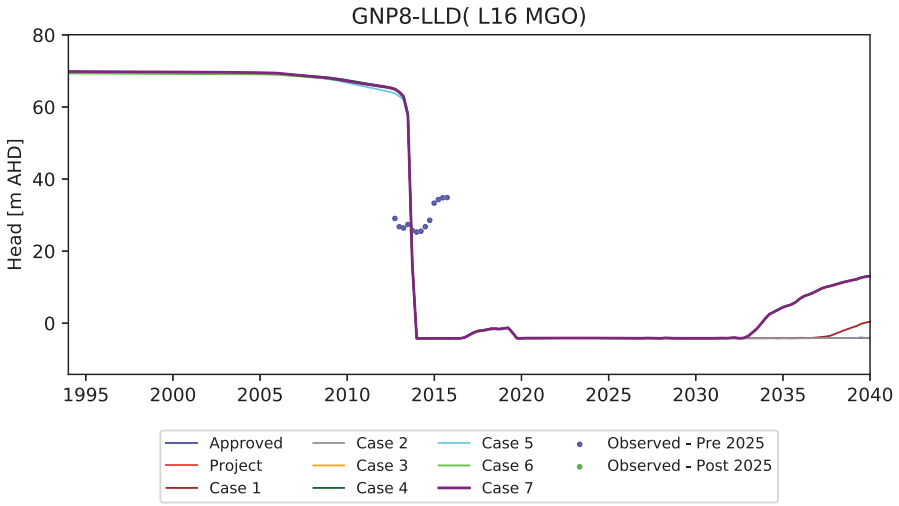

GNP7-MLd(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

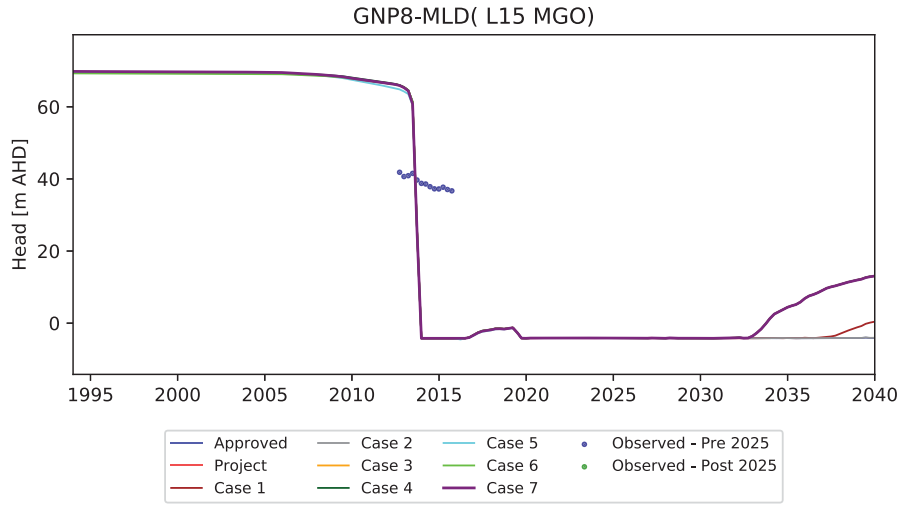

GNP7-PG(L10 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

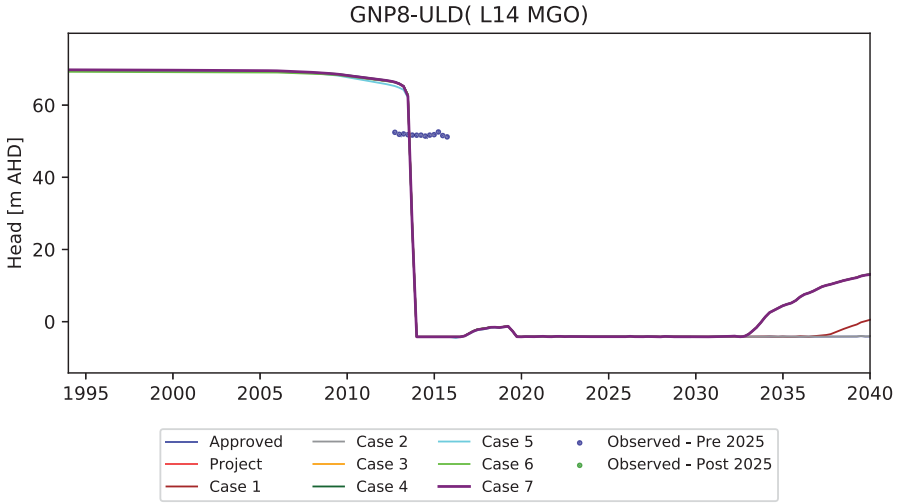

GNP7-ULd(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

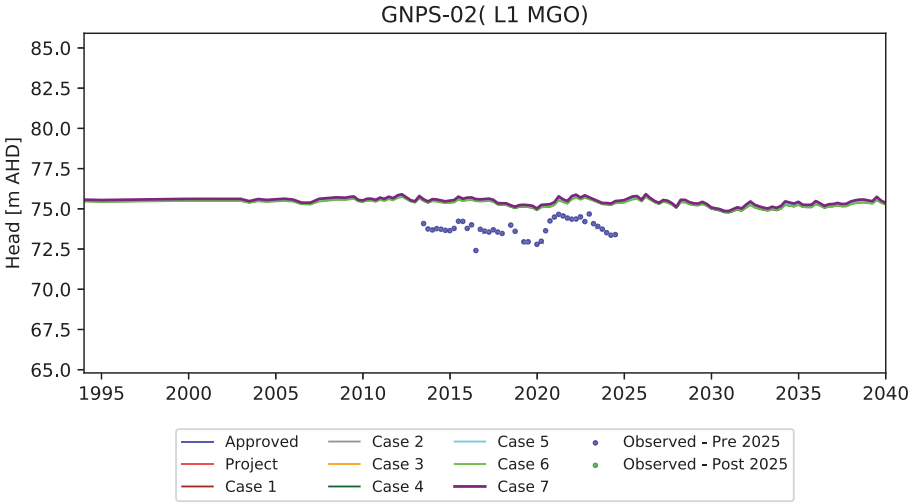

GNP8-Brt(L18 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

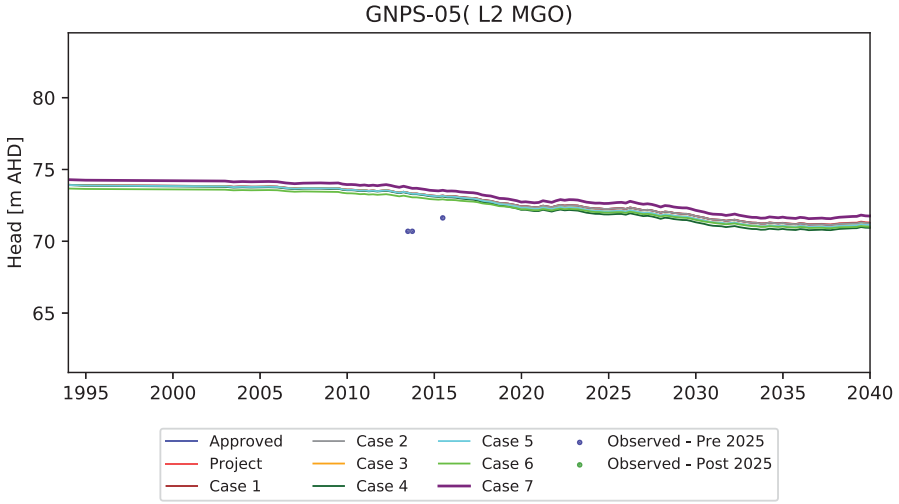

GNP8-HEB(L19 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

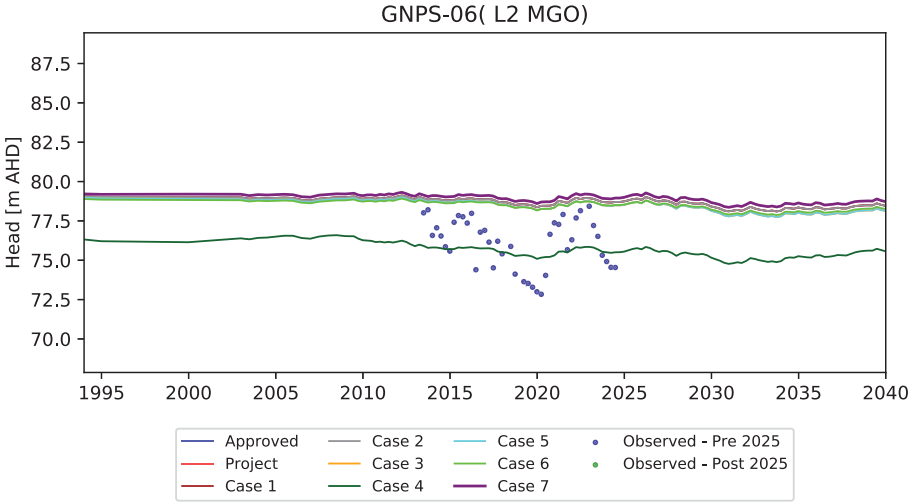

GNP8-LLD(L16 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

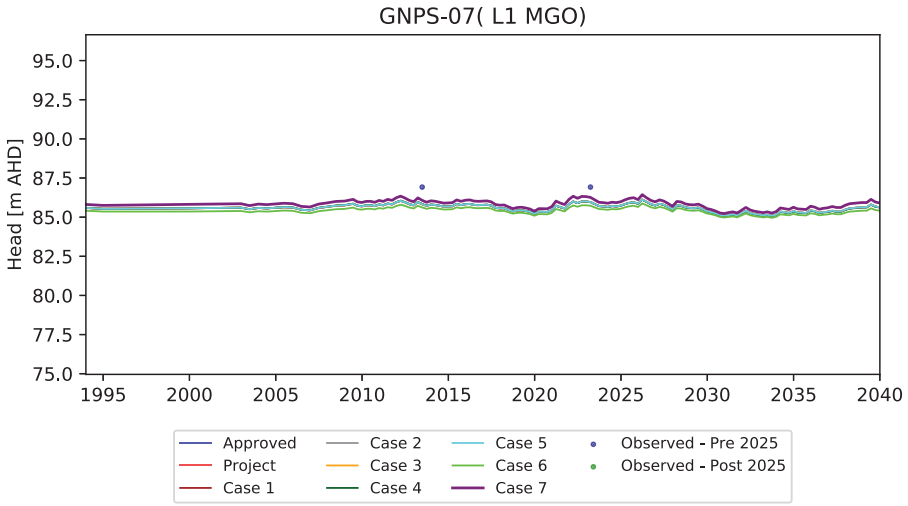

GNP8-MLD(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

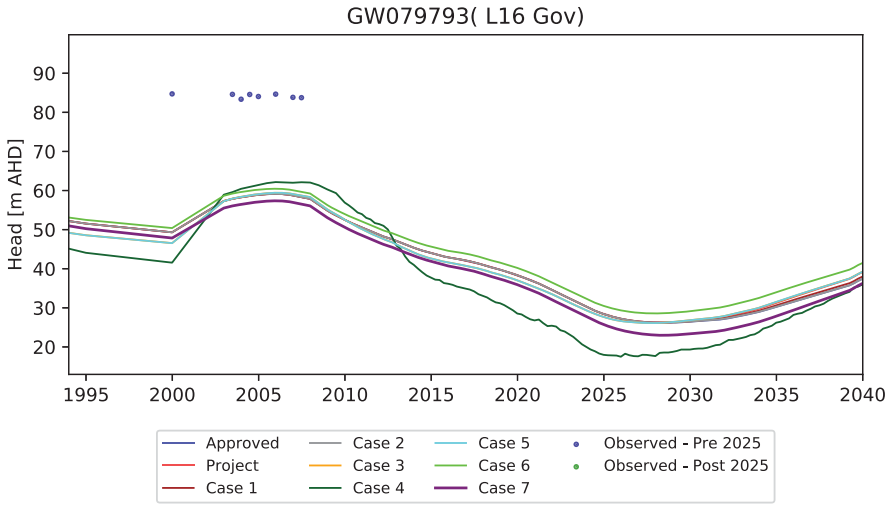

GNP8-ULD(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

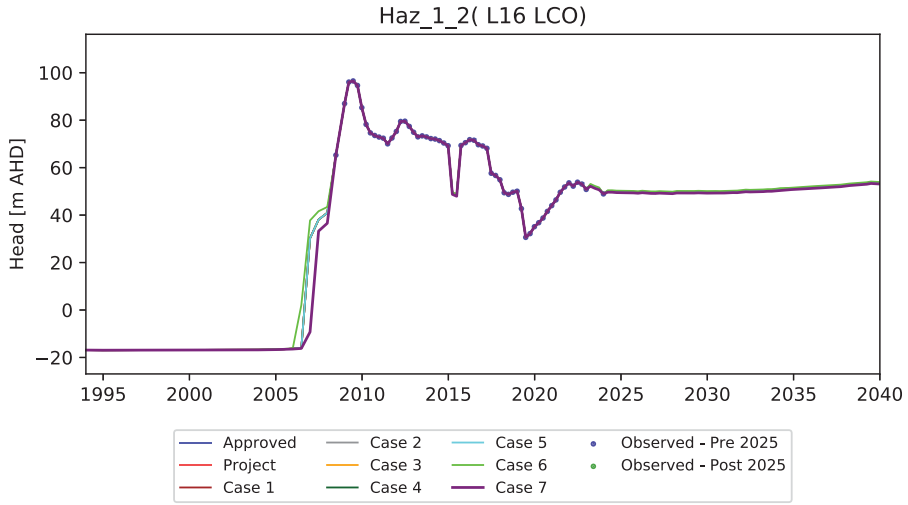

GNPS-02(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

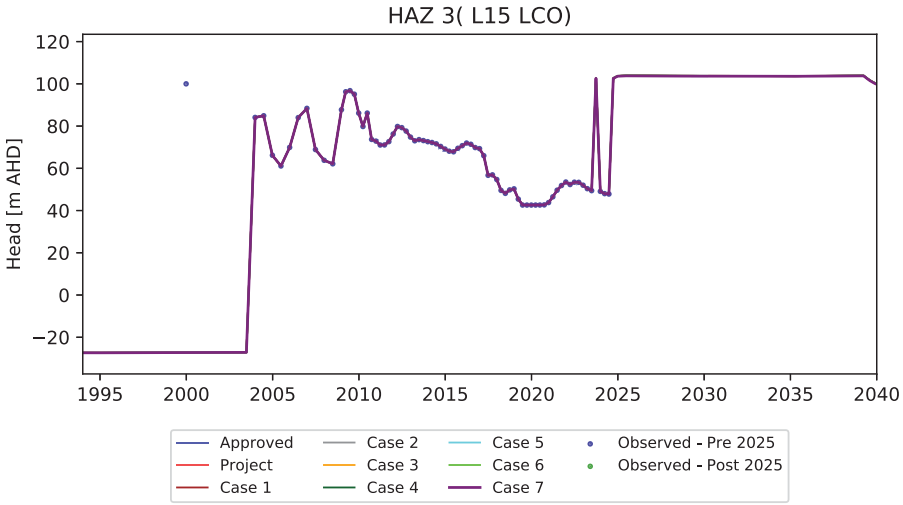

GNPS-05(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

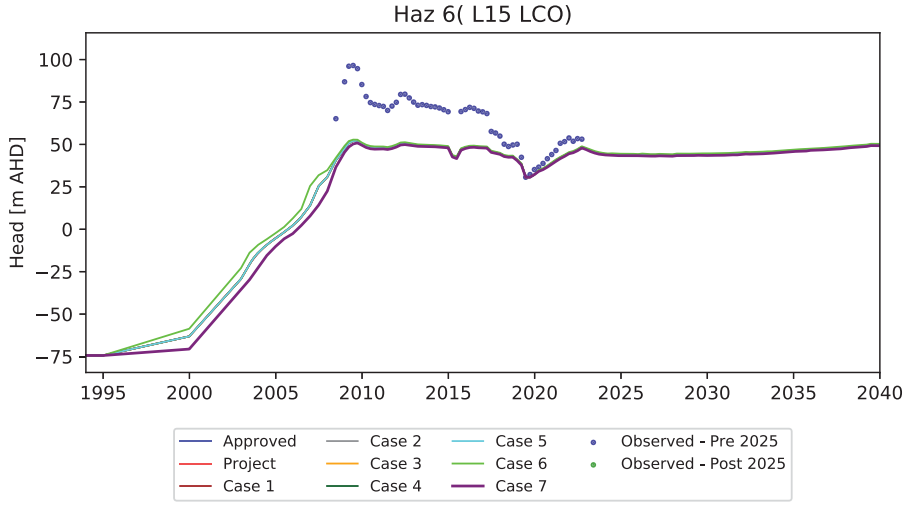

GNPS-06(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

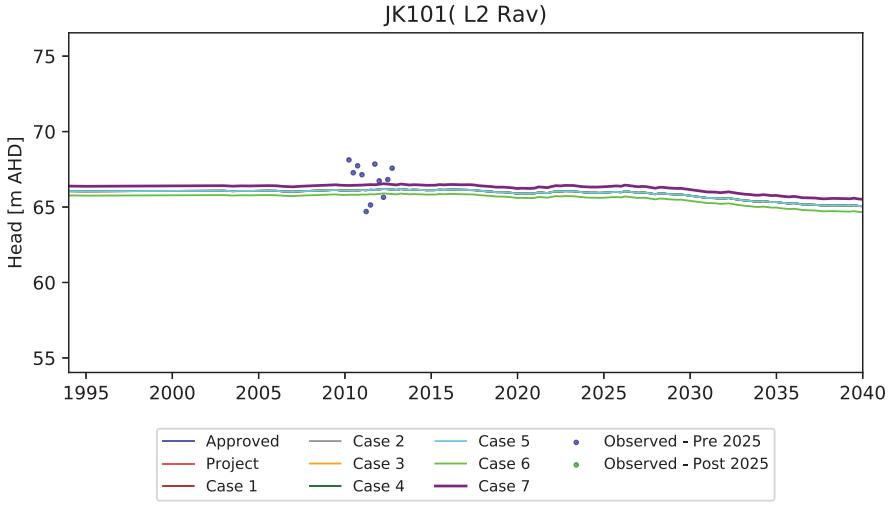

GNPS-07(L1 MGO)
Head [m AHD]
95.0
92.5
90.0
87.5
85.0
82.5
80.0
77.5
75.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

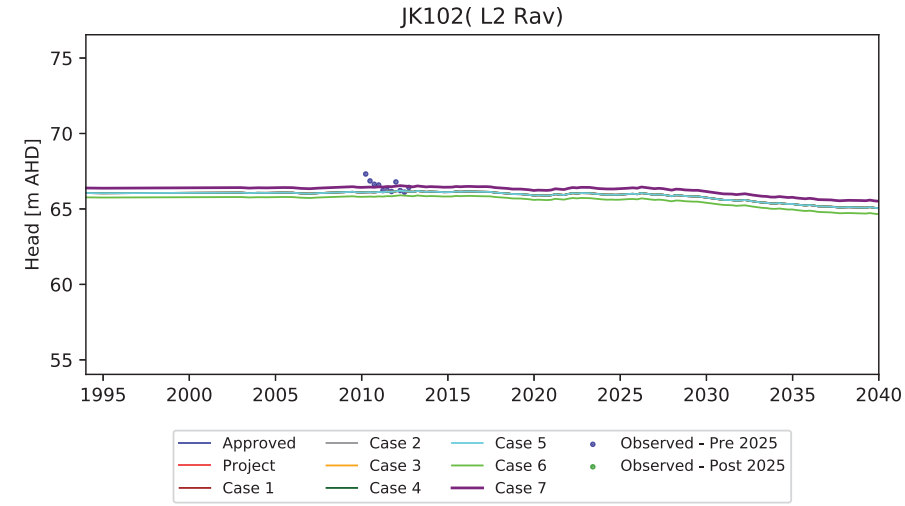

GW079793(L16 Gov)
Head [m AHD]
90
80
70
60
50
40
30
20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

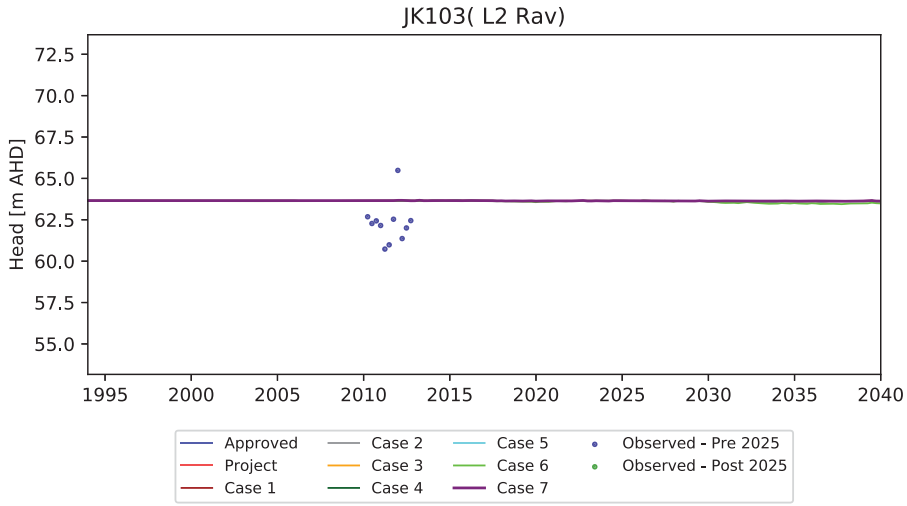

Haz_1_2(L16 LCO)
Head [m AHD]
100
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

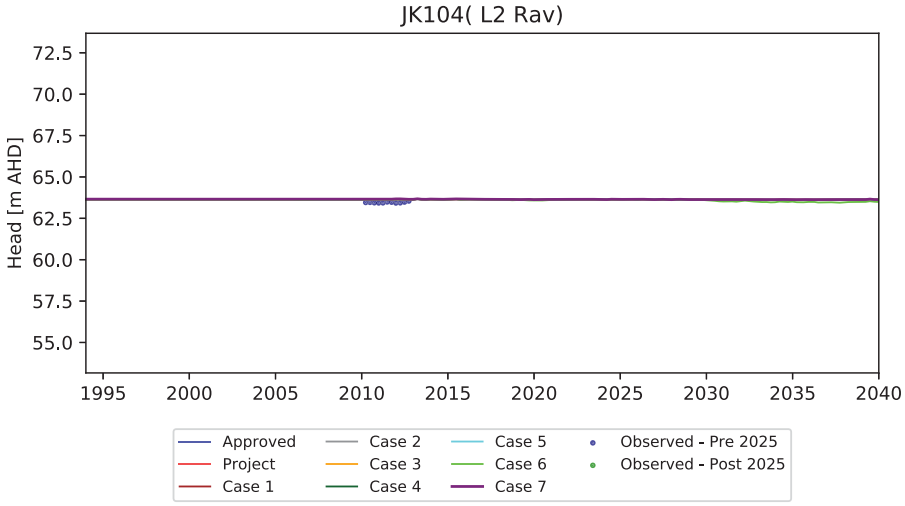

HAZ 3(L15 LCO)
Head [m AHD]
120
100
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

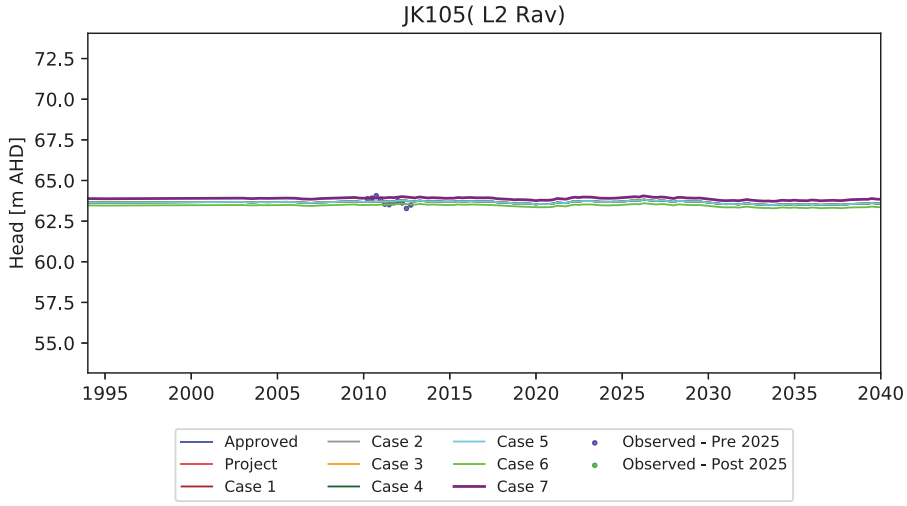

Haz 6(L15 LCO)
Head [m AHD]
100
75
50
25
0
−25
−50
−75
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

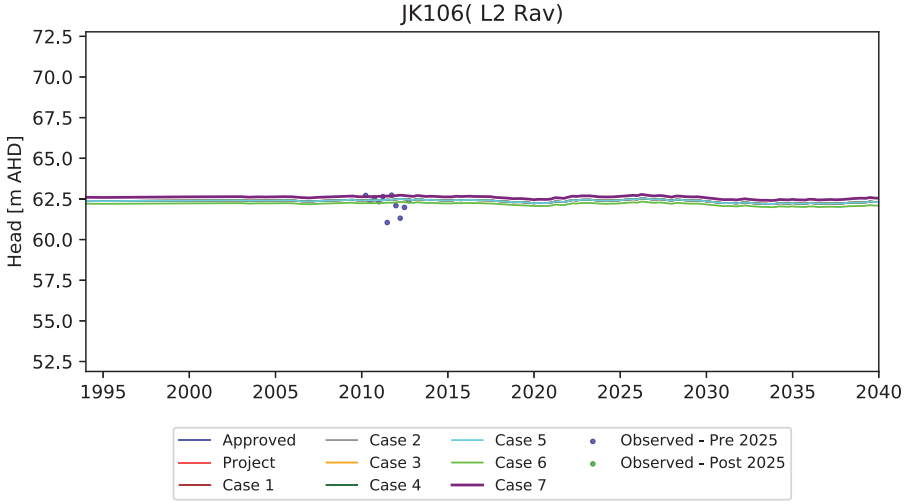

JK101(L2 Rav)
Head [m AHD]
75
70
65
60
55
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

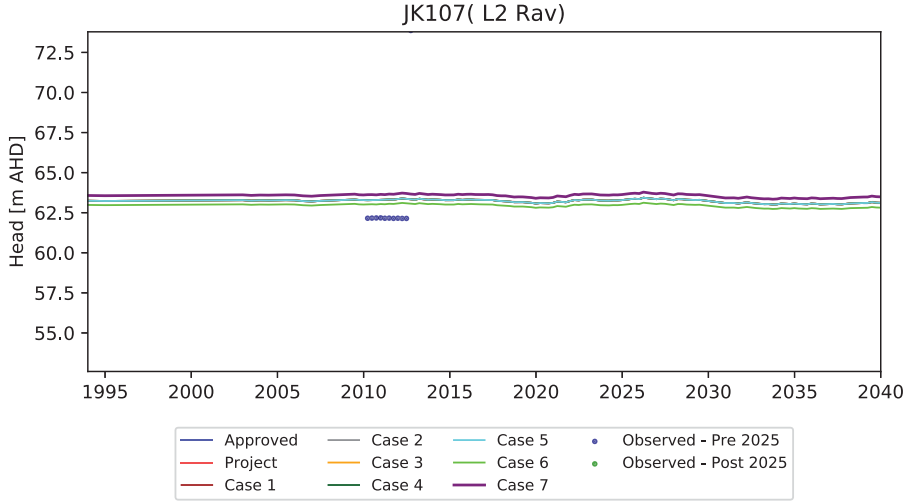

JK102(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

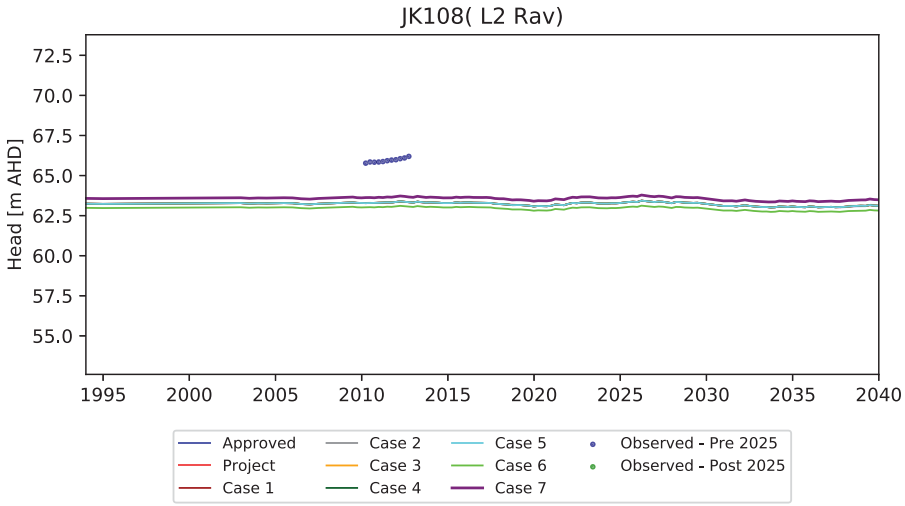

JK103(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

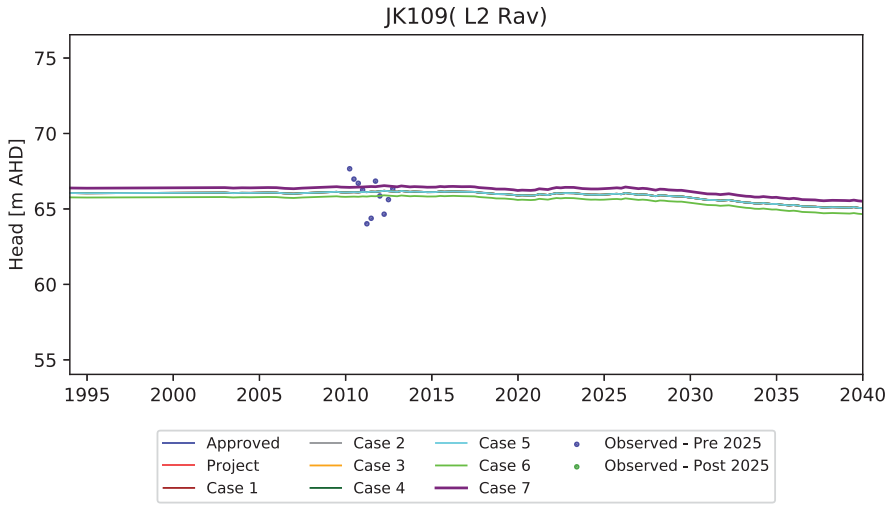

JK104(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

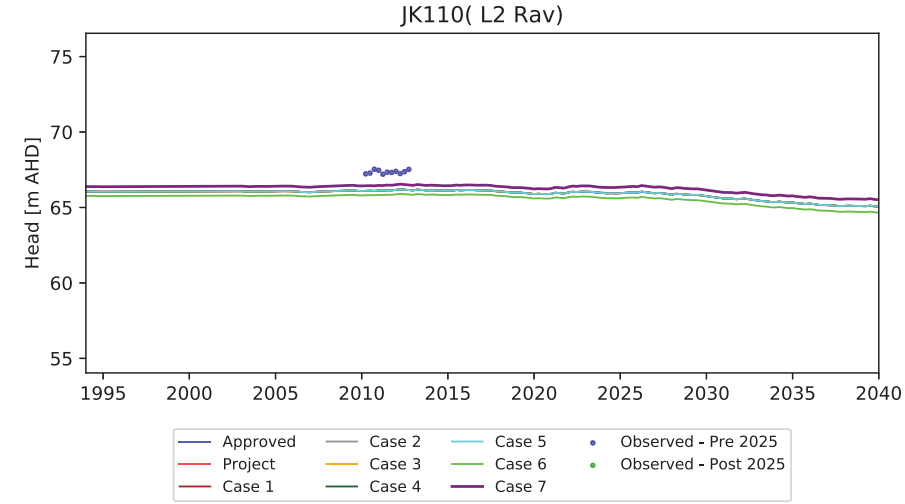

JK105(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

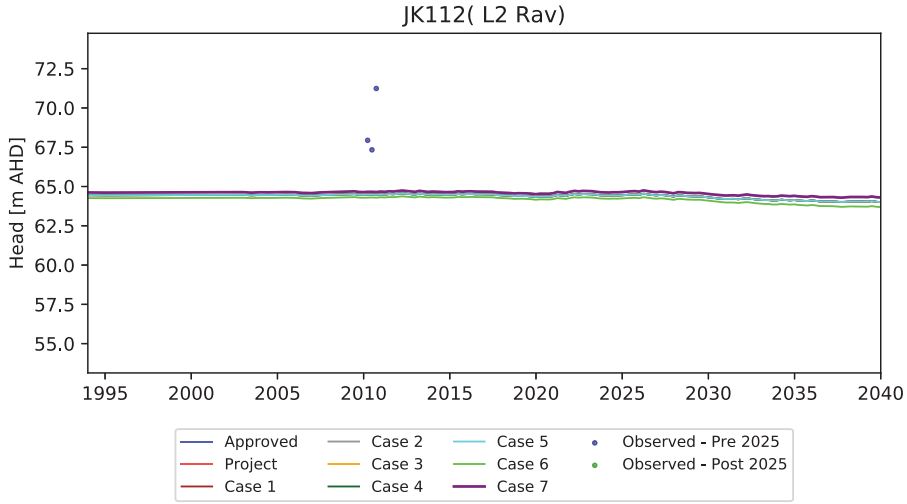

JK106(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

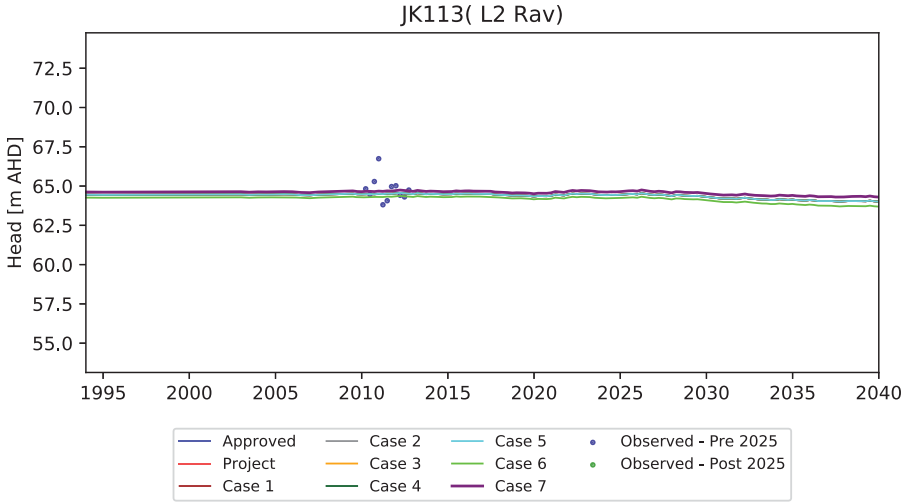

JK107(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

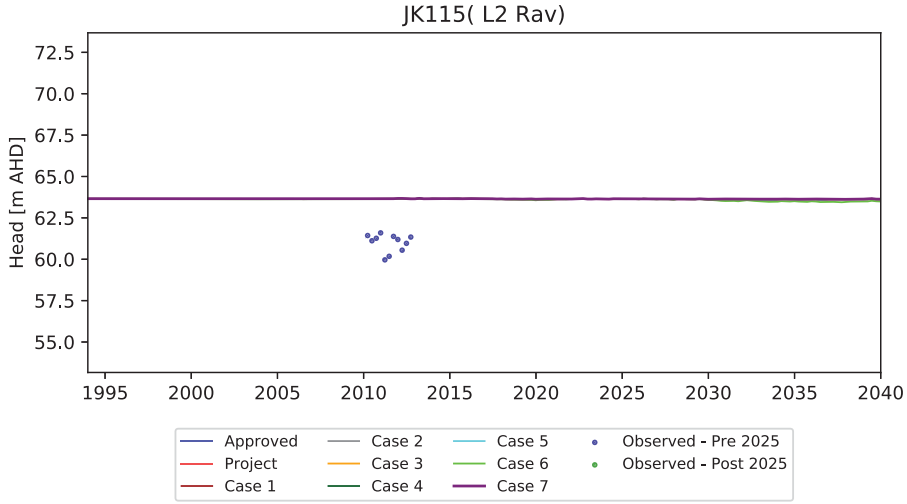

JK108(L2 Rav)
Head [m AHD]
72.5
70.0
67.5
65.0
62.5
60.0
57.5
55.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

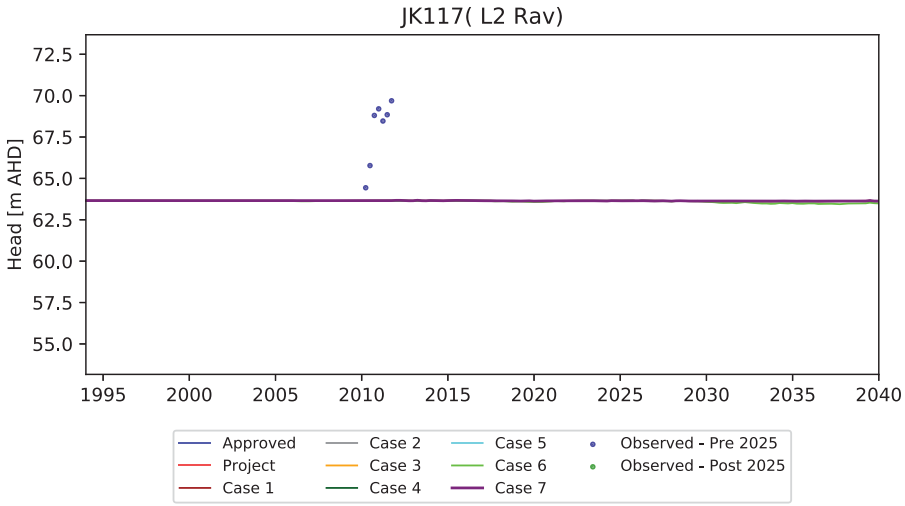

JK109(L2 Rav)
Head [m AHD]
75
70
65
60
55
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

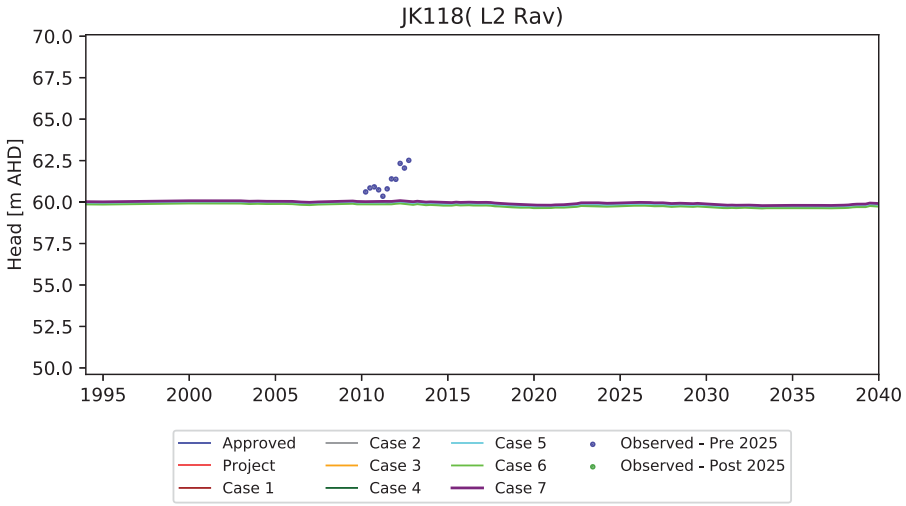

JK110(L2 Rav)
Head [m AHD]
75
70
65
60
55
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

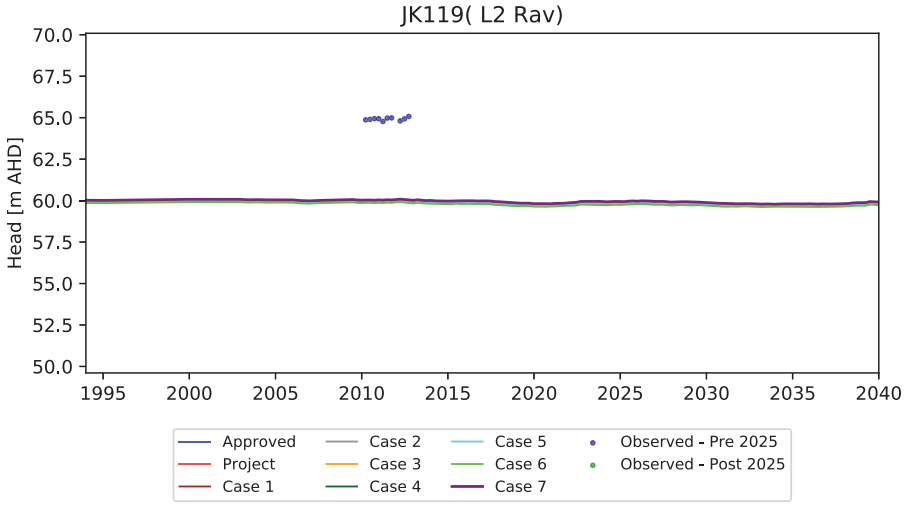

JK112(L2 Rav)
Head [m AHD]
72.5
70.0
67.5
65.0
62.5
60.0
57.5
55.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

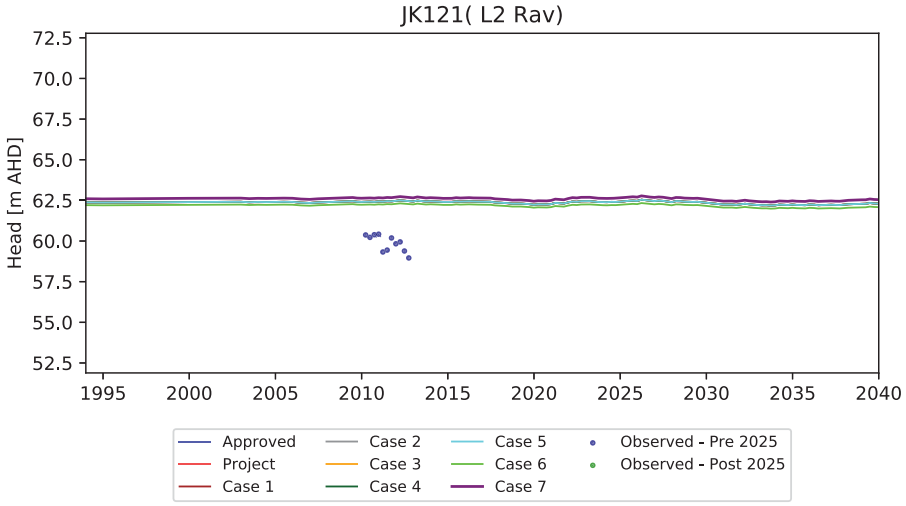

JK113(L2 Rav)
Head [m AHD]
72.5
70.0
67.5
65.0
62.5
60.0
57.5
55.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

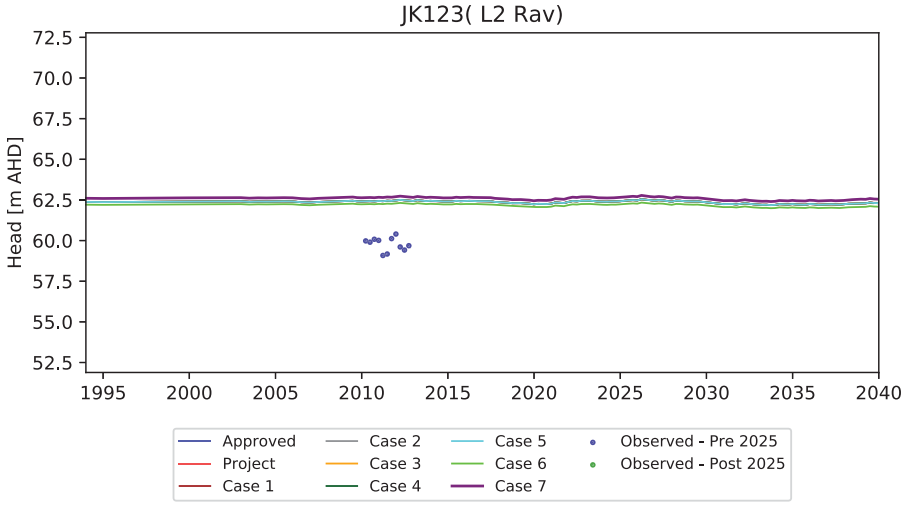

JK115(L2 Rav)
Head [m AHD]
72.5
70.0
67.5
65.0
62.5
60.0
57.5
55.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

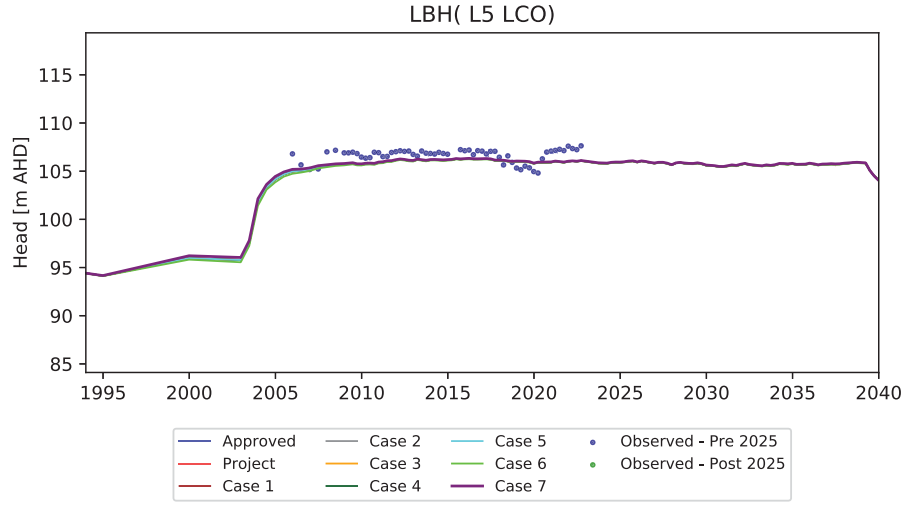

JK117(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

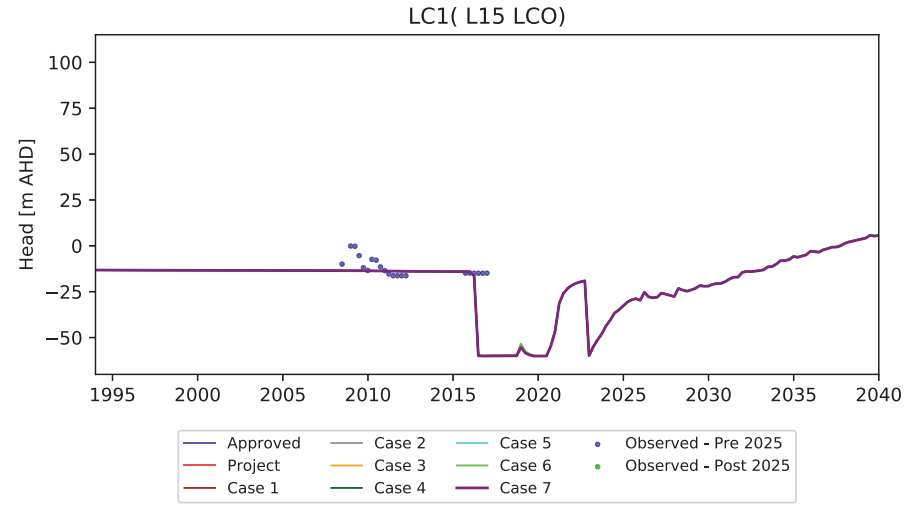

JK118(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

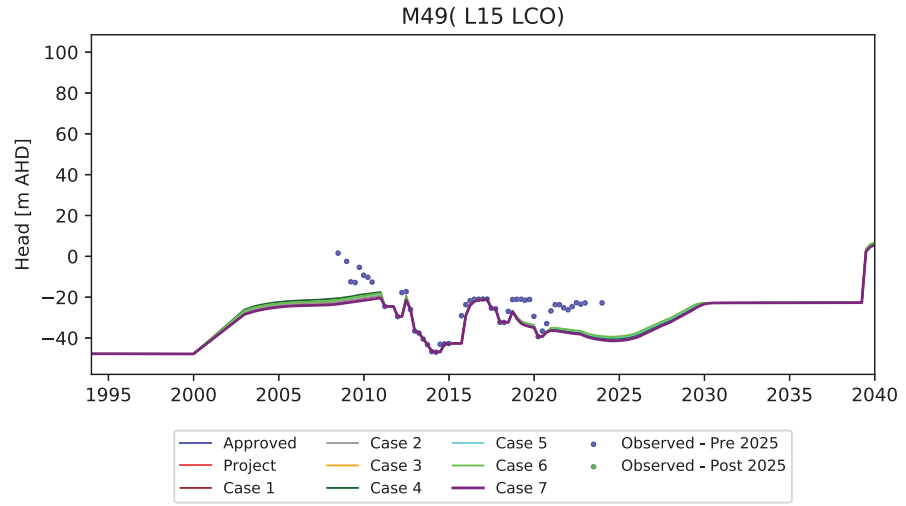

JK119(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

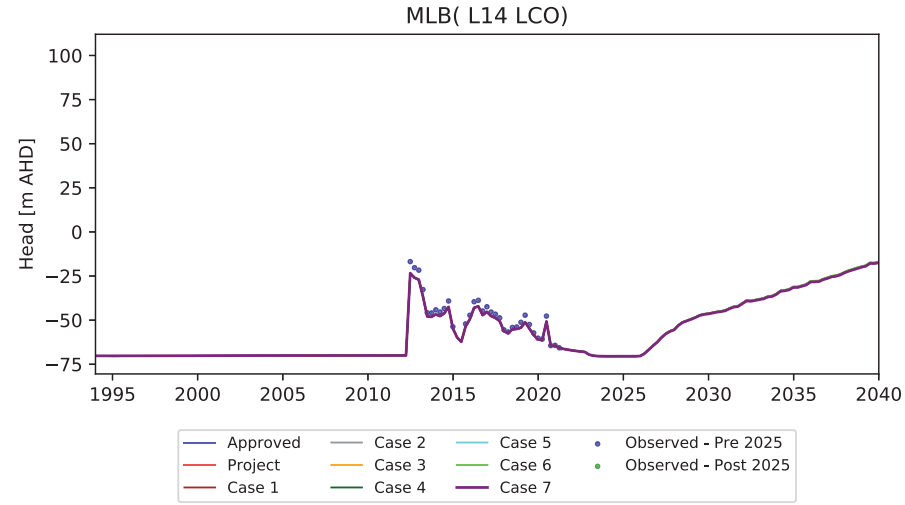

JK121(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

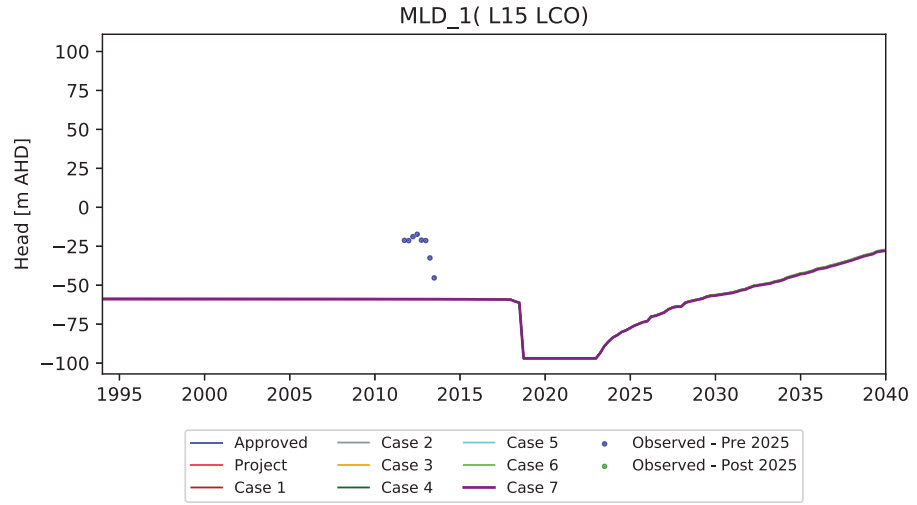

JK123(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

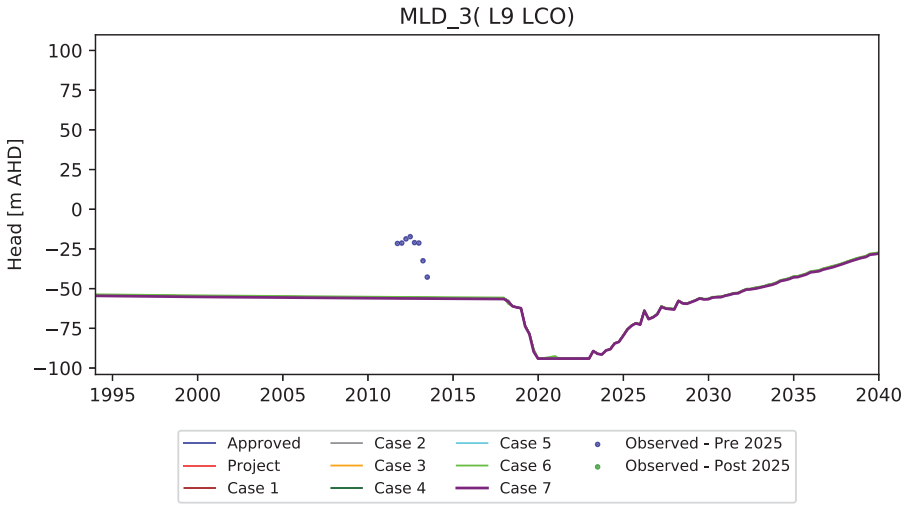

LBH(L5 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

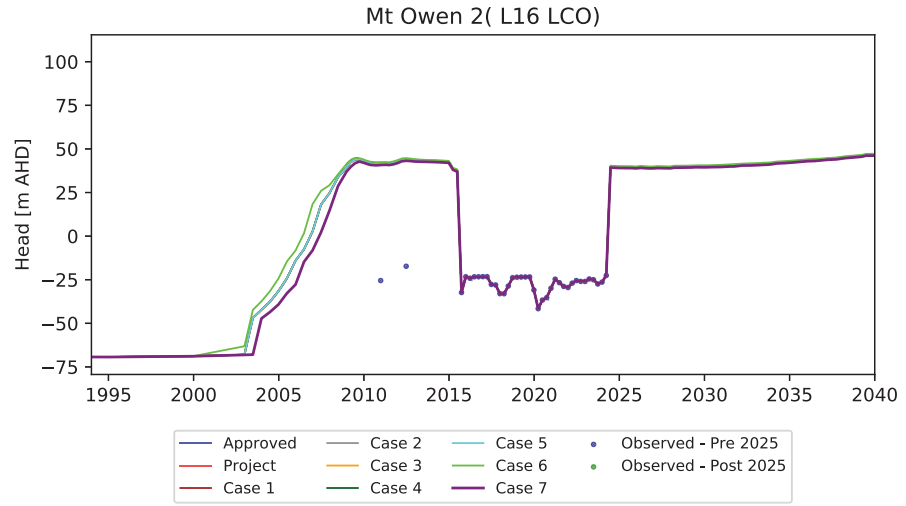

LC1(L15 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

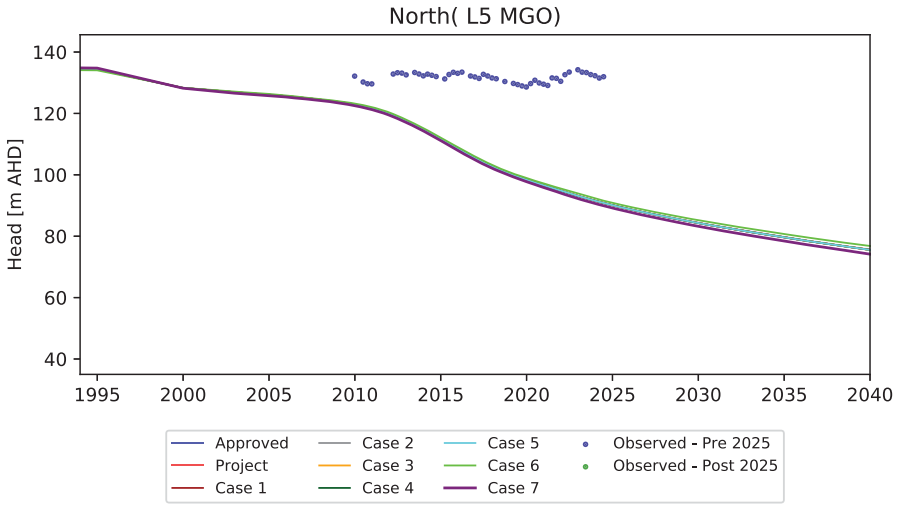

M49(L15 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

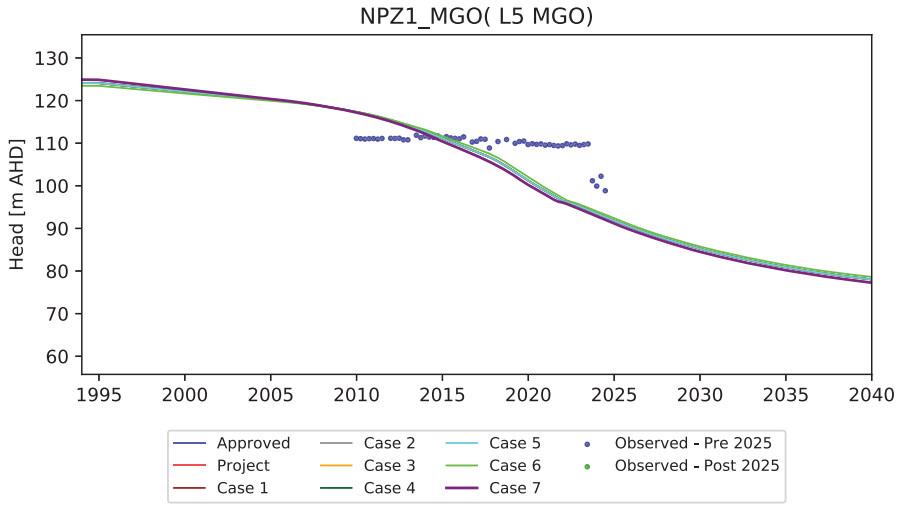

MLB(L14 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

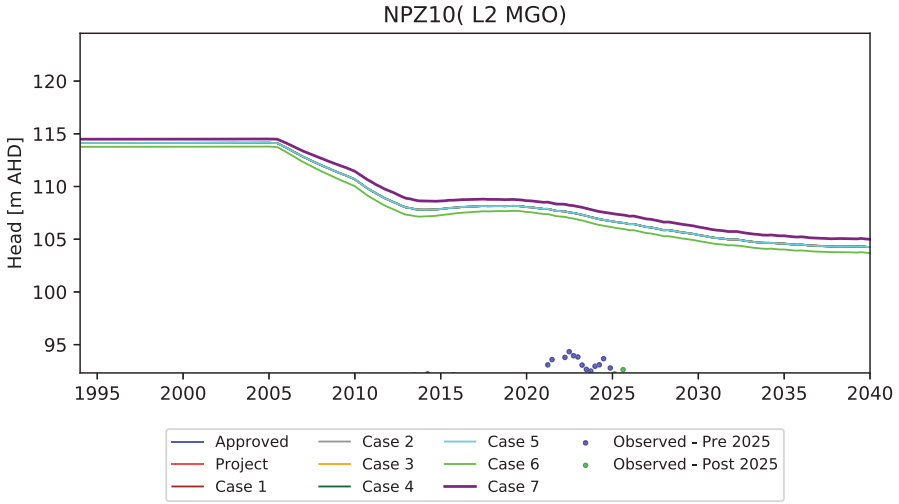

MLD_1(L15 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

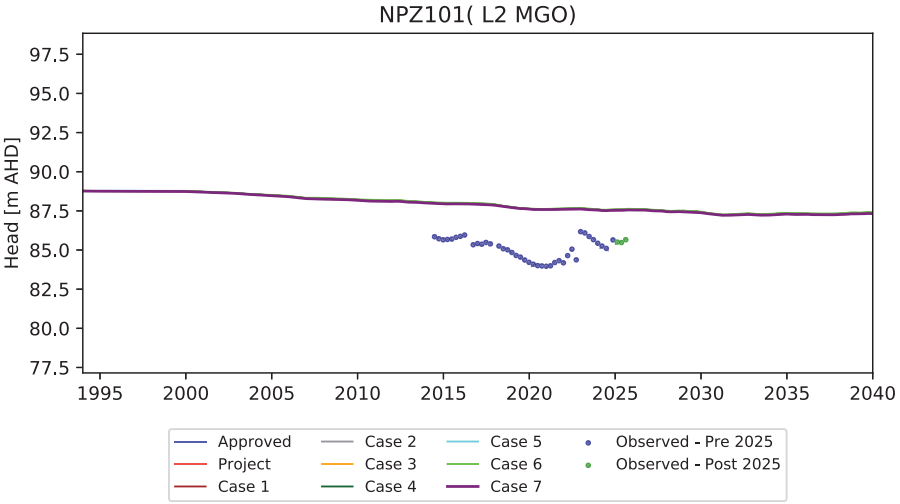

MLD_3(L9 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

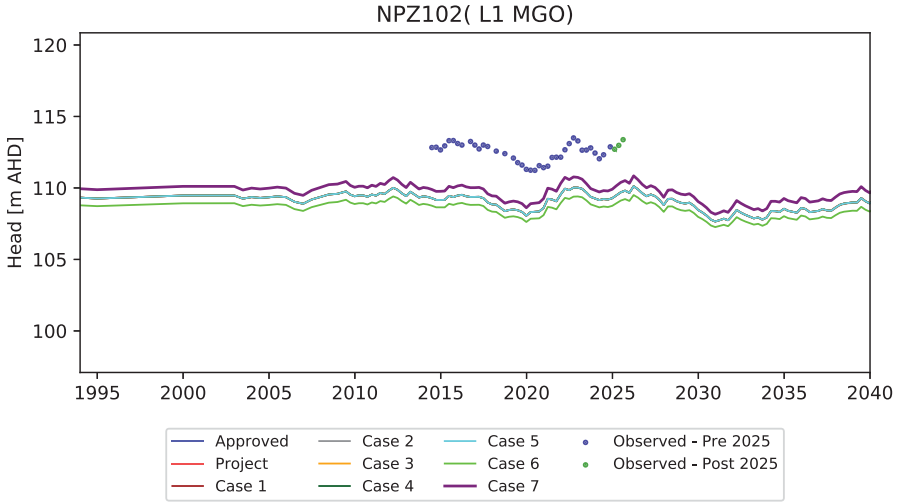

Mt Owen 2(L16 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

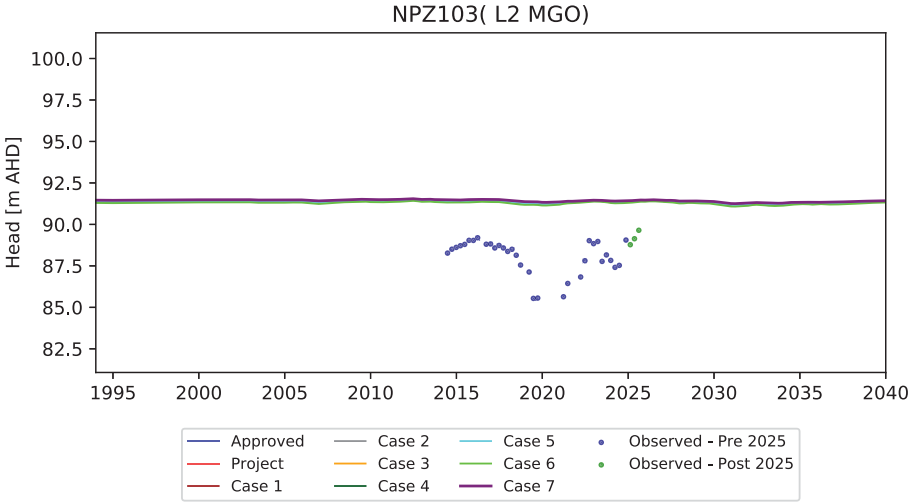

North(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

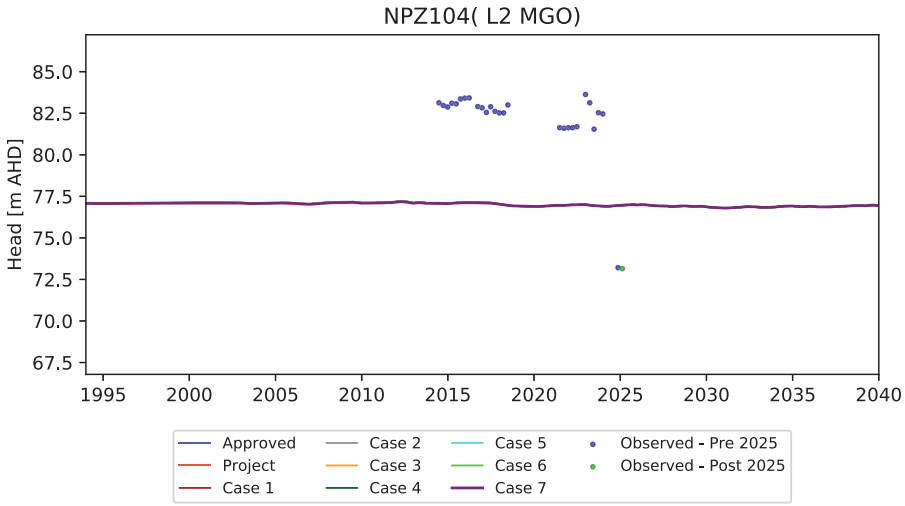

NPZ1_MGO(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

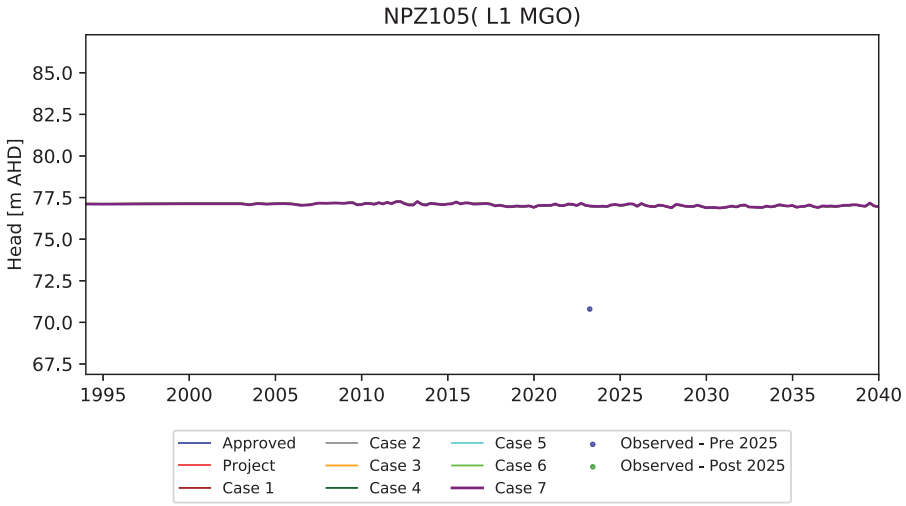

NPZ10(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

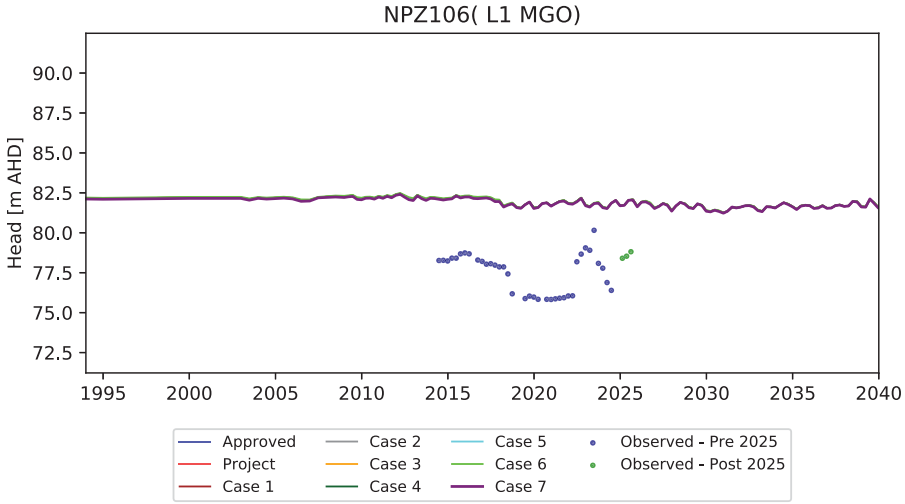

NPZ101(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

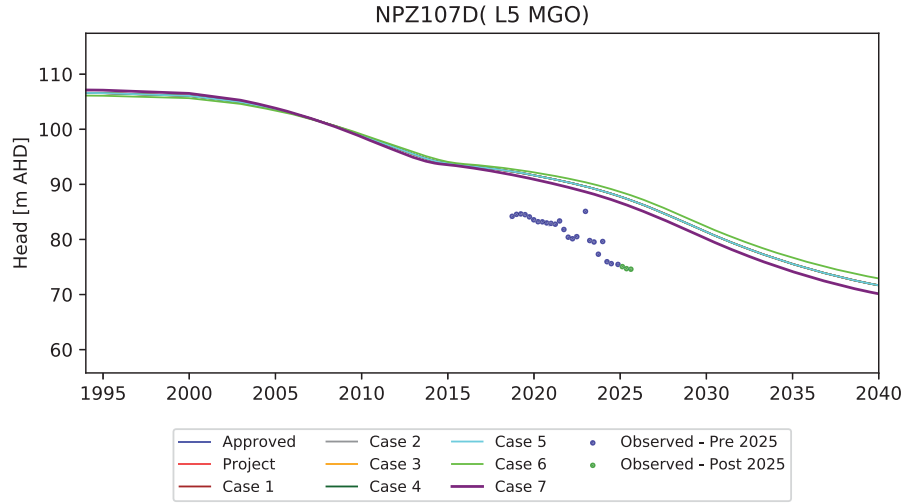

NPZ102(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

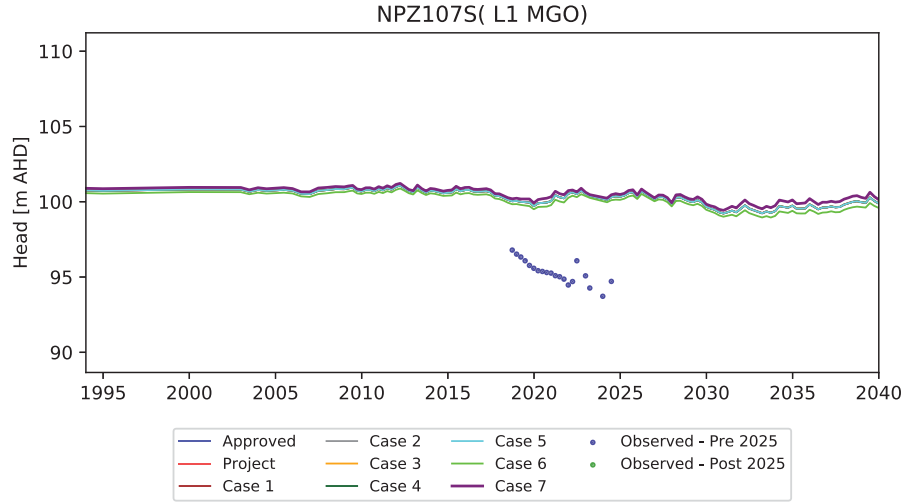

NPZ103(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

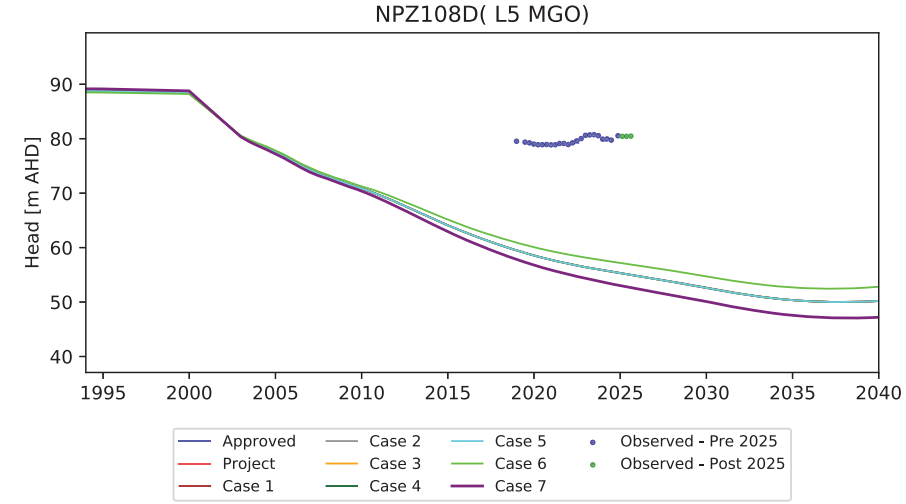

NPZ104(L2 MGO)
Head [m AHD]
85.0
82.5
80.0
77.5
75.0
72.5
70.0
67.5
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

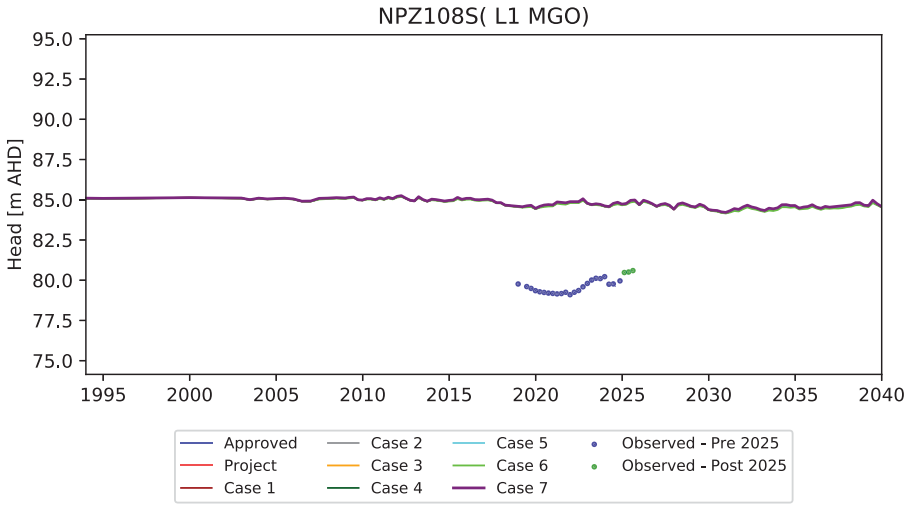

NPZ105(L1 MGO)
Head [m AHD]
85.0
82.5
80.0
77.5
75.0
72.5
70.0
67.5
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

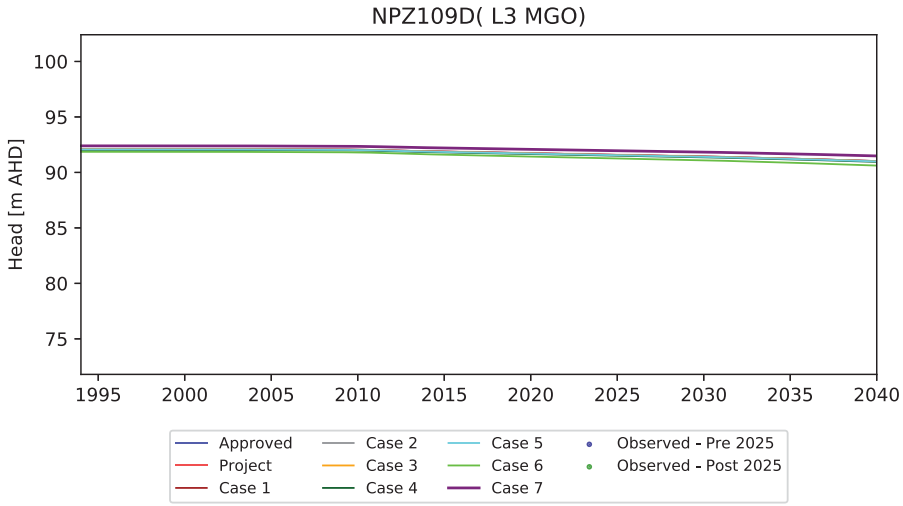

NPZ106(L1 MGO)
Head [m AHD]
90.0
87.5
85.0
82.5
80.0
77.5
75.0
72.5
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

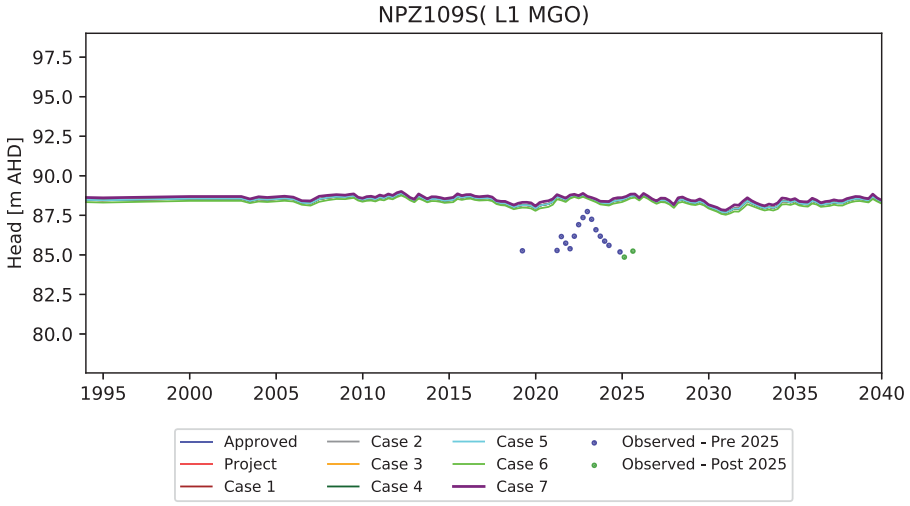

NPZ107D(L5 MGO)
Head [m AHD]
110
100
90
80
70
60
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

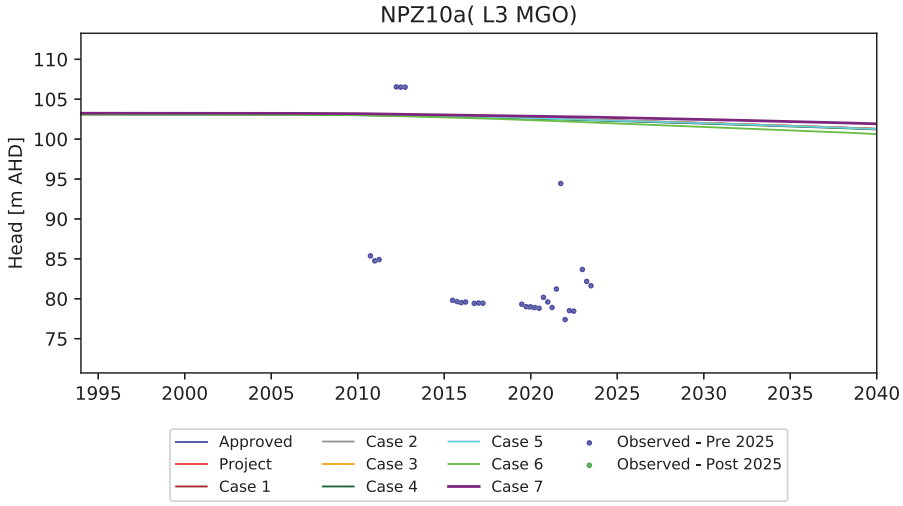

NPZ107S(L1 MGO)
Head [m AHD]
110
105
100
95
90
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

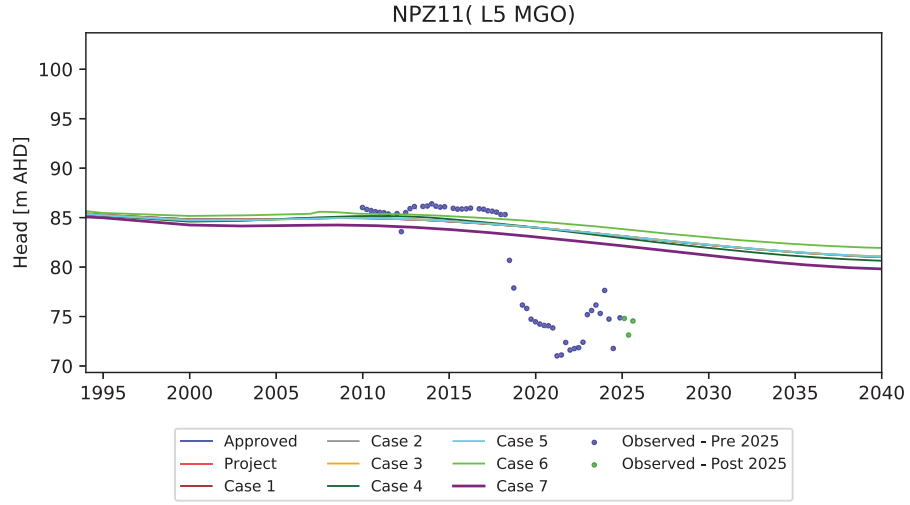

NPZ108D(L5 MGO)
Head [m AHD]
90
80
70
60
50
40
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

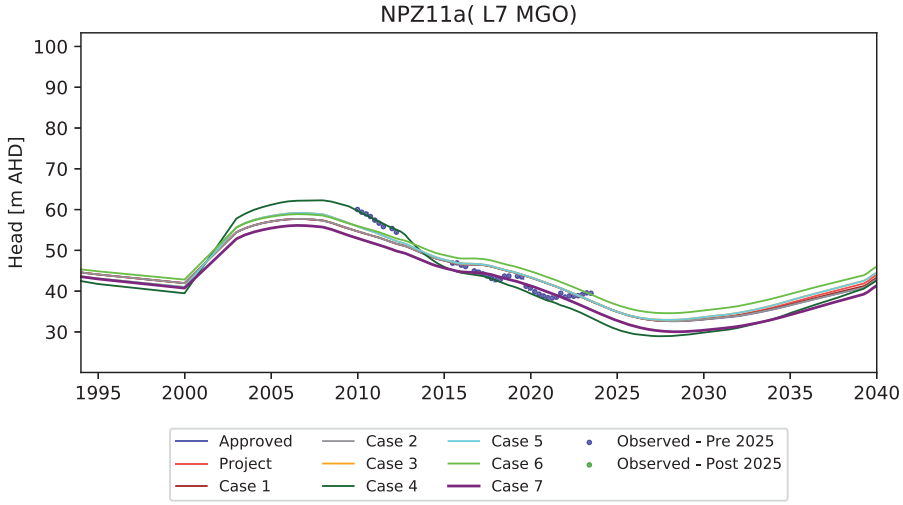

NPZ108S(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

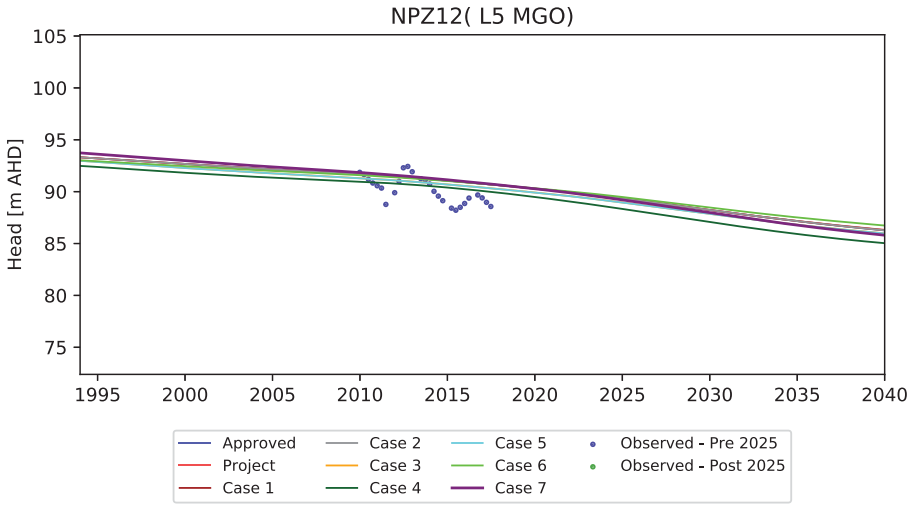

NPZ109D(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

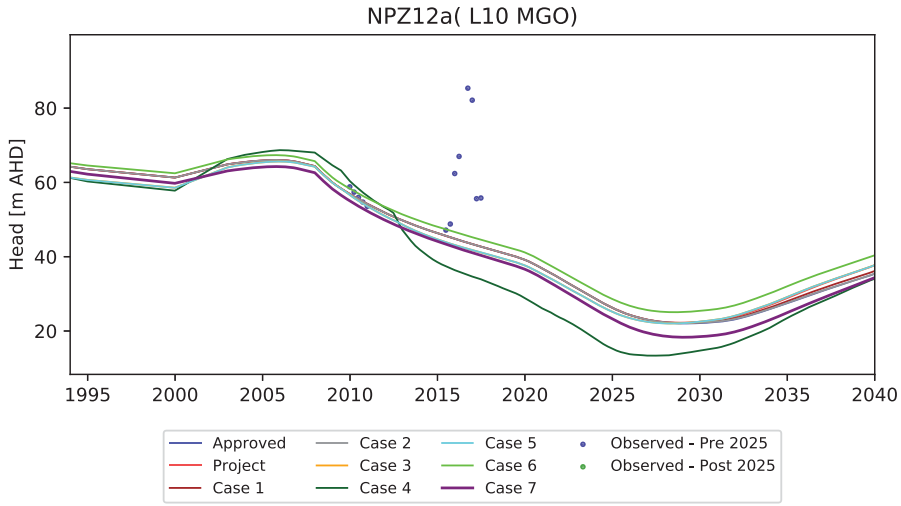

NPZ109S(L1 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

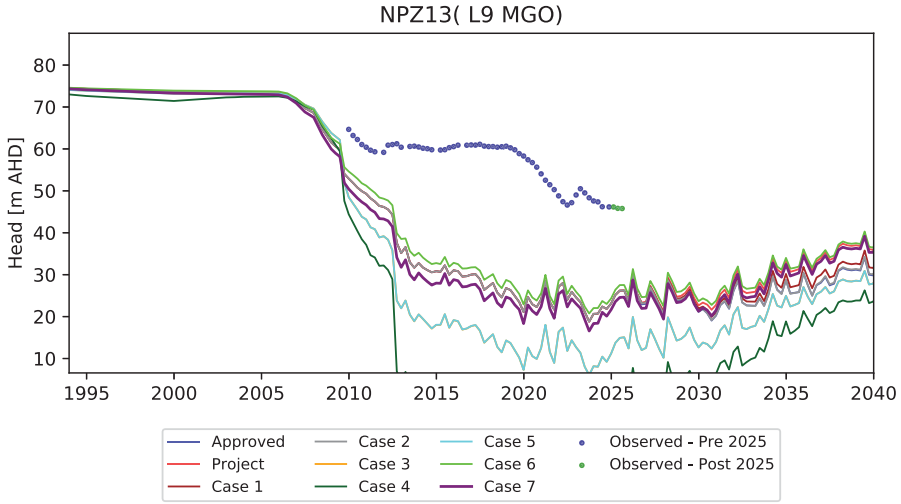

NPZ10a(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

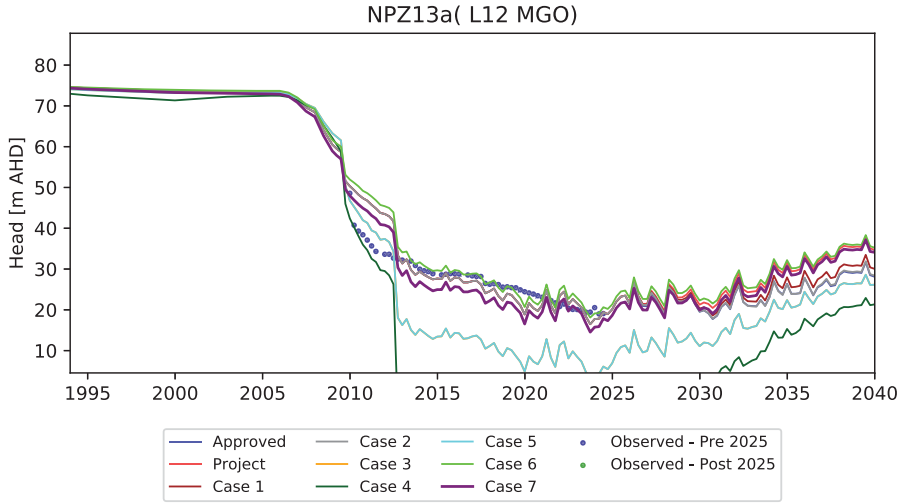

NPZ11(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

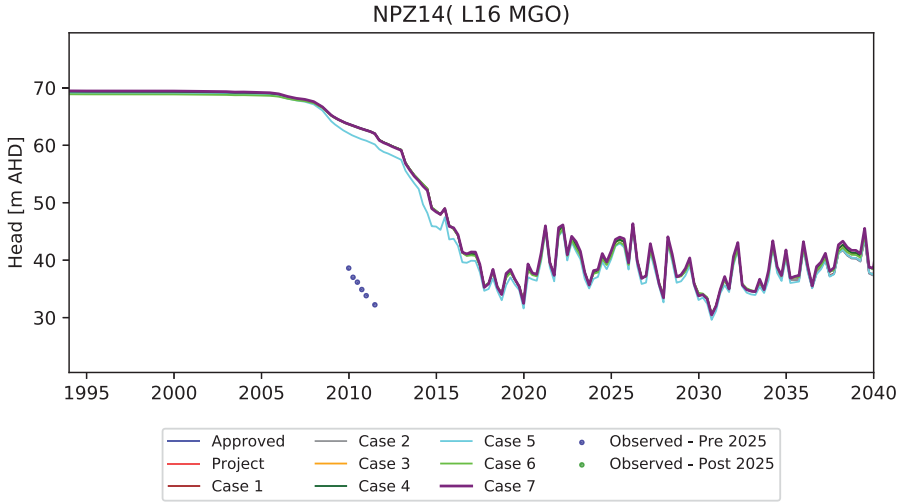

NPZ11a(L7 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

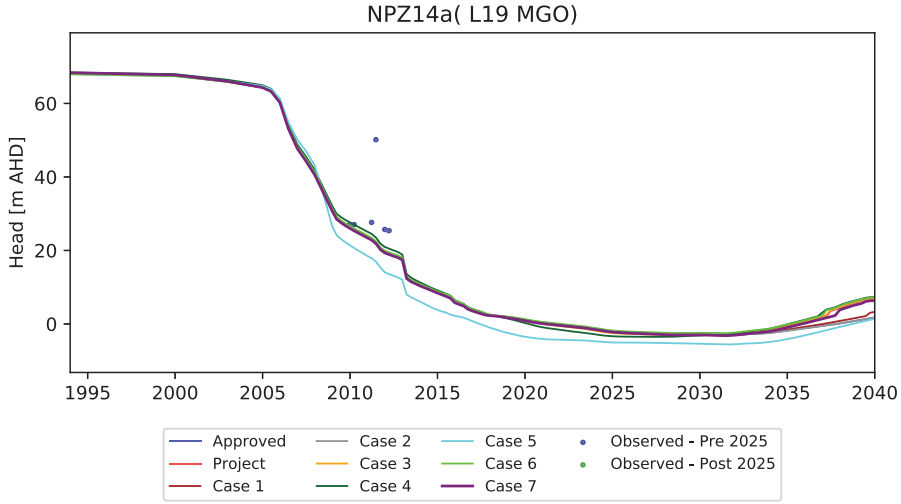

NPZ12(L5 MGO)
Head [m AHD]
105
100
95
90
85
80
75
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

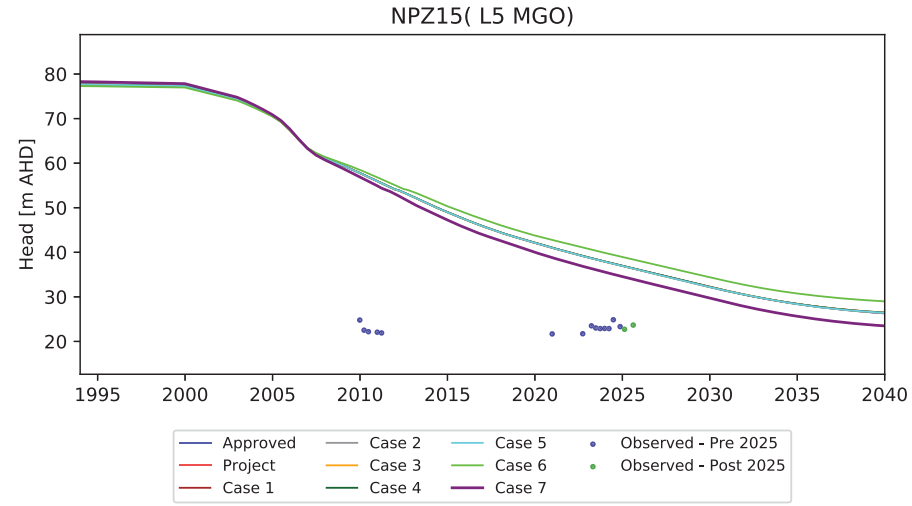

NPZ12a(L10 MGO)
Head [m AHD]
80
60
40
20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

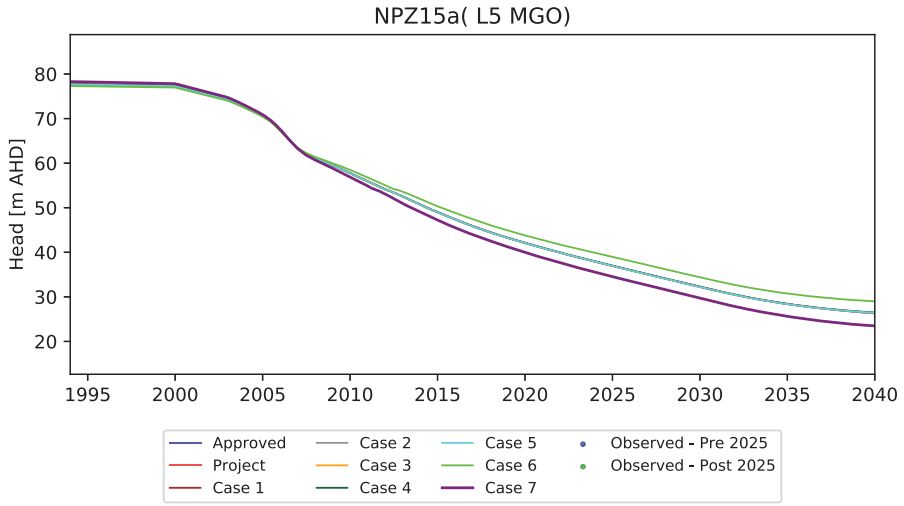

NPZ13(L9 MGO)
Head [m AHD]
80
70
60
50
40
30
20
10
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

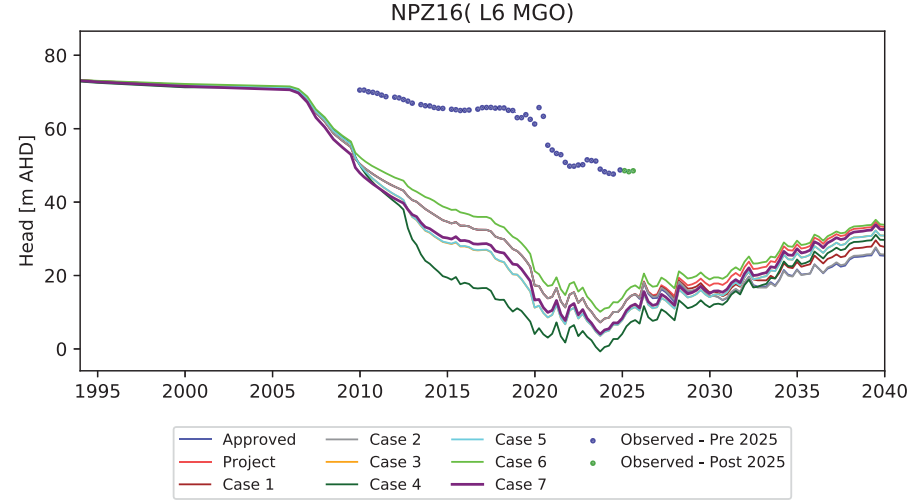

NPZ13a(L12 MGO)
Head [m AHD]
80
70
60
50
40
30
20
10
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

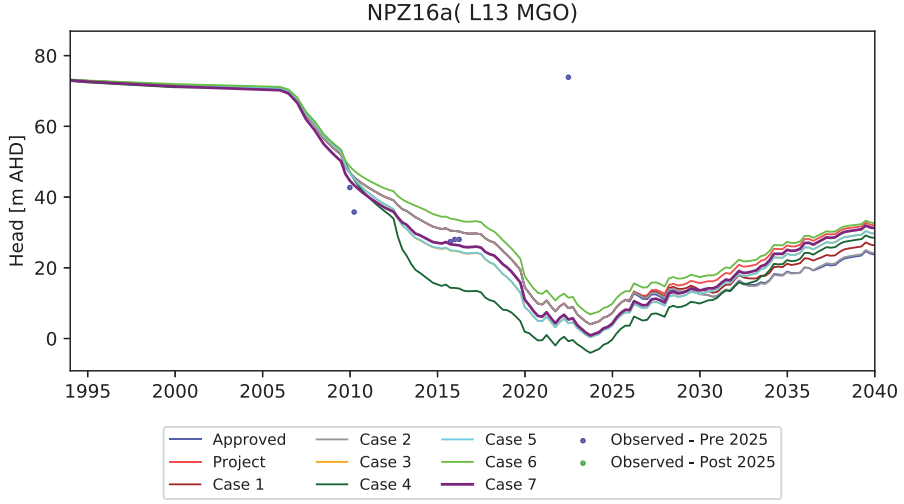

NPZ14(L16 MGO)
Head [m AHD]
70
60
50
40
30
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

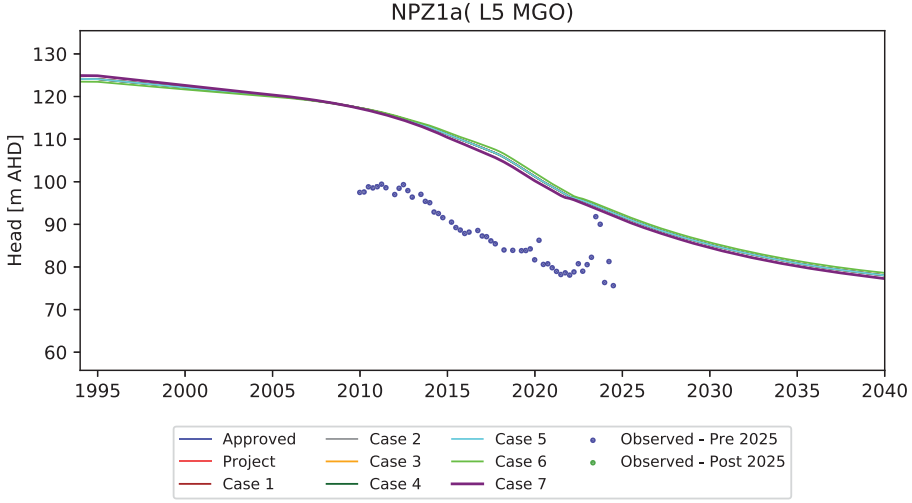

NPZ14a(L19 MGO)
Head [m AHD]
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

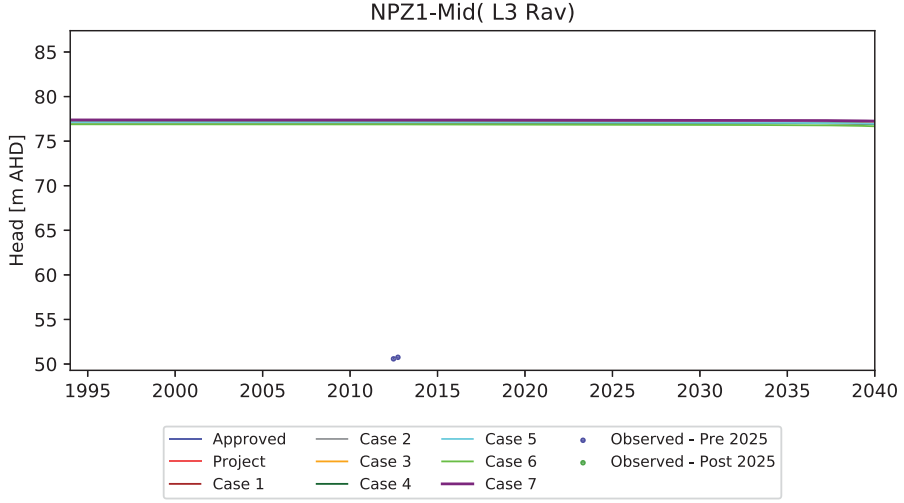

NPZ15(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

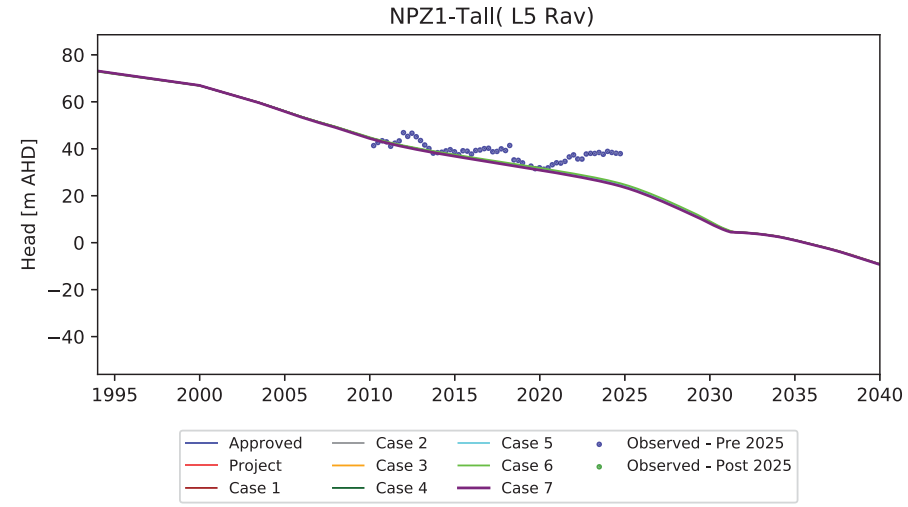

NPZ15a(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

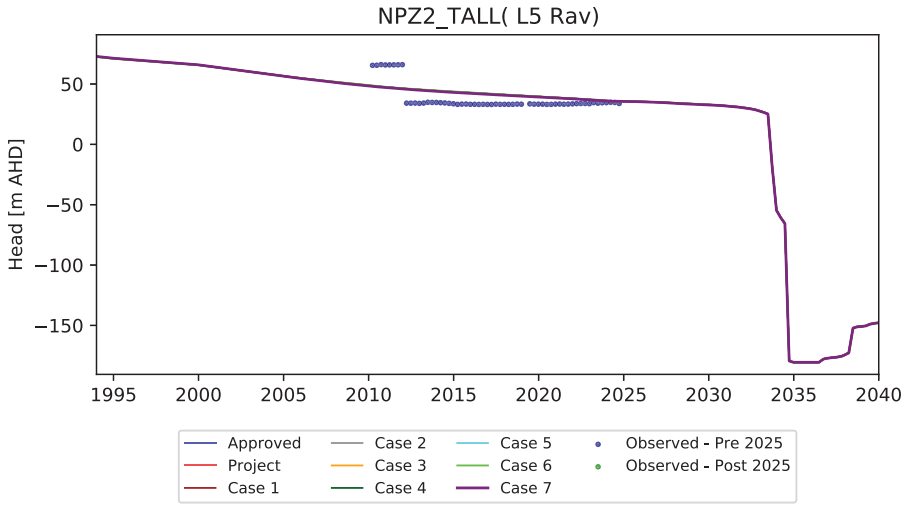

NPZ16(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

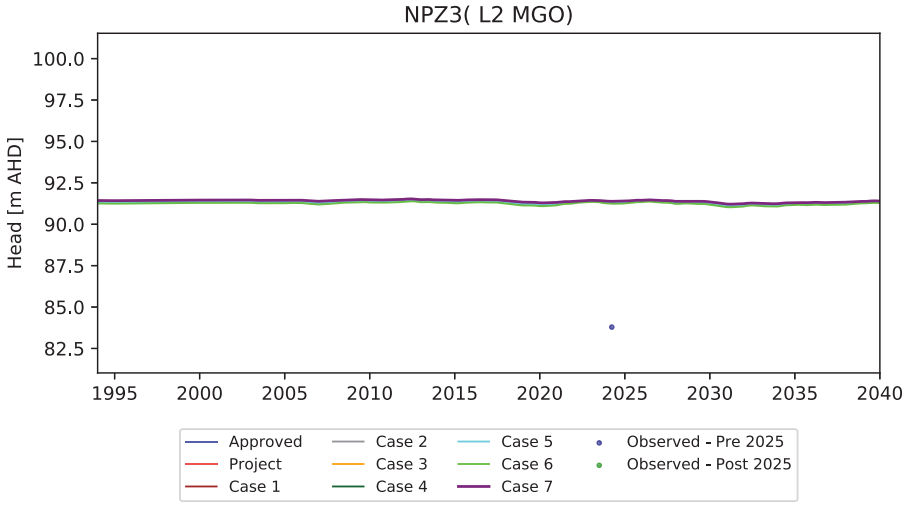

NPZ16a(L13 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

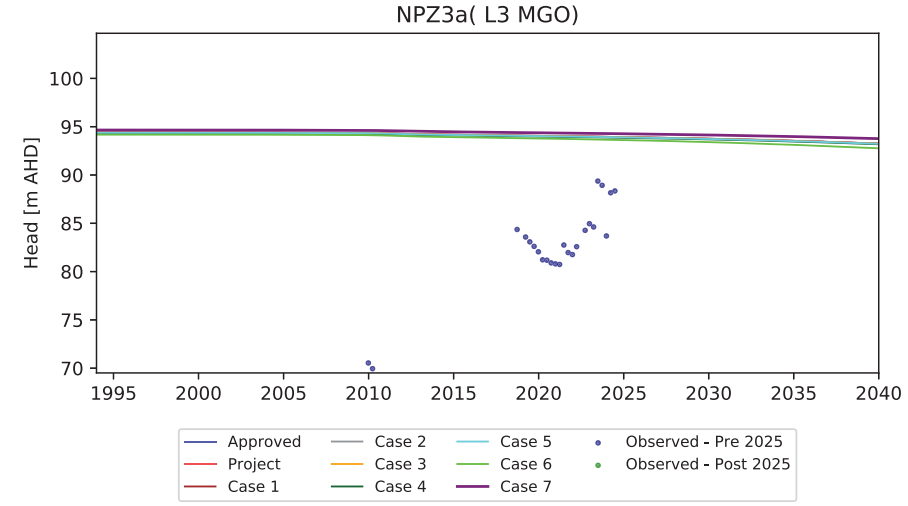

NPZ1a(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

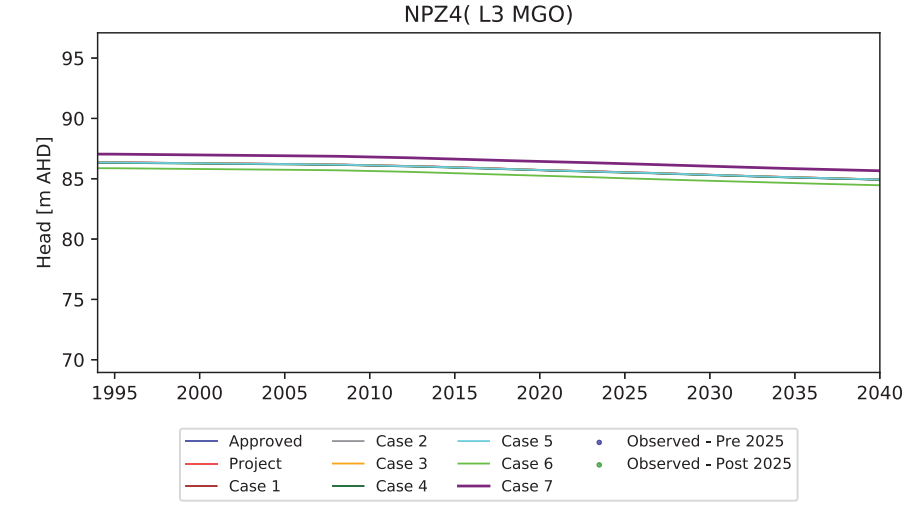

NPZ1-Mid(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

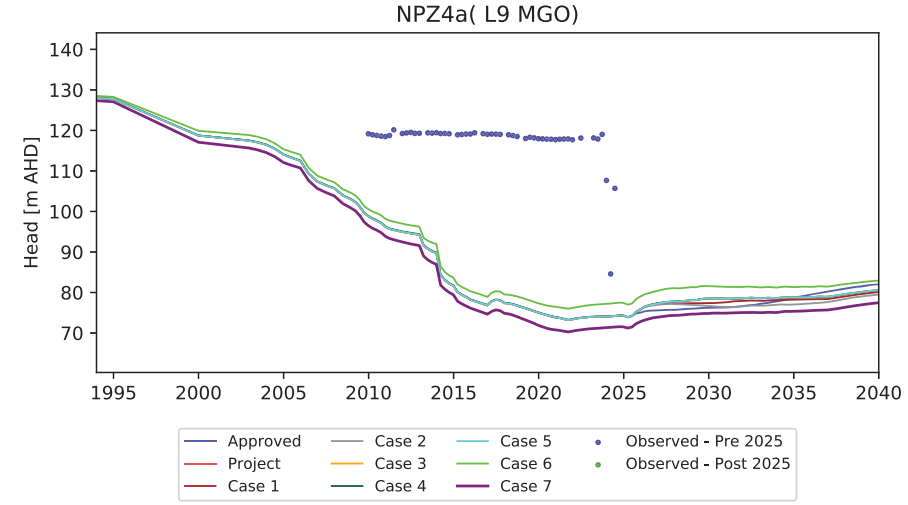

NPZ1-Tall(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

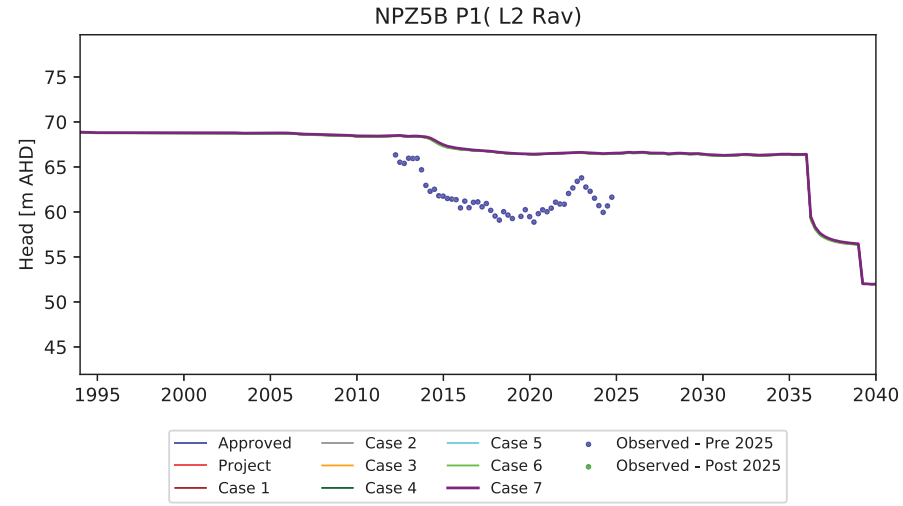

NPZ2_TALL(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

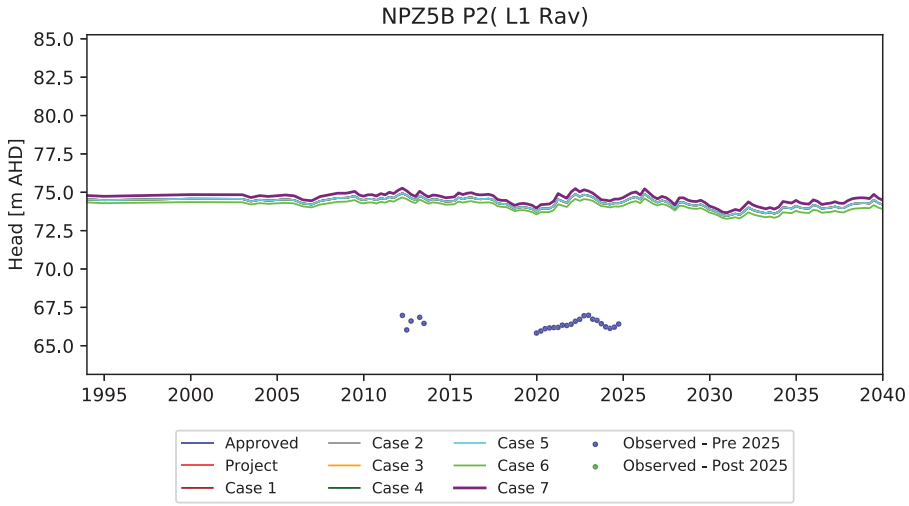

NPZ3(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

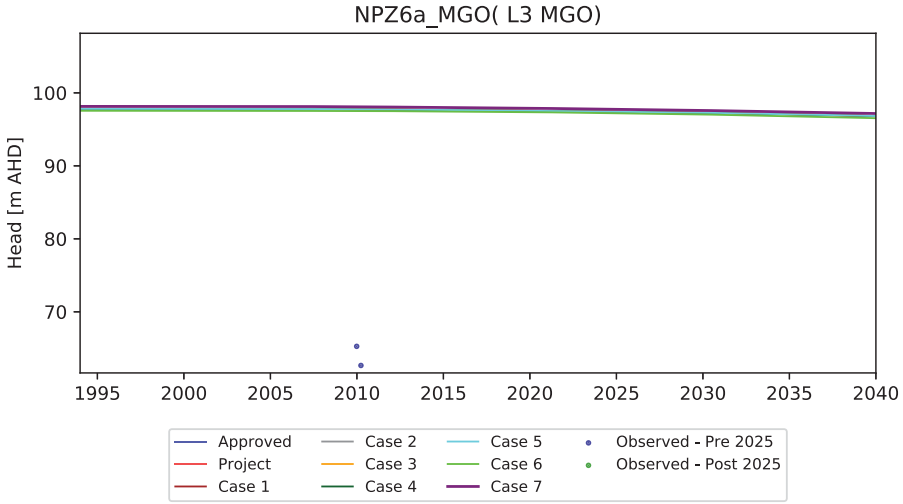

NPZ3a(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

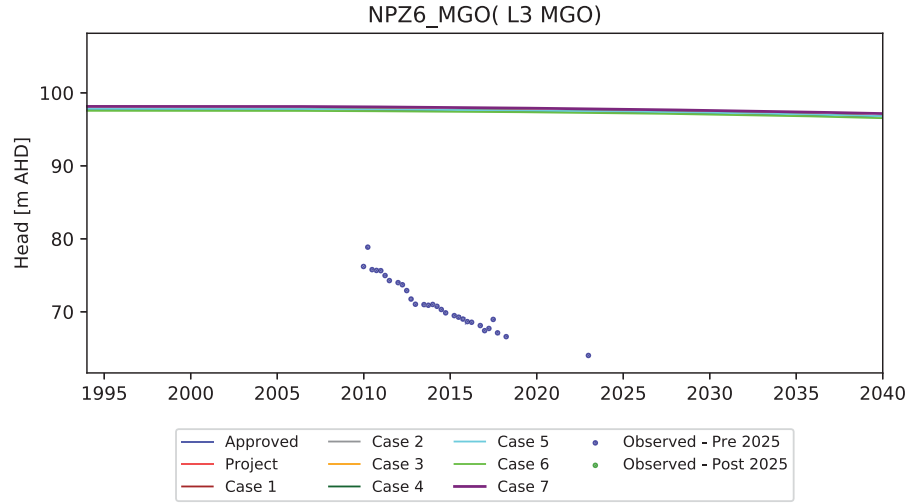

NPZ4(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

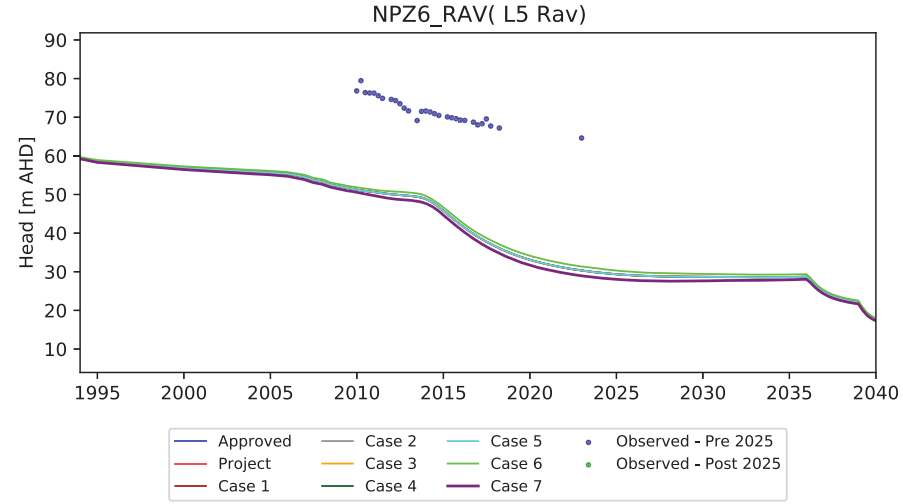

NPZ4a(L9 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

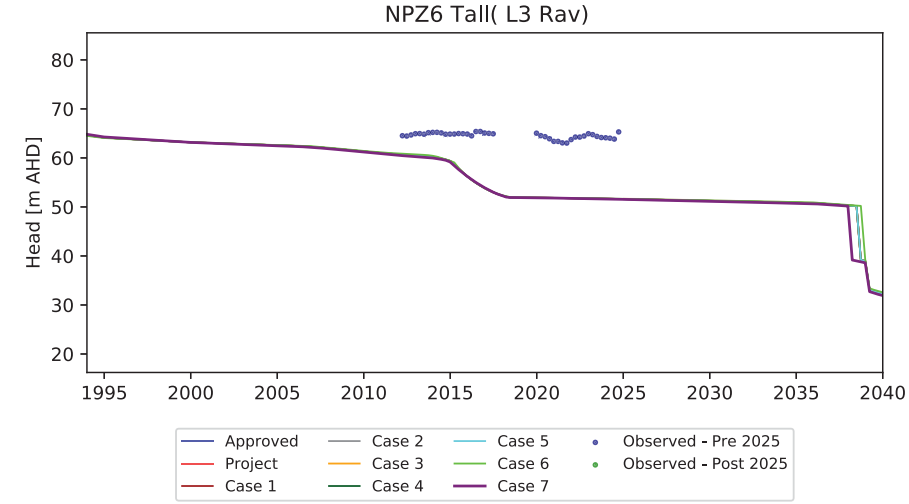

NPZ5B P1(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

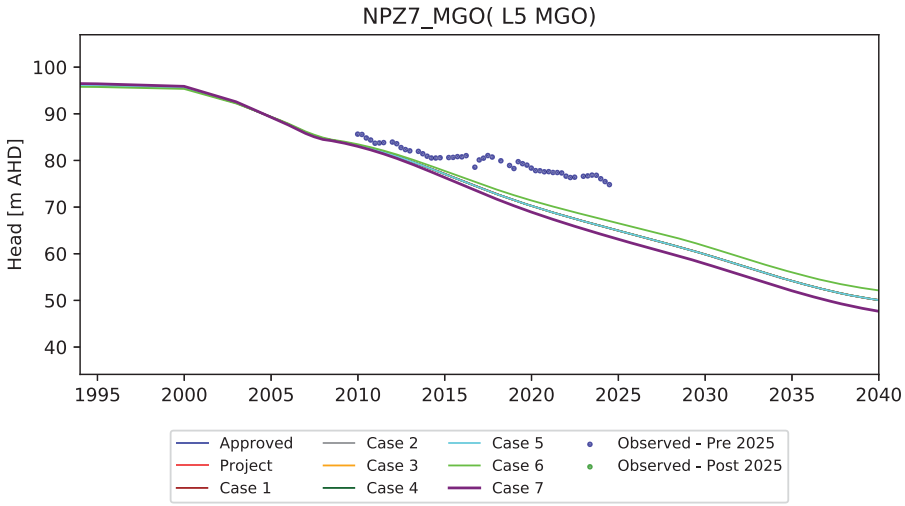

NPZ5B P2(L1 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

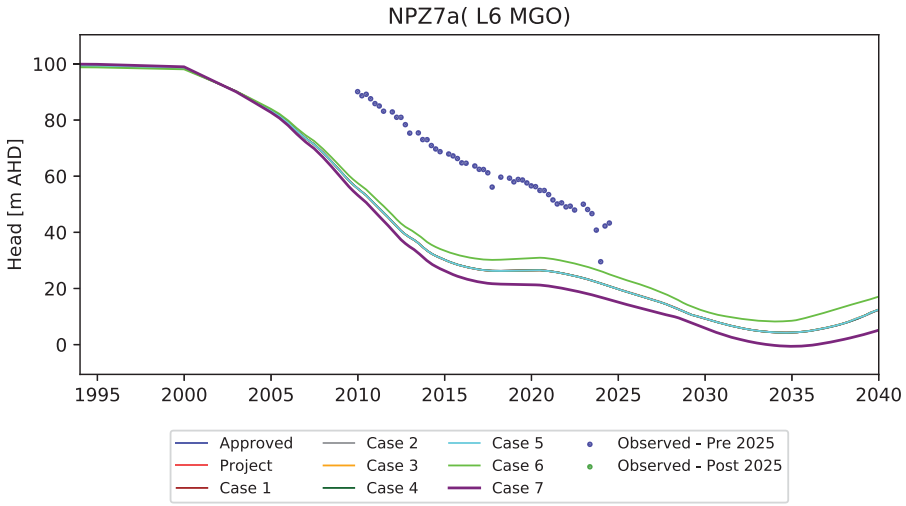

NPZ6a_MGO(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

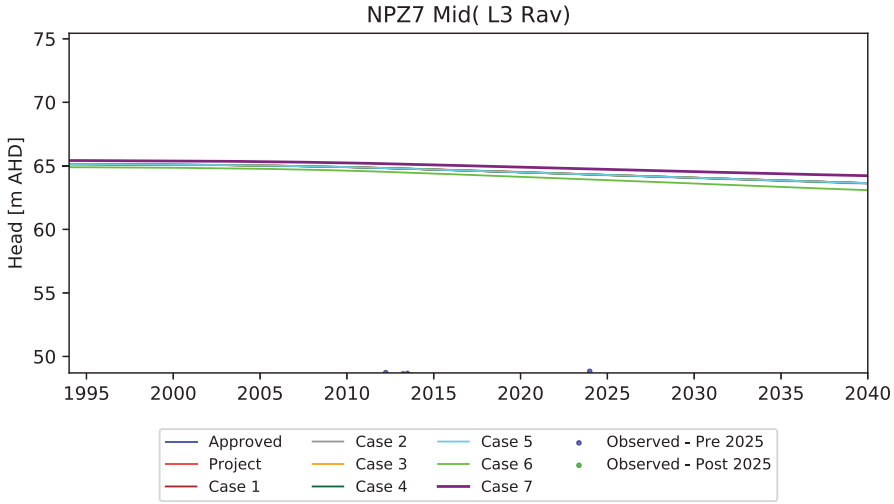

NPZ6_MGO(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

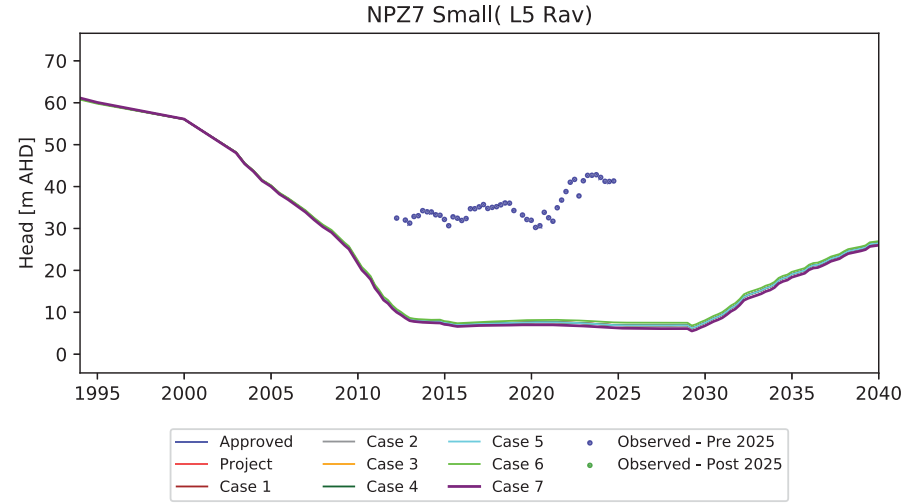

NPZ6_RAV(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

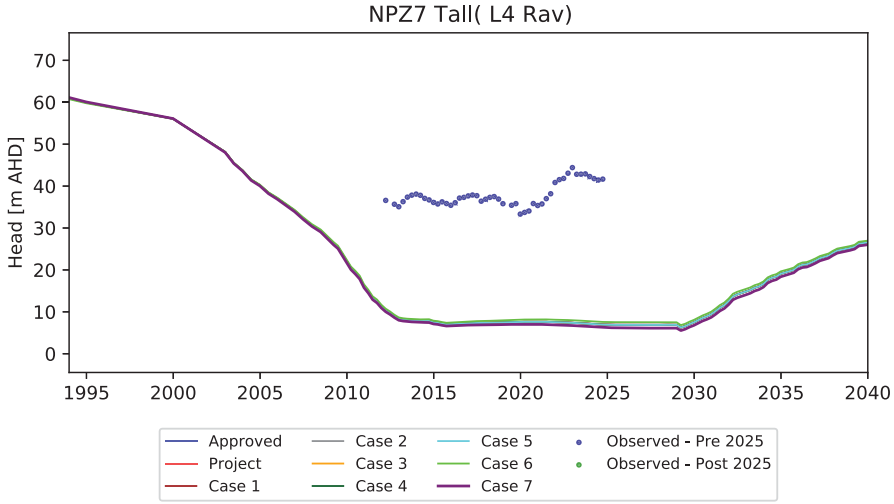

NPZ6 Tall(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

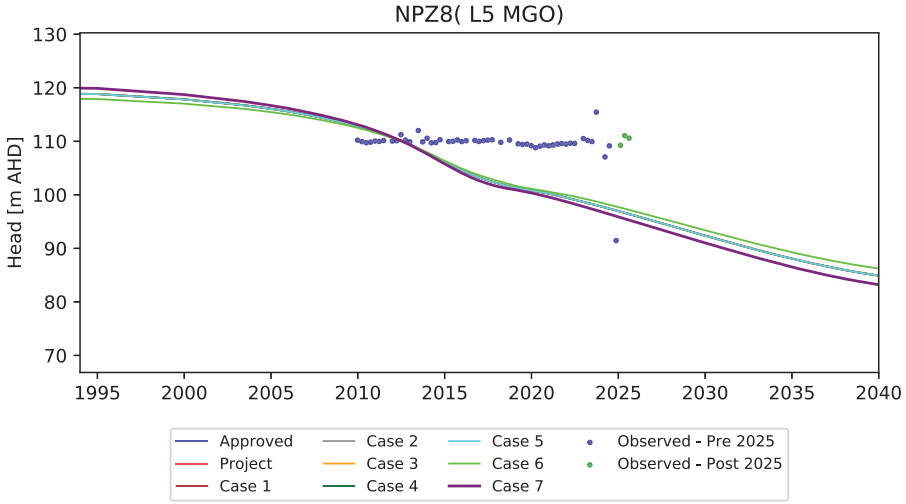

NPZ7_MGO(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

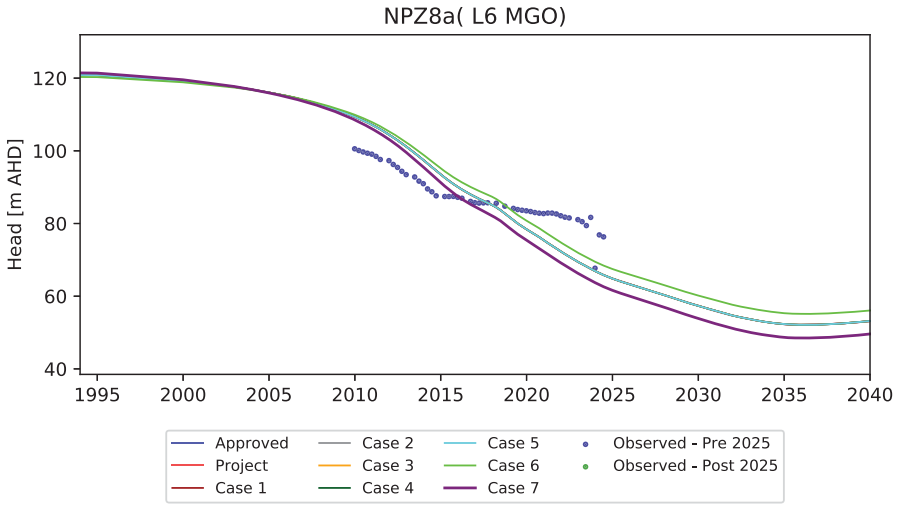

NPZ7a(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

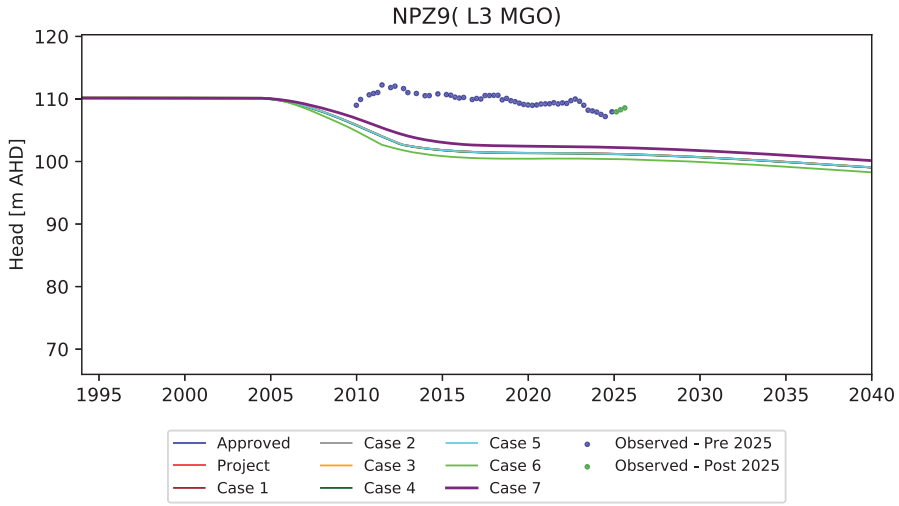

NPZ7 Mid(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

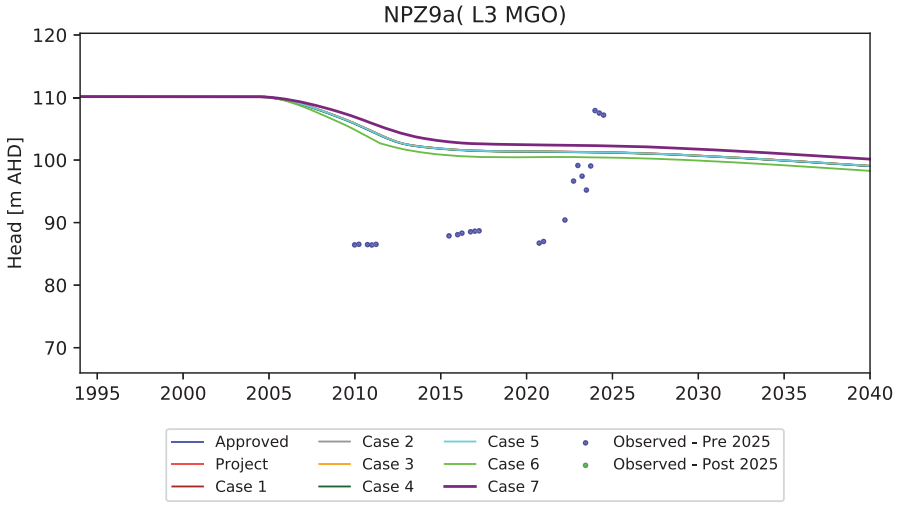

NPZ7 Small(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

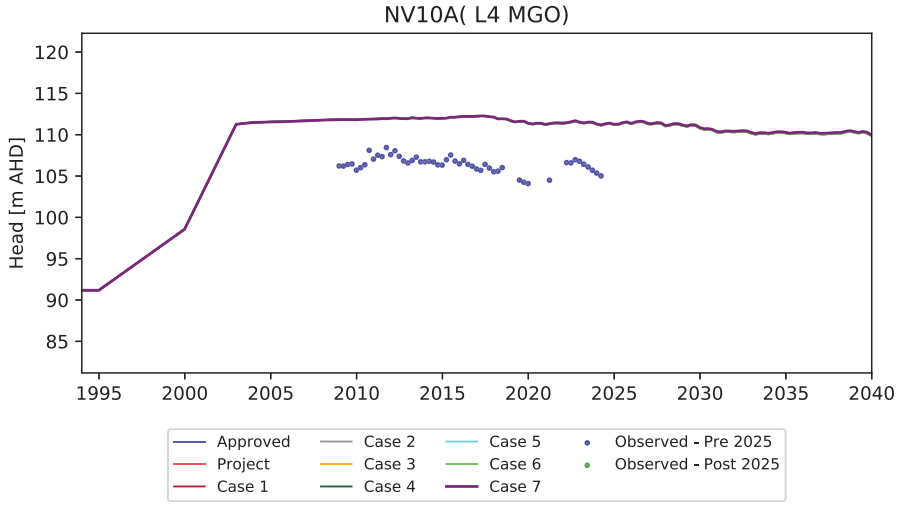

NPZ7 Tall(L4 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

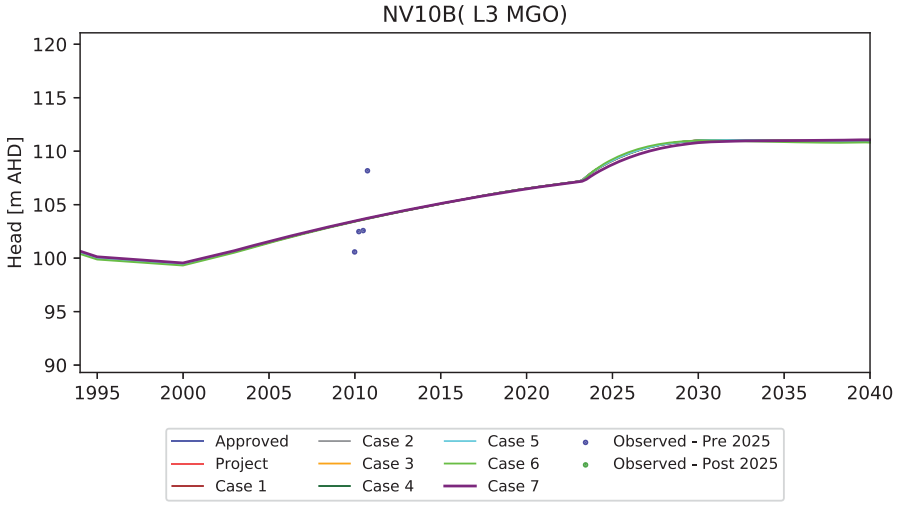

NPZ8(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

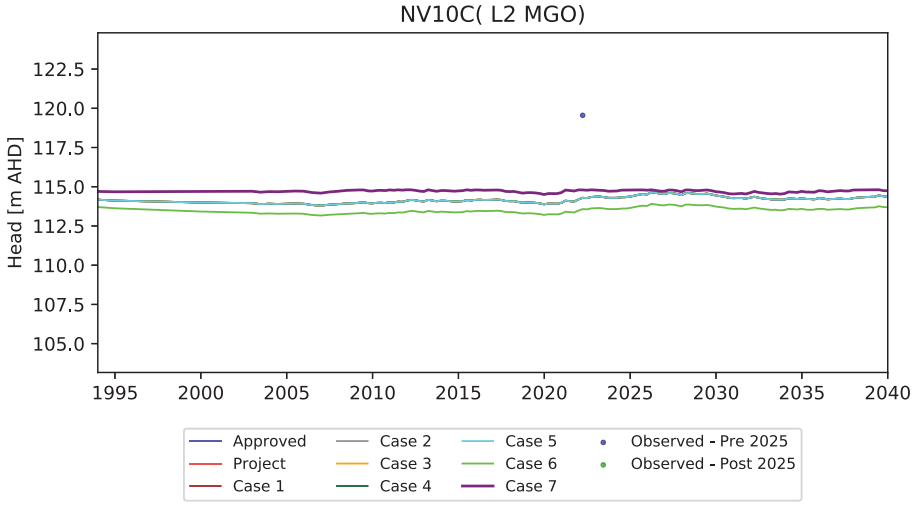

NPZ8a(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

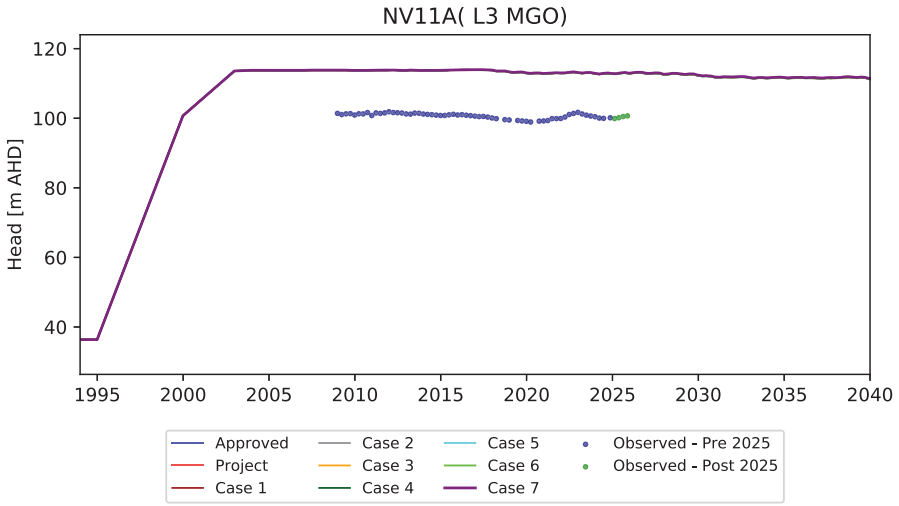

NPZ9(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

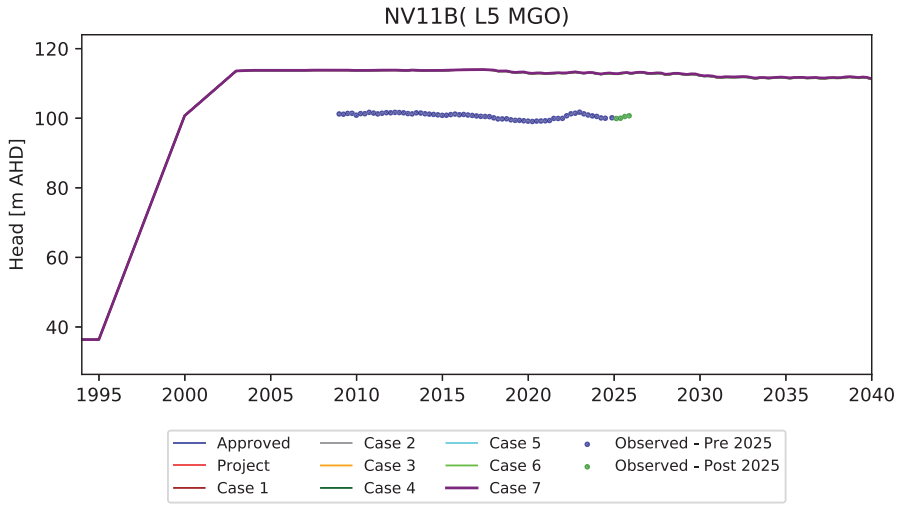

NPZ9a(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

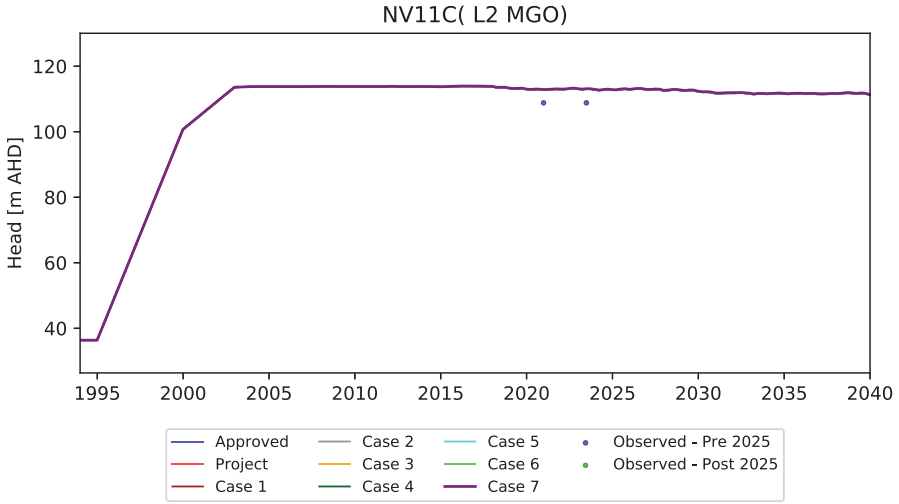

NV10A(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

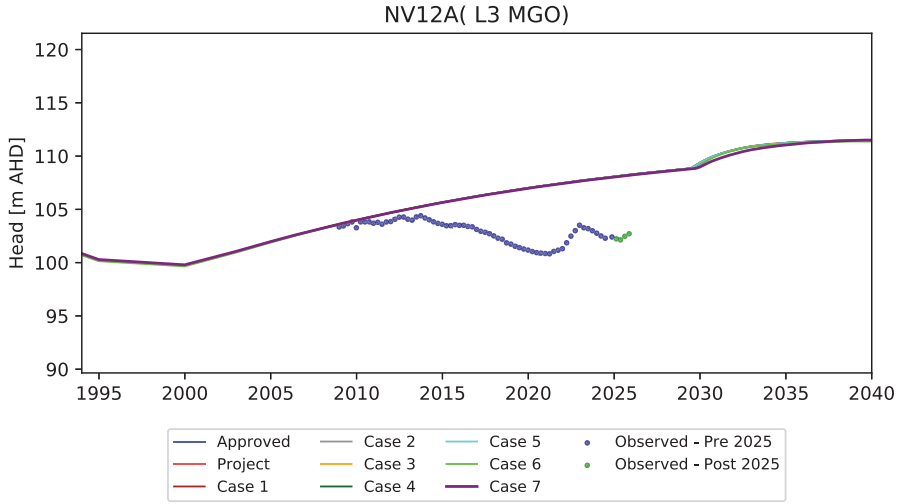

NV10B(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

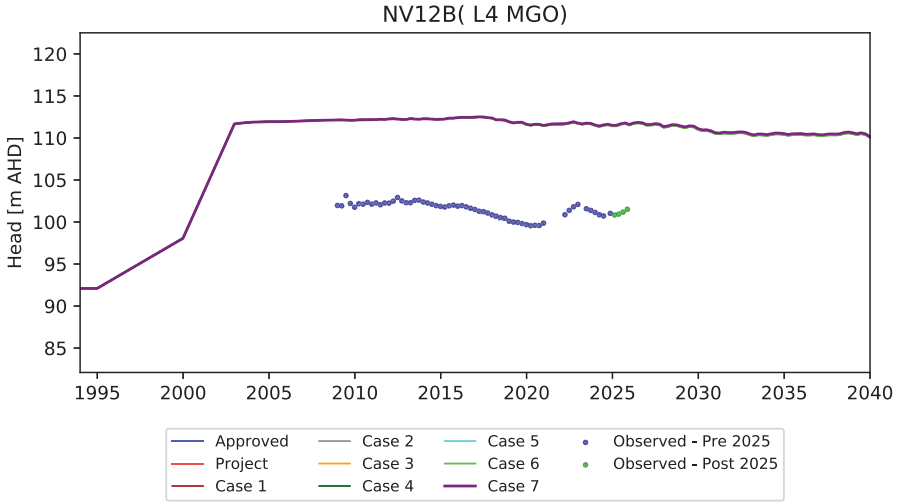

NV10C(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

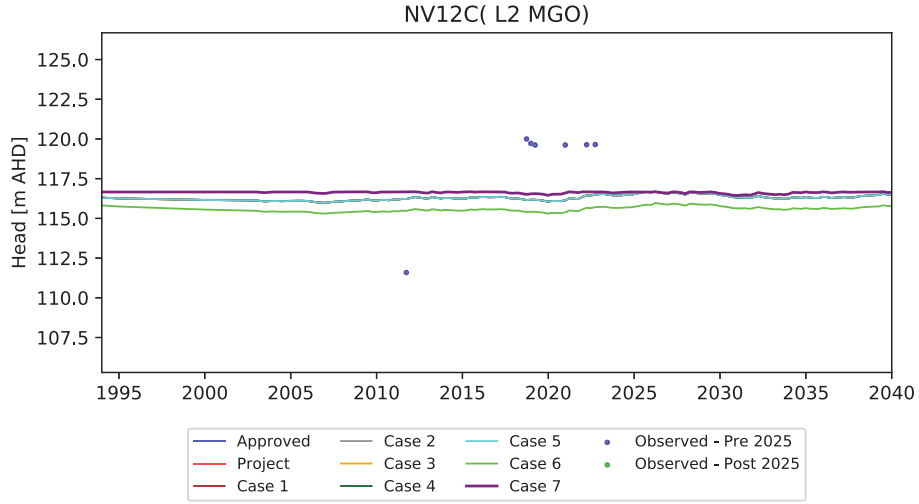

NV11A(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

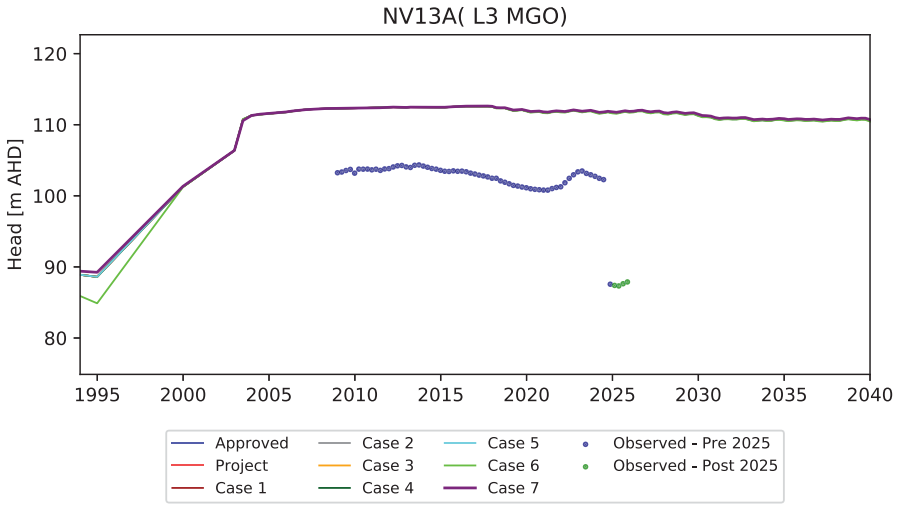

NV11B(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

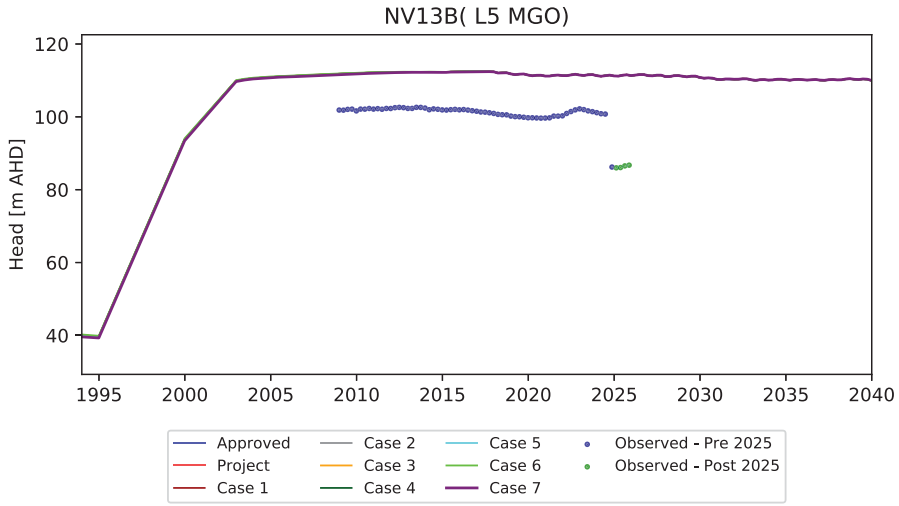

NV11C(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

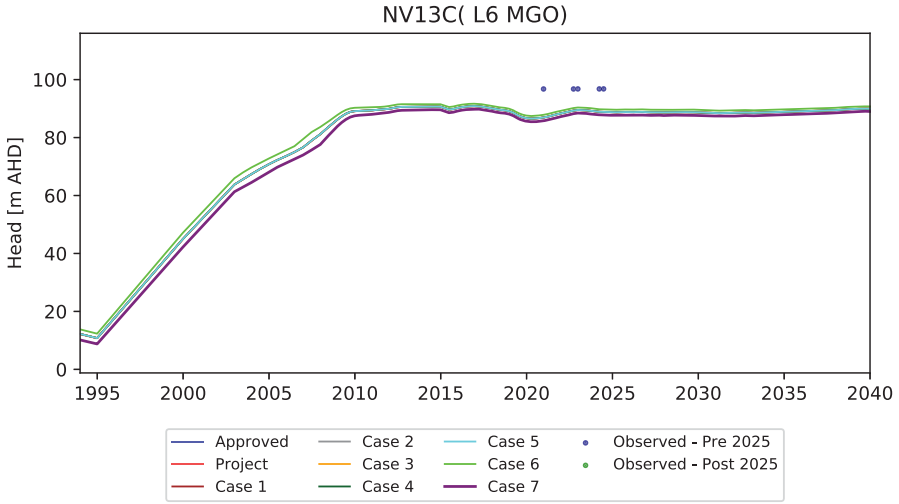

NV12A(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

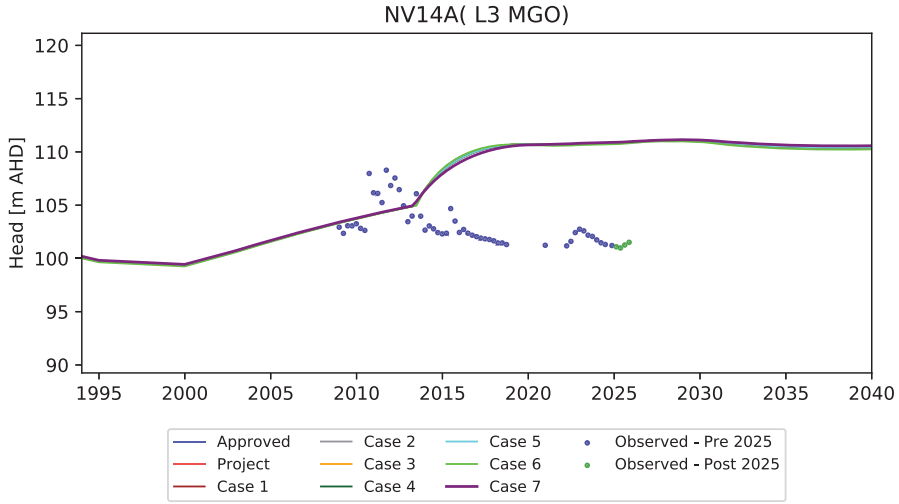

NV12B(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

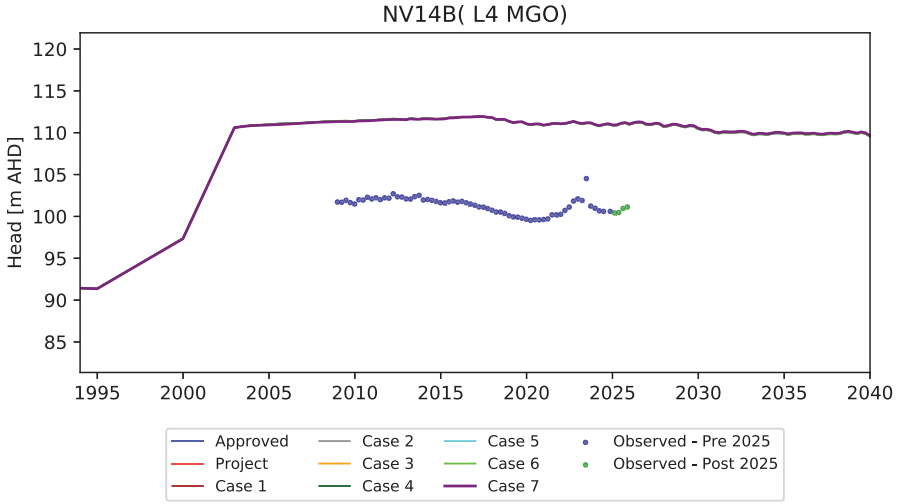

NV12C(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

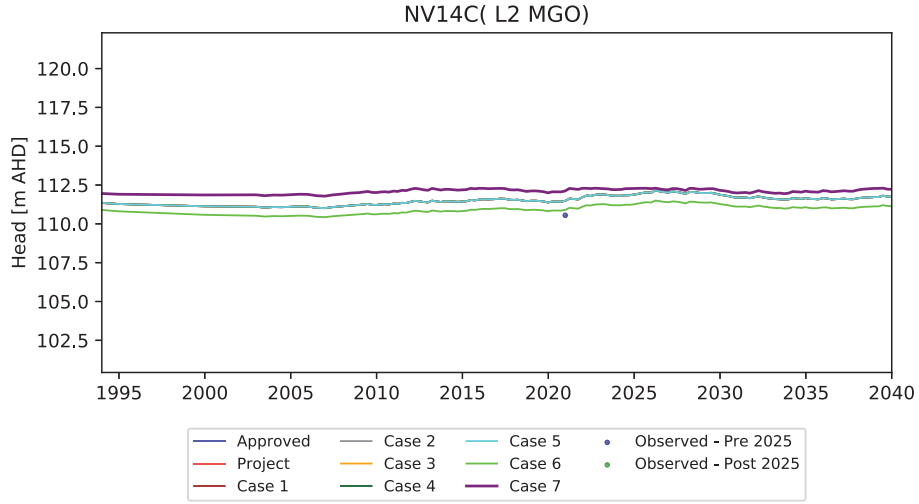

NV13A(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

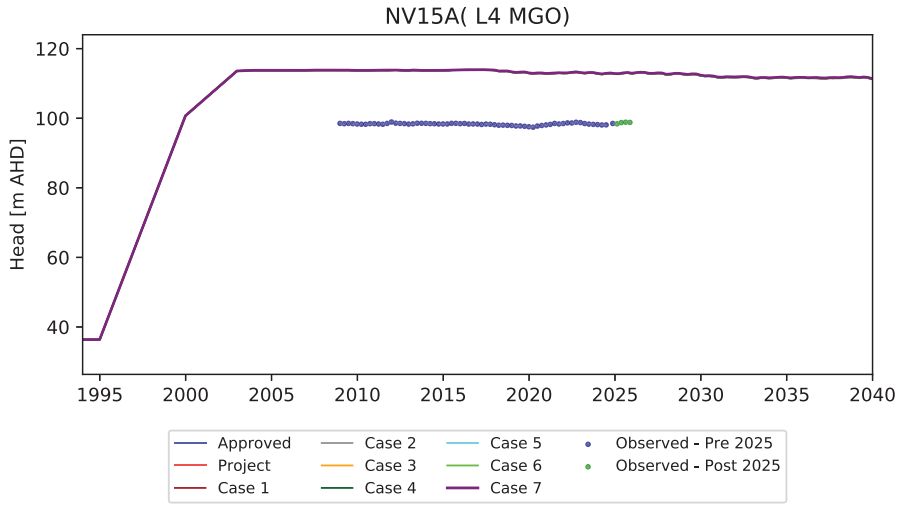

NV13B(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

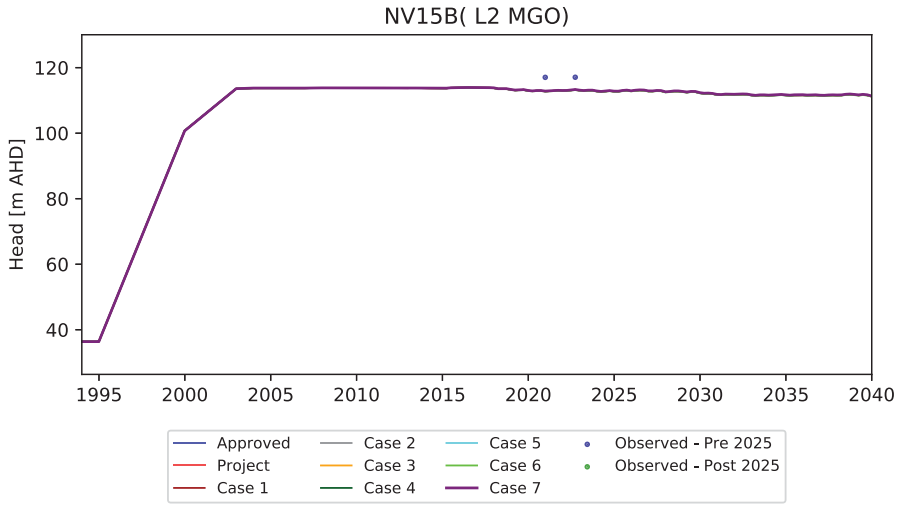

NV13C(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

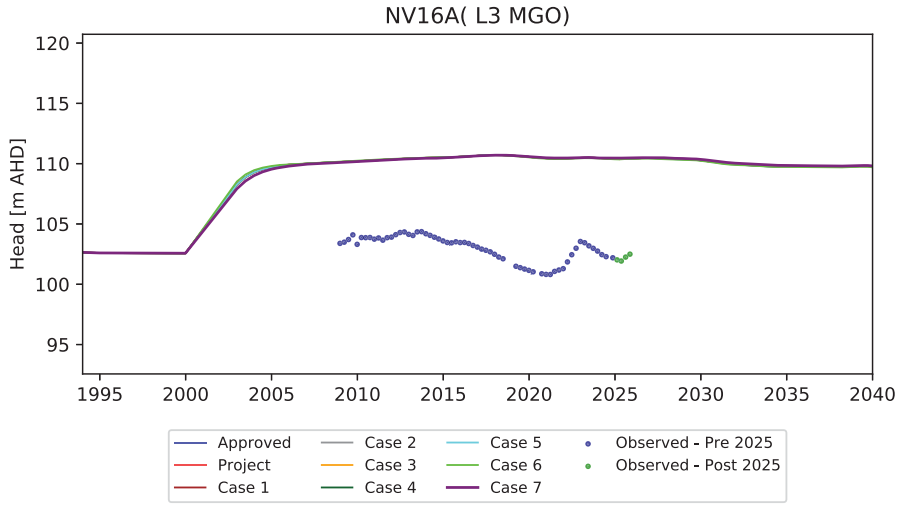

NV14A(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

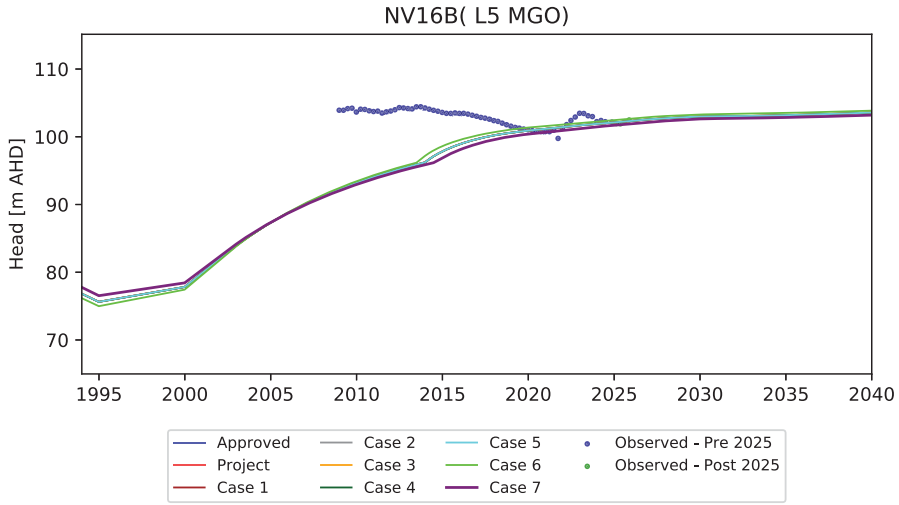

NV14B(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

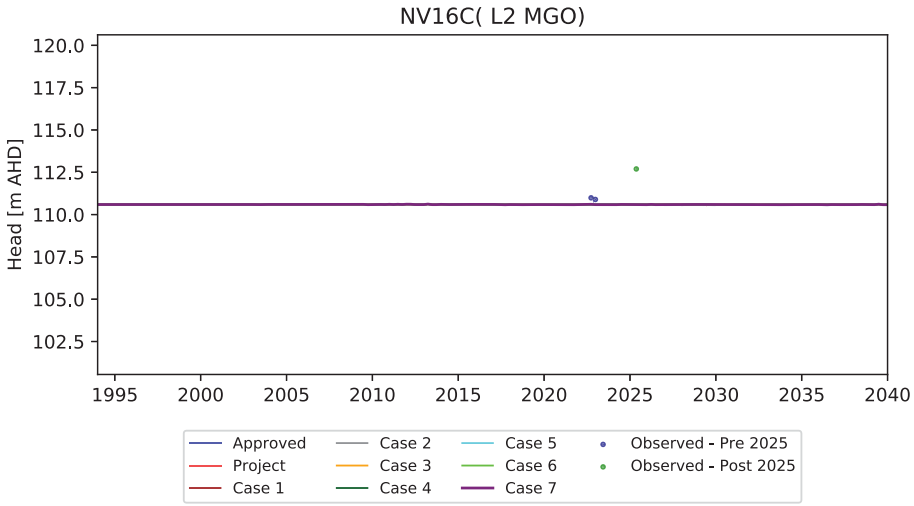

NV14C(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

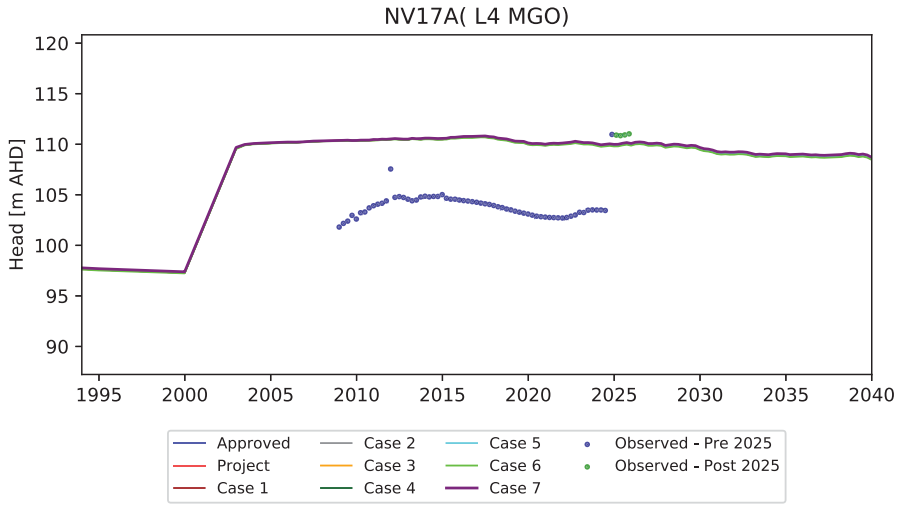

NV15A(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

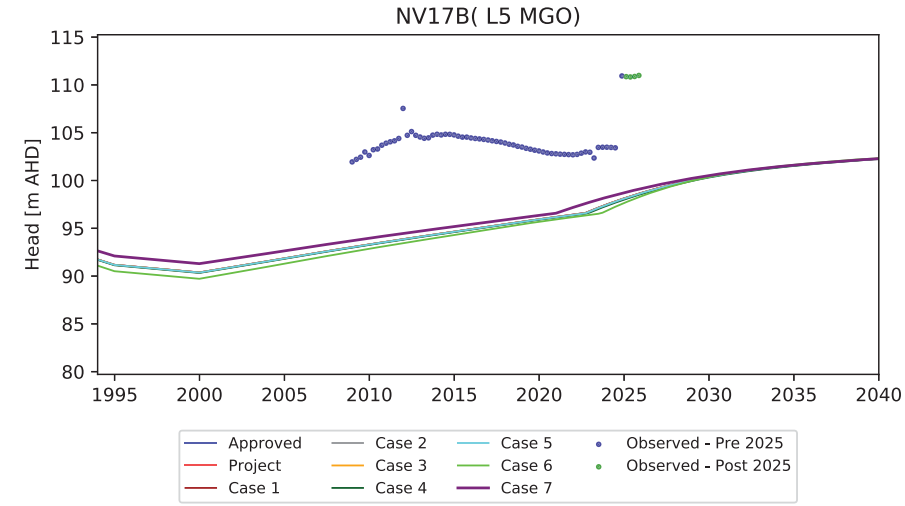

NV15B(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

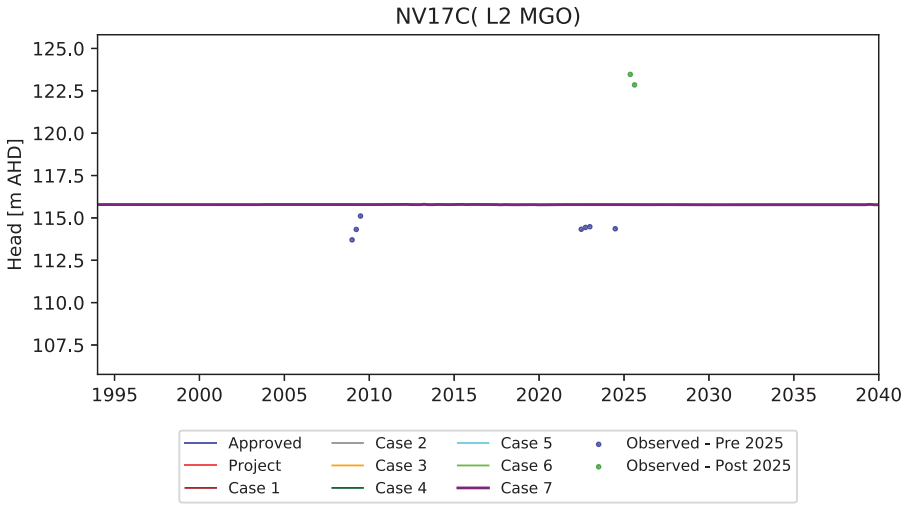

NV16A(L3 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

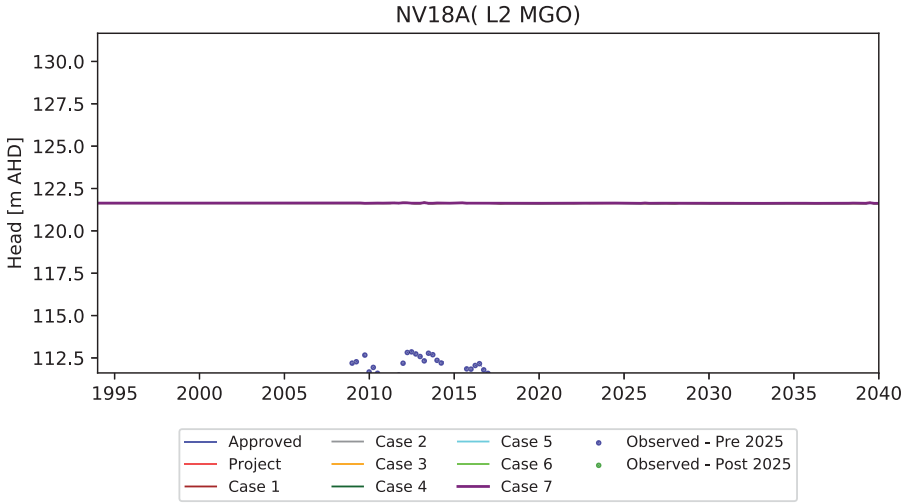

NV16B(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

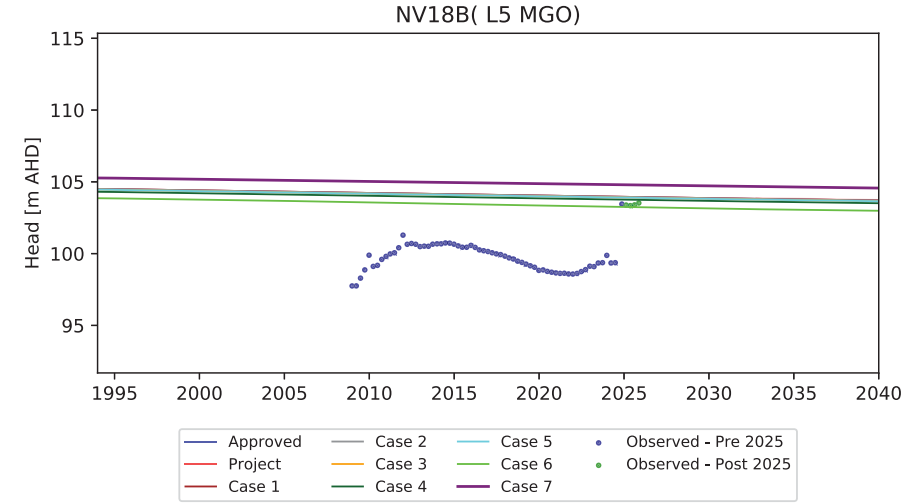

NV16C(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

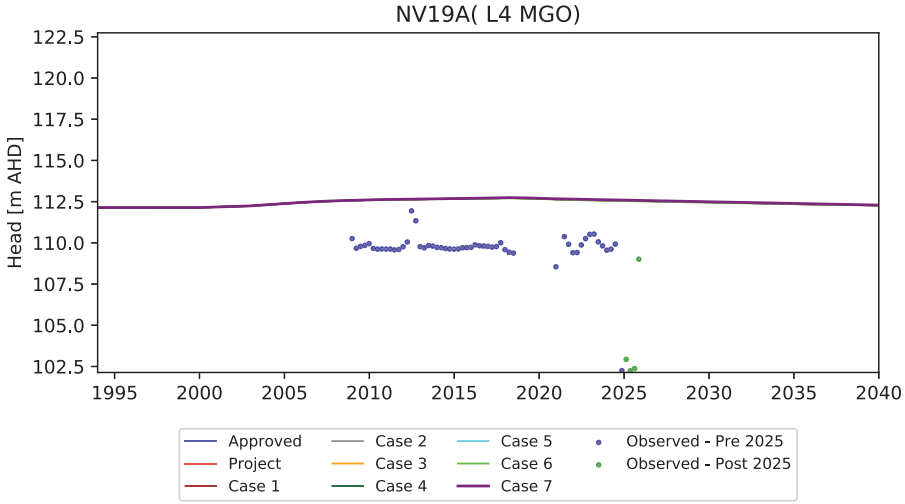

NV17A(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

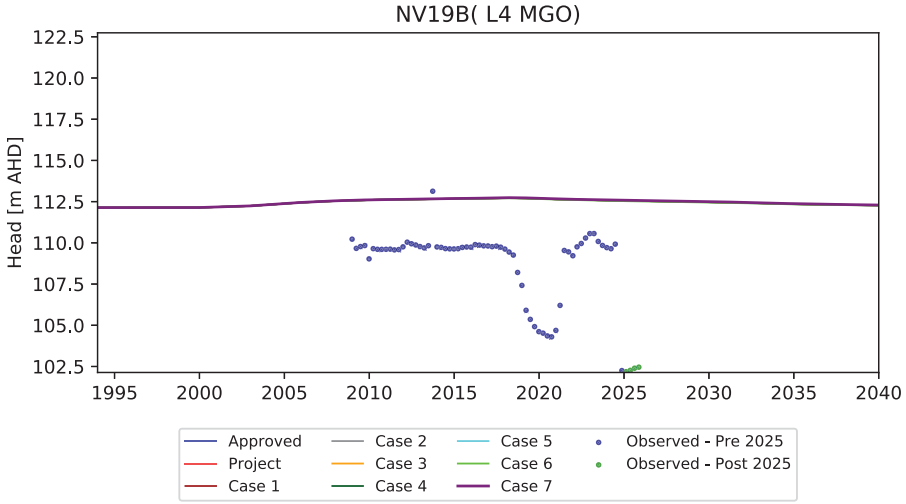

NV17B(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

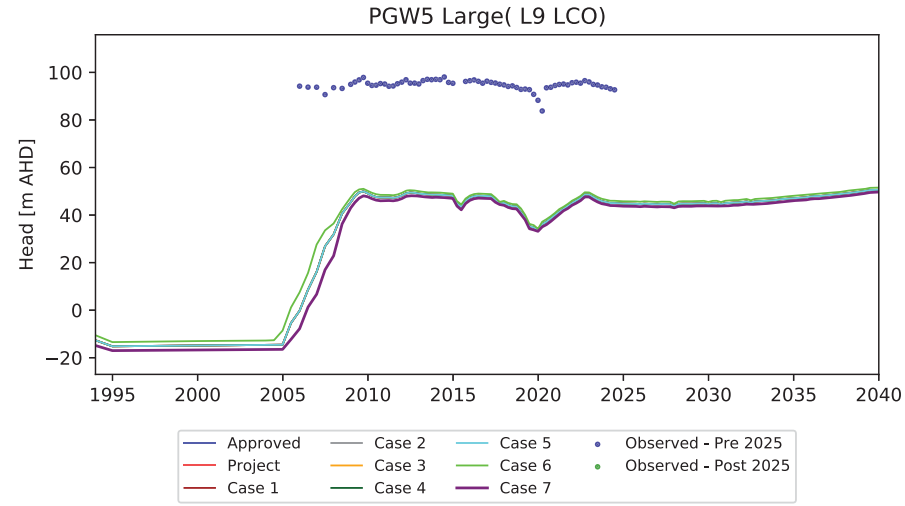

NV17C(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

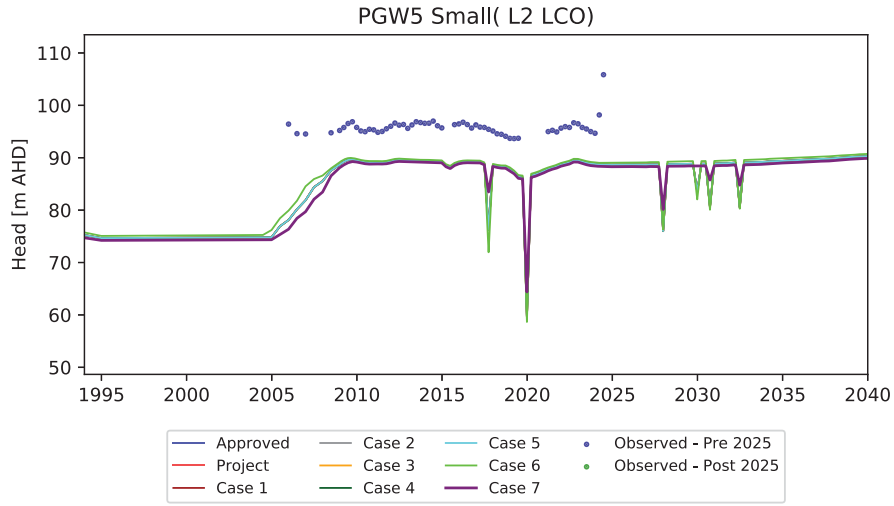

NV18A(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

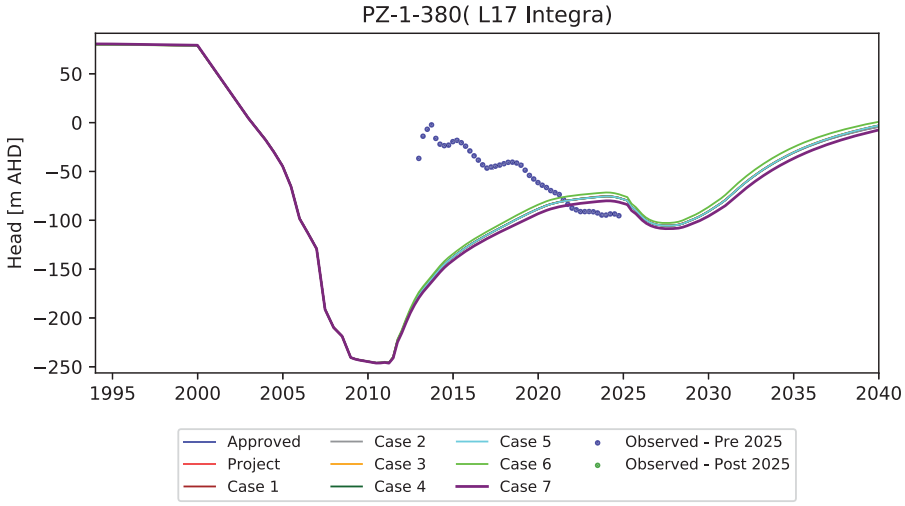

NV18B(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

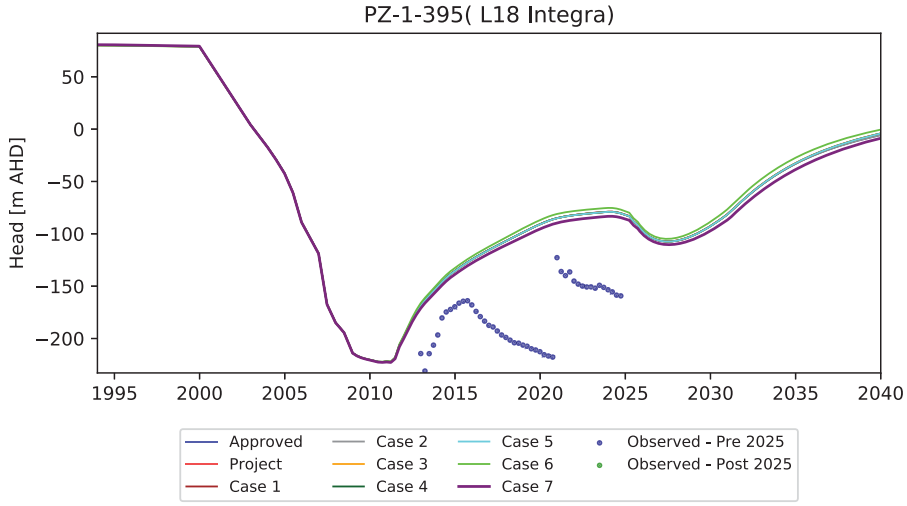

NV19A(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

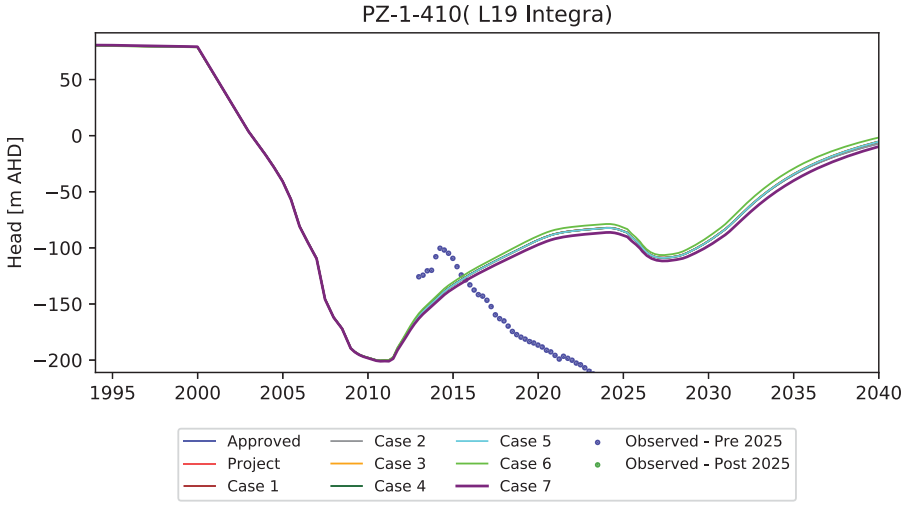

NV19B(L4 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

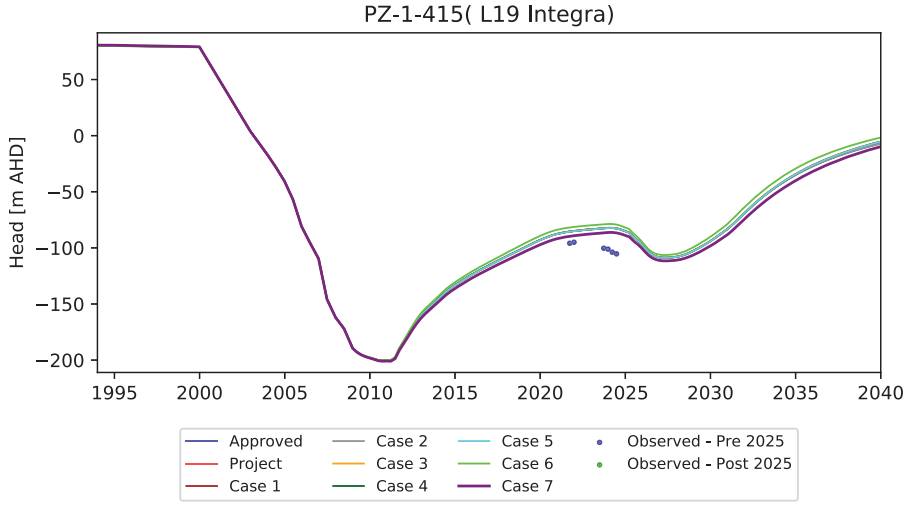

PGW5 Large(L9 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

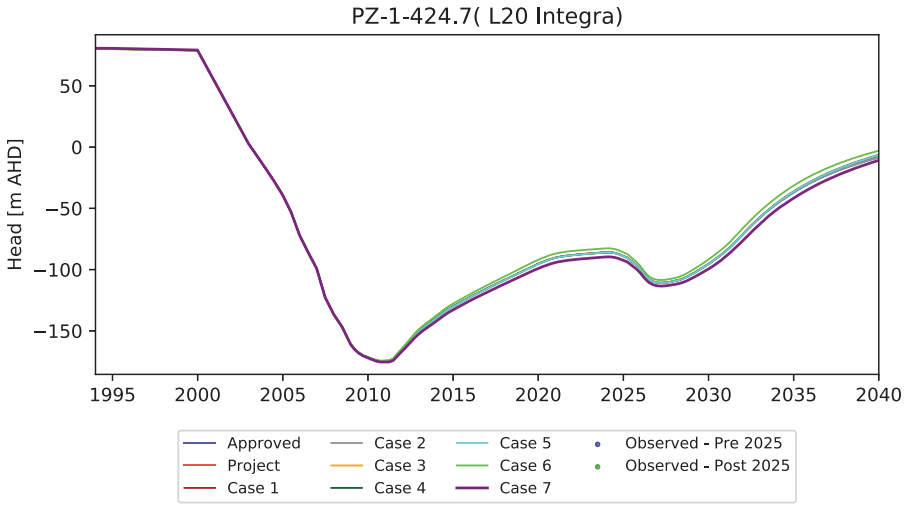

PGW5 Small(L2 LCO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

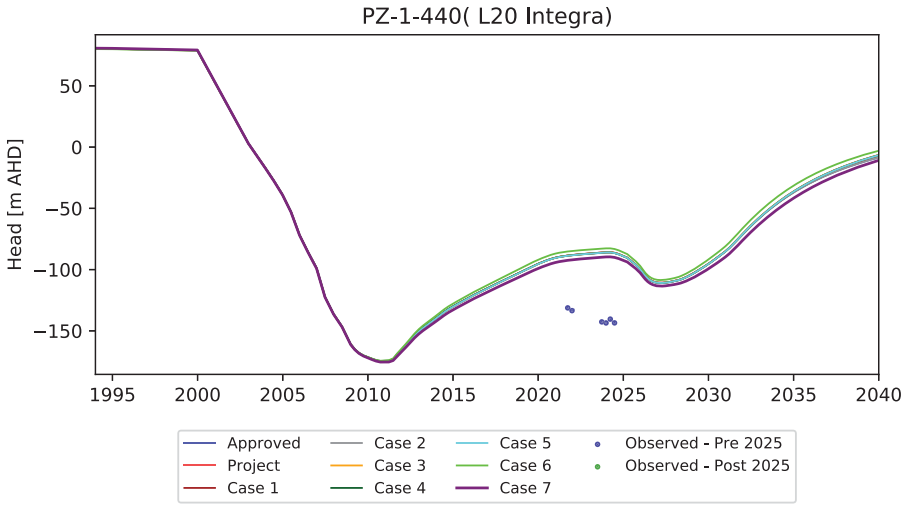

PZ-1-380(L17 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

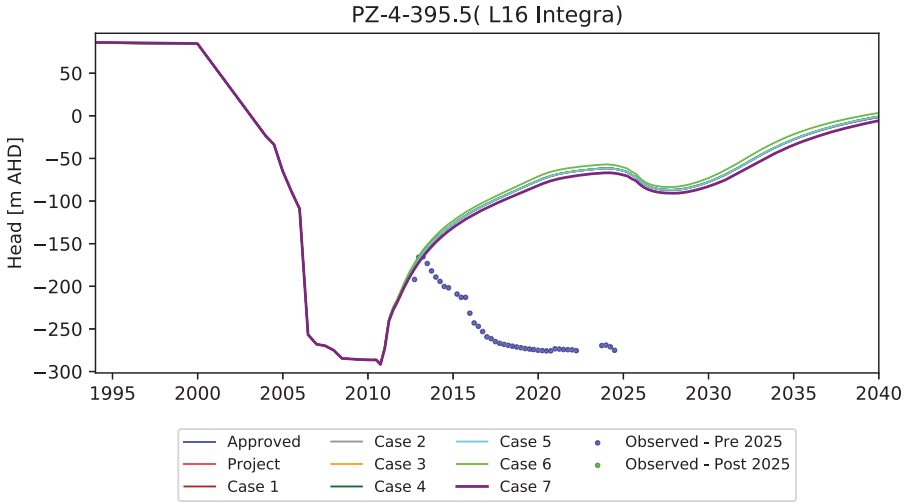

PZ-1-395(L18 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

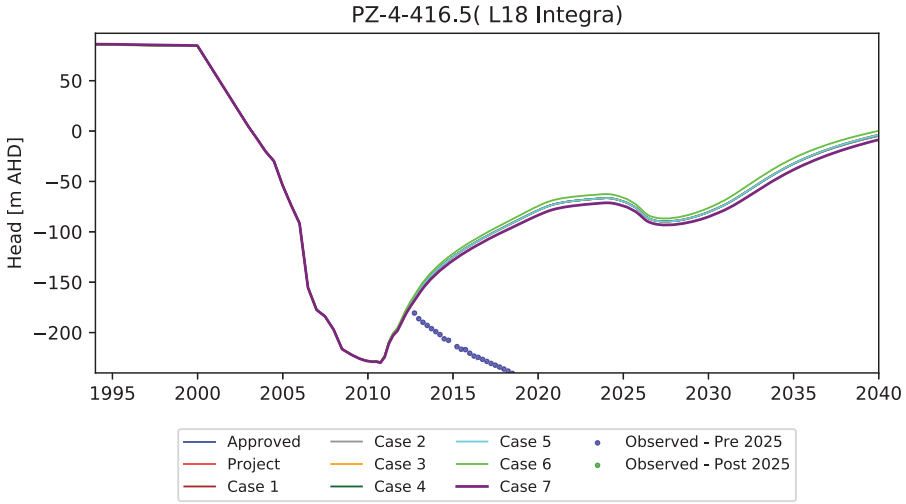

PZ-1-410(L19 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

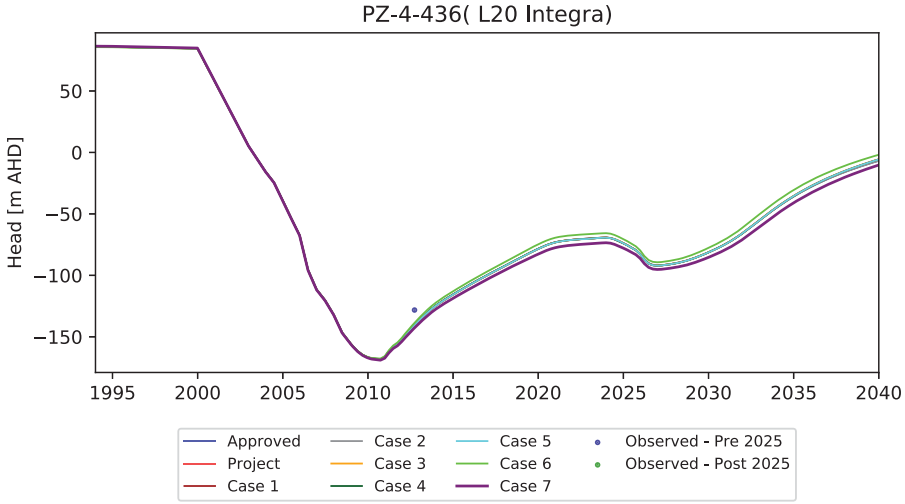

PZ-1-415(L19 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

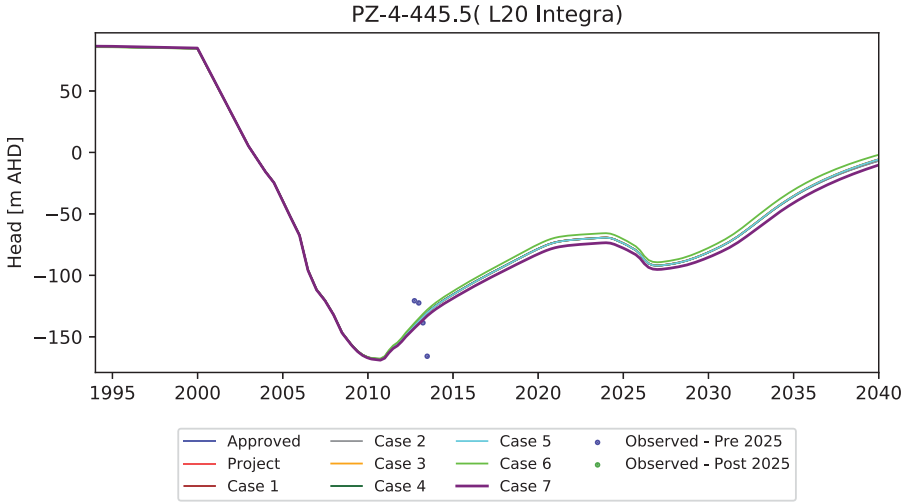

PZ-1-424.7(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

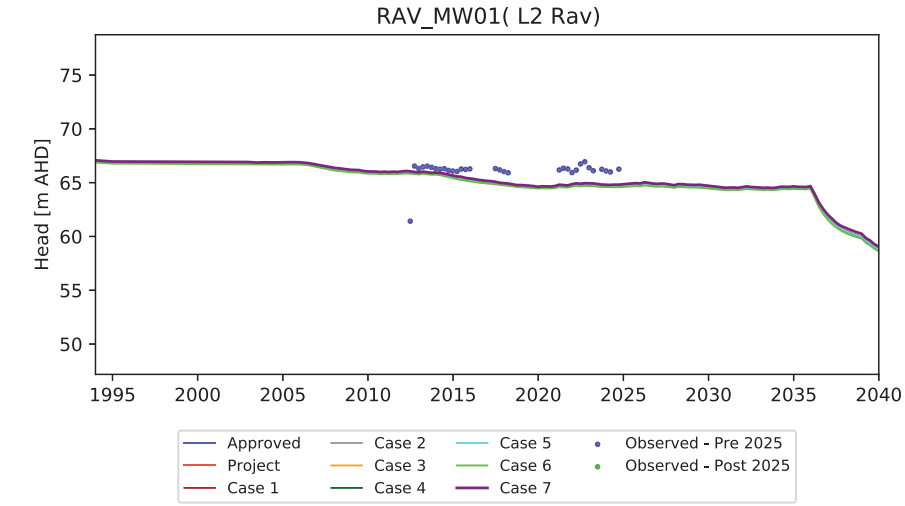

PZ-1-440(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

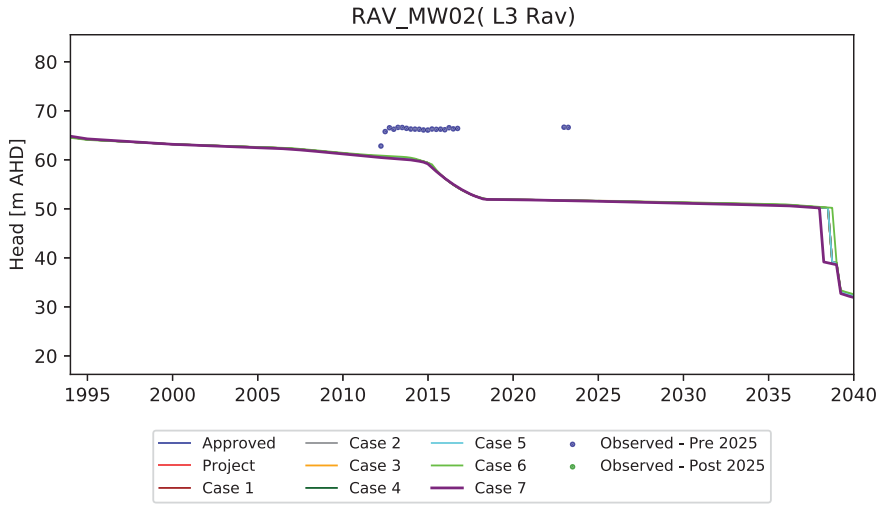

PZ-4-395.5(L16 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

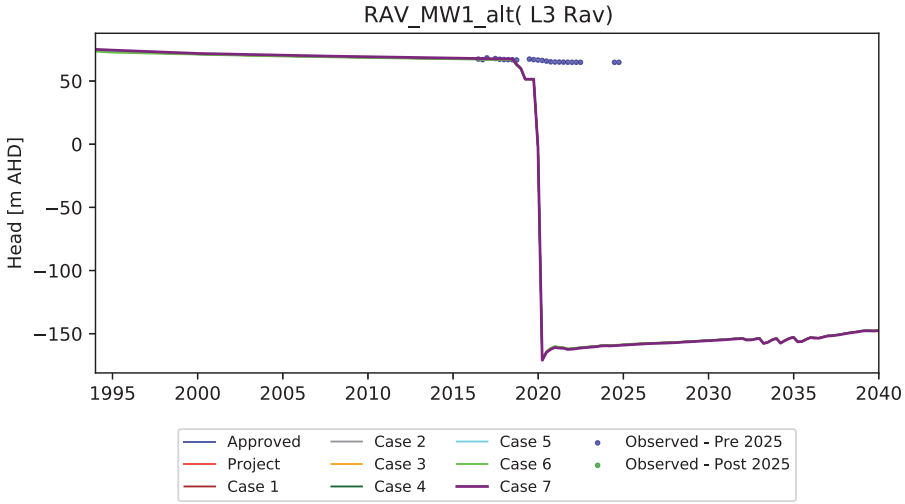

PZ-4-416.5(L18 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

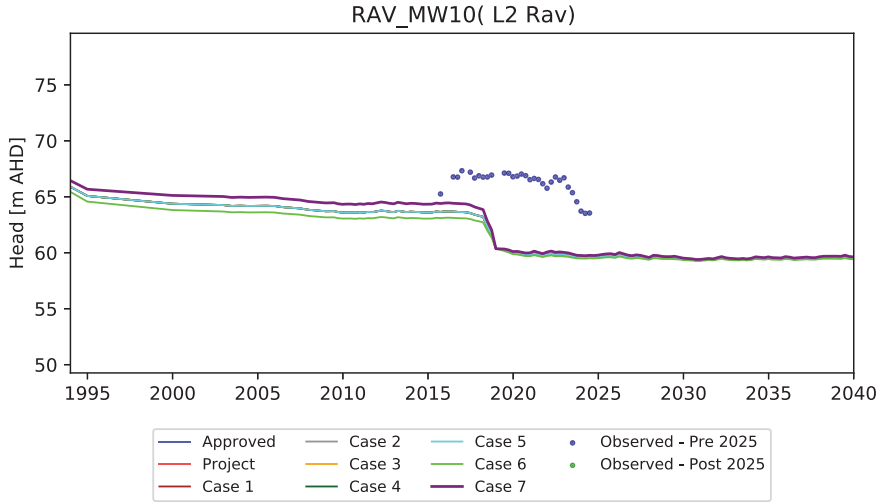

PZ-4-436(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

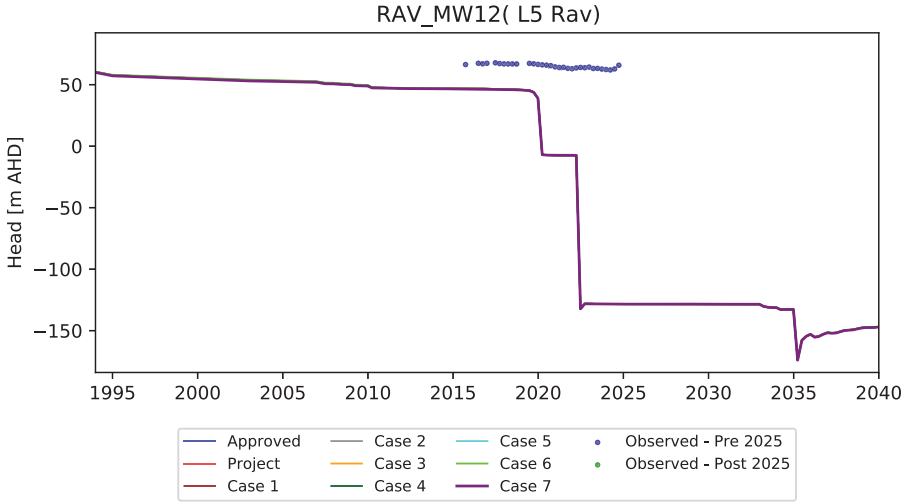

PZ-4-445.5(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

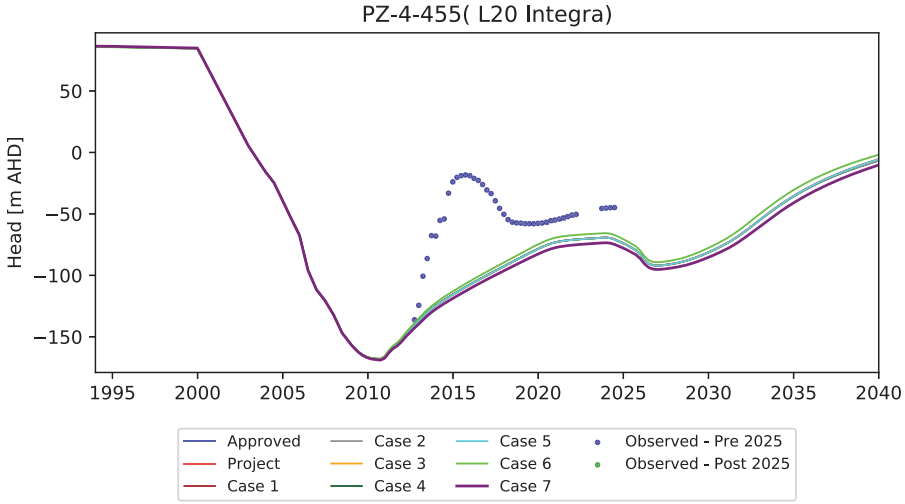

RAV_MW01(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

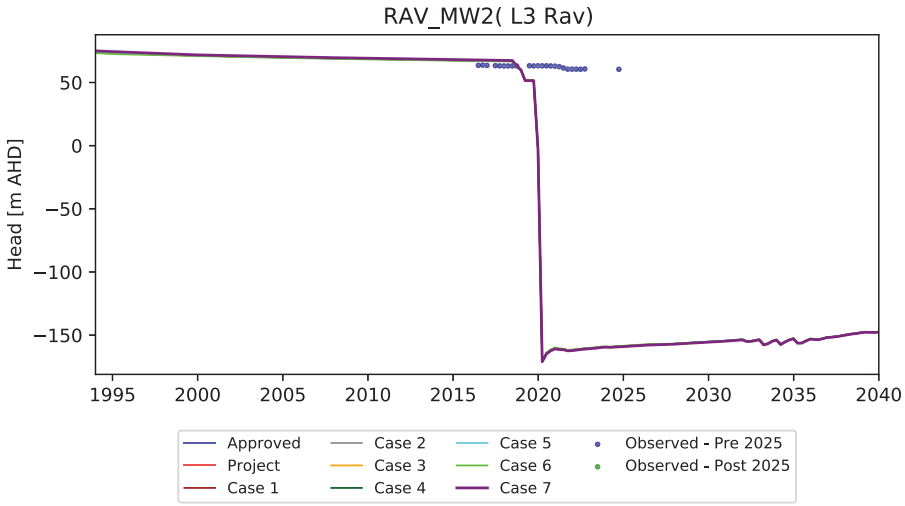

RAV_MW02(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

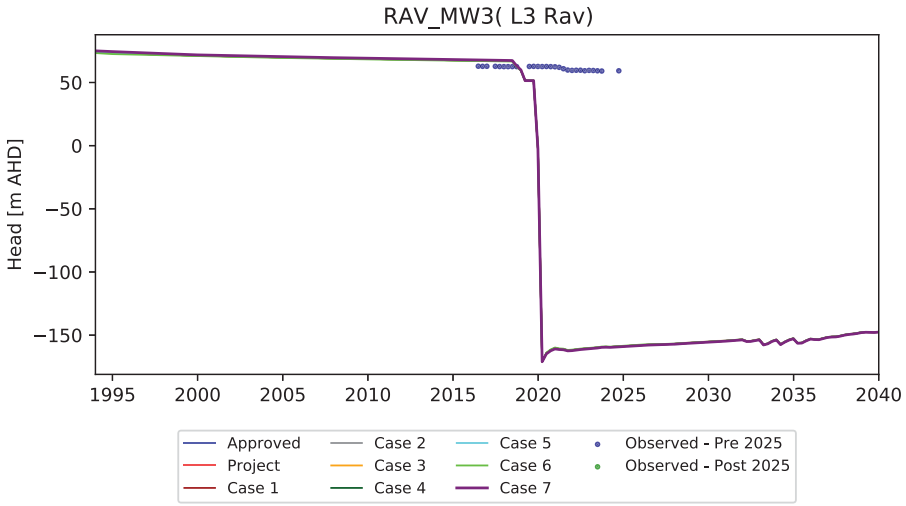

RAV_MW1_alt(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

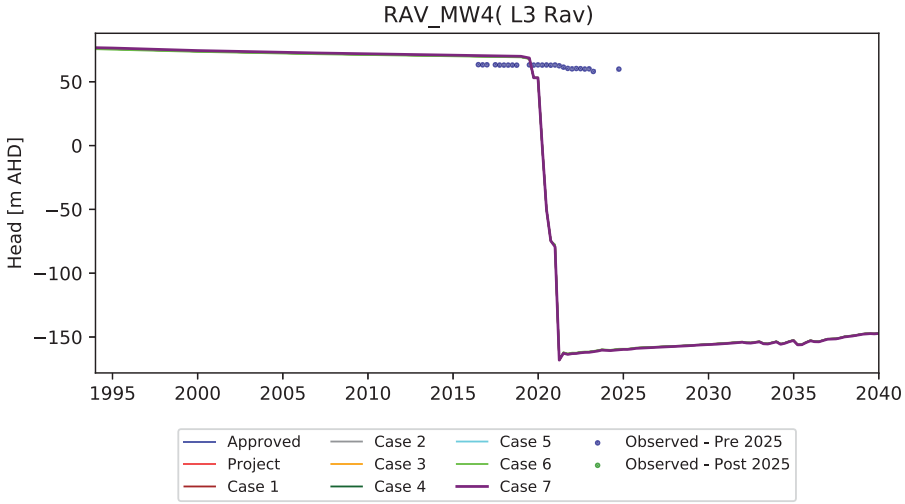

RAV_MW10(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

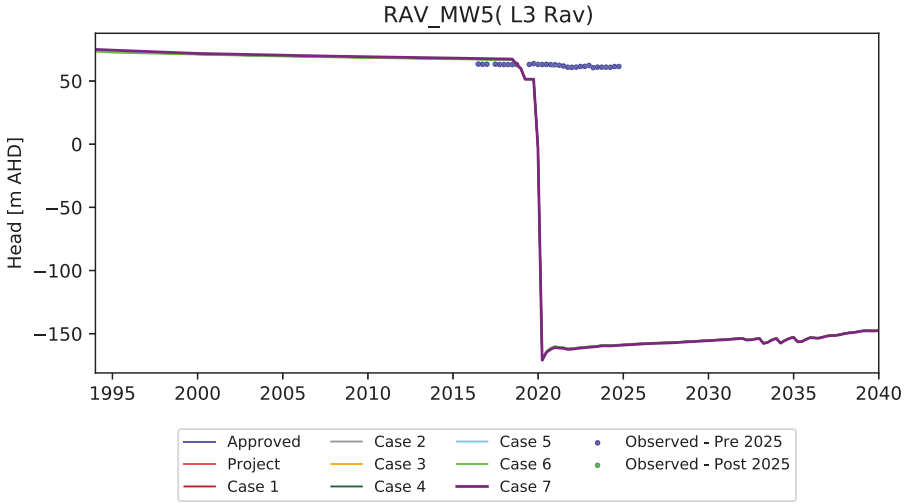

RAV_MW12(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

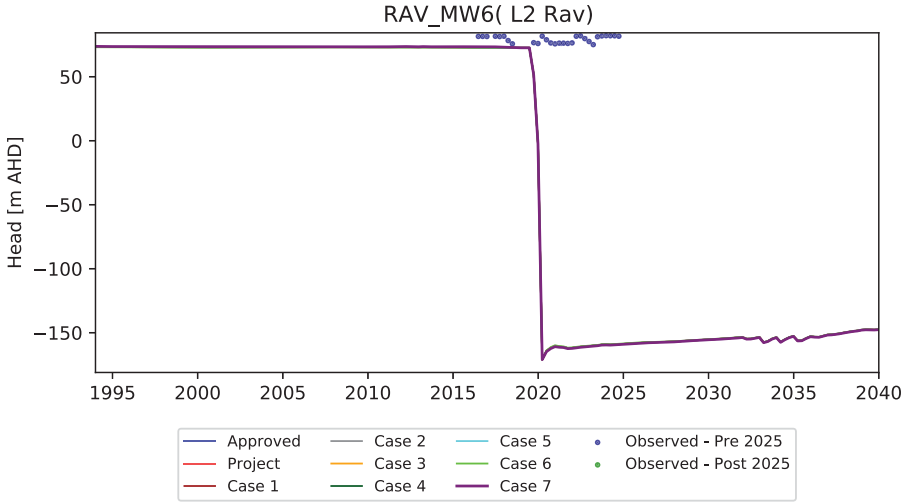

PZ-4-455(L20 Integra)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

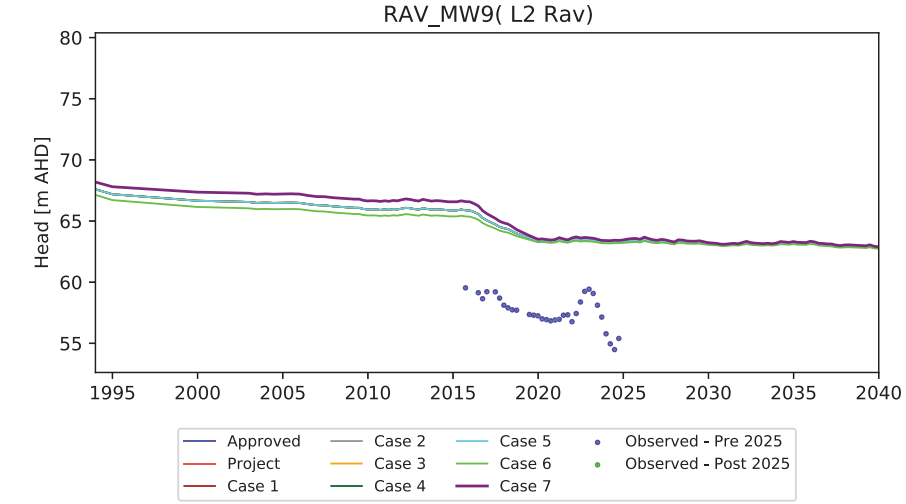

RAV_MW2(L3 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

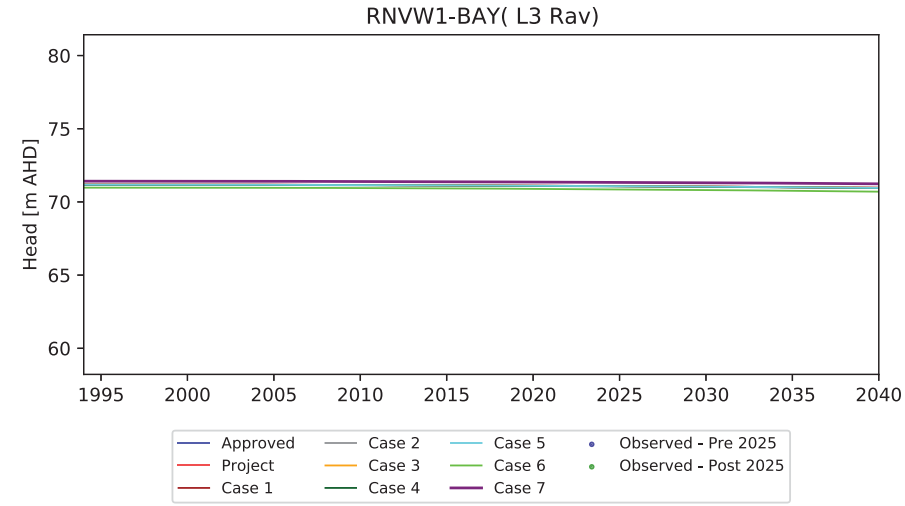

RAV_MW3(L3 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

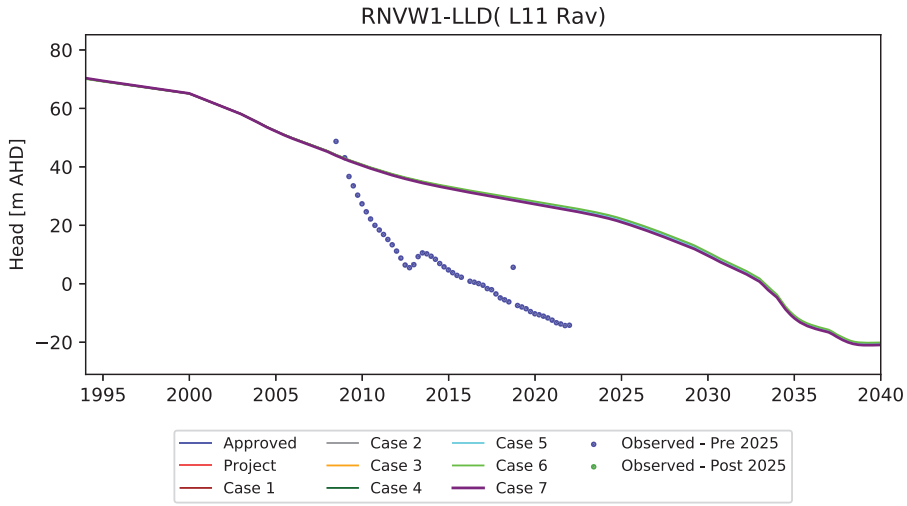

RAV_MW4(L3 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

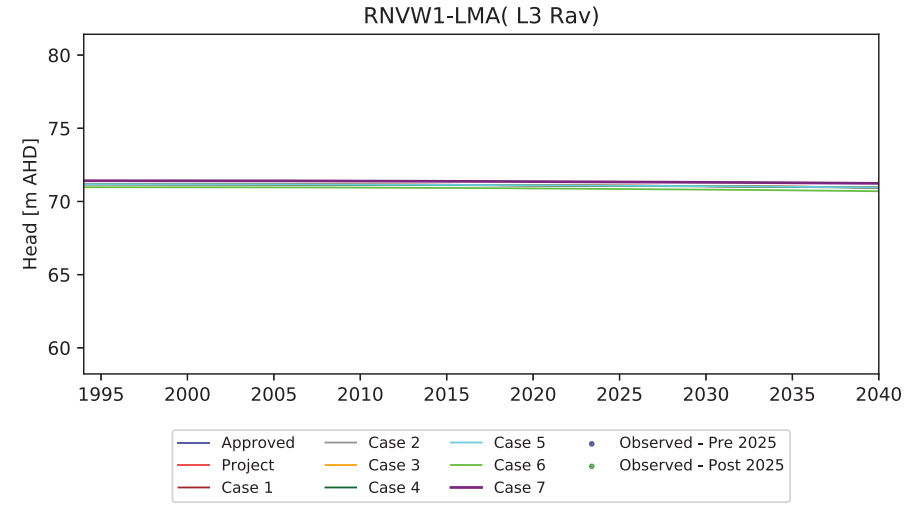

RAV_MW5(L3 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

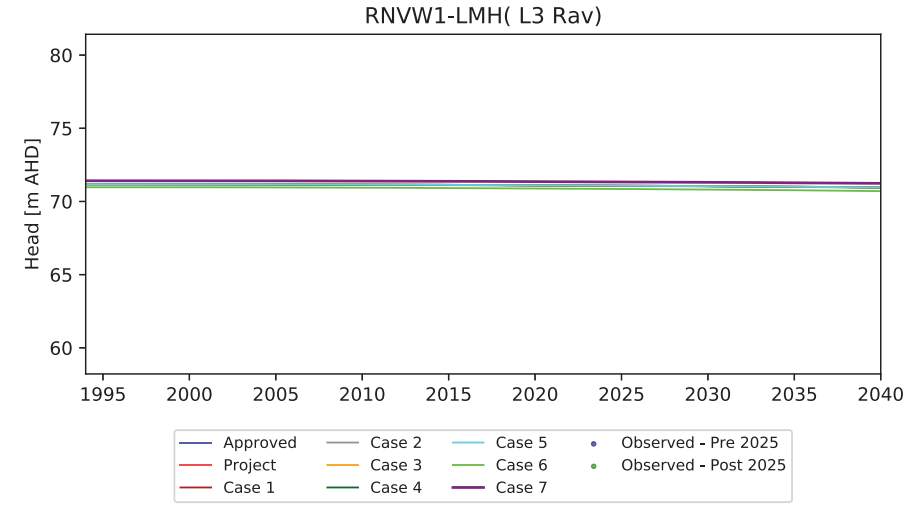

RAV_MW6(L2 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

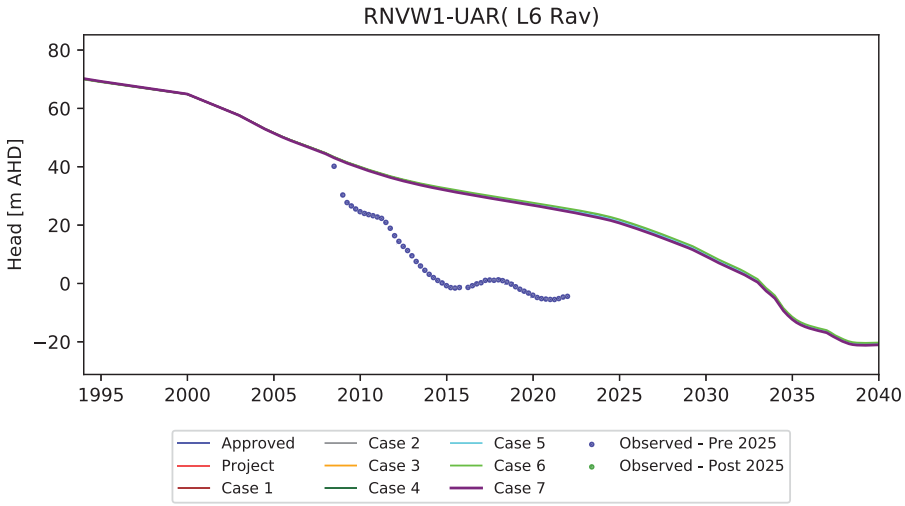

RAV_MW9(L2 Rav)
Head [m AHD]
80
75
70
65
60
55
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

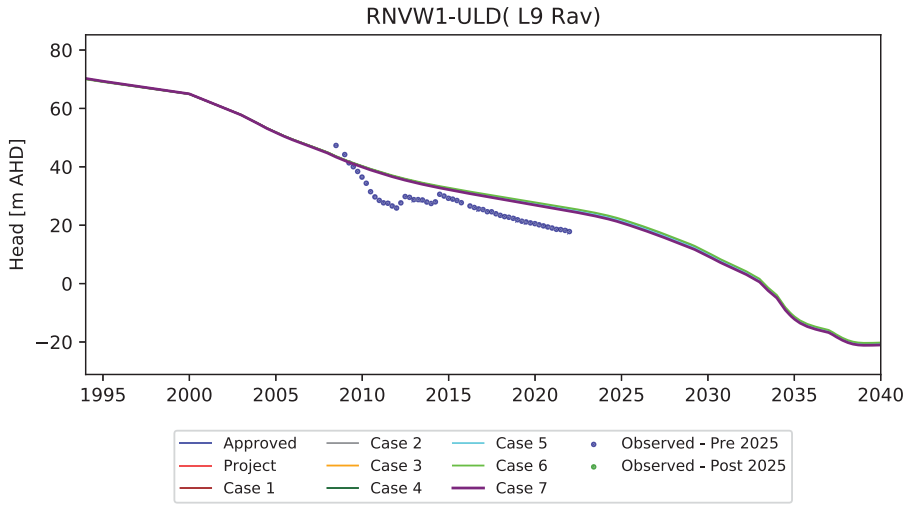

RNVW1-BAY(L3 Rav)
Head [m AHD]
80
75
70
65
60
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

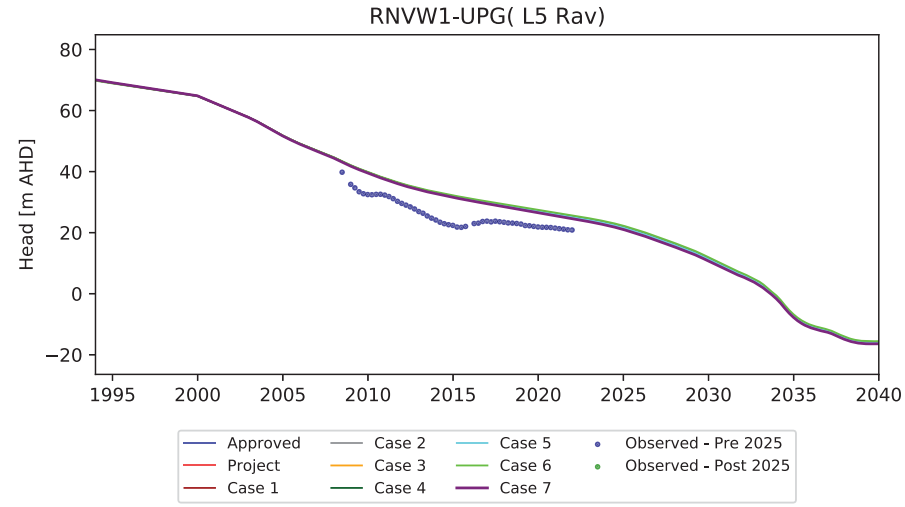

RNVW1-LLD(L11 Rav)
Head [m AHD]
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

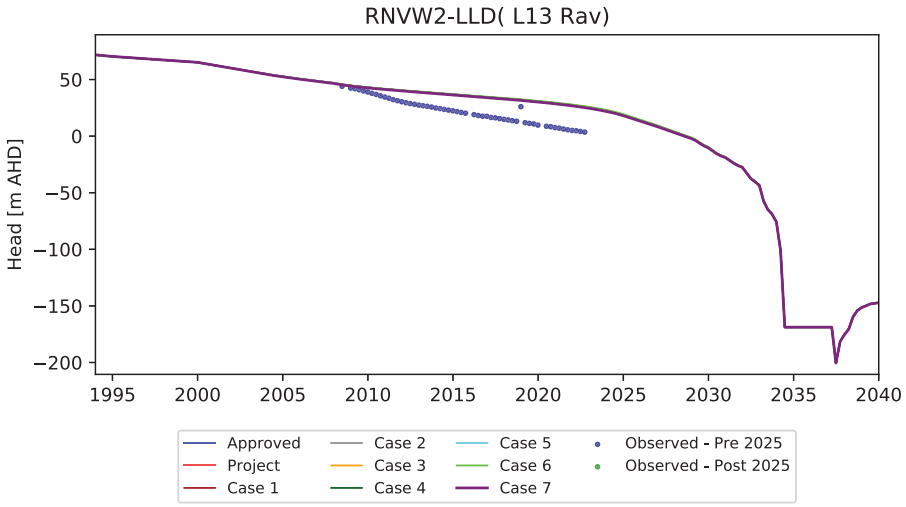

RNVW1-LMA(L3 Rav)
Head [m AHD]
80
75
70
65
60
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

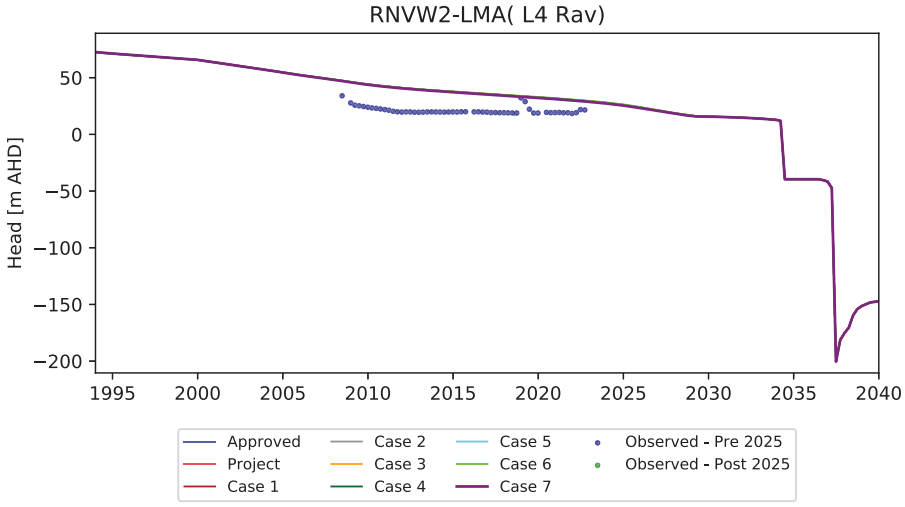

RNVW1-LMH(L3 Rav)
Head [m AHD]
80
75
70
65
60
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

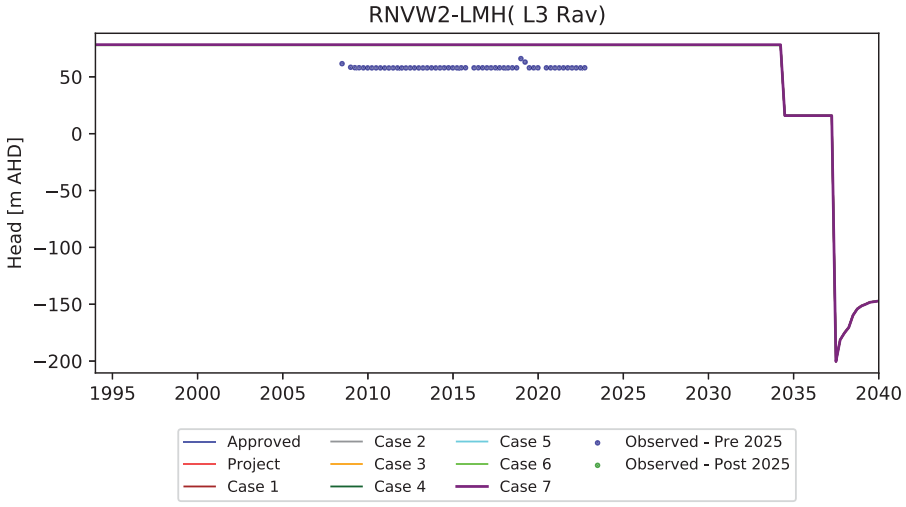

RNVW1-UAR(L6 Rav)
Head [m AHD]
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

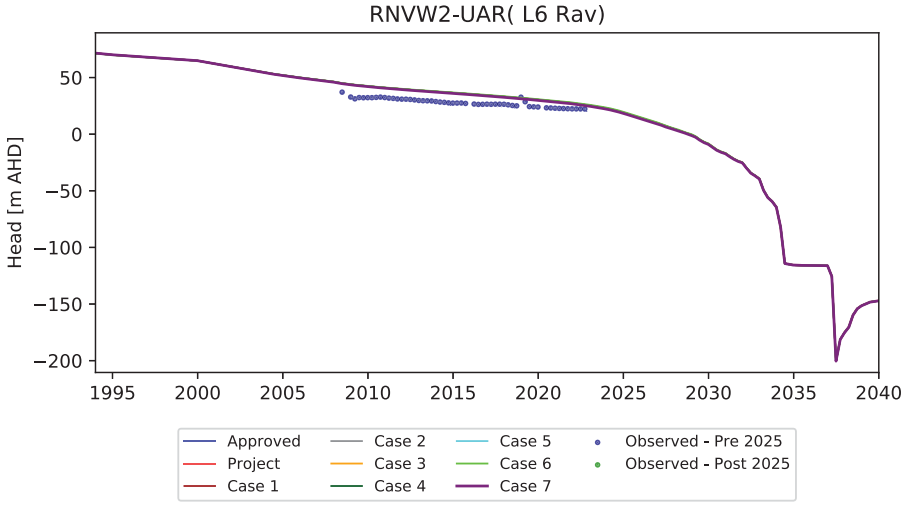

RNVW1-ULD(L9 Rav)
Head [m AHD]
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

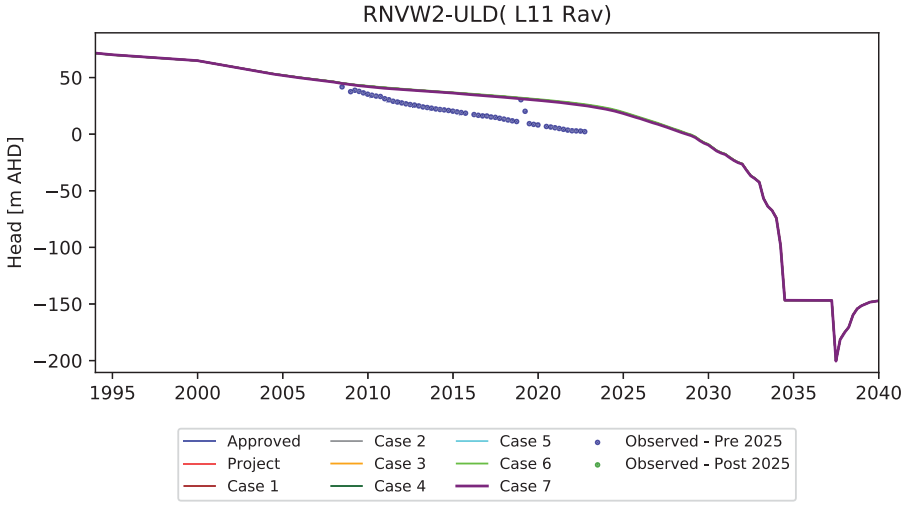

RNVW1-UPG(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

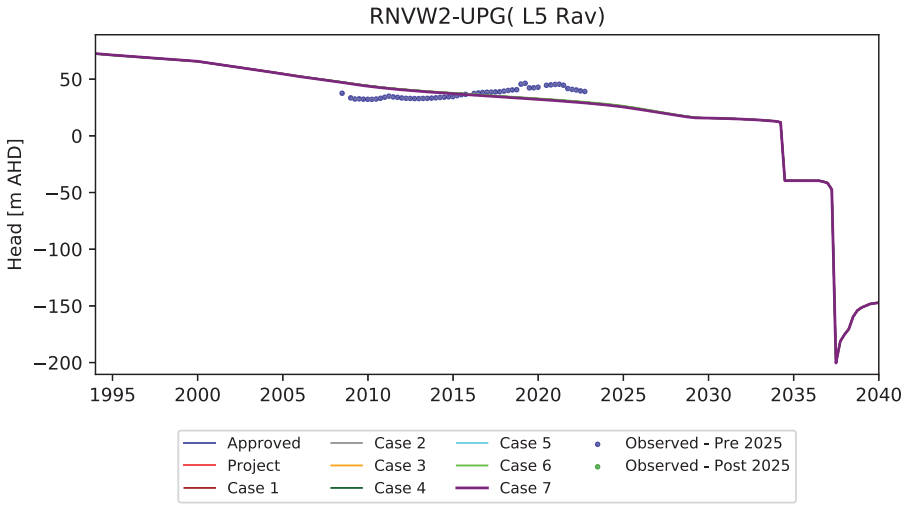

RNVW2-LLD(L13 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

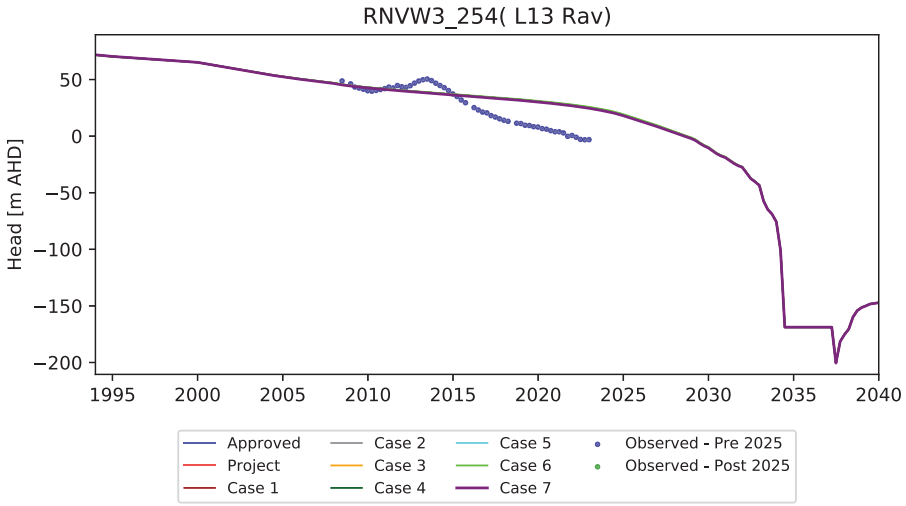

RNVW2-LMA(L4 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

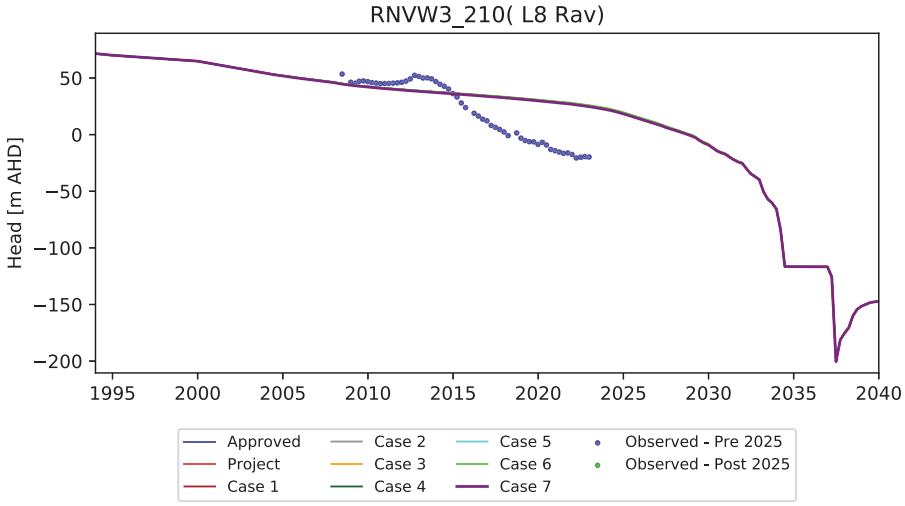

RNVW2-LMH(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

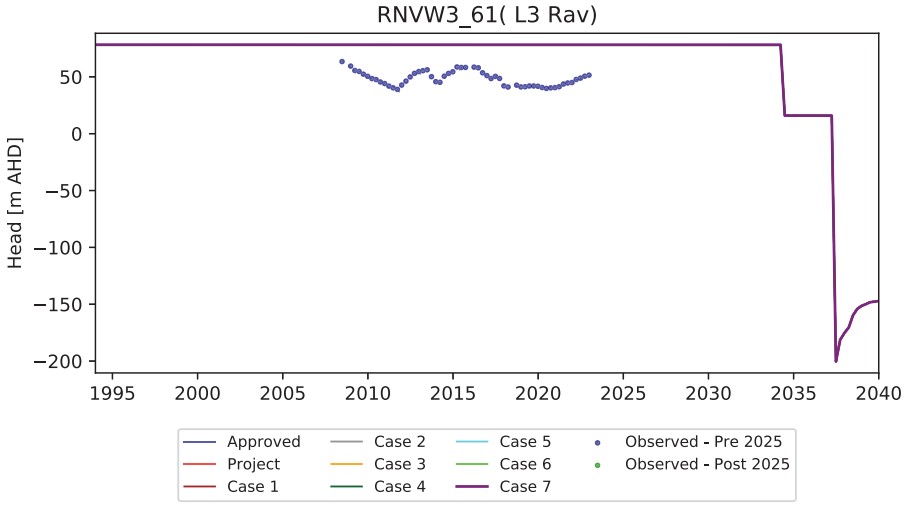

RNVW2-UAR(L6 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

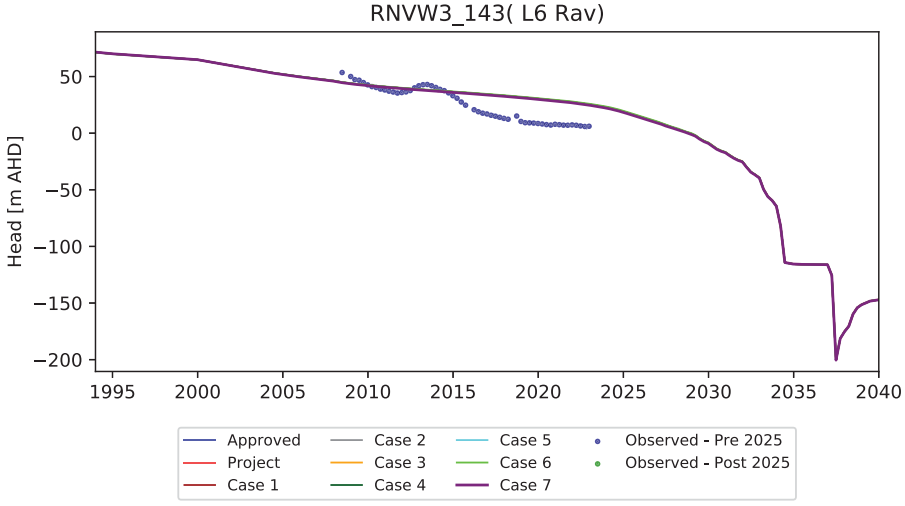

RNVW2-ULD(L11 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

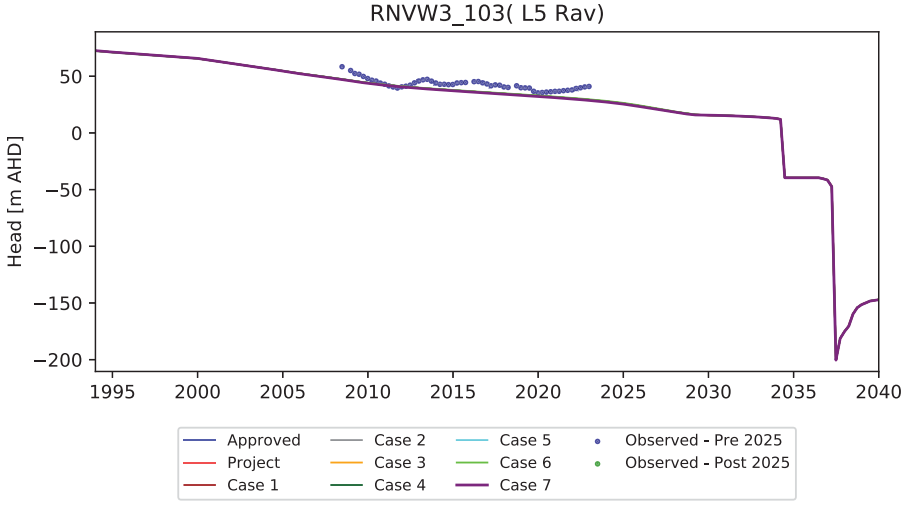

RNVW2-UPG(L5 Rav)
Head [m AHD]
50
0
−50
−100
−150
−200
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

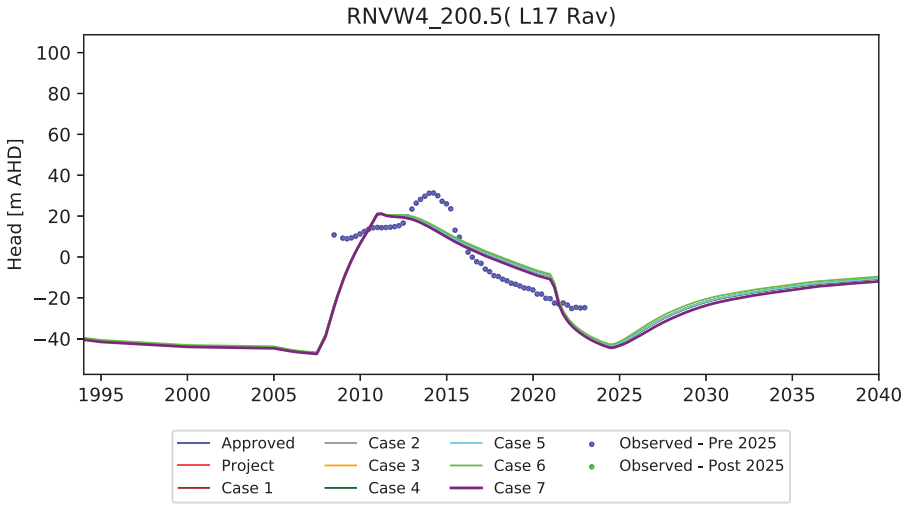

RNVW3_254(L13 Rav)
Head [m AHD]
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0
−50
−100
−150
−200
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

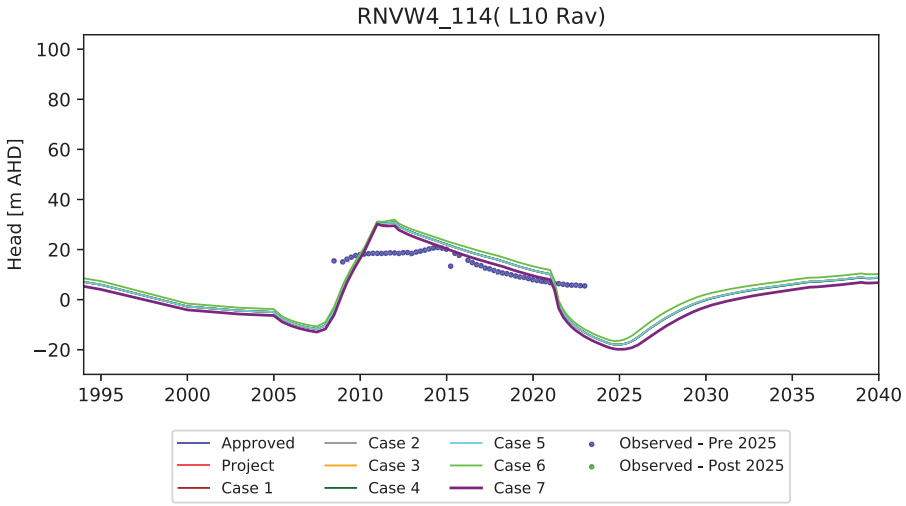

RNVW3_210(L8 Rav)
Head [m AHD]
50
0
−50
−100
−150
−200
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

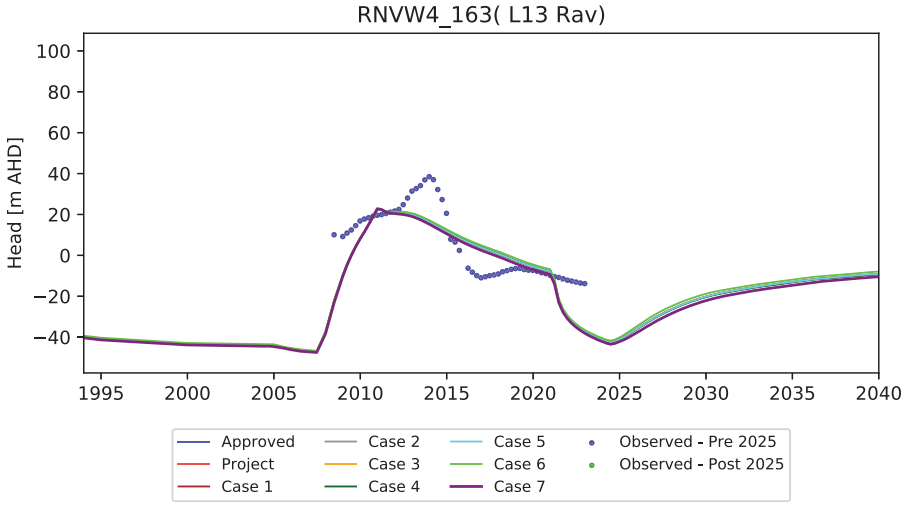

RNVW3_61(L3 Rav)
Head [m AHD]
50
0
−50
−100
−150
−200
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

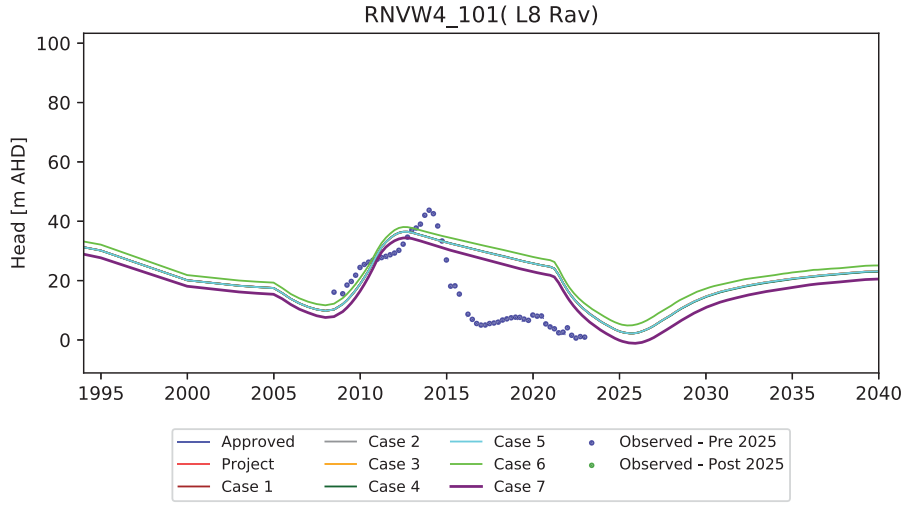

RNVW3_143(L6 Rav)
Head [m AHD]
50
0
−50
−100
−150
−200
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

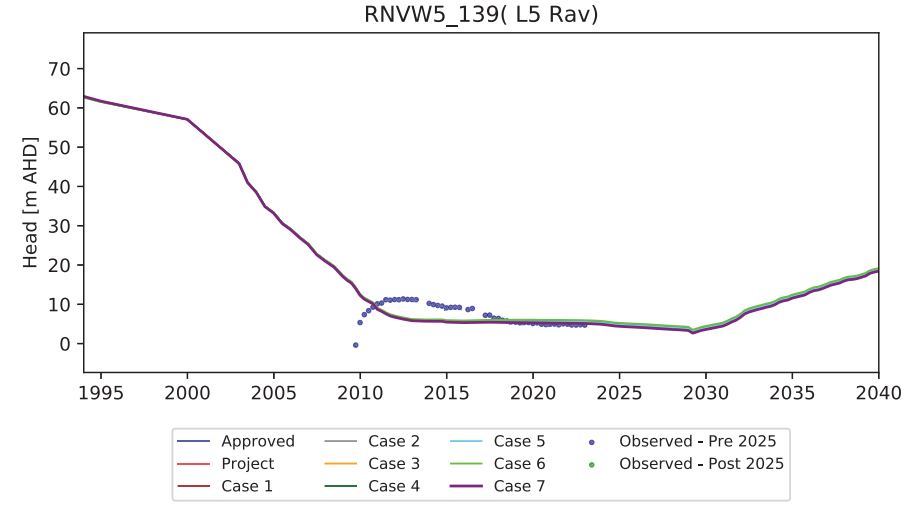

RNVW3_103(L5 Rav)
Head [m AHD]
50
0
−50
−100
−150
−200
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

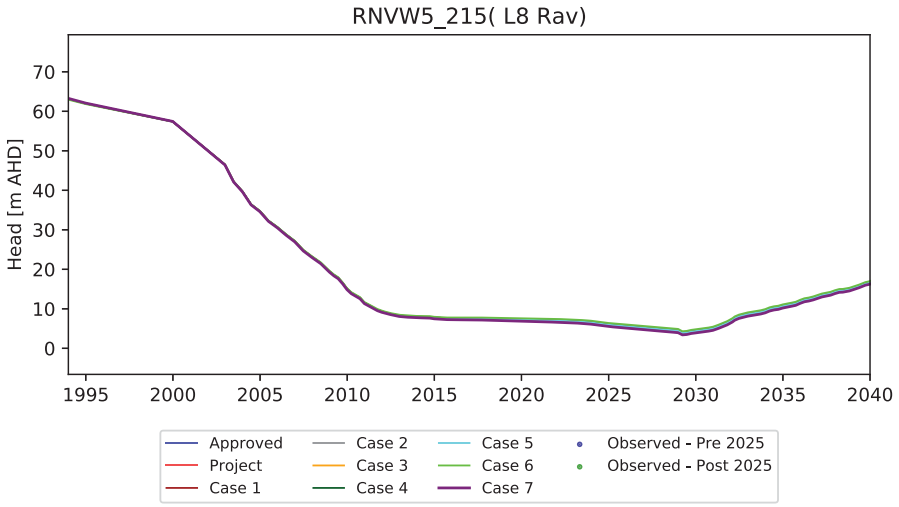

RNVW4_200.5(L17 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

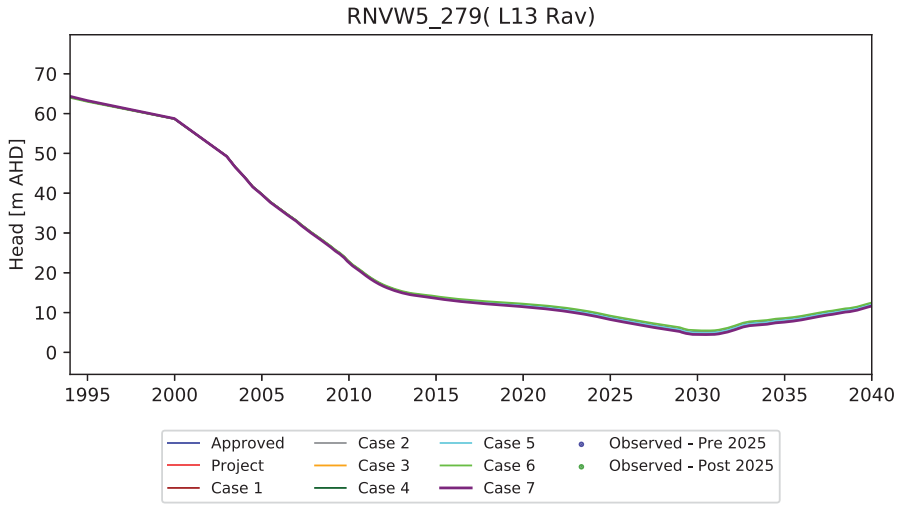

RNVW4_114(L10 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

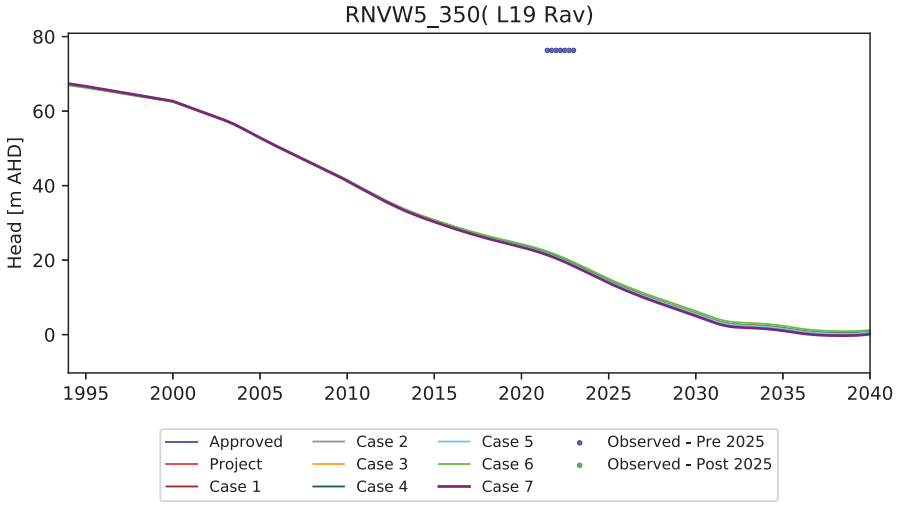

RNVW4_163(L13 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

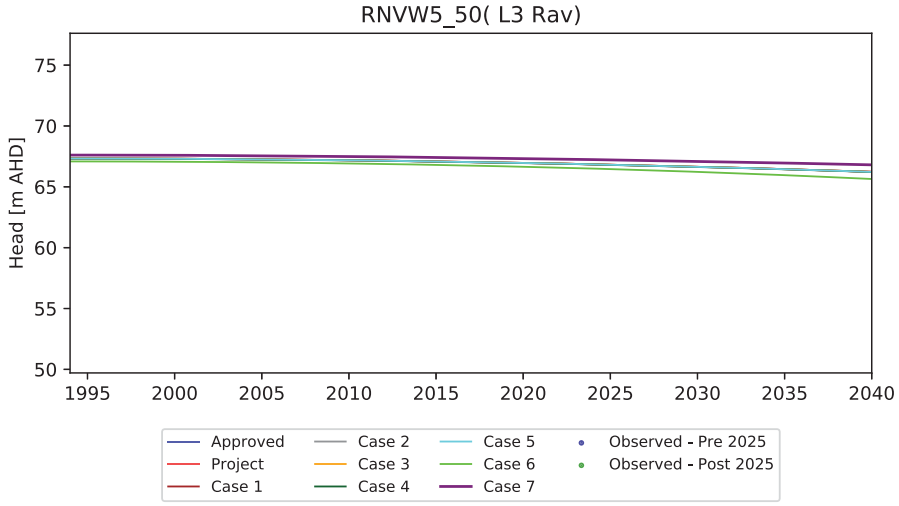

RNVW4_101(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

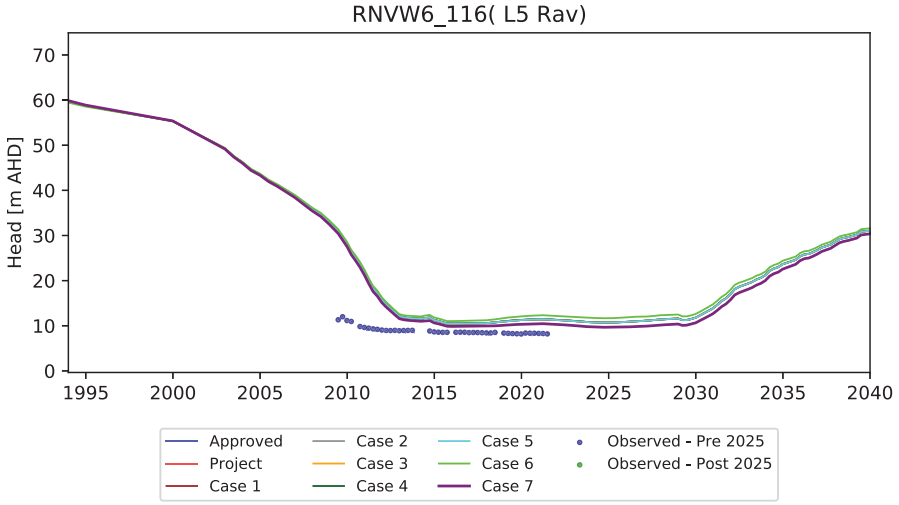

RNVW5_139(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

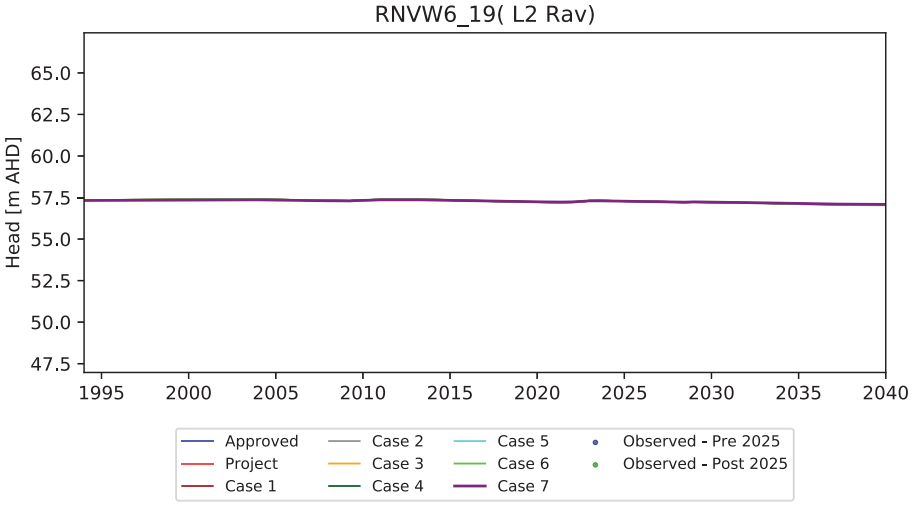

RNVW5_215(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

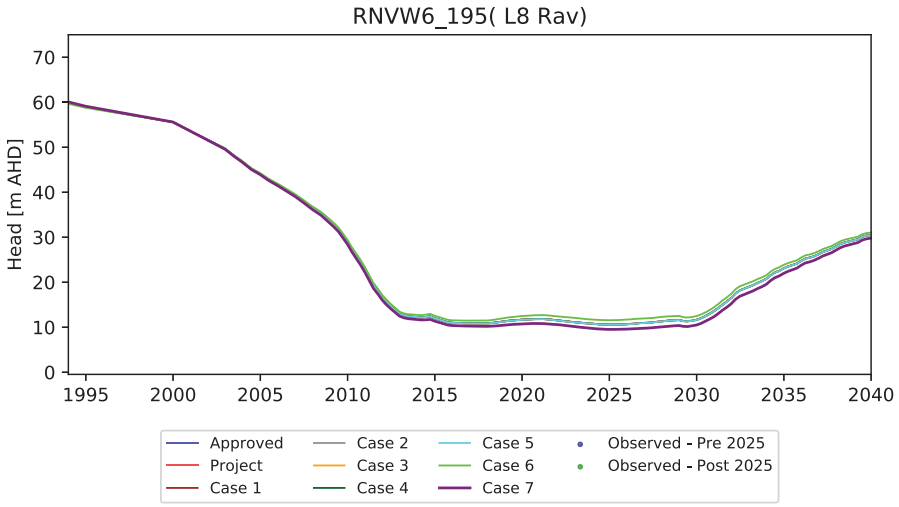

RNVW5_279(L13 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

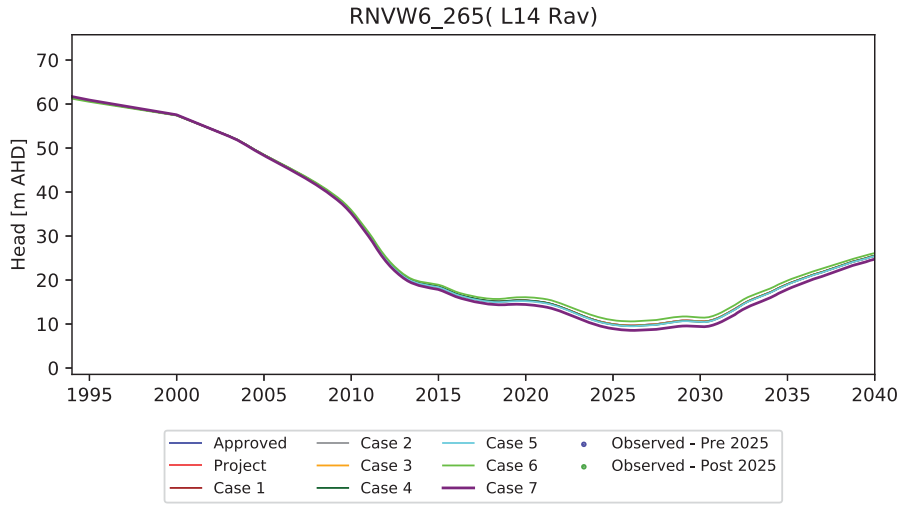

RNVW5_350(L19 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

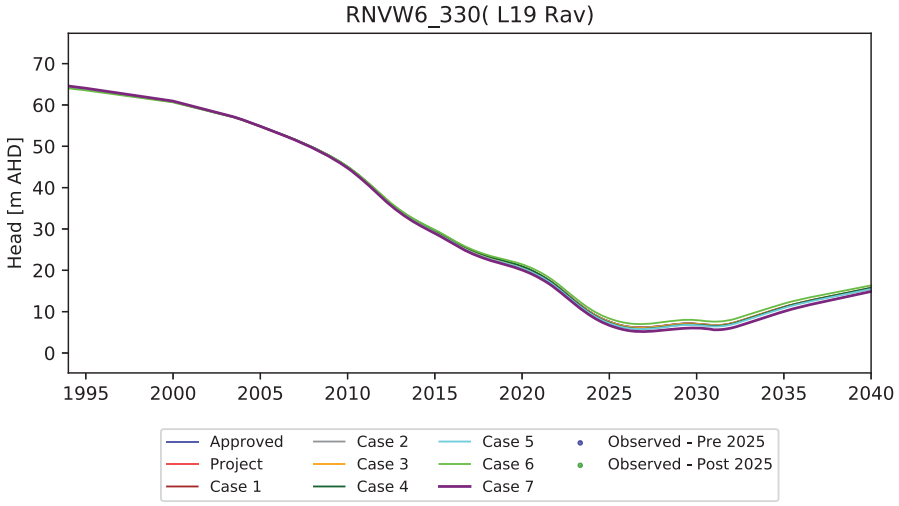

RNVW5_50(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

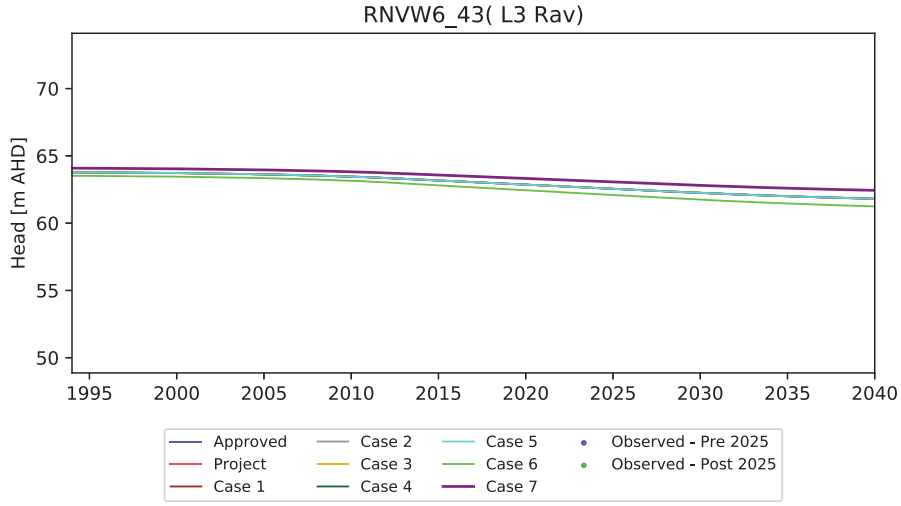

RNVW6_116(L5 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

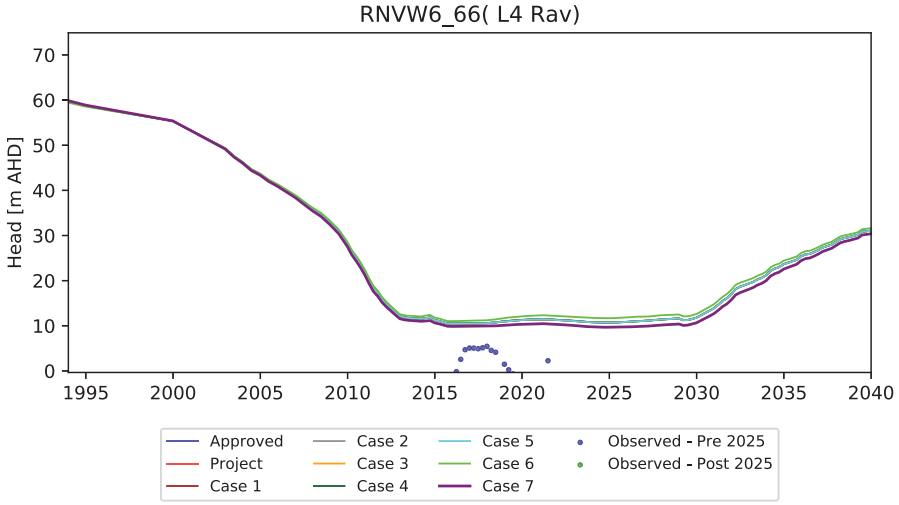

RNVW6_19(L2 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

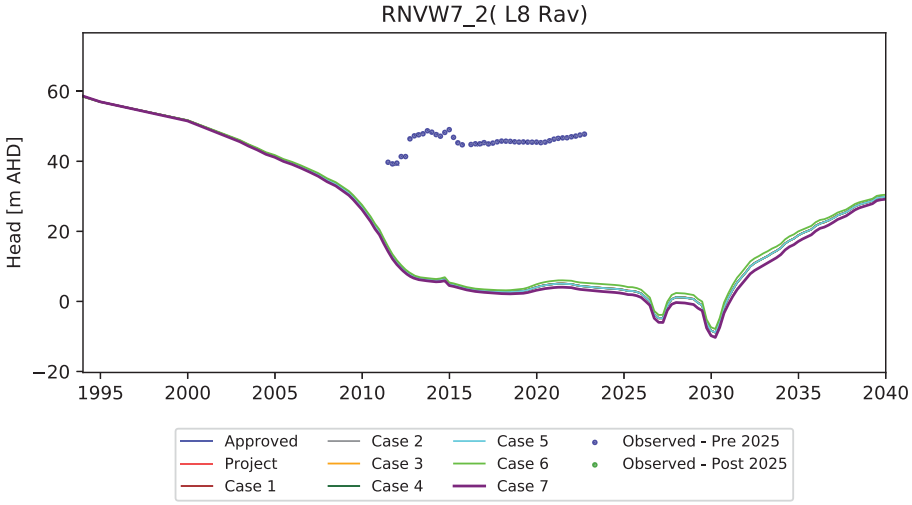

RNVW6_195(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

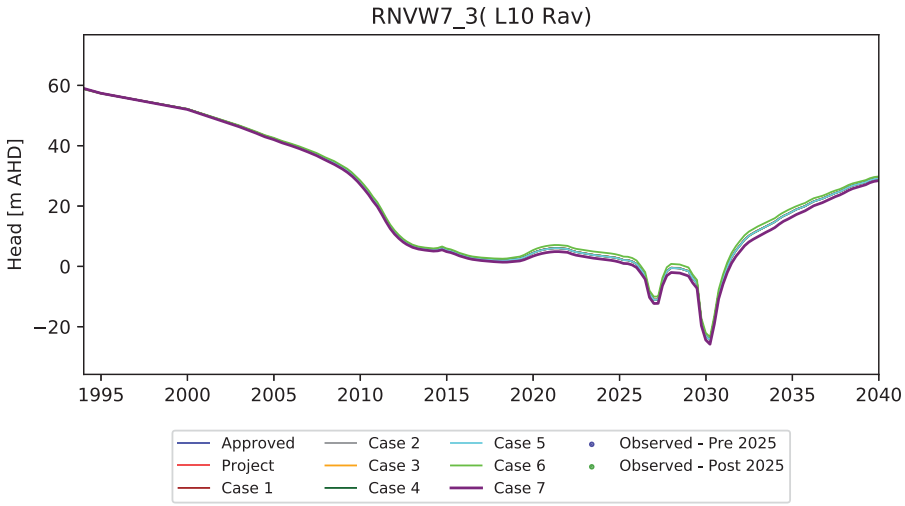

RNVW6_265(L14 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

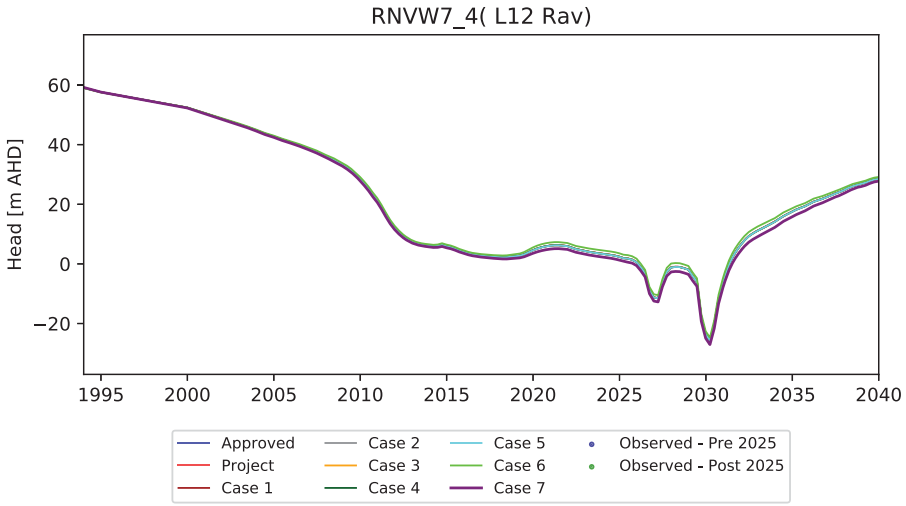

RNVW6_330(L19 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

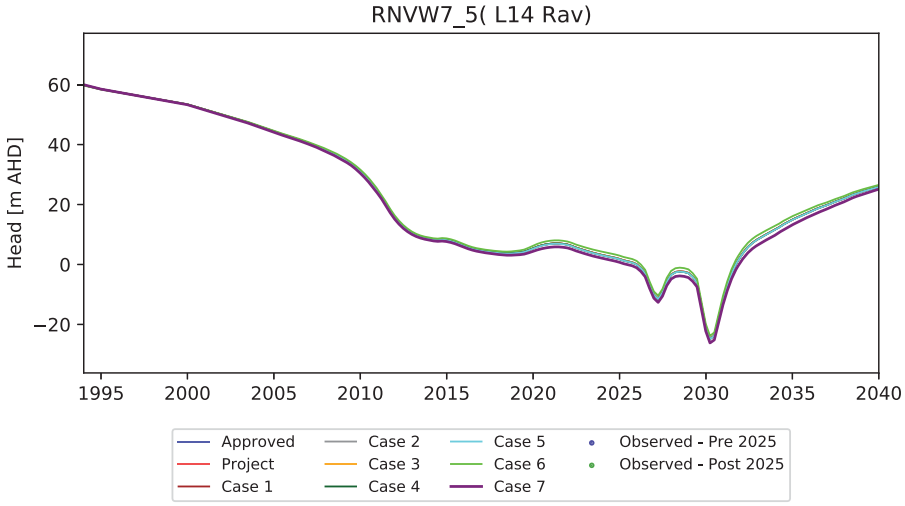

RNVW6_43(L3 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

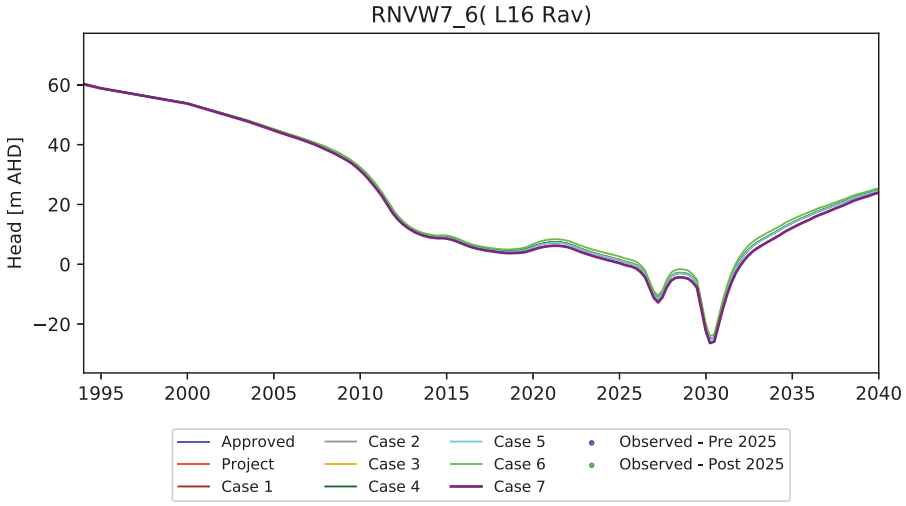

RNVW6_66(L4 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

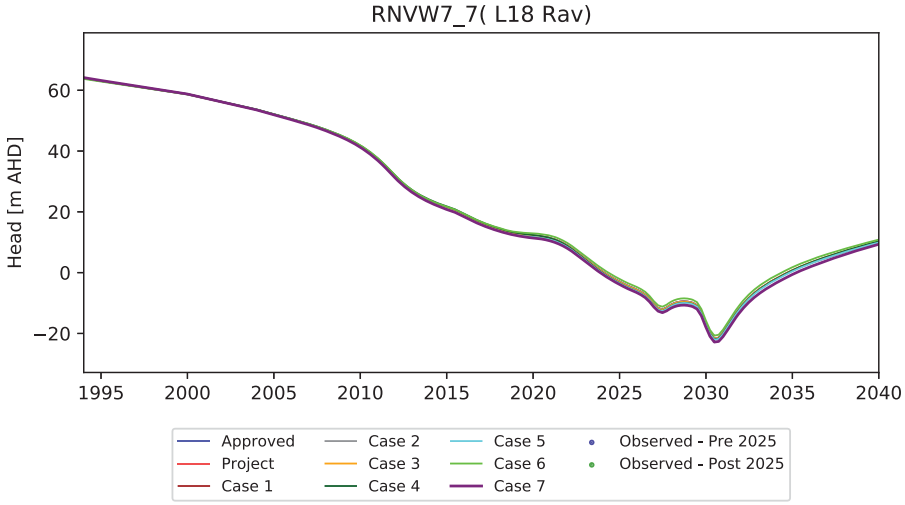

RNVW7_2(L8 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

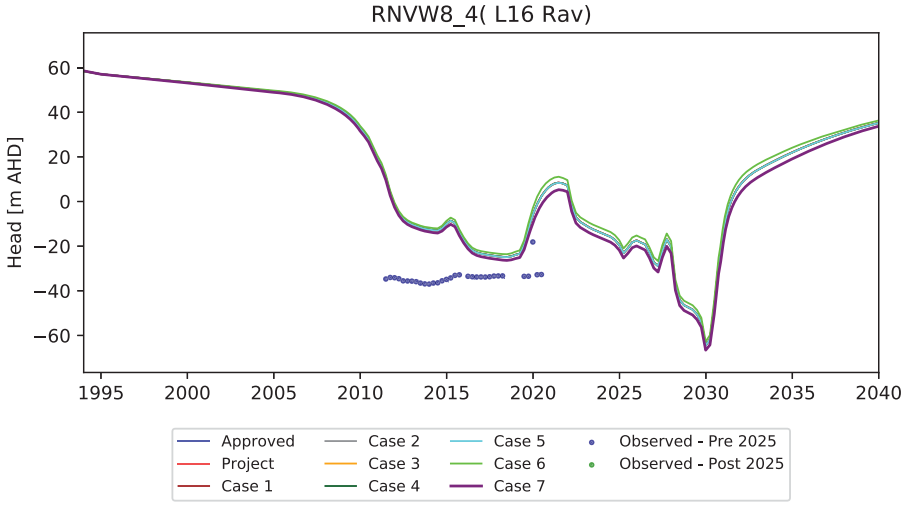

RNVW7_3(L10 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

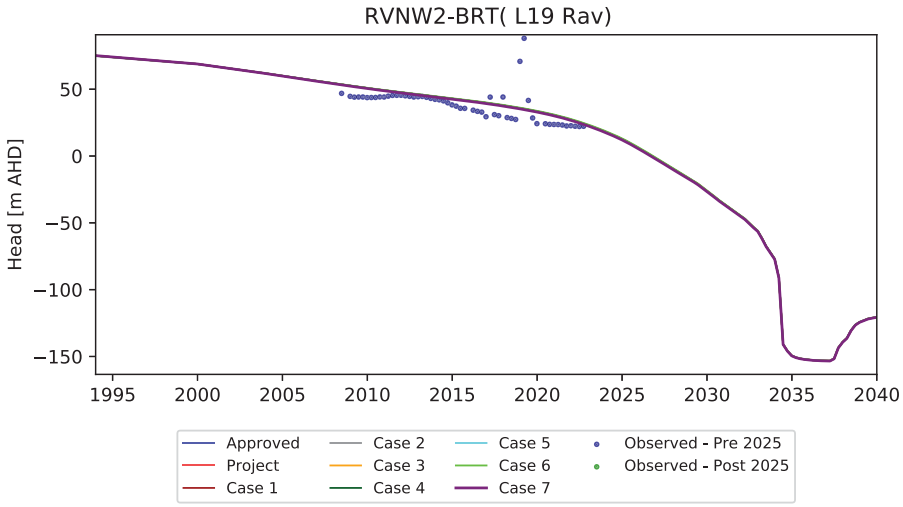

RNVW7_4(L12 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

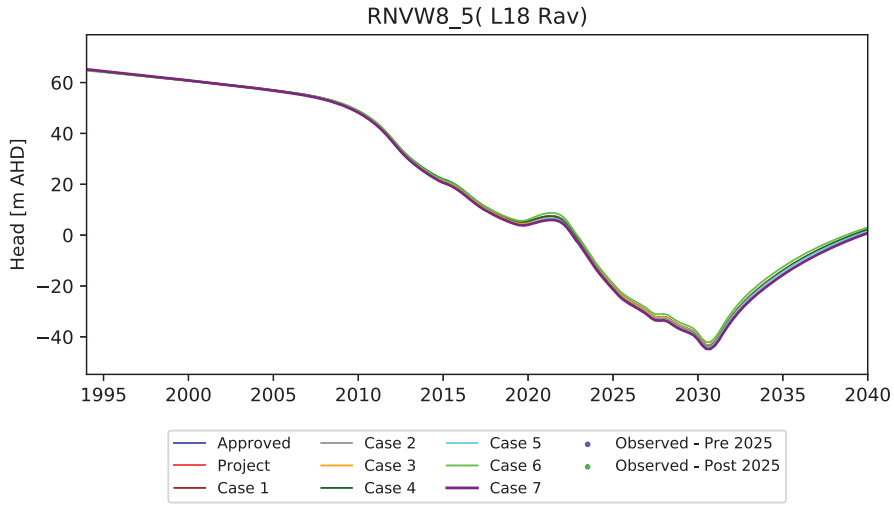

RNVW7_5(L14 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

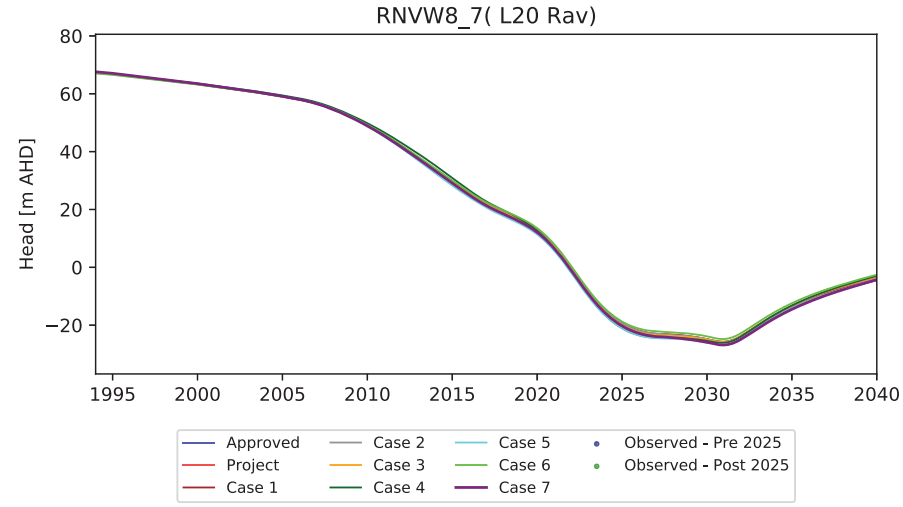

RNVW7_6(L16 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

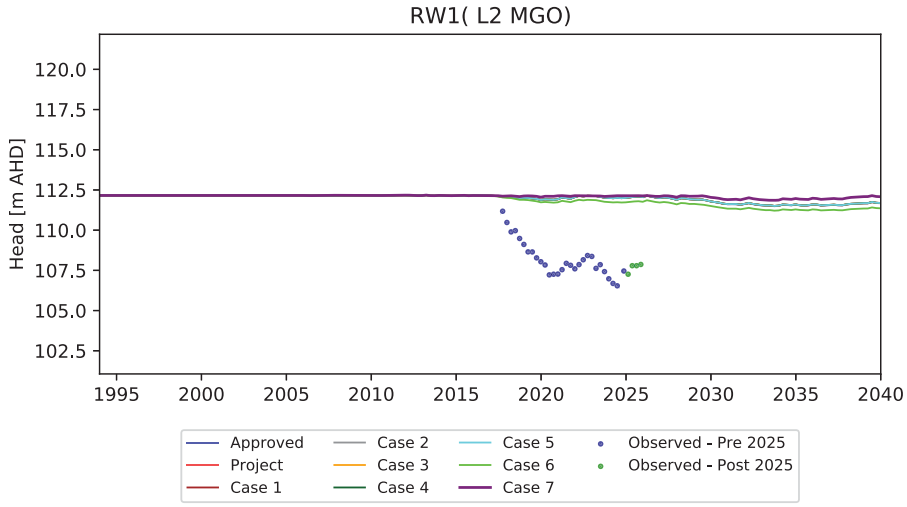

RNVW7_7(L18 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

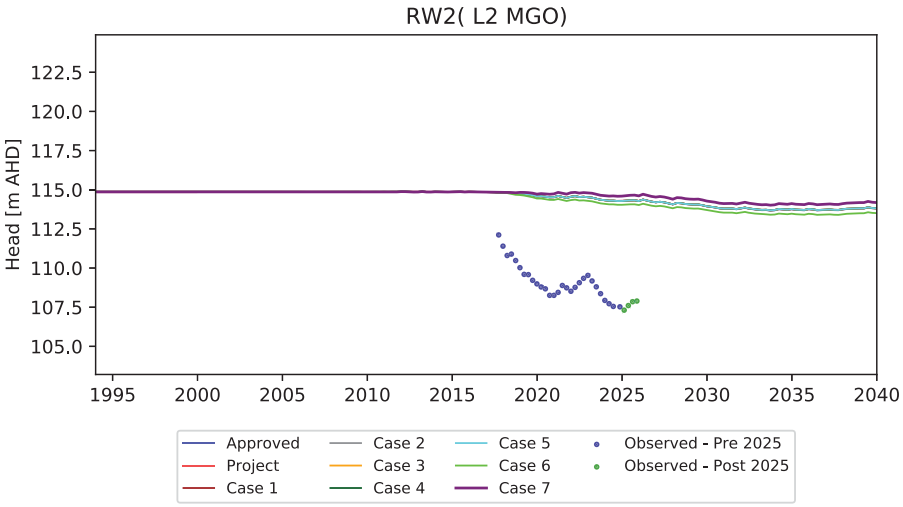

RNVW8_4(L16 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

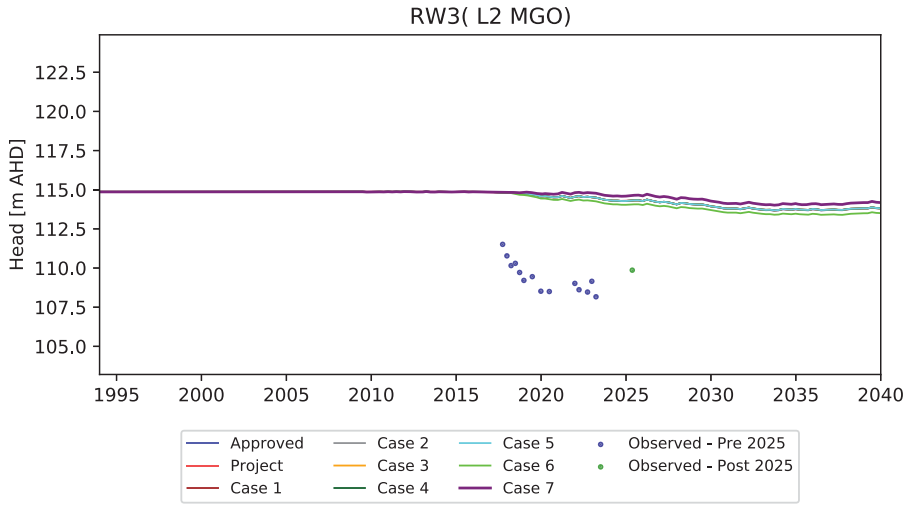

RVNW2-BRT(L19 Rav)
Head [m AHD]
50
0
−50
−100
−150
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

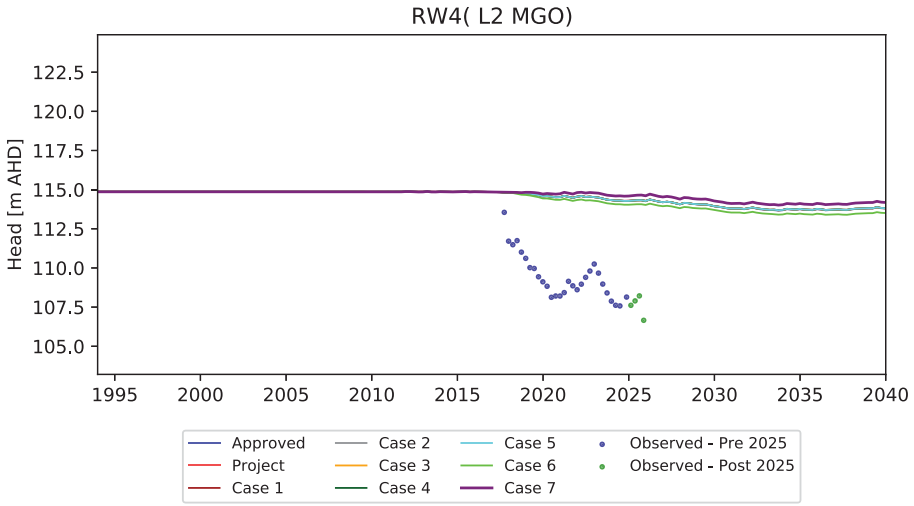

RNVW8_5(L18 Rav)
Head [m AHD]
60
40
20
0
−20
−40
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

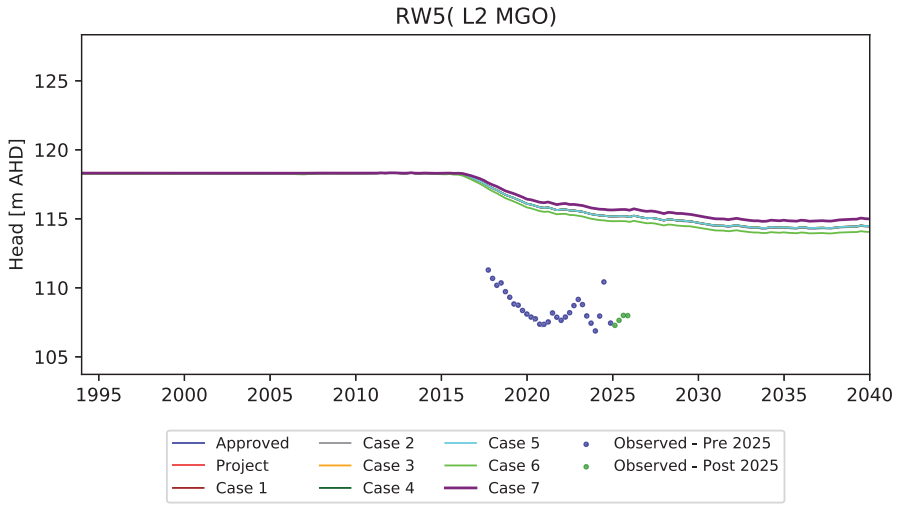

RNVW8_7(L20 Rav)
Head [m AHD]
80
60
40
20
0
−20
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

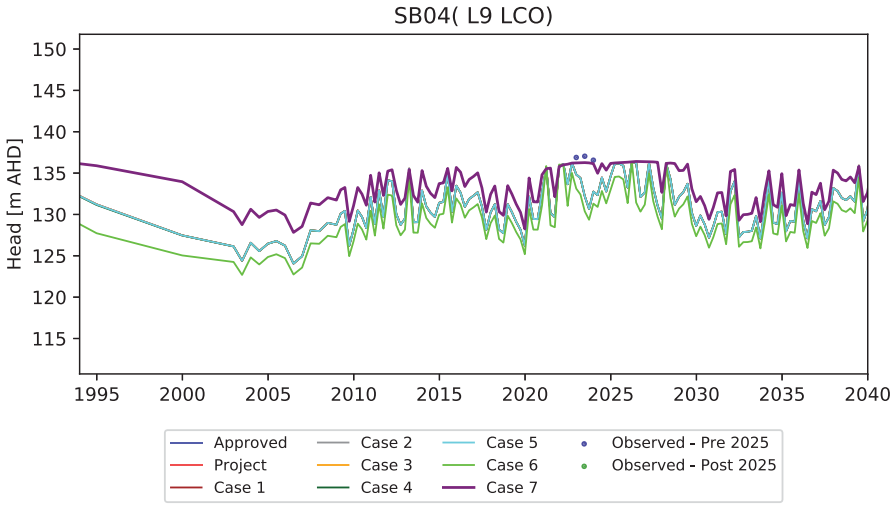

RW1(L2 MGO)
Head [m AHD]
120.0
117.5
115.0
112.5
110.0
107.5
105.0
102.5
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

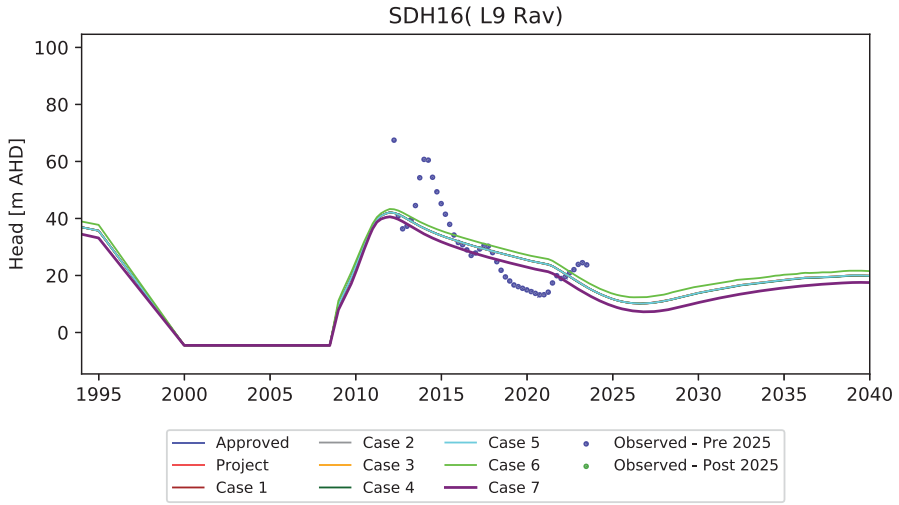

RW2(L2 MGO)
Head [m AHD]
122.5
120.0
117.5
115.0
112.5
110.0
107.5
105.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

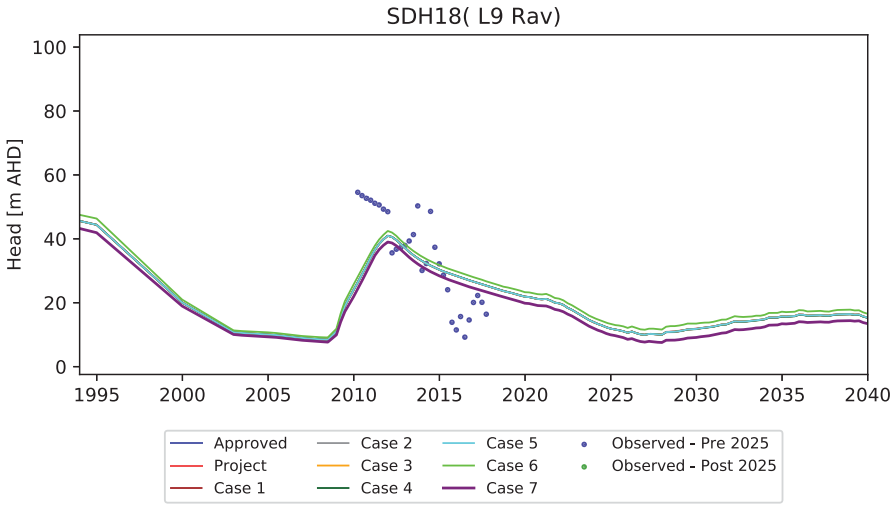

RW3(L2 MGO)
Head [m AHD]
122.5
120.0
117.5
115.0
112.5
110.0
107.5
105.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

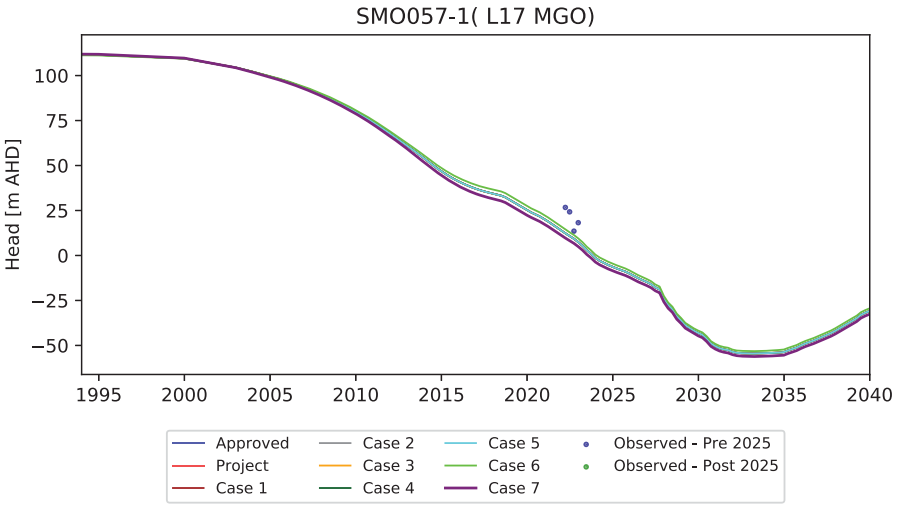

RW4(L2 MGO)
Head [m AHD]
122.5
120.0
117.5
115.0
112.5
110.0
107.5
105.0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

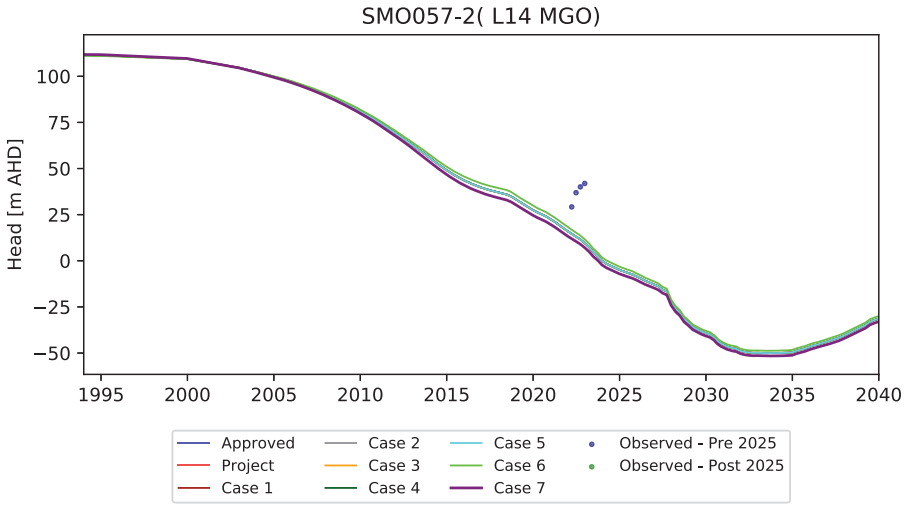

RW5(L2 MGO)
Head [m AHD]
125
120
115
110
105
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

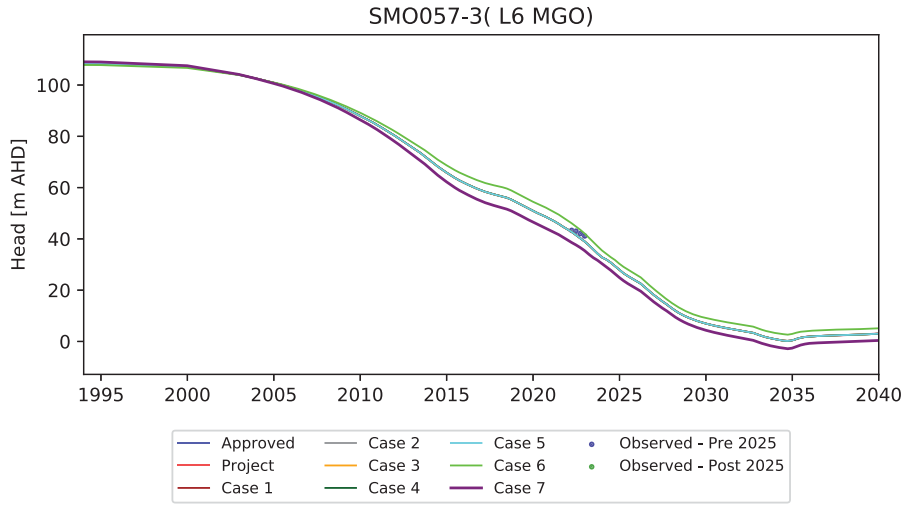

SB04(L9 LCO)
Head [m AHD]
150
145
140
135
130
125
120
115
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

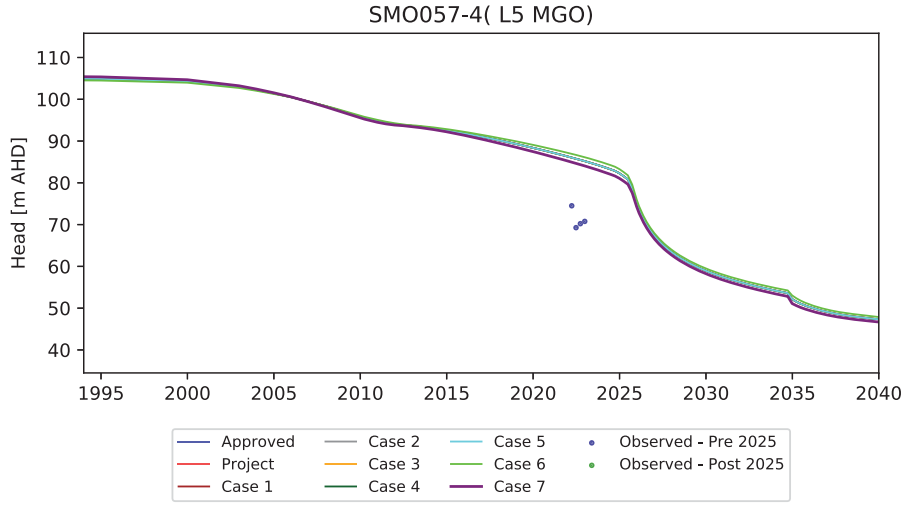

SDH16(L9 Rav)
Head [m AHD]
100
80
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

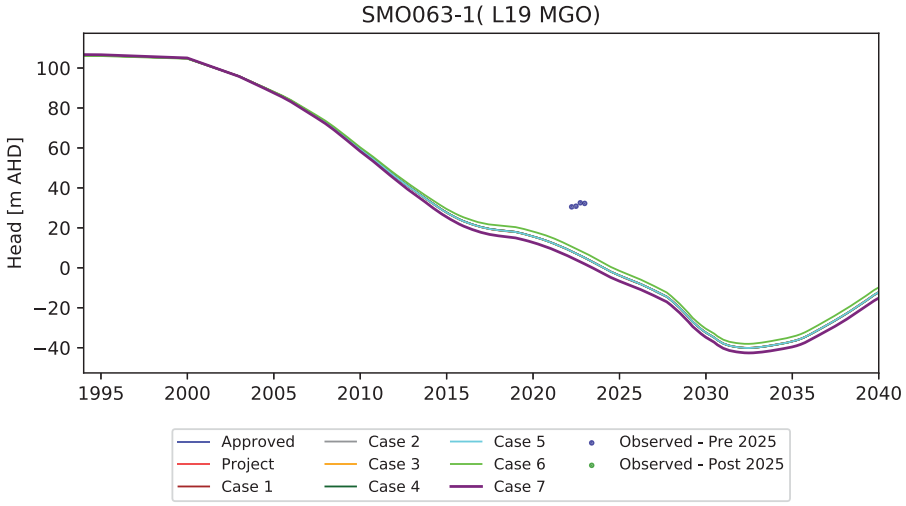

SDH18(L9 Rav)
Head [m AHD]
100
80
60
40
20
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

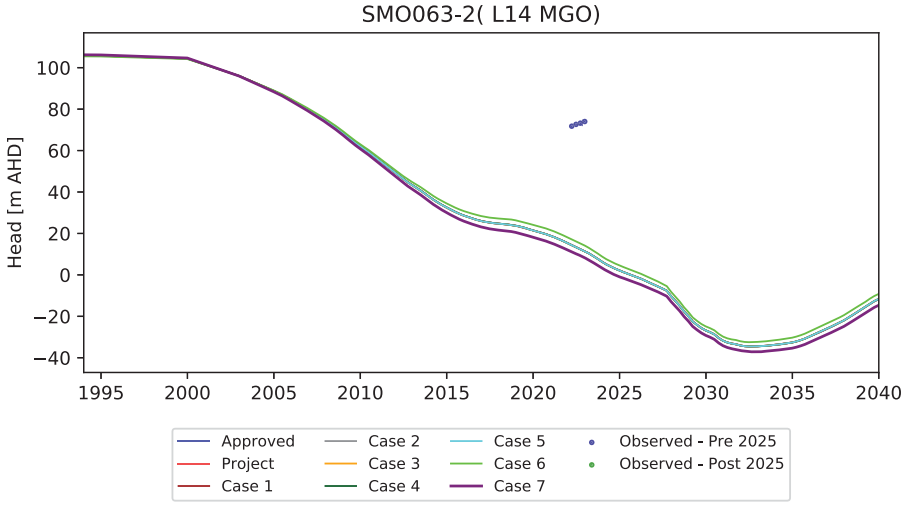

SMO057-1(L17 MGO)
Head [m AHD]
100
75
50
25
0
−25
−50
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

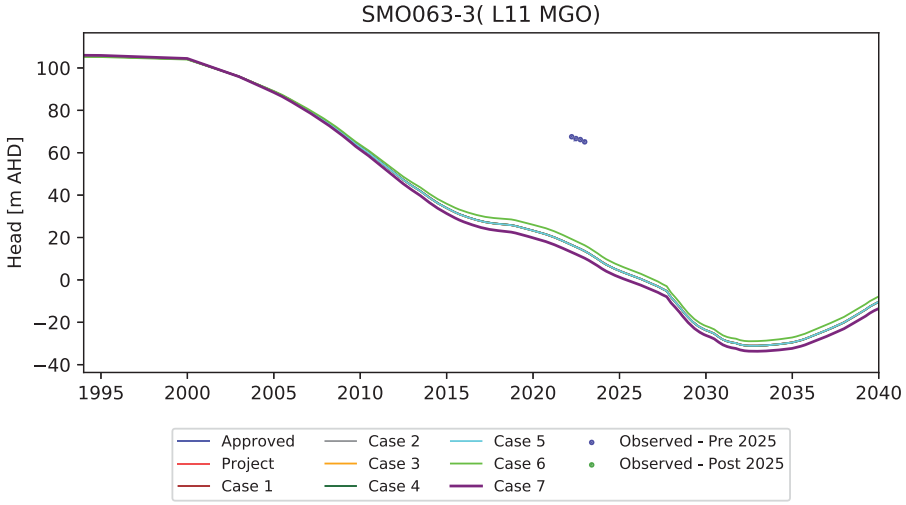

SMO057-2(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

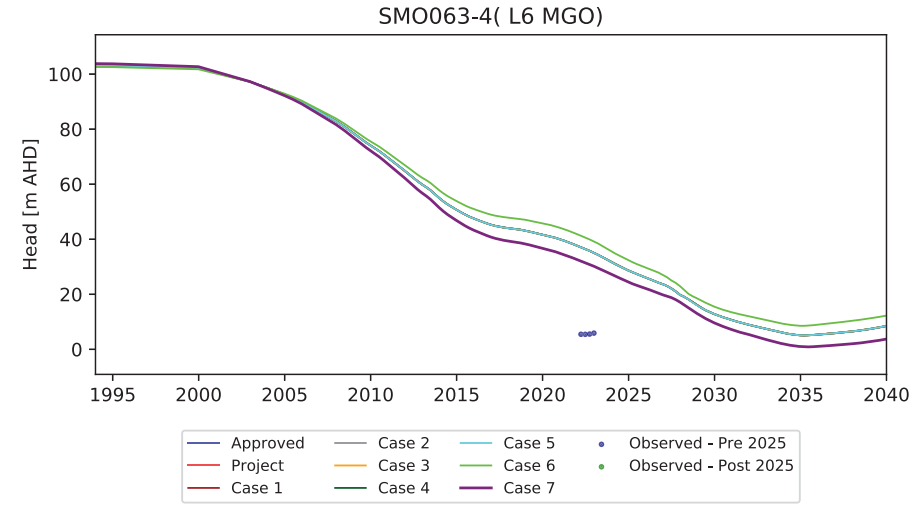

SMO057-3(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

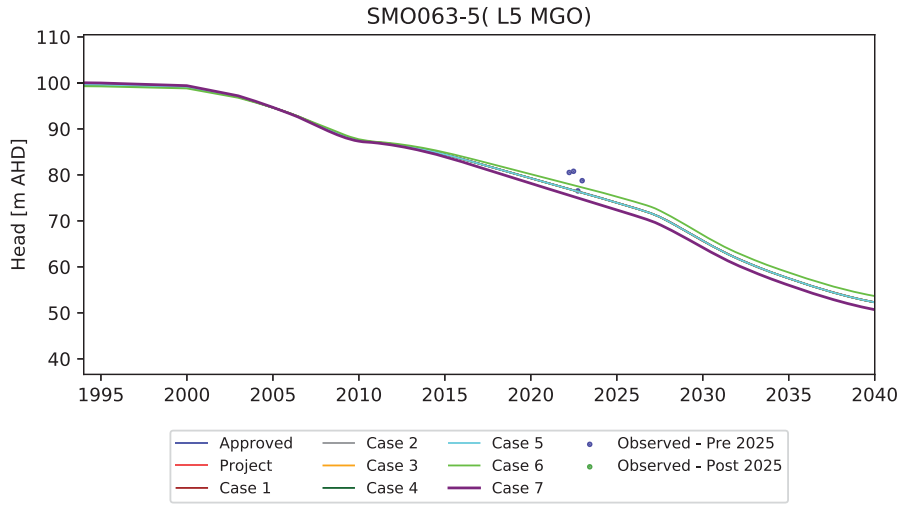

SMO057-4(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

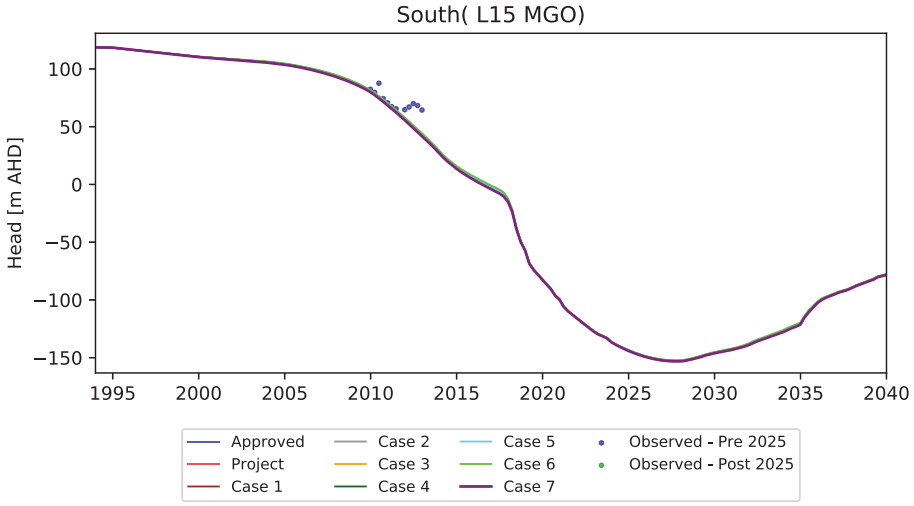

SMO063-1(L19 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

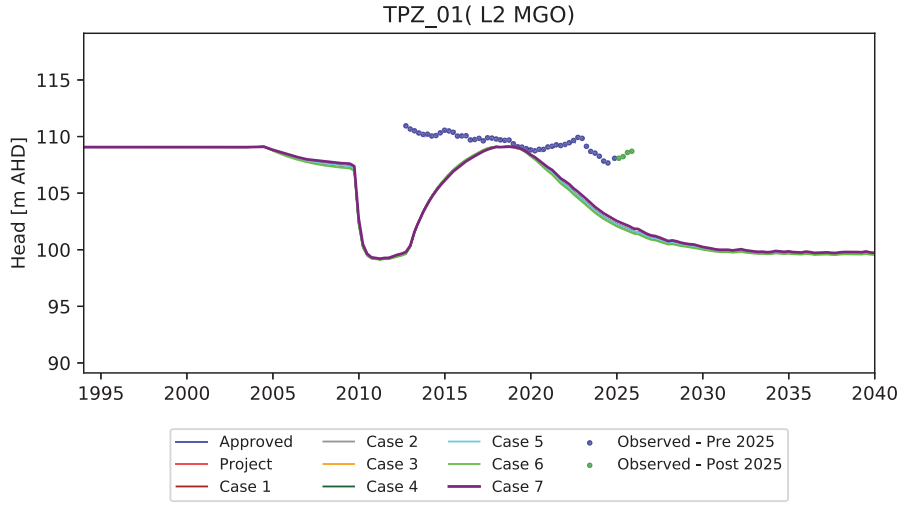

SMO063-2(L14 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

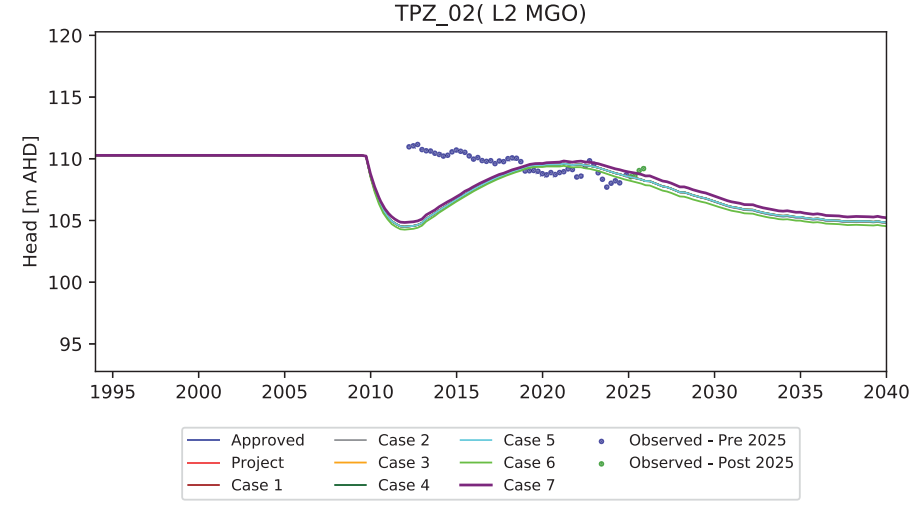

SMO063-3(L11 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

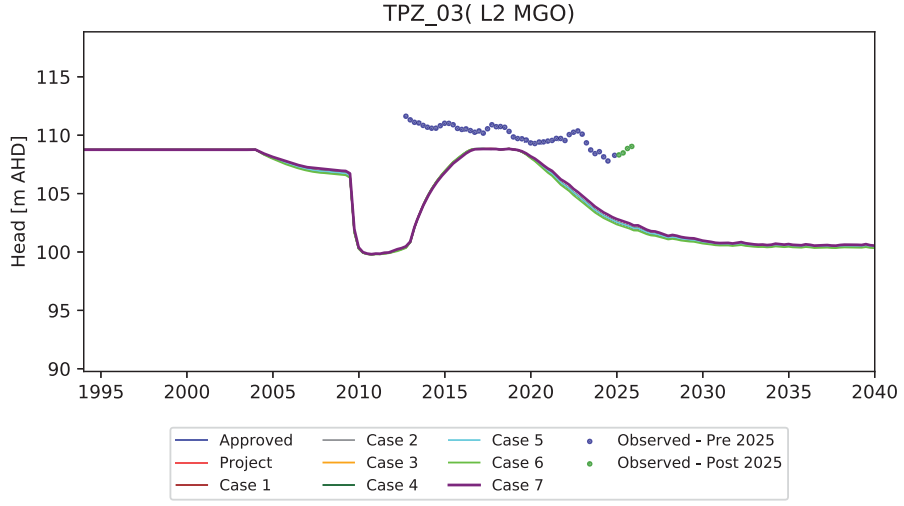

SMO063-4(L6 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

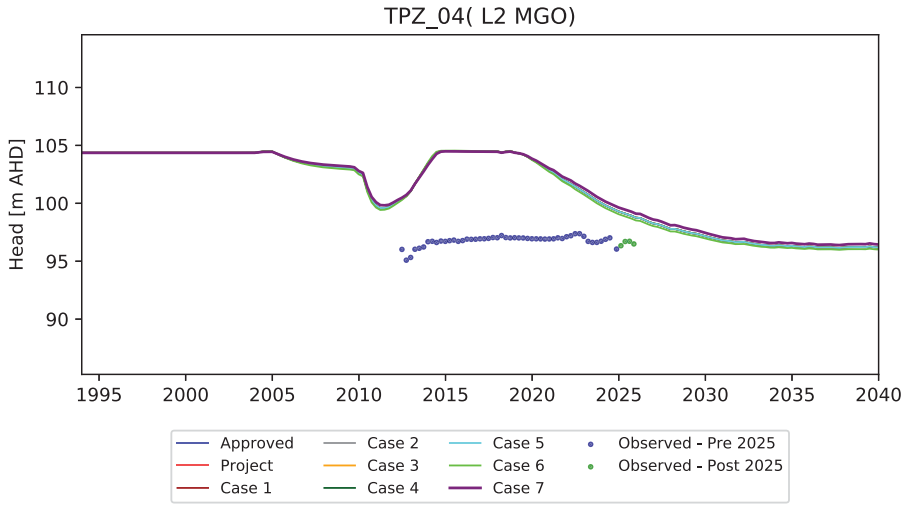

SMO063-5(L5 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

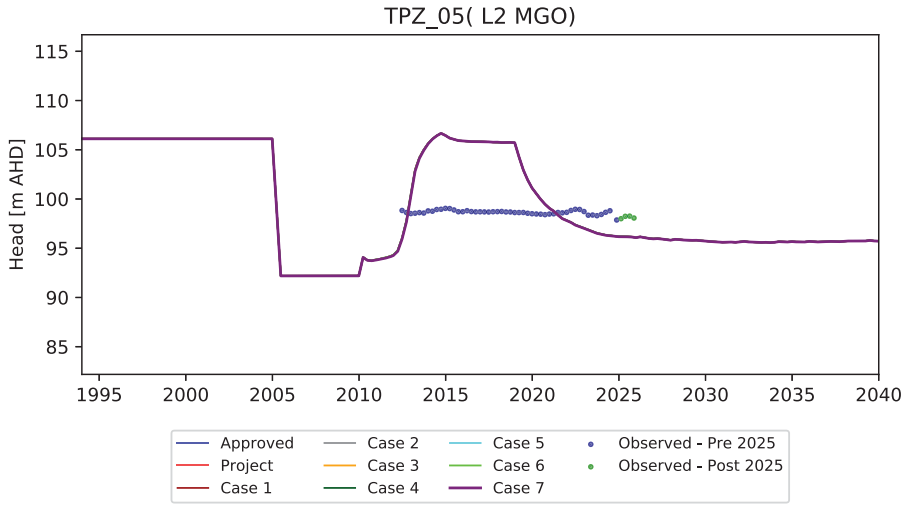

South(L15 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

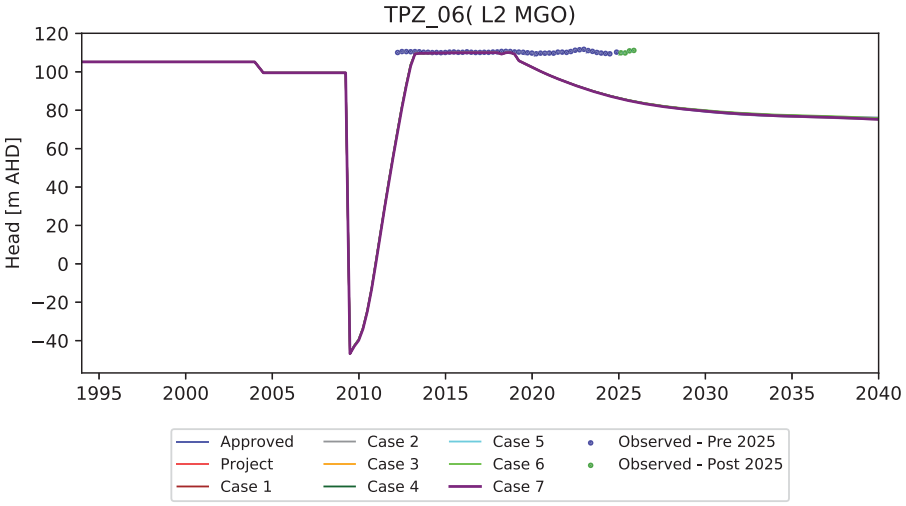

TPZ_01(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

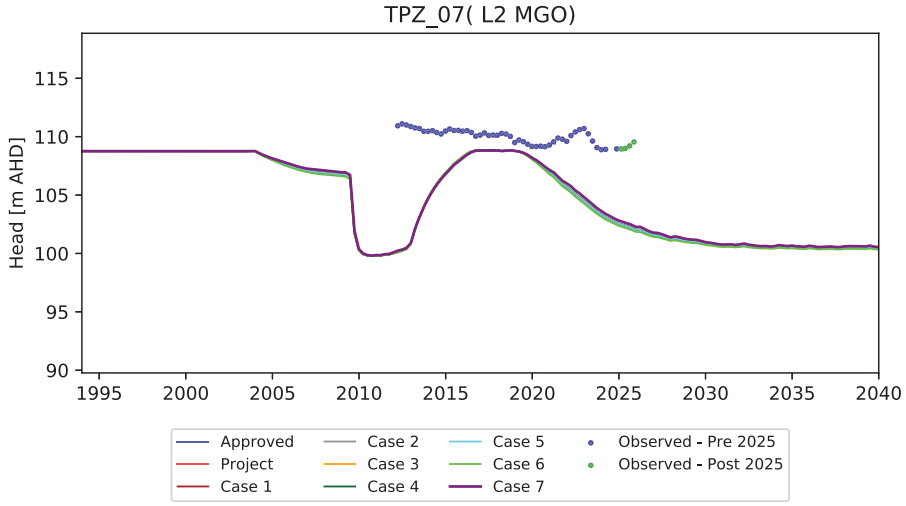

TPZ_02(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

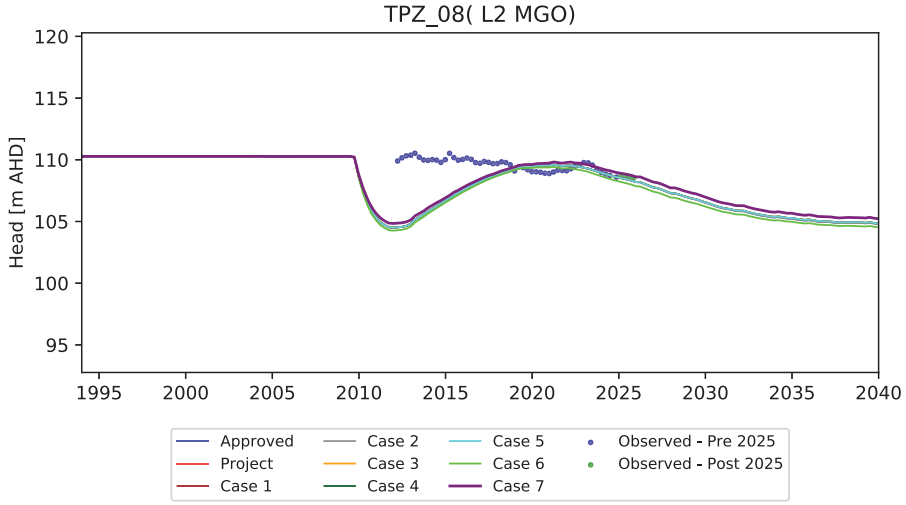

TPZ_03(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

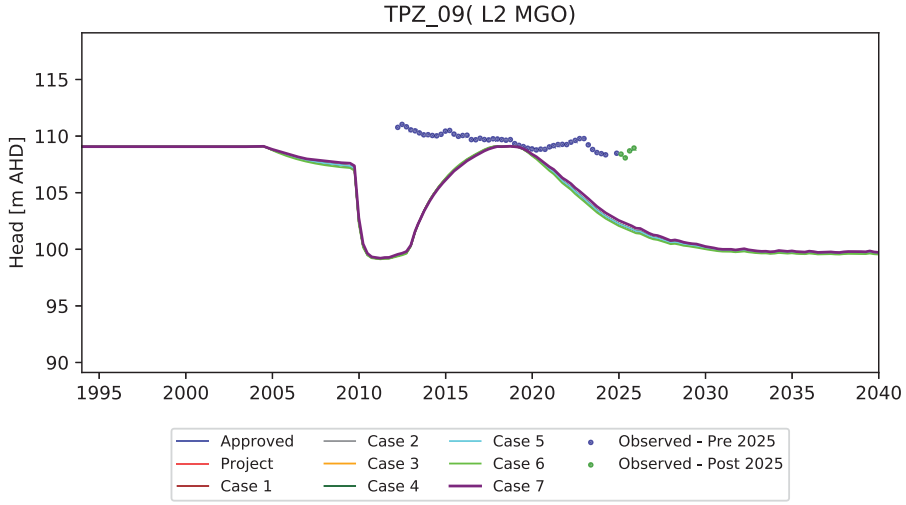

TPZ_04(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

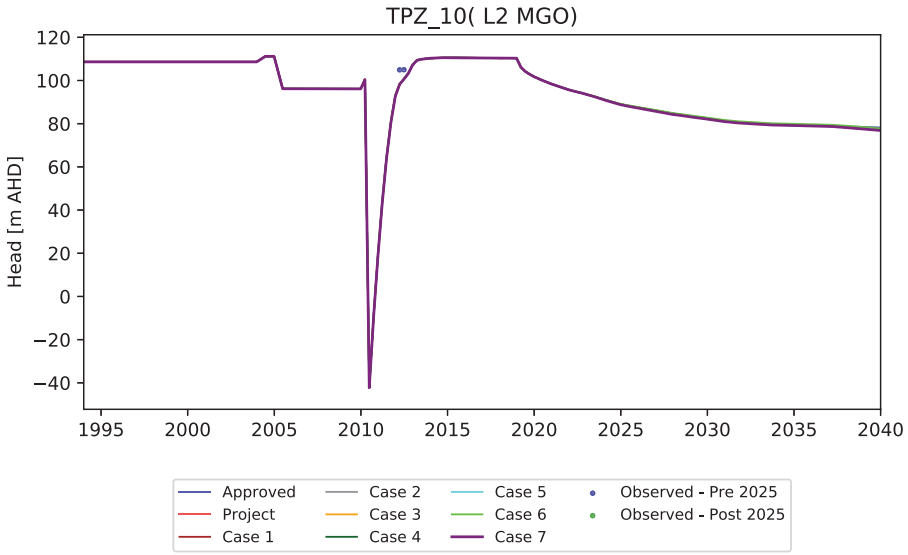

TPZ_05(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

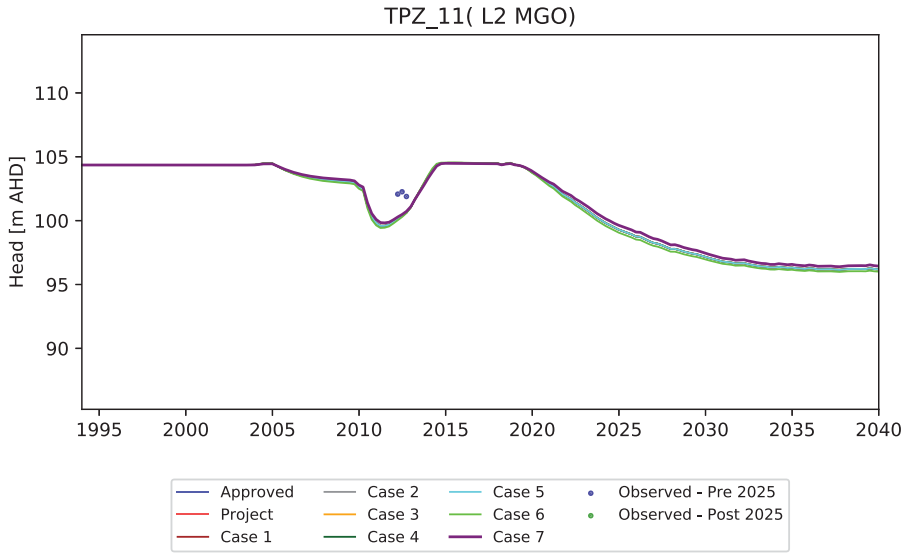

TPZ_06(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

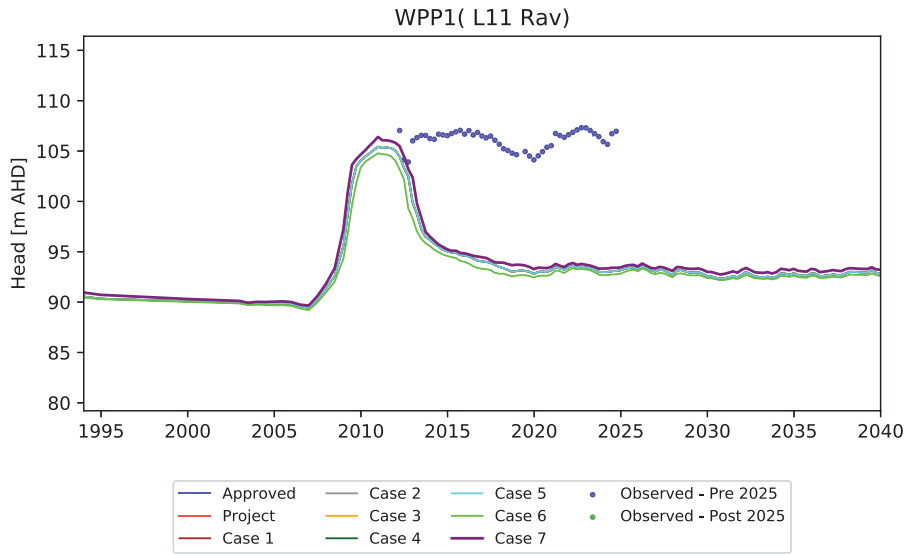

TPZ_07(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

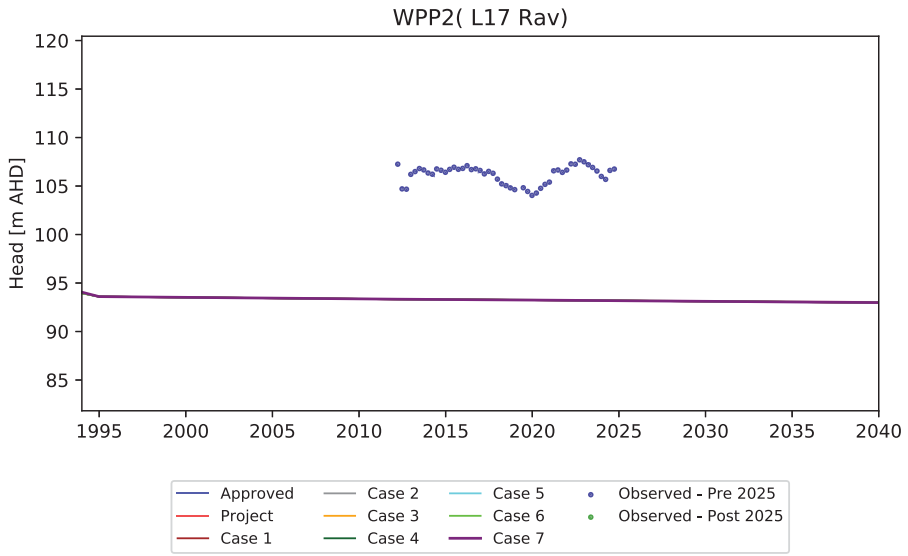

TPZ_08(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

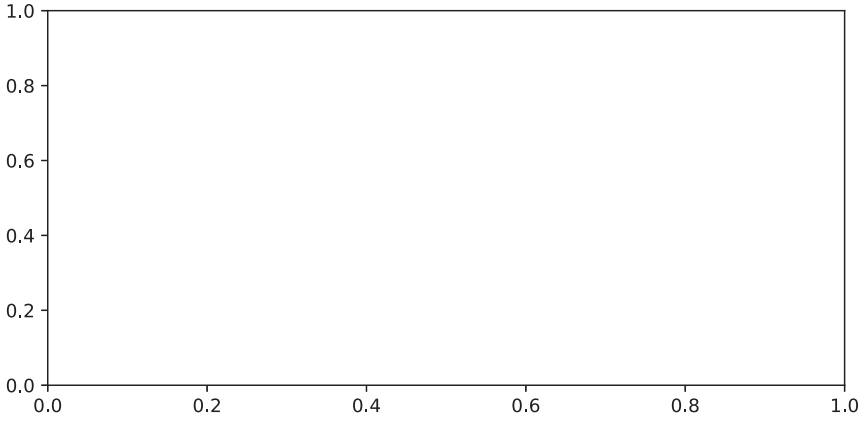

TPZ_09(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025

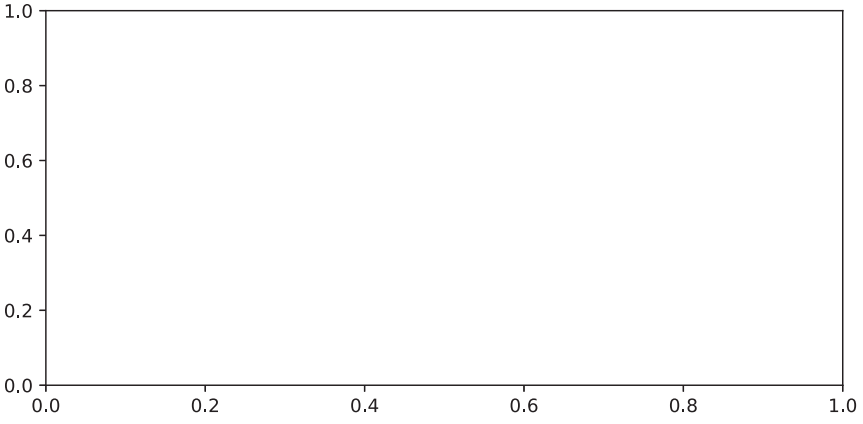

TPZ_10(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025


TPZ_11(L2 MGO)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025


WPP1(L11 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025


WPP2(L17 Rav)
Head [m AHD]
Approved
Project
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Observed - Pre 2025
Observed - Post 2025





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