



Memo

To: Bendigo-Ophir Gold Project Expert Panel **Cc:** Environmental Protection Authority

From: Eric Torvelainen, Paul Weber, Ryan Burgess, Jens Rekker and Gary Smith **Date:** 22 June 2026

Subject: Joint Response to Minute 29

Introduction

1. This memorandum is provided as part of Matakanui Gold Limited's (**MGL** or **Applicant**) response to the Expert Panel's Request for Information on the Bendigo-Ophir Gold Project (**BOGP**) contained in Minute 29 and should be read alongside the:
 - (a) legal response to Minute 29;
 - (a) updated management plans; and
 - (b) updated conditions.
2. Minute 29 discusses the following further groundwater workstreams:
 - (a) cumulative drawdown assessment of the Bendigo Aquifer;
 - (b) assessment of wetland hydrological function and sensitivity to drawdown;
 - (c) transient water load balance modelling;
 - (d) active water treatment design;
 - (e) passive water treatment concept and design;
 - (f) design of uncaptured seepage system;
 - (g) hydrogeological investigations targeting information on shallow groundwater, hydrostratigraphic unit definition and hydraulic properties; and
 - (h) 3D groundwater modelling of seepage collection systems.
3. In relation to the additional workstreams, the Minute requests that MGL provide a response on:
 - (a) how findings from new and updated assessments are proposed to be incorporated into detailed design;
 - (b) how relevant regulatory authorities would engage with MGL on these changes;
 - (c) what the certification process of any such changes would entail;

- (d) what provisions in terms of the project development timeline would be necessary around the certification process; and
 - (e) how the circumstances of the BOGP compares to Trans-Tasman Resources.
4. This response addresses (a) – (d) above and Lane Neave has prepared a response to (e).
5. The following expert witnesses have jointly prepared this response on behalf of MGL:
- (a) Eric Torvelainen;
 - (b) Dr Paul Weber;
 - (c) Gary Smith;
 - (d) Jens Rekker; and
 - (e) Ryan Burgess.
6. Each witness's qualifications are detailed in their evidence submitted on 17 April 2026 as part of MGL's response to comments made under Section 53 of the Fast-track Approvals Act 2024 (**FTA**).

Summary

7. A multi-disciplinary approach has been undertaken to determine the potential effects of the BOGP on surface water and groundwater within the project area. This has included professional advice from subject matter experts as noted at [5].
8. Numerous engineering controls are proposed to manage these potential effects on water quality within the downstream receiving environment (e.g., engineered landforms, water management and conveyance systems, water treatment, and seepage interception and collection systems). These controls are explained in the various technical assessment and management plans that have been provided as part of the application and subsequent updates. Additional explanation is provided in this memorandum.
9. The management of effects on water quality within the wider receiving environment will be managed by resource consent conditions that apply to surface and groundwaters at compliance monitoring locations.
10. Performance monitoring is proposed:
- (a) within the project area to provide early warning prior to any non-compliance of consent conditions;
 - (b) within the wider environment to confirm that the applied water quality limits are effective (e.g., performance monitoring of the Lindis River and Bendigo Creek: D.04 NEW6); and
 - (c) performance monitoring is contained in consent conditions and is explained further in the Water Management Plan.
11. MGL's experts agree that the risk of poor or unanticipated groundwater outcomes downstream is very low due to the geomorphology and geology, and lay-out of the site, performance and compliance

monitoring, and mitigations such as Seepage Interception Systems (**SIS**) that can feasibly be placed in optimal positions with water management and treatment if and when required.

12. Active water treatment for the project is a deferred activity; while the expected performance of the proposed treatment systems is understood, it would be premature to carry out detailed design on this type of treatment plant prior to carrying out water quality test work (which will only be available once mining commences):
 - (a) These types of water treatment plants require specific processes to target the expected site-specific parameters presented for treatment. Deferring the design as part of an adaptive management approach and then testing actual water generated under site conditions will remove uncertainty and ensure a robust treatment process is employed.
 - (b) Appropriate active water treatment systems are available and are very effective processes for removal of sulphate, heavy metals, and nitrates and give confidence that a robust treatment system for the project can be designed, constructed, and commissioned within the required timeframes.
13. Additional work is proposed to validate several assumptions used for the assessment of effects. These data will be used to develop appropriate engineering controls using a risk-based decision framework to ensure resource consent limits are constantly achieved. This additional work is explained in paragraph [2]. However, these packages of additional work are very unlikely to change the basic form of the standard mitigations currently proposed.
14. The updated performance and compliance monitoring, annual reporting processes, and the proposed independent Peer Review Panel (**PRP**), provide an effective mechanism for the site to be managed and mitigations to be applied to protect the downstream environment. This is applied through updated consent conditions and management plans.
15. The Expert Panel notes the challenges that it faces in determining impacts and therefore inappropriate conditions where baseline information is not yet at hand. The Expert Panel references the Trans-Tasman Resources decision where similar challenges were identified. To address these concerns, this joint response provides clarification on:
 - (a) Concerns by the Expert Panel on specific topics defined in [2] and our understanding of these issues.
 - (b) Potential impacts of the BOGP and the assessment of environmental effects that relate to the topics presented in [2].
 - (c) Baseline knowledge: Current knowledge gaps and how these will be addressed in a timely manner.
 - (d) Engineering knowledge: Current knowledge gaps and how these will be addressed in a timely manner.
 - (e) Proposed resource consent conditions to manage uncertainty, operate successfully and achieve closure objectives.
 - (f) How residual uncertainty will be managed within the management plans through adaptive management processes.

16. The technical aspects of the BOGP are complex and require independent subject matter experts to support the review of project documentation. We have recommended to MGL that this project would benefit from a PRP on selected key topics. This is common on other landfill and mining sites. MGL has accepted this recommendation, and we understand this will be reflected in the updated consent conditions. The purpose of the PRP would be to review performance monitoring results and check compliance with consent conditions and provide recommendations on measures that can be taken to achieve the ultimate closure outcomes. The PRP can be set up to report to the councils and be paid for by the company. The topics that we recommend are covered are to drive effective closure outcomes are:
 - (a) Geochemistry and mine-impacted waters.
 - (b) Hydrogeology.
 - (c) Rehabilitation.
17. We understand the PRP will also consider additional ecology topics.
18. With regard to proposed workstreams, the experts understand MGL will ensure that:
 - (a) The findings of any environmental monitoring or updated assessment will be taken into account as part of the detailed design;
 - (b) Where any detailed design is proposed and/or changes are proposed or required to management plans, they will be updated and provided to the relevant Council(s) and certification sought; and
 - (c) In accordance with the existing conditions, the Council(s) can engage technical experts to assist them with the review of any detailed design and/or proposed updated management plan required by the conditions. As noted at [1616], the Applicant has committed to a PRP to provide guidance to the relevant Council(s).

Specific Response to Request for Information

Cumulative Drawdown Assessment of the Bendigo Aquifer

19. This section was prepared by Mr Jens Rekker.

Summary of Response

20. The Expert Panel has requested further information about the drawdown effects on surrounding groundwater users being rigorously assessed and effects management applied.
21. The Project Team has existing knowledge and experience of the nature of the Bendigo Aquifer (in terms groundwater parameters and projected groundwater level response) and is confident that surrounding groundwater users will not be adversely affected.
22. It is proposed that in addition to application assessments, post-commissioning aquifer testing of the water supply bore field would include lengthy, full pumping rate and more widely instrumented testing of Bendigo Aquifer response. Subsequent aquifer testing analysis would include extended checks including cumulative drawdown modelling and individual assessments of the ability of neighbouring bores to sustain optimal water supply reliability.
23. The commissioning aquifer test and detailed evaluations of surrounding groundwater users' continuing access to water would be regulated and defined by proposed conditions of consent and

reflected in the water management plan. Monitoring of bore field groundwater level and Bendigo Aquifer quality would provide long-term surveillance and assurance, with potential triggers to effects management responses.

Key Response Points

24. The BOGP undertook drilling investigations in July 2024, including installing a 400 mm diameter, 42 m depth test production bore in the southeast of the Bendigo Aquifer and undertaking aquifer testing with observations in bores to derive groundwater properties of transmissivity and storage coefficient.
25. MGL then commissioned a drawdown assessment utilising the recommended methodology in Schedule 5 of the Otago Regional Plan: Water, namely the Theis Equation calculation of drawdown at distance from the proposed pumping bore field.
26. No adjustment or discount was included in the calculation for the lessening impact on drawdown of the Clutha / Mata Au River or Bendigo Creek recharge boundaries. For the same token, the countervailing barrier boundary of the schist boundary of the aquifer was also not included.
27. Calculated annual duration drawdown at the maximum daily rate of 8,640 m³/day. While this method indicated widespread extent of measurable drawdown effect, the ability of surrounding groundwater users to continue their lawful takes was found to be maintained.
28. The Otago Regional Council (**ORC**) reviewer raised the need for effects assessment to include the following further steps:
 - (a) More widespread groundwater level observation during the aquifer test;
 - (b) The full proposed pumping rate of 110 L/s for three days or more to impose more hydrodynamic stress upon the aquifer; and
 - (c) A *cumulative* drawdown effect assessment using stacked calculations or groundwater modelling, which would include the boundary condition effects of aquifer margin recharge sources and barriers.
29. A commissioning aquifer test will be undertaken to provide fresh and focused interpretations of intensity of drawdown throughout the aquifer surrounding the MGL water supply bore field.
30. These future determinations would add to the best information available to guide responses of specific measures of effects minimisation, any offsetting for reduced access to groundwater.
31. Having made updated determinations on the drawdown effects of the proposed MGL water supply bore field operation, determinations of drawdown effects on surrounding existing groundwater users would use the following hierarchy of measures:
 - (a) Collecting information on as many surrounding water bores as possible in terms of consented groundwater take, use, total bore depth, top and bottom of screened section, pump intake depth and range of groundwater levels;
 - (b) Collecting existing information on the tendency and measurements of surrounding bores' water level and self-induced water level decline at normal rates of groundwater abstraction;
 - (c) Collating information on the best estimates of the BOGP induced drawdown effects on surrounding water bores; and

- (d) Undertaking a cumulative drawdown assessment to evaluate whether critical freeboard levels would be breached, which may use model methods and include boundary conditions.
32. Should the above cumulative drawdown assessment point to single, or multiple existing groundwater user bores being affected, then the following consultation, investigation and remedial actions would be triggered:
- (a) In the case that the above cumulative drawdown assessment indicates a vulnerability to BOGP induced drawdown and difficulties to continued surrounding water bore pumping operation, follow-up consultation and a request to investigate remedial actions would be made to the affected bore owner.
 - (b) Investigations may include:
 - (i) detailed measurements of the affected bore(s);
 - (ii) reference to bore log, bore construction and drilling records;
 - (iii) pulling the pump unit and making essential measurements, potentially with the benefit of a downhole camera survey; and
 - (iv) measuring the internal decline in bore water level during pumping of the subject bore (specific capacity or step rate testing).
 - (c) Remedial action recommendations may include:
 - (i) lowering of the pump unit within the original bore (where feasible);
 - (ii) re-drilling of the bore and setting a deeper, larger diameter screen so as to allow lower setting of the pump unit and higher screen efficiency; and
 - (iii) provision of a replacement, high reliability water supply of equal or better water quality in the case of elevated risk of bore water supply interruption that cannot be remedied by any other means.
33. As outlined in condition NEW 5 in D.02 any remedial actions will be subject to informed consultation with individual affected surrounding bore owners and approval before these are implemented.

Assessment of Wetland Hydrological Function and Drawdown Sensitivity

34. This section was prepared by Mr Ryan Burgess.
35. The experts understand the Expert Panel has requested clarification of how well flow augmentation will mitigate potential effects on wetlands from pit dewatering associated drawdown.
36. Document B.42 assessed the potential drawdown zone of influence as a result of dewatering proposed mine voids (open pits and underground workings). Within this zone, the offset model conservatively assumed that seepage and gully fen wetlands would be totally lost, even though they may be able to tolerate some level of drawdown (should they be impacted at all), see Document B.08.
37. For the swamp/marsh wetlands associated with Rise and Shine Creek, given their interpreted surface water dominated nature (nature based on ecological field observations including landscape position, vegetation, hydrology and soils), flow augmentation is proposed to mitigate potential

drawdown effects (Document B.43). Approximately 7.5 ha of indigenous swamp/marsh wetland proposed to be created (Document B.08).

38. Proposed consent conditions require the completion for hydrological/hydrogeological field investigation and monitoring to confirm the hydraulic function (surface water dominated) of the Rise and Shine swamp/marsh wetland system.
39. Knowledge gained from advancing understanding of wetland hydrological function will confirm the sensitivity of investigated wetlands to indirect drawdown related effects, for example the degree of connectedness to the deeper groundwater system. Assessment findings will not be directly incorporated into detailed design of any engineering element. Rather, they represent further investigation to validate the current conceptualisation of the Rise and Shine swamp/marsh wetlands as being surface water dominated. Completing the proposed investigations will:
 - (a) Provide additional confidence that planned flow augmentation will successfully mitigate potential drawdown effects.
 - (b) Provide performance monitoring locations with which to track potential wetland hydrology changes as a result of the BOGP activities.
 - (c) Inform hydrological input to the detailed design of planned constructed wetlands (e.g., required flows and/or water table levels).
40. Advancing understanding of wetland sensitivity will be reflected in updates to the Ecological and Rehabilitation Management Plans responsible for managing potential effects to wetlands outside the proposed direct disturbance footprint along with the Water Management Plan. Hydrological assessment to inform detailed construction design of wetlands is underway and an assessment of the proposed lower Shepherds wetland and Shepherds TSF wetland is attached in Attachment A.

Transient Water Load Balance Modelling

41. This section was prepared by Mr Ryan Burgess.
42. The experts understand the Expert Panel has requested clarification on the operational water balance of the BOGP during operations, with the potential for a long term water surplus condition to develop.
43. Operational and Closure water balance and surface water quality conditions were assessed as part of the Substantive Application in Appendix N of B.06. As part of this assessment, the site water balance condition was evaluated with calculations suggesting that under a 'High' Case, a water surplus condition may develop after Year 8. Alternatively, a permanent water deficit condition would persist under a 'Low' Case. Potential mitigations were proposed along with development of a Site Wide Water and Load Balance Model (**WLBM**) to further refine understand of site water balance conditions.
44. ORC consent condition D.04 NEW 6A which requires the development of a Site Wide WLBM prior to the start of the BOGP Development Phase (i.e., within 6 months of the BOGP commencing). This model will be made available to ORC on request.

45. As per the Water JWS 10 June 2026 [35]:
- (a) “the scope is to develop a transient Site Wide WLBM that represents the operational period of mining, expanding upon modelling completed as part of the Substantive Application. Focus areas of the model are long-term site water balance condition and how water storage areas (e.g., the TSF supernatant pond) recover following extreme precipitation events. Surface water quality will also be simulated as part of the model. Model outputs will also support water management infrastructure design (e.g. sump sizing, TSF water storage requirements). If model results suggest an ongoing water surplus, options for mitigations will be evaluated to support detailed design of mitigations.
 - (b) The intention is for the model to be an operational tool to be used for water management and planning and updated periodically to incorporate empirical performance monitoring data collected during operations and/or as material changes to the Mine Plan occur.”
46. In addition to design input only, findings may influence water management strategy and/or mitigation options. For example, if a persistent water surplus is suggested, model results will suggest the level and timing of mitigation required such as additional water storages, evaporation cannons, or active water treatment.
47. Since the intention of the model will be for it to become an operational tool and regularly updated with performance monitoring data, it will inevitably be used to support closure planning and in particular detailed design of active and passive water treatment systems (i.e., contaminant flows and loads requiring treatment. It will also be used to for dam safety review to confirm that the supernatant pond can be effectively managed within the design limits set for the dam. The design of the dam and construction of the dam is controlled by the requirements of the Building Act (2004). Post construction dam safety is controlled by the Building (Dam Safety) Regulations 2022. These cross over for a TSF as it is being operated as it is constructed i.e., raised.
48. As the Site Wide WLBM is updated with empirical data collected as part of the performance monitoring programme, the projected water balance can be revised and updated in annual water reporting.

Active Water Treatment Design

49. This section was prepared by Mr Gary Smith.
50. This section addresses the Expert Panel’s request to provide more information on the design of the active water treatment plant. The Expert Panel notes the challenges that it faces in determining impacts and therefore inappropriate conditions where baseline information is not yet at hand. To address these concerns, we respond as follows.

Concerns by the Expert Panel on Specific Topics Regarding Active Water Treatment Design and our Understanding of these Issues

51. To achieve a robust design the following processes will be trialled during the active water treatment test work. Noting that this is not an exhaustive list, other processes may be adopted where required to achieve treatment targets and a combination of the proposed treatment systems may be included in the final design:
- (a) Chemical treatment, coagulation, and mineral precipitation.
 - (b) Membrane treatment including reverse osmosis.

- (c) Additional nitrate removal systems (fluidised or fixed bed reactors, ion exchange or passive treatment systems including wetlands may be considered).
- (d) Specific treatment of cyanide on the Shepherds TSF underdrain water stream prior to the active water treatment plant.
- (e) Sludge/Brine dewatering or concentrating for disposal.

52. The systems listed above are very effective processes for removal of sulphate, heavy metals and nitrates and give confidence that a robust treatment system for the project can be designed, constructed and commissioned within the required timeframes.

Potential Impacts of the Bendigo-Ophir Gold Project (BOGP) and the Assessment of Environmental Effects that Relate to Active Water Treatment

53. Treatment systems for active water treatment will be designed to meet the proposed water quality compliance limits as set out in proposed condition D.02 New9.

Baseline Knowledge: Current Knowledge Gaps and How These Will be Addressed in a Timely Manner

54. Active water treatment for the project is a deferred activity; while the expected performance of the proposed treatment systems is well understood, due to commercially available technology and supporting literature, it would be premature to carry out detailed design on this type of treatment plant prior to carrying out water quality test work (which will only be available once mining commences). These types of treatment plants require specific processes to target the expected parameters presented for treatment. Deferring the design as part of an adaptive management approach and then testing actual water generated under site conditions will remove uncertainty and ensure a robust treatment process is employed.

Engineering Knowledge: Current Knowledge Gaps and How These Will be Addressed in a Timely Manner

55. The engineering requirements and treatment options for the active water treatment plant are well understood. Deferred design and water quality test work on actual mine influenced water as discussed above, will allow the detailed engineering work to commence fully informed and will result in the following key outcomes prior to construction.

- (a) Correctly selected and sized process equipment.
- (b) Correctly sized plant feed and polishing pond infrastructure.
- (c) Correctly selected water quality monitoring instrumentation.
- (d) Plant discharge streams will be defined and managed, and sludge/brine disposal options will be arranged to cater for ongoing operations.
- (e) Operational and maintenance requirements will be documented, allowing provision for staffing and ongoing management of the facility.

Proposed Resource Consent Conditions to Manage Uncertainty, Operate Successfully, and Achieve Closure Objectives.

56. Proposed conditions regarding triggers for active water treatment are:

- (a) D.02 (New 6) – Trigger conditions for active treatment test work and detailed design

- (b) D.02 (New 7) – ORC approval of detailed design for active treatment.
- (c) D.02 (New 8) – Trigger for active treatment construction.
- (d) D.02 (New 9) – Active treatment plant water quality compliance limits.
- (e) D.02 (New 10) – Active treatment plant monitoring requirements.
- (f) D.02 (New 11) Active treatment plant operations and maintenance requirements.

57. The trigger points and proposed conditions listed above will ensure that the design and construction of the active water treatment plant will be completed well ahead of when it's required on the site. The design will have been informed by a rigorous testing process to give certainty that the selected processes will achieve the performance requirements.

How Residual Uncertainty Will be Managed Within the Management Plans Through Adaptive Management Processes

58. The water management plan will be updated to include the proposed Active Water Treatment studies that will be undertaken during the operational phase of the project. This will include the triggers detailed in the proposed conditions as well as the water quality objectives defined for discharge from the active water treatment plant.

Passive Water Treatment Concept and Design

59. This section was prepared by Dr Paul Weber.

60. During conferencing and through the FTA review process there have been concerns raised by subject matter experts and the Expert Panel with regards to:

- (a) The reliability of passive water treatment systems to treat mine impacted waters such that resource consent objectives can be achieved; and
- (b) Post closure management of the Passive Treatment System (PTS).

61. The potential effects that would occur from a PTS that cannot treat mine impacted waters to meet resource consent conditions would be a longer active closure period and ongoing treatment by the active water treatment plant. This would include the PTS proposed for Shepherds Creek catchment and the SRX Pit.

62. Financial provision and mechanisms need to be developed by the Applicant for the costs associated with treatment of mine impacted waters in the closure phases. It is understood this is being addressed by the Applicant.

63. The following paragraphs provides background information on passive treatment of mine impacted water to provide the Expert Panel confidence in the proposed approach at BOGP:

- (a) Passive water treatment systems are not required until closure (Year 11 of the BOGP mine plan), which provides ample time to design, test, and commission the system(s).
- (b) Studies regarding the PTS are deferred until suitable site-specific mine impacted water is available and pilot trials can be operated on site to test climatic influences of PTS performance and treatment efficiency. The approach is very common in the mining industry and the use of site-specific data to inform baseline knowledge will ultimately support the development of reliable passive treatment system.

- (c) As noted in the evidence of Dr Paul Weber dated 17 April 2027 (Part 2-12) and in Appendix A of that evidence, the use of passive treatment systems to treat mine impacted waters is a proven and reliable technology with numerous case studies provided. The caveat to this statement is that the design of a reliable PTS requires comprehensive site-specific studies.
 - (d) In this regard, as per the JWS for Water – Part 2 at [26] Dr Weber notes that the studies relating to passive water treatment need to commence 5 years prior to the PTS technology being required. This provides a sufficient timeframe to undertake bench- and pilot- scale trials over a number of years to understand site specific effects (e.g., temperature) of PTS efficiency and reliability to meet proposed water quality limits. This 5-year commitment has been proposed as a new consent condition [D.02 NEW 12].
 - (e) Passive water treatment systems have been successfully installed for the closure of mine sites. Recent New Zealand examples include:
 - (i) the Reefton Globe Progress Mine that treats elevated iron and arsenic in seepage (<https://oceanagold.com/sustainability/closure-and-relinquishment>); and
 - (ii) the Canterbury Coal Mine that treats seepage of mine impacted waters.
 - (f) The proposed treatment efficiency of the BOGP passive treatment system was determined from a desktop study and is based on a treatment train that could include an oxidation stage, an anaerobic stage, and then a polishing pond. Further details are provided in:
 - (i) B.06C - Appendix M: Water Treatment Study - Bendigo-Ophir Gold Project. MWM Report Number: J-NZ0464-002-R-Rev2.
 - (ii) Evidence of Dr Paul Weber dated 17 April (Part 2-12).
 - (g) Enhanced passive treatment systems will also be considered, which could include the addition for ferric chloride to remove arsenic and other trace metals or water-soluble carbon compounds such as acetic acid to improve anaerobic treatment processes during colder periods (e.g., winter) when biological processes are slower.
64. New consent conditions (D.02 New 12) have been proposed to ensure that studies into passive treatment of mine impacted waters will occur in a timely manner and this will include:
- (a) Bench testing - simulation of each step in the passive treatment train.
 - (b) Assessment of MIW sludge, which is required to inform the appropriate management requirements once treatment commences.
 - (c) Scaled-up testing / pilot trials to ensure the process works at the required scale.
 - (d) Studies must be informed by the results of the cover system trials required by Condition 20.
 - (e) Studies must be informed by the water load and balance modelling required by conditions to ensure that the passive treatment system is designed with adequate capacity.
65. If site-specific studies identify that the treatment efficiencies are lesser than what desktop studies indicated, then the active treatment plant will need to operate for a longer time period.

66. As stated in evidence and as acknowledged through the expert conferencing process, a passive treatment system is not a walk-away option. Ongoing monitoring, maintenance, sludge disposal, and reporting is required.
67. Passive treatment can generate secondary contaminants such as sulfide and low dissolved oxygen in discharge waters. These parameters have been added to the proposed surface water quality consent conditions. An oxidising polishing pond is proposed to treat these secondary effects and this process, which is a common method, will be validated through field trials,
68. The above studies will provide an effective and proven approach to the design and development of a passive water treatment system for closure:
- (a) The commencement of PTS trials 5 years before a PTS is required will ensure the technology is ready several years before implementation is required.
 - (b) Prior to finalisation of the PTS design, the Applicant will provide a design report to the ORC for review by the proposed BOGP PRP (or its appointed expert) to confirm the design is appropriate. This would lead to the certification of the system by ORC as being appropriate. A new consent condition D.02 NEW14 is proposed to ensure the PTS detailed design is certified by the ORC no less than three months prior to commissioning construction of the PTS. The certification criteria must be prepared by a SQEP.
 - (c) Any uncertainty regarding timing of passive treatment will not result in any different effects as active treatment will continue until passive treatment can reliably achieve water quality limits.
69. The water management plan will be updated to include the proposed passive treatment studies that will be undertaken during the operational phase of the project. As required by D.02 NEW 17 an operations and maintenance manual will be developed that will address change management.

Design of Uncaptured Seepage System

70. This section was prepared by Mr Ryan Burgess and Mr Jens Rekker.
71. The Expert Panel has requested further information about the potential for unrecovered seepage and how contingency measures will be implemented.
72. Primary seepage collection systems are proposed in the Mine Waste Storage Facilities (**MWSF**) designs. The design elements proposed include low permeability cutoff toe barriers Shepherds ELF and WELF and shallow perimeter drains for the SRX ELF. All systems will have underdrainage. The Shepherds TSF also has a cutoff, along with a number of other elements including chimney drains. The Shepherds Creek Valley Fill also has an underdrains and a cutoff toe barrier.
73. Document K.05 provides our assessment as to why the collection performance will be relatively high (e.g., >90% seepage recovered) as expected. Adaptive management has been proposed to manage risks of unacceptable levels of unrecovered seepage bypassing primary collection systems. Any 'unrecovered' seepage is most likely to still migrate along the valley bottoms therefore allowing for relatively straightforward secondary collection if required.
74. The overarching strategy is for management of seepage collection, whether via primary or secondary systems, is to manage seepage as close to the source as possible within the creek valley systems (e.g., for Shepherds Creek upstream of SC01) where hydrogeological conditions (e.g., shallow depth to water table, constrained valley, upwards groundwater gradients in valley bottom) make seepage collection straight forward (as opposed to within the Bendigo and Ardour aquifers).

75. Given the large distance between MWSFs and groundwater receptors (>1 km), there are many opportunities for secondary collection of unrecovered seepage.
76. Accordingly, outer, secondary or contingency SISs options have been proposed in either responses to consultation with ORC or the Groundwater JWS for the lower Shepherds Creek or middle Rise and Shine Creek valleys downstream of the primary SISs associated with individual MWSFs in each catchment. SIS options are described in the following sections.
77. Figures 1 and 2 of Attachment B show the conceptual arrangement of how MWSFs, seepage collection, performance and compliance groundwater monitoring are planned to be situated along the Shepherds Creek valley and Ardgour Terrace towards the Lindis River.
78. Ultimately, the need for implementation of a contingency SIS will be informed by performance monitoring (groundwater and/or surface water) where data shows an unacceptable level of unrecovered seepage. Defined triggers and actions will govern the response to performance monitoring data.
79. Triggers and actions for implementation of contingency SIS to respond to 'unrecovered' seepage will be set out in Resource Consent Condition 30 of D.04. MGL intend to discuss and refine these processes in conditions workshopping.
80. It is also noted that proposed:
 - (a) further hydrogeological investigations/characterisation (see paragraphs 114 through 130); and
 - (b) 3D groundwater modelling will support design of secondary SISs, see paragraphs [75] through [78].
81. All groundwater experts except LM agree that seepage bypass risk are low [Groundwater JWS dated 14 & 15 May 2026 paragraph 27 through 29] provided the recommended further characterisation and modelling studies (described in paragraph 31 of the JWS) are completed.
82. The experts understand MGL will ensure financial mechanisms are in place for the design, installation, and operation of SISs should they be required in the Post-closure Phase.
83. Options for interception of 'unrecovered' seepage are described below.

Shepherds Creek at SC-01 Basement Gap

84. This section was prepared by Mr Jens Rekker.
85. In the lower Shepherds Creek catchment, the surface water compliance monitoring site SC-01 is located downgradient of the main MWSFs at distances between 4,800 and 1,000 metres and the SC-01 location coincides with a narrow (approximately 50 metres) gap in the basement schist rock for Shepherds Creek to pass.
86. It is proposed to undertake further work to investigate the hydrogeological composition and groundwater flow characteristics of the basement schist rock gap beneath Shepherds Creek for any potential of groundwater underpass of the surface water monitoring site in Shepherds Creek that would lead to un-monitored catchment seepage further downgradient or uncaptured seepage potentially containing contaminants at concentrations of concern (i.e., in excess of surface water or groundwater compliance trigger concentrations). Hydrogeological characterisation of the basement gap would be directed towards determining the feasibility of underflow of SC-01, followed by

performance monitoring or contingency seepage interception in the instance that either would be required.

87. It should be stressed that the installation of a groundwater performance monitoring bore in the basement gap or the installation of a contingency SIS would be preceded by the proposed construction of subsurface characterisation using a fence of drillholes and installed bores to ascertain the properties of the subsurface through the basement gap to hold and convey groundwater independently of Shepherds Creek, including the flow rates and velocities of groundwater flow.
88. Should characterisation reveal a risk of subsurface underpass of Shepherds Creek through the basement gap, one or more actions would be undertaken:
 - (a) Groundwater performance monitoring would be instituted using an appropriate bore,
 - (b) In the instance that it was assessed to be necessary, a contingency SIS would be installed and commissioned at or very near the basement gap site.
89. Design of a contingency SIS at the basement gap at SC-01 monitoring site would examine capabilities to intercept such uncaptured seepage using one or more of the following –
 - (a) Shallow rock-filled interception drains (<5 m deep) to intercept near-surface pathways; and/or
 - (b) Interception wells to intercept deeper groundwater pathways; and/or
 - (c) Low permeability cut-off walls to enhance hydraulic control of SIS and aiding the capture of uncaptured seepage.

Rise and Shine Creek Alluvium exposed in RAS Pit Sidewall

90. This section was prepared by Mr Jens Rekker.
91. In Year 2 – Year 4 the RAS pit would begin to impinge on the Rise and Shine Creek course, which would be mitigated by the installation of the Rise and Shine Clean Water Diversion Channel crossing a bench of the RAS pit wall. The RAS pit excavation would expose the Rise and Shine Creek alluvium on the upstream side of the cut.
92. Mr Jens Rekker in paragraph 77 of the Groundwater JWS noted that the exposed alluvium would be accessible for a contingency SIS, likely a shallow rock-filled drain that would capture seepage at the base of the creek alluvium.

Downstream, Offsite Surface Water Quality Monitoring

93. This section was prepared by Mr Jens Rekker.
94. Additional surface water performance monitoring has been proposed for surface waters outside of the BOGP mining area that receive the seepage of groundwater emanating from affected groundwater systems.
95. These surface water performance monitoring sites are proposed with the objective characterising the concentrations and mass loads of potential contaminants within the downstream receiving environments on a long-term basis.

96. A water quality performance monitoring site is proposed for the Lindis River at the ORC flow and State of Environment monitoring site called Lindis at Ardgour Road.
97. A water quality performance monitoring site is proposed for Bendigo Creek at the Bendigo Station flow monitoring site, which is immediately upstream of the points that Bendigo Creek begins infiltrating to the underlying alluvium and ultimately the Bendigo Aquifer.

RAS Workings Opportunity Contingency Collector of Uncaptured Seepage

98. This section was prepared by Mr Jens Rekker.
99. A fortuitous or opportunity contingency collector for uncaptured seepage in the schist rock groundwater system will be the RAS Pit.
100. The RAS Pit sits across the Shepherds Creek and Rise and Shine Creek catchments within the proposed mining area, with a cross-section that fully penetrates the textural zone 3 and Rise & Shine Shear Zone basement materials.
101. During late operational phase, the RAS pit will significantly perturb the existing schist groundwater system and exert a pumping radius of influence over surrounding rock on both creek catchments.
102. Furthermore, the RAS Underground service tunnels and stopes penetrate further down-dip along the Rise & Shine Shear Zone and underlying textural zone 4 schist rock.
103. During operations the underground's tunnels are dewatered, whereas following the flooding of the workings in the active closure period the water within the tunnels will be at the same hydrostatic pressure as the pit lake above.
104. The RAS pit would be under a variety of target management water levels during operations, active closure and subsequently post closure.
105. The target water level maintained by dewatering pumps, slowly rising groundwater levels or drainage through the underground workings to the surface some decades into the post closure period would range between 385 metres to 490 metres Above Mean Sea Level (AMSL).
106. All target water levels within the RAS pit lake, and exerted as water pressure in underground tunnels, ranged between 385 m and 490 m AMSL, which is considerably lower than the existing 730 m AMSL elevation of the schist groundwater level measured within the core of the RAS pit.
107. The significance would be that the RAS Pit and underground workings would act as an inherent, large-scale depression in the fractured schist groundwater flow field. Analogous to a large scale well, the hydraulic effect of the depression in the groundwater surface would tend to divert down valley groundwater flow towards the RAS pit. This interception would be most intense in the late operational phase from Year 9 to 13, and more subdued following the filling of the pit lake to 490 m AMSL in the decades after full mine closure.
108. During the operational phase, any surplus of the RAS pit or the RAS Underground workings are added to the mine water circuit between the processing plant and Shepherds TSF, and thus under principles of containment and constrained discharge.
109. Even in the post closure period, with the rebound in pit lake target water level by 105 metres to an elevation of 490 metres AMSL, the pit lake and flooded underground will comprise a zone of lowered groundwater level / pressure within surrounding schist groundwater systems. This depression in groundwater surrounding the RAS pit and underground will tend to intercept upgradient and cross-gradient groundwater within the fractured rock.

110. In the post closure phase and following lake filling to 490 m AMSL, the RAS Pit and associated underground tunnels following the RSSZ will be hydraulically linked and will drain surplus water from the pit lake and flooded workings *via* the former access drift at the portal in the Shepherds Valley.
111. The Water Management Plan and associated proposed consent conditions require that the Access Drift Portal drainage flows through a chamber and channel with the ability to monitor and divert water for treatment, whether active or passive water treatment.
112. During the active closure and subsequent post closure phases, the RAS outflow will thus be subject to active treatment, passive treatment or other management, including routine monitoring through the period following mine closure.

Inherent Hydrogeological Conditions and Seepage Interception Systems

113. This section was prepared by Mr Jens Rekker.
114. Due to the geomorphology and geology of the Shepherds Valley, SISs can be feasibly placed in optimal positions to capture seepage, which is collocated with the downgradient side of MWSFs and placed at the surface or at shallower depths.
115. Investigations at the Shepherds TSF impoundment site have revealed a negative correlation between depth and effective hydraulic conductivity (i.e., permeability lessens with increasing depth) results in the rates and volumes of groundwater transmission being congregated towards shallower depths, especially within alluvium, colluvium and weathered schist horizons. Deeper and unweathered (fresh) fractured schist tends to have hydraulic conductivity at 10^{-7} metres per second (m/s) or lower.
116. For these reasons the SISs downgradient of MWSFs have a shallower focus of intercepting shallow and medium depth groundwater.
117. While a low probability event, deep seepage of groundwater originating at the bases of MWSFs could move through fresh fractured schist with longer flow path wavelengths between sites of infiltration and emergence back to the surface. The duration of longer wavelength groundwater transit would also be lengthier than the shallower flows intercepted by the SISs.
118. In this context, the enduring presence of the RAS pit lake and flooded underground tunnels provides a set of receptors for a large compartment of medium depth and deep groundwater movement around the BOGP and its managed MWSFs, which could otherwise be termed uncaptured seepage.
119. Dissolved potential of contaminants within such groundwater seepage would also be prevented from extending beyond the RAS pit and workings axis across the Shepherds and Rise & Shine creek courses. Instead, the seepage and contaminants would be controlled and treated within post closure structures erected and maintain for the purpose of water quality improvement.

Hydrogeological Investigations (targeting information on shallow groundwater, hydro stratigraphic unit definition, hydraulic properties)

120. This section was prepared by Mr Jens Rekker and Mr Ryan Burgess.
121. The Expert Panel has requested further information about the hydrogeological baseline dataset.
122. The BOGP mining, hydrogeological and geotechnical investigations have included many determinations targeting higher-order definitions of hydro stratigraphic units, associated hydraulic properties, and shallow groundwater. This includes the following across the Shepherds Creek and Rise and Shine Creek catchments (i.e, locations where potential SISs would be situated):

- (a) 70 test pits (with groundwater interception noted) and hundreds of mineral exploration drillholes.
 - (b) 36 permeability tests across 8 drillholes.
 - (c) 33 VWP sensors install across 11 drillhole strings.
123. The experts consider this baseline dataset to provide an appropriate basis for understanding hydrogeological setting within the BOGP area (e.g., Shepherds Creek valley upstream of SC01), and the likely changes to the groundwater system as a result of the BOGP, particularly around likely seepage pathways and how to best manage them.
124. The purpose of proposed further hydrogeological investigations is to:
- (a) provide site specific details to support detailed design; and
 - (b) begin to install the proposed groundwater performance monitoring network.
125. Examples of site specific detail needed for to support detailed design will include for example:
- (a) Thickness of alluvium and weathered bedrock at the Western ELF seepage collection system location.
 - (b) Thickness of weathered bedrock at the Shepherds ELF seepage collection system and permeability decay with depth.
 - (c) Groundwater levels at SRX ELF seepage collection system.
126. However, the heterogeneous nature and the large area of the BOGP Area meant that only a small volume of the subsurface materials were included in hydrogeological investigations and the information embodied into the potentially affected hydro stratigraphic units.
127. The groundwater modelling of the BOGP mining area in Document B.05 has been focused on estimating the rates of groundwater inflow in response to workings dewatering or the consequent depletion effect on Shepherds Creek and Rise and Shine Creek, rather than to simulate the movement of virtual particles (pathway tracing) or contaminant mass transport.
128. Pathway tracking and contaminant mass transport in fractured rock groundwater systems has not been attempted or reported in relation to the BOGP mining area.
129. A limited-scope sensitivity analysis examining the extent that solutes such as sulphate might be dispersed and hence concentrations reduced in the Ardgour Aquifer as undertaken and reported in document K.01. However, this has not extended upstream to the fractured schist groundwater systems in the Shepherds Creek catchment, for instance.

3D Groundwater Modelling of Seepage Collection Systems

130. This section was prepared by Mr Ryan Burgess.
131. The Expert Panel has requested further information about the potential for unrecovered (or bypass) seepage.
132. 2D groundwater modelling (Appendix A of Statement of Evidence of Ryan Burgess dated 17 April 2026) was completed to quantitatively evaluate the potential magnitude of seepage that could bypass ELF primary seepage collection systems. The model results suggested that for the Shepherds

ELF, Western ELF, and SRX ELF, seepage bypass is likely to be low (i.e., <10% of load) with appropriate engineering design.

133. 3D modelling was recommended as the next assessment step to further evaluate the predicted performance of primary seepage collection systems as 3D modelling allows for representation of certain aspects of the hydrogeological system that 2D modelling cannot (as per ORC consent condition NEW 6B). Principal aspects relevant for primary seepage collection system performance include:
 - (a) complex valley geometry; and
 - (b) potential interaction of drawdown/flow regime changes due to pit and underground voids.
134. The 3D modelling will also allow for evaluation of secondary SISs if it is found that modelling suggests additional seepage collection is required. For example, modelling can evaluate how interception wells and/or grout curtains may improve seepage recovery (if it were required), thereby supporting the design of secondary SISs.
135. For clarity, it is important to note that in practice, performance monitoring will demonstrate whether additional seepage collection is required. Modelling is then used to optimise the design a SIS if monitoring suggests one is required.

Attachment A



MEMORANDUM

Recipient: Mary Askey – Santana Minerals Ltd

From: Jim Griffiths

Date: 22 June 2026

Cc: Robyn Simcock – New Zealand Institute for Bioeconomy Science; Jeroen Lurling – RMA Ecology

Document Number: J-H-NZ0238-005-M-Rev0

Document Title: BOGP Wetland Hydrology Analysis

INTRODUCTION

Hydro Geochem Group Limited (HGG) was engaged by Matakanui Gold Limited (MGL) to provide hydrological advice for proposed constructed wetlands at the Bendigo Ophir Gold Project (BOGP). The two proposed constructed wetlands are:

- Lower Shepherds Wetland.
- Shepherds Tailings Storage Facility (TSF) Wetland.

Location of each wetland within the BOGP are shown as an attachment.

The scope of this hydrological assessment was to evaluate if sufficient surface water would be available to construct and maintain these wetland systems.

The Lower Shepherds Wetland was evaluated conceptually given the downstream location provides for sufficient upstream catchment area to generate sufficient flow to maintain wetland hydrology. In contrast, the Shepherds TSF Wetland will be situated higher in the catchment with less catchment area and runoff reporting to that location. As such, a water balance model was developed to evaluate potential for maintaining the Shepherds TSF Wetland.

CLIMATE CONDITIONS

MWM (2025) describe the climate setting for the BOGP, with monthly data shown in Figure 1. They make the following observations:

- Based on the Köppen-Geiger classification, the climate can be characterised as temperate, without a dry season, and as having a warm summer (Cfb). Mean annual air temperature is 8 °C.
- On an annual basis, precipitation (P) is approximately 510 mm while potential evaporation (PE) is approximately 815 mm.

- The climate is relatively dry, with a strong energy surplus (PE>P) present between September through March, and an energy deficit (PE<P) over the remainder of the year, most notably over winter.

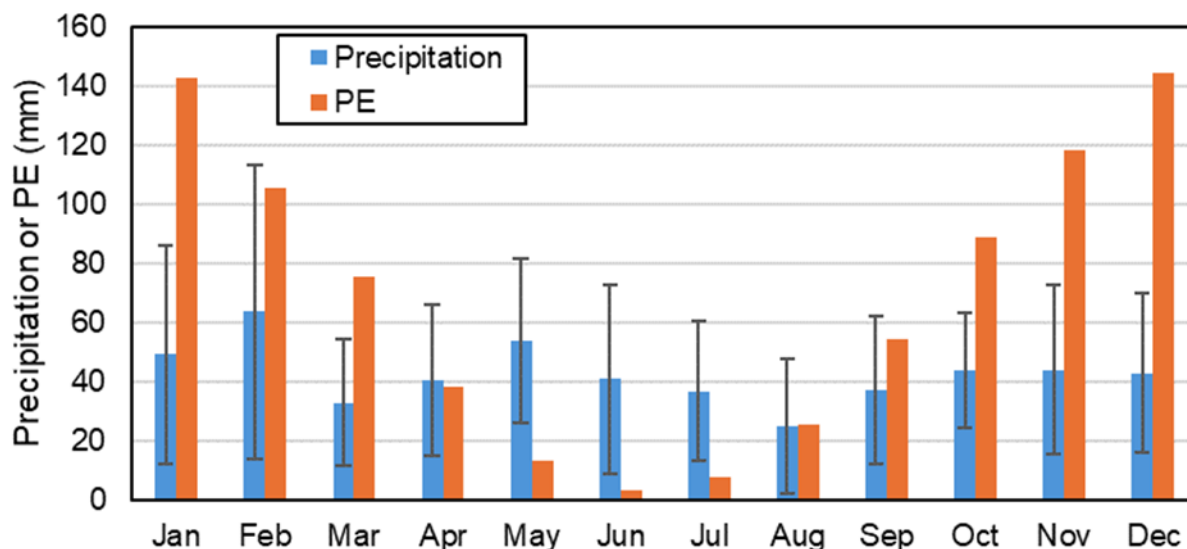


Figure 1: Monthly precipitation and PE summary.

PE=Potential Evaporation. Bars show monthly averages while error bars show rainfall standard deviation over the period of record.

Source: MWM (2025).

LOWER SHEPHERDS CREEK WETLAND

The Lower Shepherds Creek Wetland is proposed to be located within the Shepherds Creek valley bottom, as shown in (Figure 2), with an area of 1 Hecate (ha). This location is approximately 250 m upstream of the water monitoring site SC01, which has a catchment area of approximately 1,200 ha. The wetland will be constructed at the start of mining. It is noteworthy that wetland already exist near this location.

During the operational phase of the BOGP, creek flows at SC01 were forecast to be reduced by 17% on average (MWM, 2025) without mitigation. To maintain flows at SC01 during operations, MGL propose to augment Shepherds Creek flow such that pre-mining flows are maintained (HGG, 2025). For reference, recorded flows at SC01 were 15.6 L/s on average (KSL, 2025). Post-closure, the release of treated water means the surface water flow reporting to SC01 are forecast to increase by approximately 60% on average (MWM, 2025). It is therefore considered reasonable to expect sufficient water to be available to construct and maintain the Lower Shepherds Creek Wetland given the pre-mining flows will be maintained during operations and flow rates are projected to increase post-closure.

The upstream and downstream flows into and out of the existing wetland at the proposed site should be monitored to allow development of a site water balance. In addition, several shallow piezometers should be strategically placed within the wetland or near its boundaries where is suspected that sub-surface groundwater is contributing to site. Data from the piezometers can also be used to describe the annual fluctuation of subsurface water in response to surface water influx and precipitation. Analysis of data from the existing site will be used to inform the water demand of the proposed upstream extension of the wetland.

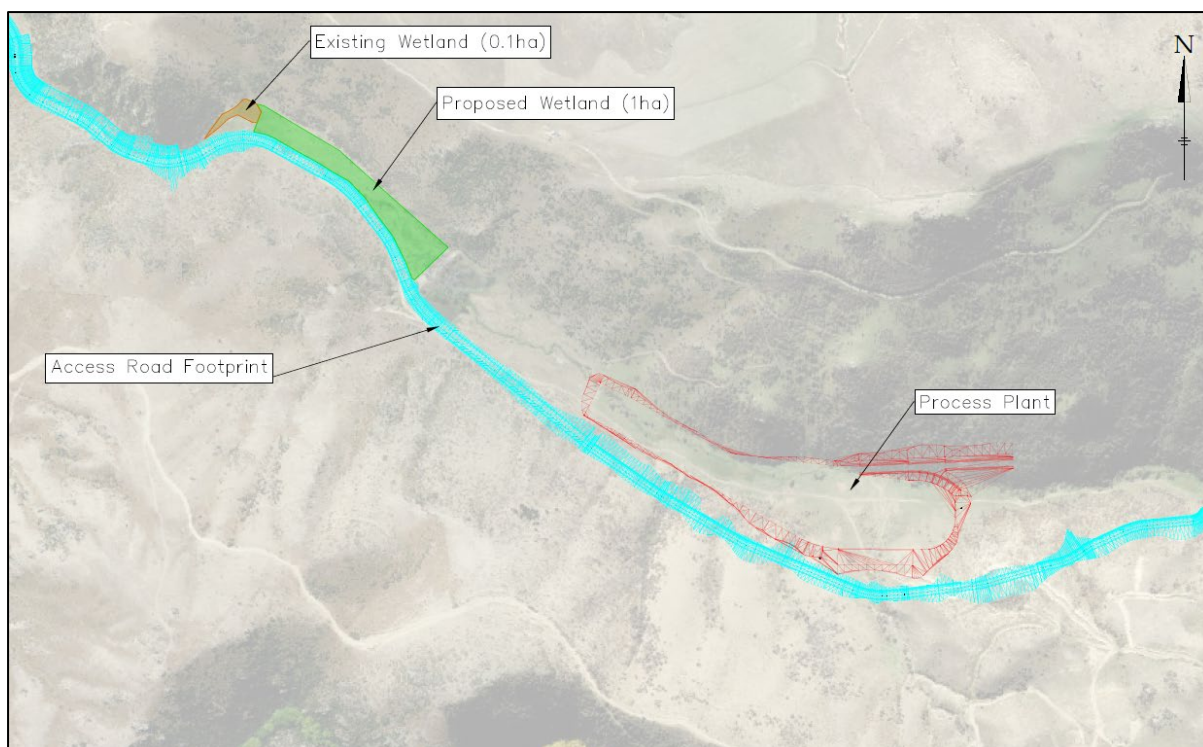


Figure 2 Location of proposed Lower Shepherds Creek Wetland.

SHEPHERDS TSF WETLAND

The Shepherds TSF Wetland is proposed to be constructed atop the Shepherds TSF following rehabilitation of this landform (see attached location map). The wetland will include the following elements:

- 0.5 ha of open water aquatic habitat.
- 1.5 ha permanently inundated vegetated swamp.
- 4.5 ha of seasonally inundated swamp/marsh.

Table 1 provides inundation requirements for the wetland¹. The standing water will be controlled by constructing a bund with a weir and spillway. The wetland will be constructed above the tailings material such that there is a physical separate between the two.

Model Objectives

Model objectives included addressing the following questions:

1. How a weir or similar overflow structure can be managed during construction and then post-closure phase of wetland (i.e. what range of water depths will need to be managed).
2. Can a minimum area of permanent water be maintained and what mitigation strategies (at the time of construction, and then once constructed) can be used.
3. What testing/verification can be done before planting (for example permeability of the tailings).

¹ Personal communication with J. Lurling (Ecology Expert) via email dated 18 June 2025.

4. How can large rainfall events (and associated volume of water) be managed, (and is it part of post-closure ongoing management?).

Table 1: Ecological inundation requirements for the TSF wetland

WETLAND TYPE	AREA (HA)	TARGET WATER DEPTH DURING INUNDATION	DRY YEAR (MIN PERIODS)	AVERAGE YEAR	WET YEAR (MAX PERIODS)
Open water aquatic habitat	0.5	1.0–2.0 m (minimum >0.5 m)	0.5 ha inundated for 12 months	0.5 ha inundated for 12 months	0.5 ha inundated for 12 months
Permanently inundated vegetated swamp	1.5	0.1–0.5 m	≥1.5 ha inundated for 8–10 months at 0.1–0.5 m depth.	≥1.5 ha inundated for 10–12 months at 0.1–0.5 m depth.	≥1.5 ha inundated for 12 months at 0.1–0.5 m depth. Temporary increases to 0.5–0.75 m depth are acceptable during high rainfall periods.
Seasonally inundated swamp/marsh	4.5	0.05–0.30 m (local hollows to 0.5 m)	Marsh areas: 1–2 months inundation at min. 0.05 m depth. Swamp areas: 1–3 months inundation at min. 0.05 m depth.	Marsh areas: 2–4 months inundation. Swamp areas: 3–8 months inundation.	Marsh areas: 4–6 months inundation at up to 0.3 m depth. Swamp areas: 6–9 months inundation up to 0.3 m depth. Local hollows may remain inundated at up to 0.5 m depth for longer periods.

Model and Assumptions

The developed model assumes that the wetland will consist of a central pond that will vary in area, volume and depth according to dimensions supplied by EGL (Table 2). The model was structured to calculate the volume of water stored in the wetland in response to precipitation, evaporation, seepage and rainfall runoff. The water-level in the wetland will be controlled by two weir control structures (Table 2 and Figure 3). The lower weir will be sited just above the elevation of minimum pond depth required (0.3 m above the surface of the TSF) to provide 2 ha of permanent water pond. A second weir will be sited at 0.7 m above the TSF surface and will be used to spill potential peak flood flows from the wetland.

The model was developed in GoldSim and run at daily timesteps, for a period of 100 years using rainfall and potential evapotranspiration timeseries reported in MWM (2025). Inflow terms to the wetland included:

- Rain falling directly onto the ponded area.
- Runoff from the rehabilitated TSF area that is not inundated by the pond.
- Runoff from undisturbed areas upstream of the TSF.

Outflow terms were:

- Evaporation from pond water surface.
- Vertical seepage of pond water into the TSF.
- Outflow via weir and spillway.

- The flow of water into and out of the wetland are described by the processes shown in Table 3.

Table 2: TSF wetland volume-area-height relationships.

	Height	Delta height	Volume to height	Delta volume	Plan area	Delta plan	Slope area	Delta slope	Depth	Area
Flood spillway	684	0.1	26850	9159.46	100732	18275	100738	18276	0.708	10 Ha water
	683.9	0.1	17691	7339.47	82457	18458	82462	18459	0.608	
Bund Crest	683.8	0.1	10351	5185.78	63999	24154	64002	24155	0.508	6 Ha Ephemeral water
	683.7	0.1	5165.4	2969.16	39846	19847	39848	19848	0.408	
Weir Invert	683.6	0.1	2196.3	1424.6	19999	10438	20000	10439	0.308	2 Ha Permanent water
	683.5	0.1	771.66	630.746	9560.2	6131.4	9560.7	6131.7	0.208	
Min height	683.4	0.1	140.92	140.842	3428.8	3396.9	3429	3397	0.108	
	683.3	0.008	0.073	0.073	31.97	31.97	31.972	31.972	0.008	
	683.292	1	0	0	0	0	0	0	0	
	682.292	-	0	-	0	-	0	-		

Source: EGL²

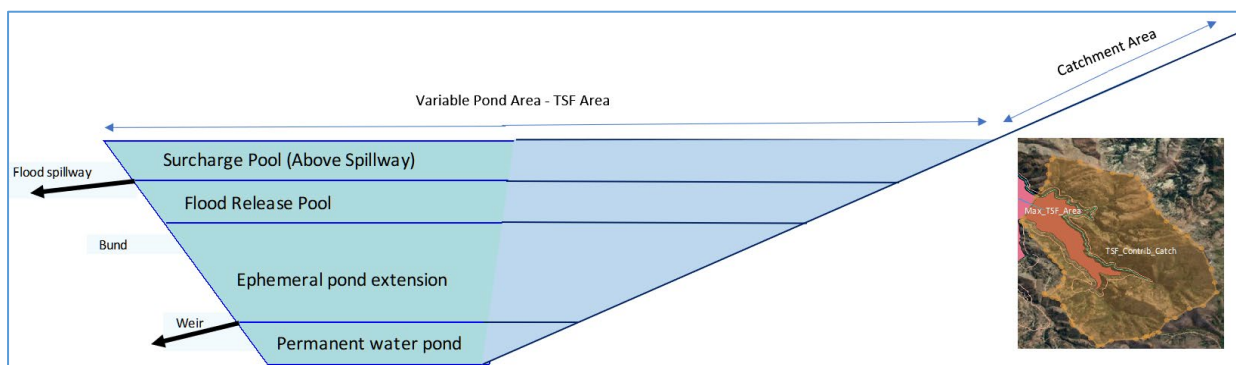


Figure 3: TSF wetland conceptual model illustrating varying pond area, thresholds, and upper catchment.

Table 3: Inputs and outputs to the wetland.

TYPE	SOURCE	CALCULATION METHOD	REFERENCE
Input	Precipitation	Total precipitation falling on pond area.	(MWM, 2025)
Input	Runoff from rehabilitated TSF surface (area varies inversely with pond size)	Runoff from non-wetted rehabilitated TSF surface calculated using assumptions for rehabilitated ground in the BOGP closure water and load balance model.	(MWM, 2025)
Input	Runoff from surrounding catchment (area = 5.8 km ²)	Runoff from surrounding catchment calculated using assumptions for undisturbed ground in the BOGP closure water and load balance model.	(MWM, 2025)
Output	Evaporation from pond water surface	Assumed to be 1.05 x PET estimated for this region, consistent with the BOGP closure water and load balance model.	(MWM, 2025)
Output	Seepage water	Saturated conductivity of the sub-surface assumed to be 5x10 ⁻⁸ m/s ³ , assumes a unit gradient beneath open water pond.	-

² Email from J. Zou dated 11 June 2026.

³ Higher values were initially used, but lower values were required to achieve minimum ponded area criteria. Exact value to be used will be refined design advances.

Output	Outflow via lower weir	Dependent on the water level within the wetland pond and calculated using equation for flow over uncontrolled weir ($Q = C L H^{1.5}$). Weir length (L) = 0.5 m	-
Output	Outflow via flood spillway	Dependent on the water level within the wetland pond and calculated using equation for flow over uncontrolled weir ($Q = C L H^{1.5}$). Weir length (L) = 2 m	-

Model Results

The model was initially set-up with the parameters indicated within Table 3. The model was first run for a period of 1, 5 and 100 years to allow illustration of short term variation and confirmation that such patterns are replicated over a longer period.

The modelled flows into and out of the TSF wetland can be divided into two groups (illustrated for the period 2025 to 2026 in Figure 4). Smaller magnitude flows include precipitation to the wetland pond (mean⁴ = 47.5 m³/day or 0.5 L/s), evaporation from the wetland pond (mean = 83.2 m³/day or 1 L/s), and seepage from the TSF wetted area (mean = 143 m³/day or 1.6 L/s). Larger magnitude flows include runoff from the surrounding undisturbed catchment (mean = 749 m³/day or 8.7 L/s), runoff generated within the non-wetted area of the TSF (mean = 7.7 m³/day or 0.1 L/s), and flow across the permanent pond weir (mean = 624 m³/day or 7.2 L/s). It is noted that catchment flows into the wetland approximate outflows through the spillway (8.6 L/s and 7.2 L/s respectively).

Modelled variation of water depth in the TSF wetland pond for the two-year simulation period (2025-2026) is shown in Figure 5 relative to the lower weir threshold (permanent water pond), bund threshold (nominal ephemeral wetland area), and flood spillway threshold. The water level dips below the preferred permanent inundation level (weir level) for two periods (46 days from February to April 2025, and 53 days from March to May 2026).

Figure 6 illustrates modelled pond area for the same period and where the equivalent permanent pond threshold area is 2 ha. For the same two dry periods, the pond area decreases to 0.8 ha at its most extreme (excluding the 6-day start-up period). Over an extended period of five years (Figure 7) there is only one more dry period in which the water level falls below 1 ha for 9 days. Over a 100 year period (Figure 8) there is a total of 193 days below 1 ha.

To reduce the amount of drainage from the pond in dry periods the wetland was modelled without the lower weir (Figure 9). This resulted in a higher mean water area (7.9 ha compared to 3.3 ha with the weir), and just 100 days in which the pond fell below 1 ha.

⁴ Means calculated for simulation period 2025 to 2124.

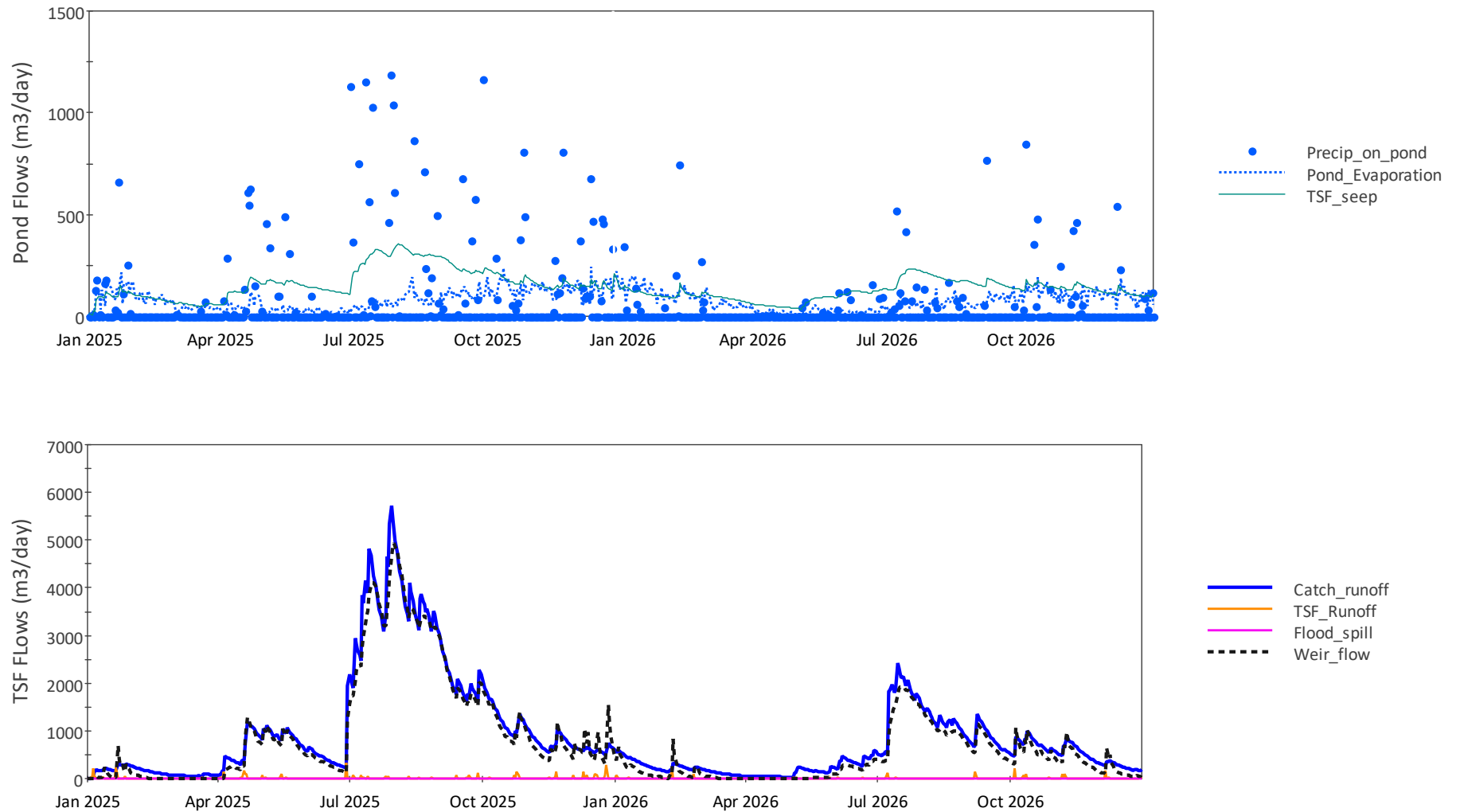


Figure 4: Modelled inputs and outputs to the TSF wetland pond (upper) and wider catchment (bottom) for period from January 2025 to December 2026.

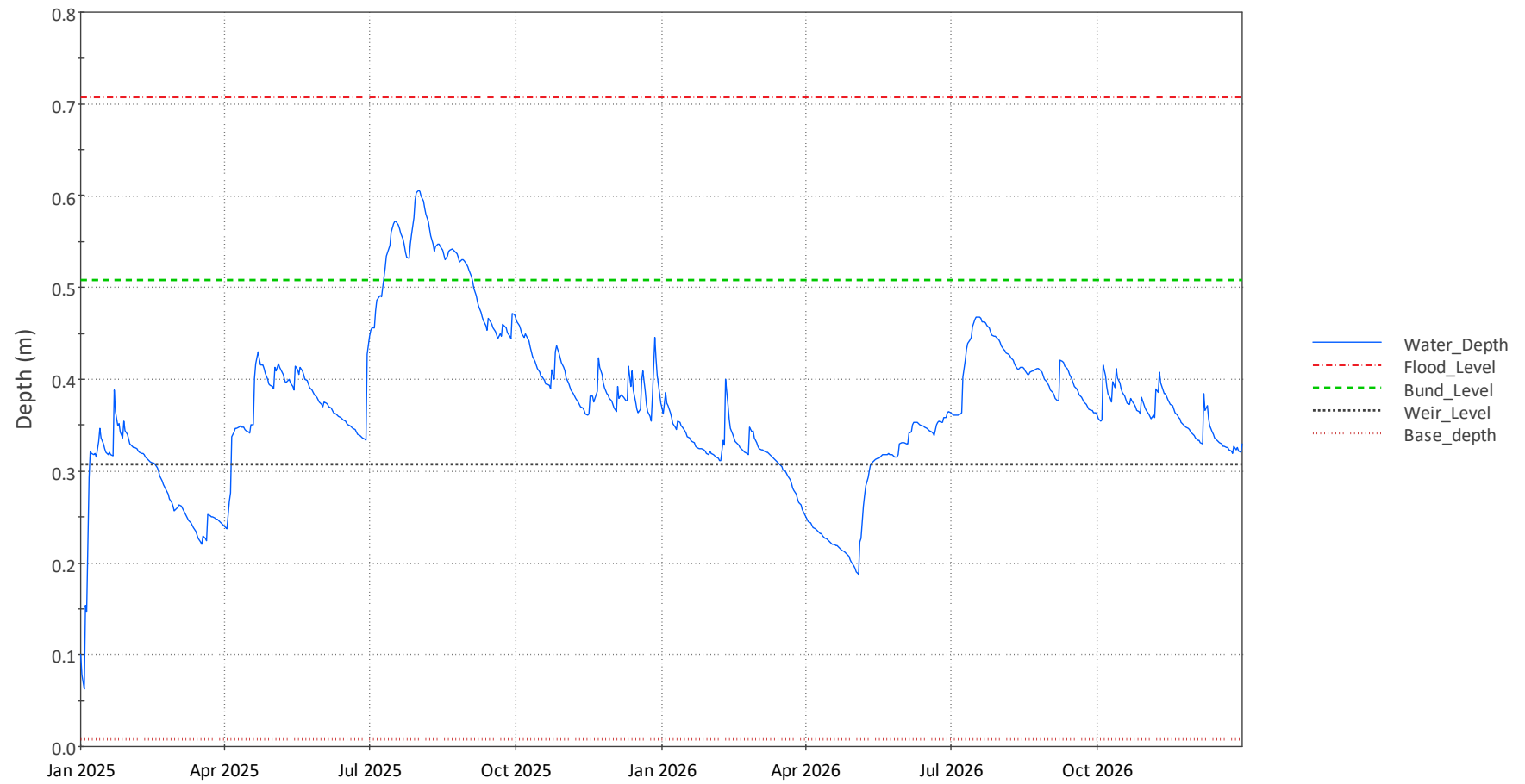


Figure 5: Modelled TSF wetland pond depth (m) from January 2025 to December 2026 (0.5 m weir, 2 m flood spillway).



Figure 6: Modelled TSF wetland pond area (ha) from January 2025 to December 2026 (0.5 m weir, 2 m flood spillway).

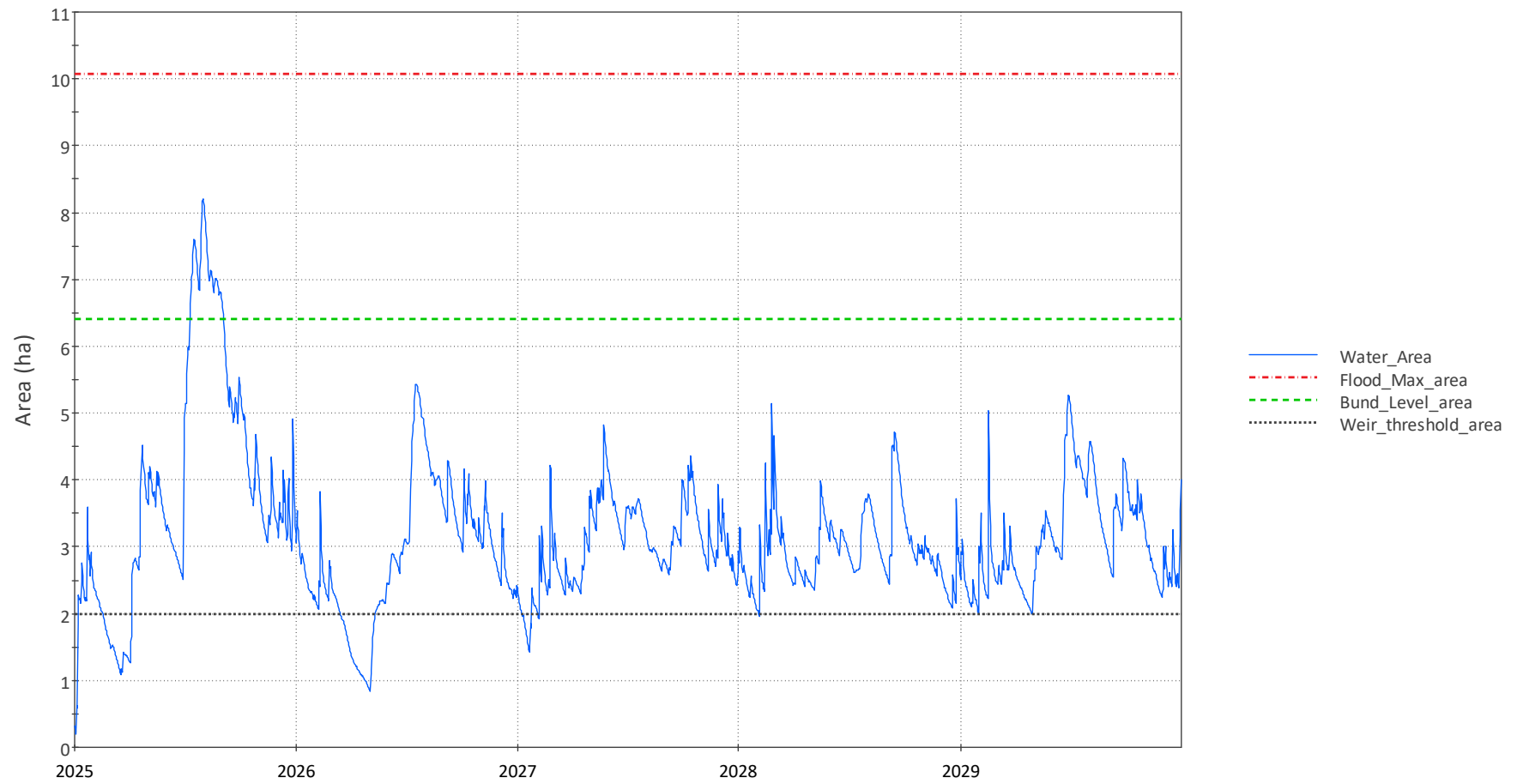


Figure 7: Modelled TSF wetland pond area (ha) from January 2025 to December 2029 (0.5 m weir, 2 m flood spillway).

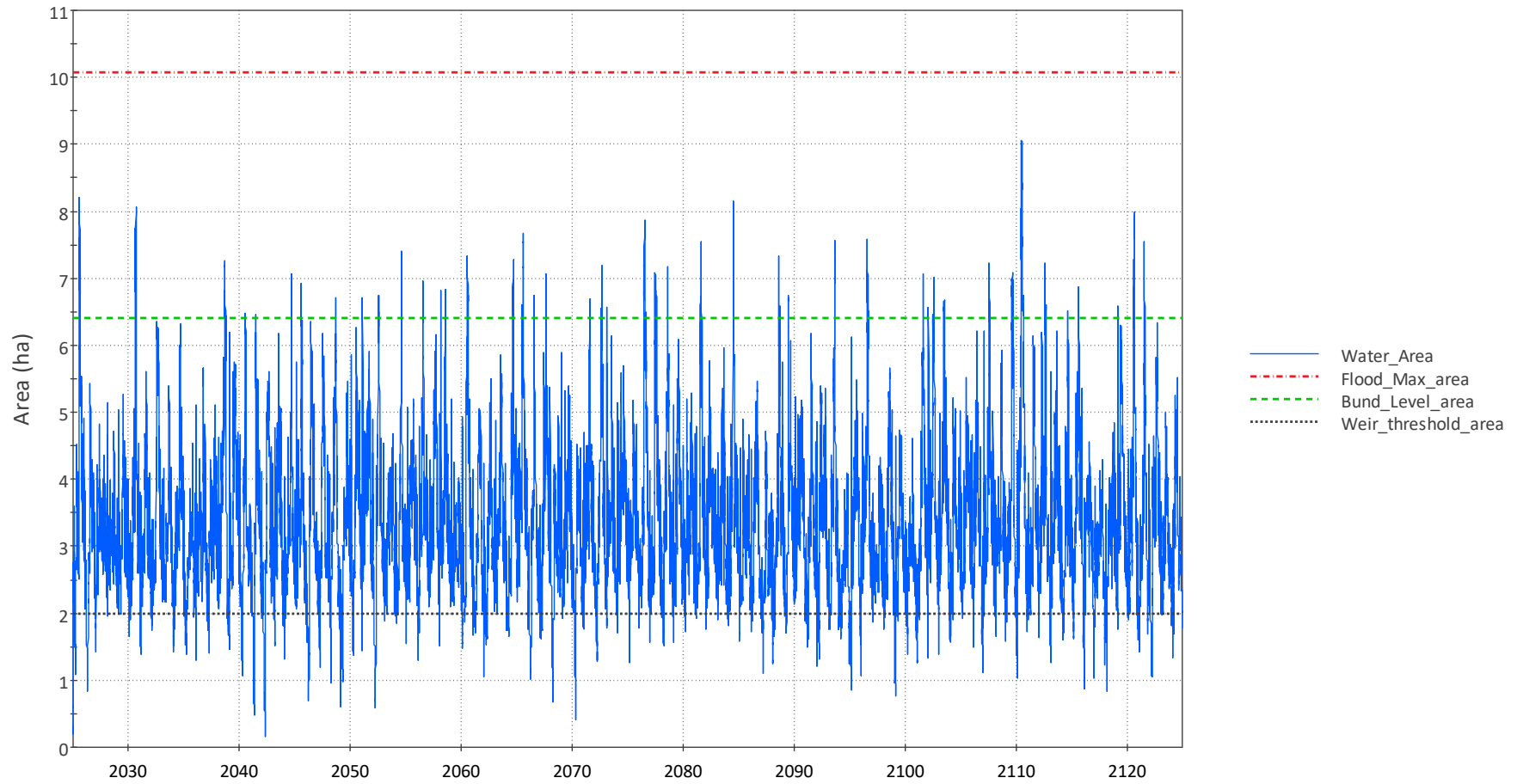


Figure 8: Modelled TSF wetland pond area (ha) from January 2025 to December 2124 (0.5 m weir, 2 m flood spillway).

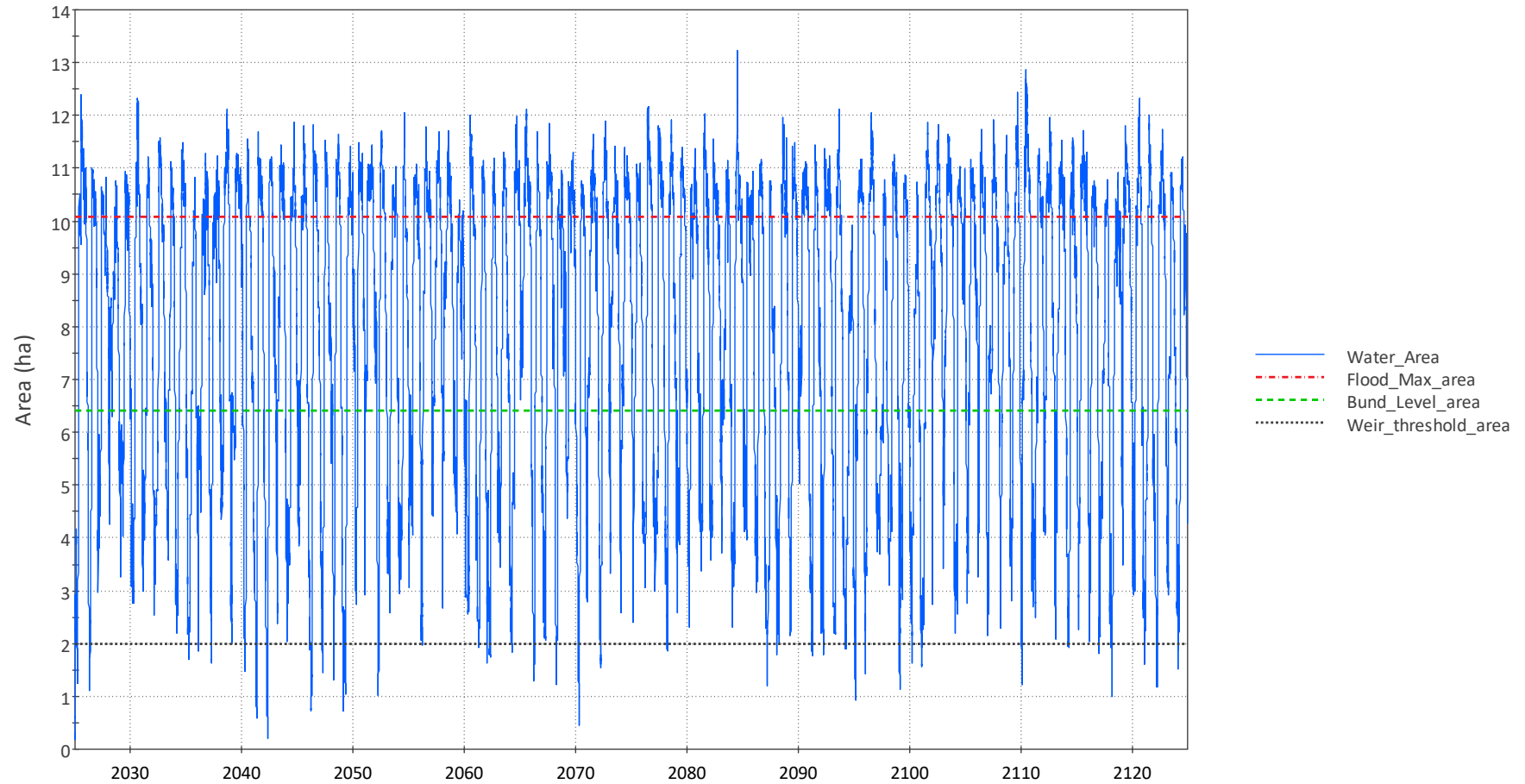


Figure 9: Modelled TSF wetland pond area (ha) from January 2025 to December 2026 (no weir, 2 m flood spillway).

Discussion

The presented model is a relatively simplistic water balance of the proposed TSF wetland. However, it allows analysis of the combined wetland inputs (precipitation and runoff) relative to nett losses (seepage, evaporation and weir spills) from the proposed wetland area. The model also allows assessment of how the wetland will respond to changes in design and management parameters (e.g., the wetland depth-area-volume specifications, and proposed wier/spill thresholds). Finally, the model can be used to inform the questions related to model objectives:

1. *How can a weir or similar overflow structure be managed during construction and then post-closure phase of the wetland (i.e. what range of water depths will need to be managed).*

Whilst the answer to this question will be influenced by the initial volume-area-depth relationships of the wetland design, it was noted from model simulations that catchment runoff (i.e., runoff generated from the catchment upstream of the TSF location) is the main control of the volume of water delivered to the wetland pond (see Figure 4). It is therefore suggested that the construction phase of the wetland occurs in the dry period that most frequently occurs at the end of summer and start of autumn. This would allow the wetland to fill in the first winter rainfall season (assuming it is an average rainfall year). Any weir or overflow system would be kept closed until the minimum required capacity of the wetland pond was reached. Continued closure of the weir to achieve additional volume would be advisable as simulations suggest that water level is more resilient to any subsequent dry periods.

2. *Can a minimum area of permanent water be maintained and what mitigation strategies (at the time of construction, and then once constructed) can be used.*

Model simulations suggest that the lower the 0.3 m water-level threshold was exceeded on 105 days in the 2-year simulation period from 2025-2026 (using a 0.5 m long weir drainage structure). If the weir was removed, the minimum threshold exceedance fell to 69 times in the same 2-year period. This suggests that the permanent water level can be better maintained using the wetland drainage structure. Other factors that will decrease the sensitivity of the wetland water level to climate fluctuations (particularly a lack of rainfall) include:

- decreasing seepage losses from the wetland by decreasing the permeability of the under-surface
- increasing the minimum water level height threshold of the wetland (high volume of stored water will improve water level resilience to dry periods)
- changing the volume-area-depth profile of the wetland design to reduce evaporative losses (as smaller area deeper wetland ponds would exhibit lower ET losses than a shall large area pond). It has also been noted that there is some flexibility in TSF design which can be shaped to provide a shallower (larger area), or deeper (smaller area) wetland footprint so as to meet ecological closure requirements (as long as engineering design objectives (i.e., retain tailing quantity and graded to spillway and culvert outlets).

The sensitivity of the wetland water-level and area can be further investigated using the model if required. However, given the ecological inundation requirements for the TSF wetland (Table 1), the model simulations suggest that the criteria to maintain a minimum open water aquatic habitat area of at least 0.5 ha can be achieved in all but the most extreme year (18 days in May 2042) within the 100-

year modelled scenarios. To reduce the risk of this happening, seepage losses through the TSF wetland could be reduced by decreasing the design surface permeability. Alternatively, strategies to augment flow into the wetland under extreme conditions could be investigated.

3. What testing/verification can be done before planting (for example permeability of the tailings).

The model results suggest flow from the upstream undisturbed catchment are the largest water balance contribution. Flow monitoring for catchment area reporting to this wetland undertaken to confirm model results are representative. The Northern Diversion Channel should be considered for installation of a monitoring system.

Model results suggest maintaining a pond area is sensitive to the quantum of seepage losses. Permeability of (i) underlying tailings and (ii) rehabilitation material should be verified by in situ (i.e., field) testing.

The Lower Shepherds Creek Wetland, if appropriately instrumented, may provide a useful analogue and knowledge base for designing the TSF Wetland. In addition, provided suitable space is available on the operational TSF, a field trial TSF wetland built prior to closure would enhance confidence in the expected performance of the constructed wetland.

A more detailed description of TSF wetland design (design topography) will help improve the model resolution to predict inundation for different vegetation assemblages (related to wetland height). Data relating to the runoff regime in the upper catchment will be needed validate catchment flows into the TSF wetland.

4. How can large rainfall events (and associated volume of water) be managed, (and is it part of post-closure ongoing management?).

Rainfall and runoff flux into the wetland were simulated based on the synthetic 100-year precipitation and evaporation timeseries. The upper flood spillway weir was set to 2 m in length for all model simulations and was able to drain 24-hour rainfall totals of up to 109 mm (which produced 7,219 m³ of catchment runoff and 2,026 m³ of runoff from the TSF surface). The maximum flow through the flood spillway was 100 L/s when the lower weir was closed to increase mean wetland water level. For comparison, the maximum flow through the lower weir (0.5 m crest) was 70 L/s. Notably, there were no flows through the flood spillway when the lower weir was operational.

CLOSING REMARKS

In summary, analysis suggest there will be sufficient water available for either wetland. The TSF wetland model suggests that if the wetland is designed with no lower weir, the pond will be deeper and larger and will be more resilient to all but the driest periods. Use of a lower weir (with crest of 0.5 m), whilst allowing flow through the wetland, will increase the risk of the pond falling below the minimum required threshold in drier periods. Water conservation in the pond could be improved in both the above situations by reducing seepage from the pond.

Please do not hesitate to contact Jim.Griffiths@hydrogeochem.com.au (+64 21 284 3011) should you wish to discuss our memorandum in greater detail.

REFERENCES

Martinez, J., Rango, A., and Roberts, R., 2008. Snowmelt Runoff Model (SRM) User's Manual. Version 1.11. USDA Jornada Experimental Range, New Mexico State University.

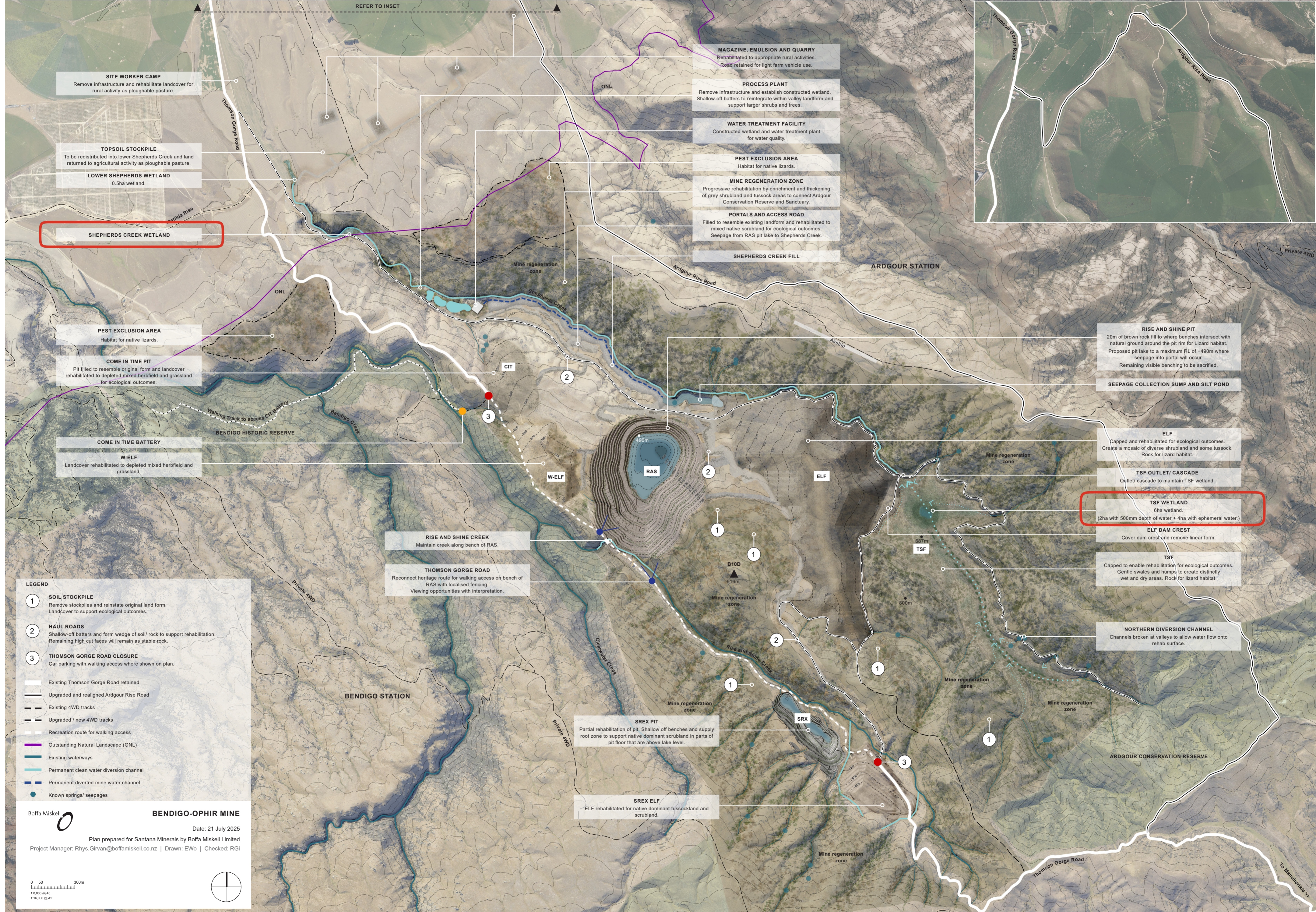
Hydro Geochem Group (HGG) 2025. BOGP Flow Augmentation Strategy, Report No. J-NZ0235-002-R-Rev0.

Kōmanawa Solutions Ltd (KSL), 2025. Rise & Shine Gold Project – Surface Water & Catchment Existing Environment & Effects Assessment. Report for Matakanui Gold Limited. RN: Z24002BOG2-Rev2. Dated 19 August 2025.

Mine Waste Management (MWM) 2025. BOGP Water and Load Balance Model Report, Report No. J-NZ0233-016-R-Rev1.

ATTACHEMENTS

LANDSCAPE CLOSURE PLAN



SITE WORKER CAMP
Remove infrastructure and rehabilitate landscape for rural activity as ploughable pasture.

TOPSOIL STOCKPILE
To be redistributed into lower Shepherds Creek and land returned to agricultural activity as ploughable pasture.

LOWER SHEPHERDS WETLAND
0.5ha wetland.

SHEPHERDS CREEK WETLAND

PEST EXCLUSION AREA
Habitat for native lizards.

COME IN TIME PIT
Pit filled to resemble original form and landcover rehabilitated to depleted mixed herbfield and grassland for ecological outcomes.

COME IN TIME BATTERY

W-ELF
Landcover rehabilitated to depleted mixed herbfield and grassland.

RISE AND SHINE CREEK
Maintain creek along bench of RAS.

THOMSON GORGE ROAD
Reconnect heritage route for walking access on bench of RAS with localised fencing. Viewing opportunities with interpretation.

SREX PIT
Partial rehabilitation of pit. Shallow off benches and supply root zone to support native dominant scrubland in parts of pit floor that are above lake level.

SREX ELF
ELF rehabilitated for native dominant tussockland and scrubland.

MAGAZINE, EMULSION AND QUARRY
Rehabilitated to appropriate rural activities. Road retained for light farm vehicle use.

PROCESS PLANT
Remove infrastructure and establish constructed wetland. Shallow-off batters to reintegrate within valley landform and support larger shrubs and trees.

WATER TREATMENT FACILITY
Constructed wetland and water treatment plant for water quality.

PEST EXCLUSION AREA
Habitat for native lizards.

MINE REGENERATION ZONE
Progressive rehabilitation by enrichment and thickening of grey shrubland and tussock areas to connect Ardgour Conservation Reserve and Sanctuary.

PORTALS AND ACCESS ROAD
Filled to resemble existing landform and rehabilitated to mixed native scrubland for ecological outcomes. Seepage from RAS pit lake to Shepherds Creek.

SHEPHERDS CREEK FILL

RISE AND SHINE PIT
20m of brown rock fill to where benches intersect with natural ground around the pit rim for Lizard habitat. Proposed pit lake to a maximum RL of +490m where seepage into portal will occur. Remaining visible benching to be sacrificed.

SEEPAGE COLLECTION SUMP AND SILT POND

ELF
Capped and rehabilitated for ecological outcomes. Create a mosaic of diverse shrubland and some tussock. Rock for lizard habitat.

TSF OUTLET/ CASCADE
Outlet/ cascade to maintain TSF wetland.

TSF WETLAND
6ha wetland. (2ha with 500mm depth of water + 4ha with ephemeral water.)

ELF DAM CREST
Cover dam crest and remove linear form.

TSF
Capped to enable rehabilitation for ecological outcomes. Gentle swales and humps to create distinctly wet and dry areas. Rock for lizard habitat.

NORTHERN DIVERSION CHANNEL
Channels broken at valleys to allow water flow onto rehab surface.

LEGEND

- 1 **SOIL STOCKPILE**
Remove stockpiles and reinstate original land form. Landcover to support ecological outcomes.
- 2 **HAUL ROADS**
Shallow-off batters and form wedge of soil/ rock to support rehabilitation. Remaining high cut faces will remain as stable rock.
- 3 **THOMSON GORGE ROAD CLOSURE**
Car parking with walking access where shown on plan.

- Existing Thomson Gorge Road retained
- Upgraded and realigned Ardgour Rise Road
- Existing 4WD tracks
- Upgraded / new 4WD tracks
- Recreation route for walking access
- Outstanding Natural Landscape (ONL)
- Existing waterways
- Permanent clean water diversion channel
- Permanent diverted mine water channel
- Known springs/ seepages

Boffa Miskell

BENDIGO-OPHIR MINE

Date: 21 July 2025

Plan prepared for Santana Minerals by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: EWo | Checked: RGI

0 50 300m

1:8,000 @ A0

1:18,000 @ A2

Attachment B

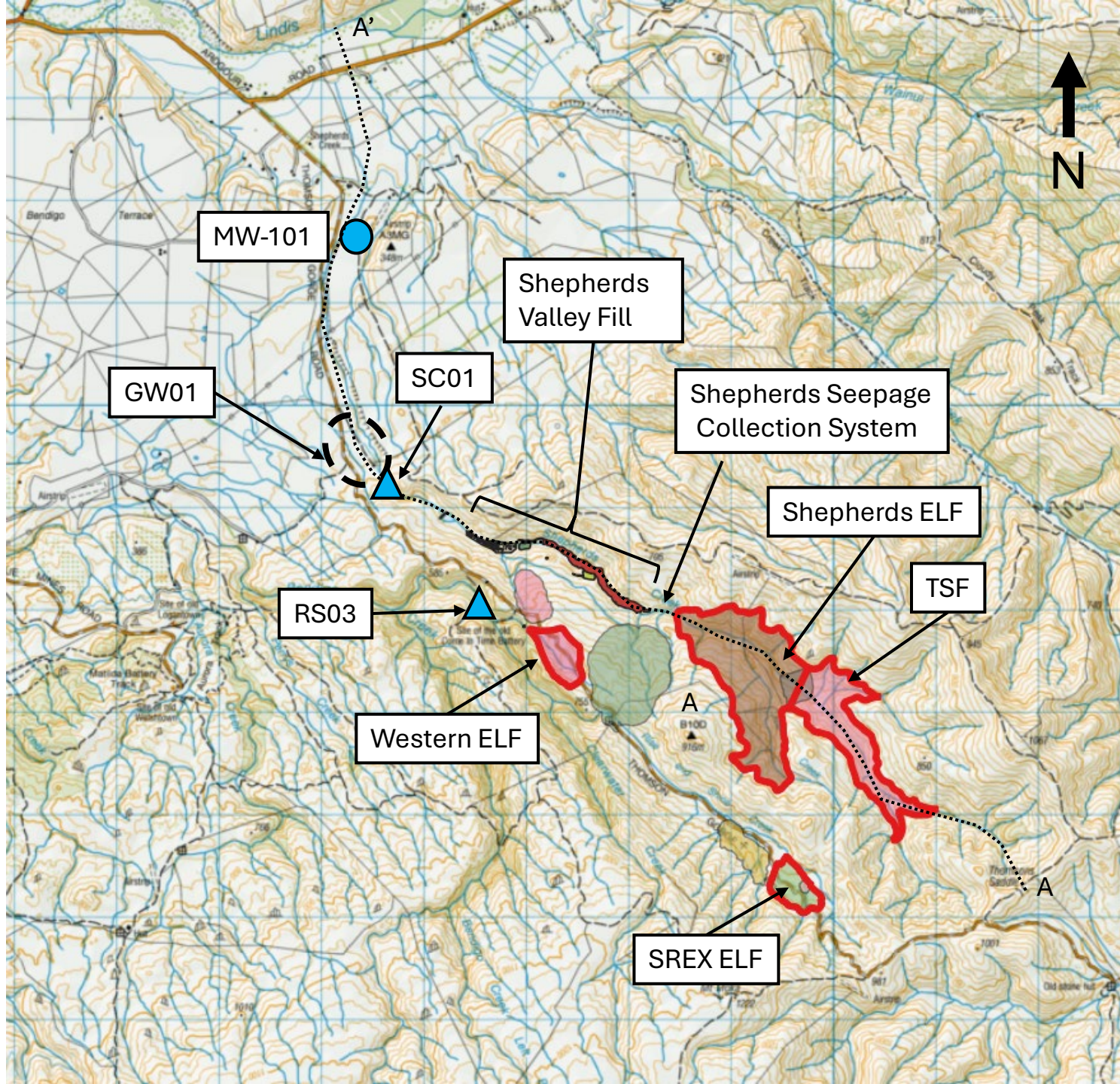


Figure 1

Shepherds Creek Valley Bottom Profile

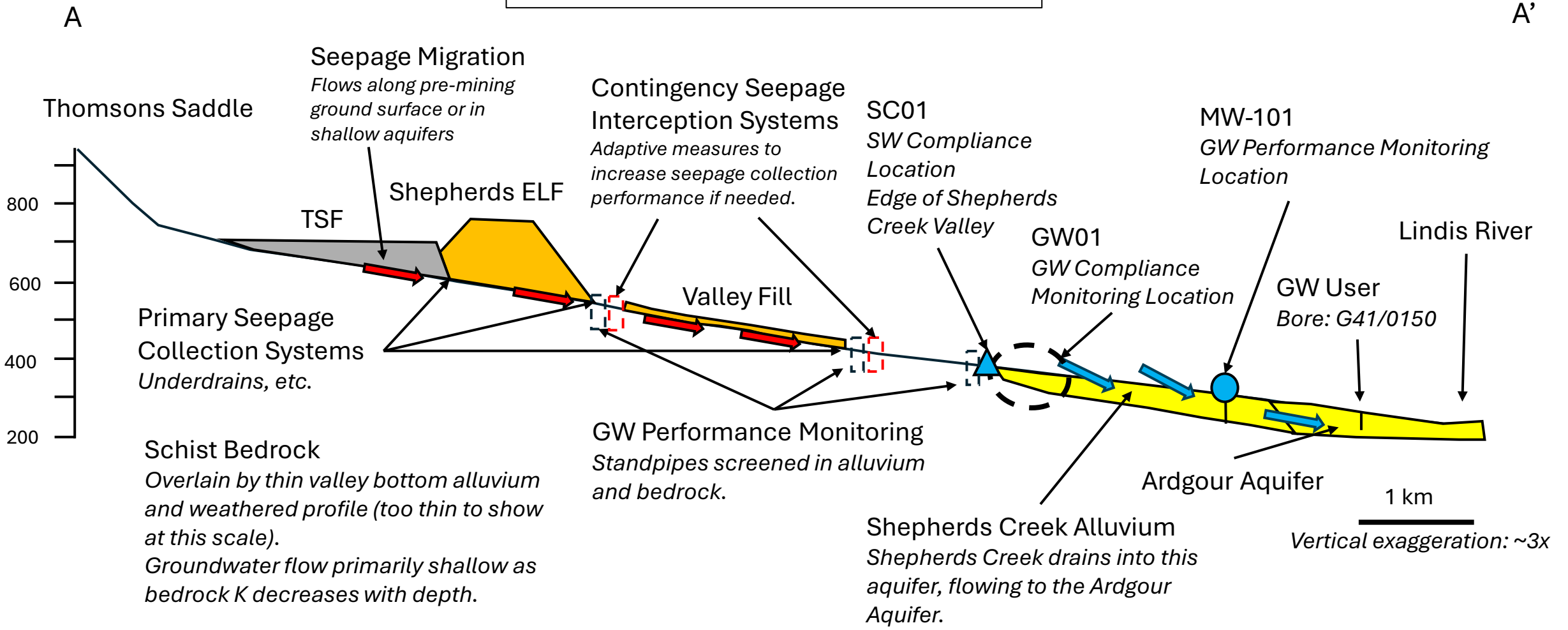


Figure 2