Amendment Report

Application for Works Approval Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Works Approval Number	W6449/2020/1
Works Approval Holder	GSM Mining Company Pty Ltd
ACN	165 235 030
File Number	DER2020/000457
Premises	Granny Smith Gold Mine Part of Mining Tenements M38/205 and M38/532 LAVERTON WA 6440 As defined by the Premises maps attached to the issued works approval
Date of Report	10/07/2023
Proposed Decision	Revised works approval granted

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A/MANAGER, INDUSTRY REGULATION
REGULATORY SERVICES

Officer delegated under section 20 of the Environmental Protection Act 1986

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1. Decision summary

Works Approval W6449/2020/1 is held by GSM Mining Company Pty Ltd (GSM) for the Granny Smith Gold Mine (the Premises), located in the Shire of Laverton.

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the construction and operation of the Premises. As a result of this assessment, Revised Works Approval W6449/2020/1 has been granted.

The Revised Works Approval issued as a result of this amendment consolidates and supersedes the existing Works Approval previously granted in relation to the Premises. The Revised Works Approval has been granted in a new format with existing conditions being transferred, but not reassessed, to the new format.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

2.2 Amendment summary and overview of Premises

GSM Mining Company Pty Ltd (GSM; the applicant) currently operates the Granny Smith Gold Mine (the Premises) which includes a processing plant and associated tailings storage facility (TSF) Cells 1 - 3 authorised under licence L8435/2010/3. GSM currently also holds Works Approval W6449/2020/1 to construct TSF Cell 4 which was granted 15 April 2021.

While undertaking the detailed design phase for TSF Cell 4, GSM found that the target basin permeability may not be achievable in areas where in-situ compaction of the natural subgrade did not meet the permeability target. Due to the scarcity of suitable construction materials, placement of a lower permeability cover material was required.

This amendment seeks to update the basin permeability (a key seepage control measure) to reflect the current design requirements and is limited to Category 5 activities from the existing Works Approval. No changes to the throughput have been requested by the Works Approval Holder.

The Premises is approximately 23 km south of Laverton, Western Australia.

2.3 Background

The following work has alread been completed under the works approval:

- permeability testing at 1 hectare intervals across the TSF basin to determine material placement;
- placement of a 300 mm thick liner comprising clayey construction material with permeability of 1.72 x 10^{-8} in zone B1 areas (Figure 1).

Works approval W6449/2020/1 currently requires a TSF basin liner that is 300 mm thick with a hydraulic conductivity of 2 x 10^{-8} m/s.

During the detailed design phase for TSF Cell 4, Golder reviewed the seepage control measures and conducted additional seepage analyses and risk assessment (Golder, 2021). Based on their review of the soil properties in the TSF Cell 4 basin and the low permeability construction materials, it was concluded there are areas of proof compaction that will not reduce the hydraulic

conductivity below 2 x 10^{-8} m/s as currently stipulated in the works approval. Consequently, it was recommended by Golder that the maximum permeability of the basin liner be relaxed to 1 x 10^{-7} m/s and that an additional layer of low permeability material be placed to reduce the hydraulic conductivity.

2.3.1 Amendments proposed

Based on recommendations made by Golder, GSM are applying for the following amendments:

- relax the maximum permeability of the basin liner in the works approval from 2 x 10^{-8} m/s to 1 x 10^{-7} m/s. The proposed liner will be made from construction materials from Childe Harold Waste Dump and/or the Cell 2 TSF tailings beach:
    - in Zone B2 areas (70 ha) (Figure 1: Zone B1 and B2 Arrangement) a 300 mm layer of TSF Cell 2 tailings or Childe Harold waste (whichever has the lowest permeability) will be placed over the subgrade and compacted to > 102% standard maximum dry density (SMD). Zone B2 areas have a permeability is determined to be > 1 x 10^{-7} m/s;
- construct a temporary runoff diversion bund at the base of the TSF Cell 3 embankment to protect the liner areas from erosion while exposed.

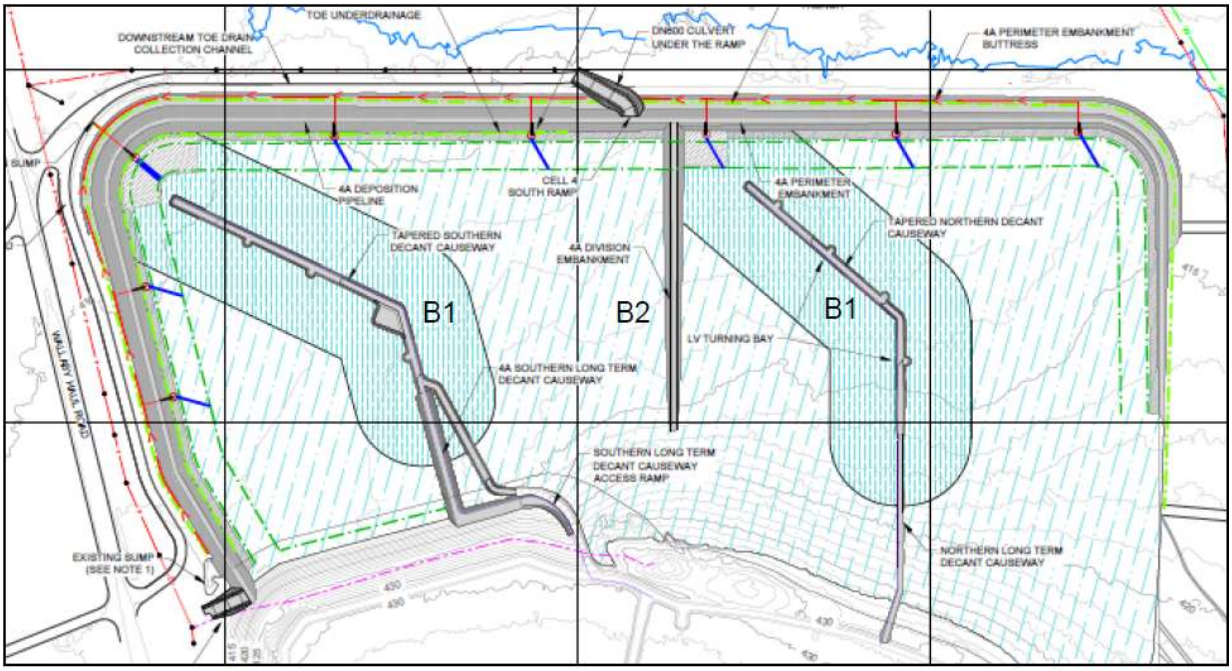

Figure 1: Zone B1 and B2 Arrangement

2.4 Mining Proposal

Mining Proposal 91496 was granted on 25 March 2021 for TSF4 for 2 sub Cells (north paddock and south paddock) and is proposed to store approximately 10 years of tailings (~16 Mt). DMIRS notified DWER on 18 January 2023 that no recent proposals in relation to TSF Cell 4 (and modification of the basin liner) had been received and that GSM should liaise with DMIRS to determine if any further approvals are required under the *Mining Act 1978*.

2.5 Other Approvals

There are several registered Aboriginal heritage sites located around Granny Smith Mine site. A heritage site located in close proximity to TSF Cell 4 is “Other heritage place 20006” approximately 30 m south of the proposed works (Figure 2: Distance to Heritage sites) and

consists of scattered artifacts with coordinates indicating that the location of the artifacts is 550 m from proposed works.

DWER notes that the applicant is responsible for ensuring appropriate approvals and stakeholder engagement has taken place under the *Aboriginal Heritage Act 1972* and subsequently the *Aboriginal Cultural Heritage Act 2021* (following completion of the transitional period from the 1972 Act[1]).

[1] Before the *Aboriginal Heritage Act 2021* is implemented there will be a transitional period during which the regulations, statutory guidelines and operational policies will be developed to ensure the ACH Act will its intended effects. During the transitional period the *Aboriginal Heritage Act 1972* will remain in force.

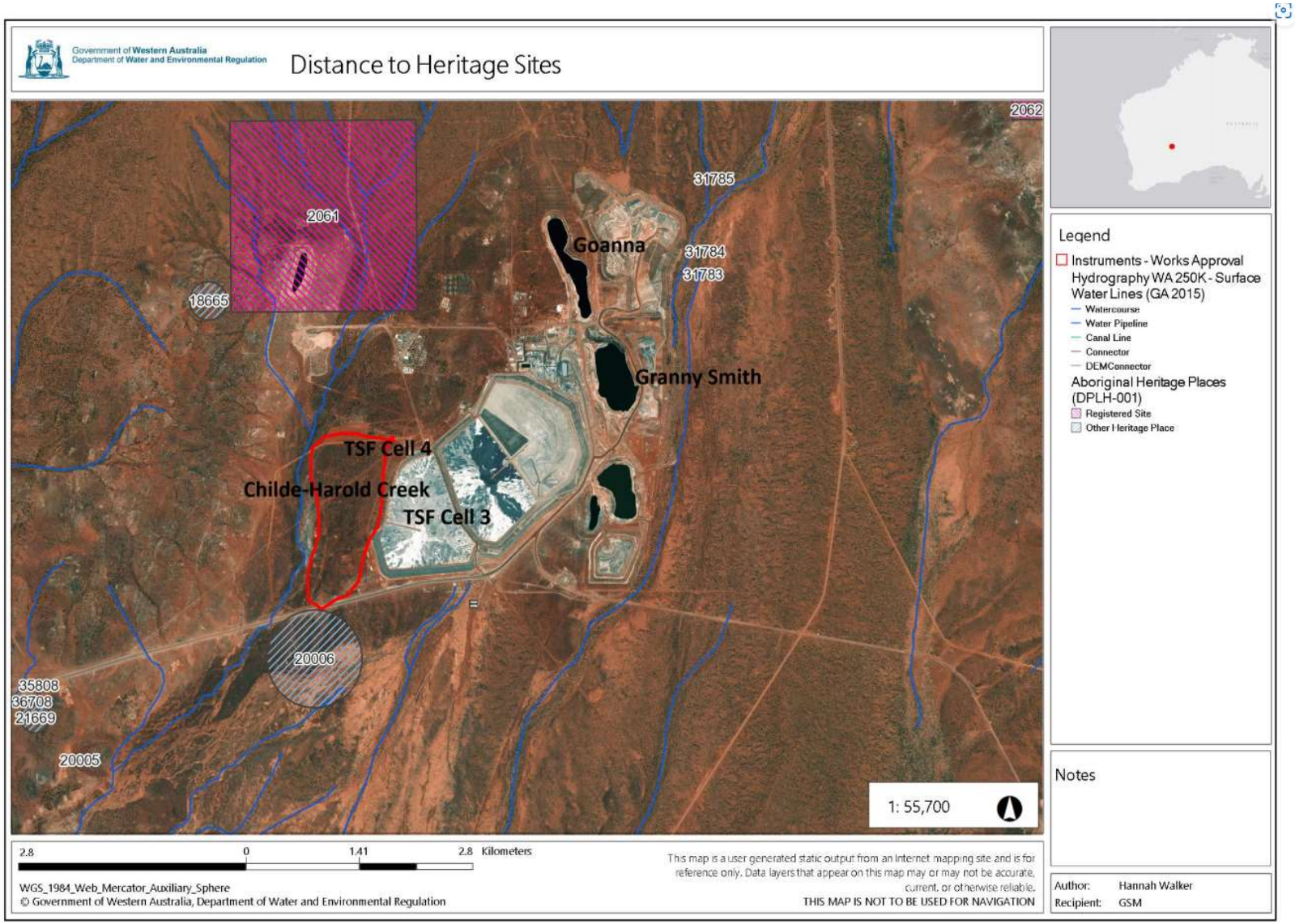

Figure 2: Distance to Heritage sites

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

To establish a Risk Event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

3.1 Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises construction and operation which have been considered in this Amendment Report are detailed in Table 1: Works Approval Holder controls below.

Table 1 also details the proposed control measures the Works Approval Holder has proposed to assist in controlling these emissions, where necessary.

Table 1: Works Approval Holder controls

Emission	Sources	Potential pathways	Proposed controls
Operation			
Increased seepage from a higher basin permeability.	TSF Cell 4	Seepage through base and embankments of TSF to surrounding soil and groundwater	<u>Existing Works Approval Controls</u> • Underdrainage and seepage collection/cut-off systems to be installed to adequately manage seepage. This will include toe drains, drainage network below the final decant pond locations, and seepage collection drain upstream of the embankment below the low permeability liner to collect shallow seepage and groundwater mounding; • A finger drainage system to be installed below the pond decant location to reduce the seepage flux through the base of TSF-Cell 4; • 12 monitoring bores proposed around the perimeter of TSF Cell 4 for groundwater monitoring; • A 2.5 m deep seepage interception trench located at the downstream toe of the embankment; • Two bunded underdrainage lines located at 14 m and 54 m upstream of the embankment;

Emission	Sources	Potential pathways	Proposed controls
			• One underdrain running along the downstream toe of the western flank of the existing Cell 3; • Maintaining the functionality of the existing PB3A and PB5 seepage recovery bores; and • Adding an additional upstream tow drain in the southern part of the basin area. Additional Controls proposed: • Zone B1 will have a 300 mm layer of Cell 2 tailings or Childe Harold waste and compact to > 102% SMD; • In Zone B2 areas (70 ha) where compacted subgrade permeability is > 1 x 10-7 m/s, a 300 mm layer of TSF Cell 2 tailings or Childe Harold waste will be placed over the subgrade and compact to > 102% SMD; • Construct a temporary runoff diversion bund at the base of the TSF Cell 3 embankment to protect the placed liner areas from erosion while exposed; • Maintaining the functionality of the existing PB3A and PB5 seepage recovery bores; and • Adding an additional upstream toe drain in the southern part of the basin area.

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors, and contractors of the Works Approval Holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 2 below provides a summary of potential environmental receptors that may be impacted because of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)). The closest community is Mount Margaret located 20 km northwest of the works and the closest town is Laverton located 23 km north of the works. Given the distance from the works these sites are not at ricks and will no longer be considered in this amendment.

Table 2: Sensitive environmental receptors and distance from prescribed activity

Environmental receptors	Distance from prescribed activity
Threatened flora	Within the vicinity of the project area.

• *Phyllanthus baeckeoides* (Priority 3) was recorded in a 2020 survey where 70 plants were recorded at one location. • *Lysiandra baeckeoides* (Priority 3) was recorded in a 2010 survey, one plant was recorded.	
Threatened fauna Long-tailed Dunnart (*Sminthopsis longicaudata)*	~200 m from the prescribed area There are also a number of recordings of Fairy Shrimp (*Branchinella latzi*) located on Lake Carey and Childe Harold.
Surface water[1]	Childe Harold Creek[1]: 150 m west, ephemeral, drains into Lake Carey Windich Creek: 700 m southeast no longer conveys surface water flow Lake Carey Salt Lake: 5 km southwest
Groundwater The Premises is located within the Goldfields Groundwater Management Area, according to the *Rights In Water Irrigation Act 1914.* Groundwater salinity mapping from the department's GIS database indicates the groundwater is hypersaline.	Groundwater depth Groundwater levels are currently suppressed due to ongoing abstraction from the seepage abstraction bores. Prior to installation of these bores (2017), groundwater to the west of TSF Cell 4 location was 1 – 3 meters below ground level (m bgl). In 2020, groundwater levels range from 1.8 – 11.2 m below ground level (bgl). Groundwater flow direction Groundwater flows to the west away from the existing TSF, towards Childe Harold Creek. The regional flow direction of groundwater is towards Lake Carey to the south-west of site. Groundwater Quality • Hypersaline (TDS 10,000-35,000 mg/L) • Near neutral pH (7.2-7.6) Groundwater users Groundwater at the Premises is not considered suitable for agricultural or pastoral use. The closest stock watering bore is located 5 km up-hydraulic gradient and is hosted within a superficial aquifer.

Note 1: Golder (2020) indicates that water catchments occur amongst the elevated rocky outcrops that act as drainage dividers. These catchments then drain southwest towards Lake Carey with Chile Harold Creek acting as a pathway. Lake Carey is dry most of the year with large flow events allow for lower salinity which causes brine shrimp to hatch (Terrestrial Ecosystems, 2020). Chile-Harold Creek is ephemeral with flow only occurring after high intensity rainfall events. This is made up of unconfined channel approximately 30 m wide by 2 m deep. The natural flow of the creek has been altered over the life of the mine.

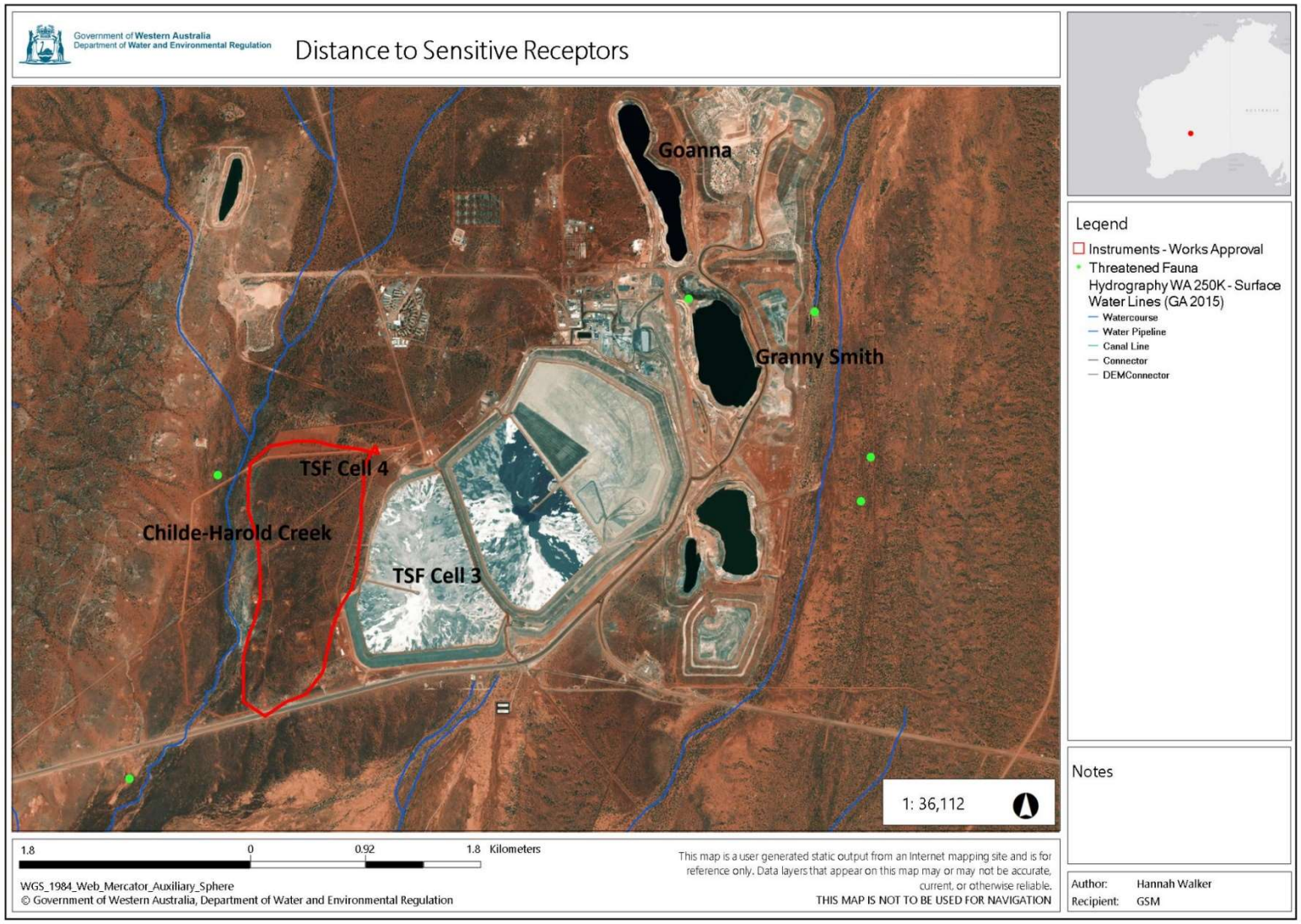

Figure 3: Distance to sensitive receptors

3.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 3.1. Where linkages are incomplete they have not been considered further in the risk assessment.

Where the Works Approval Holder has proposed mitigation measures/controls (as detailed in Section 3.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the Works Approval Holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the Works Approval as regulatory controls.

Additional regulatory controls may be imposed where the Works Approval Holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 3.

The Revised Works Approval W6449/2020/1 that accompanies this Amendment Report authorises construction and time-limited operations. The conditions in the Revised Works Approval have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

An amendment to Licence L8435/2010/3 is required following the time-limited operational phase authorised under the works approval to authorise emissions associated with the ongoing operation of the Premises i.e. use of the new TSF. A risk assessment for the operational phase has been included in this Amendment Report, however licence conditions will not be finalised until the department assesses the licence application.

Table 3. Risk assessment of potential emissions and discharges from the Premises during time limited operations

Risk Event					Risk rating[1] C = consequence L = likelihood	Works Approval Holder's controls sufficient?	Conditions[2] of works approval	Justification for additional regulatory controls
Source/Activities	**Potential emission**	**Potential pathways and impact**	**Receptors**	**Works Approval Holder's controls**				
Time limited operations								
Deposition and storage of tailings in TSF Cell 4 – modification to permeability of liner	Tailings seepage	Increased seepage (associated with new liner) through base and embankments of TSF creating groundwater mounding, degradation of groundwater quality and potential impacts to surface water quality and health of adjacent native vegetation	Childe Harold Creek Native vegetation including threatened flora	Refer to Section 3.1	C = Moderate L = Possible **Medium Risk**	Y	Condition 1 Design and construction requirements	No additional regulatory controls required. Refer to section 3.3 for detailed risk assessment

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

Note 2: Proposed Works Approval Holder's controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

3.3 Detailed risk assessment for seepage

3.3.1 Overview of risk event

Impacts to vegetation have historically been identified along the Child Harold creek line (Native Vegetation Solutions, 2021). Rising groundwater levels from additional seepage could cause additional vegetation death along the Childe Harold creek and impact the water quality.

3.3.2 Source

Characterisation of Tailings to be deposited into TSF Cell 4

Physical

Tailings from the Wallaby underground mining operation are planned to be deposited in TSF-Cell 4. The Wallaby tailings target solids content is 60% w/w. Tailings are classified as silt with sand, non-plastic, grey, fine to medium grained (Golder 2021). The tailings will be pumped into the TSF through multiple spigot discharge pipes at about 55% to 65% solids by mass which will systematically push the supernatant pond towards the decant inlets.

Chemical

Recent (2021) Wallaby tailings acid-base accounting (ABA) and net acid generation (NAG) testing are summarised in Appendix 1: Acid Base Accounting and Net Acid Generation The ABA and NAG demonstrate that tailings are non-acid forming (Golder 2021), with a significant excess of acid neutralisation capacity over acid generation potential. The results indicate that tailings with similar properties are expected to remain near neutral after being deposited to TSF Cell 4 and the risk of acid and metalliferous drainage (AMD) is negligible (Golder 2021).

Tailings test results (2021) found that samples were consistent with historical investigations. Consequently, low variability in the geochemical characteristics is expected for tailings to be disposed of into TSF Cell 4 (Golder 2021). Evidence suggests that, over time, sulphate levels may increase in Cell 4 compared with that of the current tailings (Golder 2020). Because of long term oxidation of the sulphides in tailings materials, a moderate to high sulphate concentration is expected to develop in the tailings pore water and seepage. The fresh tailings sample collected in 2020 had a total sulphur concentration of 2.13%.

Overall seepage from TSF Cell 4 is expected to be saline[2] with low concentrations of elements with environmental significance which Golder (2020) expects to have low impact on local hypersaline groundwater. The tailings liquor is expected to be saline with circum-neutral pH. Leach tests indicated a low risk of short-term metal leaching (Golder 2020).

For current process water and tailings liquor, the analytes exceeding the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines* (ANZECC & ARMCANZ 2000) for livestock drinking water quality are copper, molybdenum, nickel, and sulphate. It is considered that the copper and nickel levels are associated with cyanide complexation (Golder 2020).

Cobalt and cyanide were modelled (Golder 2020) to assess the potential impacts. Cyanide concentrations are not expected to increase above 50 mg/L Weak Acid Dissociable Cyanide (WAD CN). Decant is not expected to surpass 40 mg/L WAD CN (Goldfields 2023). Modelling indicates that cobalt will generally be of limited mobility, leading to small increases over existing background concentrations. Cyanide, although more mobile, is considered by Golder likely to break down in the natural environment (e.g. form hydrogen sulphide and evaporate or

[2] This is attributed to the use of local hypersaline groundwater and pit water for ore processing.

biodegrade) such that the risk to nearby receptors is low. Average cyanide concentrations are summarised in Appendix 1.

Estimated seepage

The seepage estimates undertaken for the original works approval application estimated a seepage rates:

- between 950 to 1200 m^3/day for the case without the low permeability layer in the TSF basin; and
- 300 to 800 m^3/day for the case where a liner was placed (to achieve hydraulic conductivity of 2.0 X 10^{-8} m/s).

Golder (2022) was commissioned by GSM to complete additional detailed seepage modelling (Appendix 2: Updated seepage modelling) for the TSF as part of the preconstruction survey. This survey indicated that seepage will be less than original calculations even though permeability of the liner will be higher. Modelling predicted 509 m^3/day as the expected maximum rate of vertical seepage through the basin floor. This rate is for seepage without the Childe Harold Waste Dump/tailings layer. This is lower than previously estimated maximum rate of 800m^3/day. A seepage rate of 486 m^3/day is predicted with the layer. Lateral seepage across areas of ferricrete is similar for both scenarios at approximately 320 m^3/day.

3.3.3 Pathway

Hydrogeology

In 2020 Golder produced a geological model covering the area of the existing and the TSF Cell 4 location. The area beneath the Cell 4 consists of:

- Superficial alluvials – 0.5 – 1 m thick
- Paleochannel, ferricrete – 1-12m thick
- Paleochannel; silt, sand, and gravel 0-15m thick
- Saprolite – 0-20m think
- Basement – to depth

Groundwater is anticipated to flow primarily through the paleochannel aquifer (Appendix 3: Paleochannel location in regard to TSF Cell 4). The paleochannel sediments are highly variable, ranging from blocky clays to sands and gravels. However, the area beneath TSF Cell 4 is clayey in nature. The drainage valley under TSF Cell 4 moves in a southwestern direction towards the Childe Harold Creek. Childe Harold Creek flows southerly and is located approximately 150 m west of the Cell 4 position. Windich Creek is approximately 800 m south (Appendix 3: Paleochannel location in regard to TSF Cell 4).

Groundwater flow through the underlying saprolite and basement is anticipated to be limited compared to the shallow paleochannel aquifer (ferricrete and sand, gravels, clays), primarily occurring in areas of significant fracturing (Golder, 2022). The ferricrete layer, within the saprolite, is also a potential pathway for seepage.

3.3.4 Groundwater monitoring

Groundwater levels

Pre-mining groundwater levels at the site typically ranged between 5 - 10 m bgl with a west sloping gradient towards Lake Carey. Groundwater levels observed in 2022 (with active use of the seepage recovery bores) were between 2 - 6 m bgl close to the existing TSF Cell 3 and as shallow as 1 - 3.5 m bgl closer to Childe Harold Creek (Gold Fields 2023). Whilst the seepage

recovery system has been effective in reducing the groundwater level surrounding, as shown in Appendix 4: Childe Harold Creek water trends 2015-2022, evidence of salt impact on vegetations surrounding Childe Harold Creek remains (Goldfields, 2023).

TSF Cell 4 is to be constructed 4 m above the groundwater table considering the elevated groundwater level associated with seepage from the existing TSF.

Standing water levels at Childe Harold

Data provided in Granny Smiths annual environmental report showed a decrease in groundwater elevation with the most significant drop occurring at the western and southern toe of Cell 3 (location of Cell 4 and towards Childe Harold Creek) with standing water levels being monitored quarterly (Goldfields 2023). The standing water level for the area surrounding Childe Harold Creek is illustrated in Figure 4**: Water level Trend at Childe Harold Creek 2015-2022** below. TSF Monitoring bores Standing Water Level summary is presented in Appendix 4: Childe Harold Creek water trends 2015-2022.

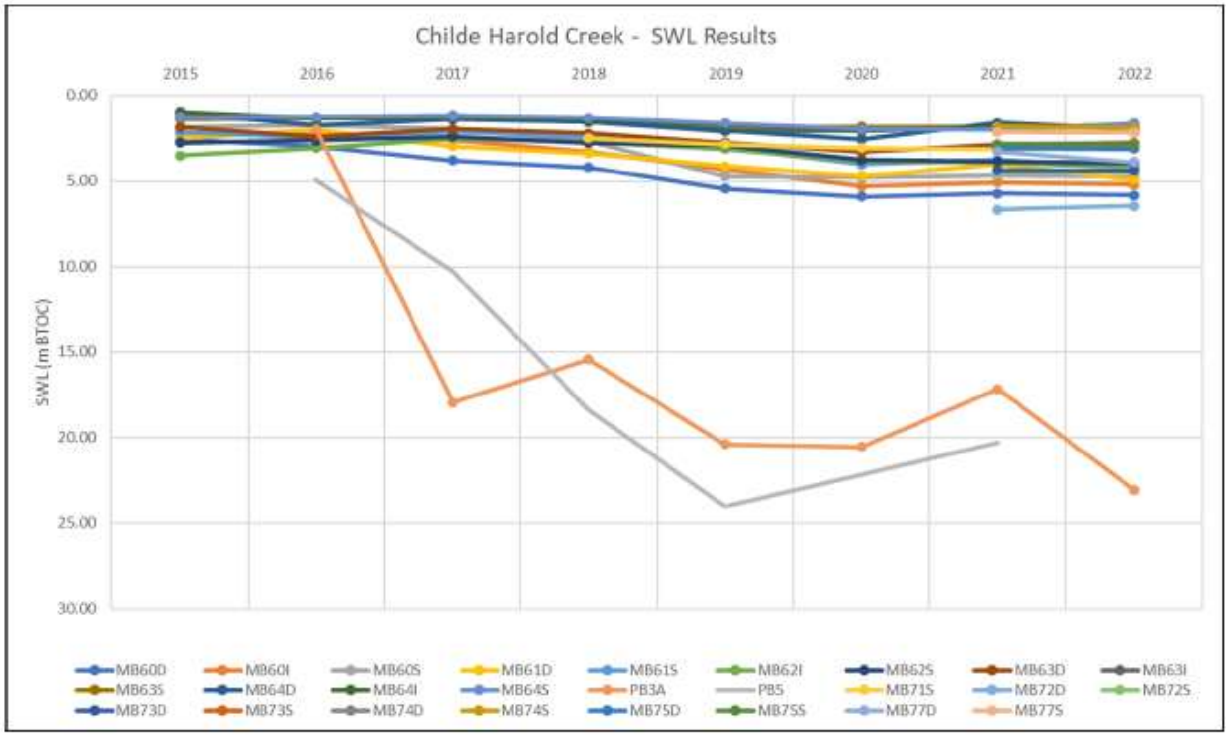

Figure 4: Water level Trend at Childe Harold Creek 2015-2022

Groundwater quality.

The earliest groundwater quality data available was recorded shortly after the commencement of TSF operations at the site in 2018. Results indicated Total Dissolved Solids (TDS) concentrations between 4,000 and 9,000 mg/L. Table 4. **Comparison Baseline Groundwater Quality** summarises the baseline groundwater quality as compared to the highest analyte concentrations recorded during December 2022 monitoring.

Table 4. Comparison Baseline Groundwater Quality

Parameter	Baseline Groundwater quality (mg/L except where stated)	Highest analyte concentration during December 2022 monitoring
pH	7.2 to 7.6 pH units	TSF MB66S – 7.81

Total dissolved Solids (TDS)	3,800 to 8,800	TSF MB53D – 64,700
Chloride	1,600 to 3,00	TSF MB 53D 44,900
Sulphate	400 to 1,000	TSF MB 53D – 6,960
Calcium	70 to 120	TSF MB 48S – 3,780
Cobalt	<0.05	TSF MB 29S - 1.09
Total Cyanide	<0.01	TSF MB 29S - 0.394

Groundwater monitoring results indicated that pH remained stable between 2018 - 2022. TDS and chloride recorded the most significant and increase since 2018. Sulphate, calcium, cobalt and cyanide levels have all increased slightly since 2018. The groundwater across this premises is not suitable for agricultural or pastoral use and there are no nearby groundwater dependent groundwater receptors with in 5km of the TSF footprint.

Seepage Recovery

Bores PB3A and PB05 are used for seepage recovery to manage groundwater mounding associated with the existing TSF Cell 3. Appendix 5: Summary of Seepage Recovery Bore Abstraction and ground water level change.[3] summarises the groundwater monitoring results since seepage recovery began in 2017. Results suggest:

- Groundwater levels within close proximity to the recovery wells continue to show a steady decline and reflect the pumping operation of the recovery well. The drawdown cone is now influencing and reducing mounding beneath Childe Harrold Creek;
- A mostly consistent pumping rate has been maintained to May 2022 allowing for continued drawdown;
- Continuing drawdown and capturing seepage further west would help maintain groundwater levels; and
- an increase in groundwater elevation occurring at the western toe of Cell 3.

3.3.5 Permeability for new basin cover materials: TSF Cell 2 tailings and Childe Harold waste dump

Cell 2 Tailings characteristics

Testing of Cell 2 dry tailings was undertaken for index characterisation, permeability, and strength. Tailings comprise sandy silt, with the fines content ranging between 50% and 77%. Compaction testing gave a permeability of 2.09 x 10^{-8} m/s when compacted to 95.2% SMD with fines content between 80 and 95% (Golder 2023).

[3] Table 9**: Summary of Seepage Recovery Bore Abstraction** in Appendix 5: Summary of Seepage Recovery Bore Abstraction and ground water level change. shows total abstraction from the two bores (PB3A and PB5). Total seepage recovery was 76,354 kL. This was below the annual average of 106,303 kL/annum (3.8 L/sec) (Goldfields 2023). Table 10**: Groundwater level change** Appendix 5: Summary of Seepage Recovery Bore Abstraction and ground water level change. shows depth to water and total drawdown measured since commencement of the seepage recovery system shows the latest (Annual Environmental Report [Goldfields 2023]).

Child Harold waste dump material

The material from the Childe Harold waste dump comprised low strength waste which breaks down on compaction to form a fine and medium silt gravel with sand. A silty fines content of 40% was recorded in a sample from the outer waste dump in 2020 (Golder, 2020). Permeability of Childe Harold Waste varies from 3.2 x 10^{-8} m/s to 1.7 x 10^{-8} m/s for confining effective stresses of 50 kPa and 400 kPa. Table 5 below illustrates the modest additional reduction in permeability that me be expected as the depths of the tailings increases over the compacted Childe Harold material liner. 50kPa approximates to a thickness of saturated tailings of 5m, and 400 kPa is equivalent to 40m thickness (Goldfields 2023).

Table 5: Hydraulic conductivity on Childe Harold compacted to 98% SMD at OMC.

Confining effective stress. σ^3 (kPa)	Dry Density, pd (t/m^3)	Permeability, k (m/s)
50	1.79	3.2 × 10^{-8}
200	1.81	2.1 × 10^{-8}
400	1.83	1.7 × 10^{-8}

Permeability test results are shown in Appendix 6: In situ permeability testing.

3.3.6 Applicant proposed controls

Existing controls under works approval W6449/2020/1

To mitigate seepage from TSF Cell 4, the following controls were conditioned as part of works approval W6449/2020/1:

- Underdrainage and seepage collection/cut-off systems to be installed;
- Maintain decant water quality below 50 mg/L cyanide as committed to in GSM Cyanide Code Certification;
- Ongoing monitoring of groundwater levels and quality, for changes in response to tailings deposition at TSF Cell 4, and to confirm compliance with the Part V licence (L8435/2010/3);
- Additional monitoring bores:
    - 12 additional groundwater monitoring bores around the Cell 4 perimeter, together with the replacement seepage recovery bores. A shallow (10 m) and deep (30 m - 70 m), bore was constructed at each location. The location of the monitoring bores is shown in Appendix 7: Monitoring bore Location below.

Additional controls proposed for this amendment

Controls proposed by the applicant as part of this amendment include:

- A liner, comprising TSF 2 tailings and/or Child Harold waste rock will be constructed across the foundation area of TSF Cell 4. The in-situ soil within the Cell 4 footprint will be moisture conditioned and compacted to a hydraulic conductivity of 1x10^{-7} m/s or less. The proposed layer will include:
    - moisture conditioning and compaction to 98% standard maximum dry density, after the removal of topsoil and scarifying the insitu soil to a minimum depth of 200 mm; and
    - compaction of the material to a minimum thickness of 300 mm.

- Adding an additional upstream toe drain in the southern part of the basin area; and
- Construct a temporary runoff diversion bund at the base of the TSF Cell 3 embankment to protect the placed liner areas from erosion while exposed.

3.3.7 DWER assessment

Whist the basin liner has a higher permeability than originally intended, the applicants most recent seepage modelling shows seepage estimates similar to or lower than estimates assessed as part of the original works approval. Therefore, there is no change in the risk profile for the premises and the existing and proposed seepage controls are sufficient to mitigate risk associated with the applicant's proposed modification to the basin liner.

The applicant proposed controls will be placed on the works approval as regulatory controls.

4. Consultation

Table 6: Consultation provides a summary of the consultation undertaken by the department.

Table 6: Consultation

Consultation method	Comments received	Department response
Department of Mines, Industry Regulation and Safety (DMIRS) advised of proposal January 2023	DMIRS replied on 18/01/23 stating/advising that DMIRS has not received any recent mining proposals in relation to TSF Cell 4 and that GSM should liaise with DMIRS to determine if any further approvals are required under the Mining Act 1978.	GSM to liaise with DMIRS to update mining proposal
Works Approval/Licence Holder was provided with draft amendment on 16 June 2023.	Licence Holder provided required additional information.	Response accepted.

5. Conclusion

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a Revised Works Approval will be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

5.1 Summary of amendments

Table 7 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the Revised Works Approval as part of the amendment process.

Table 7: Summary of works approval amendments

Condition no.	Amendments
Condition 1, Table 1	Modified seepage controls

References

1. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
2. Department of Water and Environmental Regulation (DWER) 2016, *Guideline: Environmental Siting*, Joondalup, Western Australia.
3. DWER 2017, *Guideline: Risk Assessments*, Joondalup, Western Australia.
4. Existing Licence L8435/2010/3 for Granny Smith Gold Mine, issued to GSM Mining Company Pty Ltd on 12 April 2021, available from the following website:
5. Golder (2020). *Engineering Design of TSF Cell 4 Project – Geochemistry and Water Quality Study at Granny Smith Mine. Memorandum.* Reference No. 20141725-005-M-Rev0. 18 August 2020
6. Golder (2021). *Mining Proposal for TSF Cell 4.* West Perth, Western Australia.
7. Golder Associates Pty Ltd, September 2020, *Design Report in Support of Tailings Storage Facility Cell 4 Works Approval Application, Granny Smith Gold Mine*, West Perth, Western Australia.
8. Golder Associates Pty Ltd, September 2020, *Works Approval Application – Granny Smith Gold Mine – Tailings Storage Facility 4*, West Perth, Western Australia.
9. Goldfield's (2021). *Annual Environmental Report: L8435/2021/3. For the Period 1 January 2020- 31 December 2020.* Perth, Western Australia.
10. Goldfield's (2022). *Annual Environmental Report: L8435/2021/3. For the Period 1 January 2021- 31 December 2021.* Perth, Western Australia.
11. Goldfield's (2023). *Annual Environmental Report: L8435/2021/3. For the Period 1 January 2021- 31 December 2022.* Perth, Western Australia.

    https://www.der.wa.gov.au/our-work/licences-and-works-approvals
12. Native Vegetations Solutions (2020) *Reconnaissance Flora and Vegetation Survey of Proposed TSF4, Granny Smith Mine.* Kalgoorlie, Western Australia.
13. Terrestrial Ecosystems (2020). *Vertebrate Fauna Risk Assessment: Granny Smith Tailings Storage Facility Expansion.* Mt Claremont, Western Australia.
14. WSP Golder (2023). *Application for an amendment to Works Approval (W6449/2020/1) – Request for further information: Technical Memorandum.* West Perth, Western Australia.

Appendix 1: Acid Base Accounting and Net Acid Generation

Pyrite (identified sulphide mineral) comprised of 4 – 8 wt% in the tailings samples which suggests appreciable acid generation potential. However, carbonates such as calcite and dolomite/ankerite were abundant in the tailings and formed 12 – 26% of sample mass, indicating significant acid neutralisation/buffering capacity (Golder 2020).

Table 8: Acid Base Accounting and Net Acid Generation Results (Golder 2020)

Analyte	unit	zone 60	zone 105	zone 110	zone 120	zone 120-130	zone 135	Fresh Tailings
Number of samples		3	3	17	24	3	12	1
paste pH	pH unit							7.9
paste EC	uS/cm							3840
Total-C	%	3.92	3.28	2.55	2.69	2	2.97	2.58
TOC	%	0.05	0.03	0.04	0.05	0.03	0.03	
Total-S	%	3.03	222	2.3	2.58	2.28	2.98	2.13
Sulphide-S	%	2.98	1.83	2.22	2.48	1.83	2.68	1.6
Sulphate-s	%							0.19
MPA	kg H2SO4/t	93	68	70	79	70	91	65
AP	kg H2SO4/t	91	56	66	75	56	82	49
ANC	kg H2SO4/t	240	243	207	232	175	242	210
carto-NP	kg H2.SO4/t	316	266	206	216	161	240	211
NPR	unitless	3.2	3.9	3.1	3.1	2.5	2.9	3.2
NAPP	kg H2SO4/t	-147	-176	-136	-153	-105	-151	-145
NAG PH	pH unit	9.56	10.01	9.09	9.32	9.36	8.62	9.1
NAG EC	uS/cm	296	465	316	317	317	478	
NAG (7.0)	kg H2SO4/t	-4	-3.7	-0.3	-0.5	-2	-5	<1

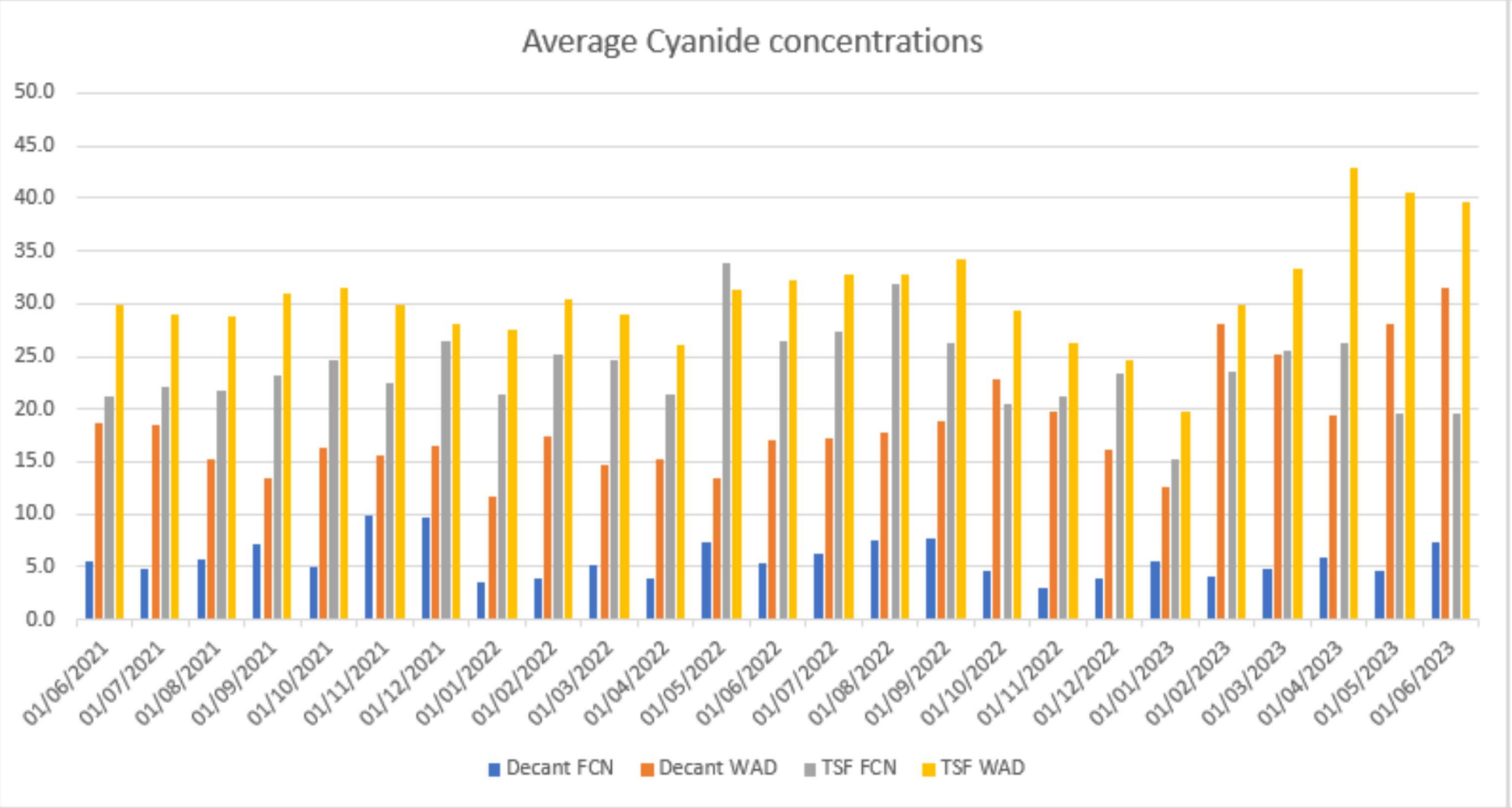

Figure 5: Average Cyanide concentrations .

Appendix 2: Updated seepage modelling

Golder (2022) explored four different scenarios for seepage modelling :

- Case 1a (liner and no seepage trench extraction), seepage flow estimate varies from 240 m^3/day to 450 m^3/day from years two to fifteen as shown in Figure 4.
- Case 1b (no liner and no seepage trench extraction), flow increases slightly from 271 to 478 m^3/day from years two to fifteen.
- Case 2a (toe underdrainage and seepage inception trench with liner) and 2b (Toe underdrainage and seepage interception trench without liner), the seepage rates increased on average 10%. This is due to the reduced pressure head in the Ferricrete.

Case 2a and 2b were selected to be implemented by GSM to reduce seepage.

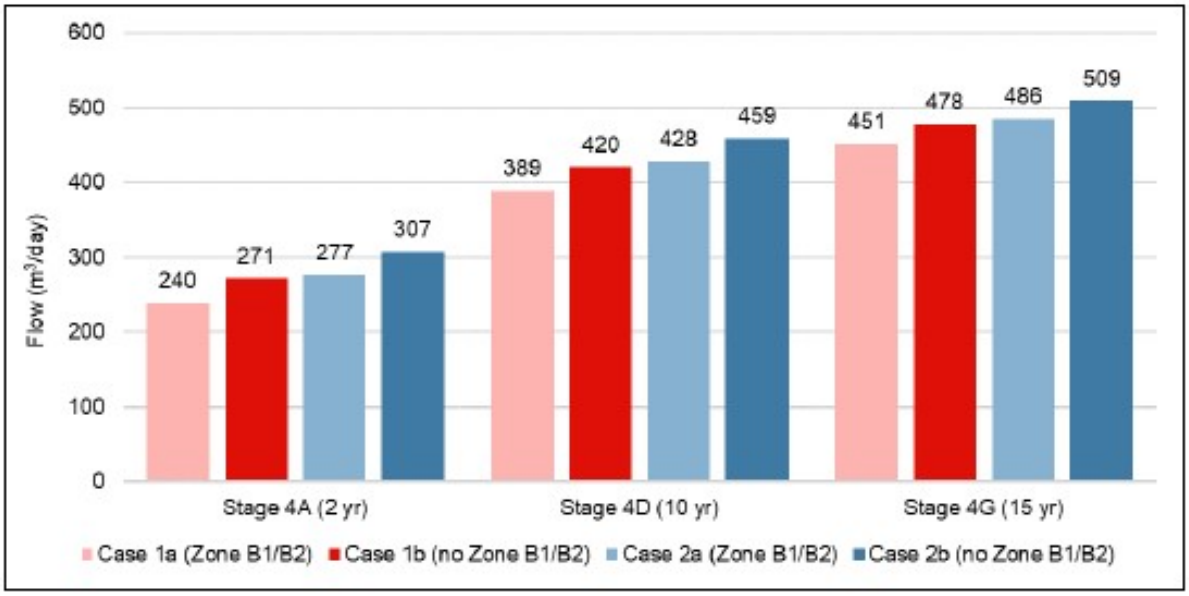

Figure 6: Seepage flow through basin floor the different cases

Once tailings begin to seep through the basin floor of the TSF, it will have a lateral flow through the fractured ferricrete in the foundation that will combine with lateral flow generated from Cell 3. Figure 5 below shows the comparison of water flow downstream through the ferricrete for the scenarios without (case 1a/1b) and with (case 2a/2b) the interception trench.

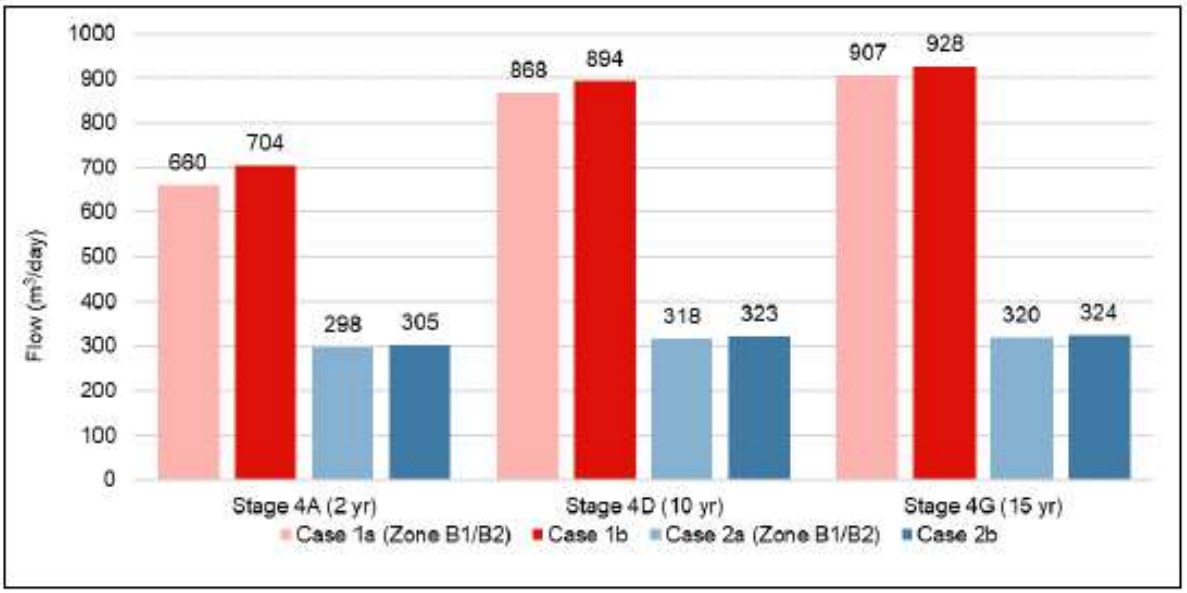

Figure 7: Seepage flow through ferricrete downstream of the embankment for the different cases

Figure 6 shows that extraction from the trench reduces the flow to less than half of the expected downstream seepage. The presence of a liner in Cell 4 is expected to have a limited impact to reducing seepage flow through ferricrete (<5% total flow).

Expected seepage through the ferricrete downstream to Cell 4 with the upstream drainage and the seepage interception trench active is expected to be 300 to 330 m^3/day throughout the life of Cell 4.

Appendix 3: Paleochannel location in regard to TSF Cell 4

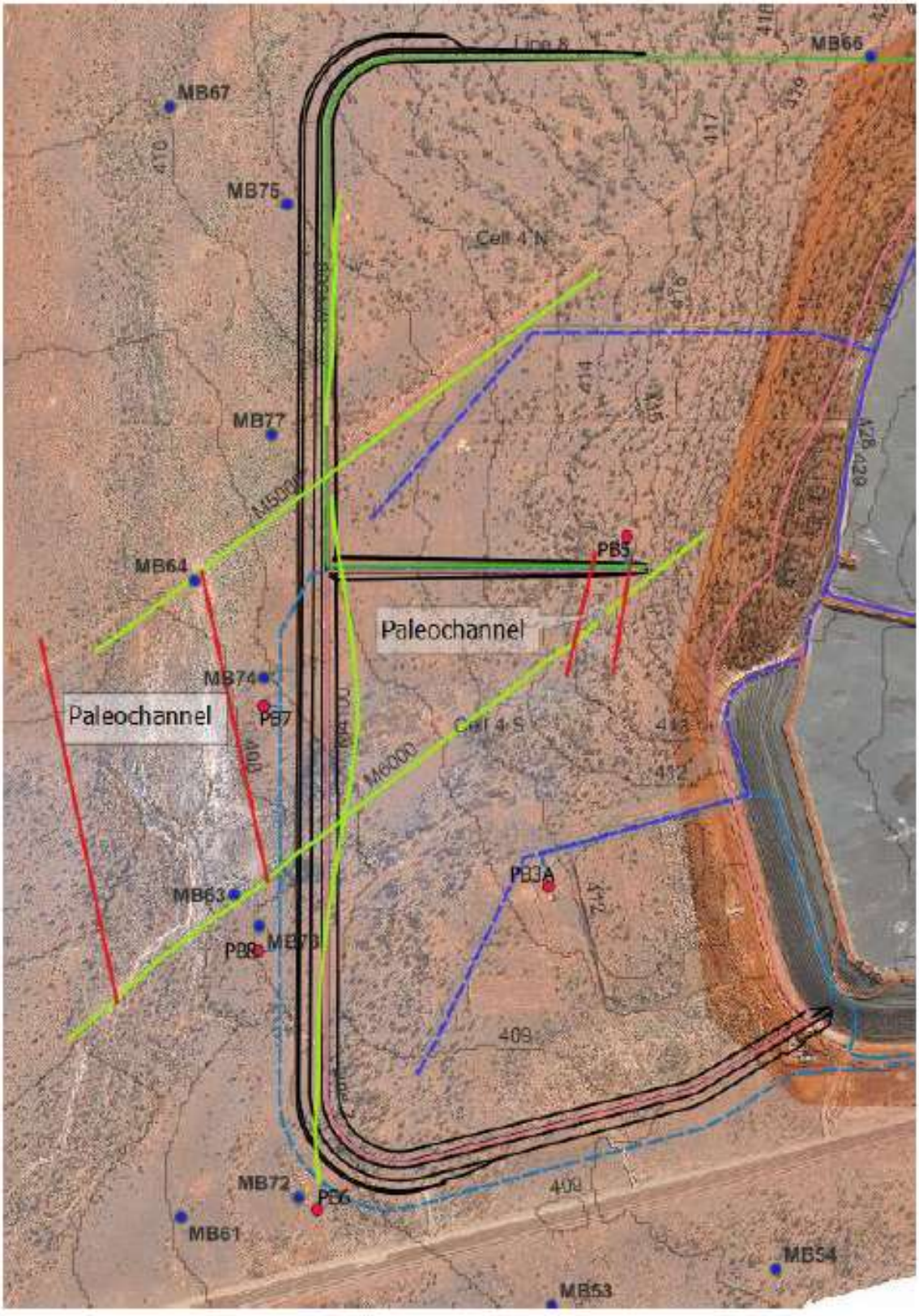

Figure 8: Location of Paleochannels

Appendix 4: Childe Harold Creek water trends 2015-2022

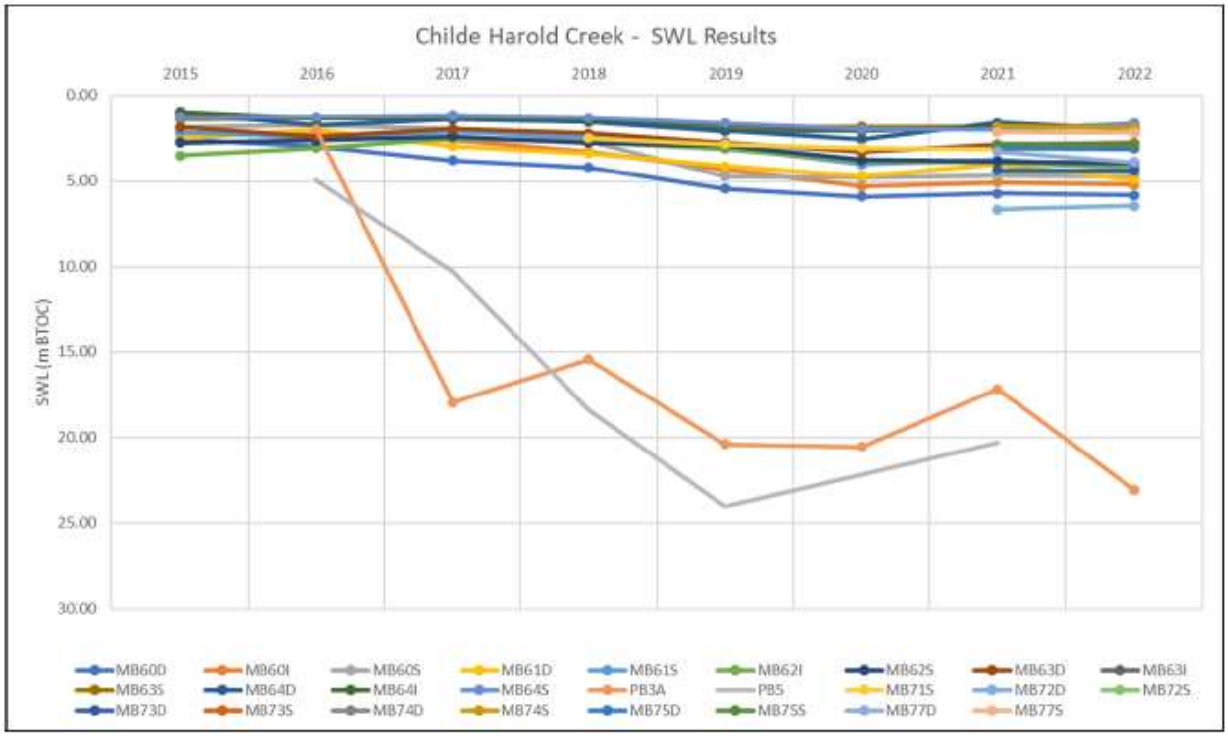

Figure 9: Water level trends 2015-2022

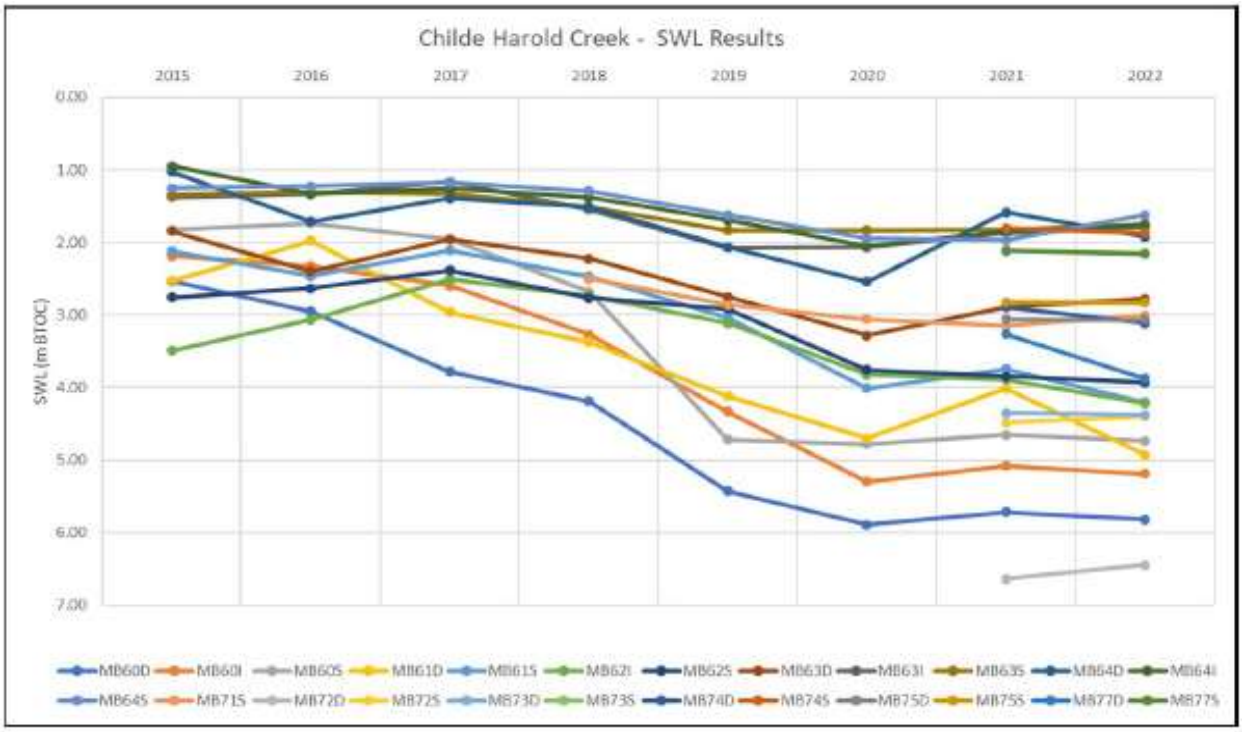

Figure 10: Water level trend adjacent to Childe Harold Creek

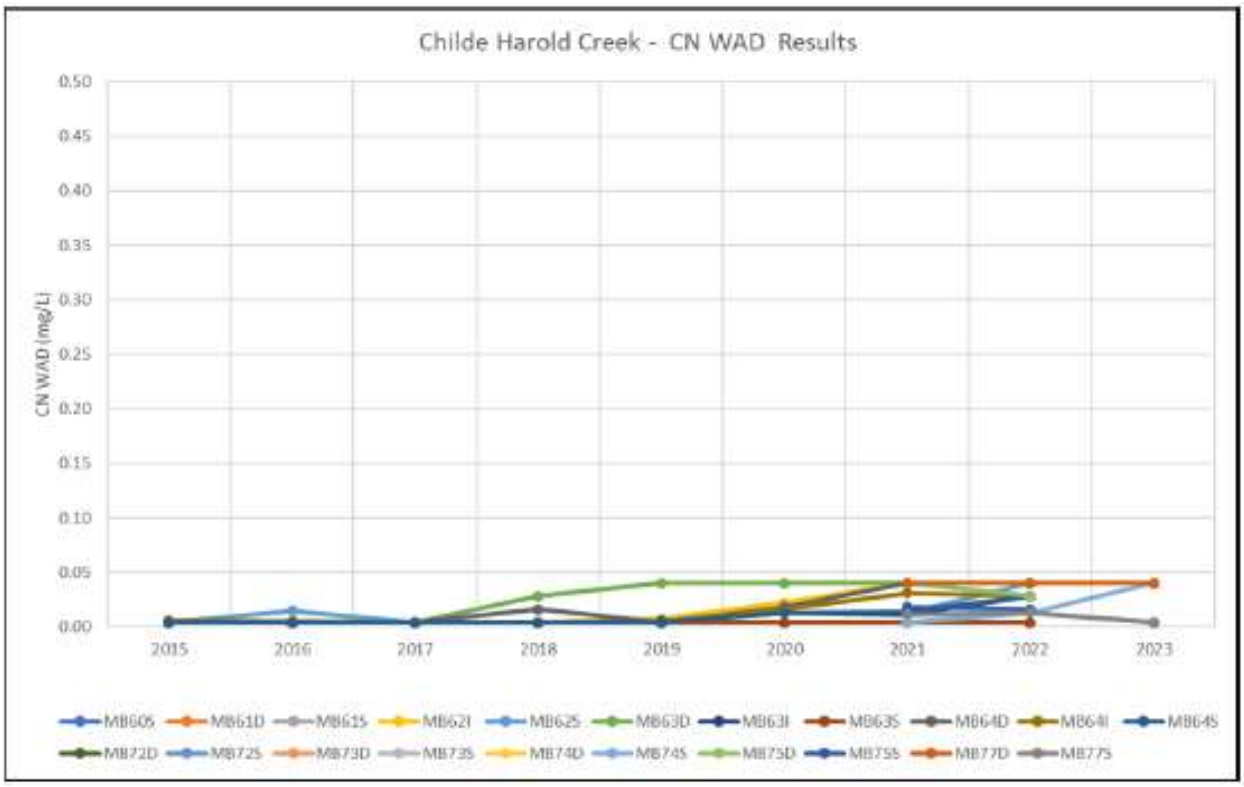

Figure 11: CN WAD trend adjacent to Childe Harold Creek

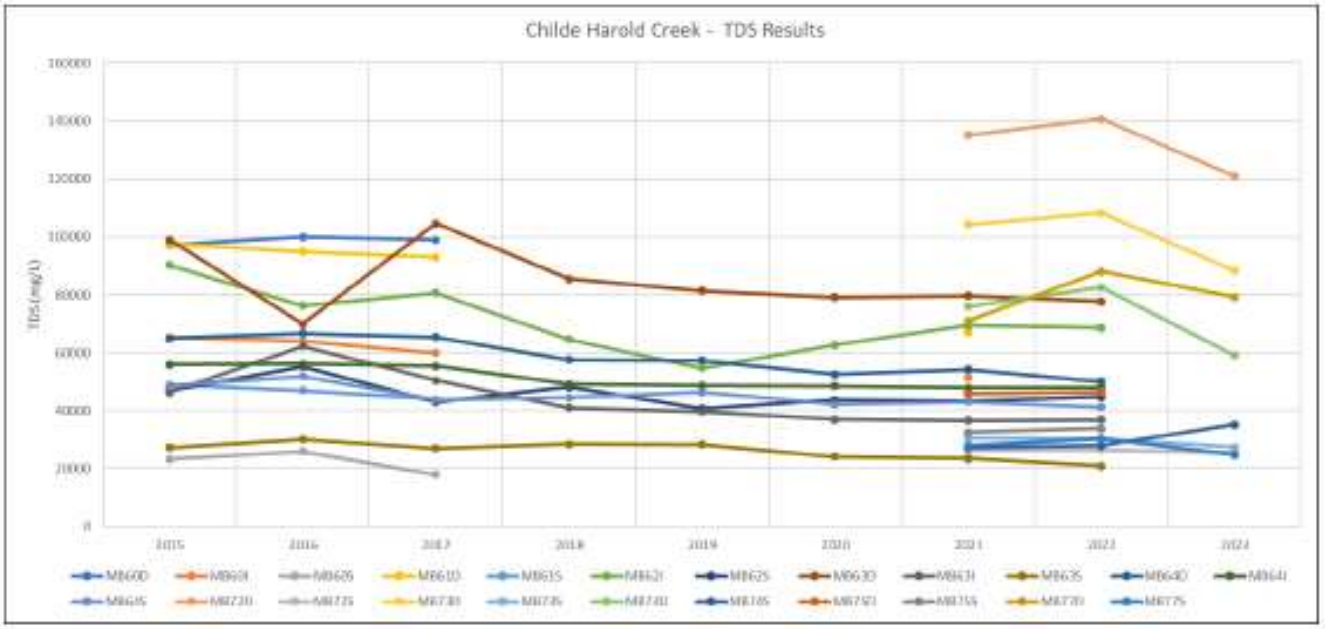

Figure 12: TDS trend adjacent Childe Harold Creek

Appendix 5: Summary of Seepage Recovery Bore Abstraction and ground water level change.

Table 9: Summary of Seepage Recovery Bore Abstraction

Details	Unites	PB3A	PB05
Start Pumping	-	24/04/2017	24/04/2017
Total Abstraction to 31/05/2022	(kL)	557.96	74.042
Average pumping rate	(L/sec)	3.4	0.5
2022 Abstraction	(kL)	73,863 (4 L/sec)	2,491 (0.1 L/sec)
Initial modified groundwater level	(m below top of collar)	1.96	4.95
	(m AHD)	409.98	410.96
Pumping water level (May-22)	(m below top of collar)	23.12	20.29
	(m AHD)	388.82	395.62
drawdown to (to date)	(m)	21.16	15.34

Table 10: Groundwater level change

Bore ID	Depth to Water Feb 2017 (pre-pumping) (mbgl)	Depth to Water May 2022 (mbgl)	Drawdown Feb 17-May 22
2A	1.6		
3A	1.604	23.12	21.52
4	1.87		
50D	1.86	11.52	9.66
50I	1.48	7.07	5.22
58D	2.19	4.11	1.92
59D	2.439	5.85	3.41
68D	2.04	6.77	4.73

Appendix 6: In situ permeability testing

Figure 13: In situ permeability tests 2023with TSF 2 tailings/Childe Harold Waste dump

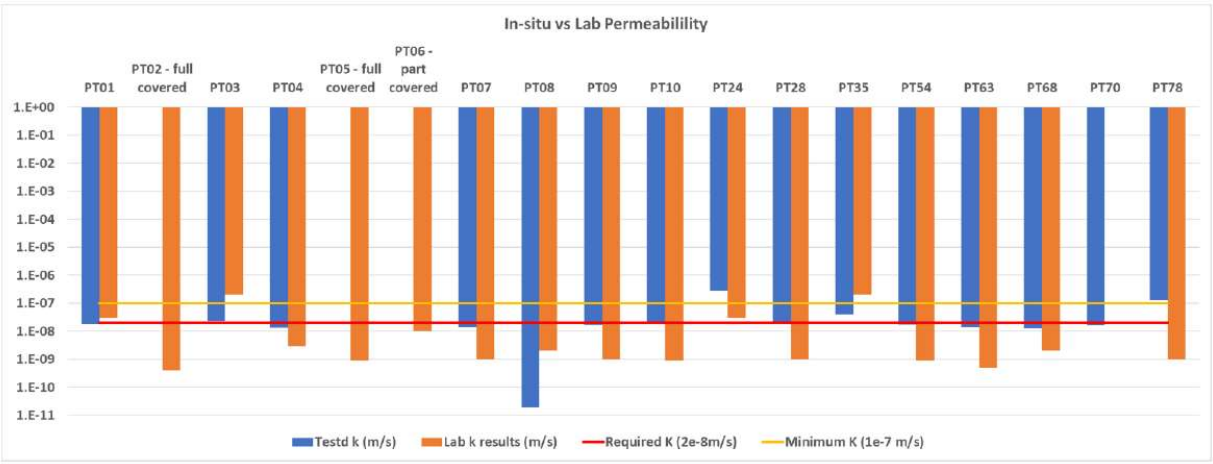

Figure 14: in situ and laboratory subgrade permeability comparison

Appendix 7: Monitoring bore Location

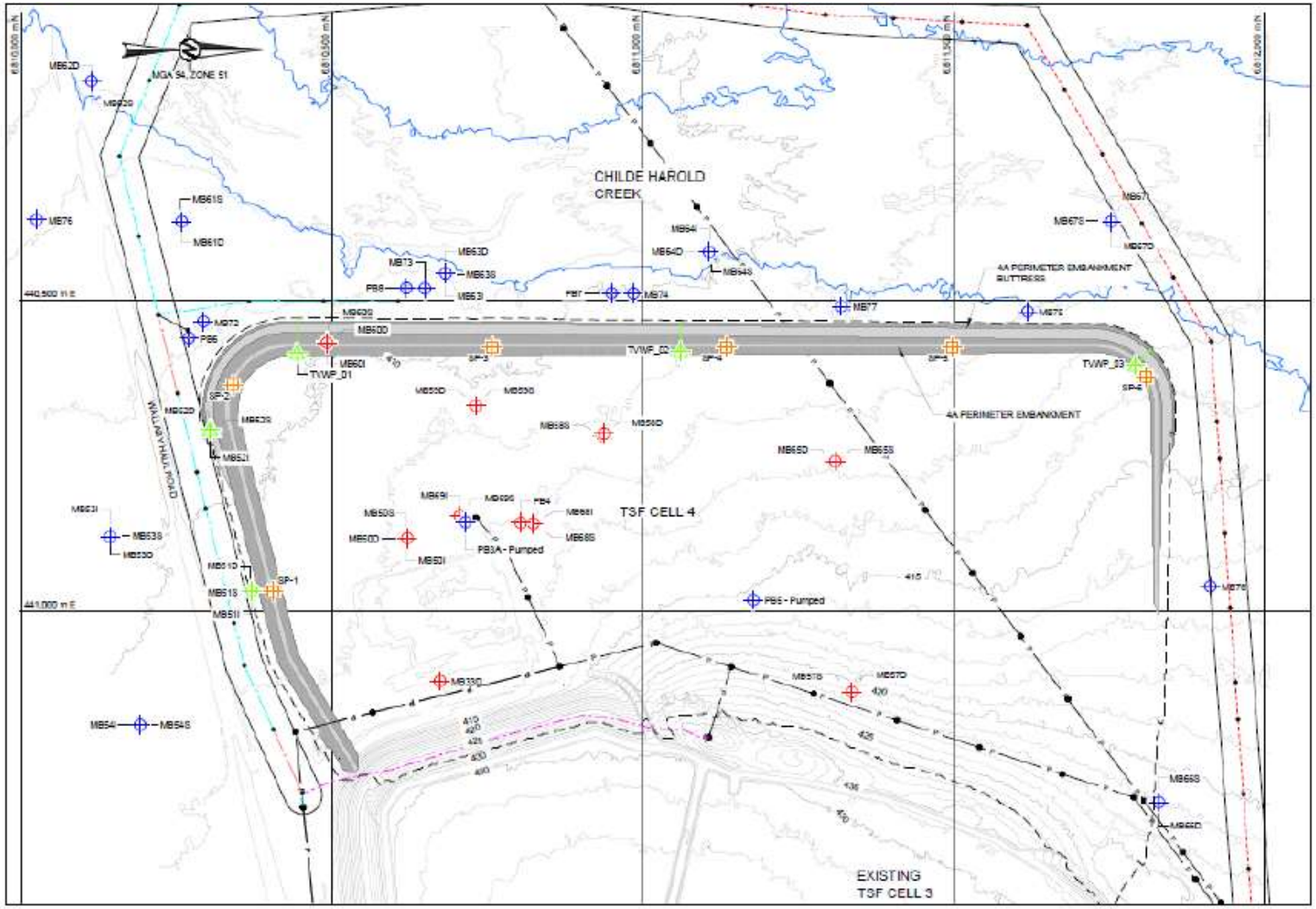

Figure 15: Location of monitoring bores

Appendix 8: Application validation summary

SECTION 1: APPLICATION SUMMARY					
Application type					
Works approval	☐				
Licence	☐	Relevant works approval number:		None	☐
		Has the works approval been complied with?		Yes ☐ No ☐	
		Has time limited operations under the works approval demonstrated acceptable operations?		Yes ☐ No ☐ N/A ☐	
		Environmental Compliance Report / Critical Containment Infrastructure Report submitted?		Yes ☐ No ☐	
		Date Report received:			
Renewal	☐	Current licence number:			
Amendment to works approval	☒	Current works approval number:	W6449/2020/1		
Amendment to licence	☐	Current licence number:			
		Relevant works approval number:		N/A	☐
Registration	☐	Current works approval number:		None	☐
Date application received		5 December 2022			
Applicant and Premises details					
Applicant name/s (full legal name/s)		GSM Mining Company Pty Ltd			
Premises name		Granny Smith Gold Mine			
Premises location		Mining leases L38/205 and L38/532			
Local Government Authority		Shire of Laverton			
Application documents					
HPCM file reference number:		DER2020/000457			
Key application documents (additional to application form):		• Golder WSP memorandum: GSM Cell 4 TSF – Basin Liner Review • Site investigation plans • Works Approval W6449 • SRK: Review of Cell 4 TSF propose basin liner – variation to works approval			

	• Authorisation to act as a Representative of the Occupier
Scope of application/assessment	
Summary of proposed activities or changes to existing operations.	Works approval W6449/2020/1 pertains to the Cell 4 Tailings Storage Facility (TSF) at Gold Fields Australia (GFA) Granny Smith Mine (GSM). When preparing the works approval application, the basin floor permeability targets included in the works approval conditions were considered achievable based on the available information. However, during the detailed designed phase of the Cell 4 TSF project, it became clear that the seepage control measure targets specifically associated with the basin or floor of the TSF: 1. May not be achievable in localised areas where insitu compaction of the natural subgrade did not meet the permeability target and placement of a cover of lower permeability was required, due to the unavailability of suitable construction materials (an example is where rocky subgrade exists at the base of the hill between Cell 4 and Cell 3) and; 2. Are not critical to achieve the overall design intent (reduce the permeability in the basin floor to limit the seepage of contaminated water that has the potential to adversely impact groundwater, soil, and native vegetation).

Category number/s (activities that cause the premises to become prescribed premises)

Table 1: Prescribed premises categories

Prescribed premises category and description	Assessed production or design capacity	Proposed changes to the production or design capacity (amendments only)
Category 5: processing of ore	4 500 000 tonnes per year	No change to throughput

Legislative context and other approvals		
Has the applicant referred, or do they intend to refer, their proposal to the EPA under Part IV of the EP Act as a significant proposal?	Yes ☐ No ☒	Referral decision No: Managed under Part V ☐ Assessed under Part IV ☐
Does the applicant hold any existing Part IV Ministerial Statements relevant to the application?	Yes ☐ No ☒	Ministerial statement No: EPA Report No:
Has the proposal been referred and/or assessed under the EPBC Act?	Yes ☐ No ☒	Reference No:
Has the applicant demonstrated occupancy (proof of occupier status)?	Yes ☒ No ☐	Certificate of title ☐ General lease ☐ Expiry: Mining lease / tenement ☒ Expiry: **M38/532 – exp: 2029**

		M38/205 – exp: 2031 Other evidence ☐ Expiry:
Has the applicant obtained all relevant planning approvals?	Yes ☒ No ☐ N/A ☐	Approval: **Mining Proposal for TSF Cell 4 REGID 91496**
Has the applicant applied for, or have an existing EP Act clearing permit in relation to this proposal?	Yes ☒ No ☐	No additional land clearance required for amendment, total project up to 150 hectares of vegetation and ground clearing is required; approved under NVCP-9100-1
Has the applicant applied for, or have an existing CAWS Act clearing licence in relation to this proposal?	Yes ☐ No ☒	Application reference No: N/A Licence/permit No: N/A
Has the applicant applied for, or have an existing RIWI Act licence or permit in relation to this proposal?	Yes ☐ No ☒	Application reference No: N/A Licence/permit No: N/A
Does the proposal involve a discharge of waste into a designated area (as defined in section 57 of the EP Act)?	Yes ☐ No ☒	N/A
Is the Premises situated in a Public Drinking Water Source Area (PDWSA)?	Yes ☐ No ☒	Name: N/A Priority: N/A Are the proposed activities/ landuse compatible with the PDWSA (refer to WQPN 25)? Yes ☐ No ☐ N/A ☒

Is the Premises subject to any other Acts or subsidiary regulations (e.g. *Dangerous Goods Safety Act 2004, Environmental Protection (Controlled Waste) Regulations 2004, State Agreement Act xxxx*)	Yes ☒ No ☐	*Mining Act 1978*
Is the Premises within an Environmental Protection Policy (EPP) Area?	Yes ☐ No ☒	
Is the Premises subject to any EPP requirements?	Yes ☐ No ☒	
Is the Premises a known or suspected contaminated site under the *Contaminated Sites Act 2003*?	Yes ☐ No ☒	Classification: N/A Date of classification: N/A