Government of Western Australia
Department of Water and Environmental Regulation

Works Approval

Works approval number	W6598/2021/1
Works approval holder	CXTGD Investment Pty Ltd
ACN	641 676 628
Registered business address	19094 Brand Highway WARRADARGE WA 6518
DWER file number	INS-0002489 DER2021/000020
Duration	02/11/2022 to 01/11/2030
Date of amendment	16/03/2026
Premises details	Erim Downs Feedlot 19094 Brand Highway WARRADARGE WA 6518 Legal description – Lot 10804 on Plan 210800

Prescribed premises category description (Schedule 1, Environmental Protection Regulations 1987)	Assessed design capacity
Category 55: Livestock saleyard or holding pen: premises on which live animals are held pending their sale, shipment or slaughter.	Not more than 12,000 Standard Cattle Units at any one time
Category 68: Cattle feedlot: premises on which the watering and feeding of cattle occurs, being premises – (a) situated 100 m or more from a watercourse; and (b) on which the number of cattle per hectare exceeds 50.	

This amended works approval is granted to the works approval holder, subject to the attached conditions, on 16 March 2026, by:

MANAGER, PROCESS INDUSTRIES
STATE-WIDE DELIVERY (ENVIRONMENTAL REGULATION)
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Instrument history

Date	Ref number	Summary of changes
13/04/2018	L9061/2017/1	Licence granted to Kalimpa Park Pty Ltd to operate a Category 55: Holding pen and Category 68: Cattle feedlot.
04/05/2020	L9061/2017/1	Licence transferred to Erim Downs Pty Ltd. CEO initiated amendment to amalgamate Amendment Notice 1 and update licence into a new format.
12/04/2021	L9061/2017/1	Decline to deal issued for licence renewal application due to insufficient information. Licence ceased to have effect.
02/11/2022	W6598/2021/1	Works approval granted to remediate and construct infrastructure, including time limited operations for a Category 55 – Holding pen and a Category 68: Cattle feedlot
16/11/2022	W6598/2021/1	CEO initiated amendment to correct administrative errors
16/03/2026	W6598/2021/1	Works approval amendment to extend expiry date by 3 years and remove duration (180 days) of time limited operations.

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 the infrastructure;
(b) in accordance with the corresponding design and construction requirements; and
(c) at the corresponding infrastructure location,

as set out in Table 1.

Table 1: Design and construction requirements

	Infrastructure	Design and construction requirements	Infrastructure location
Feedlot infrastructure			
1.	Livestock handling (induction) yard with a total area not exceeding 65 m x 100 m including 6x 5 m x 5 m holding pens	(a) Ground surface to be constructed of in-situ compacted gravel and clay or similar material to achieve an average permeability of ≤ 7.2 x 10^{-7} m/s; (b) Floor must be maintained with a downslope gradient that directs effluent and surface water runoff to the CDA1 effluent catch drains; (c) The works approval holder is to ensure a minimum of two permeability tests are conducted in areas representative of the induction yard ground surface. Tests are to be completed by a suitably qualified person and in accordance with Schedule 3. (d) If the permeability testing required by 1(c) does not meet the average permeability specified by 1(a), the works approval holder is to complete the necessary ground works in accordance with Schedule 3 to ensure the average permeability is met.	"Induction yard" as shown in Schedule 1, Figure 2.
2.	Manure storage pad with a total area not exceeding 65 m x 50 m	(a) Hardstand must be underlain by at least 300 mm of modified in-situ soils or other suitable compactable material or a synthetic liner installed by a suitably qualified person and in accordance with Schedule 2 or 3 to achieve a permeability of ≤ 1 x 10^{-9} m/s; (b) Hardstand must be bunded and graded to ensure leachate drain towards CDA1 drainage channels; (c) Permeability and compaction requirements must be demonstrated by geotechnical testing conducted by a suitably qualified person and in accordance with Schedule 3.	"Manure pad" as shown in Schedule 1, Figure 2.
3.	Controlled drainage area 1 (CDA1)	(a) Must capture all surface water runoff and effluent from the cattle feedlot pens, induction yard and manure storage pad; (b) Area must be sloped to facilitate drainage of surface water runoff and effluent to CDA1 drainage channels; (c) Drainage channels to be sloped to facilitate drainage to CDA1 sedimentation pond; (d) Stormwater must be diverted away from CDA1 using bunds and/or cut-off drains where required.	Wastewater flow path shown by the dark blue line in Schedule 1, Figure 2. Drainage channels shown in Schedule 1, Figure 4.
4.	Cattle feedlot pens – consisting of 60 pens • 50 pens with dimensions not exceeding 51 m x 42 m including cattle alleys	(a) Pen floors and cattle alleys must be constructed with a downslope gradient of at least 2.5% to direct effluent and surface water runoff to CDA1 effluent catch drains; (b) Cross slope gradients to be less than 1% to minimise pen-to-pen drainage; (c) Pen floors and cattle alley ground surfaces to be constructed of in-situ compacted gravel and clay or similar material to achieve an average permeability	"Cattle feedlot pens" as shown in Schedule 1, Figure 2 and Figure 3.

	Infrastructure	Design and construction requirements	Infrastructure location
	• 10 pens with dimensions not exceeding 51 m x 60 m including cattle alleys	of ≤ 7.2 x 10^{-7} m/s; (d) The works approval holder is to ensure a minimum of six permeability tests are conducted in areas representative of the cattle feedlot pens ground surface. Tests are to be completed by a suitably qualified person and in accordance with Schedule 3. (e) If the permeability testing required by 4(d) does not meet the average permeability specified by 4(c), the works approval holder is to complete the necessary ground works in accordance with Schedule 3 to ensure the average permeability is met.	
5.	Effluent catch drains, cross and main drains and drainage channels	(a) Drainage channels to be constructed with a minimum 0.5 m base, 3 m drain width, 1:3 battered slopes and 0.2 m depth; (b) Drainage channel for induction yard to be constructed with a minimum 0.5 m base, 2.5 m drain width, 1:3 battered slopes and 0.2 m depth; (c) Lateral cut-off drains in feedlot pens to be constructed with a minimum 0.5 m base, 2 m width, 1:3 battered slopes and 0.2 m depth; (d) Drainage infrastructure must be underlain with a minimum 300 mm in-situ compacted gravel and clay or other suitable compactable material and/or synthetic liner and topped with a suitable material to stabilise drains, prevent scouring and is able to achieve a permeability of ≤ 1 x 10^{-9} m/s; (e) All drains permeability and compaction requirements must be demonstrated by geotechnical testing conducted by a suitably qualified person and in accordance with Schedule 3.	"Drainage channels" and "Channel drains" as show in Schedule 1, Figure 2 and Figure 4.
6.	Sedimentation pond 1 • Top RL (100 m x 50 m) • Base RL (60 m x 20 m) • Volume – 6,950 m^3	(a) CDA1 sedimentation pond to have a minimum holding capacity of 6,950 m^3; (b) The pond must be constructed with a control weir discharge assembly on the discharge point of the pond to regulate drainage to effluent pond 1; (c) To be constructed to provide a maximum flow velocity of 0.005 m/s; (d) Sedimentation pond must be underlain by at least 300 mm of in-situ compacted gravel and clay or other suitable compactable material or a synthetic liner installed by a suitably qualified person and in accordance with Schedule 2 or 3 to achieve a permeability of ≤ 1 x 10^{-9} m/s; (e) Bunds and/or cut off drains to be installed where required to divert uncontaminated stormwater away from the sedimentation pond; (f) Permeability and compaction requirements must be demonstrated by geotechnical testing conducted by	"Sedimentation pond 1" as shown in Schedule 1, Figure 2 and Figure 5.

	Infrastructure	Design and construction requirements	Infrastructure location
		a suitably qualified person and in accordance with Schedule 2 or 3.	
7.	Effluent holding ponds consisting of the following: CDA1 effluent holding pond 1: • Top RL (94 m x 86 m) • Base RL (46 m x 43 m) • Volume – 16,425 m^3 CDA1 effluent holding pond 2: • Top RL (131 m x 125 m) • Base RL (69 m x 73 m) • Volume – 72,100 m^3	(a) CDA1 effluent holding pond 1 to have a minimum holding capacity of 16,425 m^3; (b) CDA1 effluent holding pond 2 to have a minimum holding capacity of 72,100 m^3, minimum depth of 2.08 m inclusive of a freeboard depth of 0.5 m; (c) All effluent holding ponds to be lined with a synthetic liner by a suitably qualified person in accordance with Schedule 2 to achieve a permeability ≤ 1 x 10^{-9} m/s; (d) Bunds and/or cut off drains to be installed where required to divert uncontaminated stormwater away from the effluent holding ponds.	"Holding Pond 1" and "Holding Pond 2" as shown in Schedule 1, Figure 2 and Figure 5.

2. The works approval holder must ensure all laboratory tests required by Schedules 2 and 3 are tested by a laboratory with current NATA accreditation for the parameters being measured.

3. Where a geosynthetic clay liner (GCL) or synthetic liner is installed for an item of infrastructure specified in condition 1, following installation the works approval holder must prepare a Construction Quality Assurance Validation Report (CQAVR).

4. The works approval holder must ensure the report(s) required by condition 3 are written and certified by a suitably qualified person and includes, but is not limited to:

(a) documentation of the quality of the completed works;
(b) demonstration of whether all requirements of the works specified in Table 1 and quality assurance provisions in Schedules 2 or 3 have been complied with;
(c) an assessment of test results against the minimum values specified in Schedules 2 or 3;
(d) certification the installed liner is free of default or defect and is fit-for-purpose; and
(e) copies of all surveys and drawings of the 'as installed' liners, inspections, and materials testing results.

Compliance reporting

5. The works approval holder must, within 28 calendar days of the infrastructure being constructed as specified in condition 1:

(a) undertake an audit of their compliance with the requirements of condition 1; and
(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

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

(a) certification by a suitably qualified person, whether or not the items of infrastructure or components thereof, as specified in condition 1, have been constructed in accordance with the relevant requirements specified in condition 1;
(b) permeability, compaction requirements and optimum moisture content must be demonstrated by geotechnical testing conducted by a suitably qualified person and in accordance with Schedules 2 or 3;
(c) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 1;
(d) labelled photographic evidence of the installation of the infrastructure; and
(e) be signed by a person authorised to represent the works approval holder and contains the printed name and position of that person.

7. Subject to condition 6(a), where an item of infrastructure or component of infrastructure has been certified as not being constructed, or does not comply with the corresponding requirements, or contains material defects, the works approval holder must:

(a) correct the non-compliant or defective works, prior to re-certifying in accordance with condition 6(a); or
(b) provide to the CEO a description of, and explanation for, any departures from the requirements specified in Table 1 that do not require rectification and do not constitute a material defect along with the Environmental Compliance Report required by condition 5.

Time-limited operations phase

Commencement and duration

8. The works approval holder may only commence time-limited operations for an item of infrastructure identified in condition 10 where the Environmental Compliance Report as required by condition 5 has been submitted by the works approval holder for that item of infrastructure.

9. The works approval holder may conduct time-limited operations for an item of infrastructure specified in condition 10 (as applicable) until such time as a licence for that item of infrastructure is granted in accordance with Division 3, Part V of the *Environmental Protection Act 1986*.

Infrastructure and equipment

10. During time-limited operations, the works approval holder must ensure the premises infrastructure listed in Table 2 is maintained and operated in accordance with the corresponding operational requirement set out in Table 2.

Table 2: Infrastructure requirements during time-limited operations

	Site infrastructure	Operational requirement	Infrastructure location
1.	Manure storage / deceased animal composting pad	(a) All deceased animals must be composted on the designated composting pad, or taken off-site to a disposal facility that is licensed to accept that kind of waste; (b) Only low risk feedstocks may be brought onto the premises as supplementary organic material for use in the composting process; (c) Composting of deceased animals is to occur such that: (i) at least 600 mm of carbon source materials such as straw is placed at the base as a	"Manure pad" as shown in Schedule 1, Figure 2.

	Site infrastructure	Operational requirement	Infrastructure location
		bedding; (ii) a deceased animal is placed on the bedding and covered with at least 500 mm of manure on all sides; (iii) composting occurs in windrows no more than two levels of deceased animals high; (iv) windrows are shaped to an apex at the top to shed rainfall; (v) windrows are initially turned after no longer than two months of decomposition and thereafter no longer than every 3 months until the completion of the decomposition process; (vi) windrows are no greater than 2 m high, 4 m wide and are angled to promote drainage towards drainage channels; and (vii) windrows must be monitored to ensure the temperature does not exceed 60°C to prevent the risk of spontaneous combustion. (d) Where a GCL is installed, the works approval holder must ensure a minimum 450 mm thick surcharge layer is maintained above the GCL (±75 mm).	
2.	Controlled drainage area 1 (CDA1)	(a) Must be maintained to ensure all leachate and surface water runoff is able to flow freely from the induction yard and cattle feedlot pens to the sedimentation pond without scouring. (b) Bunds and/or cut off drains used to divert stormwater from this area are to be maintained and repaired where required.	"Controlled drainage area 1" as shown in Schedule 1, Figure 3.
3.	Cattle feedlot pens – including cattle alleys	(a) Pens must be cleaned once the depth of dry manure on the pen surface exceeds 50 mm and thoroughly cleaned after pen de-stocking; (b) Manure harvested from pen surfaces must only be stockpiled on the manure storage/deceased animal composting pad; (c) Deceased animals to be removed from pens daily and stored on the deceased animal composting pad prior to composting or removal off-site to a disposal facility that is licensed to accept that kind of waste. (d) Where a GCL is installed, the works approval holder must ensure a minimum 450 mm thick surcharge layer is maintained above the GCL (±75 mm).	"Cattle feedlot pens" as shown in Schedule 1, Figure 2 and Figure 3.
4.	Effluent catch drains, cross drains and drainage channels	(a) Must be maintained to ensure all leachate and surface water runoff from the induction yard, manure storage pad and feedlot pens can flow freely to the sedimentation and holding pond system. (b) Where a GCL is installed, the works approval holder must ensure a minimum 450 mm thick surcharge layer is maintained above the GCL (±75 mm).	"Drainage channels" and "Channel drains" as show in Schedule 1, Figure 2 and Figure 4.

	Site infrastructure	Operational requirement	Infrastructure location
5.	Sedimentation pond	(a) Must be maintained to ensure flow velocity is less than 0.005 m/s; (b) Pond must be cleaned of solids before sludge takes up more than 60% of the design capacity of the pond; (c) An operational freeboard of at least 0.9 m must be maintained between the weir crest and the crest of the sedimentation pond embankment at all times; (d) Pond must be maintained free of vegetation. (e) Where a GCL is installed, the works approval holder must ensure a minimum 450 mm thick surcharge layer is maintained above the GCL (±75 mm).	"Sedimentation pond 1" as shown in Schedule 1, Figure 2.
6.	Effluent holding ponds • CDA1 effluent holding ponds 1 and 2	(a) An operational freeboard of at least 0.5 m must be maintained between the weir crest and the crest of all evaporation pond embankments at all times; (b) Ponds must be cleaned of solids before sludge takes up more than 10% of the design capacity of the pond.	"Holding Ponds" as shown in Schedule 1, Figure 2.
7.	Manure utilisation area (≈1,000 ha)	(a) Spreading of manure and composted carcasses to land must be done at a rate of not more than 1.47 t/ha/yr; (b) only manure and finished composted carcasses processed in accordance with condition 7 is spread over the waste utilisation area; (c) manure is evenly distributed over the waste utilisation area; (d) manure is only spread onto areas growing crops or pasture within the waste utilisation area; (e) spread manure is incorporated into the soil profile within 7 days; (f) the amount of manure spread and the waste utilisation area receiving the manure is recorded; and (g) the waste utilisation area crop is harvested at least once every 12 months. (h) Manure must not be spread when: (i) a high rainfall event is expected and within a day after a high rainfall event; (ii) within 25 m of significant stands of native vegetation; and (iii) within 100 m of drainage lines, creek lines and the Warradarge Creek.	Manure application area as indicated by the non-highlighted areas in Schedule 1, Figure 6.

Monitoring during time-limited operations

11. The works approval holder must ensure that:

(a) all soil samples are collected in accordance with DPIRD guidelines for soil sampling;

(b) all soil samples are submitted to and tested by a laboratory with current ASPAC certification (or equivalent); and

(c) all laboratory samples are submitted to and tested by a laboratory with current NATA accreditation for the parameters being measured.

12. The works approval holder must ensure that annual monitoring is undertaken at least 9 months apart.

Soil monitoring

13. During time limited operations, the works approval holder must conduct soil testing at the locations listed in Table 3, at the corresponding depths down the soil profile, for the corresponding parameters, units and frequency specified in that table.

Table 3: Soil testing requirements

Soil sampling locations	Soil profile	Parameter	Units	Frequency
At least one sample made up of at least 5 individual cores for each farm paddock across the manure utilisation area[1,2]	0 – 10 cm; 10 – 20 cm; 20 – 30 cm.	pH[1]	$CaCl_2$	Prior to the first manure spreading event to establish baseline, and annual thereafter for each paddock receiving manure in the previous 12 months period
		Electrical conductivity	mS/cm	
		Moisture content	%	
		Total nitrogen, ammonium-nitrogen, nitrate-nitrogen	mg/kg	
		Total phosphorus		
		Phosphorus retention index (PRI)	-	
		Phosphorus buffering index (PBI)	-	
		Aluminium	$CaCl_2$ extract	

Note 1: For soil sampling purposes, each farm paddock must represent a maximum area of 50 ha.
Note 2: GPS coordinates must be recorded for each sampling location, to ensure subsequent sampling events are in the same location.

14. The works approval holder must keep accurate records for the items specified in Table 4.

Table 4: Monitoring and recording of inputs and outputs

Input / Output	Parameter	Units	Frequency
Animals received and dispatched at the premises	Animals	Number	Each truck arriving/leaving the premises
Compost feedstock brought onto the premises	Feedstock type	Tonnes	Each load of low-risk feedstock brought onto the premises, by type
Solid waste applied to land	Manure and composted carcasses		Each batch
Solid waste despatched off-site			

Records and reporting

15. 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.

16. 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 condition 1;
(b) any maintenance of infrastructure that is performed in the course of complying with conditions 7 and 10;
(c) results of soil monitoring required by condition 13;
(d) records of inputs and outputs in accordance with condition 14; and
(e) complaints received under condition 15.

17. The books specified under condition 16 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
ASPAC	Australian Soil and Plant Analysis Council.
ASPAC certification	means in relation to the analysis of a sample that the laboratory is certified by ASPAC for the specified analysis at the time of the analysis.
books	has the same meaning given to that term under the EP Act.
controlled drainage area	means a self-contained catchment surrounding those parts of the feedlot complex from which uncontrolled stormwater runoff would constitute an environmental hazard.
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.
DPIRD guidelines for soil sampling	means the document entitled "*A guide for fit for purpose soil sampling*" (Fertilizer Australia 2019), available at https://fertilizer.org.au
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 has been constructed in accordance with the works approval.
EP Act	*Environmental Protection Act 1986* (WA).
EP Regulations	*Environmental Protection Regulations 1987* (WA).
freeboard	means the distance between the maximum surface water elevations and the top of retaining banks or structures at their lowest point.
high rainfall event	means rainfall above 25mm on any day as recorded at the Bureau of Meteorology Badgingarra Research Station, Station ID 009037.
low-risk feedstocks	means green waste derived from controlled collections and landscaping sources (e.g., grass, leaves, plants, branches, etc.), untreated timber (e.g., sawdust, wood shavings, timber off-cuts, etc.) and natural fibrous organics (e.g. peat, seed hulls/husks, straw, bagasse and other natural organic fibrous organics).
NATA	National Association of Testing Authorities, Australia.
NATA accredited	means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis.

Term	Definition
Phosphorus retention index (PRI)	means the ratio of phosphorus adsorbed by soil (micrograms per gram) compared to that remaining in a solution (of initial concentration of 10 mg phosphorus per litre) after 16 hours.
premises	the premises to which this works approval applies, as specified at the front of this works approval 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.
RL	means reduced level, the height or elevation above the point adopted as the site datum for the purpose of establishing levels.
sedimentation system	means a system to remove the readily-settleable fraction of the solids entrained in effluent. A sedimentation system may be a pond, basin or terrace that discharges effluent to a holding pond.
Standard Cattle Unit (SCU)	A Standard Cattle Unit is equivalent to an animal with a liveweight of 600kg.
suitably qualified person	in relation to: (a) hardstand certification, means a suitably qualified civil or structural engineer who: (i) holds a Bachelor of Engineering recognised by Engineers Australia; and (ii) has a minimum of five years of experience working in a supervisory area of civil engineering. (b) clay and/or engineered soil liner certification, means a suitably qualified civil, or geotechnical engineer who: (i) holds a Bachelor of Engineering recognised by Engineers Australia; and (ii) has a minimum of five years of experience working in a supervisory area of civil or geotechnical engineering. (c) synthetic membrane liner certification, means a suitably qualified professional working in the area of liner installation and testing of synthetic membranes with a minimum of 5 years' experience. (d) permeability testing, means a suitably qualified professional working in the area of permeability testing with a minimum of 5 years' experience.
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.
waste	has the same meaning given to that term under the EP Act.
waste utilisation area	means an area of land in which manure or compost is applied.
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

General layout and proposed remediation works plan

The general layout and proposed remediation works at the prescribed premises is shown in the map below (Figure 2).

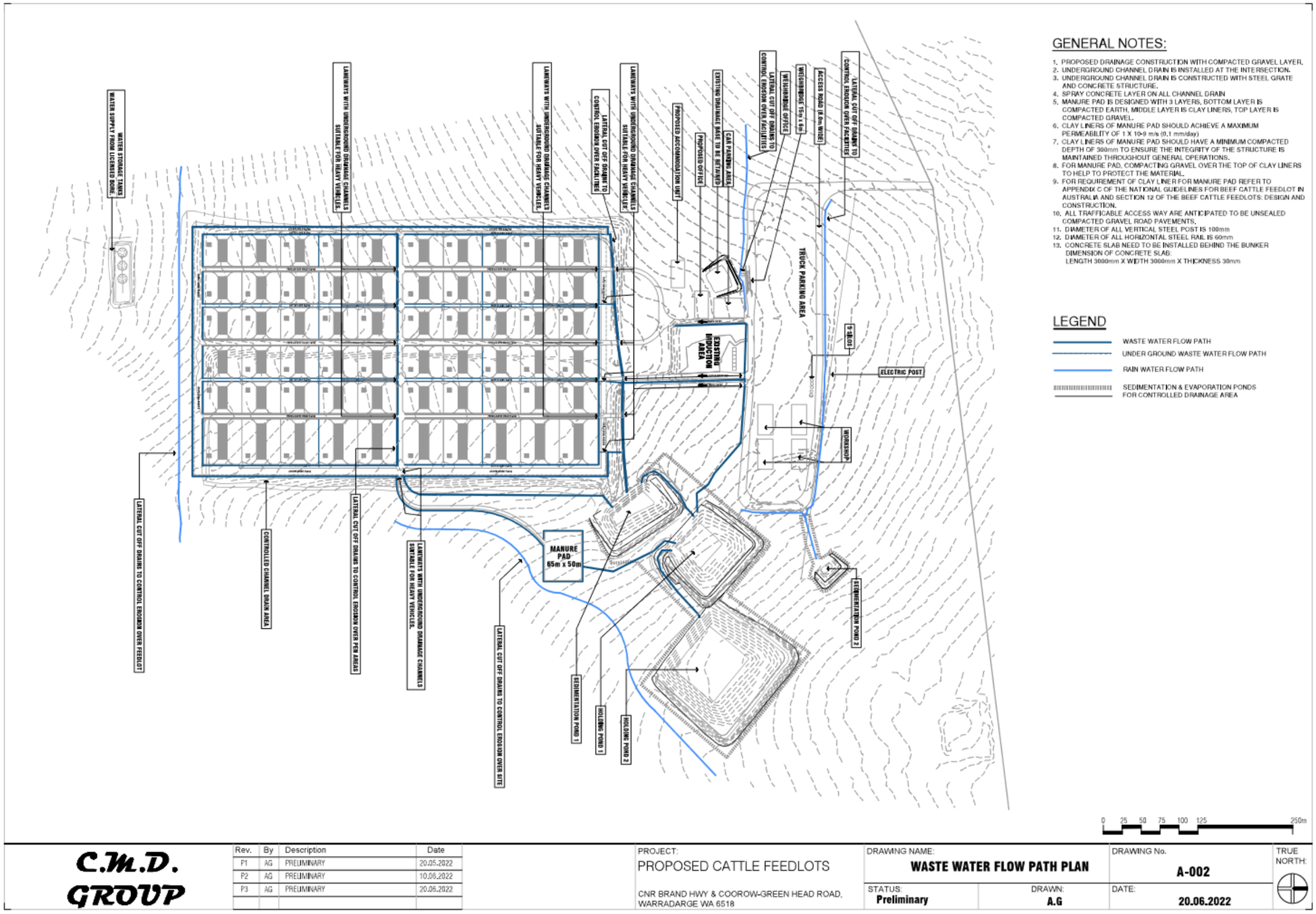


Figure 2: Map of the general layout and proposed remediation works at the prescribed premises.

Cattle feedlot pen layout plan

The cattle feedlot pen layout at the prescribed premises is shown in the plan below (Figure 3).

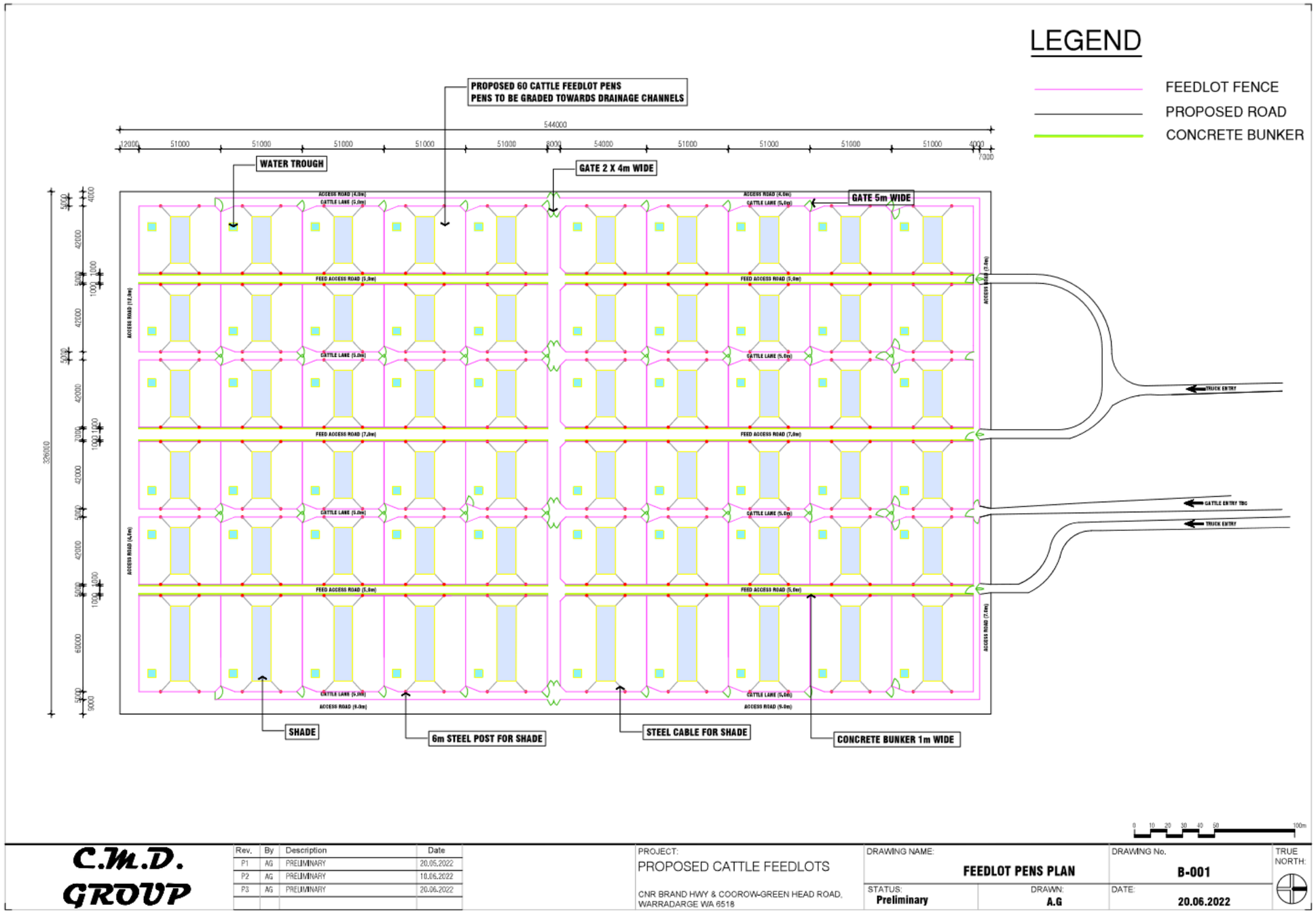
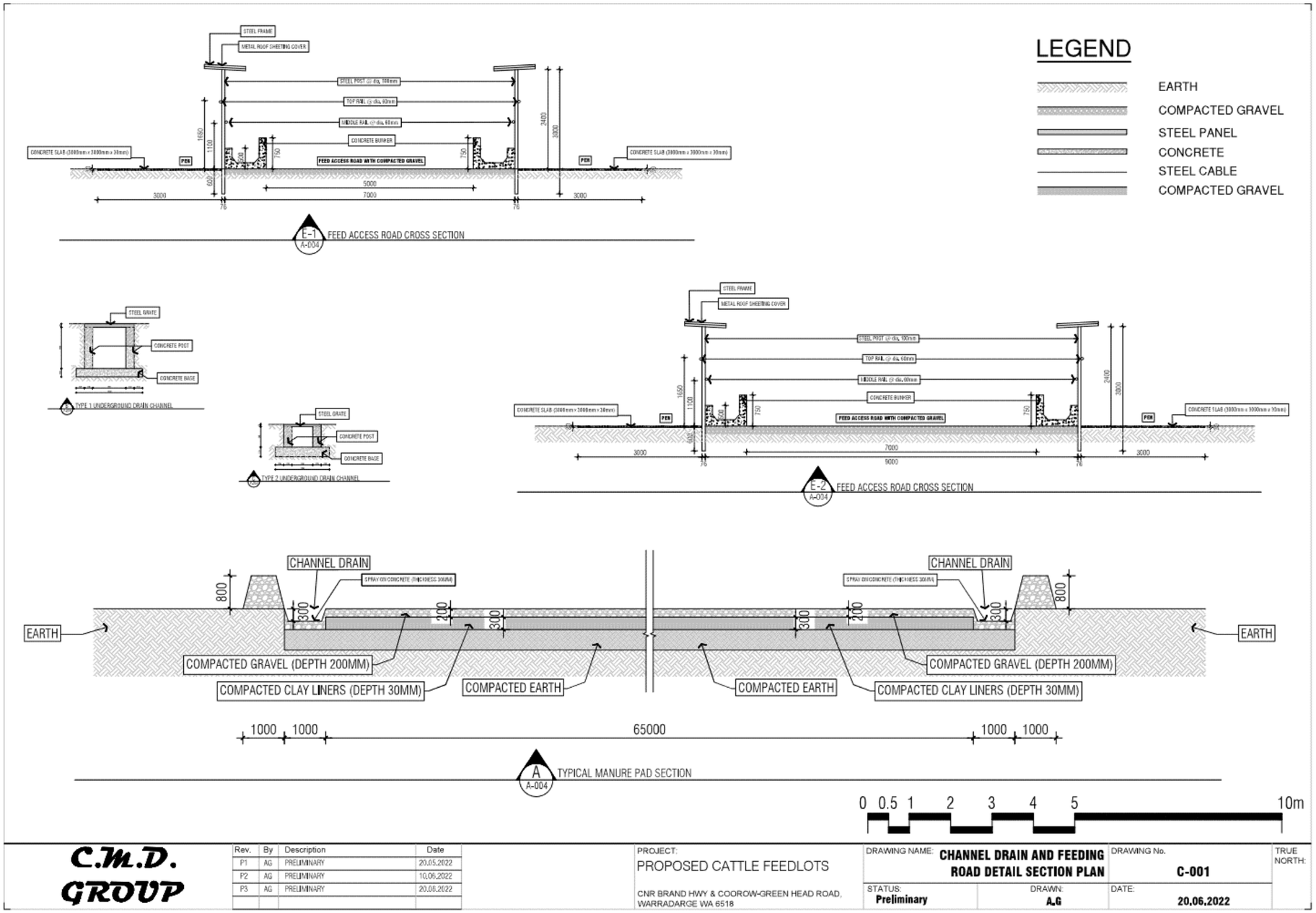


Figure 3: Map of the cattle feedlot pen layout at the prescribed premises.

Cattle feedlot pen drainage plan

The cattle feedlot pen drainage at the prescribed premises is shown in the plan below (Figure 4).



Rev.	By	Description	Date
P1	AG	PRELIMINARY	20.05.2022
P2	AG	PRELIMINARY	10.06.2022
P3	AG	PRELIMINARY	20.06.2022

Figure 4: Plan of the cattle feedlot drainage at the prescribed premises.

Sedimentation pond and holding ponds plan

The sedimentation pond and holding ponds at the prescribed premises are shown in the plan below (Figure 5).

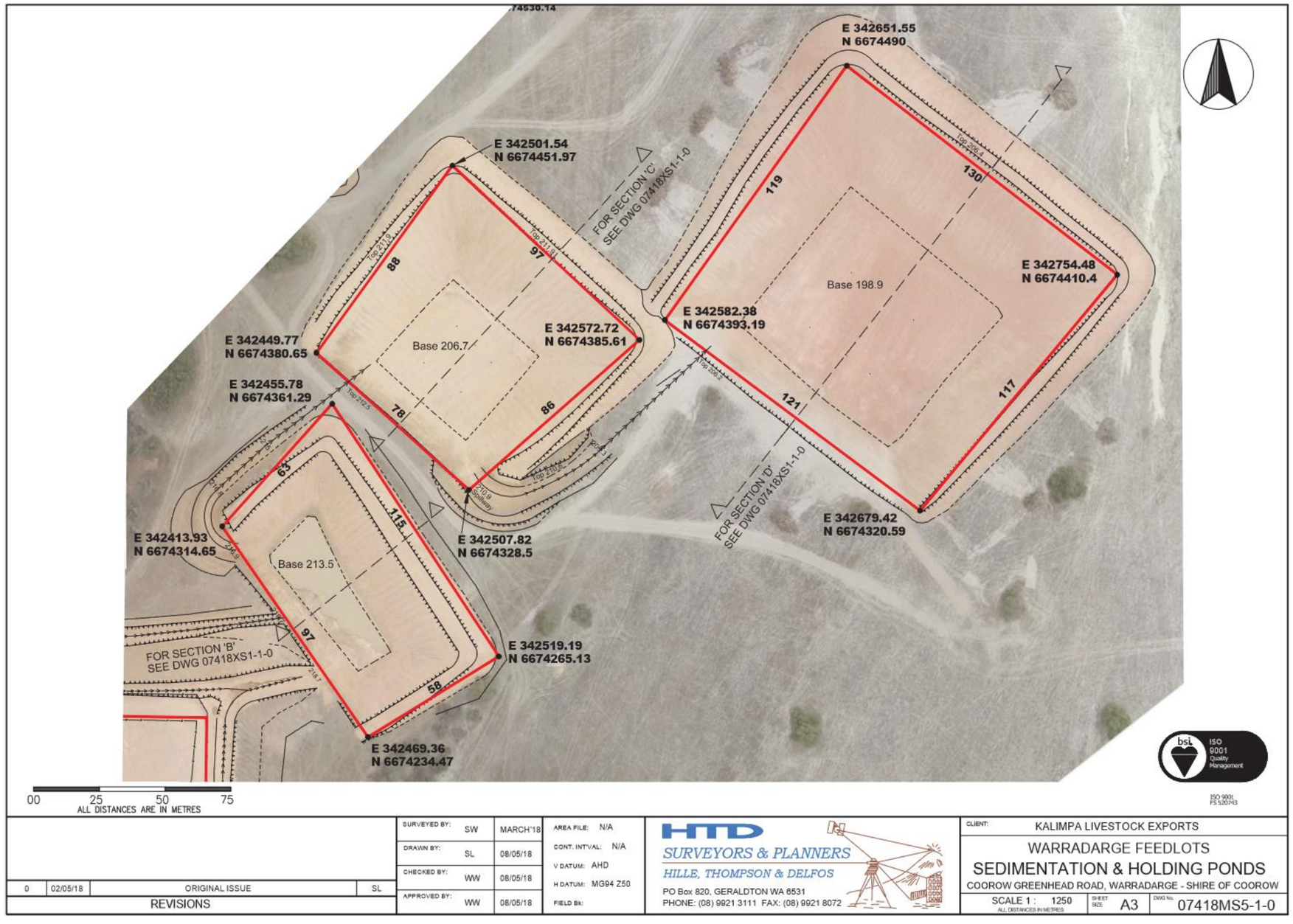


Figure 5: Plan of the sedimentation and holding ponds at the prescribed premises.

Manure utilisation (application to land) areas

The proposed manure application areas at the prescribed premises (non-highlighted areas) (Figure 6)

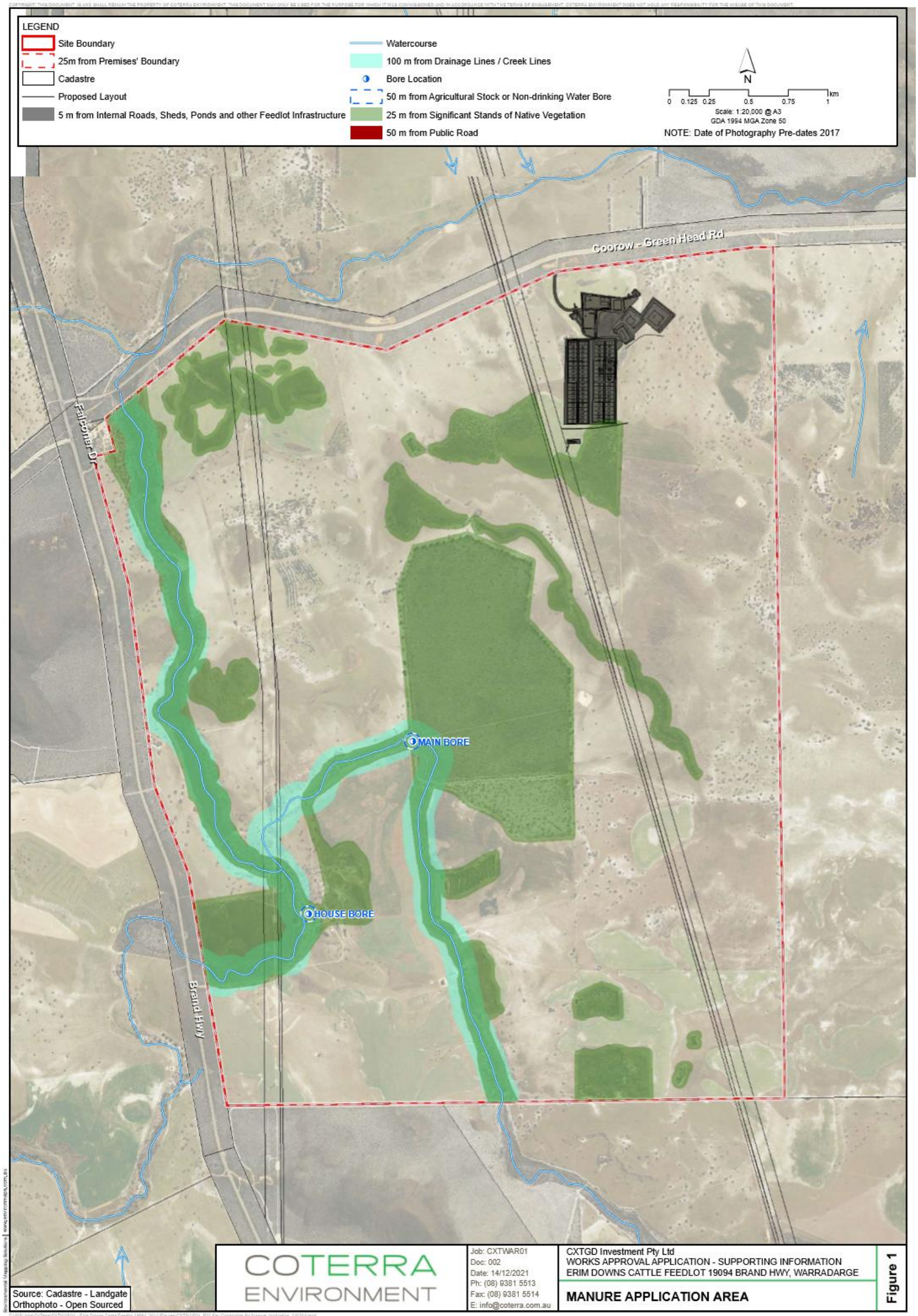


Figure 6: Map of the proposed manure application areas at the prescribed premises (non-highlighted areas).

Schedule 2: Synthetic liner installation requirements

4 Commonly used flexible liner materials are:

a polyvinyl chloride (PVC)

b high density polyethylene (HDPE)

c flexible polypropylene (FPP)

d chloro-sulfonated polyethylene (CSPE) marketed as Hypalon®

e ethylene propylene diene terpolymer (EPDM)

f composite materials such as fibre reinforced plastics, combinations of polypropylene mats and bentonite, and chloro-sulfonated polyethylene.

Naturally occurring or engineered low permeability soils are described in WQPN 27 *Liners for containing pollutants, using engineered soils* (reference 3c).

5 Liner support systems include:

a geotextiles used to prevent incompatible soils from blending, while allowing for the passage of fluids

b contaminant filtering substances such as crushed limestone, activated carbon beds and sandy loams.

A summary of properties of commonly used liner systems is provided at Appendix C.

6 All liners should be installed on a stable soil sub-base. The underside of the lowest liner should be at least 2 m above the highest wet season watertable, unless:

a effective underdrainage measures are installed to prevent upward water pressure on the liner

b allowance is made for any mounding of the watertable that may result from seepage from the containment compound.

7 All lined storage compounds should have stormwater control facilities to minimise embankment erosion. They should also have sufficient freeboard (at least 50 cm) maintained to prevent unintended overflow of water from storms with an average return frequency of at least 20 years (see reference 4), plus capacity to store rainfall resulting from a 90 percentile wet season, after allowance for any evaporative water loss and the effects of any water reuse recovery system.

Lining materials

8 All synthetic fluid containment liners should have a coefficient of permeability of less than 2×10^{-10} m/s (which equates to about 6 mm/year seepage) when tested using the American Society for Testing and Materials (ASTM) method D4716 (reference 1). For non-specified materials test methods, refer to US EPA recommendations on materials testing (reference 7a).

9 Liners should be constructed on gradients of less than 1 in 3, unless appropriate engineering methods are used to prevent liner slippage.

10 Liners that adequately resist shear forces should be used as seepage barriers to cover degradable or partly compacted materials likely to shrink or consolidate over time.

High density polyethylene geo-membranes

11 HDPE liners should have the following properties:

a minimum thickness of 0.75 mm (tolerance of up to 5%) for low hazard waste containment with mechanical jointing

b HDPE liners of 1.5 mm thickness are recommended for long-term containment facilities with heat welded joints

c specific gravity of 0.94 or more (ASTM method D1505)

d melt index of 0.05 g to 0.30 g in 10 minutes (ASTM method D1238, condition E 190/2.16)

e carbon black content of 2–3% (ASTM method D1603)

f minimum tensile strength at yield of 16 000 kN/m^2

g minimum tensile strength at break of 550 kN/m^2 (ASTM method D638, type IV 2)

h minimum elongation at yield of 10%, and at break 300% (ASTM method D638).

12 The liner should be fabricated to form the shape of excavation. All seams and joins made on site should be continuous. Panels of the liner should be overlapped by a minimum of 100 mm, prior to heat welding or mechanical jointing.

13 Any membrane welding materials should be supplied by the liner manufacturer, and should be identical with the liner membrane.

14 All seams and joins should be constructed and tested as watertight over their full length using a vacuum test unit, air pressure testing or other approved method used in the HDPE membrane industry.

15 Where fluid recovery from consolidating slurries and/or monitoring of integrity against seepage for multi-liner containment systems is needed, liners should grade to sumps connected to accessible monitoring or recovery wells to permit seepage collection by gravity. The liner should grade at not less than 1 in 100 to the sump. Herringbone pipe-work underdrainage systems may be used to assist fluid recovery.

16 HDPE liners should not be used on soils subject to differential movement (settling) as they have a low resistance to shearing and stress cracking. Low density polyethylene liners have recently been introduced to lessen these problems, but may be less resistant to abrasion, ultraviolet light and chemical attack than HDPE.

17 HDPE liner shear resistance should be tested in accordance with ASTM D5321-02.

Polyvinyl chloride liners

18 PVC liners should have a minimum thickness of 0.5 mm for low hazard waste containment, with a tolerance of 5% for short-term containment applications. A minimum thickness of 0.75 mm is recommended for long-term containment applications.

19 PVC exposed to sunlight during its operational life should be restricted to short-term projects (i.e. less than three years) due to susceptibility to ultraviolet radiation damage. Longer operational life may be achieved if the liner is buried.

20 PVC liners should not be used to contain materials incompatible with PVC such as cyanide or petroleum hydrocarbons.

21 PVC is better suited to disturbed ground than HDPE, as the properties of PVC liners allow considerable stretching before liner shear failure.

22 Where PVC is used, appropriate protection should be in place to reduce the possibility of rodent or termite attack on the liner material. Mesh barriers or approved residual pesticides should be considered.

Composite membranes

23 Composite liner systems involve 'sandwiches' made up of several different materials. They include polypropylene mesh encasing bentonite (absorbent aluminium silicate clay) commonly referred to as a geo-synthetic clay liner (GCL), ethylene inter-polymer alloy with high strength reinforcing fibres and fibre reinforced plastics e.g. CSPE (Hypalon ®). The use of these materials should be considered on a case-by-case basis, based on their suitability for the intended containment use, operational life and the local environmental setting.

Other membranes

24 Other synthetic membranes available include reinforced chlorinated polyethylene (CPER), ethylene propylene diene monomer (EPDM), butyl rubber and polyurethane coated geo-textile. Each membrane exhibits differing tensile strength, elasticity, resistance to degradation and chemical attack characteristics. These membranes should be selected on the basis of their suitability to the containment application and have a minimum thickness of 0.75 mm for long-term containment applications.

Geo-textiles

These consist of woven or felt fabrics designed to separate soils with differing particle sizes or properties, while allowing the passage of water.

25 Fabrics should be designed to resist deterioration or microbial attack over indefinite periods when buried.

26 Any geo-textile used as a backing to a liner should be a minimum thickness of 2.5 mm, be certified as needle free and weigh a minimum of 280 g/m^2.

27 Geo-textiles should be lapped or bonded in accordance with manufacturer's recommendations to provide a continuous protective layer.

Monitoring

28 The effectiveness of any lined containment should be determined by monitoring contained fluid balances, standing watertable levels and groundwater quality adjacent to the site. For guidance on monitoring, see WQPN 30 *Groundwater monitoring bores* (reference 3d).

Excerpt from Water Quality Protection Note 26: Liners for containing pollutants, using synthetic membranes

Schedule 3: Engineered soils liner installation and certification requirements

Containment design

1 Selection of an appropriate liner system depends on the hazard posed by the stored material, susceptibility of the liner material to damage by the contained material, anticipated time span for effective containment, local soil conditions, and the vulnerability of the surrounding environment.

More secure containment structures (such as multi-barrier systems) should be used in sensitive environments and for moderate- to high-hazard material containment. Typically, mining and metal processing residues stored near conservation category wetlands or drinking water sources require more secure containment than animal waste slurry in a low-sensitivity, rural catchment.

If local soils are highly permeable (such as coarse sand, gravel or karst), a high reliance is placed on the liner to contain fluid movement. Natural soils with fine textures such as clays, silts or non-fractured rock can augment the liner performance.

2 Commonly used soil liner systems consist of:

a natural in-situ low-permeability soils, grubbed to remove stones and plant roots, ripped and watered to optimum moisture content, compacted then rolled to achieve the final containment structure

b single-layer liners with material sourced from another location, placed in thin layers, moisture-conditioned, compacted, graded then rolled to achieve water retention

c multi-layer liners with interstitial granular fluid recovery or seepage monitoring layers.

Ancillary liner systems may include:

a geo-textiles used to prevent incompatible soils from blending, while allowing the passage of fluids

b contaminant filtering media such as crushed limestone, carbon beds, and sandy loams.

3 All liners should be installed on a stable sub-base. The underside of the lowest liner should be at least 2 m above the highest wet season watertable, unless:

a effective underdrainage measures are installed to prevent upward water pressure on the liner

b the containment does not hold material that relies on natural degradation processes in underlying soils to meet environmental objectives. Allowance should be made for rising or mounding of the watertable resulting from predicted leakage from the containment compound.

4 All lined storage compounds should have internal and external stormwater control facilities to minimise embankment erosion. Compounds should retain sufficient freeboard (at least 50 cm) to prevent unplanned overflow resulting from a 20-year average return frequency storm event (reference 3). The storage compound should also effectively contain the captured rainfall from a 20-year recurrence interval wet season, after allowing for losses via evaporation and seepage and the capacity of any water reuse recovery system used.

5 Lined storage compounds should be located outside flood-prone areas. A freeboard of at least 50 cm above the 100-year average recurrence interval flood level is recommended.

Liner material

6 Soils used for the lining should conform to a design specification for an effective water retaining structure. The soils should be free from plant roots and reactive, soluble and organic matter. Unless this department approves otherwise, the selected liner material should consist of an inert and insoluble blend of sand, clay and silt particles that meet the minimum criteria described in the table below.

Soil characteristic	Acceptability criterion	Test method
Percentage fines	More than 25 per cent passing a 75 micron sieve	Australian Standard (AS) 1289 3.6.1-2009
	More than 15 per cent passing a 2 micron sieve	
Liquid limit	30 to 70 per cent	AS 1289 3.1.2- 2009
Plasticity index	More than 15	AS 1289 3.3.1- 2009
Emerson class number	5 to 6	AS 1289 3.8.1- 2006

7 The liner material should be homogeneous in nature and properties, with no sandy patches exceeding the liner specification or rocks retained on a 37.5 mm sieve. Any non-conforming liner material shall be removed and replaced with conforming soil. Where necessary, soils may be blended or have bentonite clay mixed in to achieve desired uniformity and geo-technical characteristics.

8 The liner material properties should not be altered by acidic or alkaline content of the contained waste. Acidic materials may cause metal oxides in liner soils to dissolve, while alkaline wastes may dissolve silica in the liner, changing the hydraulic conductivity and increasing seepage rates.

Liner construction

9 A competent and experienced geo-technical professional should supervise construction of lined containment facilities.

10 A water allocation licence meeting the provisions of the *Rights in Water and Irrigation Act 1914* may be required to take water from the environment for liner conditioning. For licensing information, contact our nearest regional office.

11 Liners should be installed in at least two layers of equal thickness to ensure adequate compaction is achieved and to minimise the risk of leakage. The thickness of each layer thickness should be matched to the compaction capabilities of the construction equipment (layers may be up to 15 cm at their finished depth). The liner material should be moisture-conditioned to achieve the maximum (in place) design soil density exceeding the 95 per cent maximum dry density (MDD) determined using *AS 1289.5.2.1* (2003) and *AS 1289 5.4.2* (2007) (reference 5).

12 The minimum thickness of the compacted soil liner should be 30 cm. Construction tolerances should be within 5 cm.

13 The completed liner should uniformly cover both the base and perimeter of the storage compound to achieve one integrated holding facility. Particular care (using water stops and spot compaction) should be taken where pipework penetrates embankments to limit the risk of embankment 'piping' or slumping.

14 Suitable graded slopes on embankments, drainage controls and protective covers (such as rip-rap or sprayed concrete) should be used to avoid the risk of slumping and erosion. Internal erosion protection from wave action should be considered where the bank-to-bank width exceeds 50 m.

15 External drainage diversion works should be installed to protect perimeter banks from erosion by stormwater runoff.

16 Erosion controls should be put in place for any stockpiled soils used for containment construction or rehabilitation. Controls should include redirecting stormwater away from soil stockpiles and capturing turbid runoff from the stockpile. Windbreaks, covers or other suitable controls such as sealants or cover crops should be used to prevent stockpiled soil from being blown away.

Liner certification

17 The construction supervisor should conduct appropriate sampling and testing, and certify in writing that the following recommendations were followed:

a Soil used in the containment lining needs to conform to the design specification for a water retaining structure and the specified liner material characteristics (see *Liner material* recommendations above).

b The liner should be placed in the design layers matched to the compaction equipment used, moisture-conditioned and compacted (using a 'sheep's foot' roller

with tyne length matched to compacted layer thickness or similar) to achieve the completed liner soil density described above.

c Test cores should be taken from the completed containment compound as follows:

- For a containment compound footprint of less than 1 ha, tests should be conducted based on a four-by-four grid equally spaced over the base of the waste containment area. Figure 1 shows a minimum of five test locations (marked '●').

  In addition, one full-depth core test per 30 lineal m of perimeter embankment is recommended. Figure 1 shows a minimum of six equally spaced test locations (marked '⊕').

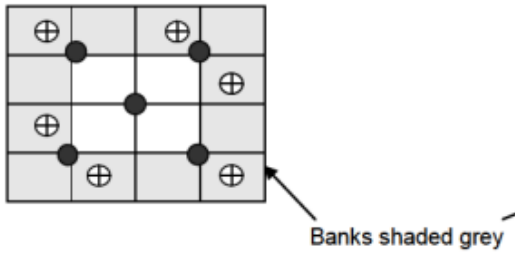


Figure 1

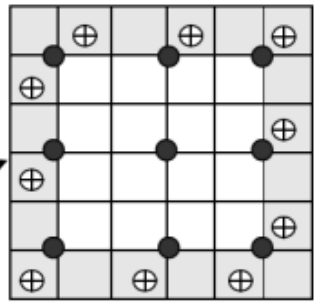


Figure 2

- For containment compound footprints greater than 1 ha, tests should be based on at least an equally spaced six-by-six grid over the base of the waste containment area, with a minimum of one test per 500 m^3 of liner material. Figure 2 shows a minimum of nine equally spaced test sites (marked '●').

  In addition, one full-depth core test per 50 lineal m of perimeter embankment is recommended. Figure 2 shows a minimum of ten equally spaced test locations (marked '⊕').

d Each soil sample core needs to be laboratory tested to confirm that the design soil density has been achieved.

e Each soil sample core should have its coefficient of permeability determined (under constant pressure head) via an accredited soil testing laboratory in accordance with *AS 1289.6.7.1* (2001). The maximum acceptable core coefficient of permeability is 10^{-9} m/s when subjected to a 1 m pressure head of water. This equates to a tolerable liner seepage rate of about 3 cm per year.

f If any soil core fails a permeability test, a further sample should be taken from the liner adjacent to the failed core hole and retested. If this second core test fails the permeability limit, the liner shall be reworked until soil core testing indicates the required coefficient permeability limitation has been achieved.

g Core test holes should be refilled with cement slurry, bentonite or other suitable sealant.

h Adequate care needs to be exercised with embankments to achieve:

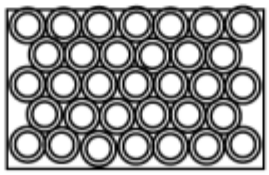
- a low-permeability seal integrated with the base liner
- erosion resistance and resistance to the threat of slumping or piping failure. For slopes, this involves placing extra fill and cutting back to design dimensions. Special attention should be given to sealing any pipework that penetrates external embankments, by installing water stops.

i The completed containment facility should be proof-tested to confirm initial seepage from each containment module is less than 4 kL/ha/day of contained area under 1 m water pressure (head) 24 hours after flooding.

Liner integrity protection

18 The base of the containment area should be flooded on completion (where practical). Water cover or moisture conditioning maintained with sprinklers should be used to avoid shrinkage, cracking and consequent loss of seal. Alternatively, where there is insufficient available water, a continuous plastic membrane or a 15 cm deep coarse granular cover may be used. This cover should be maintained until stored material is introduced in sufficient quantities to prevent shrinkage of a dry soil liner.

19 Where there is a need to periodically remove stored material by mechanical means, protective measures should be in place to avoid liner damage. One option is to provide a granular or crushed rock to a depth of at least 30 cm to cover the liner. Another option is to create a soil-filled layer of used tyres. The tyres need to be laid flat and packed closely. Typical tyre layout when shown from above:



Drainage controls

20 Where contained material with high moisture content requires consolidation, a piped subsoil drainage system set in granular material above the base liner is recommended. This system should drain seepage to a lined holding pit outside the containment for water recycling or evaporative disposal.

21 If pipework penetrates the perimeter containment embankments, then control measures (such as grouting) may be necessary to prevent seepage along the exterior of the pipes resulting in escape of contaminants or potential embankment failure.

22 Any sub-soil drain system should be designed to resist silt intrusion (by surrounding with crushed rock or a filter fabric, for example) and have accessible ports for maintenance clean-out, via flushing or rodding.

Containment integrity monitoring

23 External monitoring facilities (such as slotted casing monitoring bores) may be required to assess changes in local groundwater quality and the watertable level occurring beneath the containment facility. WQPN 30 *Groundwater monitoring bores* provides guidance on monitoring facilities (reference 2).

24 Data gathered on contaminant leakage and any groundwater mounding should be held by the facility operator for a minimum of two years after collection. If requested, monitoring data should be supplied to regulatory authorities.

Excerpt from Water Quality Protection Note 27: Liners for containing pollutants, using engineered soils