Government of Western Australia
Department of Water and Environmental Regulation

Works Approval

Works approval number	W6694/2022/1
Works approval holder	South32 Worsley Alumina Pty Ltd
ACN	008 905 155
Registered business address	Gastaldo Road ALLANSON WA 6225
DWER file number	DER2022/000252
Duration	12/10/2022 to 11/10/2025
Date of issue	12 October 2022 Worsely Alumina Refinery
Premises details	Gastaldo Road, ALLANSON WA 6225 Legal description - Lease No 3116/7574 being Wellington Locations 5314-5317 on Deposited Plan 220209 As defined by the premises maps attached to the issued works approval

Prescribed premises category description (Schedule 1, *Environmental Protection Regulations 1987*)	**Assessed production / design capacity**
Category 46: Bauxite refining	4.7 million tonnes per annual period assessed production capacity
Category 52: Electric power generation	260 Mega Watts per annual period design capacity
Category 53: Flyash disposal	110,000 tonnes per annual period assessed production capacity
Category 54: Sewage facility	270 cubic metres per day design capacity
Category 61: Liquid waste facility	100 tonnes per annual period assessed production capacity
Category 63: Class I Inert landfill site	15,000 tonnes per annual period assessed production capacity
Category 89: Putrescible landfill site	500 tonnes per annual period assessed production capacity

This works approval is granted to the works approval holder, subject to the attached conditions, on 12 October 2022, by:

Caron Goodbourn
Digitally signed by Caron Goodbourn
Date: 2022.10.12 12:20:40 +08'00'

Caron Goodbourn
MANAGER, PROCESS INDUSTRIES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

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 must:

(a) construct and/or install the infrastructure and/or equipment;

(b) in accordance with the corresponding design and construction / installation requirements; and

(c) at the corresponding infrastructure location; and

(d) within the corresponding timeframe,

as set out in Table 1.

Table 1: Design and construction / installation requirements

	Infrastructure	Design and construction / installation requirements	Infrastructure location
1.	Embankment subgrade and residue surface works	<u>Upstream embankments</u> • Includes ripping of the surface and where required treatment of localized soft areas through use of a geogrid reinforcement layer and grading of the ripped area of the width of the raise footprint; • Bauxite residue will be confirmed at a minimum undrained shear strength of >100 kPa from the residue surface to 1m depth and >40 kPa below to 2m depth prior to upstream raises being positioned on existing bauxite residue.	N/A
2.	Residue Underdrainage Infrastructure	<u>Downstream and centerline embankments</u> • Sand fingers on batter slopes placed at 8m centres on the upstream face and be 0.4m thick and 4.0m wide; • Internal residue drainage pipes consisting of slotted PVC pipes shall be placed in a sand drainage layer (sand fingers) on the batter slopes for every second finger for pipes (16m intervals); • The internal drainage pipes are connected to the residue underdrainage system which reports to the southern valley pipe head dam (SVPHD). <u>Upstream embankments</u> • Drains extend 50m from the embankment upstream toes (approximately 3 per 100m); • Sand fingers on batter slopes placed at 32 m centers on the upstream face and be 0.4m thick and 4.0m wide;	as shown in Figures 3, 4 and 5 of Schedule 1

	Infrastructure	Design and construction / installation requirements	Infrastructure location
		• Internal residue drainage pipes consisting of slotted PVC pipes shall be placed in placed in a drainage layer (sand fingers or gravel) and a geofabric layer on the batter slopes at 32m intervals on the upstream face of the upstream embankment raise; • The internal drainage pipes are connected to the residue underdrainage system which reports to the southern valley pipe head dam (SVPHD).	
3.	Tailings deposition infrastructure	• Embankment perimeter will be fitted with a mudline, deposition pipeline that contains multiple discharge spigot attachment valves, located at nominal 72m intervals; • Multiple spigots used to discharge bauxite residue sub-aerially on the upstream edge of the perimeter embankment; • Bauxite residue discharge at low velocity and spigot locations changed periodically to maximise tailings beach consolidation around the edge of the embankment and minimise the size and location of the decant pond towards the centre of each cell; • Constructed to allow a minimum 500mm operational freeboard; • Beach length of approximately 500m long and 100m wide with tailings deposition average of 55% solids and an average 0.6% degree beach slope; • Bauxite residue deposition will be managed within each cell to contain rainfall associated with a 1 in 100 year, 72- hour duration Annual Recurrence Interval rainfall event; • Use of amphirollers vehicles to accelerate drying and consolidation of bauxite residue on wet pour within 72hours to achieve an undrained shear strength of 28kPa for each 1.1m layer to achieve 72% final solids content.	N/A
4.	Surface dewatering infrastructure	• Existing decant towers and pumpshafts causeway to be raised by 5m; • Constructed decant causeways fitted with mobile surface pumps; • Recovered decant water will be recycled back into processing via the Refinery Catchment Lake (RCL)	as shown in Figures 1, 2 and 6 of Schedule 1
5.	Pipelines, mudlines,	• Bunding is provided on the downstream crest edge and crest sloped inward such that residue	as shown in Figures 2 and

	Infrastructure	Design and construction / installation requirements	Infrastructure location
	drains and decant conveyance infrastructure	lost to the surface of crest reports into the BRDA; • Configured to allow water transfer between site infrastructure, to allow stormwater from a 1:1000 year 72 hour duration Annual Recurrence Interval rainfall event to be contained within the onsite containment infrastructure on site.	3 of Schedule 1
6.	Stormwater diversion and drainage	<u>Downstream and Centerline embankments</u> • Constructed along the toe of all embankments, discharging to larger rock lined drains and then to the Freshwater Lake. • Constructed to convey flow of current embankment raise and all future embankments raises • Batter slopes treated with 50:50 mixture of topsoil and mulch for erosion control. <u>Upstream Construction</u> • Toe drains to be constructed on down-stream side of embankments and consist of a rock lined V-drain with 300mm vertical depth unless otherwise shown in drawings	as shown in Figures 2, 3 and 5 of Schedule 1
7.	Peizometers	• Vibrating Wire Peizometers placed in three locations underneath the proposed embankment to extend the existing monitoring network to monitor pore water pressure profile for the BRDA	as shown in Figure 7

2. The works approval holder must:

(a) construct the critical containment infrastructure;

(b) in accordance with the corresponding design and construction requirements; and

(c) at the corresponding infrastructure location(s); and

(d) within the corresponding timeframe(s),

as set out in Table 2.

Table 2: Critical containment infrastructure design and construction requirements

	Infrastructure	Design and construction requirements	Infrastructure location
8.	BRDA 5 Cells 1, 2, 3, 4 and 5 Embankment lift of 5 m To RL 295.5 m AHD	• Embankment raises from RL 285.5m AHD to RL 2.5 m AHD <u>Downstream and Centerline construction</u> • Incorporate a minimum of 5m of low permeability clay compacted to a minimum 98% HILF PCWD placed within a moisture content tolerance of within 2% (+/-) of its optimum moisture content • Batter slopes shall be shaped to 1 Vertical: 2:2	as shown in Figure2 2,3,4 and 6 of Schedule 1

	Infrastructure	Design and construction requirements	Infrastructure location
		Horizontal (external) and 1 Vertical:1.5 Horizontal (internal) on downstream and centerline embankment unless otherwise shown in in drawings • Crests with a 2% minimum fall with a 10m wide minimum if intended for traffic by Amphiroller vehicles • Access ramps <u>Upstream construction</u> • Constructed using in-situ soils and bauxite residue, rolled and compacted to a minimum 96% HILF PCWD placed within a moisture content tolerance of within 2% (+/-) of its optimum moisture content • Batter sloped shaped to 1Verticle: 1.5 Horizontal (external) and 1 Vertical:1.5 Horizontal (internal) on upstream embankments unless otherwise shown in drawings. • Crests with a 2% minimum fall with a 10m wide minimum if intended for traffic by Amphiroller vehicles • Access ramps	
9.	Construction of Splitter bunds between cells 1 and 2; Cells 2 and 3 Cells 5 and 6	• Batter slopes shaped to Vertical 1: 1.5 Horizontal unless otherwise shown on drawings; • 0.5m maximum lift for splitter bunds for upstream dividing walls; maximum 0.3m lift for main and downstream raises • Minimum 2% cross fall towards upstream side of embankment with a minimum 9m width if intended for use by amphirollers • Constructed using in-situ soils and bauxite residue, rolled and compacted to a minimum 96% of Standard Maximum Dry Density and placed within a moisture content tolerance of within 2% (+/-) of its optimum moisture content. • Where residue is used for construction upper 1.5m is constructed using clay from stockpiles to enable traffic area;	as shown in Figures 2,3, 4 and 6
10.	Construction of dividing wall in Cell 5 west; Cell 4/5 and Cell 4/6	• Constructed using in-situ soils and bauxite residue, rolled and compacted to a minimum 96% HILF PCWD (no control on moisture variation). • Minimum 2% cross fall towards upstream side of embankment and minimum width of 9m if intended for use by amphirollers	as shown in Figures 2 and 6

Environmental compliance reporting

3. The works approval holder must within 60 calendar days of an item of infrastructure

or equipment required by condition 1 being constructed and/or installed:

(a) undertake an audit of their compliance with the requirements of condition 1; and

(b) undertake an audit of compliance of condition 1 with the requirements of *070-Earthworks Specifications FY 2020-2024* (South32 Worsley Alumina, 2022)

(c) undertake an audit of compliance of condition 1 with the requirements *Design Report BRDA 5 – Stage 6B Raise* (LOM Engineering, 16/08/2022)

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

4. The Environmental Compliance Report required by condition 3, must include as a minimum the following:

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

(b) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 1; and

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

Critical containment Infrastructure report

5. The works approval holder must within 90 calendar days of the Critical Containment Infrastructure identified by condition 2 being constructed:

(a) undertake an audit of their compliance with the requirements of condition 2; and

(b) undertake an audit of compliance of condition 2 with the requirements of *070-Earthworks Specifications FY 2020-2024* (South32 Worsley Alumina, 2022)

(c) undertake an audit of compliance of condition 2 with the requirements *Design Report BRDA 5 – Stage 6B Raise* (LOM Engineering, 16/08/2022)

(d) prepare and submit to the CEO a Critical Containment Infrastructure Report on that compliance.

6. The Critical Containment Infrastructure Report required by condition 5 must include as a minimum the following:

(a) certification by a suitably qualified geotechnical engineer that each item of critical containment infrastructure or component thereof, as specified in condition 2, has been built and installed in accordance with the requirements specified in condition 2;

(b) as constructed plans and a detailed site plan showing the location and dimensions for each item of critical containment infrastructure or component thereof, as specified in condition 2;

(c) photographic evidence of the installation of the infrastructure;

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

(e) a Quality Control / Quality Assurance Certificate from an independent third party which demonstrates that specific components of critical containment infrastructure meet specifications

Limits to operation

7. Following completion of construction works specified in conditions 1 and 2, the works approval holder must:

(a) Within 12 months after completing construction of the works specified in condition 1 and 2, and annually thereafter, the Licence Holder must provide to the CEO an audit of BRDA 5. The audit must be carried out by a suitably qualified engineer or geotechnical specialist in accordance with Department of Mines and Petroleum (November 2015), Tailings Dam Audit – Guide; against the assumed design parameters in accordance with Tailings Storage Facility Audit – Guide; and the relevant parts of the ANCOLD (May 2012), Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure; and Department of Mines and Petroleum (2013), Tailings storage facilities in Western Australia – code of practice

(b) Submit to the CEO the audit report by 30 March 2025

8. The works approval holder must not commence deposition into BRDA 5 Cells 1, 2, 3, 4 or 5 if the audit required by condition 7(a) indicates the minimum factor of safety requirements of the BRDA embankments at the final fill level of 290.5 m AHD are not met.

9. The works approval holder must provide the audit report to the CEO at least 60 days prior to commencement of deposition into BRDA 5 Cells 1, 2, 3 ,4 or 5.

Records and reporting (general)

10. 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.

11. 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 and 2;

(b) any maintenance of infrastructure that is performed in the course of complying with condition 1 and 2; and

(c) complaints received under condition 10.

12. The books specified under condition 11 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 1 have the meanings defined.

Table 1: 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
critical containment infrastructure	means the items of infrastructure listed in condition 2.
Critical Containment Infrastructure Report	means a report to satisfy the CEO that works of critical containment infrastructure have been constructed in accordance with the works approval.
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).
FL	means the Freshwater Lake at the premises
HILF PCWD	is testing method for engineered soils which are required to meet compaction and density ratios and are subject to moisture variation
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.

Term	Definition
RCL	means the Refinery Catchment Lake at the premises
SVPHD	means Southern Valley Pipe Head Dam at the premises
suitably qualified and experienced geotechnical engineer	means a person who: (a) holds an engineering degree; and (b) has a minimum of at least three years of experience working in the area / field of geotechnical assessment of tailings storage facilities or fly ash dams
Tailings Storage Facility Audit – Guide	means the document entitled “Tailings storage facility audit – guide”, Department of Mines, Industry Regulation and Safety, 26 June 2017
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 Premises is shown in the map below. The red line depicts the Premises boundary (Figure 1).

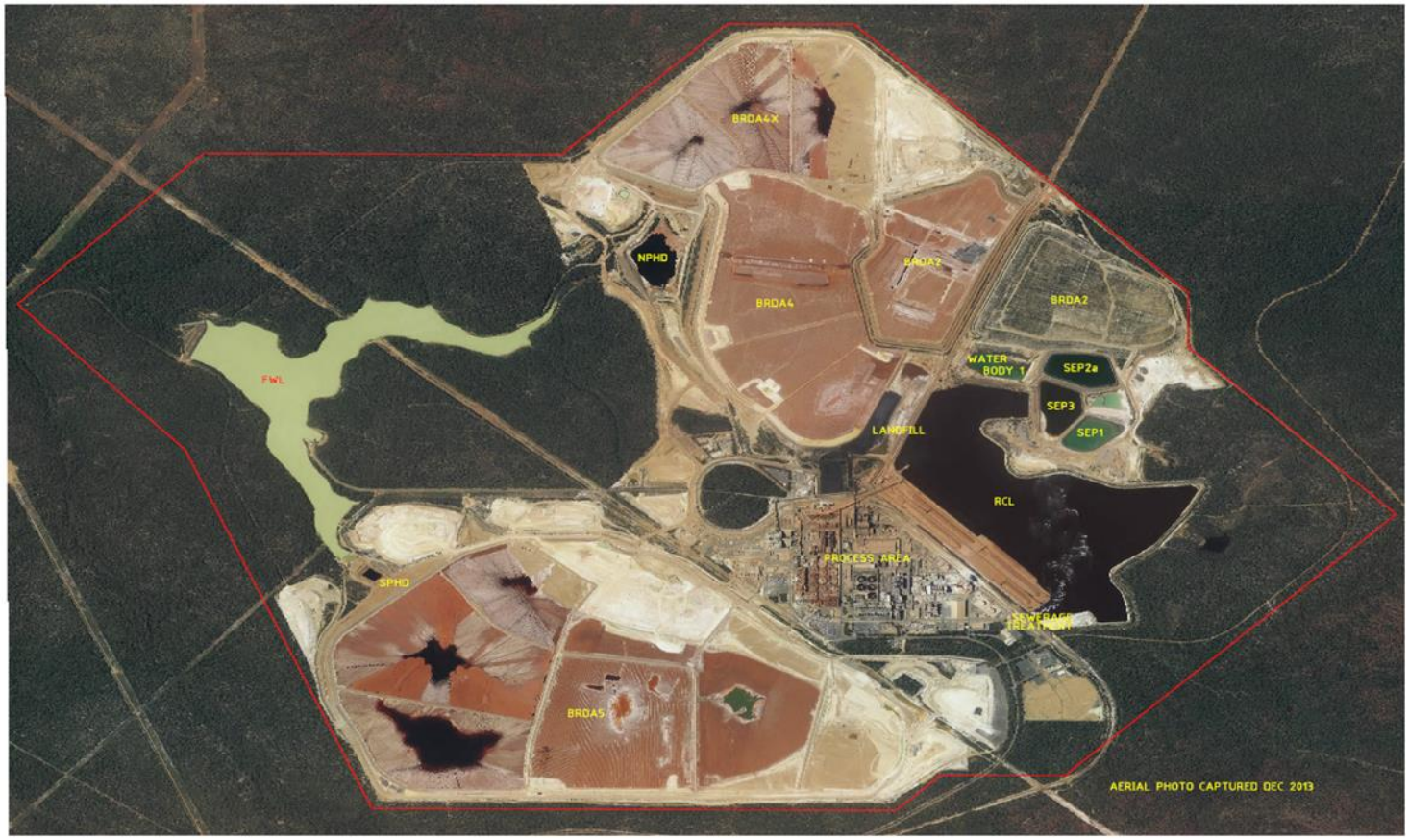

Figure 1: Map of the boundary of the prescribed premises

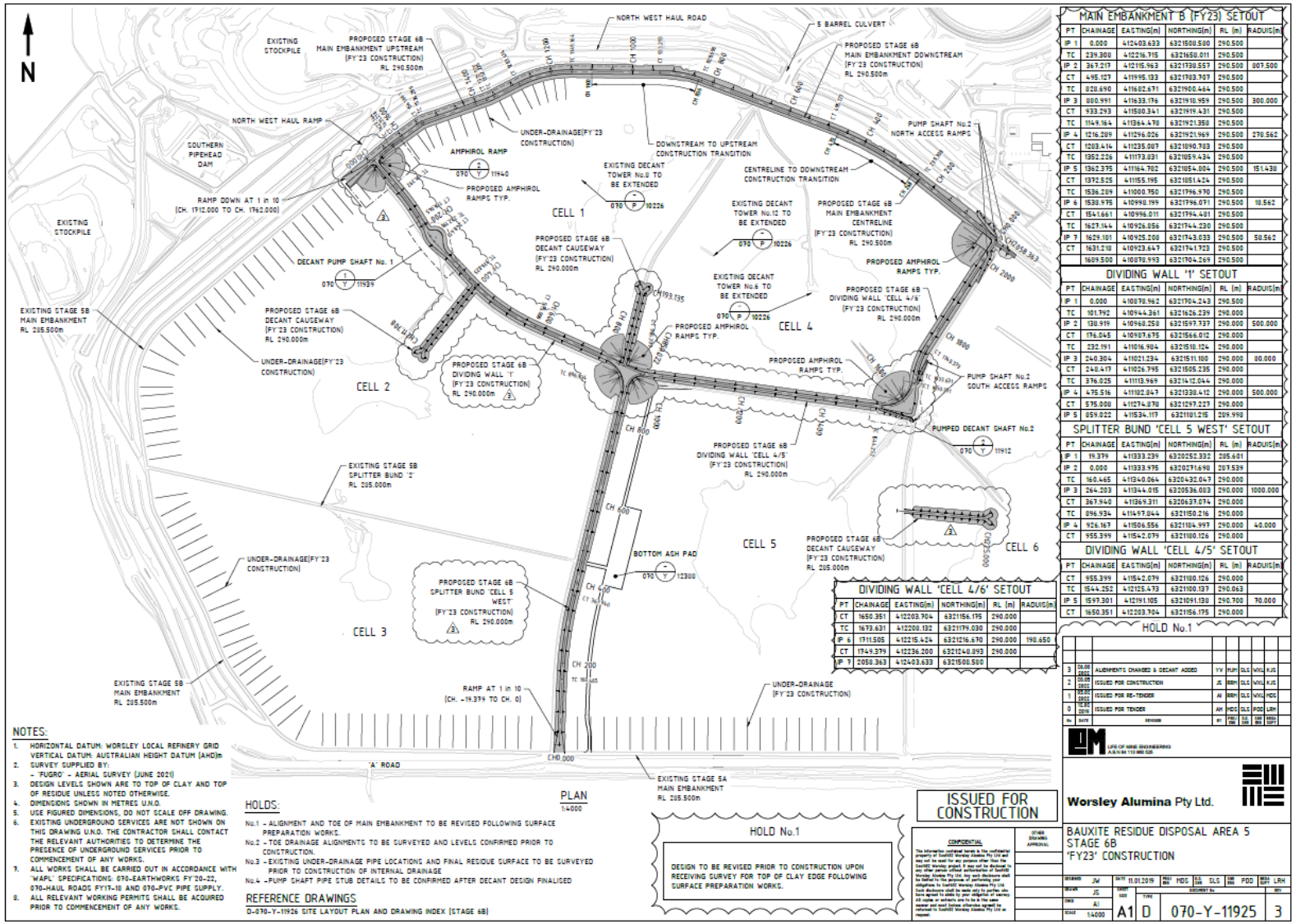

Figure 2: Diagram of construction works planned for Financial Year 2023

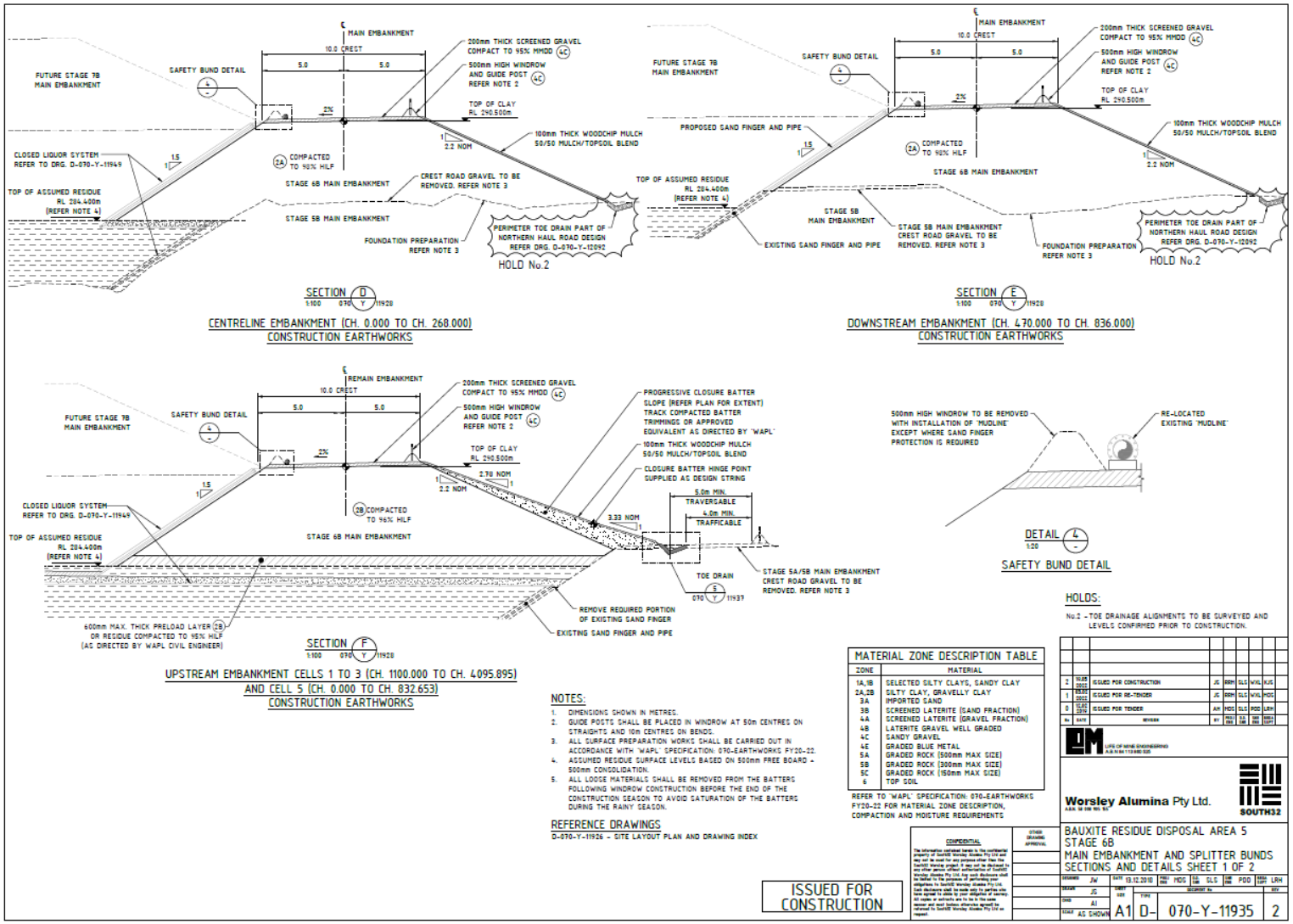

Figure 3: Diagram of construction works planned for Financial Year 2024

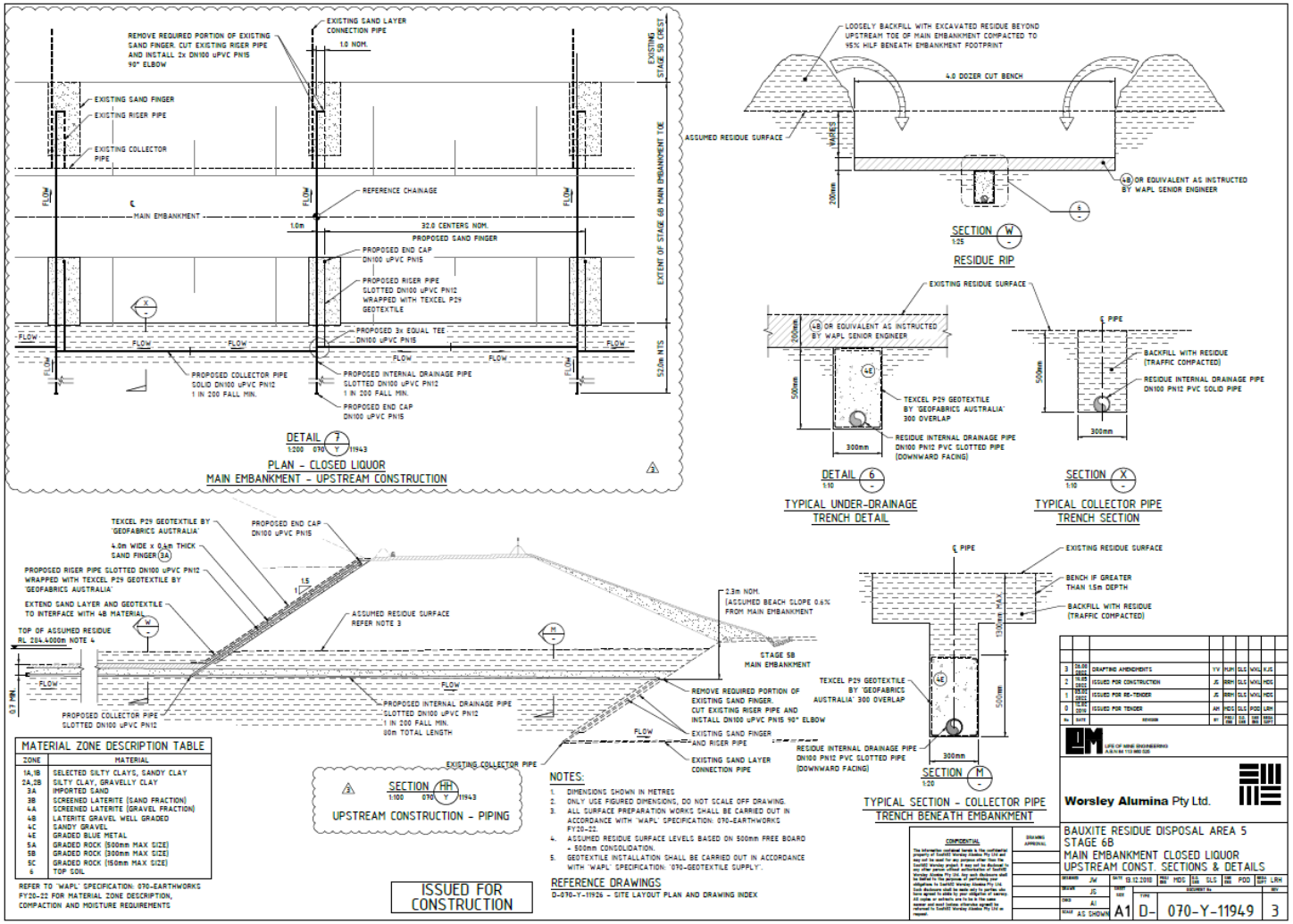

Figure 4: Diagram of construction works closed liquor system detail on upstream embankments

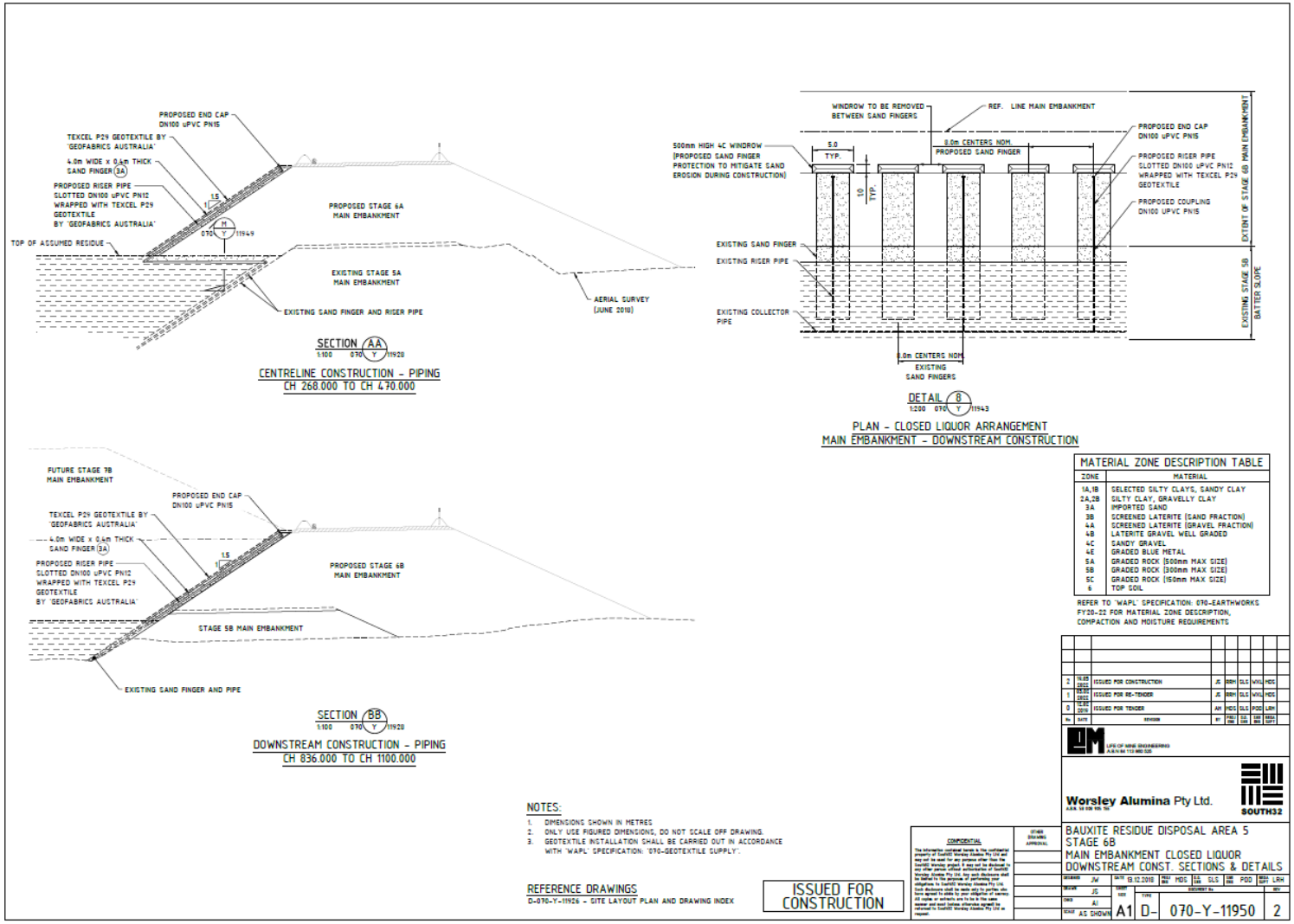

Figure 5: Diagram of construction works closed liquor system detail on downstream embankments

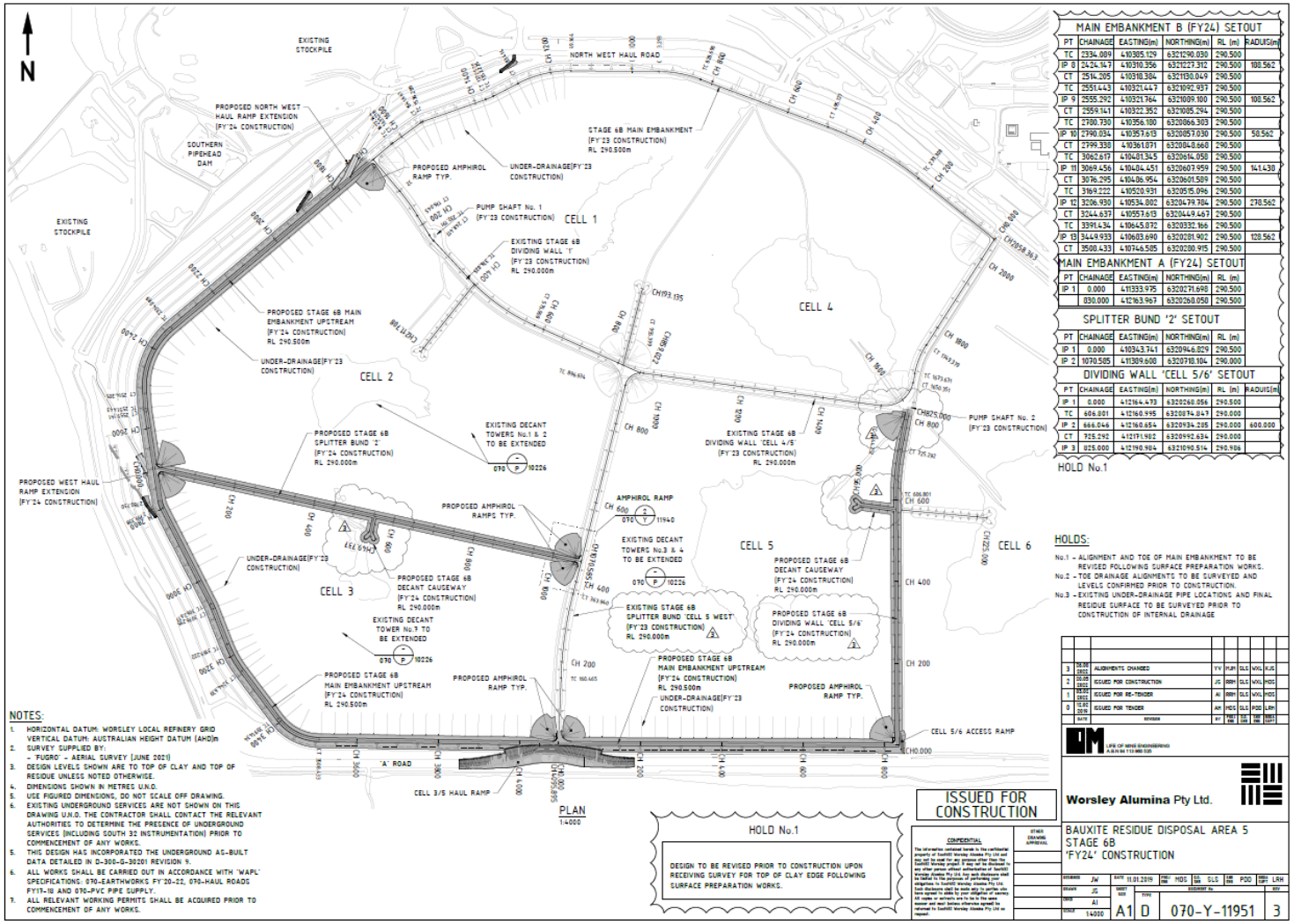

Figure 6: Diagram of construction works planned for Financial Year 2024

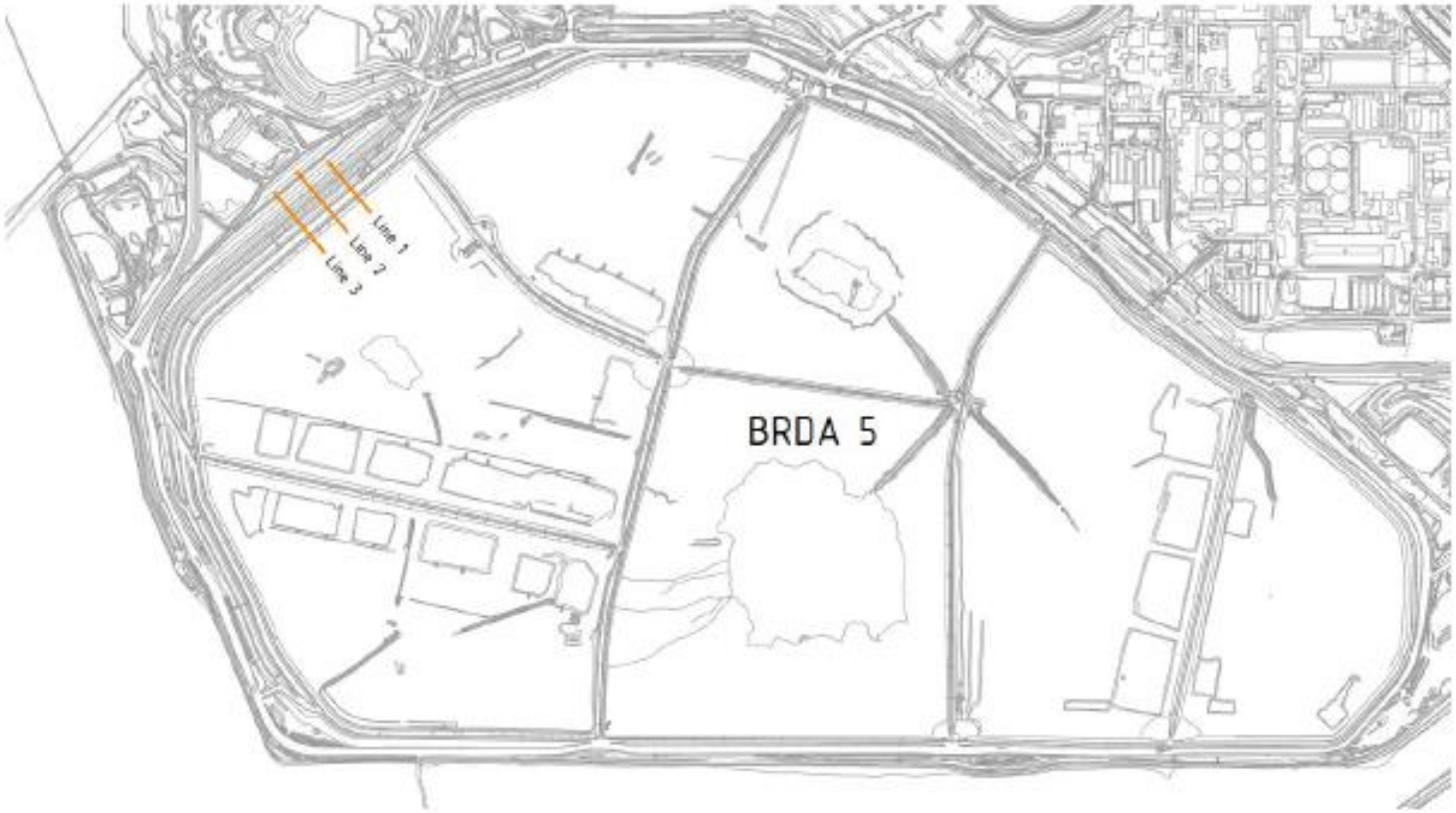

Figure 7 Vibrating wire peizometer array locations

Source Figure 59 Design Report BRDA 5 – Stage 6B