Government of Western Australia
Department of Water and Environmental Regulation

Works Approval

Works approval number	W6502/2021/1
Works approval holder	Northern Star (HBJ) Pty Ltd
ACN	127026519
Registered business address	Level 1 388 Hay Street Subiaco WA 6008
DWER file number	DER2021/000013
Duration	24/08/2021 to 23/08/2028
Date of issue	24/08/2021
Premises details	Jubilee Gold Mine Lot 15 on Plan 58833, Lot 50 on Plan 226299 and Lot 51 on Plan 226303, Feysville, Lot 103 on Plan 40395 Lot 105 on Plan 40396, Karamindie, and mining tenements M26/118, M26/143, M26/204 and M15/456

Prescribed premises category description (Schedule 1, *Environmental Protection Regulations 1987*)	**Assessed production / design capacity**
Category 5: Processing or beneficiation of metallic or non-metallic ore	1.2 Mtpa

This works approval is granted to the works approval holder, subject to the attached conditions, on 24 August 2021, by:

Lauren Edmands

Digitally signed by Lauren Edmands
Date: 2021.08.24 15:21:17 +08'00'

Lauren Edmands
MANAGER RESOURCE INDUSTRIES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Works approval history

Date	Reference number	Summary of changes
24/08/2021	W6502/2021/1	Works approval granted

Interpretation

In this works approval:

(a) the words ‘including’, ‘includes’ and ‘include’ in conditions mean “including but not limited to”, and similar, as appropriate;

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a condition, each row in a table constitutes a separate condition;

(d) any reference to an Australian or other standard, guideline, or code of practice in this works approval:

(i) if dated, refers to that particular version; and

(ii) if not dated, refers to the latest version and therefore may be subject to change over time;

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act; and

(f) unless specified otherwise, all definitions are in accordance with the EP Act.

NOTE: This works approval requires specific conditions to be met but does not provide any implied authorisation for other emissions, discharges, or activities not specified in this works approval.

Works approval conditions

The works approval holder must ensure that the following conditions are complied with:

Construction phase

Infrastructure and equipment

1. The works approval holder is authorised to construct embankment raises for TSF3A/3B to the construction height under supervision of a suitably qualified geotechnical engineer as specified in Table 1.

Table 1 Staged construction heights for TSF3A/3B

Stages	Requirements	Construction height (m)
Stage 4	Upstream construction as per Figure 2	RL358 m
Stage 5	In accordance with the provided *Design for TSF3 Raising Report (Coffey, 2020),* Sections 5 and 8 (as set out in Schedule 3)	RL361 m
Stage 6		RL364 m

2. The works approval holder must design, construct, and install groundwater monitoring wells in accordance with the requirements specified in Table 2.

Table 2 Infrastructure requirements – groundwater monitoring wells

Infrastructure	Design, construction, and installation requirements	Monitoring well location(s)	Timeframe
Groundwater monitoring well(s) JMB21, JMB22, JMB23	<u>Well design and construction:</u> Designed and constructed in accordance with *ASTM D5092/D5092M-16: Standard practice for design and installation of groundwater monitoring bores* where applicable. Well screens must target the part, or parts, of the aquifer most likely to be affected by contamination[1]. Where temporary/seasonal perched features are present, wells must be nested, and the perched features individually screened.	As depicted in Schedule 1, Figure 3: Map of proposed groundwater monitoring well locations	Must be constructed, developed (purged), and determined to be operational prior to the commencement of time limited operations.
	<u>Logging of borehole:</u> Soil samples must be collected and logged during the installation of the monitoring wells. A record of the geology encountered during drilling must be described and classified in accordance with the *Minimum Construction Requirements for Water Bores in Australia,* ensuring that sufficient information is recorded to provide a thorough understanding of the geological profile. Any observations of staining / odours or other indications of contamination must be included in the bore log.		
	<u>Well construction log:</u> Well construction details must be documented within a well construction log to		

Infrastructure	Design, construction, and installation requirements	Monitoring well location(s)	Timeframe
	demonstrate compliance with *ASTM D5092/D5092M-16* where applicable for well design and construction. The construction logs shall include elevations of the top of casing position to be used as the reference point for water-level measurements, and the elevations of the ground surface protective installations.		
	Well development: All installed monitoring wells must be developed after drilling to remove fine sand, silt, clay and any drilling mud residues from around the well screen to ensure the hydraulic functioning of the well. A detailed record should be kept of well development activities and included in the well construction log.		
	Installation survey: the vertical (top of casing) and horizontal position of each monitoring well must be surveyed and subsequently mapped by a suitably qualified surveyor.		
	Well network map: a well location map (using aerial image overlay) must be prepared and include the location of all monitoring wells in the monitoring network and their respective identification numbers.		

Note 1: refer to Section 8 of Schedule B2 of the *Assessment of Site Contamination NEPM* for guidance on well screen depth and length.

3. The works approval holder must construct and/or install the infrastructure listed in Table 3, in accordance with:

(a) the corresponding design and construction requirement / installation requirement; and

(b) at the corresponding infrastructure location; and

(c) within the corresponding timeframe,

as set out in Table 3.

Table 3 Design and construction requirements / installation requirements

Infrastructure	Design and construction requirement / installation requirement	Infrastructure location	Timeframe
Seepage recovery bores	Installation and construction of seepage recovery bores in TSF3A/3B proximity. Appropriate location and number of bores to be assessed and identified by suitably qualified hydrogeologist.	Must be situated at locations targeted to recover seepage from TSF3A/3B.	Must be constructed and determined to be operational by no later than 90 calendar days from the commencement of time limited operations for items 1, 2 and 3 as set out in Condition 8.

Compliance reporting

4. The works approval holder must within 30 calendar days of an item of infrastructure or equipment required by conditions 1, 2 and 3 being constructed and/or installed:

(a) undertake an audit of their compliance with the requirements of conditions 1, 2 and 3; and

(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

5. The Environmental Compliance Report required by condition 4, must include as a minimum the following:

(a) certification by a suitably qualified geotechnical engineer, that the infrastructure or component(s) thereof, as specified in condition 1 have been constructed in accordance with the relevant requirements specified in condition 1

(b) certification by a suitably qualified geotechnical engineer, that the infrastructure or component(s) thereof, as specified in condition 1 have been constructed to satisfy the design intent

(c) records of all construction quality control testing, the basis of any method specification adopted and any significant modifications to the original design including their justification for infrastructure or component(s) thereof, as specified in condition 1;

(d) as-built drawings for the embankment earthworks and pipework for infrastructure or component(s) thereof, as specified in condition 1;

(e) certification by a suitably qualified hydrogeologist, with a minimum of three years relevant experience, that the infrastructure or component(s) thereof, as specified in condition 2, have been constructed in accordance with the relevant requirements specified in condition 2;

(f) certification by a suitably qualified hydrogeologist, with a minimum of three years relevant experience, that the infrastructure or component(s) thereof, as specified in condition 3, have been constructed in accordance with the relevant requirements specified in condition 3;

(g) map clearly showing the location and label of installed seepage recovery bores as specified in condition 3;

(h) bore logs, justification of location and number of seepage recovery bores as specified in condition 3;

(i) be signed by a person authorised to represent the works approval holder and contains the printed name and position of that person.

Time limited operations phase

Commencement and duration

6. The works approval holder may only commence time limited operations for an item of infrastructure identified in condition 1 where the Environmental Compliance Report as required by condition 4 has been submitted by the works approval holder for that item of infrastructure, and the groundwater monitoring bores specified in condition 2 have been installed and are operational.

7. The works approval holder may conduct time limited operations for an item of infrastructure specified in condition 8:

(a) for a period not exceeding 180 calendar days from the day the works approval holder meets the requirements of condition 6 for that item of infrastructure; or

(b) until such time as a licence for that item of infrastructure is granted in accordance with Part V of the *Environmental Protection Act 1986*, if one is granted before the end of the period specified in condition 7(a)

Time limited operations requirements and emission limits

8. During time limited operations, the works approval holder must ensure that the premises infrastructure and equipment listed in Table 4 and located at the corresponding infrastructure location is maintained and operated in accordance with the corresponding operational requirement set out in Table 4.

Table 4 Infrastructure and equipment requirements during time limited operations

Item No.	Site infrastructure and equipment	Operational requirement	Infrastructure location
1.	TSF3A/3B Stage 4	• Supernatant decant water recovery system comprises of pump returning water to the process water pond for re-use in the process • Tailings deposition using subaerial deposition techniques from multiple spigot points around the crest • Requirements as set out in *Design for TSF3 Raising Report (Coffey, 2020),* sections 5 and 8 as outlined in Schedule 3.	Figure 2
2.	TSF3A/3B Stage 5		
3.	TSF3A/3B Stage 6		
4.	Seepage recovery bores	• To recover seepage resulting from TSF3A/3B during time limited operations of item 1,2 and 3 of Table 4.	To be confirmed; To recover seepage from TSF3A/3B

Compliance reporting

9. The works approval holder must submit to the CEO a report on the time limited operations within 30 calendar days of the completion date of time limited operations or 30 calendar days before the expiration date of the works approval, whichever is the sooner.

10. The works approval holder must ensure the report required by condition 9 includes the following:

(a) a summary of the time limited operations, including timeframes and amount of tailings deposited processed;

(b) a summary of groundwater monitoring results obtained during time limited operations under condition 11;

(c) volume of seepage recovered via seepage recovery bores;

(d) a review of performance and compliance against the conditions of the works approval; and

(e) where the manufacturer's design specifications and the conditions of this works approval have not been met, what measures will the works approval holder take to meet them, and what timeframes will be required to implement those measures.

Monitoring

11. The works approval holder must conduct a groundwater monitoring programme in accordance with the requirements specified in Schedule 2 and record the results of all monitoring activity conducted under that programme.

12. The works approval holder must adhere to the field quality assurance and quality control procedures specified in Schedule 2 for the monitoring required by condition 11.

13. All sample analysis must be undertaken by laboratories with current accreditation from the National Association of Testing Authorities (NATA) for the relevant parameters, unless otherwise specified in Schedule 2.

Records and reporting (general)

14. The works approval holder must record the following information in relation to complaints received by the works approval holder (whether received directly from a complainant or forwarded to them by the Department or another party) about any alleged emissions from the premises:

(a) the name and contact details of the complainant, (if provided);

(b) the time and date of the complaint;

(c) the complete details of the complaint and any other concerns or other issues raised; and

(d) the complete details and dates of any action taken by the works approval holder to investigate or respond to any complaint.

15. The works approval holder must maintain accurate and auditable books including the following records, information, reports, and data required by this works approval:

(a) the works conducted in accordance with conditions 1, 2 and 3

(b) any maintenance of infrastructure that is performed in the course of complying with conditions of this works approval;

(c) monitoring programmes undertaken in accordance with conditions 11, 12 and 13; and

(d) complaints received under condition 14.

16. The books specified under condition 15 must:

(a) be legible;

(b) if amended, be amended in such a way that the original version(s) and any subsequent amendments remain legible and are capable of retrieval;

(c) be retained by the works approval holder for the duration of the works approval; and

(d) be available to be produced to an inspector or the CEO as required.

Definitions

In this works approval, the terms in Table 5 have the meanings defined.

Table 5: Definitions

Term	Definition
books	has the same meaning given to that term under the EP Act.
CEO	means Chief Executive Officer. CEO for the purposes of notification means: Director General Department administering the *Environmental Protection Act 1986* Locked Bag 10 Joondalup DC WA 6919 info@dwer.wa.gov.au
Department	means the department established under section 35 of the *Public Sector Management Act 1994* and designated as responsible for the administration of Part V Division 3 of the EP Act.
discharge	has the same meaning given to that term under the EP Act.
emission	has the same meaning given to that term under the EP Act.
Environmental Compliance Report	means a report to satisfy the CEO that the conditioned infrastructure and/or equipment has been constructed and/or installed in accordance with the works approval.
EP Act	*Environmental Protection Act 1986* (WA).
EP Regulations	*Environmental Protection Regulations 1987* (WA).
Minimum Construction Requirements for Water Bores in Australia	means the document *Minimum Construction Requirements for Water Bores in Australia* developed by the National Uniform Drillers Licensing Committee, as amended from time to time.
monthly period	means a one-month period commencing from first day of a month until the last day of the same month.
premises	the premises to which this licence applies, as specified at the front of this licence and as shown on the premises map (Figure 1) in Schedule 1 to this works approval.
prescribed premises	has the same meaning given to that term under the EP Act.
time limited operations	refers to the operation of the infrastructure and equipment identified under this works approval that is authorised for that purpose, subject to the relevant conditions.

Term	Definition
works approval	refers to this document, which evidences the grant of the works approval by the CEO under section 54 of the EP Act, subject to the conditions.
works approval holder	refers to the occupier of the premises being the person to whom this works approval has been granted, as specified at the front of this works approval.

END OF CONDITIONS

Schedule 1: Maps

Premises map

The boundary of the prescribed premises is shown in the map below (Figure 1).

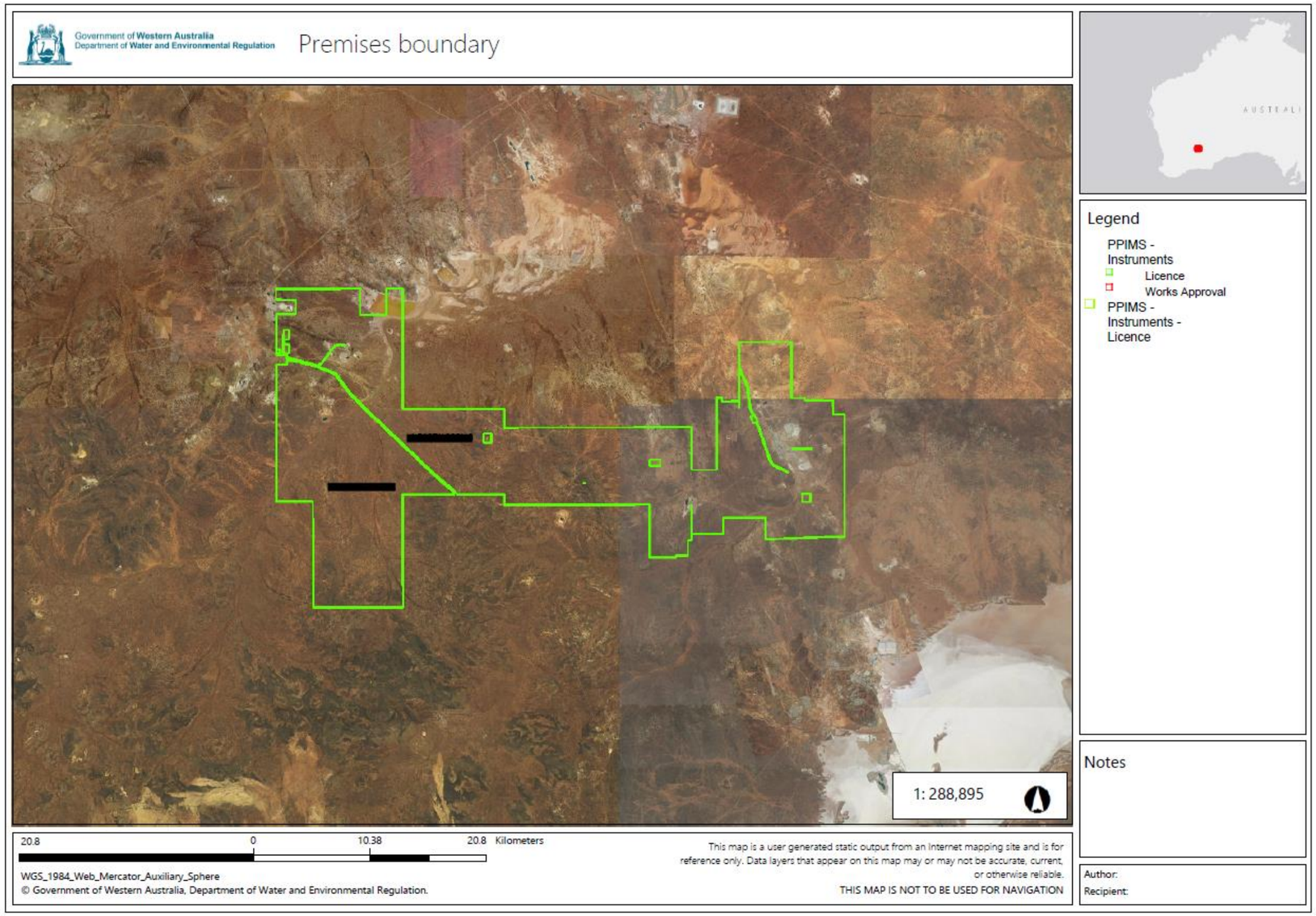


Figure 1: Map of the boundary of the prescribed premises

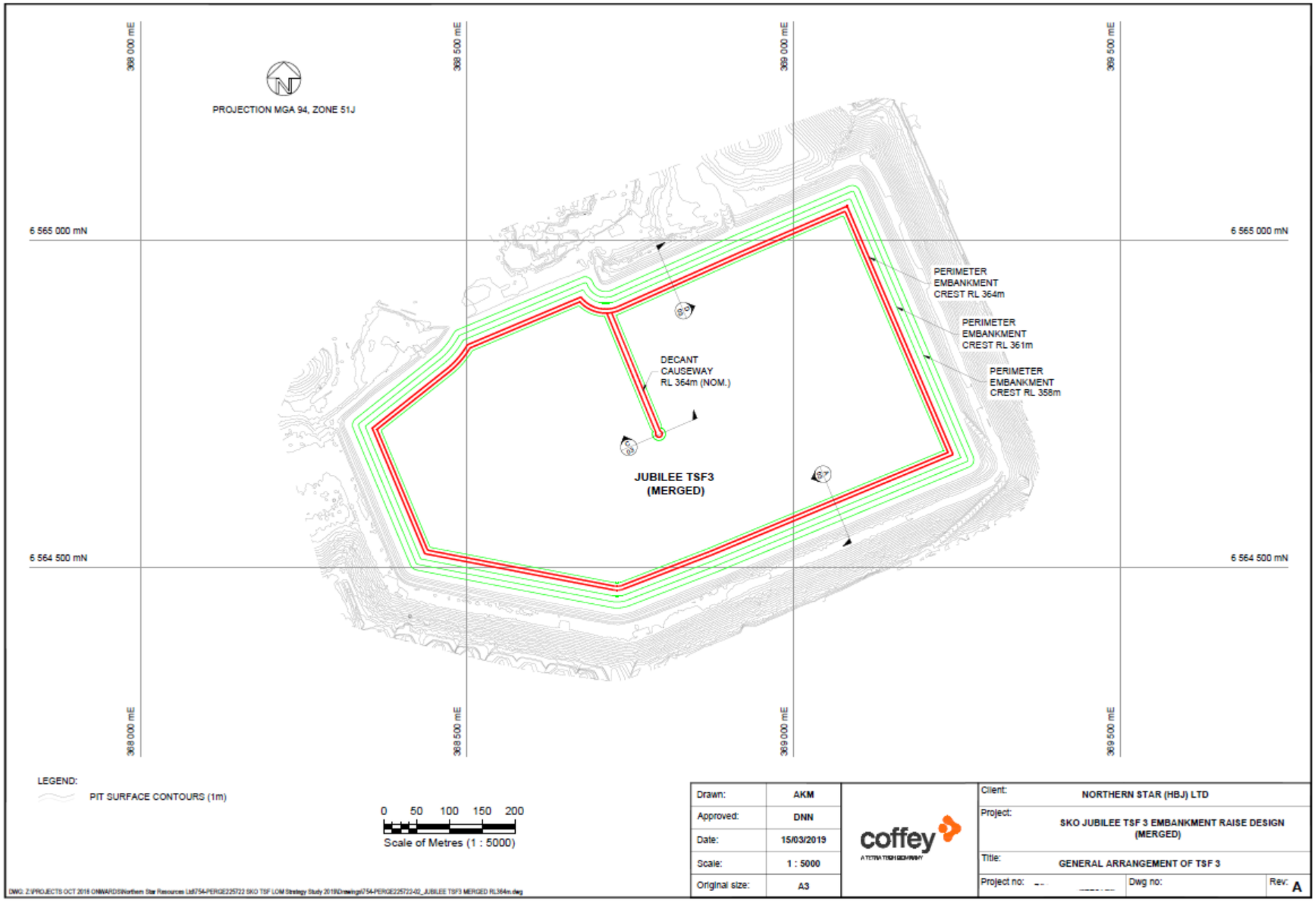


Figure 2 Proposed embankment raise for TSF3A/3B

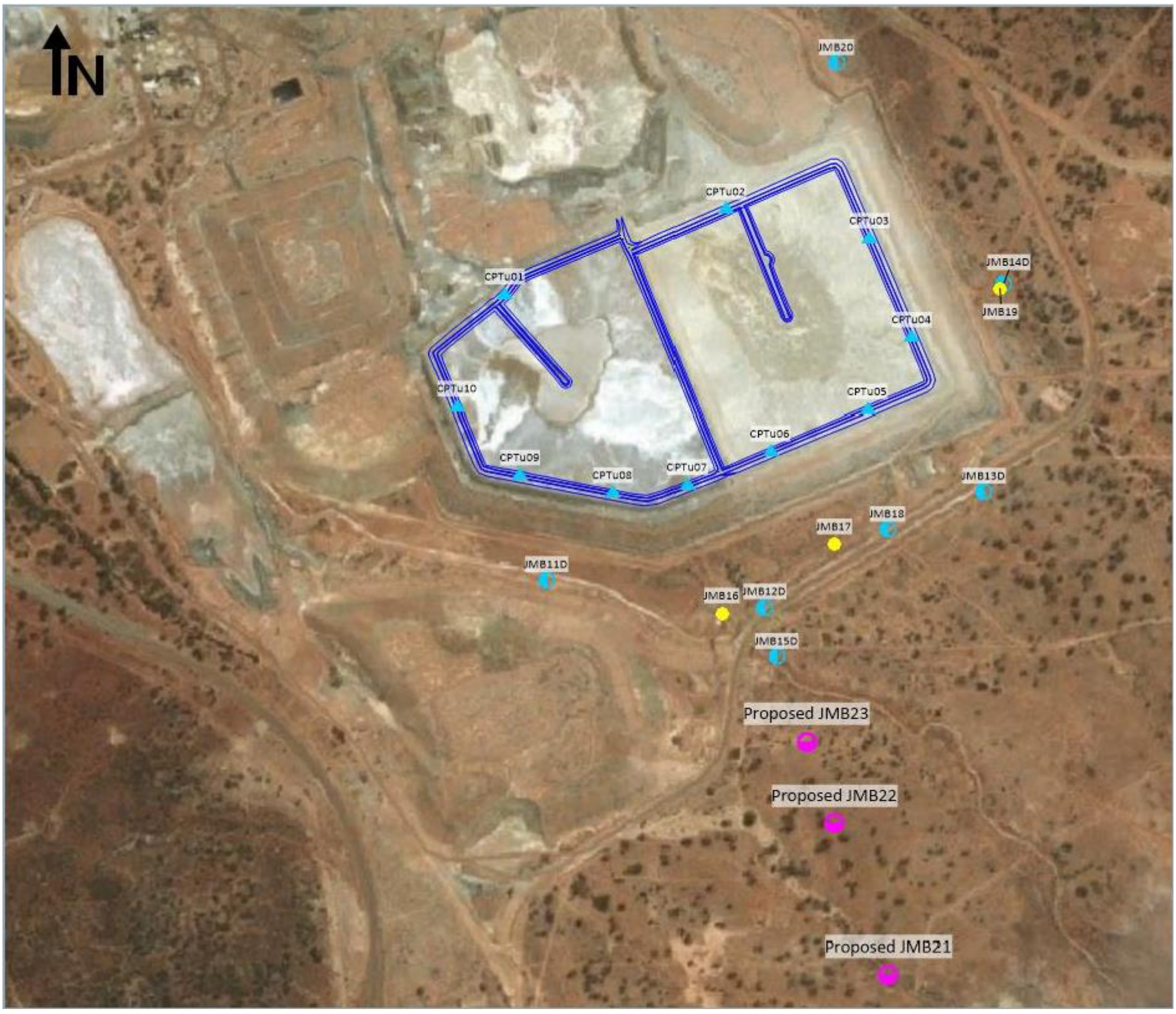


Figure 3 Map of proposed groundwater monitoring well locations

Figure 4 Production bores Bore B and Bore

Schedule 2: Monitoring

Groundwater monitoring

17. The licence holder must monitor groundwater

(a) prior to and immediately following construction of the item(s) of infrastructure specified in condition 1;

(b) during time limited operations for TSF3A/3B

for concentrations of the identified parameter(s) in accordance with Table 6.

Table 6 Groundwater monitoring of ambient concentrations

Monitoring location	Parameter	Unit	Limit	Frequency	Averaging period	Method
JMB21, JMB22, JMB23 as per Figure 3 Bore B, Bore C as per Figure 4	pH[1]	-	-	Condition 17(a) At least one campaign Condition 17(b) Monthly	Spot sample	AS/NZS 5667.1 AS/NZS 5667.11
	Total dissolved solids[1]	mg/L	-			
	WAD-CN	mg/L	-			
	Total cyanide	mg/L				
	Conductivity		-			
	Standing water level	mbgl	4			

Note 1: pH and TDS are permitted to be measured in the field in accordance with Australian Standard 5667.

Quality assurance and quality control requirements

18. The licence holder must adhere to the following field quality assurance and quality control procedures, as specified in Schedule B2 of the Assessment of Site Contamination NEPM, and must include as a minimum:

(a) decontamination procedures for the cleaning of tools and sampling equipment before sampling and between samples;

(b) field instrument calibration for instruments used on site;

(c) blind replicate samples and rinsate blanks must be collected in the field and sent to the primary laboratory to determine the precision of the field sampling and laboratory analytical program;

(d) completed field monitoring sheets / sampling logs for each sample collected, showing:

(i) time of collection;

(ii) location of collection;

(iii) initials of sampler;

(iv) sampling method;

(v) field analysis results;

(vi) duplicate type / location (if relevant); and

(vii) site observations and weather conditions, and

(e) chain-of-custody documentation must be completed which details the following information:

(i) site identification;

(ii) the sampler;

(iii) nature of the sample;

(iv) collection time and date;

(v) analyses to be performed;

(vi) sample preservation method;

(vii) departure time from site;

(viii) dispatch courier(s); and

(ix) arrival time at the laboratory.

Schedule 3: TSF design specifications

Excerpt of Section 5 (Hazard rating and design criteria) and 8 of the *Design for TSF3 Raising Report (Coffey, 2020)*

5. Hazard rating and design criteria

5.1. Hazard rating

The hazard rating/consequence category is utilised to establish various criteria for design and to assess the risk of TSF failure to a level appropriate to the consequences of such a failure.

Features of the existing TSFs 3A and 3B include:

- Constructed against ('abutting') a substantial waste rock dump on the northern side;
- Located over a kilometre from any significant infrastructure;
- Mine infrastructure (i.e. Jubilee Mill, workshops and offices) is upstream of the facilities, separated and protected by the waste rock dump;
- The topography at the highest embankment sections (southern embankments) slopes to the south-west at a nominal grade of 1:80 away from any infrastructure;

Based on the DMP (2013)2 code of practice and the results of a dam break assessment (Section 15), the hazard rating for the raised and merged TSF 3 at the final Stage 6 crest of RL364m is assessed as 'Medium, Category 1', based on the following:

- Loss of life or injury is possible although not expected;
- Potential human exposure is limited;
- Loss of livestock is possible;
- Temporary loss of assets is possible and economic repairs can be made;
- Loss of TSF storage capacity is possible, and repair is practicable;
- Temporary damage to the natural environment is possible;
- Temporary adverse effects on flora and fauna are possible; and
- Category 1 storage as the maximum embankment height is >15m.

The ANCOLD (2019)4 dam failure consequence category based on the above is derived as Medium damage (Table 1 of ANCOLD (2019)[4]), a PAR of ≥1 to ≤10, and 'Significant' (Table 2 of ANCOLD (2019)[4]). Medium damage is characterised by:

- Any breach is likely to cause less than $10M damage should the embankment fail;
- Significant impacts to business (i.e. the mine);
- Public health of <100 people will be affected;
- Social dislocation of <100 person or <20 business months;
- Impact area 5km2 or less;
- Impact duration less than 5 years;
- Damage limited to items of low conservation value (degraded or cleared rural land, ephemeral streams, non-endangered local flora and fauna. Remediation is possible; and
- The population at risk (PAR) was assessed as ≥1 to ≤10.

The raised TSF 3 has a low hazard with respect to Environmental Spill Consequence Category

(i.e. spilling of water from the dam during a 1:100-year Annual Exceedance Probability (AEP), 72-hour duration rainfall is extremely unlikely (Section 9.2)).

5.2. Design criteria

The following criteria were adopted for the TSF 3 raise design based on the consequence category assessment:

- Production rate of 1.2Mtpa for 10-year LoM;
- The raised TSF 3 can temporarily store stormwater from a 1:100-year AEP, 72-hour storm event plus minimum operational freeboard of 0.3m and beach freeboard of 0.2m (DMIRS, 2015)[3]. Embankment overtopping is unlikely. Therefore, the design does not require a spillway. Refer to Section 9.2 for freeboard details;
- Recommended design earthquake loading: Operating Basic Earthquake (OBE), 1:475-year AEP, Safe Evaluation Earthquake (SEE), 1:1,000-year AEP (ANCOLD, 2019)[4]; and
- The raised TSF 3 top surface will be covered with mine waste and topsoil at the end of the mine life to promote vegetation growth. Refer to Section 19 for closure / rehabilitation concepts.

5.3. Reporting and inspection criteria

Design (including site investigation)	Report prepared in detail by a geotechnically competent person.
Construction	Supervised by a geotechnically competent person. Provision of detailed construction report with as-built drawings.
Operation	Annual inspection and audit by competent person
Pre-closure	Inspection report by competent person confirming current status and intended decommissioning, rehabilitation and monitoring strategies with as-built drawings.
Relinquishment	Final report by competent person confirming closure objectives have been achieved.

An operating manual should be maintained on site to ensure acceptable operations to meet regulatory expectations.

Recommended inspections for a TSF classed ‘Significant’ based on ANCOLD (2019)4:

- Comprehensive: After first year of operation, then 5-yearly;
- Intermediate: Annual;
- Routine: Twice weekly to weekly;
- Special: as required, e.g.
- Seepage along the downstream slope;
- Any embankment slope failure or settlement;
- Any uncontrolled spills of tailings from the TSF footprint;
- Any sustained period where the supernatant pond size exceeds the envisaged operating pond size.

8 Tailings storage facility

8.1. Operation and design considerations

The tailings storage datasheet for TSF 3 is presented on Figure 5. The operational objectives for the merged and raised TSF 3 are focused on:

- Optimising surface water removal for the facility.
- Maximising tailings density and storage capacity by rotating deposition points regularly.
- Reducing environmental impacts (e.g. due to seepage losses) by undertaking the above.

The following considerations were made in the design:

- Tailings in the form of slurry will be discharged sub-aerially (exposed to air) from a slurry ring main around the perimeter embankment.
- Tailings will be deposited in discrete layers from multiple discharge points / spigots at low velocity. The discharge points will be circulated regularly around the facility to ensure even development of the tailings beach sloping towards the central decant facility. The length of time between successive depositions (i.e. drying time) on any one area will be maximised.
- Tailings discharge or spigotting is to be carried out such that a tailings beach forms and the supernatant water pond (from both rainfall events and tailings deposition) is maintained around the decant pump at the centre of the facility. The pond is to be maintained as far as practically possible away from the perimeter embankment at all times (i.e. not less than 150m to the embankment under normal operating conditions). Limiting the size of the supernatant water pond will reduce TSF seepage and evaporation and hence assist in optimising water recovery and tailings density.
- The tailings storage area will assume the form of a depressed cone at its top surface (due to the development of a sloped tailings beach). The facility will be able to contain a considerable volume of water during a storm event. A minimum total freeboard of 0.5m is required in addition to temporary storage of the 1:100-year AEP, 72-hour storm event (219mm), i.e. a minimum combined total freeboard of approximately 0.5m above the normal operating pond level is required (assuming a tailings beach slope of 2%).
- On decommissioning, the TSF will remain a permanent feature of the landscape and drain to an increasingly stable mass. The top surface and the embankment batters will be stabilised and rehabilitated, as described in Section 19.

8.2. Drawings

The following drawings are provided for the raised TSF 3 design from Stage 4 to final Stage 6 (Appendix B). It is noted that construction drawings for future embankment raising will be developed in the future prior to construction commencement.

Title	Drawing No.
Stage 4 Raise - General Arrangement	754-PERGE271742-01
Stage 5 Raise - General Arrangement	754-PERGE271742-02
Stage 6 Raise - General Arrangement	754-PERGE271742-03
Sections and Details	754-PERGE271742-04
Instrumentation	754-PERGE271742-05

8.3. Embankment design and construction method

The existing TSFs 3A and 3B will be merged and raised in stages (Stages 4 to 6) by upstream construction techniques using 3 x 3m lifts, from the existing Stage 3 upstream raised embankment (nominal crest RL355m) to the proposed final Stage 6 crest level of RL364m. At the ultimate crest level, the maximum height of TSF 3 will be approximately 37.5m. The deposited dried tailings located near the perimeter embankment will form the foundation of future embankment raises.

The upstream embankment raising lifts will comprise a 6m 'core' zone of compacted dried tailings borrowed from within the facility. The downstream batters of each tailings lift will be capped with a nominal 0.5m-thick mine waste layer to reduce erosion and facilitate future rehabilitation (Section 19). Each upstream embankment lift will comprise design slopes of 1:3 (vertical to horizontal) downstream and 1:1.5 (vertical to horizontal) upstream.

The embankment crest will have a 2% design crossfall towards the upstream side as well as nominal 0.4m-high windrows at both downstream and upstream edges. Due to the crossfall of the embankment crest (sloping inwards towards the storage), there will be regular 'drainage' gaps (predominantly at discharge points) in the inner windrow to allow for discharge from the crest of any collected rainfall runoff.

The various stages will incorporate a water recovery system comprising a decant rock ring (nominal 10m radius) located at the centre of the facility. The raising of the decant rock ring and access causeway will coincide with perimeter embankment raising. The decant accessway will be raised by centreline construction techniques, using traffic compacted tailings or mine waste. The decant accessway has a minimum design crest width of 6m and design slopes of 1:1 (V: H) for both side slopes and minimum 0.5m-high windrows on both crest edges. The alignment of the decant access causeway will coincide with the common embankment of TSFs 3A and 3B located at the approximate middle of the merged TSF 3.

The perimeter embankment crest will be sheeted with a nominal 100mm-thick layer of wearing course material sourced from a designated location. If tailings are used for decant accessway raising, the accessway crest will also be sheeted with 100mm-thick crushed aggregate wearing course.

Details of the embankment design are presented on drawings in Appendix B. A Scope of Works for the proposed raising and ancillary works is included as Appendix C. For planning purposes, the embankment earthworks volumes estimated for each construction stage (Stages 4 to 6) are summarised in Table 5.

Table 5 – Summary of embankment earthworks volumes

Stage	Crest RL (m)	Embankment, Compacted Tailings 'Core' Zone (m^3)	Embankment, Downstream Capping Zone (m^3)	Sheeting of Embankment (m^3)	Decant Accessway (m^3)
4	358	125,100	11,600	1,650	8,300
5	361	127,300	11,300	1,600	12,400
6 (final)	364	123,900	11,000	1,550	12,300

8.4 Storage characteristics

Table 6 summarises the storage characteristics of the merged and raised TSF 3 (Stages 4 to 6). The staged raises will provide an additional 2.74 x $10_6 m^3$ of storage volume or 4.1Mt, corresponding to about 3.4 years of production based on the advised design tonnage of

1.2Mpta, an average tailings beach slope of 1.5% and an adopted tailings dry density of 1.5t/m³. A storage capacity curve for the raised TSF 3 is presented on Figure 6.

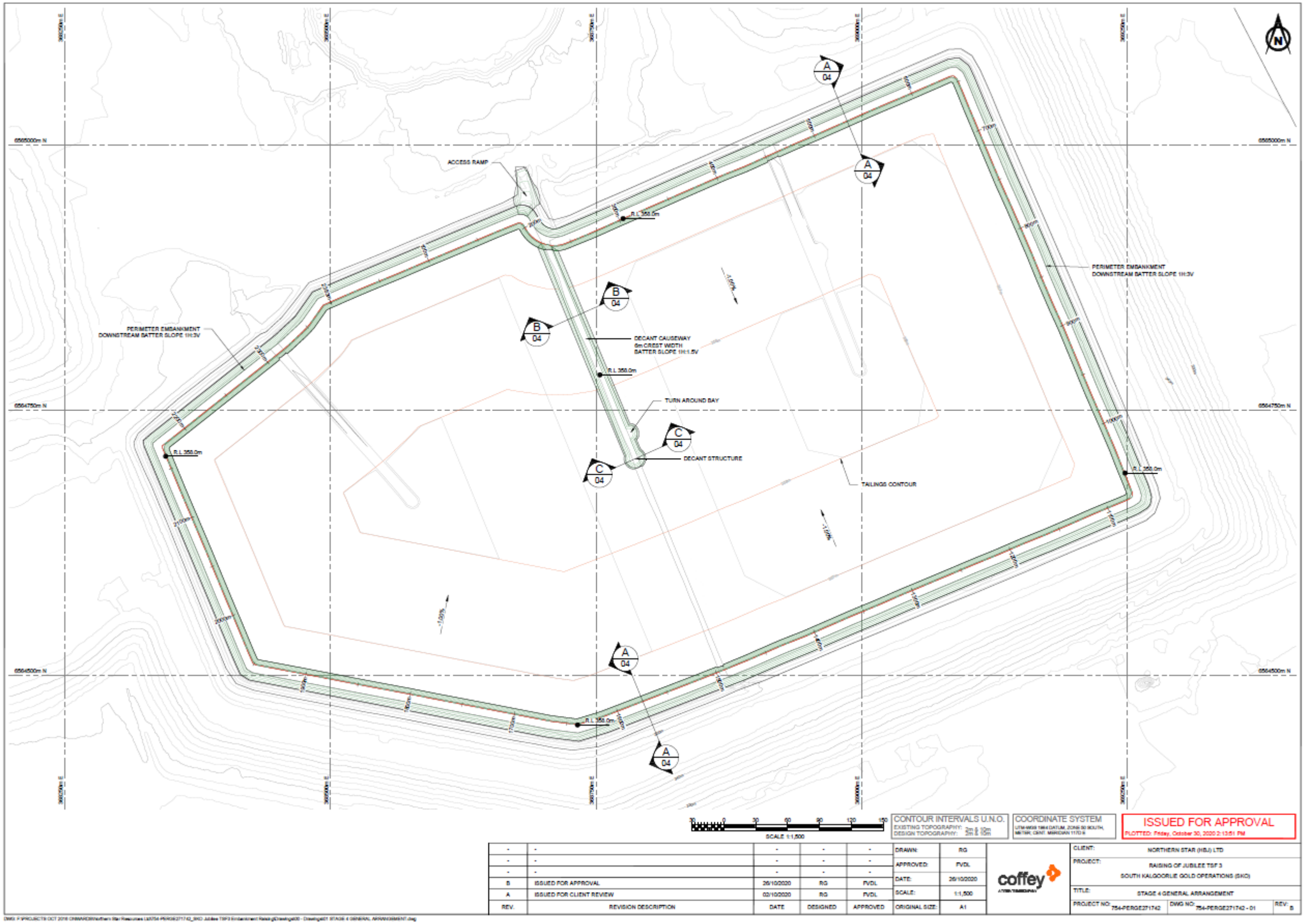
Table 6 – Summary of storage capacity by construction stage

Stage	Crest RL (m)	Maximum Height (m)	Storage Area (ha)	Storage Volume (Mm^3)	Storage Capacity (Mt)	Estimated Life (months)	Estimated Life (years)
4	358.0	36	33.6	897,700	1.34	13	1.1
5	361.0	39	31.5	948,600	1.42	14	1.2
6 (final)	364.0	42	29.4	891,100	1.34	13	1.1
Total				2,737,400	4.1	40	3.4

8.5. Decant water recovery

Tailings deposition will be completed in a manner that enables a free supernatant water pond to pool near the centre of TSF 3. It is proposed that the supernatant decant water recovery system will comprise a pontoon-mounted pump located within a rock ring of nominal 10m radius (pump to be designed by others). Access to the pump will be via the decant accessway. Return water will be pumped back to the process water pond near the plant for re-use in the process.

The decant pond of an oval shape is anticipated as the length in the longitudinal direction (east-west) of approximately 800m is about twice the length of 400m in the transverse direction (north-south). A decant pond volume of approximately 50,000m³ is proposed, which corresponds to an average pond radius of 150m (200m and 100m in the longitudinal and transverse directions, respectively) assuming an oval, conical pond geometry and average of 1.5% (1% and 2% in the longitudinal and transverse directions, respectively) tailings beach slope. This results in a minimum separation distance of 100m between the northern and southern perimeter embankment and the pond extent under normal operating conditions.


ACCESS RAMP
PERIMETER EMBANKMENT
DOWNSTREAM BATTER SLOPE 1H:3V
DECANT CAUSEWAY
6m CREST WIDTH
BATTER SLOPE 1H:1.5V
TURN AROUND BAY
DECANT STRUCTURE
TAILINGS CONTOUR
R.L 358.0m
6565000m N
6564750m N
6564500m N
CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 2m & 10m
DESIGN TOPOGRAPHY: 2m & 10m
COORDINATE SYSTEM
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DRAWN: RG
APPROVED: FVDL
DATE: 26/10/2020
SCALE: 1:1,500
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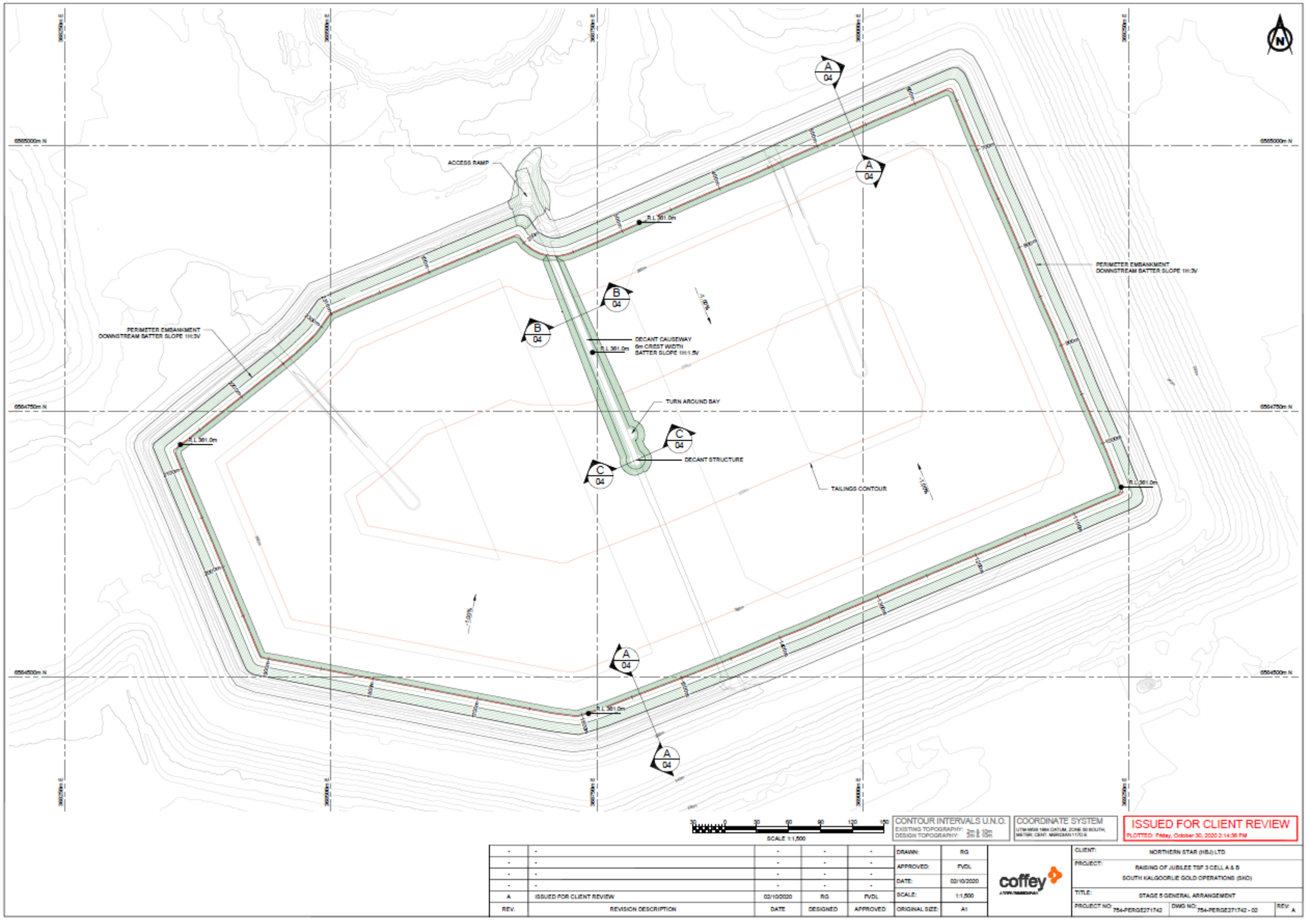
CLIENT: NORTHERN STAR (HBJ) LTD
PROJECT: RAISING OF JUBILEE TSF 3
SOUTH KALGOORLIE GOLD OPERATIONS (SKO)
TITLE: STAGE 4 GENERAL ARRANGEMENT
PROJECT NO: 754-PERGE271742
DWG NO: 754-PERGE271742 - 01
REV: B
REV. | REVISION DESCRIPTION | DATE | DESIGNED | APPROVED
B | ISSUED FOR APPROVAL | 26/10/2020 | RG | FVDL
A | ISSUED FOR CLIENT REVIEW | 02/10/2020 | RG | FVDL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PERIMETER EMBANKMENT
DOWNSTREAM BATTER SLOPE 1H:3V
R.L 361.0m
DECANT CAUSEWAY
6m CREST WIDTH
BATTER SLOPE 1H:1.5V
TURN AROUND BAY
DECANT STRUCTURE
TAILINGS CONTOUR
6565000m N
6564750m N
6564500m N
SCALE 1:1,500
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EXISTING TOPOGRAPHY:
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APPROVED: FVDL
DATE: 02/10/2020
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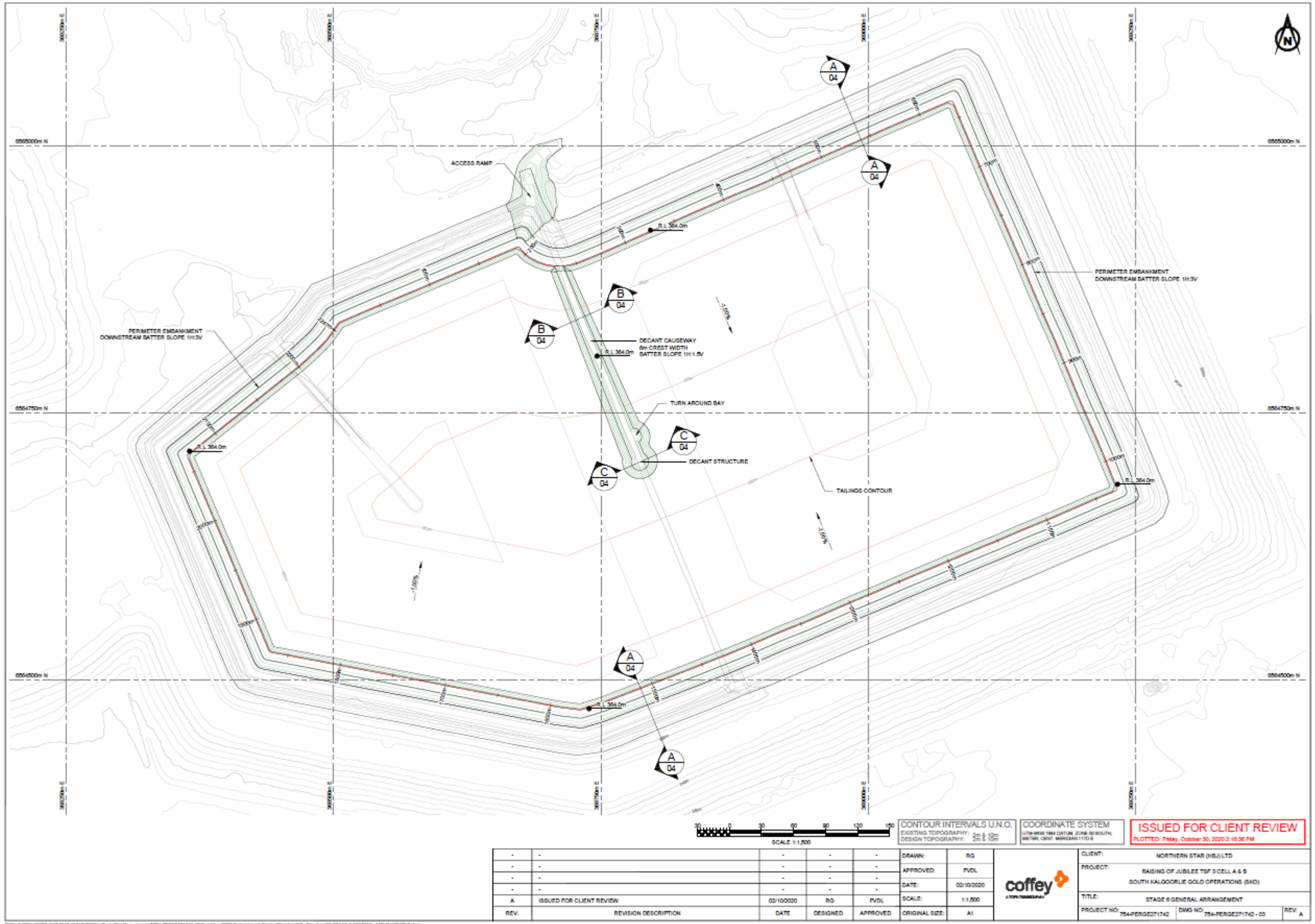
coffey
CLIENT: NORTHERN STAR (HBJ) LTD
PROJECT: RAISING OF JUBILEE TSF 3 CELL A & B
SOUTH KALGOORLIE GOLD OPERATIONS (SKO)
TITLE: STAGE 5 GENERAL ARRANGEMENT
PROJECT NO: 754-PERGE271742
DWG NO: 754-PERGE271742 - 02
REV: A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6m CREST WIDTH
BATTER SLOPE 1H:1.5V
TURN AROUND BAY
DECANT STRUCTURE
TAILINGS CONTOUR
R.L 364.0m
A 04
B 04
C 04
SCALE 1:1,500
CONTOUR INTERVALS U.N.O.
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DESIGN TOPOGRAPHY: 2m & 10m
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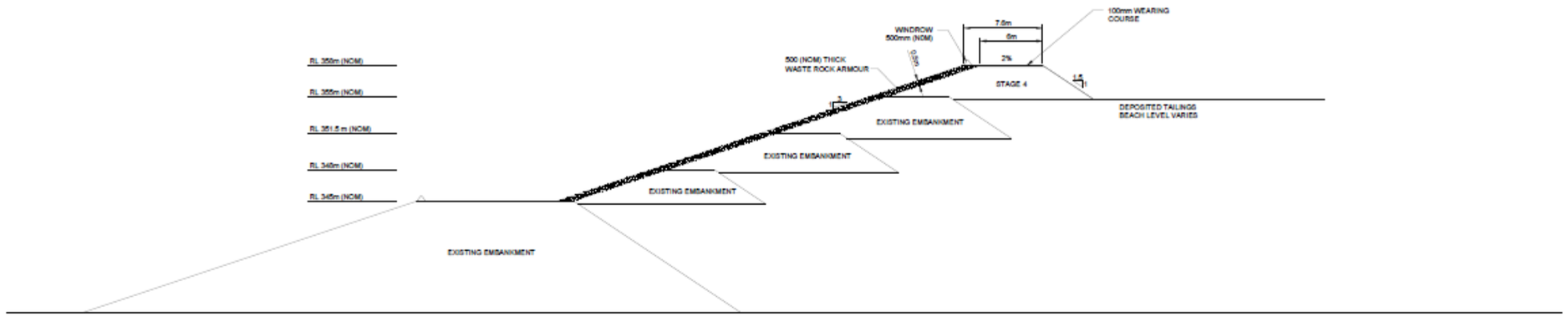
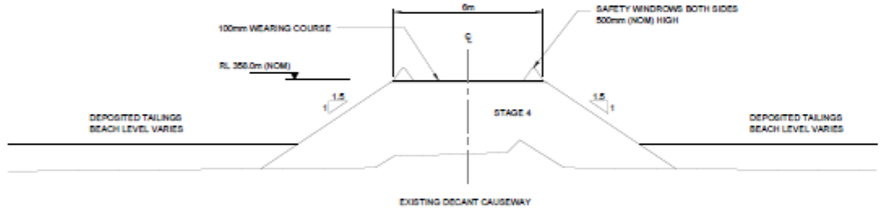
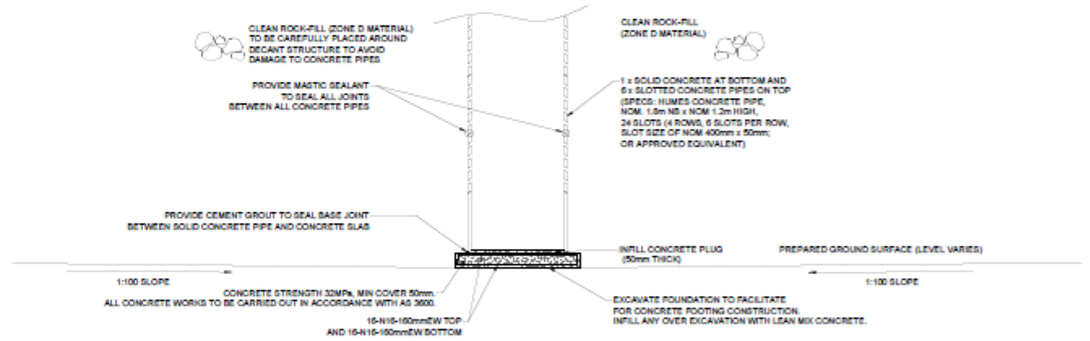
APPROVED: FVDL
DATE: 02/10/2020
SCALE: 1:1,500
ORIGINAL SIZE: A1
coffey
CLIENT: NORTHERN STAR (HBJ) LTD
PROJECT: RAISING OF JUBILEE TSF 3 CELL A & B
SOUTH KALGOORLIE GOLD OPERATIONS (SKO)
TITLE: STAGE 6 GENERAL ARRANGEMENT
PROJECT NO: 754-PERGE271742
DWG NO: 754-PERGE271742 - 03
REV: A



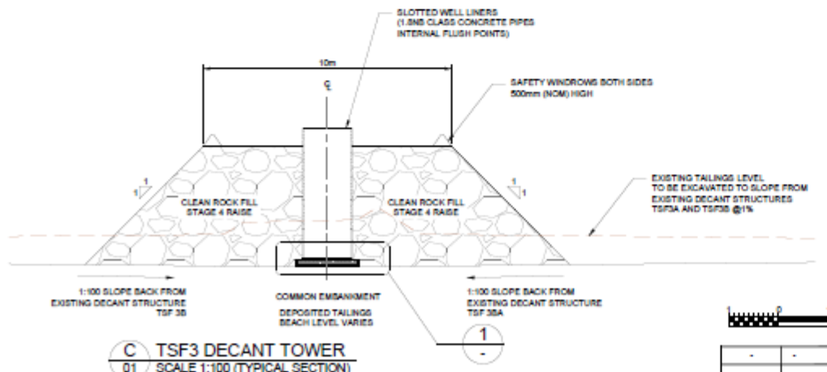
A 01 TSF PERIMETER EMBANKMENT
SCALE 1:200 (TYPICAL SECTION)



B 01 TSF3 DECANT CAUSEWAY
SCALE 1:100 (TYPICAL SECTION)



1 - DECANT FOOTING DETAIL
SCALE 1:50 (TYPICAL SECTION)



C 01 TSF3 DECANT TOWER
SCALE 1:100 (TYPICAL SECTION)

SCALE 1:50 SCALE 1:100 SCALE 1:200

ISSUED FOR APPROVAL
PLOTTED: Tuesday, November 3, 2020 11:39:28 AM

REV.	REVISION DESCRIPTION	DATE	DESIGNED	APPROVED
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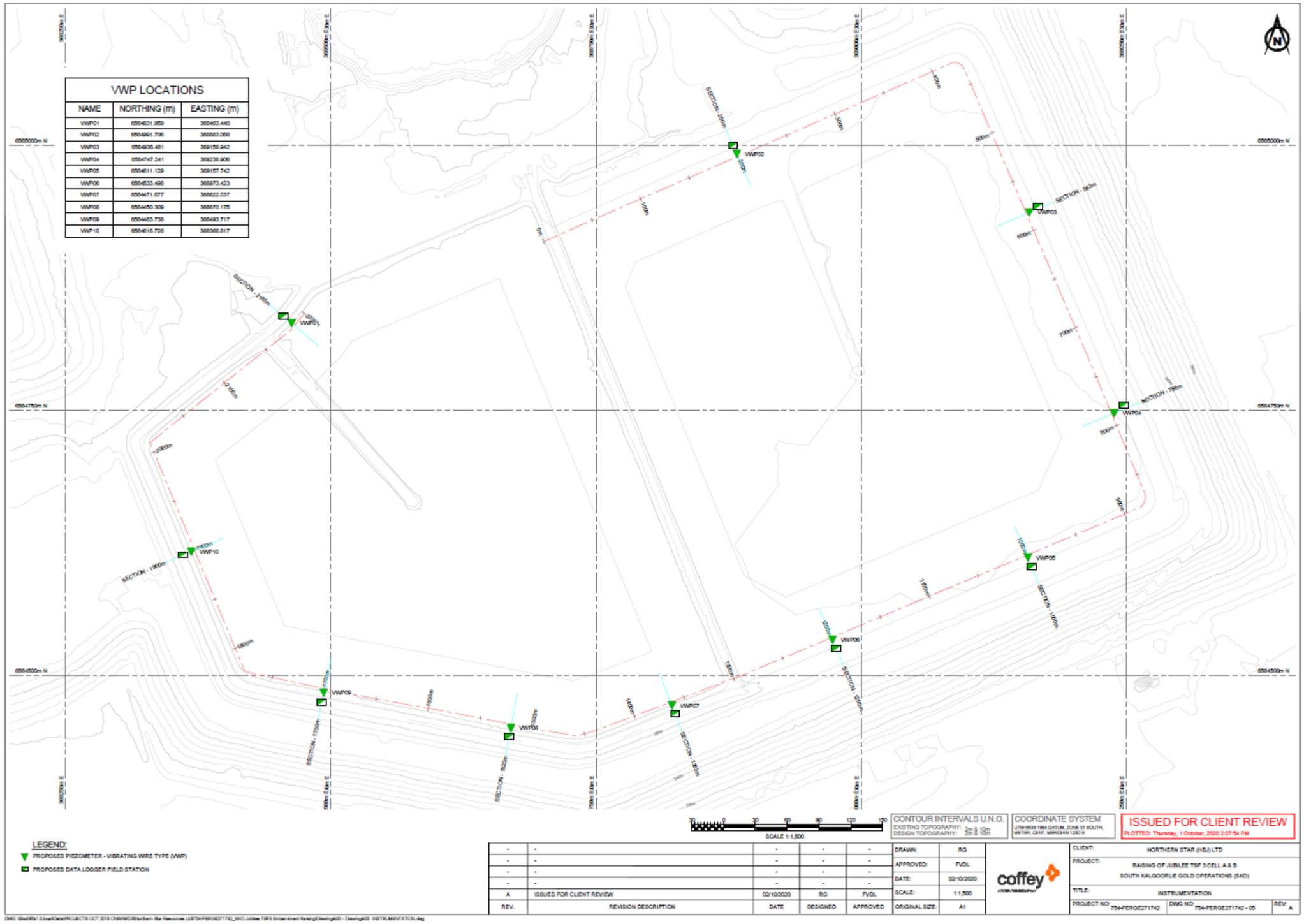
-	-	-	-	-
-	-	-	-	-
B	ISSUED FOR APPROVAL	26/10/2020	RG	FVDL
A	ISSUED FOR CLIENT REVIEW	02/10/2020	RG	FVDL

DRAWN:	RG
APPROVED:	FVDL
DATE:	26/10/2020
SCALE:	1:1,500
ORIGINAL SIZE:	A1

coffey

CLIENT: NORTHERN STAR (HBJ) LTD
PROJECT: RAISING OF JUBILEE TSF 3
SOUTH KALGOORLIE GOLD OPERATIONS (SKO)
TITLE: SECTIONS & DETAILS STAGE 4
PROJECT NO: 754-PERGE271742 DWG NO: 754-PERGE271742 - 04 REV: B


VWP LOCATIONS
NAME | NORTHING (m) | EASTING (m)
VWP01 | 6564631.959 | 368463.440
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VWP03 | 6564936.481 | 369158.942
VWP04 | 6564747.241 | 369238.906
VWP05 | 6564611.129 | 369157.742
VWP06 | 6564533.498 | 368973.423
VWP07 | 6564471.677 | 368822.037
VWP08 | 6564450.309 | 368670.175
VWP09 | 6564483.738 | 368493.717
VWP10 | 6564616.726 | 368368.617
6565000m N
6564750m N
6564500m N
SECTION - 2450m
SECTION - 963m
SECTION - 2100m
SECTION - 1900m
SECTION - 1700m
SECTION - 920m
SECTION - 1450m
SECTION - 2400m
SECTION - 1400m
SECTION - 786m
LEGEND:
PROPOSED PIEZOMETER - VIBRATING WIRE TYPE (VWP)
PROPOSED DATA LOGGER FIELD STATION
SCALE 1:1,500
CONTOUR INTERVALS U.N.O.
EXISTING TOPOGRAPHY: 2m & 10m
DESIGN TOPOGRAPHY: 2m & 10m
COORDINATE SYSTEM
ISSUED FOR CLIENT REVIEW
PLOTTED: Thursday, 1 October, 2020 2:27:54 PM
A | ISSUED FOR CLIENT REVIEW | 02/10/2020 | RG | FVDL
REV. | REVISION DESCRIPTION | DATE | DESIGNED | APPROVED
DRAWN: RG
APPROVED: FVDL
DATE: 02/10/2020
SCALE: 1:1,500
ORIGINAL SIZE: A1
coffey
CLIENT: NORTHERN STAR (HBJ) LTD
PROJECT: RAISING OF JUBILEE TSF 3 CELL A & B
SOUTH KALGOORLIE GOLD OPERATIONS (SKO)
TITLE: INSTRUMENTATION
PROJECT NO: 754-PERGE271742
DWG NO: 754-PERGE271742 - 05
REV: A