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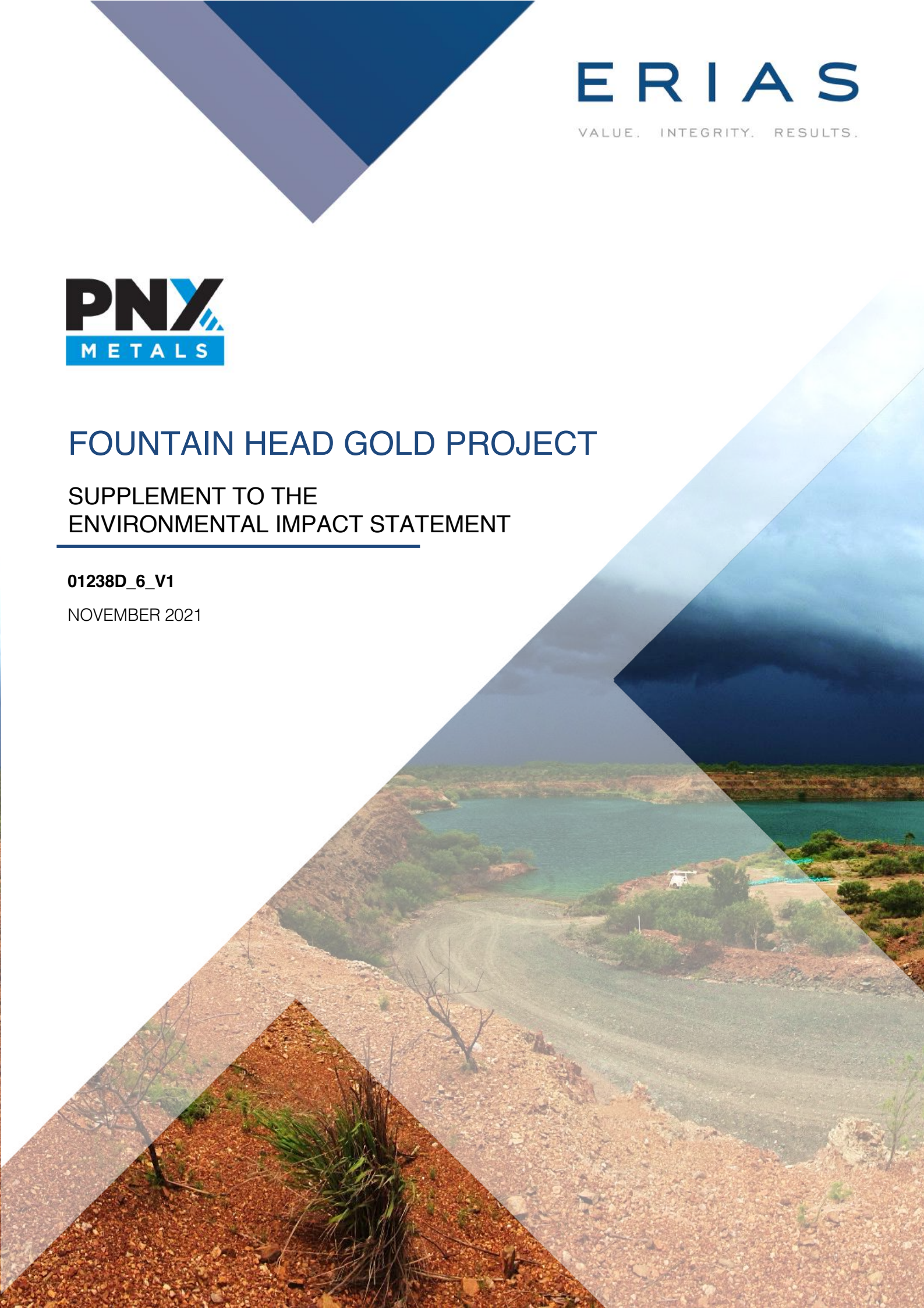
PNX METALS

FOUNTAIN HEAD GOLD PROJECT

SUPPLEMENT TO THE ENVIRONMENTAL IMPACT STATEMENT

01238D_6_V1

NOVEMBER 2021



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1. Introduction

1.1 Project Overview

PNX Metals Limited ('PNX', or the 'Proponent') (ABN: 67 127 446 271) is proposing to develop the Fountain Head Gold Project (the 'Project' or 'Fountain Head'). PNX is a publicly listed, minerals exploration company (ASX: PNX) with a significant tenement portfolio in the Pine Creek region of the Northern Territory containing both base and precious metals.

The Project involves recommencing mining of the Fountain Head pit and will include the following activities:

- Dewatering of existing open pit.
- Expansion of existing open pit.
- Construction of crushing facilities and gold processing plant.
- Construction of supporting infrastructure (i.e., workshops, power station, roads, offices etc.).
- Construction and progressive rehabilitation of the integrated waste landform (IWL).
- Construction of surface water management features i.e., sediment and runoff dams and diversions.
- Ongoing dewatering of the evaporation pond.

The Project Notice of Intent (NOI) was submitted to the Northern Territory Environment Protection Authority (NT EPA) on 20 December 2019 to determine the level of assessment required under the *Environmental Assessment Act 1982* (EA Act). On the 16 March 2020, the Statement of Reasons (SoR) were provided by the NT EPA, determining the Project would require assessment under the EA Act at the level of Environmental Impact Statement (EIS). The EIS was prepared in accordance with the Project Terms of Reference (ToR) issued by the NT EPA on 11 May 2020.

In October 2020, PNX announced a change in the processing method from heap leach to carbon in leach (CIL) processing. The NT EPA reviewed the transition arrangements according to the *Environment Protection Act 2019* (EP Act) and advised that in accordance with section 296 of the EP Act, the proposal can continue to be assessed in accordance with the prior EA Act and the associated Environmental Assessment Administrative Procedures 1984 (EAAP). It was determined by ERIAS in consultation with the NT EPA that the Project change in relation to the processing method did not alter the environmental significance of the Project, and thereby the proposal could continue to be assessed under the existing Terms of Reference (ToR).

The draft EIS was submitted for review to the NT EPA in June 2021. The draft EIS was on public exhibition for 40 business days and was available online on the NT EPA website, advertised in the NT News and hardcopies were also provided for viewing at the Adelaide River Post Office, Department of Primary Industry and Resources office (Darwin), NT Library (Darwin), Environment

Centre (Darwin), Northern Land Council head office (Darwin) and the Victoria Daly Regional Council (Pine Creek).

A total of seven submissions were received from NT advisory bodies, non-government organisations and members of the public during the public exhibition period. The submissions received on the draft EIS are provided for reference in Appendix 1.

In accordance with clause 12 of the EAAP, the NT EPA have directed PNX to provide a Supplement to the draft EIS ("the Supplement"), responding to the submissions received (Appendix 2). The NT EPA will use the information provided in both the draft EIS and Supplement EIS to inform their preparation of an assessment report for the proposal and subsequent recommendation to the Minister for Environment.

1.2 Scope and Purpose of the Supplement

The Supplement (this document) provides project design updates, additional information from specialist studies, and additional or revised management measures/commitments where required to address responses received on the draft EIS. The additional information provided in the Supplement reflects the current state of project planning, which has undergone minor changes since submission (see Chapter 2). The draft EIS and Supplement combined, along with any additional information requested by the NT EPA, will collectively constitute the EIS for the Fountain Head Gold Project.

1.3 Report Structure

The structure of the Supplement and the content provided in each section is provided in Table 1.1.

Table 1.1 – Structure of the Supplement to the EIS

Section	Content
1. Introduction	Provides a summary of the environmental assessment process for the Project to date, as well as providing the scope, purpose and structure of the Supplement
2. Project Description Updates	A summary of changes to project design that have occurred subsequent to submission of the draft EIS
3. Additional and/or Amended Information	Additional and/or contenting specialist studies undertaken in response to submissions, or ongoing and become available subsequent to submission of the draft EIS
4. Summary of Submissions Received	A summary of submissions received on the draft EIS – Appendix 1
5. Responses to Submissions	Provides PNX's response to submissions received from NT advisory bodies, non-government organisations and members of the public
6. Amended Commitments Register	Updated register containing all environmental commitments made in the draft EIS and Supplement

1.4 Associated Documentation

The following studies reports and updated management plans are provided as appendices to the Supplement:

- Generator Emissions Concentrations Review (Appendix 3).
- Groundwater Monitoring Plan (Appendix 4).
- Water Management Plan (Appendix 5).
- Waste Rock Management Plan (Appendix 6)
- Fountain Head Pit and Lake Water Quality Assessment (Appendix 8).
- Blasting Impact Report (Appendix 9).
- Mine Closure Plan (Appendix 10).

2. Project Description Updates

2.1 Introduction

There have been several changes to the Project description since the EIS was submitted for assessment in June 2021. These changes relate to the:

- Site layout.
- Integrated waste landform (IWL).
- PAF stockpile.
- Schedule.

Each are described in the following sections.

2.2 Site Layout and Disturbance Footprint

The revised site layout and disturbance footprint are shown in Figures 2.1 and 2.2, respectively. The area of the IWL has increased to allow the storage of all tailings generated on site (Section 2.3) and the separate PAF storage area to the east of the pit has been removed as PAF waste rock will now be stored within the pit (Section 2.4).

The areas associated with each key component of the Project footprint are provided in Table 2.2. The revised total Project footprint is 245.89 ha.

Table 2.2 – Project Footprint of Key Project Component

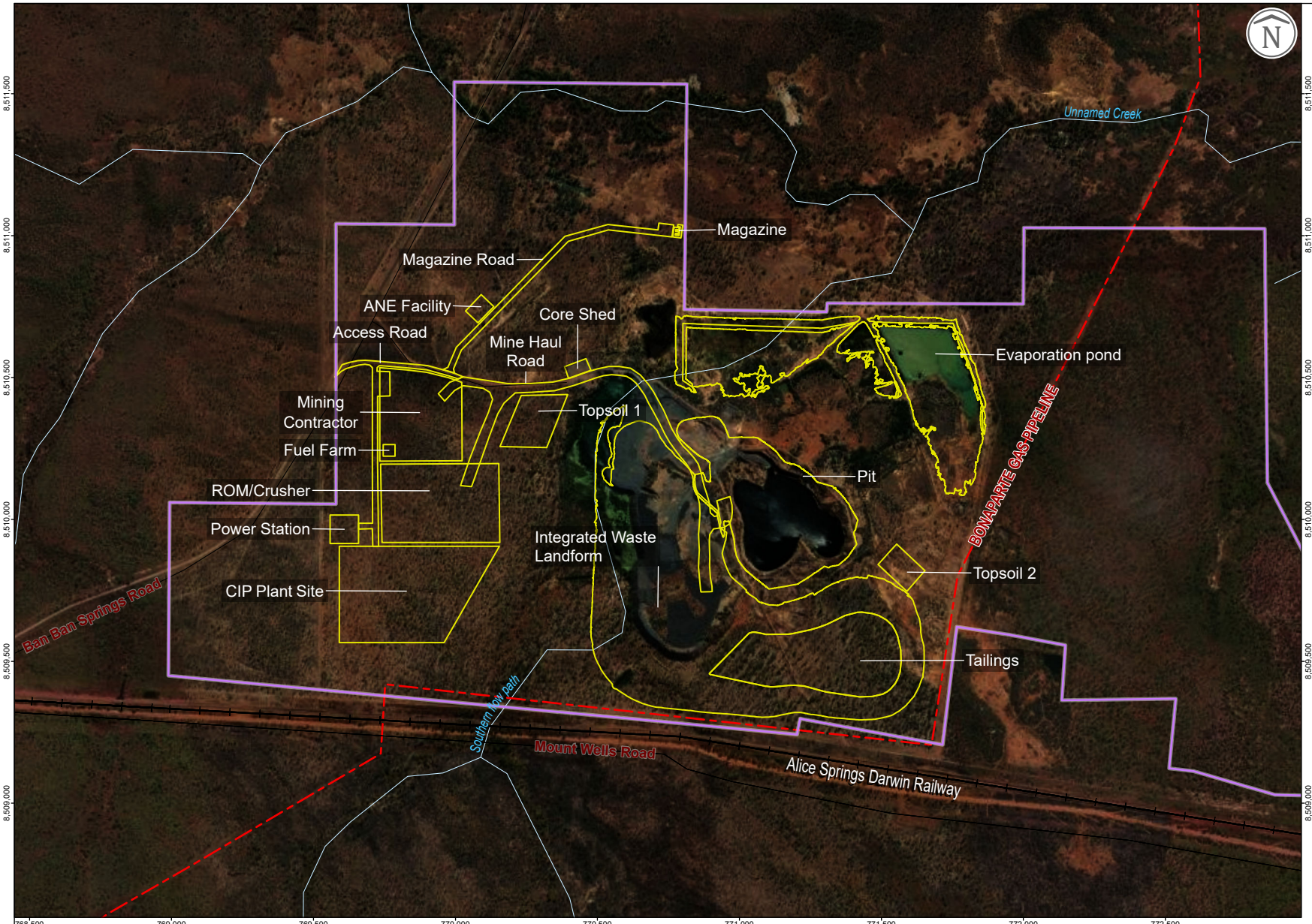
Project Component	EIS Area (ha)	Revised Area (ha)
Open pit	19.39	20.90*
PAF stockpile	2.72	0
IWL	55.0	70.37
Topsoil stockpiles	4.35	4.35
Evaporation pond	24.06	24.06
Process plant	15.81	15.81
ROM/crusher	11.19	11.19

Note: * While the pit footprint hasn't changed, the footprint includes the entrance to the pit. The total footprint area of the pit has therefore increased slightly due to the revised design for the pit entrance.

FOUNTAIN HEAD GOLD PROJECT LAYOUT

Fountain Head Gold Project | Supplement to the EIS

FIGURE 2.1



Road
Railway
Gas pipeline
Watercourse
Project area
Project infrastructure

Issue Date: 2021.11.05

Map ID: 01238D_6_GIS003_v0

Figure Number: 01238D_6_F02-1_GIS_v0-b_es

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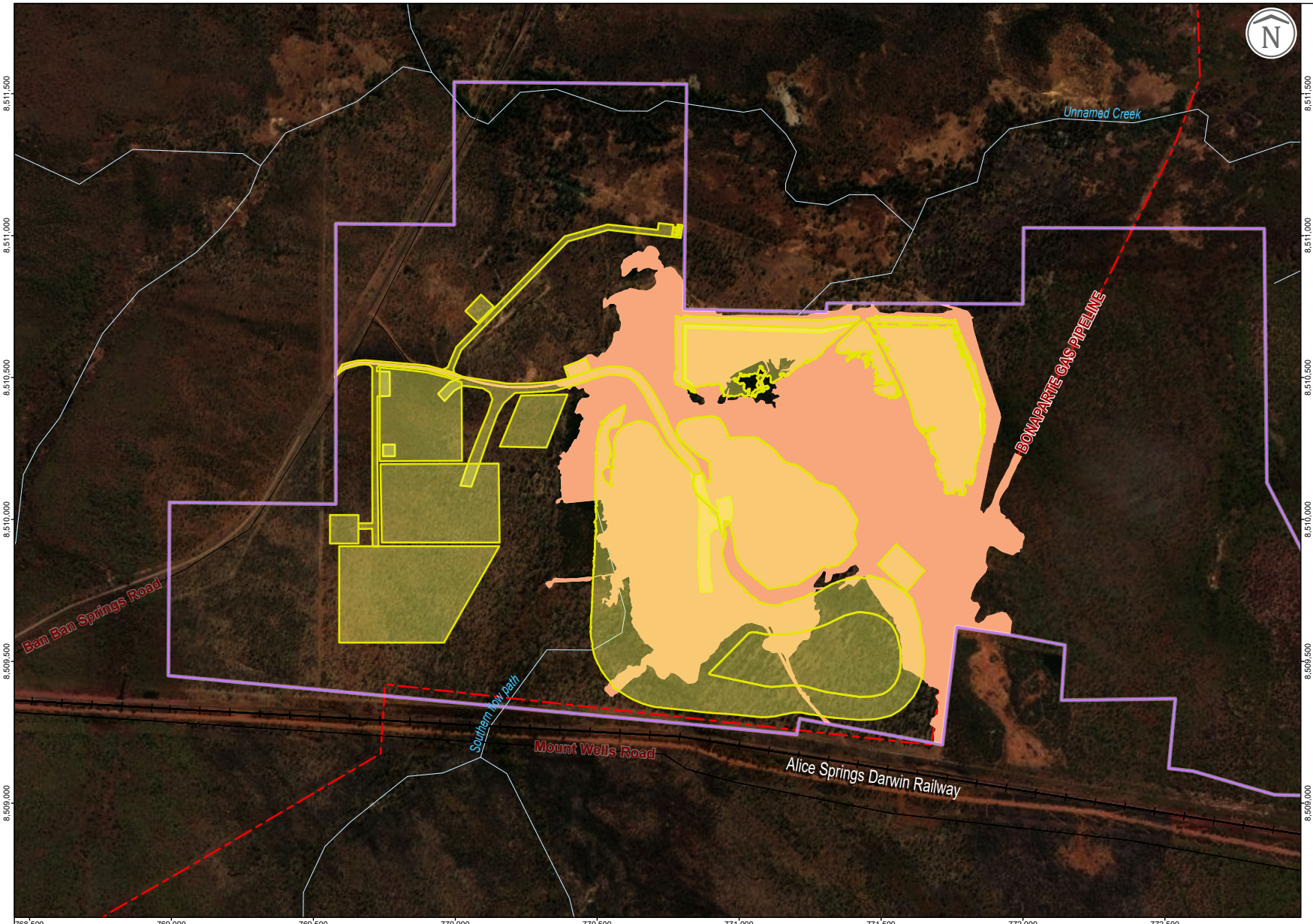
Hawthorn VIC 3122, Australia

DATA SOURCES:
Project data from PNX Metals, 2021.
Imagery © ESRI, DigitalGlobe and Partners, 2021.

EXISTING AND NEW PROJECT DISTURBANCE

Fountain Head Gold Project | Supplement to the EIS

FIGURE 2.2



Road
Railway
Gas pipeline
Watercourse
Project area
New Project disturbance
Existing Project disturbance

Issue Date: 2021.11.05

Map ID: 01238D_6_GIS001_v0

Figure Number: 01238D_6_F02-2_GIS_v0-b_es

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DATA SOURCES:
Project data from PNX Metals, 2021.
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2.3 IWL

The conceptual approach and design for the co-disposal of waste rock and tailings within the IWL remains as described in Section 3.7.1 of the EIS. Review of the IWL design that was presented in the EIS identified that it is possible to expand the IWL without impinging on the Fountain Head pit to optimise the design and increase the volume of the tailings storage. Redesigning the IWL also allows for changes in batter slopes to facilitate a more stable landform. These changes have resulted in:

- An expansion of the IWL to the west towards the Fountain Head Lake, while preserving the lake.
- An expansion of the IWL to the east, southeast of the pit.
- Creation of a tailings storage cell, completed in two stages:
  - Stage 1: tailings capacity approximately 584,000 LCM (1,226,000 t).
  - Stage 2 (over Stage 1): tailings capacity approximately 1,188,500 LCM (2,496,000 t).
- Final batter slopes of 10°, 15° and 20° on the lower, middle and upper slopes, with no berms, to reduce erosion of the rehabilitated slopes and result in a more natural landform.

The total IWL design stage capacities are presented in Table 2.3.

Table 2.3 – IWL Design Capacities

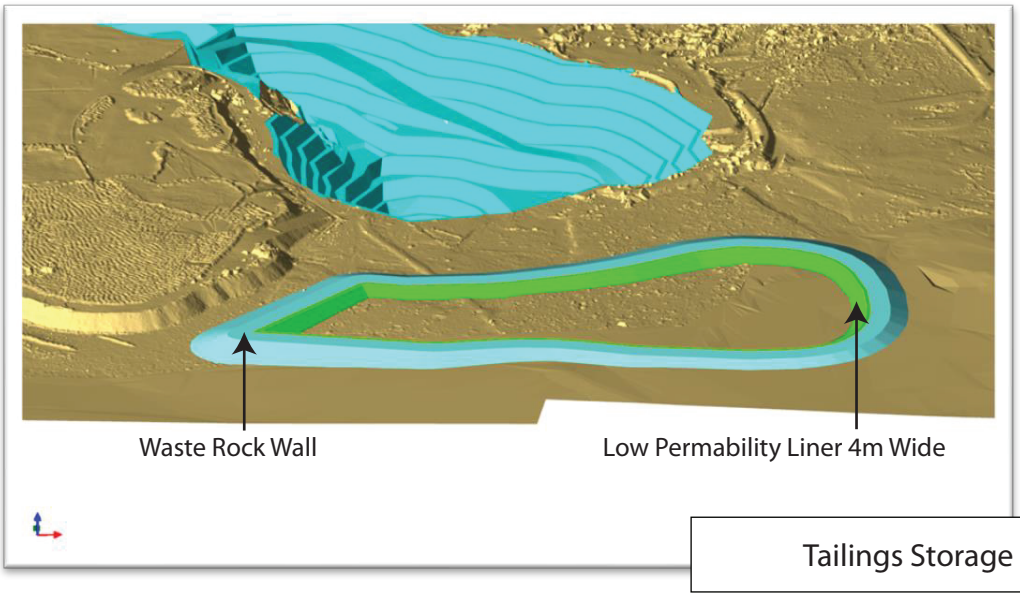
Parameter	Total
Embankment crest height (m)	22.5
Maximum waste crest height (m)	50
Tailings storage capacity (Mt)	3.72
Tailings storage capacity (Mm^3)	1.77
Waste rock capacity (Mt)	17.09
Waste rock capacity (Mm^3)	8.55
Total IWL storage capacity (Mt)	20.81
Total IWL storage capacity (Mm^3)	10.32

The IWL landform design is shown in Figure 2.3.

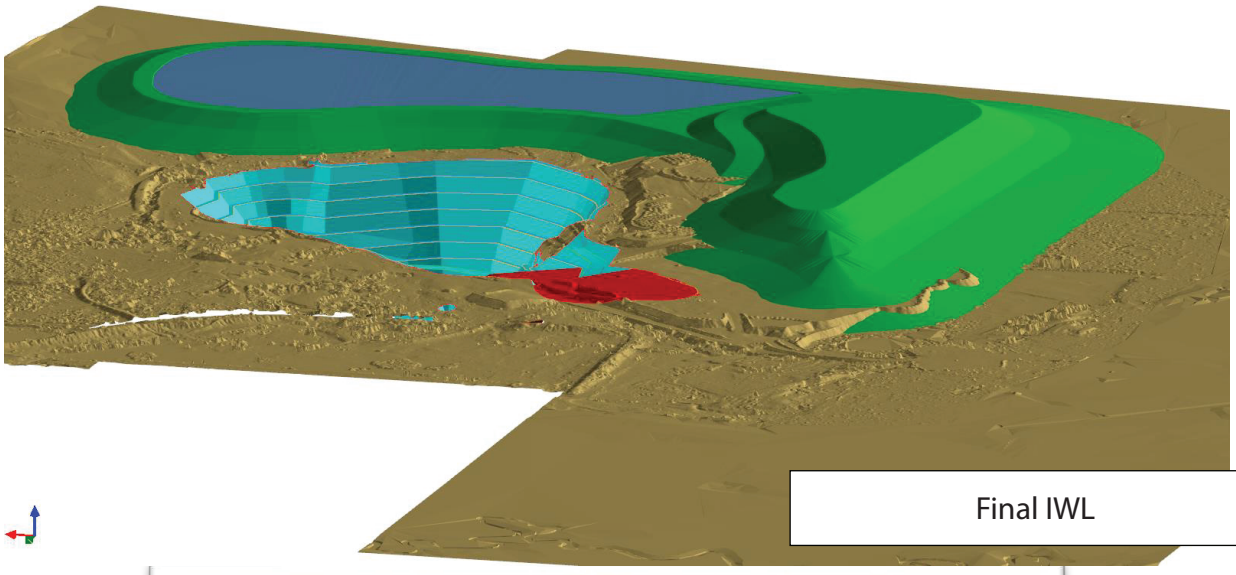
IWL LANDFORM SCHEMATIC

Fountain Head Gold Project | Supplement to the EIS

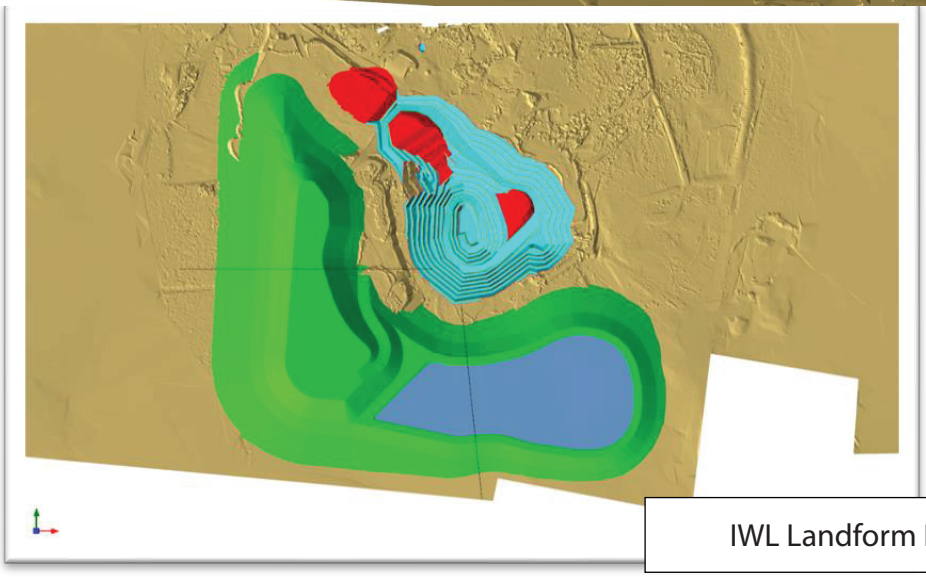
FIGURE 2.3



Tailings Storage Cell



Final IWL



IWL Landform Plan View

Source:

2021.11.08 | 01238D_6_ILL003_v0 | 01238D_6_F02-3_ILL_v0-d_es

2.4 PAF Stockpile

The PAF stockpile has been removed and PAF waste rock will be stored within the Fountain Head pit. PAF waste rock will be placed in one of three pods that are all located within the pit perimeter (Figure 2.4). These pods provide additional storage of 0.96 Mm^3 for waste rock which is significantly larger than the 280,000 m^3 of PAF and PAF-LC that has been estimated. Runoff from these pods will be managed within the pit perimeter and as part of the ongoing dewatering of the pit during mining as described in Section 3.3 of the EIS.

PAF WASTE ROCK STORAGE LOCATIONS

Fountain Head Gold Project | Supplement to the EIS

FIGURE 2.4

SCALE: 1:4,000 @ A4

0 50 100 200 M

GDA 1994 MGA Zone 52

Waste rock pod

Fountain Head Pit footprint

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Hawthorn VIC 3122, Australia

Issue Date: 05.11.2021

Map ID: 01238D_6_GIS002_v0

Figure Number: 01238D_6_F02-4_GIS_v0-d_es

DATA SOURCE:
Project data from PNX Metals, 2021.
Base data from NT Government, 2021 & GEODATA 250K, 2006.
Imagery © ESRI, DigitalGlobe and Partners, 2021.

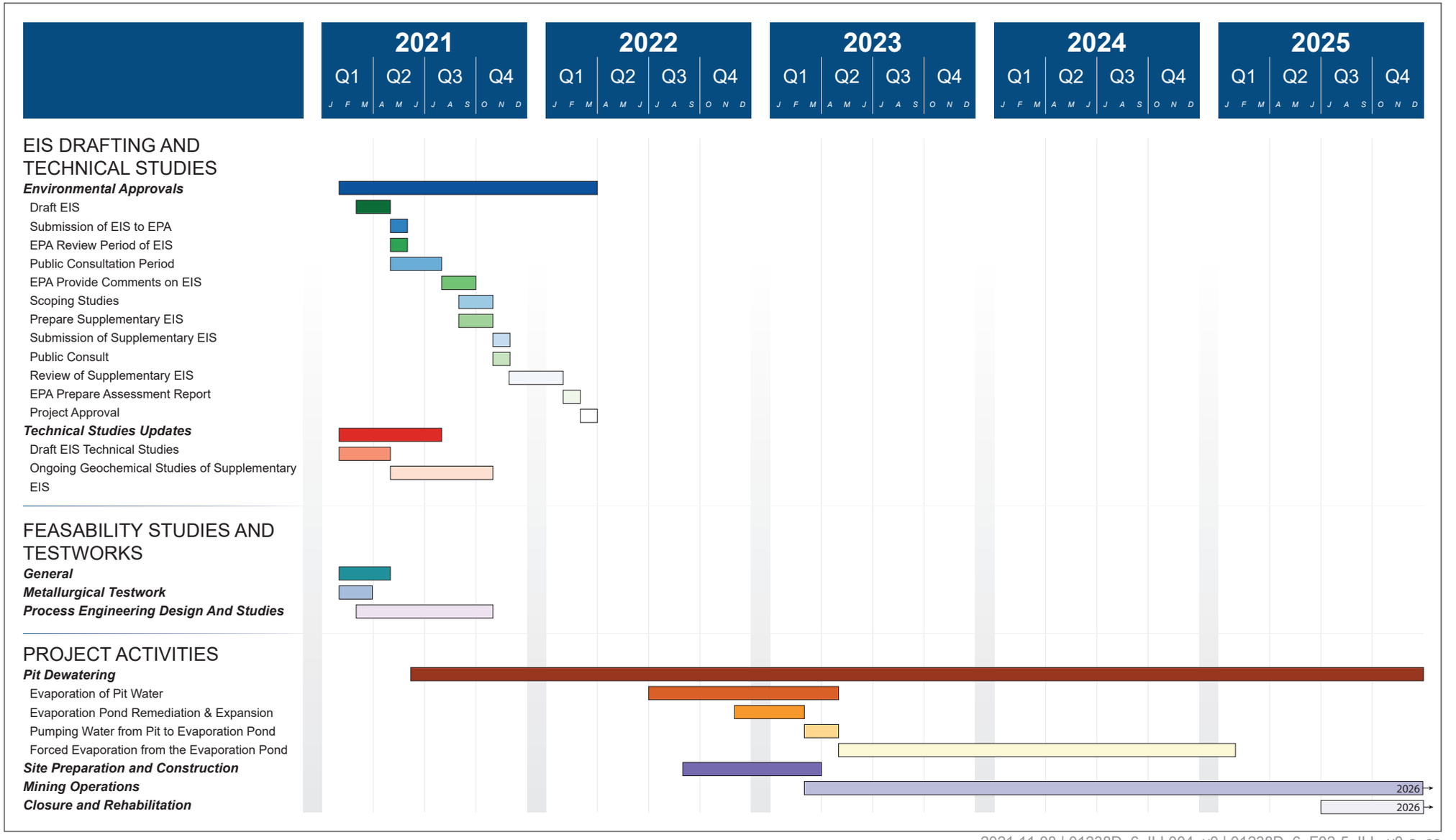
2.5 Schedule

The revised indicative Project timeline, including all Project phases, based on current Project planning is provided in Figure 2.5. Site preparation and construction will commence in Q3 2022 and is expected to be completed in Q1 2023. Operations will commence in Q1 2023.

PROJECT TIMELINE

Fountain Head Gold Project | Supplement to the EIS

FIGURE 2.5



2021.11.08 | 01238D_6_ILL004_v0 | 01238D_6_F02-5_ILL_v0-a_es

3. Additional and/or Amended Information

3.1 Additional Technical Studies

In support of the Supplementary EIS, several technical studies were commissioned to inform the information requested in the Direction.

3.2 Air Quality

An assessment was conducted by KateStone (Appendix 3) to review compliance of the proposed power station with relevant concentration limits specified in the Protection of the Environment Operation (Clean Air) Regulation 2010 (NSW). The power station will consist of 4 x Aggreko QSK50G4 diesel engines (3 x 1,500 kW diesel generators) and 1 x 1,500 kW standby unit).

Katestone used emissions data from the technical datasheet for the Aggreko QSK50G4 engine to inform emissions calculations. These emission concentrations were compared to the Group 6 emission limits specified in Schedule 4 Standards of Concentration for Scheduled Premises: General Activities and Plant specified in the Clean Air Regulation.

The review concluded that while the emission concentrations for particulate matter, VOCs and CO will be well below the standard specified in the Clean Air Regulation, the emission concentration of NOx exceeds the limit and therefore the engines proposed are not currently compliant. However, significant impacts to ambient air quality as a result of the use of the generators is not expected given the results of the air quality assessment, the location of the nearest receptor, and the short duration of use.

3.3 Groundwater

An additional groundwater assessment was undertaken to support the preparation of the supplement to the EIS (Appendix 4). This additional numerical modelling study was completed to provide a better understanding of potential mounding effects related to the storage of water in the evaporation pond. Information from the study was used to inform and further develop the groundwater monitoring program, including groundwater mounding and drawdown triggers and actions should triggers be exceeded.

3.3.1 Groundwater Mounding Modelling

A conservative modelling approach which overestimates the potential mounding effects was adopted, including exclusion of any design or features that reduce groundwater mounding, such as the pit dewatering (drawdown) or evaporation.

The greatest mounding effect will occur at proposed monitoring bore locations MB-1, MB-2 and MB-3 (locations directly adjacent to the evaporation pond) with between 2.5 and 6.5 m of mounding expected during the first four years during dewatering (Figure 3.1), with 0.2 m of mounding extending about 260 m from the evaporation pond over this same period (Figure 3.2).

At 500 years post-closure (assuming the evaporation pond remains) mounding stabilises at MB-1, MB-2 and MB -3 to between 6.3 and 8 m in the immediate vicinity of the pond (Appendix 4). Bores MB-4 and MB-8 experience minimal mounding (less than 2 m) at approximately five and 50 years. Other monitoring bores (MB-5, MB-6, MB-7 and MB-9) eventually experience mounding of less than 1 m.

It is to be noted that none of the predicted mounding would result in the surface expression of groundwater except within the evaporation pond itself, where the water table eventually rises to the surface of the pond.

Figure 3.1 – Mounding at Proposed Monitoring Bores for 50 years From Start of Operations

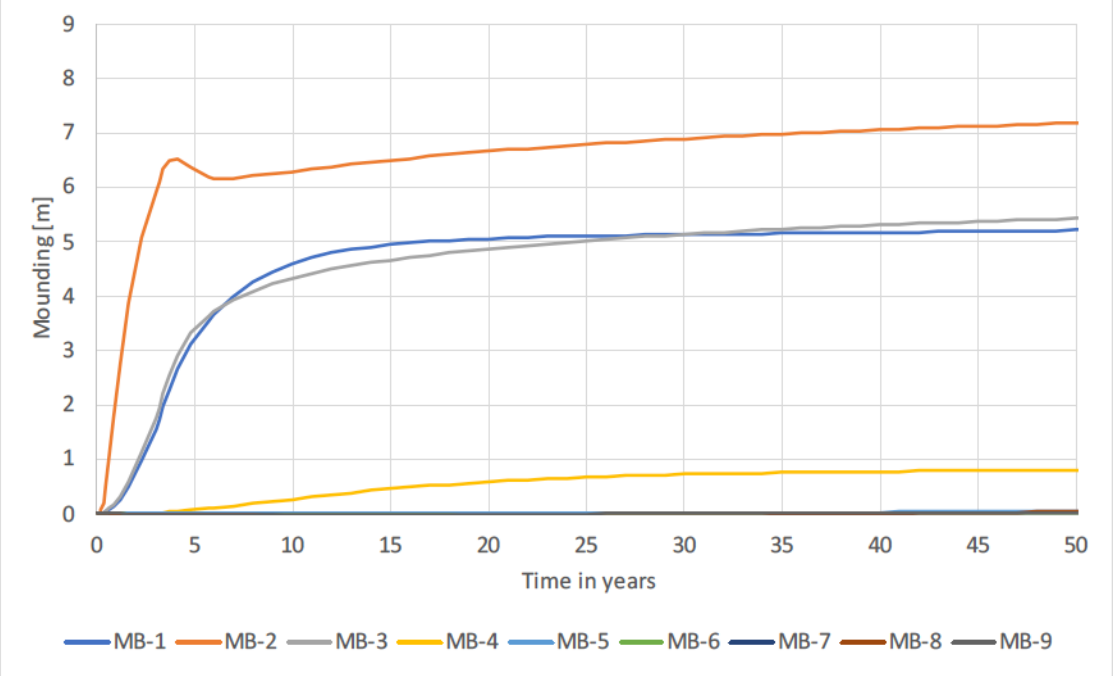
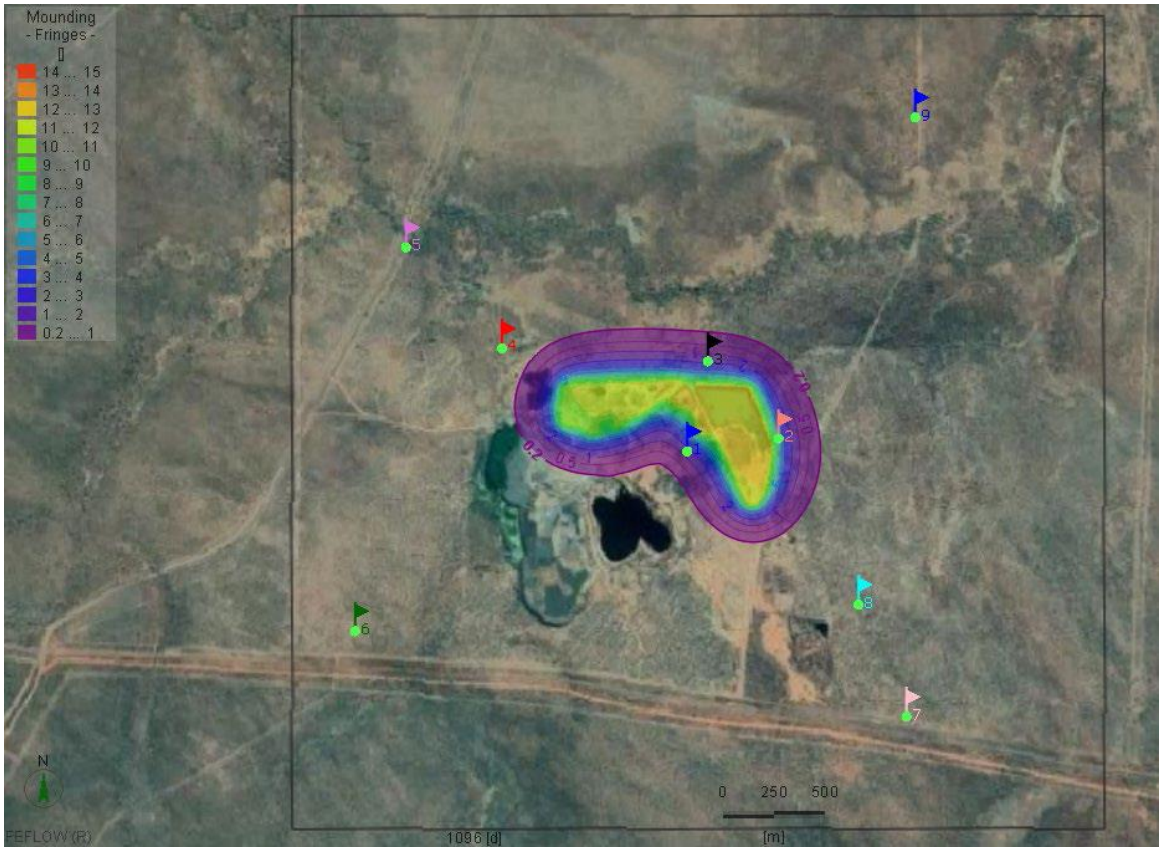


Figure 3.2 – Mounding After 3 Years of Operations (Flags Indicate the Location of Proposed Monitoring Bores)



Sensitivity testing was also undertaken due to the uncertainties associated with the hydraulic properties of the evaporation pond (CDM Smith, 2021c). The sensitivity testing showed that with a higher hydraulic conductivity or lower specific yield, mounding peaks earlier and a few metres higher. This could result in surface expressions of groundwater at the foot of the evaporation pond; however, long term mounding levels are predicted to be similar to results described above, with no risk of water table outcropping within 50 years post mining.

3.3.2 Groundwater Monitoring

The existing monitoring bore network is too shallow to monitor predicted groundwater drawdown at end of mining and incorrectly positioned to allow for measurement of drawdown propagating from the Fountain Head pit. Nine additional monitoring bores have therefore been proposed which, together with the existing monitoring bores, will enable groundwater level and groundwater quality monitoring over the life of mine and post mining. The proposed position of the bores will allow measurement of groundwater drawdown due to pit dewatering and mounding from the evaporation pond to assess groundwater level triggers.

Groundwater level triggers have been devised and are based on the end of mine groundwater levels predicted by the groundwater modelling. Should these triggers be exceeded, investigation into the water affecting activities will occur to determine the cause (s) of exceedance and re-evaluation of the groundwater model, triggers and risk assessment. This assessment approach is

described in a trigger action plan (TAP) that has been developed describing proposed actions and responses if the calculated groundwater triggers are exceeded (see Appendix 4).

No changes to the existing groundwater quality triggers have been made; however, amendments have been made to the parameters that will be monitored. This includes the addition of unfiltered metals and alignment of the measured parameters with the full livestock drinking water guidelines. As described in the TAP, should these triggers be exceeded, comparison against the 80th percentiles of the individual bores will be made at which time increased monitoring and further evaluation of the exceedances will be undertaken.

All of the changes associated with the groundwater monitoring program have been captured in the updated water management plan (WMP) in Appendix 5.

3.4 Evaporation Pond and Pit Water Quality

Additional assessment of evaporation pond and pit water quality was undertaken to support the preparation of the supplement to the EIS considering the storage of PAF material within the pit (CDM Smith, 2021b). The water balance model and nonreactive solute balance function developed for the EIS was updated using recent kinetic test data and modelling undertaken assuming PAF material storage within the pit to provide estimates of long-term Fountain Head pit lake water quality. This study was completed to assess the risk to the environment and to determine the best options to manage pit water.

Two solute balance scenarios were considered:

- Scenario 1: Assumes the Fountain Head pit is closed once mining ceases, the evaporation pond remains and no further pumping of water from the pit occurs.
- Scenario 2: Assumes diversion of 80% of the Fountain Head upper catchment water through the Fountain Head pit at the end of mining. No back pumping of the evaporation ponds occurs under this scenario; rather, water level recovery is assisted by diverting natural catchment runoff.

The results from the modelling of these scenarios are described in the following sections. The water quality modelling was undertaken on the key parameters of arsenic and acidity. A conservative modelling approach was adopted, whereby no decay or transformation of the source water components into other compounds or precipitation was assumed. Therefore, assumptions were made in the modelling which likely overpredicts the arsenic and acidity loading rates.

3.4.1 Scenario 1

3.4.1.1 Evaporation Pond

Under this scenario, dewatering activities will occur until end of mining in April 2025, at which time the PAF material from Pod 1will be pushed further into the pit leading to full submersion of PAF material from the pods and partial submersion of PAF rock associated with the exposed pit walls (similar to existing conditions), which will oxidise with time.

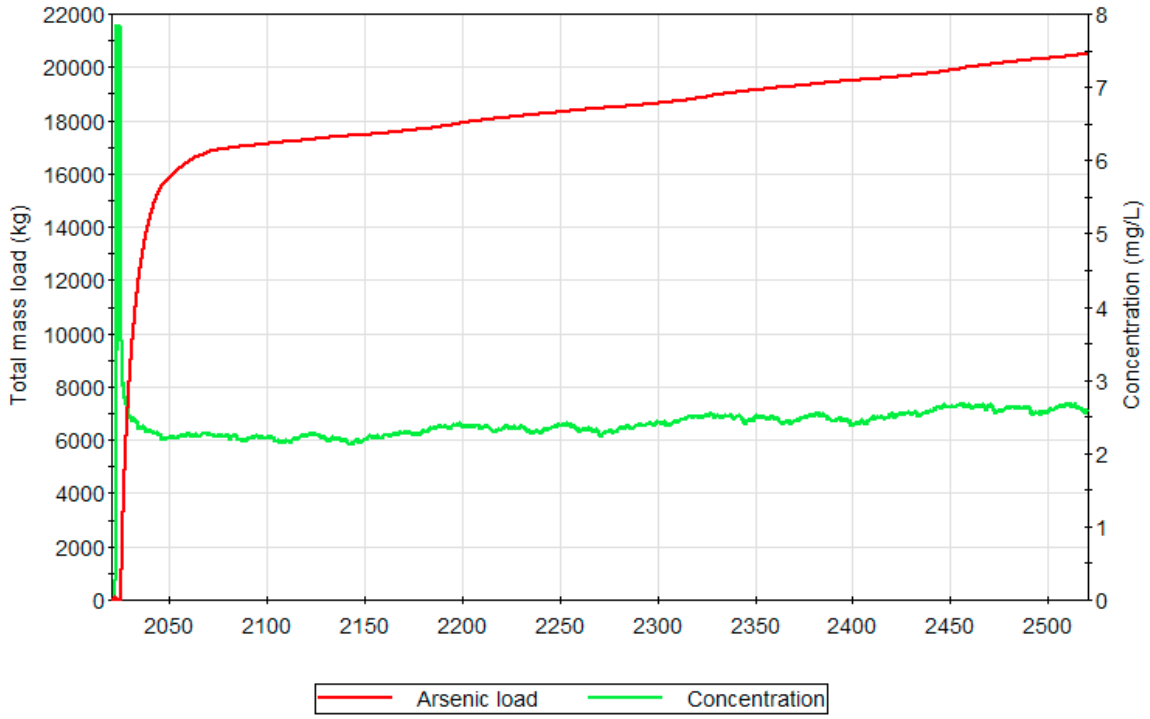
During mining operations, the Fountain Head pit will be dewatered using evaporators and pumping water to the evaporation pond. This will result in dissolved arsenic concentrations

increasing in the evaporation pond to over 40 mg/L from mid-2023, to around 80 mg/L by mid-2024. From 2026, arsenic concentrations in the evaporation pond are predicted to rapidly decrease to below the livestock drinking water guideline (0.5 mg/L) by the end of 2027 and below the aquatic ecosystem 80% protection level trigger value (0.14 mg/L) in early 2028.

3.4.1.2 Fountain Head Pit

In the Fountain Head pit, arsenic concentrations in pit water are predicted to increase quickly during mining, before declining momentarily when the pit will be allowed to fill from groundwater inflows. Under this scenario, PAF Pod 1 will be submerged within 1 year post-closure, while PAF Pod 3 and 2 will be fully submerged after approximately 2 and 30 years respectively. The dissolved arsenic concentration is predicted to decrease rapidly from approximately 8 mg/L at the end of mining to approximately 2 mg/L by 2050 due to the inflow of groundwater. After such time the dissolved arsenic concentration is predicted to increase marginally to 2.5 mg/L by 2500, due to the ongoing leaching of arsenic from the PAF rock exposed in the pit walls and the effects of evapoconcentration. Under this scenario, pit water quality is predicted to remain above the current average pit water concentration of 0.6 mg/L and also above the livestock drinking water guideline and the aquatic ecosystem 80% protection level trigger value.

Figure 3.3 – Predicted Dissolved Arsenic Concentrations of the Fountain Head Pit Water Over 500 years (Scenario 1)



Source: CDM Smith (2021b).

3.4.2 Scenario 2

3.4.2.1 Evaporation Pond

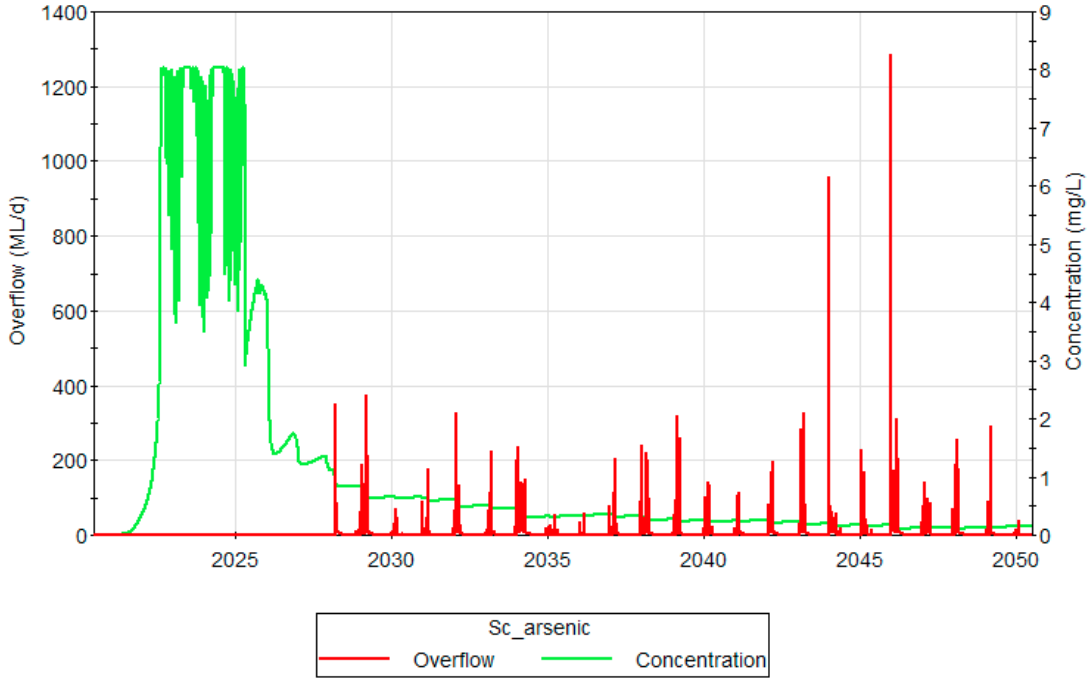
Under this scenario, 80% of the natural catchment flow which currently flows into Fountain Head Lake will be diverted through the Fountain Head pit. Mining will continue as scheduled until April 2025, at which time surface water within the upper catchment will be diverted to the pit. Under this scenario, the predicted water quality within the evaporation pond would remain as described in the previous section for Scenario 1 and all PAF material is predicted to be fully submerged within 3 years post closure.

3.4.2.2 Fountain Head Pit

In the Fountain Head pit, arsenic concentrations in pit water are predicted to peak at approximately 8 mg/L during mining operations, decreasing to less than 0.5 mg/L (livestock drinking water guideline) by 2028 once mining ceases and catchment water is diverted to the pit (Figure 3.4). Concentrations are predicted to decrease to below the aquatic ecosystem 80% protection level trigger value (0.14 mg/L) by 2046 and oscillate near this level (average concentration of 0.15 mg/L) between 2046 and 2500. This predicted concentration, based on conservative modelling assumptions, is lower than the average concentration of 0.6 mg/L measured in existing pit water.

Under Scenario 2, annual overtopping of the pit is predicted to occur during the wet season (Figure 3.4). The modelling shows that the first such event is expected to occur in the 2028 wet season, when the arsenic concentration within the pit is predicted to be approximately 0.33 mg/L. The arsenic concentration in the overflow water is predicted to remain above 0.14 mg/L (80% aquatic ecosystems protection) for about five years post-closure (until 2033), after which concentrations decrease and oscillate close to the aquatic ecosystem 80% protection level trigger value (0.14 mg/L) in the following years.

Figure 3.4 – Predicted Dissolved Arsenic Concentrations and Overflow Occurrences of the Fountain Head pit (Scenario 2)



Source: CDM Smith (2021b).

4. Summary of Submissions Received

A total of seven submissions were received from NT advisory bodies, non-government organisations and members of the public during the public exhibition period. One submission was received from the general public. Submissions were received from the following parties:

- Aboriginal Areas Protection Authority (AAPA).
- The Department of Environment, Parks and Water Security (DEPWS):
- Environment Division.
    - Water Resource Division.
    - Flora and Fauna Division.
    - Rangelands Division.
- NT Health, Centre for Disease Control Division.
- The Department of Industry, Tourism and Trade (DITT):
    - Mines Branch.
    - Tourism Division.
- Territory Families, Housing and Communities, Heritage Branch.
- NT Police, Fire and Emergency Services.

The detail of the submissions is provided in Appendix 1.

5. Response to Submissions

5.1 Submissions from the Public Exhibition Period

This section considers the submissions made on the draft EIS during the public exhibition period. Responses have been prepared where information or clarification has been requested. Where the submissions were also provided in the NT EPA Direction, these have been addressed in Section 5.2 (Submissions Provided in the Direction to Prepare a Supplement) to avoid duplication.

5.1.1 AAPA

5.1.1.1 Regulatory Requirements – Sacred Sites

Comment

The Authority confirms that PNX Metals was issued an Authority Certificate (C2021/019) (the Certificate) on 24 March 2021. The process of issuing this certificate involved consultation with custodians and did identify sacred sites nearby and downstream of (but not within) the Project Area as illustrated in Figure 3.2.

The Authority clarifies that this Certificate does not protect all intangible cultural heritage.

To protect sacred sites in accordance with the Northern Territory Aboriginal Sacred Sites Act 1989, PNX Metals must comply with the conditions of the Certificate. These include conditions for reporting to the Authority on accidental release or detection of contaminants in a waterway.

Response

PNX are committed to complying with the conditions provided in the AAPA certificate. The conditions include:

1 The applicant shall ensure that the conditions of this Certificate are included in any subsequent contract or tender documents for the works or use described herein.

2 The applicant shall ensure any agent, contractor or employee is aware of the conditions of this Certificate and the obligations of all persons (who enter on, or carry out works or use land on which there is a sacred site) under Part IV of the Northern Territory Aboriginal Sacred Sites Act 1989 (NT).

3 This Certificate shall lapse and be null and void if the works in question or the proposed use is not commenced within 24 months of this Certificate.

4 The applicant shall ensure any agent, contractor or employee is aware of the content of section 40(1) of the Northern Territory Aboriginal Sacred Sites Act 1989 (NT) which provides that this Certificate does not negate the need for consent, approval or permission for the subject works or use of the land which may be required under another statute.

5 Within the area marked Restricted Works Area 1 (RWA1) on Annexure 'A', associated with sacred site 5271-7, no work shall take place or no damage shall occur. The features

of sacred site 5271-7 include: Perennial billabong and small waterhole, inclusive of water, beds and banks.

6 Within the area marked Restricted Works Area 2 (RWA2) on Annexure 'A', associated with sacred site 5271-8, no work shall take place or no damage shall occur. The features of sacred site 5271-8 include: dark rock outcrops.

7 Any report required to be provided to the Department of Environment, Parks and Water Security (DEPWS) in connection with the accidental release of contaminants into a waterway associated with the proposed works or use must also be provided to the Authority within 24 hours of its provision to DEPWS.

8 Where the applicant detects contaminants of potential concern in a waterway or bore associated with the proposed works, it shall provide a written report of those findings to the Authority within 14 days of the contaminants being detected.

Custodians consulted for the AAPA site clearance have requested that where possible, termite mounds (3 metres or greater in height) are not disturbed as they hold cultural significance. PNX have committed to where possible, avoiding termite mounds over three metres.

No works are planned to take place within areas identified as restricted works areas (RWA). Restricted works areas identified, are not located within the Project leases. Potential impacts to sacred sites upstream of the Project (outside of the Project lease) is discussed in Section 5.2.17.2.

5.1.2 Environment Division, Environmental Authorisations Unit

5.1.2.1 Wastewater

Comment

The proponent has indicated in the draft EIS that PNX does not intend to discharge wastewater offsite and therefore do not plan on obtaining a waste discharge licence (WDL). All wastewater is planned to either be recycled e.g., through the process plant or retained on site within water storage areas such as the evaporation pond. Runoff (ANZECC/ ARMCANZ (2000) compliant) from sediment dams around bunded hardstand areas and the IWL will be diverted to the Fountain Head Lake catchment or the evaporation pond catchment prior to release offsite.

Should the proponent change plans and require waste discharge then a WDL will be required. The proponent should allow sufficient time for the application to be assessed and approved by the Controller of Water Resources. Assessment and application timeframes can be up to 60 business days and are dependent on the adequacy of the information provided.

Response

The approach to management of waste and wastewater has not changed since the submission of the draft EIS and a license to discharge water under the *Water Act 1992* will not be required as water is not proposed to be discharged off lease to waterways, such as rivers and streams.

All wastewater is still planned to either be recycled or retained on site within water storage areas such as the evaporation pond. Site water quality monitoring results will be screened against the revised ANZECC/ARMCANZ (2000) values (ANZG, 2018) to understand potential risks and inform water management strategies (as per the Water Management Plan (WMP)). Runoff from sediment dams around bunded hardstand areas and the IWL will be diverted to the Fountain Head Lake catchment or the evaporation pond catchment, whereby it will be diluted prior to release offsite.

Further, sewage from buildings (e.g., crib room or offices) will be collected in subsurface septic tanks. Solids will be removed and disposed of at a licensed facility, while wastewater will flow to a subsurface drainage field. Project septic systems will be located, constructed and managed in accordance with the Northern Territory Code of Practice for Onsite Wastewater Management.

5.1.3 Department of Environment, Parks and Water Security, Environment Division, Environmental Operations Unit

5.1.3.1 Electric Evaporators

Comment

Three electric evaporators (Minetek Evaporating Systems) will be used for dewatering operations and the proponent has employed a Gaussian Diffusion and Sedimentation (GDS) model to show that arsenic emissions from the Minetek evaporators will be within compliance limits at three receptor sites. Arsenic was modelled as the drift of droplets that evaporate to dryness as PM10 and PM2.5.

This is not a standard model to be used for compliance assessment. The proponent must explain why models specified in the NSW Approved Modelling Methods could not be used to assess emissions from the evaporators.

The proponent should also note that impact assessment criteria (IAC) of principal toxic air pollutants such as hydrogen cyanide and arsenic (listed in the NSW Approved Modelling Methods) are applied at and beyond the boundary of the facility. This is in contrast to IAC of other pollutants such as criteria pollutants, which are applied at selected offsite receptors.

The proponent should either (i) employ the services of an independent third party to review the use of the GDS model for assessing the emissions from the evaporator, or (ii) include the evaporator emissions a stationary point sources and model all emissions from the development using an approved air dispersion model.

Response

The GDS model used to undertake the assessment was chosen as fit for purpose due to the ability to assess the droplet diameter change proportional to time as well as spray drift. The model calculates the projectile trajectory through the parabolic function with standard fluid factors considered such as drag. The expected horizontal distance travelled by each droplet size is then calculated and final droplet size, with end conditions being set at either impact with pond/ground or evaporation of all liquid which will result in drift of solids. The cumulative density of droplets containing the particulate matter (PM) of interest is then determined to calculate the PM of interest solute production rate. The concentration of the PM of interest at a set distance (sensitive

receptor) from the source is then calculated using the gaussian dispersion model and compared to the standard to verify compliance.

The model demonstrated that the potential arsenic emissions produced by the proposed Evaporation system will comply with the limits set out by the relevant air quality criteria/standards.

Information provided by the manufacturer relating to the evaporation process determined:

- The evaporator system can be configured to operate automatically with triggers depending on meteorological parameters, set times, or other details.
- The evaporators are configured to obtain an efficiency of approximately 50% in order to prevent the complete evaporation of droplets which could release dissolved solids into the atmosphere.
- An evaporation efficiency of 50% reflects the reduction in droplet volume, rather than reduction in the total number of droplets, providing the example of a 200 µm diameter droplet which would result in a 100 µm diameter droplet after 50% of the droplet has evaporated.
- Dissolved species exhibit a greater affinity for water over air (i.e. are non-volatile) and tend to stay dissolved in droplets.
- Particulate matter may be produced from dissolved species if smaller droplets evaporate to dryness, however surrounding droplets may act to suppress emission of the particulate matter.

The diameter of the droplets are described to be in the order of 100's of µm. With a mean droplet diameter of that size, it is likely the evaporators would produce only a small portion of droplets with the potential to evaporate to sizes of concern for wider dispersion (arsenic criteria apply to 10 µm or smaller airborne particles). The proportion is not able to be quantified given the available information. Larger droplets are likely to fall back into the void or deposit over relatively short distances, and if dissolved solids do remain in these droplets, then the majority of arsenic would be returned to the void or remain on site.

The information provided indicates that only a small portion of dissolved arsenic in ultra-fine water droplets would have the potential to be blown in the wind drift. The nearest sensitive receptor is located 5.5 km away and concentrations of arsenic in the airborne water droplets would disperse or dilute significantly over this distance. Annual average concentrations of PM_{10} and $PM_{2.5}$ were 0.001352 and 0.000129 µg/m3 respectively, well below the compliance limit of 0.006 µg.

PNX will commit to the following management measures:

- Shutting off evaporators during wind conditions that place sensitive receptors downwind, based on measured wind conditions.
- Shutting off evaporators overnight, when dispersion conditions are typically poor (i.e., low wind speeds and mixing heights).

In addition, PNX have committed to:

- Collect baseline soil quality data on site prior to dewatering activity.
- Annual monitoring of soil quality on site, in particular within 500 m of the pit and evaporation pond until evaporator operations cease.

PNX see no basis in undertaking further modelling or independent review of the current assessment as this is not expected to provide a different outcome to the previously prepared assessment. The current commitments are also expected to effectively mitigate any potential impacts to soil quality.

5.1.4 Mining and Petroleum

5.1.4.1 Mine Pit and Evaporation Pond Water – Extraction

The draft EIS indicates that surface water will be extracted from an existing pit (Fountain Head Pit) and evaporation ponds for construction and process water for mining operations. The EIS states that advice was provided by DEPWS in June 2019 that a surface water extraction licence would not be required for dewatering of the mine pit. It is the current position of DEPWS at the time of this review of the EIS that extraction of water from the mine pit and evaporation pond does trigger licence requirements under section 45 of the *Water Act 1992*.

Recommendation: Extraction of surface water from mine pits or onsite dams requires a surface water extraction licence (SWEL) under section 45 of the *Water Act 1992*. The proponent must apply for a SWEL prior to commencement of extraction from the mine pit or evaporation pond. In applying for a SWEL the proponent must document the estimated water use in mega litres (ML) per month for each beneficial use and extraction point. An application for a SWEL should be lodged at least three to four months prior to commencing extraction for the SWEL to be processed by DEPWS.

Response

As described in Section 3.7.2 of the draft EIS, PNX intend to extract water from the existing pit (Fountain Head Pit) for dewatering and the construction and process water for mining operations.

Pit water extraction will be utilised for the following construction and operations purposes:

- Pit and road dust suppression.
- Crusher dust suppression.
- Initial water supply and makeup for the process plant and mill.
- Office ablutions.
- Vehicle washdown.
- Core cutting.
- Plant wash water.

To avoid undertaking applications for two water extraction licences, the Fountain Head Lake will no longer be utilised for Project water requirements.

PNX are currently progressing an application for the SWEL for extraction of water from the pit under section 45 of the *Water Act 1992*. This licence will be obtained prior to commencing dewatering activities at Fountain Head.

5.1.4.1 Fountain Head Lake – Extraction

The EIS documents that potable water may be sourced from the historical 'Fountain Head Lake' (a manmade surface water feature comprised a void space remining from historical alluvial mining with downstream haulage road acting as a dam). Based on information provided in the EIS, DEPWS considers that Fountain Head Lake meets the definition of a waterway under section 4 of the *Water Act 1992*. The proponent will therefore require a SWEL to take water from Fountain Head Lake under section 45 of the Act.

Recommendation: Should the proponent choose to extract water from Fountain Head Lake, an application for a SWEL must be lodged. The proponent should allow at least three to four months for the SWEL to be determined by the Controller of Water Resources.

Response

The draft EIS outlined that potable water would either be sourced from the Fountain Head Lake (if suitable) for treatment, or water would be trucked to site. As DEPWS has informed that it considers Fountain Head Lake a waterway under section 4 of the Act, it is proposed that potable water will be trucked to site and no water extracted from the Lake and therefore a SWEL will not be required. Water that would have potentially been extracted from the Fountain Head Lake for other Project purposes (e.g., dust suppression) will now solely be sourced from the existing pit.

5.1.4.2 Fountain Head Lake – Interference with a Waterway

The EIS identifies that Fountain Head Lake has been created by damming of the unnamed stream by an historical haulage road to the north. While the existing disruption to the waterway does not require authorisation under the *Water Act 1992*, any future modification to site infrastructure which alters the current water regime may trigger a requirement for a permit to interfere with a waterway under section 41 of the *Water Act 1992*.

Recommendation: Prior to commencement of construction works which may alter the flow regime of Fountain Head Lake, project specific advice about permit requirements should be sought from the Water Resources Division. Further information on permit requirements for interference with a waterway is available in the DEPWS fact sheet Mining and Petroleum Activities: Interference with a Waterway.

Response

As noted above in Section 5.1.4.1, PNX are no longer planning to extract water from the Fountain Head Lake.

The diversions proposed by CDM Smith were identified using surface water modelling and will allow for the Fountain Head Lake to flow through as it does currently through the site. Project design and management will sufficiently mitigate any potential alterations to the current water regime of the site and surrounding area from Project activities.

Should any changes to the Project result in what would be considered to be interference with the Fountain Head Lake, PNX will seek advice from the Water Resources Division on permit requirements prior to undertaking any works.

5.1.5 Environmental Operations Unit

5.1.5.1 Atmospheric Processes

Comment

The proponent has shown that the facility will have National Greenhouse and Energy Reporting (NGER) scheme reporting obligations associated with the development, nominally commencing in Year 1 of the project schedule.

The proponent should also note the facility is likely to trigger National Pollutant Inventory (NPI) reporting.

Response

The following substances associated with the Project may trigger an NPI reporting threshold: Nitrous oxide (N_2O), nitrogen dioxide (NO_2) and nitric oxide (NO) – under the umbrella heading "Oxides of Nitrogen"; $PM_{2.5}$ (only reportable from combustion sources) and PM_{10}; and carbon monoxide (CO) all fall under reportable Categories 2a. and 2b., outlined below.

2a.) 400 tonnes per year or 1 tonne per hour; or

2b.) 2,000 tonnes per year or 60,000 megawatt hours, or rated at 20 megawatts.

In addition to the above, proposed diesel generators/engines will also produce oxides of nitrogen and VOCs. There are currently 41 NPI-listed VOCs and 13 non-NPI VOCs (includes methane (CH4) and carbon monoxide (CO)). The reporting thresholds for VOCs are outlined in the below Categories.

1.) Individual VOCs:10 tonnes per year; and

1a.) TVOCs (Total VOCs), by mass: 25 tonnes per year of NPI and non-NPI VOCs together.

Hydrogen cyanide, used in the CIL process, is not currently listed as a reportable substance under Category 1.

5.1.6 Planning and Engagement

5.1.6.1 Water Management

Comment

The proposed development is not within a water control district and is not subject to a water allocation plan.

The mine is in the Mary River Beneficial uses area (NT Gazette G6, 13 February 2002). The beneficial uses are environment, riparian and cultural for surface water and environment, riparian and agriculture for groundwater. The EIS should demonstrate how the water quality objectives are

being met and the risks are being managed. The EIS and Appendix 16 (Water MP) do not specifically identify how the beneficial use and water quality objectives are going to be met.

Response

The mine is not located in the Mary River Groundwater or Surface Water beneficial use area. The Project is located within the Adelaide River surface water catchment, as shown in Figure 4.7 of the draft EIS. While the Mary River Groundwater beneficial use area does extend to include some sections of the Margaret River downstream of the Project area, the mine site is located more than 4.8 km from the nearest boundary of this groundwater beneficial use area and well outside the Mary River surface water catchment boundary. As described in Section 7.6.4 of the draft EIS, residual impacts to groundwater are predicted to be either highly localised or undetectable compared to natural conditions. As such, impacts will not extend to the Mary River Groundwater beneficial use area and there is no pathway for impacts to the Mary River Surface Water beneficial use area, given the unnamed tributary creek north of the mine site and the downstream Margaret River are located in a separate catchment.

There are currently no declared/gazetted beneficial uses for the surface waters and groundwater of the Adelaide River catchment where the Project is located. Notwithstanding, the beneficial uses identified for the adjacent Mary River groundwater and surface catchment are considered relevant to the unnamed tributary creek and the downstream Margaret River. These beneficial uses are environment, riparian and cultural for surface water and environment, riparian and agriculture for groundwater. The objectives for these beneficial uses are defined as those provided in Chapter 2 (protection of aquatic ecosystems), Chapter 3 (recreational water quality and aesthetics) and Chapter 5 (agricultural water uses) of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992).These guidelines have since been superseded by the ANZG (2018) or where no update has been provided in ANZG (2018), e.g., for livestock drinking water, more recent objectives are provided ANZECC/ARMCANZ (2000a). In the case of managing risks to recreational water, NHMRC (2008) provides the most current guidelines. As described in Section 7.5.4 of the draft EIS, residual impacts to surface water are predicted to be short term and localised (i.e., limited to the unnamed tributary creek) or undetectable with respect to natural variability.

The draft EIS and the Water Management Plan (WMP) describes the relevant measures to be implemented to mitigate impacts to surface water and groundwater to mitigate risks and identify environmental performance objectives and targets as well as monitoring measures and contingency actions. The environmental performance objectives identified in the WMP are consistent with those for the objectives for the beneficial uses identified for the Mary River (noting that there are no gazetted objectives for the Adelaide River catchment). As such, where these objectives identified in the WMP are met, the beneficial uses will also be protected and, when not met, further investigation and corrective action will be implemented as required.

The surface water management strategy is also described in detail in both the draft EIS and WMP. With respect to meeting surface water quality objectives, the performance target refers to not exceeding applicable ANZG (2018) trigger values for surface water in the downstream tributary creeks, Margaret River and Fountain Head Lake. Relevant trigger values are provided in Table 7.4 of the WMP for surface water which are proposed for the protection of aquatic ecosystems based on the default trigger values for lowland rivers in tropical Australia (for

physicochemical parameters) and the default trigger values for slightly to moderately disturbed aquatic ecosystems for toxicants (i.e., 95% to 99% protection depending on the individual toxicant). These values are also considered to inherently protect riparian beneficial uses. With respect to cultural beneficial uses, the Project area is located on Ban Ban Springs Station a large pastoral lease, with limited access for recreational uses; however, there is a recorded sacred site, a perennial billabong and small waterhole, approximately 550 m from the nearest boundary of the Project area, which is approximately 2.5 km from the Fountain Head pit The aquatic ecosystem guideline values provided in Table 7.4 of the WMP are considered appropriate to maintaining cultural beneficial uses of the downstream surface water environment. This issue is further discussed in Section 5.2.17 of this document with specific reference to the known sacred site located downstream of the Project area.

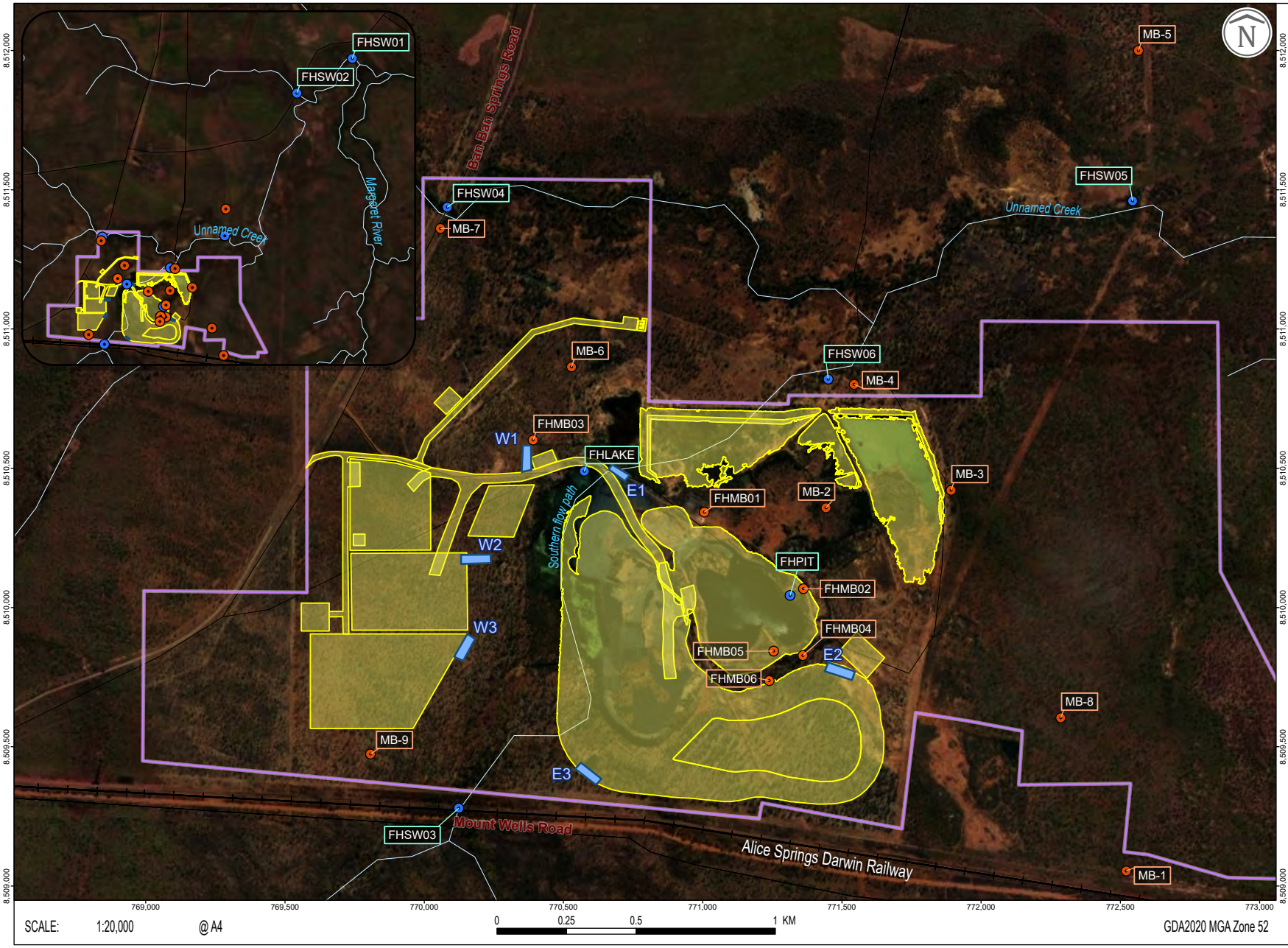
The groundwater monitoring network has been revised in the updated WMP and the analytical suite has also been expanded. Groundwater results will be compared to the livestock drinking water guidelines provided in Table 7.6 of the updated WMP and to the aquatic ecosystems guidelines provided in Table 7.4 of the updated WMP (noting that consideration of naturally elevated metals and metalloids such as arsenic and aluminium will be required). The monitoring and contingency measures outlined in the updated WMP describe how the identified objectives will be met and corrective actions/triggers that will be undertaken if required.

The updated WMP has been revised to include two additional surface water monitoring sites immediately downstream of the Project area (FHS05 & FHS06) in the unnamed tributary creek (Figure 5.1). Monitoring at FHSW06 will provide an indication of surface water quality leaving the site, and FHSW05 will provide an indication of water quality once the water leaving the site has mixed within the unnamed tributary creek immediately downstream. It will also provide a comparison to surface water quality at FHSW04, just upstream of the site.

PROPOSED SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS

Fountain Head Gold Project | Supplement to the EIS

FIGURE 5.1



Monitoring locations
- Surface water
- Groundwater
- Road
- Railway
- Watercourse
- Project area
- Sediment dam
- Infrastructure layout

Issue Date: 2021.11.24

Map ID: 01238D_6_GIS004_v0

Figure Number: 01238D_6_F05-1_GIS_v0-c_es

ERIAS, 13-25 Church Street
Hawthorn VIC 3122, Australia

DATA SOURCES:
Project data from PNX Metals, 2021.
Imagery © ESRI, DigitalGlobe and Partners, 2021.

5.1.7 NT Health, Centre for Disease Control Division

5.1.7.1 Human Health

Comment

Measures that will be taken to reduce the impact of mosquitoes, and minimise the potential to create new mosquito breeding sites, should be outlined in a mosquito management section in the Human Health section of the EIS. Guidance can be found in the Medical Entomology Personal protection from mosquitoes and biting midges handout and Guidelines for preventing mosquito breeding associated with mining sites handout.

Response

PNX will endeavour to prevent the creation of mosquito breeding habitat by reducing the instances of shallow pooling water around the site. The likelihood that the mine site will create a legacy issue for future land users by creation of mosquito breeding habitat is low. The site will be re-profiled following the completion of mining activities and the site revegetated.

Project activities will not result in additional water bodies, but an increase to a current body of standing water, through the expansion of the evaporation pond. This increase in surface water area onsite is not expected to become mosquito breeding habitat as mitigation measures proposed for the evaporation pond to create relatively unfavourable conditions for mosquito breeding (DHF, 2005) will include:

- Where possible, design of any constructed large water bodies to have relatively steep sides (45° slope minimum) to discourage the establishment of semi-aquatic vegetation that will provide suitable habitats for mosquito breeding.
- Semi-aquatic vegetation will be removed from Project waterbodies (i.e., the evaporation pond, existing pit and Fountain Head lake) as a part of site maintenance.
- Areas will be graded, where possible to enable water to drain freely as water recedes following the wet season, reducing the chance of isolated pools forming that are capable of retaining water for a period greater than five days.

All Project personnel will be informed of the risks of mosquitos and bite prevention. Information will be provided in site inductions, which will be completed by all staff and contractors. Appropriate PPE will be required to be worn, which will help reduce exposure to mosquito bites.

5.2 Submissions Provided in the Direction to Prepare a Supplement

The following requested information was provided by the NT EPA in the Direction to Prepare a Supplement EIS. Only agency comments that requested further information are addressed in this section.

5.2.1 Terrestrial Environmental Quality – Waste Rock and Geochemistry

5.2.1.1 Requested information

The waste material of concern includes ARD rock types (NAF/PAF), leachate (metals and metalloids) and Arsenic (As). Describe the management strategies, processes and actions that will be implemented to effectively discriminate and segregate the waste material.

Describe the sulphur testing program or geological controls adopted to classify and characterise waste rock.

The measures taken should minimise the generation of waste and its discharge into the environment. As defined in the Environment Protection Act, 2019 (EP Act), waste should be managed in accordance with the waste management hierarchy of approaches in order of priority:

a) avoidance of the production of waste.
b) minimisation of the production of waste.
c) re-use of waste.
d) recycling of waste.
e) recovery of energy and other resources from waste.
f) treatment of waste to reduce potentially adverse impacts.
g) disposal of waste in an environmentally sound manner.

5.2.1.2 Response

Initial testing by PNX identified that a poor correlation existed between pXRF sulphur data and Total S. As a result of this initial assessment PNX adopted Total S as its measure to identify and segregate NAF from PAF rather than pXRF.

The first phase of geochemical testing of 111 samples identified that Total S could be used to segregate NAF and PAF. As the initial sample size was small to expand the Total S database PNX undertook analysis of Total S on a further 551 samples which confirmed the criteria for waste segregation (Table 5.1).

Table 5.1 – Classification of Waste Rock

Total S	ARD Classification	Management	
		During Mining	Post Mining
<=0.2%	NAF	Segregate and place in Integrated Waste Landform	No further management measures required

≥0.2 - <=0.4%	PAF-LC	Segregate and mix with NAF in Integrated Waste Landform	No further management measures required
≥0.4%	PAF	Segregate and store within pit	Any PAF material placed within the pit which will not be permanently covered by a minimum of 2 m of water will be relocated following the completion of mining to achieve the minimum water cover

Based on the classification outlined in Table 5.1 the following volumes were calculated:

- 12.62 Mt NAF.
- 0.6 Mt PAF-LC.
- 0.15 Mt PAF.

To segregate wastes into NAF, PAF-LC and PAF during operations PNX will continue to undertake Total S analysis with a focus on fresh rock. A composite sample will be taken from each blast hole drilled into fresh rock and the sample analysed for Total S in accordance with the Waste Rock Management Plan (Appendix 6).

The EIS proposed a separate PAF stockpile located outside the open pit. It was proposed that this material would be relocated back into the pit following completion of mining where it would be covered with water as the pit refilled and therefore providing a permanent water cover. Since the EIS was completed further mine planning studies have identified that PAF waste rock can be stored within the pit rather than a separate stockpile outside the pit. A number of locations for in pit storage have been identified with a total capacity of 0.9 M LCM. Upon closure the PAF storage located in the north east portion of the pit will be relocated to a lower part of the pit to ensure that this material is permanently covered with water.

The storage of PAF waste rock in the pit rather than in a stockpile outside the pit aligns with the waste hierarchy in that:

- Storage within the pit avoids placement of PAF rock outside the pit and therefore reduces the Project footprint.
- Placement within the pit reduces the risk to the environment of accidental release as all drainage is contained within the pit.
- The disposal of PAF waste rock under permanent water cover is highlighted in the Good Practice Guidance for Management of Acid and Metalliferous Drainage in Tasmania 2020 – 2025 (Mineral Resources Tasmania) as being current best practice. The subaqueous disposal achieves secure and long term storage which is unlikely to cause any environmental legacy (MRT).

5.2.3 Rehabilitation and Closure – The Hayes Creek Project and the Fountain Head Project Mine Closure Plan

5.2.3.1 Requested information

The Terms of Reference has a requirement to include two conceptual mine closure plans. These are to address the potential scenarios where:

1 the Hayes Creek project proceeds within a short period after completion of mining in this project; and

2 the Hayes Creek project is delayed or does not proceed.

Clarify the relationship between the two projects as part of the proposal description.

Provide clear explanation and justification why the mine closure plan does not address scenario 1 – that the Hayes Creek Project proceeds within a short period after completion of mining in this project.

5.2.3.2 Response

Under current market conditions, the Hayes Creek Project is not economic. This is due to the drop in price of key commodities that were to be mined as part of the Project (lead, zinc etc.). The Hayes Creek Project, as outlined in the NOI (open pit mining of Mt Bonnie and underground mining at Iron Blow) is not planned to commence in the near future. As such, it is not possible to prepare a mine closure plan for a project which will not progress at this time and which environmental and engineering studies have not been completed to inform the preparation of a mine closure plan.

If market conditions change, and PNX begin to re-pursue the Project, PNX will inform the NT EPA. The Project would then be subject to a separate approval process from the Fountain Head Gold Project.

5.2.4 Terrestrial Ecosystems – Weeds

5.2.4.1 Requested information

Declared weeds are noted to be present in the project area and will have an impact on the landscape and the surrounding environment.

Describe measures to avoid, minimise and mitigate and control the spread of gamba and other declared weeds. Address the threat of gamba and other declared weed species including management and controls for bushfires, seed production, and seed spread.

Recommendations: In addition to the measures identified in the EIS, the following items should be addressed to demonstrate how existing dense gamba grass on the site will be controlled/ managed:

- The Weed Management Plan and the Bushfire MP should be integrated to address fuel load problems associated with existing dense gamba grass.

- The Weed MP should include measures to reduce seed spread from existing dense gamba grass stands, particularly the implementation of buffers to reduce spread offsite, or into rehabilitation areas and stockpiles.
- There are requirements for landholders of the underlying tenure (NT Portion 695) under the statutory management plan. These requirements should be considered as part of the Weed MP. It is recommended that Section 8 of the EIS (Ecologically Sustainable Development) include the requirements of the Statutory Weed MP for gamba grass. It would also be beneficial to consider the Key Threatening Process 'Invasion of northern Australia by Gamba Grass and other introduced grasses' in as part of the Weed MP.

5.2.4.2 Response

Five weed species were identified within the Project area, three of which are listed weeds in the NT:

- Gamba grass (*Andropogon gayanus*) (Zoned as Class B in the Project area).
- Grader grass (*Themeda quadrivalvis*) (Class B).
- Rubber bush (*Calotropis procera*) (Class B).
- Couch grass (*Cynodon dactylon*).
- Wild passionflower (*Passiflora foetida*).

Gamba grass is prevalent across the Project area, particularly around most of the edge of the existing pit, along the fence running parallel with the train line and scattered throughout disturbed areas. Grader grass and Rubber bush were less prevalent in isolated patches.

Gamba grass (*Andropogon gayanus*) is a very high risk weed in the Northern Territory due to its current impact (and potential for further impact) on the Northern Territory's natural environment, economy and cultural values. Within the Project area, gamba grass is zoned as a Class B weed. In addition to posing risks to the Northern Territories environmental values, gamba grass poses a significant safety hazard due to the destructive fires it can fuel. Gamba grass tussocks typically dry off late in the dry season, creating unnaturally high fuel loads. Bushfires caused by gamba grass are harder to control, require more resources and place fire fighters and volunteers at greater risk.

The statutory management plan for gamba grass (Northern Territory Government, 2020) contains legal requirements for managing gamba grass, in addition to those outlined in the WM Act. These include:

- Take reasonable action to ensure weeds are not spread.
- Do not drive machinery or vehicles through seeding weeds.
- Implement vehicle hygiene measures as required to ensure weeds are not spread.

- If carrying out activities with a high risk of weed spread – prepare a weed spread prevention plan in accordance with Preventing Weed Spread is Everybody's Business (Northern Territory Government, 2015).

All persons and organisations with gamba grass on land they own or occupy must comply with the management requirements in Tables 1 to 6 of the statutory management plan (Northern Territory Government, 2020). These requirements as well as further best practice measures to manage gamba grass will be detailed in the Weed Management Plan, as part of the overarching Mining Management Plan (MMP) for the Project. This will include measures to reduce the fuel loads associated with gamba grass, which will also be integrated into the Bushfire Management Plan.

The Weed Management Plan will also include project specific management strategies for the two other less prevalent listed species, Grader grass and Rubber bush.

These measures will be in addition to the measures currently included in the draft EIS (see Commitments Register – Appendix 7)

5.2.5 Terrestrial Ecosystems – Flora and Fauna

5.2.5.1 Requested information

Threatened species that were moderately or highly likely to occur were not recorded during the terrestrial flora and fauna survey of the project area and the risk to threatened species is considered to be low.

While the risks are considered low, Appendix 8 of the Draft EIS includes a recommendation for a site walkover to be undertaken to identify any *Acacia praetermissa* and *Stylidium ensatum*.

Appropriate survey times for *Stylidium ensatum* are during the mid-late dry season when the plant is flowering/fruiting. *Acacia praetermissa* can be surveyed at any time of year.

Provide results of additional surveys to identify any occurrence of *Acacia praetermissa* and *Stylidium ensatum* ensuring the site walkover is prior to clearing by experienced personnel, and ensure surveys are undertaken at the appropriate survey time for *Stylidium ensatum* (mid-late dry season).

Demonstrate how the environmental decision making hierarchy (as defined in the EP Act) has been applied for significant impacts.

5.2.5.2 Response

A pre-construction site walkover was conducted on 13 and 14 October 2021 by Connect Environmental to identify any *Acacia praetermissa* and *Stylidium ensatum* present at Fountain Head. Prior to the walkover a desktop assessment was undertaken to identify areas planned to be disturbed and potential habitat for the two threatened species. One target area was identified for *S. ensatum* at Fountain Head. None were identified for *A. praetermissa*.

Neither of the threatened species were identified during the site walkover. The target area for potential habitat was determined to not be a suitable for *S. ensatum* during the site walkover, as

the area had been previously disturbed by historic mining activities, was comprised mostly of open grassland and lacked most associated plant species. Soils in that area were sandy clays, though were dry and cracking. Most grass and herb ground flora had desiccated or grazed to the point of being unidentifiable. As a result, continued monitoring of the site for these species is no longer expected to be required.

5.2.6 Hydrological Processes – Water Extraction

5.2.6.1 Requested information

Provide additional/updated details on the proposals water requirements for dust suppression, construction processing plant, power station, laydown areas, access roads and infrastructure.

Include details of water demand, sources and supply, estimated water use in mega litres (ML) per month for each beneficial use, and extraction point.

As defined in the EP Act, the waste management hierarchy (avoid, minimise, re-use and recycling of wastewater) will apply.

5.2.6.2 Response

No changes to the water demand have occurred since the submission of the draft EIS. As stated in Section 5.1.4, the Fountain Head Pit will be the only area of extraction and a SWEL will be applied for prior to works taking place. No extraction will occur from groundwater or other surface water bodies, therefore beneficial uses associated with surface water such as environment, riparian and cultural are not expected to be impacted by the water demand (listed in Section 5.1.4).

5.2.7 Hydrological Processes – Groundwater

5.2.7.1 Requested information

Demonstrate that any potential impacts to groundwater, surface water, and the downstream environmental values (including GDE's), and cultural and heritage values, is in accordance with the environment decision making hierarchy to avoid, minimise, and mitigate.

1. Identify and characterise the hydrogeological regime and environmental values of the receiving environment particularly downstream of the site

2. Review and describe the existing groundwater monitoring network

3. Revise, expand and improve the local monitoring (groundwater and surface water) network for better modelling outcomes (predictions) and to reduce model uncertainty/assumptions

4. Review and refine the model input data such as estimates of hydraulic conductivity (kH and kV)

5. Monitor and collect an appropriate baseline dataset to evaluate the surface water and groundwater interactions with a focus on developing post closure monitoring of the groundwater system

6. Refine the conceptual model and improve the numerical model.

Given the relatively short life of mine, also address the limitations and uncertainties in the models in the EIS, and propose approaches to model refinement to improve predictions for surface/groundwater interactions and solute concentrations in the proposed pit lake with a focus on developing post closure monitoring of the groundwater system.

5.2.7.2 Response

As described in Section 3.3 of this document, a review of the groundwater monitoring plan was undertaken by CDM Smith (Appendix 4). Based on the recommendations of the review, the groundwater monitoring plan has been revised in the updated WMP. This revision includes a new network of groundwater monitoring bores, an expanded analytical suite, trigger levels for monitoring groundwater drawdown and mounding effects and trigger action plans for exceedances of groundwater level and groundwater quality triggers. These monitoring bores will also be utilised post-closure, as outlined in the updated Mine Closure Plan.

The updated WMP includes two additional surface water monitoring locations in the direct downstream receiving environment, in the unnamed tributary creek. These monitoring locations will provide an indication of potential impacts to surface water quality from Project activities and will be used to assess performance against the objectives and targets nominated in the WMP. One of the new monitoring locations is just upstream of the perennial billabong and small waterhole and so will also provide information about potential impacts to this culturally sensitive site.

Further information has also been included in the updated WMP regarding GDEs and beneficial uses including the downstream sacred site. Objectives have been updated in the WMP to capture the protection of these beneficial uses.

5.2.8 Hydrological Processes – Hydraulic Modelling

5.2.8.1 Requested information

Demonstrate that the proposed erosion protection, such as rock armour protection along the outer toe of the proposed Integrated Waste Landform (IWL) and, western and northern toe of the proposed Evaporation Pond is adequate to withstand the impact of flooding.

Provide information for source material for erosion protection and diversion structures.

As defined in the EP Act, the environmental decision making hierarchy to avoid, mitigate and minimise impacts to the environment must apply.

5.2.8.2 Response

Erosion protection and diversions (based on the channel) are proposed along the western side of the IWL to protect the structure and allow the natural catchment runoff from upstream of the processing area to divert around the IWL and around the north of the evaporation pond. The flood modelling shows that the outer toe, based on locations 2 and 4 in Figure 5.2 will experience peak flood levels of 0.05 to 1 m and velocity differences of approximately 0.5 to 1 m/s. As flood levels and velocities are low and as the IWL is constructed of competent rock, impacts are not expected. Rock armour will be applied along the western side of the IWL utilising competent waste rock from the pit.

Based on the modelled peak flood levels (up to 3.0 m) and velocities (1.60 m/s) at locations 6 and 7 at the evaporation pond and based on an assumed flood diversion channel with the following dimensions and parameters:

- Base width: 5 m.
- Side slopes: 1:2.5.
- Depth: at least 3 m.
- Manning's "n": 0.05.

REC Geotechnical and Tailings were requested to provide detail on the extent of the required rip-rap to protect the evaporation pond wall. The resulting minimum requirements for rip-rap protection are as follows, and will be implemented by PNX:

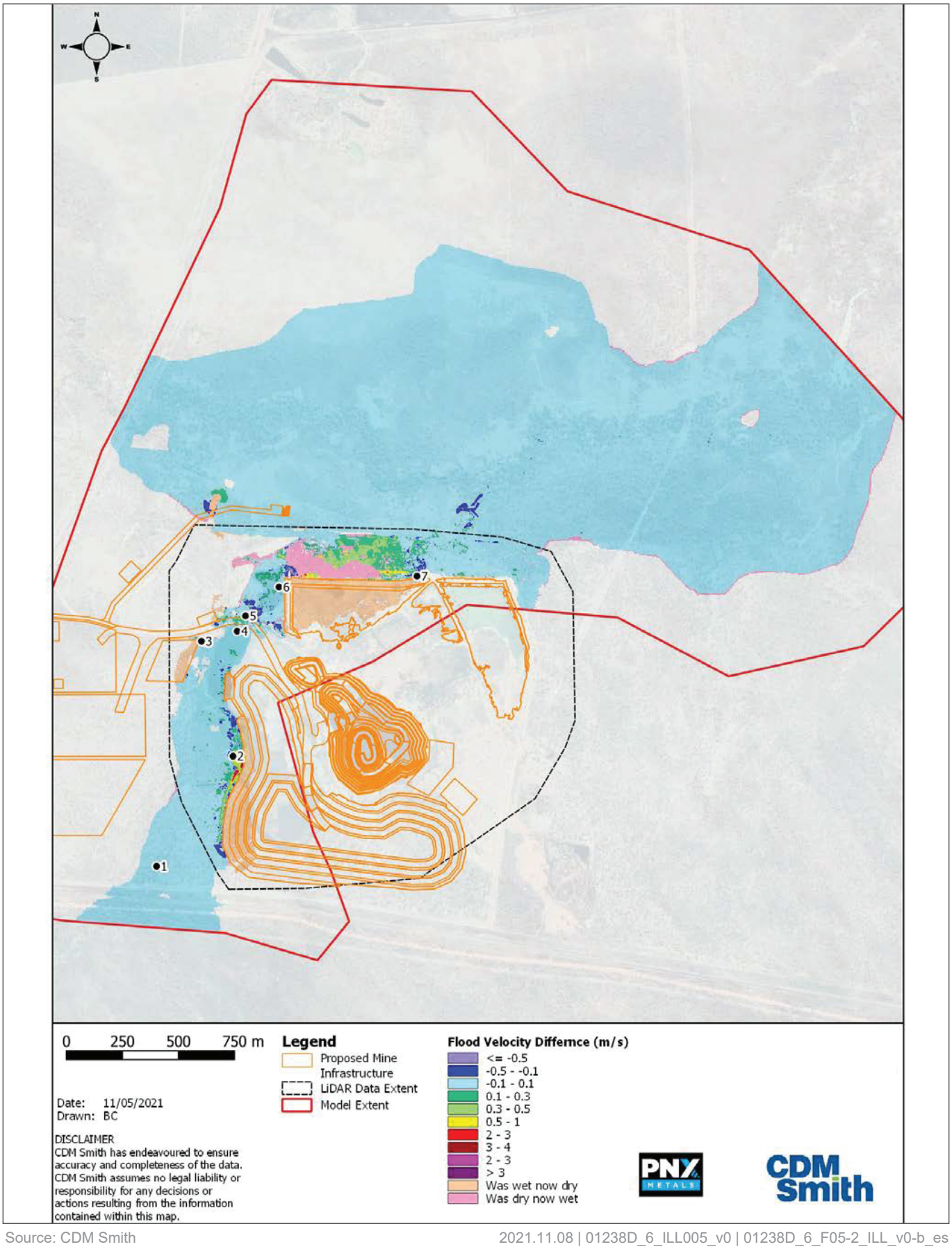
- D50: 50 mm.
- D100: 80 mm.
- Thickness: 100 mm.

Note that the allowable stress calculated for rock rip rap with a D50 of 50 mm is 31 N/mm^2. The permissible velocity is 1.68 m/s. On this basis, the waste rock material on site proposed to be used to form the rip rap material is suitable for use. Based on an assumed D50 of 150 mm, the permissible shear stress for the placed material is 191 N/mm^2, at a peak velocity of 2.9 m/s.

MODELLED PEAK FLOOD VELOCITY DIFFERENCES, PROPOSED CASE MINUS EXISTING CASE, 1% AEP

Fountain Head Gold Project | Supplement to the EIS

FIGURE 5.2



Source: CDM Smith

5.2.9 Hydrological Processes – Evaporation Dam

5.2.9.1 Requested information

Demonstrate that the Evaporation Dam is constructed and operated with a high degree of certainty that the dam can withstand impacts from flooding, dam break is avoided, and contaminated water does not enter groundwater and the downstream environment.

As defined in the EP Act, the environmental decision making hierarchy to avoid, mitigate and minimise impacts to the environment must apply.

5.2.9.2 Response

The proposed evaporation pond construction and initial stages of dewatering were approved under the revised Fountain Head Tally Ho Care and Maintenance MMP. The evaporation pond design is still in the feasibility stage, work completed to date includes:

- Geotechnical study of ground conditions for the existing wall.
- Geotechnical studies of ground conditions for the wall extension.
- Preliminary water balance model used in feasibility study design.
- Options for wall construction and spillway design for review.

The current design includes placing rock on the downstream side of the evaporation pond to provide additional stability. The evaporation pond has the capacity to hold a 1% AEP.

Before any construction will commence on this dam the following works will be undertaken:

- Complete geotechnical assessment of the existing wall.
- Design wall alignment taking into consideration potential erosion from flood water.
- Design the wall and spillway in accordance with ANCOLD (2012 & 2019) guidelines.
- Develop bill of quantities and technical specification for use in tender documents.

The current design of the evaporation pond has incorporated consideration of impacts to the environment, such as the potential for evaporation pond water to enter the downstream environment. See Section 5.2.12 for expected evaporation pond water quality. The final design will be informed by all relevant environmental studies and will consider potential impacts to the environment in accordance with the environmental decision making hierarchy.

5.2.10 Hydrological Processes – PAF Stockpile Runoff Dam

5.2.10.1 Requested information

The PAF stockpile runoff dam is preliminarily sized with a capacity to contain a 1:100 year 72 hour duration storm. The estimated storage volume of the PAF stockpile runoff dam is approximately 16.7 ML.

The PAF stockpile dam overflows to the proposed Evaporation Pond where it can provide additional water storage.

Clarify that any drains channelling contaminated water will be lined and contingencies are in place for greater than 1:100 storm events.

5.2.10.2 Response

The PAF stockpile will no longer be a feature of the Project, the PAF is now planned to be placed within the perimeter of the pit (refer to Section 2.4). Water will be pumped from the pit to the evaporation pond throughout mining to maintain a dry pit. This will result in dissolved arsenic concentrations increasing in the evaporation pond to over 40 mg/L from mid-2023, to around 80 mg/L by mid-2024. From 2026, arsenic concentrations in the evaporation pond are predicted to rapidly decrease to below the livestock drinking water guideline (0.5 mg/L) by the end of 2027 and below the aquatic ecosystem 80% protection level trigger value (0.14 mg/L) in early 2028.

5.2.11 Hydrological Processes – Mine Closure Plan and Management of Long-term Surface Flows

5.2.11.1 Requested information

The Draft EIS states that redirecting surface water flows into the pit to enable the pit to be flushed each wet season and prevent ongoing deterioration of pit water quality is currently under evaluation.

Provide the complete evaluation of the option of redirecting surface water flows into the pit to enable the pit to be flushed each wet season and prevent ongoing deterioration of pit water quality and potential impacts to the downstream environment. Include a discussion on post closure monitoring.

Clarify if this will form part of the mine closure plan for Fountain Head.

5.2.11.2 Response

Subsequent to submission of the draft EIS, water quality in the Fountain Head pit and evaporation pond has been modelled (Appendix 8) considering two scenarios. The results of this study are described in Section 3.4 and have also been included in the updated WMP.

It is to be noted that at this stage a practical design for diverting water from the Fountain Head Lake catchment to the pit has not been developed. The feasibility of such a diversion needs to be assessed and the potential impacts to the environment from diverting natural catchment runoff and the downstream discharge need to be further considered. It is also noted that the modelled scenario is highly conservative and does not consider natural degradation of arsenic or the potential precipitation of arsenic compounds. As such, actual water quality in the pit may reach 80% aquatic ecosystem protection limits earlier than predicted.

Conceptually the diversion is possible, however the base case remains as a closed system, that is, no aided recovery of the pit. It is proposed that further long term leach column testing is undertaken to provide more confidence in data for the pit water quality model to inform the design. At this point in time, PNX cannot commit to this option without a complete understanding

of the potential environmental impacts and will work to assess their options for the design of the diversion.

5.2.12 Hydrological Processes – Development of the Proposed Post-mining Fountain Head Pit Lake

5.2.12.1 Requested information

Following dewatering of the pit (phase 1), as part of phase 2 of the project (construction, mining, processing, closure and rehabilitation), an unknown volume of PAF waste rock will be placed into the mined out pit.

The post-mining Pit Lake water chemistry is likely to be altered when the PAF stockpile material is stored sub-aqueously and this has not yet been modelled or assessed in any detail.

Water quality of the pit has not been modelled/assessed with placement of PAF waste rock in the pit.

Demonstrate that the selected option to place PAF waste rock in the pit presents an environmental improvement over the pre-existing conditions at the Proposal site.

Demonstrate that there will be no ongoing costs borne by the community and government in future.

This should be demonstrated with respect to the principles of ecologically sustainable development, and the environmental decision making hierarchy as defined in the EP Act.

5.2.12.2 Response

Subsequent to submission of the draft EIS, water quality in the Fountain Head pit and evaporation pond has been modelled considering two scenarios (Appendix 8). The results of this study are described in Section 3.4 and have also been included in the updated WMP. Diverting natural catchment runoff to the pit is the preferred management option. Under this scenario, dissolved arsenic concentrations in the evaporation pond are predicted to be below the aquatic ecosystem 80% protection level trigger value (0.14 mg/L) in early 2028.

Diverting natural catchment runoff to the Fountain Head pit is predicted to decrease dissolved arsenic concentrations in pit lake water to less than 0.5 mg/L (livestock drinking water guideline[1]) by the end of 2028 and to fluctuate around 0.14 mg/L (aquatic ecosystem 80% protection level trigger value) from 2033 onwards with an average concentration of 0.15 mg/L between 2046 and 2500. This predicted concentration, based on conservative modelling assumptions, is lower than the average concentration of 0.6 mg/L measured in existing pit water. The pit is predicted to overflow each wet season from 2028 onwards, when the arsenic concentration is predicted to be initially 0.33 mg/L. For the first five years arsenic concentrations in the overflow water are predicted to be above 0.14 mg/L (80% aquatic ecosystems protection), after which concentrations

[1] The livestock drinking water guideline refers to total arsenic concentrations, whereas the model predicts dissolved concentrations. As such, the total concentration may be higher and still exceed the guideline value at this time.

decrease and oscillate close to the aquatic ecosystem 80% protection level trigger value in the following years.

The principles of ecologically sustainable development and the environmental decision-making hierarchy defined in the EP Act were applied when selecting the preferred option. The selected option is considered to have the lowest long term environmental risk and will result in improved water quality in the pit under the alternative scenario, or even the current scenario (should the Project not go ahead). Diverting the catchment runoff serves to both dilute the water in the Fountain Head pit while also shortening the period of time required to fully submerge the PAF material, thereby decreasing the arsenic loads reporting to the pit water. While the overflow from the pit water between 2028 and 2033 is predicted to exceed the aquatic ecosystem 80% protection level trigger value for dissolved arsenic, this overflow will occur during the wet season, when the downstream receiving environment (the unnamed tributary creek) has the largest capacity for dilution. Post closure monitoring will be conducted in accordance with the updated Mine Closure Plan to confirm the predictions of the model and to initiate early action or recalibration of the model if required.

As noted in the previous response (Section 5.2.11.2), the modelling at this point in time is theoretical only, and does not consider the feasibility or a practical design for diverting water from the Fountain Head Lake catchment to the pit or the potential for arsenic to naturally degrade or precipitate.

5.2.13 Aquatic Ecosystems – Aquatic Ecology

5.2.13.1 Requested information

The aquatic study (Appendix 9) was commissioned for the Hayes Creek Zinc, Gold and Silver Project, which included the Fountain Head Gold Project area.

Seven locations were investigated during the survey. The sites s1, s2, s3 and s5 lie in the Margaret River catchment (site of Iron Blow and Mount Bonnie), and are not directly relevant to this project.

The sites s7 and s6 are upstream of the project site, and s8 which is approximately 9 km downstream of the project site are relevant to Fountain Head.

The relevant downstream site (s8) is sited on the Margaret River and proximal to Woolwonga mine, and would likely be influenced by Iron Blow, Mount Bonnie and Woolwonga.

It is noted that:

- The field survey was limited to a rapid assessment and provides a snapshot.
- Diversity and abundance of riparian vegetation was not recorded.
- The selection of survey sites was limited.

It is acknowledged that the limitations to selection of suitable survey sites was the above average temperatures and the below average wet season in 2019.

Baseline characterisation, and identification of sensitive habitats and fauna species is deemed inadequate and requires greater sampling effort across environmental gradients, including the types of stream habitats, and across the degree of exposure to impacts from previous mining.

More information is required on the rationale for site selection for the baseline characterisation, and justification why data from only three sites is adequate to meet stated objectives for both fish and macroinvertebrates.

The biological monitoring program will require a hypothesis-testing framework that is structured to detect impact on, or declines in aquatic health.

- Redesign the aquatic (biological) monitoring program to adequately characterise the baseline conditions for the Fountain Head Gold Project.
- Consider site selection and the likely influence of Iron Blow, Mount Bonnie and Woolwonga.
- Clarify the discrepancy in the SIGNAL score calculations (use of SIGNAL 2 weight factors) as applied in Appendix 9 and Appendix 20.
- An adequate baseline characterisation would require a level of taxonomic resolution to species level.

5.2.13.2 Response

With regards to site selection, aside from the above average temperatures and below average wet season in 2019, the biggest factor influencing site selection is safe access. While it may appear from satellite imagery that additional sites along the unnamed tributary creek are accessible, a number of apparent access roads are in fact not accessible. Either because there are no existing tracks, the ground is too boggy, vegetation is too high, or there is a risk of encountering crocodiles. Efforts were made to survey a number of other locations upstream and downstream of the mine site; however, there was no safe access at the time and so these other sites were abandoned. It is noted that the proposed downstream monitoring site FHSW01 is a considerable distance from the mine site and could be influenced by other activities in the area. In lieu of this, it is proposed to include two additional monitoring sites immediately downstream of the Project area, in the unnamed tributary creek (Figure 5.1). These sites are able to be accessed safely and will provide a good indication of performance against the objectives and targets and potential risks to the downstream receiving environment (including the sacred billabong and small waterhole).

As discussed in the draft EIS, all potential residual impacts to aquatic biodiversity were assessed as **Negligible** to **Low**, with impacts predicted to be either short term and localised or undetectable with respect to natural variation. As such, given the low risk to aquatic biodiversity and the high degree of temporal variability in intermittent and ephemeral streams, routine monitoring of aquatic biodiversity is not proposed. Due to highly variable nature of temporary waters such as those downstream of the Project, establishing reference and test sites against which valid comparisons and meaningful interpretation can be made is highly constrained. Given that the directly downstream waters in the unnamed tributary creek do not provide permanent habitat for aquatic biodiversity and the fact that the potential impacts are predicted to be short term and localised or undetectable, it is not warranted to collect additional baseline data, or

conduct ongoing aquatic biodiversity monitoring. As outlined in the WMP, routine surface water monitoring will however be conducted. Where there are no exceedances of the applicable ANZG (2018) guidelines or detectable changes from background concentrations, then protection of aquatic biodiversity (and other surface water beneficial uses) will be inferred. Should there be exceedances of adopted trigger values, then corrective action will be implemented as per the WMP.

With respect to the discrepancy in the SIGNAL score calculations between Appendix 9 and Appendix 20 of the draft EIS, the correct values are provided in Appendix 9. Upon review of the information included in Appendix 20, there has been an issue when reproducing these tables from the original raw Excel files and so the values in each column do not reflect the column heading (e.g., the values for abundance are actually the SIGNAL 2 score, and the values for weight factor correspond to abundance, and so on. Despite the errors in Appendix 20, the totals shown for columns ‘weight factor’ and ‘SIGNAL 2 x weight factor’ and the overall SIGNAL 2 score are correct. The data shown in Figure 4.24 of the draft EIS are also correct.

Macroinvertebrates were identified by a renowned taxonomic specialist to the lowest practicable resolution, which varied from species level to sub-class. Identifying all macroinvertebrates to species level is rarely achievable and further resolution was not possible in this case. Further, it is noted that studies show that identification to family level is sufficient for detecting impacts (Naser 2009; Terlizzi et al., 2003; Somerfield and Clarke 1995) and this can help to reduce noise in the data created by lower levels of taxonomic resolution, which often results in an increase in singleton and doubletons (i.e., where only one or two individuals of one species is recorded).

It is noted that surveys of macroinvertebrates at different times of the year may have yielded a different assemblage. Given the intermittent and ephemeral nature of the waterways of the study area, there will be highly variable assemblages at various temporal scales. However, given there are no protected aquatic macroinvertebrates under federal or state legislation with potential to occur in the study area, this additional information would not have affected the outcomes of the impact assessment or the proposed monitoring regime. While the macroinvertebrate results were used to infer that waterways were likely subjected to existing anthropogenic activities, visual observations and surface water quality results also supported this finding (i.e., multiple lines of evidence), with the results indicating that the majority of sampling sites are subject to some degree of existing and prior disturbance. As already discussed, further aquatic biodiversity surveys are not proposed.

5.2.14 Air Quality – Emissions

5.2.14.1 Requested information

Although not a requirement in the terms of reference, the proponent has conducted an air quality and greenhouse gas assessment for the Fountain Head Gold Project to address emissions to the environment.

Air quality impacts for the Project have been inferred from an air quality assessment for an approved mining activity under the Mine Management Act 2001 (Mt Todd Mine) that is similar in nature and location to the Project.

The air quality assessment (Appendix 1) compared modelling and model results with Mt Todd. The approach to assessing impacts to air quality for the Fountain Head Gold Project is not considered to be good practice.

Provide a review of the potential impacts (including cumulative impacts) to air quality for the Fountain Head Gold Project using appropriate methods, to determine whether an assessment of air emissions is required.

If required, an assessment of the potential impacts (including cumulative impacts) to air quality for the Fountain Head Gold Project must be in accordance with the NSW best practice guidelines for modelling and assessment of air quality: Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales.

If required, review the use of the non-standard Gaussian Diffusion and Sedimentation model for emissions, include the evaporator emissions as stationary point sources, and model all emissions from the development using an approved air dispersion model.

As the proponent has identified toxic air pollutants such as hydrogen cyanide and arsenic, these principal toxic air pollutants (listed in the NSW Approved Modelling Methods) are to be applied at and beyond the boundary of the facility.

In addition to modelling the concentrations of arsenic and hydrogen cyanide, the following parameters must be modelled if emitted at the facility: TSP, PM10, PM2.5, NO2, SO2, CO, VOCs, metals and metalloids.

The results must be presented as a table, and as contours against impact assessment criteria, including the 1-hour hydrogen cyanide assessment criterion.

The results must demonstrate that source emissions at the development comply with relevant concentration limits specified in the Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW).

In addition to dust mitigation measures presented in the assessment, provide detailed emission control techniques and practices that will be employed for all other pollutants.

5.2.14.2 Response

Air Quality Impact Assessment

PNX commissioned KateStone Environmental to complete an air quality assessment and greenhouse gas assessment for the Project.

The assessment was conducted by estimating emissions of key pollutants due to the Project, and comparing these to emission rates and dispersion modelling results for a nearby mining operation to infer the likely impacts of the Project on air quality. Mt Todd gold mine was selected due to expected similar climatic and metrological conditions and similar dust generating activities such as haulage, handling of materials, crushing and screening and wind erosion.

Three sensitive receptors are located in the vicinity of the Project: the Grove Hill Hotel (residence), Hayes Creek Wayside Inn and Caravan Park (no longer operating) and the Ban Ban Springs Homestead, located 5.5 km east, 13 km south and 9 km north of the Project respectively.

Ground-level concentrations of TSP, PM10 and deposited dust were predicted to comply at the nearest receptor (5.5 km east) with the relevant air quality criteria. PM2.5 exceeded the criteria of 8 µg/m3. However, the Project is estimated to only contribute 0.05 µg/m^3 (~1% of the total concentration) of that total 9.8 µg/m^3, with existing backgrounds levels already exceeding the criteria.

The outcome of the EIS impact assessment was that impacts to ambient air quality are negligible and emissions contributing to state and National emissions are also negligible. A cumulative impact assessment was undertaken, and cumulative impacts to air quality was not identified as requiring further assessment. PNX see no basis in undertaking modelling as this will not provide a different outcome to the previously prepared assessment. PNX have committed to best practice and technology to manage dust and emissions in order to mitigate Project impacts. These measures will be detailed in the Project MMP.

Diesel Power Station Emissions and Clean Air Compliance Review

As discussed in Section 3.2, KateStone reviewed the expected emission concentrations for Nitrogen dioxide (NO^2) or nitric oxide (NO), Volatile organic compounds (VOCs), and solid particles for the diesel power station (provided in Appendix 3).

ERIAS in consultation with KateStone would like to note the following considerations in relation to the compliance review with the Clean Air Regulation:

- The power station will be run for approximately 3.5 years in a remote area. The nearest receptor is 5.5 km away and is not expected to be significantly impacted as a result of ambient air pollution.
- Other options have been considered and are unviable (e.g., grid power and renewables).
- Data was provided for cleaner diesel generators and the emissions were reviewed by KateStone. The level of NOx emissions remained uncompliant.
- Abatement for the diesel generators is currently not an option due to the cost and maintenance required.

Given the results of the air quality assessment, the location of the nearest receptor, and the short duration of use, significant impacts as a result of the use of the generators are not expected on ambient air quality.

See Section 3.2 for the requested results of the expected source emissions from the power station and compliance assessment against the Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW).

5.2.15 Community and Economy – Noise and Vibration

5.2.15.1 Requested information

Flyrock, air blast and ground vibrations from blasting has the potential to have an impact on stakeholders.

Provide an assessment of the project's potential impacts from blasting (flyrock, air blast and ground vibrations) to the Adelaide to Darwin railway line, the Ghan Passenger rail service, and other stakeholders, and provide additional information beyond 'Blasting will take place in daylight hours only and preferably during meal or shift breaks' that accounts for the potential noise and vibration impacts to all stakeholders.

Demonstrate the community consultation and stakeholder engagement for the project includes stakeholders listed below, and update the project stakeholder engagement plan.

- The Ghan, Journey Beyond.
- Emerald Springs Roadhouse.
- Pine Creek Railway Resort.
- Lazy Lizard Caravan Park.

5.2.15.2 Response

PNX Metals commissioned Terrock Consulting Engineers to undertake an assessment of the impact of blasting at Fountain Head on the adjacent railway and gas pipeline (Appendix 9). The edge of the pit is approximately 380 m from the Bonaparte gas Pipeline (BGP) and 550 m from the Alice Springs-Darwin Railway.

The blasting impacts assessed were the ground vibration levels generated by blasting, and the potential for flyrock. Consideration was also given to dust and blast fumes, and air blast overpressure levels. The results of the assessment are summarised below and provided in detail in Appendix 9.

Ground Vibration

Blastholes will be loaded either with ANFO explosives (density 0.8 gm/cc), or a waterproof emulsion explosive (maximum density 1.2 g/cc). Blast specifications chosen were based on those resulting in maximum ground vibration levels, to assess a worst case scenario.

The resulting vibration levels when blasting at the closest point to the railway and pipeline are 3.1 mm/s and 5.6 mm/s respectively. The resulting ground vibration levels (PPV) when blasting at the

closest point to the railway and pipeline will be well below permitted levels of 100 mm/s for rail and 20 mm/s for gas pipelines.

Flyrock

The Terrock flyrock model permits the flyrock distances for both upward ejection from the stemming column area, and outward ejection from a near vertical free face to be calculated. These distances are then used, with appropriate factors of safety, to establish clearance zones from blast sites.

Flyrock distances, and flyrock clearance zones will be well within the closest distance to the Alice Springs to Darwin Railway, and the adjacent road and powerline, subject to strict compliance with the blasting specifications.

Airblast Overpressure

Airblast overpressure levels (sometimes referred to as ‘blast noise’) have been calculated using a model that is widely used for the assessment of airblast overpressure (AOP) in mines and quarries in Australia. The selected parameters result in the maximum AOP emissions.

Results of the assessment are that Airblast overpressure levels resulting outside a 500 m blast exclusion zone can be controlled to acceptable environmental limits and at a distance of 2 km will be barely noticeable.

Dust and Blast Fumes

Dust and blast fumes will have no effect on the gas pipeline, railway line, adjacent road and powerline, However, they will be considered for the health and safety of personnel in the area, and if there are any passing trains.

For initial operations, protection to personnel in the area will be provided by not firing when the wind is blowing towards sensitive areas.

As site experience is gained, restraints due to wind direction may be modified if it is found that dust and fume hazards can be contained within specified distances from the blast and pose no hazard to the railway.

Dust and blast fume impacts can be managed by procedures that will ensure that blasts are not fired when the wind is blowing towards sensitive areas.

Sensitive Receptors (Residents and Local Business)

The Grove Hill Hotel, the closest neighbour, is located 5,675 m from the closest point of the Fountain Head pit. The ground transmitted blast vibration level will be approximately 0.1 mm/s, which is below the level of human perception. The air-transmitted vibration level (i.e., airblast overpressure, or ‘blast noise’) will be approximately 85 dBL, which is below the general level of human perception.

As a result of these findings, PNX believe it is not necessary to inform businesses which are outside the area of potential impact i.e., the Emerald Springs Roadhouse (located 22.5 km away), Pine Creek Railway Resort (located ~53 km away) and the Lazy Lizard Caravan Park (located

~53 km away). These businesses are far beyond the area of potential impact and will not be effected.

The Ghan will be consulted in relation to blasting activity.

5.2.16 Community and Economy – Noise and Vibration – Evaporators

5.2.16.1 Requested information

An environmental noise assessment has been conducted for the proposed Fountain Head Gold Project using the CONCAWE noise propagation model where the nearest sensitive receiver is the Grove Hill Hotel (currently a residence) located 5.5 km east of the closest noise sources associated with the Project.

Assessment criteria were developed for both operational and construction noise, and blasting and vibration impacts at the sensitive receptor and on pipework through the day, evening and night. Operation/construction noise and blasting were considered in the assessment and prediction models to evaluate changes to economic and social activity in regional centres that may have positive or negative impacts to the local population.

Noise and vibration emissions from evaporators were omitted from the assessment and modelling. The use of evaporators and pump system is over 9 months to dewater the pit operating at a rate of 135 m3/hr and 20.3 hr/day.

Review the modelling and include all sources of noise and vibration emissions to demonstrate that noise and vibration from the evaporators does not have a significant impact to sensitive receptors (the Grove Hill Hotel, the Hayes Creek Wayside Inn and Caravan Park, and the Ban Ban Springs Homestead), and the local population.

Ensure measures are in accordance with the environment decision making hierarchy to avoid, minimise, and mitigate as defined in the EP Act.

5.2.16.2 Response

The evaporator noise was not included in the noise assessment. ERIAS has sought advice from Sonus (specialist noise consultant). The noise from three evaporators has been predicted based on the noise data provided by the manufacturer and worst case noise propagation conditions. That is, all units operating and facing in the worst case direction and with wind blowing toward the receiver. In these conditions, the total noise from the site has the potential to increase from 31 dB(A) to 33 dB(A), which is still below the most onerous criterion of 35 dB(A) (NT Noise Management Framework Guideline). Re-running of the modelling would not provide any material change to predicted noise levels.

5.2.17 Culture and Heritage – Impacts to Sacred Sites

5.2.17.1 Requested information

The flood modelling indicates some flood impacts are expected north of the evaporation pond compared to existing conditions.

Two recorded sacred sites including a water hole are recorded to be located approximately 550 m and 1300 m downstream (north) of the Project area.

There is potential for biophysical impact on sacred sites from changes to water quality or hydrological processes that could result from the proposed activities.

Requested Supplement information:

Provide details on measures to be undertaken to avoid impacts on the sacred sites and demonstrate that potential impact to sacred sites and other cultural features as a result of flooding, accidental release or contamination of water and the downstream environment are avoided, with consideration to:

- Waterholes (and other GDE's)
- Termite mounds, and
- Condition 5 of the AAPA certificate that states "Within the area marked Restricted Works Area 1 (RWA1) on Annexure 'A', associated with sacred site 5271-7, no work shall take place or no damage shall occur".

5.2.17.2 Response

Section 6.3.3 and 6.4.3 of the WMP, as well as Chapter 7 of the draft EIS, provide a full list of mitigation measures for surface water and groundwater, respectively. These have not been included in this response.

The AAPA certificate indicates two sacred sites and restricted works areas (RWAs) in the vicinity of the Project area, one of which is a perennial billabong and small waterhole downstream of the mine, approximately 550 m from the nearest boundary of the actual Project area shown in Figure 3.2 of the draft EIS. It is noted that the actual Project area shown in this figure is significantly smaller than that shown in the AAPA certificate. The billabong and waterhole are approximately 2.5 km from the Fountain Head pit. Figure 3.2 of the draft EIS also indicates that no physical disturbance or Project activities are proposed within either RWA shown in the AAPA certificate. Although RWA2, which includes sacred site 5271-8, extends to include a section of the unnamed tributary creek downstream of the mine, the actual site is a geological feature (dark rock outcrops) located approximately 1 km north of the creek. As such, given there are no Project activities planned in this area and the site is not associated with the downstream surface water environment, no impacts or disturbance to this site will occur as a result of Project activities. Further, modelled peak flood level difference for a 1% AEP event shows no change in flood levels at the location of the sacred site. As such, no direct or indirect impacts are expected at sacred site 5271-8.

With respect to the downstream perennial billabong and waterhole located within RWA1, as discussed in Section 7.4.4 of the draft EIS, given the installation of surface flow diversions to maintain the natural catchment hydrology and that no water extraction is required from the catchment and no wastewater will be discharged from the site, no detectable change in the volume of water reporting to surface waters downstream of the mine are predicted. As such, no

changes to the surface water hydrological regime of the unnamed creek (which flows into the billabong and waterhole), or the Margaret River is predicted as a result of the Project.

Modelling was undertaken to assess the impact of Project infrastructure on flooding for the draft EIS. Under a 1% AEP flood event (i.e., 1 in 100-year probability), the model indicates flood levels at the billabong and waterhole could increase by 1 to 5 cm while no change to flood velocities are predicted (Figure 7.2 of the draft EIS). Overall, the changes in flood levels and velocities in the vicinity of the sacred site are considered negligible and unlikely to be detectable against current conditions, noting that under existing conditions the billabong and waterhole would already be subject to flooding impacts under a 1% AEP event, without the presence of the Project infrastructure.

With respect to groundwater, as described in Section 7.4.4 of the draft EIS, modelling was undertaken to assess the expected extent of groundwater drawdown due to pit dewatering and the time required for groundwater levels to rebound at the end of mining. At the end of mining, drawdown is predicted to be restricted to the near vicinity of the pit (Figure 7.3 of the draft EIS) and is predicted to be less than 0.1 m within 2 km of the pit and at the location of the billabong and waterhole. While the hydrodynamics of this system are unknown, it is modelled (BOM, 2021) to have a high likelihood of being an aquatic groundwater dependent ecosystem (i.e., a high likelihood of a reliance of surface expressions of groundwater). However, given the predicted negligible change in groundwater levels at this location, no change to the hydrology of this sacred site is expected.

There are no confirmed groundwater dependent ecosystems located within the extent of the modelled groundwater drawdown; however, the unnamed tributary creek to the north of the Project area (as well as the Margaret River) are predicted (BOM, 2021) to have a moderate potential of being terrestrial groundwater dependent ecosystems, i.e., moderate likelihood of a reliance of subsurface presence of groundwater. At the end of mining, groundwater drawdown below the unnamed tributary creek could be up to 2 m in some locations; however, 40 years post-mining, minimal change in groundwater levels compared to existing conditions is predicted, with no changes to groundwater levels below the unnamed tributary creek to the north. As such, no long-term impacts to groundwater dependent ecosystems are predicted. As described in CDM Smith (2021b) and the updated WMP, an additional network of groundwater monitoring bores is proposed to validate the modelled predictions with respect to groundwater drawdown (and mounding). Groundwater mounding from seepage in the evaporation pond may also negate some of the potential early drawdown.

As described in Section 7.5.4 of the draft EIS, impacts to surface water quality are predicted to be short term and localised (i.e., limited to the unnamed tributary creek) or undetectable with respect to natural variability. While there is the potential for some short-term impacts to extend to the downstream billabong and waterhole, it is noted that this site would already be subject to water quality impacts from the adjacent agricultural activities (evident by widespread microbial contamination of surface waters in the unnamed tributary creek and downstream Margaret River). Notwithstanding, as described in the WMP, the surface water monitoring program has been designed to assess the effectiveness of the surface water management measures and to trigger contingency actions, if required. Monitoring of surface water quality in onsite sediment dams, the evaporation pond, Fountain Head Lake and the Fountain Head pit will be routinely undertaken to

understand the potential risk to downstream surface waters from Project activities. Further, two additional monitoring sites immediately downstream of the mine (and upstream of the sacred site) in the unnamed tributary creek are now proposed (Figure 5.1) to provide additional assurances around the surface water quality directly downstream of the Project. Given the potential for short-term and localised impacts to water quality, which would likely be limited to periods of high rainfall, no impacts to the biophysical quality of the downstream billabong and waterhole are expected. The monitoring program will confirm this (refer to the WMP) and, if required, contingency actions will be implemented to address potential impacts to the downstream catchment.

As discussed in Section 5.1.1.1 of this document, PNX will avoid direct physical disturbance of termite mounds greater than 3 metres in height, which hold cultural significance. The location of these mounds has not been assessed. While these mounds could also be indirectly impacted from changes to flood regimes, as shown in Figure 7.3 of the draft EIS, beyond the immediate area adjacent to the Project footprint, minimal changes in flood heights (i.e., less than 10 cm) are predicted. As such, changes to the flood regime from the physical presence of Project infrastructure will not impact termite mounds of cultural significance.

6. Updated Commitments Register

The Project commitments register (Appendix 22 of the draft EIS) has been updated to reflect the changes to the Project design and the responses to submissions received. The amended commitments register is provided in Appendix 7. Commitments that have been added to Appendix 7 since submission of the draft EIS are summarised in Table 6.1.

Table 6.1 – New and Amended Project Commitments

No.	Discipline	Mitigation Measure/Commitment
AQ029	Air Quality	Evaporators will be shut off overnight, when dispersion conditions are typically poor (i.e., low wind speeds and mixing heights)
SW08	Surface Water	Testing the sulphur content of waste rock and placing PAF waste rock in the pit perimeter, using a >0.4% Total S cutoff for NAF material and pushing PAF material further into the open pit at completion of mining for permanent submersion
SW23	Surface Water	A surface water extraction licence (SWEL) will be obtained for extraction of water from the pit under section 45 of the *Water Act 1992* prior to commencing dewatering activities at Fountain Head
SW24	Surface Water	The Fountain Head Lake will not be utilised for Project water requirements
TE049	Terrestrial Ecology	Prepare targeted strategies to manage gamba grass, including measures to reduce potentially hazardous fuel loads, as part of the Weed Management Plan
TE050	Terrestrial Ecology	Prepare targeted strategies to manage grader grass and rubber grass infestations within the Project area, as part of the Weed Management Plan
HH01	Human Health	Where possible, design of any constructed large water bodies to have relatively steep sides (45° slope minimum) to discourage the establishment of semi-aquatic vegetation that will provide suitable habitats for mosquito breeding
HH03	Human Health	Semi-aquatic vegetation will be removed from Project waterbodies (i.e., the evaporation pond, existing pit and Fountain Head lake) as a part of site maintenance
HH04	Human Health	Areas will be graded, where possible to enable water to drain freely as water recedes following the wet season, reducing the chance of isolated pools forming that are capable of retaining water for a period greater than five days

7. References

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8. Glossary and Abbreviations

8.1 Glossary

Term	Definition
Abundance	(biological and other sciences) the quantity or amount of something present in a particular area, volume, or sample e.g., total numbers of individual animals or of taxonomic groups of animals
Alluvial	describes material deposited by, or in transit in, flowing water
Background	The circumstances, situation, or levels of a particular parameter prevailing at the time of assessment; natural or pre-existing level of a variable
Baseline	an initial value of a measure, parameter or variable used as a starting point for comparison
Berm	A cross-slope earthen bank constructed on reshaped spoil areas, typically at horizontal intervals of approximately 50 m and 1 to 1.5% longitudinal gradient, to reduce the effective slope length and control the runoff flow rate
Biodiversity	biological diversity; the variety of species (of plants, animals, etc.), their genes, and the ecosystems they comprise, in relation to a particular habitat. A high level of biodiversity is usually considered to be desirable and/or important
Bore	A hydraulic structure that facilitates the monitoring of groundwater level, collection of groundwater samples, or extraction (or injection) of groundwater. Also known as a well, monitoring well or piezometer, although piezometers are typically of small diameter and only used for measuring the groundwater elevation or potentiometric surface
Clay	A fine-grained soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay
Contaminant	Something which contaminates, i.e., renders impure via pollution. In ecology, a substance which may degrade an environment (e.g., soil or water) due to toxicity to humans, animals or plants, or detriment to beneficial uses
Contamination	Making or being made contaminated; to pollute a substance with another, unwanted, substance. Considered to have occurred when the concentration of a specific element or compound is established as being greater than the normally expected (or actually quantified) background concentration
Cumulative impact	an impact that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones
Direct impacts	Impacts that result from primary planned interactions between a planned Project activity and environmental, social and cultural heritage receptors, e.g., a Project will have discharges resulting in increased river turbidity
Diversion channel	Structures for the controlled diversion of drainage lines and watercourses around open cut pits and infrastructure areas
Dispersion	The act of dispersing; the state of being dispersed. A mixture of one substance dispersed in another medium, such as water or air. Ecology: the movement of individual animals, plants, etc., between sites; the pattern of distribution of individuals within a habitat
Disturbance	The interruption of a settled condition. Ecology: a temporary change in environmental conditions causing a change or impact to an ecosystem
Diversity	The state of being diverse. A diversity index is a quantitative measure that reflects how many different types (e.g., species) there are in a dataset, and takes into account how evenly the individuals are distributed among those types. Biological diversity (biodiversity) is the variety of species (of plants,

	animals, etc.), their genes, and the ecosystems they comprise, in a particular habitat
Drawdown	Lowering of hydraulic head
Environmental impact	The change that takes place from occurrence of any given environmental aspect. A marked effect or influence. Negative or positive effect/s caused directly or indirectly by an event or activity, or by the release of a substance into the environment, causing a change in the biological, physical and/or socio-economic environment
Environmental value	An aspect of the environment that is important or serves an important function. An environmental value may require protection due to its importance, sensitivity, vulnerability and/or worth
Flow path	The direction in which groundwater is moving
Groundwater	The water held in the pores in the ground below the water table
Hazard	Something that can cause harm; a situation that poses a level of threat to the environment, life, health or property
Hydraulic conductivity	A coefficient describing the rate at which water can move through a permeable medium. It has units of length per time. The units for hydraulic conductivity are typically $m^3/day/m^2$ or m/day
Hydrocarbon	Any of the class of organic compounds containing only hydrogen and carbon, such as any of those which are the chief compounds in petroleum and natural gas
Indirect impacts	Impacts that are subsequent to the primary planned interactions between the Project and its environmental, social and cultural heritage receptors, e.g., a Project will have discharges resulting in increased river turbidity with subsequent potential impact on health of fish species and economic livelihood of fishing dependent villagers
Leachate	Water that has percolated through a solid or semi-solid material (e.g., soil or mine waste) and leached out some of the constituent impurities
Lease Area	The Fountain Head Lease Area is composed of the following mining leases: MLN4, 1020, 1034 and ML31124
Metalloid	A class of elements chemically intermediate in properties between metals and non-metals including boron, silicon, germanium, arsenic and tellurium
Mitigation	Action(s) taken to avoid or reduce the impact of an activity on the environment, cultural and/or socio-economic interests
Operations	A project phase that comprises the operation of a facility or installation, when the core business or purpose of that asset is realised
Precipitation (chemical)	The precipitating of a substance from a solution; the condensation of a solid from a solution during a chemical reaction
Remediation	The action of remedying something, in particular of reversing or stopping environmental damage. Ecology: the restoration of an environment, land or groundwater contaminated by pollutants, to a state suitable for other, beneficial uses
Residual impact	Those impacts that remain after the effective implementation of avoidance, mitigation and management measures, which are designed to reduce the likelihood, consequence, magnitude or severity of the impact
Sediment dam	Natural or constructed drainage impoundment used to reduce the concentration of suspended particles in surface run-off water or mine effluent prior to re-use or discharge to the environment
Study area	Refers to the area surveyed for a particular study that may differ to the Project area, e.g., water quality site off lease
Topsoil	Part of the soil profile, typically the A1 horizon, usually containing more organic matter than the underlying layers

Waste rock	Rock with insufficient amounts of economically valuable elements to warrant its extraction, but which has to be removed to allow physical access to the ore.
Water balance	A term used in the context of mining to describe an inventory of drainage inputs and outputs, water volumes and the rate of flow
Water quality criteria	Maximum or minimum values of physical, chemical or biological characteristics of water, biota or sediment whose exceedance under specified conditions may result in detrimental effects to a water use
Water table	The interface between the saturated zone and unsaturated zones. The surface in an aquifer at which pore water pressure is equal to atmospheric pressure
Well	A hydraulic structure that facilitates the monitoring of groundwater level, collection of groundwater samples, or the extraction (or injection) of groundwater. Also known as a bore

8.2 Abbreviations

Abbreviation	Definition
AAPA	Aboriginal Areas Protection Authority
AEP	annual exceedance probability
ANCOLD	Australian National Committee on Large Dams
ANZECC	Australian and New Zealand Environment Conservation Council
ANZECC/ARMCANZ	Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand
ANZG	Australian and New Zealand Government
As	arsenic (element)
Au	gold
C	carbon (element)
CH_4	methane
CIP	Carbon in pulp
Cn	cyanide
CO	carbon monoxide
DENR	Northern Territory Department of Environment and Natural Resources
DEPWS	Department of Environment, Parks and Water Security
DITT	Northern Territory Department of Industry, Trade and Tourism
EA Act	*Environmental Assessment Act*
EAAP	Environmental Assessment Administrative Procedures
EIS	Environmental Impact Statement
EP Act	*Environment Protection Act 2019*
GDE	Groundwater Dependent Ecosystems
GDS	Gaussian Diffusion and Sedimentation
HCN	hydrogen cyanide
IAC	impact assessment criteria
IWL	Integrated Waste Landform

LCM	loose cubic metres
ML	Mining Lease
MMP	Mining Management Plan
MP	Management Plan
N_2O	nitrous oxide
NAF	non-acid-forming
NGER	National Greenhouse and Energy Reporting
NO	nitric oxide
NO_2	nitrogen dioxide
NOI	Notice of Intent
NPI	National Pollutant Inventory
NSW	New South Wales
NT	Not threatened (EPBC/TPWC species ranking)
NT EPA	Northern Territory Environment Protection Authority
PAF	potentially acid-forming
PM_{10}	particulates with aerodynamic diameter less than 10 µm
$PM_{2.5}$	particulates with aerodynamic diameter less than 2.5 µm
PNX Metals	PNX Metals Limited
PPE	personal protective equipment
PSD	particle size distribution
RWA	restricted works areas
SO_2	sulfur dioxide
SoR	Statement of Reasons
SWEL	surface water extraction licence
TAP	trigger action plan
ToR	Terms of Reference
TVOCs	Total volatile organic compounds
TSP	total suspended particulates
VOCs	volatile organic compounds
WDL	waste discharge license
WM Act	Weeds Management Act
WMP	Water Management Plan

Appendix 1.
Submissions Received on Draft EIS (NT Agencies)

Appendix 2.
Direction to Prepare a Supplement

Appendix 3.
Generator Emissions Concentrations Review

Appendix 4.
Groundwater Monitoring Plan

Appendix 5.
Water Management Plan

Appendix 6.
Waste Rock Management Plan

Appendix 7.
Updated Commitments Register

Appendix 8.
Pit Lake Water Quality Study

Appendix 9.
Blasting Impact Report

Appendix 10.
Mine Closure Plan